EVALUATION OF HYBRIDS AND CLONAL VARIANTS IN PINEAPPLE (*Ananas comosus* L.)

by

LALIT DHURVE
(2017-22-008)

THESIS

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DECLARATION

I, hereby declare that this thesis entitled **"Evaluation of hybrids and clonal variants in pineapple (*Ananas comosus* L.)"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Place: Vellanikkara

Date: 02/02/2022

Lalit Dhurve

(2017 -22- 008)

CERTIFICATE

Certified that this thesis entitled **"Evaluation of hybrids and clonal variants in pineapple (*Ananas comosus* L.)"** is a record of research work done independently by **Mr. Lalit Dhurve (2017-22-008)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to him.

2/2/2022

Place: Vellanikkara

Date: 02/02/2022

Dr. K. Ajith Kumar
(Major Advisor)
Dean & Associate Director of Research
College of Agriculture/
Regional Agricultural Research Station
Ambalavayal, Wayanad
Kerala- 673593

CERTIFICATE

We, undersigned members of the advisory committee of **Mr. Lalit Dhurve (2017-22-008)** a candidate for the degree of **Doctor of Philosophy in Horticulture** with major in **Fruit Science**, agree that this thesis entitled **"Evaluation of hybrids and clonal variants in pineapple (*Ananas comosus* L.)"** may be submitted by **Mr. Lalit Dhurve (2017-22-008)**, in partial fulfilment of the requirement for the degree.

2/2/2022

Dr. K. Ajith Kumar
(Major Advisor)
Dean & Associate Director of Research
College of Agriculture/ Regional Agricultural Research Station
Ambalavayal, Wayanad

02/02/2022

Dr. Jyothi Bhaskar
(Member)
Professor (Hort.) & Head
Dept. of Fruit Science
College of Agriculture, Vellanikkara

2/2/2022

Dr. A. Sobhana
(Member)
Professor (Hort.) & Head (Retd.)
Fruits Crops Research Station,
Vellanikkara

02/02/2022.

Dr. Rose Mary Francies
(Member)
Professor (Pl. Br. & Gen.)
Agricultural Research Station,
Mannuthy

2/2/2022

Dr. Deepu Mathew
(Member)
Associate Professor
Centre for Plant Biotechnology and
Molecular Biology, College of Agriculture,
Vellanikkara

2/2/2022
(Dr. J. RAJANGAM)

Dr. J. Rajangam
(External Examiner)
Professor and Head
Dept. of Fruit Science, HCRI,
Periyakulam, Tamil Nadu

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Lalit Dhurve (2017-22-008)

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DEDICATED TO
FRUITS CROPS RESEARCH STATION
& PINEAPPLE SCIENCE

INTRODUCTION

1. INTRODUCTION

Pineapple (*Ananas comosus* L.) is one of the important fruit crops of tropical India. Pineapple, a member of the Bromeliaceae family is cultivated for its delicious fruits, which are canned, frozen, or made into juices, syrups, or candied (Firoozabady and Gutterson, 2003). It was domesticated long before its first discovery and its historical origin is South America (Leal, 1990). Widely grown in almost all the tropical and subtropical regions of the world, presently it has become established as a major commercial tropical fruit in the international market.

Pineapple ranks as the third major tropical fruit following citrus and banana. Its global area, production, and productivity in 2018 were estimated at approximately 1111.37 thousand hectares, 27.92 million metric tonnes, and 25.13 MT/ha respectively (FAOSTAT, 2021). Costa Rica is the top producer of pineapple followed by the Philippines, Brazil, Indonesia, China, and India (Statista, 2021). The total estimated area under pineapple in India is 108 thousand hectares and production is 1802 thousand metric tonnes, with a productivity of 16.70 MT/ha (NHB, 2021). In India, West Bengal is the largest pineapple-producing state followed by Assam, Karnataka, Meghalaya, Manipur, Nagaland, Tripura, Bihar, Andhra Pradesh, and Kerala. Among these states, Kerala is one of the important pineapple-producing states in the country.

The excellent nutritional and bioactive properties of pineapple have played a significant role in its rise in global consumption. The juicy flesh part of the fruit is delicious in taste when eaten as fresh fruit. In addition to being eaten fresh, the fruit can also be canned and processed into different forms of juice, jam, squash, and syrup. The fresh pineapple fruit (100 g) contains 87.0 g water, 12.63 g carbohydrates, 9.26 g sugars, 1.40 g dietary fibre, 0.12 g fat, 0.54 g protein, 0.079 mg thiamine (vitamin B_1), 0.031 mg riboflavin (vitamin B_2), 0.489 mg niacin (vitamin B_3), 0.205 mg pantothenic acid (vitamin B_5), 0.110 mg vitamin B_6, 15.00 µg folate (vitamin B_9), 50.00 mg vitamin C, 13.00 mg calcium, 0.28 mg iron, 12.00 mg magnesium, 0.90 mg manganese, 8.00 mg phosphorus, 115.00 mg potassium, and 0.10 mg zinc (Devi *et al.*, 2013). It is also a rich source of important dietary fibers, bromelain (an enzyme), vitamins, and antioxidants. The bulk of the world's production of pineapple is utilized by the processing industry and fresh fruits. Approximately, 70 per cent of the pineapple is used for table purposes in the country of origin. In the case of export of pineapple products, fresh fruits, concentrated juice, and canned pineapple shares more than ₹ 3501.44 Lakhs. There is a rapid increase in demand in particular for fresh fruit from India (NHB, 2021). It is one of the most important sources of bromelain, used for the meat-tenderizing digestive enzyme in the meat industry. Pineapple growing techniques may be standardized to bring down the cost of production of fresh pineapple and its easier adoption by pineapple growers, assured market for the pineapple produce and to produce pineapple year-round may go a long way in promoting pineapple industry in India.

The global scenario of pineapple exhibits increasing demand worldwide. Around 50 per cent of produce is consumed as fresh fruit, 30 per cent as canned slices, and 20 per cent as juice concentrated preserves. Globally trade on fresh pineapple fruit has shown a 100 per cent increase during the last few decades. Even though India is the sixth-largest pineapple-producing country in the world with an 8 per cent share in production, its sharing capacity in the global market is negligible. The Asian countries import nearly two lakh tonnes of pineapple every year. The top pineapple exporting countries are Costa Rica (58.6 %), Philippines (11.06 %), Netherlands (8.48 %), United States (3.77 %), Taiwan (2.52 %), Honduras (2.12 %), Guatemala (1.83%), Mexico (1.18 %) and Spain (1.16 %). Major importers are United States (34.24 %), Netherlands (9.05 %), China (8.23 %), Japan (6.01 %), Spain (5.85 %), Germany (5.44 %), United Kingdom (5.27 %), Italy (4.90 %), and Canada (4.35 %) respectively (Tridge, 2021).

India shares 8 per cent of the total world production of pineapples. Indian pineapple export has been growing a steady manner in all parts of the world. Its export shows a constant increase from 1.98 US$ million in 2013 to 2.68 US$ million in 2020 (Tridge, 2021). India leads the pineapple export in countries like Saudi Arabia, Qatar, Maldives, UAE, Nepal, Oman, Bahrain, Italy, Kuwait, Russia, Bhutan, Germany, United States, Ameri Samoa, Hungary, Lebanon, Singapore, France, and others. In India, Kew and Mauritius are primarily grown varieties. It is majorly grown in tropical humid belts of Indian states *viz*., Kerala, Goa, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, West Bengal, Assam, Manipur, Meghalaya, Tripura, Arunachal Pradesh, Mizoram, and Nagaland. Among the states, Assam leads to the maximum area (16.30 thousand ha) under pineapple cultivation while West Bengal leading in pineapple production with 345.15 thousand MT. Overall existing productivity is less, national productivity is 16.70 MT/ha and Kerala productivity is 8.49 MT/ha when compared to world productivity of 25.13 MT/ha (NHB, 2021).

In Kerala, pineapple is grown in almost all districts, with an area of 8.22 thousand hectares and a production of 69.72 thousand MT (NHB, 2021). State pineapple production is constantly increasing over the last few years. The congenial humid tropical climate is favorable for pineapple cultivation. The finest Vazhakulam pineapple has been registered as Geographical Indication (GI) tag on 4th September 2009 for its unique fruit quality (KAU, 2021). The pineapple from Kerala is having more demands in India as well as foreign markets due to its quality, sweetness, and unique flavor. Even though pineapple is grown in almost all the districts but growing practices followed widely differs among the districts. Ernakulum is a leading pineapple growing district with more than 60 per cent area along with over 60 per cent of total pineapple production. In 2004, a hybrid between Kew and Ripley Queen, Amritha is released by Kerala Agricultural University. This hybrid also gaining popularity among the farmers for cultivation (Rajan and Prameela, 2004).

Pineapple is a cross-fertilized crop and thereby highly heterozygous. However, owing to its amenability to clonal propagation, the breeding lines or varieties can be genetically fixed. Immortalizing the genotype clonally though highly advantageous may prove to be a disadvantage too. It may lead to a drastic reduction in variability in crop forms cultivated encouraging mono-cropping of a few homogenous genotypes over large areas.

Origin of somaclonal variation provides many benefits in crop improvement of clonally reproducing crops. It is suggested to be a substitute for conservative breeding in order to obtain high-yielding variants or mutants. The general principle of breeding clonally propagated crops with appropriate ideotypes is to break the normal clonal propagation cycle by hybridization, which culminates in sexual seed production and genetic variation.

Keeping this in view, the present study is proposed to evaluate the qualitative and quantitative characters of pineapple hybrids generated through a hybridization program involving Kew and Mauritius types along with the somaclonal variants generated at the Centre for Plant Biotechnology and Molecular Biology, College of Agriculture, Vellanikkara. Molecular characterization of the promising genotypes with ISSR markers is also envisaged to detect molecular diversity and aid varietal identity. In this context, the present study was undertaken with the objectives are

- To evaluate somaclonal variants and hybrids of pineapple for yield and quality for identifying novel genotypes
- To generate DNA fingerprints of the genotypes using Inter Simple Sequence Repeats (ISSR) markers for varietal identification and assessment of genetic resemblance.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Pineapple is one of the most famous fruit of Kerala, which is well known as the queen of fruits in tropical and subtropical climates. Pineapple saw extensive variation in regards to vegetative characters, flowering characters, fruit and yield characters, and biochemical attributes. Engagement of information on a genetic variant sample of the pineapple plants permits the breeder to predict the magnitude of variability available within crop species for similar selection and development. Observations on morphological, biochemical, and molecular characterizations by using a higher range of parameters and molecular marker strategies are rather recommended for verifying their genetic heritage and choice of superior genotypes with higher yield and high quality. In this study, a try has been made to broaden clonal variants and hybrids of pineapple for yield and high quality. The literature associated to investigate studies carried out up to now on pineapple fruit development program accomplished at exceptional locations are in short reviewed and presented in this chapter underneath the subsequent relevant headings.

- Commercial varieties
- Reproductive biology
- Varietal improvement
- Molecular characterization of pineapple

2.1. Commercial varieties

Almost all species of pineapples are commercial species besides *Ananas erectifolius*. A few many years ago pineapple cultivators have been imported so many pineapple varietal germplasm for cultivation and they have selected as in keeping with their market demand options. The *Ananas comosus* varieties are especially desired because of their big quantity availability, wider distribution adaptability, and fleshy fit for the human consumption. The significance of varieties is restricted to the simplest few characters of *Ananas comosus* which are grown considerably for fruit yield and excellent quality attributes. Recently, the cultivated pineapple types were categorized into five foremost groups that are being cultivated at almost all parts in the globe (Py *et al.*, 1987). In this regard, a strive has been made to accumulate literature available on commercially grown varieties around the world. The short account of pineapple varieties evaluation of literature is organized right here with outstanding parameters.

Py *et al.* (1987) categorized all the commercially cultivated pineapples into different five groups such as cayenne group, Spanish group, queen group, Pernambuco group, and maipure group. They have reported that among the cultivated groups cayenne and Spanish are used as twin motive purpose like fresh fruit yield and canning while queen varieties are cultivated handiest for clean fruit marketplace, as they are not suitable for canning motive due to its small prominent and deeper eyes. The first group is maximum essential and most suitable to growers in addition to consumers. Cayenne group fruits are cylindrical in form and the average fruit weight is around 2.3 kg. As the fruit gains complete maturity and starts to ripen it turns light yellow to coppery yellow coloration that is appearing from base to upward direction inside the shoulders. Concerning the Spanish group, the fruits are globose in form, in phrases of fruit weight ranges from 0.9 to 1.8 kg at the same time as its skin seems pale yellow to white in colour. In which as in the case of queen pineapples, fruits are conical in shape at the side of small distinguished deep eyes and fruit weights range between 0.5 to at least 1.1 kg. Whilst it comes to complete maturity, the fruit turns to golden yellow in coloration which holds transparent quality aroma and flavor. In this series another group is Pernambuco, on this group pineapple bears 1.4 kg on mean fruit is conical in shape and fruits appear in small shallow eyes. The remaining group is maipure group, its essential characteristics are as follows fruit weight is ranges 0.8 to 2.5 kg, cylindrical ovoid to cylindrical kind shape fruits, and ripen fruit change into yellow to orange in color at maturity. It permits some important commercial varieties from around the arena to differentiate their particular characters.

Chan *et al.* (2003) reviewed that Smooth Cayenne variety was first collected by Perrotet from French Guiana in 1819, which was locally known as Maipuri. After that it is slightly adapted to all over the world with the synonyms of Kew, Giant Kew, Champaka, and Sarawak. It was gained popularity among the farmers, processors, and consumers due to its high yielding capacity, geographical adaptability, and specially canning fruits. This cultivar is required a highly specialized techniques for production and processing, that is makes it costly and attendant inconveniences.

Singh *et al.* (2005) identified and informed that availability of commercial most important pineapple varieties in North East India are Queen, Kew, Giant Kew, Mauritius, Jaldhup, Lakhat, and Baruipur local. Cultivar Queen is recommended as excellent cultivar of Tripura for fresh fruit consumption. It had received Geographical Indication (GI) tag in 2015 due to its pleasant aroma and flavor at the time of ripening. The fruits are high in TSS (13-17.2 °B) and medium acidity (0.6-0.8 %). It has been found 0.8-1.3 kg average golden yellow fruits with small prominent eyes. In addition, cultivar Kew is reportedly high yielder (1.5-2.5 kg) and oblong shape fruits. Its fruitlets are bears broad and shallow types eyes which is making more suitable for canning.

Bartholomew (2009) reported that primarily Smooth cayenne was the principle variety in all over the pineapple producing countries. It was used to fulfil both the market demand of consumers for limited fresh fruit and mostly canned slices purposes. Another Champaka variety, which is clone of Smooth Cayenne developed by Pineapple Research Institute, Hawaii. This was also bearing same characteristics of Smooth cayenne and only used for fresh consumption but due to high acidity not preferred by consumers in the market. In 1961, scientists from Pineapple Research Institute, Hawaii decided to develop a new variety which should fulfil all the market demands of across the globe. They have created the firm with large pineapple companies for funding and started the pineapple breeding work for new varieties. After crossing of complex mixture of several varieties, they have selected two hybrids PRI hybrid 58-1184 and PRI hybrid 59-443. In the continuation after several trials PRI breeding program were made again crosses between PRI hybrid 58-1184 and PRI hybrid 59-443, results new two selection hybrids were 73-50 and 73-114. These hybrid seedlings were more than 50 per cent better in performance compared to Smooth Cayenne in terms of fruit yield and quality. In 1981, PRI hybrid 73-50 renamed as MD-1 for internal use, now which is widely known as CO-2 and PRI hybrid 73-114 named as MD-2. From 1984 to 1994, MD-2 variety is expanded to Costa Rica, Europe, and USA for cultivation. Recent years, MD-2 variety almost completely replaced to Smooth Cayenne in world wide.

Joy and Anjana (2013) described that in Kerala, five pineapple varieties are under cultivation. There are Mauritius, Vazhakulam pineapple, Kew, Amritha, and MD-2 etc. which are popular among the commercial cultivars of the state. In 2004, The Kerala Agricultural University released one promising hybrid Amritha, which is cross between Kew and Ripley queen. A cultivar Vazhakulam pineapple developed through local selection has been recommended by KAU, Thrissur. The Vazhakulam pineapple is holding the Geographical Indication (GI) tag in 2009 under the Agricultural-Horticultural category due to its excellent quality pineapple fruits producing among the states.

Viana *et al.* (2013) characterized commercially cultivated Brazillian varieties such as Perola, MD-2, Smooth Cayenne, Abacaxi BRS Imperial, Abacaxi BRS Vitoria, Abacaxi BRS Ajuba. Perola is covering largest area in pineapple cultivation and most popular variety for local fresh fruit consumption in Brazil which is belongs to Pernambuco group. Similarly, MD-2 and Smooth Cayenne have been recommended as potentially commercial varieties in Caribbean region. The Brazilian Agricultural Research Corporation Embrapa has made great contribution to research and development in pineapple by evolving three hybrids and launched for commercial cultivation to various agro climatic regions of the country. Abacaxi BRS Imperial, a resistance to fusariosis and internal browning of the fruit developed by this institute through hybridization. The use of Abacaxi BRS Vitoria is released in 2006 which is having superior characteristics compare to Perola and Smooth Cayenne. It is a resistant against Fusarium wilt. The Abacaxi BRS Ajuba is found to emphasis on resistance to fusariosis with the development of this hybrid, now it is possible to grow under the northwest region of Rio Grande do Sul and valley of the Uruguay River.

Thalip *et al.* (2015) recommended that in Malaysia, currently commercially cultivated varieties are MD-2, Moris, Moris Gajah, Gandul, Josapine, Masapine, N-36, Sarawak, and Yankee. Out of these varieties, N-36 and Josapine are locally selected cultivars which are cultivated for fulfil the local fresh fruit market demands. Remaining varieties are being cultivated with the following of global standards by growers for exporting to other countries. Recently Malaysian Pineapple Industry Board (MPIB) is promoting the cultivation of MD-2 variety for industrial purpose.

Now MD-2 variety cultivation area is expanding in Malaysia and replacing to other varieties due to its popularity in pineapple industry. In Malaysia, MD-2 variety is well known as Super Sweet, Gold, Golden Ripe, and Rompine with the trade names.

Tang *et al.* (2019) reported that Taiwan Agricultural Research Institute (TARI) developed and released pineapple varieties for commercial cultivation in the Taiwan climatic region. Some of the commercially improved varieties are Tainung No. 17, Tainung No. 21, Tainung No. 22, and Tainung No. 23. Among these varieties Tainung No. 17 is locally well known as Gold Diamond, which is suitable for spring season. Its characteristics features are large size fruits, average TSS (14.5 °B), and low titratable acidity (0.28 %) along with tender fleshed variety. Tainung No. 21 named as Golden pineapple, which is bears 1.34 kg fruits. Its fruits are cylindrical in shape with high TSS (18.9 °B) and intermediate to high acidity (Tang *et al.,* 2014). Tainung No. 22 is popular as Honey Fragrance due to its distinguished flavour. This variety fruits are around 1.76 kg, total soluble solids 17.6 °B, and titratable acidity 0.43 %. This variety is adopted to hot humid climate and resistant to fruit & core cracking disorder. Tainung No. 23 is recently developed variety from TARI.

2.2. Reproductive biology

2.2.1. Cycle of development

The time period required for various growth development phases from planting to harvest of the fruits by histological analysis of pineapple plant was reported by Kuriakose (2004). The developmental cycle of pineapple exhibits different phases like vegetative growth phase, fruiting growth phase, and sucker growth phase, *etc*. respectively. In the vegetative growth phase, the morphological changes subjected from planting to the origin of flowering, the fruiting growth phase associated from differentiation of flowering to harvesting of the fruits, and the sucker growth phase begins from fruit harvesting to destructive phase of the plant. For better understanding, the growth development stages of a pineapple plant, Collins (1960) reported the average number of days required for different developmental changes that occurred in the pineapple as follows.

- From planting to the beginning of inflorescence 427 days

- From beginning to end of the formation of inflorescence 37 days
- From the end of inflorescence formation to first open flower 43 days
- Period of flowering 26 days
- Period from opening of last flower to ripening of the fruit 109 days
- Total period of fruit development 215 days
- From planting to ripe fruits 642 days

Santos *et al*. (2018) estimated that the pineapple total leaf area by simple, fast, and non-destructive methods enable results related to carbon fixation estimative, biotic, and abiotic stresses and positive correlation with yield. Their aim was to measure D leaf area and total leaf area from Pérola pineapple plants by using biometric measurements. Moreover, in order to complete the measurement of the D leaf area, the plant leaves were collected from the plants to estimate the length of the D leaf, the width of the D leaf, D leaf area, and total leaf area of the plant by using a portable leaf area meter. They have performed Pearson correlation analysis and observed a significant positive correlation among the studied variables.

2.2.2. Floral morphology

The pineapple is functionally identical monocotyledonous, monocarpic, xerophytic, CAM system (Crassulacean Acid Metabolism), and herbaceous perennial (Eggli, 2001). It consists of well-developed leaves that are 38-100 cm in length which are spirally arranged, erect and spreading curved in shape in the pineapple clasping base (Bartholomew *et al.* 2003). The pineapple bears a single terminal compact inflorescence which comprises 100-200 individual bluish flowers, each flower consists of an inferior ovary with three united carpels, three outer calyxes, and three inner bluish corollas enclosing with six filaments. The carpel consists of 20-60 ovules and each ovule contains the haploid female gametophyte in nature. The flower blooms around three weeks after emergence of inflorescence, from base to upward direction at the rate of 5-10 per day in the early morning 6-9 am (Wang *et al.*, 2020). They have normally produced auto sterile and vegetative parthenocarpy fruits, sometimes they generate seeds if cross-pollination happens between varieties (Cheng *et al.*, 2018).

Kuriakose (2004) studied that the six pineapple genotypes *viz*., Mauritius, Kew, Selection-1, Pampakuda local, Kakkoor local, and Ripley Queen for their evaluation of floral biology characters. Their salient findings were indicated that the number of flowers opened per day was significantly varied with varietal character whereas it was not varied with environmental factors. They also reported that the number of days taken to complete the flower opening was not dependent on the variety and environmental factors, while the total number of flowers in an inflorescence may vary with variety and environment.

Aragon *et al.* (2013) determined *ex vitro* pineapple plants were subjected to C_3 and CAM-inducing environmental conditions, by applying light intensity and RH, respectively 40 μmol.m-2s^{-1}/85% and 260 μmol.m-2.s^{-1}/50%. The results observed that the leaves of pineapple plants grown under CAM-inducing conditions showed higher leaf thickness and more developed cuticles and hypodermic tissue. In terms of proteomic profiles of several proteins, isoenzyme patterns, and transcriptomic profiles, five major spots were isolated and identified, two of them for the first time in *Ananas comosus* and the other three corresponding to small fragments of the large subunit of Rubisco. They also identified isoenzymes of superoxide dismutase (SOD) and catalase (CAT) by electrophoresis and the transcript levels of oxygen-evolving enhancer (OEE1) and CAT were associated with CAM metabolism in pineapple plants.

Ming *et al.* (2016) reported an important phylogenetic position of pineapple and its reference genome advances genomic research within the family Bromeliaceae and more widely among the monocots. In this study, their focus was the evolution of the crassulacean acid metabolism (CAM) photosynthesis pathway in pineapple. They have observed an acquired circadian clock cis-regulatory elements in CAM-related genes might be a critical step in the evolution of this form of photosynthesis. Their results clarified the processes and evolutionary forces leading to the multiple independent origins of CAM photosynthesis within the family Bromeliaceae and in over 400 genera across 36 families.

Adje *et al*. (2019) evaluated that the pineapple morphological diversity of fifty-five pineapple genotypes collected in Benin. They have examined ten qualitative and twenty quantitative characteristics by following stepwise discriminant and hierarchical cluster analysis to identify quantitative morphological characteristics which best discriminate plant genotypes and grouping them into morphotypes. They have identified five pineapple morphotypes and discriminated for Benin conditions, including Smooth Cayenne, Baronne de Rothschild, Pérola, Singapore Spanish, and Green Spanish. Furthermore, they have recognized significant morphological variation among the cultivars and grouped them into three clusters on the basis of the width of the D leaf, time of flowering, fruit weight, fruit diameter, fruit shelf life, and crown weight. As per the pineapple descriptors, they also have revealed that a positive correlation between fruits weight, peduncle diameter, and conicity index in Cayenne and Spanish groups of pineapple.

2.2.3. Pollination

The pollination in pineapple can be occurred naturally or by hand pollination. Wild pineapples are primarily pollinated by hummingbirds sometimes rarely night time bats also can pollinate the pineapple flowers. Apart from these pollinators, honey bees and pineapple beetles can be a secondary vector for inducing cross-pollination (Kudom and Kwapong, 2010). The cross-pollination in pineapple is possible due to the presence of gametophytic self-incompatibility. The chance of getting pineapple seeds after the crossing is quite easy because almost all the cultivars are diploid in nature, which produces sufficient functional pollen and ovules. The fourteen to twenty number of ovules are produced in two rows near the top of each locule. The cross-pollination between species, cultivars, and varieties leads to normal fertilization and produces 2000-3000 very tiny black hard seeds. The possibility of self-pollination remains incomplete due to pollen tube development comes to an end before reaches the ovary (Cheng *et al.,* 2018).

Kuriakose (2004) investigated that the six parental pineapple genotypes *viz.,* Mauritius, Kew, Selection-1, Pampakuda local, Kakkoor local, and Ripley Queen were used for hybridization in all possible combinations, studied the self-compatibility and cross-compatibility. Their studies reported that Selection-1 and Ripley Queen were showing self-incompatible in nature, whereas Pampakuda local was showed some amount of compatibility. For more results were found that

Mauritius was the better female parent for hybridization, which was showing high cross-compatibility among all the genotypes.

Sanewski (2009) proposed a strategy to minimize the heterozygous nature in indigenous pineapples through the development of parental lines with a greater level of homozygosity. He has evaluated the selfing and a range of lesser levels of inbreeding for their effects on seed production and inbreeding depression in the early growth of plantlets. The results suggested that selfing produced few seeds, and very few viable seedlings whereas sib crosses were generally unsuccessful. The highest inbreeding coefficient (0.25) was not associated with severe inbreeding depression. He also assessed the effect of inbreeding depression and the level of homozygosity on several quantitative traits including those related to fruit quality within the inbred populations.

Kudom and Kwapong (2010) carried out a survey in pineapple farms in the Central region of Ghana to identify floral visitors and their activities on the flowers. The results of the survey determined by nectar concentration and energetics and the effect of floral visitors on fruit production. They have reported that the fourteen species of butterflies and one ant species were the main insect floral visitors as well as four species of sunbirds. The mean nectar concentration was 23.30 per cent and pollination limitation did not significantly affect fruit yield. Their study showed that butterflies, ants, and sunbirds are the main floral visitors on *Ananas comosus*. However, their reports suggested that even if pollination is not crucial in pineapple cultivation, it is still essential in pineapple breeding programs to promote genetic diversity and conservation.

2.2.4. Seed formation and fertility

All the commercial varieties of pineapple categorized into gametophytic self-incompatibility groups where cultivated pineapples do not possess seeds in the fruit. However, if cross-pollination possesses between commercial cultivars that case seeds can set into the fruits of pollinated plants (Ming *et al.,* 2016). The naturally available pollination vectors can be varied with the climatic locations. As per the researcher's reports, hummingbirds, honey bees and ants would be considered the main pollinators (Kudom and Kwapong, 2010). In the pineapple flowers, the presence of a small narrow corolla tube along with non-shedding pollen grains makes it unsuitable for pollination by wind. The main feature of pineapple flowers is that they have three separate well-distinguished flower parts to match each other such as three parts of sepals, three parts of petals, and two pairs of three parts of stamens. Each part possesses a compact carpel enclosing with locules. The development of locules from the little fringy placenta and ovules produced fertile seeds in the middle axis of the pollinated fruit. The more precise structure of the carpel separates with the narrow brown lines, which contain full of nectary ducts. These nectary duct flows up nectar inside the flower to fully capable of attracting pollinators and rewarding fertile seeds if pollen grain is genetically distinct. In the absence of pollination, occasionally commercially grown pineapple plants produced small infertile seeds (Cheng *et al.*, 2018). The hybrid seeds viability is no longer than 6 months has been recorded in Cote d' Ivoire (Loison-Cabot, 1990). One of the best examples of hybrid seed formation and fertility was reported from breeders of Pineapple Research Institute, Hawaii to develop new hybrids like MD-2 and CO-2 (Paull *et al.*, 2017).

Kuriakose (2004) studied that the six parental pineapple genotypes *viz*., Mauritius, Kew, Selection-1, Pampakuda local, Kakkoor local, and Ripley Queen for stigma receptivity and seed set in all possible hybrid combinations. In their studies indicated that stigma receptivity and seed set was possible in-between the period time from 3 am to 6 pm. In case of seed germination all combinations of hybrid seeds were uniformly germinated, maximum germination was recorded in the fourth week after sowing of seeds.

Sanewski (2009) proposed that a properly designed plan to minimize the heterozygosity in pineapple by developing a greater level of homozygosity by the following selfing. Their evaluation with regards to selfing was used for their effects on seed production and the results were produced few seeds and very few viable seedlings. He also has tried backcrossing and several half-sib cross combinations which were exhibited minimal effects on seed development or early growth. Moreover, he has reported the effect of inbreeding depression and the level of homozygosity presented on several quantitative traits including those related to fruit quality.

2.3. Varietal improvement

Varietal improvement of many of our pineapple cultivars has resulted from interspecific and intraspecific hybridization, clonal selection, and biotechnological methods. The breeders also extensively used existing cultivars to improve and develop new varieties to fulfill the present market requirements. By using the related species and the same time related same genera of improved varieties with improved yield, quality, and resistance against biotic and abiotic stresses especially to mealybug pest and heart rot or root rot disease have been improved successfully (Barral *et al.,* 2019). In certain cases, natural interspecific hybridization occurs, but nowadays many hybrids have been developed through intraspecific hybridization and popularized in commercial pineapple markets such as MD-2, CO-2, and Amritha (Paull *et al.,* 2017). In the trending future, many potential opportunities towards exploitation of the existing varieties in pineapple breeding.

2.3.1. Breeding objectives

The major commercial varieties of pineapple are recognized by breeders for exploitation with the following breeding objectives. The wild type and existing cultivars should be isolated, identify, and manually characterized based on the morphology. After identifying potential cultivars should be selected for area expansion with wider geographical adaptability (Heenkenda and Sangakkara, 2008). The plant should be shorter, precocious bearer, hardy, vigorous, and spineless followed by short duration crop. It should have at least two ground suckers for getting a stable ratooning crop. The fruit stalk should be short, strong, and bearing an average of two to three slips. An average fruit should be long, cylindrical, and large flat eyes and a thinner core which should fulfill both the market demands like fresh fruit and processing properties. The varietal development also fulfills the resistance against biotic and abiotic stresses such as multiple crowns, fruit fascination, mealybug, heart rot, root rot, and plant destructive nematodes (Ray, 2002).

2.3.2. Plant ideotypes

The pineapple plant ideotypes include several functional morphological and physiological characters which contribute to improved yield and quality than predominant existing cultivars. The plant should have all the morphological and physiological features which are suitable for irrigated and rainfed climatic conditions. The important main features of pineapple plant ideotypes are as follows such as plant height, number of leaves, 'D' leaf area, total dry weight, dry matter production from various plant parts, and yield potential. Brown (1953) listed general plant vigor and large-sized fruit with better qualities should be consideration of plant ideotypes. Collins (1960) proposed ideotypes of pineapple plants include hardy, vigorous, high degree of shoot and root system, bigger size fruit, better shape fruits, excellent flavor and aroma, juicy flesh, high TSS, and multiple resistance to biotic and abiotic stresses like mealybug and heart rot.

Chan and Lee (2001) studied the possibility for developing earliness in pineapple and reported a genotype coded as A04-16, which could be forced at the seven-month stage economically, but it cannot be directly used as a variety due to its weaknesses and finally suggested that early fruiting lie in the ability to reduce the growing period from planting to forcing and early fruiting progenies should have the capacity to bear economic sized fruit on small plant mass.

Kuriakose (2004) evaluated that the six selected pineapple genotypes *viz*., Mauritius, Kew, Selection-1, Pampakuda local, Kakkoor local, and Ripley Queen for their available genetic variability. Their salient results have significantly differed in 11 plant growth parameters and 23 fruit yield and quality parameters. In their final reports of all the genotypes, only a few desirable characters differed in terms of the color of the leaf, fruit skin color, fruit weight, and pulp weight.

García *et al*. (2006) evaluated that the correlation between vegetative characters and reproductive organs at the time of induction of flowering and 50 days later when the flowers at the base of the inflorescence were opened. The results on correlation indicate that there is a high degree of dependence between flowerings and fruiting. The highest correlation coefficients were obtained between inflorescence diameter and fruit weight.

Fournier *et al*. (2007) characterized that the growth characteristics of the pineapple cultivars MD-2 and Flhoran-41 compared with Smooth Cayenne. Their evaluation of data for D leaf growth was examined for all three varieties and their results were recorded as in Flhoran-41, a D leaf weight was 70 g which was sufficient to get commercial fruits, whereas 80 g leaf weight was the standard for MD-2 and Smooth Cayenne varieties. As a matter of fact, they have realized that on farms growing Flhoran-41, it was not easy to get sufficient D-leaf weight (80 g) in Côte d'Ivoire conditions, which was ultimately led to the forcing of plants that had reduced growth rates, even more, it was yielding smaller fruits with fewer fruitless. Furthermore, they also noticed such other factors as susceptibility to nematodes can affect growth and yield and make it more difficult for growers to adapt themselves to new varieties.

Heenkenda and Sangakkara (2008) reported the wide diversity in terms of leaf spines, the shape of the lamina, emergence of suckers, crown weight, length of fruit stalk, presence of nodes in fruit stalk, and slip production in Kew and Mauritius pineapples cultivated in various agro-ecological regions in Sri Lanka. The final results recorded the Kew pineapple populations were more diverse indicating its greater adaptability.

Ding and Syazwani (2016) conducted an extensive study on aim to determine physicochemical quality, antioxidant compounds, and activity of MD-2 pineapple fruit at five ripening stages such as mature green (137 days after flowering), 25 per cent yellow (147 days after flowering), 50 per cent yellow (157 days after flowering), 75 per cent yellow (167 days after flowering), and 100 per cent yellow (177 days after flowering). These results suggest that the affected physicochemical quality of MD-2 pineapple fruit, soluble solids concentration of fruit increased from 15.41 to 18.02 per cent when the fruit ripened from mature green to stage 75 per cent yellowing, and no significant difference was found in fruit between stage 75 per cent yellow and 100 per cent yellow fruit in color. When the fruits getting ripen, the vitamin C content decreases whereas total carotenoid content increases. The total phenolic content of both 80 per cent methanol and water extraction solvents increased significantly as the fruit ripened from stage mature green to 50 per cent yellow and reduced as the fruit ripened to stage 100 per cent yellow in color.

Zhang *et al.* (2016) collected the major phonological data from seedlings of Comte de Paris *cv. Ananas comosus*. In this study, the pineapple Biologische

Bundesanstalt, Bundessortenamt, and Chemische Industrie (BBCH) scale was used for clearly understanding the entire growth cycle of pineapple with recognizable principal growth stages ordered from 0 to 9. By following the extended BBCH scale, the growth stages started with bud emergence, followed by sucker formation stage, pseudostem elongation stage, leaf development of the sucker stage, inflorescence emergence stage, flowering stage, fruit development stage, fruit ripening stage, and senescence stage. As per the phonological data, they also reported that the entire vegetative growth stage generally requires approximately 12 months, and the number of new leaves is more than four months during the fast growth period from May to October at suitable climatic temperatures.

Barral *et al.* (2019) studied the fruitlet anatomy of the MD-2 and Queen cultivars by using X-ray, fluorescence, and multiphoton microscopy. They observed the outer layer of the MD-2 cavity was continuous with thick cell walls composed of ferulic and coumaric acids. Whereas the cell walls of the Queen were less lignified at the margins, and the outer layer was intermingled with cracks. The results suggested that the lignin deposition is responsible for resistance to *Fusarium ananatum*. The major phenolics compounds such as coumaric and ferulic acids were found in higher amounts in the resistant cultivar MD-2. Finally, they have reported the combination of fruitlet anatomy and lignification plays a major role in the mechanism of host resistance to fruitlet core rot.

Viana *et al*. (2020) evaluated that the influence of the maturity stages of the pineapple genotype FRF-632 on the basis of the physical, chemical, and organoleptic evaluation of fruits. In their evaluation study, the fruits were harvested in different maturity stages such as green-ripe, spotted, turning-color, and fully yellow skin and evaluated for the quantitative and qualitative fruit characters. With regards to results, they have observed that there was no difference in the majority of the physical parameters of fruits at various maturity stages. They had an average fruit weight was 1,100 g, whereas there was a constant increase in the TSS content as well as Total Soluble Solids (TSS)/Titratable acidity (TA) ratio during ripening. The fruits harvested at the turning-colored stage and the fully yellowish stage had the highest approval and also considered ideal sweetness and acidity from consumers. Therefore, the preference mapping revealed that the physical, chemical, and organoleptic evaluation of fruits indicated the fruits harvested in the turning-colored maturity stage were most liked by consumers because they had high approval percentage, as well as ideal sweetness and lower acidity.

Wang *et al.* (2020) revealed that proper flower development is essential for successfully producing fruits and seeds. The pineapple having an availability of a high-quality genome sequence that creates an excellent model for studying fruit and floral organ development. They have sequenced twenty-seven different pineapple floral samples and integrated nine published RNA sequence datasets to generate tissue and stage-specific transcriptomic data profiles. When they have made the pairwise comparisons and weighted gene coexpression network analysis they have successfully identified ovule, stamen, petal, and fruit-specific modules as well as hub genes involved in ovule, fruit, and petal development.

Hu *et al.* (2021) identified forty-three pineapple genes containing MADS-box domains, including eleven type I and thirty-two type II genes. They have produced RNA sequence data from five pineapple floral organs such as sepals, petals, stamens, pistils, and ovules. Apart from these, the quantitative RT-PCR expressed tissue-specific expression from some of the genes. The correlation found that AcAGL6 and AcFUL1 were mainly expressed in sepals and petals, suggesting their involvement in the regulation of these floral organs. Based on the phylogenetic analysis a pineapple ABCDE model was proposed and frequent species-specific gene duplication and subsequent expression divergence, the composition, and expression of the ABCDE genes were conserved in pineapple. They also found that AcSEP1/3, AcAG, AcAGL11a/b/c, and AcFUL1 were highly expressed at different stages of fruit development and have similar expression profiles, which are implicating an essential role in fruit development and ripening processes.

2.3.4. Clonal selection

Origin of somaclonal variation provides many benefits in crop improvement of clonally reproducing crops. Clonal variation, selection, and multiplication of elite clones offer a viable tool for crop improvement in pineapple. Clonal propagation has the desired advantage in pineapple as it permits faster multiplication and maintenance of any genotype as clones. Any clone which contains a combination of desirable characters can be multiplied and tested under different environments thereby locating the superior clones through selection. It is suggested to be a substitute for conservative breeding in order to obtain high-yielding variants or mutants. The available literature concerning the present study on “Evaluation of clonal variants of pineapple (*Ananas comosus* [L.] Merr.) cv. Mauritius” has been reviewed in the following pages.

Sudhadevi *et al*. (1995) proved that the *in vitro* plants of cultivar Kew took more duration for flowering around 21.2 months whereas the plants from suckers flowered at 16.5 months. But the fruits of the tissue-culture plants took a lesser period to attain harvesting maturity (126.2 days) whereas the fruits from suckers took 136.5 days. Increased ‘D’ leaf weight and reduced leaf area were recorded by the tissue culture plants compared to suckers. The average fruit weight was more in suckers (1.9 kg with 281 g crown weight) than the fruit weight of tissue culture plants (1.0 kg with a larger crown of 420 g). Other fruit parameters like pulp/peel ratio, canning ratio, taper ratio, and quality attributes of both tissue culture plants and sucker plants were almost similar. Results of the experiment clearly indicated that *in vitro* technique in pineapple could be accepted for large scale production of elite planting material to get quality fruits.

Das and Bhowmik (1997) described somaclonal variants of pineapple cv. Kew, Queen, Smooth Cayenne, and Kew × Queen obtained from *in vitro* and leaf-bud propagation techniques of axillary buds. They observed that the hybrid Kew × Queen exhibited 10.9 per cent and 5.7 per cent of mutations in the *in vitro* and leaf-bud propagated techniques, respectively.

Pérez *et al*. (1997) noted that the phenotypic, biochemical, and genotypic characterization of pineapple cv. Red Spanish plants obtained from somaclonal variation and mutagenesis. They also showed differences for various indexes in their leaf histology with respect to the original variety without changes in chromosome number. The high heterozygosity of the pineapple species was also demonstrated.

Radha and Aravindakshan (1998) revealed that tissue culture plants exhibited a slow growth rate and flower induction was delayed by 35-40 days. But there was no significant difference between the tissue culture and sucker planted crop in terms of the fruit characters and quality parameters. They have suggested that pineapple can be successfully cultivated by using *In Vitro* multiplied plantlets, provided initial growth-enhancing treatments have to be standardized to reduce the pre-flowering duration.

Kuriakose (2004) carried out an *In Vitro* mutagenesis in a variety of Mauritius by using seven doses of irradiated gamma rays *viz*., 10, 15, 20, 25, 30, 35, and 40 Gray (Gy). In their observation results were indicated that the faster growth of plants has been observed in terms of plant height and number of leaves at 30 Gy dose. They also recorded some of the albino and chimera plants from their study.

Rodrigues *et al.* (2006) studied the occurrence of somaclonal variation in *Ananas bracteatus* cv. Striatus and the *ex vitro* development of somaclonal variants. Three kinds of somaclonal variants were observed such as *Ananas bracteatus* cv. Verde (80.13 %), Ananas *bracteatus* cv. Albino (15.93 %), and *Ananas bracteatus* cv. Variegado (3.94 %). The characteristics of the somaclonal variants remained stable.

Ines *et al.* (2009) identified various clones of the major pineapple varieties such as Smooth Cayenne, Queen, and Red Spanish. The results suggested that in order to enhance the genetic diversity of pineapple, mutation breeding and induction of somaclonal variation could be employed.

Perez *et al.* (2011) employed several morphological and physiological traits to characterize the somaclonal variants generated. Among the somaclonal variant, P_3R_5 recorded significant differences from the donor genotype, in all indicators with the exception of the stoma diameter and the photosynthetic rate.

2.3.5. Hybridization

The general principle of breeding clonally propagated crops with appropriate ideotypes is to break the normal clonal propagation cycle by hybridization, which culminates in sexual seed production and genetic variation. The first-ever pineapple breeding was started by Webber (1905) in the USA followed by many researchers who worked on pineapple breeding in different places, Holt at the Federal Station in Honolulu in 1914 and by Doty (1923) at the Hawaiian Sugar Planters Association Experiment Station. In the continuation reports, the pineapple seeds were obtained from crosses made between Cayenne and Queen at the canneries in Honolulu

(William and Fleisch, 1993). In Kerala Agricultural University pineapple breeding work was reported maximum seed set in crosses between Mauritius x Kew and lowest survival percentage of seedlings (2.5 %) obtained after six months in crosses between Kew x Ripley Queen (Radha *et al.*, 1994). The available literature concerning the present study on "Evaluation of hybrids of pineapple (*Ananas comosus* [L.] Merr.)" has been reviewed in the following paragraphs.

Cabral *et al.* (2000) observed the hybrids Smooth Cayenne, Pérola, Perolera, Primavera, and Roxo de Tefé. The results indicated that all the seven seedlings obtained from Primavera had spineless green leaves as the parent. Both seedlings obtained from Perolera have green leaves, one of them being spiny and the other spineless.

Marie *et al.* (2000) emphasized that the 700 preselected Smooth Cayenne x Manzana hybrid plants were used for diversification and specialization for the fresh fruit market and processing industry in Cote d'Ivoire to Martinique. In their first evaluation study, they have discarded many hybrid clones on the basis of major unfavorable characters such as low vigor plants, multiple crowns, fascination in fruits, spiny plants, defective fruit, and small fruitlet eyes, small fruit size, lodging plants, more collar-slips and knobs, and low pulp taste. The remaining 205 evaluated clones were showed good vigor and a short duration crop with high sugar content. Next-generation of the evaluation study, they have selected twenty-nine genotypes which were showing good vegetative vigor and productivity with high yield and early fruiting compare to Smooth Cayenne. Moreover, they have observed that slip production was reduced by selection while suckering was comparable with Smooth Cayenne. Most of the hybrids were showing highly variable and improved quality fruits compare to Smooth Cayenne such as bigger fruits, high TSS, high ascorbic acid, and low titratable acidity.

Brat *et al.* (2004) reported that a new pineapple hybrid (FLHORAN-41) as compared to the Smooth Cayenne cultivar, it was showed higher titratable acidity and soluble solids content at the full maturity stage. Its golden-yellow flesh was 2.5 times richer in carotenoids, which was due to their provitamin antioxidant nature, which is a favorable characteristic of this hybrid. They also noticed that its shell develops an attractive red-orange to scarlet color due to a higher anthocyanin content.

Kuriakose (2004) evaluated that the F_1 hybrid pineapple genotypes which were generated from crossing between the six selected parental lines *viz*., Mauritius, Kew, Selection-1, Pampakuda local, Kakkoor local, and Ripley Queen for checking of their genetic variability. In their study reports, F_1 hybrids indicated a lot of wide variability and range of segregation available all over the characters studied. F_1 hybrid plants were unique in characteristics due to the availability of independent and transgressive segregation for each character. Moreover, F_1 hybrids were totally segregated from their parental population in terms of plants with low chlorophyll content, piping character, creamy white heart during inflorescence development, white flowers, and uniform ripening fruit.

Rajan and Prameela (2004) reported that in India, pineapple hybridization work was taken up at Pineapple Research Centre, Kerala Agricultural University, Vellanikkara, and developed a hybrid variety called Amritha crossing between Kew and Ripley Queen, which was estimated to high yield of 85 tonnes per hectare. Each fruit weighs more than 1.170 kg, has a single, small crown, golden yellow color with a desirable cylindrical shape. In addition, it holds peculiar characteristics in terms of flesh color, pleasant aroma, high total soluble solids, and low acidity.

Chan (2005) worked on hybridization and selection programs in pineapple improvement in Malaysia and observed that pineapple cultivars are highly heterozygous in nature, where crossing between two genotypes often leads to fertile seed production that presents a wide spectrum of genotypes. As a pineapple breeder, his important considerations were in the hybridization program included the choice of parents, methods of crossing, time of crossing, and suitable hybrid population size. Furthermore, this segregation F_1 population was provided an excellent source of gene bank which was evidence to the Malaysian Agricultural Research and Development Institute (MARDI) for successfully developed a commercial hybrid Josapine using this methodology, and several new promising hybrids particularly those were the piping type leaf character.

Chan and Lee (2005) evaluated that the three improved piping type leaf pineapple hybrids *viz*., 53-116, 73-50, and 59-656 along with Josapine and AF3-8 used as check varieties. They have reported that the piping type leaf hybrids were completely spineless along all the leaf margins compared with the check varieties which had spines at the tip portion of the leaves. In their evaluation results, these hybrids were excelled in resistance to flesh rot and high soluble solids content (13.9-16.3%). Among these hybrids, the most promising hybrid 73-50 was found a good response to flower induction, resistance to heart rot, and bigger size fruits along with a 76 per cent higher yield than Josapine cultivar. These genotypes have one of the major drawbacks was found that the evaluated hybrids were not producing ground and aerial suckers, therefore next-generation ratooning of these hybrids may be difficult.

Cabral and Souza (2006) performed that the crossing between the pineapple species *viz*., *Ananas comosus* var. comosus, *Ananas comosus* var. erectifolius, *Ananas comosus* var. bracteatus, *Ananas comosus* var. ananassoides, and *Ananas macrodontes*. From these seven crossings, a total number of 5,104 hybrid plants have been obtained and these progenies were evaluated under field conditions. In their field evaluation study, one genotype from the crossing between *Ananas comosus* var. bracteatus x *Ananas comosus* var. comosus has been selected for the beauty of its inflorescence and its spineless leaves.

Kumar (2006) reported that an experiment on interspecific hybridization and results from F_1 hybrids obtained were recorded *viz*., crossing between *Ananas comosus* x *Ananas ananassoides* produces high sugar and acid, small core, resistance to the nematode, wilt, heart rot, and root rot, whereas cross between *Ananas comosus* x *Ananas bracteatus* provides bigger fruit size than *Ananas ananassoides*, small core, resistant to wilt, heart rot, and root rot, and similar way *Ananas comosus* x *Ananas segenarius* crossings immune to heart rot root rot and wilt.

Ventura *et al*. (2007) revealed that the crosses between the pineapple cultivars Primavera (PRI) x Smooth Cayenne (SC), allowed the origin of hundreds of hybrids by the Brazilian pineapple breeding program. After preliminary evaluations, some promising hybrids were introduced to a recurrent clonal selection of the hybrid PRI × SC-08, after evaluation of 10 years succeeding led to the cultivar Vitória, released to growers at the regions of Espírito Santo State in Brazil. Based on evaluations carried out in Brazil, the new cultivar confirmed that the resistance to fusariosis, better quality fruits, and similar characters to the commercial cultivars Pérola and Smooth Cayenne. Moreover, Vitória has spineless leaves, cylindrical shape fruits, yellow skin when ripe, the weight of fruit about 1.5 kg, a high sugar content (15.8 °Brix), intermediate acidity, and excellent flavor. It is suitable for both fresh consumptions as well as processing.

Cabral *et al.* (2009) analyzed that the inheritance pattern of main traits for the selection of pineapple hybrids which were produced through different crosses. In their analysis of variance, they have evaluated 446 hybrid plants and among these, they have selected 213 genotypes for the following traits *viz*., plant height, peduncle length, fruit weight, crown weight, total soluble solids content, and titratable acidity. In their results, they were observed that the fruit weight was decreased in most of the selected hybrid crosses, whereas the total soluble solids content was increased in all the crosses made. The difference between the crosses was confirmed and also selected for correlation studies, a positive and significant correlation was recorded between fruit weight and plant height, a similar way strong correlation was observed between fruit weight and crown weight. Moreover, a lower magnitude was observed between plant height and crown weight followed by plant height and total soluble solids content. They have also noticed a negative correlation between total soluble solids content and peduncle length.

de Poel *et al.* (2009) found that MD-2 hybrid genotypes were showed sensitive towards the external ethylene application treatments at a very early developmental stage (3 months after planting). Their exclusive results were reported that the developmental stages and the proper commercial flower induction in pineapple can be determined convenient manner by proper measurement of the D leaf length and fresh weight of the D leaf.

Souza *et al.* (2009) carried out several hybridization crosses of the botanical varieties like *Ananas comosus* var. erectifolius, *Ananas comosus* var. bracteatus, and *Ananas comosus* var. ananassoides. Their research work was aimed to evaluate the F_1 hybrids generated from one of these crosses such as *Ananas comosus* var.

ananassoides × *Ananas comosus* var. erectifolius. The hybrid genotypes results were showed that the cross between *Ananas comosus* var. ananassoides × *Ananas comosus* var. erectifolius obtained genotypes can be used as cut flowers, cut leaves, and garden plants.

Sripaoraya (2009) reported that the crossing between Smooth Cayenne and Queen has been produced several F_1 hybrids. Out of these F_1 hybrids, he has confirmed two superior hybrid genotypes such as HQC34 and RC212 along with good agronomic qualitative and quantitative characteristics. These produced F_1 hybrids from Queen x Smooth Cayenne were confirmed that spiny trait is governed by the recessive allele (ss) while dominant allele either in the homozygous condition produces piping nature.

de Souza *et al.* (2010) carried out an evaluation on forty ornamental pineapple hybrids for resistance to *Fusarium* disease in Brazil. For their evaluation, they have selected forty hybrids after making five crosses such as FRF-22xFRF-1387, FRF-1392xFRF-32, G-44xFRF-1387, FRF-1392xFRF-224, and FRF-1387xFRF-224. Their experimental results were showed that fourteen hybrids were resistant, fifteen were moderately resistant, and eleven were susceptible to *Fusarium* disease. Their final recommended cross was FRF-1392×FRF-224, which had shown 100 per cent resistance against *Fusarium* disease.

Acosta *et al.* (2011) introduced a commercial F_1 hybrid ULAM, which was produced by a cross of Cayenne x *Ananas bracteatus*. This hybrid variety had tested for Distinctiveness, Uniformity, and Stability (D.U.S) and issued a plant variety protection certificate from the Philippine government. The trial evaluation results showed encouraging characteristics of this hybrid such as plant height is 1.1 to 1.8 m with more number of slips and suckers, leaves are spiny along the margins, leaf blades are narrow and enlarged at the base, fruit weight ranges 1.1 to 1.8 kg, small tapering eyes along with long fruit neck, crown height ranges 10 to 14 cm, TSS is around 18-22 °Brix and tolerant to heart and root rot.

Hadiati *et al.* (2011) conducted research to evaluate the morphology and biochemical parameters of pineapple hybrids after making crosses between Smooth Cayenne and Queen cultivars. They have evaluated a total of 115 hybrids plants where seventy-five hybrid plants belonged to Cayenne x Queen crossing and forty hybrids were belongs to their reciprocal crosses. Their results from morphology characters reported that the distribution of spines and eye shape of the fruits affected by female genotypes. The percentage of spiny leaves was 14.3 per cent and the bearing fruit weight was 14.2 per cent less in the Cayenne x Queen hybrids respectively, when compared with Queen x Cayenne hybrids. In a similar way, plants bearing broad eyes fruit was 23.8 per cent and high TSS content was 6.7 per cent respectively higher in the Cayenne x Queen hybrids. Their potential results of Cayenne x Queen hybrids which include characters like spineless or spiny at the tip, more than one kg fruits, high TSS, and flat broad eyes fruits were recorded in CQ-4, CQ-20, CQ-22, CQ-26, and CQ-41.

Hadiati and Yuliati (2012) aimed was to evaluate pineapple hybrids after crossing the following genotypes such as Cayenne, Queen, *Ananas bracteatus*, and Merah parental genotypes for qualitative and quantitative characters. Totally 108 hybrid genotypes were evaluated *viz*., fifty-eight hybrid genotypes from Cayenne x Queen, twenty-four hybrids were from Cayenne x *Ananas bracteatus*, and the remaining twenty-six hybrids were from Cayenne x Merah crossings. Their results recorded that the cross between Cayenne x Queen hybrids were produced small crowns (100 g) and sweeter taste (20 °Brix) fruits. The crosses from Cayenne x *Ananas bracteatus* hybrids were mostly small core diameter (1.5 cm). Moreover, Cayenne x Merah hybrids were found big size fruit (1500 g) and high flesh thickness (4 cm). On the other hand, the hybrid genotypes which were possessing better characters such as spineless or spines at the tip, high total soluble solids (20 °Brix), and flat broad to prominent eyes were characterized in CQ-20, CB-1, CQ-16, and CQ-41 improved hybrid genotypes.

Viana *et al.* (2013) evaluated that the physicochemical characteristics of four new improved hybrids in Brazil such as SC×PRI-21, SC-48×PRI-02, and PE×SC-73 and PA×PE-01. Their results of evaluated hybrids were showed that SC-48×PRI-02, PE×SC-73, and PA×PE-01 had higher TSS, along with reducing and total sugars contents when these hybrids were compared with check varieties like Smooth Cayenne, BRS Vitória, and Pérola. They have characterized the hybrid PE×SC-73 for its intense yellow pulp, high TSS, carotenoids, and vitamin C, due to these improved parameters it was considered as a promising cultivar in Brazil.

Costa Junior *et al.* (2016) evaluated two ornamental pineapple hybrids (PL01 and PL04) by using pineapple descriptors to recommend these hybrids as new cultivars for flower production. They have studied the response to floral induction as well as the stability and homogeneity of the hybrids in two production cycles. In the flower evaluation reports, they have determined the number of days taken from planting to harvest of the stem as a cut flower was 17 months in the first production cycle and 13.5 months in the second production cycle for both the hybrids. Final results, they have found that these novel genotypes were outstanding in terms of genetic stability and homogeneity.

2.3.6. Biotechnological methods

The biotechnological methods involving DNA isolation, gel electrophoresis, NanoDrop analysis, molecular markers, and Polymerase Chain Reactions (PCR) are as follows for molecular characterization. To intensify these techniques DNA based fingerprinting has been implemented in the characterization of pineapple genotypes. A large number of molecular markers have been developed and used for genetic diversity analysis. It has been suggested that the markers should be chosen on the basis of the objectives of the study. In general, molecular markers for the identification of genotypes, detection of the structure of the genetic variability, and relatedness of availability of plant sources have been utilized for PCR characterization (Wang *et al*., 2017).

Charlotte *et al*. (2016) developed a new modified standard protocol for the extraction of genomic DNA from pineapple leaves. They have modified the CTAB method for the isolation of high molecular genomic DNA from the eighteen pineapple young leaves (three to four weeks old) samples including three parts of the leaves *viz*., the leaf apex, the mid-blade, and the tender leaf base of two pineapple cultivars Sugarloaf and Smooth Cayenne. As per the evidence proposed that the successfully extracted DNA was 51.76 µg/ml DNA obtained from the tender leaf base portion, which was recorded higher DNA content than old protocols which can be followed for other species of Bromeliaceae. The DNA extracted with the new protocol was successfully tested PCR amplification by using Simple Sequence Repeat (SSR) markers.

Souza *et al*. (2017) evaluated that the genetic variability of thirteen pineapple genotypes to ascertain their use of fiber composites as mechanical reinforcement in industry and examines the possible association from seventeen Inter Simple Sequence Repeats (ISSR) primers for fiber quality components by nonparametric spearman correlation test. By using qualitative and quantitative data analysis, their study of genetic diversity showed that there are almost all genotypes were genetically close to a relative of pineapple (curauá), whose leaf fibers are generally utilized in the industry. Out of these 217 ISSR amplified bands, 11 were selected on the basis of their high correlation (0.63 to 0.77) with all four variables for fiber quality components. Their further recommendation was to enable the identification of a set of molecular markers that can be used for the selection of promising genotypes after sequencing and validation.

2.4. Molecular characterization of pineapple

The abundance, multi-allelic behaviour, high polymorphism, dominant inheritance, and excellent reproducibility of Inter Simple Sequence Repeats (ISSR) markers make these ideal for genetic diversity studies and marker-assisted selection in plant breeding. The analytical procedures include PCR, only low quantities of template DNA are required (50-100mg pre reaction). ISSRs are largely distributed throughout the genome as well.

Carlier *et al*. (2006) developed two genetic maps by using three polymorphic markers of *Ananas comosus* var. bracteatus and *Ananas comosus* var. comosus. In their new map, they have integrated the previously published maps and included markers that had remained unlinked, as genotypes were homozygous in nature, as well as recently identified primers. As the new map consists of seven linkage groups that were integrated markers from both parents, the first cluster consisted of 21 markers from a parent, the second cluster was grouped with six markers from one parent, and 12 smaller linkage clusters, which were covered around 62 % of the pineapple genome. Whereas, 21 out of 32 ISSR markers were amplified for adequate mapping.

Prakash *et al*. (2009) confirmed the variability in a newly developed superior clone PQM-1 with parent cultivar Queen as evident through morphological characters, fruit quality analysis, and PCR amplified DNA fingerprints. In the study, the ISSR analysis result has highly discriminated the clone with the parental line. Three ISSR primers indicated the genetic differences of PQM-1 with parent source Queen.

Vanijajiva (2012) utilized Inter Simple Sequence Repeats (ISSR) markers to assess genetic diversity and genetic relationships among 15 accessions of pineapple [*Ananas comosus* (L.) Merr.] in Thailand and concluded that ISSR analysis is a rapid and suitable method for studying genetic diversity among indigenous and hybrids.

Donzo (2015) conducted that a clonal fidelity analysis of pineapple (*Ananas comosus* L.) was using Inter Simple Sequence Repeats (ISSR) markers and reported a 27 per cent variation between clones and mother plants.

da Silva *et al*. (2016) evaluated that the viability of pineapple plants conserved *in vitro* for 10 years, by triggering resumed growth and measuring the propagative potential and genetic fidelity using Inter Simple Sequence Repeats (ISSR) markers. They have reported that there is no somaclonal variation was detected in some of the clones of the *Ananas comosus* var. Comosus and *Ananas comosus* var. Ananassoides, however probable somaclonal variants were detected in two accessions of *Ananas comosus* var. Bracteatus, when compared to the control plants in the field conditions.

Wang *et al*. (2017) assessed that the genetic diversity of 36 pineapple genotypes by using two different molecular markers Inter Simple Sequence Repeats (ISSR) and Simple Sequence Repeats (SSR). In their results, thirteen ISSR primers were amplified by 96 bands, from which 91 bands were polymorphic, whereas twenty SSR primers were amplified with 73 bands, of which 70 bands were polymorphic. Besides this, Polymorphism Information Content (PIC = 0.29) produced by using the SSR marker was higher compared to ISSR markers (PIC = 0.24), which makes the SSR system is more useful than the ISSR system for assessing the diversity in various pineapple genotypes.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The investigations envisage evaluating the qualitative and quantitative characters of potential hybrids selected through a hybridization program to evolving Kew and Mauritius types along with the somaclonal variants of the Mauritius variety. It is also aimed to molecular characterization of the promising genotypes with ISSR markers to detect molecular diversity and aid varietal identity. The procedures adopted are discussed below.

3.1. Experimental site

The experiments were conducted for the period from August 2017 to August 2021 at Fruits Crops Research Station, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala.

3.1.1. Location

The Fruits Crops Research Station, Kerala Agricultural University, Vellanikkara situated at 10° 31' N latitude to 76° 3' E longitude and at an altitude of 22.25 m above MSL.

3.1.2. Soil

The pineapple research orchard soil type is laterite and soil pH is ranges 5.0-6.0.

3.1.3. Climate

The climate is tropical humid climate. The climatological data during the period of investigation are given in Appendix I.

3.2. Materials

3.2.1. Somaclones

Seventy five clones of Mauritius variety developed at Centre for Plant Biotechnology and Molecular Biology, College of Agriculture, Vellanikkara were used for field evaluation study.

3.2.2. Mauritius x Kew

Twenty five Mauritius x Kew hybrids selected based on fruit weight and fruit quality in a preliminary study were used for field experiment.

3.2.3. Kew x Mauritius

Ten Kew x Mauritius hybrids selected based on fruit yield and quality in a previous study were used for field evaluation.

3.3. Methods

3.3.1. Experiment I: Evaluation of somaclones

Seventy five clones of Mauritius variety developed at CPBMB, College of Agriculture, Vellanikkara were planted by following an augmented block design and evaluated at Fruits Crops Research Station, Thrissur, Kerala (Plate 3.3.1.1 and Plate 3.3.1.2). Cultural practices were carried out according to POP recommendations of KAU (KAU, 2016). Morphological, quality and biochemical characterization of the somaclones have been done.

Number of treatments: 75

Genotypes (T)

T_1 to T_{75}: Somaclonal variants of variety Mauritius (MV_1-MV_{75})

3.3.2. Experiment II: Evaluation of hybrids

Twenty five Mauritius x Kew and ten Kew x Mauritius hybrids selected based on fruit weight (more than 1 kg per fruit) and fruit quality parameters like fruit shape, TSS and sweetness (10 ^{o}Brix) in a preliminary study were evaluated following randomized block design with two replication during normal season along with varieties Mauritius, Kew and Amritha (Plate 3.3.2.1 to Plate 3.3.2.3). Two line planting was done and experiments were carried out according to POP recommendations of KAU (KAU, 2016). Ten number of suckers were planted under each treatment and five number of plants taken for recording observations. Observations on morphological, quality and biochemical characters of each genotype were recorded.

Experiment II (a)

Design of experiment: RBD

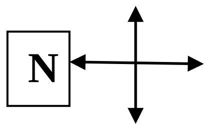
Number of treatments: 28

Plate 3.3.1.1. Experimental plot of somaclones at early stage

Plate 3.3.1.2. Experimental plot of somaclones at maturity stage

T_{58} (MV_{58})	**T_{59} (MV_{59})**	**T_{60} (MV_{60})**	**T_{61} (MV_{61})**	**T_{62} (MV_{62})**	**T_{63} (MV_{63})**	**T_{64} (MV_{64})**	**T_{65} (MV_{65})**	**T_{66} (MV_{66})**	**T_{67} (MV_{67})**	**T_{68} (MV_{68})**	**T_{69} (MV_{69})**	**T_{70} (MV_{70})**	**T_{71} (MV_{71})**	**T_{72} (MV_{72})**	**T_{73} (MV_{73})**	**T_{74} (MV_{74})**	**T_{75} (MV_{75})**	**Mauritius**
T_{39} (MV_{39})	**T_{40} (MV_{40})**	**T_{41} (MV_{41})**	**T_{42} (MV_{42})**	**T_{43} (MV_{43})**	**T_{44} (MV_{44})**	**T_{45} (MV_{45})**	**T_{46} (MV_{46})**	**T_{47} (MV_{47})**	**T_{48} (MV_{48})**	**T_{49} (MV_{49})**	**T_{50} (MV_{50})**	**T_{51} (MV_{51})**	**T_{52} (MV_{52})**	**T_{53} (MV_{53})**	**T_{54} (MV_{54})**	**T_{55} (MV_{55})**	**T_{56} (MV_{56})**	**T_{57} (MV_{57})**
T_{20} (MV_{20})	**T_{21} (MV_{21})**	**T_{22} (MV_{22})**	**T_{23} (MV_{23})**	**T_{24} (MV_{24})**	**T_{25} (MV_{25})**	**T_{26} (MV_{26})**	**T_{27} (MV_{27})**	**T_{28} (MV_{28})**	**T_{29} (MV_{29})**	**T_{30} (MV_{30})**	**T_{31} (MV_{31})**	**T_{32} (MV_{32})**	**T_{33} (MV_{33})**	**T_{34} (MV_{34})**	**T_{35} (MV_{35})**	**T_{36} (MV_{36})**	**T_{37} (MV_{37})**	**T_{38} (MV_{38})**
T_{1} (MV_{1})	**T_{2} (MV_{2})**	**T_{3} (MV_{3})**	**T_{4} (MV_{4})**	**T_{5} (MV_{5})**	**T_{6} (MV_{6})**	**T_{7} (MV_{7})**	**T_{8} (MV_{8})**	**T_{9} (MV_{9})**	**T_{10} (MV_{10})**	**T_{11} (MV_{11})**	**T_{12} (MV_{12})**	**T_{13} (MV_{13})**	**T_{14} (MV_{14})**	**T_{15} (MV_{15})**	**T_{16} (MV_{16})**	**T_{17} (MV_{17})**	**T_{18} (MV_{18})**	**T_{19} (MV_{19})**

Fig. 3.3.1.1. Layout of somaclonal variants of pineapple variety Mauritius



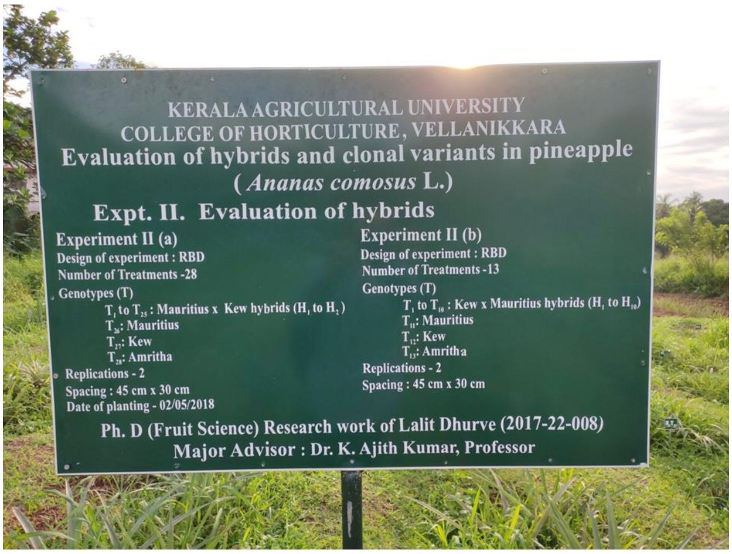


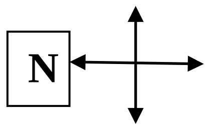
Plate 3.3.2.1. Experimental plot of hybrids

Plate 3.3.2.2. Experimental plot of hybrids at 39 leaf stage

Plate 3.3.2.3. Experimental plot of hybrids at fruit maturity stage

Mauritius x Kew hybrids							
R_1T_1 (H 17)	R_1T_3 (H 85)	R_1T_5 (H 48)	R_1T_7 (H 43)	R_2T_1 (H 17)	R_2T_3 (H 85)	R_2T_5 (H 48)	R_2T_7 (H 43)
R_1T_6 (H 62)	R_1T_8 (H 66)	R_1T_2 (H 16)	R_1T_4 (H 91)	R_2T_6 (H 62)	R_2T_8 (H 66)	R_2T_2 (H 16)	R_2T_4 (H 91)
R_1T_9 (H 77)	R_1T_{11} (H 63)	R_1T_{13} (H 78)	R_1T_{15} (H 59)	R_2T_9 (H 77)	R_2T_{11} (H 63)	R_2T_{13} (H 78)	R_2T_{15} (H 59)
R_1T_{14} (H 70)	R_1T_{16} (H 60)	R_1T_{10} (H 92)	R_1T_{12} (H 27)	R_2T_{14} (H 70)	R_2T_{16} (H 60)	R_2T_{10} (H 92)	R_2T_{12} (H 27)
R_1T_{17} (H 49)	R_1T_{19} (H 10)	R_1T_{21} (H 30)	R_1T_{23} (H 7)	R_2T_{17} (H 49)	R_2T_{19} (H 10)	R_2T_{21} (H 30)	R_2T_{23} (H 7)
R_1T_{22} (H 14)	R_1T_{24} (H 35)	R_1T_{18} (H 54)	R_1T_{20} (H 15)	R_2T_{22} (H 14)	R_2T_{24} (H 35)	R_2T_{18} (H 54)	R_2T_{20} (H 15)
R_1T_{25} (H 19)	R_1T_{26} (Mauritius)	R_1T_{27} (Kew)	R_1T_{28} (Amritha)	R_2T_{25} (H 19)	R_2T_{26} (Mauritius)	R_2T_{27} (Kew)	R_2T_{28} (Amritha)
Kew x Mauritius hybrids							
R_1T_1 (H 98)	R_1T_3 (H 115)	R_1T_5 (H 99)	R_1T_7 (H 110)	R_2T_1 (H 98)	R_2T_3 (H 115)	R_2T_5 (H 99)	R_2T_7 (H 110)
R_1T_4 (H 101)	R_1T_6 (H 104)	R_1T_8 (H 116)	R_1T_2 (H 118)	R_2T_4 (H 101)	R_2T_6 (H 104)	R_2T_8 (H 116)	R_2T_2 (H 118)
R_1T_9 (H 121)	R_1T_{11} (Mauritius)	R_1T_{13} (Amritha)	R_1T_{10} (H 111)	R_2T_9 (H 121)	R_2T_{11} (Mauritius)	R_2T_{13} (Amritha)	R_2T_{10} (H 111)
R_1T_{12} (Kew)				R_2T_{12} (Kew)			

Fig. 3.3.2.1. Layout of field evaluated pineapple hybrids



Genotypes (T)

T_1 to T_{25}: Mauritius x Kew hybrids (H_1 to H_{25})

T_{26}: Mauritius

T_{27}: Kew

T_{28}: Amritha

Replication: 2

Experiment II (b)

Design of experiment: RBD

Number of treatments: 13

Genotypes (T)

T_1 to T_{10}: Kew x Mauritius hybrids (H_1 to H_{10})

T_{11}: Mauritius

T_{12}: Kew

T_{13}: Amritha

Replication: 2

3.3.3. Experiment III: Molecular characterization of promising hybrids and somaclones

Superior genotypes of experiment I and II were selected for molecular analysis.

DNA extraction was done from young leaves (three to four weeks old) of each of the genotype using modified CTAB method (Doyle and Doyle, 1987).

In order to ascertain their genetic background, fifty and fifteen ISSR markers had been used in experiments I and II respectively for genotyping the cultivars.

3.4. Design of the experiments

The laid out plan of the Experiment-I is presented in Plate 3.3.1.1, Plate 3.3.1.2 and Fig. 3.3.1.1. Whereas, field view layout of the Experiment-II is presented in Plate 3.3.2.1, Plate 3.3.2.2, Plate 3.3.2.3, and Fig. 3.3.2.1.

3.5. Observations

3.5.1. Vegetative characters (Monthly intervals)

3.5.1.1. Plant height

The height of the plant from the ground level to the tip of the longest leaf was measured at its 39 leaf stage in monthly intervals and expressed in centimetres.

3.5.1.2. Number of leaves per plant

The total number of leaves was recorded at its 39 leaf stage in monthly intervals and the units were expressed in numbers.

3.5.1.3. Length of ‘D’ leaf

The ‘D’ leaf length was recorded at its 39 leaf stage in monthly intervals and the units were expressed in centimetres.

3.5.1.4. Breadth of ‘D’ leaf

The ‘D’ leaf breadth was recorded at its 39 leaf stage in monthly intervals and the units were expressed in centimetres.

3.5.1.5. ‘D’ leaf area

The ‘D’ leaf area was worked out using the formula suggested by Balakrishnan *et al.* (1978) and the units were expressed in square centimetres.

LA= L x B x 0.725

Where LA= Leaf area in cm^2, L= length of ‘D’ leaf in cm, B= breadth of ‘D’ leaf in cm, and 0.725 is the constant.

3.5.1.6. Leaf Area Index (LAI)

Leaf area index is the ratio of the total leaf area of per plant to the total land area occupied per plant (cm^2). LAI was worked out from the formula suggested by Watson (1952) for all the treatments at different stages of growth.

$$\text{LAI} = \frac{\text{Total leaf area per plant (cm}^2\text{)}}{\text{Total land area occupied per plant (cm}^2\text{)}}$$

3.5.1.7. Distribution of spines

Distribution of spines was observed on middle leaves with the following internationally accepted norms for the scoring and coding of descriptor states, which are continuously variable with respect to spines behind tip or near base only, spines behind tip or near base, spines along all margins, and spines occur irregularly along both margins as describe in descriptors for pineapple (IBPGR, 1991) and the units were expressed in descriptive numbers on a 1-9 scale.

3.5.1.8. Direction of spines

Direction of spines was observed on middle leaves with the following internationally accepted norms for the scoring and coding of descriptor states, which are continuously variable with respect to ascendant, descendent, and both as describe in descriptors for pineapple (IBPGR, 1991) and the units were expressed in descriptive numbers on a 1-9 scale.

3.5.1.9. Colouration of leaf spines

Colour of leaf spines were specified with the following internationally accepted norms for the scoring and coding of standard colour chart for plant tissues (Royal Horticultural Society Colour Chart), which are strongly recommended for all graded colour characters with respect to yellowish/greenish, orange, reddish/pinkish *etc*. as describe in descriptors for pineapple (IBPGR, 1991) and the units were expressed in descriptive numbers on a 1-9 scale.

3.5.1.10. Spine stiffness

Spine stiffness was recorded with the following internationally accepted norms for the scoring and coding of descriptor states, which are continuously variable with respect to weak, intermediate, and stiff (IBPGR, 1991) and the units were expressed in descriptive numbers on a 1-9 scale.

3.5.1.11. Spine length

Spine length was observed on middle leaves and the measurements were made according to the SI system and the units were expressed in millimetres.

3.5.1.12. Number of suckers per plant

The mean number of suckers produced per plant was recorded after harvest of the crop and the units were expressed in numbers.

3.5.1.13. Position of suckers

Suckers are found in two positions with respect to the mother plant such as underground sucker (arising from stem buds below the ground level) and aerial sucker (arising from buds in leaf axils above the ground level). The number of suckers per plant in each position was recorded and the units were expressed as percentage.

3.5.1.14. Number of slips per plant

The mean number of slips produced just bottom of fruits per plant was recorded after harvest of the crop and the units were expressed in numbers.

3.5.2. Flowering characters

3.5.2.1. Days to attain ideal leaf stage for flowering

The time taken from planting to attain ideal leaf stage for flowering (39-42 leaf stage when maximum physiological maturity is occurred in the plant) in each treatment was recorded and the units were expressed in number of days.

3.5.2.2. Days for initiation of flowering (visual)

The mean number of days taken from ethrel application to the appearance of reddish colour at the heart of the plant was recorded and the units were expressed in number of days.

3.5.2.3. Days for 50 per cent flowering

The mean number of days taken from ethrel application to emergence of inflorescence in 50 per cent of the plants in each treatment was recorded and the units were expressed in number of days.

3.5.2.4. Flowering phase

The number of days from the opening of the first flower to the opening of the last flower in an inflorescence was recorded and the units were expressed in number of days.

3.5.3. Fruit and yield characters

3.5.3.1. Days for fruit maturity

The mean number of days taken from opening of the first flower to development of three quarters of the colour on the fruit when the aggregate fruit reaches the standard cultivar size for harvest was worked out for each treatment and the units were expressed in number of days.

3.5.3.2. Crop duration

The mean number of days taken from planting to fruit maturity/harvestibility was counted out and the units were expressed in number of days.

3.5.3.3. Presence of crown

Presence of crown observed on fully mature fruits and presence/absence of character was scored as per the descriptors for pineapple (IBPGR, 1991). It was classified and expressed as absent (0) and present (+).

3.5.3.4. Crown shape

Crown shape was observed on fully mature fruits and scoring was recorded according to descriptors for pineapple (IBPGR, 1991). These were classified with the following internationally accepted norms of descriptor states, which are continuously variable with respect to seven groups namely cone, oblong blocky, acron (heart shaped), long-conical, lengthened cylindrical, lengthened cylindrical with bunchy top, and other *etc*. respectively. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.5. Crown characters

Crown characters were observed on fully mature fruits and scoring was recorded with the following internationally accepted norms of descriptors for pineapple (IBPGR, 1991). These were classified into three groups namely normal, multiple, and single with crownlets (crownslips) and the units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.6. Number of crowns surmounting fruit

Number of crowns surmounting fruit was observed on fruit maturity and scoring was recorded average of five fruits by following internationally accepted norms of descriptors for pineapple (IBPGR, 1991). The units were expressed in numbers.

3.5.3.7. Attitude of crown foliage

Attitude of crown foliage was observed on full fruit maturity and scoring was recorded with the following norms of descriptor states, which are continuously variable according to descriptors for pineapple (IBPGR, 1991). These were classified into four groups namely erect, semi-erect, horizontal, and drooping. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.8. Colour of crown leaves

Colour of crown leaves were observed on full maturity of fruits and scoring was done according to descriptors for pineapple (IBPGR, 1991). These were classified with descriptive states, which are continuously variable into ten groups *viz.,* greenish/green, green with yellow mottling, green with red mottling, reddish orange, red, dark red, purplish/pinkish, dark red-purple/pink, silvery white, and other. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.9. Presence of spines on crown leaves

Presence of spines on crown leaves was observed on fully mature fruits and presence/absence of character was scored according to descriptors for pineapple (IBPGR, 1991). These were classified into four groups such as smooth, spines at the tip, spiny-serrate, and piping. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.10. Crown attachment to fruit

Crown attachment to fruit was observed on fully matured fruits and score was recorded as per the descriptors for pineapple (IBPGR, 1991). These were classified into descriptive scores, which are continuously variable with respect to, without neck (sessile-like), with short neck, and with distinct neck. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.11. Colour of crown attachment area/basal leaves (collar)

Colour of crown attachment area/basal leaves (collar) were observed on fully matured fruits and score was recorded according to descriptors for pineapple (IBPGR, 1991). These were classified into fourteen groups *viz.*, yellowish/yellow, silvery green, greenish/green, dark green/blackish green, green with orange mottling, green with red mottling, light/dark-orange, light/dark-red, pinkish/pink, red purplish, dark red-purple, purple, purplish blue, and other *etc.* respectively. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.12. Fruit shape

Fruit shape was observed on fruit maturity/harvestibility and scoring was recorded according to descriptors for pineapple (IBPGR, 1991). These were classified into eleven groups *viz*., square-like, oval, round, conical, long-conical, pyramidal (cylindrical with maximum diameter near base), cylindrical (tapering slightly from near base), cylindrical (tapering sharply from near base), pyriform (pear shaped), reniform, and other *etc*. respectively. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.13. Fruit colour when ripe

Fruit colour was observed at physiological ripeness and scoring was recorded according to descriptors for pineapple (IBPGR, 1991). These were classified into ten groups *viz*., green, silvery green, yellow with green mottling, dull yellow, bright yellow, golden yellow, deep yellow to orange, reddish orange, brownish, and other *etc*. respectively. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.14. Presence of "eye" (Berry) corking

Presence of "eye" (Berry) corking was observed at physiological ripeness of fruits and presence/absence of character was noted as per the descriptors for pineapple (IBPGR, 1991). These were notified and expressed as absent (0) and present (+).

3.5.3.15. Presence of crowns coming from an "eye" (Berry)

Presence of crowns coming from an "eye" (Berry) was observed at physiological ripeness of fruits and presence/absence of character was recorded according to descriptors for pineapple (IBPGR, 1991). These were classified and expressed as absent (0) and present (+).

3.5.3.16. Number of eyes

Number of eyes was observed at physiological ripeness of fruits and mean number of eyes were counted, average of five fruits according to descriptors for pineapple (IBPGR, 1991). The units were expressed in numbers.

3.5.3.17. Profile of eyes

Profile of eyes was observed at physiological ripeness of fruits and scoring was done according to descriptors for pineapple (IBPGR, 1991). These were classified into three group's namely flat, normal, prominent and the units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.18. Relative surface of eyes

Relative surface of eyes was observed at physiological ripeness of fruits and score was given according to descriptors for pineapple (IBPGR, 1991). These were classified into three group's *viz.*, small, medium, and large. The units were expressed in descriptive numbers on a 1-9 scale.

3.5.3.19. Length of the fruit

The length of fruit was recorded and the units were expressed in centimetres.

3.5.3.20. Girth of the fruit

The girth of the fruit in the middle portion was recorded and the units were expressed in centimetres.

3.5.3.21. Breadth of the fruit

The mean fruit breadth was calculated by average breadth of top, middle, and bottom portion of the fruit. The breadth of the fruit at three portions, namely top three-fourth, middle and bottom one-fourth were recorded and the units were expressed in centimetres.

3.5.3.22. Taper ratio of the fruit

The ratio of the diameter of the fruit at ¾ and ¼ height of the fruit was calculated by using the formula and the units were expressed in percentage.

$$\text{Taper ratio} = \frac{\text{Breadth at top } ¾}{\text{Breadth at bottom } ¼}$$

3.5.3.23. Fruit weight with crown

The weight of fruits with crown intact, was recorded immediately after harvest and the units were expressed in kilograms.

3.5.3.24. Fruit weight without crown

The weight of fruits without crown, was recorded immediately after removing of crowns and the units were expressed in kilograms.

3.5.3.25. Crown weight

The weight of crown was recorded after removing from harvested fruits and the units were expressed in kilograms.

3.5.3.26. Yield per plant

The mean fruit yield per plant was worked out from the fruit weight and the units were expressed in kilograms per plant.

3.5.3.27. Estimated yield

The estimated yield per hectare was worked out by multiplying of yield per plant with number of plants per hectare and the units were expressed in tonnes per hectare.

Estimated yield (t/ha) = Yield per plant (kg) x number of plants per hectare

3.5.3.28. Shelf life

The self-life was calculated as number of days from harvest till the fruits remained marketable. The fruits were rated as not marketable when more than 50 per cent of fruits in a lot showed incidence of spoilage. The units were expressed in average number of days.

3.5.3.29. Peel weight

Peeling of fruits was done carefully and peel weight was noted down and the units were recorded in kg.

3.5.3.30. Pulp weight

After removing the peel and central core, the weight of the pulp in kg was recorded for each fruit.

3.5.3.31. Pulp percentage

Pulp percentage was worked out from the above observations and the units were expressed in percentage.

$$\text{Pulp percentage} = \frac{\text{Pulp weight}}{\text{Weight of fruit without crown}} \times 100$$

3.5.4. Qualitative analysis of fruits

3.5.4.1. Juice

A known weight of the fruit pulp was squeezed in a muslin cloth to extract the juice content was calculated using the formula and expressed as percentage.

$$\text{Juice (\%)} = \frac{\text{Weight of juice}}{\text{Weight of fruit pulp}} \times 100$$

3.5.4.2. TSS

Total soluble solids were found out using a digital refractometer and expressed as degree brix (°Brix).

3.5.4.3. Acidity

Ten *grams* of macerated fruit sample was mixed with distilled water and made upto a known volume. An aliquot of the filtered solution was titrated against 0.1N sodium hydroxide using phenolphthalein as indicator. The acidity was calculated using the formula and expressed as percentage of citric acid (AOAC, 2000).

$$\text{Acidity (\%)} = \frac{\text{Titre x Normality of alkali x Volume made up x Equivalent weight of acid}}{\text{Volume of sample taken for estimation x Weight / volume of sample taken x 1000}} \times 100$$

3.5.4.4. Total sugars

For this we have taken 50 ml filtered solution which was made for reducing sugar and added 50 ml distilled water after that we have added 5 g citric acid and boil the solution till upto citric acid dissolved. After that solution was transferred to 250 ml volumetric flask and put small pH paper into volumetric flask that time colour changes to light pink then we have added 1N NaOH until pH paper colour turned to blue. Afterwards we have made that solution to 250 ml by adding distilled water and transferred into burette for titration. Titrate against 5 ml each of Fehling solution A and B mixture taken in the conical flask and we have given heat to the conical flask solution by adding 2 drops of methylene blue as indicator at the time of titration. The titration have been done till upto colour changes to brick red colour. The total sugar was calculated using the formula and the units were expressed as percentage (AOAC, 2000).

$$\text{Total sugar (\%)} = \frac{\text{Factor x Dilution x 100}}{\text{Titre value x Volume of filtrate x Weight of sample taken}}$$

3.5.4.5. Reducing sugars

Ten *grams* of macerated fruit sample was mixed with distilled water and then transfer to 250 ml volumetric flask after that we have added 2 ml lead acetate 45 % then after 10 minutes we have added 2 ml potassium oxalate 22 % then shake well and made upto 250 ml volume by adding distilled water. After that we have filtered the solution and supernatant solution have taken in a burette and titrate against 5 ml each of Fehling solution A and B mixture taken in the conical flask. We have given heat to the conical flask solution by adding 2 drops of methylene blue as indicator at the time of titration. The titration have been done till upto colour changes to brick red colour. The reducing sugar was calculated using the formula and expressed as percentage (AOAC, 2000).

$$\text{Reducing sugar (\%)} = \frac{\text{Factor x Dilution x 100}}{\text{Titre value x Weight of sample taken}}$$

3.5.4.6. Non-reducing sugars

Non-reducing sugars were calculated by subtracting the amount of reducing sugars from the total sugars. The Non-reducing sugar was calculated using the formula and expressed as percentage (AOAC, 2000).

Non-reducing sugars (%) = Total sugar (%) -Reducing sugar (%)

3.5.4.7. Sugar/acid ratio

Sugar/acid ratio was worked out by dividing the value of total sugars by the value of titrable acidity and units were expressed as percentage.

3.5.4.8. Fibre

The crude fibre content was estimated by the acid-alkali method as suggested by Chopra and Kanwar (1978). Two *grams* of dried and powdered sample was boiled with 200 ml of 1.25 per cent sulphuric acid for thirty minutes. It was filtered through a muslin cloth and washed with boiling water. The residue was again boiled with 200 ml of 1.25 per cent sodium hydroxide for 30 minutes. Repeated the filtration and the residue was washed with 1.25 per cent sulphuric acid, water, and alcohol. The residue was transferred to a preweighed ashing dish, dried, cooled and weighed, and ignited in a muffle furnace at 600 °C for 30 minutes, cooled in a desiccator, and weighed. The crude fibre content of the sample was calculated from the loss in weight on the ignition and expressed in percentage (%) on a fresh weight basis. The crude fibre content was calculated as follows.

$$\text{Crude fibre (\%)} = \frac{(W_2-W_1) - (W_3-W_1)}{\text{Weight of sample}} \times 100$$

Where, W_1 – Weight of empty crucible, W_2 – Weight of crucible with residue, W_3 – Weight of ignited sample with crucible.

3.5.4.9. Total carotenoids

The total carotenoids of pineapple fruit were estimated by following the spectrophotometric method (de Carvalho *et al.*, 2012). To estimate the total carotenoids, 15 g fruit sample, and 3 g celite 545 were taken into a mortar and ground up to fine paste by adding 25 ml acetone. Then, this solution is transferred to a 250 ml Buchner flask and filtered by using a sintered funnel (5µm) under vacuum condition. This procedure is repeated three times for getting a colorless supernatant solution. After that extract is transferred to a 500 ml separating funnel and 40 ml petroleum ether is added. After that by adjusting the separating valve acetone is removed from solution frequently by adding double distilled water for preventing emulsion formation. Then at the last aqueous phase is discarded from the extract solution. This procedure was repeated four times for getting a clear solution up to it becomes without residual solvent. Then the final extract is transferred to a 50 ml volumetric flask by using a funnel that contains 15 g anhydrous sodium sulfate. Finally, the volume was made up of 50 ml by adding petroleum ether. Then absorbance was recorded in a spectrophotometer at 450 nm against solvent petroleum ether blank. The total carotenoids were calculated by the following the formula and expressed as µg/g.

$$\text{Total carotenoids } (\mu g/g) = \frac{A \times V \text{ (mL)} \times 10^4}{2592 \times P \text{ (g)}}$$

Where A= Absorbance, V= Total extract volume, P= Sample weight, and 2592 is the β-carotene Extinction Coefficient in petroleum ether.

3.5.4.10. Ascorbic acid

Ascorbic acid content was estimated by the volumetric method (Sadasivam and Manickam, 1992). The dye solution was prepared using (42 mg of sodium bicarbonate and 52 mg of 2, 6, dichloro phenol indophenols dye in 200 ml of distilled water). Then about 100 mg of pure dry crystalline vitamin C was taken and makeup to 100 ml using 4 per cent oxalic acid to get the stock solution. The working standard solution (100 ml) was prepared by diluting a 10 ml stock solution using 4 per cent oxalic acid. After that 5 ml, each working standard solution and 4 per cent oxalic acid was pipetted into a conical flask and titrated against the dye solution. The resulting point was the appearance of pale pink color which was observed for a few minutes. The titration was repeated 3 times to get the accurate value. The amount of dye consumed (V_1) was equal to the amount of vitamin C present in the working standard solution. The sample was made into pulp and 10 ml pulp (V_s) was taken and made up to 100 ml with 4 per cent oxalic acid solution. Then 5 ml of the made-up solution was pipette into a conical flask and was titrated against the dye (V_2). The quantity of vitamin C (mg) present in 100 g of sample was calculated as follows and expressed as mg/100 g.

$$\text{Ascorbic acid (mg/100 g)} = \frac{0.5\ (\text{mg}) \times V_2\ (\text{mL}) \times 100\ (\text{mL})}{V_1\ (\text{mL}) \times 5\ (\text{mL}) \times Vs\ (\text{g})} \times 100$$

Where V_1= Titre value of working standard solution of ascorbic acid, V_2= Titre value of working standard solution of fruit sample, and V_s= Weight of the sample.

3.6. Organoleptic evaluation

The scorecard including the quality attributes like appearance, color, flavor, taste, texture, juiciness, sweetness, and overall acceptability was prepared for sensory evaluation of the ripe fruits. A series of sensory evaluations were carried out using the 9 points Hedonic scale rating for each attribute at the laboratory level by a panel of ten judges between the age group of 18-40 years as suggested by Jellinek (1985). A score of 5.5 and above was considered acceptable. The total score was also calculated separately using the average of each attribute. The scorecard used is attached as Appendix II, III, and IV.

3.7. Pest and disease incidence

Observations on pests, diseases, and physiological disorders of both the experiment plants were taken during the research work. The incidence of pest and diseases were observed and recorded using the formula given by Berger (1980) as under:

$$\text{Per cent pest/disease incidence} = \frac{\text{Number of pest/disease infected plants}}{\text{Total number of plants observed}} \times 100$$

3.8. Statistical analysis

Statistical analysis was performed by using the different selection criteria for somaclones and hybrids. Somaclones was selected by calculating index scores (Singh and Chaudhary,1985) and hybrids was selected based on selection index (Smith, 1937).

3.8.1. Selection criteria for somaclones

Statistical analysis was performed by using the selection criteria for somaclones using index scores as suggested by Singh and Chaudhary (1985). Data on all the most desirable and undesirable traits were used to calculate the selection index score. By using suitable class intervals, the range of variability with regard to a character is classified into three groups for the characters *viz*., fruit weight, pulp weight, TSS, crown weight, peel weight, eye profile, eye relative surface, time taken for physiological maturity, and titratable acidity. From the classified groups, 1st index group will get an index score of 1, 2nd group will be scored 2, and 3rd group will be scoring 3. If characters are undesirable then negative index scores will be given. The sum of index values with regard to all the characters allotted to an individual is the indication of individual's worth (Singh and Chaudhary, 1985).

3.8.1.1. Selection of elite clones

All the somaclonal variants of pineapple variety Mauritius were classified into three groups for the characters *viz*., fruit weight, pulp weight, TSS, crown weight, peel weight, eye profile, eye relative surface, time taken for physiological maturity, and titratable acidity. Based on these grouping characters index values were calculated, the index scores of individual clones were judged and those clones which ranked within the highest index values were carried forward for molecular characterization. From these, field evaluated suckers, crowns and slips were planted at Fruits Crops Research Station, Vellanikkara for further evaluation.

3.8.2. Selection criteria for hybrids

The selection of superior hybrids based on simultaneous selection indices was conducted using the statistical software INDOSTAT version 8.1 developed by Indostat Services Ltd., Hyderabad, India.

3.8.2.1. Selection index

The selection index developed by Smith (1937) using the discriminant function of Fisher (1936) was used to discriminate the genotypes based on selected characters. The selection index is described by the function,

$$I = b_1x_1 + b_2x_2 + \ldots\ldots\ldots + b_nx_n$$

and the merit of a plant is described by the function,

$$H = a_1G_1 + a_2G_2 + …..+ a_nG_n$$

where x_1, x_2…… x_n are the phenotypic values and G_1, G_2….. G_n are genotypic values of the plants for the characters, x_1, x_2…… x_n and H is the genetic worth of the plant. It is assumed that the economic weight assigned to each character is equal to unity *i.e.,* a_1, a_2….. $a_n = 1$

The regression coefficients (b) are determined such that the correlation between H and I is maximum. The procedure will be reduce to an equation of the form, $b = p^{-1} G_a$ where P is the phenotypic variance–covariance matrix and G is the genotypic variance-covariance matrix.

3.8.2.2. Selection of superior hybrids

All the hybrids of Mauritius x Kew and their reciprocal crosses were analysed for selection index using the statistical software INDOSTAT version 8.1. Based on the most desirable characteristics namely fruit weight, pulp weight, TSS, and undesirable characters such as crown weight, peel weight, eye profile, eye relative surface, time taken for physiological maturity, and titratable acidity. The original replicated values were used for simultaneous selection indices. In relation to this, the selection index score of individual hybrids were judged and those hybrids which ranked within the highest index values in the selection indices were carried forward for molecular characterization. For their continuous study, suckers, crowns, and slips were planted at Fruits Crops Research Station, Vellanikkara for further evaluation.

3.9. Molecular characterization

3.9.1. Plant materials

Samples of young leaves (three to four weeks old from selected somaclones and hybrids) collected from the pineapple live collection of the Fruits Crops Research Station, Kerala Agricultural University, Vellanikkara, and samples of Mauritius, Kew, and Amritha (as a check) were used in this study. Each pineapple leaf sample was covered with aluminum foil after removing from plants and kept inside the icebox after appropriate labeling of treatment names. These samples were cleanly washed with tap water and kept on at -20° C until being used for DNA extraction. The genomic DNA extraction was done by following the CTAB method (Doyle and Doyle, 1987).

3.9.2. Reasants used for DNA extraction

Table 3.9.2. Reasants for membrane lysis and incubation time used for DNA isolation.

Protocol contents	Concentration	Quantity for 100 ml
2 % CTAB buffer		
CTAB (%)	2 %	2 g
Tris HCl (mM), pH=8	500 mM	1.211 g
NaCl (M)	1.3 M	8.181 g
EDTA (mM)	5 mM	734.100 mg
Distilled water	-	100 ml
Other content		
Polyvinylpyrrolidone (PVP)	1 %	1 g
β-mercaptoethanol (%)	0.1 %	0.1 ml
Incubation (min.) (65°)	90 min.	
Chloroform: Isoamyl alcohol (100 ml)		
Chloroform	-	96 ml
Isoamyl alcohol	-	4 ml
70 % ethanol (100 ml)		
Ethanol (%)	99.9 %	70 ml
Distilled water	-	30 ml
Chilled isopropanol		
Sterile distilled water		

3.9.3. Genomic DNA isolation procedure

For genomic DNA extraction from pineapple leaves we have taken 0.6 g of chilled fresh young leaf cut into small pieces in mortal and made it fine powdered ground with the help of pestle by adding freshly prepared stock solution of 2 ml (2000 µl) 2 per cent CTAB buffer, 0.1 per cent β mercaptoethanol (20 µl) and pinch of Poly Vinyl Pyrrolidone (PVP) for initial homogenization. Then after grinding solution is transferred to 2 ml (2000 µl) micro centrifuged tubes and these tubes were kept in the Eppendorf centrifuge machine for 10 minutes at 10000 rpm and 4 °C for centrifugation. After centrifugation carefully pipette out 1 ml (1000 µl) supernatant and transferred to new 2 ml micro centrifuged tubes and then an extra 2 per cent CTAB solution @ 750 µl per tube was added and labeled with particular treatments. After completion of labeling of tubes thoroughly mixed the supernatant by shaking and kept it for incubation in a water bath for 90 minutes at 65 °C. After incubation equal proportion 1000 µl supernatant mixture and 1000 µl chloroform: isoamyl alcohol (24:1) were added to new microcentrifuge tubes. After that these tubes were kept for centrifugation for 15 minutes at 10000 rpm and 4 °C. After completion of this process we can observe separated three-layered content solution in centrifuge tubes viz., the aqueous top layer (DNA with a small quantity of RNA), middle layer (protein and fine particles), and lower layer (chloroform, pigments, and cell debris). From this aqueous phase was transferred to another 1.5 ml microcentrifuge tubes and DNA was precipitated by adding cold Isopropanol 0.6 volume (Supernatant – 800 µl, Isopropanol – 480 µl). Then these tubes were stored at -20 °C for 30 minutes to 1 hour for complete precipitation of DNA particles. After precipitation of DNA those tubes were again centrifuged at 10000 rpm and 4 °C for 15 minutes. Then the supernatant was discarded carefully and DNA pellets were washed three times with 70 per cent ethanol (200 µl) and kept for evaporation of ethanol droplets from the DNA pellet containing tubes at room temperature. Then after that DNA pellets were dissolved in 50 µl sterile double distilled water or 100 µl TE buffer and stored at -20 °C after specific labeling. In gel electrophoresis 0.8 per cent agarose gel was run at constant 80 voltage for 30- 45 minutes for DNA quality check and assessed the purity of DNA quality based on gel documentation.

3.9.4. Assessing quality and quantity of DNA isolated by gel electrophoresis

The quality and quantity of DNA isolated were assessed by using gel electrophoresis (Sambrook *et al.,* 1989).

In molecular laboratory always we have to maintain hygienic protocol for getting appropriate results of our experiments. Before starting work, the work surface should be cleaned, wiped gel casting tray, and gel casting combs with 70 per cent ethanol. Then gel casting tray and combs were placed desirably horizontal surface. The preparation of TAE buffer (50X) 1 litre required Tris buffer- 242 g (500 mM), EDTA-1.8612 g (5 mM, pH-8), glycerol acetic acid- 75.1 ml. For this, we have to adjust the pH 8 of EDTA by adding 1 N NaOH and make-up 100 ml solution. For dissolving all these three components heating was done and meanwhile, 1 liter volume 50 X TAE stock buffer was prepared by adding sterile double distilled water. Then 1 liter TAE buffer (1X) working standard solution was prepared by incorporation of 20 ml TAE buffer (50X) and 980 ml sterile double distilled water. Agarose (0.8 g) weighed and taken into a conical flask and gently poured the 100 ml TAE buffer (1X) and get it dissolved completely by boiling in the microwave oven until it becomes a clear solution. The agarose solution was take it out from the microwave and allowed to cool at room temperature about 42 to 45 °C and added ethidium bromide (0.5 µg/ml) and slowly mixed well with that agarose solution without forming bubbles. Then gently poured that agarose solution into gel casting tray and combs were fixed into the tray and kept as such for setting the gel for at least 30 minutes. The comb was carefully taken out from the gel without breaking the gel wells. The gel was transferred to the electrophoresis tank and the good side should be fixed towards the negatively charged cathode electrodes. In the electrophoresis tank, gel wells were submerged with 1X TAE buffer. Then 5 µl DNA sample along with 1 µl loading dye (6x) was loaded into well by using a micropipette and 5 µl diluted DNA ladder (20 µl 10X ladder + 30 µl 6X loading dye + 100 µl DNAs free water) loaded in first well. After this tank was closed with a tank lid and anode and cathode charged electrodes were connected to the power supplier machine and the gel was run at a constant 80V for 30 to 45 minutes. The power supply was turned off after 30 minutes and anode and cathode charged connections were removed from the electrophoresis tank. Then the gel was taken out from the electrophoresis unit and transferred to the UV transilluminator system for checking of DNA present in the gel. The DNA template fluoresces under UV light due to the presence of ethidium bromide. The quality and quantity of DNA assessed by clarity and intactness of bands. The DNA template images were documented and saved in a gel documentation system for future use.

3.9.5. Gel documentation

The DNA template image was analyzed and documented in a manual gel documentation system. The gel profile was examined for three types of bands as a topmost band (protein contamination), the middle thicker band (good quality DNA), and lower sheared bands (RNA contamination).

3.9.6. Assessing quality and quantity of DNA isolated by NanoDrop method

The quality and quantity of genomic DNA isolated were assessed using NanoDrop. They put on the power plugs and switch on the NanoDrop system. After completing the booting process, the NanoDrop software was set to zero by taking 2 µl DNAs free double distilled water as a blank sample. In this instrument 1 ml DNA sample was measured at 260 nm and 280 nm wavelengths. The based optical density ratio of OD_{260}/OD_{280} was assessed and recorded the purity of DNA content. The ratio of OD_{260}/OD_{280} assessed quality indicated 1.8 to 2 was pure DNA. If the optical density ratio was less than 1.8 it was referred to as protein contamination and for values greater than 2, evident was RNA contamination was inferred (Wilson and Walker, 2010). The quantity of DNA was obtained based on the relation of optical density with a genomic DNA sample with a concentration of 40 µg/ml (double-stranded) recorded at 260 nm. The quantity of DNA concentration was calculated by following the given equation.

$1\ OD_{260} = 40\ \mu g/ml\ (ds)$

$DNA\ (\mu g/ml) = OD_{260} \times 40\ \mu g/ml$

Where DNA (µg/ml) is the DNA concentration, OD_{260} is the absorbance at 260 nm, and 40 µg/ml is the concentration of DNA when $OD_{260} = 1$.

Procedure of NanoDrop

- Firstly put on the manual NanoDrop system connected plugs into the switchboard and press to start button of the NanoDrop instrument.
- Then after completion of the booting process, selected the nucleic acid option on the touch screen and on next step pressed to 260/280.
- After that open the instrument lid along with the sampling arm and pipetted 2 µl DNAs free autoclaved water onto the lower pedestal.
- After this bring down the sampling arm and closed the lid, press the blank symbolic button, and examined the 260/280 value is zero.
- Then take up the lid along with the upper sampling arm and wiped out both the upper and lower sides of the measurement pedestal with tissue paper.
- Similarly, 2 µl sample was pipetted on measurement pedestal and closed the lid, pressed the sample symbolic button, and data was noted down into the notebook.

- After completion of the measurement, open the lid and wiped out the sample from both the parts of the sampling arm and measurement pedestal.
- After completion of the procedure, put off the instrument button and removed the instrument-connected power plugs from the switchboard.

3.9.7. PCR amplification with ISSR

The good quality and quantity genomic DNA isolated from the pineapple young leaf samples were used for ISSR analysis. The ISSR markers were used for PCR amplification of genomic DNA. The PCR amplification carried out to perform in a total volume of 20 µl different component reaction mixture and the total volume mixture containing different components are as follows 2 µl -genomic DNA (40 ng), 3 µl- 10X Taq assay buffer A with $MgCl_2$, 1.5 µl- dNTP mix (10 mM each), 1.5 µl- primer (10 pM), 11.6 µl- autoclaved distilled water (H_2O), and 0.4 µl- Taq DNA polymerase (3U). The ISSR marker amplification was carried out to perform in an Eppendorf Mastercycler Nexus Gradient PCR under the following circumstances: an initial denaturation at 94 °C for 2 minutes, followed by 35 cycles of denaturation at 94 °C for 30 seconds, primer annealing at 40 °C to 60 °C (depending on primer used) for 1 minute, primer extension at 72 °C for 2 minutes, final extension at 72 °C for 10 minutes. After completion of the PCR amplification process, the sample was held at 4 °C for infinity.

3.9.8. ISSR analysis

A total of fifty ISSR primers were screened and used for genetic diversity analysis of pineapple genotypes. The primers were listed from different sources and tabulated based on their better amplification patterns in the below format (Table 3.9.8).

The PCR amplified products were manually gel electrophoresed on 1.8 per cent agarose gel by using freshly prepared 1X TAE buffer stained with 0.5 µg/ml ethidium bromide (EtBr) along with diluted DNA ladder (100-bp DNA ladder). The gel profile was visualized under UV light and the resulting banding patterns were documented by using a gel documentation system for future analysis. The documented gel images of ISSR were manually examined to confirm the reproducibility of the DNA amplification pattern. The banding pattern of monomorphic and polymorphic numbers was counted and recorded for further data analysis.

Table 3.9.8. Primer nucleotide sequences screened for ISSR analysis in this study.

Serial no.	Primer name	Nucleotide sequences (5'–3')	Tm (°C)
1	7	5'-(CT)8G-3'	54.0
2	901	5'-(GT)6G-3'	54.0
3	17899A	5'-(CA)6AC-3'	50.0
4	AW-3	5'-(GT)5G-3'	54.0
5	(CT)10A	5'-(CT)10A-3'	55.0
6	DAT	5'-(GA)8G-3'	54.0
7	DiGT5C	5'-C(GT)8-3'	54.0
8	(GACAC)4	5'-(GACAC)4-3'	50.0
9	GOOFY	5'-(GT)7G-3'	56.0
10	HB-8	5'-(GA)6G-3'	37.0
11	HB-9	5'-(GT)6G-3'	37.0
12	IS-6	5'-(GA)8C-3'	49.0
13	IS-8	5'-(AG)8C-3'	54.0
14	IS-9	5'-T(GT)7A-3'	54.7
15	IS-11	5'-(CA)8G-3'	40.0
16	IS-61	5'-(GA)8T-3'	50.0
17	IS-65	5'-(AG)8T-3'	47.0
18	ISSR-1	5'-(CA)8GT-3'	54.0
19	ISSR-2	5'-(GA)8CG-3'	54.0
20	ISSR-3	5'-(GA)8CTCAG-3'	45.0
21	ISSR-4	5'-(CA)8TG-3'	51.0
22	ISSR-5	5'-(CA)8G-3'	42.5
23	ISSR-6	5'-(GA)8GT-3'	46.0
24	ISSR-7	5'-(AG)8CTT-3'	45.0
25	ISSR-9	5'-(CT)8G-3'	45.0
26	ISSR-10	5'-GC(AC)7-3'	54.0
27	ISSR-16	5'-(GT)8C-3'	53.0
28	ISSR-18	5'-(ACC)6-3'	40.0
29	ISSR-21	5'-(ATG)6-3'	52.0
30	ISSR-24	5'-(GACA)4-3'	40.0
31	MAO	5'-(CTC)4C-3'	39.0
32	MANNY	5'-(CAC)4C-3'	52.3
33	OMAR	5'-(GAG)4C-3'	54.3
34	(TC)10G	5'-(TC)10G-3'	62.0
35	UBC-807	5'-(AG)8T-3'	54.0
36	UBC-808	5'-(AG)8C-3'	54.0
37	UBC-809	5'-(AG)8G-3'	54.0
38	UBC-810	5'-(GA)8T-3'	42.9
39	UBC-811	5'-(GA)8C-3'	53.0

40	UBC-812	5'-(GA)8A-3'	48.5
41	UBC-814	5'-(CT)8-3'	40.3
42	UBC-830	5'-(TG)8-3'	56.2
43	UBC-841	5'-(GA)8-3'	47.0
44	UBC-843	5'-(CT)8A-3'	37.6
45	UBC-844	5'-(CT)8C-3'	54.0
46	UBC-855	5'-(AC)8T-3'	60.2
47	UBC-858	5'-(TG)8T-3'	59.4
48	UBC-864	5'-(ATG)6-3'	54.0
49	UBC-873	5'-(GACA)4-3'	45.1
50	UBC-899	5'-(CA)6G-3'	52.0

3.9.9. Molecular data scoring and statistical analysis

The molecular data scoring was done for existing bands of documented gel profiles with the help of quantity one software (BIO-RAD) in the gel documentation system. In this system, the 100-bp ladder was used as a tracker of molecular weight size marker for all the documented gel along with gel-loaded DNA samples. The Jacquard's Coefficient similarity Index was measured and based on the similarity Coefficient analysis a dendrogram was generated by using the UPGMA method. In the Unweighed Pair Group Method with Arithmetic Mean (UPGMA), the only reproducible, clearly distinct, and well-resolved DNA fragments were considered. In this method smeared and weak fragments were excluded from the analysis. The resulting data to estimate the level of genetic diversity were analyzed by using the program software package NTsys (Rohlf, 2005).

3.9.10. Nature of amplification

The UVITEC Fire Reader software was used to capture the nature of amplification, the electrophoresed gel profile was analyzed in a gel documentation system. In observations, the percentage of polymorphism was recorded as monomorphic or polymorphic by using the nature of the banding pattern.

3.9.11. Number of amplicons

The UVITEC Fire Reader software was used to count the average number of effective amplicons resolved on the electrophoresed gel in a manual gel documentation system.

3.9.12. Size of amplicons

The size of amplicons were recorded in the range of base pairs (bp) by comparison with a known 100 bp ladder. The frequency of size of amplicons of documented gel profile was estimated by using UVITEC Fire Reader software and data was tabulated in the format.

3.9.13. Uniqueness of amplicons

To identify the uniqueness of amplicons, the UVITEC gel documentation system was used and the uniqueness frequency was recorded in terms of size in base pairs (bp) by comparing the banding pattern observed in documented gel picture.

RESULT AND DISCUSSION

4. RESULT AND DISCUSSION

Results of the studies on “Evaluation of hybrids and clonal variants in pineapple (*Ananas comosus* L.)” are presents in this chapter.

4.1. Somaclonal variants

A detailed experiment was conducted at Fruit Crops Research Station, Vellanikkara, for selecting somaclonal variants of pineapple variety Mauritius. Seventy five plants were initially tagged based on general vigour and biometric observations of previous work.

The various observations on morphological characters *viz.*, vegetative characters (monthly), flowering characters, fruit and yield characters recorded as per the descriptors for pineapple suggested by International Board for Plant Genetic Resources Rome, Italy (IBPGR, 1991) were analyzed and the results are presented in Table 4.1.1.1. to Table 4.1.1.5.

4.1.1. Variability

4.1.1.1. Vegetative characters (Monthly intervals)

The data showing vegetative characters are given at its 39 leaf stage of the somaclonal variants of pineapple variety Mauritius from Table 4.1.1.1a to Table 4.1.1.1f.

4.1.1.1.1. Plant height

The data related to plant height is presented in Table 4.1.1.1a to Table 4.1.1.1c. The plant height of the somaclones ranged from 67.00 cm to 95.00 cm. The lowest plant height of 67.00 cm was noted in treatment T-15 and highest value of 95.00 cm in treatment T-46 at its 39 leaf stage of the somaclonal variants of pineapple variety Mauritius. The control treatment (Mauritius) attained average plant height of 81.00 cm.

4.1.1.1.2. Number of leaves per plant

The data related to average number of leaves per plant is presented in Table 4.1.1.1a to Table 4.1.1.1c. Average number of leaves per plant ranged from 39.00 to 46.00. At 39 leaf stage (maximum physiological maturity) of the somaclonal variants of pineapple variety Mauritius, maximum number of leaves was observed in treatment T-49 (46.00) and minimum number of leaves (39.00) in treatments namely, T-2, T-9, T-12, T-21, T-25, T-38, T-41, T-42, T-46, T-48, T-51, T-55, T-56, T-60, T-65, T-72, and T-74. The control treatment Mauritius was recorded 41 average number of leaves per plant.

4.1.1.1.3. Length of 'D' leaf

The data related to lengths of D leaf is presented in Table 4.1.1.1a to Table 4.1.1.1c. Length of D leaf of the treatments ranged from 48.00 cm to 78.00 cm. The lowest D leaf length of 48.00 cm was noted in treatment T-71 and highest D leaf length of 78.00 cm in treatment T-46 at 39 leaf stage of the somaclonal variants of pineapple variety Mauritius. Whereas, check variety Mauritius was noted 64.00 cm length of D leaf.

4.1.1.1.4. Breadth of 'D' leaf

The data related to breadths of D leaf is presented in Table 4.1.1.1a to Table 4.1.1.1c. Breadth of D leaf of treatments ranged from 2.00 cm to 6.00 cm. At 39 leaf stage of the somaclonal variants of pineapple variety Mauritius, breadth of D leaf was maximum in treatment T-50 (6.00 cm) and minimum breadth of D leaf (2.00 cm) was recorded in treatments *viz*., T-9, T-11, T-32, T-33, T-34, T-43, and T-64. While, the breadth of D leaf of the Mauritius was noted down 3.50 cm.

4.1.1.1.5. 'D' leaf area

The data related to D leaf area is presented in Table 4.1.1.1a to Table 4.1.1.1c. The D leaf area of the treatments ranged from 79.75 cm^2 to 282.75 cm^2. The lowest D leaf area of 79.75 cm^2 was noted in treatment T-64 and highest D leaf area of 282.75 cm^2 was obtained in treatment T-46 at 39 leaf stage of the somaclonal variants of pineapple variety Mauritius. Whereas, the Mauritius has D leaf area of 162.40 cm^2.

4.1.1.1.6. Leaf Area Index (LAI)

The data related to leaf area index is presented in Table 4.1.1.1a to Table 4.1.1.1c. Leaf area index of treatments ranged from 2.17 to 8.72. Leaf area index was maximum in treatment T-24 (8.72) and minimum in treatment T-18 (2.17). Similarly, it was observed that Mauritius responded 4.93 leaf area index.

4.1.1.1.7. Spine length

The data related to spine length is presented in Table 4.1.1.1a to Table 4.1.1.1c. Spine length of the treatments ranged from 0.18 mm to 0.30 mm. The lowest spine length of 0.18 mm was noted in treatment T-29 and T-49, whereas highest spine length of 0.30 mm recorded in treatment T-3 at 39 leaf stage of the somaclonal variants of pineapple variety Mauritius. While, the mean value of 0.24 mm was noticed in control Mauritius variety.

4.1.1.1.8. Number of suckers per plant

The data related to mean number of suckers produced per plant is presented in Table 4.1.1.1a to Table 4.1.1.1c. The number of suckers per plant ranged from 1 to 12. The highest number of suckers per plant was recorded in treatment T-68 (12) and lowest (1) in treatments namely T-1, T-9, T-10, T-11, T-16, T-19, T-20, T-31, T-33, T-39, T-43, T-46, T-47, T-53, T-54, T-59, T-60, T-64, and T-66. However, the average number of suckers per plant (5) was observed with check variety Mauritius.

4.1.1.1.9. Number of slips per plant

The data related to mean number of slips produced per plant is presented in Table 4.1.1.1a to Table 4.1.1.1c. The number of slips per plant ranged from 1 to 7. The highest number of slips per plant was recorded in treatment T-58 (7) and lowest (1) in treatments namely T-11, T-49, T-56, and T-69. However, the average number of slips per plant (3) was observed with check variety Mauritius.

4.1.1.1.10. Distribution of spines

The data related to distribution of spines is presented in Table 4.1.1.1d to Table 4.1.1.1f. In all the treatments, the distribution of spines per plant observed non-significantly along all margins.

4.1.1.1.11. Direction of spines

The data related to direction of spines is presented in Table 4.1.1.1d to Table 4.1.1.1f. Only ascending order of spines was observed in all treatments.

4.1.1.1.12. Colouration of leaf spines

The data related to colour of leaf spines is presented in Table 4.1.1.1d to Table 4.1.1.1f. Among the treatments, colouration of spines found mostly reddish/red then followed by purplish/pinkish and yellowish/greenish.

4.1.1.1.13. Spine stiffness

The data related to spine stiffness is presented in Table 4.1.1.1d to Table 4.1.1.1f. All the treatment observed intermediate stiffness of spines.

4.1.1.1.14. Position of suckers

The data related to position of suckers is presented in Table 4.1.1.1d to Table 4.1.1.1f. Among the treatments, 51.32 % of the treatments produced both underground suckers and aerial suckers, following 39.47 % of treatments produced only underground suckers, and 9.21 % of treatment produced aerial suckers only. In the control treatment (Mauritius), usually both underground suckers and aerial suckers were observed.

4.1.1.2. Flowering characters

4.1.1.2.1. Days to attain ideal leaf stage for flowering

The data related to number of days taken to attain ideal leaf stage for flowering for different clonal treatments is presented in Table 4.1.1.2a and Table 4.1.1.2b. Among various treatments, T-30 recorded significantly the less number of days to attain ideal leaf stage for flowering (312.00 d). Whereas, the treatments *viz.*, T-5, T-6, T-7, and T-53 took more number of days (420.00 d) to attain ideal leaf stage for flowering. However, the Mauritius variety was taken average number of days (396.00 d) to attain ideal leaf stage for flowering.

4.1.1.2.2. Days for initiation of flowering (visual)

The mean number of days taken from ethrel application to the appearance of reddish colour inflorescence at the heart of the plant was recorded by different clonal variant treatments is presented in Table 4.1.1.2a and Table 4.1.1.2b. Among various clonal variant treatments, T-5 and T-58 recorded significantly the less number of days for initiation of flowering (35.00 d). The treatment T-13 and T-24 took more number

Table 4.1.1.1a. Quantitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage

Treatments	Plant height (cm)	Number of leaves per plant	Length of D leaf (cm)	Breadth D leaf (cm)	D leaf area (cm^2)	Leaf Area Index (LAI)	Spine length (mm)	Number of suckers per plant	Number of slips per plant
T 1	77.00	42.00	64.00	4.00	185.60	5.77	0.22	1.00	0.00
T 2	82.00	39.00	63.00	5.00	228.38	6.60	0.20	3.00	2.00
T 3	82.00	43.00	61.00	3.50	154.79	4.93	0.30	3.00	0.00
T 4	85.00	43.00	59.00	4.00	171.10	5.45	0.25	4.00	2.00
T 5	88.00	43.00	50.00	5.00	181.25	5.77	0.22	2.00	2.00
T 6	77.00	41.00	56.00	3.50	142.10	4.32	0.20	2.00	0.00
T 7	89.00	44.00	60.00	5.00	217.50	7.09	0.22	2.00	3.00
T 8	73.00	42.00	53.00	4.50	172.91	6.02	0.22	4.00	0.00
T 9	75.00	39.00	59.00	2.00	85.55	2.47	0.24	1.00	0.00
T 10	82.00	40.00	63.00	4.50	205.54	6.09	0.28	1.00	4.00
T 11	83.00	42.00	64.00	2.00	92.80	2.89	0.22	1.00	1.00
T 12	84.00	39.00	64.00	2.50	116.00	3.35	0.26	2.00	0.00
T 13	78.00	40.00	62.00	2.50	108.75	3.22	0.20	3.00	0.00
T 14	79.00	41.00	63.00	3.00	137.03	3.36	0.22	2.00	0.00
T 15	67.00	43.00	53.00	3.50	134.49	3.53	0.24	2.00	0.00
T 16	75.00	41.00	62.00	4.00	179.80	3.93	0.22	1.00	0.00
T 17	87.00	41.00	72.00	3.50	182.70	7.60	0.24	2.00	0.00
T 18	69.00	43.00	50.00	3.00	108.75	2.17	0.22	4.00	0.00
T 19	85.00	41.00	69.00	3.00	150.08	4.29	0.24	1.00	0.00
T 20	81.00	40.00	65.00	3.00	141.38	2.66	0.24	1.00	0.00
T 21	86.00	39.00	67.00	3.00	145.73	4.76	0.22	3.00	0.00
T 22	91.00	40.00	77.00	3.50	195.39	6.36	0.20	2.00	3.00
T 23	83.00	42.00	66.00	5.00	239.25	3.61	0.22	7.00	0.00
T 24	84.00	41.00	68.00	4.50	221.85	8.72	0.22	3.00	0.00
T 25	87.00	39.00	70.00	3.00	152.25	4.40	0.24	5.00	0.00

Table 4.1.1.1b. Quantitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage

Treatments	Plant height (cm)	Number of leaves per plant	Length of D leaf (cm)	Breadth D leaf (cm)	D leaf area (cm^2)	Leaf Area Index (LAI)	Spine length (mm)	Number of suckers per plant	Number of slips per plant
T 26	83.00	40.00	62.00	5.50	247.23	7.33	0.22	3.00	5.00
T 27	80.00	41.00	59.00	2.50	106.94	3.25	0.24	4.00	0.00
T 28	78.00	40.00	59.00	3.00	128.33	3.80	0.24	4.00	0.00
T 29	74.00	45.00	55.00	2.50	99.69	3.32	0.18	2.00	0.00
T 30	79.00	40.00	59.00	2.50	106.94	3.17	0.24	2.00	0.00
T 31	85.00	43.00	69.00	2.50	125.06	4.35	0.26	1.00	2.00
T 32	86.00	42.00	69.00	2.00	100.05	3.72	0.22	3.00	0.00
T 33	80.00	45.00	65.00	2.00	94.25	3.14	0.24	1.00	0.00
T 34	77.00	40.00	61.00	2.00	88.45	3.08	0.20	2.00	0.00
T 35	91.00	41.00	72.00	3.50	182.70	5.55	0.22	2.00	0.00
T 36	85.00	42.00	61.00	3.50	154.79	4.82	0.23	3.00	0.00
T 37	91.00	41.00	75.00	3.50	190.31	5.78	0.24	2.00	0.00
T 38	84.00	39.00	68.00	4.50	221.85	6.41	0.24	2.00	0.00
T 39	80.00	41.00	62.00	4.00	179.80	5.46	0.26	1.00	0.00
T 40	82.00	45.00	61.00	3.00	132.68	4.42	0.24	2.00	0.00
T 41	83.00	39.00	61.00	3.50	154.79	4.47	0.20	2.00	0.00
T 42	81.00	39.00	59.00	4.00	171.10	4.94	0.24	2.00	0.00
T 43	79.00	40.00	60.00	2.00	87.00	2.58	0.22	1.00	0.00
T 44	84.00	41.00	70.00	3.50	177.63	5.39	0.20	9.00	0.00
T 45	83.00	40.00	63.00	3.50	159.86	4.74	0.22	3.00	5.00
T 46	95.00	39.00	78.00	5.00	282.75	8.17	0.26	1.00	0.00
T 47	78.00	42.00	55.00	3.50	139.56	4.34	0.22	1.00	0.00
T 48	80.00	39.00	64.00	3.00	139.20	4.02	0.26	2.00	2.00
T 49	84.00	46.00	67.00	5.00	242.88	8.28	0.18	3.00	1.00
T 50	79.00	41.00	61.00	6.00	265.35	5.74	0.22	6.00	0.00
T 51	73.00	39.00	52.00	3.00	113.10	3.27	0.22	2.00	0.00
T 52	78.00	42.00	54.00	2.50	97.88	3.05	0.25	8.00	3.00

Table 4.1.1.1c. Quantitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage

Treatments	Plant height (cm)	Number of leaves per plant	Length of D leaf (cm)	Breadth D leaf (cm)	D leaf area (cm^2)	Leaf Area Index (LAI)	Spine length (mm)	Number of suckers per plant	Number of slips per plant
T 53	91.00	41.00	70.00	5.00	253.75	7.71	0.22	1.00	0.00
T 54	70.00	41.00	52.00	3.40	128.18	3.89	0.22	1.00	0.00
T 55	81.00	39.00	62.00	3.50	157.33	4.55	0.24	2.00	0.00
T 56	89.00	39.00	68.00	4.80	236.64	6.84	0.20	3.00	1.00
T 57	83.00	42.00	64.00	4.50	208.80	6.50	0.25	4.00	0.00
T 58	74.00	39.00	56.00	3.00	121.80	3.52	0.20	2.00	7.00
T 59	80.00	42.00	63.00	3.50	159.86	4.97	0.26	1.00	0.00
T 60	79.00	39.00	61.00	3.50	154.79	4.47	0.23	1.00	4.00
T 61	83.00	42.00	70.00	3.50	177.63	5.53	0.20	5.00	0.00
T 62	84.00	43.00	65.00	3.00	141.38	4.50	0.23	7.00	0.00
T 63	85.00	41.00	69.00	3.50	175.09	5.32	0.27	2.00	0.00
T 64	71.00	40.00	55.00	2.00	79.75	2.36	0.24	1.00	0.00
T 65	80.00	39.00	59.00	3.50	149.71	4.32	0.24	3.00	0.00
T 66	74.00	42.00	59.00	3.50	149.71	4.66	0.22	1.00	0.00
T 67	86.00	41.00	71.00	3.00	154.43	4.69	0.22	7.00	0.00
T 68	79.00	43.00	60.00	4.50	195.75	6.24	0.21	12.00	6.00
T 69	78.00	42.00	62.00	4.50	202.28	6.29	0.24	3.00	1.00
T 70	74.00	45.00	55.00	4.00	159.50	5.32	0.23	6.00	0.00
T 71	79.00	41.00	48.00	5.50	191.40	5.81	0.20	5.00	0.00
T 72	80.00	39.00	58.00	5.50	231.28	6.68	0.23	5.00	0.00
T 73	82.00	41.00	64.00	3.50	162.40	4.93	0.24	6.00	0.00
T 74	72.00	39.00	53.00	4.00	153.70	4.44	0.21	5.00	0.00
T 75	85.00	40.00	62.00	5.50	247.23	7.33	0.22	2.00	0.00
Mauritius	81.00	41.00	64.00	3.50	162.40	4.93	0.24	5.00	3.00

Table 4.1.1.1d. Qualitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage

Treatments	Distribution of spines	Direction of spines	Colouration of leaf spines	Spine stiffness	Position of suckers
T 1	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Aerial sucker
T 2	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Both (aerial+underground sucker)
T 3	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 4	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 5	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 6	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Aerial sucker
T 7	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 8	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 9	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 10	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Aerial sucker
T 11	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Aerial sucker
T 12	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 13	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 14	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Underground sucker
T 15	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Underground sucker
T 16	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Underground sucker
T 17	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Both (aerial+underground sucker)
T 18	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Underground sucker
T 19	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 20	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 21	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Underground sucker
T 22	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 23	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 24	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 25	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Both (aerial+underground sucker)
T 26	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Aerial sucker

Table 4.1.1.1e. Qualitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage

Treatments	Distribution of spines	Direction of spines	Colouration of leaf spines	Spine stiffness	Position of suckers
T 27	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 28	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 29	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 30	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 31	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 32	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 33	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 34	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 35	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 36	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 37	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 38	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 39	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 40	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 41	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 42	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 43	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Both (aerial+underground sucker)
T 44	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 45	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 46	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 47	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 48	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Underground sucker
T 49	Spines along all margins	Only ascendant	Yellowish/ greenish	Intermediate	Both (aerial+underground sucker)
T 50	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 51	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 52	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker
T 53	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Aerial sucker
T 54	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Underground sucker

Table 4.1.1.1f. Qualitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage

Treatments	Distribution of spines	Direction of spines	Colouration of leaf spines	Spine stiffness	Position of suckers
T 55	Spines along all margins	Only ascendant	Purplish/ pinkish	Intermediate	Both (aerial+underground sucker)
T 56	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 57	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 58	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 59	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 60	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 61	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 62	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 63	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 64	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 65	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 66	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 67	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 68	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 69	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Underground sucker
T 70	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 71	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 72	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 73	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 74	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)
T 75	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Aerial sucker
Mauritius	Spines along all margins	Only ascendant	Reddish/ red	Intermediate	Both (aerial+underground sucker)

of days (50.00 d) for initiation of flowering. When it comes to Mauritius, it was noted that 42.00 days for initiation of flowering.

4.1.1.2.3. Days for 50 per cent flowering

The mean number of days taken from ethrel application to emergence of inflorescence in 50 per cent of the plants in each treatment was recorded and presented in Table 4.1.1.2a and Table 4.1.1.2b. Among various treatments, number of days to 50 per cent flowering not applicable for somaclonal variants due to planting of augmented block design single plant single treatment.

4.1.1.2.4. Flowering phase

The number of days from the opening of the first flower to the opening of the last flower in an inflorescence was recorded and presented in Table 4.1.1.2a and Table 4.1.1.2b. Among the treatments, treatment T-17, T-27, T-32, T-47, T-50, and T-51 recorded significantly the less number of days of flowering phase (17.00 d) and more number of days of flowering phase (26.00 d) in treatment T-13. While check variety Mauritius has taken 24 days of flowering phase.

4.1.1.3. Fruit and yield characters

4.1.1.3.1. Days for fruit maturity

The data related to mean number of days to fruit maturity for each treatment was recorded and presented in Table 4.1.1.3a to Table 4.1.1.3d. Among all the treatments, Treatment T-7 recorded significantly the less number of days to fruit maturity (91.00 d). While, treatment T-25 took more number of days to fruit maturity (307.00 d). Whereas, 160 days to fruit maturity of the fruit was counted in check Mauritius variety.

4.1.1.3.2. Crop duration

The data related to crop duration was worked out for each treatment and data is presented in Table 4.1.1.3a to Table 4.1.1.3d. Among all the treatments, treatment T-41 recorded significantly the less number of days for crop duration (544.00 d). While, treatment T-25 took more number of days for crop duration (752.00 d). Where, the crop duration of 636 days was recorded in check variety Mauritius.

4.1.1.3.3. Presence of crown

The data related to presence of crown is presented in Table 4.1.1.3a to Table 4.1.1.3d. As per the descriptor, crown was present in all the treatments.

4.1.1.3.4. Crown shape

The data related to crown shape of all the treatments is presented in Table 4.1.1.3a to Table 4.1.1.3d. Among the 75 treatments, 56 % of the treatments came under the shape of lengthened cylindrical crown, 22.66 % with the shape of long-conical crown, 12 % with the shape of cone type, 8 % with the shape of lengthened cylindrical with bunchy top, and 1.33 % with the shape of oblong blocky type. While, the check variety Mauritius showed the long conical to lengthened cylindrical type crown shapes.

4.1.1.3.5. Crown characters

The data related to crown characters of all the treatments is presented in Table 4.1.1.3a to Table 4.1.1.3d. Among the 75 treatments and check variety Mauritius, all the treatments showed normal crown characters except T-24 and T-61, which were observed multiple crown character.

4.1.1.3.6. Number of crowns surmounting fruit

The data related to number of crowns surmounting fruit is presented in Table 4.1.1.3a to Table 4.1.1.3d. The number of crowns surmounting fruit per plant was not varied significantly among the treatments. All the treatments observed single crown except T-24 and T-61, each was observed three crowns.

4.1.1.3.7. Attitude of crown foliage

The data related to attitude of crown foliage of all the treatments is presented in Table 4.1.1.3a to Table 4.1.1.3d. Among the 75 treatments, 60 % of the treatments came under the attitude of crown foliage of semi-erect, 26.66 % with the attitude of crown foliage erect type and 6.66 % of each with the attitude of crown foliage horizontal and drooping type respectively. Whereas, Mauritius showed semi-erect type attitude of crown foliage.

Table 4.1.1.2a. Flower characters of somaclonal variants of pineapple variety Mauritius

Treatments	Days to attain ideal leaf stage for flowering	Days for initiation of flowering (visual)	Days for 50 per cent flowering	Flowering phase (days)
T 1	322.00	42.00	Not applicable	23.00
T 2	405.00	43.00	Not applicable	21.00
T 3	352.00	39.00	Not applicable	22.00
T 4	339.00	40.00	Not applicable	20.00
T 5	420.00	35.00	Not applicable	18.00
T 6	420.00	45.00	Not applicable	24.00
T 7	420.00	38.00	Not applicable	22.00
T 8	415.00	36.00	Not applicable	20.00
T 9	322.00	43.00	Not applicable	19.00
T 10	336.00	40.00	Not applicable	21.00
T 11	322.00	42.00	Not applicable	23.00
T 12	352.00	37.00	Not applicable	24.00
T 13	332.00	50.00	Not applicable	26.00
T 14	393.00	46.00	Not applicable	18.00
T 15	332.00	49.00	Not applicable	20.00
T 16	342.00	39.00	Not applicable	19.00
T 17	341.00	48.00	Not applicable	17.00
T 18	342.00	44.00	Not applicable	19.00
T 19	383.00	38.00	Not applicable	21.00
T 20	327.00	48.00	Not applicable	24.00
T 21	373.00	38.00	Not applicable	25.00
T 22	357.00	40.00	Not applicable	24.00
T 23	410.00	43.00	Not applicable	22.00
T 24	346.00	50.00	Not applicable	23.00
T 25	362.00	49.00	Not applicable	20.00
T 26	346.00	43.00	Not applicable	18.00
T 27	393.00	47.00	Not applicable	17.00
T 28	383.00	46.00	Not applicable	20.00
T 29	332.00	47.00	Not applicable	23.00
T 30	312.00	41.00	Not applicable	22.00
T 31	352.00	42.00	Not applicable	19.00
T 32	322.00	42.00	Not applicable	17.00
T 33	362.00	44.00	Not applicable	20.00
T 34	362.00	43.00	Not applicable	22.00
T 35	393.00	47.00	Not applicable	23.00
T 36	383.00	37.00	Not applicable	25.00
T 37	357.00	39.00	Not applicable	23.00
T 38	335.00	49.00	Not applicable	20.00
T 39	362.00	44.00	Not applicable	21.00
T 40	364.00	41.00	Not applicable	18.00
T 41	336.00	49.00	Not applicable	19.00
T 42	393.00	47.00	Not applicable	22.00
T 43	366.00	48.00	Not applicable	24.00
T 44	364.00	49.00	Not applicable	23.00
T 45	383.00	38.00	Not applicable	25.00

Table 4.1.1.2b. Flower characters of somaclonal variants of pineapple variety Mauritius

Treatments	Days to attain ideal leaf stage for flowering	Days for initiation of flowering (visual)	Days for 50 per cent flowering	Flowering phase (days)
T 46	389.00	46.00	Not applicable	20.00
T 47	363.00	48.00	Not applicable	17.00
T 48	404.00	37.00	Not applicable	18.00
T 49	376.00	49.00	Not applicable	19.00
T 50	411.00	43.00	Not applicable	17.00
T 51	383.00	47.00	Not applicable	17.00
T 52	415.00	39.00	Not applicable	18.00
T 53	420.00	36.00	Not applicable	20.00
T 54	362.00	44.00	Not applicable	20.00
T 55	383.00	37.00	Not applicable	24.00
T 56	383.00	49.00	Not applicable	23.00
T 57	336.00	43.00	Not applicable	24.00
T 58	404.00	35.00	Not applicable	20.00
T 59	366.00	47.00	Not applicable	21.00
T 60	383.00	46.00	Not applicable	25.00
T 61	367.00	41.00	Not applicable	20.00
T 62	363.00	48.00	Not applicable	21.00
T 63	364.00	45.00	Not applicable	24.00
T 64	383.00	49.00	Not applicable	23.00
T 65	393.00	47.00	Not applicable	22.00
T 66	363.00	41.00	Not applicable	20.00
T 67	353.00	47.00	Not applicable	19.00
T 68	361.00	48.00	Not applicable	18.00
T 69	336.00	39.00	Not applicable	20.00
T 70	367.00	41.00	Not applicable	24.00
T 71	365.00	47.00	Not applicable	23.00
T 72	326.00	41.00	Not applicable	24.00
T 73	399.00	43.00	Not applicable	19.00
T 74	383.00	46.00	Not applicable	18.00
T 75	321.00	48.00	Not applicable	23.00
Mauritius	396.00	42.00	Not applicable	24.00

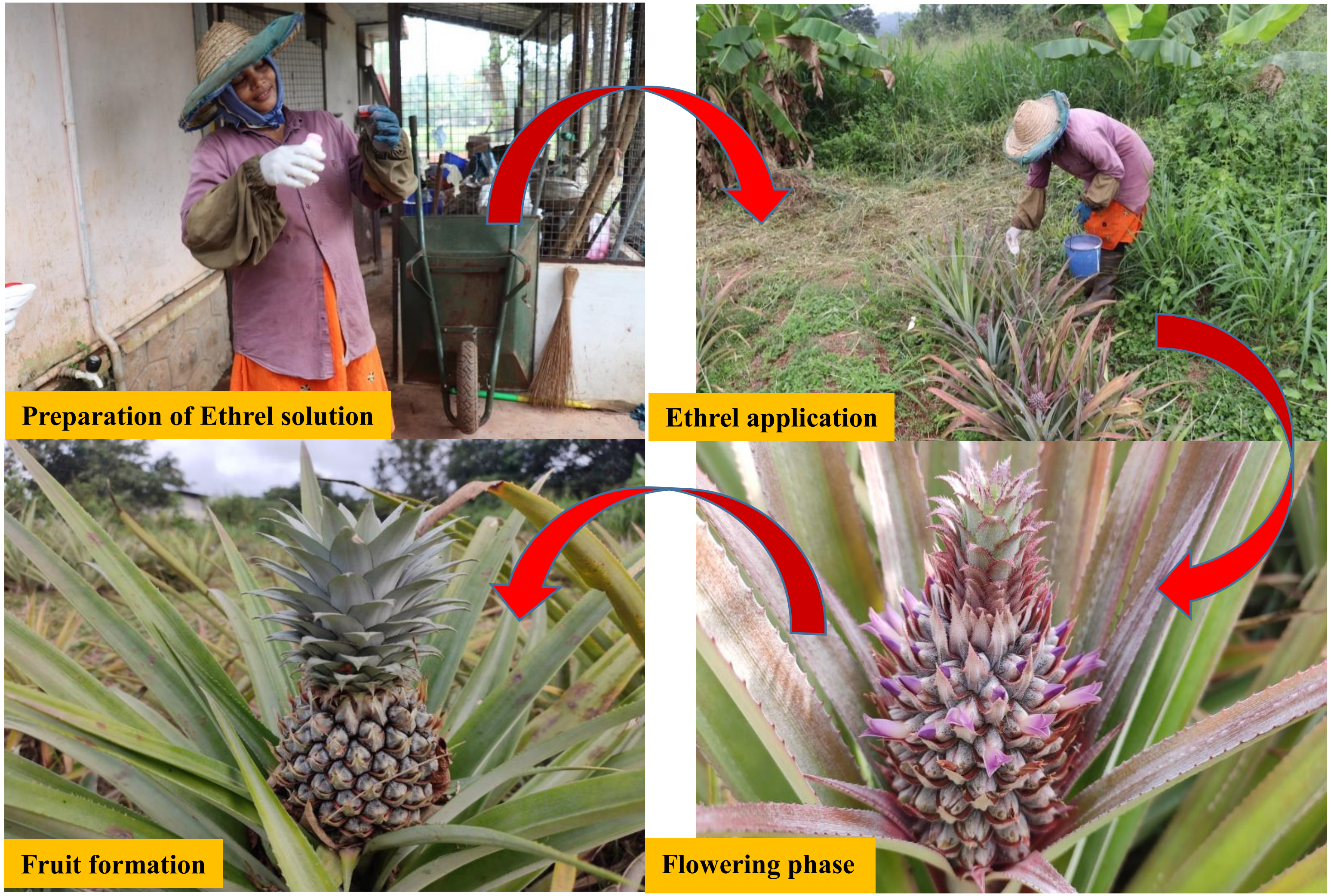


Plate 4.1.1.2. Flower characters of somaclonal variants

Table 4.1.1.3a. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Days for fruit maturity	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 1	153.00	554.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 2	170.00	653.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 3	118.00	545.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 4	139.00	552.00	Present (+)	Cone	Normal	1	Semi erect
T 5	92.00	579.00	Present (+)	Long conical	Normal	1	Drooping
T 6	149.00	652.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 7	91.00	585.00	Present (+)	Long conical	Normal	1	Semi erect
T 8	175.00	660.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 9	151.00	549.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 10	150.00	561.00	Present (+)	Long conical	Normal	1	Semi erect
T 11	147.00	548.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 12	186.00	613.00	Present (+)	Long conical	Normal	1	Erect
T 13	132.00	554.00	Present (+)	Lengthened cylindrical with bunchy top	Normal	1	Semi erect
T 14	132.00	603.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 15	138.00	553.00	Present (+)	Long conical	Normal	1	Erect
T 16	135.00	549.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 17	126.00	546.00	Present (+)	Cone	Normal	1	Semi erect
T 18	133.00	552.00	Present (+)	Long conical	Normal	1	Erect
T 19	145.00	601.00	Present (+)	Long conical	Normal	1	Erect
T 20	141.00	554.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 21	155.00	605.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 22	118.00	553.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect

Table 4.1.1.3b. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Days for fruit maturity	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 23	94.00	583.00	Present (+)	Lengthened cylindrical	Normal	1	Horizontal
T 24	130.00	563.00	Present (+)	Oblong blocky	Multiple	3	Erect
T 25	307.00	752.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 26	137.00	558.00	Present (+)	Cone	Normal	1	Semi erect
T 27	131.00	602.00	Present (+)	Lengthened cylindrical with bunchy top	Normal	1	Horizontal
T 28	146.00	609.00	Present (+)	Lengthened cylindrical with bunchy top	Normal	1	Semi erect
T 29	141.00	557.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 30	161.00	550.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 31	120.00	547.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 32	152.00	547.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 33	108.00	548.00	Present (+)	Cone	Normal	1	Semi erect
T 34	111.00	552.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 35	128.00	605.00	Present (+)	Cone	Normal	1	Semi erect
T 36	146.00	605.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 37	130.00	563.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 38	135.00	553.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 39	105.00	546.00	Present (+)	Long conical	Normal	1	Semi erect
T 40	109.00	546.00	Present (+)	Long conical	Normal	1	Semi erect
T 41	126.00	544.00	Present (+)	Long conical	Normal	1	Erect
T 42	131.00	607.00	Present (+)	Long conical	Normal	1	Erect
T 43	95.00	547.00	Present (+)	Cone	Normal	1	Semi erect

Table 4.1.1.3c. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Days for fruit maturity	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 44	96.00	546.00	Present (+)	Long conical	Normal	1	Semi erect
T 45	155.00	615.00	Present (+)	Long conical	Normal	1	Semi erect
T 46	112.00	581.00	Present (+)	Lengthened cylindrical with bunchy top	Normal	1	Drooping
T 47	135.00	577.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 48	134.00	607.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 49	121.00	579.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 50	95.00	580.00	Present (+)	Lengthened cylindrical	Normal	1	Horizontal
T 51	138.00	599.00	Present (+)	Long conical	Normal	1	Erect
T 52	95.00	581.00	Present (+)	Lengthened cylindrical	Normal	1	Drooping
T 53	93.00	583.00	Present (+)	Lengthened cylindrical	Normal	1	Drooping
T 54	113.00	553.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 55	151.00	609.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 56	159.00	628.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 57	147.00	564.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 58	129.00	602.00	Present (+)	Long conical	Normal	1	Erect
T 59	103.00	551.00	Present (+)	Cone	Normal	1	Semi erect
T 60	142.00	610.00	Present (+)	Cone	Normal	1	Semi erect
T 61	111.00	553.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 62	164.00	610.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 63	105.00	552.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 64	144.00	613.00	Present (+)	Lengthened cylindrical with bunchy top	Normal	1	Drooping

Table 4.1.1.3d. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Days for fruit maturity	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 65	126.00	602.00	Present (+)	Lengthened cylindrical	Normal	1	Erect
T 66	110.00	548.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 67	138.00	571.00	Present (+)	Long conical	Normal	1	Semi erect
T 68	162.00	603.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 69	139.00	548.00	Present (+)	Lengthened cylindrical	Normal	1	Horizontal
T 70	107.00	553.00	Present (+)	Lengthened cylindrical	Normal	1	Horizontal
T 71	193.00	642.00	Present (+)	Cone	Normal	1	Semi erect
T 72	148.00	553.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 73	129.00	604.00	Present (+)	Lengthened cylindrical	Normal	1	Semi erect
T 74	137.00	598.00	Present (+)	Long conical	Normal	1	Semi erect
T 75	149.00	555.00	Present (+)	Lengthened cylindrical with bunchy top	Normal	1	Semi erect
Mauritius	160.00	636.00	Present (+)	Long conical to lengthened cylindrical	Normal	1	Semi erect

4.1.1.3.8. Colour of crown leaves

The data related to colour of crown leaves of all the treatments is presented in Table 4.1.1.3e to Table 4.1.1.3i. Among the 75 treatments, 41.33 % of the treatments came under crown leaves of green colour with red mottling, followed by 24 % of treatments with the crown leaves greenish/green and silvery white colours. Whereas, 8 % of treatments with the crown leaves of purplish/pinkish colour and 2.66 % of treatments observed green with yellow mottling coloured crown leaves. Whereas, Mauritius was showing green with red mottling coloured of crown leaves.

4.1.1.3.9. Presence of spines on crown leaves

The data related to presence of spines on crown leaves of all the treatments is presented in Table 4.1.1.3e to Table 4.1.1.3i. Presence of spines on crown leaves, among the 75 treatments and Mauritius, all treatments observed crown leaves of spiny serrate.

4.1.1.3.10. Crown attachment to fruit

The data related to crown attachment to fruit is presented in Table 4.1.1.3e to Table 4.1.1.3i. With short distinct neck was observed across all the treatments.

4.1.1.3.11. Colour of crown attachment area/basal leaves (collar)

According to descriptors, the data related to colour of crown attachment area/basal leaves (collar) of all the treatments was varied significantly and presented in Table 4.1.1.3e to Table 4.1.1.3i. Ttreatments namely T-1, T-2, T-3, T-14, T-15, T-16, T-18, T-19, T-20, T-22, T-29, T-31, T-34, T-41, T-42, T-45, T-58, and T-65 observed silvery green type leaves. Ttreatments such as T-4, T-6, T-8, T-37, T-49, T-69, and T-70 identified yellowish/yellow type leaves. Ttreatments T-50, T-74, and T-75 observed greenish green type leaves. Treatment T-25 recorded red purplish type leaves, T-40 was observed as a green with orange mottling leaves, and T-17 was green with red mottling leaves. Remaining treatments showed pinkish/pink type leaves.

4.1.1.3.12. Fruit shape

The data related to fruit shape of all the treatments is presented in Table 4.1.1.3e to Table 4.1.1.3i. Fruit shape, among the 75 treatments, 30.26 % of the treatments came under the shape of cylindrical tapering slightly from near base, 22.37 % with the shape of conical type, 19.74 % with the shape of oval type, 7.89 % with the shape of pyramidal type, 6.58 % with the shape of round type, 6.58 % with the shape of reniform type, 3.95 % with the shape of pyriform type, and 2.63 % with the shape of square like. While, the check variety Mauritius showed the long conical type fruit shapes.

4.1.1.3.13. Fruit colour when ripe

The data related to fruit colour of all the treatments is presented in Table 4.1.1.3e to Table 4.1.1.3i. Colour of fruits, among the 75 treatments, 43.42 % of the treatments came under golden yellow colour fruits, followed by 23.68 % of treatments with the bright yellow colour fruits. Whereas, 18.42 % of treatments with the deep yellow to orange colour fruits and 14.47 % of treatments observed yellow with green mottling coloured fruits. Whereas, Mauritius was showing bright yellow to golden yellow coloured fruits.

4.1.1.3.14. Presence of “eye” (Berry) corking

The data related to presence of “eye” (Berry) corking presented in Table 4.1.1.3j to Table 4.1.1.3m. Presence of “eye” (Berry) corking, among the 75 treatments and parent source Mauritius, all treatments showed presence of “eye” (Berry) corking of fruits.

4.1.1.3.15. Presence of crowns coming from an “eye” (Berry)

The data related to presence of crowns coming from an “eye” (Berry) is presented in Table 4.1.1.3j to Table 4.1.1.3m. Presence of crowns coming from an “eye” (Berry), among the 75 treatments along with control treatment Mauritius, all treatments were observed presence of crowns coming from an “eye” (Berry) of fruits.

4.1.1.3.16. Number of eyes

The data related to eyes number of fruit is presented in Table 4.1.1.3j to Table 4.1.1.3m. The mean fruit eyes number were varied between 53.00 and 146.00 with the highest number of eyes in treatment T-10 and the lowest number of eyes in treatment T-65. However, average eye numbers of 112.00 was recorded in the check variety Mauritius.

Table 4.1.1.3e. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe
T 1	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 2	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Cylindrical, tapering slightly from near base	Golden yellow
T 3	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Pyriform	Golden yellow
T 4	Green with red mottling	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 5	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 6	Green with yellow mottling	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Oval	Deep yellow to orange
T 7	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Pyriform	Golden yellow
T 8	Green with red mottling	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Round	Bright yellow
T 9	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Bright yellow
T 10	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Yellow with green mottling
T 11	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Golden yellow
T 12	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Golden yellow
T 13	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Pyramidal	Golden yellow
T 14	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Oval	Yellow with green mottling
T 15	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Round	Yellow with green mottling
T 16	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Oval	Golden yellow

Table 4.1.1.3f. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe
T 17	Green with red mottling	Spiny serrate	With short, distinct neck	Green with red mottling	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 18	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Pyramidal	Golden yellow
T 19	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Cylindrical, tapering slightly from near base	Yellow with green mottling
T 20	Silvery white	Spiny serrate	With short, distinct neck	Silvery green	Oval	Golden yellow
T 21	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Yellow with green mottling
T 22	Green with yellow mottling	Spiny serrate	With short, distinct neck	Silvery green	Cylindrical, tapering slightly from near base	Golden yellow
T 23	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Bright yellow
T 24	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Square like	Deep yellow to orange
T 25	Green with red mottling	Spiny serrate	With short, distinct neck	Red purplish	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 26	Purplish / pinkish	Spiny serrate	With short, distinct neck	Pinkish/ pink	Pyramidal	Yellow with green mottling
T 27	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Golden yellow
T 28	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Golden yellow
T 29	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Conical	Deep yellow to orange

Table 4.1.1.3g. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe
T 30	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Reniform	Bright yellow
T 31	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Conical	Yellow with green mottling
T 32	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Golden yellow
T 33	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Yellow with green mottling
T 34	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Pyriform	Golden yellow
T 35	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Bright yellow
T 36	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Bright yellow
T 37	Purplish / pinkish	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Cylindrical, tapering slightly from near base	Golden yellow
T 38	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Golden yellow
T 39	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Reniform	Golden yellow
T 40	Greenish / green	Spiny serrate	With short, distinct neck	Green with orange mottling	Reniform	Yellow with green mottling
T 41	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Oval	Bright yellow
T 42	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Oval	Deep yellow to orange
T 43	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Bright yellow
T 44	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Pyramidal	Bright yellow

Table 4.1.1.3h. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe
T 45	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Round	Golden yellow
T 46	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Bright yellow
T 47	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Bright yellow
T 48	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Golden yellow
T 49	Green with red mottling	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 50	Silvery white	Spiny serrate	With short, distinct neck	Greenish/ green	Conical	Golden yellow
T 51	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Golden yellow
T 52	Purplish / pinkish	Spiny serrate	With short, distinct neck	Pinkish/ pink	Reniform	Yellow with green mottling
T 53	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Bright yellow
T 54	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Golden yellow
T 55	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Golden yellow
T 56	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Round	Bright yellow
T 57	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Deep yellow to orange
T 58	Green with red mottling	Spiny serrate	With short, distinct neck	Silvery green	Pyramidal	Bright yellow

Table 4.1.1.3i. Fruit and crown characters of somaclonal variants of pineapple variety Mauritius

Treatments	Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe
T 59	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Golden yellow
T 60	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Golden yellow
T 61	Silvery white	Spiny serrate	With short, distinct neck	Pinkish/ pink	Square like	Golden yellow
T 62	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Golden yellow
T 63	Purplish / pinkish	Spiny serrate	With short, distinct neck	Pinkish/ pink	Oval	Golden yellow
T 64	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Pyramidal	Bright yellow
T 65	Greenish / green	Spiny serrate	With short, distinct neck	Silvery green	Round	Golden yellow
T 66	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Golden yellow
T 67	Greenish / green	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Bright yellow
T 68	Purplish / pinkish	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Deep yellow to orange
T 69	Green with red mottling	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Conical	Deep yellow to orange
T 70	Green with red mottling	Spiny serrate	With short, distinct neck	Yellowish/ yellow	Cylindrical, tapering slightly from near base	Golden yellow
T 71	Purplish / pinkish	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Golden yellow
T 72	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Cylindrical, tapering slightly from near base	Golden yellow
T 73	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Reniform	Yellow with green mottling
T 74	Green with red mottling	Spiny serrate	With short, distinct neck	Greenish/ green	Conical	Bright yellow
T 75	Green with red mottling	Spiny serrate	With short, distinct neck	Greenish/ green	Cylindrical, tapering slightly from near base	Deep yellow to orange
Mauritius	Green with red mottling	Spiny serrate	With short, distinct neck	Pinkish/ pink	Conical	Bright yellow

4.1.1.3.17. Profile of eyes

The data related to profile of eyes of all the treatments is presented in Table 4.1.1.3j to Table 4.1.1.3m. Profile of eyes, among the 75 treatments, 94.66 % of the treatments came under the normal type of profile of eyes, 2.66 % of treatments with flat type of profile of eyes (T-9, T-12) and 2.66 % of treatments (T-40, T-46) with prominent type of profile of eyes. Whereas, Mauritius variety was observed normal type of profile of eyes.

4.1.1.3.18. Relative surface of eyes

The data related to relative surface of eyes of all the treatments is presented in Table 4.1.1.3j to Table 4.1.1.3m. Relative surface of eyes, among the 75 treatments, 74.66 % of treatments came under medium relative surface of eyes, and 25.33 % of treatments with the small relative surface of eyes. With regards to check variety Mauritius, it was observed that medium relative surface of eye fruits.

4.1.1.3.19. Length of the fruit

The data related to length of fruit is presented in Table 4.1.1.3j to Table 4.1.1.3m. The length of fruit varied between 9.30 cm (T-56) and 17.40 cm (T-71). The mean length of the fruit (11.35 cm) was recorded in Mauritius.

4.1.1.3.20. Girth of the fruit

The data related to girth of fruit is presented in Table 4.1.1.3j to Table 4.1.1.3m. The girth of the fruit varied between 23.95 cm and 35.20 cm. The highest girth was observed in treatment T-10 and the lowest fruit girth observed in treatment T-29. Whereas, average girth of the fruit (28.55 cm) was recorded in Mauritius.

4.1.1.3.21. Breadth of the fruit

The data related to breadth of fruit is presented in Table 4.1.1.3j to Table 4.1.1.3m. The mean fruit breadth varied between 7.97 cm and 10.63 cm with the highest value in treatment T-10 and the lowest value in treatment T-12. While, the average breadth of fruit (8.76 cm) was noted down in control treatment Mauritius.

4.1.1.3.22. Taper ratio of the fruit

The data related to taper ratio of all the treatments is presented in Table 4.1.1.3j to Table 4.1.1.3m. Taper ratio of the fruit ranged from 0.71 to 0.93. The maximum taper ratio (0.93) of the fruit was recorded in treatment T-20, whereas the minimum taper ratio (0.71) was observed in treatment T-44. The average taper ratio (0.82) of the fruit was noted down in Mauritius variety.

4.1.1.3.23. Fruit weight with crown

The data related to fruit weight with crown is presented in Table 4.1.1.3n to Table 4.1.1.3q. Among the treatments, the highest fruit weight with crown of 1.27 kg was recorded in treatment T-10 and the lowest fruit weight with crown of 0.49 kg in treatment T-64. Whereas, the average fruit weight with crown of 0.62 kg was noted in Mauritius.

4.1.1.3.24. Fruit weight without crown

The data related to fruit weight without crown is presented in Table 4.1.1.3n to Table 4.1.1.3q. Among the treatments, the highest fruit weight without crown of 1.16 kg was recorded in treatment T-10 and the lowest fruit weight without crown of 0.42 kg in treatment T-54. Whereas, the average fruit weight without crown of 0.48 kg was noted in Mauritius.

4.1.1.3.25. Crown weight

The data related to crown weight is presented in Table 4.1.1.3n to Table 4.1.1.3q. Among the treatments, the highest crown weight of 0.17 kg was recorded in treatment T-24 and the lowest crown weight of 0.03 kg in treatment T-26. Similarly, the average crown weight of 0.14 kg was note down from the Mauritius.

4.1.1.3.26. Yield per plant

The data related to fruit yield of all the treatments is presented in Table 4.1.1.3n to Table 4.1.1.3q. Among the treatments, highest fruit yield (1.27 kg/plant) was found in treatment T-10, while treatment T-64 recorded the lowest fruit yield (0.49 kg/plant). Whereas, the average fruit yield of Mauritius was around 0.62 kg/plant.

Table 4.1.1.3j. Fruit characters of somaclonal variants of pineapple variety Mauritius

Treatments	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes	Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 1	Present (+)	Present (+)	88.50	Normal	Medium	13.30	32.00	9.87	0.84
T 2	Present (+)	Present (+)	87.00	Normal	Small	12.10	29.40	9.07	0.91
T 3	Present (+)	Present (+)	98.50	Normal	Small	12.50	29.10	9.27	0.75
T 4	Present (+)	Present (+)	101.00	Normal	Small	15.60	32.60	9.53	0.77
T 5	Present (+)	Present (+)	57.00	Normal	Medium	10.30	31.50	8.70	0.92
T 6	Present (+)	Present (+)	74.00	Normal	Small	12.90	27.90	8.40	0.86
T 7	Present (+)	Present (+)	59.00	Normal	Medium	12.40	31.10	8.63	0.86
T 8	Present (+)	Present (+)	67.00	Normal	Medium	10.70	28.30	8.67	0.81
T 9	Present (+)	Present (+)	71.00	Flat	Medium	11.05	28.30	8.43	0.83
T 10	Present (+)	Present (+)	146.00	Normal	Medium	16.50	35.20	10.63	0.81
T 11	Present (+)	Present (+)	79.00	Normal	Medium	11.45	28.35	9.70	0.84
T 12	Present (+)	Present (+)	83.00	Flat	Medium	13.20	29.45	7.97	0.86
T 13	Present (+)	Present (+)	92.50	Normal	Medium	12.80	29.65	9.43	0.78
T 14	Present (+)	Present (+)	72.50	Normal	Small	12.45	28.65	8.13	0.89
T 15	Present (+)	Present (+)	69.00	Normal	Medium	14.20	28.40	8.07	0.78
T 16	Present (+)	Present (+)	76.00	Normal	Medium	10.25	28.05	8.83	0.84
T 17	Present (+)	Present (+)	112.00	Normal	Small	15.10	32.30	9.97	0.79
T 18	Present (+)	Present (+)	88.00	Normal	Medium	14.50	30.50	8.70	0.75
T 19	Present (+)	Present (+)	88.00	Normal	Medium	14.90	33.10	9.90	0.88
T 20	Present (+)	Present (+)	78.00	Normal	Medium	11.30	29.60	8.80	0.93
T 21	Present (+)	Present (+)	79.50	Normal	Medium	12.20	28.45	8.97	0.87
T 22	Present (+)	Present (+)	89.00	Normal	Small	13.40	32.40	9.80	0.86

Table 4.1.1.3k. Fruit characters of somaclonal variants of pineapple variety Mauritius

Treatments	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes	Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 23	Present (+)	Present (+)	80.00	Normal	Medium	13.60	33.10	8.97	0.79
T 24	Present (+)	Present (+)	104.00	Normal	Medium	13.20	33.50	9.83	0.87
T 25	Present (+)	Present (+)	112.00	Normal	Small	15.65	32.55	9.30	0.87
T 26	Present (+)	Present (+)	85.00	Normal	Medium	12.60	31.60	9.23	0.77
T 27	Present (+)	Present (+)	76.50	Normal	Medium	14.55	28.20	8.67	0.85
T 28	Present (+)	Present (+)	67.00	Normal	Medium	12.05	27.95	8.50	0.83
T 29	Present (+)	Present (+)	65.00	Normal	Medium	12.75	23.95	8.57	0.90
T 30	Present (+)	Present (+)	76.00	Normal	Medium	12.55	28.40	8.73	0.83
T 31	Present (+)	Present (+)	93.00	Normal	Medium	14.00	32.80	9.53	0.78
T 32	Present (+)	Present (+)	78.50	Normal	Medium	13.05	28.95	8.87	0.83
T 33	Present (+)	Present (+)	79.50	Normal	Medium	10.95	27.35	9.10	0.77
T 34	Present (+)	Present (+)	80.00	Normal	Medium	14.10	29.20	8.87	0.91
T 35	Present (+)	Present (+)	99.00	Normal	Medium	13.70	29.10	8.60	0.81
T 36	Present (+)	Present (+)	123.50	Normal	Medium	14.75	30.40	9.83	0.87
T 37	Present (+)	Present (+)	85.00	Normal	Medium	12.80	30.90	9.07	0.86
T 38	Present (+)	Present (+)	92.50	Normal	Medium	13.00	28.55	9.57	0.88
T 39	Present (+)	Present (+)	84.00	Normal	Medium	12.65	29.25	9.60	0.80
T 40	Present (+)	Present (+)	89.50	Prominent	Small	12.70	28.15	9.77	0.85
T 41	Present (+)	Present (+)	79.00	Normal	Medium	13.90	31.60	9.33	0.84
T 42	Present (+)	Present (+)	81.50	Normal	Medium	11.40	29.60	9.57	0.81
T 43	Present (+)	Present (+)	77.00	Normal	Small	12.45	32.20	10.30	0.74
T 44	Present (+)	Present (+)	102.50	Normal	Medium	12.95	29.75	9.00	0.71
T 45	Present (+)	Present (+)	64.50	Normal	Medium	9.50	26.95	8.17	0.86

Table 4.1.1.3l. Fruit characters of somaclonal variants of pineapple variety Mauritius

Treatments	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes	Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 46	Present (+)	Present (+)	92.00	Prominent	Small	12.50	31.90	8.30	0.74
T 47	Present (+)	Present (+)	74.00	Normal	Medium	13.10	29.90	8.07	0.90
T 48	Present (+)	Present (+)	79.00	Normal	Medium	10.30	27.55	8.33	0.82
T 49	Present (+)	Present (+)	90.00	Normal	Small	14.30	31.50	9.30	0.80
T 50	Present (+)	Present (+)	62.00	Normal	Medium	11.20	30.80	8.50	0.88
T 51	Present (+)	Present (+)	60.00	Normal	Medium	11.40	30.20	8.43	0.92
T 52	Present (+)	Present (+)	66.00	Normal	Medium	13.30	33.30	9.03	0.78
T 53	Present (+)	Present (+)	66.00	Normal	Medium	12.10	31.60	8.90	0.79
T 54	Present (+)	Present (+)	56.00	Normal	Medium	12.20	27.90	8.50	0.90
T 55	Present (+)	Present (+)	80.50	Normal	Small	12.30	28.00	8.70	0.84
T 56	Present (+)	Present (+)	53.50	Normal	Medium	9.30	26.90	9.17	0.92
T 57	Present (+)	Present (+)	67.50	Normal	Medium	10.20	26.65	9.03	0.84
T 58	Present (+)	Present (+)	66.00	Normal	Medium	10.60	29.40	8.67	0.93
T 59	Present (+)	Present (+)	81.00	Normal	Small	12.80	30.40	9.43	0.78
T 60	Present (+)	Present (+)	85.00	Normal	Medium	12.50	30.10	9.23	0.80
T 61	Present (+)	Present (+)	88.00	Normal	Medium	13.60	31.50	9.17	0.80
T 62	Present (+)	Present (+)	66.00	Normal	Medium	9.45	27.85	9.27	0.72
T 63	Present (+)	Present (+)	87.50	Normal	Small	11.40	29.80	9.33	0.84
T 64	Present (+)	Present (+)	57.00	Normal	Medium	9.60	29.10	8.20	0.77
T 65	Present (+)	Present (+)	53.00	Normal	Medium	11.50	28.50	8.57	0.82
T 66	Present (+)	Present (+)	102.50	Normal	Medium	13.65	32.50	9.63	0.81
T 67	Present (+)	Present (+)	83.00	Normal	Medium	13.65	32.10	9.93	0.90
T 68	Present (+)	Present (+)	77.50	Normal	Medium	13.55	29.95	9.37	0.82

Table 4.1.1.3m. Fruit characters of somaclonal variants of pineapple variety Mauritius

Treatments	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes	Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 69	Present (+)	Present (+)	93.00	Normal	Small	15.20	32.20	9.70	0.75
T 70	Present (+)	Present (+)	84.00	Normal	Small	13.60	31.90	9.50	0.89
T 71	Present (+)	Present (+)	100.00	Normal	Small	17.40	34.60	9.87	0.74
T 72	Present (+)	Present (+)	85.00	Normal	Small	12.90	30.10	9.10	0.80
T 73	Present (+)	Present (+)	86.00	Normal	Medium	14.05	30.30	9.50	0.83
T 74	Present (+)	Present (+)	80.50	Normal	Medium	12.25	28.85	8.90	0.90
T 75	Present (+)	Present (+)	87.00	Normal	Medium	12.20	29.90	9.10	0.79
Mauritius	Present (+)	Present (+)	112.00	Normal	Medium	11.35	28.55	8.76	0.82

4.1.1.3.27. Estimated yield

The data related to fruit yield of all the treatments is presented in Table 4.1.1.3n to Table 4.1.1.3q. Among the treatments, highest estimated fruit yield (51.27 t/ha) was found in treatment T-10, while treatment T-45 recorded the lowest estimated fruit yield (16.67 t/ha). Whereas, the average estimated fruit yield of Mauritius was around 18.00 t/ha.

4.1.1.3.28. Shelf life

The data related to shelf-life of all the treatments is presented in Table 4.1.1.3n to Table 4.1.1.3q. The shelf-life was calculated as number of days from day of harvesting to till the fruits remained marketable. The fruits were rated as not marketable when more than 50 % of fruits in a lot showed incidence of spoilage. Shelf life of all the treatments varied from 6 to 9 days under ambient conditions. Majority of the treatments (72 %) had a shelf life of 9 days. Whereas, Mauritius had fruit shelf life of 7 days.

4.1.1.3.29. Peel weight

The data related to peel weight of all the treatments is presented in Table 4.1.1.3n to Table 4.1.1.3q. Peel weight ranged from 0.08 kg to 0.25 kg. Treatment T-31 showed maximum peel weight while treatment T-47 showed the minimum peel weight. The average peel weight (0.13 kg) of the fruit was note down in Mauritius variety.

4.1.1.3.30. Pulp weight

The data related to pulp weight of all the treatments is presented in Table 4.1.1.3n to Table 4.1.1.3q. Pulp weight varied from 0.20 kg to 0.78 kg. Among the treatments, highest pulp weight (0.78 kg) was found in treatment T-10 while treatment T-45 recorded the lowest pulp weight (0.20 kg). The average pulp weight of 0.33 kg of the fruit was recorded in check variety Mauritius.

4.1.1.3.31. Pulp percentage

The data related to pulp percentage of all the treatments is presented in Table 4.1.1.3n to Table 4.1.1.3q. Pulp percentage ranged from 32.37 to 78.12 %. The highest pulp percentage (78.12 %) of the fruit was recorded in treatment T-24, whereas the lowest pulp percentage (32.37 %) was in treatment T-40. The pulp percentage 67.60 % of the fruit was noted in Mauritius.

4.1.1.4. Qualitative analysis of fruits

4.1.1.4.1. Juice

The data related to juice percentage of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Juice percentage ranged from 73.42 to 96.69 %. The highest juice percentage of the fruit was recorded in treatment T-4, whereas the lowest juice percentage (73.42 %) was in treatment T-3. The average data of juice percentage (86.76 %) of the fruit was observed in Mauritius variety.

4.1.1.4.2. TSS

The data related to TSS of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Wide variability were observed among the treatments with regard to the total soluble solids (TSS), which ranged from 9.00 to 15.20 °Brix. The highest value of 15.20 °Brix was recorded in treatment T-56 and the lowest value of 9.00 °Brix was recorded in treatment T-3 and T-13. The average data of total soluble solids (11.23 °Brix) of the fruit was assessed in Mauritius.

4.1.1.4.3. Acidity

The data related to acidity of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Titratable acidity ranged from 0.26 to 1.54 %. Treatment T-9, T-16, T-20, T-29, T-32, and T-59 recorded the highest acidity of 1.54 %, whereas treatment T-24 had the lowest acidity of 0.26 %. The mean data with regards to acidity (1.17 %) of the fruit was measured in check Mauritius variety.

4.1.1.4.4. Total sugars

The data related to total sugar content of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Total sugar content ranged from 8.40 to 14.00 % among the treatments. Treatment T-12, T-18, and T-35 recorded the highest value of 14.00 %, while treatment T-4 recorded the lowest value of 8.40 %. The mean value with respect to total sugars (11.31 %) of the fruit was calculated in check variety Mauritius.

Table 4.1.1.3n. Fruit and yield characters of somaclonal variants of pineapple variety Mauritius

Treatments	Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage (%)
T 1	0.74	0.66	0.08	0.74	30.02	7.00	0.22	0.39	59.00
T 2	0.67	0.61	0.06	0.67	26.91	6.00	0.18	0.32	52.79
T 3	0.82	0.75	0.07	0.82	24.34	7.00	0.15	0.34	45.19
T 4	0.92	0.87	0.05	0.92	37.01	8.00	0.12	0.63	71.95
T 5	0.61	0.50	0.11	0.61	24.72	9.00	0.13	0.27	53.41
T 6	0.57	0.51	0.06	0.57	22.87	6.00	0.14	0.29	56.86
T 7	0.59	0.50	0.09	0.59	23.92	7.00	0.14	0.28	55.56
T 8	0.55	0.46	0.09	0.55	22.06	7.00	0.13	0.29	63.60
T 9	0.55	0.47	0.08	0.55	22.14	8.00	0.13	0.27	56.52
T 10	1.27	1.16	0.11	1.27	51.27	6.00	0.22	0.78	66.90
T 11	0.71	0.66	0.05	0.71	20.91	9.00	0.15	0.28	42.38
T 12	0.74	0.66	0.08	0.74	29.69	7.00	0.13	0.42	64.06
T 13	0.78	0.70	0.08	0.78	25.63	8.00	0.18	0.33	46.18
T 14	0.54	0.49	0.05	0.54	21.65	9.00	0.15	0.26	53.04
T 15	0.54	0.46	0.08	0.54	21.98	7.00	0.12	0.26	56.47
T 16	0.61	0.49	0.12	0.61	18.79	7.00	0.12	0.22	44.76
T 17	0.94	0.88	0.06	0.94	38.06	8.00	0.12	0.40	45.48
T 18	0.62	0.55	0.07	0.62	24.89	9.00	0.15	0.31	57.35
T 19	0.88	0.79	0.09	0.88	35.47	6.00	0.22	0.49	63.01
T 20	0.61	0.50	0.11	0.61	24.81	9.00	0.13	0.29	56.75
T 21	0.67	0.61	0.06	0.67	22.77	7.00	0.17	0.28	45.04
T 22	0.84	0.77	0.07	0.84	33.94	6.00	0.20	0.45	58.81

Table 4.1.1.3o. Fruit and yield characters of somaclonal variants of pineapple variety Mauritius

Treatments	Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage (%)
T 23	0.74	0.67	0.07	0.74	29.82	8.00	0.19	0.38	55.95
T 24	0.95	0.78	0.17	0.95	38.46	8.00	0.12	0.61	78.12
T 25	1.16	1.06	0.10	1.16	40.52	7.00	0.12	0.64	59.74
T 26	0.73	0.70	0.03	0.73	29.49	6.00	0.17	0.49	69.63
T 27	0.65	0.59	0.06	0.65	26.40	9.00	0.15	0.37	63.36
T 28	0.57	0.50	0.07	0.57	22.66	8.00	0.19	0.23	46.26
T 29	0.60	0.48	0.12	0.60	21.96	9.00	0.15	0.28	58.40
T 30	0.62	0.55	0.07	0.62	24.93	7.00	0.18	0.28	51.97
T 31	0.83	0.70	0.13	0.83	33.53	6.00	0.25	0.37	52.56
T 32	0.65	0.56	0.09	0.65	26.42	9.00	0.15	0.29	50.22
T 33	0.58	0.54	0.04	0.58	17.96	7.00	0.15	0.21	37.73
T 34	0.71	0.56	0.15	0.71	28.68	8.00	0.16	0.30	54.48
T 35	0.68	0.64	0.04	0.68	25.78	9.00	0.17	0.34	53.41
T 36	0.90	0.84	0.06	0.90	31.39	7.00	0.18	0.42	49.70
T 37	0.70	0.62	0.08	0.70	28.36	9.00	0.17	0.41	65.50
T 38	0.86	0.78	0.08	0.86	25.13	6.00	0.16	0.32	40.69
T 39	0.73	0.66	0.07	0.73	25.73	8.00	0.16	0.32	47.66
T 40	0.89	0.83	0.06	0.89	23.86	6.00	0.20	0.27	32.37
T 41	0.78	0.64	0.14	0.78	31.35	7.00	0.23	0.35	54.06
T 42	0.64	0.53	0.11	0.64	23.98	8.00	0.14	0.31	57.56
T 43	0.96	0.90	0.06	0.96	28.44	9.00	0.10	0.45	48.95
T 44	0.66	0.60	0.06	0.66	24.24	7.00	0.18	0.31	50.71

Table 4.1.1.3p. Fruit and yield characters of somaclonal variants of pineapple variety Mauritius

Treatments	Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage (%)
T 45	0.51	0.46	0.05	0.51	16.67	7.00	0.10	0.20	43.39
T 46	0.64	0.56	0.08	0.64	25.69	8.00	0.16	0.31	55.04
T 47	0.95	0.86	0.09	0.95	29.15	9.00	0.08	0.33	38.29
T 48	0.61	0.54	0.07	0.61	20.26	7.00	0.12	0.24	45.32
T 49	0.80	0.74	0.06	0.80	32.24	6.00	0.21	0.40	53.78
T 50	0.56	0.48	0.08	0.56	22.79	7.00	0.15	0.27	55.56
T 51	0.62	0.54	0.08	0.62	24.97	8.00	0.14	0.30	55.93
T 52	0.68	0.61	0.07	0.68	27.55	6.00	0.17	0.35	56.17
T 53	0.60	0.54	0.06	0.60	24.16	6.00	0.16	0.29	53.36
T 54	0.53	0.42	0.11	0.53	21.57	7.00	0.11	0.24	58.10
T 55	0.57	0.52	0.05	0.57	22.83	8.00	0.16	0.28	53.24
T 56	0.62	0.55	0.07	0.62	18.14	9.00	0.11	0.24	43.51
T 57	0.77	0.72	0.05	0.77	19.49	7.00	0.14	0.27	37.57
T 58	0.60	0.52	0.08	0.60	24.40	8.00	0.14	0.28	54.02
T 59	0.71	0.65	0.06	0.71	23.39	9.00	0.14	0.29	44.48
T 60	0.68	0.64	0.04	0.68	24.54	8.00	0.13	0.32	50.16
T 61	0.97	0.81	0.16	0.97	34.91	7.00	0.14	0.48	59.11
T 62	0.81	0.75	0.06	0.81	20.56	8.00	0.13	0.27	35.93
T 63	0.66	0.59	0.07	0.66	22.70	7.00	0.18	0.24	40.00
T 64	0.49	0.43	0.06	0.49	19.72	8.00	0.09	0.22	50.70
T 65	0.50	0.44	0.06	0.50	20.28	9.00	0.13	0.26	58.30
T 66	0.79	0.72	0.07	0.79	31.33	7.00	0.20	0.38	53.02

Table 4.1.1.3q. Fruit and yield characters of somaclonal variants of pineapple variety Mauritius

Treatments	Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage (%)
T 67	0.90	0.82	0.08	0.90	34.28	8.00	0.17	0.46	55.65
T 68	0.72	0.66	0.06	0.72	27.03	9.00	0.16	0.32	47.78
T 69	0.88	0.82	0.06	0.88	35.55	6.00	0.22	0.43	52.45
T 70	0.88	0.79	0.09	0.88	35.47	7.00	0.21	0.44	55.95
T 71	1.18	1.14	0.04	1.18	47.83	8.00	0.19	0.57	49.65
T 72	0.73	0.66	0.07	0.73	29.49	8.00	0.18	0.36	55.15
T 73	0.87	0.81	0.06	0.87	30.34	6.00	0.19	0.35	42.54
T 74	0.66	0.60	0.06	0.66	24.06	8.00	0.16	0.33	54.75
T 75	0.73	0.63	0.10	0.73	29.41	9.00	0.16	0.35	56.37
Mauritius	0.62	0.48	0.14	0.62	18.00	7.00	0.13	0.33	67.60

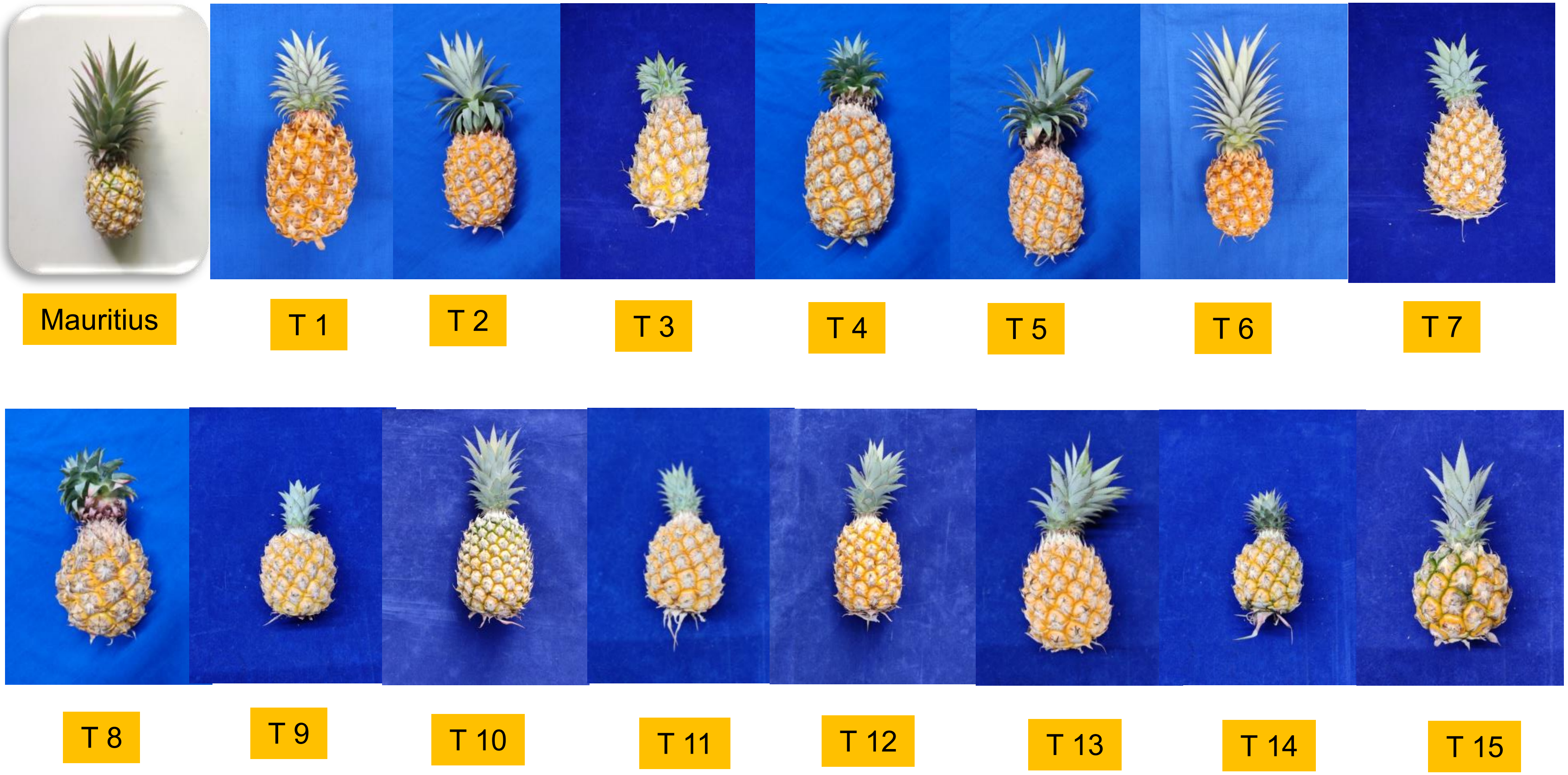


Plate 4.1.1.3a. Fruit variability of somaclonal variants

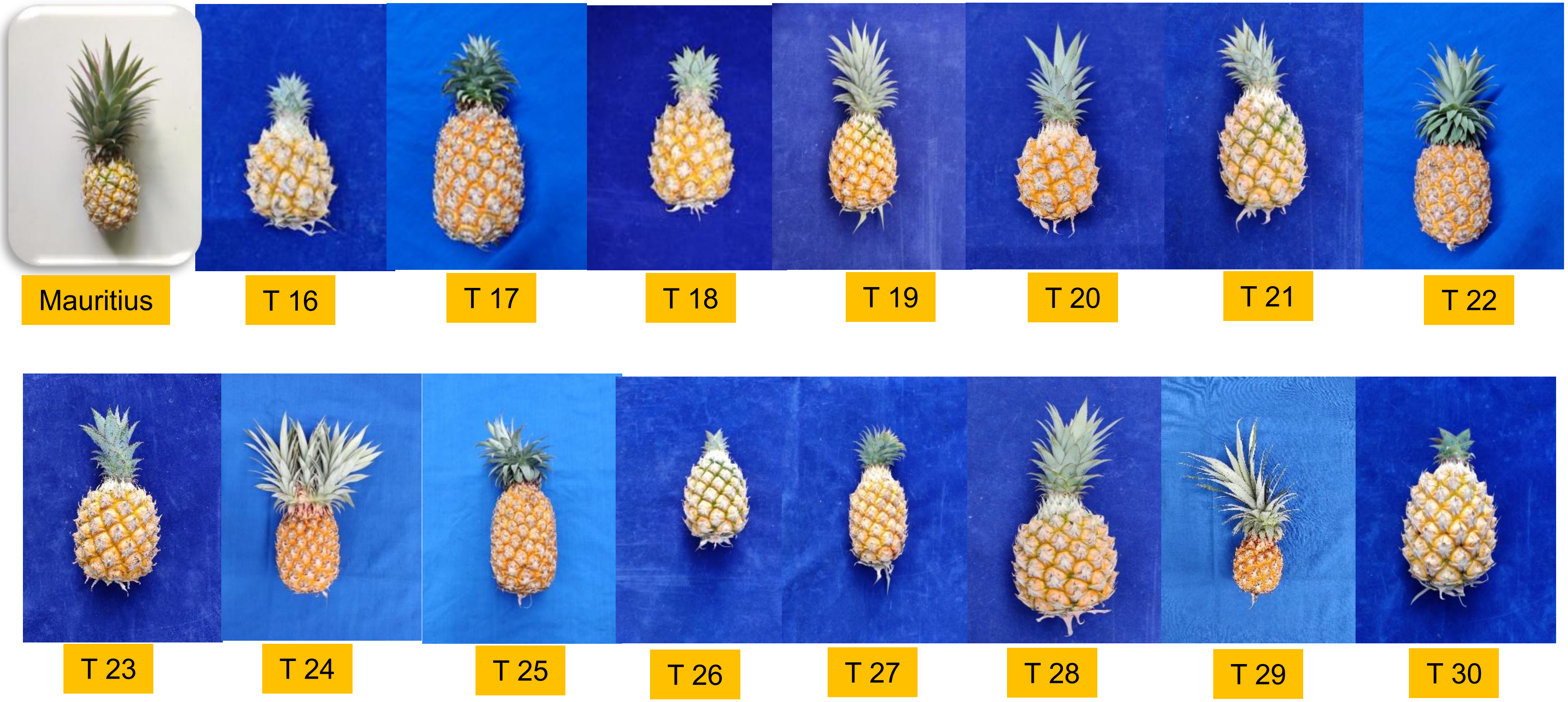


Plate 4.1.1.3b. Fruit variability of somaclonal variants

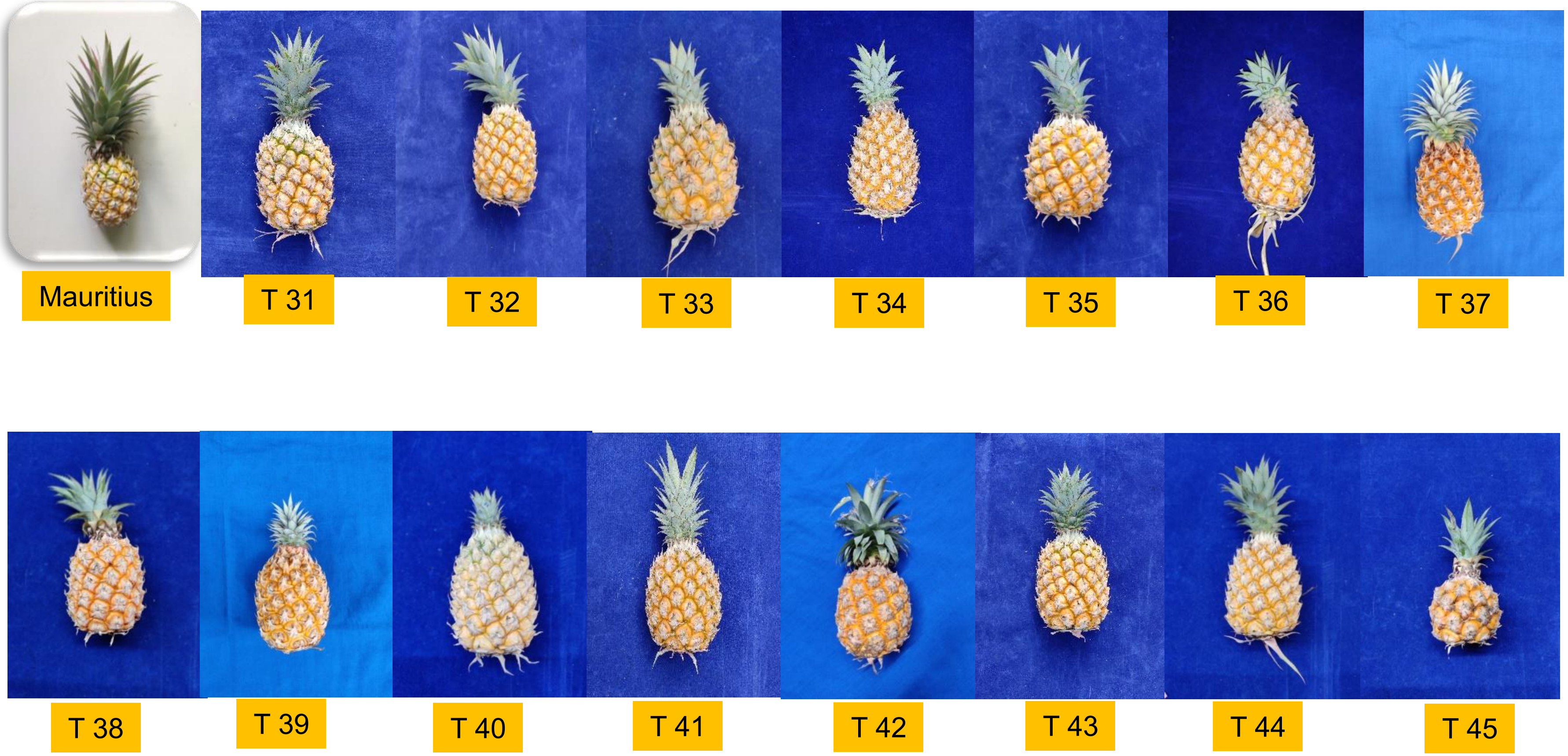


Plate 4.1.1.3c. Fruit variability of somaclonal variants

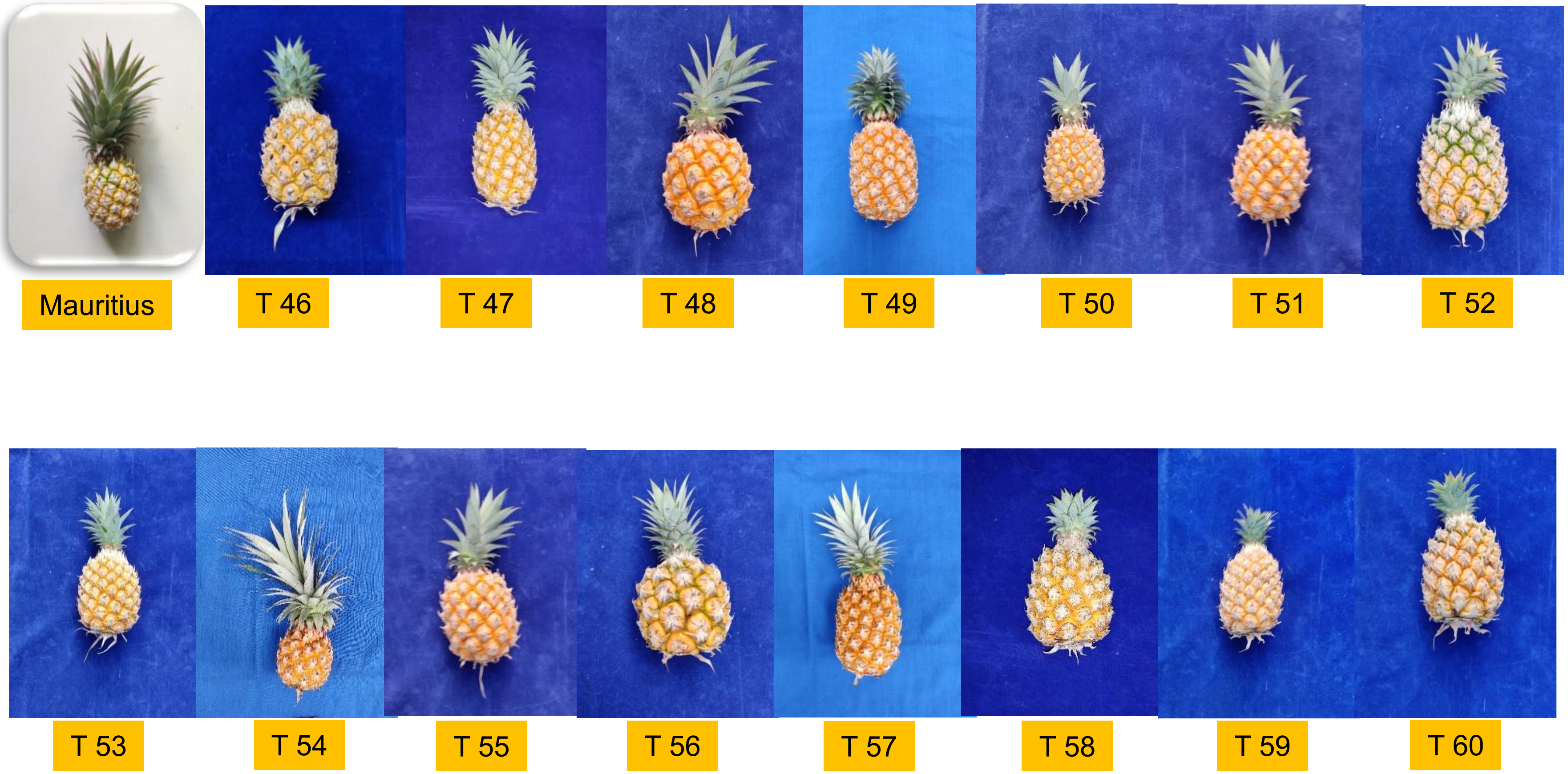


Plate 4.1.1.3d. Fruit variability of somaclonal variants

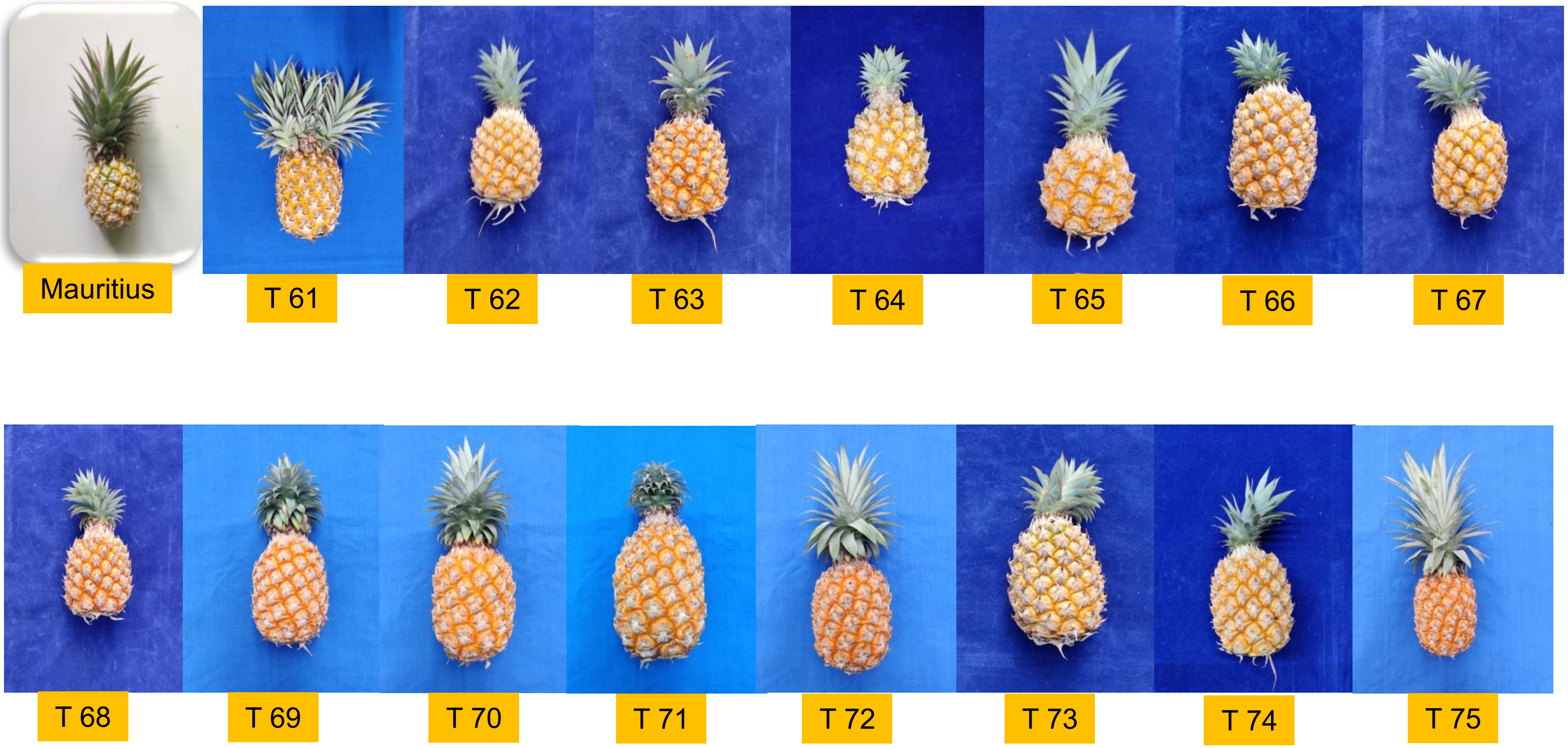


Plate 4.1.1.3e. Fruit variability of somaclonal variants

4.1.1.4.5. Reducing sugars

The data related to reducing sugar content of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Reducing sugar content varied from 1.38 to 5.45 %. The highest value of 5.45 % was observed in treatment T-6 and the lowest value of 1.38 % was in treatment T-27. The average reducing sugars (2.35 %) of the fruit was carefully calculated in Mauritius variety.

4.1.1.4.6. Non-reducing sugars

The data related to non-reducing sugar content of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Non-reducing sugar content varied from 3.55 to 12.37 % with the highest value being recorded in treatment T-35 and the lowest value in treatment T-6. The data related to non-reducing sugars (8.96 %) of the fruit was totalled in control treatment Mauritius variety.

4.1.1.4.7. Sugar/acid ratio

The data related to TSS/acid ratio of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. TSS/acid ratio was worked out by dividing the value of total soluble solids by the value of titratable acidity. TSS/acid ranged from 7.81 to 47.69. The maximum TSS/acid ratio of the fruit was recorded in treatment T-24 (47.69), whereas the minimum TSS/acid ratio (7.81) was in treatment T-31. The average TSS/acid ratio data (9.59) of the fruit was calculated for Mauritius.

4.1.1.4.8. Fibre

The data related to fibre content of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. The fibre content ranged from 20.00 to 43.30 %. Treatment T-5 recorded the highest value of 43.30 %, whereas treatment T-4 had the lowest value of 20.00 %. The mean data with regards to fibre content (32.95 %) of the fruit was assessed in check variety.

4.1.1.4.9. Total carotenoids

The data related to total carotenoids content of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. All the clonal variant treatments recorded total carotenoids content ranged from 106.81 to 387.00 mg/100g. Treatment T-27 recorded the highest value of 387.00 mg/100g, whereas treatment T-8 recorded the lowest value of 106.81 mg/100g. The average total carotenoids content (235.39 mg/100g) of the fruit was estimated in Mauritius variety.

4.1.1.4.10. Ascorbic acid

The data related to ascorbic acid content of all the treatments is presented in Table 4.1.1.4a and Table 4.1.1.4b. Ascorbic acid content varied widely among the treatments and ranged from 10.26 to 184.62 mg/100g. The highest content of 184.62 mg/100g was recorded in treatment T-15, whereas treatment T-4, T-6, T-17, T-22, and T-75 recorded the lowest content of 10.26 mg/100g. The mean ascorbic acid content (72.12 mg/100g) of the fruit was estimated in the check variety Mauritius.

4.1.1.5. Organoleptic evaluation

The data related to organoleptic evaluation of somaclonal variants of pineapple variety Mauritius, the mean value of each attribute and total score of each treatment is presented in Table 4.1.1.5a and Table 4.1.1.5b. The highest total sensory score (sum of mean of each attribute) was recorded in treatment T-33 (42.60) followed by treatment T-45 (42.50), Mauritius (42.20), T-55 (41.70) and the lowest total score was recorded in treatment T-61 (26.60). They were most preferred/accepted by panellists because of their better fruit colour, taste, flavour, texture and overall acceptability.

Evaluation of seventy five somaclones under open field conditions along with the parental clone Mauritius, pointed out existence of wide variability for all the traits. Many of somaclonal variants exhibited higher desirability compared of parental clone Mauritius. The per cent variation in traits among the somaclonal variants over the parental clone Mauritius is given in Table 4.1.1a and Table 4.1.1b. It is observed that the higher per cent increased in fruit weight with crown (104.84 %) and pulp weight (137.66 %) was observed in T-10 (fruit weight with crown: 1.27 kg; pulp weight: 0.78 kg) compared to Mauritius (fruit weight with crown: 0.62 kg; pulp weight: 0.33 kg). Whereas, T-64 (0.49 kg) registered a decreased in fruit weight with crown (20.97 %) and T-45 (0.20 kg) in pulp weight (39.21 %). Similarly, an increasing in TSS was also observed compared to Mauritius in T-56 (15.20 °Brix; 35.35 %). In comparison to Mauritius high per cent decrease was evident with respect to traits *viz*., days to attain ideal leaf stage for flowering (T-30; 312.00 d; 21.21 %), crown weight (T-26; 0.03 kg;

Table 4.1.1.4a. Fruit quality analysis of somaclonal variants of pineapple variety Mauritius

Treatments	Juice (%)	TSS (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)	Sugar/ acid ratio	Fibre (%)	Total carotenoids (mg 100 g-1)	Ascorbic acid (mg 100 g-1)
T 1	87.14	13.30	0.96	12.73	2.38	10.35	13.85	31.30	294.12	23.08
T 2	92.55	13.20	0.90	9.21	1.56	7.65	14.67	21.10	247.68	20.51
T 3	73.42	9.00	1.02	11.01	4.07	6.94	8.82	31.10	232.20	143.59
T 4	96.96	12.50	0.90	8.40	3.27	5.13	13.89	20.00	255.42	10.26
T 5	93.98	11.20	0.77	10.32	3.23	7.09	14.55	43.30	184.21	30.77
T 6	94.83	10.50	0.77	9.00	5.45	3.55	13.64	32.20	216.72	10.26
T 7	95.71	15.10	1.41	10.14	3.95	6.19	10.71	20.92	371.52	20.51
T 8	93.79	13.90	1.02	11.11	5.07	6.04	13.63	21.40	106.81	15.38
T 9	81.05	12.60	1.54	11.97	3.26	8.71	8.18	37.70	278.64	25.64
T 10	95.12	11.75	0.77	10.22	2.98	7.24	15.26	33.50	247.68	46.15
T 11	78.54	11.40	0.77	13.57	3.98	9.59	14.81	36.55	224.46	71.79
T 12	87.14	12.90	0.90	14.00	1.92	12.08	14.33	32.20	286.38	107.69
T 13	85.81	9.00	0.90	12.73	2.21	10.52	10.00	31.10	263.16	61.54
T 14	87.54	13.30	0.90	12.35	2.69	9.66	14.78	34.40	270.90	41.03
T 15	83.46	14.00	1.15	9.46	2.80	6.66	12.17	37.50	301.86	184.62
T 16	81.52	13.30	1.54	10.20	3.57	6.63	8.64	37.33	239.94	41.03
T 17	90.34	12.30	1.02	10.53	3.36	7.17	12.06	34.40	294.12	10.26
T 18	87.14	14.50	1.28	14.00	4.62	9.38	11.33	29.32	208.98	128.21
T 19	76.78	12.30	1.02	12.59	2.08	10.51	12.06	34.30	332.82	143.59
T 20	73.55	14.00	1.54	10.25	3.67	6.58	9.09	31.10	170.28	46.15
T 21	87.14	14.30	1.02	9.31	2.30	7.01	14.02	34.80	185.76	97.44
T 22	94.49	13.00	0.90	10.16	3.47	6.69	14.44	32.10	247.68	10.26
T 23	93.62	11.70	0.90	10.61	4.23	6.38	13.00	37.11	294.12	20.51
T 24	95.53	12.40	0.26	11.67	3.63	8.04	47.69	32.20	309.60	15.38
T 25	85.23	11.55	1.15	12.36	2.53	9.83	10.04	30.30	301.86	25.64
T 26	95.27	13.60	1.41	11.86	2.56	9.30	9.65	34.60	216.72	41.03
T 27	88.17	13.10	1.02	12.46	1.38	11.08	12.84	38.10	387.00	46.15
T 28	89.03	10.70	0.77	11.93	1.84	10.09	13.90	37.30	294.12	158.97
T 29	85.33	14.70	1.54	13.46	3.13	10.33	9.55	35.70	325.08	82.05
T 30	83.59	11.20	0.90	12.89	2.41	10.48	12.44	31.30	247.68	56.41
T 31	86.77	10.00	1.28	12.64	2.11	10.53	7.81	34.60	270.90	46.15
T 32	87.79	14.80	1.54	12.28	3.59	8.69	9.61	32.60	201.24	71.79
T 33	83.50	11.40	0.90	12.24	2.10	10.14	12.67	31.40	294.12	51.28
T 34	89.91	12.90	1.28	13.16	3.20	9.96	10.08	31.90	247.68	51.28
T 35	88.84	13.10	0.90	14.00	1.63	12.37	14.56	35.70	208.98	112.82
T 36	85.06	14.30	1.02	12.61	1.83	10.78	14.02	32.40	224.46	25.64
T 37	94.39	12.60	1.02	11.11	4.91	6.20	12.35	30.20	247.68	20.51
T 38	86.23	14.60	1.28	9.74	3.56	6.18	11.41	34.10	216.72	117.95
T 39	86.41	10.30	0.90	13.44	3.00	10.44	11.44	34.80	371.52	56.41
T 40	91.82	9.20	0.90	12.59	1.83	10.76	10.22	30.70	340.56	82.05
T 41	89.23	9.40	1.02	10.10	1.98	8.12	9.22	34.30	270.90	51.28
T 42	87.23	11.00	0.64	12.32	1.80	10.52	17.19	28.80	294.12	66.67
T 43	87.33	11.10	1.09	11.39	3.20	8.19	10.18	31.21	247.68	38.46
T 44	84.80	13.00	0.90	11.40	2.77	8.63	14.44	34.80	325.08	56.41
T 45	84.97	12.30	0.90	12.39	2.12	10.27	13.67	34.50	294.12	97.44

Table 4.1.1.4b. Fruit quality analysis of somaclonal variants of pineapple variety Mauritius

Treatments	Juice (%)	TSS (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)	Sugar/ acid ratio	Fibre (%)	Total carotenoids (mg 100 g-1)	Ascorbic acid (mg 100 g-1)
T 46	92.16	13.10	1.15	10.69	4.11	6.58	11.39	31.10	356.04	30.77
T 47	85.95	14.60	0.90	12.64	2.42	10.22	16.22	34.30	201.24	87.18
T 48	83.08	12.30	0.77	11.42	2.12	9.30	15.97	34.60	154.80	92.31
T 49	91.71	9.60	0.90	13.92	2.91	11.01	10.67	36.20	294.12	20.51
T 50	90.37	11.70	1.15	10.77	2.80	7.97	10.17	31.00	363.78	25.64
T 51	86.96	11.40	0.64	12.37	2.38	9.99	17.81	29.10	255.42	46.15
T 52	79.77	10.30	1.02	12.28	2.77	9.51	10.10	37.50	232.20	20.51
T 53	87.06	13.70	0.77	11.61	2.95	8.66	17.79	32.60	193.50	25.64
T 54	88.46	12.90	1.28	10.77	2.79	7.98	10.08	34.90	170.28	153.85
T 55	87.33	13.10	0.77	12.70	2.05	10.65	17.01	29.05	309.60	61.54
T 56	83.08	15.20	0.90	12.92	1.72	11.20	16.89	36.40	239.94	97.44
T 57	88.85	14.20	1.15	10.89	1.69	9.20	12.35	34.57	162.54	30.77
T 58	89.03	12.40	0.77	12.70	2.01	10.69	16.10	34.30	139.32	56.41
T 59	89.13	14.30	1.54	10.48	2.92	7.56	9.29	32.70	193.50	51.28
T 60	85.06	12.10	0.77	9.46	3.09	6.37	15.71	34.46	247.68	51.28
T 61	85.33	14.45	1.34	9.33	3.48	5.85	10.78	31.50	294.12	100.00
T 62	84.54	11.90	0.90	10.97	2.80	8.17	13.22	34.10	371.52	82.05
T 63	82.16	10.20	0.77	10.90	1.79	9.11	13.25	31.43	201.24	71.79
T 64	85.51	11.70	0.77	12.46	2.80	9.66	15.19	32.01	301.86	76.92
T 65	90.38	14.10	1.02	12.73	2.02	10.71	13.82	34.58	317.34	87.18
T 66	84.62	9.10	1.02	13.65	1.88	11.77	8.92	32.59	278.64	61.54
T 67	89.62	11.10	0.64	12.09	2.80	9.29	17.34	31.26	208.98	41.03
T 68	84.54	12.60	1.02	12.66	1.49	11.17	12.35	32.11	263.16	71.79
T 69	92.29	10.30	0.77	10.26	2.79	7.47	13.38	35.21	185.76	15.38
T 70	90.95	11.00	0.77	10.19	3.38	6.81	14.29	37.10	255.42	15.38
T 71	89.10	10.50	0.90	10.49	2.41	8.08	11.67	38.65	294.12	15.38
T 72	89.84	9.80	0.77	13.38	2.77	10.61	12.73	36.10	170.28	25.64
T 73	84.19	12.70	0.77	11.67	2.85	8.82	16.49	36.54	239.94	61.54
T 74	83.59	13.60	1.02	11.95	2.00	9.95	13.33	39.01	193.50	76.92
T 75	89.27	10.40	0.77	10.62	2.80	7.82	13.51	33.34	325.08	10.26
Mauritius	86.76	11.23	1.17	11.31	2.35	8.96	9.60	32.95	235.39	72.12

Table 4.1.1.5a. Organoleptic evaluation of somaclonal variants of pineapple variety Mauritius

Treatments	Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank	Total score
T 1	5.90	6.90	7.60	6.60	6.70	33.70
T 2	6.80	7.50	9.20	7.80	7.80	39.10
T 3	6.70	6.60	6.90	5.90	6.50	32.60
T 4	9.50	6.30	5.80	4.90	6.60	33.10
T 5	6.30	7.90	7.90	8.60	7.60	38.30
T 6	6.10	8.60	8.60	6.20	7.30	36.80
T 7	7.00	8.20	8.20	9.10	8.10	40.60
T 8	7.50	8.70	8.70	6.50	7.80	39.20
T 9	7.40	8.60	6.70	5.40	7.00	35.10
T 10	9.70	5.00	5.00	4.10	5.90	29.70
T 11	7.50	7.30	8.50	7.50	7.70	38.50
T 12	7.40	7.10	7.80	6.80	7.20	36.30
T 13	7.60	6.80	7.30	6.30	7.00	35.00
T 14	7.90	9.30	9.30	6.10	8.10	40.70
T 15	7.20	8.90	8.90	7.50	8.10	40.60
T 16	7.10	7.80	7.80	8.40	7.70	38.80
T 17	9.70	6.20	5.70	4.80	6.60	33.00
T 18	7.20	7.80	5.80	8.30	7.20	36.30
T 19	4.10	6.50	6.30	5.30	5.50	27.70
T 20	6.50	7.90	7.90	8.50	7.70	38.50
T 21	6.30	7.50	9.10	7.80	7.60	38.30
T 22	9.40	6.60	6.70	5.70	7.10	35.50
T 23	5.80	7.00	7.70	6.70	6.80	34.00
T 24	9.50	6.10	5.60	4.70	6.40	32.30
T 25	9.80	5.60	5.20	4.30	6.20	31.10
T 26	7.40	7.10	7.90	6.90	7.30	36.60
T 27	6.00	7.70	7.70	7.90	7.30	36.60
T 28	4.00	8.50	8.50	9.40	7.60	38.00
T 29	7.80	8.20	5.20	8.90	7.50	37.60
T 30	7.40	7.80	8.80	8.30	8.00	40.30
T 31	8.00	6.60	6.80	5.80	6.80	34.00
T 32	7.80	7.70	7.70	7.90	7.70	38.80
T 33	8.30	8.30	8.30	9.20	8.50	42.60
T 34	7.80	7.30	8.40	7.40	7.70	38.60
T 35	7.50	7.50	8.90	7.80	7.90	39.60
T 36	7.80	6.50	6.00	5.00	6.30	31.60
T 37	7.70	7.30	8.70	7.70	7.80	39.20
T 38	6.90	6.50	6.60	5.60	6.40	32.00
T 39	6.00	7.10	7.00	7.00	6.70	33.80
T 40	7.40	6.60	6.10	5.10	6.30	31.50

Table 4.1.1.5b. Organoleptic evaluation of somaclonal variants of pineapple variety Mauritius

Treatments	Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank	Total score
T 41	7.10	6.80	7.40	6.40	6.90	34.60
T 42	7.60	7.70	7.70	8.00	7.70	38.70
T 43	9.60	5.90	5.40	4.50	6.30	31.70
T 44	7.00	7.60	9.30	7.80	7.90	39.60
T 45	7.30	9.40	9.40	7.90	8.50	42.50
T 46	7.10	7.80	7.80	8.00	7.60	38.30
T 47	9.30	6.00	5.50	4.60	6.30	31.70
T 48	7.20	8.00	8.00	8.70	7.90	39.80
T 49	6.20	6.80	7.10	6.10	6.50	32.70
T 50	6.60	8.60	8.60	5.30	7.20	36.30
T 51	6.50	7.80	7.80	8.20	7.50	37.80
T 52	6.50	7.40	8.80	7.70	7.60	38.00
T 53	6.80	8.20	8.20	9.00	8.00	40.20
T 54	7.30	9.40	4.90	6.90	7.10	35.60
T 55	7.10	8.50	8.50	9.30	8.30	41.70
T 56	7.60	7.80	7.80	8.10	7.80	39.10
T 57	5.20	6.90	7.50	6.50	6.50	32.60
T 58	7.70	8.00	8.00	8.80	8.10	40.60
T 59	7.90	7.30	8.60	7.60	7.80	39.20
T 60	7.30	7.50	9.00	7.80	7.90	39.50
T 61	5.80	5.80	5.30	4.40	5.30	26.60
T 62	7.10	6.70	7.00	6.00	6.70	33.50
T 63	6.70	7.60	9.50	7.90	7.90	39.60
T 64	7.40	9.80	6.80	8.80	8.20	41.00
T 65	6.60	9.50	5.90	7.70	7.40	37.10
T 66	7.20	6.80	7.20	6.20	6.80	34.20
T 67	4.60	6.40	5.90	5.00	5.40	27.30
T 68	5.90	7.30	8.30	7.30	7.20	36.00
T 69	9.20	6.50	6.20	5.20	6.70	33.80
T 70	6.60	6.50	6.40	5.40	6.20	31.10
T 71	9.40	5.70	5.10	4.20	6.10	30.50
T 72	7.40	7.20	8.10	7.10	7.40	37.20
T 73	6.90	6.50	6.50	5.50	6.30	31.70
T 74	7.90	7.60	9.40	7.90	8.20	41.00
T 75	9.10	7.20	8.20	7.20	7.90	39.60
Mauritius	8.70	8.30	8.60	8.20	8.40	42.20

Plate 4.1.1.5. Sensory evaluation of somaclonal variants

76.64 %), peel weight (T-47; 0.08 kg; 36.03 %), eye profile (T-9 & T-12; flat; 40 %), and acidity (T-24; 0.26 %; 77.78 %). However, 40 per cent variation was observed in eye relative surface. Thus, existence of several desire somaclonal variants was evident among the 75 treatments studied.

Improvement of yield and other related traits is a basic objective in any breeding programme. Selection of genotypes with better mean performance will be effectual for further crop improvement pineapple (Cabral *et al.*, 1993). The reliable conformity for this can be known from the cluster mean. Selection criteria provides appropriate weightage to the phenotypic values of two or more characters to be used simultaneously for the selection. It involves the discriminant function analysis meant for isolating superior genotypes (Fisher, 1936). Selection criteria aids to increase the efficiency of selection of suitable genotypes by taking into account the most desirable and undesirable characters in terms of fruit yield and quality. de Souza *et al.* (2000) recommended selection criteria for predicted breeding values for nine plant and fruit characteristics of 28 peach genotypes. Moreira *et al.* (2019) recommended a selection based on suitable indices, and commend it as more efficient than individual selection, based on phenotypic and genotypic values predicted by REML/BLUP in papaya genotypes in order to recommend for farmers.

4.1.2. Selection of somaclonal variants

Construction of selection indices criteria assigns the most appropriate weightage to the phenotypic values of two or more characters to be used simultaneously for the selection. Even though there are many methods for the calculation of selection indices, discriminate function is widely used by the researchers. In the present investigation, selection criteria for somaclones using index scores (Singh and Chaudhary, 1985) was used to identify novel genotypes with higher yield and quality characters. In the present study, data on all the somaclonal variants of Mauritius were scored for the three most desirable characteristics *viz.*, fruit weight with crown, pulp weight, TSS, and six undesirable characters such as crown weight, peel weight, eye profile, eye relative surface, days to attain ideal leaf stage for flowering, and titratable acidity.

The cumulative index value of desirable and undesirable traits in terms of fruit yield and quality was calculated. The cumulative index values with regard to all the characters allotted to an individual was used as the indication of individual's worth. The genotypes were ranked according to their cumulative index values. The cumulative index value obtained by the somaclonal variants are given in Table 4.1.2. The somaclonal variants were ranked based on their cumulative index value. The somaclonal variant T-4, with score (-1) ranked first, followed by T-17 with score (-2) in second position, T-25 and T-43 ranked third, while T-24 & T-71 were next (Rank 4). The treatments T-10, T-22, T-47, T-69, and T-75 each with a score of (-5), ranked fifth. Mauritius the parental clone, however, ranked the 11th with a cumulative index value of (-11), whereas, T-31 ranked the least (12th). The eleven treatments (upto rank 5th) were selected as elite type in terms of fruit yield and quality among the 75 somaclonal variants screened. These selected 11 treatments along with Mauritius were selected for molecular characterization.

In the present study selection criteria was formulated based on nine characters *viz.*, fruit weight with crown, pulp weight, TSS, crown weight, peel weight, profile of eyes, relative surface of eyes, days to attain ideal leaf stage for flowering, and titratable acidity. The somaclonal variant T-4 ranked first, followed by T-17 in second position, T-25 and T-43 ranked third, while T-24 & T-71 were next rank 4th. The treatments T-10, T-22, T-47, T-69, and T-75 each ranked fifth. Mauritius the parental clone, however, ranked the 11th with a cumulative index value of (-11). The eleven treatments (upto rank 5th) were selected as elite type in terms of fruit yield and quality among the 75 somaclonal variants screened. Cabral *et al.* (1993) recommended fruit weight, pulp weight, crown weight, TSS, and titratable acidity as most important selection characters of pineapple cultivars. Chan (2005) suggested for selection of novel genotypes, Johor cultivar has high fruit yield and canning properties (Chan and Lee, 1985), Josapine cultivar is precocious and have good shelf life (Chan and Lee, 1996), Scarlett has showed early flowering in pineapple (d'Eeckenbrugge and Marie, 2000). The hybrid MD-2 is excellent cultivar for fresh fruit market (Janick, 2003).

Hence, the results indicated that the superior lines *viz.*, T-4, T-17, T-25, T-43, T-24, T-71, T-10, T-22, T-47, T-69, and T-75, which secured ranks within fifth under selection criteria, could be considered as novel genotypes in terms of fruit yield and quality among the 75 screened genotypes along with parent source. The promising selected lines with high yield and quality potential could be functionally validated and

Table 4.1.1a. Per cent variation in somaclonal variants over parental clone Mauritius

Treatments	Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)
T 1	19.35	18.43	19.44	-18.69	-40.88	69.28	0.00	0.00	-17.95
T 2	8.06	17.54	-1.38	2.27	-59.12	41.98	0.00	-40.00	-23.08
T 3	32.26	-19.86	4.28	-11.11	-50.00	17.01	0.00	-40.00	-12.82
T 4	48.39	11.31	91.72	-14.39	-66.42	-4.83	0.00	-40.00	-23.08
T 5	-1.61	-0.27	-18.53	6.06	-16.79	-1.71	0.00	0.00	-34.19
T 6	-8.06	-6.50	-11.18	6.06	-59.12	7.65	0.00	-40.00	-34.19
T 7	-4.84	34.46	-14.25	6.06	-35.77	10.77	0.00	0.00	20.51
T 8	-11.29	23.78	-11.18	4.80	-34.31	2.97	0.00	0.00	-12.82
T 9	-11.29	12.20	-18.38	-18.69	-42.70	2.97	-40.00	0.00	31.62
T 10	104.84	4.63	137.66	-15.15	-20.44	71.62	0.00	0.00	-34.19
T 11	14.52	1.51	-14.40	-18.69	-64.60	18.57	0.00	0.00	-34.19
T 12	19.35	14.87	28.02	-11.11	-39.78	4.92	-40.00	0.00	-23.08
T 13	25.81	-19.86	-0.01	-16.16	-45.26	37.69	0.00	0.00	-23.08
T 14	-12.90	18.43	-21.14	-0.76	-63.14	14.67	0.00	-40.00	-23.08
T 15	-12.90	24.67	-19.76	-16.16	-41.61	-4.83	0.00	0.00	-1.71
T 16	-1.61	18.43	-32.01	-13.64	-13.87	-6.00	0.00	0.00	31.62
T 17	51.61	9.53	23.12	-13.89	-57.66	-9.51	0.00	-40.00	-12.82
T 18	0.00	29.12	-4.45	-13.64	-47.45	15.45	0.00	0.00	9.40
T 19	41.94	9.53	51.29	-3.28	-31.39	73.18	0.00	0.00	-12.82
T 20	-1.61	24.67	-12.41	-17.42	-19.71	2.97	0.00	0.00	31.62
T 21	8.06	27.34	-15.17	-5.81	-59.85	28.72	0.00	0.00	-12.82
T 22	35.48	15.76	39.04	-9.85	-50.36	59.14	0.00	-40.00	-23.08
T 23	19.35	4.19	15.15	3.54	-51.82	48.22	0.00	0.00	-23.08
T 24	53.23	10.42	88.04	-12.63	21.17	-7.95	0.00	0.00	-77.78
T 25	87.10	2.85	94.48	-8.59	-30.66	-10.29	0.00	-40.00	-1.71
T 26	17.74	21.10	48.84	-12.63	-76.64	32.62	0.00	0.00	20.51
T 27	4.84	16.65	14.39	-0.76	-52.92	17.01	0.00	0.00	-12.82
T 28	-8.06	-4.72	-29.87	-3.28	-46.72	50.17	0.00	0.00	-34.19
T 29	-3.23	30.90	-13.79	-16.16	-13.87	20.52	0.00	0.00	31.62
T 30	0.00	-0.27	-13.18	-21.21	-47.81	41.20	0.00	0.00	-23.08
T 31	33.87	-10.95	13.32	-11.11	-8.03	95.02	0.00	0.00	9.40
T 32	4.84	31.79	-12.56	-18.69	-37.59	14.28	0.00	0.00	31.62
T 33	-6.45	1.51	-36.91	-8.59	-72.26	15.84	0.00	0.00	-23.08
T 34	14.52	14.87	-6.90	-8.59	10.95	24.81	0.00	0.00	9.40
T 35	9.68	16.65	4.43	-0.76	-72.63	29.89	0.00	0.00	-23.08
T 36	45.16	27.34	28.02	-3.28	-56.93	41.20	0.00	0.00	-12.82
T 37	12.90	12.20	25.57	-9.85	-44.53	31.06	0.00	0.00	-12.82
T 38	38.71	30.01	-2.92	-15.40	-42.34	22.86	0.00	0.00	9.40
T 39	17.74	-8.28	-3.37	-8.59	-50.36	27.94	0.00	0.00	-23.08
T 40	43.55	-18.08	-17.62	-8.08	-56.93	56.80	40.00	-40.00	-23.08
T 41	25.81	-16.30	5.97	-15.15	-0.73	77.86	0.00	0.00	-12.82
T 42	3.23	-2.05	-5.52	-0.76	-22.63	5.31	0.00	0.00	-45.30
T 43	54.84	-1.16	36.29	-7.58	-59.85	-19.65	0.00	-40.00	-6.84
T 44	6.45	15.76	-6.44	-8.08	-55.11	39.25	0.00	0.00	-23.08
T 45	-17.74	9.53	-39.21	-3.28	-64.60	-22.77	0.00	0.00	-23.08

Table 4.1.1b. Per cent variation in somaclonal variants over parental clone Mauritius

Treatments	Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain to ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)
T 46	3.23	16.65	-6.28	-1.77	-41.61	21.69	40.00	-40.00	-1.71
T 47	53.23	30.01	1.37	-8.33	-35.40	-36.03	0.00	0.00	-23.08
T 48	-1.61	9.53	-25.89	2.02	-45.99	-4.05	0.00	0.00	-34.19
T 49	29.03	-14.51	21.89	-5.05	-57.66	62.26	0.00	-40.00	-23.08
T 50	-9.68	4.19	-17.31	3.79	-43.07	20.13	0.00	0.00	-1.71
T 51	0.00	1.51	-7.51	-3.28	-43.07	9.21	0.00	0.00	-45.30
T 52	9.68	-8.28	5.97	4.80	-51.82	32.62	0.00	0.00	-12.82
T 53	-3.23	21.99	-12.41	6.06	-54.74	23.25	0.00	0.00	-34.19
T 54	-14.52	14.87	-25.27	-8.59	-16.79	-17.31	0.00	0.00	9.40
T 55	-8.06	16.65	-15.63	-3.28	-60.22	21.69	0.00	-40.00	-34.19
T 56	0.00	35.35	-26.04	-3.28	-49.64	-10.68	0.00	0.00	-23.08
T 57	24.19	26.45	-16.24	-15.15	-66.42	6.48	0.00	0.00	-1.71
T 58	-3.23	10.42	-13.63	2.02	-40.15	9.21	0.00	0.00	-34.19
T 59	14.52	27.34	-11.80	-7.58	-55.84	8.04	0.00	-40.00	31.62
T 60	9.68	7.75	-1.69	-3.28	-73.72	3.36	0.00	0.00	-34.19
T 61	56.45	28.67	47.00	-7.32	16.79	7.65	0.00	0.00	14.53
T 62	30.65	5.97	-17.46	-8.33	-54.74	-0.93	0.00	0.00	-23.08
T 63	6.45	-9.17	-28.03	-8.08	-50.00	41.59	0.00	-40.00	-34.19
T 64	-20.97	4.19	-33.85	-3.28	-54.74	-28.23	0.00	0.00	-34.19
T 65	-19.35	25.56	-20.37	-0.76	-59.12	-0.15	0.00	0.00	-12.82
T 66	27.42	-18.97	16.84	-8.33	-49.27	59.53	0.00	0.00	-12.82
T 67	45.16	-1.16	40.27	-10.86	-42.34	31.45	0.00	0.00	-45.30
T 68	16.13	12.20	-2.76	-8.84	-58.03	27.55	0.00	0.00	-12.82
T 69	41.94	-8.28	31.08	-15.15	-53.28	74.74	0.00	-40.00	-34.19
T 70	41.94	-2.05	35.37	-7.32	-35.77	65.38	0.00	-40.00	-34.19
T 71	90.32	-6.50	73.96	-7.83	-70.80	49.78	0.00	-40.00	-23.08
T 72	17.74	-12.73	11.48	-17.68	-48.91	43.54	0.00	-40.00	-34.19
T 73	40.32	13.09	6.12	0.76	-56.57	48.22	0.00	0.00	-34.19
T 74	6.45	21.10	0.61	-3.28	-54.74	21.30	0.00	0.00	-12.82
T 75	17.74	-7.39	8.42	-18.94	-27.01	24.81	0.00	-40.00	-34.19
Mauritius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

can be involved in breeding programme to improve its performance under commercial cultivation (Chan, 2005).

4.2. Mauritius x Kew hybrids

A detailed experiment was conducted at Fruits Crops Research Station, Vellanikkara, for selecting hybrids of Mauritius and Kew variety of pineapple. Twenty five Mauritius x Kew hybrids were initially tagged based on general vigour and biometric observations were recorded.

The various observations on morphological characters *viz.*, vegetative characters (monthly), flowering characters, fruit and yield characters recorded as per the descriptors for pineapple suggested by International Board for Plant Genetic Resources Rome, Italy (IBPGR, 1991) were recorded and the results are presented in Table 4.2.1.1a to Table 4.2.1.5.

4.2.1. Variability

4.2.1.1. Vegetative characters (Monthly intervals)

The data showing vegetative characters of Mauritius x Kew hybrids along with parents and one check variety Amritha is given at its 39 leaf stage of the plant in Table 4.2.1.1a and Table 4.2.1.1b.

4.2.1.1.1. Plant height

The data related to plant height is presented in Table 4.2.1.1a. The plant height of the Mauritius x Kew hybrids ranged from 89.46 cm to 109.02 cm. The lowest plant height of 89.46 cm was noted in treatment T-14 (H-70) and highest plant height of 109.02 cm in treatment T-27 (Kew) at its 39 leaf stage of the plant.

4.2.1.1.2. Number of leaves per plant

The data related to average number of leaves per plant is presented in Table 4.2.1.1a. Average number of leaves per plant ranged from 38.47 to 42.24. In the experimental plants, maximum number of leaves (42.24) was observed in treatment T-8 (H-66) and minimum number of leaves (38.47) in treatment T-12 (H-27).

4.2.1.1.3. Length of 'D' leaf

The data related to length of D leaf is presented in Table 4.2.1.1a. Length of D leaf of the treatments ranged from 51.80 cm to 61.94 cm. The lowest D leaf length of 51.80 cm was noted in treatment T-19 (H-10) and highest D leaf length of 61.94 cm in treatment T-26 (Mauritius) at its 39 leaf stage of the plant.

4.2.1.1.4. Breadth of 'D' leaf

The data related to breadth of D leaf is presented in Table 4.2.1.1a. Breadth of D leaf of treatments ranged from 2.18 cm to 4.46 cm. At 39 leaf stage of the plant breadth of D leaf was maximum (4.46) in treatment T-17 (H-49) and minimum breadth of D leaf (2.18) in treatment T-4 (H-91).

4.2.1.1.5. 'D' leaf area

The data related to 'D' leaf area is presented in Table 4.2.1.1a. The 'D' leaf area of the treatments ranged from 84.45 cm^2 to 182.69 cm^2. The lowest 'D' leaf area of 84.45 cm^2 was noted in treatment T-4 (H-91) and highest 'D' leaf area of 182.69 cm^2 was obtained in treatment T-17 (H-49) at its 39 leaf stage of the plant.

4.2.1.1.6. Leaf Area Index (LAI)

The data related to leaf area index is presented in Table 4.2.1.1a. Leaf area index of treatments ranged from 2.54 to 5.26. Leaf area index was maximum (5.26) in treatment T-25 (Mauritius) and minimum leaf area index (2.54) in treatment T-4 (H-91).

4.2.1.1.7. Spine length

The data related to spine length is presented in Table 4.2.1.1a. Spine length of the treatments ranged from 0.17 mm to 0.33 mm. The lowest spine length of 0.17 mm was noted in treatment T-27 (Kew) whereas highest spine length of 0.33 mm in treatment T-3 (H-85) at its 39 leaf stage of the plant.

4.2.1.1.8. Number of suckers per plant

The data related to mean number of suckers produced per plant is presented in Table 4.2.1.1a. The number of suckers per plant ranged from 0.54 to 2.87 at 15 months

Table 4.1.2. Cumulative index values of somaclonal variants of pineapple variety Mauritius

Treatments	Cumulative index values	Rank	Treatments	Cumulative index values	Rank	Treatments	Cumulative index values	Rank
T 1	-8	8	T 26	-6	6	T 51	-8	8
T 2	-6	6	T 27	-9	9	T 52	-10	10
T 3	-6	6	T 28	-9	9	T 53	-8	8
T 4	**-1**	**1**	T 29	-8	8	T 54	-9	9
T 5	-9	9	T 30	-7	7	T 55	-6	6
T 6	-8	8	T 31	-12	12	T 56	-6	6
T 7	-10	10	T 32	-8	8	T 57	-7	7
T 8	-8	8	T 33	-8	8	T 58	-10	10
T 9	-7	7	T 34	-11	11	T 59	-6	6
T 10	**-5**	**5**	T 35	-9	9	T 60	-7	7
T 11	-7	7	T 36	-6	6	T 61	-8	8
T 12	-6	6	T 37	-7	7	T 62	-6	6
T 13	-7	7	T 38	-7	7	T 63	-7	7
T 14	-6	6	T 39	-9	9	T 64	-7	7
T 15	-7	7	T 40	-8	8	T 65	-7	7
T 16	-7	7	T 41	-10	10	T 66	-9	9
T 17	**-2**	**2**	T 42	-9	9	T 67	-6	6
T 18	-7	7	**T 43**	**-3**	**3**	T 68	-8	8
T 19	-8	8	T 44	-8	8	**T 69**	**-5**	**5**
T 20	-7	7	T 45	-7	7	T 70	-7	7
T 21	-7	7	T 46	-10	10	**T 71**	**-4**	**4**
T 22	**-5**	**5**	**T 47**	**-5**	**5**	T 72	-6	6
T 23	-9	9	T 48	-8	8	T 73	-8	8
T 24	**-4**	**4**	T 49	-6	6	T 74	-7	7
T 25	**-3**	**3**	T 50	-11	11	**T 75**	**-5**	**5**
						Mauritius	-11	11

after planting. The highest number of suckers per plant (2.87) was recorded in treatment T-9 (H-77) and lowest number of suckers per plant (0.54) in treatment T-13 (H-78).

4.2.1.1.9. Number of slips per plant

The data related to mean number of slips produced per plant is presented in Table 4.2.1.1a. The number of slips per plant ranged from 0.20 to 2.13 at 15 months after planting. The highest number of slips per plant (2.13) was recorded in treatment T-13 (H-78) and lowest number of slips per plant (0.20) in treatment T-6 (H-62).

4.2.1.1.10. Distribution of spines

The data related to distribution of spines is presented in Table 4.2.1.1b. In all the treatments, the distribution of spines per plant significantly slight variation were observed. The lowest descriptive score of distribution of spines of 1.64 was noted in treatment T-27 (Kew) and highest descriptive score of distribution of spines of 3.90 each of in treatment T-10 (H-92) and T-14 (H-70) at its 39 leaf stage of the plant.

4.2.1.1.11. Direction of spines

The data related to direction of spines is presented in Table 4.2.1.1b. Only ascending order of spines was observed in all treatments.

4.2.1.1.12. Colouration of leaf spines

The data related to colour of leaf spines is presented in Table 4.2.1.1b. Among the treatments, colouration of spines found mostly reddish then followed by pinkish. The lowest descriptive score of colouration of spines of 1.64 was noted in treatment T-8 (H-66) and highest descriptive score of colouration of spines of 4.00 each of in treatment T-4 (H-91), T-9 (H-77), T-13 (H-78), T-14 (H-70), T-18 (H-54), T-20 (H-15), T-24 (H-35), T-26 (Mauritius), and T-28 (Amritha) at its 39 leaf stage of the plant.

4.2.1.1.13. Spine stiffness

The data related to spine stiffness is presented in Table 4.2.1.1b. All the treatments observed intermediate stiffness of spine.

4.2.1.1.14. Position of suckers

The data related to position of suckers is presented in Table 4.2.1.1b. Among the treatments, 78.57 % of the treatments produced both aerial sucker and underground suckers and 21.43 % of treatments produced aerial suckers only.

4.2.1.2. Flowering characters

4.2.1.2.1. Days to attain ideal leaf stage for flowering

The data related to number of days taken to attain ideal leaf stage for flowering for different treatments is presented in Table 4.2.1.2. Among various treatments, T-27 (Kew) recorded significantly the less number of days to attain ideal leaf stage for flowering (175.10 d). Whereas, the treatment T-26 (Mauritius) took more number of days (196.30 d) to attain ideal leaf stage for flowering.

4.2.1.2.2. Days for initiation of flowering (visual)

The mean number of days taken from ethrel application to the appearance of reddish colour inflorescence at the heart of the plant was recorded by different treatments is presented in Table 4.2.1.2. Among various treatments, T-27 (Kew) recorded significantly the less number of days for initiation of flowering (39.74 d). The treatment T-9 (H-77) took more number of days (52.97 d) for initiation of flowering.

4.2.1.2.3. Days for 50 per cent flowering

The mean number of days taken from ethrel application to emergence of inflorescence in 50 per cent of the plants in each treatment was recorded and presented in Table 4.2.1.2. Among various treatments, T-27 (Kew) recorded significantly the less number of days to 50 per cent flowering (45.50 d). Whereas, treatment T-9 (H-77) took more number of days (58.42 d) for 50 per cent flowering.

4.2.1.2.4. Flowering phase

The number of days from the opening of the first flower to the opening of the last flower in an inflorescence was recorded and presented in Table 4.2.1.2. Among the treatments, T-2 (H-16) recorded significantly the less number of days of flowering phase (19.92 d) and more number of days of flowering phase (26.14 d) in treatment T-26 (Mauritius).

Table 4.2.1.1a. Quantitatively vegetative characters of Mauritius x Kew hybrids at its 39 leaf stage

Treatments		Plant height (cm)	Number of leaves per plant	Length of D leaf (cm)	Breadth D leaf (cm)	D leaf area (cm^2)	Leaf Area Index (LAI)	Spine length (mm)	Number of suckers per plant	Number of slips per plant
T 1	H 17	92.97	40.97	54.04	2.54	99.37	3.02	0.25	2.34	1.20
T 2	H 16	94.54	39.77	55.30	3.30	132.26	3.89	0.23	2.07	1.12
T 3	H 85	93.10	39.77	57.44	2.74	113.92	3.35	0.33	0.80	1.84
T 4	H 91	92.54	40.57	53.47	2.18	84.45	2.54	0.25	1.54	0.29
T 5	H 48	94.44	38.64	51.90	3.81	142.86	4.09	0.22	1.34	1.91
T 6	H 62	93.80	40.80	55.70	3.29	132.65	4.01	0.27	1.60	0.20
T 7	H 43	94.40	38.74	56.60	3.99	163.71	4.71	0.21	2.60	0.86
T 8	H 66	90.64	42.24	58.20	3.40	143.45	4.49	0.28	1.34	1.30
T 9	H 77	93.90	38.87	55.07	3.28	130.80	3.77	0.21	2.87	1.00
T 10	H 92	91.57	39.80	56.47	3.54	144.71	4.27	0.22	1.60	0.30
T 11	H 63	89.97	38.57	56.77	3.59	147.71	4.22	0.25	1.07	1.75
T 12	H 27	90.40	38.47	56.77	3.54	145.44	4.14	0.25	1.80	0.40
T 13	H 78	91.27	40.04	54.07	3.38	132.24	3.92	0.20	0.54	2.13
T 14	H 70	89.47	41.47	58.07	3.64	153.11	4.71	0.20	1.17	1.03
T 15	H 59	92.24	41.77	61.30	3.32	147.34	4.56	0.27	2.70	1.40
T 16	H 60	91.70	40.17	58.37	3.46	145.73	4.34	0.22	1.80	1.20
T 17	H 49	93.47	38.77	56.57	4.46	182.69	5.25	0.19	2.07	0.60
T 18	H 54	93.04	38.77	56.90	3.40	140.12	4.02	0.22	1.80	0.48
T 19	H 10	91.90	40.30	51.80	3.15	118.49	3.53	0.23	1.97	1.34
T 20	H 15	92.30	40.27	58.94	3.67	156.57	4.67	0.21	1.07	1.24
T 21	H 30	92.24	38.70	56.47	3.54	144.75	4.16	0.22	1.54	0.30
T 22	H 14	91.30	38.60	57.24	2.94	121.51	3.48	0.21	1.34	1.10
T 23	H 7	89.97	40.77	56.54	3.31	135.55	4.09	0.27	0.80	1.53
T 24	H 35	91.64	41.74	55.30	3.57	142.87	4.42	0.24	2.27	0.25
T 25	H 19	94.44	39.24	58.54	4.27	180.96	5.26	0.21	2.44	0.49
T 26	Mauritius	100.53	42.10	61.94	2.92	130.97	4.09	0.28	2.70	1.08
T 27	Kew	109.02	41.54	57.57	2.64	109.97	3.38	0.17	1.00	0.56
T 28	Amritha	91.36	40.64	52.44	2.64	100.13	3.01	0.22	1.80	1.14

Table 4.2.1.1b. Qualitatively vegetative characters of Mauritius x Kew hybrids at its 39 leaf stage

Treatments		Position of suckers	Distribution of spines	Direction of spines	Colouration of leaf spines	Spine stiffness
T 1	H 17	Aerial and underground sucker	3.00	Only ascendant	2.80	Intermediate
T 2	H 16	Aerial and underground sucker	3.88	Only ascendant	3.27	Intermediate
T 3	H 85	Aerial sucker	3.00	Only ascendant	2.80	Intermediate
T 4	H 91	Aerial and underground sucker	3.00	Only ascendant	4.00	Intermediate
T 5	H 48	Aerial and underground sucker	3.27	Only ascendant	2.80	Intermediate
T 6	H 62	Aerial and underground sucker	3.27	Only ascendant	3.70	Intermediate
T 7	H 43	Aerial and underground sucker	3.00	Only ascendant	2.27	Intermediate
T 8	H 66	Aerial and underground sucker	2.74	Only ascendant	1.64	Intermediate
T 9	H 77	Aerial and underground sucker	3.27	Only ascendant	4.00	Intermediate
T 10	H 92	Aerial and underground sucker	3.90	Only ascendant	3.27	Intermediate
T 11	H 63	Aerial and underground sucker	3.07	Only ascendant	3.63	Intermediate
T 12	H 27	Aerial and underground sucker	2.80	Only ascendant	3.80	Intermediate
T 13	H 78	Aerial and underground sucker	3.00	Only ascendant	4.00	Intermediate
T 14	H 70	Aerial and underground sucker	3.90	Only ascendant	4.00	Intermediate
T 15	H 59	Aerial and underground sucker	3.00	Only ascendant	2.80	Intermediate
T 16	H 60	Aerial and underground sucker	3.00	Only ascendant	2.54	Intermediate
T 17	H 49	Aerial and underground sucker	3.54	Only ascendant	3.40	Intermediate
T 18	H 54	Aerial and underground sucker	3.64	Only ascendant	4.00	Intermediate
T 19	H 10	Aerial sucker	3.07	Only ascendant	2.27	Intermediate
T 20	H 15	Aerial sucker	3.00	Only ascendant	4.00	Intermediate
T 21	H 30	Aerial sucker	3.00	Only ascendant	2.97	Intermediate
T 22	H 14	Aerial sucker	3.00	Only ascendant	3.60	Intermediate
T 23	H 7	Aerial sucker	3.00	Only ascendant	2.80	Intermediate
T 24	H 35	Aerial and underground sucker	3.27	Only ascendant	4.00	Intermediate
T 25	H 19	Aerial and underground sucker	3.54	Only ascendant	2.67	Intermediate
T 26	Mauritius	Aerial and underground sucker	3.00	Only ascendant	4.00	Intermediate
T 27	Kew	Aerial and underground sucker	1.64	Only ascendant	3.80	Intermediate
T 28	Amritha	Aerial and underground sucker	3.00	Only ascendant	4.00	Intermediate

Table 4.2.1.2. Flower characters of Mauritius x Kew hybrids

Treatments		Days to attain ideal leaf stage for flowering	Days for initiation of flowering (visual)	Days for 50 per cent flowering	Flowering phase
T 1	H 17	182.75	46.98	52.19	20.82
T 2	H 16	183.75	46.67	51.65	19.92
T 3	H 85	180.50	43.09	48.36	21.09
T 4	H 91	183.57	45.70	51.32	22.47
T 5	H 48	187.10	48.24	53.58	21.37
T 6	H 62	188.10	47.25	52.54	21.15
T 7	H 43	184.30	49.98	54.99	20.05
T 8	H 66	181.08	47.36	52.81	21.78
T 9	H 77	182.37	52.97	58.42	21.80
T 10	H 92	189.54	44.64	50.43	23.14
T 11	H 63	183.50	46.50	51.72	20.88
T 12	H 27	178.14	49.04	54.43	21.54
T 13	H 78	183.24	43.60	49.18	22.30
T 14	H 70	190.61	45.41	50.60	20.77
T 15	H 59	178.14	47.80	53.08	21.10
T 16	H 60	188.57	49.74	55.10	21.44
T 17	H 49	183.94	43.90	49.50	22.40
T 18	H 54	181.37	47.47	52.49	20.07
T 19	H 10	182.59	46.92	52.69	23.09
T 20	H 15	182.76	49.15	54.62	21.87
T 21	H 30	188.77	41.40	46.84	21.74
T 22	H 14	178.57	49.27	55.17	23.60
T 23	H 7	186.00	44.67	50.04	21.49
T 24	H 35	181.92	45.54	50.75	20.82
T 25	H 19	182.48	48.85	54.02	20.68
T 26	Mauritius	196.30	48.90	55.44	26.14
T 27	Kew	175.10	39.74	45.50	23.04
T 28	Amritha	180.57	49.40	55.64	24.97

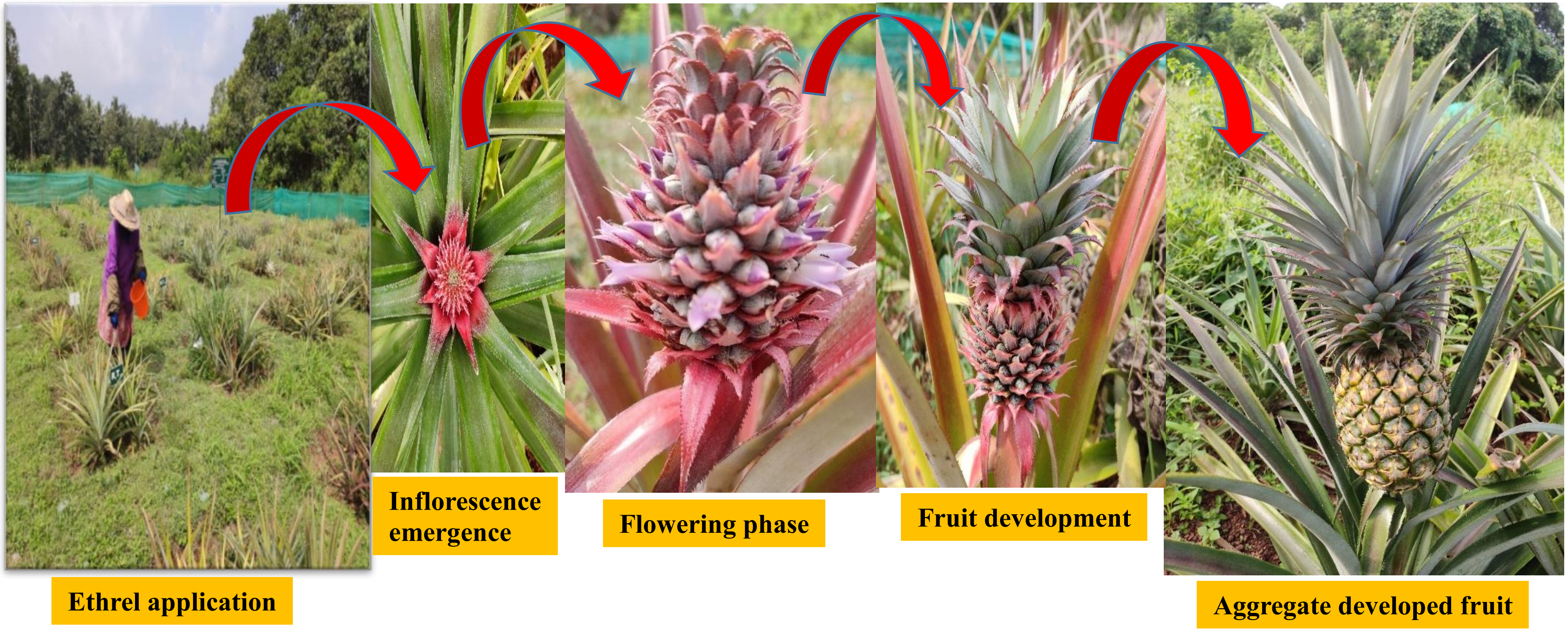


Plate 4.2.1.2. Flower characters of Mauritius x Kew hybrids

4.2.1.3. Fruit and yield characters

4.2.1.3.1. Days for fruit maturity

The mean number of days taken for fruit maturity for each treatment was recorded and data is presented in Table 4.2.1.3a and Table 4.2.1.3b. In the Mauritius x Kew hybrids, Treatment T-27 (Kew) recorded significantly the less number of days to fruit maturity (138.00 d). While, it was observed that treatment T-17 (H-49) took more number of days for fruit maturity (157.20 d).

4.2.1.3.2. Crop duration

The data related to crop duration was worked out for each treatment and data is presented in Table 4.2.1.3a and Table 4.2.1.3b. In the Mauritius x Kew hybrids treatments, Treatment T-27 (Kew) recorded significantly minimum crop duration (352.84 d). While, it was observed that treatment T-6 (H-62) took maximum crop duration for fruit maturity (388.28 d).

4.2.1.3.3. Presence of crown

The data related to presence of crown is presented in Table 4.2.1.3a and Table 4.2.1.3b. According to the descriptor, crown was present in all the treatments.

4.2.1.3.4. Crown shape

The data related to crown shape of all the treatments are presented in Table 4.2.1.3a and Table 4.2.1.3b. Among the treatments, the data related to crown shape was varied significantly. The highest descriptive score of crown shape of 5.50 was recorded in both the treatments T-17 (H-49) and T-27 (Kew) whereas the lowest descriptive score of crown shape of 1.50 in each treatments such as T-8 (H-66) and T-21 (H-30).

4.2.1.3.5. Crown characters

The data related to crown characters of all the treatments is presented in Table 4.2.1.3a and Table 4.2.1.3b. From all the 28 treatments, the data related to crown characters were varied significantly. The highest descriptive score of crown characters of 2.00 was recorded in treatment T-6 (H-62), whereas the lowest descriptive score of crown characters of 1.00 in each treatments such as T-5 (H-48), T-10 (H-92), T-16 (H-

60), T-17 (H-49), T-21 (H-30), T-22 (H-14), T-23 (H-7), T-26 (Mauritius), T-27 (Kew) and T-28 (Amritha). Remaining treatments showed the normal crown characters.

4.2.1.3.6. Number of crowns surmounting fruit

The data related to number of crowns surmounting fruit is presented in Table 4.2.1.3a and Table 4.2.1.3b. Among the treatments, the highest number of crowns surmounting fruit per plant of 5.50 was recorded in treatment T-1 (H-17) and the lowest number of crowns surmounting fruit per plant of 1.00 in each treatments such as T-2 (H-16), T-4 (H-91), T-9 (H-77), T-11 (H-63), T-12 (H-27), T-18 (H-54), T-21 (H-30), T-22 (H-14), T-25 (H-19), T-26 (Mauritius), T-27 (Kew), and T-28 (Amritha).

4.2.1.3.7. Attitude of crown foliage

The data related to attitude of crown foliage of all the treatments is presented in Table 4.2.1.3a and Table 4.2.1.3b. The data related to attitude of crown foliage was varied significantly in the range of 2.00 to 5.00. The highest descriptive score of attitude of crown foliage of 5.00 was recorded in each of the treatments were T-2 (H-16), T-4 (H-91), T-12 (H-27), T-17 (H-49), T-19 (H-10) and T-25 (H-19) whereas the lowest descriptive score of attitude of crown foliage of 2.00 in each treatments such as T-3 (H-85), T-5 (H-48), T-8 (H-66), T-14 (H-70), T-16 (H-60), T-21 (H-30) and T-23 (H-7).

4.2.1.3.8. Colour of crown leaves

The data related to colour of crown leaves of all the treatments is presented in Table 4.2.1.3c and Table 4.2.1.3d. As per the guidelines among the treatments, colour of crown leaves ranged from 1.00 to 8.50. The maximum descriptive score (8.50) of the colour of crown leaves was recorded in treatment T-18 (H-54), whereas the minimum descriptive score (1.00) was in treatment T-13 (H-78) and T-27 (Kew).

4.2.1.3.9. Presence of spines on crown leaves

The data related to presence of spines on crown leaves of all the treatments is presented in Table 4.2.1.3c and Table 4.2.1.3d. Among the 28 treatments, all the treatments varied significantly and presence of spines on crown leaves ranged from 1.00 to 3.00. The maximum descriptive score (3.00) of the presence of spines on crown leaves was recorded in treatments *viz.*, T-1 (H-17), T-4 (H-91), T-5 (H-48), T-7 (H-43),

Table 4.2.1.3a. Fruit and crown characters of Mauritius x Kew hybrids

Treatments		Days for fruit maturity (days)	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 1	H 17	147.07	376.79	Present (+)	2.50	1.50	5.50	4.00
T 2	H 16	143.34	373.75	Present (+)	5.00	1.50	1.00	5.00
T 3	H 85	142.92	366.50	Present (+)	2.50	1.50	4.00	2.00
T 4	H 91	141.36	370.63	Present (+)	4.50	1.50	1.00	5.00
T 5	H 48	149.17	384.50	Present (+)	4.50	1.00	2.00	2.00
T 6	H 62	152.94	388.28	Present (+)	3.00	1.50	2.00	3.00
T 7	H 43	140.33	374.61	Present (+)	5.00	1.50	3.00	4.00
T 8	H 66	142.82	371.25	Present (+)	1.50	1.50	2.00	2.00
T 9	H 77	142.17	377.50	Present (+)	3.50	1.50	1.00	4.00
T 10	H 92	146.87	381.04	Present (+)	5.00	1.00	3.50	4.00
T 11	H 63	147.84	377.84	Present (+)	3.00	1.50	1.00	2.00
T 12	H 27	149.34	376.50	Present (+)	4.00	1.50	1.00	5.00
T 13	H 78	150.34	377.17	Present (+)	3.50	1.50	2.00	4.00
T 14	H 70	143.02	379.04	Present (+)	3.00	1.50	4.50	2.00
T 15	H 59	148.24	374.17	Present (+)	3.00	2.00	3.50	3.00
T 16	H 60	146.74	385.04	Present (+)	5.00	1.50	2.00	2.00
T 17	H 49	157.20	385.04	Present (+)	5.50	1.00	2.00	5.00
T 18	H 54	145.00	373.84	Present (+)	3.00	1.50	1.00	4.00
T 19	H 10	151.84	381.34	Present (+)	4.00	1.50	3.00	5.00
T 20	H 15	145.72	377.62	Present (+)	4.50	1.50	1.50	3.00
T 21	H 30	149.67	379.84	Present (+)	1.50	1.00	1.00	2.00

Table 4.2.1.3b. Fruit and crown characters of Mauritius x Kew hybrids

Treatments		Days for fruit maturity (days)	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 22	H 14	153.00	380.84	Present (+)	4.50	1.00	1.00	3.00
T 23	H 7	152.21	382.87	Present (+)	5.00	1.00	2.00	2.00
T 24	H 35	145.77	373.22	Present (+)	4.00	1.50	1.50	4.00
T 25	H 19	146.29	377.62	Present (+)	4.00	1.50	1.00	5.00
T 26	Mauritius	140.77	385.97	Present (+)	4.50	1.00	1.00	3.00
T 27	Kew	138.00	352.84	Present (+)	5.50	1.00	1.00	3.00
T 28	Amritha	140.87	370.84	Present (+)	5.00	1.00	1.00	3.00

T-9 (H-77), T-13 (H-78), T-16 (H-60), T-21 (H-30), T-22 (H-14), T-23 (H-7), T-26 (Mauritius), and T-28 (Amritha) whereas the minimum descriptive score (1.00) of the presence of spines on crown leaves was in treatment T-27 (Kew). Remaining treatments showed the spiny serrate.

4.2.1.3.10. Crown attachment to fruit

The data related to crown attachment to fruit is presented in Table 4.2.1.3c and Table 4.2.1.3d. As per the descriptors crown attachment to fruit varied significantly among the treatments. Among the treatments, the lowest crown attachment to fruit descriptive score of 1.00 was recorded in treatment T-20 (H-15) and followed by score of 1.50 in each treatments such as T-1 (H-17), T-6 (H-62), T-8 (H-66), T-13 (H-78), T-14 (H-70), T-18 (H-54), and T-19 (H-10). Remaining treatments, the descriptive score of crown attachment to fruit of 2.00 was recorded.

4.2.1.3.11. Colour of crown attachment area/basal leaves (collar)

According to descriptors, the data related to colour of crown attachment area/basal leaves (collar) of all the treatments was varied significantly and presented in Table 4.2.1.3c and Table 4.2.1.3d. Among the treatments, the highest descriptive score of colour of crown attachment area/basal leaves (collar) of 9.50 was recorded in treatment T-23 (H-7) and the lowest descriptive score of colour of crown attachment area/basal leaves (collar) of 1.50 in each treatments such as T-5 (H-48), T-6 (H-62), T-7 (H-43), and T-8 (H-66).

4.2.1.3.12. Fruit shape

The data related to fruit shape of all the treatments are presented in Table 4.2.1.3c and Table 4.2.1.3d. Among the treatments, the data related to fruit shape was varied significantly. The highest descriptive score of fruit shape of 9.40 was recorded in the treatment T-1 (H-17) whereas, it was observed that treatment T-3 (H-85) was showed the lowest descriptive score of fruit shape of 2.00.

4.2.1.3.13. Fruit colour when ripe

The data related to fruit colour when ripe of all the treatments was varied significantly and presented in Table 4.2.1.3c and Table 4.2.1.3d. Among the treatments, the highest descriptive score of fruit colour of 7.95 was recorded in treatment T-10 (H-92) and the lowest descriptive score of fruit colour of 1.20 in treatment T-22 (H-14).

4.2.1.3.14. Presence of "eye" (Berry) corking

The data related to presence of "eye" (Berry) corking is presented in Table 4.2.1.3c and Table 4.2.1.3d. Among the 28 treatments, all treatments showed presence of "eye" (Berry) corking of fruits.

4.2.1.3.15. Presence of crowns coming from an "eye" (Berry)

The data related to presence of crowns coming from an "eye" (Berry) is presented in Table 4.2.1.3c and Table 4.2.1.3d. Among the 28 treatments, all treatments showed presence of crowns coming from an "eye" (Berry) of fruits.

4.2.1.3.16. Number of eyes

The data related to number of eyes of fruit is presented in Table 4.2.1.3c and Table 4.2.1.3d. The mean number of eyes were varied between 47.37 and 191.87. The highest number of eyes was recorded in treatment T-14 (H-70) and the lowest number of eyes in treatment T-19 (H-10).

4.2.1.3.17. Profile of eyes

The data related to profile of eyes of all the treatments is presented in Table 4.2.1.3e and Table 4.2.1.3f. Among the 28 treatments, profile of eyes ranged from 3.38 to 6.37. The maximum descriptive profile of eyes score (6.37) of the fruit was recorded in treatment T-4 (H-91), whereas the minimum descriptive profile of eyes score (3.38) was in treatment T-23 (H-7).

4.2.1.3.18. Relative surface of eyes

The data related to relative surface of eyes of all the treatments is presented in Table 4.2.1.3e and Table 4.2.1.3f. Relative surface of eyes ranged from 3.57 to 6.07. The maximum descriptive relative surface of eyes score (6.07) of the fruit was recorded in treatment T-15 (H-59), whereas the minimum descriptive relative surface of eyes score (3.57) was in treatment T-5 (H-48).

Table 4.2.1.3c. Fruit and crown characters of Mauritius x Kew hybrids

Treatments		Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes
T 1	H 17	6.00	3.00	1.50	2.00	9.40	3.68	Present (+)	Present (+)	147.25
T 2	H 16	2.00	2.50	2.00	3.00	2.60	1.52	Present (+)	Present (+)	70.00
T 3	H 85	5.00	2.50	2.00	6.00	2.00	5.20	Present (+)	Present (+)	73.29
T 4	H 91	6.00	3.00	2.00	5.00	4.80	1.28	Present (+)	Present (+)	88.14
T 5	H 48	2.50	3.00	2.00	1.50	8.20	2.00	Present (+)	Present (+)	88.97
T 6	H 62	5.00	2.50	1.50	1.50	4.20	4.16	Present (+)	Present (+)	133.95
T 7	H 43	5.00	3.00	2.00	1.50	6.20	6.20	Present (+)	Present (+)	100.49
T 8	H 66	5.00	2.50	1.50	1.50	7.20	3.56	Present (+)	Present (+)	102.25
T 9	H 77	5.50	3.00	2.00	7.50	2.30	6.92	Present (+)	Present (+)	57.67
T 10	H 92	5.00	2.00	2.00	1.50	2.60	7.95	Present (+)	Present (+)	76.40
T 11	H 63	2.00	2.50	2.00	2.50	7.80	7.93	Present (+)	Present (+)	94.59
T 12	H 27	5.50	2.50	2.00	2.00	2.90	3.70	Present (+)	Present (+)	147.67
T 13	H 78	1.00	3.00	1.50	6.00	4.40	6.40	Present (+)	Present (+)	157.97
T 14	H 70	8.00	1.50	1.50	7.50	3.75	3.60	Present (+)	Present (+)	191.87
T 15	H 59	5.00	3.00	2.00	5.50	7.40	3.00	Present (+)	Present (+)	99.67
T 16	H 60	5.00	3.00	2.00	2.00	4.84	1.80	Present (+)	Present (+)	59.25
T 17	H 49	2.00	1.50	2.00	6.00	2.76	6.80	Present (+)	Present (+)	86.57
T 18	H 54	8.50	2.00	1.50	2.50	7.68	3.60	Present (+)	Present (+)	80.47
T 19	H 10	3.50	2.50	1.50	6.00	5.52	7.40	Present (+)	Present (+)	47.37
T 20	H 15	4.00	2.50	1.00	6.00	3.20	5.00	Present (+)	Present (+)	60.38

Table 4.2.1.3d. Fruit and crown characters of Mauritius x Kew hybrids

Treatments		Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes
T 21	H 30	2.00	3.00	2.00	3.00	3.28	5.40	Present (+)	Present (+)	81.80
T 22	H 14	5.00	3.00	2.00	9.00	5.00	1.20	Present (+)	Present (+)	74.74
T 23	H 7	2.50	3.00	2.00	9.50	4.16	3.60	Present (+)	Present (+)	69.25
T 24	H 35	5.50	2.50	2.00	6.00	3.66	2.80	Present (+)	Present (+)	160.29
T 25	H 19	6.00	2.50	2.00	6.50	4.56	6.80	Present (+)	Present (+)	77.38
T 26	Mauritius	3.00	3.00	2.00	9.00	7.92	7.60	Present (+)	Present (+)	108.87
T 27	Kew	1.00	1.00	2.00	2.00	6.95	3.40	Present (+)	Present (+)	91.44
T 28	Amritha	3.00	3.00	2.00	9.00	4.93	4.80	Present (+)	Present (+)	85.27

4.2.1.3.19. Length of the fruit

The data related to length of fruit is presented in Table 4.2.1.3e and Table 4.2.1.3f. The length of fruit varied between 9.15 cm and 19.55 cm. The maximum length of fruit (19.55 cm) was recorded in treatment T-6 (H-62) and the minimum length of fruit (9.15 cm) was recorded in treatment T-9 (H-77).

4.2.1.3.20. Girth of the fruit

The data related to girth of fruit is presented in Table 4.2.1.3e and Table 4.2.1.3f. The girth of the fruit varied between 26.25 cm and 57.40 cm. The maximum girth was observed in treatment T-14 (H-70) and the minimum girth of the fruit in treatment T-16 (H-60).

4.2.1.3.21. Breadth of the fruit

The data related to breadth of fruit is presented in Table 4.2.1.3e and Table 4.2.1.3f. The mean fruit breadth varied between 5.98 cm and 12.15 cm. The maximum breadth of fruit was recorded in treatment T-7 (H-43) and the minimum breadth of fruit in treatment T-21 (H-30).

4.2.1.3.22. Taper ratio of the fruit

The data related to taper ratio of the fruit of all the treatments is presented in Table 4.2.1.3e and Table 4.2.1.3f. Taper ratio of the fruit ranged from 0.75 to 0.93. The maximum taper ratio (0.93) of the fruit was recorded in treatment T-14 (H-70), whereas the minimum taper ratio (0.75) of the fruit was in treatment T-11 (H-63).

4.2.1.3.23. Fruit weight with crown

The data related to fruit weight with crown is presented in Table 4.2.1.3g and Table 4.2.1.3h. Among the treatments, the highest fruit weight with crown of 2.15 kg was recorded in treatment T-24 (H-35) and the lowest fruit weight with crown of 0.57 kg in treatment T-21 (H-30).

4.2.1.3.24. Fruit weight without crown

The data related to fruit weight without crown is presented in Table 4.2.1.3g and Table 4.2.1.3h. Among the treatments, the highest fruit weight without crown of

1.82 kg was recorded in treatment T-24 (H-35) and the lowest fruit weight without crown of 0.34 kg in treatment T-16 (H-60).

4.2.1.3.25. Crown weight

The data related to crown weight is presented in Table 4.2.1.3g and Table 4.2.1.3h. Among the treatments, the highest crown weight of 0.51 kg was recorded in treatment T-18 (H-54) and the lowest crown weight of 0.10 kg in treatment T-26 (Mauritius).

4.2.1.3.26. Yield per plant

The data related to yield per plant is presented in Table 4.2.1.3g and Table 4.2.1.3h. Among the treatments, the highest fruit yield per plant of 2.15 kg was recorded in treatment T-24 (H-35) and the lowest fruit yield per plant of 0.57 kg in treatment T-21 (H-30).

4.2.1.3.27. Estimated yield

The data related to estimated fruit yield of all the Mauritius x Kew hybrids treatments is presented in Table 4.2.1.3g and Table 4.2.1.3h. From among the 28 treatments, highest estimated fruit yield (66.38 t/ha) was found in treatment T-1 (H-17), while treatment T-9 (H-77) recorded the lowest estimated fruit yield (18.41 t/ha).

4.2.1.3.28. Shelf life

The data related to shelf-life of all the treatments is presented in Table 4.2.1.3g and Table 4.2.1.3h. Shelf life of all the treatments varied from 6.75 to 9.00 days under ambient conditions. Treatment T-19 (H-10) recorded minimum self-life of the fruit (6.75 d). Whereas, treatments T-15 (H-59), T-17 (H-49), and T-18 (H-54) showed maximum self-life of the fruit (9.00 d).

4.2.1.3.29. Peel weight

The data related to peel weight of all the treatments is presented in Table 4.2.1.3g and Table 4.2.1.3h. Peel weight ranged from 0.08 kg to 0.24 kg. Treatment T-15 (H-59) showed maximum peel weight (0.24 kg) while treatment T-9 (H-77) showed the minimum peel weight (0.08 kg).

Table 4.2.1.3e. Fruit characters of Mauritius x Kew hybrids

Treatments		Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 1	H 17	3.75	3.92	16.10	41.10	11.65	0.91
T 2	H 16	4.42	5.00	10.35	32.80	8.86	0.89
T 3	H 85	3.58	4.42	11.85	31.50	9.04	0.92
T 4	H 91	6.37	4.90	13.70	37.85	10.62	0.84
T 5	H 48	3.83	3.57	16.50	38.75	11.09	0.87
T 6	H 62	3.91	3.91	19.55	36.95	10.48	0.83
T 7	H 43	3.60	4.97	13.60	40.80	12.15	0.89
T 8	H 66	5.52	4.91	17.50	38.50	11.45	0.82
T 9	H 77	4.60	5.00	9.15	27.25	7.75	0.81
T 10	H 92	4.80	5.00	10.65	27.50	8.04	0.90
T 11	H 63	6.33	4.00	16.30	32.35	9.25	0.75
T 12	H 27	5.13	4.47	10.30	29.80	8.88	0.85
T 13	H 78	5.00	5.00	15.15	33.55	9.77	0.81
T 14	H 70	3.86	4.31	15.25	57.40	9.42	0.93
T 15	H 59	3.73	6.07	14.90	37.80	11.20	0.84
T 16	H 60	5.00	5.00	9.85	26.25	8.18	0.90
T 17	H 49	5.53	4.47	11.30	31.50	9.23	0.82
T 18	H 54	5.53	4.47	13.80	39.70	8.60	0.89
T 19	H 10	3.93	4.80	10.30	29.95	8.77	0.89
T 20	H 15	5.00	5.00	10.75	30.21	8.57	0.90
T 21	H 30	4.27	5.20	10.45	26.50	5.98	0.86

Table 4.2.1.3f. Fruit characters of Mauritius x Kew hybrids

Treatments		Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 22	H 14	5.67	4.33	10.85	34.85	9.84	0.90
T 23	H 7	3.38	4.75	12.55	34.25	9.62	0.89
T 24	H 35	3.93	4.61	10.55	43.20	9.62	0.89
T 25	H 19	4.07	4.21	11.10	28.85	8.95	0.90
T 26	Mauritius	4.80	4.47	15.05	31.90	8.31	0.83
T 27	Kew	4.00	5.00	12.75	34.10	9.47	0.84
T 28	Amritha	5.00	5.00	11.65	30.00	8.34	0.85

4.2.1.3.30. Pulp weight

The data related to pulp weight of all the treatments is presented in Table 4.2.1.3g and Table 4.2.1.3h. Pulp weight varied from 0.23 kg to 1.59 kg. Among the treatments, highest pulp weight (1.59 kg) was found in treatment T-1 (H-17) while treatment T-16 (H-60) recorded the lowest pulp weight (0.23 kg).

4.2.1.3.31. Pulp percentage

The data related to pulp percentage of all the treatments is presented in Table 4.2.1.3g and Table 4.2.1.3h. Pulp percentage ranged from 60.53 to 89.56 %. The highest pulp percentage (89.56 %) of the fruit was recorded in treatment T-1 (H-17), whereas the lowest pulp percentage (60.53 %) was in treatment T-9 (H-77).

4.2.1.4. Qualitative analysis of fruits

4.2.1.4.1. Juice

The data related to juice percentage of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Juice percentage ranged from 77.61 to 95.16 %. The highest juice percentage (95.16 %) of the fruit was recorded in treatment T-3 (H-85), whereas the lowest juice percentage (77.61 %) was in treatment T-1 (H-17).

4.2.1.4.2. TSS

The data related to TSS of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Wide variability were observed among the treatments with regard to the total soluble solids (TSS), which ranged from 12.16 to 16.82 °Brix. The highest TSS of 16.82 °Brix was recorded in treatment T-28 (Amritha) and the lowest TSS of 12.16 °Brix was recorded in treatment T-11 (H-63).

4.2.1.4.3. Acidity

The data related to acidity of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Titratable acidity ranged from 0.81 to 1.05 %. Treatment T-15 (H-59) recorded the highest acidity of 1.05 %, whereas treatment T-7 (H-43) had the lowest acidity of 0.81 %.

4.2.1.4.4. Total sugars

The data related to total sugar percentage of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Total sugar percentage was ranged from 5.40 to 12.91 %. Among the treatments, Treatment T-9 (H-77) recorded the highest total sugar percentage of 12.91 %, while treatment T-6 (H-62) recorded the lowest total sugar percentage of 5.40 %.

4.2.1.4.5. Reducing sugars

The data related to reducing sugar percentage of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Reducing sugar percentage varied from 1.92 to 4.12 %. The highest reducing sugar percentage of 4.12 % was assessed in treatment T-3 (H-85) and the lowest reducing sugar percentage of 1.92 % was in treatment T-24 (H-35).

4.2.1.4.6. Non-reducing sugars

The data related to non-reducing sugar percentage of all the treatments are presented in Table 4.2.1.4a and Table 4.2.1.4b. Non-reducing sugar percentage varied from 0.97 to 10.87 %. The highest non-reducing sugar percentage (10.87 %) being recorded in treatment T-24 (H-35) and the lowest non-reducing sugar percentage (0.97 %) in treatment T-1 (H-17).

4.2.1.4.7. Sugar/acid ratio

The data related to TSS/acid ratio of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. TSS/acid ranged from 2.46 to 22.00. The maximum TSS/acid ratio (22.00) of the fruit was recorded in treatment T-7 (H-43), whereas the minimum TSS/acid ratio (2.46) was in treatment T-1 (H-17).

4.2.1.4.8. Fibre

The data related to fibre percentage of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Fibre percentage ranged from 26.75 to 35.22 %. Treatment T-5 (H-48) recorded the highest fibre percentage of 35.22 %, whereas treatment T-2 (H-16) had the lowest fibre percentage of 26.75 %.

Table 4.2.1.3g. Fruit and yield characters of Mauritius x Kew hybrids

Treatments		Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage
T 1	H 17	2.12	1.77	0.35	2.12	66.38	7.50	0.15	1.59	89.56
T 2	H 16	0.76	0.59	0.17	0.76	23.10	7.71	0.10	0.45	77.05
T 3	H 85	0.68	0.56	0.12	0.68	20.12	7.68	0.10	0.41	73.27
T 4	H 91	1.12	0.92	0.20	1.12	31.02	7.99	0.16	0.68	73.33
T 5	H 48	1.45	1.33	0.12	1.45	45.01	8.00	0.15	1.10	82.20
T 6	H 62	1.44	1.29	0.15	1.44	34.78	7.52	0.13	1.07	82.73
T 7	H 43	1.50	1.26	0.24	1.50	47.59	6.84	0.11	1.08	85.59
T 8	H 66	1.77	1.35	0.42	1.77	38.44	7.38	0.19	1.08	79.76
T 9	H 77	0.68	0.40	0.28	0.68	18.41	8.00	0.08	0.25	60.53
T 10	H 92	0.78	0.63	0.15	0.78	19.03	8.17	0.09	0.46	72.51
T 11	H 63	1.06	0.95	0.11	1.06	24.60	7.38	0.15	0.79	82.51
T 12	H 27	0.88	0.53	0.35	0.88	51.15	7.97	0.10	0.39	74.33
T 13	H 78	1.12	0.77	0.35	1.12	43.81	7.90	0.12	0.60	77.41
T 14	H 70	1.83	1.57	0.26	1.83	48.25	7.71	0.18	1.31	83.26
T 15	H 59	1.40	1.14	0.26	1.40	51.25	9.00	0.24	0.80	70.27
T 16	H 60	0.62	0.34	0.28	0.62	18.65	7.75	0.09	0.23	67.87
T 17	H 49	0.81	0.63	0.18	0.81	25.51	9.00	0.10	0.45	72.85
T 18	H 54	1.47	0.96	0.51	1.47	33.72	9.00	0.14	0.75	77.74
T 19	H 10	0.75	0.48	0.27	0.75	20.02	6.75	0.08	0.36	75.18
T 20	H 15	0.71	0.46	0.25	0.71	21.53	7.75	0.10	0.33	72.49
T 21	H 30	0.57	0.47	0.10	0.57	24.27	8.50	0.13	0.30	63.94
T 22	H 14	1.04	0.73	0.31	1.04	20.63	7.64	0.08	0.55	74.99

Table 4.2.1.3h. Fruit and yield characters of Mauritius x Kew hybrids

Treatments		Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage
T 23	H 7	1.01	0.79	0.22	1.01	28.53	7.00	0.12	0.57	71.97
T 24	H 35	2.15	1.82	0.33	2.15	49.24	7.34	0.18	1.29	70.84
T 25	H 19	0.95	0.76	0.19	0.95	28.52	7.84	0.12	0.60	78.60
T 26	Mauritius	1.02	0.92	0.10	1.02	36.94	7.94	0.15	0.73	78.43
T 27	Kew	1.13	0.92	0.21	1.13	33.38	7.50	0.14	0.75	82.02
T 28	Amritha	0.65	0.55	0.10	0.65	23.77	7.25	0.13	0.40	72.96

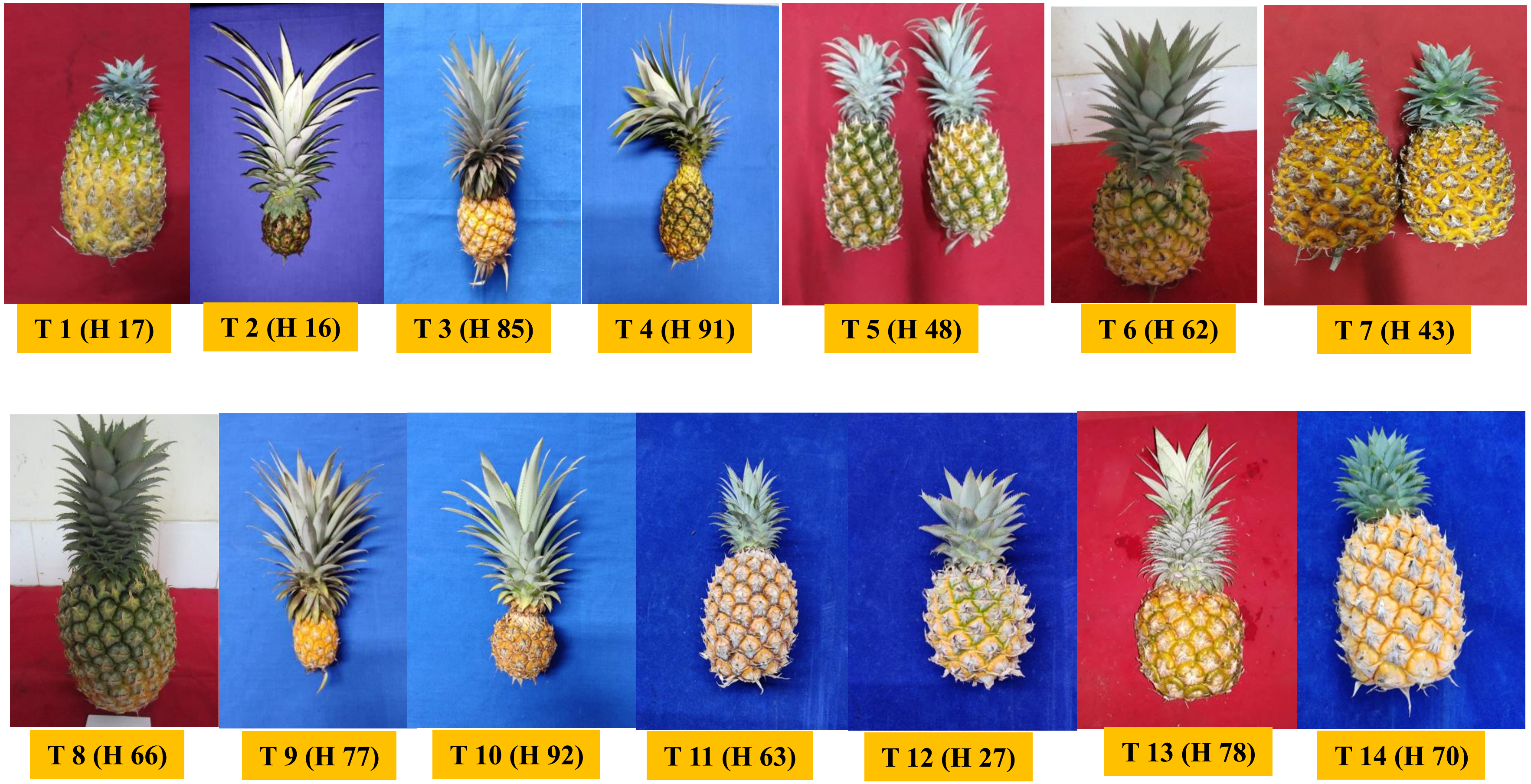


Plate 4.2.1.3a. Fruit variability of Mauritius x Kew hybrids

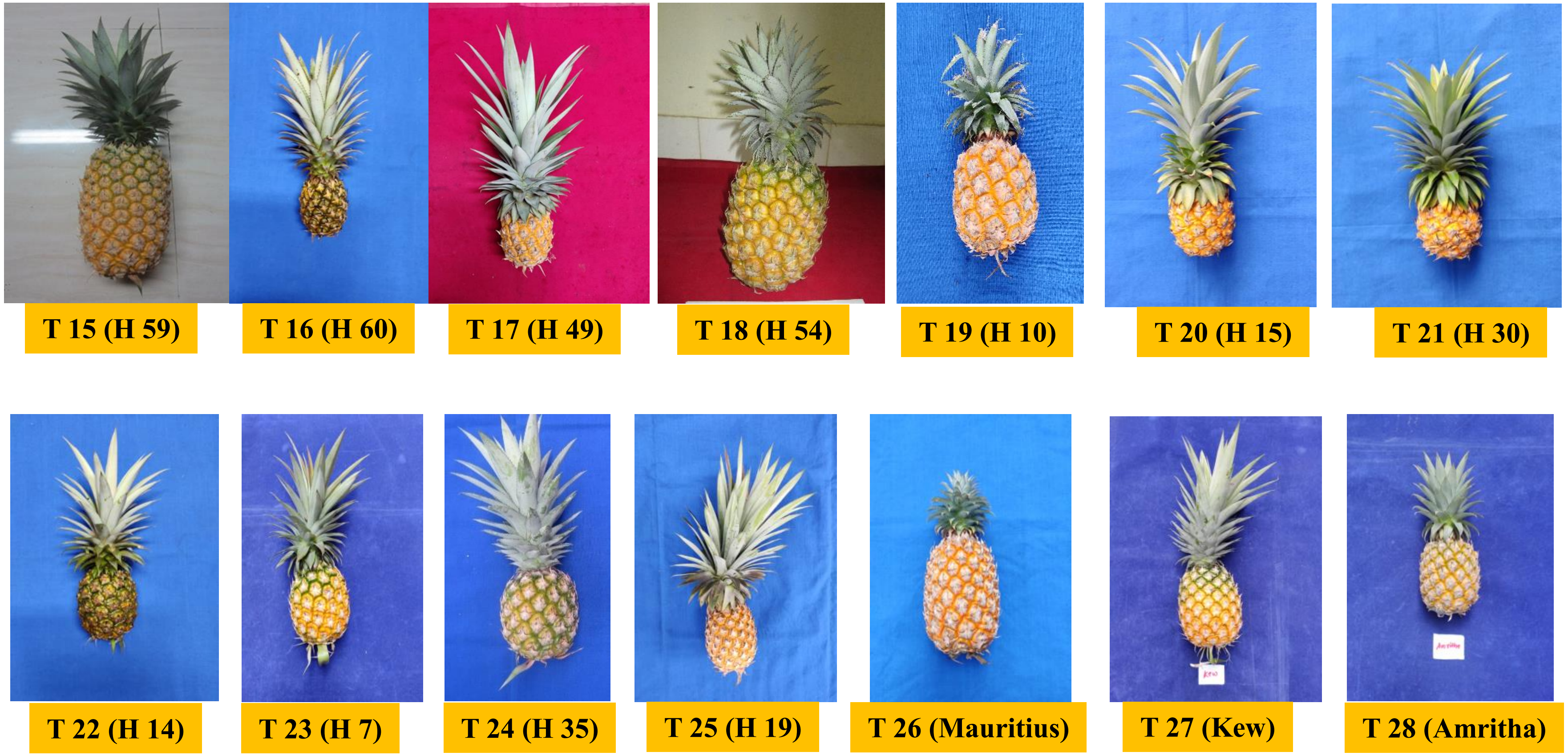


Plate 4.2.1.3b. Fruit variability of Mauritius x Kew hybrids

4.2.1.4.9. Total carotenoids

The data related to total carotenoids content of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. In all the treatments, total carotenoids content ranged from 208.21 to 325.34 mg/100g. Treatment T-14 (H-70) recorded the maximum total carotenoids content of 325.34 mg/100g, whereas treatment T-23 (H-7) recorded the minimum total carotenoids content of 208.21 mg/100g.

4.2.1.4.10. Ascorbic acid

The data related to ascorbic acid content of all the treatments is presented in Table 4.2.1.4a and Table 4.2.1.4b. Ascorbic acid content varied widely among the treatments and ranged from 22.05 to 104.11 mg/100g. The maximum ascorbic acid content of 104.11 mg/100g was recorded in treatment T-15 (H-59), whereas treatment T-3 (H-85) recorded the minimum ascorbic acid content of 22.05 mg/100g.

4.2.1.5. Organoleptic evaluation of Mauritius x Kew hybrids

The data related to organoleptic evaluation of Mauritius x Kew hybrids, the mean value of each attribute and total score of each treatment is presented in Table 4.2.1.5. Among the 28 treatments studied, the highest total sensory score (sum of mean of each attribute) was recorded in treatment T-01 (H-17, 44.20) followed by treatments T-08 (H-66, 43.30), T-14 (H-70, 43.30), T-24 (H-35, 43.30), T-07 (H-43, 42.70) respectively and the lowest total score was recorded in treatment T-20 (H-15, 38.50) and T-27 (Kew, 38.50). They were most preferred/accepted by panellists because of their better fruit colour, taste, flavour, texture and overall acceptability.

Evaluation of twenty five hybrids under open field conditions along with their parental clones Mauritius, Kew and one check variety Amritha, pointed out existence of wide variability for all the traits. Many of hybrids exhibited higher desirability compared of mid parent. The per cent variation in traits among the hybrids over mid parent is given in Table 4.2.1a and Table 4.2.1b. It is observed that the higher per cent increased in fruit weight with crown (100.00 %) and pulp weight (114.86 %) was observed in T-24 (H-35; fruit weight with crown: 2.15 kg) and T-1 (H-17; pulp weight: 1.59 kg) compared to mid parent (fruit weight with crown: 1.08 kg; pulp weight: 0.74 kg). Whereas, T-21 (H-30; 0.57 kg) registered a decreased in fruit weight with crown (46.98 %) and T-16 (H-60; 0.23 kg) in pulp weight (68.92 %). Similarly, an increasing in TSS was also observed compared to mid parent (MP) in T-7 (H-43; 15.75 °Brix; 21.20 %). In comparison to MP high per cent decrease was evident with respect to traits *viz*., days to attain ideal leaf stage for flowering (T-15: H-59; 178.14 d; 4.07 %), crown weight (T-21: H-30; 0.10 kg; 37.50 %), peel weight (T-9: H-77; T-19: H-10; T-22: H-14; 0.08 kg; 46.67 %), profile of eyes (T-23: H-7; 3.38; 23.18 %), relative surface of eyes (T-5: H-48; 3.57; 24.60 %), and acidity (T-7: H-43; 0.81 %; 8.47 %). Thus, existence of several desire hybrids was evident among the 28 treatments studied.

Improvement of yield and other related traits is a basic objective in any breeding programme. Intercrossing of genotypes with better mean performance will be effectual for further crop improvement pineapple (Kuriakose, 2004). The reliable conformity for this can be known from the cluster mean. Selection index provides appropriate weightage to the phenotypic values of two or more characters to be used simultaneously for the selection. It involves the discriminant function analysis meant for isolating superior genotypes (Fisher, 1936). Selection index formulation aids to increase the efficiency of selection of suitable genotypes by taking into account the most desirable and undesirable characters in terms of fruit yield and quality. de Souza *et al.* (2000) recommended selection index formulation for predicted breeding values for nine plant and fruit characteristics of 28 peach genotypes. Moreira *et al.* (2019) recommended a selection based on suitable index, and commend it as more efficient than individual selection, based on phenotypic and genotypic values predicted by REML/BLUP in Papaya genotypes in order to recommend for farmers.

4.2.2. Selection index of Mauritius x Kew hybrids

Construction of selection indices criteria assigns the most appropriate weightage to the phenotypic values of two or more characters to be used simultaneously for the selection. Even though there are many methods for the calculation of selection indices, discriminate function is widely used by the researchers. In the present investigation, the index value for each genotype was determined by following the simultaneous selection index (Smith, 1937) was used to discriminate the genotypes in terms of table purpose with higher yield and quality characters. In the present study, data on all the Mauritius x Kew hybrids were scored for the three most desirable characteristics *viz.*, fruit weight with crown, pulp weight, TSS, and six undesirable characters such as crown weight, peel

Table 4.2.1.4a. Fruit quality analysis of Mauritius x Kew hybrids

Treatments		Juice (%)	TSS (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)	Sugar/ acid ratio	Fibre (%)	Total carotenoids (mg 100 g-1)	Ascorbic acid (mg 100 g-1)
T 1	H 17	77.61	14.53	0.85	11.73	3.65	0.97	17.09	33.28	275.80	49.40
T 2	H 16	89.37	12.42	0.92	10.22	2.65	7.57	13.50	26.75	254.24	31.80
T 3	H 85	95.16	13.32	0.89	10.78	4.12	6.67	14.97	27.91	248.30	22.05
T 4	H 91	86.46	14.91	0.91	11.65	3.79	7.86	16.38	30.87	268.68	37.60
T 5	H 48	88.05	13.97	0.86	12.81	2.24	10.57	16.24	35.22	312.44	69.75
T 6	H 62	82.63	14.29	0.87	5.40	3.34	2.06	16.43	33.51	282.25	44.79
T 7	H 43	80.93	15.75	0.81	11.07	3.53	7.55	19.44	33.53	278.90	52.31
T 8	H 66	83.78	13.21	0.83	12.03	2.61	9.43	15.92	34.03	267.81	78.64
T 9	H 77	87.57	13.69	0.88	12.91	2.41	10.50	15.56	33.19	223.43	66.32
T 10	H 92	85.08	13.63	1.00	9.28	3.57	5.72	13.63	31.78	275.55	91.80
T 11	H 63	91.11	12.16	0.93	9.97	2.59	7.38	13.08	33.58	277.09	91.20
T 12	H 27	87.90	13.07	0.89	12.33	2.81	9.52	14.69	32.93	238.91	75.73
T 13	H 78	87.18	13.24	1.01	10.91	3.42	7.49	13.11	32.82	262.13	54.19
T 14	H 70	84.83	13.40	0.84	10.65	2.98	7.67	15.95	34.26	325.34	68.55
T 15	H 59	87.61	13.59	1.05	11.66	3.11	8.55	12.94	32.80	240.46	104.11
T 16	H 60	85.58	15.28	0.87	9.00	3.31	5.69	17.56	33.24	284.32	41.03
T 17	H 49	88.24	14.79	0.96	10.06	3.72	6.34	15.41	29.41	226.99	52.82
T 18	H 54	84.76	13.92	0.90	9.62	2.95	6.67	15.47	34.94	282.51	81.72

Table 4.2.1.4b. Fruit quality analysis of Mauritius x Kew hybrids

Treatments		Juice (%)	TSS (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)	Sugar/ acid ratio	Fibre (%)	Total carotenoids (mg 100 g-1)	Ascorbic acid (mg 100 g-1)
T 19	H 10	86.87	14.65	0.91	10.56	2.86	7.70	16.10	32.62	270.90	93.67
T 20	H 15	89.60	13.69	0.88	12.91	2.41	10.50	15.56	33.19	223.43	66.32
T 21	H 30	90.38	13.08	0.99	11.81	2.90	8.90	13.21	33.24	284.32	66.93
T 22	H 14	83.48	14.44	0.97	11.56	3.02	8.54	14.89	34.36	215.17	83.59
T 23	H 7	86.14	13.91	1.03	10.71	2.72	7.98	13.50	33.17	208.21	63.59
T 24	H 35	85.03	15.07	0.86	12.78	1.92	10.87	17.52	33.15	238.65	73.34
T 25	H 19	93.97	14.67	0.89	12.35	2.21	10.15	16.48	34.02	286.38	85.13
T 26	Mauritius	89.79	13.52	0.89	11.99	2.16	9.83	15.19	33.06	228.33	64.79
T 27	Kew	86.54	12.47	0.88	11.69	4.10	7.59	14.17	35.10	255.42	44.27
T 28	Amritha	87.87	16.82	0.86	10.86	3.28	7.58	19.56	34.71	267.55	50.09

Table 4.2.1.5. Organoleptic evaluation of Mauritius x Kew hybrids

Treatments		Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank	Total score
T 1	H 17	8.50	9.40	8.30	9.20	8.80	44.20
T 2	H 16	8.30	8.40	9.00	7.90	8.40	42.00
T 3	H 85	8.10	8.30	8.00	9.30	8.40	42.10
T 4	H 91	7.40	8.90	8.60	8.80	8.40	42.10
T 5	H 48	8.90	7.70	8.30	7.90	8.20	41.00
T 6	H 62	7.90	8.60	8.90	6.10	7.80	39.30
T 7	H 43	8.00	9.20	7.90	9.10	8.50	42.70
T 8	H 66	9.20	8.90	9.10	7.50	8.60	43.30
T 9	H 77	7.70	8.30	8.00	8.80	8.20	41.00
T 10	H 92	7.40	7.80	8.80	8.30	8.00	40.30
T 11	H 63	6.80	8.40	8.20	9.00	8.10	40.50
T 12	H 27	7.30	8.70	8.00	8.70	8.10	40.80
T 13	H 78	8.50	7.50	8.90	7.80	8.10	40.80
T 14	H 70	9.00	8.60	9.30	7.80	8.60	43.30
T 15	H 59	8.70	8.90	8.50	7.90	8.50	42.50
T 16	H 60	9.10	7.80	8.20	7.20	8.00	40.30
T 17	H 49	8.30	7.90	9.00	7.80	8.20	41.20
T 18	H 54	7.50	8.70	8.90	6.50	7.90	39.50
T 19	H 10	7.80	8.30	8.60	7.70	8.10	40.50
T 20	H 15	7.90	7.30	8.00	7.60	7.70	38.50
T 21	H 30	8.60	7.50	8.30	7.80	8.00	40.20
T 22	H 14	7.60	8.00	8.70	8.10	8.10	40.50
T 23	H 7	8.10	8.10	7.80	8.40	8.10	40.50
T 24	H 35	8.80	8.90	9.10	7.90	8.60	43.30
T 25	H 19	7.60	8.00	7.70	8.00	7.80	39.10
T 26	Mauritius	8.70	8.30	8.60	7.40	8.20	41.20
T 27	Kew	7.50	7.30	8.50	7.50	7.70	38.50
T 28	Amritha	8.50	8.10	8.90	8.50	8.50	42.50

Plate 4.2.1.5. Sensory evaluation of Mauritius x Kew hybrids

Table 4.2.1a. Per cent variation in Mauritius x Kew hybrids over mid parental clone

Treatments		Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)
T 1	H 17	97.21	11.81	114.86	-1.59	118.75	0.00	-14.77	-17.21	-3.95
T 2	H 16	-29.30	-4.42	-39.19	-1.05	6.25	-33.33	0.45	5.60	3.95
T 3	H 85	-36.74	2.50	-44.59	-2.80	-25.00	-33.33	-18.64	-6.65	0.56
T 4	H 91	4.19	14.74	-8.11	-1.15	25.00	6.67	44.77	3.48	2.82
T 5	H 48	34.88	7.50	48.65	0.75	-25.00	0.00	-12.95	-24.60	-2.82
T 6	H 62	33.95	9.97	44.59	1.29	-6.25	-13.33	-11.14	-17.42	-1.69
T 7	H 43	39.53	21.20	45.95	-0.75	50.00	-26.67	-18.18	4.96	-8.47
T 8	H 66	64.65	1.65	45.95	-2.49	162.50	26.67	25.45	3.70	-6.21
T 9	H 77	-36.74	5.35	-66.22	-1.79	75.00	-46.67	4.55	5.60	-0.56
T 10	H 92	-27.44	4.89	-37.84	2.06	-6.25	-40.00	9.09	5.60	12.99
T 11	H 63	-1.40	-6.43	6.76	-1.18	-31.25	0.00	43.86	-15.52	5.08
T 12	H 27	-18.14	0.58	-47.30	-4.08	118.75	-33.33	16.59	-5.60	0.56
T 13	H 78	4.19	1.89	-18.92	-1.33	118.75	-20.00	13.64	5.60	14.12
T 14	H 70	70.23	3.12	77.03	2.64	62.50	20.00	-12.27	-8.98	-5.08
T 15	H 59	30.23	4.58	8.11	-4.07	62.50	60.00	-15.23	28.19	18.64
T 16	H 60	-42.33	17.58	-68.92	1.55	75.00	-40.00	13.64	5.60	-1.69
T 17	H 49	-24.65	13.81	-39.19	-0.95	12.50	-33.33	25.68	-5.60	8.47
T 18	H 54	36.74	7.12	1.35	-2.33	218.75	-6.67	25.68	-5.60	1.69

Table 4.2.1b. Per cent variation in Mauritius x Kew hybrids over mid parental clone

Treatments		Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)
T 19	H 10	-30.23	12.74	-51.35	-1.68	68.75	-46.67	-10.68	1.37	2.82
T 20	H 15	-33.95	5.35	-55.41	-1.58	56.25	-33.33	13.64	5.60	-0.56
T 21	H 30	-46.98	0.65	-59.46	1.65	-37.50	-13.33	-2.95	9.82	11.86
T 22	H 14	-3.26	11.12	-25.68	-3.84	93.75	-46.67	28.86	-8.55	9.60
T 23	H 7	-6.05	7.04	-22.97	0.16	37.50	-20.00	-23.18	0.32	16.38
T 24	H 35	100.00	15.97	74.32	-2.04	106.25	20.00	-10.68	-2.64	-2.82
T 25	H 19	-11.63	12.89	-18.92	-1.73	18.75	-20.00	-7.50	-11.09	0.56
Mid parent (MP)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

weight, profile of eyes, relative surface of eyes, days to attain ideal leaf stage for flowering, and titratable acidity.

The selection index value of desirable and undesirable traits in terms of fruit yield and quality was calculated. The selection index values with regard to all the characters allotted to an individual was used as the indication of individual's worth. The genotypes were ranked according to their selection index values. The selection index value obtained by the hybrids are given in Table 4.2.2a, Table 4.2.2b, and Fig. 4.2.2. The Mauritius x Kew hybrids were ranked based on their selection index value The hybrid line, T-1 (H-17), with selection index value 2245.43 was ranked first, followed by T-24 (H-35) with an index value of 1738.20 in second position, T-14 (H-70; 1032.51) ranked third, T-7 (H-43; 670.79) ranked fourth, T-8 (H-66; 611.68) ranked fifth, and T-15 (H-59; 586.18) was next sixth spot. The genotype, T-10 (H-92), obtained the least selection index value (-882.11). The six superior hybrid lines (upto rank 6th) were considered as novel genotypes in terms of table purpose fruit yield and quality among the 28 genotypes screened. These selected six hybrid lines along with parental clones Mauritius, Kew, and check variety Amritha were selected for molecular characterization.

In the present study selection indices was formulated based on nine characters *viz*., fruit weight with crown, pulp weight, TSS, crown weight, peel weight, eye profile, eye relative surface, days to attain ideal leaf stage for flowering, and titratable acidity. The hybrid line, T-1 (H-17) was ranked first, followed by T-24 (H-35), T-14 (H-70), T-7 (H-43), T-8 (H-66), and T-15 (H-59) were next five spots. The genotype, T-10 (H-92), obtained the least selection index value (-882.11). The six superior hybrid lines (upto rank 6th) were considered as novel genotypes in terms of table purpose fruit yield and quality among the 28 genotypes screened. Cabral *et al.* (1993) recommended fruit weight, pulp weight, crown weight, TSS, and titratable acidity as most important selection characters of pineapple cultivars. Chan (2005) suggested for selection of novel types, Johor cultivar has high fruit yield and canning properties (Chan and Lee, 1985), Josapine cultivar is precocious and have good shelf life (Chan and Lee, 1996), Scarlett has showed early flowering in pineapple (d'Eeckenbrugge and Marie, 2000). The hybrid MD-2 is excellent cultivar for fresh fruit market (Janick, 2003).

Hence, the results revealed that the superior hybrid lines H-17, H-35, H-70, H-43, H-66, and H-59, which secured ranks within six under selection index, could be considered as table purpose genotypes in terms of fruit yield and quality among the 28 screened genotypes. Of six lines, H-17 and H-35 are promising hybrids with high yield and quality potential could be functionally validated and can be involved in breeding programme to improve its performance under commercial cultivation (Chan, 2005).

4.3. Kew x Mauritius hybrids

A detailed experiment was conducted at Fruit Crops Research Station, Vellanikkara, for selecting hybrids of Kew and Mauritius variety of pineapple. Ten Kew x Mauritius hybrids along with parent source Mauritius, Kew, and check variety Amritha were initially tagged based on general vigour and biometric observations were recorded.

The various observations on morphological characters *viz.*, vegetative characters (monthly), flowering characters, fruit and yield characters recorded as per the descriptors for pineapple suggested by International Board for Plant Genetic Resources Rome, Italy (IBPGR, 1991) were observed and the results are presented in Table 4.3.1.1a to Table 4.3.1.5.

4.3.1. Variability

4.3.1.1. Vegetative characters (Monthly intervals)

The data showing vegetative characters of Kew x Mauritius hybrids along with parents and one check variety Amritha is given in Table 4.3.1.1a and Table 4.3.1.1b.

4.3.1.1.1. Plant height

The data related to plant height is presented in Table 4.3.1.1a. The plant height of the hybrids ranged from 87.42 cm to 107.12 cm. The minimum plant height of 87.42 cm was noted in treatment T-1 (H-98) and maximum plant height of 107.12 cm in treatment T-2 (H-118) at its 39 leaf stage of the plant.

4.3.1.1.2. Number of leaves per plant

The data related to average number of leaves per plant is presented in Table 4.3.1.1a. Average number of leaves per plant ranged from 38.60 to 41.49. At 39 leaf

Table 4.2.2a. Variables and selection index of Mauritius x Kew hybrids

Treatments		Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)	Selection index value	Rank
T 1	**H 17**	**2.12**	**14.53**	**1.59**	**182.75**	**0.35**	**0.15**	**3.75**	**3.92**	**0.85**	**2245.43**	**1**
T 2	H 16	0.76	12.42	0.45	183.75	0.17	0.10	4.42	5.00	0.92	-643.84	23
T 3	H 85	0.68	13.32	0.41	180.50	0.12	0.10	3.58	4.42	0.89	-790.53	27
T 4	H 91	1.12	14.91	0.68	183.57	0.2	0.16	6.37	4.90	0.91	-134.04	14
T 5	H 48	1.45	13.97	1.10	187.10	0.12	0.15	3.83	3.57	0.86	218.66	10
T 6	H 62	1.44	14.29	1.07	188.10	0.15	0.13	3.91	3.91	0.87	225.31	9
T 7	**H 43**	**1.50**	**15.75**	**1.08**	**184.30**	**0.24**	**0.11**	**3.60**	**4.97**	**0.81**	**670.79**	**4**
T 8	**H 66**	**1.77**	**13.21**	**1.08**	**181.08**	**0.42**	**0.19**	**5.52**	**4.91**	**0.83**	**611.68**	**5**
T 9	H 77	0.68	13.69	0.25	182.37	0.28	0.08	4.60	5.00	0.88	-673.91	25
T 10	H 92	0.78	13.63	0.46	189.53	0.15	0.09	4.80	5.00	1.00	-882.11	28
T 11	H 63	1.06	12.16	0.79	183.50	0.11	0.15	6.33	4.00	0.93	-176.25	15
T 12	H 27	0.88	13.07	0.39	178.13	0.35	0.10	5.13	4.47	0.89	-113.26	13
T 13	H 78	1.12	13.24	0.60	183.23	0.35	0.12	5.00	5.00	1.01	54.80	11
T 14	**H 70**	**1.83**	**13.40**	**1.31**	**190.61**	**0.26**	**0.18**	**3.86**	**4.31**	**0.84**	**1032.51**	**3**
T 15	**H 59**	**1.40**	**13.59**	**0.80**	**178.14**	**0.26**	**0.24**	**3.73**	**6.07**	**1.05**	**586.18**	**6**
T 16	H 60	0.62	15.28	0.23	188.57	0.28	0.09	5.00	5.00	0.87	-590.84	22
T 17	H 49	0.81	14.79	0.45	183.93	0.18	0.10	5.53	4.47	0.96	-667.40	24
T 18	H 54	1.47	13.92	0.75	181.37	0.51	0.14	5.53	4.47	0.90	424.09	7

Table 4.2.2b. Variables and selection index of Mauritius x Kew hybrids

Treatments		Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)	Selection index value	Rank
T 19	H 10	0.75	14.65	0.36	182.58	0.27	0.08	3.93	4.80	0.91	-741.37	26
T 20	H 15	0.71	13.69	0.33	182.76	0.25	0.10	5.00	5.00	0.88	-439.56	19
T 21	H 30	0.57	13.08	0.30	188.77	0.10	0.13	4.27	5.20	0.99	-527.48	20
T 22	H 14	1.04	14.44	0.55	178.57	0.31	0.08	5.67	4.33	0.97	-359.82	17
T 23	H 7	1.01	13.91	0.57	185.99	0.22	0.12	3.38	4.75	1.03	-414.09	18
T 24	**H 35**	**2.15**	**15.07**	**1.29**	**181.91**	**0.33**	**0.18**	**3.93**	**4.61**	**0.86**	**1738.20**	**2**
T 25	H 19	0.95	14.67	0.60	182.48	0.19	0.12	4.07	4.21	0.89	300.18	8
T 26	Mauritius	1.02	13.52	0.73	196.30	0.10	0.15	4.80	4.47	0.89	-54.24	12
T 27	Kew	1.13	12.47	0.75	175.10	0.21	0.14	4.00	5.00	0.88	-320.66	16
T 28	Amritha	0.65	16.82	0.40	180.57	0.10	0.13	5.00	5.00	0.86	-578.72	21

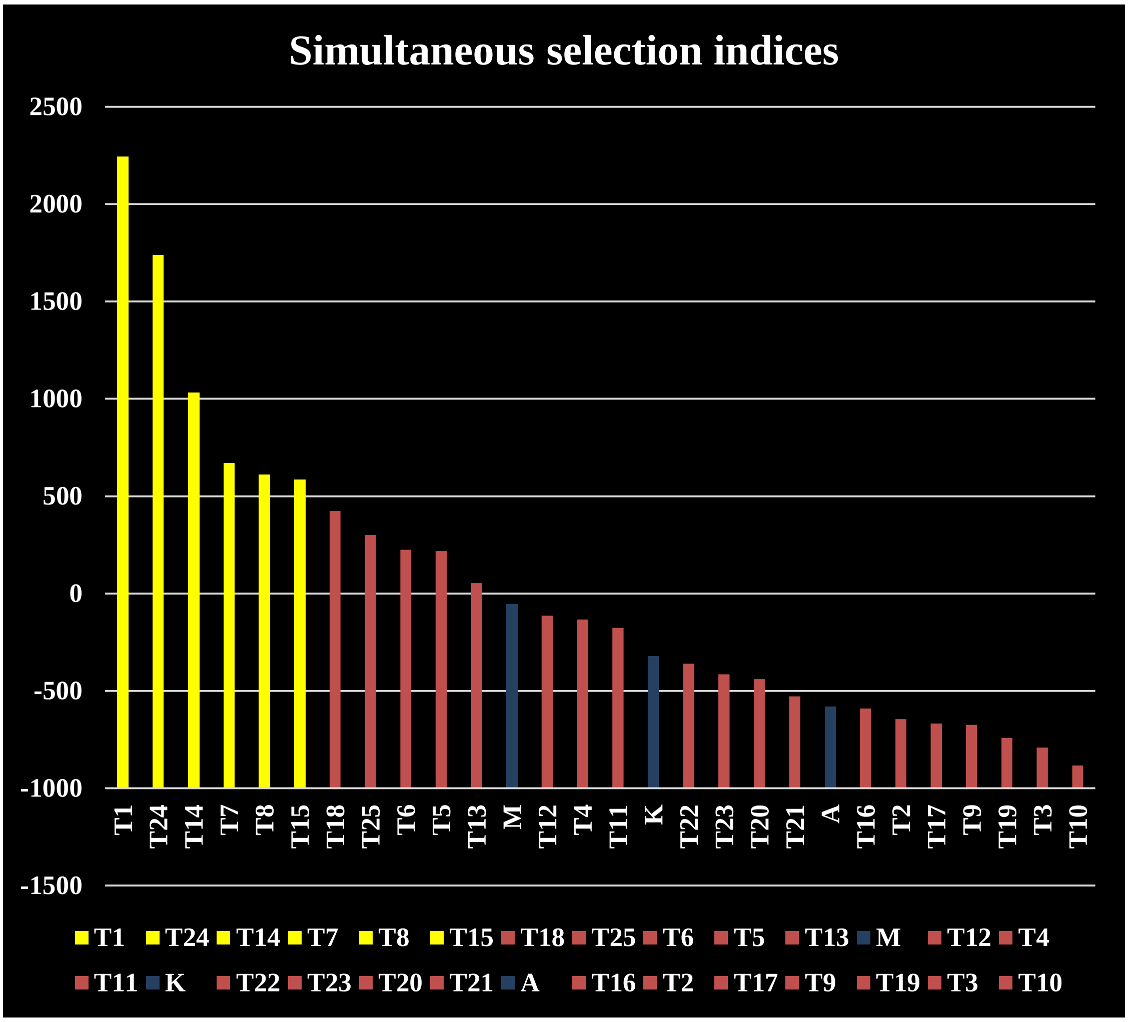


Fig. 4.2.2. Selection index of field evaluated Mauritius x Kew hybrids

stage of the plant maximum number of leaves (41.49) was observed in treatment T-5 (H-99) and minimum number of leaves (38.60) in treatment T-7 (H-110).

4.3.1.1.3. Length of 'D' leaf

The data related to length of D leaf is presented in Table 4.3.1.1a. Length of D leaf of the treatments ranged from 51.90 cm to 61.30 cm. The minimum D leaf length of 51.90 cm was noted in treatment T-8 (H-116) and maximum D leaf length of 61.30 cm in treatment T-6 (H-104) at its 39 leaf stage of the plant.

4.3.1.1.4. Breadth of 'D' leaf

The data related to breadth of D leaf is presented in Table 4.3.1.1a. Breadth of D leaf of treatments ranged from 2.54 cm to 4.46 cm. At 39 leaf stage of the plant breadth of D leaf was maximum (4.46) in treatment T-2 (H-118) and minimum breadth of D leaf (2.54) in treatment T-8 (H-116).

4.3.1.1.5. 'D' leaf area

The data related to 'D' leaf area is presented in Table 4.3.1.1a. The 'D' leaf area of the treatments ranged from 99.15 cm^2 to 198.21 cm^2. The lowest 'D' leaf area of 99.15 cm^2 was noted in treatment T-6 (H-104) and highest 'D' leaf area of 198.21 cm^2 in treatment T-2 (H-118) at its 39 leaf stage of the plant.

4.3.1.1.6. Leaf Area Index (LAI)

The data related to leaf area index is presented in Table 4.3.1.1a. Leaf area index of treatments ranged from 2.93 to 5.90. Leaf area index was maximum (5.90) in treatment T-2 (H-118) and minimum leaf area index (2.93) in treatment T-8 (H-116).

4.3.1.1.7. Spine length

The data related to spine length is presented in Table 4.3.1.1a. Spine length of the treatments ranged from 0.17 mm to 0.33 mm. The lowest spine length of 0.17 mm was noted in treatment T-12 (Kew) whereas highest spine length of 0.33 mm in treatment T-1 (H-98) at its 39 leaf stag of the plant.

4.3.1.1.8. Number of suckers per plant

The data related to mean number of suckers produced per plant is presented in Table 4.3.1.1a. The number of suckers per plant ranged from 0.54 to 2.00. The highest number of suckers per plant (2.00) was recorded in treatment T-8 (H-116) and lowest number of suckers per plant (0.54) in treatment T-12 (Kew).

4.3.1.1.9. Number of slips per plant

The data related to mean number of slips produced per plant is presented in Table 4.3.1.1a. The number of slips per plant ranged from 0.35 to 2.03. The highest number of slips per plant (2.03) was recorded in treatment T-10 (H-111) and lowest number of slips per plant (0.35) in treatment T-5 (H-99).

4.3.1.1.10. Distribution of spines

The data related to distribution of spines is presented in Table 4.3.1.1b. Among all the treatments the distribution of spines per plant significantly slightly varied with field evaluated treatments. The lowest descriptive score of 1.80 was noted in treatment T-12 (Kew) and highest descriptive score of 3.74 in treatment T-7 (H-110) at its 39 leaf stage of the plant.

4.3.1.1.11. Direction of spines

The data related to direction of spines is presented in Table 4.3.1.1b. Only ascending order of spines was observed in all treatments.

4.3.1.1.12. Colouration of leaf spines

The data related to colour of leaf spines is presented in Table 4.3.1.1b. Among the treatments, the lowest descriptive score of colouration of leaf spines of 1.73 was noted in treatment T-4 (H-101) and highest descriptive score of colouration of leaf spines of 4.00 each of in treatment T-11 (Mauritius) and T-13 (Amritha) at its 39 leaf stage of the plant.

4.3.1.1.13. Spine stiffness

The data related to spine stiffness is presented in Tables 4.3.1.1b. All the treatment observed intermediate stiffness of spines.

Table 4.3.1.1a. Quantitatively vegetative characters of Kew x Mauritius hybrids at its 39 leaf stage

Treatments		Plant height (cm)	Number of leaves per plant	Length of D leaf (cm)	Breadth D leaf (cm)	D leaf area (cm^2)	Leaf Area Index (LAI)	Spine length (mm)	Number of suckers per plant	Number of slips per plant
T 1	H 98	87.42	41.42	54.04	3.38	132.50	3.98	0.33	1.27	1.02
T 2	H 118	107.12	39.73	55.30	4.46	198.21	5.90	0.25	1.07	0.44
T 3	H 115	91.59	39.40	57.44	3.67	152.83	4.44	0.28	1.27	1.09
T 4	H 101	92.85	39.82	53.47	3.81	160.40	4.97	0.22	1.54	1.22
T 5	H 99	88.53	41.49	58.20	3.29	136.53	4.13	0.25	1.34	0.35
T 6	H 104	89.60	40.62	61.30	2.64	99.15	3.03	0.25	1.07	1.32
T 7	H 110	89.73	38.60	56.60	3.54	144.93	4.06	0.20	1.60	1.11
T 8	H 116	88.98	38.98	51.90	2.54	102.57	2.93	0.21	2.00	0.86
T 9	H 121	96.46	40.02	55.07	3.99	164.60	4.80	0.22	1.07	1.13
T 10	H 111	88.42	40.53	56.47	3.46	130.19	3.82	0.25	1.34	2.03
T 11	Mauritius	89.71	38.82	56.77	3.64	149.82	4.31	0.29	1.64	1.20
T 12	Kew	93.18	38.75	56.77	3.54	149.04	4.26	0.17	0.54	0.70
T 13	Amritha	88.31	39.47	54.07	3.54	141.77	4.24	0.23	1.07	1.05

4.3.1.1.14. Position of suckers

The data related to position of suckers is presented in Table 4.3.1.1b. Among the treatments, 76.93 % of the treatments produced both underground sucker and aerial suckers, 15.39 % of treatments produced aerial suckers only, and 7.69 % of treatments produced underground suckers only.

4.3.1.2. Flowering characters

4.3.1.2.1. Days to attain ideal leaf stage for flowering

The data related to number of days taken to attain ideal leaf stage for flowering for different treatments is presented in Table 4.3.1.2. Among various treatments, T-11 (Mauritius) recorded significantly the less number of days to attain ideal leaf stage for flowering (178.13 d). Whereas, the treatment T-12 (Kew) took more number of days (190.61 d) to attain ideal leaf stage for flowering.

4.3.1.2.2. Days for initiation of flowering (visual)

The mean number of days taken from ethrel application to the appearance of reddish colour inflorescence at the heart of the plant was recorded by different treatments is presented in Table 4.3.1.2. Among various treatments, T-2 (H-118) recorded significantly the less number of days for initiation of flowering (43.08 d). The treatment T-7 (H-110) took more number of days (49.98 d) for initiation of flowering.

4.3.1.2.3. Days for 50 per cent flowering

The mean number of days taken from ethrel application to emergence of inflorescence in 50 per cent of the plants in each treatment was recorded and presented in Table 4.3.1.2. Among various treatments, T-2 (H-118) recorded significantly the less number of days to 50 per cent flowering (48.35 d). Whereas, treatment T-6 (H-104) took more number of days (55.09 d) for 50 per cent flowering.

4.3.1.2.4. Flowering phase

The number of days for flowering phase was recorded and presented in Table 4.3.1.2. Among the treatments, T-7 (H-110) recorded significantly the less number of days for flowering phase (20.04 d) and more number of days for flowering phase (23.13 d) in treatment T-10 (H-111).

4.3.1.3. Fruit and yield characters

4.3.1.3.1. Days for fruit maturity

The mean number of days taken for fruit maturity of each treatment was recorded and presented in Table 4.3.1.3a. Among all the Kew x Mauritius hybrids, Treatment T-7 (H-110) recorded significantly the less number of days to fruit maturity (140.33 d). While, treatment T-1 (H-98) took more number of days to fruit maturity (157.20 d).

4.3.1.3.2. Crop duration

The data related to crop duration was worked out for each treatment and data is presented in Table 4.3.1.3a. In all the Kew x Mauritius hybrids, Treatment T-2 (H-118) recorded significantly minimum crop duration (366.50 d). While, treatment T-5 (H-99) took maximum crop duration for fruit maturity (388.28 d).

4.3.1.3.3. Presence of crown

The data related to presence of crown is presented in Table 4.3.1.3a. As per the descriptor, crown was present in all the treatments.

4.3.1.3.4. Crown shape

The data related to crown shape of all the treatments is presented in Table 4.3.1.3a. Among the treatments, the highest descriptive score of crown shape of 6.00 was recorded in treatment T-12 (Kew) whereas the lowest descriptive score of crown shape of 1.00 was obtained in treatment T-8 (H-116).

4.3.1.3.5. Crown characters

The data related to crown characters of all the treatments is presented in Table 4.3.1.3a. From all the 13 treatments, the highest descriptive score of crown characters of 2.00 was recorded in treatments T-3 (H-115), T-9 (H-121), and T-10 (H-111), whereas the lowest descriptive score of crown characters of 1.00 was obtained in remaining treatments such as T-1 (H-98), T-2 (H-118), T-5 (H-99), T-6 (H-104), T-8 (H-116), T-11 (Mauritius), T-12 (Kew) and T-13 (Amritha).

Table 4.3.1.1b. Qualitatively vegetative characters of Kew x Mauritius hybrids at its 39 leaf stage

Treatments		Distribution of spines	Direction of spines	Colouration of leaf spines	Spine stiffness	Position of suckers
T 1	H 98	3.00	Only ascendant	2.00	Intermediate	Aerial and underground sucker
T 2	H 118	3.27	Only ascendant	3.80	Intermediate	Aerial sucker
T 3	H 115	3.27	Only ascendant	3.80	Intermediate	Aerial and underground sucker
T 4	H 101	3.20	Only ascendant	1.73	Intermediate	Aerial and underground sucker
T 5	H 99	2.84	Only ascendant	3.47	Intermediate	Aerial and underground sucker
T 6	H 104	3.27	Only ascendant	3.80	Intermediate	Underground sucker
T 7	H 110	3.74	Only ascendant	3.80	Intermediate	Aerial and underground sucker
T 8	H 116	2.74	Only ascendant	3.70	Intermediate	Aerial and underground sucker
T 9	H 121	3.00	Only ascendant	3.80	Intermediate	Aerial and underground sucker
T 10	H 111	2.47	Only ascendant	3.47	Intermediate	Aerial and underground sucker
T 11	Mauritius	3.00	Only ascendant	4.00	Intermediate	Aerial and underground sucker
T 12	Kew	1.80	Only ascendant	3.80	Intermediate	Aerial sucker
T 13	Amritha	3.00	Only ascendant	4.00	Intermediate	Aerial and underground sucker

Table 4.3.1.2. Flower characters of Kew x Mauritius hybrids

Treatments		Days to attain ideal leaf stage for flowering	Days for initiation of flowering (visual)	Days for 50 per cent flowering	Flowering phase (days)
T 1	H 98	183.93	43.90	49.50	22.40
T 2	H 118	180.50	43.08	48.35	21.08
T 3	H 115	182.75	46.98	52.18	20.81
T 4	H 101	183.57	45.70	51.32	22.46
T 5	H 99	188.10	47.24	52.53	21.14
T 6	H 104	188.57	49.73	55.09	21.43
T 7	H 110	184.30	49.98	54.99	20.04
T 8	H 116	187.10	48.23	53.57	21.37
T 9	H 121	181.08	47.36	52.80	21.77
T 10	H 111	189.53	44.63	50.41	23.13
T 11	Mauritius	178.13	49.03	54.41	21.53
T 12	Kew	190.61	45.41	50.60	20.77
T 13	Amritha	183.50	46.50	51.72	20.88

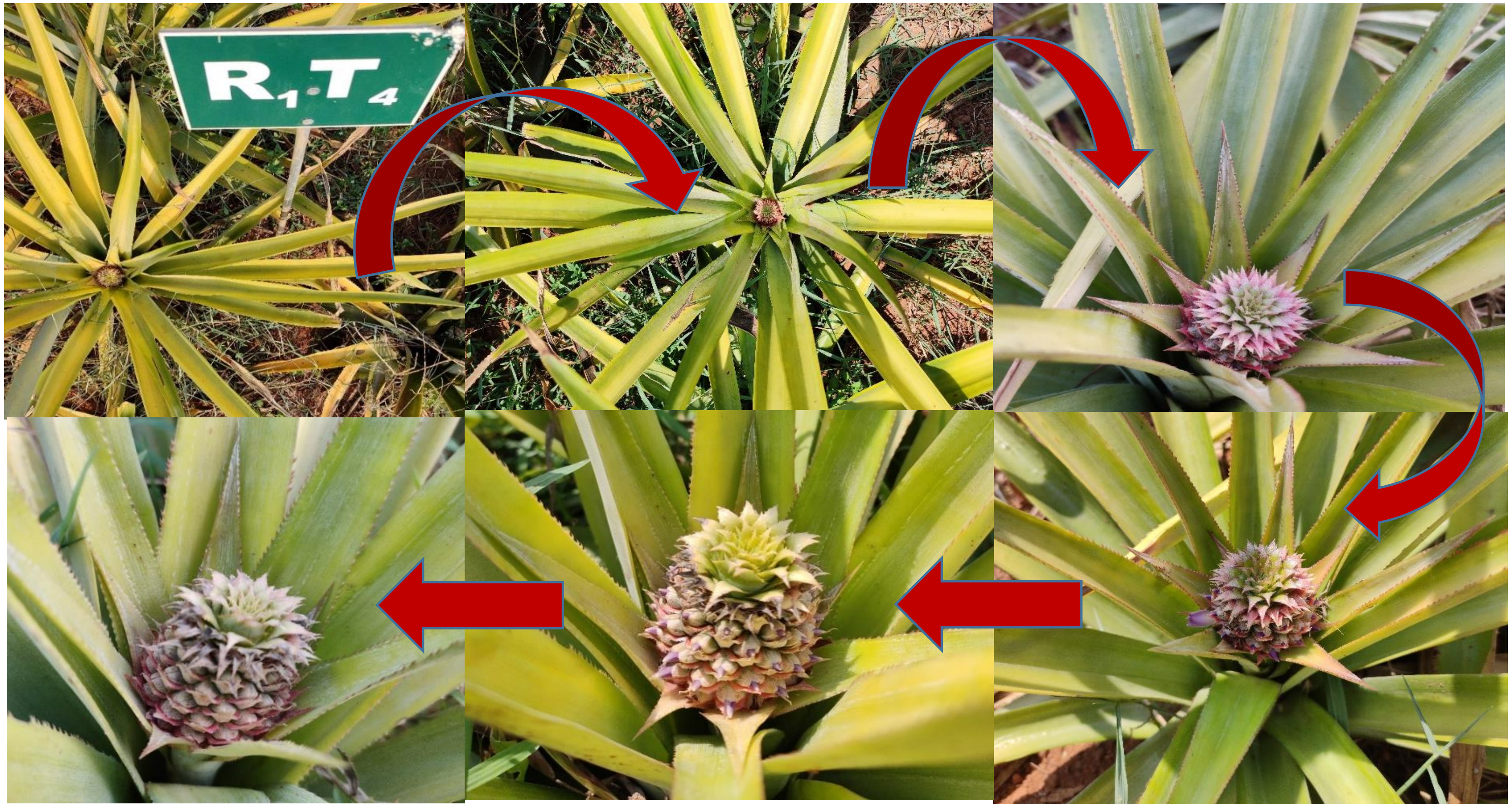


Plate 4.3.1.2. Flower characters of Kew x Mauritius hybrids

4.3.1.3.6. Number of crowns surmounting fruit

The data related to number of crowns surmounting fruit is presented in Table 4.3.1.3a. Among the treatments, the highest number of crowns surmounting fruit per plant of 3.50 was recorded in treatment T-3 (H-115) and the lowest number of crowns surmounting fruit per plant of 1.00 in each treatments such as T-1 (H-98), T-2 (H-118), T-5 (H-99), T-6 (H-104), T-8 (H-116), T-11 (Mauritius), T-12 (Kew), and T-13 (Amritha).

4.3.1.3.7. Attitude of crown foliage

The data related to attitude of crown foliage of all the treatments is presented in Table 4.3.1.3a. The highest descriptive score of attitude of crown foliage of 5.00 was recorded in treatment T-3 (H-115) and T-9 (H-121) whereas the lowest descriptive score of attitude of crown foliage of 2.00 was noted in treatment T-2 (H-118).

4.3.1.3.8. Colour of crown leaves

The data related to colour of crown leaves of all the treatments is presented in Table 4.3.1.3b. In all the treatments, colour of crown leaves descriptive score was ranged from 1.00 to 8.00. The maximum descriptive score (8.00) of colour of crown leaves was recorded in treatment T-5 (H-99), whereas the minimum descriptive score (1.00) was recorded in treatment T-6 (H-104).

4.3.1.3.9. Presence of spines on crown leaves

The data related to presence of spines on crown leaves of all the treatments is presented in Table 4.3.1.3b. In all the 13 treatments, descriptive score of presence of spines on crown leaves was ranged from 1.00 to 3.50. The maximum descriptive score (3.50) of presence of spines on crown leaves was recorded in treatment T-5 (H-99) whereas the minimum descriptive score (1.00) was observed in treatment T-12 (Kew).

4.3.1.3.10. Crown attachment to fruit

The data related to crown attachment to fruit is presented in Table 4.3.1.3b. As per the descriptor, with short distinct neck of crown attachment to fruit was observed across all the treatments.

4.3.1.3.11. Colour of crown attachment area/basal leaves (collar)

The data related to colour of crown attachment area/basal leaves (collar) of all the treatments is presented in Table 4.3.1.3b. Among the treatments, the highest descriptive score of colour of crown attachment area/basal leaves (collar) of 9.00 was recorded in treatment T-5 (H-99) and T-13 (Amritha), whereas the lowest descriptive score of colour of crown attachment area/basal leaves (collar) of 2.00 in each treatments such as T-8 (H-116), T-10 (H-111), and T-12 (Kew).

4.3.1.3.12. Fruit shape

The data related to fruit shape of all the treatments is presented in Table 4.3.1.3b. Among the treatments, the highest descriptive score of fruit shape of 9.83 was recorded in treatment T-2 (H-118) whereas the lowest descriptive score of fruit shape of 2.45 was obtained in treatment T-6 (H-104).

4.3.1.3.13. Fruit colour when ripe

The data related to fruit colour when ripe of all the treatments is presented in Table 4.3.1.3b. Among the treatments, the highest descriptive score of fruit colour when ripe of 8.53 was recorded in treatment T-3 (H-115), whereas the lowest descriptive score of fruit colour when ripe of 3.72 in treatment T-12 (Kew).

4.3.1.3.14. Presence of "eye" (Berry) corking

The data related to presence of "eye" (Berry) corking is presented in Table 4.3.1.3b. Among the 13 treatments, all treatments showed presence of "eye" (Berry) corking of fruits.

4.3.1.3.15. Presence of crowns coming from an "eye" (Berry)

The data related to presence of crowns coming from an "eye" (Berry) is presented in Table 4.3.1.3b. In all the 13 treatments, all treatments showed presence of crowns coming from an "eye" (Berry) of fruits.

4.3.1.3.16. Number of eyes

The data related to number of eyes is presented in Table 4.3.1.3b. The mean number of eyes were varied between 37.17 and 108.70. The highest number of eyes

Table 4.3.1.3a. Fruit and crown characters of Kew x Mauritius hybrids

Treatments		Days for fruit maturity	Crop duration (days)	Presence of crown	Crown shape	Crown characters	Number of crowns surmounting fruit	Attitude of crown foliage
T 1	H 98	157.20	385.03	Present (+)	5.50	1.00	1.00	3.00
T 2	H 118	142.92	366.50	Present (+)	4.00	1.00	1.00	2.00
T 3	H 115	147.06	376.79	Present (+)	3.00	2.00	3.50	5.00
T 4	H 101	141.36	370.63	Present (+)	3.50	1.50	2.00	3.00
T 5	H 99	152.93	388.28	Present (+)	5.00	1.00	1.00	4.00
T 6	H 104	146.73	385.03	Present (+)	5.00	1.00	1.00	3.00
T 7	H 110	140.33	374.61	Present (+)	4.00	1.50	2.00	4.00
T 8	H 116	149.17	384.50	Present (+)	1.00	1.00	1.00	3.00
T 9	H 121	142.82	371.25	Present (+)	3.00	2.00	3.00	5.00
T 10	H 111	146.87	381.03	Present (+)	3.50	2.00	2.50	3.00
T 11	Mauritius	149.34	376.50	Present (+)	4.50	1.00	1.00	3.00
T 12	Kew	143.02	379.04	Present (+)	6.00	1.00	1.00	3.00
T 13	Amritha	147.83	377.83	Present (+)	5.00	1.00	1.00	3.00

was recorded in treatment T-11 (Mauritius) and the lowest number of eyes was counted in treatment T-6 (H-104).

4.3.1.3.17. Profile of eyes

The data related to profile of eyes of all the treatments is presented in Table 4.3.1.3c. Among the 13 treatments, profile of eyes descriptive score was ranged from 3.25 to 5.33. The maximum descriptive score (5.33) of profile of eyes of fruit was recorded in treatment T-6 (H-104), whereas the minimum descriptive score (3.25) for profile of eyes was recorded in treatment T-3 (H-115).

4.3.1.3.18. Relative surface of eyes

The data related to relative surface of eyes of all the treatments is presented in Table 4.3.1.3c. Relative surface of eyes descriptive score was ranged from 3.00 to 6.07. The maximum descriptive score (6.07) of relative surface of eyes of the fruit was recorded in treatment T-8 (H-116), whereas the minimum descriptive score (3.00) of relative surface of eyes was obtained in treatment T-4 (H-101).

4.3.1.3.19. Length of the fruit

The data related to length of fruit is presented in Table 4.3.1.3c. The length of fruit varied between 7.84 cm and 17.80 cm. The maximum length of fruit in treatment T-9 (H-121) and the minimum length of fruit in treatment T-10 (H-111).

4.3.1.3.20. Girth of the fruit

The data related to girth of fruit is presented in Table 4.3.1.3c. The girth of the fruit varied between 26.65 cm and 38.95 cm. The maximum girth of the fruit was observed in treatment T-2 (H-118) and the minimum girth of the fruit in treatment T-10 (H-111).

4.3.1.3.21. Breadth of the fruit

The data related to breadth of fruit is presented in Table 4.3.1.3c. The mean fruit breadth varied between 7.00 cm and 11.93 cm. The maximum breadth of fruit was recorded in treatment T-2 (H-118) and the minimum breadth of fruit was measured in treatment T-6 (H-104).

4.3.1.3.22. Taper ratio of the fruit

The data related to taper ratio of the fruit of all the treatments is presented in Table 4.3.1.3c. Taper ratio was ranged from 0.74 to 0.94. The maximum taper ratio (0.94) of the fruit was recorded in treatment T-4 (H-101), whereas the minimum taper ratio (0.74) of the fruit was observed in treatment T-3 (H-115).

4.3.1.3.23. Fruit weight with crown

The data related to fruit weight with crown is presented in Table 4.3.1.3d. Among the treatments, the highest fruit weight with crown of 1.59 kg was recorded in treatment T-2 (H-118) and the lowest fruit weight with crown of 0.55 kg in treatment T-6 (H-104).

4.3.1.3.24. Fruit weight without crown

The data related to fruit weight without crown is presented in Table 4.3.1.3d. Among the treatments, the highest fruit weight without crown of 1.48 kg was recorded in treatment T-2 (H-118) and the lowest fruit weight without crown of 0.42 kg in treatment T-6 (H-104).

4.3.1.3.25. Crown weight

The data related to crown weight is presented in Table 4.3.1.3d. Among the treatments, the highest crown weight of 0.28 kg was recorded in treatment T-7 (H-110) and the lowest crown weight of 0.07 kg in treatment T-8 (H-116).

4.3.1.3.26. Yield per plant

The data related to fruit yield per plant of all the Kew x Mauritius hybrids is presented in Table 4.3.1.3d. Among the treatments, the highest fruit yield per plant of 1.59 kg was recorded in treatment T-2 (H-118) and the lowest fruit yield per plant of 0.55 kg in treatment T-6 (H-104).

4.3.1.3.27. Estimated yield

The data related to estimated fruit yield of all the Kew x Mauritius hybrids is presented in Table 4.3.1.3d. From among the 13 treatments, highest estimated fruit yield (64.08 t/ha) was found in treatment T-2 (H-118), while treatment T-6 (H-104) recorded the lowest estimated fruit yield (22.18 t/ha).

Table 4.3.1.3b. Fruit and crown characters of Kew x Mauritius hybrids

Treatments		Colour of crown leaves	Presence of spines on crown leaves	Crown attachment to fruit	Colour of crown attachment area/basal leaves (collar)	Fruit shape	Fruit colour when ripe	Presence of "eye" (berry) corking	Presence of crowns coming from an "eye" (berry)	Number of eyes
T 1	H 98	7.50	3.00	2.00	6.50	7.53	4.43	Present (+)	Present (+)	85.35
T 2	H 118	7.00	3.00	2.00	8.00	9.83	3.74	Present (+)	Present (+)	69.95
T 3	H 115	3.00	3.00	2.00	2.50	7.25	8.53	Present (+)	Present (+)	70.20
T 4	H 101	7.50	2.00	2.00	2.50	4.26	7.11	Present (+)	Present (+)	86.98
T 5	H 99	8.00	3.50	2.00	9.00	2.52	7.05	Present (+)	Present (+)	83.12
T 6	H 104	1.00	3.00	2.00	3.00	2.45	4.27	Present (+)	Present (+)	37.17
T 7	H 110	3.00	3.00	2.00	5.00	7.65	6.62	Present (+)	Present (+)	100.48
T 8	H 116	2.00	3.00	2.00	2.00	7.44	6.24	Present (+)	Present (+)	85.77
T 9	H 121	5.00	3.00	2.00	5.50	7.19	6.28	Present (+)	Present (+)	108.60
T 10	H 111	3.00	3.00	2.00	2.00	2.46	6.31	Present (+)	Present (+)	56.63
T 11	Mauritius	3.00	3.00	2.00	5.50	7.01	7.01	Present (+)	Present (+)	108.70
T 12	Kew	2.00	1.00	2.00	2.00	7.84	3.72	Present (+)	Present (+)	87.10
T 13	Amritha	3.00	3.00	2.00	9.00	5.95	6.93	Present (+)	Present (+)	85.60

Table 4.3.1.3c. Fruit characters of Kew x Mauritius hybrids

Treatments		Profile of eyes	Relative surface of eyes	Length of the fruit (cm)	Girth of the fruit (cm)	Breadth of the fruit (cm)	Taper ratio of the fruit
T 1	H 98	5.00	4.30	13.00	31.85	7.93	0.76
T 2	H 118	3.90	3.95	15.70	38.95	11.93	0.85
T 3	H 115	3.25	3.95	12.28	33.88	9.44	0.74
T 4	H 101	3.67	3.00	10.60	33.98	11.80	0.94
T 5	H 99	5.00	5.00	12.50	30.30	8.50	0.86
T 6	H 104	5.33	4.47	9.60	28.40	7.00	0.92
T 7	H 110	5.03	5.40	11.30	34.20	9.30	0.92
T 8	H 116	5.33	6.07	11.20	35.30	9.85	0.90
T 9	H 121	4.47	5.00	17.80	38.00	11.40	0.87
T 10	H 111	4.27	5.00	7.84	26.65	7.29	0.90
T 11	Mauritius	4.80	4.80	14.56	31.21	8.14	0.83
T 12	Kew	4.00	5.00	12.20	33.22	9.72	0.84
T 13	Amritha	5.00	5.00	11.80	30.98	8.55	0.85

4.3.1.3.28. Shelf life

The data related to shelf-life of all the treatments is presented in Table 4.3.1.3d. Shelf life of all the treatments was varied from 7.00 to 9.00 days under ambient conditions. Treatment T-13 (Amritha) recorded significantly minimum self-life of the fruit (7.00 d). While, treatment T-6 (H-104) took maximum self-life of the fruit (9.00 d).

4.3.1.3.29. Peel weight

The data related to peel weight of all the treatments is presented in Table 4.3.1.3d. Peel weight was ranged from 0.08 kg to 0.19 kg. Treatment T-1 (H-98) showed maximum peel weight (0.19 kg) while treatment T-6 (H-104) showed the minimum peel weight (0.08 kg).

4.3.1.3.30. Pulp weight

The data related to pulp weight of all the treatments is presented in Table 4.3.1.3d. Pulp weight was varied from 0.32 kg to 1.19 kg. Among the treatments, highest pulp weight (1.19 kg) was found in treatment T-2 (H-118) while treatment T-6 (H-104) recorded the lowest pulp weight (0.32 kg).

4.3.1.3.31. Pulp percentage

The data related to pulp percentage of all the treatments is presented in Table 4.3.1.3d. Pulp percentage was ranged from 61.03 to 81.43 %. The highest pulp percentage (81.43 %) of the fruit was recorded in treatment T-7 (H-110), whereas the lowest pulp percentage (61.03 %) was obtained in treatment T-13 (Amritha).

4.3.1.4. Qualitative analysis of fruits

4.3.1.4.1. Juice

The data related to juice percentage of all the treatments is presented in Table 4.3.1.4. Juice percentage was ranged from 83.48 to 95.16 %. The highest juice percentage (95.16 %) of the fruit was recorded in treatment T-3 (H-115), whereas the lowest juice percentage (83.48 %) was measured in treatment T-13 (Amritha).

4.3.1.4.2. TSS

The data related to TSS of all the treatments is presented in Table 4.3.1.4. Wide variability were observed among the treatments with regard to the total soluble solids (TSS), which was ranged from 12.78 to 18.59 °Brix. The highest TSS of 18.59 °Brix was recorded in treatment T-6 (H-104) and the lowest TSS of 12.78 °Brix was assessed in treatment T-12 (Kew).

4.3.1.4.3. Acidity

The data related to acidity of all the treatments is presented in Table 4.3.1.4. Titratable acidity was ranged from 0.72 to 0.87 %. Treatment T-12 (Kew) recorded the highest acidity of 0.87 %, whereas treatment T-6 (H-104) had the lowest acidity of 0.72 %.

4.3.1.4.4. Total sugars

The data related to total sugar percentage of all the treatments is presented in Table 4.3.1.4. Total sugar percentage was ranged from 9.00 to 12.78 % among the treatments. Treatment T-1 (H-98) recorded the highest total sugar percentage of 12.78 %, while treatment T-12 (Kew) recorded the lowest total sugar percentage of 9.00 %.

4.3.1.4.5. Reducing sugars

The data related to reducing sugar percentage of all the treatments is presented in Table 4.3.1.4. Reducing sugar percentage was varied from 1.92 to 4.12 %. The highest reducing sugar percentage of 4.12 % was obtained in treatment T-3 (H-115) and the lowest reducing sugar percentage of 1.92 % was assessed in treatment T-1 (H-98).

4.3.1.4.6. Non-reducing sugars

The data related to non-reducing sugar percentage of all the treatments is presented in Table 4.3.1.4. Non-reducing sugar percentage was varied from 5.69 to 10.87 %. The highest non-reducing sugar percentage (10.87 %) was calculated in treatment T-1 (H-98) and the lowest non-reducing sugar percentage (5.69 %) was obtained in treatment T-12 (Kew).

Table 4.3.1.3d. Fruit and yield characters of Kew x Mauritius hybrids

Treatments		Fruit weight with crown (kg)	Fruit weight without crown (kg)	Crown weight (kg)	Yield per plant (kg)	Estimated yield (t/ha)	Shelf life (days)	Peel weight (kg)	Pulp weight (kg)	Pulp percentage (%)
T 1	H 98	0.90	0.80	0.10	0.90	36.53	7.45	0.19	0.52	64.73
T 2	H 118	1.59	1.48	0.11	1.59	64.08	7.53	0.16	1.19	80.17
T 3	H 115	1.10	0.94	0.16	1.10	44.27	7.38	0.16	0.71	76.35
T 4	H 101	1.12	0.95	0.17	1.12	45.20	8.35	0.16	0.70	74.15
T 5	H 99	0.78	0.59	0.19	0.78	31.70	7.50	0.16	0.44	73.66
T 6	H 104	0.55	0.42	0.13	0.55	22.18	9.00	0.08	0.32	76.09
T 7	H 110	0.99	0.71	0.28	0.99	40.14	7.33	0.13	0.59	81.43
T 8	H 116	0.73	0.66	0.07	0.73	29.48	8.00	0.14	0.50	76.06
T 9	H 121	1.37	1.27	0.10	1.37	55.38	8.50	0.15	1.00	78.90
T 10	H 111	0.68	0.52	0.16	0.68	27.59	8.17	0.08	0.36	69.60
T 11	Mauritius	1.04	0.94	0.10	1.04	42.05	8.27	0.19	0.67	71.52
T 12	Kew	0.98	0.77	0.21	0.98	39.43	7.50	0.18	0.51	66.86
T 13	Amritha	0.74	0.64	0.10	0.74	29.87	7.00	0.15	0.39	61.03

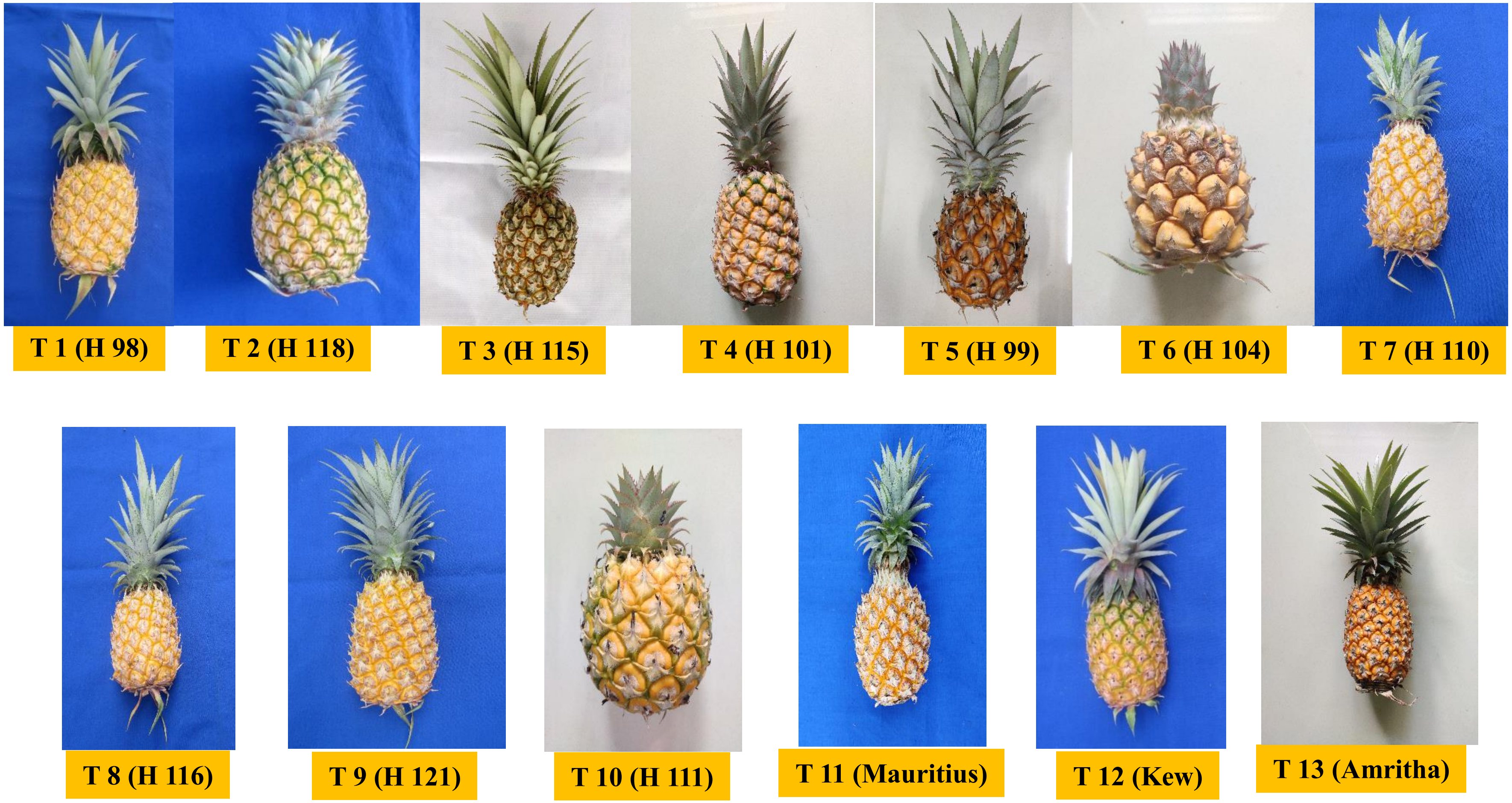


Plate 4.3.1.3. Fruit variability of Kew x Mauritius hybrids

4.3.1.4.7. Sugar/acid ratio

The data related to TSS/acid ratio of all the treatments is presented in Table 4.3.1.4. TSS/acid ratio was worked out by dividing the value of total soluble solids by the value of titratable acidity. TSS/acid was ranged from 9.61 to 16.73. The maximum TSS/acid ratio (16.73) of the fruit was recorded in treatment T-1 (H-98), whereas the minimum TSS/acid ratio (9.61) was noted in treatment T-7 (H-110).

4.3.1.4.8. Fibre

The data related to fibre percentage of all the treatments is presented in Table 4.3.1.4. Fibre percentage was ranged from 27.91 to 35.10 %. Treatment T-8 (H-116) was recorded the highest fibre percentage of 35.10 %, whereas treatment T-3 (H-115) had the lowest fibre percentage of 27.91 %.

4.3.1.4.9. Total carotenoids

The data related to total carotenoids content of all the treatments is presented in Table 4.3.1.4. In all the Kew x Mauritius hybrids, total carotenoids content was ranged from 215.17 to 284.32 mg/100g. Treatment T-14 (H-70) recorded the highest total carotenoids content of 284.32 mg/100g, whereas treatment T-4 (H-101) was assessed the lowest total carotenoids content of 215.17 mg/100g.

4.3.1.4.10. Ascorbic acid

The data related to ascorbic acid content of all the treatments is presented in Table 4.3.1.4. Ascorbic acid content was varied widely among the hybrids and ranged from 41.03 to 104.11 mg/100g. The highest ascorbic acid content of 104.11 mg/100g was recorded in treatment T-6 (H-104), whereas treatment T-12 (Kew) was analysed the lowest ascorbic acid content of 41.03 mg/100g.

4.3.1.5. Organoleptic evaluation of Kew x Mauritius hybrids

The data related to organoleptic evaluation of Kew x Mauritius hybrids, the mean value of each attribute and total score of each treatment is presented in Table 4.3.1.5. Among the 13 treatments studied, the highest total score (sum of mean of each attribute) was recorded in treatment T-13 (Amritha, 43.80) followed by treatments T-03 (H-115, 43.60), T-02 (H-118, 43.50), T-09 (H-121, 43.30), T-11 (Mauritius, 42.80) respectively and the lowest total sensory score was recorded in treatment T-01 (H-98, 40.70). They were most preferred/accepted by panellists because of their better fruit colour, taste, flavour, texture and overall acceptability.

Evaluation of ten hybrids under open field conditions along with their parental clones Mauritius, Kew and one check variety Amritha, pointed out existence of wide variability for all the traits. Many of hybrids exhibited higher desirability compared of mid parent. The per cent variation in traits among the hybrids over the mid parent is given in Table 4.3.1. It is observed that the higher per cent increased in fruit weight with crown (57.43 %) and pulp weight (101.69 %) was observed in T-2 (H-118; fruit weight with crown: 1.59 kg; pulp weight: 1.19 kg) compared to mid parent (fruit weight with crown: 1.01 kg; pulp weight: 0.59 kg). Whereas, T-6 (H-104; fruit weight with crown: 0.55 kg; pulp weight: 0.32 kg) registered a decreased in fruit weight with crown (45.54 %) and pulp weight (45.76 %). Similarly, an increasing in TSS was also observed compared to mid parental clone in T-6 (H-104; 18.59 °Brix; 40.94 %). In comparison to mid parental clone high per cent decrease was evident with respect to traits *viz*., days to attain ideal leaf stage for flowering (T-2: H-118; 180.50 d; 2.10 %), crown weight (T-8: H-116; 0.07 kg; 56.25 %), peel weight (T-6: H-104; 0.08 kg; 57.89 %), profile of eyes (T-3: H-115; 3.25; 26.14 %), relative surface of eyes (T-4: H-101; 3.00; 38.78 %), and acidity (T-6: H-104; 0.72 %; 13.25 %). Thus, existence of several desire hybrids was evident among the 13 treatments studied.

Improvement of yield and other related traits is a basic objective in any breeding programme. Intercrossing of genotypes with better mean performance will be effectual for further crop improvement pineapple (Kuriakose, 2004). The reliable conformity for this can be known from the cluster mean. Selection index provides appropriate weightage to the phenotypic values of two or more characters to be used simultaneously for the selection. It involves the discriminant function analysis meant for isolating superior genotypes (Fisher, 1936). Selection index formulation aids to increase the efficiency of selection of suitable genotypes by taking into account the most desirable and undesirable characters in terms of fruit yield and quality. de Souza *et al.* (2000) recommended selection index formulation for predicted breeding values for nine plant and fruit characteristics of 28 peach genotypes. Moreira *et al.* (2019) recommended a selection based on suitable index, and commend it as more efficient than individual

Table 4.3.1.4. Fruit quality analysis of Kew x Mauritius hybrids

Treatments		Juice (%)	TSS (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Sugar/ acid ratio	Fibre (%)	Total carotenoids (mg 100 g-1)	Ascorbic acid (mg 100 g-1)
T 1	H 98	85.03	15.07	0.81	12.78	1.92	10.87	16.73	33.15	238.65	73.34
T 2	H 118	87.90	13.07	0.79	12.33	2.81	9.52	10.76	32.93	238.91	75.73
T 3	H 115	95.16	13.32	0.80	10.78	4.12	6.67	11.56	27.91	248.30	47.05
T 4	H 101	90.38	13.08	0.74	11.81	2.90	8.90	13.47	33.24	284.32	66.93
T 5	H 99	88.24	15.29	0.86	10.06	3.72	6.34	12.37	29.41	226.99	52.82
T 6	H 104	87.61	18.59	0.72	11.66	3.11	8.55	12.09	32.80	240.46	104.11
T 7	H 110	86.87	14.65	0.78	10.56	2.86	7.70	9.61	32.62	270.90	93.67
T 8	H 116	86.54	17.02	0.78	11.69	4.10	7.59	13.00	35.10	255.42	44.27
T 9	H 121	83.78	13.21	0.73	12.03	2.61	9.43	11.49	34.03	267.81	78.64
T 10	H 111	87.87	17.82	0.76	10.86	3.28	7.58	12.79	34.71	267.55	50.09
T 11	Mauritius	87.61	13.59	0.79	11.66	3.11	8.55	12.09	32.80	240.46	79.11
T 12	Kew	85.58	12.78	0.87	9.00	3.31	5.69	13.47	33.24	284.32	41.03
T 13	Amritha	83.48	15.94	0.84	11.56	3.02	8.54	14.65	34.36	215.17	83.59

Table 4.3.1.5. Organoleptic evaluation of Kew x Mauritius hybrids

Treatments		Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank	Total score
T 1	H 98	8.20	8.10	8.30	8.00	8.10	40.70
T 2	H 118	8.90	9.40	8.40	8.10	8.70	43.50
T 3	H 115	9.10	8.90	8.60	8.30	8.70	43.60
T 4	H 101	8.60	8.80	8.10	7.90	8.30	41.70
T 5	H 99	8.30	8.20	8.70	7.70	8.20	41.10
T 6	H 104	9.00	8.10	8.40	8.50	8.50	42.50
T 7	H 110	8.70	8.30	7.80	8.60	8.30	41.70
T 8	H 116	7.90	8.90	8.60	7.90	8.30	41.60
T 9	H 121	8.70	9.00	8.20	8.80	8.60	43.30
T 10	H 111	7.80	8.50	8.30	8.50	8.20	41.30
T 11	Mauritius	8.60	8.20	8.50	9.00	8.50	42.80
T 12	Kew	7.60	8.00	8.90	8.70	8.30	41.50
T 13	Amritha	9.00	8.90	8.40	8.80	8.70	43.80

Table 4.3.1. Per cent variation in Kew x Mauritius hybrids over mid parental clone

Treatments		Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)
T 1	H 98	-10.89	14.25	-11.86	-0.24	-37.50	0.00	13.64	-12.24	-2.41
T 2	H 118	57.43	-0.91	101.69	-2.10	-31.25	-15.79	-11.36	-19.39	-4.82
T 3	H 115	8.91	0.99	20.34	-0.88	0.00	-15.79	-26.14	-19.39	-3.61
T 4	H 101	10.89	-0.83	18.64	-0.43	6.25	-15.79	-16.59	-38.78	-10.84
T 5	H 99	-22.77	15.92	-25.42	2.02	18.75	-15.79	13.64	2.04	3.61
T 6	H 104	-45.54	40.94	-45.76	2.28	-18.75	-57.89	21.14	-8.78	-13.25
T 7	H 110	-1.98	11.07	0.00	-0.04	75.00	-31.58	14.32	10.20	-6.02
T 8	H 116	-27.72	29.04	-15.25	1.48	-56.25	-26.32	21.14	23.88	-6.02
T 9	H 121	35.64	0.15	69.49	-1.78	-37.50	-21.05	1.59	2.04	-12.05
T 10	H 111	-32.67	35.10	-38.98	2.80	0.00	-57.89	-2.95	2.04	-8.43
Mid parent (MP)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

selection, based on phenotypic and genotypic values predicted by REML/BLUP in papaya genotypes in order to recommend for farmers.

4.3.2. Selection index of Kew x Mauritius hybrids

The selection indices gives the most appropriate weightage to the phenotypic values of two or more characters to be used simultaneously for the selection. Even though there are many methods for the calculation of selection indices, discriminate function is widely used by the researchers. In the present investigation, the selection index value for each genotype was determined by following the simultaneous selection index (Smith, 1937) was used to discriminate the genotypes in terms of canning purpose with superior yield and quality characters. In the present study selection index computation was based on the three most desirable characteristics such as fruit weight with crown, pulp weight, TSS, and six undesirable characters such as crown weight, peel weight, eye profile, eye relative surface, days to attain ideal leaf stage for flowering, and titratable acidity.

The Kew x Mauritius hybrid genotypes were ranked according to their selection index scores. The scores obtained for the hybrids based on the selection index are given in Table 4.3.2 and Fig. 4.3.2. The hybrid line, H-118, with selection index score (-6237.80) was ranked 1st, followed by H-115 (-6496.90), H-121 (-6734.60), and H-101 (-6924.00). The hybrid genotype, H-111, obtained the least selection index score (-8438.20). The four superior hybrid lines *viz.*, H-118, H-115, H-121, and H-101, could be considered as novel genotypes in terms of canning purpose fruit yield and quality among the 13 genotypes screened. These four selected hybrid lines along with their parental clones Kew, Mauritius, and one check variety Amritha were confirmed for molecular characterization.

In the present study selection indices was formulated based on nine characters and based on the selection index value, the hybrid line, H-118, with selection index score (-6237.80) was ranked 1st, followed by H-115 (2nd), H-121 (3rd), and H-101 (4th). The hybrid genotype, H-111, obtained the least selection index score (-8438.20). The four superior hybrid lines could be considered as novel genotypes in terms of canning purpose fruit yield and quality among the 13 genotypes screened. Cabral *et al.* (1993) recommended fruit weight, pulp weight, crown weight, TSS, and titratable acidity as most important selection characters of pineapple cultivars. Chan (2005) suggested for selection of novel genotypes, Johor cultivar has high fruit yield and canning properties (Chan and Lee, 1985), Josapine cultivar is precocious and have good shelf life (Chan and Lee, 1996), Scarlett has showed early flowering in pineapple (d'Eeckenbrugge and Marie, 2000). The hybrid MD-2 is excellent cultivar for fresh fruit market (Janick, 2003).

Therefore, the results from selection indices revealed that the superior hybrid lines H-118, H-115, H-121, and H-101, which secured ranks within four under selection index, could be considered as canning purpose genotypes in terms of fruit yield and quality among the 13 screened genotypes. Out of them, the promising hybrids H-118 and H-121 are with high yield and quality potential could be functionally validated and can be involved in breeding programme to improve its performance under commercial cultivation (Chan, 2005).

4.4. Pest and disease incidence

Observations on major pests and diseases incidence were observed and percentage data was tabulated in Table 4.4 for somaclones and hybrids and depicted the incidence of all these problems (Plate 4.4).

4.5. Physiological disorders

Observations on physiological disorders were observed for somaclones and hybrids and depicted all these disorders (Plate 4.5).

4.6. Molecular characterization

4.6.1. Genotyping of somaclonal variants of pineapple variety Mauritius by using molecular markers

Somaclonal variants of pineapple variety Mauritius were grown out by following cultural practices as per the package of practices (POP) recommendations of Kerala Agricultural University and somaclonal variants identification were recorded and described as per the descriptors for pineapple suggested by International Board for Plant Genetic Resources Rome, Italy (IBPGR, 1991).

Table 4.3.2. Variables and selection index of Kew x Mauritius hybrids

Treatments		Fruit weight with crown (kg)	TSS (°Brix)	Pulp weight (kg)	Days to attain ideal leaf stage for flowering	Crown weight (kg)	Peel weight (kg)	Profile of eyes	Relative surface of eyes	Acidity (%)	Selection index value	Rank
T 1	H 98	0.90	15.07	0.52	183.93	0.10	0.19	5.00	4.30	0.81	-7941.69	11
T 2	**H 118**	**1.59**	**13.07**	**1.19**	**180.50**	**0.11**	**0.16**	**3.90**	**3.95**	**0.79**	**-6237.83**	**1**
T 3	**H 115**	**1.10**	**13.32**	**0.71**	**182.75**	**0.16**	**0.16**	**3.25**	**3.95**	**0.8**	**-6496.88**	**2**
T 4	**H 101**	**1.12**	**13.08**	**0.70**	**183.57**	**0.17**	**0.16**	**3.67**	**3.00**	**0.74**	**-6924.05**	**4**
T 5	H 99	0.78	15.29	0.44	188.10	0.19	0.16	5.00	5.00	0.86	-7043.74	5
T 6	H 104	0.55	18.59	0.32	188.57	0.13	0.08	5.33	4.47	0.72	-7831.12	10
T 7	H 110	0.99	14.65	0.59	184.30	0.28	0.13	5.03	5.40	0.78	-7288.70	8
T 8	H 116	0.73	17.02	0.50	187.10	0.07	0.14	5.33	6.07	0.78	-7239.95	7
T 9	**H 121**	**1.37**	**13.21**	**1.00**	**181.08**	**0.10**	**0.15**	**4.47**	**5.00**	**0.73**	**-6734.64**	**3**
T 10	H 111	0.68	17.82	0.36	189.53	0.16	0.08	4.27	5.00	0.76	-8438.19	13
T 11	Mauritius	1.04	13.59	0.67	178.13	0.10	0.19	4.80	4.80	0.79	-7088.48	6
T 12	Kew	0.98	12.78	0.51	190.61	0.21	0.18	4.00	5.00	0.87	-7533.23	9
T 13	Amritha	0.74	15.94	0.39	183.50	0.10	0.15	5.00	5.00	0.84	-8106.03	12

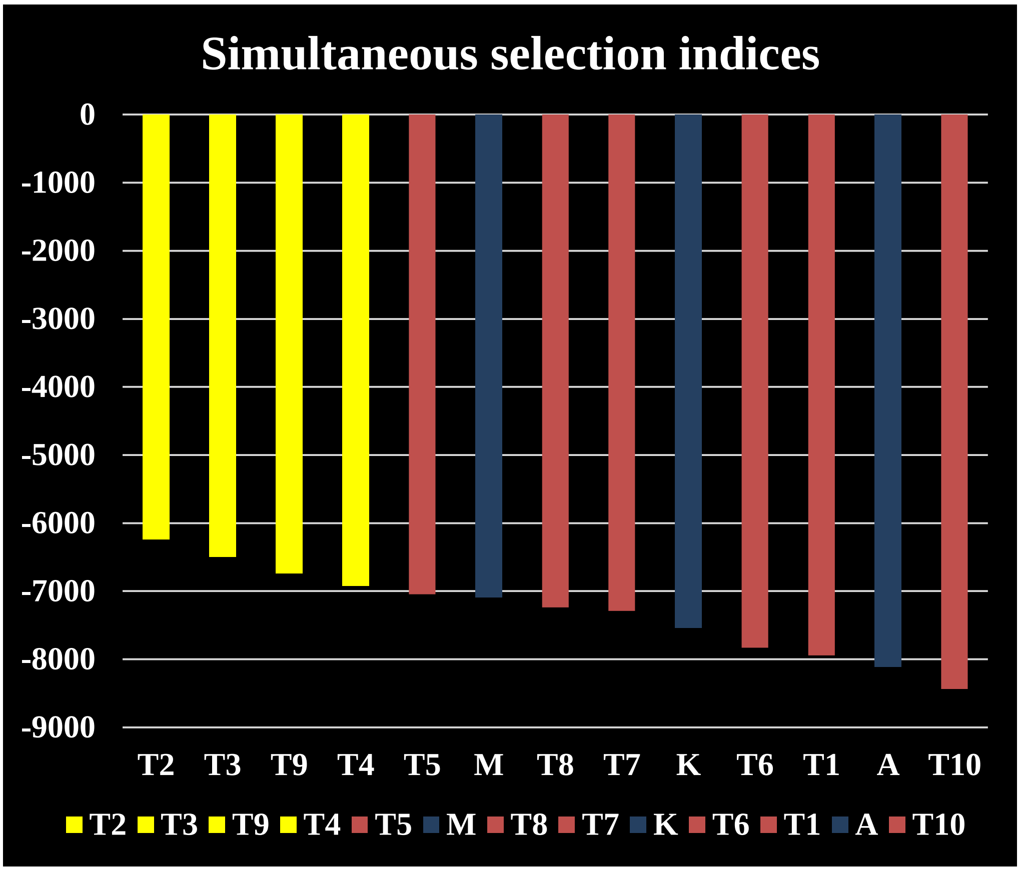


Fig. 4.3.2. Selection index of field evaluated Kew x Mauritius hybrids

Table 4.4. Percentage pest/disease incidence of somaclones and hybrids

Pest/Disease	Per cent pest/disease incidence of somaclones	Per cent pest/disease incidence of hybrids
Mealy bug	3.95	2.80
Fruit rot/butt rot/leaf rot/base rot	1.12	1.71
Root rot/heart rot	5.26	1.10
Black rot/soft rot	9.21	3.29
Leaf spot	9.74	5.37

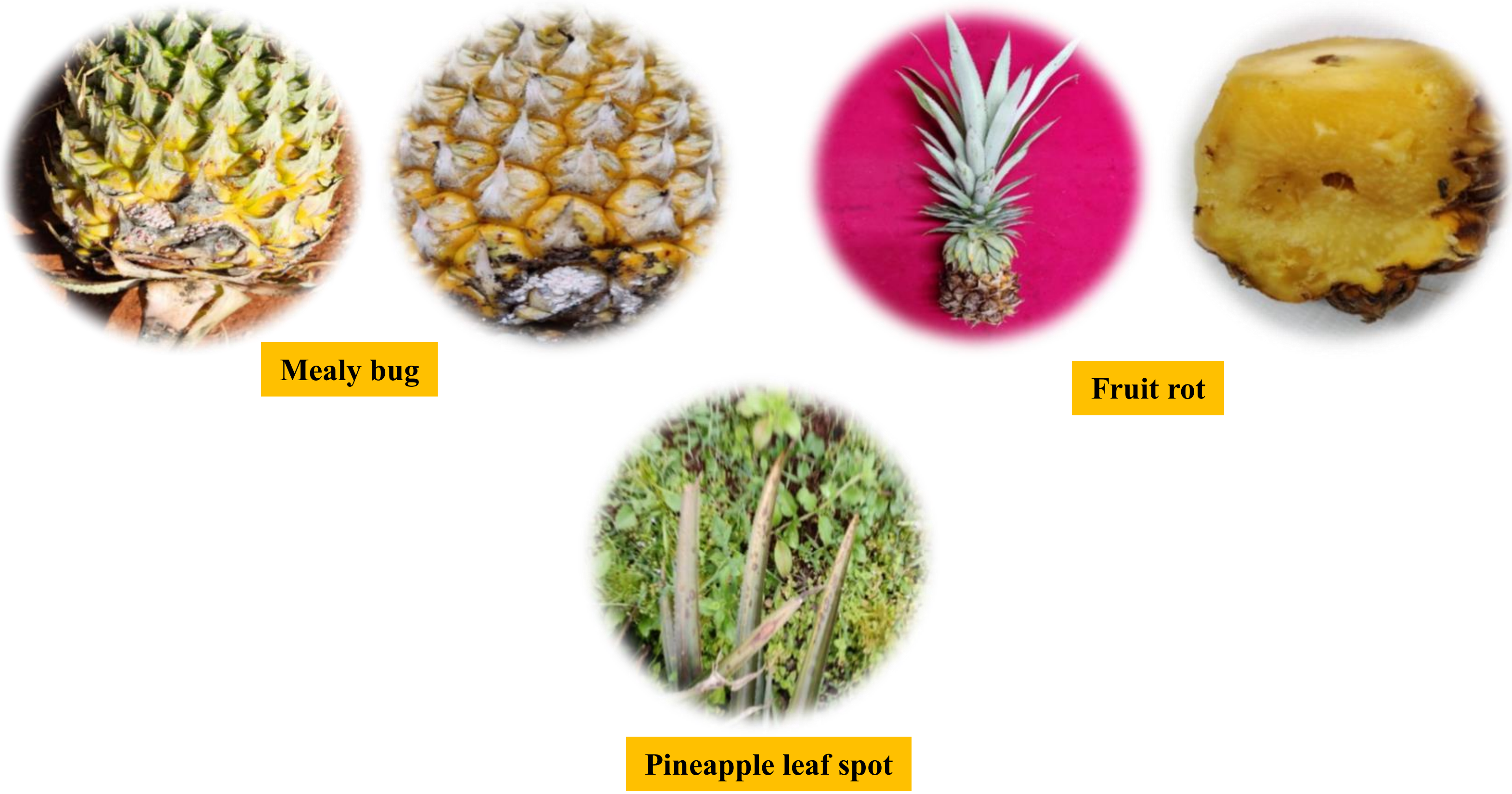


Plate 4.4. Pest and disease incidence of pineapple fruits

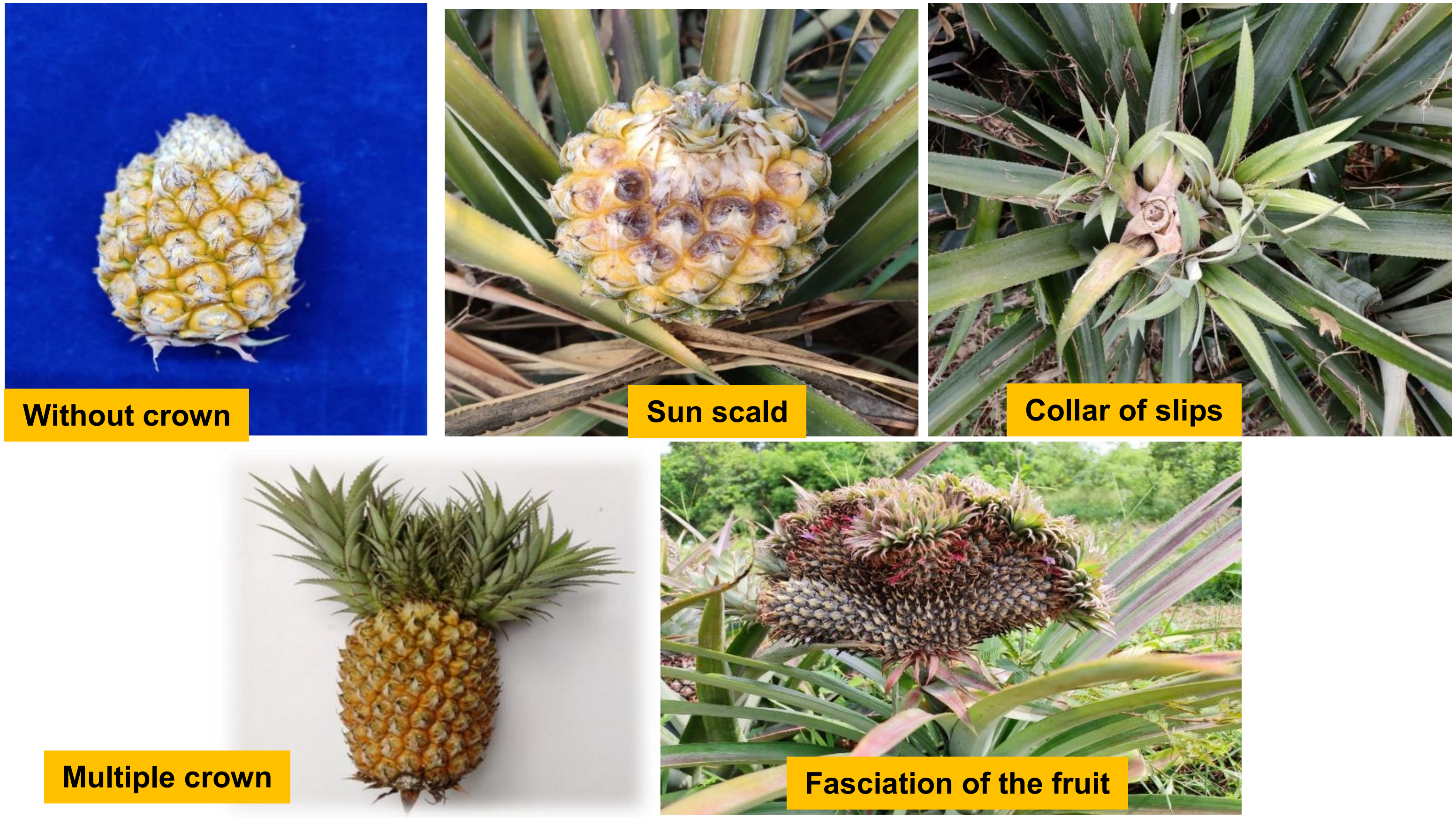


Plate 4.5. Physiological disorders of pineapple fruits

With the advances of molecular breeding, in addition to morphological characterization, molecular characterization of the promising genotypes with ISSR markers was also envisaged to detect molecular diversity and aid varietal identity.

4.6.1.1. ISSR Marker analysis for characterization of somaclonal variants of pineapple variety Mauritius

Inter simple sequence repeats (ISSR) markers were used to characterise 11 somaclonal variants along with parent source Mauritius. ISSR markers that produced unique amplicons were followed for generating DNA fingerprints of selected variants.

4.6.1.1.1. Quality and quantity of DNA isolated

The isolation of high-quality molecular genomic DNA is the most important crucial thing for all molecular study of plant genotypes because of the extraction of impure and adulterated (proteins, polyphenols, *etc*.) DNA may change the end outcome results.

The high molecular genomic DNA was extracted from young leaves (three to four weeks old) of each of the genotypes using the modified CTAB method (Doyle and Doyle, 1987). These were tested for their quantity and quality (Table 4.6.1.1.1) by following manually Agarose Gel Electrophoresis method and NanoDrop assessing. The extracted DNA (Deoxyribonucleic acid) was confirmed to be of pure and sufficient quality for genomic analyses through Agarose Gel Electrophoresis as well as the assessing DNA purity through NanoDrop computation of the optical density values (ratio between absorbance at 260 nm and 280 nm). For quantity checking (µg/ml) of extracted molecular genomic DNA was also found to be significant enough to assure reproducibility of genomic analysis.

4.6.1.1.2. Genotyping of the somaclonal variants of pineapple variety Mauritius with ISSR markers

To characterize and measure the extent of variation between the eleven selected somaclones, and parent material Mauritius, genomic DNA of each selected genotypes were subjected to polymerase chain reaction amplification using fifty ISSR markers for somaclonal variants, which were mentioned earlier in Table 3.9.8. Among the fifty ISSR markers were used for PCR amplification, only thirty were showed polymorphic amplification. The nature of amplicons, number of amplicons, size of amplicons (bp), uniqueness of amplicons, the total number of amplicons, and Polymorphic Information Content (PIC) were generated using the ISSR markers are tabulated (Table 4.6.1.1.2a and Table 4.6.1.1.2b).

In the ISSR primer sequences used in the investigations, a total of 514 amplicons were generating good and clear amplicons, of which 485 were found to be clearly amplified polymorphic in nature between all the eleven somaclonal variants of pineapple variety Mauritius. The total number of amplified amplicons detected by an individual primer ranged from 4 to 29, with an average of 17.13 amplicons per primer. The minimum number of amplicons was recorded in UBC-844 (4) and the highest number of amplicons were produced by UBC-808 (29) followed by DAT (27), UBC-841 (26), IS-65 (26), and ISSR-10 (26). The results are similar to the findings of da Silva *et al.* (2016) were reported the number of amplified bands for each primer varied from 1 to 8 with a mean of 4 bands per primer. Souza *et al.* (2017) had generated the number of amplified bands detected in the ISSR marker associated with the quality of pineapple fiber varied from 5 to 20 per primer. Wang *et al.* (2017), who screened 13 ISSR primers among 36 pineapple accessions and observed a range of 4 to 14 amplicons per primer also substantiate the present result.

On the other hand, polymorphic amplicons produced per primer varied from 2 to 29, with an average of 16.17 amplicons per primer. While, the minimum number of polymorphic amplicons was recorded in UBC-844 (2) and the highest number of polymorphic amplicons were produced by UBC-808 (29) followed by DAT (27), UBC-841 (26), IS-65 (26), and ISSR-10 (26). The results are similar to the findings of da Silva *et al.* (2016) were reported the number of polymorphic amplified bands for each primer varied with a mean of 10 bands per primer. Wang *et al.* (2017), who screened 13 ISSR primers among the 36 pineapple accessions and scored a total of 96 bands, of which 91 were polymorphic in nature. While, among the primers tested in the 12 genotypes produced easily detectable fragments on agarose gel, providing the number of the uniqueness of amplicons ranged from 1 to 6. The minimum number of unique amplicons were recorded in AW-3, UBC-807, IS-61, ISSR-3, and (CT)10A and the highest number of unique amplicons were produced by UBC-809 and ISSR-10.

Table 4.6.1.1.1. Quality and quantity of DNA isolated of somaclonal variants of pineapple variety Mauritius

Varieties	Quantity (µg/ml)	Optical density values (260/280)
Mauritius	401.44	2.213
Treatment 4 (MV_4)	245.24	2.168
Treatment 10 (MV_{10})	112.20	2.212
Treatment 17 (MV_{17})	330.48	2.142
Treatment 22 (MV_{22})	225.70	2.205
Treatment 24 (MV_{24})	103.95	1.874
Treatment 25 (MV_{25})	249.73	2.130
Treatment 43 (MV_{43})	452.30	2.199
Treatment 47 (MV_{47})	288.04	2.153
Treatment 69 (MV_{69})	465.25	2.155
Treatment 71 (MV_{71})	160.54	2.182
Treatment 75 (MV_{75})	333..46	2.145

All the screened ISSR primers according to their ability to generate polymorphic in nature, the size of the overall amplicons varied from 44 bp (ISSR-24: 44 bp-1356 bp) to 1921 bp (ISSR-4: 266 bp-1921 bp). Similar results have been reported by Vanijajiva (2012) had observed the size of amplified 56 bands ranged from 100 bp to 2000 bp in pineapple accession on using 4 ISSR markers.

The percentage polymorphic amplicons (PPA) ranged from 50 to 100 per cent with an average of 91.16 per cent across 30 ISSR primers across the twelve genotypes of pineapple studied. The lowest percentage polymorphic amplicons were recorded in ISSR-9 and UBC-844, whereas the highest percentage polymorphic amplicons were generated from 901, AW-3, (CT)10A, DAT, IS-65, ISSR-6, ISSR-7, ISSR-10, ISSR-18, ISSR-21, ISSR-24, (TC)10G, UBC-808, UBC-812, and UBC-841. This result was approximately less than that reported in another study on pineapple (93.65 % Wang *et al.*, 2017) but more than that reported by Vanijajiva (2012) in pineapple (41.66-53.84 %).

The Polymorphic Information Content (PIC) generates an assessment of the unfair power of a primer to distinguish genotypes based on both the number of alleles produced and their relative frequency (Wang *et al.*, 2017). The primers with polymorphic information contents more than 0.50 are generally expected to be capable and beneficial in genotyping and also for determining the degree of polymorphism at a given locus (Vijayan, 2005). The Polymorphic Information Content (PIC) for 30 ISSR primers varied from 0.32 for UBC-844 to 0.94 for ISSR-24, and the average value was 0.74. Similar result findings were recorded by Wang *et al.* (2017), who screened 13 ISSR primers among 36 pineapple accessions and observed a PIC values of 0.13 to 0.36 with an average of 0.24.

ISSR analysis results (Table 4.6.1.1.2a and Table 4.6.1.1.2b) indicated that out of 30 ISSR markers, 22 markers recorded a PIC values of more than 0.70. These were pointed out high discrimination and potential variation of those indicators. Wang *et al.* (2017) stated that a high PIC value indicates high polymorphism and the presence of a higher percentage of GA/TC repeats than the non-polymorphic primers, which may be the reason that shows the high diversity and differentiation power of that marker among the pineapple genotypes.

4.6.1.1.3. Cluster analysis and dendrogram construction using ISSR data

The cluster analysis using the ISSR profile indicated that the presence of high genetic variation between all somaclonal variants studied. The phylogenetic reconstruction based on the corresponding Jaccard's similarity coefficient (JSCs) was performed using the unweighted pair group method with arithmetic averaging (UPGMA) approach after analysis of amplification patterns generated by 30 polymorphic markers across the twelve somaclonal genotypes.

A UPGMA based dendrogram showed that the twelve pineapple genotypes could be further classified into three main clusters (I-III) when the similarity coefficient was 0.64 (Table 4.6.1.1.3.1 and Fig. 4.6.1.1.3). Among the three clusters, cluster II was the largest cluster, consisting of six pineapple genotypes (T-22, T-24, T-25, T-43, T-47, and T-69) and was divided into two, sub-clusters IIA with three genotypes (T-22, T-24, and T-25) and sub-cluster IIB with three genotypes (T-43, T-47, and T-69), whereas, cluster I have consisted four pineapple genotypes (Mauritius, T-4, T-10, and T-17) and this was also classified into two sub-clusters, sub-clusters IA with three genotypes (Mauritius, T-4, and T-10) and sub-cluster IB with T-17, the remaining cluster III was consisting of two genotypes namely T-71 and T-75. The results showed that genotypes Mauritius, T-4, T-10, and T-17 are characteristically related at genomic levels which have been generated by the 30 ISSR markers screened in the present evaluation study.

The Jaccard's similarity coefficients (JSCs) data recorded are presented in Table 4.6.1.1.3.2. The genetic similarity indices obtained on the basis of corresponding 30 ISSR markers between the twelve pineapple genotypes ranged from 0.58 to 0.81, which indicates that the existence of a moderate level of variation between the studied genotypes. This may be due to the use of genotypes from the same parent source Mauritius rather than dissimilar ones. A similar finding of results of pineapple accessions ranged of Jaccard's similarity coefficient values (0.50 to 0.89) was found during ISSR analysis, with an average of 0.74 genetic diversity analysis of pineapple genotypes (Wang *et al.*, 2017).

Among the pineapple genotypes evaluated, genotypes T-43 and T-47, registered the high level of Jaccard's genetic similarity relationship among the selected somaclonal variant genotypes with parent material Mauritius studied with a genetic

Table 4.6.1.1.2a. Particulars of ISSR primer profiling in the somaclonal variants of pineapple variety Mauritius

Sl. no.	Primer name	Annealing temperature (°C)	Nature of amplification	Number of amplicons	Number of polymorphic amplicons	Size of amplicons (bp)	Uniqueness of amplicons	PIC	PPA
1	901	54.0	Polymorphic	13	13	346-1294	5	0.85	100.00
2	17899A	50.0	Polymorphic	5	4	216-1759	3	0.79	80.00
3	AW 3	54.0	Polymorphic	12	12	245-988	1	0.75	100.00
4	(CT)10A	55.0	Polymorphic	9	9	511-1054	1	0.77	100.00
5	DAT	54.0	Polymorphic	27	27	137-1113	4	0.85	100.00
6	DiGT5C	54.0	Polymorphic	17	16	469-1417	2	0.69	94.12
7	IS 8	54.0	Polymorphic	16	13	204-930	0	0.68	81.25
8	IS 61	50.0	Polymorphic	25	24	203-1021	1	0.76	96.00
9	IS 65	47.0	Polymorphic	26	26	235-1184	4	0.86	100.00
10	ISSR 2	54.0	Polymorphic	14	13	243-1050	3	0.70	92.86
11	ISSR 3	45.0	Polymorphic	11	9	350-995	1	0.66	81.82
12	ISSR 4	51.0	Polymorphic	20	19	266-1921	5	0.81	95.00
13	ISSR 6	46.0	Polymorphic	12	12	332-747	0	0.60	100.00
14	ISSR 7	45.0	Polymorphic	14	14	188-870	4	0.83	100.00
15	ISSR 9	45.0	Polymorphic	8	4	341-1126	0	0.34	50.00
16	ISSR 10	54.0	Polymorphic	26	26	200-1236	6	0.90	100.00
17	ISSR 18	40.0	Polymorphic	19	19	446-1264	2	0.87	100.00
18	ISSR 21	52.0	Polymorphic	24	24	308-1500	4	0.88	100.00
19	ISSR 24	40.0	Polymorphic	21	21	44-1356	5	0.94	100.00
20	MANNY	52.3	Polymorphic	17	15	291-1219	3	0.72	88.24

Table 4.6.1.1.2b. Particulars of ISSR primer profiling in the somaclonal variants of pineapple variety Mauritius

Sl. no.	Primer name	Annealing temperature (°C)	Nature of amplification	Number of amplicons	Number of polymorphic amplicons	Size of amplicons (bp)	Uniqueness of amplicons	PIC	PPA
21	OMAR	54.3	Polymorphic	20	19	185-1156	4	0.79	95.00
22	(TC)10G	62.0	Polymorphic	17	17	302-865	2	0.87	100.00
23	UBC 807	54.0	Polymorphic	12	8	204-1125	1	0.42	66.67
24	UBC 808	54.0	Polymorphic	29	29	311-1329	5	0.85	100.00
25	UBC 809	54.0	Polymorphic	24	22	231-1053	6	0.73	91.67
26	UBC 812	48.5	Polymorphic	18	18	352-1035	4	0.82	100.00
27	UBC 841	47.0	Polymorphic	26	26	288-1629	4	0.74	100.00
28	UBC 844	54.0	Polymorphic	4	2	219-692	0	0.32	50.00
29	UBC 864	54.0	Polymorphic	15	12	280-923	0	0.58	80.00
30	UBC 899	52.0	Polymorphic	13	12	162-1067	2	0.75	92.31

similarity coefficient of 0.81, indicating higher similarity in the genetic makeup of composition among them, followed by genotypes T-24 and T-25 (0.80). The minimum similarity was showed by parent genotype Mauritius with T-71 and T-75 (0.58), which is indicating that the existence of significant genetic variation between these three variants. The genetic similarity coefficient values help the breeder to select these two selected somaclonal variants for the varietal selection program that would be leading to the creation of the current situation demanding pineapple variety for yield and quality.

To summarise the research findings of somaclonal variants of pineapple variety Mauritius, the 30 ISSR primers can be widely considered for genetic diversity differentiation, identification of variant genotypes, cultivars, varieties, and genetic diversity analysis of pineapple. This further indicated that the capability of these microsatellite-based ISSR genetic markers in fingerprinting as it examines and detects variation in different parts of genomic sequence among genotypes neutrally without any biases. The current study investigation was confirmed with previous studies conducted in pineapple (da Silva *et al.*, 2016; Souza *et al.*, 2017; Wang *et al.*, 2017).

4.6.1.1.4. DNA fingerprinting using polymorphic ISSR

To generate ISSR fingerprinting of eleven somaclonal variants of pineapple variety Mauritius along with parent source Mauritius used in this study, the markers that generated at least one genotype-specific unique amplicons were selected. Thirty polymorphic primers were used for fingerprinting and their detailed explanations are given below. The number of amplicons produced and the range of molecular amplicons size are presented in Table 4.6.1.1.2a and Table 4.6.1.1.2b.

4.6.1.1.4.1**. 901**

Plate 4.6.1.1.4.1 showing the amplification picture of ISSR primer 901. At 1294 bp and 717 bp for variant treatment T-71 and similarly at 1225 bp and 379 bp in somaclonal variant treatment T-4, whereas at 346 bp for Mauritius, the known microsatellite primer produced uniqueness (Fig. 4.6.1.1.4.1) making it completely appropriate for distinguishing these somaclones.

4.6.1.1.4.2**. 17899A**

The banding pattern created by 17899A was carefully counted. This ISSR primer produced unique bands at 1759 bp for Mauritius, at 688 bp and 583 bp from variant treatment T-24 (Fig. 4.6.1.1.4.2). As a result, this primer may be considered for the identity of these variants.

4.6.1.1.4.3**. AW-3**

AW-3 generated an amplification pattern in the gel is depicted in Plate 4.6.1.1.4.3. In somaclonal variant T-75, a unique amplification was obtained at 616 bp (Fig. 4.6.1.1.4.3) revealing its discriminatory power. Therefore, it may prove to be an ideal ISSR marker for clear proof of identity of treatment T-75.

4.6.1.1.4.4**. (CT)10A**

From the PCR obtained gel picture was evaluated for unique amplified bands generated by (CT)10A (Fig. 4.6.1.1.4.4), variant genotype T-69 had a unique fragment at 680 bp. Thus, this ISSR primer (CT)10A can be recommended for fingerprinting and identifying the T-69.

4.6.1.1.4.5**. DAT**

This marker generated a unique amplifying gel profile (Plate 4.6.1.1.4.5) that produced polymorphic amplicons in somaclonal variant T-71 at 1113 bp and 942 bp (Fig. 4.6.1.1.4.5). Furthermore, various banding patterns were recorded at 1013 bp for T-4 and at 223 bp for T-75. Hence, DAT can be used as a perfect primer for identifying these somaclones.

4.6.1.1.4.6**. DiGT5C**

Plate 4.6.1.1.4.6 shows the amplification of the banding pattern of ISSR marker DiGT5C. This primer is generated unique amplicons (Fig. 4.6.1.1.4.6) at 1383 bp for somaclonal variant T-10 and at 525 bp for the parent source Mauritius, making it appropriate for detecting these two variable genotypes.

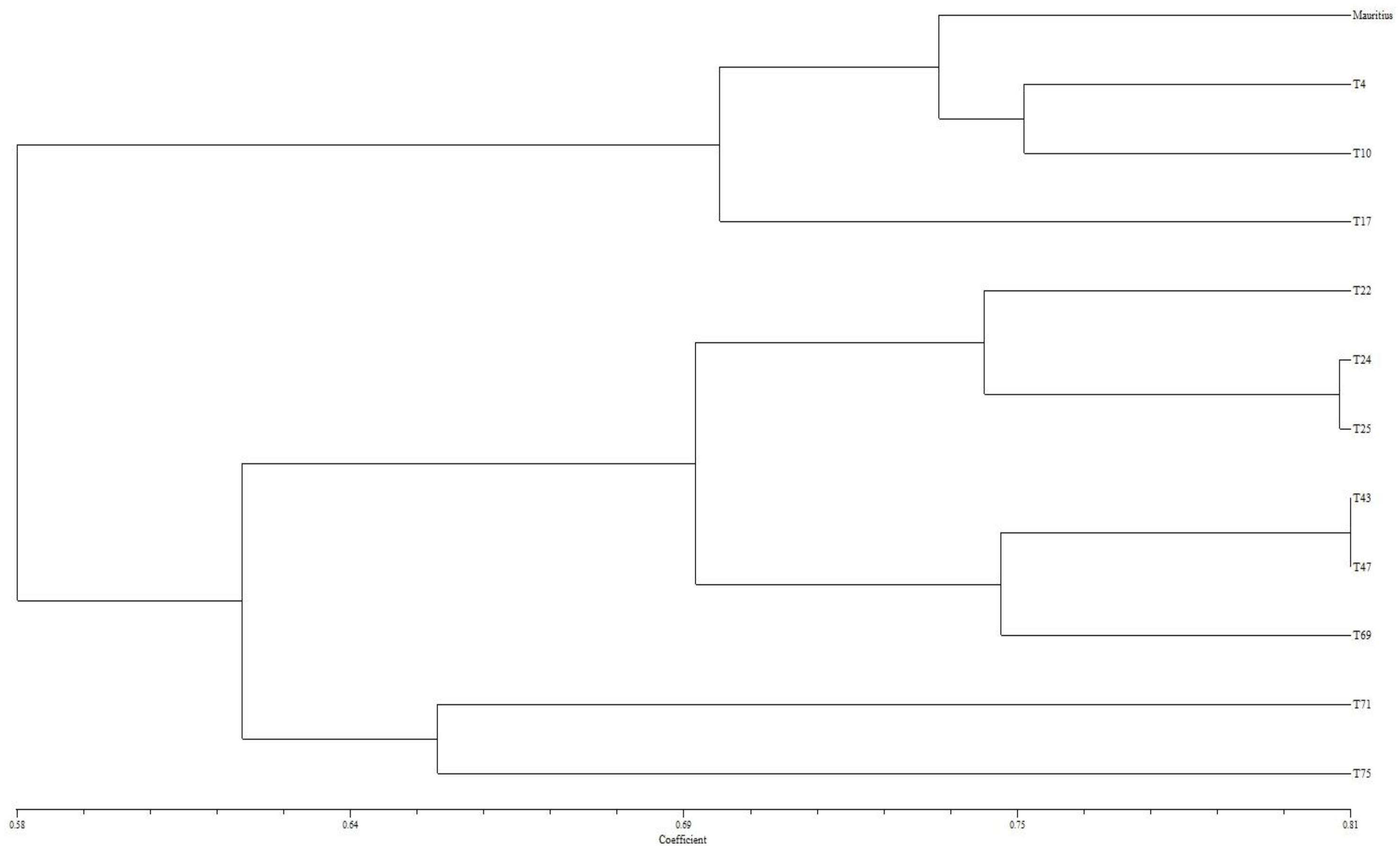


Fig. 4.6.1.1.3. Based on molecular data cluster analysis of somaclonal variants

Table 4.6.1.1.3.1. Clustering of the somaclonal variants of pineapple variety Mauritius based on ISSR profile

Cluster	Number of genotypes	Genotypes of cluster
I	4	Mauritius, T-4, T-10, T-17
II	6	T-22, T-24, T-25, T-43, T-47, T-69
III	2	T-71, T-75

Table 4.6.1.1.3.2. Pair wise similarity between the somaclonal variants of pineapple variety Mauritius based on ISSR profile

	Mauritius	T-4	T-10	T-17	T-22	T-24	T-25	T-43	T-47	T-69	T-71	T-75
Mauritius	-											
T-4	0.72	-										
T-10	0.72	0.75	-									
T-17	0.70	0.70	0.70	-								
T-22	0.58	0.58	0.58	0.58	-							
T-24	0.58	0.58	0.58	0.58	0.73	-						
T-25	0.58	0.58	0.58	0.58	0.73	0.80	-					
T-43	0.58	0.58	0.58	0.58	0.69	0.69	0.69	-				
T-47	0.58	0.58	0.58	0.58	0.69	0.69	0.69	0.81	-			
T-69	0.58	0.58	0.58	0.58	0.69	0.69	0.69	0.74	0.74	-		
T-71	0.58	0.58	0.58	0.58	0.62	0.62	0.62	0.62	0.62	0.62	-	
T-75	0.58	0.58	0.58	0.58	0.62	0.62	0.62	0.62	0.62	0.62	0.65	-

4.6.1.1.4.7**. IS-61**

Counting of amplified amplicons for its unique pattern of twelve genotypes of pineapple documented by the primer IS-61 (Plate 4.6.1.1.4.7) yielded a unique band at 768 bp in somaclonal variant genotype T-75 (Fig. 4.6.1.1.4.7).

4.6.1.1.4.8**. IS-65**

Twelve pineapple genotypes DNA trials were documented in gel amplification by using primer IS-65 and the gel image with amplified pattern is presented (Plate 4.6.1.1.4.8). The more distinct and unique amplicons were recorded in genotype T-71 at 1184 bp, in somaclonal variant genotype T-75 at 1158 bp, in somaclonal variant genotype T-47 at 890 bp, and 235 bp (Fig. 4.6.1.1.4.8) in variety Mauritius.

4.6.1.1.4.9**. ISSR-2**

On careful analysis of gel profile of the amplified polymorphic banding patterns generated by ISSR-2 in the twelve pineapple genotypes under this study (Plate 4.6.1.1.4.9), two unique amplicons were observed at 836 bp and 243 bp in the T-4. Respectively, one unique band was noted in the T-22 at 377 bp (Fig. 4.6.1.1.4.9). This result makes ISSR-2 effective in distinguishing these various treatments from each other.

4.6.1.1.4.10**. ISSR-3**

By examining the PCR amplified gel image of ISSR-3 with twelve pineapple variant genotypes for unique DNA amplicons (Plate 4.6.1.1.4.10) and the distinct band was obtained at 350 bp in Mauritius (Fig. 4.6.1.1.4.10).

4.6.1.1.4.11**. ISSR-4**

Amplification of genomic DNA of eleven somaclonal variants of pineapple variety Mauritius along with parent source using primer ISSR-4 (Plate 4.6.1.1.4.11) generated unique amplicons in treatment T-25 at 1921 bp, in treatment T-71 at 1816 bp, in treatment T-75 at 891 bp, in treatment T-10 at 366 bp, and 266 bp in genotype Mauritius (Fig. 4.6.1.1.4.11). Hence, ISSR-4 can be successfully used for differentiating five pineapple genotypes.

4.6.1.1.4.12**. ISSR-7**

The amplification pattern of twelve genotypes of pineapple in this study generated by ISSR-7 (Plate 4.6.1.1.4.12) was documented to identify unique amplicons. At 870 bp and 684 bp, unique bands were found for the T-71, followed by T-75 at 826 bp and 274 bp (Fig. 4.6.1.1.4.12). Thus, this ISSR primer can play a useful role in variants identification and making fingerprints.

4.6.1.1.4.13. **ISSR-10**

The PCR-produced amplification pattern of twelve different pineapple genotypes by using ISSR-10 (Plate 4.6.1.1.4.13) was analyzed. One unique fragment at 1127 bp was obtained in treatment T-4. Similarly, more unique bands were noted at 1236 bp, 1086 bp, 822 bp, 629 bp, and 338 bp in treatment T-75 (Fig. 4.6.1.1.4.13) respectively, making this primer suitable for identifying these two variant somaclones from selected genotypes.

4.6.1.1.4.14**. ISSR-18**

Plate 4.6.1.1.4.14 showing the gel documented profile generated by this primer ISSR-18. This marker observed unique amplicons at 1264 bp and 955 bp in the treatment T-71 (Fig. 4.6.1.1.4.14) making it suitable for identifying this somaclone.

4.6.1.1.4.15**. ISSR-21**

ISSR 21 fragmented amplicons in gel profile are shown in Plate 4.6.1.1.4.15. Clear unique bands at 1362 bp and 825 bp (Fig. 4.6.1.1.4.15) were recorded in somaclonal variant T-43. Respectively, the uniqueness of bands was found at 884 bp for Mauritius and at 688 bp for variant treatment T-69. This ISSR primer may be approved to generate the fingerprints for the above-selected variant genotypes and henceforward can help in varietal identification.

4.6.1.1.4.16**. ISSR-24**

ISSR-24 generated amplification pattern produced unique and distinct amplicons at 1256 bp, 1033 bp, 1000 bp, 563 bp, and 429 bp in the treatments T-47, T-4, Mauritius, T-22, and T-71 respectively (Fig. 4.6.1.1.4.16). From this result, the primer ISSR-24 is an ideal primer for characterizing the somaclonal variants from the parent source Mauritius.

4.6.1.1.4.17**. MANNY**

Genomic DNA fragmentation of twelve variant pineapple genotypes by using MANNY (Plate 4.6.1.1.4.17) amplified unique fragments in somaclonal variant T-24 at 1219 bp, in the somaclonal variant T-47 at 968 bp, and at 720 bp in variant T-22 (Fig. 4.6.1.1.4.17). ISSR primer MANNY can be effectively referred to for distinguishing above mentioned somaclones.

4.6.1.1.4.18**. OMAR**

The amplification pattern in the gel picture generated by OMAR (Plate 4.6.1.1.4.18) was wisely counted. This primer was produced unique amplicons at 1156 bp for genotype T-71, more distinct amplicons at 936 bp, and at 646 bp, whereas for genotype T-25 at 815 bp (Fig. 4.6.1.1.4.18), and henceforward, it can be capable to use for distinguishing between these two genotypes T-25 and T-71 as well as other studied genotypes.

4.6.1.1.4.19**. (TC)10G**

Scoring of amplified gel picture of twelve pineapple genotypes produced by this ISSR primer (TC)10G noticed unique bands at 621 bp for T-25 and 557 bp for T-43 (Fig. 4.6.1.1.4.19).

4.6.1.1.4.20**. UBC-807**

UBC-807 detected for identification of amplification of various fragments in the studied pineapple genotypes (twelve) is depicted in Plate 4.6.1.1.4.20. In the variant genotype T-22, a unique band at 712 basepairs was found (Fig. 4.6.1.1.4.20) to consider the difference of this marker. This primer can be used as an ideal primer for unequivocal identification of this selected variant.

4.6.1.1.4.21**. UBC-808**

The recording of amplified amplicons in twelve pineapple genotypes generated by this genetic marker UBC-808 (Plate 4.6.1.1.4.21) produced unique fragments at 1329 bp, 1050 bp, 688 bp, and 543 basepairs in variant genotype T-71 and at 1100 bp in variant genotype T-4 (Fig. 4.6.1.1.4.21). Henceforth, these two variant genotypes can be distinguished from each other as well as from additionally evaluated genotypes using UBC-808.

4.6.1.1.4.22**. UBC-809**

The PCR finding of the amplified gel profile of twelve pineapple genotypes by using UBC-809 (Plate 4.6.1.1.4.22) was recorded. A uniqueness of amplicons at 886 bp was found (Fig. 4.6.1.1.4.22) for variant genotype T-4. For more unique bands generated through amplification of gel image at 852 bp for somaclonal variant T-25, whereas variant genotype T-75 was amplified at 728 bp and 414 bp. Different unique bands were also generated at 449 bp and 231 bp for Mauritius. This ISSR marker hence proved to be appropriate for genetic diversity documentation of the variant genotypes of pineapple.

4.6.1.1.4.23**. UBC-812**

The amplifying pattern obtained by ISSR primer UBC-812 (Plate 4.6.1.1.4.23) was counted to detection of unique amplicons. This primer was yielded unique bands at 1035 bp and 858 bp in somaclonal treatment T-71, followed by T-10 at 951 and at 425 bp in T-75 (Fig. 4.6.1.1.4.23). From this, it can be recommended for the identification of variants of Mauritius.

4.6.1.1.4.24**. UBC-841**

The screening of primer UBC-841 produced unique amplicons in gel documentation (Fig. 4.6.1.1.4.24 and Plate 4.6.1.1.4.24) in somaclonal variant genotype T-22 (1547 bp), parental source Mauritius (1494 bp), and somaclonal variant genotype T-4 (1218 bp and 721 bp). Thus UBC-841 can aid as a perfect primer for identifying fingerprints of genotypes T-4, T-22, and Mauritius.

4.6.1.1.4.25**. UBC-899**

Carefully counting of amplified gel profile was recorded by using the primer UBC-899 (Plate 4.6.1.1.4.25) revealed that the presence of two unique amplicons at 1067 bp for T-47 and at 661 bp in somaclonal variant T-24 (Fig. 4.6.1.1.4.25).

Accordingly, UBC-899 can be successfully utilized for the characterization of the said variants.

4.6.1.1.5. DNA fingerprinting of individual somaclonal variants of pineapple variety Mauritius using ISSR profile

The individual data of somaclonal variants of pineapple variety Mauritius by using ISSR profile images with the help of selected 30 ISSR markers for further utilization of locating useful unique amplicons in each variant genotypes. An associated unique amplicons color chart was developed. These result findings can be highly useful in distinguishing and characterizing these selected genotypes from the others. The individual somaclonal variants-wise DNA fingerprint details are explained below.

4.6.1.1.5.1. **Mauritius**

On examination of PCR amplified gel images produced by 30 selected ISSR primers, it was noted that nine primers *viz*., DiGT5C at 525 bp, UBC-841 at 1494 bp, IS-65 at 235 bp, UBC-809 at 449 bp and 231 bp, ISSR-21 at 884 bp, 901 at 346 bp, 17899A at 1759 bp, ISSR-3 at 350 bp, and ISSR-21 at 1000 bp observed carefully unique and distinct amplicons in the variety Mauritius. The size of amplicons (bp) generated by these nine ISSR primers ranged from 231 bp to 1759 bp. The fingerprints generated in a variety of Mauritius using clearly distinct fragments with the nine primers are presented in Fig. 4.6.1.1.5.1.

4.6.1.1.5.2. **T-4**

From the amplification of PCR amplified gel profiles observed for somaclonal variant treatment T-4 using 30 ISSR genetic markers, eight polymorphic primers were selected to make the fingerprint of the variant treatment T-4 (Fig. 4.6.1.1.5.2). At 243 bp (ISSR-2), 379 bp (901), 721 bp (UBC-841), 836 bp (ISSR-2), 886 bp (UBC-809), 1013 bp (DAT), 1033 bp (ISSR-24), 1100 bp (UBC-808), 1127 bp (ISSR-10), 1218 bp (UBC-841), and 1225 bp (901) unique amplicons were obtained for the treatment T-4. The size amplicons produced by these eight polymorphic primers ranged from 243 bp to 1225 bp. Maximum unique amplicons were generated by ISSR primers UBC-841 (2), 901 (2), and ISSR-2 (2) respectively and the minimum number of unique bands (1) counted by UBC-808, UBC-809, DAT, ISSR-10, and ISSR-24.

4.6.1.1.5.3. **T-10**

Three out of 30 ISSR primers identified distinct and unique amplicons in somaclonal variant genotype T-10 (Fig. 4.6.1.1.5.3). The size of all unique amplicons generated by ISSR-4, DiGT5C, and UBC-812 in this variant ranged from 366 bp to 1383 bp. The number of unique amplicons amplified varies at 366 bp (ISSR-4), 951 bp (DiGT5C), and 1383 bp (UBC-812). It was observed that the unique bands produced by markers ISSR-4, DiGT5C, and UBC-812 respectively, can be used for making the fingerprint of this variant treatment T-10.

4.6.1.1.5.4. **T-17**

From the amplified gel images observed for the genomic DNA of somaclonal variant T-17 using 30 ISSR primers, these primers were not distinguished any unique bands to make fingerprint for this treatment T-17.

4.6.1.1.5.5. **T-22**

The fingerprint of PCR-produced gel was documented based on a unique banding pattern produced by six primers out of 30 ISSR microsatellite primers. The number of unique bands amplified at 266 bp (ISSR-4), 377 bp (ISSR-2), 563 bp (ISSR-24), 712 bp (UBC-807), 720 bp (MANNY), and 1547 bp (UBC-841) in this somaclonal variant of Mauritius (T-22) and the size of the amplicons ranged from 266 bp to 1547 bp. These markers were selected to develop the resourceful fingerprint for this somaclonal variant of Mauritius (Fig. 4.6.1.1.5.5).

4.6.1.1.5.6. **T-24**

From the amplification of gel profiles analyzed for the genomic DNA of somaclonal variant treatment T-24 by using 30 ISSR primers, three polymorphic primers were found to make fingerprints. The amplicons sizes generated by these three selected ISSR primers ranged from 583 bp to 1219 bp. Maximum unique amplicons were recorded by ISSR primer 17899A (2) while, single unique bands were noticed in two primers MANNY and UBC-899. Two polymorphic unique bands were produced by 17899A at 583 bp and 688 bp, whereas, primers MANNY and UBC-899 produced unique fragments at 1219 bp and 661 bp, respectively (Fig. 4.6.1.1.5.6). These three primers were used to obtain the DNA fingerprints of this variant T-24.

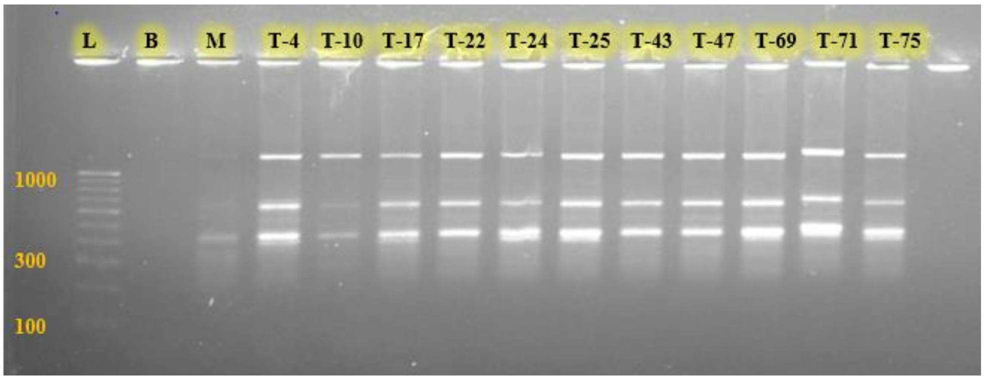


Plate 4.6.1.1.4.1. PCR amplified gel image of 901

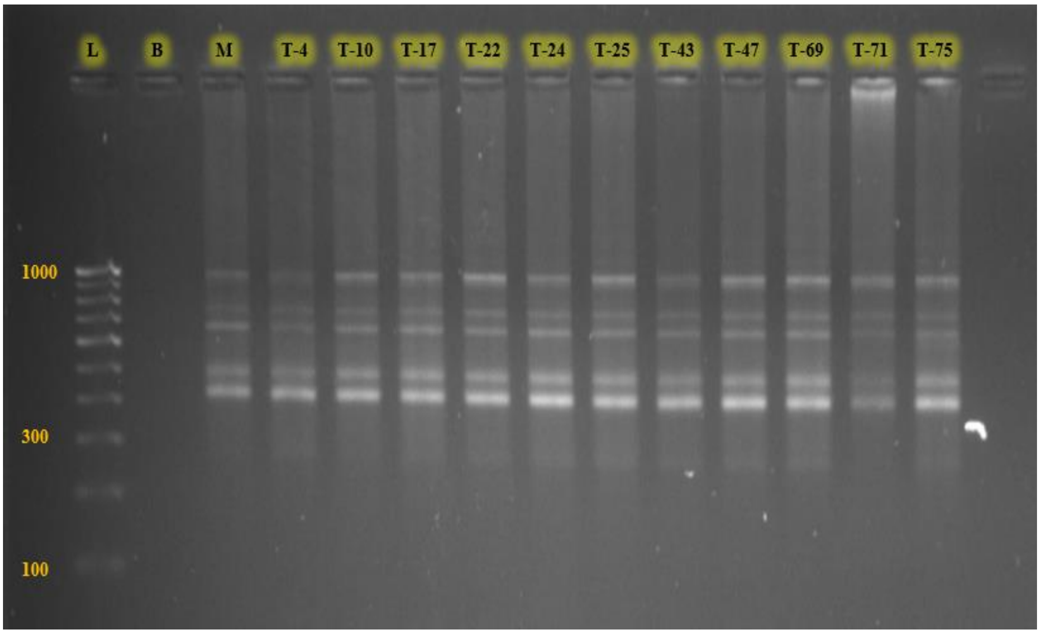


Plate 4.6.1.1.4.3. PCR amplified gel image of AW-3

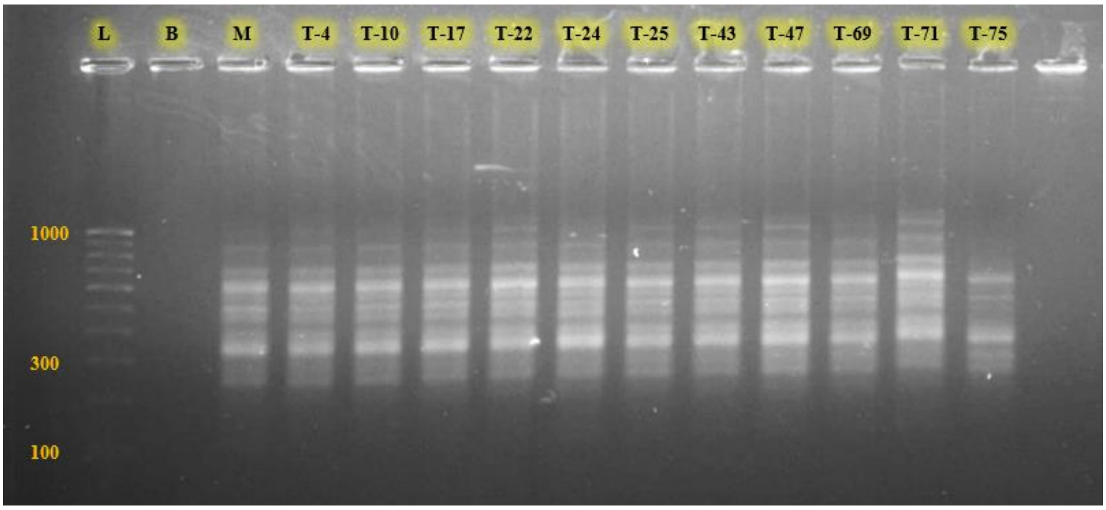


Plate 4.6.1.1.4.5. PCR amplified gel image of DAT

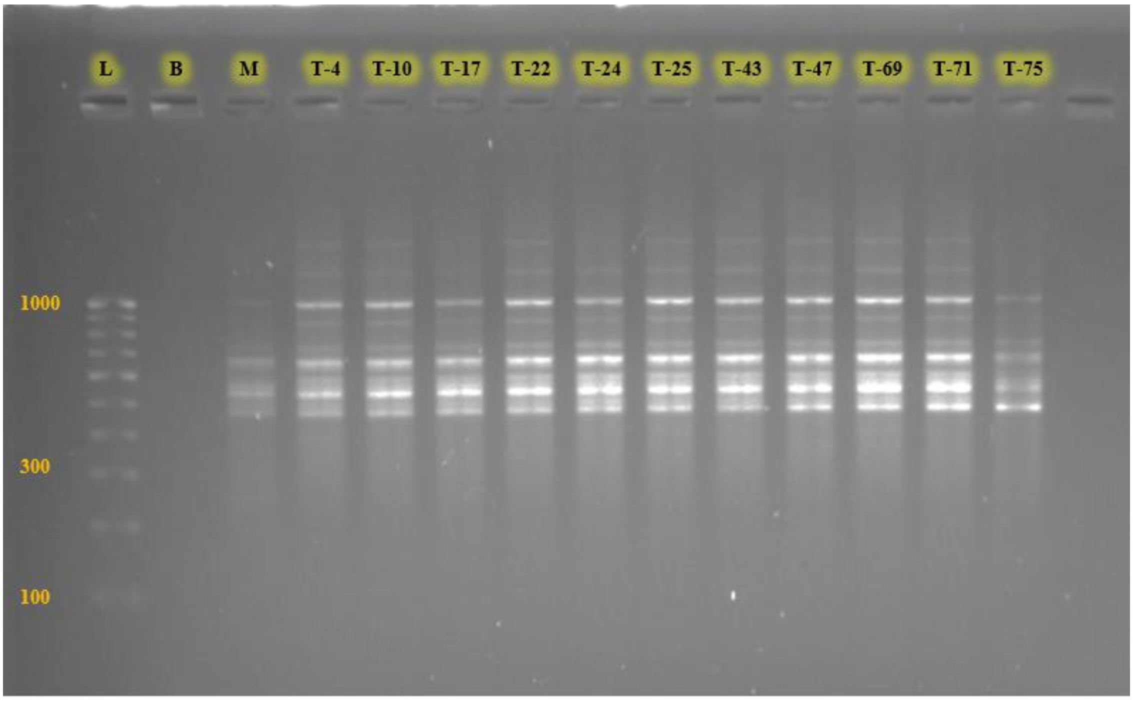


Plate 4.6.1.1.4.6. PCR amplified gel image of DiGT5C

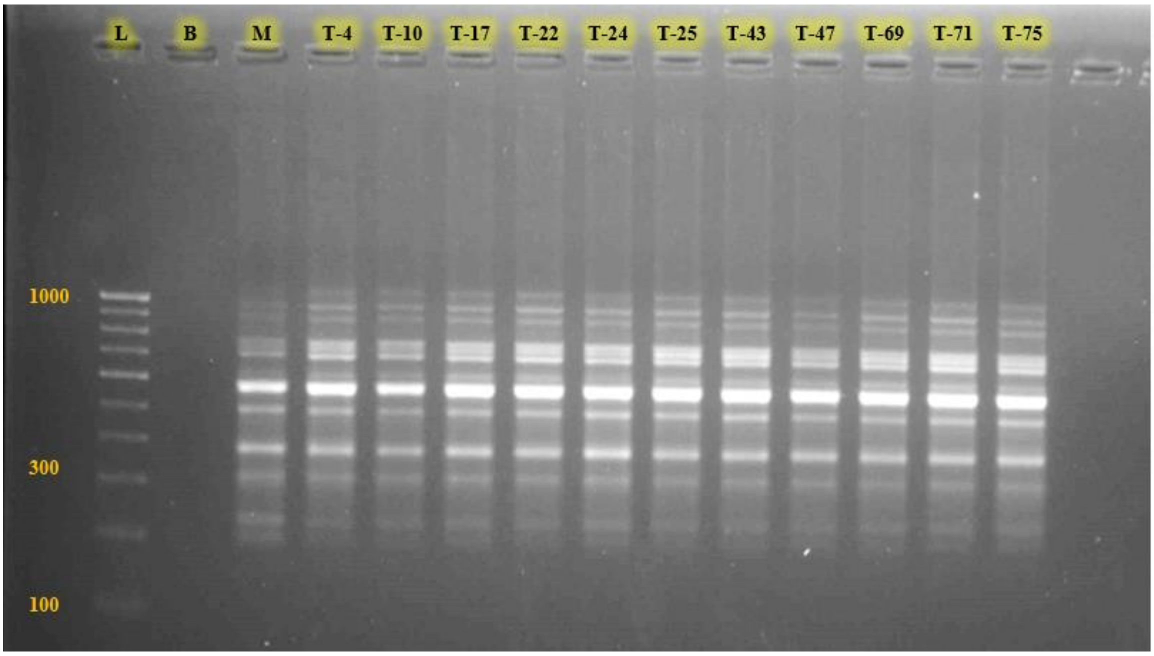


Plate 4.6.1.1.4.7. PCR amplified gel image of IS-61

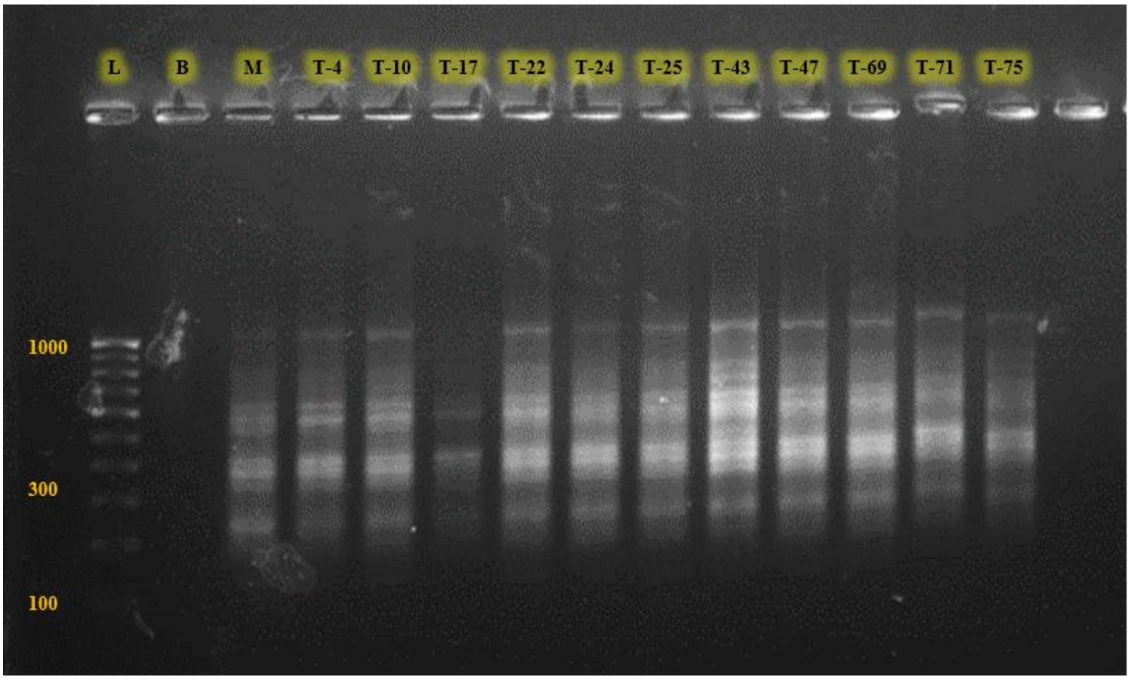


Plate 4.6.1.1.4.8. PCR amplified gel image of IS-65

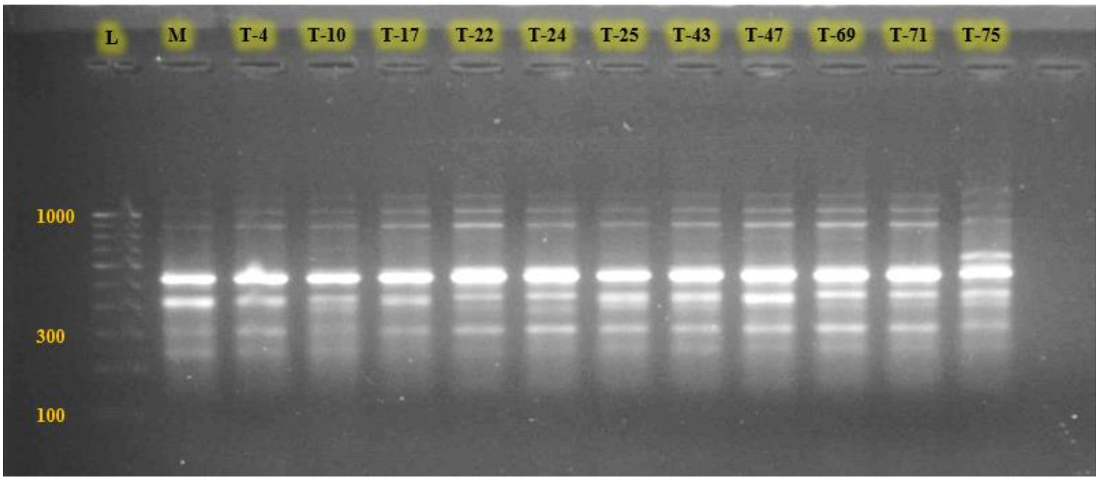


Plate 4.6.1.1.4.9. PCR amplified gel image of ISSR-2

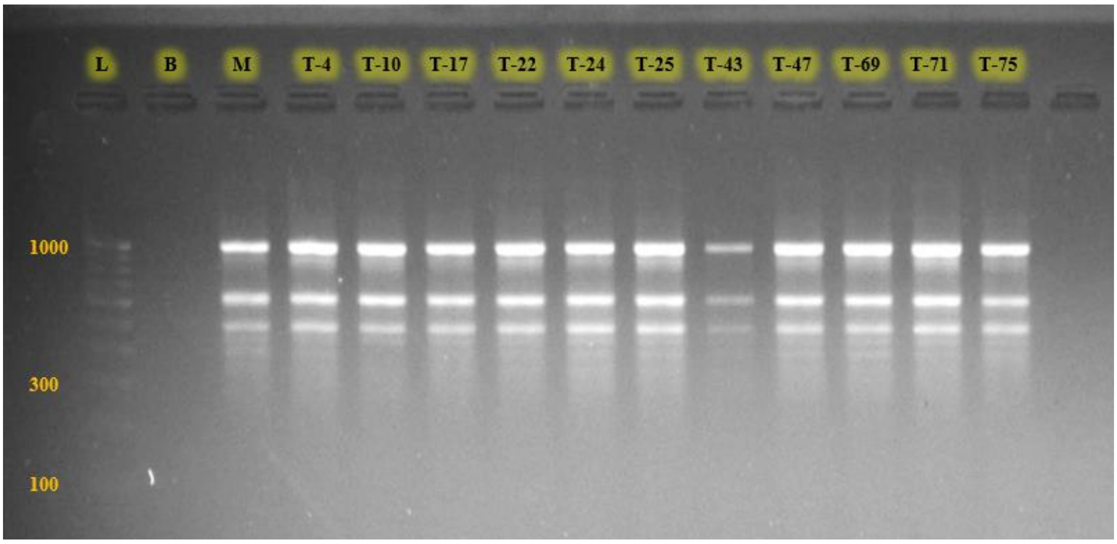


Plate 4.6.1.1.4.10. PCR amplified gel image of ISSR-3

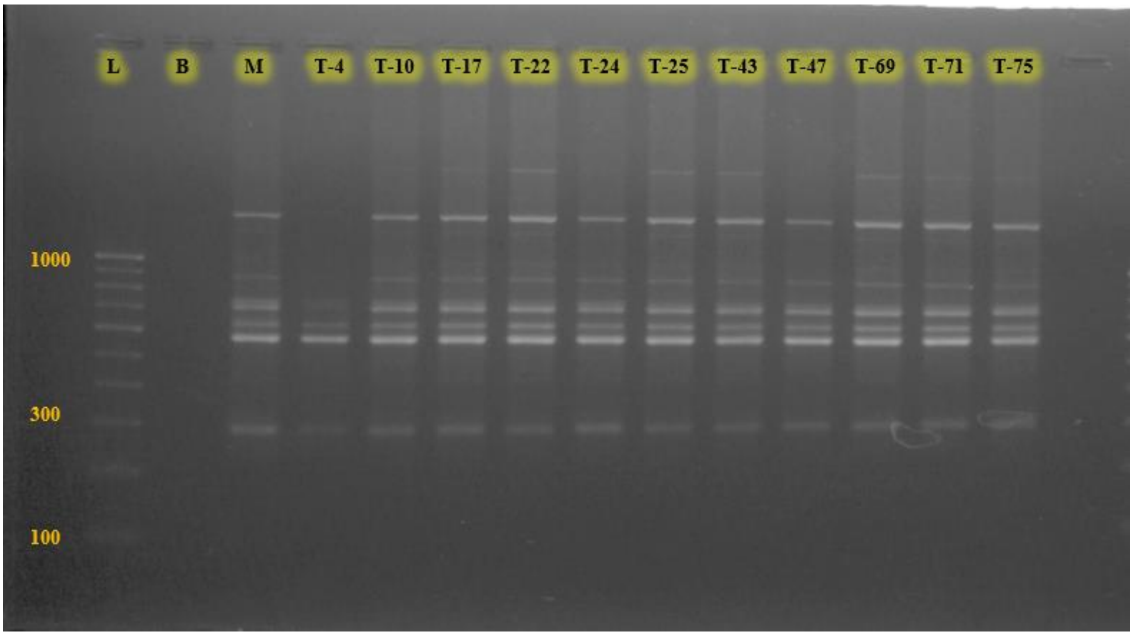


Plate 4.6.1.1.4.11. PCR amplified gel image of ISSR-4

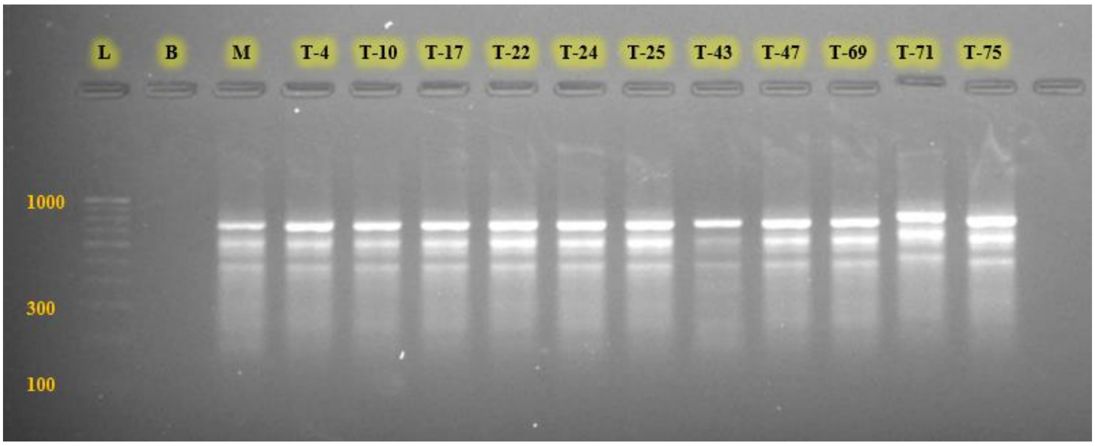


Plate 4.6.1.1.4.12. PCR amplified gel image of ISSR-7

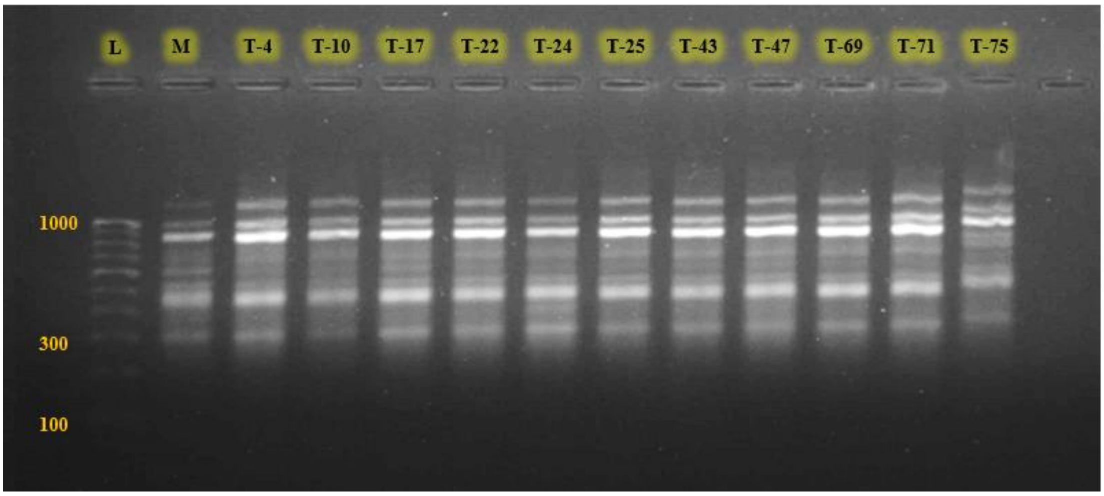


Plate 4.6.1.1.4.13. PCR amplified gel image of ISSR-10

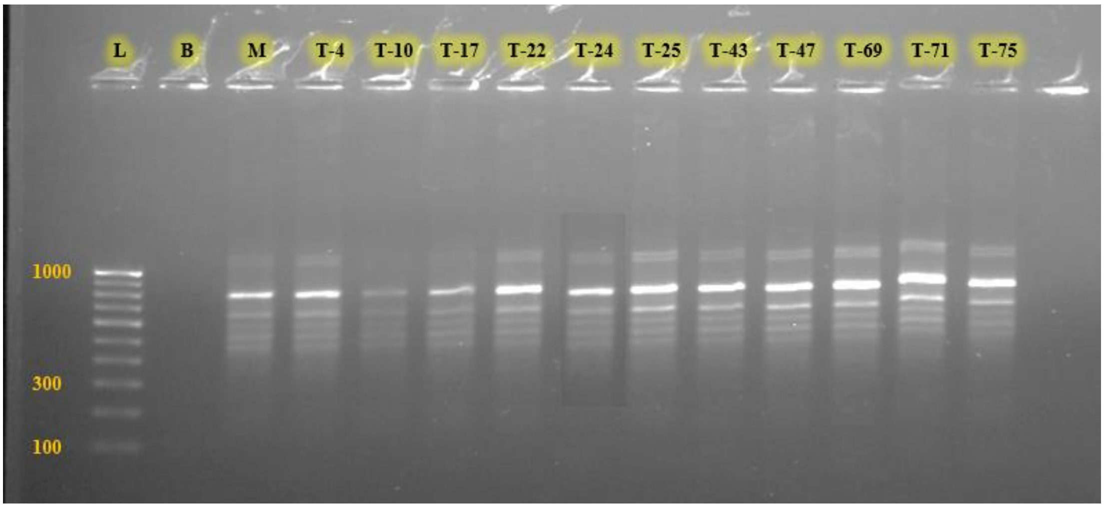


Plate 4.6.1.1.4.14. PCR amplified gel image of ISSR-18

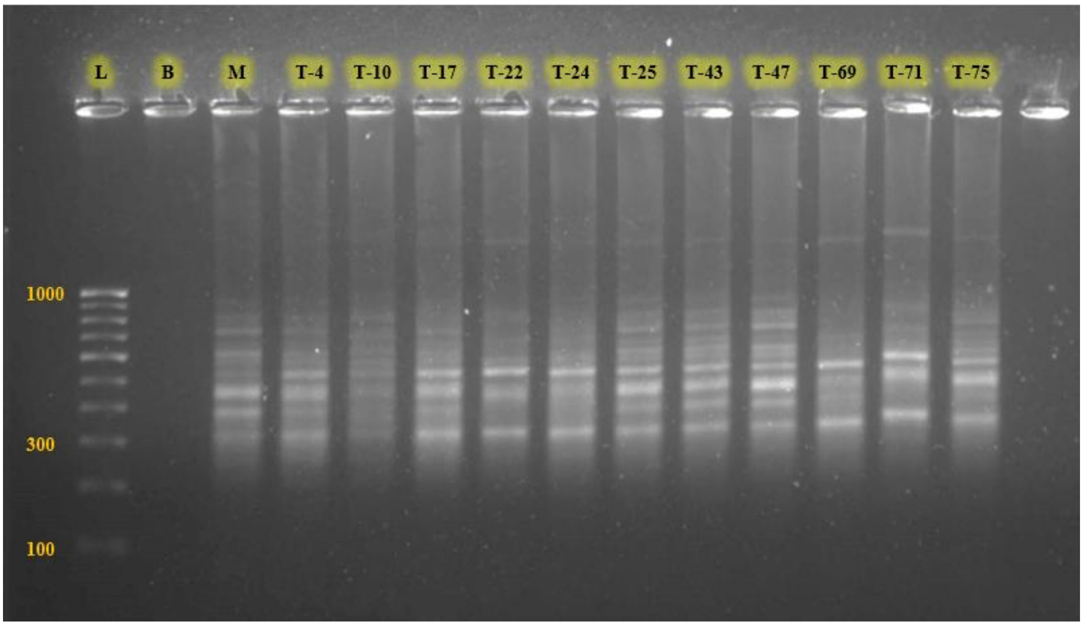


Plate 4.6.1.1.4.15. PCR amplified gel image of ISSR-21

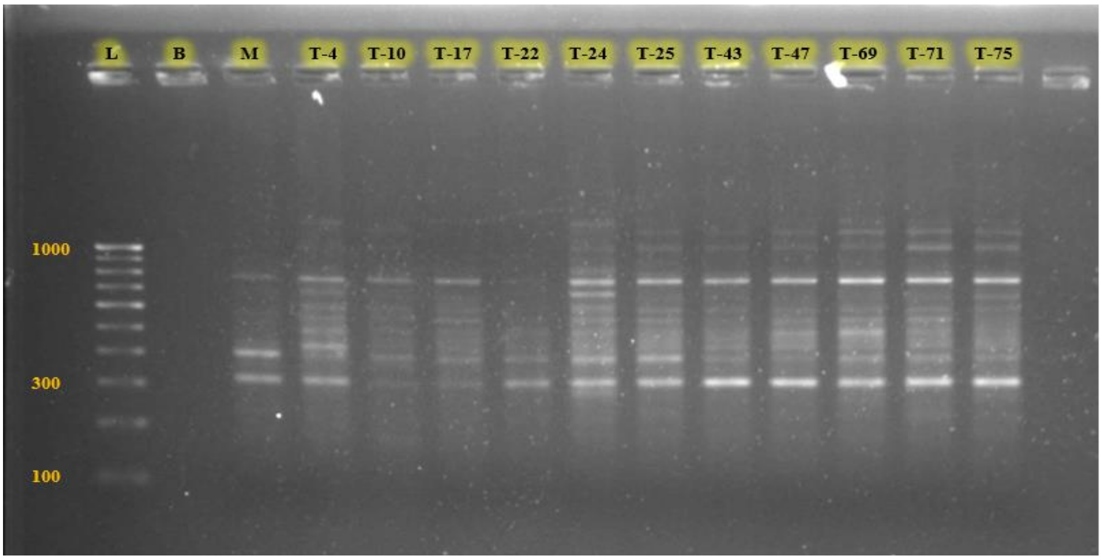


Plate 4.6.1.1.4.17. PCR amplified gel image of MANNY

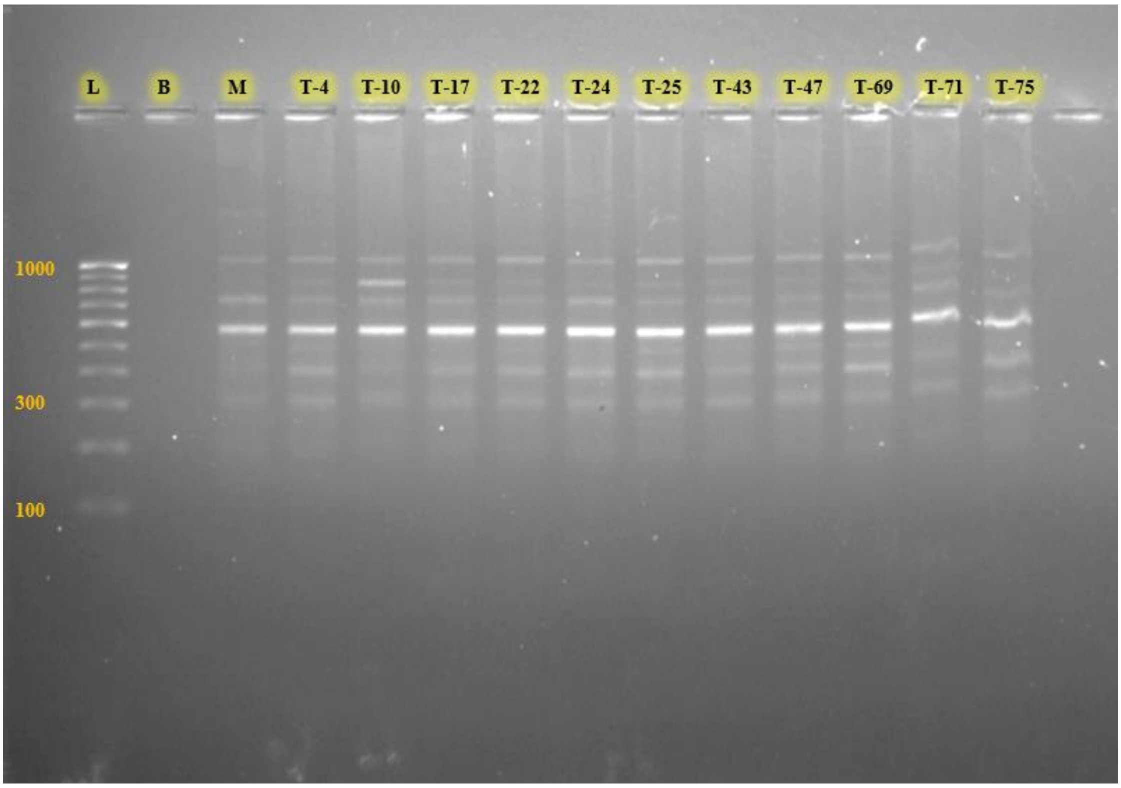


Plate 4.6.1.1.4.18. PCR amplified gel image of OMAR

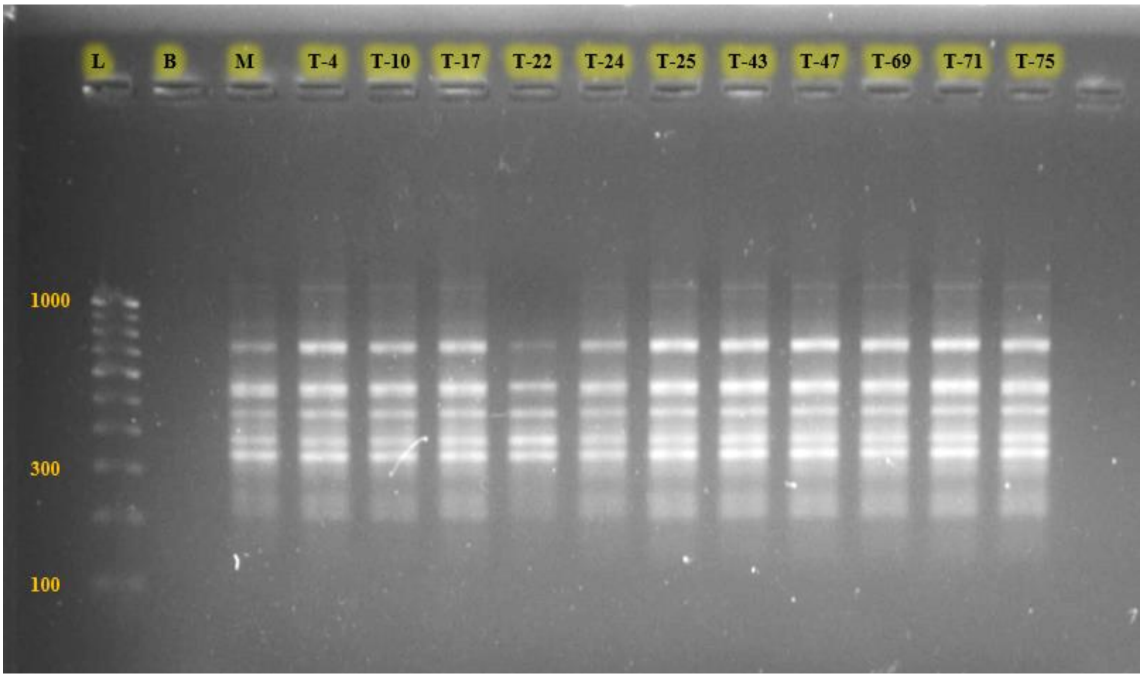


Plate 4.6.1.1.4.20. PCR amplified gel image of UBC-807

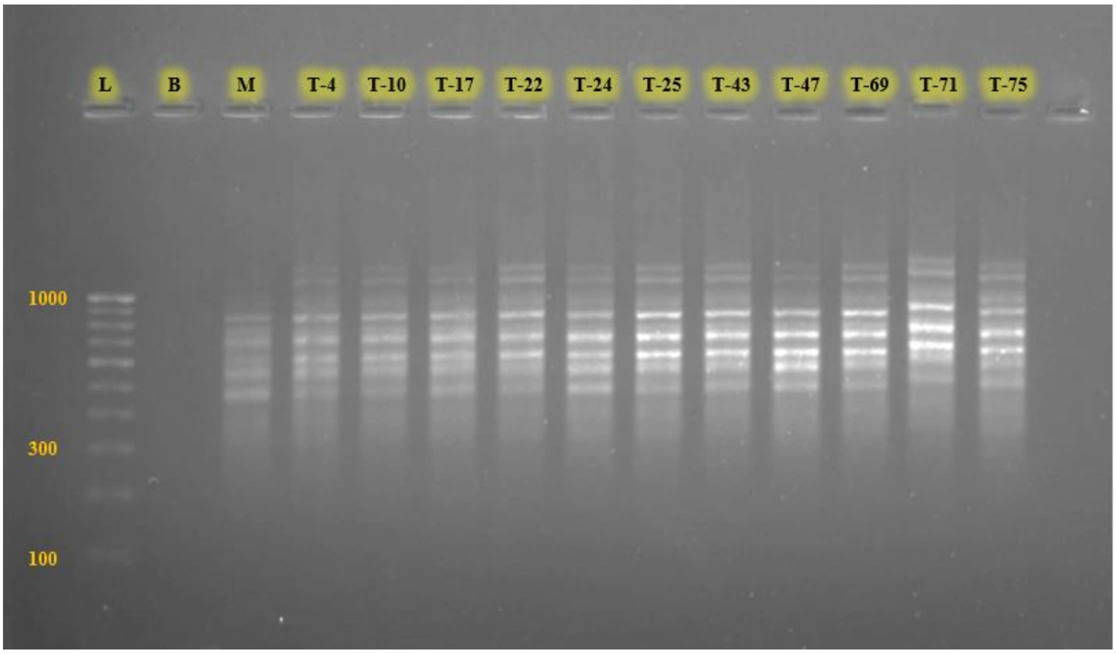


Plate 4.6.1.1.4.21. PCR amplified gel image of UBC-808

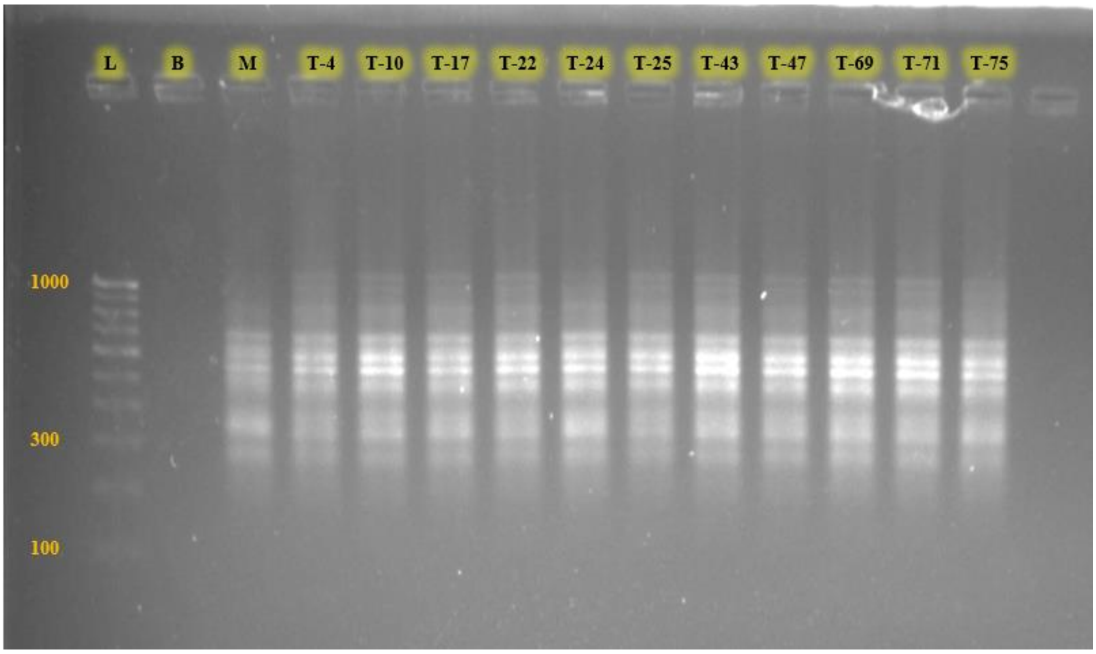


Plate 4.6.1.1.4.22. PCR amplified gel image of UBC-809

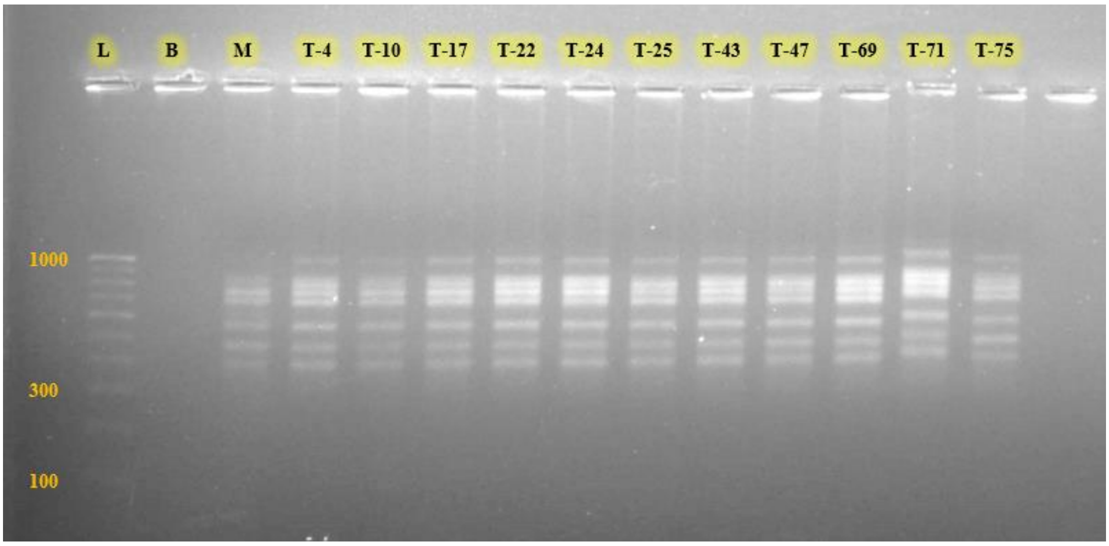


Plate 4.6.1.1.4.23. PCR amplified gel image of UBC-812

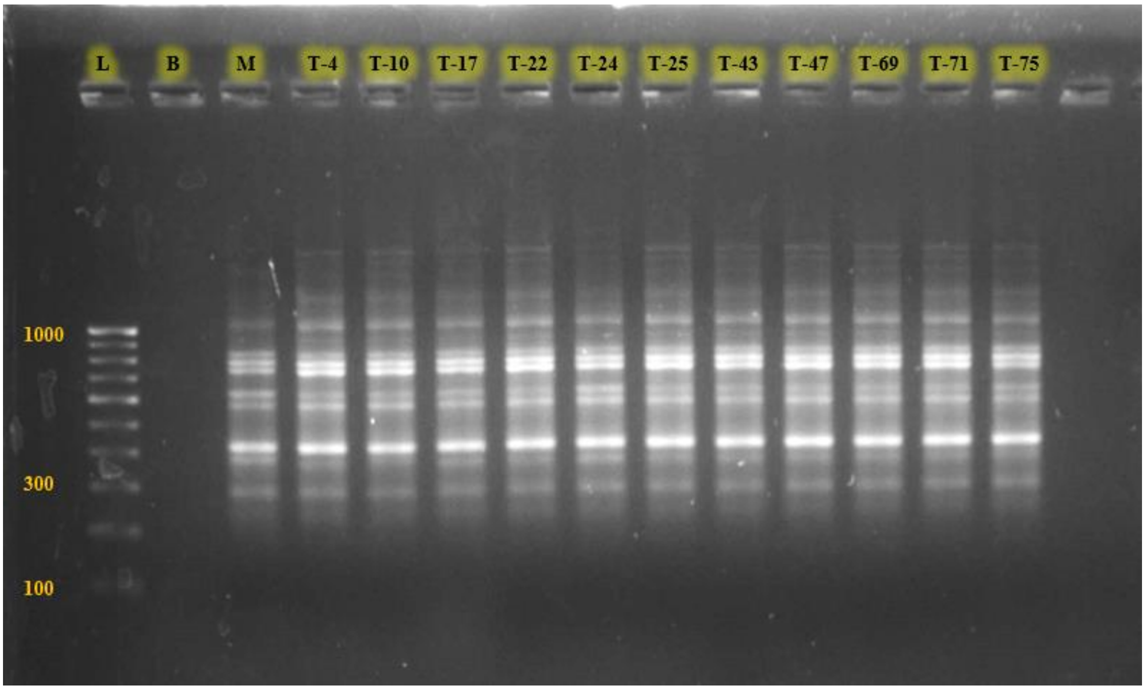


Plate 4.6.1.1.4.24. PCR amplified gel image of UBC-841

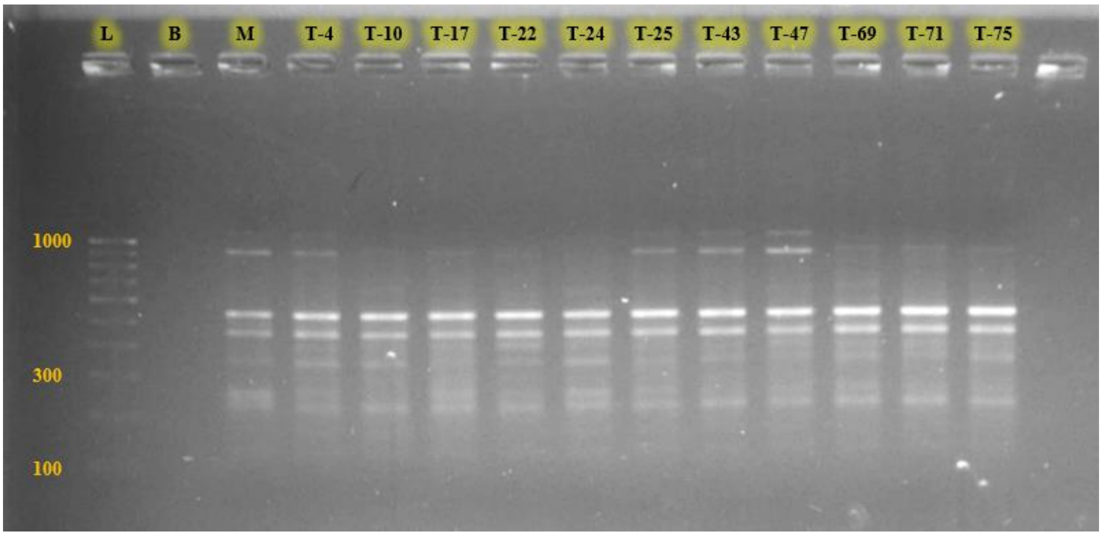


Plate 4.6.1.1.4.25. PCR amplified gel image of UBC-899

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1294	0	0	0	0	0	0	0	0	0	0	1	0
1256	0	0	1	1	1	1	1	1	1	1	0	1
1225	0	1	0	0	0	0	0	0	0	0	0	0
717	0	0	0	0	0	0	0	0	0	0	1	0
682	0	0	0	1	1	1	1	1	1	1	0	1
648	0	1	1	0	0	0	0	0	0	0	0	0
553	0	1	0	0	1	0	0	1	1	1	0	0
488	0	0	0	0	0	0	0	0	0	0	1	1
457	0	1	1	1	1	1	1	1	1	1	0	0
431	1	0	0	0	0	0	0	0	0	0	1	1
405	0	0	0	1	0	1	1	0	0	0	0	0
379	0	1	0	0	0	0	0	0	0	0	0	0
346	1	0	0	0	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.1. Colour chart of 901

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1759	1	0	0	0	0	0	0	0	0	0	0	0
688	0	0	0	0	0	1	0	0	0	0	0	0
583	0	0	0	0	0	1	0	0	0	0	0	0
334	0	1	0	0	0	1	0	0	0	0	0	0
240	1	1	1	1	1	1	1	1	1	1	1	1

Fig. 4.6.1.1.4.2. Colour chart of 17899A

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
988	1	0	0	1	0	0	0	0	0	0	0	0
957	0	1	1	0	1	1	1	1	1	1	1	1
748	1	1	1	1	1	0	0	0	0	0	0	0
722	0	0	0	0	0	1	1	1	1	1	1	1
670	1	1	1	1	0	0	0	0	0	0	0	0
644	0	0	0	0	1	1	1	1	1	1	1	0
616	0	0	0	0	0	0	0	0	0	0	0	1
485	1	1	1	1	1	1	0	0	0	0	1	0
451	0	0	0	0	0	0	1	1	1	1	0	1
425	1	1	1	1	1	0	0	0	0	0	0	0
393	0	1	0	0	0	1	1	1	1	1	1	1
259	0	0	0	0	1	1	1	0	1	1	0	0

Fig. 4.6.1.1.4.3. Colour chart of AW-3

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1054	0	1	0	1	0	0	0	0	0	0	0	0
1004	0	0	0	0	1	1	0	0	0	0	1	0
970	0	0	0	0	0	0	0	1	1	1	0	0
706	1	1	1	1	1	1	1	1	1	0	1	1
680	0	0	0	0	0	0	0	0	0	1	0	0
631	0	1	0	1	1	1	0	0	0	0	0	0
598	0	0	1	1	0	0	0	0	0	0	0	0
561	1	1	1	1	1	1	0	1	1	1	1	1
531	0	1	0	0	1	1	1	0	0	0	0	0

Fig. 4.6.1.1.4.4. Colour chart of (CT)10A

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1113	0	0	0	0	0	0	0	0	0	0	1	0
1069	0	0	0	0	1	0	1	1	1	1	0	0
1013	0	1	0	0	0	0	0	0	0	0	0	0
942	0	0	0	0	0	0	0	0	0	0	1	0
900	0	0	1	0	0	0	0	1	1	1	0	0
866	0	0	0	0	1	1	0	0	0	0	0	0
839	1	1	0	1	0	0	1	0	0	0	0	0
808	0	0	0	0	0	0	0	1	0	0	1	0
775	0	0	0	0	0	0	0	0	1	1	0	1
731	0	0	0	0	1	1	1	1	0	0	0	0
700	0	1	1	1	0	0	0	0	0	0	0	0
627	1	0	0	0	0	0	0	0	0	0	1	0
582	0	0	0	0	0	0	0	1	1	1	0	1
541	0	0	1	1	1	1	1	0	0	0	0	0
514	1	1	0	0	0	0	0	1	1	0	1	0
486	1	0	0	0	1	1	1	0	0	1	1	1
459	0	0	0	1	0	1	1	1	1	0	0	0
432	1	1	1	0	1	1	0	1	0	1	1	0
400	1	0	1	0	1	0	1	0	1	0	0	0
373	0	1	0	1	0	0	0	0	0	0	0	0
347	0	0	0	0	1	1	1	1	1	1	1	1
316	1	1	1	1	0	0	0	0	0	0	1	0
287	0	0	0	1	1	1	1	1	1	1	0	1
250	1	1	1	0	0	0	0	0	0	0	0	0
223	0	0	0	0	0	0	0	0	0	0	0	1
186	0	0	0	0	0	1	1	1	1	1	1	1
160	1	1	1	1	1	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.5. Colour chart of DAT

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1417	0	1	0	0	1	0	1	1	1	1	1	0
1383	0	0	1	0	0	0	0	0	0	0	0	0
1233	0	0	0	1	1	1	1	1	1	1	1	0
1194	0	1	1	0	0	0	0	0	0	0	0	0
1039	0	0	0	0	0	1	1	1	1	1	1	1
1011	1	1	1	1	1	0	0	0	0	0	0	0
905	0	0	0	1	1	1	1	1	1	1	1	0
879	0	1	1	0	0	0	0	0	0	0	0	0
759	0	0	0	0	1	1	1	1	1	1	1	1
729	0	1	1	1	0	0	0	0	0	0	0	0
679	0	0	0	1	1	1	1	1	1	1	1	1
650	1	1	1	0	0	0	0	0	0	0	0	0
607	0	0	0	1	1	0	1	1	1	1	1	0
581	1	1	1	0	0	1	0	0	0	0	0	1
553	0	1	1	1	1	1	1	1	1	1	1	1
525	1	0	0	0	0	0	0	0	0	0	0	0
492	1	1	1	1	1	1	1	1	1	1	1	1

Fig. 4.6.1.1.4.6. Colour chart of DiGT5C

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1021	0	1	1	1	1	0	0	0	0	0	0	0
989	0	0	0	0	0	1	1	0	0	0	0	0
962	0	0	0	0	0	0	0	1	0	1	0	0
925	0	1	1	1	1	1	0	0	0	0	1	0
895	1	0	0	0	0	0	1	1	1	0	0	1
858	0	1	1	1	1	1	0	0	0	1	1	1
822	0	0	0	0	0	0	1	1	0	0	0	0
796	0	0	0	0	0	0	0	0	1	1	1	0
768	0	0	0	0	0	0	0	0	0	0	0	1
733	1	1	1	1	0	0	0	0	0	0	0	0
700	1	0	0	0	1	1	1	1	1	0	0	0
672	0	1	1	1	1	1	0	1	0	1	1	1
642	0	0	0	0	0	0	1	1	1	1	1	0
612	0	1	1	0	1	1	0	0	0	0	0	1
586	1	0	0	1	0	0	1	1	0	0	0	0
557	0	1	1	1	1	1	0	0	0	0	1	1
530	0	0	0	0	0	0	1	1	1	1	1	0
503	1	1	0	0	0	0	0	0	0	0	0	1
476	0	0	1	1	1	1	1	1	1	0	0	0
448	0	0	0	0	0	0	0	0	0	1	1	1
369	1	1	1	1	1	1	1	1	1	1	0	0
343	0	0	0	0	0	0	0	0	0	0	1	1
303	1	1	1	1	1	1	1	1	1	1	0	0
277	0	0	0	0	0	0	0	0	0	0	1	1
214	1	1	1	1	1	1	1	1	1	1	1	1

Fig. 4.6.1.1.4.7. Colour chart of IS-61

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1184	0	0	0	0	0	0	0	0	0	0	1	0
1158	0	0	0	0	0	0	0	0	0	0	0	1
1132	0	0	0	0	0	0	0	1	1	1	0	0
1095	0	0	0	0	1	0	1	0	0	0	0	0
1063	0	1	1	0	0	1	0	0	0	0	0	0
920	0	0	0	0	0	0	0	0	0	0	1	1
890	0	0	0	0	0	0	0	0	1	0	0	0
857	0	0	0	0	1	0	1	1	0	1	0	0
814	0	0	1	0	0	1	0	0	0	0	1	0
781	0	0	0	0	1	0	0	1	1	0	0	0
722	0	0	1	0	0	0	0	0	0	1	1	1
692	0	0	0	0	0	0	0	1	1	0	0	0
664	0	0	0	1	1	1	1	0	0	1	1	0
636	1	1	1	0	0	0	0	1	1	0	0	0
607	0	0	0	1	1	1	1	1	0	1	0	1
570	1	1	1	0	0	1	1	0	0	0	0	0
532	0	0	1	0	1	0	0	1	0	0	1	1
491	0	0	0	0	0	0	0	1	1	1	1	1
460	0	0	1	1	1	1	1	1	1	1	1	0
427	1	1	0	0	1	1	1	0	0	1	0	1
398	1	1	1	1	0	0	1	1	1	0	0	0
367	1	0	0	1	1	1	0	0	0	0	0	0
334	0	1	1	0	0	0	0	0	0	0	1	1
298	0	0	0	0	0	0	0	1	1	1	0	0
271	1	1	1	0	1	1	1	0	0	0	0	0
235	1	0	0	0	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.8. Colour chart of IS-65

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1050	0	0	0	0	1	1	1	1	1	1	1	0
988	0	0	0	1	0	0	0	0	0	0	0	1
891	0	0	1	1	1	1	1	1	1	1	1	0
836	0	1	0	0	0	0	0	0	0	0	0	0
800	0	0	0	0	0	0	0	0	1	1	0	0
673	0	0	0	1	0	1	1	1	1	0	1	1
547	1	1	1	0	1	0	0	0	0	1	0	0
469	0	0	1	0	1	1	1	1	1	1	1	1
437	1	1	0	1	0	0	0	0	0	0	0	0
411	0	0	1	0	0	1	1	1	0	0	1	1
377	0	0	0	0	1	0	0	0	0	0	0	0
345	1	1	1	1	1	1	1	1	1	1	1	1
276	1	0	1	1	1	1	1	1	1	1	1	1
243	0	1	0	0	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.9. Colour chart of ISSR-2

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
995	1	1	1	1	1	1	1	1	1	1	1	1
930	0	0	0	0	0	1	1	0	0	0	0	0
900	1	1	0	1	1	0	0	0	0	1	1	1
863	0	0	1	0	0	0	0	0	1	0	0	0
714	1	1	1	1	1	1	1	1	1	1	1	1
579	1	1	1	0	1	1	1	1	1	1	1	0
552	0	0	0	1	0	0	0	0	0	0	0	1
473	1	0	1	0	0	0	0	0	0	1	0	1
428	0	0	0	1	0	0	0	0	0	0	1	0
391	0	1	0	0	1	1	1	0	1	1	1	1
350	1	0	0	0	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.10. Colour chart of ISSR-3

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1921	0	0	0	0	0	0	1	0	0	0	0	0
1879	0	0	0	0	1	0	0	1	0	1	0	0
1816	0	0	0	0	0	0	0	0	0	0	1	0
1521	1	0	1	0	0	1	0	0	0	0	0	0
1489	0	0	0	1	1	0	0	0	0	0	0	0
1463	0	0	0	0	0	0	1	1	1	1	0	0
1426	0	0	0	0	0	0	0	0	0	0	1	1
995	1	0	0	1	0	0	0	0	0	0	0	0
962	0	0	1	0	1	1	1	0	1	0	0	0
930	0	0	0	0	0	0	0	1	0	1	1	0
891	0	0	0	0	0	0	0	0	0	0	0	1
756	1	0	1	1	1	0	0	0	0	0	0	0
729	0	0	0	0	0	1	1	1	1	1	1	1
663	1	1	1	1	1	1	1	1	1	0	0	1
637	0	0	0	0	0	0	0	0	0	1	1	0
594	1	1	1	1	1	1	1	1	1	1	1	1
406	1	1	0	1	1	0	0	0	0	0	0	0
366	0	0	1	0	0	0	0	0	0	0	0	0
295	1	1	1	1	0	1	1	1	1	1	1	1
266	0	0	0	0	1	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.11. Colour chart of ISSR-4

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
870	0	0	0	0	0	0	0	0	0	0	1	0
826	0	0	0	0	0	0	0	0	0	0	0	1
800	0	0	0	0	1	0	1	1	1	1	0	0
765	1	1	1	1	0	1	0	0	0	0	0	0
684	0	0	0	0	0	0	0	0	0	0	1	0
647	0	0	0	0	0	0	0	0	1	1	0	1
609	1	1	1	1	1	1	1	1	0	1	1	0
580	0	0	0	1	0	0	1	0	1	0	0	1
554	1	1	1	0	1	1	0	0	0	0	1	0
510	0	0	0	0	0	0	0	1	1	1	0	1
482	1	1	1	1	1	1	1	0	0	0	0	0
278	0	0	0	0	0	0	0	0	0	0	0	1
239	0	1	0	0	0	0	0	1	1	1	1	0
210	1	0	1	1	1	1	1	0	0	0	0	0

Fig. 4.6.1.1.4.12. Colour chart of ISSR-7

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1236	0	0	0	0	0	0	0	0	0	0	0	1
1186	0	0	0	0	0	1	1	0	1	1	1	0
1155	0	0	1	1	1	0	0	1	0	0	0	0
1127	0	1	0	0	0	0	0	0	0	0	0	0
1086	0	0	0	0	0	0	0	0	0	0	0	1
1041	0	0	0	0	0	0	1	0	1	1	1	0
1014	0	0	1	1	1	1	0	1	0	0	0	1
972	1	1	0	0	0	0	0	0	0	0	0	0
944	0	0	0	0	0	1	0	0	1	1	1	0
917	0	0	1	1	1	0	1	1	0	0	0	1
884	1	1	0	0	0	0	0	0	0	0	0	0
822	0	0	0	0	0	0	0	0	0	0	0	1
793	0	0	0	0	0	0	0	0	0	1	1	0
747	0	0	0	0	0	1	1	1	1	0	0	0
717	0	1	1	1	1	0	0	0	0	0	0	0
629	0	0	0	0	0	0	0	0	0	0	0	1
603	1	0	0	0	0	0	0	0	0	1	1	0
570	0	1	0	0	1	1	1	1	1	0	0	1
535	1	0	1	1	0	0	0	0	0	0	0	1
507	0	0	0	0	0	1	1	1	1	1	1	0
476	0	1	1	1	1	0	0	0	0	0	0	0
449	1	1	0	0	0	0	0	0	0	0	0	0
338	0	0	0	0	0	0	0	0	0	0	0	1
300	0	0	0	0	0	0	0	1	1	1	1	0
273	0	0	0	1	1	1	1	0	0	0	0	0
219	1	1	0	0	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.13. Colour chart of ISSR-10

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1.264	0	0	0	0	0	0	0	0	0	0	1	0
1.214	0	0	0	0	0	0	0	0	1	1	1	1
1.182	0	0	0	0	1	0	1	1	0	0	0	0
1.141	1	0	0	1	0	0	0	0	0	1	0	1
1.114	0	1	0	0	1	0	1	1	1	0	0	0
0.955	0	0	0	0	0	0	0	0	0	0	1	0
0.900	0	0	0	0	0	0	0	0	0	1	0	1
0.863	0	0	0	0	1	1	1	1	1	0	0	0
0.826	0	1	1	1	0	0	0	0	0	0	0	0
0.792	1	0	0	0	0	0	0	0	0	0	1	0
0.737	0	0	0	0	0	0	0	0	0	1	0	1
0.707	0	0	0	0	1	0	1	1	1	0	1	0
0.674	0	1	1	1	0	0	0	0	0	1	0	1
0.640	0	0	0	1	1	1	1	1	1	0	1	0
0.600	1	1	1	0	0	0	0	0	0	1	0	1
0.567	0	0	0	1	1	1	1	1	1	0	1	0
0.539	1	1	1	0	0	0	0	0	0	1	0	1
0.500	0	0	0	0	1	0	1	1	1	0	0	0
0.470	1	1	1	1	0	1	0	0	0	0	0	0

Fig. 4.6.1.1.4.14. Colour chart of ISSR-18

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1500	0	0	0	0	0	0	0	0	0	0	1	1
1400	0	0	0	0	1	0	1	0	1	1	0	0
1362	0	0	0	0	0	0	0	1	0	0	0	0
949	0	0	0	0	0	0	1	0	1	0	0	0
884	1	0	0	0	0	0	0	0	0	0	0	0
856	0	1	0	0	0	0	1	0	1	0	1	0
825	0	0	0	0	0	0	0	1	0	0	0	0
810	1	0	1	0	1	0	0	0	0	0	0	0
783	0	1	0	0	0	0	0	1	1	0	0	1
745	1	1	0	0	0	0	1	0	0	0	1	0
716	0	0	1	1	1	1	0	0	0	0	0	0
688	0	0	0	0	0	0	0	0	0	1	0	0
660	0	0	0	0	0	0	0	0	1	0	0	1
630	1	1	1	0	0	0	1	1	0	0	1	0
604	0	0	0	1	0	1	0	0	1	0	0	1
574	0	0	0	0	1	0	0	1	1	1	0	0
541	1	1	1	1	1	1	1	0	0	0	1	0
506	0	0	0	1	0	0	0	1	1	1	0	1
479	0	0	0	0	1	1	1	0	1	0	0	1
453	1	1	1	1	1	0	0	0	0	1	0	0
416	0	0	0	1	0	0	1	1	1	0	0	0
386	1	1	1	0	0	0	0	0	0	0	1	1
353	0	0	0	0	0	1	1	1	1	1	0	0
327	1	1	1	1	1	0	0	0	0	0	1	0

Fig. 4.6.1.1.4.15. Colour chart of ISSR-21

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1356	0	0	0	0	0	0	0	0	0	1	0	1
1256	0	0	0	0	0	0	0	0	1	0	0	0
1222	1	1	0	0	0	0	0	1	0	0	0	0
1178	0	0	0	0	0	0	0	0	0	1	0	1
1078	0	0	1	0	0	1	0	1	1	0	0	0
1033	0	1	0	0	0	0	0	0	0	0	0	0
1000	1	0	0	0	0	0	0	0	0	0	0	0
618	0	0	0	0	0	1	1	0	0	0	0	0
563	0	0	0	0	1	0	0	0	0	0	0	0
535	0	1	0	0	0	0	0	1	0	0	0	0
429	0	0	0	0	0	0	0	0	0	0	1	0
394	0	0	0	0	0	0	0	0	0	1	0	1
357	0	0	0	0	0	1	1	1	1	0	0	0
323	0	0	1	0	1	0	0	0	0	0	1	0
267	1	1	0	0	0	0	0	0	0	0	0	0
233	0	0	0	0	0	0	0	0	0	1	0	1
200	0	0	0	1	0	0	0	0	1	0	1	0
171	0	0	0	0	1	1	1	1	0	0	0	1
140	0	0	1	0	0	0	0	0	0	1	0	0
111	1	1	0	0	0	0	1	1	1	0	0	0
69	1	1	0	1	1	1	0	0	0	0	0	0

Fig. 4.6.1.1.4.16. Colour chart of ISSR-24

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1219	0	0	0	0	0	1	0	0	0	0	0	0
1163	0	0	0	0	0	0	0	0	1	1	1	1
1038	0	0	0	0	0	1	1	1	0	1	0	0
1000	0	0	0	0	0	0	0	0	0	0	1	1
968	0	0	0	0	0	0	0	0	1	0	0	0
796	1	0	0	0	0	1	0	0	0	0	0	0
749	0	1	1	1	0	1	1	1	1	1	1	1
720	0	0	0	0	1	0	0	0	0	0	0	0
669	0	1	0	0	0	1	0	0	0	0	0	0
639	0	0	0	0	0	0	0	0	0	0	1	1
582	0	1	0	1	0	1	1	0	1	1	1	1
556	0	1	1	0	0	0	0	1	0	0	1	0
526	0	0	0	1	0	1	1	0	1	1	0	0
480	0	1	1	0	1	1	1	1	1	1	1	1
423	0	1	0	1	0	0	0	1	1	0	1	1
394	1	1	1	1	1	1	1	1	1	1	1	1
313	1	1	1	1	1	1	1	1	1	1	1	1

Fig. 4.6.1.1.4.17. Colour chart of MANNY

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1156	0	0	0	0	0	0	0	0	0	0	1	0
1069	0	1	0	0	1	0	0	1	1	1	0	1
1038	1	0	1	1	0	1	1	0	0	0	0	0
936	0	0	0	0	0	0	0	0	0	0	1	0
873	1	1	0	1	1	0	0	0	1	1	0	0
847	0	0	1	0	0	1	0	1	0	0	1	0
815	0	0	0	0	0	0	1	0	0	0	0	0
780	0	0	0	0	0	0	0	0	0	1	0	1
746	1	1	0	1	1	1	0	1	1	0	0	0
718	0	0	1	0	0	0	1	0	0	0	0	0
646	0	0	0	0	0	0	0	0	0	0	1	0
597	1	0	0	0	0	0	0	0	1	1	0	1
567	0	1	1	1	1	1	1	1	0	0	0	0
522	0	0	0	1	0	0	0	0	0	1	0	0
494	0	1	0	0	1	0	1	0	1	0	1	0
443	0	0	1	0	0	0	0	0	0	0	0	1
416	1	1	0	1	1	1	1	1	1	1	0	0
349	0	0	0	0	0	0	0	0	0	0	1	1
319	1	1	1	1	1	1	1	1	1	1	0	0
210	1	1	1	1	1	1	1	1	1	1	1	1

Fig. 4.6.1.1.4.18. Colour chart of OMAR

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
865	1	1	0	1	0	0	0	0	1	0	1	0
839	0	0	0	0	0	1	1	1	0	0	0	0
791	0	0	0	1	0	0	0	0	0	1	0	0
758	0	1	0	0	1	0	1	1	0	0	1	0
726	0	0	0	0	0	0	0	0	1	0	0	1
692	0	1	0	0	1	0	0	0	0	1	0	0
654	0	0	0	1	0	0	0	0	1	0	0	0
621	0	0	0	0	0	0	1	0	0	0	0	0
584	1	0	1	1	1	0	0	0	0	0	0	0
557	0	0	0	0	0	0	0	1	0	0	0	0
529	0	0	0	0	0	0	1	0	0	0	1	0
492	1	1	1	1	1	1	1	1	1	1	0	1
444	0	1	0	0	0	0	0	0	0	0	1	0
415	0	1	0	1	1	0	1	1	0	0	0	1
377	0	0	0	0	0	0	0	0	0	1	1	0
348	1	0	1	1	1	1	0	0	1	0	0	0
314	0	1	0	0	0	0	1	0	0	1	0	0

Fig. 4.6.1.1.4.19. Colour chart of (TC)10G

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1125	0	1	0	0	0	0	1	1	1	1	1	1
1069	0	0	1	1	0	0	0	0	0	0	0	0
854	0	0	0	0	0	0	0	1	0	0	1	0
738	1	1	1	1	0	1	1	1	1	1	1	1
712	0	0	0	0	1	0	0	0	0	0	0	0
552	1	1	1	1	1	1	1	1	1	1	1	1
462	1	1	1	1	1	1	1	1	1	1	1	1
382	1	1	1	1	1	1	1	1	1	1	1	1
339	1	1	1	1	1	1	1	1	1	1	1	1
302	0	0	0	1	1	1	1	1	1	1	1	1
239	1	1	1	1	0	1	1	1	1	1	1	1
212	0	1	1	1	1	0	1	1	1	0	0	0

Fig. 4.6.1.1.4.20. Colour chart of UBC-807

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1329	0	0	0	0	0	0	0	0	0	0	1	0
1300	0	0	0	0	1	1	0	1	1	1	0	1
1271	0	0	0	1	0	0	1	0	0	0	0	0
1243	0	1	1	0	0	0	0	0	0	0	1	0
1186	0	0	0	0	1	0	1	1	1	1	0	1
1157	0	0	1	1	0	1	0	0	0	0	0	0
1100	0	1	0	0	0	0	0	0	0	0	0	0
1050	0	0	0	0	0	0	0	0	0	0	1	0
1021	0	0	1	0	0	0	0	1	1	1	0	0
985	0	1	0	0	1	1	1	0	0	0	0	1
955	0	0	0	1	0	0	0	0	0	0	1	0
884	0	0	0	0	1	1	1	1	1	1	0	1
857	1	1	1	1	0	0	0	0	0	0	0	0
780	1	0	0	0	0	0	0	0	0	0	1	0
751	0	0	0	1	1	1	1	1	1	1	0	1
723	1	1	1	0	0	0	0	0	0	0	0	0
688	0	0	0	0	0	0	0	0	0	0	1	0
657	0	0	0	1	1	1	1	1	1	1	0	1
626	1	1	1	0	0	0	0	0	0	1	1	0
597	0	0	0	1	1	0	0	1	1	0	0	1
570	1	1	1	0	0	1	1	0	0	0	0	0
543	0	0	0	0	0	0	0	0	0	0	1	0
517	0	0	0	0	0	1	0	1	1	1	0	1
490	1	1	1	1	1	0	1	0	0	0	0	0
442	0	0	0	0	0	0	0	0	0	1	1	1
414	0	1	0	1	1	1	1	1	1	0	0	0
385	1	0	1	0	0	0	0	0	0	0	0	0
352	0	0	0	0	0	1	1	1	1	1	1	1
322	1	1	1	1	1	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.21. Colour chart of UBC-808

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1053	0	1	1	1	1	1	1	1	1	0	0	1
1021	0	0	0	0	0	0	0	0	0	1	1	0
961	0	1	1	1	1	0	0	1	0	0	0	0
924	0	0	0	0	0	0	0	0	1	1	1	1
886	0	1	0	0	0	0	0	0	0	0	0	0
852	0	0	0	0	0	0	1	0	0	0	0	0
825	0	0	1	0	1	1	0	0	0	0	0	0
795	1	0	0	1	0	0	0	1	0	1	0	0
763	0	1	0	0	0	0	0	0	1	0	1	0
728	0	0	0	0	0	0	0	0	0	0	0	1
671	1	1	1	1	1	1	1	1	0	0	0	0
638	0	0	0	0	0	0	0	0	1	1	1	1
594	1	1	1	1	1	1	1	1	0	0	0	0
565	0	0	0	0	0	0	0	0	1	1	1	1
537	1	1	1	1	1	1	1	1	1	1	1	0
506	1	0	0	0	0	0	0	0	0	0	0	1
476	0	1	1	1	1	1	1	1	1	1	1	1
449	1	0	0	0	0	0	0	0	0	0	0	0
414	0	0	0	0	0	0	0	0	0	0	0	1
368	1	1	1	1	1	1	1	1	1	1	1	1
339	1	1	1	0	1	1	1	1	0	1	1	0
313	0	0	0	1	0	0	0	0	1	0	0	1
263	1	1	1	1	1	1	1	1	1	1	1	1
231	1	0	0	0	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.22. Colour chart of UBC-809

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1035	0	0	0	0	0	0	0	0	0	0	1	0
985	0	1	0	1	1	1	1	1	1	1	0	1
951	0	0	1	0	0	0	0	0	0	0	0	0
858	0	0	0	0	0	0	0	0	0	0	1	0
831	0	0	0	1	1	1	0	0	0	1	0	1
800	1	1	1	0	0	0	1	1	1	0	1	0
755	0	0	0	1	1	0	0	1	1	1	0	1
722	1	1	1	0	0	1	1	0	0	0	1	0
693	0	0	0	0	1	1	1	1	1	1	0	0
661	1	1	1	1	0	0	0	0	0	0	0	1
603	0	0	0	0	0	0	0	0	1	1	1	1
571	1	1	1	1	1	1	1	1	0	0	0	0
528	0	0	0	0	0	0	0	0	0	1	1	1
492	0	0	0	0	1	1	1	0	1	0	0	0
465	1	1	0	1	0	0	0	1	0	0	1	0
425	0	0	0	0	0	0	0	0	0	0	0	1
394	0	0	0	0	1	1	1	1	1	1	0	0
367	1	1	1	1	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.23. Colour chart of UBC-812

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1629	0	0	0	0	1	0	0	1	0	1	1	1
1600	0	1	1	0	0	0	1	0	1	0	0	0
1547	0	0	0	0	1	0	0	0	0	0	0	0
1494	1	0	0	0	0	0	0	0	0	0	0	0
1459	0	0	0	0	0	0	0	0	0	1	1	0
1418	0	0	1	0	1	0	0	0	0	0	0	0
1324	0	0	0	0	1	1	1	1	1	1	0	0
1282	0	0	1	1	0	0	0	0	0	0	1	1
1218	0	1	0	0	0	0	0	0	0	0	0	0
1088	0	0	0	0	1	1	1	1	1	1	1	1
1041	1	1	1	1	0	0	0	0	0	0	0	0
952	0	0	1	0	1	0	0	0	0	0	0	0
880	0	0	0	0	0	0	1	1	1	1	0	1
854	0	0	1	1	1	1	0	0	0	0	1	0
824	1	1	0	0	1	1	1	1	1	1	1	1
786	1	1	1	1	0	1	1	1	1	1	1	1
755	1	0	1	1	1	0	0	0	0	0	0	0
721	0	1	0	0	0	0	0	0	0	0	0	0
660	0	0	0	0	1	1	1	1	1	1	1	1
628	1	1	1	1	0	0	0	0	0	1	1	1
600	1	1	1	1	1	1	1	1	1	0	0	0
445	0	0	0	1	1	1	1	1	1	1	1	1
418	1	1	1	0	0	0	0	0	0	0	0	1
385	1	1	1	1	1	1	1	1	1	1	1	0
321	1	0	0	0	1	1	1	1	1	1	1	1
292	0	1	1	1	0	0	0	0	0	0	0	0

Fig. 4.6.1.1.4.24. Colour chart of UBC-841

	1	2	3	4	5	6	7	8	9	10	11	12
Amplicons size (bp)/ genotypes	**Mauritius**	**T-4**	**T-10**	**T-17**	**T-22**	**T-24**	**T-25**	**T-43**	**T-47**	**T-69**	**T-71**	**T-75**
1067	0	0	0	0	0	0	0	0	1	0	0	0
945	1	0	0	0	0	0	1	1	1	1	1	1
911	0	1	0	1	1	0	0	0	0	0	0	0
661	0	0	0	0	0	1	0	0	0	0	0	0
529	1	0	0	0	0	1	1	1	1	1	1	1
500	0	1	1	1	1	0	0	0	0	0	0	0
456	1	1	1	1	1	1	1	1	1	1	1	1
411	0	0	0	1	1	0	0	0	0	1	1	0
372	1	0	0	0	0	1	1	1	1	1	1	1
345	0	1	1	1	1	0	0	0	0	0	0	0
256	0	0	0	0	0	1	1	0	0	1	0	0
220	1	0	0	1	0	0	0	1	1	1	1	1
185	0	1	1	1	1	1	1	0	0	0	0	0

Fig. 4.6.1.1.4.25. Colour chart of UBC-899

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

4.6.1.1.5.7. **T-25**

Four primers out of 30 ISSR primers produced unique fragments that help in characterizing variant treatment T-25 from the other eleven various treatments studied. Hence, genomic DNA fingerprints of this variant can be made from these four primers. Fig. 4.6.1.1.5.7 depicts the amplification size of unique fragments documented by these four ISSR primers. Totally four unique amplicons were detected by the 4 ISSR primers at 621 bp (TC)10G, 815 bp (OMAR), 852 bp (UBC-809), and 1921 bp (ISSR-4) respectively.

4.6.1.1.5.8. **T-43**

The fingerprints of the PCR-produced gel profile were documented based on unique amplifying patterns presented by two out of 30 ISSR genetic primers. The number of unique amplicons counted at 557 bp for (TC)10G primer, while, 825 bp and 1362 bp for ISSR-21 primer in the somaclonal variant of Mauritius (T-43), and the size of the amplicons ranged from 557 bp to 1362 bp. These two markers were found to produce the clear fingerprint for this variant T-43 (Fig. 4.6.1.1.5.8).

4.6.1.1.5.9. **T-47**

Four markers out of 30 ISSR primers recognized distinct and unique fragments in somaclonal variant T-47 (Fig. 4.6.1.1.5.9). The number of unique bands generated by IS-65, MANNY, UBC-899, and ISSR-24 in this variant genotype ranged from 890 bp to 1256 bp. The unique amplicons vary with primers at 890 bp (IS-65), 968 bp (MANNY), 1067 bp (UBC-899), and 1256 bp (ISSR-24). It was identified that the unique bands produced by these markers, can be used for generating the fingerprints of this variant T-47.

4.6.1.1.5.10. **T-69**

The amplification patterns of PCR amplified gel images were documented for a somaclonal variant of Mauritius treatment T-69 by assessing 30 ISSR markers, two ISSR primers were identified to generate the unique fingerprint of the somaclonal variant T-69 (Fig. 4.6.1.1.5.10). At 680 bp (CT)10A and 688 bp (ISSR-21) unique bands were counted for the treatment T-69. The size of unique amplicons made by these polymorphic primers ranged from 680 bp to 688 bp.

4.6.1.1.5.11. **T-71**

From the amplified gel images ten out of 30 ISSR multilocus markers yielded unique sequences that help in distinguishing somaclonal variant T-71 from closely related other somaclones studied. Hence, unique sequences amplified of genomic DNA can be obtained from these 10 dominant primers *viz*., ISSR-4, OMAR, IS-65, UBC-808, 901, DAT, UBC-812, ISSR-7, ISSR-18, and ISSR-24. Fig. 4.6.1.1.5.11 depicting the size of the amplicons of unique bands generated by these 10 ISSR primers. Overall, 20 unique amplicons were produced by the 10 ISSR primers and the number of unique bands detected by each primer ranged from 1 to 4.

4.6.1.1.5.12. **T-75**

From the result obtained, nine ISSR primers documented unique amplicons that help in recognizing and characterizing the T-75 from other closely related pineapple genotypes screened. From this screening, these DNA fingerprinting can be used successfully from these 9 primers namely ISSR-4, AW-3, IS-61, IS-65, UBC-809, DAT, UBC-812, ISSR-7, and ISSR-10. Fig. 4.6.1.1.5.12 showing the size of unique bands produced by the 9 ISSR primers. The total number of fifteen unique fragments were amplifying by the nine primers and the range of a number of unique amplicons detected by each primer was noted from 1 to 5.

In contrast to current study, the research findings were summarized with the evident of a combination of various dominant ISSR markers generated high level of uniqueness of bands could be helpful in creating varietal identity and differentiating individuals from a diverse pineapple populations. However, an individual ISSR primer that could be indicative of the complex genetic relationship between all the twelve selected pineapple genotypes was not observed. But, ISSR primer ISSR-4 developed unique DNA fingerprints in five somaclonal variants T-10 (366 bp), T-22 (266 bp), T-25 (1921 bp), T-71 (1816 bp), and T-75 (891 bp). Similarly, ISSR primer ISSR-24 generated uniqueness of DNA fingerprints in five somaclonal variant treatments T-4 (1033 bp), Mauritius (1000 bp), T-22 (563 bp), T-47 (1256), and T-71 (429 bp) and could distinguish between these eight selected variants along with parent source Mauritius and can help identify them appropriately.

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ primers	**901**	**17899A**	**DiGT5C**	**IS 65**	**ISSR 3**	**ISSR 21**	**ISSR 24**	**UBC 809**	**UBC 841**
1759	0	1	0	0	0	0	0	0	0
1494	0	0	0	0	0	0	0	0	1
1000	0	0	0	0	0	0	1	0	0
884	0	0	0	0	0	1	0	0	0
525	0	0	1	0	0	0	0	0	0
449	0	0	0	0	0	0	0	1	0
350	0	0	0	0	1	0	0	0	0
346	1	0	0	0	0	0	0	0	0
235	0	0	0	1	0	0	0	0	0
231	0	0	0	0	0	0	0	1	0

Fig. 4.6.1.1.5.1. Fingerprint for pineapple variety Mauritius using nine ISSR primer profiles

	1	2	3	4	5	6	7	8
Amplicons size (bp)/ primers	**901**	**DAT**	**ISSR 2**	**ISSR 10**	**ISSR 24**	**UBC 808**	**UBC 809**	**UBC 841**
1225	1	0	0	0	0	0	0	0
1218	0	0	0	0	0	0	0	1
1127	0	0	0	1	0	0	0	0
1100	0	0	0	0	0	1	0	0
1033	0	0	0	0	1	0	0	0
1013	0	1	0	0	0	0	0	0
886	0	0	0	0	0	0	1	0
836	0	0	1	0	0	0	0	0
721	0	0	0	0	0	0	0	1
379	1	0	0	0	0	0	0	0
243	0	0	1	0	0	0	0	0

Fig. 4.6.1.1.5.2. Fingerprint for somaclonal variant (T-4) of pineapple variety Mauritius using eight ISSR primer profiles

	1	2	3
Amplicons size (bp)/ primers	**DiGT5C**	**ISSR 4**	**UBC 812**
1383	0	1	0
951	0	0	1
366	1	0	0

Fig. 4.6.1.1.5.3. Fingerprint for somaclonal variant (T-10) of pineapple variety Mauritius using three ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6
Amplicons size (bp)/ primers	**ISSR 2**	**ISSR 4**	**ISSR 24**	**MANNY**	**UBC 807**	**UBC 841**
1547	0	0	0	0	0	1
720	0	0	0	1	0	0
712	0	0	0	0	1	0
563	0	0	1	0	0	0
377	1	0	0	0	0	0
266	0	1	0	0	0	0

Fig. 4.6.1.1.5.5. Fingerprint for somaclonal variant (T-22) of pineapple variety Mauritius using six ISSR primer profiles

	1	2	3
Amplicons size (bp)/ primers	**17899A**	**MANNY**	**UBC 899**
1219	0	1	0
688	1	0	0
661	0	0	1
583	1	0	0

Fig. 4.6.1.1.5.6. Fingerprint for somaclonal variant (T-24) of pineapple variety Mauritius using three ISSR primer profiles

	1	2	3	4
Amplicons size (bp)/ primers	**ISSR 4**	**OMAR**	**(TC)10G**	**UBC 809**
1921	1	0	0	0
852	0	0	0	1
815	0	1	0	0
621	0	0	1	0

Fig. 4.6.1.1.5.7. Fingerprint for somaclonal variant (T-25) of pineapple variety Mauritius using four ISSR primer profiles

	1	2
Amplicons size (bp)/ primers	**ISSR 21**	**(TC)10G**
1362	1	0
825	1	0
557	0	1

Fig. 4.6.1.1.5.8. Fingerprint for somaclonal variant (T-43) of pineapple variety Mauritius using two ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4
Amplicons size (bp)/ primers	**IS 65**	**ISSR 24**	**MANNY**	**UBC 899**
1256	0	1	0	0
1067	0	0	0	1
968	0	0	1	0
890	1	0	0	0

Fig. 4.6.1.1.5.9. Fingerprint for somaclonal variant (T-47) of pineapple variety Mauritius using four ISSR primer profiles

	1	2
Amplicons size (bp)/ primers	**(CT)10A**	**ISSR 21**
688	0	1
680	1	0

Fig. 4.6.1.1.5.10. Fingerprint for somaclonal variant (T-69) of pineapple variety Mauritius using two ISSR primer profiles

	1	2	3	4	5	6	7	8	9	10
Amplicons size (bp)/ primers	**901**	**DAT**	**IS 65**	**ISSR 4**	**ISSR 7**	**ISSR 18**	**ISSR 24**	**OMAR**	**UBC 808**	**UBC 812**
1816	0	0	0	1	0	0	0	0	0	0
1329	0	0	0	0	0	0	0	0	1	0
1294	1	0	0	0	0	0	0	0	0	0
1264	0	0	0	0	0	1	0	0	0	0
1184	0	0	1	0	0	0	0	0	0	0
1156	0	0	0	0	0	0	0	1	0	0
1113	0	1	0	0	0	0	0	0	0	0
1050	0	0	0	0	0	0	0	0	1	0
1035	0	0	0	0	0	0	0	0	0	1
955	0	0	0	0	0	1	0	0	0	0
942	0	1	0	0	0	0	0	0	0	0
936	0	0	0	0	0	0	0	1	0	0
870	0	0	0	0	1	0	0	0	0	0
858	0	0	0	0	0	0	0	0	0	1
717	1	0	0	0	0	0	0	0	0	0
688	0	0	0	0	0	0	0	0	1	0
684	0	0	0	0	1	0	0	0	0	0
646	0	0	0	0	0	0	0	1	0	0
543	0	0	0	0	0	0	0	0	1	0
429	0	0	0	0	0	0	1	0	0	0

Fig. 4.6.1.1.5.11. Fingerprint for somaclonal variant (T-71) of pineapple variety Mauritius using ten ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ primers	**AW 3**	**DAT**	**IS 61**	**IS 65**	**ISSR 4**	**ISSR 7**	**ISSR 10**	**UBC 809**	**UBC 812**
1236	0	0	0	0	0	0	1	0	0
1158	0	0	0	1	0	0	0	0	0
1086	0	0	0	0	0	0	1	0	0
891	0	0	0	0	1	0	0	0	0
826	0	0	0	0	0	1	0	0	0
822	0	0	0	0	0	0	1	0	0
768	0	0	1	0	0	0	0	0	0
728	0	0	0	0	0	0	0	1	0
629	0	0	0	0	0	0	1	0	0
616	1	0	0	0	0	0	0	0	0
425	0	0	0	0	0	0	0	0	1
414	0	0	0	0	0	0	0	1	0
338	0	0	0	0	0	0	1	0	0
278	0	0	0	0	0	1	0	0	0
223	0	1	0	0	0	0	0	0	0

Fig. 4.6.1.1.5.12. Fingerprint for somaclonal variant (T-75) of pineapple variety Mauritius using nine ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

4.6.2. Genotyping of Mauritius x Kew hybrids by using molecular markers

In the current study, Mauritius x Kew hybrids were grown out by following cultural practices as per the package of practices (POP) recommendations of Kerala Agricultural University and promising hybrid identification were recorded and described as per the descriptors for pineapple suggested by International Board for Plant Genetic Resources Rome, Italy (IBPGR, 1991).

With the advances of molecular breeding, in addition to morphological characterization, molecular characterization of the promising genotypes with ISSR markers was also envisaged to detect molecular diversity and aid varietal identity.

4.6.2.1. ISSR Marker analysis for characterization of Mauritius x Kew hybrids of pineapple

Inter simple sequence repeats (ISSR) markers were used to characterise, six Mauritius x Kew hybrids. ISSR markers that produced unique amplicons were followed for generating DNA fingerprints of selected hybrids.

4.6.2.1.1. Quality and quantity of DNA isolated

The isolation of high-quality molecular genomic DNA is the most important crucial thing for all molecular study of plant genotypes because of the extraction of impure and adulterated (proteins, polyphenols, *etc*.) DNA may change the end outcome results.

The high molecular genomic DNA was extracted from young leaves (three to four weeks old) of each of the genotypes using the modified CTAB method (Doyle and Doyle, 1987). These were tested for their quantity and quality (Table 4.6.2.1.1) by following manually Agarose Gel Electrophoresis method and NanoDrop assessing. The extracted DNA (Deoxyribonucleic acid) was confirmed to be of pure and sufficient quality for genomic analyses through Agarose Gel Electrophoresis as well as the assessing DNA purity through NanoDrop computation of the optical density values (ratio between absorbance at 260 nm and 280 nm). For quantity checking (µg/ml) of extracted molecular genomic DNA was also found to be significant enough to assure reproducibility of genomic analysis.

4.6.2.1.2. Genotyping of Mauritius x Kew hybrids with ISSR markers

To characterize and measure the extent of variation between the six Mauritius x Kew hybrids selected, along with parent material Mauritius, Kew and check variety Amritha, genomic DNA of each selected genotypes were subjected to polymerase chain reaction (PCR) amplification using fifteen ISSR markers for promising hybrids, which were mentioned in chapter-3 in Table 3.9.8. Among the fifteen ISSR markers were used for PCR amplification, all were showed polymorphic amplification. The nature of amplicons, number of amplicons, size of amplicons (bp), uniqueness of amplicons, the total number of amplicons, and Polymorphic Information Content (PIC) were generated using the ISSR markers are tabulated (Table 4.6.2.1.2).

In the ISSR primer sequences used in the investigations, a total of 260 amplicons were generating good and clear amplicons, of which 242 were found to be clearly amplified polymorphic in nature between all the six Mauritius x Kew hybrids selected, along with parent material Mauritius, Kew and check variety Amritha. The total number of amplified amplicons detected by an individual primer ranged from 11 to 25, with an average of 17.33 amplicons per primer. The minimum number of amplicons were recorded in IS-65 (11) and ISSR-4 (11), whereas, the highest number of amplicons was produced by UBC-864 (25) followed by UBC-811 (24), DiGT5C (23), MANNY (22), and ISSR-21 (20). The results are similar to the findings of da Silva *et al.* (2016) were reported the number of amplified bands for each primer varied from 1 to 8 with a mean of 4 bands per primer. Souza *et al.* (2017) had generated the number of amplified bands detected in the ISSR marker associated with the quality of pineapple fiber varied from 5 to 20 per primer. Wang *et al.* (2017), who screened 13 ISSR primers among 36 pineapple accessions and observed a range of 4 to 14 amplicons per primer also substantiate the present result.

On the other hand, the number of polymorphic amplicons produced per primer varied from 6 to 25, with an average of 16.13 amplicons per primer. While, the minimum number of polymorphic amplicons was recorded in IS-65 (6) and the highest number of polymorphic amplicons were produced by UBC-864 (25) followed by UBC-811 (24), DiGT5C (23), MANNY (20), and ISSR-21 (19). The results are similar to the findings of da Silva *et al.* (2016) were reported the number of polymorphic amplified bands for each primer varied with a mean of 10 bands per primer. Wang *et al.* (2017),

Table 4.6.2.1.1. Quality and quantity of DNA isolated of Mauritius x Kew hybrids

Varieties	Quantity (µg/ml)	Optical density values (260/280)
Mauritius	49.147	1.899
Kew	56.315	1.990
Amritha	126.98	2.189
H-17 (Treatment 1)	164.04	2.137
H-35 (Treatment 24)	146.17	2.142
H-43 (Treatment 7)	229.47	2.131
H-59 (Treatment 15)	169.18	2.071
H-66 (Treatment 8)	180.22	2.198
H-70 (Treatment 14)	132.62	2.041

who screened 13 ISSR primers among the 36 pineapple accessions and scored a total of 96 bands, of which 91 were polymorphic in nature. While, among the primers tested in the six Mauritius x Kew hybrids selected, along with parent material Mauritius, Kew and check variety Amritha produced easily detectable fragments on agarose gel, providing the number of the uniqueness of amplicons ranged from 1 to 7. The minimum number of unique amplicons was recorded in ISSR-10 (1) and the highest number of unique amplicons was produced by UBC-864 (7) followed by DiGT5C (6), MANNY (6), and UBC-811 (5).

All the screened ISSR primers according to their ability to generate polymorphic in nature, the size of the overall amplicons varied from 88 bp (OMAR: 88 bp-1100 bp) to 1467 bp (UBC-864: 323 bp-1467 bp). Similar results have been reported by Vanijajiva (2012) had observed the size of amplified 56 bands ranged from 100 bp to 2000 bp in pineapple accession on using 4 ISSR markers.

The percentage polymorphic amplicons (PPA) ranged from 54.55 to 100 per cent with an average of 91.55 per cent across fifteen ISSR primers across the nine genotypes of pineapple studied. The lowest percentage polymorphic amplicons were recorded in IS-65 (54.55 %), whereas the highest (100 %) percentage polymorphic amplicons were generated from DiGT5C, ISSR-4, OMAR, UBC-808, UBC-809, and UBC-811. This result was approximately less than that reported in another study on pineapple (93.65 % Wang *et al.,* 2017) but more than that reported by Vanijajiva (2012) in pineapple (41.66-53.84 %).

The Polymorphic Information Content (PIC) generates an assessment of the unfair power of a primer to distinguish genotypes based on both the number of alleles produced and their relative frequency (Wang *et al.,* 2017). The primers with polymorphic information contents more than 0.50 are generally expected to be capable and beneficial in genotyping and also for determining the degree of polymorphism at a given locus (Vijayan, 2005). The Polymorphic Information Content (PIC) for 15 ISSR primers varied from 0.43 for IS-65 to 0.93 for UBC-864, and the average value was 0.73. Similar result findings were recorded by Wang *et al.* (2017), who screened 13 ISSR primers among 36 pineapple accessions and observed a PIC values of 0.13 to 0.36 with an average of 0.24.

ISSR analysis results (Table 4.6.2.1.2) indicated that out of 15 ISSR markers, 10 markers recorded a PIC values of more than 0.70. These were pointed out high discrimination and potential variation of those indicators. Wang *et al.* (2017) stated that a high PIC value indicates high polymorphism and the presence of a higher percentage of GA/TC repeats than the non-polymorphic primers, which may be the reason that shows the high diversity and differentiation power of that marker among the pineapple hybrids.

4.6.2.1.3. Cluster analysis and dendrogram construction of Mauritius x Kew hybrids using ISSR data

The cluster analysis using the ISSR profile indicated that the presence of high genetic variation between all the six Mauritius x Kew hybrids selected, along with parent material Mauritius, Kew and check variety Amritha studied. The phylogenetic reconstruction based on the corresponding Jaccard's similarity coefficient (JSCs) was performed using the unweighted pair group method with arithmetic averaging (UPGMA) approach after analysis of amplification patterns generated by fifteen polymorphic markers across the nine pineapple genotypes.

A UPGMA based dendrogram showed that the nine pineapple genotypes could be further classified into three main clusters (I-III) when the similarity coefficient was 0.61 (Table 4.6.2.1.3.1 and Fig. 4.6.2.1.3). Among the three clusters, cluster II was the largest cluster, consisting of six pineapple genotypes (Kew, H-17, H-35, H-43, H-59, and H-66) and was divided into two, sub-clusters IIA with two genotypes (H-59 and H-66) and sub-cluster IIB with four genotypes (Kew, H-17, H-35, and H-43), this was also classified into two sub-clusters, sub-clusters IIBA with two genotypes (Kew and H-17) and sub-cluster IIBB with H-35 and H-43, whereas, cluster III have consisted two pineapple genotypes (Mauritius and Amritha), the remaining cluster I was consisting of single genotype H-70. The results showed that genotypes Mauritius, Amritha, Kew, H-17, H-35, H-43, H-59, and H-66 are characteristically related at genomic levels which have been generated by the 15 ISSR markers screened in the present evaluation study.

The Jaccard's similarity coefficients (JSCs) data recorded are present in Table 4.6.2.1.3.2. The genetic similarity indices obtained on the basis of corresponding 15

Table 4.6.2.1.2. Particulars of ISSR primer profiling in the Mauritius x Kew hybrids

Sl no.	Primer name	Annealing temperature (°C)	Nature of amplification	Number of amplicons	Number of polymorphic amplicons	Size of amplicons (bp)	Uniqueness of amplicons	PIC	PPA
1	AW 3	54.0	Polymorphic	15	14	283-1337	4	0.72	93.33
2	DiGT5C	54.0	Polymorphic	23	23	432-1450	6	0.87	100.00
3	IS 61	50.0	Polymorphic	17	16	221-1067	4	0.69	94.12
4	IS 65	47.0	Polymorphic	11	6	327-1079	3	0.43	54.55
5	ISSR 2	54.0	Polymorphic	16	14	243-1221	3	0.67	87.50
6	ISSR 4	51.0	Polymorphic	11	11	307-1367	4	0.73	100.00
7	ISSR 10	54.0	Polymorphic	15	12	304-1178	1	0.60	80.00
8	ISSR 21	52.0	Polymorphic	20	19	273-1350	3	0.74	95.00
9	MANNY	52.3	Polymorphic	22	20	228-1271	6	0.80	90.91
10	OMAR	54.3	Polymorphic	14	14	88-1100	3	0.74	100.00
11	UBC 807	54.0	Polymorphic	12	10	234-1087	3	0.61	83.33
12	UBC 808	54.0	Polymorphic	18	17	370-1308	3	0.73	94.44
13	UBC 809	54.0	Polymorphic	17	17	258-1073	3	0.88	100.00
14	UBC 811	53.0	Polymorphic	24	24	231-1258	5	0.82	100.00
15	UBC 864	54.0	Polymorphic	25	25	323-1467	7	0.93	100.00

ISSR markers between the nine pineapple genotypes ranged from 0.56 to 0.74, which indicates that the existence of a moderate level of variation between the studied genotypes. This may be due to the use of genotypes from the same parent source Mauritius and Kew rather than dissimilar ones. A similar finding of results of pineapple accessions ranged of Jaccard's similarity coefficient values (0.50 to 0.89) was found during ISSR analysis, with an average of 0.74 genetic diversity analysis of pineapple genotypes (Wang *et al.*, 2017).

Among the pineapple hybrids evaluated, hybrid H-59 and H-66, registered the high level of Jaccard's genetic similarity relationship among the selected hybrids with parent source Mauritius and Kew studied with a genetic similarity coefficient of 0.74, indicating higher similarity in the genetic makeup of composition among them, followed by hybrids H-17, H-35, and H-43 (0.72). The minimum similarity was showed by hybrid H-70 with parent genotypes Mauritius, Kew, and check variety Amritha (0.56), which is indicating that the existence of significant genetic variation between these selected hybrids. The genetic similarity coefficient values help the breeder to select these three selected promising hybrids (H-17, H-35, and H-43) for the varietal hybridization program that would be leading to the creation of the current situation demanding pineapple variety for yield and quality.

To summarise the research findings of Mauritius x Kew hybrids, the 50 ISSR primers can be widely considered for genetic diversity differentiation, identification of variant genotypes, cultivars, varieties, and genetic diversity analysis of pineapple. This further indicated that the capability of these microsatellite-based ISSR genetic markers in fingerprinting as it examines and detects variation in different parts of genomic sequence among genotypes neutrally without any biases. The current study investigation was confirmed with previous studies conducted in pineapple (da Silva *et al.*, 2016; Souza *et al.*, 2017; Wang *et al.*, 2017).

4.6.2.1.4. DNA fingerprinting using polymorphic ISSR

To generate ISSR fingerprinting of six Mauritius x Kew hybrids along with parent source Mauritius, Kew, and check variety Amritha used in this study, the markers that generated at least one genotype-specific unique amplicons were selected. Fifteen polymorphic primers were used for fingerprinting and their detailed explanations are given below. The number of amplicons produced and the range of molecular amplicons size are presented in Table 4.6.2.1.2.

4.6.2.1.4.1. **AW-3**

AW-3 generated an amplification pattern in the gel is depicted in Plate 4.6.2.1.4.1. In Mauritius x Kew hybrids H-70, two unique amplification were obtained at 283 bp and 1337 bp (Fig. 4.6.2.1.4.1.), whereas a unique amplicons were also recorded at 1287 bp for hybrid H-66 and 1050 bp for Mauritius revealing its discriminatory power. Therefore, it may prove to be an ideal ISSR marker for clear proof of identity of variety Mauritius and hybrids namely H-66, H-70.

4.6.2.1.4.2. **DiGT5C**

Plate 4.6.2.1.4.2 shows the amplification of the banding pattern of ISSR marker DiGT5C. This primer is generated unique amplicons (Fig. 4.6.2.1.4.2) at 1417 bp for hybrid H-35, 1400 bp and 1167 bp for H-17, 1300 bp and 1067 bp for H-70, and at 567 bp for the check variety Amritha, making it appropriate for detecting these variable promising hybrids.

4.6.2.1.4.3. **IS-61**

Counting of amplified amplicons for its unique pattern of Mauritius x Kew hybrid genotypes of pineapple documented by the primer IS-61 (Plate 4.6.2.1.4.3) yielded a unique bands at 1067 bp and 877 bp in variety Kew, similarly hybrid genotype H-70 amplified unique bands at 648 bp and 474 bp (Fig. 4.6.2.1.4.3).

4.6.2.1.4.4. **IS-65**

The Mauritius x Kew hybrid genotypes DNA trials were documented in gel amplification by using primer IS-65 and the gel image with amplified pattern is presented (Plate 4.6.2.1.4.4). The more distinct and unique amplicons were recorded in hybrid H-17 at 763 bp and 597 bp, followed by hybrid genotype H-66 at 1079 bp (Fig. 4.6.2.1.4.4).

4.6.2.1.4.5. **ISSR-2**

On careful analysis of gel profile of the amplified polymorphic banding patterns generated by ISSR-2 in the nine pineapple hybrid genotypes under this study (Plate

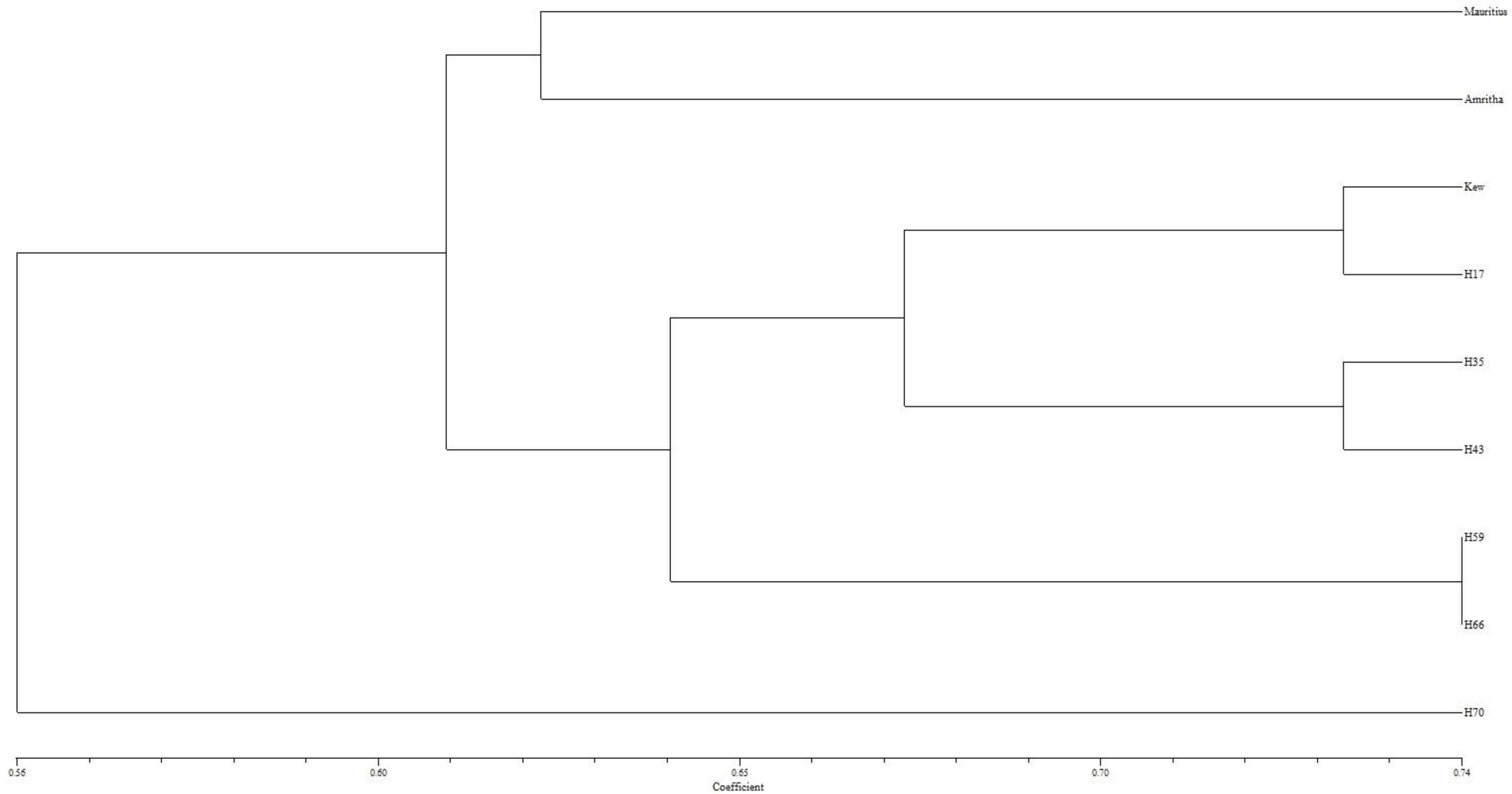


Fig. 4.6.2.1.3. Based on molecular data cluster analysis of Mauritius x Kew hybrids

Table 4.6.2.1.3.1. Clustering of the Mauritius x Kew hybrids based on ISSR profile

Cluster	Number of genotypes	Genotypes of cluster
I	1	H-70
II	6	Kew, H-17, H-35, H-43, H-59, and H-66
III	2	Mauritius, Amritha

Table 4.6.2.1.3.2. Pair wise similarity between the Mauritius x Kew hybrids based on ISSR profile

	Mauritius	Kew	Amritha	H-17	H-35	H-43	H-59	H-66	H-70
Mauritius	-								
Kew	0.61	-							
Amritha	0.62	0.62	-						
H-17	0.61	0.72	0.62	-					
H-35	0.61	0.72	0.62	0.72	-				
H-43	0.61	0.72	0.62	0.72	0.64	-			
H-59	0.61	0.64	0.62	0.64	0.64	0.64	-		
H-66	0.61	0.64	0.62	0.64	0.64	0.64	0.74	-	
H-70	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	-

4.6.2.1.4.5). Respectively, a unique amplicons were observed at 1221 bp for hybrid H-35, 767 bp for Amritha, and 467 bp in the H-66 (Fig. 4.6.2.1.4.5). This result makes ISSR-2 effective in distinguishing these hybrids from each other.

4.6.2.1.4.6. **ISSR-4**

Amplification of genomic DNA of Mauritius x Kew hybrids along with parent material using primer ISSR-4 (Plate 4.6.2.1.4.6) generated unique amplicons in hybrid H-70 at 1322 bp, in hybrid H-35 at 1211 bp, in donar parent Kew at 697 bp, and 586 bp in recurrent parent Mauritius (Fig. 4.6.2.1.4.6). Hence, ISSR-4 can be successfully used for differentiating two hybrids along with parent genotypes.

4.6.2.1.4.7. **ISSR-10**

The PCR-produced amplification pattern of selected Mauritius x Kew hybrids along with parent genotypes by using ISSR-10 (Plate 4.6.2.1.4.7) was analyzed. One unique fragment at 956 bp was obtained in hybrid H-70 (Fig. 4.6.2.1.4.7), making this primer suitable for identifying this promising hybrid from selected genotypes.

4.6.2.1.4.8. **ISSR-21**

ISSR-21 fragmented amplicons in gel profile are shown in Plate 4.6.2.1.4.8. Clear unique bands at 1306 bp and 273 bp (Fig. 4.6.2.1.4.8) were recorded in hybrid H-70. Respectively, the uniqueness of bands was found at 830 bp for recurrent parent Mauritius. This ISSR primer may be approved to generate the fingerprints for the above-selected hybrid along with Mauritius and henceforward can help in varietal identification.

4.6.2.1.4.9. **MANNY**

Genomic DNA fragmentation of selected Mauritius x Kew hybrids along with check genotypes by using MANNY (Plate 4.6.2.1.4.9) amplified unique fragments were in check variety Amritha at 1271 bp, 940 bp, 693 bp, and 354 bp respectively. In case hybrid H-35 at 1235 bp and at 976 bp in hybrid H-70 (Fig. 4.6.2.1.4.9). ISSR primer MANNY can be effectively referred to for distinguishing above mentioned hybrids.

4.6.2.1.4.10. **OMAR**

The amplification pattern in the gel picture generated by OMAR (Plate 4.6.2.1.4.10) was wisely counted. This primer was produced unique amplicons at 1100 bp for hybrid H-17, more distinct amplicons at 813 bp for hybrid H-70, whereas for hybrid genotype H-66 at 498 bp (Fig. 4.6.2.1.4.10), and henceforward, it can be capable to use for distinguishing between these three hybrid genotypes as well as other studied genotypes.

4.6.2.1.4.11. **UBC-807**

UBC-807 detected for identification of amplification of various fragments in the studied Mauritius x Kew hybrids (six) is depicted in Plate 4.6.2.1.4.11. In case of recurrent parent, unique amplicons was recorded at 484 bp whereas for hybrid H-59 uniqueness was at 927 bp. In the promising hybrid genotype H-70, a unique band at 1087 bp was found (Fig. 4.6.2.1.4.11) to consider the difference of this marker. This primer can be used as an ideal primer for unequivocal identification of this selected prominent hybrids.

4.6.2.1.4.12. **UBC-808**

The recording of amplified amplicons in selected six Mauritius x Kew hybrids along with check genotypes generated by this genetic marker UBC-808 (Plate 4.6.2.1.4.12) produced unique fragments at 1038 bp, 705 bp, and 370 bp in hybrid H-17, Mauritius, and hybrid H-35 (Fig. 4.6.2.1.4.12). Henceforth, these two hybrid along with Mauritius can be distinguished from each other as well as from additionally evaluated hybrids using UBC-808.

4.6.2.1.4.13. **UBC-809**

The PCR finding of the amplified gel profile of selected six Mauritius x Kew hybrids along with check genotypes by using UBC-809 (Plate 4.6.2.1.4.13) was recorded. A uniqueness of amplicons at 987 bp was found (Fig. 4.6.2.1.4.13) for hybrid genotype H-17. For more unique bands generated through amplification of gel image at 472 bp for Kew, whereas check genotype Amritha was amplified at 343 bp. This ISSR marker hence proved to be appropriate for genetic diversity documentation of the hybrid genotype H-17, Kew, and Amritha.

4.6.2.1.4.14. **UBC-811**

The screening of primer UBC-811 produced unique amplicons in gel documentation (Fig. 4.6.2.1.4.14 and Plate 4.6.2.1.4.14) in promising selected hybrid H-70 at 1211 bp, 1063 bp, 984 bp, and 658 bp respectively. In similar way hybrid H-43 amplified uniqueness at 392 bp. Thus UBC-811 can aid as a perfect primer for identifying fingerprints of M x K hybrid genotypes H-43 and H-70.

4.6.2.1.4.15. **UBC-864**

The amplifying pattern obtained by ISSR primer UBC-864 (Plate 4.6.2.1.4.15) was counted to detection of unique amplicons. This primer was yielded four unique bands at 1220 bp, 1093 bp, 732 bp, and 600 bp in variety Mauritius, followed by H-35 amplified two unique bands at 1133 bp and 789 bp and at 1193 bp in H-70 (Fig. 4.6.2.1.4.15). From this, it can be recommended for the identification of selected M x K hybrids along with Mauritius.

4.6.2.1.5. DNA fingerprinting of individual Mauritius x Kew hybrids along with check varieties using ISSR profile

The individual data of selected six Mauritius x Kew hybrids along with check varieties namely Mauritius, Kew, and Amritha by using ISSR profile images with the help of selected 15 ISSR markers for further utilization of locating useful unique amplicons in each prominent hybrid genotypes. An associated unique amplicons color chart was developed. These result findings can be highly useful in distinguishing and characterizing these selected hybrid genotypes from the others. The individual genotypes wise DNA fingerprint details are explained below.

4.6.2.1.5.1**. Mauritius**

On examination of PCR amplified gel images produced by fifteen selected ISSR primers, it was noted that six primers *viz*., AW-3 at 1050 bp, ISSR-4 at 586 bp, ISSR-21 at 830 bp, UBC-807 at 484 bp, and UBC-808 at 705 bp observed carefully unique and distinct amplicons. In addition to more amplification, UBC-864 was generated four unique bands at 1220 bp, 1093 bp, 732 bp, and 600 bp respectively. The size of amplicons (bp) generated by these six ISSR primers ranged from 484 bp to 1220 bp.

The fingerprints generated in a variety of Mauritius using clearly distinct fragments with the six primers are presented in Fig. 4.6.2.1.5.1.

4.6.2.1.5.2. **Kew**

From the amplification of PCR amplified gel profiles observed for donor parent Kew using 15 ISSR genetic markers, three polymorphic primers were selected to make the fingerprint of the Kew (Fig. 4.6.2.1.5.2). Two unique bands were produced IS-61 at 1067 bp and 877 bp. In addition to these amplifications at 697 bp (ISSR-4) and 472 bp (UBC-809) unique amplicons were obtained for the Kew. The size of amplicons produced by these three polymorphic primers ranged from 472 bp to 1067 bp. Maximum unique amplicons were generated by ISSR primers IS-61 (2) and the minimum number of unique bands (1) counted by ISSR-4 and UBC-809.

4.6.2.1.5.3. **Amritha**

Four out of 15 ISSR primers identified distinct and unique amplicons in check variety Amritha (Fig. 4.6.2.1.5.3). The size of all unique amplicons generated by DiGT5C, ISSR-2, MANNY, and UBC-809 in Amritha ranged from 343 bp to 1271 bp. The number of unique amplicons amplified varies at 567 bp (DiGT5C), 767 bp (ISSR-2), and 343 bp (UBC-809). More in unique amplification four unique fragments were observed correspondingly in MANNY at 1271 bp, 940 bp, 693 bp, and 354 bp. It was noticed that the unique bands produced by markers DiGT5C, ISSR-2, MANNY, and UBC-809 individually, can be used for making the fingerprint of Amritha.

4.6.2.1.5.4. **H-17**

The fingerprint of PCR-produced gel was documented based on a unique banding pattern produced by five primers out of 15 ISSR microsatellite primers. The number of unique bands amplified at 1400 bp and 1167 bp for DiGT5C, 763 bp and 597 bp for IS-65, 1100 bp (OMAR), 1038 bp (UBC-808), and 987 bp (UBC-809) in this hybrid H-17 and the size of the amplicons ranged from 597 bp to 1400 bp. These markers were selected to develop the resourceful fingerprint for this promising hybrid (Fig. 4.6.2.1.5.4).

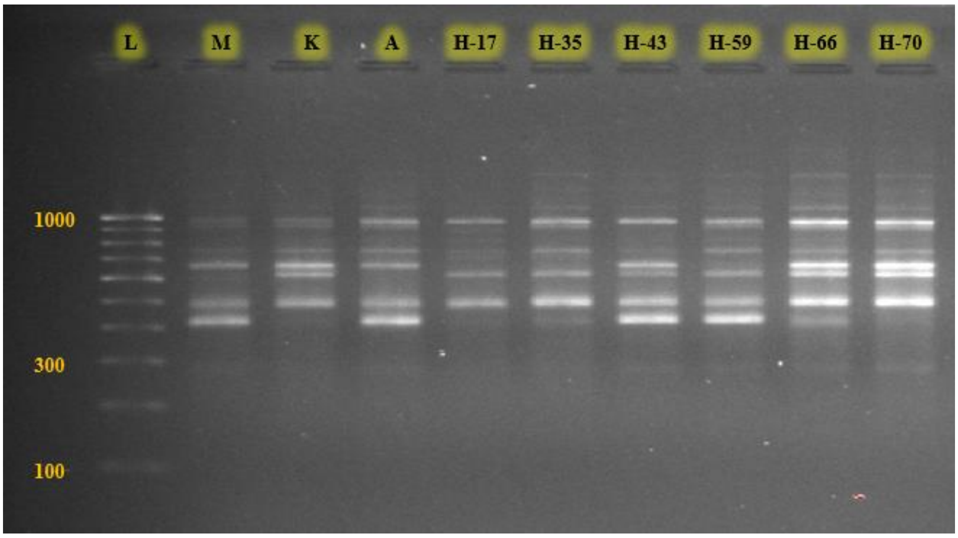


Plate 4.6.2.1.4.1. PCR amplified gel image of ISSR primers AW-3

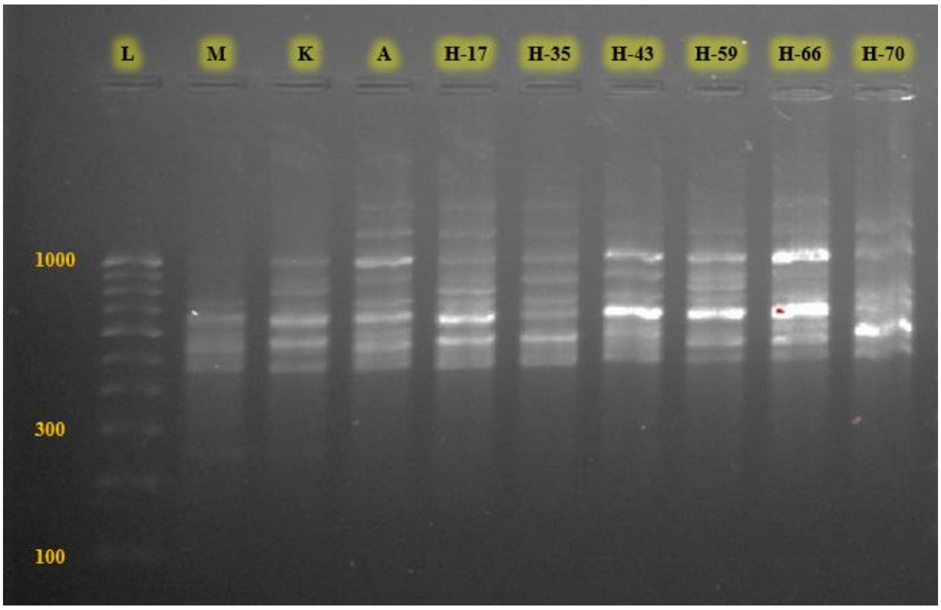


Plate 4.6.2.1.4.2. PCR amplified gel image of ISSR primer DiGT5C

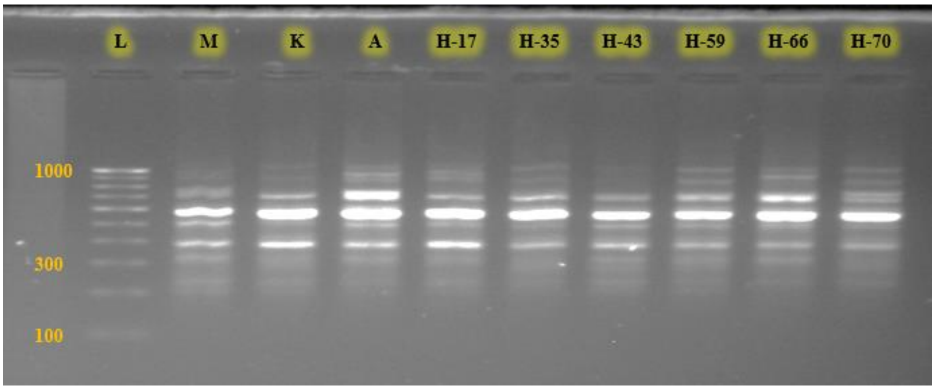


Plate 4.6.2.1.4.3. PCR amplified gel image of ISSR primer IS-61

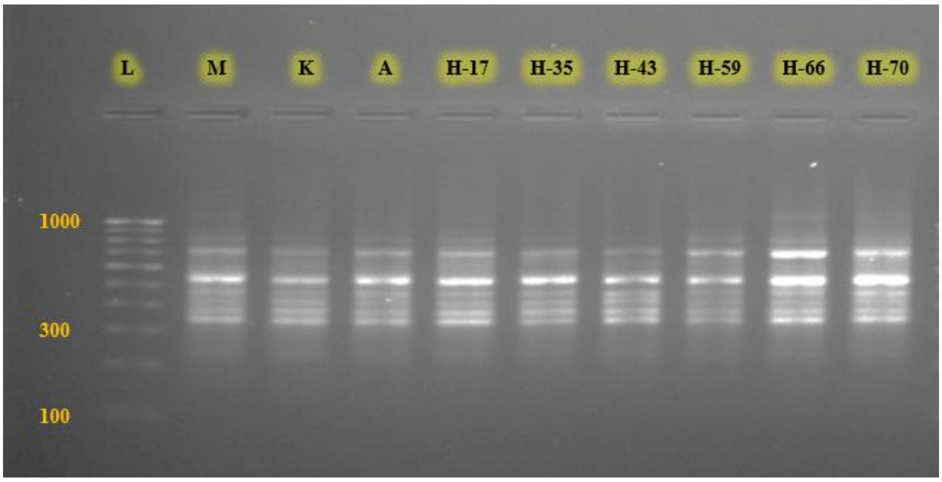


Plate 4.6.2.1.4.4. PCR amplified gel image of ISSR primer IS-65

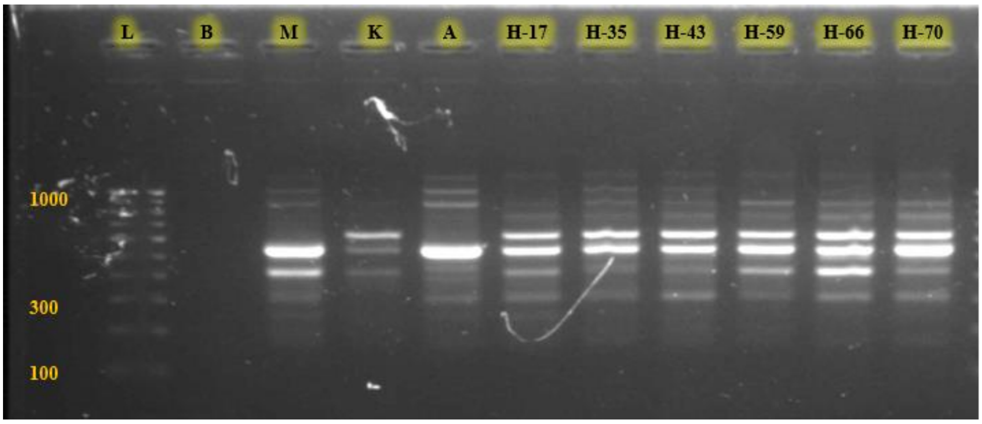


Plate 4.6.2.1.4.5. PCR amplified gel image of ISSR primer ISSR-2

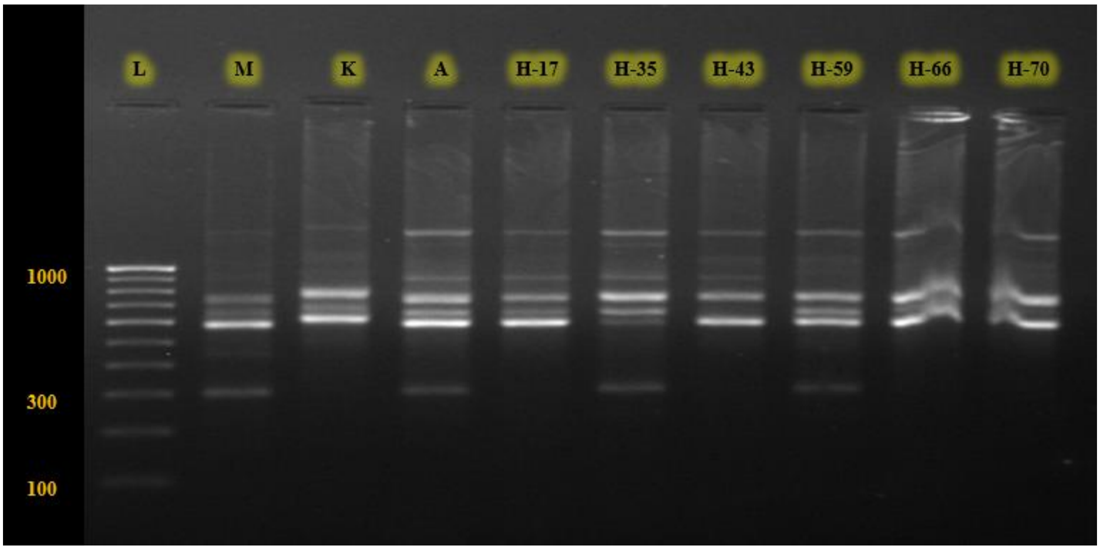


Plate 4.6.2.1.4.6. PCR amplified gel image of ISSR primer ISSR-4

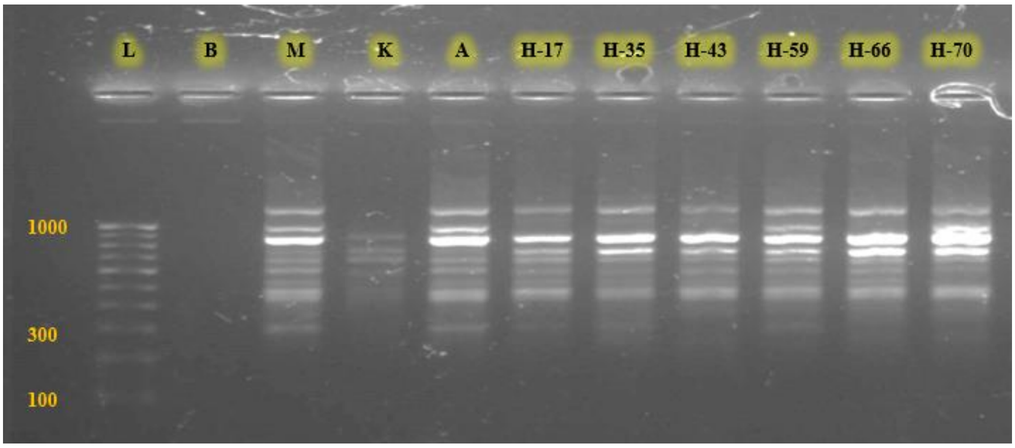


Plate 4.6.2.1.4.7. PCR amplified gel image of ISSR primer ISSR-10

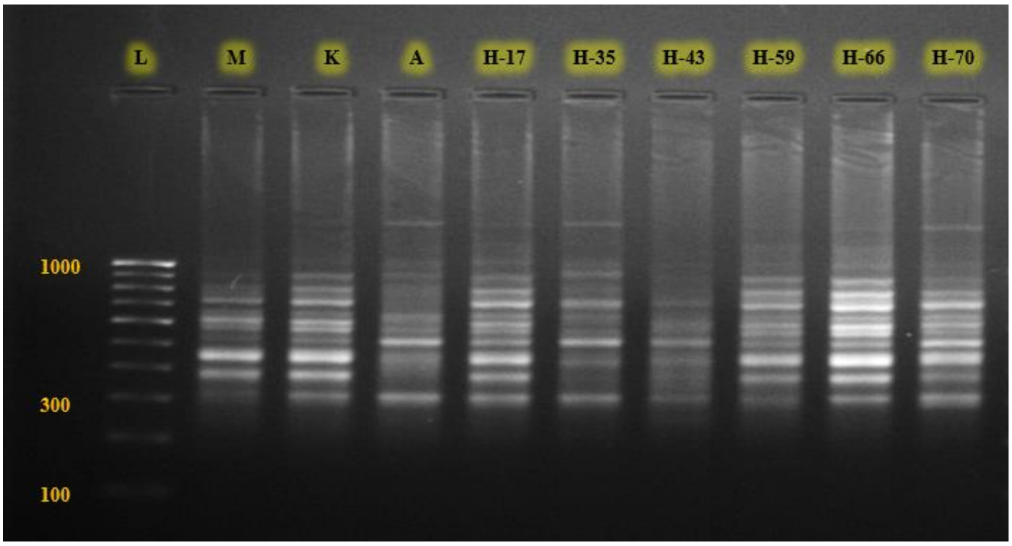


Plate 4.6.2.1.4.8. PCR amplified gel image of ISSR primer ISSR-21

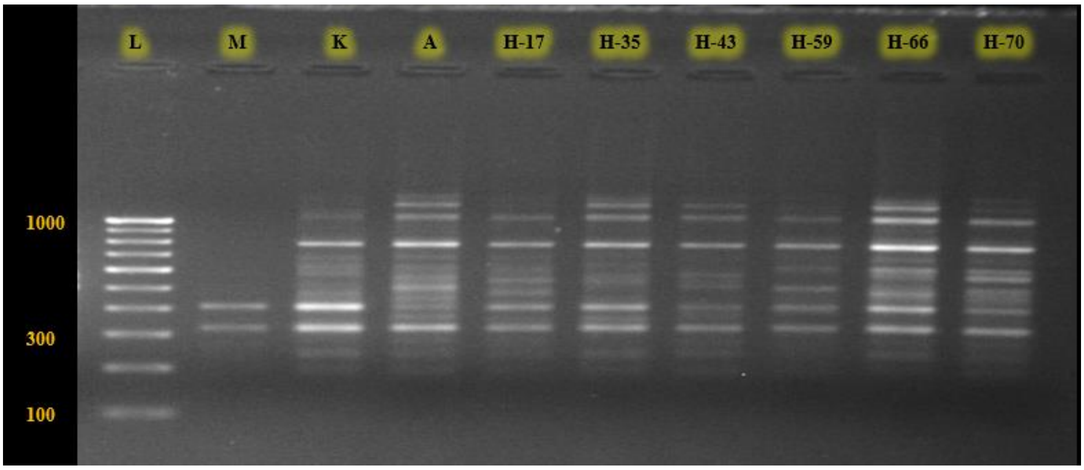


Plate 4.6.2.1.4.9. PCR amplified gel image of ISSR primer MANNY

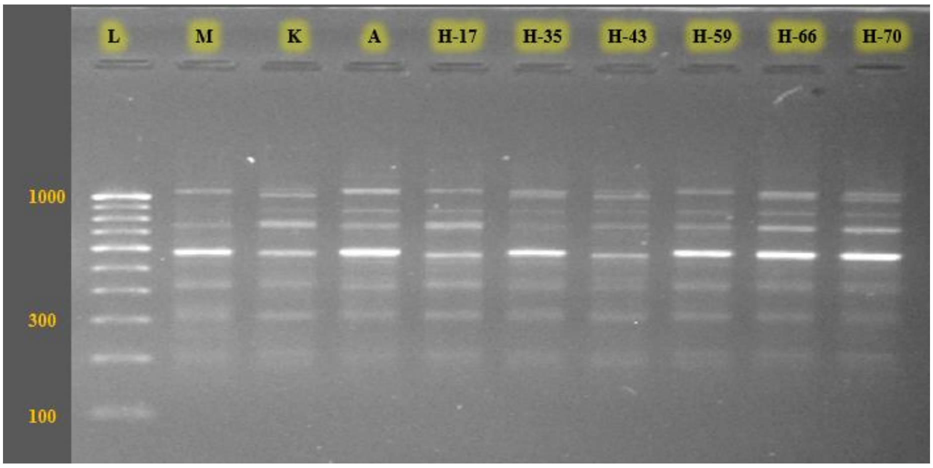
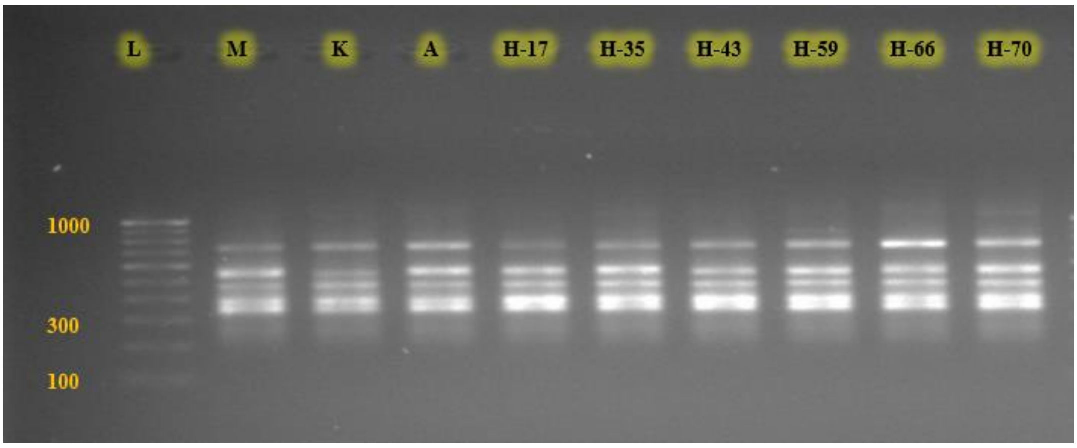


Plate 4.6.2.1.4.10. PCR amplified gel image of ISSR primer OMAR



Plates 4.6.2.1.4.11. PCR amplified gel image of ISSR primer UBC-807

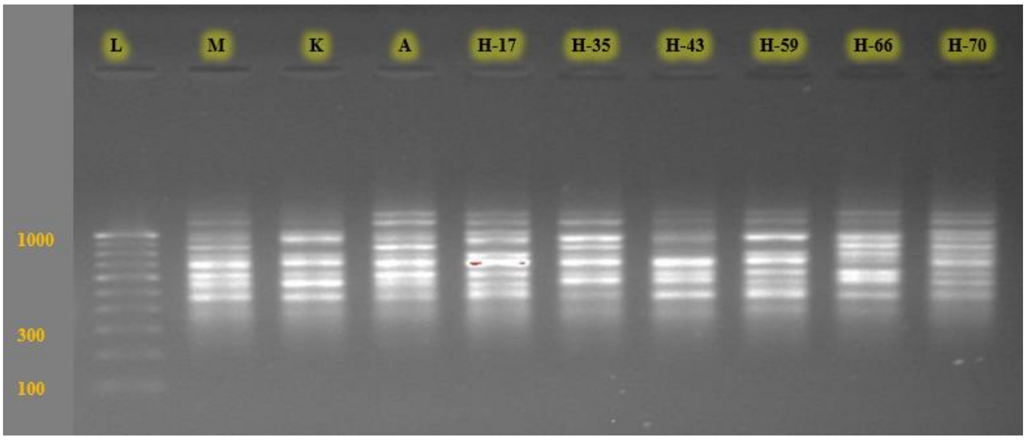


Plate 4.6.2.1.4.12. PCR amplified gel image of ISSR primer UBC-808

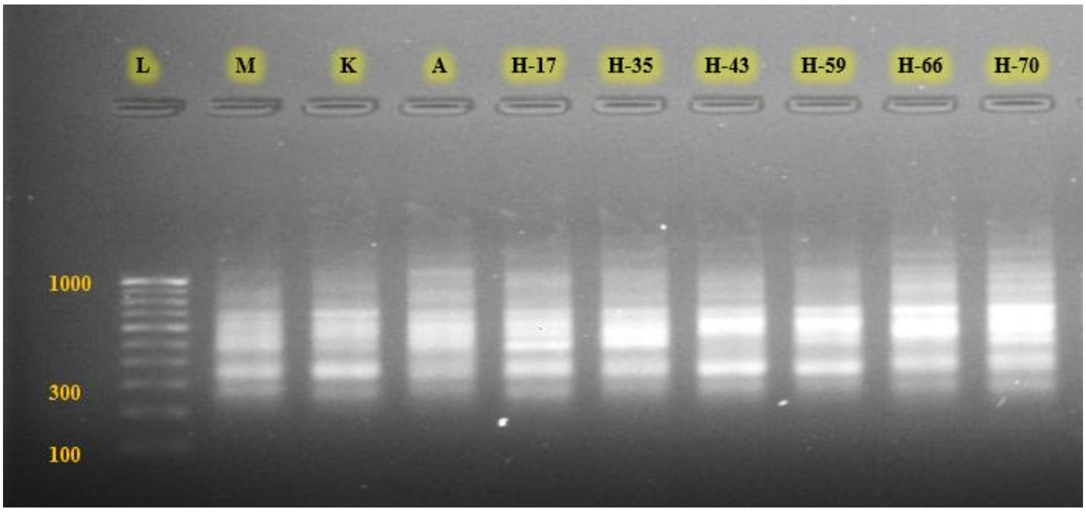


Plate 4.6.2.1.4.13. PCR amplified gel image of ISSR primer UBC-809

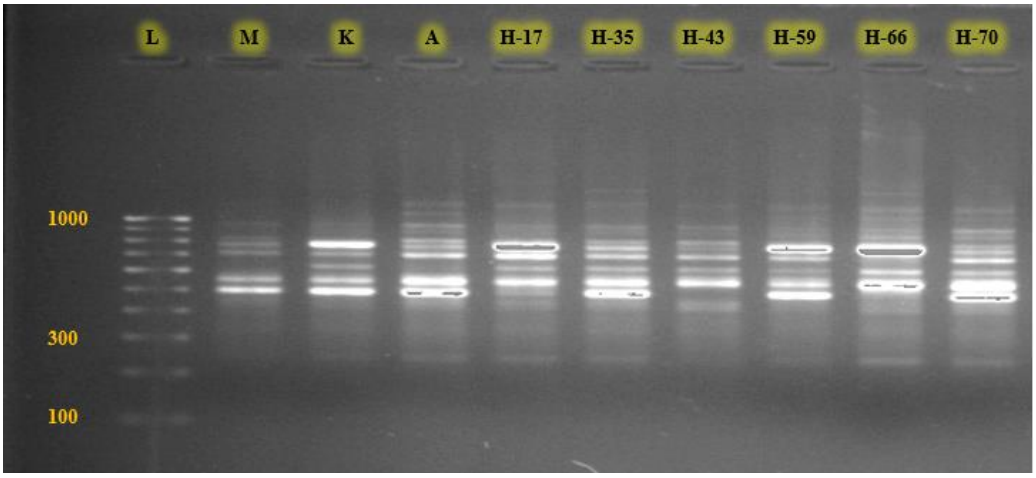


Plate 4.6.2.1.4.14. PCR amplified gel image of ISSR primer UBC-811

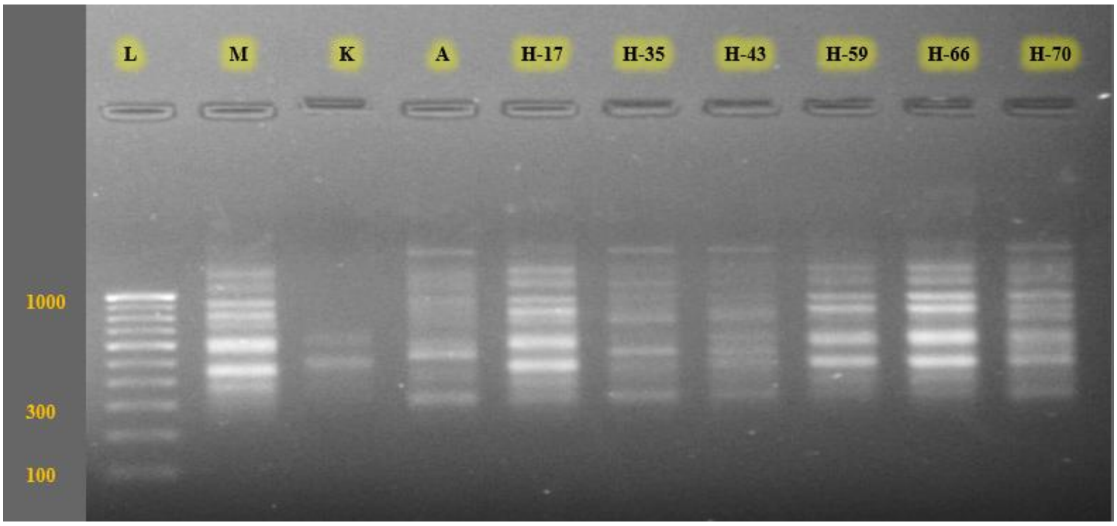


Plate 4.6.2.1.4.15. PCR amplified gel image of ISSR primer UBC-864

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1337	0	0	0	0	0	0	0	0	1
1287	0	0	0	0	0	0	0	1	0
1087	0	0	0	0	1	0	0	1	1
1050	1	0	0	0	0	0	0	0	0
1000	1	1	1	1	1	1	1	1	0
970	1	1	0	0	0	0	0	0	1
933	0	0	0	0	1	0	1	1	0
878	1	1	1	0	0	0	0	0	0
757	0	1	1	1	1	0	1	1	1
690	1	1	1	0	0	1	0	1	1
650	0	1	0	1	0	0	1	1	1
620	0	0	0	0	1	1	0	0	0
494	1	1	1	1	1	1	1	1	1
433	1	0	1	0	1	1	1	1	0
283	0	0	0	0	0	0	0	0	1

Fig. 4.6.2.1.4.1. Colour chart of ISSR primers AW-3

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1450	0	0	1	0	0	0	0	1	0
1417	0	0	0	0	1	0	0	0	0
1400	0	0	0	1	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	1
1250	0	0	0	0	1	1	0	0	0
1200	0	0	1	0	0	0	1	0	0
1167	0	0	0	1	0	0	0	0	0
1067	0	0	0	0	0	0	0	0	1
1017	0	0	0	0	1	1	1	1	0
984	1	1	1	1	0	0	0	0	0
882	0	0	0	0	0	1	1	0	1
831	0	0	1	0	1	0	0	0	0
789	0	1	0	0	0	0	1	0	0
756	0	0	1	1	0	1	0	0	1
723	0	1	1	0	1	0	1	0	0
688	1	0	1	1	0	0	0	1	1
641	0	0	1	0	1	1	1	0	0
610	1	1	0	1	0	0	0	0	1
567	0	0	1	0	0	0	0	0	0
540	0	1	1	1	1	1	1	1	0
507	1	0	1	0	0	0	0	0	1
473	0	0	0	1	1	1	1	1	0
439	1	1	1	0	0	0	0	0	0

Fig. 4.6.2.1.4.2. Colour chart of ISSR primer DiGT5C

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1067	0	1	0	0	0	0	0	0	0
1040	0	0	1	0	1	0	0	0	0
1000	0	0	0	0	0	0	1	1	1
959	0	0	1	1	0	0	0	0	0
913	1	0	0	1	1	0	0	1	0
877	0	1	0	0	0	0	0	0	0
849	0	0	1	0	0	0	1	0	1
734	1	0	1	0	0	0	0	0	1
700	0	1	0	1	1	1	1	1	0
648	0	0	0	0	0	0	0	0	1
582	1	1	1	1	1	0	1	1	0
557	0	0	0	1	1	1	0	1	1
510	1	1	1	1	1	1	1	1	0
474	0	0	0	0	0	0	0	0	1
387	1	1	1	1	1	1	1	1	1
326	1	1	1	1	1	1	1	1	0
239	1	1	1	1	0	1	0	1	1

Fig. 4.6.2.1.4.3. Colour chart of ISSR primer IS-61

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1079	0	0	0	0	0	0	0	1	0
805	1	0	1	0	1	0	1	1	1
763	0	0	0	1	0	0	0	0	0
700	1	1	1	1	1	1	1	1	1
597	0	0	0	1	0	0	0	0	0
543	1	0	0	0	0	1	0	0	0
518	1	1	1	1	1	0	1	1	1
460	1	1	1	1	1	1	1	1	1
421	1	1	1	1	1	1	1	1	1
373	1	1	1	1	1	1	1	1	1
339	1	1	1	1	1	1	1	1	1

Fig. 4.6.2.1.4.4. Colour chart of ISSR primer IS-65

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1221	0	0	0	0	1	0	0	0	0
1193	0	0	1	0	0	1	1	1	1
1043	1	0	0	0	1	0	0	0	0
1014	0	0	1	0	0	1	1	0	0
886	1	0	1	1	1	1	1	1	1
794	0	0	0	1	1	1	1	1	1
767	0	0	1	0	0	0	0	0	0
636	1	1	1	1	1	1	1	1	1
531	0	1	1	1	1	1	1	1	1
497	1	0	0	0	1	0	0	0	0
467	0	0	0	0	0	0	0	1	0
430	1	1	1	1	1	1	1	1	1
369	0	0	1	1	0	0	0	0	0
337	1	0	0	0	1	1	1	1	1
308	0	0	1	1	1	0	0	0	0
251	1	0	0	1	0	0	0	0	0

Fig. 4.6.2.1.4.5. Colour chart of ISSR primer ISSR-2

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1367	1	1	1	1	1	1	1	1	0
1322	0	0	0	0	0	0	0	0	1
1211	0	0	0	0	1	0	0	0	0
916	0	0	1	1	1	1	0	0	0
780	0	1	0	0	1	1	1	1	0
745	1	0	1	1	0	0	0	0	1
697	0	1	0	0	0	0	0	0	0
662	1	0	1	1	1	0	1	1	0
619	0	1	1	1	1	1	1	1	1
586	1	0	0	0	0	0	0	0	0
316	1	0	1	0	1	0	1	0	0

Fig. 4.6.2.1.4.6. Colour chart of ISSR primer ISSR-4

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1178	1	0	1	1	1	1	1	1	1
1067	0	0	0	1	0	1	1	0	0
1039	0	0	0	0	1	0	0	1	0
984	1	0	1	0	0	0	1	0	0
956	0	0	0	0	0	0	0	0	1
888	0	1	0	1	1	1	1	0	0
859	1	0	1	0	0	0	0	1	1
757	1	1	1	1	1	1	1	1	1
693	1	1	1	1	1	1	1	1	1
614	1	1	1	1	1	1	1	1	1
541	1	0	1	1	1	0	0	1	0
506	0	0	0	0	1	1	1	1	1
477	1	0	1	1	1	1	0	0	1
447	1	0	1	1	0	0	1	1	0
308	1	0	1	0	0	0	0	0	0

Fig. 4.6.2.1.4.7. Colour chart of ISSR primer ISSR-10

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1350	0	0	1	0	1	0	0	0	0
1306	0	0	0	0	0	0	0	0	1
900	0	1	0	0	1	0	0	0	0
867	0	0	1	1	0	0	1	1	1
830	1	0	0	0	0	0	0	0	0
796	0	1	0	1	1	0	0	0	0
757	0	0	0	0	0	0	1	1	1
715	1	1	0	1	1	1	0	0	0
681	0	0	0	0	0	1	1	1	1
640	1	1	1	1	1	0	1	0	1
609	1	1	0	1	0	0	0	1	0
577	0	0	0	1	0	0	1	1	1
549	0	0	1	0	1	0	1	1	1
505	0	1	1	1	1	1	1	1	1
469	1	1	1	0	0	0	0	0	0
444	0	1	0	1	0	1	1	1	1
413	1	0	0	0	1	0	0	0	0
381	0	1	0	1	0	0	1	1	1
317	1	1	1	1	1	1	1	1	1
273	0	0	0	0	0	0	0	0	1

Fig. 4.6.2.1.4.8. Colour chart of ISSR primer ISSR-21

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1271	0	0	1	0	0	0	0	0	0
1235	0	0	0	0	1	0	0	0	0
1194	0	0	1	0	0	0	0	1	0
1165	0	0	0	0	1	1	0	1	0
1041	0	1	1	1	1	1	0	0	0
1006	0	0	0	0	0	0	1	1	0
976	0	0	0	0	0	0	0	0	1
940	0	0	1	0	0	0	0	0	0
777	0	1	1	1	1	1	1	0	0
749	0	0	0	0	0	0	0	1	1
693	0	0	1	0	0	0	0	0	0
664	0	1	0	0	0	0	0	1	0
610	0	1	1	0	0	0	1	1	1
574	0	1	1	0	0	1	0	1	1
542	0	0	0	1	1	0	0	0	0
506	0	1	1	0	0	1	1	0	1
475	0	0	0	1	0	0	0	1	0
446	0	0	1	0	0	0	0	0	1
407	1	1	1	1	1	1	1	1	1
354	0	0	1	0	0	0	0	0	0
321	1	1	1	1	1	1	1	1	1
236	0	1	0	0	1	1	0	1	0

Fig. 4.6.2.1.4.9. Colour chart of ISSR primer MANNY

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1100	0	0	0	1	0	0	0	0	0
1067	1	0	1	0	0	0	1	0	0
1033	0	1	0	0	1	1	0	1	1
851	0	0	1	1	0	0	1	1	0
813	0	0	0	0	0	0	0	0	1
747	0	1	1	0	1	0	1	0	0
711	1	0	0	1	0	1	0	1	1
581	1	1	1	1	1	0	1	0	0
553	0	0	0	0	0	1	0	1	1
498	0	0	0	0	0	0	0	1	0
457	1	1	1	1	0	1	0	1	1
423	0	0	0	0	1	0	1	0	0
225	1	1	1	1	1	1	1	1	0
109	0	1	0	1	1	1	1	1	0

Fig. 4.6.2.1.4.10. Colour chart of ISSR primer OMAR

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1087	0	0	0	0	0	0	0	0	1
927	0	0	0	0	0	0	1	0	0
782	0	0	0	0	0	1	1	1	1
759	1	1	1	1	1	0	0	0	0
596	0	0	1	1	1	1	1	1	1
564	1	1	0	0	0	0	0	0	0
515	0	1	1	1	1	1	1	1	1
484	1	0	0	0	0	0	0	0	0
407	1	1	1	1	1	1	1	1	1
372	1	1	1	1	1	1	1	1	1
285	1	1	0	1	1	1	1	0	1
253	0	0	1	0	0	0	0	1	1

Fig. 4.6.2.1.4.11. Colour chart of ISSR primer UBC-807

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1308	0	0	1	0	1	0	1	1	0
1269	1	0	0	1	0	0	0	0	1
1200	0	0	0	0	0	1	1	1	0
1169	0	0	1	1	1	0	0	0	1
1077	0	1	0	0	0	0	0	0	1
1038	0	0	0	1	0	0	0	0	0
992	1	0	0	0	0	0	1	1	0
960	0	1	1	1	1	1	0	0	1
882	1	0	1	0	1	0	0	1	1
800	0	1	0	1	0	0	1	1	0
740	0	1	1	1	1	1	1	0	1
705	1	0	0	0	0	0	0	0	0
638	1	0	1	1	1	1	1	0	1
588	0	0	1	0	1	1	1	1	0
559	1	1	0	1	0	0	0	0	1
493	1	1	1	1	1	1	1	1	1
397	1	1	0	1	0	1	1	0	0
370	0	0	0	0	1	0	0	0	0

Fig. 4.6.2.1.4.12. Colour chart of ISSR primer UBC-808

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1073	0	0	1	0	0	0	0	0	1
987	0	0	0	1	0	0	0	0	0
942	0	0	0	0	0	0	0	1	1
826	0	0	1	0	1	1	0	0	0
734	0	0	0	0	0	0	1	1	1
705	0	1	1	1	1	1	0	0	0
657	1	0	0	0	0	0	1	0	1
613	0	1	1	1	0	1	0	0	0
578	0	0	0	0	1	0	0	1	0
546	0	0	0	0	0	0	1	0	1
507	1	0	1	1	1	1	0	0	0
472	0	1	0	0	0	0	0	0	0
422	0	0	0	0	0	0	0	1	1
374	1	1	0	1	1	1	1	0	0
343	0	0	1	0	0	0	0	0	0
295	0	0	0	0	0	1	0	1	1
267	1	1	0	1	0	0	0	0	0

Fig. 4.6.2.1.4.13. Colour chart of ISSR primer UBC-809

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1258	0	0	0	0	1	0	0	1	0
1211	0	0	0	0	0	0	0	0	1
1132	0	0	1	1	1	0	0	0	0
1100	0	0	0	0	0	0	1	1	0
1063	0	0	0	0	0	0	0	0	1
1011	0	0	1	0	0	0	0	1	0
984	0	0	0	0	0	0	0	0	1
952	1	1	1	1	0	0	0	0	0
910	0	0	0	0	1	1	1	1	0
879	0	0	1	0	0	0	0	0	1
829	0	0	0	0	0	0	1	1	1
791	0	1	1	0	1	1	0	0	0
756	1	0	1	1	1	1	1	1	1
719	1	1	0	1	0	0	0	0	1
685	0	0	1	1	1	1	1	1	0
658	0	0	0	0	0	0	0	0	1
628	0	1	0	1	1	1	0	0	0
600	0	0	0	0	0	0	1	1	1
549	1	1	1	1	1	1	0	1	0
518	1	0	0	0	0	0	1	0	1
487	0	1	1	1	1	0	1	0	1
432	0	0	0	1	0	1	0	0	0
392	0	0	0	0	0	1	0	0	0
244	0	0	1	1	1	0	0	1	1

Fig. 4.6.2.1.4.14. Colour chart of ISSR primer UBC-811

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7	8	9
Amplicons size (bp)/ genotypes	**Mauritius**	**Kew**	**Amritha**	**H 17**	**H 35**	**H 43**	**H 59**	**H 66**	**H 70**
1467	0	0	0	0	1	0	0	0	1
1440	0	0	1	0	0	1	0	0	0
1273	0	0	0	1	0	0	1	1	0
1220	1	0	0	0	0	0	0	0	0
1193	0	0	0	0	0	0	0	0	1
1160	0	0	1	1	0	0	1	1	0
1133	0	0	0	0	1	0	0	0	0
1093	1	0	0	0	0	0	0	0	0
1013	0	0	0	0	0	0	1	1	1
960	0	0	1	1	0	0	0	0	0
926	1	0	0	0	0	0	0	0	1
881	0	0	1	1	0	0	1	1	0
843	1	0	0	0	0	1	0	0	1
789	0	0	0	0	1	0	0	0	0
732	1	0	0	0	0	0	0	0	0
662	0	0	0	0	0	0	0	1	1
634	0	1	0	1	0	0	1	0	0
600	1	0	0	0	0	0	0	0	0
569	0	0	1	0	1	1	0	0	0
530	0	0	0	0	0	1	1	1	1
500	0	1	0	1	0	0	0	0	0
463	1	0	1	0	0	0	0	0	0
411	1	0	0	1	0	0	0	1	0
362	0	0	0	0	1	0	0	0	1
335	0	0	1	1	0	1	0	0	0

Fig. 4.6.2.1.4.15. Colour chart of ISSR primer UBC-864

Colour code for shared amplicons among genotypes

Unique amplicons	Polymorphic amplicons	Monomorphic amplicons

4.6.2.1.5.5. **H-35**

From the amplification of gel profiles analyzed for the genomic DNA of selected hybrid H-35 by using 15 ISSR primers, six polymorphic primers were found to make fingerprints. The amplicons sizes generated by these six selected ISSR primers ranged from 370 bp to 1417 bp. Maximum unique amplicons were recorded by ISSR primer UBC-864 (2) while, single unique bands were noticed in five primers namely DiGT5C, ISSR-2, ISSR-4, MANNY, and UBC-808. Two polymorphic unique bands were produced by UBC-864 at 1133 bp and 789 bp, whereas, primers DiGT5C, ISSR-2, ISSR-4, MANNY, and UBC-808 produced unique fragments at 1417 bp, 1221 bp, 1211 bp, 1235 bp, and 370 bp correspondingly (Fig. 4.6.2.1.5.5). These three primers were used to obtain the DNA fingerprints of this variant T-24.

4.6.2.1.5.6. **H-43**

From the amplified gel images observed for the genomic DNA of selected Mauritius x Kew hybrid H-43 using 15 ISSR primers, out of these primers UBC-811 was amplified and distinguished unique amplifying band at 392 bp (Fig. 4.6.2.1.5.6) to make fingerprint for this hybrid H-43.

4.6.2.1.5.7. **H-59**

A single primer out of 15 ISSR primers produced unique fragment that help in characterizing selected Mauritius x Kew hybrid H-59 from the other hybrid treatments studied. A unique amplicons was detected by the UBC-807 ISSR primer at 927 bp (Fig. 4.6.2.1.5.7). Hence, genomic DNA fingerprints of this hybrid can be made from the UBC-807 primer.

4.6.2.1.5.8. **H-66**

The fingerprints of the PCR-produced gel profile were documented based on unique amplifying patterns presented by four out of 15 ISSR genetic primers. The number of unique amplicons counted at 1287 bp for AW-3 primer, 1079 bp for IS-65, 467 bp for ISSR-2, and 498 bp for OMAR primer in the promising hybrid H-66 and the size of the amplicons ranged from 467 bp to 1287 bp. These four markers were found to produce the clear fingerprint for this selected hybrid (Fig. 4.6.2.1.5.8).

4.6.2.1.5.9. **H-70**

Eleven markers out of 15 ISSR primers recognized distinct and unique fragments in Mauritius x Kew hybrid H-70 (Fig. 4.6.2.1.5.9). The number of unique bands generated by AW-3, DiGT5C, IS-61, ISSR-4, ISSR-10, ISSR-21, MANNY, OMAR, UBC-807, UBC-811, and UBC-864 in this selected promising hybrid ranged from 273 bp to 1337 bp. The unique amplicons vary with primers at 1337 bp and 283 bp for AW-3, 1300 bp and 1067 bp for DiGT5C, 648 bp and 474 bp for IS-61, 1322 bp (ISSR-4), 956 bp (ISSR-10), 1306 bp and 273 bp for ISSR-21, 976 bp (MANNY), 813 bp (OMAR), 1087 bp (UBC-807), and 1193 bp (UBC-864). In adding to four more unique bands were recorded in UBC-811 at 1211 bp, 1063 bp, 984 bp, and 658 bp respectively. It was identified that the unique bands produced by these markers, can be used for generating the fingerprints of this prominent hybrid H-70.

In contrast to the current study, the research findings were summarized with the evident of a combination of various dominant ISSR markers generated high level of uniqueness of bands could be helpful in creating varietal identity and differentiating individuals from a diverse pineapple populations. However, an individual ISSR primer that could be indicative of the complex genetic relationship between all the hybrids selected pineapple genotypes was not observed. But, ISSR primer DiGT5C developed DNA fingerprints in Amritha (567 bp), H-17 (1400 bp and 1167 bp), H-35 (1417 bp), H-70 (1300 bp and 1067 bp) and could distinguish between these four varieties and can help identify them appropriately. Another primer, In case of ISSR-4 also found unique DNA fingerprints in Mauritius (586 bp), Kew (697 bp), H-35 (1211 bp), and H-70 (1322 bp) can differentiate between these four selected hybrid genotypes and may help to identification them correctly.

4.6.3. Genotyping of Kew x Mauritius hybrids by using molecular markers

In the current study, Kew x Mauritius hybrids were grown out by following cultural practices as per the package of practices (POP) recommendations of Kerala Agricultural University and promising hybrid identification were recorded and described as per the descriptors for pineapple suggested by International Board for Plant Genetic Resources Rome, Italy (IBPGR, 1991).

	1	2	3	4	5	6
Amplicons size (bp)/ primers	**AW 3**	**ISSR 4**	**ISSR 21**	**UBC 807**	**UBC 808**	**UBC 864**
1220	0	0	0	0	0	1
1093	0	0	0	0	0	1
1050	1	0	0	0	0	0
830	0	0	1	0	0	0
732	0	0	0	0	0	1
705	0	0	0	0	1	0
600	0	0	0	0	0	1
586	0	1	0	0	0	0
484	0	0	0	1	0	0

Fig. 4.6.2.1.5.1. Fingerprint for pineapple variety Mauritius using six ISSR primer profiles

	1	2	3
Amplicons size (bp)/ primers	**IS 61**	**ISSR 4**	**UBC 809**
1067	1	0	0
877	1	0	0
697	0	1	0
472	0	0	1

Fig. 4.6.2.1.5.2. Fingerprint for pineapple variety Kew using three ISSR primer profiles

	1	2	3	4
Amplicons size (bp)/ primers	**DiGT5C**	**ISSR 2**	**MANNY**	**UBC 809**
1271	0	0	1	0
940	0	0	1	0
767	0	1	0	0
693	0	0	1	0
567	1	0	0	0
354	0	0	1	0
343	0	0	0	1

Fig. 4.6.2.1.5.3. Fingerprint for pineapple variety Amritha using four ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5
Amplicons size (bp)/ primers	**DiGT5C**	**IS 65**	**OMAR**	**UBC 808**	**UBC 809**
1400	1	0	0	0	0
1167	1	0	0	0	0
1100	0	0	1	0	0
1038	0	0	0	1	0
987	0	0	0	0	1
763	0	1	0	0	0
597	0	1	0	0	0

Fig. 4.6.2.1.5.4. Fingerprint for Mauritius x Kew hybrid (H-17) using five ISSR primer profiles

	1	2	3	4	5	6
Amplicons size (bp)/ primers	**DiGT5C**	**ISSR 2**	**ISSR 4**	**MANNY**	**UBC 808**	**UBC 864**
1417	1	0	0	0	0	0
1235	0	0	0	1	0	0
1221	0	1	0	0	0	0
1211	0	0	1	0	0	0
1133	0	0	0	0	0	1
789	0	0	0	0	0	1
370	0	0	0	0	1	0

Fig. 4.6.2.1.5.5. Fingerprint for Mauritius x Kew hybrid (H-35) using six ISSR primer profiles

	1
Amplicons size (bp)/ primers	**UBC 811**
392	1

Fig. 4.6.2.1.5.6. Fingerprint for Mauritius x Kew hybrid (H-43) using one ISSR primer profiles

	1
Amplicons size (bp)/ primers	**UBC 807**
927	1

Fig. 4.6.2.1.5.7. Fingerprint for Mauritius x Kew hybrid (H-59) using one ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4
Amplicons size (bp)/ primers	**AW-3**	**IS-65**	**ISSR-2**	**OMAR**
1287	1	0	0	0
1079	0	1	0	0
498	0	0	0	1
467	0	0	1	0

Fig. 4.6.2.1.5.8. Fingerprint for Mauritius x Kew hybrid (H-66) using four ISSR primer profiles

	1	2	3	4	5	6	7	8	9	10	11
Amplicons size (bp)/ primers	**AW -3**	**DiGT5C**	**IS-61**	**ISSR-4**	**ISSR-10**	**ISSR-21**	**MANNY**	**OMAR**	**UBC-807**	**UBC-811**	**UBC-864**
1337	1	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	1	0	0	0	0	0	0	0
1306	0	0	0	0	0	1	0	0	0	0	0
1300	0	1	0	0	0	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	1	0
1193	0	0	0	0	0	0	0	0	0	0	1
1087	0	0	0	0	0	0	0	0	1	0	0
1067	0	1	0	0	0	0	0	0	0	0	0
1063	0	0	0	0	0	0	0	0	0	1	0
984	0	0	0	0	0	0	0	0	0	1	0
976	0	0	0	0	0	0	1	0	0	0	0
956	0	0	0	0	1	0	0	0	0	0	0
813	0	0	0	0	0	0	0	1	0	0	0
658	0	0	0	0	0	0	0	0	0	1	0
648	0	0	1	0	0	0	0	0	0	0	0
474	0	0	1	0	0	0	0	0	0	0	0
283	1	0	0	0	0	0	0	0	0	0	0
273	0	0	0	0	0	1	0	0	0	0	0

Fig. 4.6.2.1.5.9. Fingerprint for Mauritius x Kew hybrid (H-70) using four ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

With the advances of molecular breeding, in addition to morphological characterization, molecular characterization of the promising hybrid genotypes with ISSR markers was also envisaged to detect molecular diversity and aid varietal identity.

4.6.3.1. ISSR Marker analysis for characterization of Kew x Mauritius hybrids of pineapple

Inter simple sequence repeats (ISSR) markers were used to characterise, four Kew x Mauritius hybrids. ISSR markers that produced unique amplicons were followed for generating DNA fingerprints of selected promising hybrids.

4.6.3.1.1. Quality and quantity of DNA isolated

The isolation of high-quality molecular genomic DNA is the most important crucial thing for all molecular study of plant genotypes because of the extraction of impure and adulterated (proteins, polyphenols, *etc*.) DNA may change the end outcome results.

The high molecular genomic DNA was extracted from young leaves (three to four weeks old) of each of the genotypes using the modified CTAB method (Doyle and Doyle, 1987). These were tested for their quantity and quality (Table 4.6.3.1.1) by following manually Agarose Gel Electrophoresis method and NanoDrop assessing. The extracted DNA (Deoxyribonucleic acid) was confirmed to be of pure and sufficient quality for genomic analyses through Agarose Gel Electrophoresis as well as the assessing DNA purity through NanoDrop computation of the optical density values (ratio between absorbance at 260 nm and 280 nm). For quantity checking (µg/ml) of extracted molecular genomic DNA was also found to be significant enough to assure reproducibility of genomic analysis.

4.6.3.1.2. Genotyping of Kew x Mauritius hybrids with ISSR markers

To characterize and measure the extent of variation between the four Kew x Mauritius hybrids selected, along with parent material Kew, Mauritius, and check variety Amritha, genomic DNA of each selected genotypes were subjected to Polymerase Chain Reaction (PCR) amplification using fifteen ISSR markers for promising four hybrids, which were mentioned in chapter-3 (Table 3.9.8). Among the fifteen ISSR markers were used for PCR amplification, all were showed polymorphic amplification. The nature of amplicons, number of amplicons, size of amplicons (bp), uniqueness of amplicons, Polymorphic Information Content (PIC), and Percentage Polymorphic Amplicons (PPA) were generated using the ISSR markers are tabulated (Table 4.6.3.1.2).

In the ISSR primer sequences used in the investigations, a total of 272 amplicons were generating good and clear amplicons, of which 247 were found to be clearly amplified polymorphic in nature between all the four Kew x Mauritius hybrids selected, along with parent material Kew, Mauritius, and check variety Amritha. The total number of amplified amplicons detected by an individual primer ranged from 10 to 28, with an average of 18.13 amplicons per primer. The minimum number of amplicons were recorded in UBC-844 (10), whereas, the highest number of amplicons was produced by MANNY (28) followed by UBC-864 (23), IS-61 (21), ISSR-21 (21), DiGT5C (20), and ISSR-10 (20). The results are similar to the findings of da Silva *et al.* (2016) were reported the number of amplified bands for each primer varied from 1 to 8 with a mean of 4 bands per primer. Souza *et al.* (2017) had generated the number of amplified bands detected in the ISSR marker associated with the quality of pineapple fiber varied from 5 to 20 per primer. Wang *et al.* (2017), who screened 13 ISSR primers among 36 pineapple accessions and observed a range of 4 to 14 amplicons per primer also substantiate the present result.

On the other hand, the number of polymorphic amplicons produced per primer varied from 6 to 24, with an average of 16.47 amplicons per primer. While, the minimum number of polymorphic amplicons was recorded in UBC-844 (6) and the highest number of polymorphic amplicons were produced by MANNY (24) followed by UBC-864 (23), IS-61 (20), and ISSR-10 (20). The results are similar to the findings of da Silva *et al.* (2016) were reported the number of polymorphic amplified bands for each primer varied with a mean of 10 bands per primer. Wang *et al.* (2017), who screened 13 ISSR primers among the 36 pineapple accessions and scored a total of 96 bands, of which 91 were polymorphic in nature. While, among the primers tested in the four Kew x Mauritius hybrids selected, along with parent material Kew, Mauritius, and check variety Amritha produced easily detectable fragments on agarose gel, providing the number of the uniqueness of amplicons ranged from 1 to 6. The minimum number

Table 4.6.3.1.1. Quality and quantity of DNA isolated of Kew x Mauritius hybrids

Varieties	Quantity (µg/ml)	Optical density values (260/280)
Kew	106.63	1.637
Mauritius	199.47	2.173
Amritha	427.45	2.134
H-101 (Treatment 4)	100.44	2.126
H-115 (Treatment 3)	402.96	2.173
H-118 (Treatment 2)	110.99	2.004
H-121 (Treatment 9)	214.71	2.109

of unique amplicons was recorded in UBC-844 (1) and the highest number of unique amplicons was produced by ISSR-4 (6) and UBC-864 (6) followed by UBC-809 (5).

All the screened ISSR primers according to their ability to generate polymorphic in nature, the size of the overall amplicons varied from 178 bp (MANNY: 178 bp-1543 bp) to 1621 bp (ISSR-4: 271 bp-1621 bp). Similar results have been reported by Vanijajiva (2012) had observed the size of amplified 56 bands ranged from 100 bp to 2000 bp in pineapple accession on using 4 ISSR markers.

The Polymorphic Information Content (PIC) generates an assessment of the unfair power of a primer to distinguish genotypes based on both the number of alleles produced and their relative frequency (Wang *et al.,* 2017). The primers with polymorphic information contents more than 0.50 are generally expected to be capable and beneficial in genotyping and also for determining the degree of polymorphism at a given locus (Vijayan, 2005). The Polymorphic Information Content (PIC) for 15 ISSR primers varied from 0.41 for UBC-844 to 0.81 for UBC-809, and the average value was 0.68. Similar result findings were recorded by Wang *et al.* (2017), who screened 13 ISSR primers among 36 pineapple accessions and observed a PIC values of 0.13 to 0.36 with an average of 0.24.

The percentage polymorphic amplicons (PPA) ranged from 60.00 to 100 per cent with an average of 89.85 per cent across fifteen ISSR primers across the seven genotypes of pineapple studied. The lowest percentage polymorphic amplicons were recorded in UBC-844 (60.00 %), whereas the highest (100 %) percentage polymorphic amplicons were generated from ISSR-4, ISSR-10, UBC-809, and UBC-864. This result was approximately less than that reported in another study (93.65 %) on pineapple (Wang *et al.,* 2017) but more than that reported by Vanijajiva (2012) in pineapple (41.66-53.84 %).

ISSR analysis results (Table 4.6.3.1.2) indicated that out of 15 ISSR markers, 7 markers recorded a PIC values of more than 0.70. These were pointed out high discrimination and potential variation of those indicators. Wang *et al.* (2017) stated that a high PIC value indicates high polymorphism and the presence of a higher percentage of GA/TC repeats than the non-polymorphic primers, which may be the reason that shows the high diversity and differentiation power of that marker among the pineapple hybrids.

4.6.3.1.3. Cluster analysis and dendrogram construction of Kew x Mauritius hybrids using ISSR data

The cluster analysis using the ISSR profiles indicated that the presence of high genetic variation between all the four Kew x Mauritius hybrids selected, along with parent source Kew, Mauritius, and check variety Amritha studied. The phylogenetic reconstruction based on the corresponding Jaccard's similarity coefficient (JSCs) was performed using the unweighted pair group method with arithmetic averaging (UPGMA) approach after analysis of amplification patterns generated by fifteen polymorphic markers among the seven pineapple genotypes.

A UPGMA based dendrogram showed that the seven pineapple genotypes could be further classified into three main clusters (I-III) when the similarity coefficient was 0.60 (Table 4.6.3.1.3.1 and Fig. 4.6.3.1.3). Among the three clusters, cluster I was the largest cluster, consisting of four pineapple hybrid genotypes (H-101, H-115, H-118, and H-121) and was divided into two, sub-clusters IA with three genotypes (H-115, H-118, and H-121), this was also classified into two sub-clusters, sub-clusters IAA with one genotype (H-115) and sub-cluster IAB with H-118 and H-121, following sub-cluster IB with single genotype H-101, whereas, cluster II have consisted two pineapple genotypes (Mauritius and Amritha), the remaining cluster III was consisting of recurrent parent Kew. The results showed that genotypes Kew, Mauritius, Amritha, H-101, H-115, H-118, and H-121 are characteristically related at genomic levels which have been generated by the 15 ISSR markers screened in the present evaluation study.

The Jaccard's similarity coefficients (JSCs) data recorded are present in Table 4.6.3.1.3.2. The genetic similarity indices obtained on the basis of corresponding 15 ISSR markers between the seven pineapple genotypes ranged from 0.53 to 0.79, which indicates that the existence of a moderate level of variation between the studied hybrid genotypes. This may be due to the use of genotypes from the same parent source Kew and Mauritius rather than dissimilar ones. A similar finding of results of pineapple accessions ranged of Jaccard's similarity coefficient values (0.50 to 0.89) was found during ISSR analysis, with an average of 0.74 genetic diversity analysis of pineapple genotypes (Wang *et al.*, 2017).

Among the pineapple hybrids evaluated, hybrid H-118 and H-121, registered the high level of Jaccard's genetic similarity relationship among the selected hybrids

Table 4.6.3.1.2. Particulars of ISSR primers profiling in the Kew x Mauritius hybrids

Sl no.	Primer name	Annealing temperature (°C)	Nature of amplification	Number of amplicons	Number of polymorphic amplicons	Size of amplicons (bp)	Uniqueness of amplicons	PIC	PPA
1	AW 3	54.0	Polymorphic	16	15	363-1411	4	0.70	93.75
2	DiGT5C	54.0	Polymorphic	20	17	247-1444	4	0.66	85.00
3	IS 61	50.0	Polymorphic	21	20	193-1056	3	0.69	95.24
4	IS 65	47.0	Polymorphic	18	13	200-1086	4	0.55	72.22
5	ISSR 2	54.0	Polymorphic	15	14	391-1171	3	0.60	93.33
6	ISSR 4	51.0	Polymorphic	19	19	271-1621	6	0.80	100.00
7	ISSR 10	54.0	Polymorphic	20	20	244-1400	4	0.80	100.00
8	ISSR 21	52.0	Polymorphic	21	19	200-1508	4	0.69	90.48
9	MANNY	52.3	Polymorphic	28	24	178-1543	2	0.61	85.71
10	OMAR	54.3	Polymorphic	12	11	207-1087	2	0.60	91.67
11	UBC 809	54.0	Polymorphic	19	19	255-1408	5	0.81	100.00
12	UBC 811	53.0	Polymorphic	16	14	253-1253	3	0.71	87.50
13	UBC 841	50.5	Polymorphic	14	13	307-1233	3	0.74	92.86
14	UBC 844	50.6	Polymorphic	10	6	276-953	1	0.41	60.00
15	UBC 864	54.0	Polymorphic	23	23	283-1487	6	0.77	100.00

with parent source Kew and Mauritius studied with a genetic similarity coefficient of 0.79, indicating higher similarity in the genetic makeup of composition among them, followed by hybrid H-115 is connected with H-118 and H-121 at 0.72 genetic similarity coefficient. In case of Mauritius and Amritha connected roots were noticed at 0.63 genetic similarity coefficient. Similarly, at 0.61 genetic similarity coefficient rooted connections were observed in H-101 with H-115, H-118, and H-121 hybrid genotypes. At the point of 0.56 genetic similarity coefficient analysis, Mauritius and Amritha were connected with H-101, H-115, H-118, and H-121 hybrid genotypes. The minimum similarity was showed by recurrent parent Kew with other genotypes at 0.53, which is indicating that the existence of significant genetic variation between these selected hybrids. The genetic similarity coefficient values help the breeder to select these two selected promising hybrids (H-118 and H-121) for the varietal hybridization program that would be leading to the creation of the current situation demanding pineapple variety for yield and quality.

To summarise the research findings of Kew x Mauritius hybrids, the 15 ISSR primers can be widely considered for genetic diversity differentiation, identification of variant genotypes, cultivars, varieties, and genetic diversity analysis of pineapple. This further indicated that the capability of these microsatellite-based ISSR genetic markers in fingerprinting as it examines and detects variation in different parts of genomic sequence among genotypes neutrally without any biases. The current study investigation was confirmed with previous studies conducted in pineapple (da Silva *et al.*, 2016; Souza *et al.*, 2017; Wang *et al.*, 2017).

4.6.3.1.4. DNA fingerprinting using polymorphic ISSR

To generate ISSR fingerprinting of four Kew x Mauritius hybrids along with parent source Kew, Mauritius, and check variety Amritha used in this study, the markers that generated at least one genotype-specific unique amplicons were selected. Fifteen polymorphic primers were used for fingerprinting and their detailed explanations are given below. The number of amplicons produced and the range of molecular amplicons size are presented in Table 4.6.3.1.2.

4.6.3.1.4.1. **AW-3**

Plate 4.6.3.1.4.1 showing the amplification picture of ISSR primer AW-3. At 608 bp for recurrent parent Kew and similarly at 486 bp and 363 bp in donor parent Mauritius, whereas at 1133 bp for check variety Amritha, the known microsatellite primer produced uniqueness (Fig. 4.6.3.1.4.1) making it completely appropriate for distinguishing these genotypes.

4.6.3.1.4.2. **DiGT5C**

The banding pattern created by DiGT5C (Plate 4.6.3.1.4.2) was carefully counted. This ISSR primer produced unique bands at 1181 bp for Kew, at 1350 bp, 1087 bp, and 726 bp from Kew x Mauritius hybrid H-121 (Fig. 4.6.3.1.4.2). As a result, this primer may be considered for the identity of these promising genotypes.

4.6.3.1.4.3. **IS-61**

This marker generated a unique amplifying gel profile (Plate 4.6.3.1.4.3) that produced polymorphic amplicons in variety Kew at 1028 bp (Fig. 4.6.3.1.4.3). Furthermore, various banding patterns were recorded at 989 bp for variety Amritha and at 960 bp for selected hybrid H-115. Hence, IS-61 can be used as a perfect primer for identifying these three genotypes.

4.6.3.1.4.4. **IS-65**

Carefully counting of amplified gel profile was recorded by using the primer IS-65 (Plate 4.6.3.1.4.4) revealed that the presence of four unique amplicons at 1029 bp for variety Kew, at 970 bp and 279 bp in selected Kew x Mauritius hybrid H-118, while, at 676 bp in promising hybrid H-121 (Fig. 4.6.3.1.4.4). Accordingly, IS-65 can be successfully utilized for the characterization of the said genotypes.

4.6.3.1.4.5. **ISSR-2**

By examining the PCR amplified gel image of ISSR-2 with seven pineapple genotypes for unique DNA amplicons (Plate 4.6.3.1.4.5) and the distinct band were obtained at 1171 bp, 877 bp, and 787 bp in variety Kew (Fig. 4.6.3.1.4.5).

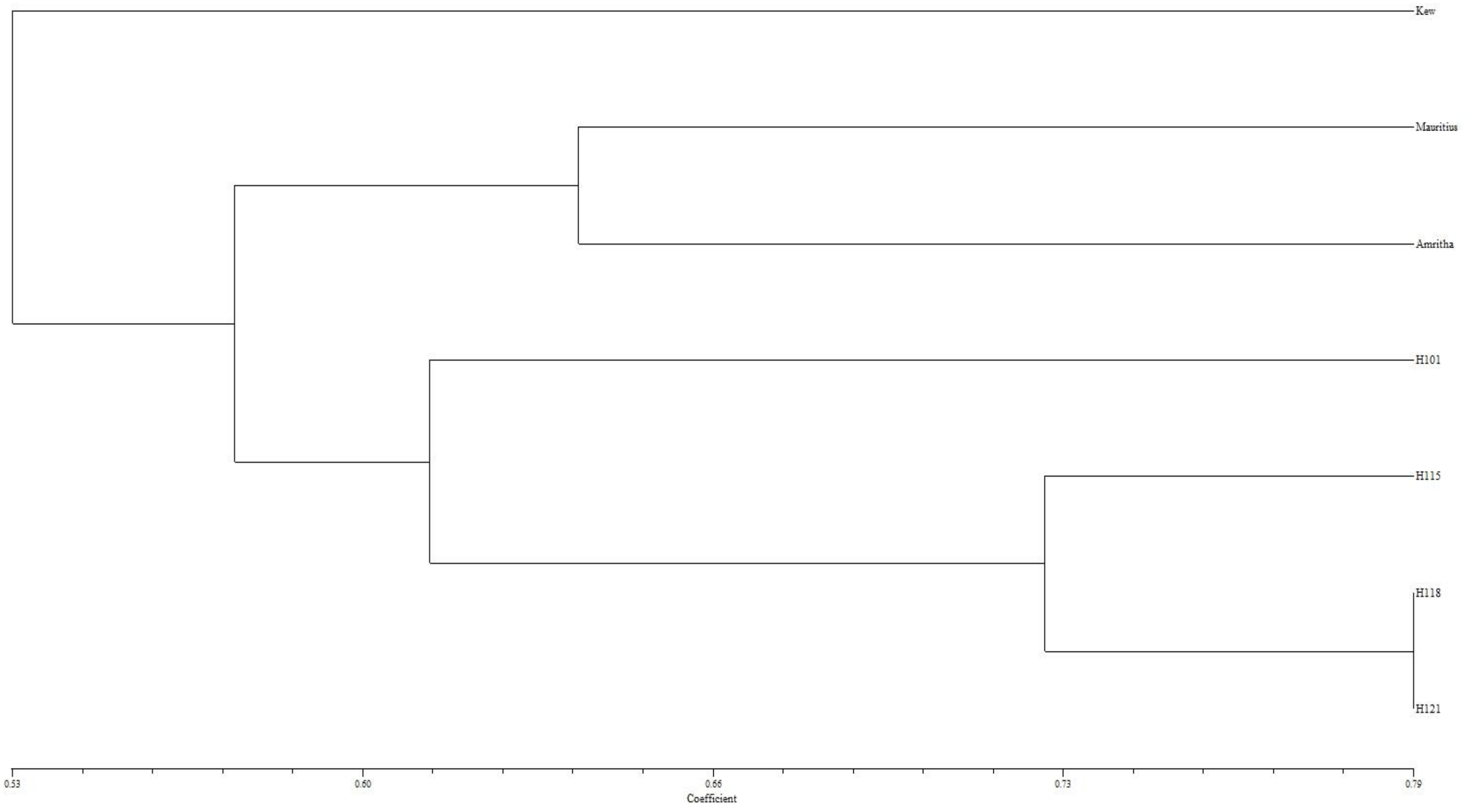


Fig. 4.6.3.1.3. Based on molecular data cluster analysis of selected Kew x Mauritius hybrids

Table 4.6.3.1.3.1. Clustering of the Kew x Mauritius hybrids based on ISSR profiles

Cluster	Number of genotypes	Genotypes of cluster
I	4	H-101, H-115, H-118, and H-121
II	2	Mauritius, Amritha
III	1	Kew

Table 4.6.3.1.3.2. Pair wise similarity between the Kew x Mauritius hybrids based on ISSR profiles

	Kew	Mauritius	Amritha	H-101	H-115	H-118	H-121
Kew	-						
Mauritius	0.53	-					
Amritha	0.53	0.63	-				
H-101	0.53	0.56	0.56	-			
H-115	0.53	0.56	0.56	0.61	-		
H-118	0.53	0.56	0.56	0.61	0.72	-	
H-121	0.53	0.56	0.56	0.61	0.72	0.79	-

4.6.3.1.4.6. **ISSR-4**

The amplification pattern of seven selected genotypes of pineapple in this study generated by ISSR-4 (Plate 4.6.3.1.4.6) was documented to identify unique amplicons. At 1621 bp, 1064 bp, and 730 bp unique bands were found for the variety Kew, followed by selected promising hybrid H-101 at 1221 bp, 1021 bp, and 659 bp (Fig. 4.6.3.1.4.6). Thus, this ISSR primer can play a useful role in identification and making fingerprints of Kew and hybrid H-101.

4.6.3.1.4.7. **ISSR-10**

Scoring of amplified gel picture of seven selected pineapple genotypes produced by this ISSR primer ISSR-10 (Plate 4.6.3.1.4.7) noticed unique bands at 1400 bp for variety Amritha, 1215 bp for variety Kew, 936 bp for variety Mauritius, and 1015 bp for selected hybrid H-118 (Fig. 4.6.3.1.4.7), making this primer suitable for identifying this promising selected genotypes.

4.6.3.1.4.8. **ISSR-21**

From the PCR obtained gel picture was evaluated for unique amplified bands generated by ISSR-21 (Plate 4.6.3.1.4.8 and Fig. 4.6.3.1.4.8), recurrent variety Kew had a unique fragment at 1508 bp. Clear unique bands at 720 bp and 389 bp were recorded in variety Mauritius. Respectively, the uniqueness of bands was found at 929 bp for selected hybrid H-101.Thus, this ISSR primer ISSR-21 can be recommended for fingerprinting and identifying the above mentioned varieties.

4.6.3.1.4.9. **MANNY**

Plate 4.6.3.1.4.9 showing the gel documented profile generated by this primer MANNY. This marker observed unique amplicons at 1410 bp and 1143 bp in the check hybrid variety Amritha (Fig. 4.6.3.1.4.9) making it suitable for identifying this variety.

4.6.3.1.4.10. **OMAR**

OMAR generated amplification pattern (Plate 4.6.3.1.4.10) produced unique and distinct amplicons at 721 bp and 410 bp in the donor parent Mauritius (Fig. 4.6.3.1.4.10). From this result, the primer OMAR is an ideal primer for characterizing the Mauritius from the other selected varieties.

4.6.3.1.4.11. **UBC-809**

The banding pattern generated by UBC-809 (Plate 4.6.3.1.4.11) was scored to detect unique amplicons. This primer yielded an unique amplicons at 1408 bp in Kew, 460 bp for Mauritius, 1283 bp for Amritha, 1167 bp for selected hybrid H-115, and 667 bp for hybrid H-118 (Fig. 4.6.3.1.4.11), proving its utility in fingerprinting and identification of these selected hybrids along with check varieties .

4.6.3.1.4.12. **UBC-811**

By examining the gel image of DNA amplification profile obtained by UBC-811 of four pineapple selected hybrids along with check varieties (Plate 4.6.3.1.4.12), unique and distinct bands at 656 bp and 438 bp in check variety Kew were obtained (Fig. 4.6.3.1.4.12). Hence, primer UBC-811 can be used for fingerprint identification of the Kew.

4.6.3.1.4.13. **UBC-841**

The PCR amplification profile of seven pineapple varietal treatments using ISSR primer UBC-841 (Plate 4.6.3.1.4.13) was recorded. An unique amplicons at 1233 bp and 855 bp were obtained (Fig. 4.6.3.1.4.13) in variety Kew and at 1120 bp uniqueness of band was observed in hybrid H-121, making this primer suitable for identification of Kew and hybrid variety H-121 from a varietal treatments.

4.6.3.1.4.14. **UBC-844**

The screening of primer UBC-844 made unique amplicons in gel documentation (Fig. 4.6.3.1.4.14 and Plate 4.6.3.1.4.14) in selected Kew x Mauritius hybrid H-121 at 397 bp. Thus, UBC-844 can aid as a perfect primer for identifying fingerprints of Kew x Mauritius hybrid genotype H-121.

4.6.3.1.4.15. **UBC-864**

The amplifying profile obtained by ISSR primer UBC-864 (Plate 4.6.3.1.4.15) was analyzed to detection of unique amplicons. This primer was yielded four unique bands at 1287 bp, 986 bp, 878 bp, and 786 bp in check variety Amritha, followed by hybrid H-115 amplified a unique band at 959 bp and at 1407 bp in hybrid H-121 (Fig.

4.6.3.1.4.15). From this, it can be recommended for the identification of selected Kew x Mauritius hybrids along with Amritha.

4.6.3.1.5. DNA fingerprinting of individual Kew x Mauritius hybrids along with check varieties using ISSR profiles

The individual data of selected four Kew x Mauritius hybrids along with check varieties namely Kew, Mauritius, and Amritha by using ISSR profile images with the help of selected 15 ISSR markers for further utilization of locating useful unique amplicons in each prominent hybrid genotypes. An associated unique amplicons color chart was developed. These result findings can be highly useful in distinguishing and characterizing these selected hybrid genotypes from the others. Some salient findings of the individual genotypes wise DNA fingerprint details are explained below.

4.6.3.1.5.1. **Kew**

Salient findings from the amplification of PCR amplified gel profiles observed for recurrent parent Kew using 15 ISSR genetic markers, eleven polymorphic primers were readout to make the fingerprint of the Kew (Fig. 4.6.3.1.5.1). Two unique bands were produced AW-3 at 1350 bp and 608 bp. In addition to these findings of unique amplifications at 1181 bp (DiGT5C), 1028 bp (IS-61), 1029 bp (IS-65), three unique bands for ISSR-2 at 1171 bp, 877 bp, and 787 bp, three unique amplified bands for ISSR-4 at 1621 bp, 1064 bp, and 730 bp, 1215 bp (ISSR-10), 1508 bp (ISSR-21), 1408 bp (UBC-809), four unique fragments for UBC-811 at 855 bp, 656 bp, 523 bp, and 438 bp, while, 1233 bp (UBC-841) unique amplicons were obtained for the Kew. The size of amplicons produced by these eleven polymorphic primers ranged from 438 bp to 1621 bp. Maximum unique amplicons were generated by ISSR primers UBC-811 (4) and the minimum number of unique bands (1) counted by primers namely DiGT5C, IS-61, IS-65, ISSR-10, ISSR-21, UBC-809, and UBC-841.

4.6.3.1.5.2. **Mauritius**

On examination of PCR amplified gel profiles produced by fifteen selected ISSR primers, it was noted that five primers *viz*., AW-3 at 486 bp and 363 bp, ISSR-10 at 936 bp, ISSR-21 at 720 bp and 389 bp, OMAR at 721 bp and 410 bp, and UBC-809 at 460 bp observed carefully unique and distinct amplicons. The size of amplicons (bp) generated by these five ISSR primers ranged from 363 bp to 936 bp. The fingerprints generated in a variety of Mauritius using clearly distinct fragments with the five primers are presented in Fig. 4.6.3.1.5.2.

4.6.3.1.5.3. **Amritha**

Six out of 15 ISSR primers identified distinct and unique amplicons in check variety Amritha (Fig. 4.6.3.1.5.3). The size of all unique amplicons generated by markers *viz*., AW-3, IS-61, ISSR-10, MANNY, UBC-809 and UBC-864 in Amritha ranged from 786 bp to 1410 bp. The number of unique amplicons amplified varies at 1133 bp (AW-3), 989 bp (IS-61), 1400 bp (ISSR-10), and 1283 bp (UBC-809). Some more result findings in unique amplification four unique fragments were observed correspondingly in UBC-864 at 1287 bp, 986 bp, 878 bp, and 786 bp, while, two unique amplified amplicons were noted in ISSR marker MANNY at 1410 bp and 1143 bp. It was noticed that the unique bands produced by markers AW-3, IS-61, ISSR-10, MANNY, UBC-809, and UBC-864 individually, can be used for making the fingerprint of Amritha.

4.6.3.1.5.4. **H-101**

The fingerprint of PCR-produced gel profiles were documented based on a unique banding pattern produced by two primers out of 15 ISSR microsatellite primers. The number of unique bands amplified at 1221 bp, 1021 bp, and 659 bp for ISSR-4, whereas 929 bp for ISSR-21 in this selected Kew x Mauritius hybrid (H-101) and the size of the amplicons ranged from 659 bp to 1221 bp. These two markers were selected to develop the resourceful fingerprints for this promising hybrid (Fig. 4.6.3.1.5.4).

4.6.3.1.5.5. **H-115**

From the amplification of gel profiles analyzed for the genomic DNA of selected hybrid H-115 by using 15 ISSR primers, three polymorphic primers were found to make unique fingerprints. The amplicons sizes generated by these three selected ISSR primers ranged from 959 bp to 1167 bp. A polymorphic unique bands were produced by amplified primers such as IS-61 at 960 bp, UBC-809 at 1167 bp, and UBC-864 at 959 bp correspondingly (Fig. 4.6.3.1.5.5). These three primers were used to obtain the DNA fingerprints of this prominent hybrid H-115.

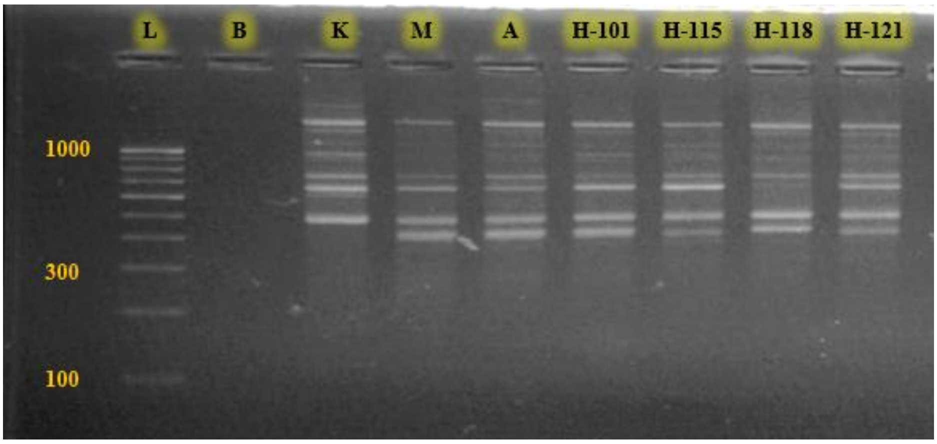


Plate 4.6.3.1.4.1. PCR amplified gel image of ISSR primers AW-3

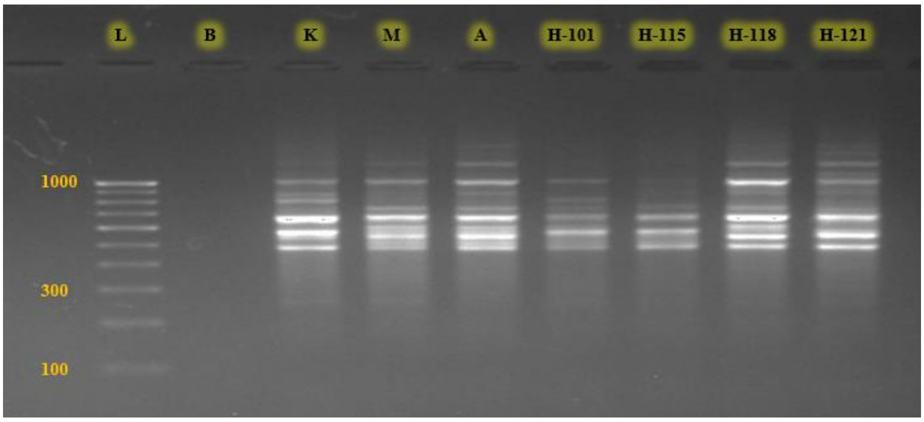


Plate 4.6.3.1.4.2. PCR amplified gel image of ISSR primer DiGT5C

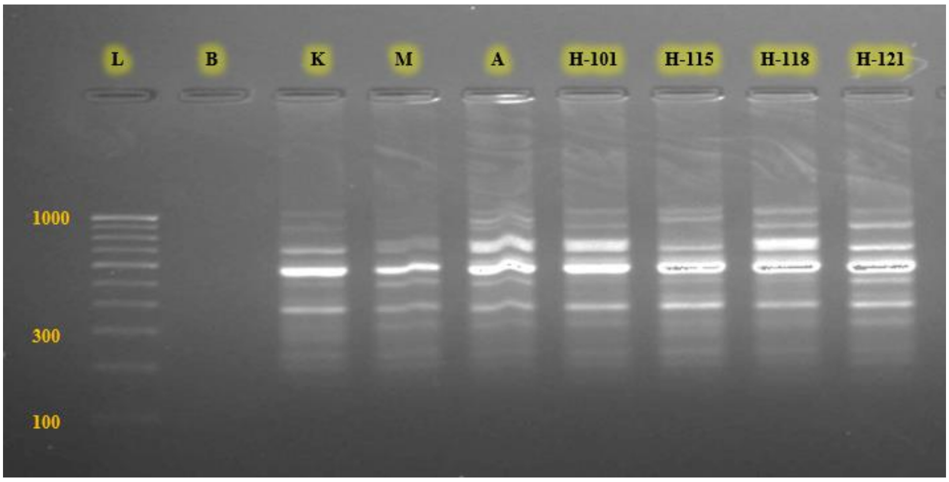


Plate 4.6.3.1.4.3. PCR amplified gel image of ISSR primer IS-61

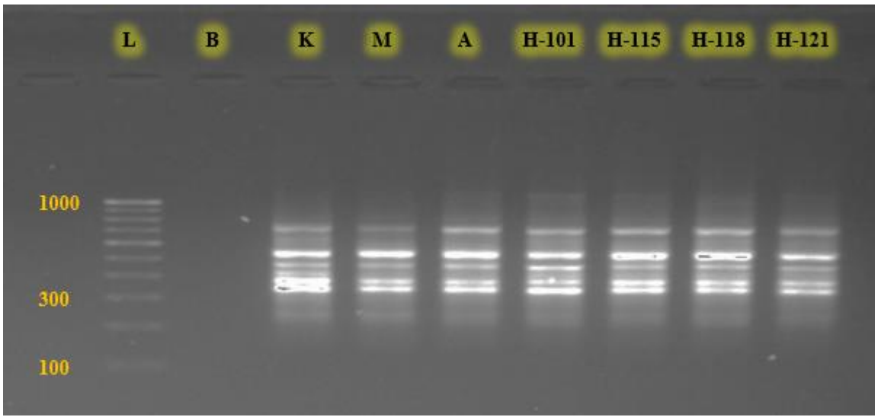


Plate 4.6.3.1.4.4. PCR amplified gel image of ISSR primer IS-65

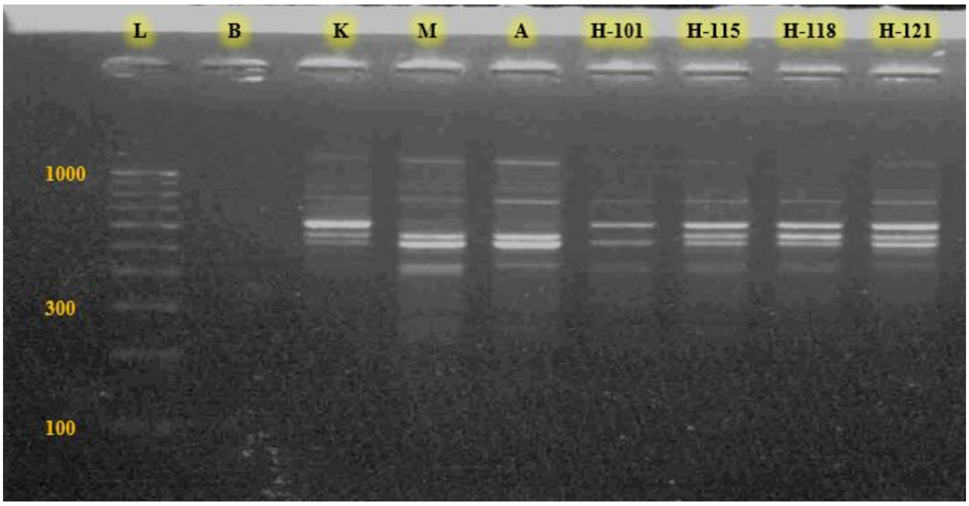


Plate 4.6.3.1.4.5. PCR amplified gel image of ISSR primer ISSR-2

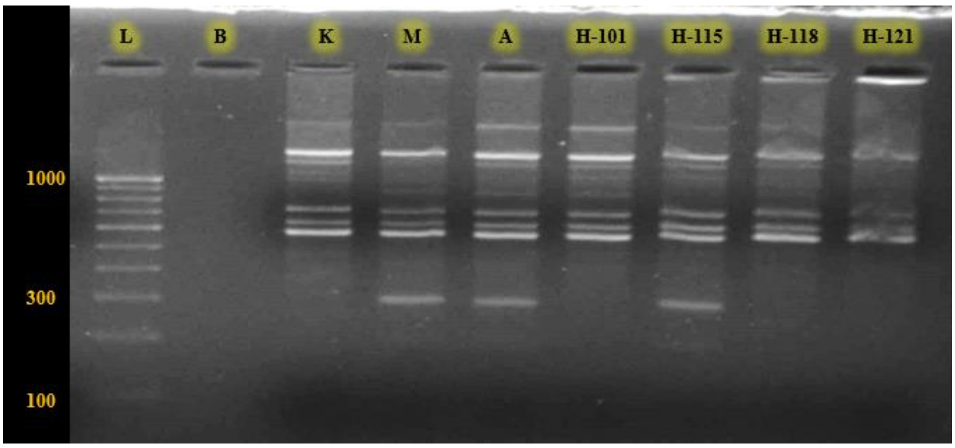


Plate 4.6.3.1.4.6. PCR amplified gel image of ISSR primer ISSR-4

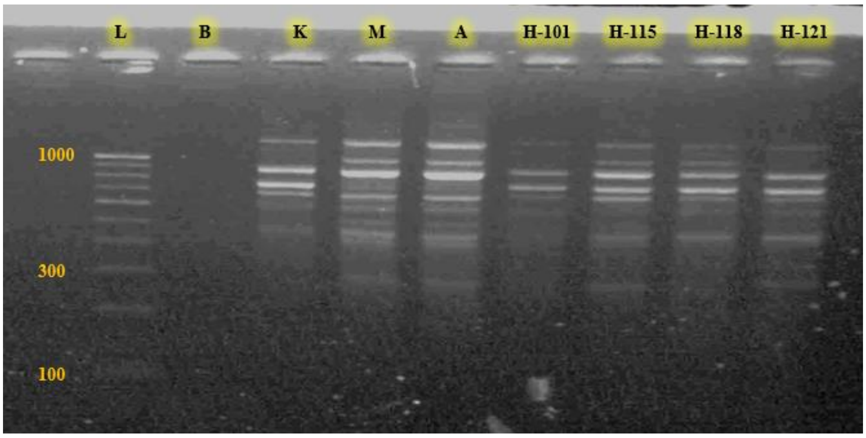


Plate 4.6.3.1.4.7. PCR amplified gel image of ISSR primer ISSR-10

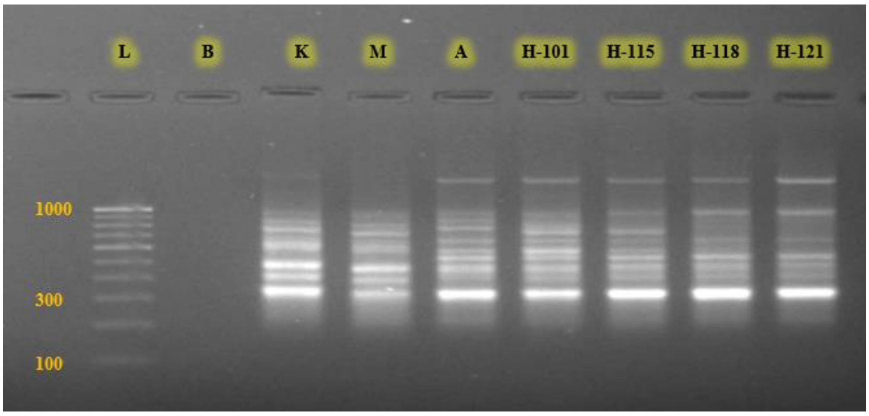


Plate 4.6.3.1.4.8. PCR amplified gel image of ISSR primer ISSR-21

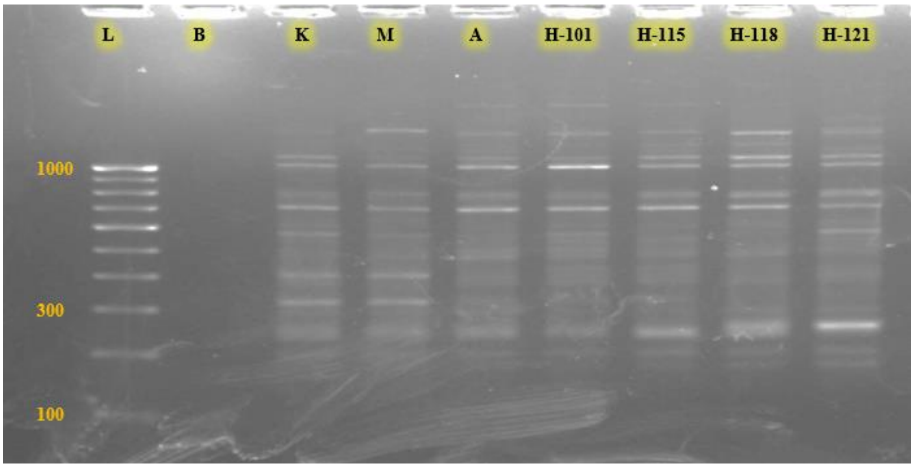


Plate 4.6.3.1.4.9. PCR amplified gel image of ISSR primer MANNY

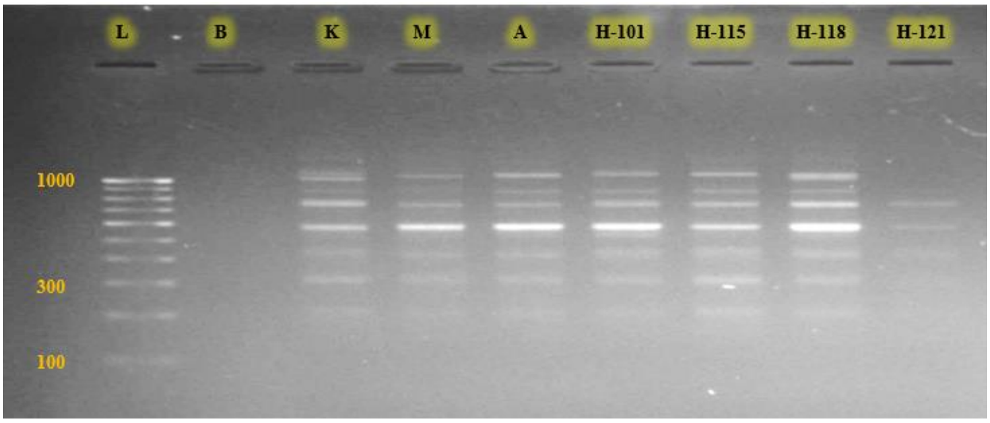


Plate 4.6.3.1.4.10. PCR amplified gel image of ISSR primer OMAR

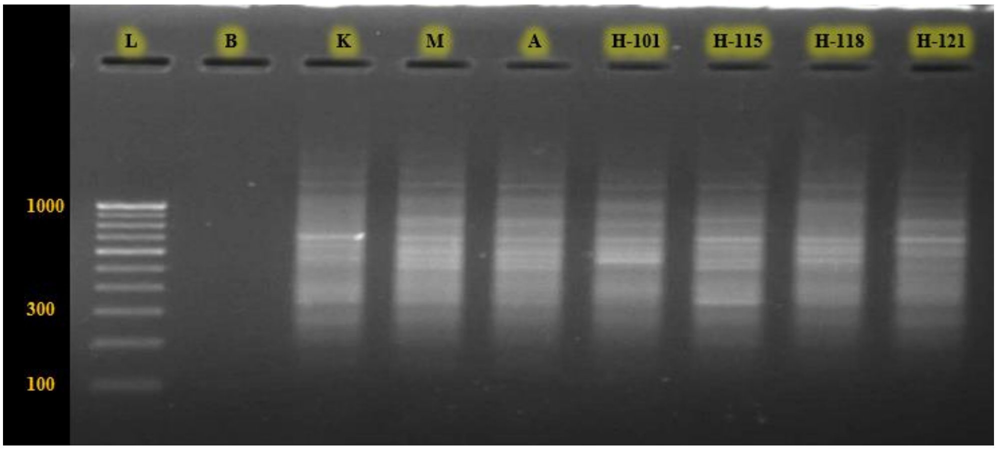


Plate 4.6.3.1.4.11. PCR amplified gel image of ISSR primer UBC-809

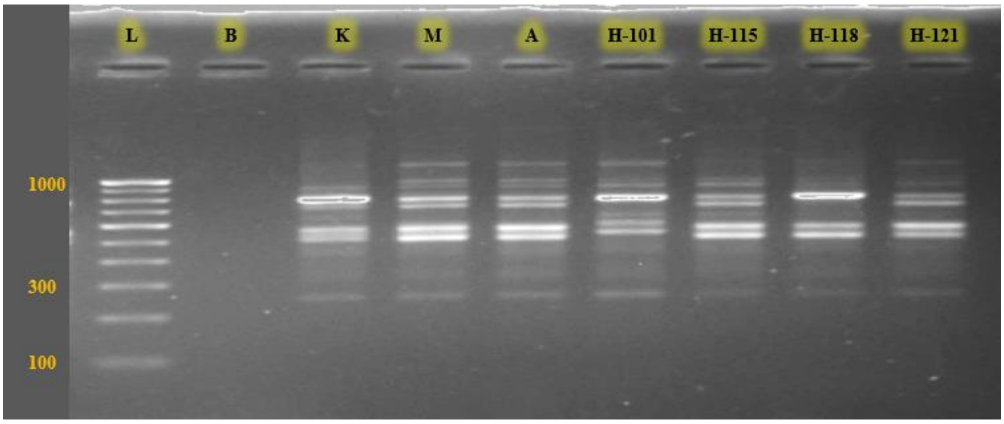


Plate 4.6.3.1.4.12. PCR amplified gel image of ISSR primer UBC-811

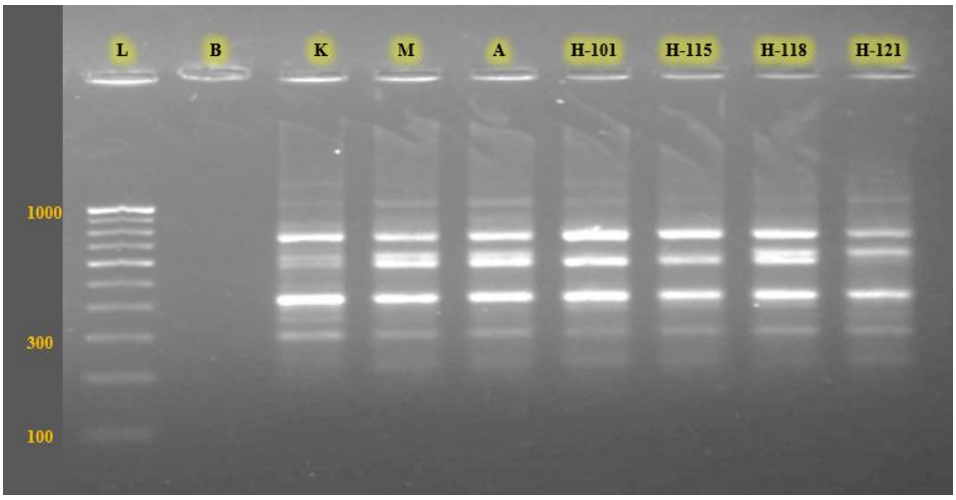


Plate 4.6.3.1.4.13. PCR amplified gel image of ISSR primer UBC-841

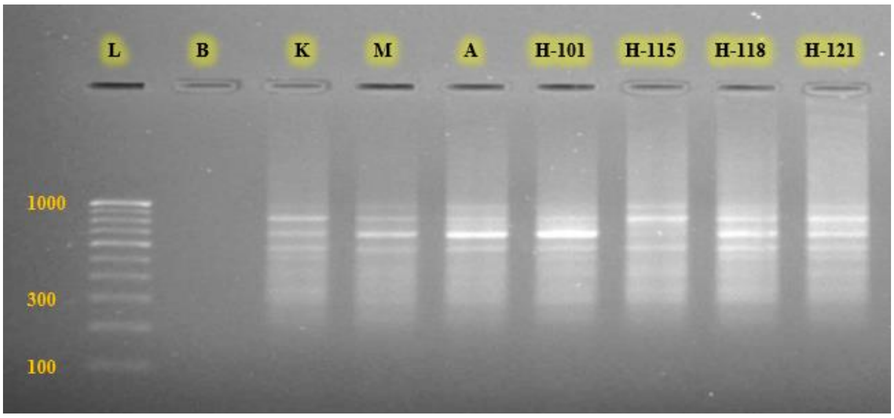


Plate 4.6.3.1.4.14. PCR amplified gel image of ISSR primer UBC-844

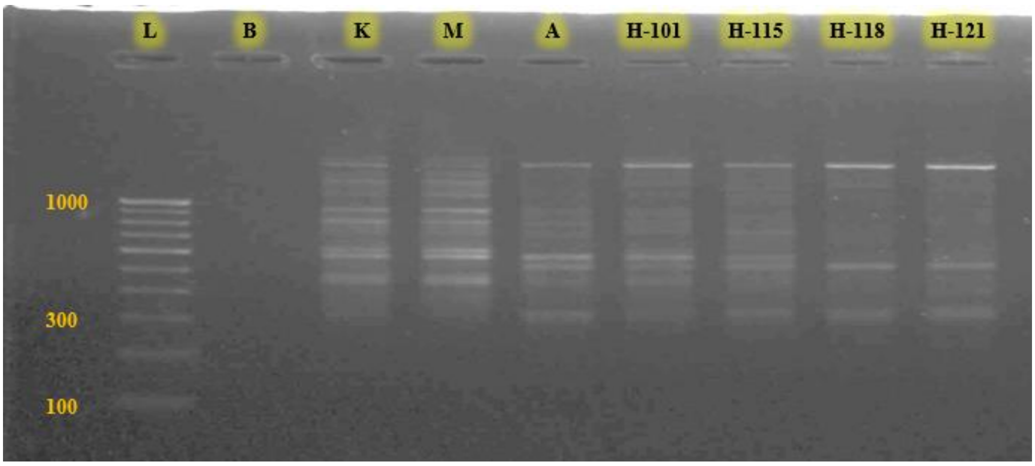


Plate 4.6.3.1.4.15. PCR amplified gel image of ISSR primer UBC-864

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1411	1	0	1	0	0	0	0
1244	1	1	1	1	1	0	0
1211	0	0	0	0	0	1	1
1167	1	0	0	0	0	1	1
1133	0	0	1	0	0	0	0
1078	1	1	1	0	0	0	0
1033	0	0	0	0	1	1	1
962	1	1	0	1	0	0	0
928	0	0	0	0	1	1	1
764	1	1	1	1	1	1	1
671	1	1	1	1	1	0	1
608	1	0	0	0	0	0	0
513	1	0	1	1	1	1	1
486	0	1	0	0	0	0	0
437	0	1	1	1	1	1	1
363	0	1	0	0	0	0	0

Fig. 4.6.3.1.4.1. Colour chart of ISSR primers AW-3

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1444	0	0	1	0	0	1	1
1350	0	0	0	0	0	0	1
1231	0	1	1	0	0	1	1
1181	1	0	0	0	0	0	0
1087	0	0	0	0	0	0	1
1056	0	0	0	1	1	0	0
1025	1	1	1	0	0	1	1
900	0	1	1	0	0	1	1
873	1	0	0	0	1	0	0
835	1	1	0	1	0	0	0
805	0	0	1	0	0	0	1
756	0	1	1	1	1	1	0
726	0	0	0	0	0	0	1
680	1	1	1	1	1	1	1
614	0	1	1	1	0	1	0
586	1	0	0	1	1	0	1
558	0	1	1	0	1	1	1
529	0	1	1	1	0	0	0
500	1	1	1	1	1	1	1
272	1	1	1	1	1	1	1

Fig. 4.6.3.1.4.2. Colour chart of ISSR primer DiGT5C

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1056	0	0	1	1	1	1	1
1028	1	0	0	0	0	0	0
989	0	0	1	0	0	0	0
960	0	0	0	0	1	0	0
916	0	0	1	1	0	1	1
885	1	0	0	0	1	0	0
785	0	1	0	1	0	0	0
750	0	0	1	0	0	1	0
722	0	1	0	1	1	1	1
694	1	0	1	1	0	0	0
610	0	0	1	0	1	1	1
581	1	1	0	1	0	1	1
524	0	1	1	1	1	1	1
495	1	0	0	0	1	1	1
419	1	0	1	0	1	1	1
391	1	1	0	1	0	0	0
330	1	0	1	1	1	1	1
302	0	1	0	0	1	0	0
262	1	0	0	0	1	0	1
233	1	1	1	1	1	1	1
200	1	1	0	1	0	0	0

Fig. 4.6.3.1.4.3. Colour chart of ISSR primer IS-61

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1086	0	1	1	1	1	1	1
1029	1	0	0	0	0	0	0
970	0	0	0	0	0	1	0
853	1	1	0	0	1	0	0
823	0	0	1	0	0	1	1
789	0	0	0	1	1	0	0
705	1	1	1	1	1	1	0
676	0	0	0	0	0	0	1
621	1	0	1	1	1	1	0
589	0	1	0	0	1	0	0
525	1	1	1	1	1	1	1
462	1	1	1	1	1	1	1
409	1	0	0	0	1	1	1
372	1	1	1	1	1	1	1
332	1	1	1	1	1	1	1
279	0	0	0	0	0	1	0
239	1	1	1	1	1	1	1
205	1	1	0	1	0	0	0

Fig. 4.6.3.1.4.4. Colour chart of ISSR primer IS-65

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1171	1	0	0	0	0	0	0
1129	0	1	1	0	1	0	1
907	0	1	1	0	0	0	0
877	1	0	0	0	0	0	0
837	0	0	1	0	1	1	1
787	1	0	0	0	0	0	0
758	0	1	1	1	1	1	1
717	0	1	1	0	0	0	0
628	1	1	1	0	0	0	0
597	0	0	0	1	1	1	1
553	1	1	1	0	1	1	1
521	1	1	1	1	1	1	1
479	1	1	1	0	1	1	1
438	0	1	1	1	1	1	1
411	0	1	1	1	1	1	1

Fig. 4.6.3.1.4.5. Colour chart of ISSR primer ISSR-2

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1621	1	0	0	0	0	0	0
1579	0	1	1	0	0	0	0
1550	0	0	0	1	1	1	0
1279	1	1	0	0	0	0	0
1250	0	0	1	0	1	1	1
1221	0	0	0	1	0	0	0
1179	1	1	0	0	0	0	0
1150	0	0	1	1	1	1	1
1064	1	0	0	0	0	0	0
1021	0	0	0	1	0	0	0
993	1	0	0	0	1	1	0
839	0	1	1	1	0	0	0
730	1	0	0	0	0	0	0
692	0	1	1	0	1	1	1
659	0	0	0	1	0	0	0
619	1	1	1	1	1	0	0
589	1	0	0	0	0	1	1
561	0	1	1	1	1	1	1
282	0	1	1	0	1	0	0

Fig. 4.6.3.1.4.6. Colour chart of ISSR primer ISSR-4

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1400	0	0	1	0	0	0	0
1215	1	0	0	0	0	0	0
1177	0	1	0	1	0	0	0
1146	0	0	1	0	1	1	1
1015	0	0	0	0	0	1	0
936	0	1	0	0	0	0	0
907	0	0	1	0	1	1	0
829	1	1	1	1	0	0	0
787	0	0	0	0	1	1	1
722	1	0	0	1	0	0	0
683	0	1	0	0	1	1	1
650	1	1	0	0	0	0	0
618	0	0	1	1	1	1	1
580	1	1	1	0	1	0	0
545	0	0	0	1	0	1	1
487	0	1	1	0	0	0	1
449	1	1	0	0	1	0	0
419	0	1	1	0	0	1	1
391	0	0	1	0	1	1	1
268	0	1	1	0	1	0	1

Fig. 4.6.3.1.4.7. Colour chart of ISSR primer ISSR-10

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1508	1	0	0	0	0	0	0
1438	0	0	1	1	1	1	1
984	1	1	1	0	1	1	1
929	0	0	0	1	0	0	0
861	1	0	1	0	0	0	0
830	0	1	0	0	1	1	1
795	0	0	1	1	0	0	0
755	1	0	0	1	1	0	0
720	0	1	0	0	0	0	0
676	1	0	1	0	0	1	1
648	0	0	0	1	1	0	0
617	1	1	0	0	0	0	0
575	0	0	1	1	1	0	0
539	0	0	1	1	1	1	1
483	1	0	0	0	1	1	1
452	0	1	1	1	0	0	0
416	1	0	1	1	1	1	1
389	0	1	0	0	0	0	0
333	1	1	1	1	1	1	1
250	1	0	0	0	1	0	0
213	1	1	1	1	1	1	1

Fig. 4.6.3.1.4.8. Colour chart of ISSR primer ISSR-21

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1543	0	0	1	1	1	0	0
1448	0	0	0	0	1	1	1
1410	0	0	1	0	0	0	0
1343	1	1	1	0	0	0	0
1314	0	0	0	1	1	1	1
1229	0	0	0	0	1	1	0
1181	0	1	0	0	0	0	1
1143	0	0	1	0	0	0	0
1114	1	1	0	0	1	1	1
1086	0	0	1	1	0	0	0
1038	1	1	0	0	1	1	1
1005	0	0	1	1	0	0	0
808	0	0	1	0	0	0	1
781	1	1	0	1	1	1	0
717	1	1	1	1	1	1	1
635	1	1	1	1	0	1	1
593	1	0	0	0	1	0	1
566	0	1	1	1	1	1	0
535	1	0	0	1	0	0	1
498	1	1	1	1	1	1	1
438	0	0	0	1	1	1	1
406	1	1	1	0	0	1	1
370	1	1	1	1	1	0	0
326	1	1	1	0	1	0	1
296	1	1	1	0	0	1	0
259	1	1	1	1	1	1	1
228	1	1	1	1	1	1	1
201	1	0	0	0	1	1	1

Fig. 4.6.3.1.4.9. Colour chart of ISSR primer MANNY

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1087	0	0	1	0	1	0	0
1060	0	0	0	1	0	1	0
1027	1	1	0	0	0	0	0
879	1	1	1	1	1	1	0
756	1	0	1	1	1	1	1
721	0	1	0	0	0	0	0
578	1	1	1	1	1	1	1
520	0	0	1	1	0	0	0
441	1	0	1	1	1	1	1
410	0	1	0	0	0	0	0
312	1	1	1	1	1	1	0
214	1	0	1	1	1	1	0

Fig. 4.6.3.1.4.10. Colour chart of ISSR primer OMAR

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1408	1	0	0	0	0	0	0
1283	0	0	1	0	0	0	0
1242	1	1	0	1	0	1	0
1167	0	0	0	0	1	0	0
1058	0	1	1	0	0	0	0
1000	0	0	0	1	0	1	0
826	0	1	0	0	1	0	1
788	0	0	1	1	0	0	0
700	1	1	1	1	1	0	1
667	0	0	0	0	0	1	0
640	1	0	0	0	1	0	0
613	0	1	1	0	0	1	1
564	1	1	0	1	1	1	0
512	0	0	1	0	1	0	1
460	0	1	0	0	0	0	0
418	0	0	1	1	0	0	0
383	1	0	0	0	0	1	1
340	1	1	1	0	1	1	0
271	1	0	1	0	1	0	0

Fig. 4.6.3.1.4.11. Colour chart of ISSR primer UBC-809

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1253	0	0	0	1	0	0	1
1218	0	1	1	0	0	0	0
1041	0	1	1	1	0	0	0
982	1	1	1	1	1	1	1
862	0	0	0	1	1	1	1
830	1	1	1	0	0	0	0
778	0	1	1	0	1	0	1
688	0	0	0	1	1	1	0
656	1	0	0	0	0	0	0
614	0	0	0	1	1	1	1
588	1	1	1	1	0	0	0
552	0	1	1	0	1	1	1
523	1	0	0	0	0	0	0
465	0	0	1	0	1	0	0
438	1	0	0	0	0	0	0
269	1	1	1	1	1	1	1

Fig. 4.6.3.1.4.12. Colour chart of ISSR primer UBC-811

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1233	1	0	0	0	0	0	0
1120	0	0	0	0	0	0	1
1067	0	1	1	0	0	0	0
1033	1	0	0	1	0	0	0
885	0	1	1	0	0	0	0
855	1	0	0	0	0	0	0
781	0	0	0	1	1	1	1
753	1	1	1	0	0	0	0
656	0	1	1	0	0	1	1
624	1	0	1	1	1	1	1
593	1	1	0	0	0	0	0
451	1	1	1	1	1	1	1
347	1	0	0	1	1	1	1
315	1	1	1	0	0	0	0

Fig. 4.6.3.1.4.13. Colour chart of ISSR primer UBC-841

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
953	1	1	1	1	1	1	1
818	1	1	1	1	1	1	1
675	1	1	1	1	1	1	1
584	1	1	1	1	1	1	1
518	1	0	0	1	0	1	1
427	1	1	1	1	1	1	0
397	0	0	0	0	0	0	1
345	1	0	0	0	1	1	0
296	0	0	1	1	1	1	1
276	1	1	0	0	0	0	0

Fig. 4.6.3.1.4.14. Colour chart of ISSR primer UBC-844

	1	2	3	4	5	6	7
Amplicons size (bp)/ genotypes	**Kew**	**Mauritius**	**Amritha**	**H-101**	**H-115**	**H-118**	**H-121**
1487	1	1	0	0	0	0	0
1440	1	1	1	1	1	1	0
1407	0	0	0	0	0	0	1
1313	1	1	0	1	0	0	0
1287	0	0	1	0	0	0	0
1240	1	1	0	0	0	0	0
1187	0	0	0	1	0	1	0
1140	0	0	1	0	1	0	1
1073	1	1	0	1	0	0	0
986	0	0	1	0	0	0	0
959	0	0	0	0	1	0	0
912	1	1	0	1	0	0	1
878	0	0	1	0	0	0	0
825	1	1	0	1	1	0	0
786	0	0	1	0	0	0	0
721	1	1	1	1	1	0	0
607	1	1	0	1	0	0	0
575	1	1	1	1	1	0	0
525	0	1	1	1	1	1	1
452	1	1	1	1	0	0	0
416	0	0	0	0	1	1	1
320	1	0	1	0	1	1	1
287	0	0	0	0	1	1	0

Fig. 4.6.3.1.4.15. Colour chart of ISSR primer UBC-864

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

4.6.3.1.5.6. **H-118**

Result findings from the amplified gel images observed for the genomic DNA of selected Kew x Mauritius hybrid (H-118) using 15 ISSR primers, out of these three primers *viz*., IS-65, ISSR-10, and UBC-809 were amplified and distinguished unique amplifying bands at 970 bp and 279 bp for IS-65, 1050 bp for ISSR-10, and 667 bp for UBC-809 (Fig. 4.6.3.1.5.6) to make fingerprint for this selected hybrid H-118.

4.6.3.1.5.7. **H-121**

Salient findings from a five primers out of 15 ISSR primers produced unique fragments that help in characterizing selected Kew x Mauritius hybrid (H-121) from the other varietal treatments studied. A unique amplicons were detected by the DiGT5C three different basepairs namely 1350 bp, 1087 bp, and 726 bp, unique amplicons for IS-65 at 676 bp, for UBC-841 at 1120 bp, for UBC-844 at 397 bp, and for UBC-864 ISSR primer at 1407 bp (Fig. 4.6.3.1.5.7). Hence, genomic DNA fingerprints of this hybrid (H-121) can be made from these five primers.

In contrast to the present study, the research salient findings were summarized with the evident of a combination of various dominant ISSR markers generated high level of uniqueness of bands could be helpful in creating varietal identity and differentiating individuals from a diverse pineapple populations. However, an individual ISSR primer that could be indicative of the complex genetic relationship between all the hybrids selected pineapple genotypes was not observed. However, ISSR primer UBC-809 developed DNA fingerprints in Kew (1408 bp), Mauritius (460 bp), Amritha (1283 bp), H-115 (1167 bp), and H-118 (667 bp), could distinguish between these five varieties and can help identify them appropriately. Another primer, In case of ISSR-10 also found unique DNA fingerprints in Kew (1215 bp), Mauritius (936 bp), Amritha (1400 bp), and H-118 (1015 bp) can differentiate between these four selected pineapple genotypes and may help to identification them appropriately.

	1	2	3	4	5	6	7	8	9	10	11
Amplicons size (bp)/ primers	**AW-3**	**DiGT5C**	**IS-61**	**IS-65**	**ISSR-2**	**ISSR-4**	**ISSR-10**	**ISSR-21**	**UBC-809**	**UBC-811**	**UBC-841**
1621	0	0	0	0	0	1	0	0	0	0	0
1508	0	0	0	0	0	0	0	1	0	0	0
1408	0	0	0	0	0	0	0	0	1	0	0
1350	1	0	0	0	0	0	0	0	0	0	0
1233	0	0	0	0	0	0	0	0	0	0	1
1215	0	0	0	0	0	0	1	0	0	0	0
1181	0	1	0	0	0	0	0	0	0	0	0
1171	0	0	0	0	1	0	0	0	0	0	0
1064	0	0	0	0	0	1	0	0	0	0	0
1029	0	0	0	1	0	0	0	0	0	0	0
1028	0	0	1	0	0	0	0	0	0	0	0
877	0	0	0	0	1	0	0	0	0	0	0
855	0	0	0	0	0	0	0	0	0	1	0
787	0	0	0	0	1	0	0	0	0	0	0
730	0	0	0	0	0	1	0	0	0	0	0
656	0	0	0	0	0	0	0	0	0	1	0
608	1	0	0	0	0	0	0	0	0	0	0
523	0	0	0	0	0	0	0	0	0	1	0
438	0	0	0	0	0	0	0	0	0	1	0

Fig. 4.6.3.1.5.1. Fingerprint for pineapple variety Kew using eleven ISSR primer profiles

	1	2	3	4	5
Amplicons size (bp)/ primers	**AW-3**	**ISSR-10**	**ISSR-21**	**OMAR**	**UBC-809**
936	0	1	0	0	0
721	0	0	0	1	0
720	0	0	1	0	0
486	1	0	0	0	0
460	0	0	0	0	1
410	0	0	0	1	0
389	0	0	1	0	0
363	1	0	0	0	0

Fig. 4.6.3.1.5.2. Fingerprint for pineapple variety Mauritius using five ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3	4	5	6
Amplicons size (bp)/ primers	**AW-3**	**IS-61**	**ISSR-10**	**MANNY**	**UBC-809**	**UBC-864**
1410	0	0	0	1	0	0
1400	0	0	1	0	0	0
1287	0	0	0	0	0	1
1283	0	0	0	0	1	0
1143	0	0	0	1	0	0
1133	1	0	0	0	0	0
989	0	1	0	0	0	0
986	0	0	0	0	0	1
878	0	0	0	0	0	1
837	0	0	0	0	0	0
786	0	0	0	0	0	1

Fig. 4.6.3.1.5.3. Fingerprint for pineapple variety Amritha using six ISSR primer profiles

	1	2
Amplicons size (bp)/ primers	**ISSR-4**	**ISSR-21**
1221	1	0
1021	1	0
929	0	1
659	1	0

Fig. 4.6.3.1.5.4. Fingerprint for Kew x Mauritius hybrid (H-101) using two ISSR primer profiles

	1	2	3
Amplicons size (bp)/ primers	**IS-61**	**UBC-809**	**UBC-864**
1167	0	1	0
960	1	0	0
959	0	0	1

Fig. 4.6.3.1.5.5. Fingerprint for Kew x Mauritius hybrid (H-115) using six ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

	1	2	3
Amplicons size (bp)/ primers	**IS-65**	**ISSR-10**	**UBC-809**
1015	0	1	0
970	1	0	0
667	0	0	1
279	1	0	0

Fig. 4.6.3.1.5.6. Fingerprint for Kew x Mauritius hybrid (H-118) using three ISSR primer profiles

	1	2	3	4	5
Amplicons size (bp)/ primers	**DiGT5C**	**IS-65**	**UBC-841**	**UBC-844**	**UBC-864**
1407	0	0	0	0	1
1350	1	0	0	0	0
1120	0	0	1	0	0
1087	1	0	0	0	0
726	1	0	0	0	0
676	0	1	0	0	0
397	0	0	0	1	0

Fig. 4.6.3.1.5.7. Fingerprint for Kew x Mauritius hybrid (H-121) using five ISSR primer profiles

Colour code for shared amplicons among genotypes

Unique amplicons	**Polymorphic amplicons**	**Monomorphic amplicons**

SUMMARY

5. SUMMARY

The present investigation entitled "Evaluation of hybrids and clonal variants in pineapple (*Ananas comosus* L.)" was conducted during August 2017 to August 2021 at Fruits Crops Research Station, Vellanikkara, Department of Fruit Science, and Department of Seed Science & Technology, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala. The objectives of the research work were to evaluate the somaclonal variants and hybrids of pineapple for yield and quality for identifying novel genotypes and to generate DNA fingerprints of the genotypes using Inter Simple Sequence Repeats (ISSR) markers for varietal identification and assessment of genetic resemblance.

In the plant material for Experiment-I comprised of 75 somaclonal variants derived from the pineapple cultivar Mauritius, developed at Centre for Plant Biotechnology and Molecular Biology, College of Agriculture, Vellanikkara. They were field planted and evaluated at Fruits Crops Research Station, Vellanikkara. The material for Experiment-II comprised of 25 Mauritius x Kew and 10 Kew x Mauritius hybrids. They were selected and evaluated at Fruits Crops Research Station, Vellanikkara, by adopting randomized block design with two replications during the normal season along with cultivars Mauritius, Kew, and Amritha. In the material for Experiment-III, molecular characterization of 11 superior somaclonal variants of pineapple variety Mauritius along with the parental source was carried out using fifty ISSR markers. Similarly molecular characterization of six Mauritius x Kew and four Kew x Mauritius promising hybrids and three check varieties namely Mauritius, Kew, and Amritha were carried out using fifteen ISSR markers.

Salient findings of the somaclonal variants of pineapple variety Mauritius

- ❖ Eight quantitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage, revealed that all the variants under study exhibited values such as plant height (67-95 cm), the number of leaves (39-46), length of D leaf (48-78 cm), breadth of D leaf (2-6 cm), 'D' leaf area (79.75-282.75 cm), leaf area index (2.17-8.72), number of suckers per plant (1-12), number of slips per plant (1-7), and spine length (0.18-0.30 mm).

- Five qualitatively vegetative characters of somaclonal variants of pineapple variety Mauritius at its 39 leaf stage, observed that all the variants under study differed with regard to the distribution of spines (spines along all margins), the direction of spines (only ascendant), the coloration of leaf spines (reddish/red, purplish/pinkish, and yellowish/greenish), spine stiffness (intermediate type), and position of suckers (aerial and underground suckers),
- Flower characterization of somaclonal variants of pineapple variety Mauritius, revealed that all the variants under this study varied with regard to days to attain ideal leaf stage for flowering (312-420 days), days for flower initiation of flowering (35-50 days), and flowering phase (17-26 days).
- Fruit and yield characterization of somaclonal variants of pineapple variety Mauritius, the data noted that all the variants under this study, days for fruit maturity (91-307 days), crop duration (544-752 days), presence of crown (present), crown shape (56 % lengthened cylindrical, 22.66 % long-conical, 12 % cone, 8 % lengthened cylindrical with bunchy top, and 1.33 % oblong blocky type), crown characters (normal to multiple), number of crowns surmounting fruit (1-3), the attitude of crown foliage (60 % semi-erect, 26.66 % erect, 6.66 % horizontal, and 6.66 % drooping type), color of crown leaves (41.33 % green with red mottling, 24 % greenish/green, 24 % silvery-white, 8 % purplish/pinkish, and 2.66 % green with yellow mottling), presence of spines on crown leaves (spiny-serrate), crown attachment to the fruit (with short, distinct neck), the color of crown attachment area/basal leaves (60 % pinkish/pink, 24 % silvery-green, 9.33 % yellowish/yellow, 4 % greenish/green, 1.33 % red purplish, and 1.33 % green with red mottling leaves), fruit shape (30.26 % cylindrical tapering slightly from near base, 22.37 % conical type, 19.74 % oval type, 7.89 % pyramidal type, 6.58 % round type, 6.58 % reniform type, 3.95 % pyriform type, and 2.63 % square like), fruit colour when ripe (43.42 % golden yellow colour fruits, 23.68 % bright yellow colour fruits, 18.42 % deep yellow to orange colour fruits and 14.47 % yellow with green mottling coloured fruits), presence of “eye” (Berry) corking (present), presence of crowns coming from an “eye” (Berry, present), number of eyes (53-146), profile of eyes (94.66 % normal, 2.66 % flat type, and 2.66 % prominent type), relative surface of eyes

(73.33 % medium type and 26.66 % small type), length of the fruit (9.30-17.40 cm), the girth of the fruit (23.95-35.20 cm), breadth of the fruit (7.97-10.63 cm), taper ratio of the fruit (0.71-0.93), fruit weight with crown (0.49-1.27 kg), fruit weight without crown (0.42-1.16 kg), crown weight (0.03-0.17 kg), yield per plant (0.49-1.27 kg), estimated yield (16.67-51.27 t/ha), shelf life (6-9 days)**,** peel weight (0.08-0.25 kg), pulp weight (0.20-0.78 kg), and pulp percentage (32.37-78.12 %).

- ❖ Fruit quality analysis of somaclonal variants were assessed *viz*., juice (73.42-96.69 %), TSS (9-15.20 °Brix), acidity (0.26-1.54 %), total sugars (8.40-14.00 %), reducing sugars (1.38-5.45 %), non-reducing sugars (3.55-12.37 %), sugar/acid ratio (7.81-47.69), fibre (20.00-43.30 %), total carotenoids (106.81-387.00 mg/100g), and ascorbic acid (10.26-184.62 mg/100 g) were recorded for the treatments to elucidate the influence of various treatments on fruit quality.
- ❖ In organoleptic evaluation, the sensory profile of the most preferred somaclonal variants were T-6, T-33, T-57, and T-69.
- ❖ As per the selection criteria for somaclones using index scores as suggested by Singh and Chaudhary (1985), it was observed that the sum of index values of somaclones which secured rank with the highest index scores within the eleven were identified. Accordingly, eleven somaclones T-4, T-17, T-71, T-47, T-43, T-25, T-22, T-24, T-75, T-10 and T-69 were selected for further molecular characterization.
- ❖ Among the 50 ISSR markers that were used for PCR amplification, only 30 have shown polymorphic amplification. The nature of amplicons (polymorphic), the number of amplicons (4-29), number of polymorphic amplicons (2-29), size of amplicons (44-1921 bp), uniqueness of amplicons (1-6), Polymorphic Information Content (0.32-0.94), and Percentage Polymorphic Amplicons (50-100 %) were recorded from ISSR marker profiles.
- ❖ ISSR analysis results have shown that out of 30 ISSR markers, 22 markers have PIC values of more than 0.70. This has shown the high discrimination potential of the marker system. A UPGMA based dendrogram showed that the 12 pineapple genotypes could be classified into three main clusters (I-III) with the similarity coefficient of 0.64. Among the three clusters, cluster II was the

largest, consisting of six lines (T-22, T-24, T-25, T-43, T-47, and T-69), cluster I had four lines (Mauritius, T-4, T-10, and T-17), and cluster III had two lines (T-71 and T-75).

- The genetic similarity indices among the 12 lines obtained on the basis of 30 ISSR markers ranged from 0.58 to 0.81, indicating a moderate level of variation among the studied genotypes. Among the lines evaluated, minimum (0.58) similarity was showed by the parent genotype Mauritius with the somaclonal variants T-71 and T-75, indicating the existence of significant genetic variation among these three variants.

Salient findings of the promising Mauritius x Kew hybrids

- Eight quantitatively vegetative characters of 25 Mauritius x Kew hybrids along with parents and one check variety Amritha at its 39 leaf stage, revealed that all the hybrids under study exhibited the values such as plant height (89.46-109.02 cm), number of leaves (38.47-42.24), length of D leaf (51.80-61.94 cm), breadth of D leaf (2.18-4.46 cm), 'D' leaf area (84.45-182.69 cm), leaf area index (2.54-5.26), number of suckers per plant (0.54-2.87), number of slips per plant (0.20-2.13), and spine length (0.17-0.33 mm).
- Five qualitatively vegetative characters of 25 Mauritius x Kew hybrids along with parents and one check variety Amritha at its 39 leaf stage, observed that all the hybrids under study differed with regard to the distribution of spines (spines behind tip to spines along all margins), the direction of spines (only ascendant), the coloration of leaf spines (yellowish/greenish to purplish/pinkish), and spine stiffness (intermediate type), and position of suckers (78.57 % aerial and underground suckers and 21.43 % aerial suckers only),
- Flower characterization of 25 Mauritius x Kew hybrids along with parents and one check variety Amritha, recorded that all the hybrids under this study varied with regard to days to attain ideal leaf stage for flowering (175.10-196.30 days), days for flower initiation of flowering (39.74-52.97 days), days for 50 per cent flowering (45.50-58.42 days), and flowering phase (19.92-26.14 days).

- Fruit and yield characterization of twenty-five Mauritius x Kew hybrids along with parents and one check variety Amritha, noted that all the hybrids under this study differed with regard to days for fruit maturity (138.00-157.20 days), crop duration (352.84-388.28 days), presence of crown (present), crown shape (cone to lengthened cylindrical type), crown characters (normal to multiple type), number of crowns surmounting fruit (1-5.50), the attitude of crown foliage (erect to horizontal types), color of crown leaves (greenish/green to dark red-purple/pink), presence of spines on crown leaves (smooth to spiny-serrate type), crown attachment to the fruit (without neck to with short, distinct neck), the color of crown attachment area/basal leaves (yellowish/yellow to pinkish/pink), fruit shape (oval to pyriform), fruit colour when ripe (green to deep yellow orange), presence of "eye" (Berry) corking (present), presence of crowns coming from an "eye" (Berry, present), number of eyes (47.37-191.87), profile of eyes (flat to normal type), relative surface of eyes (small to medium type), length of the fruit (9.15-19.55 cm), the girth of the fruit (26.25-57.40 cm), breadth of the fruit (5.98-12.15 cm), taper ratio of the fruit (0.75-0.93), fruit weight with crown (0.57-2.15 kg), fruit weight without crown (0.34-1.82 kg), crown weight (0.10-0.51 kg), yield per plant (0.57-2.15 kg), estimated yield (18.41-66.38 t/ha), shelf life (6.75-9.00 days), peel weight (0.08-0.24 kg), pulp weight (0.23-1.59 kg), and pulp percentage (60.53-89.56 %).
- Fruit quality analysis was assessed for among the hybrids *viz*., juice (77.61-95.16 %), TSS (12.16-16.82 °Brix), acidity (0.81-1.05 %), total sugars (5.40-12.91 %), reducing sugars (1.92-4.12 %), non-reducing sugars (0.97-10.87 %), sugar/acid ratio (2.46-22.00), fibre (26.75-35.22 %), total carotenoids (208.21-325.34 mg/100g), and ascorbic acid (22.05-104.11 mg/100 g).
- Based on organoleptic evaluation, the most preferred promising Mauritius x Kew hybrids were found to be T-01 (H-17) followed by treatments T-08 (H-66), T-14 (H-70), T-24 (H-35), and T-07 (H-43).
- As per the selection index developed by Smith (1937) for Mauritius x Kew hybrids, it was found that the indices have identified six promising hybrids. Accordingly, six Mauritius x Kew hybrids T-1 (H-17), T-7 (H-43), T-8 (H-66),

T-14 (H-70), T-15 (H-59), and T-24 (H-35) were selected for further molecular characterization.

- ❖ All the fifteen ISSR markers that were used for PCR amplification have showed polymorphic amplification. Nature of amplicons (polymorphic), number of amplicons (11-25), number of polymorphic amplicons (6-25), size of amplicons (88-1467 bp), uniqueness of amplicons (1-7), Polymorphic Information Content (0.43-0.93), and Percentage Polymorphic Amplicons (54.55-100 %) were recorded.
- ❖ In ISSR analysis, out of 15 primers, 10 had PIC values of more than 0.70. This has shown high discrimination potential of these markers. A UPGMA based dendrogram showed that the nine lines could be classified into three main clusters (I-III) as the similarity coefficient of 0.61. Among the three clusters, cluster II was the largest, consisting of six lines (Kew, H-17, H-35, H-43, H-59, and H-66), cluster III had of two lines (Mauritius and Amritha), whereas, cluster I had H-70.
- ❖ The genetic similarity indices among the nine lines ranged from 0.56 to 0.74, indicating a moderate level of variation. Among the hybrids H-17, H-35, and H-43 had the high level of Jaccard's genetic similarity relationship with parent sources Mauritius and Kew, with a similarity coefficient of 0.72.

Salient findings of the promising Kew x Mauritius hybrids

- ❖ Eight quantitatively vegetative characters of 10 Kew x Mauritius hybrids along with parents and one check variety Amritha at its 39 leaf stage, revealed that all the hybrids under study exhibited the values such as plant height (87.42-107.12 cm), number of leaves (38.60-41.49), length of D leaf (51.90-61.30 cm), breadth of D leaf (2.54-4.46 cm), 'D' leaf area (99.15-198.21 cm), leaf area index (2.93-5.90), number of suckers per plant (0.54-2.00), number of slips per plant (0.35-2.03), and spine length (0.17-0.33 mm).
- ❖ Five qualitatively vegetative characters of 10 Kew x Mauritius hybrids along with parents and one check variety Amritha at its 39 leaf stage, expressed that all the hybrids under study differed with regard to distribution of spines (spines behind tip to spines along all margins), the direction of spines (only ascendant),

the coloration of leaf spines (yellowish/greenish to purplish/pinkish), spine stiffness (intermediate type), and the position of suckers (76.92 % both aerial and underground type suckers, 15.38 % aerial suckers, and 7.69 % underground suckers),

- Flower characterization of 10 Kew x Mauritius hybrids along with parents and one check variety Amritha, recorded that all the hybrids under this study varied with regard to days to attain ideal leaf stage for flowering (178.13-190.61 days), days for flower initiation of flowering (43.08-49.98 days), days for 50 per cent flowering (48.35-55.09 days), and flowering phase (20.04-23.13 days).
- Fruit and yield characterization of 10 Kew x Mauritius hybrids along with parents and one check variety Amritha, measured that all the hybrids under this study significantly differed with regard to days for fruit maturity (140.33-157.20 days), crop duration (366.50-388.28 days), presence of crown (present), crown shape (cone to lengthened cylindrical with bunchy top type), crown characters (normal to multiple type), number of crowns surmounting fruit (1-3.50), the attitude of crown foliage (erect to horizontal types), color of crown leaves (greenish/green to dark red-purple/pink), presence of spines on crown leaves (smooth to spiny-serrate type), crown attachment to the fruit (with short, distinct neck), the color of crown attachment area/basal leaves (silvery green to pinkish/pink), fruit shape (oval to pyriform type), fruit colour when ripe (yellow with green mottling to reddish orange), presence of "eye" (Berry) corking (present), presence of crowns coming from an "eye" (Berry, present), number of eyes (37.17-108.70), profile of eyes (flat to normal type), relative surface of eyes (small to medium type), length of the fruit (7.84-17.80 cm), the girth of the fruit (26.65-38.95 cm), breadth of the fruit (7.00-11.93 cm), taper ratio of the fruit (0.74-0.94), fruit weight with crown (0.55-1.59 kg), fruit weight without crown (0.42-1.48 kg), crown weight (0.07-0.28 kg), yield per plant (0.55-1.59 kg), estimated yield (22.18-64.08 t/ha), shelf life (7.00-9.00 days)**,** peel weight (0.08-0.19 kg), pulp weight (0.32-1.19 kg), pulp percentage (61.03-81.43 %),
- Qualitative analysis of fruit characters were manually analysed *viz*., juice (48-95.16 %), TSS (12.78-18.59 °Brix), acidity (0.72-0.87 %), total sugars (9.00-12.78 %), reducing sugars (1.92-4.12 %), non-reducing sugars (5.69-10.87 %),

sugar/acid ratio (9.61-16.73), fibre (27.91-35.10 %), total carotenoids (215.17-284.32 mg/100g), and ascorbic acid (41.03-104.11 mg/100g).

- On the basis of hedonic scale, the most preferred promising Kew x Mauritius hybrids were found to be T-13 (Amritha) followed by treatments T-03 (H-115), T-02 (H-118), T-09 (H-121), and T-11 (Mauritius).
- With the selection index of Kew x Mauritius hybrids, it was found that the indices have identified four promising hybrids. Accordingly, four hybrids T-9 (H-121), T-2 (H-118), T-4 (H-101), and T-3 (H-115) were selected for further molecular characterization.
- All the fifteen ISSR markers used for PCR analysis showed polymorphic amplification. The nature of amplicons (polymorphic), the number of amplicons (10-28), number of polymorphic amplicons (6-24), size of amplicons (178-1621 bp), uniqueness of amplicons (1-6), Polymorphic Information Content (0.41-0.81), and Percentage Polymorphic Amplicons (60-100 %) were recorded for the ISSR primers.
- Of the 15 ISSR primers, seven had PIC values of more than 0.70. This has shown high discrimination potential of the primers. A UPGMA based dendrogram showed that the seven pineapple genotypes can be classified into three main clusters (I-III) with the similarity coefficient of 0.60. Among the three clusters, cluster I was the largest, consisting of four hybrids (H-101, H-115, H-118, and H-121), cluster II had two cultivars (Mauritius and Amritha), whereas, cluster III accommodated parent Kew.
- The genetic similarity indices obtained on the basis of ISSR analysis among the seven pineapple hybrids ranged from 0.53 to 0.79, indicating moderate level of variation. H-115, H-118, and H-121 have registered a high level of Jaccard's genetic similarity values with parent source Kew and Mauritius, as a genetic similarity coefficient of 0.66.

CONCLUSION

This study has analyzed 75 somaclones derived from cv. Mauritius, 25 hybrids of Mauritius x Kew, and 10 hybrids of Kew x Mauritius. Based on the selection indices developed, the superior somaclones and hybrids were identified. The identified lines were characterized using the ISSR molecular marker system which had revealed the genetic relativeness among the superior somaclones and the hybrids.

FUTURE LINE OF WORK

- The characterized somaclonal variants and promising hybrids are to be registered under PPV & FR Act, 2001.
- Yield and quality contributing characters of the selected somaclonal variants and promising hybrids are to be assessed for more number of seasons and better yielding genotypes could be promoted for commercial cultivation.
- Confirmation of molecular characterization can be done including more check varieties and also more ISSR markers.
- The sequence data of unique amplicons generated through PCR amplified ISSR markers could be used in generating STMS and SNP primers for detecting minor differences among and within selected lines of somaclones and hybrids.

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EVALUATION OF HYBRIDS AND CLONAL VARIANTS IN PINEAPPLE (*Ananas comosus* L.)

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LALIT DHURVE

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ABSTRACT OF THE THESIS

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Kerala Agricultural University

DEPARTMENT OF FRUIT SCIENCE

COLLEGE OF AGRICULTURE

VELLANIKKARA, THRISSUR - 680 656

KERALA, INDIA

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ABSTRACT

The present investigation entitled "Evaluation of hybrids and clonal variants in pineapple (*Ananas comosus* L.)" was conducted during August 2017 to August 2021 at Department of Fruit Science, College of Agriculture, Thrissur, Kerala. The objectives of the research work were to evaluate the somaclonal variants and hybrids of pineapple for yield and quality for identifying novel genotypes and to generate DNA fingerprints of the genotypes using ISSR markers for varietal identification and assessment of genetic resemblance.

The plant material for Experiment-I comprised of 75 somaclonal variants derived from the pineapple cultivar Mauritius. They were field planted and evaluated at FCRS. The material for Experiment-II comprised of 25 numbers of Mauritius x Kew and 10 numbers of Kew x Mauritius hybrids which were selected and evaluated at FCRS, by adopting RBD with two replications during the normal season along with the cultivars Mauritius, Kew, and Amritha. For Experiment-III, molecular characterization of 11 superior somaclones along with the parental source was carried out using fifty ISSR markers. Similarly molecular characterization of 10 promising hybrids and three check varieties namely Mauritius, Kew, and Amritha were carried out using fifteen ISSR markers.

All the somaclonal variants of Mauritius and their field evaluated hybrids were scored based on the most desirable and undesirable characters. Statistical analysis was performed by using the different selection criteria for somaclones and hybrids. Somaclones were selected by calculating index scores (Singh and Chaudhary,1985) and hybrids were selected based on selection index (Smith, 1937). With relation to this, the scores of individual genotypes were judged and those genotypes which ranked with the highest index values in the selection indices were carried forward for further study.

The statistical analysis was performed by using the selection criteria for somaclones using index scores as suggested by Singh and Chaudhary (1985). It was observed that the sum of index values of somaclones which secured rank with the highest index scores within the eleven were identified. Accordingly, eleven somaclones T-4, T-17, T-71, T-47, T-43, T-25, T-22, T-24, T-75, T-10 and T-69 were selected for further molecular

characterization. Among the 50 ISSR markers that were used for PCR amplification, only 30 showed polymorphic amplification. The unique amplicons (1-6) and PIC (0.32-0.94) were recorded from ISSR marker profiles. A UPGMA based dendrogram, minimum (0.58) similarity was showed by the parent genotype Mauritius with the somaclonal variants T-71 and T-75, indicating the existence of significant genetic variation among these three variants.

The selection index developed by Smith (1937) was used to discriminate the genotypes based on selected characters. As per the selection index of Mauritius x Kew hybrids, it was found that the indices have identified the six hybrids. Accordingly, six numbers of Mauritius x Kew hybrids T-1 (H-17), T-7 (H-43), T-8 (H-66), T-14 (H-70), T-15 (H-59), and T-24 (H-35) were selected for further molecular characterization. All the 15 ISSR markers that were used for PCR amplification showed polymorphic amplification. The uniqueness of amplicons (1-7) and PIC (0.43-0.93) were recorded. A UPGMA based dendrogram showed that the hybrids H-17, H-35, and H-43 had the high level of Jaccard's genetic similarity relationship with parent sources Mauritius and Kew, with a similarity coefficient of 0.72.

With the selection index of Kew x Mauritius hybrids, it was found that the indices have identified the four hybrids. Accordingly, four hybrids T-9 (H-121), T-2 (H-118), T-4 (H-101), and T-3 (H-115) were selected for further molecular characterization. All the fifteen ISSR markers used for PCR analysis showed polymorphic amplification. The uniqueness of amplicons (1-6) and PIC (0.41-0.81) were recorded for the ISSR primers. A UPGMA based dendrogram showed that the H-115, H-118, and H-121 have registered a high level of Jaccard's genetic similarity values with parent source Kew and Mauritius, with a genetic similarity coefficient of 0.66.

Thus, this study has analyzed 75 somaclones derived from cv. Mauritius, 25 hybrids of Mauritius x Kew, and 10 hybrids of Kew x Mauritius. Based on the selection indices developed, the superior somaclones and hybrids were identified. The identified lines were characterized using the ISSR molecular marker system which had revealed the genetic relativeness among the selected somaclones and the hybrids.

സംഗ്രഹം

"പൈനാപ്പിൾ (അനനാസ് കോമോസസ് എൽ) സങ്കരയിനങ്ങളുടെയും ക്ലോണൽ വേരിയന്റുകളുടെയും മൂല്യനിർണ്ണയം" എന്ന തലക്കെട്ടിലാണ് 2017 ഓഗസ്റ്റ് മുതൽ 2021 ഓഗസ്റ്റ് വരെ ഡിപ്പാർട്ട്മെന്റ് ഓഫ് ഫ്രൂട്ട് സയൻസ്, കോളേജ് ഓഫ് അഗ്രികൾച്ചർ, തൃശ്ശൂർ, കേരളയുടെ ഇപ്പോഴത്തെ ഗവേഷണ പ്രവർത്തനങ്ങൾ നടത്തിയത്. പൈനാപ്പിളിന്റെ സോമക്ലോൺ വകഭേദങ്ങളും സങ്കരയിനങ്ങളും വിലയിരുത്തുക എന്നതായിരുന്നു ഗവേഷണ പ്രവർത്തനങ്ങൾ. വിളവും ഗുണനിലവാരവും അടിസ്ഥാനമാക്കി പുതിയ ജനിതകരൂപങ്ങൾ തിരിച്ചറിയുന്നതിനും ഐഎസ്എസ്ആർ മാർക്കറുകൾ ഉപയോഗിച്ചു ഡിഎൻഎ വിരലടയാളങ്ങൾ സൃഷ്ടിക്കുന്നതിനും ജനിതകത്തിന്റെ വൈവിദ്ധ്യം മനസിലാക്കുന്നതും ലക്ഷ്യമിട്ടായിരുന്നു ഈ ഗവേഷണ പ്രവർത്തനങ്ങൾ.

പരീക്ഷണത്തിനുള്ള ഗവേഷണ വസ്തു പൈനാപ്പിൾ ഇനം മൊറീഷ്യസ് നിന്ന് ഉരുത്തിരിഞ്ഞ 75 സോമക്ലോൺ വകഭേദങ്ങൾ ആയിരുന്നു, അവ എഫ്സിആർഎസിൽ നട്ടുപിടിപ്പിച്ച് വിലയിരുത്തി. എഫ്. സി. ആർ. എസ് - ൽ നിന്ന് തിരഞ്ഞെടുത്ത 25 മൗറീഷ്യസ് x ക്യു ഹൈബ്രിഡുകളും, 10 ക്യു x മൗറീഷ്യസ് ഹൈബ്രിഡുകളും ആയിരുന്നു പരീക്ഷണത്തിനുള്ള ഗവേഷണ വസ്തു. ആർ ബി ഡി രീതി സ്വീകരിച്ചുകൊണ്ട് മൊറീഷ്യസ്, ക്യൂ, അമൃത എന്നീ ഇനങ്ങളോടൊപ്പം രണ്ട് തവണയായി സാധാരണ സീസണിൽ ആയിരുന്നു ഈ പരീക്ഷണം. പരീക്ഷണം-I I I -ന്, 11 മുന്തിയ സോമക്ലോണുകളുടെയും അവയുടെ ഉറവിടത്തിന്റെയും തന്മാത്രാ സ്വഭാവം അമ്പത് ഐഎസ്എസ്ആർ മാർക്കറുകൾ ഉപയോഗിച്ചാണ് നടത്തിയത്. അതുപോലെ 10 മികച്ച സങ്കരയിനങ്ങളുടെയും മൗറീഷ്യസ്, ക്യൂ, അമൃത എന്നീ മൂന്ന് ചെക്ക് ഇനങ്ങളുടെയും തന്മാത്ര സ്വഭാവം പതിനഞ്ച് ഐഎസ്എസ്ആർ മാർക്കറുകൾ ഉപയോഗിച്ചു നടത്തി.

ഏറ്റവും അഭിലഷണീയവും അനഭിലഷണീയവുമായ പരാമീറ്ററുകൾ അടിസ്ഥാനമാക്കി മൗറീഷ്യസിന്റെ എല്ലാ സോമാക്ലോണൽ വകഭേദങ്ങളും അവയുടെ വിലയിരുത്തിയ സങ്കരയിനങ്ങളും സ്കോർ ചെയ്തു. സോമാക്ലോണുകൾക്കും സങ്കരയിനങ്ങൾക്കുമായി വ്യത്യസ്ത തിരഞ്ഞെടുക്കൽ മാനദണ്ഡങ്ങൾ ഉപയോഗിച്ചാണ് സ്റ്റാറ്റിസ്റ്റിക്കൽ വിലയിരുത്തൽ നടത്തിയത്. സൂചിക സ്കോറുകൾ (സിംഗും ചൗധരിയും, 1985) കണക്കാക്കിയാണ് സോമാക്ലോണുകൾ തിരഞ്ഞെടുത്തത്, കൂടാതെ സങ്കരയിനങ്ങളെ തിരഞ്ഞെടുത്തത് സെലക്ഷൻ സൂചികയെ (സ്മിത്ത്, 1937) അടിസ്ഥാനമാക്കിയാണ്. ഇതിനെ അടിസ്ഥാനമാക്കി വ്യക്തിഗത ജനിതകമാതൃകകളുടെ സ്കോറുകൾ വിലയിരുത്തപ്പെട്ടു, തുടർന്ന് തിരഞ്ഞെടുപ്പ് സൂചികകളിലെ ഏറ്റവും ഉയർന്ന സൂചിക മൂല്യങ്ങൾ ഉള്ള ജനിതകയിനങ്ങളെ കൂടുതൽ പഠനത്തിനായി തിരഞ്ഞെടുത്തു.

സോമാക്ലോണുകൾ തിരഞ്ഞെടുക്കുന്നതിനുള്ള സ്റ്റാറ്റിസ്റ്റിക്കൽ വിലയിരുത്തൽ നടത്തിയത് സിംഗും ചൗധരിയും (1985) നിർദ്ദേശിച്ച പ്രകാരം സൂചിക സ്കോറുകൾ ഉപയോഗിച്ചാണ്. ഏറ്റവും ഉയർന്ന സൂചിക സ്കോറുകളുള്ള റാങ്ക് നേടിയ സോമാക്ലോണുകളുടെ സൂചിക മൂല്യങ്ങളുടെ ആകെത്തുക പതിനൊന്നിനുള്ളിൽ വരുന്നവ തിരഞ്ഞെടുത്തു. ടി -4, ടി -17, ടി -71, ടി -47, ടി -43, ടി -25, ടി -22, ടി -24, ടി -75, ടി -10, ടി -69 എന്നി പതിനൊന്ന് സോമാക്ലോണുകൾ, ആണ് കൂടുതൽ തന്മാത്ര സ്വഭാവം മനസിലാകുന്നതിനായി

തിരഞ്ഞെടുത്തത്. പി സി ആർ ആംപ്ലിഫിക്കേഷനായി ഉപയോഗിച്ച 50 ഐഎസ്എസ്ആർ മാർക്കറുകളിൽ, 30 മാർക്കറുകൾ മാത്രമാണ് പോളിമോർഫിക് ആംപ്ലിഫിക്കേഷൻ കാണിച്ചത്. അദ്വിതീയ ആംപ്ലിക്കോണുകൾ (1-6), പി ഐ സി (0.32-0.94) എന്നിവ ഐഎസ്എസ്ആർ മാർക്കർ പ്രൊഫൈലുകളിൽ നിന്ന് രേഖപ്പെടുത്തിയിട്ടുണ്ട്. യുപിജിഎംഎ അടിസ്ഥാനമാക്കിയുള്ള ഡെൻഡ്രോഗ്രാം പ്രകാരം മാതൃ ജനിതകരൂപമായ മൗറീഷ്യസ് കുറഞ്ഞത് (0.58) സാമ്യം ടി -71, ടി -75 എന്നീ സോമാക്ലോണുകലുമായി കാണിക്കുന്നു. ആയതിനാൽ, ഈ മൂന്ന് വകഭേദങ്ങൾ തമ്മിൽ കാര്യമായ ജനിതക വ്യതിയാനം ഉണ്ടെന്ന് സൂചിപ്പിക്കുന്നു.

സ്വഭാവം അടിസ്ഥാനമാക്കി തിരഞ്ഞെടുത്ത ജനിതകയിനങ്ങളുടെ വിവേചനത്തിനായി സ്മിത്ത് (1937) വികസിപ്പിച്ചെടുത്ത സെലക്ഷൻ ഇൻഡക്സ് ഉപയോഗിച്ചു. മൗറീഷ്യസ് x ക്യൂവിന്റെ തിരഞ്ഞെടുപ്പ് സൂചിക പ്രകാരം, ആറ് സങ്കരയിനങ്ങളെ തിരിച്ചറിഞ്ഞതായി കണ്ടെത്തി. അതനുസരിച്ച്, ആറ്, മൗറീഷ്യസ് x ക്യൂ സങ്കരയിനങ്ങൾ ടി -1 (എച്ച് -17), ടി -7 (എച്ച് -43), ടി -8 (എച്ച് -66), ടി -14 (എച്ച് -70), ടി -15 (എച്ച് -59), ടി -24 (എച്ച് -35) കൂടുതൽ തന്മാത്രാ സ്വഭാവ പഠനത്തിനായി തിരഞ്ഞെടുത്തു. പി സി ആർ ആംപ്ലിഫിക്കേഷനായി ഉപയോഗിച്ച 15 ഐഎസ്എസ്ആർ മാർക്കറുകളും പോളിമോർഫിക് ആംപ്ലിഫിക്കേഷൻ കാണിച്ചു. അദ്വിതീയ ആംപ്ലിക്കോണുകൾ (1-7), പി ഐ സി (0.43-0.93) എന്നിവ ഐഎസ്എസ്ആർ മാർക്കർ പ്രൊഫൈലുകളിൽ നിന്ന് രേഖപ്പെടുത്തിയിട്ടുണ്ട്. യുപിജിഎംഎ ഡെൻഡ്രോഗ്രാമിൽ, ജാക്കാർഡിന്റെ ജനിതക സാമ്യത്തിന്റെ അടിസ്ഥാനമാക്കി, സങ്കരയിനങ്ങളായ എച്ച് -17, എച്ച് -35, എച്ച് -43 എന്നിവ മാതൃ സ്രോതസ്സുകളായ മൗറീഷ്യസ്, ക്യൂ എന്നിവയുമായി ഉയർന്ന സാമ്യത സൂചിക (0.72) കാണിക്കുന്നു.

ക്യൂ x മൗറീഷ്യസ് സങ്കരയിനങ്ങളുടെ തിരഞ്ഞെടുപ്പ് സൂചിക ഉപയോഗിച്ച്, സൂചികകൾ നാല് സങ്കരയിനങ്ങളെ തിരിച്ചറിഞ്ഞു. അതനുസരിച്ച്, നാല് സങ്കരയിനം ടി -9 (എച്ച് -121), ടി -2 (എച്ച് -118), ടി - 4 (എച്ച് -101), ടി -3 (എച്ച് -115) എന്നിവ കൂടുതൽ തന്മാത്രാ സ്വഭാവസവിശേഷതയ്ക്കായി തിരഞ്ഞെടുത്തു. പിസിആർ വിശകലനത്തിനായി ഉപയോഗിച്ച പതിനഞ്ച് ഐഎസ്എസ്ആർ മാർക്കറുകൾ പോളിമോർഫിക് ആംപ്ലിഫിക്കേഷൻ കാണിക്കുന്നു. ഐഎസ്എസ്ആർ പ്രൈമറുകൾക്കായി ആംപ്ലിക്കോണുകളുടെ പ്രത്യേകതയും (1-6), പി ഐ സി (0.41-0.81) രേഖപ്പെടുത്തിയിട്ടുണ്ട്. യുപിജിഎംഎ ഡെൻഡ്രോഗ്രാമിൽ, ജാക്കാർഡിന്റെ ജനിതക സാമ്യത്തിന്റെ അടിസ്ഥാനമാക്കി, സങ്കരയിനങ്ങളായ എച്ച് -115, എച്ച് -118, എച്ച് -121 എന്നിവ മാതൃ സ്രോതസ്സുകളായ ക്യൂ, മൗറീഷ്യസ് എന്നിവയുമായി ഉയർന്ന സാമ്യത സൂചിക (0.66) കാണിക്കുന്നു.

അങ്ങനെ, ഈ പഠനം സിവി. മൗറീഷ്യസിൽ നിന്ന് ഉരുത്തിരിഞ്ഞ 75 സോമാക്ലോണുകൾ, 25 മൗറീഷ്യസ് x ക്യൂവിന്റെ സങ്കരയിനങ്ങളും, ക്യൂ x മൗറീഷ്യസിന്റെ 10 സങ്കരയിനങ്ങളും വിശകലനം ചെയ്തു. തിരഞ്ഞെടുപ്പ് സൂചികകൾ അടിസ്ഥാനമാക്കി മികച്ച സോമാക്ലോണുകളും സങ്കരയിനങ്ങളും തിരിച്ചറിഞ്ഞു. ഐഎസ്എസ്ആർ മോളിക്യുലാർ മാർക്കർ സിസ്റ്റം ഉപയോഗിച്ചാണ് തിരഞ്ഞെടുത്ത സോമാക്ലോണുകളുടെയും സങ്കരയിനങ്ങളുടേയും ജനിതക ആപേക്ഷികതയും ജനിതക സ്വഭാവങ്ങളും തിരിച്ചറിഞ്ഞത്.

Appendix-I

Climatological data during the period of evaluation of pineapple somaclones and hybrids

Months	Average temperature (°C)	Humidity (%)	Rainfall (mm)
August 2017 to December 2017	27.80	82.40	1257.50
January 2018 to December 2018	27.67	79.75	1465.00
January 2019 to December 2019	28.08	77.25	626.80
January 2020 to December 2020	28.00	78.58	2246.00
January 2021 to August 2021	28.13	78.50	697.80

Appendix-II

Score card for sensory evaluation of somaclones of Mauritius pineapple

9 point hedonic scale

Treatments	**Colour**	**Taste**	**Flavour**	**Texture**	**Overall acceptability**
T-1					
T-2					
T-3					
T-4					
T-5					
T-6					
T-7					
T-8					
T-9					
T-10					
T-11					
T-12					
T-13					
T-14					
T-15					
T-16					
T-17					
T-18					
T-19					
T-20					
T-21					
T-22					
T-23					
T-24					
T-25					
T-26					
T-27					
T-28					
T-29					
T-30					
T-31					
T-32					
T-33					
T-34					
T-35					
T-36					
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T-69					
T-70					
T-71					
T-72					
T-73					
T-74					
T-75					

Note: you are provided with the samples of pineapple fruit and are requested to rank them according to the scale given below as per your liking

Scale:

9 Like Extremely
8 Like Very Much
7 Like Moderately
6 Like Slightly
5 Neither like nor Dislike

4 Dislike Slightly
3 Dislike Moderately
2 Dislike Very Much
1 Dislike Extremely

Date:

Name:

Signature:

Appendix-III

Score card for sensory evaluation of Mauritius x Kew hybrids

9 point hedonic scale

Treatments	**Colour**	**Taste**	**Flavour**	**Texture**	**Overall acceptability**
T-1 (H-17)					
T-2 (H-16)					
T-3 (H-85)					
T-4 (H-91)					
T-5 (H-48)					
T-6 (H-62)					
T-7 (H-43)					
T-8 (H-66)					
T-9 (H-77)					
T-10 (H-92)					
T-11 (H-63)					
T-12 (H-27)					
T-13 (H-78)					
T-14 (H-70)					
T-15 (H-59)					
T-16 (H-60)					
T-17 (H-49)					
T-18 (H-54)					
T-19 (H-10)					
T-20 (H-15)					
T-21 (H-30)					
T-22 (H-14)					
T-23 (H-7)					
T-24 (H-35)					
T-25 (H-19)					
T-26 (Mauritius)					
T-27 (Kew)					
T-28 (Amritha)					

Note: you are provided with the samples of pineapple fruit and are requested to rank them according to the scale given below as per your liking

Scale:

9 Like Extremely
8 Like Very Much
7 Like Moderately
6 Like Slightly
5 Neither like nor Dislike

4 Dislike Slightly
3 Dislike Moderately
2 Dislike Very Much
1 Dislike Extremely

Date:

Name:

Signature:

Appendix-IV

Score card for sensory evaluation of Kew x Mauritius hybrids

9 point hedonic scale

Treatments	**Colour**	**Taste**	**Flavour**	**Texture**	**Overall acceptability**
T-1 (H-98)					
T-2 (H-118)					
T-3 (H-115)					
T-4 (H-101)					
T-5 (H-99)					
T-6 (H-104)					
T-7 (H-110)					
T-8 (H-116)					
T-9 (H-121)					
T-10 (H-111)					
T-11 (Mauritius)					
T-12 (Kew)					
T-13 (Amritha)					

Note: you are provided with the samples of pineapple fruit and are requested to rank them according to the scale given below as per your liking

Scale:

9 Like Extremely
8 Like Very Much
7 Like Moderately
6 Like Slightly
5 Neither like nor Dislike
4 Dislike Slightly
3 Dislike Moderately
2 Dislike Very Much
1 Dislike Extremely

Date:

Name:

Signature:

Appendix-V

Table 4.1.1.1.1. Plant height (cm) of somaclonal variants of pineapple variety Mauritius

Treatments	Plant height (cm)											
	1 MAP	**2 MAP**	**3 MAP**	**4 MAP**	**5 MAP**	**6 MAP**	**7 MAP**	**8 MAP**	**9 MAP**	**10 MAP**	**11 MAP**	**12 MAP**
T 1	47.00	51.00	56.00	60.00	63.00	65.00	67.00	69.00	71.00	73.00	75.00	77.00
T 2	56.00	58.00	61.00	63.00	65.00	67.00	70.00	72.00	75.00	77.00	79.00	82.00
T 3	54.00	58.00	60.00	62.00	64.00	67.00	71.00	74.00	76.00	78.00	80.00	82.00
T 4	51.00	53.00	56.00	59.00	61.00	64.00	69.00	72.00	77.00	80.00	82.00	85.00
T 5	38.00	42.00	49.00	55.00	63.00	67.00	72.00	75.00	79.00	81.00	84.00	88.00
T 6	41.00	44.00	47.00	50.00	52.00	54.00	57.00	60.00	64.00	68.00	72.00	77.00
T 7	50.00	52.00	53.00	58.00	64.00	69.00	72.00	77.00	81.00	83.00	86.00	89.00
T 8	41.00	44.00	47.00	49.00	52.00	55.00	58.00	61.00	64.00	67.00	70.00	73.00
T 9	49.00	51.00	54.00	57.00	60.00	62.00	64.00	66.00	67.00	69.00	72.00	75.00
T 10	55.00	58.00	60.00	62.00	64.00	66.00	68.00	70.00	73.00	76.00	79.00	82.00
T 11	51.00	56.00	59.00	61.00	64.00	67.00	71.00	74.00	77.00	79.00	82.00	83.00
T 12	55.00	58.00	61.00	64.00	67.00	69.00	72.00	74.00	77.00	79.00	81.00	84.00
T 13	50.00	52.00	55.00	57.00	60.00	62.00	63.00	66.00	69.00	71.00	74.00	78.00
T 14	51.00	54.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00	73.00	75.00	79.00
T 15	40.00	43.00	46.00	48.00	51.00	53.00	55.00	58.00	61.00	63.00	65.00	67.00

T 16	41.00	43.00	45.00	47.00	49.00	51.00	62.00	65.00	68.00	70.00	72.00	75.00
T 17	58.00	61.00	63.00	66.00	69.00	72.00	75.00	78.00	80.00	83.00	85.00	87.00
T 18	35.00	37.00	40.00	42.00	44.00	47.00	50.00	54.00	57.00	61.00	64.00	69.00
T 19	54.00	56.00	59.00	62.00	65.00	69.00	72.00	75.00	77.00	80.00	82.00	85.00
T 20	51.00	54.00	56.00	58.00	62.00	65.00	67.00	69.00	71.00	74.00	78.00	81.00
T 21	53.00	55.00	58.00	62.00	65.00	67.00	69.00	71.00	74.00	79.00	82.00	86.00
T 22	61.00	63.00	65.00	68.00	71.00	74.00	77.00	80.00	82.00	85.00	88.00	91.00
T 23	52.00	55.00	58.00	61.00	64.00	66.00	68.00	70.00	73.00	77.00	80.00	83.00
T 24	55.00	58.00	60.00	63.00	66.00	68.00	70.00	73.00	75.00	78.00	81.00	84.00
T 25	50.00	54.00	57.00	60.00	64.00	70.00	72.00	74.00	77.00	80.00	84.00	87.00
T 26	50.00	53.00	55.00	59.00	62.00	65.00	68.00	71.00	74.00	77.00	80.00	83.00
T 27	48.00	51.00	54.00	57.00	59.00	61.00	63.00	66.00	68.00	72.00	75.00	80.00
T 28	46.00	49.00	51.00	55.00	59.00	62.00	65.00	67.00	70.00	72.00	75.00	78.00
T 29	46.00	48.00	51.00	53.00	55.00	59.00	62.00	64.00	67.00	69.00	71.00	74.00
T 30	46.00	49.00	52.00	55.00	59.00	62.00	65.00	68.00	70.00	73.00	76.00	79.00
T 31	55.00	57.00	59.00	62.00	65.00	69.00	71.00	74.00	77.00	79.00	81.00	85.00
T 32	54.00	58.00	61.00	63.00	66.00	69.00	72.00	75.00	78.00	81.00	83.00	86.00
T 33	53.00	55.00	57.00	60.00	63.00	65.00	68.00	70.00	72.00	75.00	77.00	80.00
T 34	48.00	50.00	52.00	54.00	59.00	61.00	64.00	66.00	69.00	71.00	74.00	77.00
T 35	60.00	63.00	65.00	68.00	72.00	74.00	78.00	81.00	84.00	86.00	89.00	91.00
T 36	46.00	49.00	51.00	58.00	61.00	64.00	69.00	74.00	78.00	81.00	83.00	85.00
T 37	59.00	62.00	65.00	68.00	71.00	75.00	77.00	80.00	83.00	86.00	89.00	91.00
T 38	59.00	62.00	64.00	66.00	68.00	70.00	72.00	74.00	76.00	78.00	81.00	84.00

T 39	49.00	51.00	54.00	56.00	59.00	62.00	66.00	69.00	71.00	74.00	77.00	80.00
T 40	47.00	50.00	52.00	54.00	57.00	61.00	63.00	67.00	72.00	75.00	78.00	82.00
T 41	51.00	54.00	57.00	59.00	61.00	63.00	68.00	71.00	74.00	76.00	79.00	83.00
T 42	48.00	50.00	53.00	55.00	59.00	62.00	67.00	70.00	73.00	76.00	79.00	81.00
T 43	51.00	53.00	55.00	57.00	60.00	62.00	65.00	68.00	70.00	73.00	76.00	79.00
T 44	57.00	60.00	62.00	65.00	67.00	70.00	73.00	75.00	77.00	79.00	81.00	84.00
T 45	52.00	55.00	57.00	60.00	63.00	65.00	69.00	72.00	74.00	77.00	80.00	83.00
T 46	66.00	69.00	71.00	73.00	75.00	78.00	82.00	85.00	88.00	91.00	93.00	95.00
T 47	43.00	46.00	49.00	52.00	55.00	58.00	62.00	66.00	69.00	71.00	74.00	78.00
T 48	48.00	51.00	54.00	59.00	62.00	64.00	66.00	70.00	72.00	75.00	77.00	80.00
T 49	53.00	56.00	59.00	62.00	64.00	67.00	70.00	73.00	76.00	79.00	81.00	84.00
T 50	47.00	50.00	52.00	55.00	57.00	61.00	64.00	67.00	70.00	73.00	76.00	79.00
T 51	41.00	44.00	47.00	49.00	52.00	55.00	57.00	60.00	64.00	67.00	70.00	73.00
T 52	44.00	48.00	52.00	54.00	57.00	60.00	63.00	65.00	69.00	71.00	74.00	78.00
T 53	58.00	61.00	63.00	65.00	68.00	70.00	74.00	78.00	81.00	84.00	88.00	91.00
T 54	53.00	55.00	57.00	60.00	62.00	65.00	68.00	70.00	73.00	76.00	79.00	70.00
T 55	61.00	63.00	65.00	68.00	71.00	74.00	77.00	80.00	82.00	84.00	87.00	81.00
T 56	53.00	56.00	59.00	61.00	64.00	67.00	69.00	71.00	74.00	77.00	80.00	89.00
T 57	45.00	47.00	49.00	51.00	53.00	56.00	59.00	62.00	65.00	67.00	70.00	83.00
T 58	48.00	51.00	55.00	59.00	61.00	63.00	67.00	71.00	73.00	76.00	78.00	74.00
T 59	50.00	52.00	55.00	58.00	61.00	64.00	68.00	70.00	72.00	75.00	77.00	80.00
T 60	50.00	52.00	55.00	58.00	61.00	64.00	68.00	70.00	72.00	75.00	77.00	79.00
T 61	58.00	61.00	63.00	65.00	67.00	70.00	73.00	75.00	77.00	79.00	81.00	83.00

T 62	56.00	59.00	61.00	65.00	67.00	69.00	71.00	73.00	76.00	79.00	82.00	84.00
T 63	59.00	61.00	63.00	65.00	67.00	69.00	71.00	74.00	77.00	80.00	83.00	85.00
T 64	43.00	47.00	50.00	52.00	55.00	58.00	61.00	63.00	65.00	67.00	69.00	71.00
T 65	47.00	49.00	51.00	54.00	59.00	63.00	65.00	68.00	71.00	74.00	77.00	80.00
T 66	48.00	51.00	53.00	55.00	57.00	59.00	62.00	65.00	67.00	69.00	72.00	74.00
T 67	60.00	63.00	66.00	69.00	71.00	73.00	76.00	78.00	80.00	82.00	84.00	86.00
T 68	50.00	53.00	56.00	60.00	63.00	65.00	68.00	71.00	73.00	75.00	77.00	79.00
T 69	49.00	51.00	53.00	56.00	59.00	62.00	65.00	67.00	70.00	73.00	75.00	78.00
T 70	41.00	44.00	47.00	50.00	53.00	55.00	58.00	61.00	65.00	68.00	71.00	74.00
T 71	42.00	45.00	48.00	51.00	54.00	58.00	61.00	65.00	68.00	71.00	75.00	79.00
T 72	48.00	50.00	53.00	56.00	58.00	61.00	64.00	66.00	69.00	72.00	76.00	80.00
T 73	52.00	54.00	57.00	60.00	62.00	64.00	67.00	71.00	73.00	76.00	79.00	82.00
T 74	43.00	46.00	49.00	51.00	53.00	56.00	59.00	62.00	65.00	67.00	69.00	72.00
T 75	49.00	52.00	55.00	59.00	62.00	65.00	69.00	72.00	76.00	78.00	81.00	85.00

Months after planting (MAP)

Appendix-VI

Table 4.1.1.1.2. Number of leaves per plant of somaclonal variants of pineapple variety Mauritius

Treatments	Number of leaves per plant											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	9.00	11.00	13.00	15.00	17.00	20.00	23.00	26.00	30.00	34.00	39.00	42.00
T 2	14.00	16.00	18.00	21.00	23.00	26.00	28.00	29.00	31.00	33.00	36.00	39.00
T 3	12.00	15.00	18.00	20.00	24.00	27.00	29.00	31.00	33.00	35.00	37.00	43.00
T 4	14.00	16.00	18.00	20.00	23.00	25.00	27.00	29.00	32.00	34.00	39.00	43.00
T 5	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	29.00	33.00	37.00	43.00
T 6	16.00	18.00	20.00	22.00	24.00	26.00	29.00	32.00	34.00	36.00	37.00	41.00
T 7	13.00	15.00	17.00	19.00	21.00	23.00	25.00	32.00	33.00	36.00	40.00	44.00
T 8	13.00	15.00	17.00	19.00	21.00	25.00	26.00	28.00	33.00	35.00	38.00	42.00
T 9	14.00	17.00	20.00	23.00	25.00	27.00	30.00	33.00	35.00	37.00	38.00	39.00
T 10	19.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	36.00	38.00	40.00
T 11	10.00	12.00	15.00	17.00	19.00	22.00	25.00	29.00	32.00	35.00	38.00	42.00
T 12	8.00	10.00	12.00	15.00	17.00	20.00	23.00	26.00	29.00	32.00	35.00	39.00
T 13	11.00	13.00	16.00	19.00	21.00	24.00	27.00	30.00	33.00	35.00	37.00	40.00
T 14	11.00	13.00	16.00	18.00	21.00	25.00	27.00	30.00	33.00	35.00	38.00	41.00
T 15	10.00	12.00	14.00	17.00	20.00	24.00	29.00	32.00	35.00	38.00	40.00	43.00
T 16	11.00	13.00	15.00	18.00	21.00	24.00	27.00	30.00	33.00	35.00	39.00	41.00

T 17	14.00	16.00	18.00	20.00	22.00	25.00	27.00	29.00	31.00	33.00	37.00	41.00
T 18	12.00	15.00	18.00	21.00	24.00	27.00	29.00	31.00	33.00	36.00	38.00	43.00
T 19	11.00	13.00	15.00	17.00	19.00	22.00	25.00	28.00	30.00	33.00	36.00	41.00
T 20	12.00	15.00	17.00	20.00	23.00	25.00	29.00	31.00	33.00	36.00	38.00	40.00
T 21	6.00	8.00	10.00	12.00	15.00	17.00	19.00	21.00	24.00	29.00	34.00	39.00
T 22	15.00	17.00	19.00	21.00	25.00	27.00	29.00	31.00	33.00	35.00	38.00	40.00
T 23	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	30.00	32.00	38.00	42.00
T 24	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00	29.00	31.00	37.00	41.00
T 25	9.00	11.00	13.00	15.00	17.00	20.00	23.00	25.00	28.00	31.00	35.00	39.00
T 26	14.00	16.00	18.00	20.00	22.00	26.00	29.00	31.00	33.00	35.00	36.00	40.00
T 27	11.00	13.00	15.00	17.00	20.00	23.00	26.00	29.00	32.00	35.00	38.00	41.00
T 28	11.00	13.00	15.00	17.00	20.00	23.00	26.00	29.00	31.00	35.00	37.00	40.00
T 29	12.00	14.00	16.00	18.00	22.00	26.00	29.00	32.00	35.00	38.00	40.00	45.00
T 30	13.00	15.00	17.00	20.00	24.00	27.00	30.00	33.00	35.00	37.00	39.00	40.00
T 31	12.00	14.00	16.00	18.00	20.00	23.00	26.00	29.00	32.00	35.00	38.00	43.00
T 32	11.00	13.00	16.00	19.00	21.00	24.00	27.00	30.00	33.00	35.00	37.00	42.00
T 33	10.00	12.00	15.00	18.00	20.00	22.00	24.00	28.00	31.00	35.00	38.00	45.00
T 34	8.00	10.00	13.00	16.00	19.00	21.00	23.00	25.00	29.00	32.00	35.00	40.00
T 35	9.00	11.00	14.00	16.00	19.00	22.00	25.00	27.00	30.00	33.00	36.00	41.00
T 36	11.00	13.00	15.00	17.00	20.00	23.00	26.00	29.00	32.00	35.00	37.00	42.00
T 37	10.00	13.00	16.00	18.00	20.00	23.00	25.00	28.00	31.00	35.00	37.00	41.00
T 38	10.00	12.00	15.00	17.00	20.00	24.00	27.00	30.00	33.00	36.00	39.00	39.00
T 39	9.00	11.00	13.00	16.00	19.00	21.00	24.00	27.00	30.00	33.00	36.00	41.00

T 40	11.00	13.00	15.00	17.00	20.00	23.00	25.00	28.00	33.00	36.00	39.00	45.00
T 41	13.00	16.00	19.00	21.00	24.00	26.00	29.00	32.00	35.00	37.00	38.00	39.00
T 42	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	28.00	31.00	35.00	39.00
T 43	11.00	13.00	16.00	19.00	22.00	25.00	28.00	30.00	33.00	36.00	39.00	40.00
T 44	10.00	13.00	15.00	17.00	19.00	21.00	24.00	28.00	31.00	34.00	37.00	41.00
T 45	14.00	16.00	18.00	20.00	23.00	25.00	27.00	30.00	33.00	35.00	37.00	40.00
T 46	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	34.00	37.00	39.00
T 47	11.00	13.00	15.00	17.00	20.00	23.00	26.00	29.00	32.00	35.00	37.00	42.00
T 48	14.00	16.00	18.00	20.00	22.00	24.00	26.00	29.00	31.00	33.00	35.00	39.00
T 49	13.00	15.00	17.00	19.00	22.00	24.00	27.00	30.00	33.00	36.00	39.00	46.00
T 50	15.00	17.00	19.00	21.00	23.00	25.00	28.00	31.00	33.00	36.00	38.00	41.00
T 51	9.00	11.00	13.00	15.00	18.00	21.00	24.00	27.00	30.00	33.00	35.00	39.00
T 52	16.00	18.00	20.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	38.00	42.00
T 53	12.00	14.00	16.00	18.00	20.00	22.00	25.00	29.00	31.00	34.00	37.00	41.00
T 54	10.00	12.00	14.00	17.00	20.00	23.00	26.00	29.00	32.00	35.00	38.00	41.00
T 55	11.00	13.00	15.00	17.00	19.00	21.00	24.00	27.00	30.00	33.00	36.00	39.00
T 56	10.00	12.00	15.00	17.00	20.00	23.00	26.00	29.00	32.00	35.00	38.00	39.00
T 57	19.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	42.00
T 58	14.00	16.00	18.00	20.00	23.00	26.00	29.00	31.00	33.00	35.00	38.00	39.00
T 59	9.00	11.00	13.00	16.00	19.00	21.00	25.00	29.00	32.00	35.00	38.00	42.00
T 60	11.00	13.00	15.00	17.00	20.00	23.00	26.00	29.00	31.00	33.00	35.00	39.00
T 61	8.00	10.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00	33.00	36.00	42.00
T 62	9.00	11.00	13.00	16.00	19.00	22.00	25.00	28.00	30.00	33.00	35.00	43.00

T 63	11.00	13.00	15.00	17.00	20.00	23.00	26.00	29.00	31.00	34.00	36.00	41.00
T 64	12.00	14.00	16.00	18.00	20.00	22.00	24.00	27.00	31.00	34.00	37.00	40.00
T 65	11.00	13.00	15.00	17.00	20.00	23.00	26.00	28.00	30.00	33.00	35.00	39.00
T 66	13.00	15.00	17.00	19.00	21.00	24.00	27.00	29.00	31.00	34.00	37.00	42.00
T 67	11.00	13.00	16.00	19.00	22.00	25.00	27.00	29.00	32.00	35.00	37.00	41.00
T 68	13.00	15.00	17.00	19.00	21.00	23.00	26.00	29.00	32.00	35.00	39.00	43.00
T 69	11.00	12.00	14.00	16.00	18.00	20.00	22.00	25.00	27.00	29.00	35.00	42.00
T 70	17.00	19.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	38.00	45.00
T 71	17.00	19.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	38.00	41.00
T 72	14.00	16.00	18.00	20.00	22.00	25.00	27.00	29.00	31.00	33.00	36.00	39.00
T 73	15.00	17.00	20.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	38.00	41.00
T 74	10.00	12.00	14.00	16.00	18.00	21.00	24.00	27.00	30.00	33.00	36.00	39.00
T 75	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	37.00	40.00

Months after planting (MAP)

Appendix-VII

Table 4.1.1.1.3. Length of 'D' leaf of somaclonal variants of pineapple variety Mauritius

Treatments	Length of 'D' leaf											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	27.00	30.00	33.00	37.00	41.00	45.00	50.00	54.00	58.00	60.00	62.00	64.00
T 2	40.00	42.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00
T 3	33.00	35.00	37.00	39.00	41.00	44.00	47.00	50.00	53.00	55.00	57.00	61.00
T 4	35.00	38.00	40.00	43.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00	59.00
T 5	22.00	24.00	27.00	29.00	31.00	33.00	36.00	38.00	42.00	44.00	47.00	50.00
T 6	30.00	32.00	34.00	36.00	38.00	40.00	43.00	46.00	49.00	51.00	53.00	56.00
T 7	35.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	55.00	57.00	60.00
T 8	28.00	30.00	32.00	35.00	37.00	40.00	42.00	44.00	46.00	48.00	50.00	53.00
T 9	34.00	36.00	38.00	40.00	43.00	45.00	47.00	49.00	51.00	54.00	56.00	59.00
T 10	39.00	41.00	43.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00	60.00	63.00
T 11	30.00	33.00	35.00	39.00	42.00	45.00	49.00	51.00	56.00	59.00	61.00	64.00
T 12	32.00	34.00	38.00	41.00	44.00	46.00	49.00	52.00	55.00	58.00	61.00	64.00
T 13	34.00	36.00	38.00	41.00	44.00	47.00	50.00	52.00	55.00	57.00	60.00	62.00
T 14	35.00	37.00	40.00	42.00	45.00	49.00	51.00	54.00	57.00	59.00	61.00	63.00
T 15	25.00	27.00	30.00	33.00	35.00	38.00	40.00	43.00	46.00	48.00	51.00	53.00
T 16	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00	62.00

T 17	44.00	46.00	48.00	50.00	53.00	55.00	58.00	61.00	63.00	66.00	69.00	72.00
T 18	23.00	25.00	27.00	30.00	32.00	35.00	37.00	40.00	42.00	44.00	47.00	50.00
T 19	38.00	41.00	43.00	45.00	49.00	52.00	54.00	56.00	59.00	62.00	65.00	69.00
T 20	36.00	38.00	41.00	44.00	47.00	49.00	51.00	54.00	56.00	58.00	62.00	65.00
T 21	39.00	41.00	43.00	45.00	47.00	50.00	53.00	55.00	58.00	62.00	65.00	67.00
T 22	47.00	50.00	53.00	56.00	59.00	61.00	63.00	65.00	68.00	71.00	74.00	77.00
T 23	36.00	38.00	41.00	44.00	47.00	50.00	52.00	55.00	58.00	61.00	64.00	66.00
T 24	40.00	42.00	44.00	47.00	50.00	53.00	55.00	58.00	60.00	63.00	66.00	68.00
T 25	33.00	35.00	39.00	43.00	46.00	48.00	50.00	54.00	57.00	60.00	64.00	70.00
T 26	32.00	35.00	38.00	40.00	42.00	45.00	48.00	50.00	53.00	55.00	59.00	62.00
T 27	31.00	34.00	36.00	38.00	41.00	44.00	46.00	48.00	51.00	54.00	57.00	59.00
T 28	28.00	31.00	34.00	36.00	38.00	40.00	43.00	46.00	49.00	51.00	55.00	59.00
T 29	30.00	32.00	34.00	37.00	39.00	42.00	44.00	46.00	48.00	51.00	53.00	55.00
T 30	28.00	31.00	33.00	35.00	38.00	41.00	43.00	46.00	49.00	52.00	55.00	59.00
T 31	39.00	41.00	43.00	45.00	48.00	51.00	55.00	57.00	59.00	62.00	65.00	69.00
T 32	37.00	39.00	42.00	45.00	49.00	52.00	54.00	58.00	61.00	63.00	66.00	69.00
T 33	36.00	38.00	41.00	44.00	47.00	50.00	53.00	55.00	57.00	60.00	63.00	65.00
T 34	35.00	37.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	54.00	59.00	61.00
T 35	42.00	45.00	47.00	49.00	51.00	54.00	57.00	60.00	63.00	65.00	68.00	72.00
T 36	30.00	33.00	35.00	37.00	39.00	41.00	44.00	46.00	49.00	51.00	58.00	61.00
T 37	41.00	44.00	48.00	50.00	52.00	56.00	59.00	62.00	65.00	68.00	71.00	75.00
T 38	39.00	41.00	43.00	48.00	51.00	54.00	57.00	59.00	62.00	64.00	66.00	68.00
T 39	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00	54.00	56.00	59.00	62.00

T 40	35.00	36.00	38.00	40.00	42.00	44.00	47.00	50.00	52.00	54.00	57.00	61.00
T 41	34.00	36.00	38.00	41.00	44.00	47.00	49.00	51.00	54.00	57.00	59.00	61.00
T 42	33.00	35.00	37.00	39.00	42.00	44.00	46.00	48.00	50.00	53.00	55.00	59.00
T 43	36.00	38.00	40.00	42.00	44.00	46.00	48.00	51.00	53.00	55.00	57.00	60.00
T 44	42.00	44.00	47.00	49.00	51.00	54.00	57.00	60.00	62.00	65.00	67.00	70.00
T 45	34.00	37.00	39.00	42.00	44.00	46.00	50.00	52.00	55.00	57.00	60.00	63.00
T 46	50.00	52.00	54.00	57.00	60.00	63.00	66.00	69.00	71.00	73.00	75.00	78.00
T 47	25.00	28.00	31.00	34.00	36.00	38.00	40.00	43.00	46.00	49.00	52.00	55.00
T 48	35.00	37.00	40.00	42.00	44.00	46.00	48.00	51.00	54.00	59.00	62.00	64.00
T 49	37.00	40.00	42.00	44.00	47.00	50.00	53.00	56.00	59.00	62.00	64.00	67.00
T 50	33.00	35.00	37.00	40.00	42.00	44.00	47.00	50.00	52.00	55.00	57.00	61.00
T 51	25.00	27.00	30.00	32.00	34.00	36.00	39.00	41.00	44.00	47.00	49.00	52.00
T 52	27.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	48.00	52.00	54.00
T 53	43.00	45.00	47.00	49.00	51.00	55.00	58.00	61.00	63.00	65.00	68.00	70.00
T 54	26.00	28.00	31.00	34.00	36.00	38.00	40.00	43.00	45.00	47.00	50.00	52.00
T 55	37.00	41.00	43.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00	60.00	62.00
T 56	36.00	39.00	42.00	44.00	47.00	50.00	55.00	58.00	61.00	63.00	65.00	68.00
T 57	39.00	41.00	43.00	45.00	47.00	49.00	51.00	53.00	56.00	59.00	61.00	64.00
T 58	28.00	31.00	33.00	35.00	37.00	42.00	45.00	47.00	49.00	51.00	53.00	56.00
T 59	32.00	34.00	38.00	41.00	43.00	45.00	48.00	51.00	55.00	59.00	61.00	63.00
T 60	33.00	37.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	55.00	58.00	61.00
T 61	41.00	43.00	47.00	51.00	54.00	56.00	58.00	61.00	63.00	65.00	67.00	70.00
T 62	34.00	36.00	40.00	42.00	44.00	48.00	51.00	53.00	56.00	59.00	61.00	65.00

T 63	44.00	46.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00
T 64	25.00	29.00	31.00	34.00	36.00	38.00	40.00	43.00	47.00	50.00	52.00	55.00
T 65	30.00	32.00	35.00	37.00	40.00	42.00	45.00	47.00	49.00	51.00	54.00	59.00
T 66	35.00	37.00	40.00	42.00	44.00	46.00	48.00	51.00	53.00	55.00	57.00	59.00
T 67	41.00	44.00	48.00	51.00	53.00	55.00	58.00	60.00	63.00	66.00	69.00	71.00
T 68	33.00	35.00	37.00	40.00	42.00	44.00	46.00	48.00	50.00	53.00	56.00	60.00
T 69	34.00	36.00	38.00	40.00	43.00	46.00	49.00	51.00	53.00	56.00	59.00	62.00
T 70	27.00	29.00	31.00	33.00	36.00	39.00	41.00	44.00	47.00	50.00	53.00	55.00
T 71	20.00	22.00	24.00	26.00	28.00	30.00	33.00	36.00	39.00	42.00	45.00	48.00
T 72	29.00	31.00	34.00	36.00	39.00	42.00	45.00	48.00	50.00	53.00	56.00	58.00
T 73	38.00	41.00	43.00	45.00	47.00	49.00	52.00	54.00	57.00	60.00	62.00	64.00
T 74	26.00	29.00	32.00	34.00	36.00	38.00	41.00	43.00	46.00	49.00	51.00	53.00
T 75	28.00	30.00	33.00	36.00	39.00	42.00	45.00	49.00	52.00	55.00	59.00	62.00

Months after planting (MAP)

Appendix-VIII

Table 4.1.1.1.4. Breadth of 'D' leaf of somaclonal variants of pineapple variety Mauritius

Treatments	Breadth of 'D' leaf											
	1 MAP	**2 MAP**	**3 MAP**	**4 MAP**	**5 MAP**	**6 MAP**	**7 MAP**	**8 MAP**	**9 MAP**	**10 MAP**	**11 MAP**	**12 MAP**
T 1	2.00	2.50	3.00	4.00	4.00	4.00	3.00	3.50	4.00	3.00	4.50	4.00
T 2	3.00	3.50	4.00	3.00	3.20	3.50	3.00	3.00	3.00	2.50	2.50	5.00
T 3	3.00	3.00	2.50	3.50	4.00	3.00	3.00	2.50	3.00	3.00	3.50	3.50
T 4	3.00	2.50	3.60	2.50	3.00	3.00	3.50	2.50	3.00	2.50	5.00	4.00
T 5	2.50	1.50	2.50	3.00	2.50	2.50	2.00	2.50	3.00	3.50	3.00	5.00
T 6	3.00	3.00	2.50	1.50	2.50	3.00	2.50	3.00	4.00	2.50	5.00	3.50
T 7	3.00	3.00	3.50	2.50	3.00	3.40	2.50	3.00	3.00	3.00	3.00	5.00
T 8	3.00	2.50	2.80	2.00	2.50	3.00	3.00	3.00	3.50	2.00	4.00	4.50
T 9	2.00	3.00	2.50	1.50	2.50	3.00	2.50	3.00	5.00	4.00	3.00	2.00
T 10	3.00	2.50	2.50	3.00	2.00	3.00	3.00	2.50	3.50	3.00	2.50	4.50
T 11	2.50	1.50	2.50	3.00	2.50	2.00	3.00	3.00	2.00	3.60	3.50	2.00
T 12	2.00	3.00	3.00	2.00	3.50	2.50	3.00	2.50	3.00	3.50	2.00	2.50
T 13	2.50	2.50	1.50	2.50	3.00	2.50	3.00	3.50	3.50	3.80	3.50	2.50
T 14	2.50	3.00	2.50	3.00	3.50	2.50	3.00	3.30	2.00	2.50	2.50	3.00
T 15	1.50	2.00	2.50	1.50	2.50	3.00	2.50	3.00	4.00	3.10	3.00	3.50
T 16	3.50	2.50	3.00	3.50	2.50	3.00	2.50	3.50	3.50	2.00	3.50	4.00

T 17	3.30	2.50	3.10	2.00	3.50	3.00	3.00	3.00	4.00	2.50	5.00	3.50
T 18	3.50	3.00	2.50	2.00	3.00	3.00	2.00	2.50	4.50	3.00	2.00	3.00
T 19	3.00	3.00	4.00	3.00	2.50	2.50	4.00	2.50	2.00	1.50	3.00	3.00
T 20	2.50	3.00	2.50	2.00	3.00	3.00	2.00	2.00	3.00	4.00	2.00	3.00
T 21	3.00	3.00	3.00	2.50	4.00	3.00	2.50	3.20	2.50	3.00	3.50	3.00
T 22	2.00	2.50	2.00	2.50	3.50	2.80	3.00	2.00	2.50	5.50	4.00	3.50
T 23	3.00	3.00	2.50	2.50	3.00	2.50	3.00	4.00	3.00	3.00	2.50	5.00
T 24	4.00	3.50	2.50	2.50	3.00	3.00	2.50	2.50	4.00	3.00	6.00	4.50
T 25	2.50	3.00	2.50	2.00	3.00	3.00	2.00	3.00	4.50	3.90	2.50	3.00
T 26	3.00	3.50	3.00	3.10	2.50	3.00	3.80	2.50	3.00	4.00	2.50	5.50
T 27	2.50	2.00	3.00	2.50	3.00	3.00	2.50	2.50	3.40	2.00	2.50	2.50
T 28	2.50	3.00	2.50	2.00	3.00	3.00	2.00	2.50	3.50	1.00	2.50	3.00
T 29	2.50	2.50	3.00	3.00	3.00	2.50	3.00	3.00	2.50	3.40	3.40	2.50
T 30	3.00	3.00	3.20	3.00	3.50	3.50	3.00	3.00	3.00	4.10	3.50	2.50
T 31	2.50	3.00	2.50	2.00	3.00	3.00	3.00	3.50	3.00	3.60	2.00	2.50
T 32	1.50	3.00	2.50	2.00	3.00	3.50	3.00	3.50	2.00	3.60	2.50	2.00
T 33	1.00	1.50	3.00	3.00	2.50	2.00	3.00	3.50	2.50	4.40	2.00	2.00
T 34	2.50	3.00	2.50	3.00	2.50	2.00	3.00	3.00	2.00	4.00	2.00	2.00
T 35	3.00	2.50	4.00	3.00	4.30	4.00	2.00	3.00	3.60	2.00	2.50	3.50
T 36	2.50	3.00	3.50	2.50	2.00	3.00	3.50	2.50	3.40	2.00	4.00	3.50
T 37	4.00	3.50	3.00	2.00	2.50	3.80	3.50	2.00	3.00	2.50	4.50	3.50
T 38	2.00	3.00	2.50	2.00	3.00	3.50	3.00	3.00	2.50	4.10	3.00	4.50
T 39	1.30	2.00	1.50	3.00	3.00	2.00	3.00	2.50	4.00	3.10	1.00	4.00

T 40	1.50	2.00	3.00	2.50	4.00	3.00	3.00	2.50	3.00	3.50	2.00	3.00
T 41	2.50	2.00	3.00	3.50	2.50	3.00	3.50	4.00	2.50	2.80	2.50	3.50
T 42	2.40	3.00	2.50	2.00	3.00	3.50	3.00	4.50	2.80	2.00	3.00	4.00
T 43	2.00	3.00	2.50	2.00	3.00	3.00	3.00	2.50	4.00	3.80	2.50	2.00
T 44	3.00	3.50	3.00	2.50	3.50	4.00	3.00	3.50	3.00	4.00	3.00	3.50
T 45	1.50	2.50	3.00	2.50	2.00	3.00	3.50	2.00	3.60	3.00	2.50	3.50
T 46	4.00	3.00	3.00	2.00	3.00	1.50	3.00	4.00	3.00	2.00	3.50	5.00
T 47	2.00	1.50	3.00	3.00	2.80	2.00	4.00	2.00	2.60	1.50	3.00	3.50
T 48	3.00	2.50	4.00	3.00	4.00	4.00	3.50	3.50	1.50	2.50	3.50	3.00
T 49	2.50	2.50	3.50	1.50	3.00	3.00	3.00	2.00	3.00	2.50	6.00	5.00
T 50	2.50	2.00	4.00	3.00	3.00	1.50	3.00	3.00	3.00	2.00	3.50	6.00
T 51	3.00	3.00	2.80	2.50	4.00	3.00	3.00	2.50	3.50	1.00	3.00	3.00
T 52	3.00	2.80	2.50	2.50	4.00	3.00	2.40	1.50	2.50	3.00	2.50	2.50
T 53	2.50	3.50	3.30	2.50	3.00	2.50	2.50	3.50	3.30	2.50	2.00	5.00
T 54	1.50	2.50	3.00	1.50	3.00	3.00	2.80	3.00	4.00	3.20	1.50	3.40
T 55	3.00	3.50	2.50	2.50	3.50	3.30	2.50	2.00	2.80	1.00	3.00	3.50
T 56	1.50	3.00	3.00	2.80	3.00	3.50	3.00	2.50	3.50	2.00	4.00	4.80
T 57	1.00	3.00	2.00	2.50	1.50	3.00	3.00	2.80	2.00	3.50	2.00	4.50
T 58	3.50	3.30	2.50	2.50	4.00	2.50	3.00	2.70	1.50	2.50	3.50	3.00
T 59	2.00	3.00	2.50	1.80	2.50	2.40	2.00	4.00	2.50	3.50	2.00	3.50
T 60	2.50	2.40	3.50	3.50	2.50	3.00	2.50	4.00	3.50	1.50	3.50	3.50
T 61	2.00	3.00	2.50	2.50	3.50	3.30	2.50	3.00	4.00	4.80	1.50	3.50
T 62	2.10	2.00	3.00	2.50	2.00	3.00	2.50	2.50	3.50	3.50	2.00	3.00

T 63	1.00	1.50	3.00	3.00	2.80	3.50	3.50	3.00	4.00	4.70	1.50	3.50
T 64	2.50	2.40	3.50	3.00	2.00	3.00	2.50	2.00	3.00	1.00	2.80	2.00
T 65	3.00	3.00	2.50	3.50	4.00	2.50	3.00	2.50	2.50	2.00	3.00	3.50
T 66	1.00	1.80	2.50	2.40	2.00	3.00	3.50	3.80	2.00	3.00	2.00	3.50
T 67	2.00	3.00	2.50	1.50	2.00	3.00	2.50	3.00	3.80	1.50	2.50	3.00
T 68	1.50	3.00	2.00	3.50	1.50	2.50	3.50	3.00	2.50	2.00	3.00	4.50
T 69	3.50	3.00	2.50	1.50	2.50	3.00	3.00	2.00	3.00	2.50	4.00	4.50
T 70	3.00	3.00	2.80	3.00	2.50	3.50	3.00	2.00	3.00	3.00	5.00	4.00
T 71	3.50	1.50	2.50	2.30	2.20	2.50	3.50	3.00	2.50	4.00	2.50	5.50
T 72	2.00	3.50	2.00	3.00	2.10	2.00	3.00	2.50	2.00	3.00	2.50	5.50
T 73	3.50	2.00	2.00	3.00	2.50	2.50	4.00	3.00	4.20	3.00	4.00	3.50
T 74	3.00	2.50	1.50	3.50	2.00	3.00	2.50	3.50	3.00	3.00	2.80	4.00
T 75	3.50	2.50	1.50	2.50	3.00	2.50	3.00	3.00	2.00	3.00	2.50	5.50

Months after planting (MAP)

Appendix-IX

Table 4.1.1.1.5. D leaf area of somaclonal variants of pineapple variety Mauritius

Treatments	D leaf Area											
	1 MAP	**2 MAP**	**3 MAP**	**4 MAP**	**5 MAP**	**6 MAP**	**7 MAP**	**8 MAP**	**9 MAP**	**10 MAP**	**11 MAP**	**12 MAP**
T 1	39.15	54.38	71.78	107.30	118.90	130.50	108.75	137.03	168.20	130.50	202.28	185.60
T 2	87.00	106.58	130.50	102.23	113.68	129.41	115.28	119.63	123.98	106.94	110.56	228.38
T 3	71.78	76.13	67.06	98.96	118.90	95.70	102.23	90.63	115.28	119.63	144.64	154.79
T 4	76.13	68.88	104.40	77.94	97.88	102.23	124.34	92.44	115.28	99.69	206.63	171.10
T 5	39.88	26.10	48.94	63.08	56.19	59.81	52.20	68.88	91.35	111.65	102.23	181.25
T 6	65.25	69.60	61.63	39.15	68.88	87.00	77.94	100.05	142.10	92.44	192.13	142.10
T 7	76.13	82.65	101.50	76.13	95.70	113.39	87.00	108.75	113.10	119.63	123.98	217.50
T 8	60.90	54.38	64.96	50.75	67.06	87.00	91.35	95.70	116.73	69.60	145.00	172.91
T 9	49.30	78.30	68.88	43.50	77.94	97.88	85.19	106.58	184.88	156.60	121.80	85.55
T 10	84.83	74.31	77.94	97.88	68.15	106.58	110.93	96.06	139.56	123.98	108.75	205.54
T 11	54.38	35.89	63.44	84.83	76.13	65.25	106.58	110.93	81.20	153.99	154.79	92.80
T 12	46.40	73.95	82.65	59.45	111.65	83.38	106.58	94.25	119.63	147.18	88.45	116.00
T 13	61.63	65.25	41.33	74.31	95.70	85.19	108.75	131.95	139.56	157.04	152.25	108.75
T 14	63.44	80.48	72.50	91.35	114.19	88.81	110.93	129.20	82.65	106.94	110.56	137.03
T 15	27.19	39.15	54.38	35.89	63.44	82.65	72.50	93.53	133.40	107.88	110.93	134.49
T 16	78.66	59.81	76.13	93.89	70.69	89.18	77.94	114.19	119.26	71.05	129.41	179.80

T 17	105.27	83.38	107.88	72.50	134.49	119.63	126.15	132.68	182.70	119.63	250.13	182.70
T 18	58.36	54.38	48.94	43.50	69.60	76.13	53.65	72.50	137.03	95.70	68.15	108.75
T 19	82.65	89.18	124.70	97.88	88.81	94.25	156.60	101.50	85.55	67.43	141.38	150.08
T 20	65.25	82.65	74.31	63.80	102.23	106.58	73.95	78.30	121.80	168.20	89.90	141.38
T 21	84.83	89.18	93.53	81.56	136.30	108.75	96.06	127.60	105.13	134.85	164.94	145.73
T 22	68.15	90.63	76.85	101.50	149.71	123.83	137.03	94.25	123.25	283.11	214.60	195.39
T 23	78.30	82.65	74.31	79.75	102.23	90.63	113.10	159.50	126.15	132.68	116.00	239.25
T 24	116.00	106.58	79.75	85.19	108.75	115.28	99.69	105.13	174.00	137.03	287.10	221.85
T 25	59.81	76.13	70.69	62.35	100.05	104.40	72.50	117.45	185.96	169.65	116.00	152.25
T 26	69.60	88.81	82.65	89.90	76.13	97.88	132.24	90.63	115.28	159.50	106.94	247.23
T 27	56.19	49.30	78.30	68.88	89.18	95.70	83.38	87.00	125.72	78.30	103.31	106.94
T 28	50.75	67.43	61.63	52.20	82.65	87.00	62.35	83.38	124.34	36.98	99.69	128.33
T 29	54.38	58.00	73.95	80.48	84.83	76.13	95.70	100.05	87.00	125.72	130.65	99.69
T 30	60.90	67.43	76.56	76.13	96.43	104.04	93.53	100.05	106.58	154.57	139.56	106.94
T 31	70.69	89.18	77.94	65.25	104.40	110.93	119.63	144.64	128.33	161.82	94.25	125.06
T 32	40.24	84.83	76.13	65.25	106.58	131.95	117.45	147.18	88.45	164.43	119.63	100.05
T 33	26.10	41.33	89.18	95.70	85.19	72.50	115.28	139.56	103.31	191.40	91.35	94.25
T 34	63.44	80.48	72.50	91.35	79.75	66.70	104.40	108.75	75.40	156.60	85.55	88.45
T 35	91.35	81.56	136.30	106.58	158.99	156.60	82.65	130.50	164.43	94.25	123.25	182.70
T 36	54.38	71.78	88.81	67.06	56.55	89.18	111.65	83.38	120.79	73.95	168.20	154.79
T 37	118.90	111.65	104.40	72.50	94.25	154.28	149.71	89.90	141.38	123.25	231.64	190.31
T 38	56.55	89.18	77.94	69.60	110.93	137.03	123.98	128.33	112.38	190.24	143.55	221.85
T 39	34.87	56.55	44.59	93.53	97.88	68.15	106.58	92.44	156.60	125.86	42.78	179.80

T 40	38.06	52.20	82.65	72.50	121.80	95.70	102.23	90.63	113.10	137.03	82.65	132.68
T 41	61.63	52.20	82.65	104.04	79.75	102.23	124.34	147.90	97.88	115.71	106.94	154.79
T 42	57.42	76.13	67.06	56.55	91.35	111.65	100.05	156.60	101.50	76.85	119.63	171.10
T 43	52.20	82.65	72.50	60.90	95.70	100.05	104.40	92.44	153.70	151.53	103.31	87.00
T 44	91.35	111.65	102.23	88.81	129.41	156.60	123.98	152.25	134.85	188.50	145.73	177.63
T 45	36.98	67.06	84.83	76.13	63.80	100.05	126.88	75.40	143.55	123.98	108.75	159.86
T 46	145.00	113.10	117.45	82.65	130.50	68.51	143.55	200.10	154.43	105.85	190.31	282.75
T 47	36.25	30.45	67.43	73.95	73.08	55.10	116.00	62.35	86.71	53.29	113.10	139.56
T 48	76.13	67.06	116.00	91.35	127.60	133.40	121.80	129.41	58.73	106.94	157.33	139.20
T 49	67.06	72.50	106.58	47.85	102.23	108.75	115.28	81.20	128.33	112.38	278.40	242.88
T 50	59.81	50.75	107.30	87.00	91.35	47.85	102.23	108.75	113.10	79.75	144.64	265.35
T 51	54.38	58.73	60.90	58.00	98.60	78.30	84.83	74.31	111.65	34.08	106.58	113.10
T 52	58.73	60.90	58.00	61.63	104.40	82.65	69.60	45.68	79.75	104.40	94.25	97.88
T 53	77.94	114.19	112.45	88.81	110.93	99.69	105.13	154.79	150.73	117.81	98.60	253.75
T 54	28.28	50.75	67.43	36.98	78.30	82.65	81.20	93.53	130.50	109.04	54.38	128.18
T 55	80.48	104.04	77.94	81.56	119.26	117.23	92.44	76.85	111.65	41.33	130.50	157.33
T 56	39.15	84.83	91.35	89.32	102.23	126.88	119.63	105.13	154.79	91.35	188.50	236.64
T 57	28.28	89.18	62.35	81.56	51.11	106.58	110.93	107.59	81.20	149.71	88.45	208.80
T 58	71.05	74.17	59.81	63.44	107.30	76.13	97.88	92.00	53.29	92.44	134.49	121.80
T 59	46.40	73.95	68.88	53.51	77.94	78.30	69.60	147.90	99.69	149.71	88.45	159.86
T 60	59.81	64.38	101.50	106.58	79.75	100.05	87.00	145.00	131.95	59.81	147.18	154.79
T 61	59.45	93.53	85.19	92.44	137.03	133.98	105.13	132.68	182.70	226.20	72.86	177.63
T 62	51.77	52.20	87.00	76.13	63.80	104.40	92.44	96.06	142.10	149.71	88.45	141.38

T 63	31.90	50.03	110.93	115.28	111.65	144.64	149.71	132.68	182.70	221.49	72.86	175.09
T 64	45.31	50.46	78.66	73.95	52.20	82.65	72.50	62.35	102.23	36.25	105.56	79.75
T 65	65.25	69.60	63.44	93.89	116.00	76.13	97.88	85.19	88.81	73.95	117.45	149.71
T 66	25.38	48.29	72.50	73.08	63.80	100.05	121.80	140.51	76.85	119.63	82.65	149.71
T 67	59.45	95.70	87.00	55.46	76.85	119.63	105.13	130.50	173.57	71.78	125.06	154.43
T 68	35.89	76.13	53.65	101.50	45.68	79.75	116.73	104.40	90.63	76.85	121.80	195.75
T 69	86.28	78.30	68.88	43.50	77.94	100.05	106.58	73.95	115.28	101.50	171.10	202.28
T 70	58.73	63.08	62.93	71.78	65.25	98.96	89.18	63.80	102.23	108.75	192.13	159.50
T 71	50.75	23.93	43.50	43.36	44.66	54.38	83.74	78.30	70.69	121.80	81.56	191.40
T 72	42.05	78.66	49.30	78.30	59.38	60.90	97.88	87.00	72.50	115.28	101.50	231.28
T 73	96.43	59.45	62.35	97.88	85.19	88.81	150.80	117.45	173.57	130.50	179.80	162.40
T 74	56.55	52.56	34.80	86.28	52.20	82.65	74.31	109.11	100.05	106.58	103.53	153.70
T 75	71.05	54.38	35.89	65.25	84.83	76.13	97.88	106.58	75.40	119.63	106.94	247.23

Months after planting (MAP)

Appendix-X

Table 4.1.1.1.6. Leaf area index of somaclonal variants of pineapple variety Mauritius

Treatments	Leaf area index											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	0.26	0.44	0.69	1.19	1.50	1.93	1.85	2.64	3.74	3.29	5.84	5.77
T 2	0.90	1.26	1.74	1.59	1.94	2.49	2.39	2.57	2.85	2.61	2.95	6.60
T 3	0.64	0.85	0.89	1.47	2.11	1.91	2.20	2.08	2.82	3.10	3.96	4.93
T 4	0.79	0.82	1.39	1.15	1.67	1.89	2.49	1.99	2.73	2.51	5.97	5.45
T 5	0.32	0.25	0.54	0.79	0.79	0.93	0.89	1.28	1.96	2.56	2.57	5.77
T 6	0.77	0.93	0.91	0.64	1.22	1.68	1.67	2.37	3.58	2.47	5.27	4.32
T 7	0.73	0.92	1.28	1.07	1.49	1.93	1.61	2.58	2.76	3.19	3.67	7.09
T 8	0.59	0.60	0.82	0.71	1.04	1.61	1.76	1.98	2.85	1.80	4.08	6.02
T 9	0.51	0.99	1.02	0.74	1.44	1.96	1.89	2.61	4.79	4.29	3.52	2.47
T 10	1.19	1.16	1.33	1.81	1.36	2.29	2.55	2.35	3.62	3.31	3.06	6.09
T 11	0.40	0.32	0.70	1.07	1.07	1.06	1.97	2.38	1.92	3.99	4.36	2.89
T 12	0.27	0.55	0.73	0.66	1.41	1.24	1.82	1.82	2.57	3.49	2.29	3.35
T 13	0.50	0.63	0.49	1.05	1.49	1.51	2.18	2.93	3.41	4.07	4.17	3.22
T 14	0.52	0.77	0.86	1.22	1.78	1.64	2.22	2.87	2.02	2.77	3.11	3.36
T 15	0.20	0.35	0.56	0.45	0.94	1.47	1.56	2.22	3.46	3.04	3.29	3.53
T 16	0.64	0.58	0.85	1.25	1.10	1.59	1.56	2.54	2.92	1.84	3.74	3.93

T 17	1.09	0.99	1.44	1.07	2.19	2.22	2.52	2.85	4.20	2.92	6.86	7.60
T 18	0.52	0.60	0.65	0.68	1.24	1.52	1.15	1.66	3.35	2.55	1.92	2.17
T 19	0.67	0.86	1.39	1.23	1.25	1.54	2.90	2.11	1.90	1.65	3.77	4.29
T 20	0.58	0.92	0.94	0.95	1.74	1.97	1.59	1.80	2.98	4.49	2.53	2.66
T 21	0.38	0.53	0.69	0.72	1.51	1.37	1.35	1.98	1.87	2.90	4.15	4.76
T 22	0.76	1.14	1.08	1.58	2.77	2.48	2.94	2.16	3.01	7.34	6.04	6.36
T 23	0.58	0.73	0.77	0.95	1.36	1.34	1.84	2.84	2.80	3.15	3.27	3.61
T 24	1.12	1.18	1.00	1.20	1.69	1.96	1.85	2.10	3.74	3.15	7.87	8.72
T 25	0.40	0.62	0.68	0.69	1.26	1.55	1.24	2.18	3.86	3.90	3.01	4.40
T 26	0.72	1.05	1.10	1.33	1.24	1.89	2.84	2.08	2.82	4.14	2.85	7.33
T 27	0.46	0.47	0.87	0.87	1.32	1.63	1.61	1.87	2.98	2.03	2.91	3.25
T 28	0.41	0.65	0.68	0.66	1.22	1.48	1.20	1.79	2.86	0.96	2.73	3.80
T 29	0.48	0.60	0.88	1.07	1.38	1.47	2.06	2.37	2.26	3.54	3.87	3.32
T 30	0.59	0.75	0.96	1.13	1.71	2.08	2.08	2.45	2.76	4.24	4.03	3.17
T 31	0.63	0.92	0.92	0.87	1.55	1.89	2.30	3.11	3.04	4.20	2.65	4.35
T 32	0.33	0.82	0.90	0.92	1.66	2.35	2.35	3.27	2.16	4.26	3.28	3.72
T 33	0.19	0.37	0.99	1.28	1.26	1.18	2.05	2.89	2.37	4.96	2.57	3.14
T 34	0.38	0.60	0.70	1.08	1.12	1.04	1.78	2.01	1.62	3.71	2.22	3.08
T 35	0.61	0.66	1.41	1.26	2.24	2.55	1.53	2.61	3.65	2.30	3.29	5.55
T 36	0.44	0.69	0.99	0.84	0.84	1.52	2.15	1.79	2.86	1.92	4.61	4.82
T 37	0.88	1.08	1.24	0.97	1.40	2.63	2.77	1.86	3.25	3.20	6.35	5.78
T 38	0.42	0.79	0.87	0.88	1.64	2.44	2.48	2.85	2.75	5.07	4.15	6.41
T 39	0.23	0.46	0.43	1.11	1.38	1.06	1.89	1.85	3.48	3.08	1.14	5.46

T 40	0.31	0.50	0.92	0.91	1.80	1.63	1.89	1.88	2.76	3.65	2.39	4.42
T 41	0.59	0.62	1.16	1.62	1.42	1.97	2.67	3.51	2.54	3.17	3.09	4.47
T 42	0.38	0.62	0.65	0.63	1.15	1.57	1.56	2.67	2.11	1.76	3.10	4.94
T 43	0.43	0.80	0.86	0.86	1.56	1.85	2.17	2.05	3.76	4.04	3.06	2.58
T 44	0.68	1.08	1.14	1.12	1.82	2.44	2.20	3.16	3.10	4.75	3.99	5.39
T 45	0.38	0.79	1.13	1.13	1.09	1.85	2.54	1.68	3.51	3.21	2.98	4.74
T 46	1.29	1.17	1.39	1.10	1.93	1.12	2.55	3.85	3.20	2.67	5.22	8.17
T 47	0.30	0.29	0.75	0.93	1.08	0.94	2.23	1.34	2.06	1.38	3.10	4.34
T 48	0.79	0.79	1.55	1.35	2.08	2.37	2.35	2.78	1.35	2.61	4.08	4.02
T 49	0.65	0.81	1.34	0.67	1.67	1.93	2.31	1.80	3.14	3.00	8.04	8.28
T 50	0.61	0.76	1.16	1.02	1.63	1.80	2.35	2.46	2.79	2.96	4.48	5.74
T 51	0.36	0.48	0.59	0.64	1.31	1.22	1.51	1.49	2.48	0.83	2.76	3.27
T 52	0.70	0.81	0.86	1.05	1.93	1.65	1.50	1.05	1.95	2.71	2.65	3.05
T 53	0.69	1.18	1.33	1.18	1.64	1.62	1.95	3.33	3.46	2.97	2.70	7.71
T 54	0.21	0.45	0.70	0.47	1.16	1.41	1.56	2.01	3.09	2.83	1.53	3.89
T 55	0.66	1.00	0.87	1.03	1.68	1.82	1.64	1.54	2.48	1.01	3.48	4.55
T 56	0.29	0.75	1.02	1.12	1.51	2.16	2.30	2.26	3.67	2.37	5.31	6.84
T 57	0.40	1.39	1.06	1.51	1.02	2.29	2.55	2.63	2.11	4.10	2.56	6.50
T 58	0.74	0.88	0.80	0.94	1.83	1.47	2.10	2.11	1.30	2.40	3.79	3.52
T 59	0.31	0.60	0.66	0.63	1.10	1.22	1.29	3.18	2.36	3.88	2.49	4.97
T 60	0.49	0.62	1.13	1.34	1.18	1.70	1.68	3.11	3.03	1.46	3.82	4.47
T 61	0.35	0.69	0.76	1.03	1.83	2.08	1.87	2.65	4.06	5.53	1.94	5.53
T 62	0.35	0.43	0.84	0.90	0.90	1.70	1.71	1.99	3.16	3.66	2.29	4.50

T 63	0.26	0.48	1.23	1.45	1.65	2.46	2.88	2.85	4.20	5.58	1.94	5.32
T 64	0.40	0.52	0.93	0.99	0.77	1.35	1.29	1.25	2.35	0.91	2.89	2.36
T 65	0.53	0.67	0.70	1.18	1.72	1.30	1.89	1.77	1.97	1.81	3.05	4.32
T 66	0.24	0.54	0.91	1.03	0.99	1.78	2.44	3.02	1.76	3.01	2.27	4.66
T 67	0.48	0.92	1.03	0.78	1.25	2.22	2.10	2.80	4.11	1.86	3.43	4.69
T 68	0.35	0.85	0.68	1.43	0.71	1.36	2.25	2.24	2.15	1.99	3.52	6.24
T 69	0.70	0.70	0.71	0.52	1.04	1.48	1.74	1.37	2.31	2.18	4.44	6.29
T 70	0.74	0.89	0.98	1.22	1.21	1.98	1.92	1.47	2.50	2.82	5.41	5.32
T 71	0.64	0.34	0.68	0.74	0.83	1.09	1.80	1.80	1.73	3.16	2.30	5.81
T 72	0.44	0.93	0.66	1.16	0.97	1.13	1.96	1.87	1.66	2.82	2.71	6.68
T 73	1.07	0.75	0.92	1.67	1.58	1.78	3.24	2.70	4.24	3.38	5.06	4.93
T 74	0.42	0.47	0.36	1.02	0.70	1.29	1.32	2.18	2.22	2.61	2.76	4.44
T 75	0.84	0.73	0.53	1.06	1.51	1.47	2.03	2.37	1.79	3.01	2.93	7.33

Months after planting (MAP)

Appendix-XI

Table 4.1.1.1.7. Number of suckers per plant of somaclonal variants of pineapple variety Mauritius

Treatments	Number of suckers per plant											
	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP	13 MAP	14 MAP	15 MAP	16 MAP	17 MAP	18 MAP
T 1	0	0	0	0	0	0	0	0	0	1	1	1
T 2	0	0	0	0	0	0	0	0	0	2	3	3
T 3	0	0	0	0	0	0	0	0	0	2	3	3
T 4	0	0	0	0	0	0	0	0	0	0	3	4
T 5	0	0	0	0	0	0	0	0	0	0	1	2
T 6	0	0	0	0	0	0	0	0	0	2	2	2
T 7	0	0	0	0	0	0	0	0	0	2	2	2
T 8	0	0	0	0	0	0	0	0	0	3	3	4
T 9	0	0	0	0	0	0	0	0	0	0	1	1
T 10	0	0	0	0	0	0	0	0	0	0	0	1
T 11	0	0	0	0	0	0	0	0	0	1	1	1
T 12	0	0	0	0	0	0	0	0	0	0	0	2
T 13	0	0	0	0	0	0	0	0	0	2	3	3
T 14	0	0	0	0	0	0	0	0	0	0	0	2
T 15	0	0	0	0	0	0	0	0	0	1	2	2
T 16	0	0	0	0	0	0	0	0	0	1	1	1

T 17	0	0	0	0	0	0	0	0	0	0	0	2
T 18	0	0	0	0	0	0	0	0	0	2	3	4
T 19	0	0	0	0	0	0	0	0	0	0	1	1
T 20	0	0	0	0	0	0	0	0	0	1	1	1
T 21	0	0	0	0	0	0	0	0	0	0	3	3
T 22	0	0	0	0	0	0	0	0	0	0	2	2
T 23	0	0	0	0	0	0	0	0	0	1	7	7
T 24	0	0	0	0	0	0	0	0	0	0	2	3
T 25	0	0	0	0	0	0	0	0	0	2	4	5
T 26	0	0	0	0	0	0	0	0	0	0	2	3
T 27	0	0	0	0	0	0	0	0	0	0	0	4
T 28	0	0	0	0	0	0	0	0	0	0	3	4
T 29	0	0	0	0	0	0	0	0	0	1	2	2
T 30	0	0	0	0	0	0	0	0	0	2	2	2
T 31	0	0	0	0	0	0	0	0	0	1	1	1
T 32	0	0	0	0	0	0	0	0	0	3	3	3
T 33	0	0	0	0	0	0	0	0	0	1	1	1
T 34	0	0	0	0	0	0	0	0	0	1	2	2
T 35	0	0	0	0	0	0	0	0	0	0	0	2
T 36	0	0	0	0	0	0	0	0	0	0	0	3
T 37	0	0	0	0	0	0	0	0	0	0	1	2
T 38	0	0	0	0	0	0	0	0	0	2	2	2
T 39	0	0	0	0	0	0	0	0	0	1	1	1

T 40	0	0	0	0	0	0	0	0	0	2	2	2
T 41	0	0	0	0	0	0	0	0	0	1	2	2
T 42	0	0	0	0	0	0	0	0	0	0	1	2
T 43	0	0	0	0	0	0	0	0	0	1	1	1
T 44	0	0	0	0	0	0	0	0	0	9	9	9
T 45	0	0	0	0	0	0	0	0	0	0	0	3
T 46	0	0	0	0	0	0	0	0	0	0	1	1
T 47	0	0	0	0	0	0	0	0	0	0	1	1
T 48	0	0	0	0	0	0	0	0	0	0	2	2
T 49	0	0	0	0	0	0	0	0	0	0	1	3
T 50	0	0	0	0	0	0	0	0	0	0	4	6
T 51	0	0	0	0	0	0	0	0	0	0	0	2
T 52	0	0	0	0	0	0	0	0	0	0	0	8
T 53	0	0	0	0	0	0	0	0	0	0	0	1
T 54	0	0	0	0	0	0	0	0	0	0	1	1
T 55	0	0	0	0	0	0	0	0	0	0	0	2
T 56	0	0	0	0	0	0	0	0	0	0	2	3
T 57	0	0	0	0	0	0	0	0	0	0	3	4
T 58	0	0	0	0	0	0	0	0	0	0	1	2
T 59	0	0	0	0	0	0	0	0	0	1	1	1
T 60	0	0	0	0	0	0	0	0	0	0	1	1
T 61	0	0	0	0	0	0	0	0	0	2	3	5
T 62	0	0	0	0	0	0	0	0	0	1	2	7

T 63	0	0	0	0	0	0	0	0	0	1	2	2
T 64	0	0	0	0	0	0	0	0	0	0	1	1
T 65	0	0	0	0	0	0	0	0	0	0	1	3
T 66	0	0	0	0	0	0	0	0	0	1	1	1
T 67	0	0	0	0	0	0	0	0	0	1	1	7
T 68	0	0	0	0	0	0	0	0	0	1	3	12
T 69	0	0	0	0	0	0	0	0	0	0	1	3
T 70	0	0	0	0	0	0	0	0	0	0	3	6
T 71	0	0	0	0	0	0	0	0	0	0	2	5
T 72	0	0	0	0	0	0	0	0	0	0	3	5
T 73	0	0	0	0	0	0	0	0	0	1	1	6
T 74	0	0	0	0	0	0	0	0	0	1	1	5
T 75	0	0	0	0	0	0	0	0	0	0	0	2

Months after planting (MAP)

Appendix-XII

Table 4.1.1.1.8. Spine length (mm) of somaclonal variants of pineapple variety Mauritius

Treatments	Spine length (mm)											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	0.20	0.20	0.30	0.20	0.20	0.22	0.20	0.20	0.30	0.20	0.20	0.22
T 2	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 3	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
T 4	0.20	0.25	0.40	0.20	0.20	0.25	0.20	0.25	0.40	0.20	0.20	0.25
T 5	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 6	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 7	0.20	0.20	0.30	0.20	0.20	0.22	0.20	0.20	0.30	0.20	0.20	0.22
T 8	0.30	0.20	0.20	0.20	0.20	0.22	0.30	0.20	0.20	0.20	0.20	0.22
T 9	0.20	0.20	0.30	0.20	0.30	0.24	0.20	0.20	0.30	0.20	0.30	0.24
T 10	0.30	0.30	0.30	0.30	0.20	0.28	0.30	0.30	0.30	0.30	0.20	0.28
T 11	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 12	0.20	0.30	0.30	0.20	0.30	0.26	0.20	0.30	0.30	0.20	0.30	0.26
T 13	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 14	0.20	0.30	0.20	0.20	0.20	0.22	0.20	0.30	0.20	0.20	0.20	0.22
T 15	0.30	0.20	0.20	0.20	0.30	0.24	0.30	0.20	0.20	0.20	0.30	0.24
T 16	0.30	0.20	0.20	0.20	0.20	0.22	0.30	0.20	0.20	0.20	0.20	0.22

T 17	0.30	0.20	0.30	0.20	0.20	0.24	0.30	0.20	0.30	0.20	0.20	0.24
T 18	0.20	0.30	0.20	0.20	0.20	0.22	0.20	0.30	0.20	0.20	0.20	0.22
T 19	0.30	0.30	0.20	0.20	0.20	0.24	0.30	0.30	0.20	0.20	0.20	0.24
T 20	0.30	0.20	0.20	0.20	0.30	0.24	0.30	0.20	0.20	0.20	0.30	0.24
T 21	0.20	0.30	0.20	0.20	0.20	0.22	0.20	0.30	0.20	0.20	0.20	0.22
T 22	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 23	0.20	0.30	0.20	0.20	0.20	0.22	0.20	0.30	0.20	0.20	0.20	0.22
T 24	0.20	0.20	0.30	0.20	0.20	0.22	0.20	0.20	0.30	0.20	0.20	0.22
T 25	0.20	0.30	0.20	0.30	0.20	0.24	0.20	0.30	0.20	0.30	0.20	0.24
T 26	0.20	0.20	0.20	0.20	0.30	0.22	0.20	0.20	0.20	0.20	0.30	0.22
T 27	0.30	0.20	0.20	0.20	0.30	0.24	0.30	0.20	0.20	0.20	0.30	0.24
T 28	0.30	0.20	0.30	0.20	0.20	0.24	0.30	0.20	0.30	0.20	0.20	0.24
T 29	0.10	0.20	0.20	0.20	0.20	0.18	0.10	0.20	0.20	0.20	0.20	0.18
T 30	0.20	0.30	0.30	0.20	0.20	0.24	0.20	0.30	0.30	0.20	0.20	0.24
T 31	0.30	0.25	0.26	0.29	0.20	0.26	0.30	0.25	0.26	0.29	0.20	0.26
T 32	0.20	0.30	0.20	0.20	0.20	0.22	0.20	0.30	0.20	0.20	0.20	0.22
T 33	0.20	0.30	0.30	0.20	0.20	0.24	0.20	0.30	0.30	0.20	0.20	0.24
T 34	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 35	0.10	0.29	0.30	0.20	0.20	0.22	0.10	0.29	0.30	0.20	0.20	0.22
T 36	0.20	0.28	0.10	0.27	0.30	0.23	0.20	0.28	0.10	0.27	0.30	0.23
T 37	0.30	0.20	0.30	0.20	0.20	0.24	0.30	0.20	0.30	0.20	0.20	0.24
T 38	0.30	0.20	0.20	0.20	0.30	0.24	0.30	0.20	0.20	0.20	0.30	0.24
T 39	0.20	0.20	0.30	0.30	0.30	0.26	0.20	0.20	0.30	0.30	0.30	0.26

T 40	0.30	0.30	0.20	0.20	0.20	0.24	0.30	0.30	0.20	0.20	0.20	0.24
T 41	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 42	0.30	0.30	0.20	0.20	0.20	0.24	0.30	0.30	0.20	0.20	0.20	0.24
T 43	0.30	0.20	0.20	0.20	0.20	0.22	0.30	0.20	0.20	0.20	0.20	0.22
T 44	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 45	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 46	0.30	0.20	0.30	0.20	0.30	0.26	0.30	0.20	0.30	0.20	0.30	0.26
T 47	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 48	0.30	0.20	0.30	0.30	0.20	0.26	0.30	0.20	0.30	0.30	0.20	0.26
T 49	0.10	0.20	0.20	0.20	0.20	0.18	0.10	0.20	0.20	0.20	0.20	0.18
T 50	0.20	0.20	0.20	0.20	0.30	0.22	0.20	0.20	0.20	0.20	0.30	0.22
T 51	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 52	0.20	0.30	0.30	0.20	0.25	0.25	0.20	0.30	0.30	0.20	0.25	0.25
T 53	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 54	0.20	0.20	0.20	0.20	0.30	0.22	0.20	0.20	0.20	0.20	0.30	0.22
T 55	0.20	0.20	0.30	0.20	0.30	0.24	0.20	0.20	0.30	0.20	0.30	0.24
T 56	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 57	0.25	0.20	0.20	0.30	0.30	0.25	0.25	0.20	0.20	0.30	0.30	0.25
T 58	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 59	0.25	0.30	0.25	0.20	0.30	0.26	0.25	0.30	0.25	0.20	0.30	0.26
T 60	0.20	0.25	0.30	0.20	0.20	0.23	0.20	0.25	0.30	0.20	0.20	0.23
T 61	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
T 62	0.25	0.20	0.20	0.20	0.30	0.23	0.25	0.20	0.20	0.20	0.30	0.23

T 63	0.30	0.30	0.30	0.25	0.20	0.27	0.30	0.30	0.30	0.25	0.20	0.27
T 64	0.20	0.20	0.20	0.30	0.30	0.24	0.20	0.20	0.20	0.30	0.30	0.24
T 65	0.20	0.30	0.20	0.20	0.30	0.24	0.20	0.30	0.20	0.20	0.30	0.24
T 66	0.20	0.20	0.25	0.25	0.20	0.22	0.20	0.20	0.25	0.25	0.20	0.22
T 67	0.20	0.20	0.20	0.30	0.20	0.22	0.20	0.20	0.20	0.30	0.20	0.22
T 68	0.20	0.20	0.20	0.20	0.25	0.21	0.20	0.20	0.20	0.20	0.25	0.21
T 69	0.25	0.20	0.20	0.30	0.25	0.24	0.25	0.20	0.20	0.30	0.25	0.24
T 70	0.30	0.20	0.25	0.20	0.20	0.23	0.30	0.20	0.25	0.20	0.20	0.23
T 71	0.30	0.20	0.20	0.10	0.20	0.20	0.30	0.20	0.20	0.10	0.20	0.20
T 72	0.20	0.20	0.20	0.30	0.25	0.23	0.20	0.20	0.20	0.30	0.25	0.23
T 73	0.30	0.20	0.20	0.30	0.20	0.24	0.30	0.20	0.20	0.30	0.20	0.24
T 74	0.30	0.20	0.20	0.15	0.20	0.21	0.30	0.20	0.20	0.15	0.20	0.21
T 75	0.30	0.20	0.18	0.20	0.20	0.22	0.30	0.20	0.18	0.20	0.20	0.22

Months after planting (MAP)

Appendix-XIII

Table 4.1.1.1.9. Position of suckers of somaclonal variants of pineapple variety Mauritius

Treatments	Position of suckers											
	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP	13 MAP	14 MAP	15 MAP	16 MAP	17 MAP	18 MAP
T 1	1	1	1	1	1	1	1	1	1	3	3	3
T 2	1	1	1	1	1	1	1	1	1	1	3	3
T 3	1	1	1	1	1	1	1	1	1	3	5	5
T 4	1	1	1	1	1	1	1	1	1	1	3	5
T 5	1	1	1	1	1	1	1	1	1	1	3	3
T 6	1	1	1	1	1	1	1	1	1	1	3	3
T 7	1	1	1	1	1	1	1	1	1	1	3	3
T 8	1	1	1	1	1	1	1	1	1	1	3	3
T 9	1	1	1	1	1	1	1	1	1	1	3	3
T 10	1	1	1	1	1	1	1	1	1	1	1	3
T 11	1	1	1	1	1	1	1	1	1	3	3	3
T 12	1	1	1	1	1	1	1	1	1	1	1	3
T 13	1	1	1	1	1	1	1	1	1	1	3	3
T 14	1	1	1	1	1	1	1	1	1	1	1	3
T 15	1	1	1	1	1	1	1	1	1	3	3	3
T 16	1	1	1	1	1	1	1	1	1	3	3	3

T 17	1	1	1	1	1	1	1	1	1	1	1	3
T 18	1	1	1	1	1	1	1	1	1	3	3	5
T 19	1	1	1	1	1	1	1	1	1	1	3	3
T 20	1	1	1	1	1	1	1	1	1	3	3	3
T 21	1	1	1	1	1	1	1	1	1	1	3	3
T 22	1	1	1	1	1	1	1	1	1	1	3	3
T 23	1	1	1	1	1	1	1	1	1	1	3	7
T 24	1	1	1	1	1	1	1	1	1	1	3	3
T 25	1	1	1	1	1	1	1	1	1	3	5	5
T 26	1	1	1	1	1	1	1	1	1	1	3	3
T 27	1	1	1	1	1	1	1	1	1	1	5	5
T 28	1	1	1	1	1	1	1	1	1	1	3	5
T 29	1	1	1	1	1	1	1	1	1	1	3	3
T 30	1	1	1	1	1	1	1	1	1	1	3	3
T 31	1	1	1	1	1	1	1	1	1	3	3	3
T 32	1	1	1	1	1	1	1	1	1	3	3	3
T 33	1	1	1	1	1	1	1	1	1	3	3	3
T 34	1	1	1	1	1	1	1	1	1	3	3	3
T 35	1	1	1	1	1	1	1	1	1	1	1	3
T 36	1	1	1	1	1	1	1	1	1	1	1	3
T 37	1	1	1	1	1	1	1	1	1	1	1	1
T 38	1	1	1	1	1	1	1	1	1	1	3	3
T 39	1	1	1	1	1	1	1	1	1	3	3	3

T 40	1	1	1	1	1	1	1	1	1	3	3	3
T 41	1	1	1	1	1	1	1	1	1	3	3	3
T 42	1	1	1	1	1	1	1	1	1	1	3	3
T 43	1	1	1	1	1	1	1	1	1	3	3	3
T 44	1	1	1	1	1	1	1	1	1	7	7	7
T 45	1	1	1	1	1	1	1	1	1	1	1	3
T 46	1	1	1	1	1	1	1	1	1	1	3	3
T 47	1	1	1	1	1	1	1	1	1	1	3	3
T 48	1	1	1	1	1	1	1	1	1	1	1	3
T 49	1	1	1	1	1	1	1	1	1	1	1	3
T 50	1	1	1	1	1	1	1	1	1	1	5	7
T 51	1	1	1	1	1	1	1	1	1	1	3	3
T 52	1	1	1	1	1	1	1	1	1	1	1	7
T 53	1	1	1	1	1	1	1	1	1	1	1	3
T 54	1	1	1	1	1	1	1	1	1	1	1	3
T 55	1	1	1	1	1	1	1	1	1	1	3	3
T 56	1	1	1	1	1	1	1	1	1	1	3	3
T 57	1	1	1	1	1	1	1	1	1	1	3	5
T 58	1	1	1	1	1	1	1	1	1	1	3	3
T 59	1	1	1	1	1	1	1	1	1	3	3	3
T 60	1	1	1	1	1	1	1	1	1	1	3	3
T 61	1	1	1	1	1	1	1	1	1	3	3	5
T 62	1	1	1	1	1	1	1	1	1	1	3	7

T 63	1	1	1	1	1	1	1	1	1	3	3	3
T 64	1	1	1	1	1	1	1	1	1	1	3	3
T 65	1	1	1	1	1	1	1	1	1	1	3	3
T 66	1	1	1	1	1	1	1	1	1	3	3	3
T 67	1	1	1	1	1	1	1	1	1	3	3	7
T 68	1	1	1	1	1	1	1	1	1	3	3	7
T 69	1	1	1	1	1	1	1	1	1	1	3	3
T 70	1	1	1	1	1	1	1	1	1	1	3	7
T 71	1	1	1	1	1	1	1	1	1	1	3	7
T 72	1	1	1	1	1	1	1	1	1	1	3	5
T 73	1	1	1	1	1	1	1	1	1	1	3	3
T 74	1	1	1	1	1	1	1	1	1	1	3	5
T 75	1	1	1	1	1	1	1	1	1	1	1	3

Months after planting (MAP)

Appendix-XIV

Table 4.1.1.1.10. Distribution of spines of somaclonal variants of pineapple variety Mauritius

Treatments	Distribution of spines											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	3	3	3	3	3	3	3	3	3	3	3	3
T 2	3	3	3	3	3	3	3	3	3	3	3	3
T 3	3	3	3	3	3	3	3	3	3	3	3	3
T 4	3	3	3	3	3	3	3	3	3	3	3	3
T 5	3	3	3	3	3	3	3	3	3	3	3	3
T 6	3	3	3	3	3	3	3	3	3	3	3	3
T 7	3	3	3	3	3	3	3	3	3	3	3	3
T 8	3	3	3	3	3	3	3	3	3	3	3	3
T 9	3	3	3	3	3	3	3	3	3	3	3	3
T 10	3	3	3	3	3	3	3	3	3	3	3	3
T 11	3	3	3	3	3	3	3	3	3	3	3	3
T 12	3	3	3	3	3	3	3	3	3	3	3	3
T 13	3	3	3	3	3	3	3	3	3	3	3	3
T 14	3	3	3	3	3	3	3	3	3	3	3	3
T 15	3	3	3	3	3	3	3	3	3	3	3	3
T 16	3	3	3	3	3	3	3	3	3	3	3	3

T 17	3	3	3	3	3	3	3	3	3	3	3	3
T 18	3	3	3	3	3	3	3	3	3	3	3	3
T 19	3	3	3	3	3	3	3	3	3	3	3	3
T 20	3	3	3	3	3	3	3	3	3	3	3	3
T 21	3	3	3	3	3	3	3	3	3	3	3	3
T 22	3	3	3	3	3	3	3	3	3	3	3	3
T 23	3	3	3	3	3	3	3	3	3	3	3	3
T 24	3	3	3	3	3	3	3	3	3	3	3	3
T 25	3	3	3	3	3	3	3	3	3	3	3	3
T 26	3	3	3	3	3	3	3	3	3	3	3	3
T 27	3	3	3	3	3	3	3	3	3	3	3	3
T 28	3	3	3	3	3	3	3	3	3	3	3	3
T 29	3	3	3	3	3	3	3	3	3	3	3	3
T 30	3	3	3	3	3	3	3	3	3	3	3	3
T 31	3	3	3	3	3	3	3	3	3	3	3	3
T 32	3	3	3	3	3	3	3	3	3	3	3	3
T 33	3	3	3	3	3	3	3	3	3	3	3	3
T 34	3	3	3	3	3	3	3	3	3	3	3	3
T 35	3	3	3	3	3	3	3	3	3	3	3	3
T 36	3	3	3	3	3	3	3	3	3	3	3	3
T 37	3	3	3	3	3	3	3	3	3	3	3	3
T 38	3	3	3	3	3	3	3	3	3	3	3	3
T 39	3	3	3	3	3	3	3	3	3	3	3	3

T 40	3	3	3	3	3	3	3	3	3	3	3	3
T 41	3	3	3	3	3	3	3	3	3	3	3	3
T 42	3	3	3	3	3	3	3	3	3	3	3	3
T 43	3	3	3	3	3	3	3	3	3	3	3	3
T 44	3	3	3	3	3	3	3	3	3	3	3	3
T 45	3	3	3	3	3	3	3	3	3	3	3	3
T 46	3	3	3	3	3	3	3	3	3	3	3	3
T 47	3	3	3	3	3	3	3	3	3	3	3	3
T 48	3	3	3	3	3	3	3	3	3	3	3	3
T 49	3	3	3	3	3	3	3	3	3	3	3	3
T 50	3	3	3	3	3	3	3	3	3	3	3	3
T 51	3	3	3	3	3	3	3	3	3	3	3	3
T 52	3	3	3	3	3	3	3	3	3	3	3	3
T 53	3	3	3	3	3	3	3	3	3	3	3	3
T 54	3	3	3	3	3	3	3	3	3	3	3	3
T 55	3	3	3	3	3	3	3	3	3	3	3	3
T 56	3	3	3	3	3	3	3	3	3	3	3	3
T 57	3	3	3	3	3	3	3	3	3	3	3	3
T 58	3	3	3	3	3	3	3	3	3	3	3	3
T 59	3	3	3	3	3	3	3	3	3	3	3	3
T 60	3	3	3	3	3	3	3	3	3	3	3	3
T 61	3	3	3	3	3	3	3	3	3	3	3	3
T 62	3	3	3	3	3	3	3	3	3	3	3	3

T 63	3	3	3	3	3	3	3	3	3	3	3	3
T 64	3	3	3	3	3	3	3	3	3	3	3	3
T 65	3	3	3	3	3	3	3	3	3	3	3	3
T 66	3	3	3	3	3	3	3	3	3	3	3	3
T 67	3	3	3	3	3	3	3	3	3	3	3	3
T 68	3	3	3	3	3	3	3	3	3	3	3	3
T 69	3	3	3	3	3	3	3	3	3	3	3	3
T 70	3	3	3	3	3	3	3	3	3	3	3	3
T 71	3	3	3	3	3	3	3	3	3	3	3	3
T 72	3	3	3	3	3	3	3	3	3	3	3	3
T 73	3	3	3	3	3	3	3	3	3	3	3	3
T 74	3	3	3	3	3	3	3	3	3	3	3	3
T 75	3	3	3	3	3	3	3	3	3	3	3	3

Months after planting (MAP)

Appendix-XV

Table 4.1.1.1.11. Direction of spines of somaclonal variants of pineapple variety Mauritius

Treatments	Direction of spines											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	1	1	1	1	1	1	1	1	1	1	1	1
T 2	1	1	1	1	1	1	1	1	1	1	1	1
T 3	1	1	1	1	1	1	1	1	1	1	1	1
T 4	1	1	1	1	1	1	1	1	1	1	1	1
T 5	1	1	1	1	1	1	1	1	1	1	1	1
T 6	1	1	1	1	1	1	1	1	1	1	1	1
T 7	1	1	1	1	1	1	1	1	1	1	1	1
T 8	1	1	1	1	1	1	1	1	1	1	1	1
T 9	1	1	1	1	1	1	1	1	1	1	1	1
T 10	1	1	1	1	1	1	1	1	1	1	1	1
T 11	1	1	1	1	1	1	1	1	1	1	1	1
T 12	1	1	1	1	1	1	1	1	1	1	1	1
T 13	1	1	1	1	1	1	1	1	1	1	1	1
T 14	1	1	1	1	1	1	1	1	1	1	1	1
T 15	1	1	1	1	1	1	1	1	1	1	1	1
T 16	1	1	1	1	1	1	1	1	1	1	1	1

T 17	1	1	1	1	1	1	1	1	1	1	1	1
T 18	1	1	1	1	1	1	1	1	1	1	1	1
T 19	1	1	1	1	1	1	1	1	1	1	1	1
T 20	1	1	1	1	1	1	1	1	1	1	1	1
T 21	1	1	1	1	1	1	1	1	1	1	1	1
T 22	1	1	1	1	1	1	1	1	1	1	1	1
T 23	1	1	1	1	1	1	1	1	1	1	1	1
T 24	1	1	1	1	1	1	1	1	1	1	1	1
T 25	1	1	1	1	1	1	1	1	1	1	1	1
T 26	1	1	1	1	1	1	1	1	1	1	1	1
T 27	1	1	1	1	1	1	1	1	1	1	1	1
T 28	1	1	1	1	1	1	1	1	1	1	1	1
T 29	1	1	1	1	1	1	1	1	1	1	1	1
T 30	1	1	1	1	1	1	1	1	1	1	1	1
T 31	1	1	1	1	1	1	1	1	1	1	1	1
T 32	1	1	1	1	1	1	1	1	1	1	1	1
T 33	1	1	1	1	1	1	1	1	1	1	1	1
T 34	1	1	1	1	1	1	1	1	1	1	1	1
T 35	1	1	1	1	1	1	1	1	1	1	1	1
T 36	1	1	1	1	1	1	1	1	1	1	1	1
T 37	1	1	1	1	1	1	1	1	1	1	1	1
T 38	1	1	1	1	1	1	1	1	1	1	1	1
T 39	1	1	1	1	1	1	1	1	1	1	1	1

T 40	1	1	1	1	1	1	1	1	1	1	1	1
T 41	1	1	1	1	1	1	1	1	1	1	1	1
T 42	1	1	1	1	1	1	1	1	1	1	1	1
T 43	1	1	1	1	1	1	1	1	1	1	1	1
T 44	1	1	1	1	1	1	1	1	1	1	1	1
T 45	1	1	1	1	1	1	1	1	1	1	1	1
T 46	1	1	1	1	1	1	1	1	1	1	1	1
T 47	1	1	1	1	1	1	1	1	1	1	1	1
T 48	1	1	1	1	1	1	1	1	1	1	1	1
T 49	1	1	1	1	1	1	1	1	1	1	1	1
T 50	1	1	1	1	1	1	1	1	1	1	1	1
T 51	1	1	1	1	1	1	1	1	1	1	1	1
T 52	1	1	1	1	1	1	1	1	1	1	1	1
T 53	1	1	1	1	1	1	1	1	1	1	1	1
T 54	1	1	1	1	1	1	1	1	1	1	1	1
T 55	1	1	1	1	1	1	1	1	1	1	1	1
T 56	1	1	1	1	1	1	1	1	1	1	1	1
T 57	1	1	1	1	1	1	1	1	1	1	1	1
T 58	1	1	1	1	1	1	1	1	1	1	1	1
T 59	1	1	1	1	1	1	1	1	1	1	1	1
T 60	1	1	1	1	1	1	1	1	1	1	1	1
T 61	1	1	1	1	1	1	1	1	1	1	1	1
T 62	1	1	1	1	1	1	1	1	1	1	1	1

T 63	1	1	1	1	1	1	1	1	1	1	1	1
T 64	1	1	1	1	1	1	1	1	1	1	1	1
T 65	1	1	1	1	1	1	1	1	1	1	1	1
T 66	1	1	1	1	1	1	1	1	1	1	1	1
T 67	1	1	1	1	1	1	1	1	1	1	1	1
T 68	1	1	1	1	1	1	1	1	1	1	1	1
T 69	1	1	1	1	1	1	1	1	1	1	1	1
T 70	1	1	1	1	1	1	1	1	1	1	1	1
T 71	1	1	1	1	1	1	1	1	1	1	1	1
T 72	1	1	1	1	1	1	1	1	1	1	1	1
T 73	1	1	1	1	1	1	1	1	1	1	1	1
T 74	1	1	1	1	1	1	1	1	1	1	1	1
T 75	1	1	1	1	1	1	1	1	1	1	1	1

Months after planting (MAP)

Appendix-XVI

Table 4.1.1.1.12. Colouration of leaf spines of somaclonal variants of pineapple variety Mauritius

Treatments	Colouration of leaf spines											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	4	4	4	4	4	4	4	4	4	4	4	4
T 2	1	1	1	1	1	1	1	1	1	1	1	1
T 3	4	4	4	4	4	4	4	4	4	4	4	4
T 4	4	4	4	4	4	4	4	4	4	4	4	4
T 5	4	4	4	4	4	4	4	4	4	4	4	4
T 6	4	4	4	4	4	4	4	4	4	4	4	4
T 7	4	4	4	4	4	4	4	4	4	4	4	4
T 8	4	4	4	4	4	4	4	4	4	4	4	4
T 9	4	4	4	4	4	4	4	4	4	4	4	4
T 10	4	4	4	4	4	4	4	4	4	4	4	4
T 11	4	4	4	4	4	4	4	4	4	4	4	4
T 12	4	4	4	4	4	4	4	4	4	4	4	4
T 13	4	4	4	4	4	4	4	4	4	4	4	4
T 14	1	1	1	1	1	1	1	1	1	1	1	1
T 15	1	1	1	1	1	1	1	1	1	1	1	1
T 16	1	1	1	1	1	1	1	1	1	1	1	1

T 17	1	1	1	1	1	1	1	1	1	1	1	1
T 18	1	1	1	1	1	1	1	1	1	1	1	1
T 19	4	4	4	4	4	4	4	4	4	4	4	4
T 20	4	4	4	4	4	4	4	4	4	4	4	4
T 21	1	1	1	1	1	1	1	1	1	1	1	1
T 22	4	4	4	4	4	4	4	4	4	4	4	4
T 23	4	4	4	4	4	4	4	4	4	4	4	4
T 24	3	3	3	3	3	3	3	3	3	3	3	3
T 25	1	1	1	1	1	1	1	1	1	1	1	1
T 26	4	4	4	4	4	4	4	4	4	4	4	4
T 27	4	4	4	4	4	4	4	4	4	4	4	4
T 28	4	4	4	4	4	4	4	4	4	4	4	4
T 29	4	4	4	4	4	4	4	4	4	4	4	4
T 30	3	3	3	3	3	3	3	3	3	3	3	3
T 31	3	3	3	3	3	3	3	3	3	3	3	3
T 32	3	3	3	3	3	3	3	3	3	3	3	3
T 33	3	3	3	3	3	3	3	3	3	3	3	3
T 34	3	3	3	3	3	3	3	3	3	3	3	3
T 35	3	3	3	3	3	3	3	3	3	3	3	3
T 36	3	3	3	3	3	3	3	3	3	3	3	3
T 37	4	4	4	4	4	4	4	4	4	4	4	4
T 38	4	4	4	4	4	4	4	4	4	4	4	4
T 39	4	4	4	4	4	4	4	4	4	4	4	4

T 40	3	3	3	3	3	3	3	3	3	3	3	3
T 41	3	3	3	3	3	3	3	3	3	3	3	3
T 42	3	3	3	3	3	3	3	3	3	3	3	3
T 43	1	1	1	1	1	1	1	1	1	1	1	1
T 44	3	3	3	3	3	3	3	3	3	3	3	3
T 45	3	3	3	3	3	3	3	3	3	3	3	3
T 46	3	3	3	3	3	3	3	3	3	3	3	3
T 47	3	3	3	3	3	3	3	3	3	3	3	3
T 48	1	1	1	1	1	1	1	1	1	1	1	1
T 49	1	1	1	1	1	1	1	1	1	1	1	1
T 50	4	4	4	4	4	4	4	4	4	4	4	4
T 51	4	4	4	4	4	4	4	4	4	4	4	4
T 52	4	4	4	4	4	4	4	4	4	4	4	4
T 53	4	4	4	4	4	4	4	4	4	4	4	4
T 54	4	4	4	4	4	4	4	4	4	4	4	4
T 55	4	4	4	4	4	4	4	4	4	4	4	4
T 56	3	3	3	3	3	3	3	3	3	3	3	3
T 57	3	3	3	3	3	3	3	3	3	3	3	3
T 58	3	3	3	3	3	3	3	3	3	3	3	3
T 59	3	3	3	3	3	3	3	3	3	3	3	3
T 60	3	3	3	3	3	3	3	3	3	3	3	3
T 61	3	3	3	3	3	3	3	3	3	3	3	3
T 62	3	3	3	3	3	3	3	3	3	3	3	3

T 63	3	3	3	3	3	3	3	3	3	3	3	3
T 64	3	3	3	3	3	3	3	3	3	3	3	3
T 65	3	3	3	3	3	3	3	3	3	3	3	3
T 66	3	3	3	3	3	3	3	3	3	3	3	3
T 67	3	3	3	3	3	3	3	3	3	3	3	3
T 68	3	3	3	3	3	3	3	3	3	3	3	3
T 69	3	3	3	3	3	3	3	3	3	3	3	3
T 70	3	3	3	3	3	3	3	3	3	3	3	3
T 71	3	3	3	3	3	3	3	3	3	3	3	3
T 72	3	3	3	3	3	3	3	3	3	3	3	3
T 73	3	3	3	3	3	3	3	3	3	3	3	3
T 74	3	3	3	3	3	3	3	3	3	3	3	3
T 75	3	3	3	3	3	3	3	3	3	3	3	3

Months after planting (MAP)

Appendix-XVII

Table 4.1.1.1.13. Spine stiffness of somaclonal variants of pineapple variety Mauritius

Treatments	Spine stiffness											
	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP	7 MAP	8 MAP	9 MAP	10 MAP	11 MAP	12 MAP
T 1	5	5	5	5	5	5	5	5	5	5	5	5
T 2	5	5	5	5	5	5	5	5	5	5	5	5
T 3	5	5	5	5	5	5	5	5	5	5	5	5
T 4	5	5	5	5	5	5	5	5	5	5	5	5
T 5	5	5	5	5	5	5	5	5	5	5	5	5
T 6	5	5	5	5	5	5	5	5	5	5	5	5
T 7	5	5	5	5	5	5	5	5	5	5	5	5
T 8	5	5	5	5	5	5	5	5	5	5	5	5
T 9	5	5	5	5	5	5	5	5	5	5	5	5
T 10	5	5	5	5	5	5	5	5	5	5	5	5
T 11	5	5	5	5	5	5	5	5	5	5	5	5
T 12	5	5	5	5	5	5	5	5	5	5	5	5
T 13	5	5	5	5	5	5	5	5	5	5	5	5
T 14	5	5	5	5	5	5	5	5	5	5	5	5
T 15	5	5	5	5	5	5	5	5	5	5	5	5
T 16	5	5	5	5	5	5	5	5	5	5	5	5

T 17	5	5	5	5	5	5	5	5	5	5	5	5
T 18	5	5	5	5	5	5	5	5	5	5	5	5
T 19	5	5	5	5	5	5	5	5	5	5	5	5
T 20	5	5	5	5	5	5	5	5	5	5	5	5
T 21	5	5	5	5	5	5	5	5	5	5	5	5
T 22	5	5	5	5	5	5	5	5	5	5	5	5
T 23	5	5	5	5	5	5	5	5	5	5	5	5
T 24	5	5	5	5	5	5	5	5	5	5	5	5
T 25	5	5	5	5	5	5	5	5	5	5	5	5
T 26	5	5	5	5	5	5	5	5	5	5	5	5
T 27	5	5	5	5	5	5	5	5	5	5	5	5
T 28	5	5	5	5	5	5	5	5	5	5	5	5
T 29	5	5	5	5	5	5	5	5	5	5	5	5
T 30	5	5	5	5	5	5	5	5	5	5	5	5
T 31	5	5	5	5	5	5	5	5	5	5	5	5
T 32	5	5	5	5	5	5	5	5	5	5	5	5
T 33	5	5	5	5	5	5	5	5	5	5	5	5
T 34	5	5	5	5	5	5	5	5	5	5	5	5
T 35	5	5	5	5	5	5	5	5	5	5	5	5
T 36	5	5	5	5	5	5	5	5	5	5	5	5
T 37	5	5	5	5	5	5	5	5	5	5	5	5
T 38	5	5	5	5	5	5	5	5	5	5	5	5
T 39	5	5	5	5	5	5	5	5	5	5	5	5

T 40	5	5	5	5	5	5	5	5	5	5	5	5
T 41	5	5	5	5	5	5	5	5	5	5	5	5
T 42	5	5	5	5	5	5	5	5	5	5	5	5
T 43	5	5	5	5	5	5	5	5	5	5	5	5
T 44	5	5	5	5	5	5	5	5	5	5	5	5
T 45	5	5	5	5	5	5	5	5	5	5	5	5
T 46	5	5	5	5	5	5	5	5	5	5	5	5
T 47	5	5	5	5	5	5	5	5	5	5	5	5
T 48	5	5	5	5	5	5	5	5	5	5	5	5
T 49	5	5	5	5	5	5	5	5	5	5	5	5
T 50	5	5	5	5	5	5	5	5	5	5	5	5
T 51	5	5	5	5	5	5	5	5	5	5	5	5
T 52	5	5	5	5	5	5	5	5	5	5	5	5
T 53	5	5	5	5	5	5	5	5	5	5	5	5
T 54	5	5	5	5	5	5	5	5	5	5	5	5
T 55	5	5	5	5	5	5	5	5	5	5	5	5
T 56	5	5	5	5	5	5	5	5	5	5	5	5
T 57	5	5	5	5	5	5	5	5	5	5	5	5
T 58	5	5	5	5	5	5	5	5	5	5	5	5
T 59	5	5	5	5	5	5	5	5	5	5	5	5
T 60	5	5	5	5	5	5	5	5	5	5	5	5
T 61	5	5	5	5	5	5	5	5	5	5	5	5
T 62	5	5	5	5	5	5	5	5	5	5	5	5

T 63	5	5	5	5	5	5	5	5	5	5	5	5
T 64	5	5	5	5	5	5	5	5	5	5	5	5
T 65	5	5	5	5	5	5	5	5	5	5	5	5
T 66	5	5	5	5	5	5	5	5	5	5	5	5
T 67	5	5	5	5	5	5	5	5	5	5	5	5
T 68	5	5	5	5	5	5	5	5	5	5	5	5
T 69	5	5	5	5	5	5	5	5	5	5	5	5
T 70	5	5	5	5	5	5	5	5	5	5	5	5
T 71	5	5	5	5	5	5	5	5	5	5	5	5
T 72	5	5	5	5	5	5	5	5	5	5	5	5
T 73	5	5	5	5	5	5	5	5	5	5	5	5
T 74	5	5	5	5	5	5	5	5	5	5	5	5
T 75	5	5	5	5	5	5	5	5	5	5	5	5

Months after planting (MAP)

Appendix-XVIII

Table 4.1.1.5. Organoleptic evaluation of somaclonal variants of pineapple variety Mauritius

Treatments	Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank
T 1	59.00	69.00	76.00	66.00	67.00
T 2	68.00	75.00	92.00	78.00	78.00
T 3	67.00	66.00	69.00	59.00	65.00
T 4	95.00	63.00	58.00	49.00	66.00
T 5	63.00	79.00	79.00	86.00	76.00
T 6	61.00	86.00	86.00	62.00	73.00
T 7	70.00	82.00	82.00	91.00	81.00
T 8	75.00	87.00	87.00	65.00	78.00
T 9	74.00	86.00	67.00	54.00	70.00
T 10	97.00	50.00	50.00	41.00	59.00
T 11	75.00	73.00	85.00	75.00	77.00
T 12	74.00	71.00	78.00	68.00	72.00
T 13	76.00	68.00	73.00	63.00	70.00
T 14	79.00	93.00	93.00	61.00	81.00
T 15	72.00	89.00	89.00	75.00	81.00
T 16	71.00	78.00	78.00	84.00	77.00
T 17	97.00	62.00	57.00	48.00	66.00
T 18	72.00	78.00	58.00	83.00	72.00
T 19	41.00	65.00	63.00	53.00	55.00
T 20	65.00	79.00	79.00	85.00	77.00
T 21	63.00	75.00	91.00	78.00	76.00
T 22	94.00	66.00	67.00	57.00	71.00
T 23	58.00	70.00	77.00	67.00	68.00
T 24	95.00	61.00	56.00	47.00	64.00
T 25	98.00	56.00	52.00	43.00	62.00
T 26	74.00	71.00	79.00	69.00	73.00
T 27	60.00	77.00	77.00	79.00	73.00
T 28	40.00	85.00	85.00	94.00	76.00
T 29	78.00	82.00	52.00	89.00	75.00
T 30	74.00	78.00	88.00	83.00	80.00
T 31	80.00	66.00	68.00	58.00	68.00
T 32	78.00	77.00	77.00	79.00	77.00
T 33	83.00	83.00	83.00	92.00	85.00
T 34	78.00	73.00	84.00	74.00	77.00
T 35	75.00	75.00	89.00	78.00	79.00
T 36	78.00	65.00	60.00	50.00	63.00
T 37	77.00	73.00	87.00	77.00	78.00
T 38	69.00	65.00	66.00	56.00	64.00
T 39	60.00	71.00	70.00	70.00	67.00
T 40	74.00	66.00	61.00	51.00	63.00
T 41	71.00	68.00	74.00	64.00	69.00
T 42	76.00	77.00	77.00	80.00	77.00
T 43	96.00	59.00	54.00	45.00	63.00
T 44	70.00	76.00	93.00	78.00	79.00

T 45	73.00	94.00	94.00	79.00	85.00
T 46	71.00	78.00	78.00	80.00	76.00
T 47	93.00	60.00	55.00	46.00	63.00
T 48	72.00	80.00	80.00	87.00	79.00
T 49	62.00	68.00	71.00	61.00	65.00
T 50	66.00	86.00	86.00	53.00	72.00
T 51	65.00	78.00	78.00	82.00	75.00
T 52	65.00	74.00	88.00	77.00	76.00
T 53	68.00	82.00	82.00	90.00	80.00
T 54	73.00	94.00	49.00	69.00	71.00
T 55	71.00	85.00	85.00	93.00	83.00
T 56	76.00	78.00	78.00	81.00	78.00
T 57	52.00	69.00	75.00	65.00	65.00
T 58	77.00	80.00	80.00	88.00	81.00
T 59	79.00	73.00	86.00	76.00	78.00
T 60	73.00	75.00	90.00	78.00	79.00
T 61	58.00	58.00	53.00	44.00	53.00
T 62	71.00	67.00	70.00	60.00	67.00
T 63	67.00	76.00	95.00	79.00	79.00
T 64	74.00	98.00	68.00	88.00	82.00
T 65	66.00	95.00	59.00	77.00	74.00
T 66	72.00	68.00	72.00	62.00	68.00
T 67	46.00	64.00	59.00	50.00	54.00
T 68	59.00	73.00	83.00	73.00	72.00
T 69	92.00	65.00	62.00	52.00	67.00
T 70	66.00	65.00	64.00	54.00	62.00
T 71	94.00	57.00	51.00	42.00	61.00
T 72	74.00	72.00	81.00	71.00	74.00
T 73	69.00	65.00	65.00	55.00	63.00
T 74	79.00	76.00	94.00	79.00	82.00
T 75	91.00	72.00	82.00	72.00	79.00
Mauritius	87.00	83.00	86.00	82.00	84.00
Kendall’s Coefficient	**0.003**	**0.002**	**0.003**	**0.004**	**0.001**

Appendix-XIX

Table 4.1. Range of quantitative characters of somaclonal variants of variety Mauritius

Characters	Minimum	Maximum
Plant height	67.00 (T 15)	95.00 (T 46)
Number of leaves	39.00 (T 2)	46.00 (T 49)
Length D leaf	48.00 (T 71)	78.00 (T 46)
Breadth D leaf	2.00 (T 9)	6.00 (T 50)
D leaf area	79.75 (T 64)	282.75 (T 46)
Leaf area index	2.17 (T 18)	8.72 (T 24)
Days to attain ideal leaf stage for flowering	312.00 (T 30)	420.00 (T 5)
Days for initiation of flowering (Visual)	35.00 (T 5)	50.00 (T 13)
Flowering phase (days)	17.00 (T 17)	26.00 (T 13)
Days for fruit maturity	91.00 (T 7)	307.00 (T 25)
Crop duration (days)	544.00 (T 41)	752.00 (T 25)
Length of the fruit (cm)	9.30 (T 56)	17.40 (T 71)
Girth of the fruit (cm)	23.95 (T 29)	35.20 (T 10)
Breadth of the fruit (cm)	7.97 (T 12)	10.63 (T 10)
Taper ratio of the fruit	0.71 (T 44)	0.93 (T 20)
Fruit weight with crown (kg)	0.49 (T 64)	1.27 (T10)
Crown weight (kg)	0.03 (T 26)	0.17 (T 24)
Shelf life	6 (T 73)	9 (T 5)
Peel weight (kg)	0.08 (T 47)	0.25 (T 31)
Pulp weight (kg)	0.20 (T 45)	0.78 (T10)
Pulp percentage	32.37 (T 40)	78.12 (T 24)
Juice (%)	73.42 (T 3)	96.96 (T 4)
TSS (°Brix)	9.00 (T 3)	15.20 (T 56)
Acidity (%)	0.26 (T 24)	1.54 (T 9)
Total sugars (%)	8.40 (T 4)	14.00 (T 12)
Reducing sugars (%)	1.38 (T 27)	5.45 (T 6)
Non reducing sugars (%)	3.55 (T 6)	12.37 (T 35)
Sugar/acid ratio	7.81 (T 31)	47.69 (T 24)
Fibre (%)	20.00 (T 4)	43.30 (T 5)
Total carotenoids (mg 100 g-^{1})	106.81 (T 8)	387.00 (T 27)
Ascorbic acid (mg 100 g-^{1})	10.26 (T 4)	184.62 (T 15)

Appendix-XX

Table 4.2.1.1.1. Plant height (cm) of Mauritius x Kew hybrids

Treatments		Plant height (cm)					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 17	72.30	76.97	81.97	85.44	89.24	92.97
T 02	H 16	73.27	78.10	83.10	86.47	90.64	94.54
T 03	H 85	71.77	77.57	82.40	85.97	89.54	93.10
T 04	H 91	69.94	74.74	80.10	85.10	89.27	92.54
T 05	H 48	74.10	77.77	81.70	86.07	89.70	94.44
T 06	H 62	72.94	76.87	80.77	85.74	89.90	93.80
T 07	H 43	75.10	79.20	83.74	87.40	90.87	94.40
T 08	H 66	69.07	73.97	77.37	82.24	86.30	90.64
T 09	H 77	73.30	78.20	81.94	86.47	89.74	93.90
T 10	H 92	72.64	76.37	79.37	83.64	87.30	91.57
T 11	H 63	70.10	74.10	78.40	81.77	86.04	89.97
T 12	H 27	72.47	76.27	79.74	83.20	87.20	90.40
T 13	H 78	71.04	74.77	79.60	83.37	87.44	91.27
T 14	H 70	69.90	74.54	78.54	81.74	85.47	89.47
T 15	H 59	73.40	77.77	82.14	85.97	89.24	92.24
T 16	H 60	70.74	75.10	80.20	83.74	88.27	91.70
T 17	H 49	73.04	77.57	81.57	85.14	89.74	93.47
T 18	H 54	72.37	77.10	81.20	84.94	88.94	93.04
T 19	H 10	69.90	75.64	80.80	83.80	87.94	91.90
T 20	H 15	70.44	74.64	79.74	83.80	88.20	92.30
T 21	H 30	70.60	74.87	79.70	84.24	88.04	92.24
T 22	H 14	69.70	73.70	78.90	82.97	86.97	91.30
T 23	H 7	69.10	74.27	78.07	82.44	85.70	89.97
T 24	H 35	71.54	75.27	78.47	83.37	87.74	91.64
T 25	H 19	72.70	77.24	82.24	87.14	90.44	94.44
T 26	Mauritius	73.47	77.24	81.27	86.70	92.57	100.53
T 27	Kew	75.64	79.80	84.90	91.24	100.57	109.02
T 28	Amritha	68.30	72.30	77.20	81.24	84.80	91.36
Months after planting (MAP)							

Appendix-XXI

Table 4.2.1.1.2. Number of leaves per plant of Mauritius x Kew hybrids

Treatments		Number of leaves per plant					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 17	24.94	27.57	30.57	33.47	36.37	40.97
T 02	H 16	24.57	27.87	30.87	32.97	36.24	39.77
T 03	H 85	25.04	27.94	30.57	33.04	35.87	39.77
T 04	H 91	25.27	28.27	30.94	33.57	35.77	40.57
T 05	H 48	22.94	26.04	29.04	31.94	35.27	38.64
T 06	H 62	24.40	27.40	29.87	32.87	35.24	40.80
T 07	H 43	23.97	26.87	30.04	33.04	35.57	38.74
T 08	H 66	23.44	26.44	29.44	32.87	35.87	42.24
T 09	H 77	24.37	26.77	29.77	32.57	35.04	38.87
T 10	H 92	23.90	26.90	29.27	32.10	34.74	39.80
T 11	H 63	24.14	26.40	29.20	32.20	35.47	38.57
T 12	H 27	24.57	26.94	29.30	32.20	35.20	38.47
T 13	H 78	24.60	26.87	29.40	32.94	36.10	40.04
T 14	H 70	25.54	28.27	30.37	33.30	35.60	41.47
T 15	H 59	24.57	27.57	31.27	34.27	37.07	41.77
T 16	H 60	25.80	28.54	31.84	34.57	37.04	40.17
T 17	H 49	23.07	26.07	28.70	31.70	34.97	38.77
T 18	H 54	23.60	26.60	29.60	32.60	35.87	38.77
T 19	H 10	24.74	27.74	30.74	33.54	36.07	40.30
T 20	H 15	24.57	27.20	29.57	32.57	35.94	40.27
T 21	H 30	24.54	27.54	30.44	32.90	35.37	38.70
T 22	H 14	23.97	26.60	28.97	32.14	35.04	38.60
T 23	H 7	23.74	26.64	30.24	33.40	36.60	40.77
T 24	H 35	23.44	26.27	28.90	32.37	35.20	41.74
T 25	H 19	24.57	27.57	30.20	33.30	36.04	39.24
T 26	Mauritius	24.04	27.04	30.20	33.57	36.57	42.10
T 27	Kew	25.44	28.44	31.44	34.27	37.37	41.54
T 28	Amritha	24.27	26.90	29.54	32.80	36.27	40.64
Months after planting (MAP)							

Appendix-XXII

Table 4.2.1.1.3. Length of 'D' leaf of Mauritius x Kew hybrids

Treatments		Length of 'D' leaf					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 17	39.90	42.70	45.97	49.04	51.94	54.04
T 02	H 16	43.14	45.40	48.20	50.30	52.57	55.30
T 03	H 85	44.77	46.97	49.87	52.60	54.70	57.44
T 04	H 91	41.30	44.10	46.47	48.74	51.27	53.47
T 05	H 48	38.07	40.44	43.27	45.90	48.90	51.90
T 06	H 62	42.07	44.70	47.24	49.97	52.60	55.70
T 07	H 43	42.97	45.70	48.60	51.24	54.24	56.60
T 08	H 66	44.80	47.44	49.90	52.10	55.10	58.20
T 09	H 77	42.20	44.77	47.14	49.77	52.40	55.07
T 10	H 92	43.10	45.74	48.64	51.10	53.74	56.47
T 11	H 63	42.74	45.90	48.54	51.44	54.24	56.77
T 12	H 27	44.04	46.40	49.30	51.40	54.47	56.77
T 13	H 78	42.14	44.60	46.87	49.24	51.80	54.07
T 14	H 70	43.90	46.70	49.60	52.24	54.87	58.07
T 15	H 59	47.30	49.94	52.94	55.94	59.10	61.30
T 16	H 60	46.90	49.37	51.64	53.64	55.90	58.37
T 17	H 49	44.30	46.40	48.77	51.30	54.10	56.57
T 18	H 54	44.24	46.87	49.14	51.87	54.07	56.90
T 19	H 10	37.54	40.44	43.07	45.80	48.54	51.80
T 20	H 15	45.54	48.10	50.74	53.47	56.30	58.94
T 21	H 30	45.54	47.64	49.64	51.74	54.10	56.47
T 22	H 14	44.37	46.57	49.14	51.87	54.77	57.24
T 23	H 7	43.54	45.90	48.74	51.37	53.74	56.54
T 24	H 35	42.07	44.54	47.60	50.40	52.94	55.30
T 25	H 19	45.94	48.40	51.14	53.60	56.07	58.54
T 26	Mauritius	48.87	51.14	53.77	56.94	59.20	61.94
T 27	Kew	44.10	46.57	49.57	52.47	55.10	57.57
T 28	Amritha	40.37	42.37	44.90	47.27	49.80	52.44
Months after planting (MAP)							

Appendix-XXIII

Table 4.2.1.1.4. Breadth of 'D' leaf of Mauritius x Kew hybrids

Treatments		Breadth of 'D' leaf					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	2.35	2.97	2.45	2.95	2.85	2.54
T 02	**H 16**	2.79	2.02	2.62	2.62	3.25	3.30
T 03	**H 85**	2.90	2.14	2.87	2.74	3.14	2.74
T 04	**H 91**	1.87	2.17	2.00	1.72	2.24	2.18
T 05	**H 48**	2.34	1.74	2.74	2.69	3.49	3.81
T 06	**H 62**	2.44	2.17	2.45	2.42	3.20	3.29
T 07	**H 43**	2.54	3.10	3.14	3.67	3.94	3.99
T 08	**H 66**	2.82	1.87	2.74	2.69	3.00	3.40
T 09	**H 77**	1.87	1.82	3.05	2.65	2.92	3.28
T 10	**H 92**	2.05	1.90	2.64	2.90	3.09	3.54
T 11	**H 63**	2.24	1.82	2.32	3.05	3.34	3.59
T 12	**H 27**	2.35	1.59	2.64	2.32	2.95	3.54
T 13	**H 78**	2.45	2.00	2.35	2.27	2.90	3.38
T 14	**H 70**	2.40	2.19	2.80	2.62	3.25	3.64
T 15	**H 59**	2.45	2.19	2.85	3.00	3.69	3.32
T 16	**H 60**	1.92	1.24	2.42	2.37	3.10	3.46
T 17	**H 49**	2.27	2.09	2.80	3.02	3.89	4.46
T 18	**H 54**	2.05	1.69	2.50	2.32	2.95	3.40
T 19	**H 10**	1.92	1.97	2.60	2.69	3.60	3.15
T 20	**H 15**	2.09	1.90	2.72	2.72	3.35	3.67
T 21	**H 30**	2.45	1.92	3.27	3.55	3.60	3.54
T 22	**H 14**	2.62	2.05	2.92	2.69	2.84	2.94
T 23	**H 7**	2.54	1.92	3.05	3.15	3.60	3.31
T 24	**H 35**	3.07	2.25	3.20	3.25	3.30	3.57
T 25	**H 19**	1.87	1.40	2.85	3.62	2.95	4.27
T 26	**Mauritius**	2.42	1.79	2.32	2.19	2.42	2.92
T 27	**Kew**	2.09	1.45	2.32	2.27	2.64	2.64
T 28	**Amritha**	1.92	1.34	2.05	2.05	2.37	2.64
Months after planting (MAP)							

Appendix-XXIV

Table 4.2.1.1.5. 'D' leaf area of Mauritius x Kew hybrids

Treatments		'D' leaf area					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	67.84	91.76	81.66	104.90	107.39	99.37
T 02	**H 16**	86.97	66.23	91.35	95.32	123.81	132.26
T 03	**H 85**	94.09	72.68	103.59	104.33	124.31	113.92
T 04	**H 91**	55.83	69.22	67.38	60.67	83.02	84.45
T 05	**H 48**	64.65	50.95	85.88	89.37	123.30	142.86
T 06	**H 62**	74.31	70.20	83.92	87.46	121.97	132.65
T 07	**H 43**	79.10	102.62	110.50	136.31	154.99	163.71
T 08	**H 66**	91.43	64.13	98.94	101.42	119.84	143.45
T 09	**H 77**	57.14	58.89	104.28	95.77	110.83	130.80
T 10	**H 92**	64.06	63.00	92.91	107.43	120.18	144.71
T 11	**H 63**	69.25	60.40	81.46	113.73	131.08	147.71
T 12	**H 27**	74.99	53.30	94.17	86.27	116.48	145.44
T 13	**H 78**	74.83	64.67	79.79	80.82	108.85	132.24
T 14	**H 70**	76.47	73.97	100.89	99.26	129.54	153.11
T 15	**H 59**	84.04	79.10	109.46	121.66	157.88	147.34
T 16	**H 60**	64.99	44.11	90.28	91.91	125.48	145.73
T 17	**H 49**	72.69	70.05	98.79	111.84	152.15	182.69
T 18	**H 54**	65.80	57.27	89.06	87.03	115.57	140.12
T 19	**H 10**	52.23	57.78	81.30	89.18	126.81	118.49
T 20	**H 15**	68.84	66.25	99.86	105.23	136.71	156.57
T 21	**H 30**	80.89	66.13	117.49	133.16	141.21	144.75
T 22	**H 14**	84.19	69.14	103.75	100.95	112.38	121.51
T 23	**H 7**	79.93	63.78	107.80	117.42	140.33	135.55
T 24	**H 35**	93.33	72.49	110.30	118.68	126.61	142.87
T 25	**H 19**	62.12	49.10	105.61	140.39	119.88	180.96
T 26	**Mauritius**	85.65	66.23	90.22	90.21	103.73	130.97
T 27	**Kew**	66.66	48.94	83.19	86.15	105.26	109.97
T 28	**Amritha**	56.17	41.25	66.80	70.32	85.43	100.13
Months after planting (MAP)							

Appendix-XXV

Table 4.2.1.1.6. Leaf Area Index (LAI) of Mauritius x Kew hybrids

Treatments		Leaf Area Index (LAI)					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 17	1.25	1.87	1.85	2.60	2.89	3.02
T 02	H 16	1.58	1.36	2.09	2.32	3.32	3.89
T 03	H 85	1.75	1.50	2.34	2.55	3.30	3.35
T 04	H 91	1.05	1.45	1.54	1.51	2.20	2.54
T 05	H 48	1.10	0.98	1.85	2.12	3.22	4.09
T 06	H 62	1.35	1.43	1.86	2.13	3.18	4.01
T 07	H 43	1.41	2.04	2.46	3.34	4.09	4.71
T 08	H 66	1.59	1.26	2.16	2.47	3.18	4.49
T 09	H 77	1.03	1.17	2.30	2.31	2.88	3.77
T 10	H 92	1.13	1.26	2.02	2.55	3.09	4.27
T 11	H 63	1.24	1.18	1.76	2.71	3.44	4.22
T 12	H 27	1.36	1.06	2.04	2.06	3.04	4.14
T 13	H 78	1.36	1.29	1.74	1.97	2.91	3.92
T 14	H 70	1.45	1.55	2.28	2.45	3.42	4.71
T 15	H 59	1.53	1.62	2.54	3.09	4.34	4.56
T 16	H 60	1.24	0.93	2.13	2.35	3.44	4.34
T 17	H 49	1.24	1.35	2.10	2.63	3.94	5.25
T 18	H 54	1.15	1.13	1.95	2.10	3.07	4.02
T 19	H 10	0.96	1.19	1.85	2.22	3.39	3.53
T 20	H 15	1.25	1.34	2.19	2.54	3.64	4.67
T 21	H 30	1.47	1.35	2.65	3.25	3.70	4.16
T 22	H 14	1.49	1.36	2.23	2.40	2.92	3.48
T 23	H 7	1.41	1.26	2.41	2.90	3.80	4.09
T 24	H 35	1.62	1.41	2.36	2.85	3.30	4.42
T 25	H 19	1.13	1.00	2.36	3.46	3.20	5.26
T 26	Mauritius	1.53	1.33	2.02	2.24	2.81	4.09
T 27	Kew	1.26	1.03	1.94	2.19	2.91	3.38
T 28	Amritha	1.01	0.82	1.46	1.71	2.30	3.01
Months after planting (MAP)							

Appendix-XXVI

Table 4.2.1.1.7. Number of suckers per plant of Mauritius x Kew hybrids

Treatments		Number of suckers per plant		
		13 MAP	14 MAP	15 MAP
T 01	**H 17**	1.07	1.80	2.34
T 02	**H 16**	0.90	1.54	2.07
T 03	**H 85**	0.27	0.54	0.80
T 04	**H 91**	0.27	1.17	1.54
T 05	**H 48**	0.80	1.34	1.34
T 06	**H 62**	0.80	1.34	1.60
T 07	**H 43**	1.17	2.07	2.60
T 08	**H 66**	0.29	0.88	1.34
T 09	**H 77**	1.17	2.07	2.87
T 10	**H 92**	0.80	1.07	1.60
T 11	**H 63**	0.54	0.80	1.07
T 12	**H 27**	0.80	1.54	1.80
T 13	**H 78**	0.00	0.27	0.54
T 14	**H 70**	0.54	1.07	1.17
T 15	**H 59**	0.90	1.80	2.70
T 16	**H 60**	0.80	1.44	1.80
T 17	**H 49**	1.07	1.70	2.07
T 18	**H 54**	0.64	1.54	1.80
T 19	**H 10**	1.07	1.44	1.97
T 20	**H 15**	0.27	0.80	1.07
T 21	**H 30**	0.27	1.07	1.54
T 22	**H 14**	0.27	1.07	1.34
T 23	**H 7**	0.27	0.54	0.80
T 24	**H 35**	0.74	1.64	2.27
T 25	**H 19**	0.80	1.70	2.44
T 26	**Mauritius**	1.07	1.80	2.70
T 27	**Kew**	0.27	0.80	1.00
T 28	**Amritha**	0.90	1.44	1.80

Months after planting (MAP)

Appendix-XXVII

Table 4.2.1.1.8. Spine length (mm) of Mauritius x Kew hybrids

Treatments		Spine length (mm)					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	0.20	0.25	0.23	0.21	0.23	0.25
T 02	**H 16**	0.20	0.20	0.25	0.21	0.20	0.23
T 03	**H 85**	0.20	0.25	0.23	0.21	0.20	0.33
T 04	**H 91**	0.25	0.20	0.28	0.25	0.20	0.25
T 05	**H 48**	0.21	0.25	0.20	0.28	0.25	0.22
T 06	**H 62**	0.25	0.20	0.21	0.25	0.20	0.27
T 07	**H 43**	0.21	0.20	0.25	0.21	0.20	0.21
T 08	**H 66**	0.20	0.25	0.20	0.27	0.23	0.28
T 09	**H 77**	0.27	0.20	0.25	0.14	0.20	0.21
T 10	**H 92**	0.24	0.30	0.30	0.21	0.20	0.22
T 11	**H 63**	0.21	0.20	0.25	0.21	0.20	0.25
T 12	**H 27**	0.28	0.25	0.25	0.23	0.30	0.25
T 13	**H 78**	0.20	0.20	0.20	0.21	0.20	0.20
T 14	**H 70**	0.21	0.25	0.20	0.21	0.20	0.20
T 15	**H 59**	0.30	0.30	0.15	0.25	0.20	0.27
T 16	**H 60**	0.20	0.25	0.21	0.20	0.25	0.22
T 17	**H 49**	0.25	0.25	0.22	0.25	0.25	0.19
T 18	**H 54**	0.20	0.20	0.26	0.20	0.20	0.22
T 19	**H 10**	0.25	0.20	0.27	0.25	0.20	0.23
T 20	**H 15**	0.25	0.25	0.22	0.25	0.25	0.21
T 21	**H 30**	0.15	0.20	0.19	0.15	0.20	0.22
T 22	**H 14**	0.25	0.25	0.22	0.25	0.25	0.21
T 23	**H 7**	0.28	0.28	0.23	0.28	0.28	0.27
T 24	**H 35**	0.20	0.25	0.21	0.20	0.25	0.24
T 25	**H 19**	0.25	0.25	0.28	0.25	0.25	0.21
T 26	**Mauritius**	0.20	0.25	0.21	0.20	0.25	0.28
T 27	**Kew**	0.15	0.20	0.19	0.15	0.20	0.17
T 28	**Amritha**	0.23	0.25	0.28	0.23	0.25	0.22
Months after planting (MAP)							

Appendix-XXVIII

Table 4.2.1.1.9. Position of suckers of Mauritius x Kew hybrids

Treatments		Position of suckers					
		13 MAP		14 MAP		15 MAP	
		Root	Stem	Root	Stem	Root	Stem
T 01	**H 17**	25.00	75.00	14.59	85.42	33.75	66.25
T 02	**H 16**	58.34	41.67	51.43	48.57	50.79	49.21
T 03	**H 85**	0.00	100.00	0.00	100.00	0.00	100.00
T 04	**H 91**	100.00	0.00	67.50	32.50	68.57	31.43
T 05	**H 48**	33.33	66.67	20.00	80.00	20.00	80.00
T 06	**H 62**	33.33	66.67	20.00	80.00	16.67	83.33
T 07	**H 43**	22.50	77.50	38.10	61.91	50.51	49.50
T 08	**H 66**	0.00	100.00	33.33	66.67	60.00	40.00
T 09	**H 77**	22.50	77.50	25.40	74.61	18.34	81.67
T 10	**H 92**	66.67	33.33	50.00	50.00	50.00	50.00
T 11	**H 63**	0.00	100.00	33.33	66.67	50.00	50.00
T 12	**H 27**	33.33	66.67	58.57	41.43	64.59	35.42
T 13	**H 78**	0.00	0.00	100.00	0.00	75.00	25.00
T 14	**H 70**	0.00	100.00	25.00	75.00	22.50	77.50
T 15	**H 59**	29.17	70.84	29.17	70.84	38.89	61.12
T 16	**H 60**	66.67	33.33	36.67	63.34	29.17	70.84
T 17	**H 49**	50.00	50.00	30.95	69.05	38.10	61.91
T 18	**H 54**	41.67	58.34	34.29	65.72	29.17	70.84
T 19	**H 10**	0.00	100.00	0.00	100.00	0.00	100.00
T 20	**H 15**	0.00	100.00	0.00	100.00	0.00	100.00
T 21	**H 30**	0.00	100.00	0.00	100.00	0.00	100.00
T 22	**H 14**	0.00	100.00	0.00	100.00	0.00	100.00
T 23	**H 7**	0.00	100.00	0.00	100.00	0.00	100.00
T 24	**H 35**	75.00	25.00	64.59	35.42	72.08	27.92
T 25	**H 19**	33.33	66.67	46.43	53.57	53.98	46.03
T 26	**Mauritius**	25.00	75.00	29.17	70.84	29.17	70.84
T 27	**Kew**	0.00	100.00	33.33	66.67	26.67	73.34
T 28	**Amritha**	29.17	70.84	36.67	63.34	29.17	70.84
Months after planting (MAP)							

Appendix-XXIX

Table 4.2.1.1.10. Distribution of spines of Mauritius x Kew hybrids

Treatments		Distribution of spines					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	3.00	3.00	3.00	3.00	3.00	3.00
T 02	**H 16**	3.88	3.88	3.88	3.88	3.88	3.88
T 03	**H 85**	3.00	3.00	3.00	3.00	3.00	3.00
T 04	**H 91**	3.00	3.00	3.00	3.00	3.00	3.00
T 05	**H 48**	3.27	3.27	3.27	3.27	3.27	3.27
T 06	**H 62**	3.27	3.27	3.27	3.27	3.27	3.27
T 07	**H 43**	3.00	3.00	3.00	3.00	3.00	3.00
T 08	**H 66**	2.74	2.74	2.74	2.74	2.74	2.74
T 09	**H 77**	3.27	3.27	3.27	3.27	3.27	3.27
T 10	**H 92**	3.90	3.90	3.90	3.90	3.90	3.90
T 11	**H 63**	3.07	3.07	3.07	3.07	3.07	3.07
T 12	**H 27**	2.80	2.80	2.80	2.80	2.80	2.80
T 13	**H 78**	3.00	3.00	3.00	3.00	3.00	3.00
T 14	**H 70**	3.90	3.90	3.90	3.90	3.90	3.90
T 15	**H 59**	3.00	3.00	3.00	3.00	3.00	3.00
T 16	**H 60**	3.00	3.00	3.00	3.00	3.00	3.00
T 17	**H 49**	3.54	3.54	3.54	3.54	3.54	3.54
T 18	**H 54**	3.64	3.64	3.64	3.64	3.64	3.64
T 19	**H 10**	3.07	3.07	3.07	3.07	3.07	3.07
T 20	**H 15**	3.00	3.00	3.00	3.00	3.00	3.00
T 21	**H 30**	3.00	3.00	3.00	3.00	3.00	3.00
T 22	**H 14**	3.00	3.00	3.00	3.00	3.00	3.00
T 23	**H 7**	3.00	3.00	3.00	3.00	3.00	3.00
T 24	**H 35**	3.27	3.27	3.27	3.27	3.27	3.27
T 25	**H 19**	3.54	3.54	3.54	3.54	3.54	3.54
T 26	**Mauritius**	3.00	3.00	3.00	3.00	3.00	3.00
T 27	**Kew**	1.64	1.64	1.64	1.64	1.64	1.64
T 28	**Amritha**	3.00	3.00	3.00	3.00	3.00	3.00
Months after planting (MAP)							

Appendix-XXX

Table 4.2.1.1.11. Direction of spines of Mauritius x Kew hybrids

Treatments		Direction of spines					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	1.00	1.00	1.00	1.00	1.00	1.00
T 02	**H 16**	1.00	1.00	1.00	1.00	1.00	1.00
T 03	**H 85**	1.00	1.00	1.00	1.00	1.00	1.00
T 04	**H 91**	1.00	1.00	1.00	1.00	1.00	1.00
T 05	**H 48**	1.00	1.00	1.00	1.00	1.00	1.00
T 06	**H 62**	1.00	1.00	1.00	1.00	1.00	1.00
T 07	**H 43**	1.00	1.00	1.00	1.00	1.00	1.00
T 08	**H 66**	1.00	1.00	1.00	1.00	1.00	1.00
T 09	**H 77**	1.00	1.00	1.00	1.00	1.00	1.00
T 10	**H 92**	1.00	1.00	1.00	1.00	1.00	1.00
T 11	**H 63**	1.00	1.00	1.00	1.00	1.00	1.00
T 12	**H 27**	1.00	1.00	1.00	1.00	1.00	1.00
T 13	**H 78**	1.00	1.00	1.00	1.00	1.00	1.00
T 14	**H 70**	1.00	1.00	1.00	1.00	1.00	1.00
T 15	**H 59**	1.00	1.00	1.00	1.00	1.00	1.00
T 16	**H 60**	1.00	1.00	1.00	1.00	1.00	1.00
T 17	**H 49**	1.00	1.00	1.00	1.00	1.00	1.00
T 18	**H 54**	1.00	1.00	1.00	1.00	1.00	1.00
T 19	**H 10**	1.00	1.00	1.00	1.00	1.00	1.00
T 20	**H 15**	1.00	1.00	1.00	1.00	1.00	1.00
T 21	**H 30**	1.00	1.00	1.00	1.00	1.00	1.00
T 22	**H 14**	1.00	1.00	1.00	1.00	1.00	1.00
T 23	**H 7**	1.00	1.00	1.00	1.00	1.00	1.00
T 24	**H 35**	1.00	1.00	1.00	1.00	1.00	1.00
T 25	**H 19**	1.00	1.00	1.00	1.00	1.00	1.00
T 26	**Mauritius**	1.00	1.00	1.00	1.00	1.00	1.00
T 27	**Kew**	1.00	1.00	1.00	1.00	1.00	1.00
T 28	**Amritha**	1.00	1.00	1.00	1.00	1.00	1.00
Months after planting (MAP)							

Appendix-XXXI

Table 4.2.1.1.12. Colouration of leaf spines of Mauritius x Kew hybrids

Treatments		Colouration of leaf spines					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	2.80	2.80	2.80	2.80	2.80	2.80
T 02	**H 16**	3.27	3.27	3.27	3.27	3.27	3.27
T 03	**H 85**	2.80	2.80	2.80	2.80	2.80	2.80
T 04	**H 91**	4.00	4.00	4.00	4.00	4.00	4.00
T 05	**H 48**	2.80	2.80	2.80	2.80	2.80	2.80
T 06	**H 62**	3.70	3.70	3.70	3.70	3.70	3.70
T 07	**H 43**	2.27	2.27	2.27	2.27	2.27	2.27
T 08	**H 66**	1.64	1.64	1.64	1.64	1.64	1.64
T 09	**H 77**	4.00	4.00	4.00	4.00	4.00	4.00
T 10	**H 92**	3.27	3.27	3.27	3.27	3.27	3.27
T 11	**H 63**	3.63	3.63	3.63	3.63	3.63	3.63
T 12	**H 27**	3.80	3.80	3.80	3.80	3.80	3.80
T 13	**H 78**	4.00	4.00	4.00	4.00	4.00	4.00
T 14	**H 70**	4.00	4.00	4.00	4.00	4.00	4.00
T 15	**H 59**	2.80	2.80	2.80	2.80	2.80	2.80
T 16	**H 60**	2.54	2.54	2.54	2.54	2.54	2.54
T 17	**H 49**	3.40	3.40	3.40	3.40	3.40	3.40
T 18	**H 54**	4.00	4.00	4.00	4.00	4.00	4.00
T 19	**H 10**	2.27	2.27	2.27	2.27	2.27	2.27
T 20	**H 15**	4.00	4.00	4.00	4.00	4.00	4.00
T 21	**H 30**	2.97	2.97	2.97	2.97	2.97	2.97
T 22	**H 14**	3.60	3.60	3.60	3.60	3.60	3.60
T 23	**H 7**	2.80	2.80	2.80	2.80	2.80	2.80
T 24	**H 35**	4.00	4.00	4.00	4.00	4.00	4.00
T 25	**H 19**	2.67	2.67	2.67	2.67	2.67	2.67
T 26	**Mauritius**	4.00	4.00	4.00	4.00	4.00	4.00
T 27	**Kew**	3.80	3.80	3.80	3.80	3.80	3.80
T 28	**Amritha**	4.00	4.00	4.00	4.00	4.00	4.00
Months after planting (MAP)							

Appendix-XXXII

Table 4.2.1.1.13. Spine stiffness of Mauritius x Kew hybrids

Treatments		Spine stiffness					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 17**	5.00	5.00	5.00	5.00	5.00	5.00
T 02	**H 16**	5.00	5.00	5.00	5.00	5.00	5.00
T 03	**H 85**	5.00	5.00	5.00	5.00	5.00	5.00
T 04	**H 91**	5.00	5.00	5.00	5.00	5.00	5.00
T 05	**H 48**	5.00	5.00	5.00	5.00	5.00	5.00
T 06	**H 62**	5.00	5.00	5.00	5.00	5.00	5.00
T 07	**H 43**	5.00	5.00	5.00	5.00	5.00	5.00
T 08	**H 66**	5.00	5.00	5.00	5.00	5.00	5.00
T 09	**H 77**	5.00	5.00	5.00	5.00	5.00	5.00
T 10	**H 92**	5.00	5.00	5.00	5.00	5.00	5.00
T 11	**H 63**	5.00	5.00	5.00	5.00	5.00	5.00
T 12	**H 27**	5.00	5.00	5.00	5.00	5.00	5.00
T 13	**H 78**	5.00	5.00	5.00	5.00	5.00	5.00
T 14	**H 70**	5.00	5.00	5.00	5.00	5.00	5.00
T 15	**H 59**	5.00	5.00	5.00	5.00	5.00	5.00
T 16	**H 60**	5.00	5.00	5.00	5.00	5.00	5.00
T 17	**H 49**	5.00	5.00	5.00	5.00	5.00	5.00
T 18	**H 54**	5.00	5.00	5.00	5.00	5.00	5.00
T 19	**H 10**	5.00	5.00	5.00	5.00	5.00	5.00
T 20	**H 15**	5.00	5.00	5.00	5.00	5.00	5.00
T 21	**H 30**	5.00	5.00	5.00	5.00	5.00	5.00
T 22	**H 14**	5.00	5.00	5.00	5.00	5.00	5.00
T 23	**H 7**	5.00	5.00	5.00	5.00	5.00	5.00
T 24	**H 35**	5.00	5.00	5.00	5.00	5.00	5.00
T 25	**H 19**	5.00	5.00	5.00	5.00	5.00	5.00
T 26	**Mauritius**	5.00	5.00	5.00	5.00	5.00	5.00
T 27	**Kew**	5.00	5.00	5.00	5.00	5.00	5.00
T 28	**Amritha**	5.00	5.00	5.00	5.00	5.00	5.00
Months after planting (MAP)							

Appendix-XXXIII

Table 4.2.1.5. Organoleptic evaluation of Mauritius x Kew hybrids

Treatments		Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank
T 1	H 17	85.00	94.00	83.00	92.00	88.00
T 2	H 16	83.00	84.00	90.00	79.00	84.00
T 3	H 85	81.00	83.00	80.00	93.00	84.00
T 4	H 91	74.00	89.00	86.00	88.00	84.00
T 5	H 48	89.00	77.00	83.00	79.00	82.00
T 6	H 62	79.00	86.00	89.00	61.00	78.00
T 7	H 43	80.00	92.00	79.00	91.00	85.00
T 8	H 66	92.00	89.00	91.00	75.00	86.00
T 9	H 77	77.00	83.00	80.00	88.00	82.00
T 10	H 92	74.00	78.00	88.00	83.00	80.00
T 11	H 63	68.00	84.00	82.00	90.00	81.00
T 12	H 27	73.00	87.00	80.00	87.00	81.00
T 13	H 78	85.00	75.00	89.00	78.00	81.00
T 14	H 70	90.00	86.00	93.00	78.00	86.00
T 15	H 59	87.00	89.00	85.00	79.00	85.00
T 16	H 60	91.00	78.00	82.00	72.00	80.00
T 17	H 49	83.00	79.00	90.00	78.00	82.00
T 18	H 54	75.00	87.00	89.00	65.00	79.00
T 19	H 10	78.00	83.00	86.00	77.00	81.00
T 20	H 15	79.00	73.00	80.00	76.00	77.00
T 21	H 30	86.00	75.00	83.00	78.00	80.00
T 22	H 14	76.00	80.00	87.00	81.00	81.00
T 23	H 7	81.00	81.00	78.00	84.00	81.00
T 24	H 35	88.00	89.00	91.00	79.00	86.00
T 25	H 19	76.00	80.00	77.00	80.00	78.00
T 26	Mauritius	87.00	83.00	86.00	74.00	82.00
T 27	Kew	75.00	73.00	85.00	75.00	77.00
T 28	Amritha	85.00	81.00	89.00	85.00	85.00
Kendall's Coefficient		**0.006**	**0.005**	**0.003**	**0.008**	**0.001**

Appendix-XXXIV

Table 4.2. Range of quantitative characters of Mauritius x Kew hybrids

Characters	Minimum	Maximum
Plant height (cm)	89.46 (T 14)	109.02 (T 27)
Number of leaves	38.47 (T 12)	42.24 (T 8)
Length D leaf (cm)	51.80 (T 19)	61.94 (T 26)
Breadth D leaf (cm)	2.18 (T 4)	4.46 (T 17)
D leaf area (cm^2)	84.45 (T 4)	182.69 (T 17)
Leaf area index	2.54 (T 4)	5.26 (T 25)
Days to attain ideal leaf stage for flowering	175.10 (T 27)	196.30 (T 26)
Days for initiation of flowering (Visual)	39.74 (T 27)	52.97 (T 9)
Days for 50 per cent flowering	45.50 (T 27)	58.42 (T 9)
Flowering phase (days)	19.92 (T 2)	26.14 (T 26)
Days for fruit maturity	138.00 (T 27)	157.20 (T 17)
Crop duration (days)	352.84 (T 27)	388.28 (T 6)
Length of the fruit (cm)	9.15 (T 9)	19.55 (T 6)
Girth of the fruit (cm)	26.25 (T 16)	57.40 (T 14)
Breadth of the fruit (cm)	5.98 (T 21)	12.15 (T 7)
Taper ratio of the fruit	0.75 (T 11)	0.93 (T 14)
Fruit weight with crown (kg)	0.57 (T 21)	2.15 (T 24)
Crown weight (kg)	0.10 (T 26)	0.51 (T 18)
Shelf life (days)	6.75 (T 19)	9.00 (T 15)
Peel weight (kg)	0.08 (T 9)	0.24 (T 15)
Pulp weight (kg)	0.23 (T 16)	1.59 (T 1)
Pulp percentage (%)	60.53 (T 9)	89.56 (T 1)
Juice (%)	77.61 (T 1)	95.16 (T 3)
TSS (°Brix)	12.16 (T 11)	16.82 (T 28)
Acidity (%)	0.81 (T 7)	1.05 (T 15)
Total sugars (%)	5.40 (T 6)	12.91 (T 99)
Reducing sugars (%)	1.92 (T 24)	4.12 (T 3)
Non reducing sugars (%)	0.97 (T 1)	10.87 (T 24)
Sugar/acid ratio	2.46 (T 1)	22.00 (T 7)
Fibre (%)	26.75 (T 2)	35.22 (T 5)
Total carotenoids (mg 100 g-1)	208.21 (T 23)	325.34 (T 14)
Ascorbic acid (mg 100 g-1)	22.05 (T 3)	104.11 (T 15)

Appendix-XXXV

Table 4.3.1.1.1. Plant height of Kew x Mauritius hybrids

Treatments		Plant height (cm)					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	60.58	65.24	71.73	76.91	83.36	87.42
T 02	**H 118**	64.67	70.27	76.96	83.27	94.09	107.12
T 03	**H 115**	62.49	67.69	73.64	80.13	86.02	91.59
T 04	**H 101**	62.49	67.58	74.07	80.71	88.16	92.85
T 05	**H 99**	60.64	65.82	71.13	77.27	82.98	88.53
T 06	**H 104**	63.27	67.73	73.71	78.60	84.60	89.60
T 07	**H 110**	59.78	64.93	72.42	77.84	84.98	89.73
T 08	**H 116**	60.91	64.60	71.60	76.60	84.84	88.98
T 09	**H 121**	63.38	68.73	74.58	80.07	89.07	96.46
T 10	**H 111**	60.22	64.29	71.24	75.69	84.02	88.42
T 11	**Mauritius**	62.58	67.35	73.89	78.35	84.96	89.71
T 12	**Kew**	62.49	67.58	74.07	80.71	88.16	93.18
T 13	**Amritha**	60.38	64.71	70.80	76.82	83.42	88.31
Months after planting (MAP)							

Table 4.3.1.1.2. Number of leaves per plant of Kew x Mauritius hybrids

Treatments		Number of leaves per plant					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	28.33	30.57	32.47	35.37	36.83	41.42
T 02	**H 118**	27.67	30.87	31.97	36.07	36.67	39.73
T 03	**H 115**	28.67	30.57	32.04	34.54	36.00	39.40
T 04	**H 101**	27.33	30.94	31.40	34.27	34.83	39.82
T 05	**H 99**	26.34	29.44	30.70	34.87	35.17	41.49
T 06	**H 104**	27.50	31.27	32.44	35.57	37.17	40.62
T 07	**H 110**	27.17	30.04	31.87	34.24	34.67	38.60
T 08	**H 116**	26.67	29.04	31.44	33.44	34.00	38.98
T 09	**H 121**	26.17	29.77	30.57	34.37	35.34	40.02
T 10	**H 111**	27.10	29.27	30.80	33.40	35.00	40.53
T 11	**Mauritius**	26.40	29.20	30.90	34.80	35.83	38.82
T 12	**Kew**	27.54	29.30	32.20	34.20	35.50	38.75
T 13	**Amritha**	26.07	29.40	30.80	34.44	35.00	39.47
Months after planting (MAP)							

Appendix-XXXVI

Table 4.3.1.1.3. Length of 'D' leaf of Kew x Mauritius hybrids

Treatments		Length of 'D' leaf					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	39.90	42.70	45.97	49.04	51.94	54.04
T 02	**H 118**	43.14	45.40	48.20	50.30	52.57	55.30
T 03	**H 115**	44.77	46.97	49.87	52.60	54.70	57.44
T 04	**H 101**	41.30	44.10	46.47	48.74	51.27	53.47
T 05	**H 99**	44.80	47.44	49.90	52.10	55.10	58.20
T 06	**H 104**	47.30	49.94	52.94	55.94	59.10	61.30
T 07	**H 110**	42.97	45.70	48.60	51.24	54.24	56.60
T 08	**H 116**	38.07	40.44	43.27	45.90	48.90	51.90
T 09	**H 121**	42.20	44.77	47.14	49.77	52.40	55.07
T 10	**H 111**	43.10	45.74	48.64	51.10	53.74	56.47
T 11	**Mauritius**	42.74	45.90	48.54	51.44	54.24	56.77
T 12	**Kew**	44.04	46.40	49.30	51.40	54.47	56.77
T 13	**Amritha**	42.14	44.60	46.87	49.24	51.80	54.07
Months after planting (MAP)							

Table 4.3.1.1.4. Breadth of 'D' leaf of Kew x Mauritius hybrids

Treatments		Breadth of 'D' leaf					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	2.45	2.00	2.35	2.27	2.90	3.38
T 02	**H 118**	2.27	2.09	2.80	3.02	3.89	4.46
T 03	**H 115**	2.09	1.90	2.72	2.72	3.35	3.67
T 04	**H 101**	2.34	1.74	2.74	2.69	3.49	3.81
T 05	**H 99**	2.44	2.17	2.45	2.42	3.20	3.29
T 06	**H 104**	1.92	1.34	2.05	2.05	2.37	2.64
T 07	**H 110**	2.05	1.90	2.64	2.90	3.09	3.54
T 08	**H 116**	2.35	2.97	2.45	2.95	2.85	2.54
T 09	**H 121**	2.54	3.10	3.14	3.67	3.94	3.99
T 10	**H 111**	1.92	1.24	2.42	2.37	3.10	3.46
T 11	**Mauritius**	2.40	2.19	2.80	2.62	3.25	3.64
T 12	**Kew**	2.35	1.59	2.64	2.32	2.95	3.54
T 13	**Amritha**	2.45	1.92	3.27	3.55	3.60	3.54
Months after planting (MAP)							

Appendix-XXXVII

Table 4.3.1.1.5. 'D' leaf area of Kew x Mauritius hybrids

Treatments		'D' leaf area					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	74.85	64.67	79.85	81.04	108.91	132.50
T 02	**H 118**	77.84	75.67	107.47	122.48	166.68	198.21
T 03	**H 115**	67.84	64.7	98.34	103.73	132.85	152.83
T 04	**H 101**	75.15	58.53	96.88	100.05	136.89	160.40
T 05	**H 99**	78.49	73.27	87.28	91.01	127.07	136.53
T 06	**H 104**	52.26	39.29	64.01	68.07	83.40	99.15
T 07	**H 110**	64.06	63.01	93.10	107.44	120.39	144.93
T 08	**H 116**	71.68	96.25	83.91	106.87	108.68	102.57
T 09	**H 121**	81.47	105.34	111.87	138.01	154.45	164.60
T 10	**H 111**	52.99	36.36	75.92	78.87	109.90	130.19
T 11	**Mauritius**	76.63	73.67	100.08	97.63	128.34	149.82
T 12	**Kew**	74.79	53.83	94.93	87.87	117.35	149.04
T 13	**Amritha**	78.81	64.83	116.50	133.50	142.95	141.77
Months after planting (MAP)							

Table 4.3.1.1.6. Leaf Area Index (LAI) of Kew x Mauritius hybrids

Treatments		Leaf Area Index (LAI)					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	1.57	1.46	1.92	2.12	2.97	3.98
T 02	**H 118**	1.60	1.73	2.54	3.27	4.53	5.90
T 03	**H 115**	1.44	1.46	2.33	2.65	3.54	4.44
T 04	**H 101**	1.52	1.34	2.25	2.54	3.53	4.97
T 05	**H 99**	1.53	1.60	1.98	2.35	3.31	4.13
T 06	**H 104**	1.06	0.91	1.54	1.79	2.30	3.03
T 07	**H 110**	1.29	1.40	2.20	2.72	3.09	4.06
T 08	**H 116**	1.42	2.07	1.95	2.65	2.74	2.93
T 09	**H 121**	1.58	2.32	2.53	3.51	4.04	4.80
T 10	**H 111**	1.06	0.79	1.73	1.95	2.85	3.82
T 11	**Mauritius**	1.50	1.59	2.29	2.52	3.41	4.31
T 12	**Kew**	1.53	1.17	2.26	2.23	3.09	4.26
T 13	**Amritha**	1.52	1.41	2.66	3.41	3.71	4.24
Months after planting (MAP)							

Appendix-XXXVIII

Table 4.3.1.1.7. Number of suckers per plant of Kew x Mauritius hybrids

Treatments		Number of suckers per plant		
		13 MAP	14 MAP	15 MAP
T 01	**H 98**	0.37	1.27	1.27
T 02	**H 118**	0.80	1.07	1.07
T 03	**H 115**	0.80	1.00	1.27
T 04	**H 101**	0.54	1.44	1.54
T 05	**H 99**	0.80	1.07	1.34
T 06	**H 104**	0.54	0.80	1.07
T 07	**H 110**	0.80	1.34	1.60
T 08	**H 116**	0.90	1.64	2.00
T 09	**H 121**	0.54	0.80	1.07
T 10	**H 111**	0.54	1.34	1.34
T 11	**Mauritius**	0.64	1.37	1.64
T 12	**Kew**	0.00	0.27	0.54
T 13	**Amritha**	0.54	0.80	1.07

Months after planting (MAP)

Table 4.3.1.1.8. Spine length (mm) of Kew x Mauritius hybrids

Treatments		Spine length (mm)					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	**H 98**	0.20	0.25	0.23	0.21	0.20	0.33
T 02	**H 118**	0.25	0.20	0.28	0.25	0.20	0.25
T 03	**H 115**	0.20	0.25	0.20	0.27	0.23	0.28
T 04	**H 101**	0.24	0.30	0.30	0.21	0.20	0.22
T 05	**H 99**	0.21	0.20	0.25	0.21	0.20	0.25
T 06	**H 104**	0.28	0.25	0.25	0.23	0.30	0.25
T 07	**H 110**	0.20	0.20	0.20	0.21	0.20	0.20
T 08	**H 116**	0.27	0.20	0.25	0.14	0.20	0.21
T 09	**H 121**	0.24	0.30	0.30	0.21	0.20	0.22
T 10	**H 111**	0.21	0.20	0.25	0.21	0.20	0.25
T 11	**Mauritius**	0.22	0.25	0.25	0.25	0.26	0.29
T 12	**Kew**	0.15	0.17	0.19	0.16	0.17	0.17
T 13	**Amritha**	0.23	0.23	0.28	0.24	0.27	0.23
Months after planting (MAP)							

Appendix-XXXIX

Table 4.3.1.1.9. Position of suckers of Kew x Mauritius hybrids

Treatments		Position of suckers					
		13 MAP		14 MAP		15 MAP	
		Root	Stem	Root	Stem	Root	Stem
T 01	H 98	0.00	100.00	20.83	79.17	20.83	79.17
T 02	H 118	0.00	100.00	0.00	100.00	0.00	100.00
T 03	H 115	0.00	100.00	26.67	73.33	41.67	58.33
T 04	H 101	50.00	50.00	18.33	81.67	24.29	75.71
T 05	H 99	66.66	33.33	75.00	25.00	60.00	40.00
T 06	H 104	66.67	33.33	100.00	0.00	100.00	0.00
T 07	H 110	0.00	100.00	10.00	90.00	29.17	70.83
T 08	H 116	12.50	87.50	18.75	81.25	25.00	75.00
T 09	H 121	0.00	100.00	0.00	100.00	33.33	66.67
T 10	H 111	50.00	50.00	60.00	40.00	60.00	40.00
T 11	Mauritius	37.50	62.50	19.64	80.36	32.50	67.50
T 12	Kew	0.00	0.00	0.00	100.00	0.00	100.00
T 13	Amritha	0.00	100.00	66.67	33.33	25.00	75.00
Months after planting (MAP)							

Table 4.3.1.1.10. Distribution of spines of Kew x Mauritius hybrids

Treatments		Distribution of spines					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 98	3.00	3.00	3.00	3.00	3.00	3.00
T 02	H 118	3.27	3.27	3.27	3.27	3.27	3.27
T 03	H 115	3.27	3.27	3.27	3.27	3.27	3.27
T 04	H 101	3.20	3.20	3.20	3.20	3.20	3.20
T 05	H 99	2.84	2.84	2.84	2.84	2.84	2.84
T 06	H 104	3.27	3.27	3.27	3.27	3.27	3.27
T 07	H 110	3.74	3.74	3.74	3.74	3.74	3.74
T 08	H 116	2.74	2.74	2.74	2.74	2.74	2.74
T 09	H 121	3.00	3.00	3.00	3.00	3.00	3.00
T 10	H 111	2.47	2.47	2.47	2.47	2.47	2.47
T 11	Mauritius	3.00	3.00	3.00	3.00	3.00	3.00
T 12	Kew	1.80	1.80	1.80	1.80	1.80	1.80
T 13	Amritha	3.00	3.00	3.00	3.00	3.00	3.00
Months after planting (MAP)							

Appendix-XXXX

Table 4.3.1.1.11. Direction of spines of Kew x Mauritius hybrids

Treatments		Direction of spines					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 98	1.00	1.00	1.00	1.00	1.00	1.00
T 02	H 118	1.00	1.00	1.00	1.00	1.00	1.00
T 03	H 115	1.00	1.00	1.00	1.00	1.00	1.00
T 04	H 101	1.00	1.00	1.00	1.00	1.00	1.00
T 05	H 99	1.00	1.00	1.00	1.00	1.00	1.00
T 06	H 104	1.00	1.00	1.00	1.00	1.00	1.00
T 07	H 110	1.00	1.00	1.00	1.00	1.00	1.00
T 08	H 116	1.00	1.00	1.00	1.00	1.00	1.00
T 09	H 121	1.00	1.00	1.00	1.00	1.00	1.00
T 10	H 111	1.00	1.00	1.00	1.00	1.00	1.00
T 11	Mauritius	1.00	1.00	1.00	1.00	1.00	1.00
T 12	Kew	1.00	1.00	1.00	1.00	1.00	1.00
T 13	Amritha	1.00	1.00	1.00	1.00	1.00	1.00
Months after planting (MAP)							

Table 4.3.1.1.12. Colouration of leaf spines of Kew x Mauritius hybrids

Treatments		Colouration of leaf spines					
		1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
T 01	H 98	2.00	2.00	2.00	2.00	2.00	2.00
T 02	H 118	3.80	3.80	3.80	3.80	3.80	3.80
T 03	H 115	3.80	3.80	3.80	3.80	3.80	3.80
T 04	H 101	1.73	1.73	1.73	1.73	1.73	1.73
T 05	H 99	3.47	3.47	3.47	3.47	3.47	3.47
T 06	H 104	3.80	3.80	3.80	3.80	3.80	3.80
T 07	H 110	3.80	3.80	3.80	3.80	3.80	3.80
T 08	H 116	3.70	3.70	3.70	3.70	3.70	3.70
T 09	H 121	3.80	3.80	3.80	3.80	3.80	3.80
T 10	H 111	3.47	3.47	3.47	3.47	3.47	3.47
T 11	Mauritius	4.00	4.00	4.00	4.00	4.00	4.00
T 12	Kew	3.80	3.80	3.80	3.80	3.80	3.80
T 13	Amritha	4.00	4.00	4.00	4.00	4.00	4.00
Months after planting (MAP)							

Appendix-XXXXI

Table 4.3.1.1.13. Spine stiffness of Kew x Mauritius hybrids

Treatments		Spine stiffness					
		1 MAP	**2 MAP**	**3 MAP**	**4 MAP**	**5 MAP**	**6 MAP**
T 01	**H 98**	5.00	5.00	5.00	5.00	5.00	5.00
T 02	**H 118**	5.00	5.00	5.00	5.00	5.00	5.00
T 03	**H 115**	5.00	5.00	5.00	5.00	5.00	5.00
T 04	**H 101**	5.00	5.00	5.00	5.00	5.00	5.00
T 05	**H 99**	5.00	5.00	5.00	5.00	5.00	5.00
T 06	**H 104**	5.00	5.00	5.00	5.00	5.00	5.00
T 07	**H 110**	5.00	5.00	5.00	5.00	5.00	5.00
T 08	**H 116**	5.00	5.00	5.00	5.00	5.00	5.00
T 09	**H 121**	5.00	5.00	5.00	5.00	5.00	5.00
T 10	**H 111**	5.00	5.00	5.00	5.00	5.00	5.00
T 11	**Mauritius**	5.00	5.00	5.00	5.00	5.00	5.00
T 12	**Kew**	5.00	5.00	5.00	5.00	5.00	5.00
T 13	**Amritha**	5.00	5.00	5.00	5.00	5.00	5.00
Months after planting (MAP)							

Appendix-XXXXII

Table 4.3.1.5. Organoleptic evaluation of Kew x Mauritius hybrids

Treatments		Colour Mean Rank	Taste Mean Rank	Flavour Mean Rank	Texture Mean Rank	Overall acceptability Mean Rank
T 1	H 98	82.00	81.00	83.00	80.00	81.00
T 2	H 118	89.00	94.00	84.00	81.00	87.00
T 3	H 115	91.00	89.00	86.00	83.00	87.00
T 4	H 101	86.00	88.00	81.00	79.00	83.00
T 5	H 99	83.00	82.00	87.00	77.00	82.00
T 6	H 104	90.00	81.00	84.00	85.00	85.00
T 7	H 110	87.00	83.00	78.00	86.00	83.00
T 8	H 116	79.00	89.00	86.00	79.00	83.00
T 9	H 121	87.00	90.00	82.00	88.00	86.00
T 10	H 111	78.00	85.00	83.00	85.00	82.00
T 11	Mauritius	86.00	82.00	85.00	90.00	85.00
T 12	Kew	76.00	80.00	89.00	87.00	83.00
T 13	Amritha	90.00	89.00	84.00	88.00	87.00
Kendall's Coefficient		**0.016**	**0.013**	**0.005**	**0.011**	**0.003**

Appendix-XXXXIII

Table 4.3. Range of quantitative characters of Kew x Mauritius hybrids

Characters	Minimum	Maximum
Plant height (cm)	87.42 (T 1)	107.12 (T 2)
Number of leaves	38.60 (T 7)	41.49 (T 5)
Length D leaf (cm)	51.90 (T 8)	61.30 (T 6)
Breadth D leaf (cm)	2.54 (T 8)	4.46 (T 2)
D leaf area (cm^2)	99.15 (T 6)	198.21 (T 2)
Leaf area index	2.93 (T 8)	5.90 (T 2)
Days to attain ideal leaf stage for flowering	178.13 (T 11)	190.61 (T 12)
Days for initiation of flowering (Visual)	43.08 (T 2)	49.98 (T 7)
Days for 50 per cent flowering	48.35 (T 2)	55.09 (T 6)
Flowering phase (days)	20.04 (T 7)	23.13 (T 10)
Days for fruit maturity	140.33 (T 7)	157.20 (T 1)
Crop duration (days)	366.50 (T 2)	388.28 (T 5)
Length of the fruit (cm)	7.84 (T 10)	17.80 (T 9)
Girth of the fruit (cm)	26.65 (T 10)	38.95 (T 2)
Breadth of the fruit (cm)	7.00 (T 6)	11.93 (T 2)
Taper ratio of the fruit	0.74 (T 3)	0.94 (T 4)
Fruit weight with crown (kg)	0.55 (T 6)	1.59 (T 2)
Crown weight (kg)	0.07 (T 8)	0.28 (T 7)
Shelf life (days)	7.00 (T 13)	9.00 (T 6)
Peel weight (kg)	0.08 (T 6)	0.19 (T 1)
Pulp weight (kg)	0.32 (T 6)	1.19 (T 2)
Pulp percentage (%)	61.03 (T 13)	81.43 (T 7)
Juice (%)	83.48 (T 13)	95.16 (T 3)
TSS (°Brix)	12.78 (T 12)	18.59 (T 6)
Acidity (%)	0.72 (T 6)	0.87 (T 12)
Total sugars (%)	9.00 (T 12)	12.78 (T 1)
Reducing sugars (%)	1.92 (T 1)	4.12 (T 3)
Non-reducing sugars (%)	5.69 (T 12)	10.87 (T 1)
Sugar/acid ratio	9.61 (T 7)	16.73 (T 1)
Fibre (%)	27.91 (T 3)	35.10 (T 8)
Total carotenoids (mg 100 g-1)	215.17 (T 4)	284.32 (T 14)
Ascorbic acid (mg 100 g-1)	41.03 (T 12)	104.11 (T 6)