

**TORTOISE BEETLES (COLEOPTERA: CHRYSOMELIDAE:
CASSIDINAE) OF KERALA**

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KERALA, INDIA**

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CASSIDINAE) OF KERALA**

by

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(2018-11-042)

THESIS

**Submitted in partial fulfilment of the
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DEPARTMENT OF AGRICULTURAL ENTOMOLOGY

COLLEGE OF AGRICULTURE

VELLAYANI, THIRUVANANTHAPURAM-695 522

KERALA, INDIA

2020

DECLARATION

I, hereby declare that this thesis entitled “**TORTOISE BEETLES (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE) OF KERALA**” 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.

Vellayani,

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LIST OF ABBREVIATIONS AND SYMBOLS USED

| | |
|--------------|---------------------------|
| % | Per cent |
| Mm | Milli metre |
| GPS | Global positioning system |
| °C | Degree celcius |
| <i>et al</i> | And others |
| ♂ | Male |
| ♀ | Female |
| <i>viz.,</i> | Namely |
| sp. | Species |
| ° | Degrees |
| ' | Minutes |
| " | Seconds |
| N | North |
| E | East |
| Coll. | Collection |
| Fig. | Figure |

Introduction

1. INTRODUCTION

The tortoise beetles (cassidines) and leaf-mining beetles (hispines) belong to subfamily Cassidinae, the second largest clade within the leaf beetle family Chrysomelidae. They are exceptionally diverse and cosmopolitan with 6319 described species (3371 hispines and 2948 cassidines) in 341 genera. Of the 36 cassidine tribes, 18 are restricted to the New World and 17 to the Old World, while Cassidini alone enjoys a worldwide distribution (Borowiec & Swietojanska, 2014).

Cassidines are recognized by their bright colour and round body. Adult colour varies from black to orange to matte to metallic, as well as iridescent to golden (Chaboo, 2007). The name 'cassida' and the common name "tortoise beetles" alludes to the rounded body, pronotum and elytra with flared or explanate margins, as well as the head retracted into the pronotum. Diverse and attractive colours of Cassidinae have earned them names, such as "living jewels" (Maulik, 1919). Size of adults ranges from 3 mm in case of the tiny *Oxylepus* Desbrochers to 30 mm of the elongate *Alurnus bipunctatus* (Oliver). Adults of Eugenysini are the widest cassidines, with greatly expanded elytral margins. Larval size also vary similarly, from 1 to 40 mm long, with *Alurnus* larvae reaching 40 mm (Mariau, 2004).

Eggs are laid in singles or groups, with protective oothecal covering. A few Neotropical cassidines are subsocial, in which parental care is evident. Cassidine larvae are open feeders. However, Notosacanthini are exceptions being regarded as cassidines based on adult morphology, yet possessing mining larvae as in hispines. Probably this tribe is an evolutionary intermediary between the hispine and cassidine lineages. Tortoise beetles have five active free-living instars. Cassidine larvae are elongate, oval, flattened, with numerous lateral projections (scoli) on the thorax and abdomen. Scoli and caudal process (urogomphi) can be quite long and branched. These structures are also retained in pupae. Cassidine larvae retain their faeces and exuvia on their dorsum forming dorsal faecal shield. In *Silana farinsa* (Boheman), the faecal shield is in molten stage. Pupation is external and the pupae are capable of making movements. Gregariousness is a common trait in cassidines from clustered eggs to pupal stages. Cycloalexi is a defensive behaviour exhibited by some gregarious cassidine larvae. When disturbed, larvae form tight circle and jerk their body synchronously. Adults are reluctant to fly, however, when threatened, they

perform an escape response by freely falling through vegetation and feigning death, called thanatosis (Bleich, 1928; Nichols, 1989).

Sexual dimorphism is minimal and limited to a very few species, however, females may be 10–20% longer than males (Jolivet, 1999). *Acromis sparsa* males are easily distinguishable by having the antero-lateral elytral corners projected (Chaboo, 2007).

Cassidinae are associated with a broad spectrum of host plants. Members of the hispine lineage, in general, feed on monocots while the trophic relations of cassidines are skewed towards dicots (Crowson, 1981). Cassidines feed on 36 dicot families with marked preferences for Convolvulaceae and Asteraceae (Borowiec & Swietojanska, 2014). Many cassidines are significant crop pests. Species of *Aspidimorpha* and *Cassida* infest sweet potato. Being host specific, cassidines are used as biocontrol agents against invasive weeds.

The most frequent predators of cassidines are bugs (Heteroptera: Pentatomidae, Reduviidae), spiders (Araneae), wasps (Hymenoptera: Vespidae), and ground beetles (Coleoptera: Carabidae) (Olmstead, 1996; Eisner and Eisner, 2000). Eggs are preyed upon by bugs and ants. Cox (1994) has listed ten families of Hymenoptera and three subfamilies of Tachnidae (Diptera) as parasitoids of cassidines.

The grossly out-dated Maulik's (1919) century old monograph on Cassidinae and Hispinae, under the Fauna of British India series, is the latest comprehensive study on the tortoise beetles of the Indian subcontinent. Despite being diverse, ecologically and economically important, there has been no attempt to study the tortoise beetles of Kerala. The present study is an attempt to bridge this gap with the following objectives:

1. Collection and identification of tortoise beetles of Kerala
2. Preparation of an illustrated key to species and update the taxonomy
3. Provide descriptions and diagnosis of tortoise beetle taxa of Kerala
4. Gather information on host plants and distribution.

Review of Literature

2. REVIEW OF LITERATURE

Tortoise beetles belong to Chrysomelidae, the family of leaf beetles. This is one of the largest animal families, encompassing more than 40,000 named species classified in approximately 2330 genera and 12 subfamilies (Seeno and Wilcox, 1982; Morse *et al.*, 2014). The subfamily Cassidinae accounts for about 16% of leaf beetle diversity and forms the second largest clade within Chrysomelidae after Galerucinae with an account of 6319 described species (3371 hispines and 2948 cassidines) in 341 genera (Borowiec & Swietojanska, 2014).

Of the 36 extant tribes of Cassidinae, 18 are restricted to the New World and 17 to the Old World, while Cassidini alone enjoys a worldwide distribution. The hispine group is comparatively more diverse in the Old World (1800 versus 1572 species), whereas the cassidine group is dominant in the New World (1639 versus 1309 species) (Borowiec & Swietojanska, 2014).

2.1 ECONOMIC IMPORTANCE OF CASSIDINAE

Cassidinae are associated with a broad spectrum of host plants. Members of the hispine lineage, in general, feed on monocots, while the trophic relations of cassidines are skewed towards dicots (Crowson, 1981). The cassidine tribes Delocraniini and Hemisphaerotini are exceptions, being confined exclusively to monocots. Cassidines feed on 36 dicot families with marked preferences for Convolvulaceae and Asteraceae; other host plant families include Arecaceae, Boraginaceae, Caryophyllaceae, Chenopodiaceae, Lamiaceae and Solanaceae (Jolivet, 1988; Jolivet & Hawkeswood, 1995; Borowiec and Swietojanska, 2014). Cassidinae have evolved three different feeding strategies: the tortoise beetles have exophagous larvae as well as adults, those of hispines are leaf mining larvae and open feeding adults, and the third type, the cryptic larvae and adults living in rolled leaves. In the cassidine lineage, only larvae of Notosacanthini are leaf miners, while all others are exophagous and active on leaf surfaces, both as adults as well as grubs (Borowiec and Swietojanska, 2014).

Cassidines feed on major food crops including corn, rice, sugarcane, bamboo, date palm, and coconut (Maulik, 1919). *Craspedonta leayana* (Basiprionotini) is one of the most significant cassidine pests in India causing damage to an important Asian pulpwood tree, *Gmelina arborea* (Verbenaceae) (Garthwaite, 1939; Beeson, 1941). Several cassidine tribes are pests of economically important palms (Mariau, 2004). About 70 species of cassidines, belonging to the genera *Aspidimorpha*, *Cassida*, *Glyphocassis*, and *Omaspides* etc. feed on sweet potato, which is an important food crop globally (Borowiec & Swietojanska, 2020).

Cassidines, being host specific, are preferred candidates in applied biological control programmes of noxious weeds. *Cassida hemisphaerica* was used for the control of *Silene cucubalus* in Canada (Maw, 1976). *Cassida rubiginosa* has been introduced and used for the successful management of thistle (*Cirsium arvense*) in Canada (Ang *et al.*, 1995). *Cassida litigiosa* was investigated for the control of *Chrysanthemoides monilifera* and was introduced to Australia (Kleinjan & Scott, 1996). Species of *Gratiana* were used in South Africa to control *Solanum sisymbriifolium*. Several individuals of *Octotoma*, *Uroplata* and *Charidotis* were introduced to control Lantana in many Pacific islands, South Africa and Australia (Siebert, 1975; Broughton, 2001; Williams, 2004).

2.2 TAXONOMY

Laterille was the pioneer in the classification of Chrysomelidae, and proposed the name Chrysomelines in 1802. Gyellenhal in 1813 proposed the group Cassidites for the chrysomelid genus *Cassida* and the group name Hispoideae for *Hispa atra* (Linnaeus). Chapuis, known as the father of Chrysomelidae studies, classified leaf beetles into a single family, then further divided the family into four sections and 15 tribes. Chapuis (1874) combined the tribe Hispides and Cassidites together in the fourth section, Cryptostomes. In 1908, Jacoby modified the Chapuis system to include five divisions and 16 subfamilies. The subfamilies Hispinae and Cassidinae were included in the division Cryptostoma. Chen (1940) proposed a new system of classification, in which the family Chrysomelidae was rearranged into six divisions, each with family rank. Thus the family Cassididae included two subfamilies:

Hispidinae and Cassidinae. His classification was based on the general external characteristics of adults, venation of the hind wing and structure and bionomics of larvae. Monoros (1959) placed Hispidinae and Cassidinae under the category Cassidiformes. Gressitt and Kimoto (1961), in their monograph on Chrysomelidae of China and Korea, included 17 subfamilies within the family Chrysomelidae and considered Hispidinae and Cassidinae as subfamilies. Chen (1964) proposed classification of the superfamily Chrysomeloidea into six families and 18 subfamilies. The family Hispididae included three subfamilies Cassidinae, Hispidinae as well as Anisoderinae. Chen in 1973 proposed a new superfamily Cassidoidea and raised the subfamilies of the old system to families such as Cassididae, Anisoderidae, Hispididae and Callispidae. He also proposed tribes of uncertain position such as Hemishaerotini, Spilophoroni, Delocranini and Imatidiini.

Franz Spaeth, Austrian entomologist and a specialist in the subfamily Cassidinae, wrote the first world catalogue of Cassidinae in 1914, where he classified them under three unnamed tribes. Franz Spaeth (1923) had commenced preparation of a manuscript on the Cassidinae for publication in Wytzman's *Genera Insectorum* when the second world war broke out hence the plan of the work was altered to produce a monographic version of the subfamily, including species as well as genera. Unfortunately the first copy was destroyed in Russian bombing of Vienna. Proof-copy of the first volume and a few sheets of the manuscript alone could be salvaged. Spaeth reviewed all previously established genera, consigned some of them to subgenera or synonyms, and also some new genera as well as subgenera were erected. Hincks (1952), based on this proof-copy, prepared a paper called the genera of the Cassidinae with a review of 19 tribes, key to the tribes and a list of all genera proposed by Spaeth, including descriptions of several new genera and nomenclatorial changes with designation of type species for each genus. Borowiec (1995) used 19 binary characters, including both adult as well as larval features, to record the first modern phylogenetic analysis of Cassidinae. According to Borowiec, Hispidinae s.str. and Cassidinae s.str. are paraphyletic and synonymized both under the name Hispidinae, without discussing the family-group name priority and reduced the number of cassidine tribes from 19 to 11. Borowiec proposed the informal name cassidoid

hispidinae for tortoise beetles and hispidinae for hispines. Reid (1995) did an analysis of subfamilial relationships in the Chrysomelidae based on cladistic analysis of 29 family-rank taxa using 71 characters. He proposed merger of hispidine and cassidine groups into a single subfamily and used the name Hispidinae for it. According to Staines (2002), the group name Cassidinae has priority over Hispidinae since it appears first on page in the same publication of Gyellenhal (1813).

Historically disparate works on cassidine and hispidine beetles has resulted in independent taxonomic trajectory for each of them. Chaboo (2007) was the first to integrate biological and morphological works for the cassidine clade. Bouchard *et al.*, (2011) listed 38 tribes within the subfamily Cassidinae. Borowiec and Swietojanska (2014) listed 37 tribes: 25 representing the hispidine lineage (Alurnini, Anisoderini, Aroidini, Arescini, Bothryonopini, Callispini, Callohispidini, Cephaloleiini, Chalepini, Colaenomendorini, Cryptonychini, Cubispini, Eurispini, Exothispini, Gonophorini, Hispidini, Hispidoleptini, Hybospispini, Leptispini, Oediopalpini, Oncocephalini, Promecothecini, Prosopodontini, Sceloenoplini and Spilophorini) and 12 of cassidine lineage (Aspidimorphini, Basiprionotini, Cassidini, Delocraniini, Dorynotini, Eugenyssini, Goniocheniini, Hemispaerotini, Mesomphaliini, Notosacanthini, Omocerini and Physonotini). Imatidiini and Uroplatini listed by Bouchard *et al.* (2011) were omitted because Imatidiini are the oldest available name for Cephaloleiini and Uroplatini were synonymized with Chalepini (Staines, 2002). Tribe Cubispini was treated as a hispidine tribe by Borowiec and Swietojanska (2014)

2.3 INDIAN CASSIDINES

The monograph under the Fauna of British India series on Cassidinae and Hispidinae (Maulik, 1919) is the only comprehensive work on Cassidinae of the Indian subcontinent. Lech Borowiec has contributed immensely towards the study of Cassidinae of the Indian subcontinent. Borowiec (1999), in his World Catalogue of Cassidinae, listed 2760 species, which is also available on a digital platform as an interactive manual, including synonyms, distribution, host plants, literature, and colour photographs of majority of the species as well as a detailed generic key.

Haruo Takizawa (1980) made descriptions of immature stages of fourteen species of Indian cassidinae such as, *Laccoptera quatuordecimnotata*, *L. quadrimaculata*, *Aspidimorpha spaethi*, *A. dorsata*, *A. furcata*, *A. sanctaegrucis*, *A. miliaris*, *Chiridopsis bipunctata*, *C. promiscula*, *Oocassida cruenta*, *Cassida (Taiwania) obtusata*, *C. (Taiwania) sp. 1*, *C. (Taiwania) sp. 2*, and *Silana farinosa*. Based on Mr. Y. Komia and Mr. M. Imasaka private collection, Takizawa (1985; 1987; 1988; 1989) published notes on chrysomelid beetles of India and its neighbouring areas. One hundred and sixty species were listed by him separately under 4 geographic headings.

Borowiec and Ghate (1999) described a new species *Chiridopsis nigropunctata* from Maharashtra and redescribed *Chiridopsis selecta*. Borowiec and Swietojanska (2000) described a new species from Karnataka, viz. *Chiridopsis ghatei*. Ghate and Ranade (2002) reported *Epistictina reicheana* from new localities in Karnataka and Maharashtra on *Stereospermum colais* with information about the larval stages, pupa, and ootheca.

Thirty seven species of tortoise beetles, belonging to 11 genera, collected over five years, were listed along with their host plants by Ghate *et al.*, (2003). This includes *Cassida* (11 species), *Aspidimorpha* (7 species), *Chiridopsis* (6 species), *Laccoptera* (5 species), *Notosacantha* (2 species), and one species each of *Epistictina*, *Craspedonta*, *Conchyloctenia*, *Capelocassis*, *Oocassida* and *Rhytidocassis*.

One hundred and forty four species of cassidines belonging to 18 genera in six tribes are known from India. Twenty eight species, in seven genera belonging to four tribes are recorded from Kerala, according to the online catalogue of tortoise beetles by Borowiec and Swietojanska (2020).

2.3.1 Tribe Aspidomorphini Chapuis 1875

Includes 287 species in 6 genera, of which 28 species belonging to 4 genera are known from India (Maulik, 1919; Borowiec and Swietojanska, 2020).

The genus *Aspidimorpha* Hope, 1840 comprises 200 species in 10 subgenera, of which 15 species occur in India. They are *A. amabilis*, *A. chandrika*, *A. dorsata*, *A.*

furcata, *A. fusconoata*, *A. fuscopunctata*, *A. indica*, *A. inuncta*, *A. limbipennis*, *A. miliaris*, *A. musta*, *A. orbicularis*, *A. orientalis*, and *A. sanctaegrucis* (Borowiec and Swietojanska, 2020). There are reports of *A. fuscopunctata*, *A. inuncta*, *A. miliaris*, *A. sanctaegrucis* and, *A. furcata* from Kerala (Maulik, 1919; Borowiec and Swietojanska, 2020).

Of the seven species of *Conchyloctenia* Spaeth, 1902 reported worldwide, only *Conchyloctenia nigrovittata*, distributed in Bengal, Chattisgarh, Maharashtra as well as Mysore, occurs in India (Borowiec and Swietojanska, 2020).

The genus *Laccoptera* Boheman, 1855 consists of 66 species classified within 10 subgenera. There are reports of 11 species from various parts of India (*Laccoptera nepalensis*, *L. quatuordecimnotata*, *L. tredecimpunctata*, *L. foveolata*, *L. jawalagiriana*, *L. depressa*, *L. sulcata*, *L. meghalayaensis*, *L. novemdecimnotata*, *L. vigintisexnotata*, *L. sedecimmaculata*). Four of them, *L. nepalensis*, *L. quatuordecimnotata*, *L. sulcata*, and *L. tredecimpunctata*, were reported from Kerala (Maulik, 1919; Borowiec and Swietojanska, 2020).

Nilgiraspis Spaeth, 1932, represented by the widely distributed *Nilgiraspis andrewesi*, occurs in China, Yunnan, South India, Laos and Thailand (Borowiec and Swietojanska, 2020).

2.3.2 Tribe Basiprionotini Hincks, 1952

Includes 8 genera and 90 species, of which 9 species belonging to 3 genera occur in India (Borowiec and Swietojanska, 2020).

Of the 64 described species of *Basiprionota* Chevrolat, 1836, five occur in India: *Basiprionota decemmaculata*, *Basiprionota decemstillata*, *Basiprionota pudica*, *Basiprionota sexmaculata*, and *Basiprionota westermanni* (Borowiec and Swietojanska, 2020). There is no record of the genus from Kerala.

Genus *Craspidonta* Latreille, 1807, contains six described species, is represented in India by *Craspidonta leayana* which is a major pest of *Gmelina arborea* (Beeson, 1941).

Three out of five species of *Epistictina* Hincks, 1950, viz. *Epistictina reicheana*, *Epistictina viridimaculata*, and *Epistictina weisei* are known from Kerala.

2.3.3. Tribe Cassidini Gyllenhal, 1813

This is the most diverse tribe of tortoise beetles with more than 1000 species placed in 88 genera, of which 42 are restricted to the Old World and 46 to the New World (Borowiec and Swietojanska, 2020).

The monotypic genus *Capelocassis* Spaeth, 1952, represented by *Capelocassis dorsata*, occurs in Tamil Nadu; Uttar Pradesh and Jharkhand (Ghate, *et al.*, 2003).

Cassida Linnaeus, 1758 is the most speciose genus of tortoise beetles. Distributed worldwide, the genus contains 458 species, of which 52 are present in India. Eight of them, *Cassida andrewesi*, *Cassida conspurcata*, *Cassida circumdata*, *Cassida delesserti*, *Cassida devalaensis*, *Cassida ruralis*, *Cassida socialis*, and *Cassida subtilis* occur in Kerala (Maulik, 1919; Borowiec and Swietojanska, 2020).

Chiridopsis Spaeth, 1922 consists of 66 species, of which 17 are reported from various parts of India. Most species from India were reviewed by Maulik (1919). Four species viz. *C. bipunctata*, *C. novemkalamkita*, *C. sexplagiata*, and *C. undecimnotata*, are known to occur in Kerala

Glyphocassis Spaeth, 1914 comprises three species. *Glyphocassis trilineata* is known from NE India (Maulik, 1919; Borowiec and Swietojanska, 2020).

Genus *Oocassida* Weise, 1897, contains 5 species. *O. cruenta* and *O. pudibunda* are known from India. They are pests of ber, *Ziziphus* sp. (Nair, 1975)

Rhytidocassis Spaeth, 1941 consists of 8 species. Only *Rhytidocassis indicola* occurs in India (Maulik, 1919; Borowiec and Swietojanska, 2020).

The monotypic genus *Silana* Spaeth, 1914 was erected by Spaeth to accommodate *Cassida farinosa* described from Sri Lanka by Boheman in 1856. Takizawa (1980, 1985) reported this beetle in south India feeding on *Ziziphus* sp.

(Rhamnaceae). Mohamed and Ahmad (1996) reported the beetle from Peninsular Malaysia feeding on *Murraya koenigii* (Rutaceae). This is a serious pest of curry leaf in Kerala (Premila *et al.*, 2003)

Genus *Thalaspida* Weise, 1899 consists of six species of which *T. biramosa* and *T. cribrata* were known from India (Maulik, 1919; Borowiec and Swietojanska, 2020).

Thalaspidosoma Spaeth, 1901, mostly occurring in the Indo-Malayan subregion, consists of 9 species. *Thalaspidosoma assamensis* is the only Indian representative of the genus (Borowiec and Swietojanska, 2020).

2.3.4. Tribe Mesomphalini Chapuis, 1875

Consists of 25 genera of which *Omaspides* Chevrolat, 1836 is known from India (Maulik, 1919; Borowiec and Swietojanska, 2020).

Omaspides consists of 40 species, of which *Omaspides clathrata* and *Omaspides trifasciata* occur in India (Maulik, 1919; Borowiec and Swietojanska, 2020).

2.3.5. Tribe Notosacanthini Hincks, 1952

This tribe consists of 3 genera. *Notosacantha* Chevrolat, 1837 includes 271 species and is represented in India by 27 species. *N. bertounesquei*, *N. tenella* and *N. nathani* occur in Kerala (Maulik, 1919; Borowiec and Swietojanska, 2020).

2.3.6. Tribe Omocerini Hincks, 1952

This tribe consists of 7 genera of which *Discomorpha* Chevrolat, 1836 is reported from India. The genus *Discomorpha* comprises 63 species, mostly from the Neotropical Region. Only *Discomorpha tricolor* is known from India (Borowiec and Swietojanska, 2020).

Material and Methods

3. MATERIAL AND METHODS

The present study deals with the taxonomy of tortoise beetles of Kerala (Chrysomelidae, Cassidinae: Cassidini *sensu lato*). A total of 311 specimens of cassidines were examined during the study. The detailed methods adopted during the course of the study are given below.

3.1. COLLECTION, PROCESSING AND ACQUISITION OF SPECIMENS

The Travancore Insect Collection, housed in the Department of Entomology, College of Agriculture, Vellayani contains specimens from all over the country, collected over the last two decades. This study is based mainly on this collection. Besides the preserved specimens, field collections were also carried out. The taxa studied are from various ecosystems such as agricultural fields to scrub jungles, sholas, grasslands and tropical evergreen forests. Samples from 48 localities in 12 districts, representing all biogeographical zones in the state were studied (Map 1).

All specimens studied are currently being held in the Travancore Insect Collection. A portion of the material will be transferred to the National Bureau of Agricultural Insect Resources, Bengaluru.

3.1.1. Field Collection

Field collections were made in Thiruvananthapuram, Thrissur, Idukki and Ernakulam Districts.

3.1.1.1. Collection Techniques

Tortoise beetles generally feed on various kinds of dicotyledonous plants, including herbs, shrubs, vines and trees. Selective searching for various feeding symptoms such as leaf trenches and holes by adults and larvae and then hand picking various life stages was the most common method of specimen collection. Once the host plant was located, it was easy to collect the various stages. A hand net was often used to reach the upper canopy. Cassidines have very strong affinity towards members of the sweet potato family Convolvulaceae and the mint family Lamiaceae. Such prospective host plant species were intensively searched. Collecting immature stages from the field and rearing them till adult emergence was the most rewarding method of collection as this provided host plant data as well as natural history information.

The collected beetles were transferred to alcohol filled vials for killing and temporary preservation. Whenever possible, a series of specimens were collected to compensate for the loss of appendages as well as to ascertain variability. Vials containing dead specimens were taken to the laboratory for processing and preservation for further studies.

3.1.2. Processing of specimens

3.1.2.1. Mounting and labelling

The collected tortoise beetles were glued on triangular paper points mounted on nylon headed stainless insect pins (No.3). Beetles were glued to paper point using Fevicol® in such a way that the right side of the thorax is attached to the point, which enabled examination of head, prosternum and abdomen. All the specimens were labelled giving details of locality, GPS co-ordinates, date of collection, host plants and name of collector, whenever possible. Specimens were dried in hot air oven set at 50 °C. The specimens were then arranged in unit trays and stored in airtight insect boxes containing paradichlorobenzene or naphthalene.

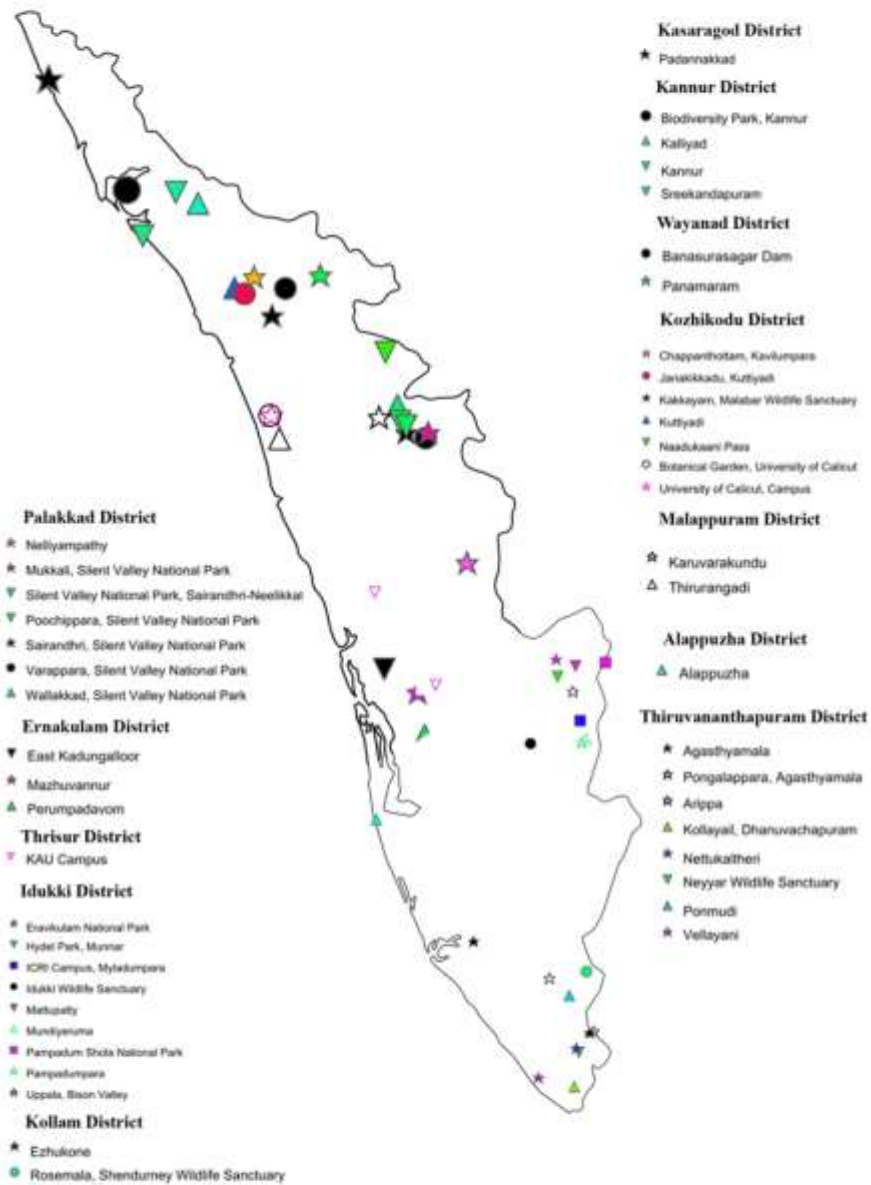
3.2. IDENTIFICATION

The specimens were identified up to the generic as well as species level using descriptions and keys provided by Maulik (1919), Kimoto (1999) and Borowiec and Swietojanska (2020). The habitus images of nearly almost all species, given by Borowiec

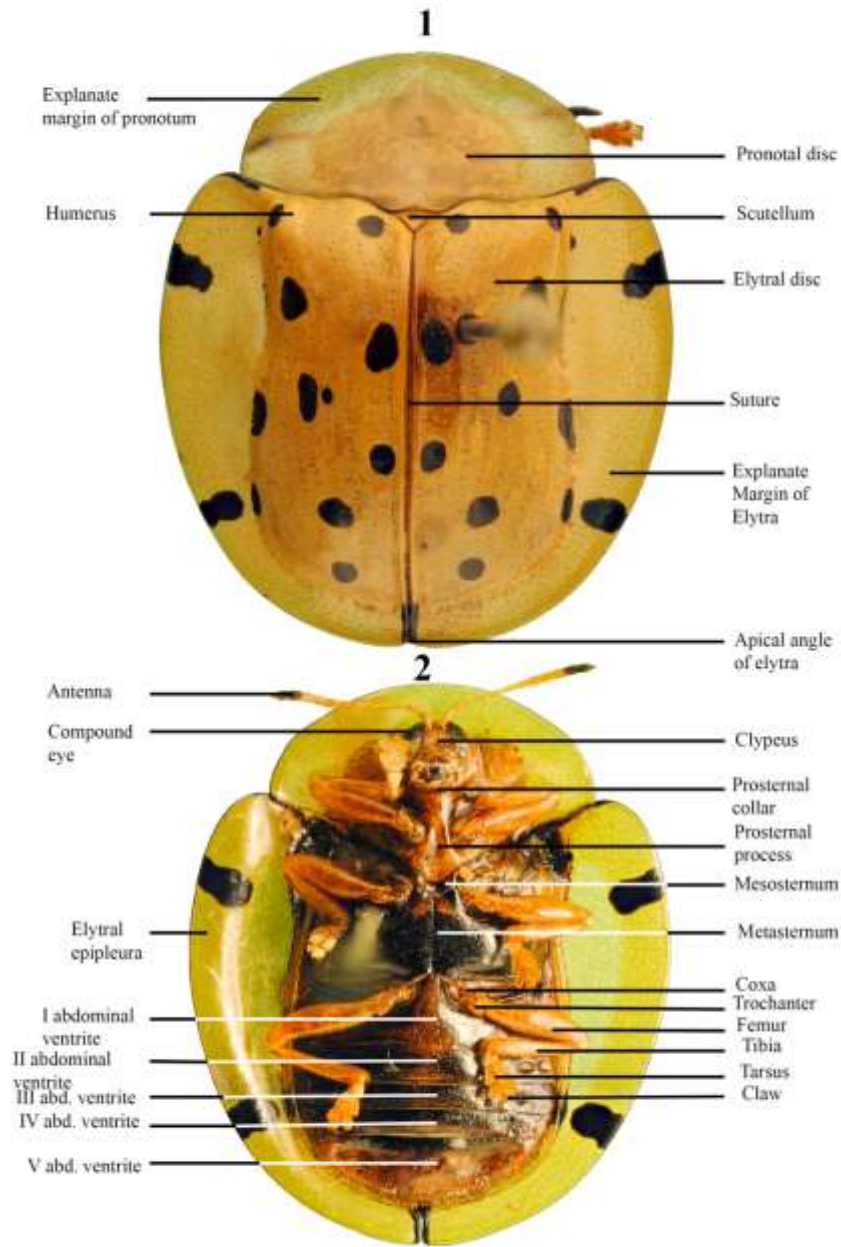
(http://www.cassidae.uni.wroc.pl/katalog%20internetowy/references_K.htm) were extremely useful in confirming the identifications.

3.3 DESCRIPTIONS

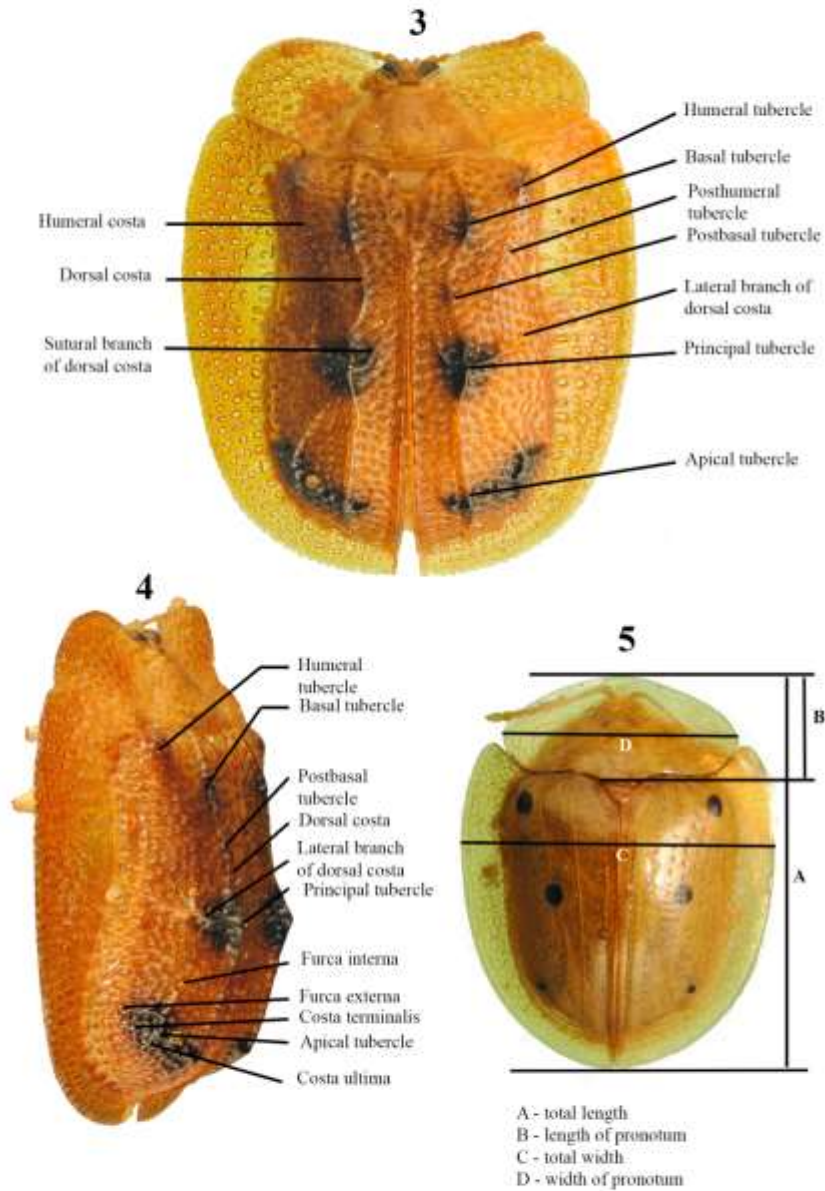
The descriptive terminology follows (Chaboo, 2007; Borowiec & Le Tirant, 2013). Diagnoses of all taxa treated here as well as species descriptions were prepared. Detailed description of morphological characters and variation within the species were recorded. The morphological terminologies are illustrated in Figs 1 & 2. Terminology for elytral sculptures in *Notosacantha* (after Borowiec & Le Tirant, 2013) are given in Figs 3 & 4.



Map1 Localities of specimens examined



Figs 1 & 2. External morphology of cassidines. 1. dorsal aspect, 2. ventral aspect.



Figs 3 & 4. Terminology of clytral sculpture, 3. dorsal view, 4. dorso later view.
Fig. 5. Measurements

3.3.1. Terminology

Clypeus: the part of head to which labrum is attached anteriorly.

Crenulated: regions with small scallops, evenly rounded.

Elytra: the first pair of wings in beetles that are modified to form a hard shell.

Elytral disc: the upper part of elytra between elytral bases and the sloped elytral apex.

Epipleura: inflexed outer side of elytra

Explanate margins: the expanded margins of elytra or pronotum.

Frons: the upper anterior portion of head capsule.

Frontoclypeus: clypeus is usually fused with frons in cassidines called frontoclypeus.

Gena: lateral sclerites of head

Mesosternum: the ventral sclerite of the middle segment of the thorax.

Pronotum: the dorsal sclerite of the prothorax.

Prosternal collar: anterior part of the prosternum expanded anteriorly forming a plate which partially conceals the mouth parts.

Prosternal process: posterior projection of the mesal portion of the prosternum in the intercoxal region.

Scutellum: the triangular part of the mesothorax placed between the bases of the elytra.

Sternite: ventral portion of a segment of thorax or abdomen

Suture: the longitudinal junctional line between each elytron

Tarsal Claw: the spur which is curved and projected from apex of last tarsal segment on either side of the pretarsus

Tarsus: the foot; the jointed appendage attached at the apex of the tibia, bearing the claws; the distal part of the leg.

Tubercle: small bumps or projections from a surface.

3.4. PHOTOGRAPHS

Habitus of all species studied were colour photographed using AF Micro Nikkor 60 mm macrolens mounted on a Nikon D3000 SLR camera. The camera was mounted on a Wemacro stack rail, positioned vertically. Three Ikea 201.696.58 Jansjo Desk Work LED Lamps, with suitable diffusers, were used to uniformly illuminate the specimens. Wemacro rail android Bluetooth control app, installed on a

smartphone, was used to remotely control the imaging system. Multiple images at different depths of plane were taken and were stacked together using Helicon focus software. The high resolution images thus obtained were edited with Adobe Photoshop.

Some of the diagnostic characters were photographed at higher magnification using a Canon EOS camera mounted on a Leica DM 1000 compound microscope. The specimens were illuminated and multiple images, taken at different depths of plane, were stacked and then edited as described above.

3.5. MEASUREMENTS

Four specimens each of a species were measured. When the specimens were fewer, the available ones were measured.

Measurements of various body parts mentioned below were made with the help of a standardized ocular micrometer placed in one of the eyepieces of a stereoscopic microscope . All measurements are expressed in millimetres. The letters in parentheses indicate the way the parts are measured as indicated in Fig. 5.

Body length (A): Measured as distance between anteriormost margin of pronotum or head and elytral apex.

Pronotal length (B): distance between anterior corner to the base of pronotum

Body width (C): maximum horizontal distance between lateral explanate margins of elytra

Pronotal width (D): maximum distance between lateral margins of pronotum

Length ratio of antennomeres: the proportionate of length of each antennomere to the length of first antennomere.

Results

4. RESULTS

The present study recognizes 33 species of cassidines placed in 11 genera, classified under four tribes, from Kerala. Three hundred and eleven specimens of tortoise beetles from various ecosystems in Kerala were examined and the results are presented here.

TAXONOMY

Key to the genera of tortoise beetles of Kerala

1. In dorsal view, head visible, not covered by pronotum (Fig. 6) 2
 - In dorsal view, head not visible, concealed under explanate margin of pronotum (Fig. 7) 5
- 2 (1) Interocular region strongly produced into an anterior prolongation above antennal sockets; antennomeres 7–11 forms a thick club; pronotum at least 2.5 times as broad as long (Fig. 8) *Notosacantha* Chevrolat
 - Interocular region not strongly produced into an anterior prolongation above antennal sockets; distal antennomeres not forming a thick club; pronotum not very broad, less than 2.5 times as broad as long (Fig. 9) 3
- 3(2) Mouth parts partially visible (Fig. 11); antennomeres distinctly striated from 4th or 5th onwards, antennomere 8–10 cylindrical (Fig. 10)... *Epistictina* Hincks
 - Mouth parts completely hidden by prosternal collar (Fig. 12); antennomeres distinctly striated from 6th or 7th onwards; antennomere 8–10 slightly depressed 4
- 4(3) Pronotal and elytral margins broadly expanded; anterior margin of pronotum deeply emarginated (Fig.13); length 9.0 – 10.5 mm..... *Basiprionota* Chevrolat
 - Pronotal and elytral margins narrowly expanded; anterior margin of pronotum weakly emarginated (Fig.14); length 12.0 – 15.0 mm..... *Craspedonta* Chevrolat
- 5(1) Tarsal claws bearing a comb-like structure at the base (Fig.15) 6
 - Tarsal claws lacking a comb-like structure at the base (Fig 16) 8

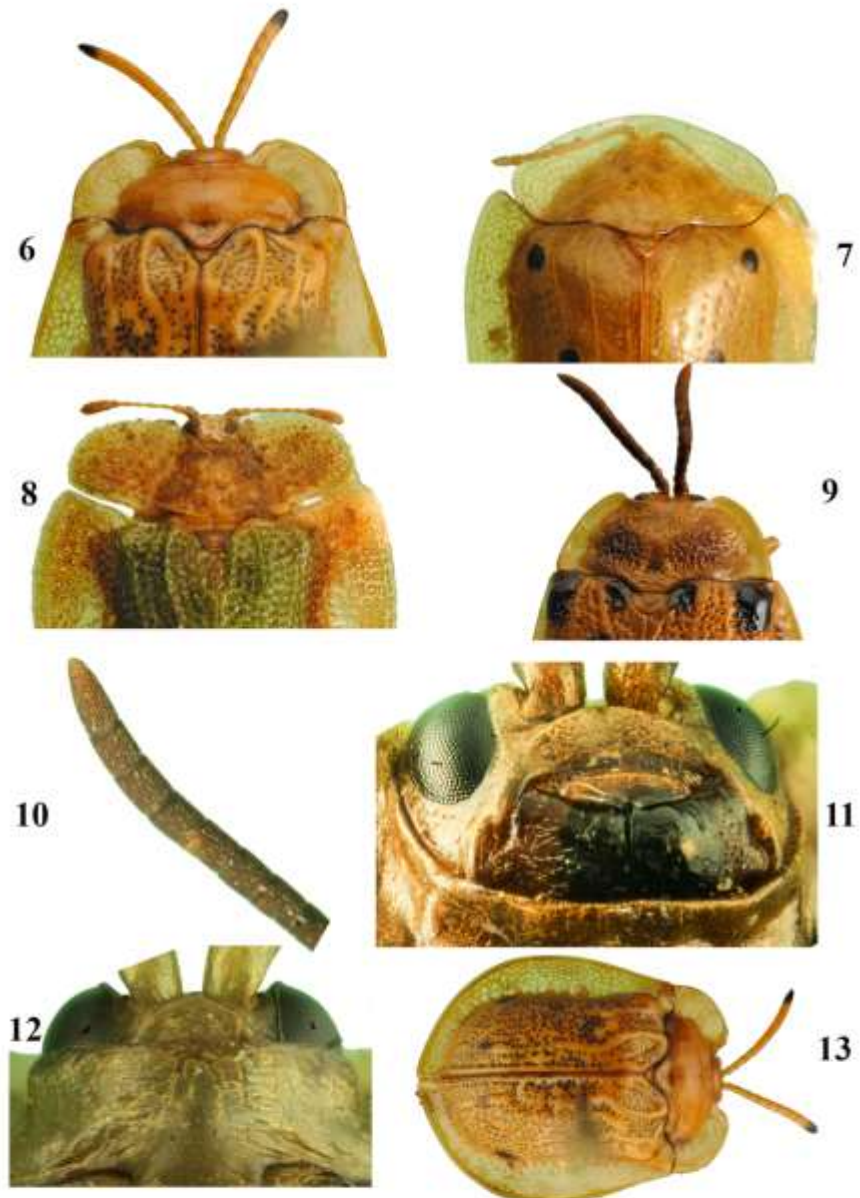
- 6(5) Four basal antennomeres smooth and glabrous (Fig.17)
 *Nilgiraspis* Spaeth
 – Six basal antennomeres smooth and glabrous (Fig.18) 7
- 7(6) Body roundate or oval (Fig.19) *Aspidimorpha* Hope
 – Body triangular, narrowed posteriorly (Fig.20) *Laccoptera* Boheman
- 8(5) Pronotum ventrally with a deep and long antennal groove, that accommodates
 whole antenna (Fig. 21) 9
 – Pronotum ventrally without a deep and long antennal groove (Fig. 22) 10
- 9(8) Last two antennomeres projecting beyond posterior margin of pronotum (Fig.
 23) *Chiridopsis* Spaeth
 – Antenna not reaching posterior margin of pronotum (Fig. 24)
 *Oocassida* Weise
- 10(8) Second joint of antenna longer than third (Fig. 25); live beetles covered with a
 white coating (Fig. 51) *Silana* Spaeth
 – Second joint of antenna shorter than third (Fig. 18); live beetles never covered
 with a white coating (Figs 39 – 44) *Cassida* Linnaeus

4.1 TRIBE ASPIDIMORPHINI

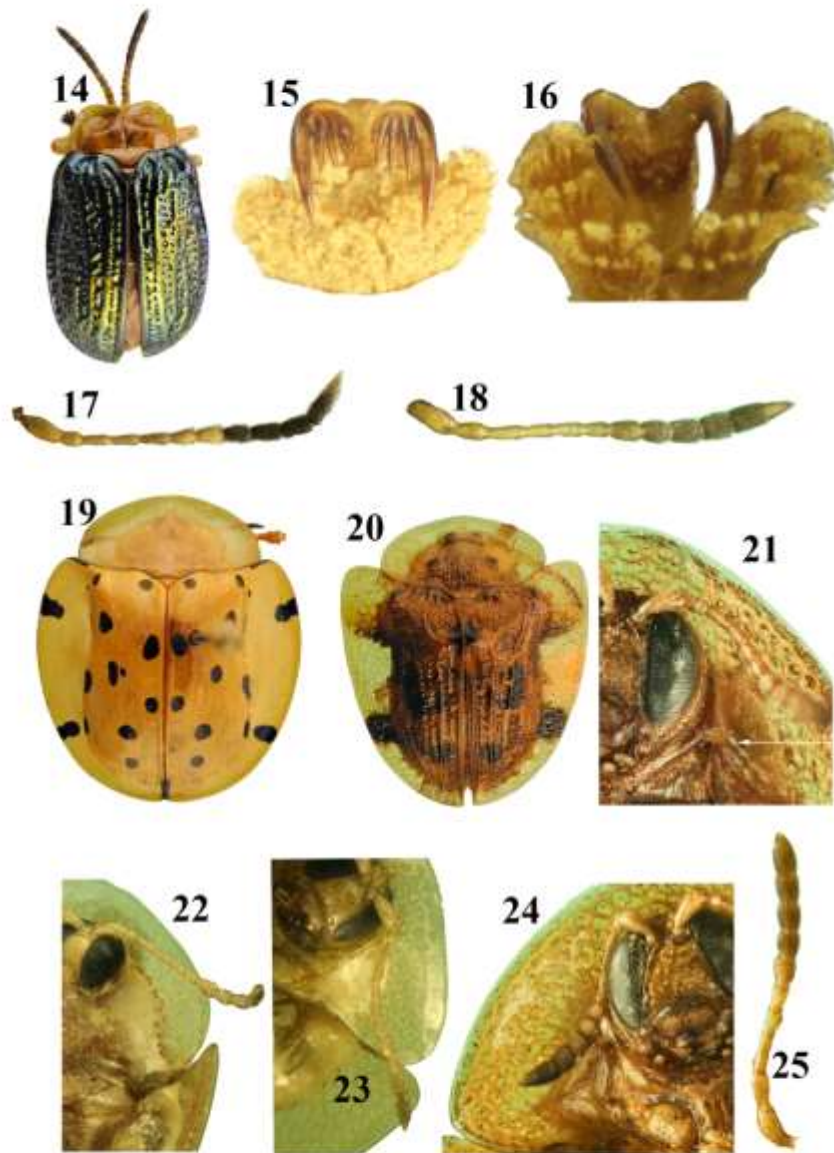
Diagnosis. Head externally not visible in dorsal view, metepisternum not entirely fused with metepimeron, tarsal claws pectinate.

4.1.1 Genus *Aspidimorpha* Hope, 1840

Diagnosis. Body length 5.40–6.30 mm; width 5.00–14.60 mm. Viewed dorsally, body rounded, with breadth nearly approaching length; head completely concealed by explanate margin of prothorax. Tarsal claw with a comb-like process on inner as well as outer sides. First antennomere thick, long; second small, about as long as wide; third nearly 2.5 times longer than second; fourth and fifth subequal, each longer than second, shorter than third. Pronotum semi elliptical; basal margin narrowly lined with red or black, bisinuate, with a row of marginal setae. Explanate margins of pronotum as well as elytra semitransparent with a honeycomb-like structure. Elytra with base wider than pronotum; anterior margin crenulated, except at explanate margins.



Figs. 6 – 13. 6. *Basiprionota* sp., head & pronotum; 7. *Chiridopsis bipunctata*, pronotum, clytral base; 8. *Notosacantha* sp. 1, head & pronotum; 9. *Epistictina reicheana*, head & pronotum; 10. *E. reicheana*, distal 8 antennomeres; 11. *E. reicheana*, mouth opening; 12. *Craspedonta leayana*; 13. *Basiprionota* sp., habitus.



Figs. 14 – 21. 14. *Craspedonta leayana*, habitus; 15. *Aspidimorpha millaris*, claw; 16. *Silana farinosa*, claw; 17. *Nilgiruspis andrewesi*, antenna; 18. *Cassida circumdata*, antenna; 19. *Aspidimorpha millaris*, habitus; 20. *Laccoptera nepalensis*, habitus; 21. *Oocassida cruenta*, antennal groove; 22. *Cassida circumdata*, pronotum, ventral view; 23. *Chiridopsis bipunctata*, antenna; 24. *Oocassida cruenta*, antenna; 25. *Silana farinosa*, antenna.

4.1.1.1 *Aspidomorpha furcata* (Thunberg, 1789)

(Fig. 26)

Cassida furcata Thunberg, 1789

Cassida dorsata Olivier, 1790.

Cassida micans Fabricius, 1801

Aspidomorpha micans Boheman, 1854

Aspidomorpha micans Morsbach, 1865

Diagnosis. Small sized; body length 5.50–6.62 mm, width 5.00–6.40 mm; round bodied; yellow to red insects. Pronotum unmarked. Scutellum impunctate, uniformly yellow, lined with red in some specimens. Dorsal conical hump present. Elytral colour and markings variable, in few specimens, elytra red brown with an elliptical pale area at centre, with in that a dark circular spot; majority pale forms with scattered red gradient either throughout disc or along raised portions; In a few specimens, two lateral red bands starting behind middle, that converge together across suture, along with a red spot at dorsal conical hump. Elytral disc smooth, shiny with ill-defined rows of fine punctures. Elytral explanate margin marked anteriorly.

Description. Body length 5.50–6.62 mm, width 5.00–6.40 mm; length of pronotum 1.90–2.0 mm, width 3.80–4.30 mm; length/width ratio of body 1.10–1.03, length/width ratio of pronotum 0.50–0.40.

General colour pale yellow to red brown; pronotum without any markings. Explanate margins of elytra as well as pronotum transparent; anterior margin of elytral explanate margin narrowly lined with red. Elytral disc colour and markings variable; majority pale forms with scattered red gradient either throughout disc or along raised portions; in few specimens elytra red brown with elliptical pale area at centre, with in that a dark circular spot; in some specimens, two lateral red bands starting beyond middle, those converge together across suture, along with that a red spot at dorsal conical hump. Scutellum impunctate, uniformly yellow to red; lined with red in some. Head and body red to yellow, sometimes with black gradients. Legs and antennae, except last one or two antennomeres at apex, uniformly yellow.

Eyes elliptical. Gena distinct. Clypeal plate longer than wide; clypeal grooves not distinct. Labrum emarginated.

Ratio of length of antennomeres I-XI 1: 0.47: 1.17: 0.58: 0.58: 0.35: 0.58: 0.58: 0.58: 0.52: 0.88.

Pronotum pale yellow, almost transparent opaque in a few specimens; pronotal disc with mostly one or two punctures mesally at base, some impunctate; disc sloping gradually from posterior to anterior. Pronotum highly broader than long with maximum width across lateral corners; anterior margin obtusely curved medially in majority to slightly convex at middle in few; lateral corners nearly at right angles. Explanate margins transparent in majority of specimens, opaque in some; impunctate. Portion above head as well as explanate margins with honeycomb-like structure.

Disc of elytra convex with top of convexity at dorsal conical hump. Humeri bulged. Elytral disc smooth, shiny with ill-defined rows of fine punctures; approximately in 9–10 rows; rows incomplete, sometimes with large gaps between punctures. Elytral explanate margin impunctate, semi-transparent to opaque with well developed honeycomb-like structure. Anterior corner of explanate margin with dark markings. Suture lined with red in majority of specimens. Maximum width of explanate margin almost equal to width of elytron. Elytral epipleura without setae.

Length of prosternal collar shorter than distance between anterior of prosternum with forecoxal cavity. Prosternal process posteriorly convex. Narrowest width of prosternal process subequal to the length of foretrochanter. The posterior widest portion of process with elliptical marking with fine punctures with in it in some specimens.

Tarsi moderately broad; last tarsomere extending upto marginal setae of third segment, except marginal setae. Claws separated by a distance subequal to length of claw.

Remarks. *Aspidimorpha furcata* closely resembles *A. inuncta* in having a dorsal hump as well as being similar in size and colour. However, *A. furcata* can be separated from *A. inuncta* by the posterior margin of elytral explanate margin being not marked by a dark transverse band (Fig. 26), where as in *A. inuncta*, both anterior as well as posterior margins of elytral explanate margin are marked (Fig. 28). Elytral colour is highly variable in *A. furcata*, from pale to red brown.

Material examined (30 specimens). **India: Kerala:** 11 ♂ 2 ♀ / Pampadumpara / 9° 47' 33.7"N 77° 99' 31"E/ 6.v.2019/ Amritha Hari Coll.; 2 ♂ 1 ♀ 2

sex un specified same data except date/ 4.vi.2019; 1 ♂ same data except date 29.v.2019; Vellayani 18 m msl (4 specimens) 2 ♂ / 8° 25' 47.5"N 76° 59' 8.3"E/ 8.i.2019/ Amritha Hari Coll.; 1 ♂ / 6.iv.2019/ A.P. Balan Coll.; 1 ♀ /2011/ Shameem K. M Coll.; Mattupetty (3 specimens) 1♂ 1 ♀ 1 unsexed / 10° 6' 43.9"N 77° 8' 12.7"E/ 2.vi.2019/ Amritha Hari coll.; Perumpadavom 15 m msl (3 specimens)/ 3 ♂ / 9° 49' 46.3"N 76° 31' 19"E/ 8.x.2019/ Amritha Hari Coll.; Nadukani pass 259 m msl 1 ♂/ 11° 23' 35.8"N 76° 21' 45.0"E/ 13.x.2012/ Prathapan K. D.& Shameem K. M. Coll.; ICRI Campus Myladumpara 1 ♂ / 22.iv.2013/ Prathapan K D Coll.; Janakikkadu 1 ♂ / 27.xi.2013/ Shameem K. M Coll.; Panamaram msl 1 ♂/ 11° 42' 26.1"N 76° 05' 44.2"E / 8.xi.2012/ M Nassar and Renjith Coll.; Arippa forest 236 m msl 1 ♂ / 08° 50' 11.0"N 77° 01' 46.1"E / 13.xi.2014 / Shameem K. M. Coll.; 1 ♂ Kuttiyadi , Janakikkadu / 14.iii.2013/ Shameem K. M. Coll.

Host plants. *Ipomoea batatas*, *I. aquatica*, *I. cairica*, *I. digitata* (Gressitt, 1952); *Calystegia* sp. (Takizawa, 1978); *Argyreia nervosa* (Takizawa, 1985); *Argyreia hookeri*, *Ipomoea excavata*, *I. hederacea*, *I. sp.*, *Lettsomia elliptica*, *Merremia umbellata* (Ghate *et al.*, 2003); *Convolvulus nummularis*, *Evolvulus alsinoides*, , *I. batatas*, *I. coccinea*, *I. fistulosa*, *I. hgispida*, *I. indica*, *I. obscura*, *I. palmata*, *I. pestigridis*, *I. pilosa*, *I. violacea*, *Merremia emarginata*, *M. tridentata* (Kalaichelvan *et al.*, 2004)

Distribution. Cambodia; China; India; Indonesia; Malaysia; Myanmar; Nepal; Sri Lanka; Sumatra; Taiwan; Thailand; Vietnam (Borowiec and Swietojanska, 2020). Recorded from Karnataka, Kerala and Tamil Nadu by Nair (1975).

4.1.1.2 *Aspidimorpha fuscopunctata* Boheman, 1854

(Fig. 27)

Aspidimorpha rubrodorsata Boheman, 1854

Diagnosis. Yellow to red yellow. Body length 5.50–5.80 mm, width 4.30–5.16 mm. Elytra without any markings. Pronotum impunctate, uniformly yellow, shiny, smooth. Disc of elytra with punctures in ill-defined rows, dorsal conical hump present. Elytral explanate margins unmarked, impunctate, semi-transparent with honeycomb-like structure.

Description. Length of body 5.50–5.80 mm, width 4.30–5.16 mm; length of pronotum 1.80–1.90 mm, width 3.70–3.90 mm; length/ width ratio of body 1.14, length/ width ratio of pronotum 0.48.

General colour red yellow; dorsum without markings. Body moderately convex with a dorsal conical hump behind scutellum. Head, appendages, body, antennae except, distal two antennomeres, uniform yellow to red brown. Scutellum impunctate, smooth, uniformly yellow, narrowly lined with red along apical margins.

Eyes elliptical, large. Gena distinct. Clypeus wider than long; clypeal grooves absent. Labrum anteriorly emarginated.

Ratio of length of antennomeres I–XI 1: 0.46: 0.53: 0.69: 0.69: 0.38: 0.53: 0.62: 0.62: 0.69: 1.46.

Pronotum impunctate, uniformly yellow; sloping from posterior to anterior; broader than long. Anterior margin strongly curved, lateral margins rounded. Explanate margins and portion above head with honeycomb-like structure.

Suture narrowly lined with red. Elytral disc convex with top of convexity at dorsal conical hump; slope and sides declining gradually. Humeri raised, protruding laterally. Elytral disc yellow without any markings. Elytral punctures fine, shallow with red tinge; approximately in 9 ill-defined rows; interstriae not prominent. Costae present. Elytral explanate margins unmarked, impunctate, semi-transparent with honeycomb-like structure. Elytral epipleura without setae.

Prosternal collar shorter than distance between anterior of prosternum to forecoxal cavity. Narrowest width of prosternal process almost equal to length of foretrochanter. Posterior portion of prosternal process convex.

Tarsi moderately slim; last tarsomere extending upto apical margin of marginal setae of third tarsomere. Claws separated by a distance subequal to length of a claw.

Remarks. *Aspidimorpha fuscopunctata* is similar to *A. inuncta* and *A. furcata* in having the dorsal hump and similar coloration. However, *A. fuscopunctata* can be easily separated from both *A. inuncta* and *A. furcata* since the elytral explanate margin is unmarked both anteriorly and posteriorly, while the anterior margin is invariably marked in both of them.

Material examined. India: Kerala (2 specimens): 1 specimen / unsexed / Vellayani 18m msl /6.vi.2010/ A.P. Balan Coll.; 1 specimen / unsexed/ Vellayani 18m msl /8° 25' 47.5"N 76° 59' 8.3"E/ 22.viii.2016/ S R Hiremath Coll.

Host plants. Convolvulaceae: *Ipomoea* sp. (Takizawa, 1980); *Argyreia sericea* (Ghate *et al.*, 2003).

Distribution. China; India (Kerala, Sikkim, Tamil Nadu); Indonesia; Laos; Malaysia; Myanmar; Nepal; the Philippines; Thailand; Vietnam (Borowiec and Swietojanska, 2020).

4.1.1.3 *Aspidomorpha ? inuncta* Boheman, 1854

(Fig. 28)

Aspidomorpha spaethi Maulik, 1918

Diagnosis. Body length 6.80–8.20 mm, width 5.90–6.80 mm. Elytral disc yellow to red yellow without any markings; smooth and shiny; with a prominent dorsal conical hump. Elytral explanate margin with anterior as well as posterior corners marked; punctures and honeycomb-like structure present; margins slightly reflexed.

Description. Body length 6.8–8.2 mm, width 5.9–6.8 mm; length of pronotum 2.1–2.3 mm, width 4.4–4.9 mm; length/width ratio of body 1.1–1.2, length /width ratio of pronotum 0.48– 0.46.

Yellow to red brown insects with a prominent dorsal conical hump. Laterally, anterior as well as posterior corners of elytral explanate margins marked with black. Scutellum triangular, impunctate, uniform yellow to red.

Eyes large. Gena distinct. Clypeus as broad as long with a longitudinal depression. Clypeal grooves not distinct. Labrum emarginated.

Ratio of length of antennomeres I-XI 1: 0.35: 1: 0.5: 0.5: 0.35: 0.55: 0.5: 0.5: 0.5: 0.95.

Pronotum impunctate, uniformly yellow, pronotal disc wider than long with maximum width across middle; sloping gradually from posterior to anterior; shape of anterior margin obtusely curved medially, lined with red; lateral margin rounded. Pronotal disc smooth, shiny; portion above head with honeycomb-like structure.

Explanate margins pale yellow, semi-transparent, with well developed honeycomb-like structure.

Length of prosternal collar shorter than distance between anterior margin of prosternal process to forecoxal cavity. Prosternal collar at its narrowest width subequal to length of foretrochanter. Posterior region of prosternal process with elliptical region with puncture like markings within it; posterior margin of process convex.

Elytral disc convex with top of convexity at dorsal conical hump. Disc without any markings; smooth and shiny. Anterior margin bisinuate. Humeri bulged, protruding laterally. Elytral punctures shallow in ill-defined rows. Distance between adjacent punctures and between rows variable. Suture at its extreme apex dark in some specimens. Explanate margin with anterior and posterior corners with dark brown marking. Explanate margin with puncture and honeycomb-like structure, margins slightly reflexed. Elytral epipleura without setae.

Last tarsomere extending beyond marginal setae of third tarsomere. Claws separated by a distance greater than length of claw.

Remarks. *Aspidomorpha ?inuncta* resembles *A. furcata* due to similar coloration and presence of dorsal hump. However, *A. inuncta* can be separated from *A. furcata* easily as both anterior as well as posterior angles of elytral explanate margin are marked (only anterior angles are marked in *A. furcata*).

Material examined (1 specimen). **India: Kerala:** Malabar wild life sanctuary, Kakkayam/ 22.x.2017/ Shameem K.M. Coll.

Host plants. Convolvulaceae: *Ipomoea carnea*, *Rivea hypocrateriformis* (Ghate *et al.*, 2003).

Distribution. India (Kerala, Tamil Nadu) (Borowiec and Swietojanska, 2020).

4.1.1.4 *Aspidomorpha miliaris* (Fabricius, 1775)

(Figs 15, 19, 29)

Cassida miliaris Fabricius, 1775

Cassida quatuordecim-punctata Oliver, 1808

Aspidomorpha celebensis Blanchard, 1853

Aspidomorpha amplissima Boheman, 1854

Diagnosis. Body length 5.40–16.30 mm, width 10.70–12.32 mm. Ground colour yellow with variable markings, 7–12 markings on each elytron, three near to suture, with last spot just beyond middle; 5 spots in a line; 2–4 spots near lateral margin. Size and shapes of spots variable, elliptical to circular. Explanate margins of elytra with a dark stripe each anteriorly and posteriorly. Extreme apex of suture black. Pronotum without any markings or rarely with a black spot. Explanate margin at its widest point as wide as elytral disc. Dorsal conical hump absent.

Description. Body length 10.70–11.62 mm, width 10.70–12.32 mm; length of pronotum 3.00–3.90 mm, width 7.30–8.30 mm; length/ width ratio of body 0.94; length/ width ratio of pronotum 0.41.

General body colour yellow brown; elytral markings variable. Pronotum unmarked, rarely with a black spot in middle. Scutellum uniformly yellow, anterior margin of elytra, suture apically black or rarely lighter. Explanate margin with a pair of black elongate marking each anteriorly and posteriorly. In some specimens one or more marginal markings absent. Each elytron with 7–12 black spots, excluding black stripes on explanate margin; Three near to suture, with last spot just beyond middle; 5 spots in a line starting from humeri converging towards apex of suture; 2 to 4 spots near to lateral margin. Scutellum triangular, impunctate, gently convex. Size and shape of spots variable. Last 2 or 3 antennomeres piceous; rest of antennae, legs yellow. Ventrites variable in colour from yellow to piceous.

Gena distinct. Clypeus as wide as long; clypeal grooves absent. Anterior margin of labrum deeply emarginated.

Ratio of length of antennomeres I–XI 1: 0.5: 1.05: 0.75: 0.75: 0.55: 0.75: 0.55: 0.6: 0.6: 1.

Pronotum almost twice as wide as long, sparsely minutely punctate. Anterior margin obtusely convex to indistinctly concave in middle; lateral margins nearly at right angle. Pronotal disc sloping from posterior to anterior. Explanate margin impunctate, with honeycomb-like structure.

Either side of suture with an elongate depression posterior to scutellum. Anterior elytral margin sinuate, crenate; narrowly black, which thickens laterally. Elytral disc convex, strongly declining; top of convexity at post-scutellar area. Dorsal conical hump absent. Humeri well developed with depression mesally. Each elytron

with 10 regular rows of punctures. Distance between adjacent rows three to five times distance between adjacent punctures in a row. Second and third elytral spots near suture contain a few more punctures. Interstriae three, four and five raised. Surface of elytra shiny. Explanate margin of elytra impunctate with honeycomb-like structure; widest point as wide as elytral disc. Elytral epipleura without setae.

Prosternal collar shorter than half distance between anterior margin of prosternum to forecoxal cavity. Prosternal process gently depressed along middle. Minimum width of prosternal process less than length of foretrochanter.

Tarsi broad; last tarsomere extends beyond apex of marginal setae of third tarsomere. Claws separated by a distance subequal to length of a claw.

Remarks. *Aspidimorpha miliaris* and *A. sanctaecrucis* are the largest members of the genus in Kerala. However, *A. miliaris* can be easily separated from all other members of the genus in Kerala by the absence of the dorsal hump (Fig. 25). *Aspidimorpha miliaris* is highly variable in color and elytral markings.

Material examined. India (6 specimens): **Kerala:** 2 ♂ Vellayani 18m msl /8° 25' 47.5"N 76° 59' 8.3"E/11.vii.2018/Amritha Hari Coll.; 2 ♀ Panamaram 11° 42' 26.1"N 76° 05' 44.2"E / 8.xi.2012/ M. Nasser & Ranjith Coll.; 1♂ same locality; 1♂ Shendurney WLS, Rose Mala 08° 51' 49.5"N 77° 10' 54"E / 18.11.2011. Shameem K. M. Coll.

Host plants. *Calonyction bonanox*, *Convolvulus* sp., *Ipomoea triloba*, *I. pescaprae*, *I. batatas* (Gressitt, 1952); Nair (1975) recorded this as a pest of sweet potato in Kerala; *Ipomoea carnea*, *I. aquatica* (Ramesh, 1996); *Ipomoea carnea*, *I. sp* (Ghate *et al.*, 2003); *Ipomoea fistulosa*, *I. palmata*, *I. violacea* (Kalaichelvan *et al.*, 2004); *Ipomoea carneafistulosa* (Sultan *et al.*, 2008).

Distribution. Bangladesh; China; Hongkong; India; Indonesia; Laos; Malaysia; Myanmar; Nepal; New Guinea; Pakistan; Philippines; Thailand; Vietnam (Borowiec and Swietojanska, 2020).

4.1.1.5 *Aspidimorpha sanctaecrucis* (Fabricius, 1792)

(Fig. 30)

Cassida st. cruces Fabricius, 1792

Cassida jamaisensis Oliver, 1790

Aspidomorpha bajula Boheman, 1854

Aspidomorpha fraternal Baly, 1863

Aspidomorpha orientalis Gemminger and Harold, 1876

Diagnosis. Body length 15.60–16.30 mm, width 14.30–14.60 mm. Elytra uniform yellow to red brown to brown; lateral anterior and posterior corners of explanate margin with dark bands originally on its ventral side, visible dorsally. On each elytron behind scutellum, a depression raised along centre with prominently raised margins; dorsal conical hump present. Elytral punctures evident, approximately in 9 rows. Explanate margins very broad.

Description. Body length 15.60–16.30 mm, width 14.30–14.60 mm; length of pronotum 4.00–4.30 mm, width 9.50–9.70 mm; length/width ratio of body 1.09, length width ratio of pronotum 0.42.

General colour yellow to brown; head and body yellow or red brown; legs, antennae except last two antennomeres uniformly yellow. Mesosternal ventrite with an elliptical transverse black marking basally in a few specimens. Elytra uniform yellow to red brown to brown; lateral anterior and posterior corners of explanate margin with dark bands originally on its ventral side, visible dorsally.

Eyes elliptical. Gena distinct. Clypeal plate depressed medially; clypeal grooves fine throughout length, visible, with a row of setae in some specimens. Labrum emarginated.

Ratio of length of antennomeres 1-XI 1: 0.33: 1.06: 0.66: 0.66: 0.5: 0.66: 0.53: 0.56: 0.26: 0.9.

Pronotum yellow brown, region above head black in some specimens. Pronotum much broader than long with maximum width across middle; sloping from posterior to anterior. Shape of anterior margin variable, obtusely curved to slightly emarginate in middle; rounded at lateral corners. Pronotal disc smooth and shiny; portion above head with honeycomb-like structure in a few or with some random punctures in some examples. Explanate margin semitransparent with well developed honeycomb-like structure. Explanate margin finely punctate.

Length of prosternal collar less than half the distance between collar and forecoxal cavity. Prosternal process in its narrowest point is subequal to length of

foretrochanter. Prosternal process sparsely setose. Distal widest part of prosternal process with an elliptical shaped transverse depression; posterior margin convex.

In some specimens, humeri bulged, protruded forward. On each elytron behind scutellum, a depression raised along centre with prominently raised margins. Elytral disc convex with top of convexity at dorsal conical hump. Elytral punctures highly variable, approximately in 9 rows; distance between two rows variable, almost 2-5 times distance between adjacent punctures within a row. Second and third interstriae raised. Anterior elytral margins narrowly lined with black. Elytral disc shiny. Explanate margins semi-transparent, pale yellow with honeycomb-like structure with scattered punctures. Elytral epipleura with minute setae.

Tarsi thick, last tarsomere extending beyond apex of third. Claws separated by a distance greater than length of a claw.

Remarks. *Aspidimorpha sanctaecrucis* has base of elytra between humerus and scutellum with a prominent ridge and longitudinal depression, which is unique compared to all other species in Kerala. Resembles *A. miliaris* by size as well as anterior and posterior angles of the elytral explanate margin are marked. However, it can be readily separated from *A. miliaris* by the presence of the prominent dorsal hump (Fig. 30), which is absent in *A. miliaris* (Fig. 29). Explanate margin of the elytra are broader than the width of the elytral disc. Body length exceeding 15 mm, this is the largest species of *Aspidimorpha* in Kerala.

Material examined. India (5 specimens): **Kerala:** 1 ♀ 4 ♂ : Silent valley National park Sairandhri/ 1030 m/ 11° 5' 35.8"N 76° 26' 47.7"E /15.xi.2011/ Prathapan K. D.& Shameem K. M. Coll.

Host plants. *Ipomoea* sp. *Ipomoea carnea*, *Argyria hookeri*, *Rivea hypocrateriformis*, *R. ornate* (Ghate *et al.*, 2003) *Ipomoea aquatica*, *I. batatus*, *I. fistulosa*, *I. palmate*, *I. violacea* (Kalaichelvan *et al.*, 2004)

Distribution. Bangladesh; Bhutan; Cambodia; Ceylon; China; India (Karnataka, Kerala); Indonesia; Myanmar; Laos; Malaysia; Nepal; Pakistan ; Philippines; Thailand; Vietnam. (Maulik, 1919; Borowiec and Swietojanska, 2020).

Key to the species of *Aspidimorpha* of Kerala

1. Posterior to scutellum, the dorsal surface is not raised into a pointed, conical hump *A. miliaris* (Fabricius, 1775)
- Posterior to scutellum, the dorsal surface is raised into a pointed, conical hump 2
- 2(1) Neither anterior nor posterior angles of elytral explanate margin with a dark transverse band *A. fuscopunctata* Boheman, 1854
- Both anterior and posterior angles or at least anterior angle of elytral explanate margin with a dark transverse band 3
- 3(2) Anterior angles of elytral explanate margins with a dark transverse band; posterior angles without dark band *A. furcata* (Thunberg, 1789)
- Both anterior and posterior angles of elytral explanate margins with a dark transverse band 4
- 4(3) Length 6.5 – 8.5 mm; base of elytra between humerus and scutellum without prominent ridge or depression *A. inuncta* Boheman, 1854
- Length 15.5 – 16.5 mm; base of elytra between humerus and scutellum with a prominent ridge and longitudinal depression *A. sanctaecrucis* (Fabricius, 1792)

4.1.2 Genus *Lacoptera* Boheman, 1855

Diagnosis. Body length 7.70–10.32 mm, width 4.77–8.39 mm. In dorsal view, body triangular, narrowed posteriorly, head completely concealed under explanate margin of prothorax. Antennae long and slender; basal six antennomeres thin, smooth, shiny; apical five antennomeres thick, hairy, last few piceous; first antennomere thick, second small rounded, third much longer than second, length of IV-VI decreasing gradually. Tarsal claw with comb-like structure on inner as well as outer sides, at least outer with indentations. Pronotum elliptical, basal margin bisinuate; narrowly lined with black. Base of elytra broader than pronotum; anterior elytral margin, bisinuate, crenate, narrowly lined with black.

4.1.2.1 *Laccoptera nepalensis* Boheman, 1855

(Figs. 20, 31)

Laccoptera (Laccopteroidea) nepalensis Boheman, 1855

Cassida quadrimaculata Thunberg, 1789

Laccoptera quatuordecimmaculata Thunberg, 1789

Laccoptera quadrimaculata Boheman, 1856

Laccoptera bohemani Weise, 1910

Laccoptera quadrimaculata bohemani Spaeth 1914

Laccoptera thunbergi Spaeth, 1914

Diagnosis. Body length 7.70–9.16 mm, width 6.5–7.62 mm. Red yellow to deep red. Pronotum basally with two dark spots. Elytra yellow to red brown with variable black markings; explanate margin of elytra at base with a patch of same colour as that of disc and bordered behind with black, rest of margin paler and hyaline with a dark band on lateral posterior corner. Dorsal conical hump present, marked with black. Suture at extreme apex black, absent in a few.

Description. Body length 7.70–9.16 mm, width 6.5–7.62 mm; length of pronotum 1.92–2.61 mm, width 6.5–7.62 mm; length/width ratio of body 1.18; length/width ratio of pronotum 0.29.

Red yellow to deep red. Pronotum with two dark spots basally. Elytra yellow to red brown; elytral markings variable. Explanate margin of elytra at base with a patch of same colour as that of disc, bordered behind with black, rest of margin paler and hyaline with a dark band on lateral posterior corner. Elytral markings variable; each elytron with three black spots, with a common dark spot on dorsal coical hump, two lateral transverse bands, of which posterior transverse band extends to explanate margin; some specimens with indistinct or no markings; some with neumerous fuscous shadings. Scutellum impunctate, yellow to red. Head, legs, antennae except last 1-2 antennomeres uniformly yellow to red; mesosternum with a black transverse marking basally; abdominal ventrites with black fuscous shadings.

Eyes elliptical large; gena not distinct. Clypeus longer than wide; clypeal margins with setae in some; anterior portion of clypeus triangular, raised. Labrum emarginated.

Ratio of length of antennomeres I-XI 1: 0.38: 0.95: 0.80: 0.76: 0.61: 0.61: 0.61: 0.52: 0.52: 0.95.

Anterior margin of pronotum convex medially, lateral margins obtuse, basal margin bisinuate, narrowly lined with black and a row of marginal setae. Pronotum broader than long with maximum width across middle. Pronotal surface wrinkled, portion above head triangular flap-like, raised. Explanate margin as well as portion above head with honeycomb-like structure; honeycomb clearly visible to opaque. Very few specimens with its anterior margin with a characteristic v-shaped cut.

Suture at extreme apex dark to rarely unpigmented in some. Elytral disc convex, strongly declining; top of convexity at dorsal conical hump. Anterior margin of elytra with a heart shaped slightly depressed region, demarcated by raised second interstriae, posterior margins of scutellum as well as dorsal conical hump. Elytral punctures deep, regular in 9-10 rows, interstriae 2, 4 prominently raised; transverse interstriae present; distance between rows, punctures within a row variable; marginal rows closely placed to each other than those on disc. Humeri bulged. Explanate margin punctate, with honeycomb-like structure. Elytral epipleura without setae.

Prosternal collar not distinct. Prosternal process in its narrowest point wider than length of foretrochanter; process with a longitudinal depression medially; posteriorly convex.

Last tarsomere extending beyond third. Claws separated by a distance more than length of a claw.

Remarks. *Laccoptera nepalensis* can be differentiated from the other four species by the explanate margin of elytra at base with a patch of same colour as that of disc, bordered behind with black, while rest of the margin is paler and hyaline with a dark band on lateral posterior corner. It can be separated from *L. quatordecimnotata* and *L. tredecimpunctata* by three black spots on each elytral disc (six black spots on each elytral disc in both *L. quatordecimnotata* and *L. tredecimpunctata*).

Material examined. **India** (63 specimens): **Kerala:** (21 specimens) : Pampadumpara / 9° 47' 33.7"N 77° 99' 31"E/ 4.vi.2019/ Amritha Hari Coll.; Pampadumpara same data except date, 29.i.2019; 3 specimens: Pampadumpara 28 m msl / 9° 47' 33.7"N 77° 99' 31"E/ 4.vi.2019/ Amritha Hari Coll.; 7 specimens : Nelliampathi 10° 30' 43.2"N 76° 54' 43.2"E/ 23.v.2019/ Sangamesh R. H. Coll.;6

specimens: Mattupetty 10° 6' 43.2"N 77° 8' 12.7"E/ i.ii.2019/ Amritha Hari Coll.; 1 specimen: Vellayani 18m / 8° 25' 47.5"N 76° 59' 8.3"E/10.xii.2018/ Amritha Hari coll.; Vellayani 18 m / 8° 25' 47.5"N 76° 59' 8.3"E/21.v.2013/ Shameem K. M. Coll.; Vellayani 18 m 8° 25' 47.5"N 76° 59' 8.3"E 11.viii.2016/ Sangamesh R. H. Coll.;Kerala : Agasthyamala 1022 m/8° 37' 04.5"N 77° 13' 46.7"E/ 24.iii.2014/ Prathapan K. D. &Shameem K. M. Coll.;Kannur : Biodiversity park Sreekandapuram: 12° 01' 60"N 75° 29' 59.99"E/ 19.vii.2016/ Sangamesh R. H and A. K.S Coll.; Munnar /24.xi.2002/ Prathapan K. D. Coll.; Calicut University Campus/26.xi.2013/ Shameem K Coll.; (2 specimens) Munnar, Hydrel park 1464m 10° 04' 08.5"N 77° 03' 47.3"E/23.iv.2013/ Prathapan K. D. Coll.; ICRI Campus, Myladumpara/ 22.iv.2013/ Prathapan K. D. Coll.; Pampadumpara/ 24.x.2015/ Prathapan K. D. Coll.;Munnar/ 1.i.2002/ Prathapan K. D. Coll.; Munnar/ 13.viii.2011/ Prathapan K. D. Coll.; Kavilumpara, Chappanthottam / 4.viii.2017/ Prathapan K. D. Coll.;Agasthyamala , Athirumala 1022m / 08° 37' 04.5"N 77° 13' 46.7"E/ 24.iii.2014/ Prathapan K. D. and Shameem K.M. Coll.;Wayanad, Banasurasagar dam/ 7.ix.2014/Shameem K M. Coll.;Kavilumpara, Chappanthttam/ 4.viii.2017/ Prathapan K.D. Coll.; Mazhuvannur 754 m/ 11° 43' 45"N 75° 59' 15"E/21.x.2018/ Viswajyothi K. Coll.

Host plants. *Calystegia soldanella* (Chujo and Kimoto, 1961); *Ipomoea indica* (Takizawa, 1975); *Ipomoea* sp. (Takizawa, 1978); *Ipomoea carnea* ssp. *fistulosa*, *I. nil* (Sultan *et al.*, 2008).

Distribution. China, South and East China, India (Andaman Islands, 'Cochin State', 'Madras', Kerala); Indonesia; Japan; Laos; Malaysia; Myanmar, Nepal; Pakistan; Singapore; Thailand; Vietnam (Borowiec and Swietojanska, 2020).

4.1.2.2 *Laccoptera quatuordecimnotata* Boheman, 1855

(Fig. 32)

Laccoptera (Laccopteroidea) quatuordecimnotata Boheman, 1855

Laccoptera quatordecimpunctata Medvedev, 1957

Diagnosis. Body length 9.77–10.32 mm. Ground colour pale yellow to dark red. Each elytron with six black spots; anteriorly, one spot on humeri; two semi-circular spots just behind scutellum along suture, together forms a circular spot; 2 spots medially, anterior larger spot and posterior small spot near apex; two semi-

circular spots laterally spreads to explanate margins forming two bands. Suture on its extreme apex black. Mesosternum with a black transverse patch.

Description. Body length 9.77–10.32 mm, width 5.77–8.39 mm; length of pronotum 2.31–2.69, width 5.85–8.16 mm; length/width ratio of body 1.69, length/width ratio of pronotum 0.39.

Body highly convex; pale yellow to dark red. Pronotum with two circular spots along horizontal midline. Each elytron with six black spots; anteriorly, one spot on humeri; two semi-circular spots just behind scutellum along suture, together forms a circular spot; 2 spots medially, anterior larger spot and posterior small spot near apex; two semi-circular spots laterally spreads to explanate margins forming two bands. Suture on its extreme apex, black. Head, legs and body yellow to red. Mesosternum with a black transverse patch. Last few antennomeres piceous.

Eyes large; gena not distinct. Clypeus bulged anteriorly; clypeal groove distinct. Labrum emarginated.

Ratio of length of antennomeres I-XI 1: 0.4: 1.2: 0.92: 0.8: 0.72: 0.8: 0.76: 0.8: 0.84: 1.4.

Anterior margin of pronotum highly convex at its centre; lateral margin nearly at 90 degree; basal margin with a row of marginal setae. Pronotum twice as wide as long; with shallow punctures in some. Explanate margins as well as the portion above head with honeycomb-like structure, in some specimens explanate margins opaque, honeycomb not clearly visible; pronotum sloping from posterior to anterior.

Scutellum impunctate. Elytral disc highly convex with top of convexity at post-scutellar area, slope declining gradually to sides. Anterior of elytra behind scutellum, interstriae along with raised transverse striae forms a heart shaped region with fine punctures inside it. Punctures deep, in well-defined 9 rows; interstriae 2 and 4 raised; punctures wider than long, rectangular shaped. Distance between punctures within a row equals distance between adjacent rows. Explanate margins with punctuations, some with honeycomb-like structure. Elytral epipleura without setae.

Prosternal collar not distinct; prosternal groove with a longitudinal depression mesally. Minimum width of prosternal process is subequal to length of foretrochanter; posterior portion convex.

Tarsi with last tarsomere extending just beyond third tarsomere. Claws separated by a distance greater than length of a claw.

Remarks. *Lacoptera quatuordecimnotata* resembles *L. tredecimpunctata* in having six spots on each elytron. However, apex of the suture is black and the spots on the explanate margin extend to the elytral margin in *L. quatuordecimnotata*.

Material examined. India (2 specimens) : **Kerala:** Silent Valley National Park, Sairandhri 1030 m/ 11° 03' 53.3"N 76° 26' 47.7"E/15.xi.2011/ Prathapan K. D. & Shameem K. M. Coll.; Silent Valley National Park, Mukkali 557 m/ 11° 03' 53.3"N 76° 32' 10.9 "E/14.xi.2011/ Prathapan K. D. and Shameem K. M. Coll.

Host plants. Unknown.

Distribution: India (Jawalagiri, Nilgiri Hills, North Salem, Wayanad) (Borowiec and Swietojanska, 2020).

4.1.2.3 *Lacoptera tredecimpunctata* (Fabricius, 1801)

(Fig. 33)

Cassida 13 punctata Fabricius, 1801

Aspidomorpha philippinensis Blanchard, 1853

Lacoptera philippinensis Boheman, 1855

Lacoptera indica Gemminger and Harold, 1876

Lacoptera 4- punctate Gemminger and Harold, 1876

Lacoptera 3- punctata Gemminger and Harold, 1876

Cassida miliaris Spaeth, 1914

Diagnosis. Body length 8.70mm, width 4.77mm. Pronotum with two circular spots basally. Each elytron with six black spots; anteriorly, one spot on humeri; two semi-circular spots just behind scutellum along suture, together forms a circular hump; 2 spots medially, anterior larger spot and posterior small spot near apex; two spots laterally, which slightly spreads to explanate margins. Scutellum impunctate, uniformly yellow.

Description. Body length 8.70 mm, width 4.77 mm; length of pronotum 2.5 mm, width 4.77 mm; length/width ratio of body 1.85, length/ width ratio of pronotum 0.53.

General body colour yellow; pronotum with two circular spots basally. Each elytron with six black spots; anteriorly, one spot on humeri; two semi-circular spots just behind scutellum along suture, together forms a circular spot at hump; 2 spots medially, anterior larger spot and posterior small spot near apex; two spots laterally, which slightly spreads to explanate margins. Scutellum impunctate, uniformly yellow. Head, body and legs uniformly yellow.

Eyes large, elliptical; gena not distinct. Clypeus raised anteriorly, forming a triangle.

Length/width ratio of antennomeres I-XI 1: .05: 0.94: 0.83: 0.77: 0.61: 0.55: 0.66: 0.72: 0.72: 1.38.

Pronotum oval in shape; uniformly yellow; anterior margin narrowly curved, lateral margins obtuse, more or less like a straight line; basal margin bisinuate, narrowly lined with black. Pronotum almost twice as wide as long, pronotal disc sloping from posterior to anterior smooth with some punctures basally. Explanate margin as well as portion above head with well developed honeycomb-like structure.

Elytra uniformly yellow, anterior margin of elytra crenulated, lined with black, antero-lateral corners rounded. Elytral punctures in regular well-defined 10 rows, interstriae 1, 2, 4, 6 raised, distance between two adjacent rows twice distance between two adjacent punctures within a row; transverse interstriae prominent. Disc of elytra convex with top of convexity at dorsal conical hump. Explanate margin with some random punctures. Elytral epipleura without setae.

Prosternal collar narrow, prosternal process with a longitudinal depression mesally, narrowest width of prosternal process subequal to the length of foretrochanter, posterior portion of the process convex.

Tarsi with last tarsomere extending up to third, except marginal setae. Claws separated by a distance greater than length of a claw.

Remarks. *Laccoptera tredecimpunctata* closely resembles *L. quatuordecimnotata* in general colour and elytral markings. In *L. quatuordecimnotata*, the sutural apex is black, while it is unmarked in *L. tredecimpunctata*. However, the

black elytral apex in *L. quatuordecimnotata* was found to be an unreliable character, as some specimens had unmarked elytral apex.

Material examined. India : Kerala (1 specimen) Silent Valley National Park, Mukkali 557 m / 11° 03' 53.3"N 76° 32' 10.9"E/ 14.xi.2011/ Prathapan K. D. and Shameem K. M. Coll.

Host plants. Unknown.

Distribution: China; India (Kerala), Indonesia; Philippines; Thailand (Borowiec and Swietojanska, 2020).

4.1.2.4 *Laccoptera (Sindia) sulcata* (Oliver, 1808)

Sindia sulcata Borowiec, 1996

Sindia clathrata Weise, 1897

Material examined. Nil.

Host plants. Unknown.

Distribution: India (Bengal: Calcutta, Bombay: Nasik, Kerala: Madras) (Maulik, 1919).

Key to the species of *Laccoptera* of Kerala

1. Length 11.5 – 14 mm; red brown with black markings; pronotum with nine black spots; elytra with deep quadrate pits with punctures inside *L. sulcata* (Oliver, 1808)
 - Length 7.5 – 10.5 mm; straw brown to light brown without red tint, with black markings; pronotum with two black spots; elytra with deep punctures, no quadrate pits with punctures inside 2
 - 2(1) Elytral suture without an apical black spot *L. tredecimpunctata* (Fabricius, 1801)
 - Elytral suture with an apical black spot 3
 - 3(2) Explanate margin of elytra with a distinctly lighter semicircular area in middle, bordered mesally by two black patches, the semicircular area being distinctly lighter than disc of elytra; length 7.5- 9.5 mm *L. nepalensis* Boheman, 1855

- Explanate margin of elytra entirely concolorous with disc of elytra; length 9.7-10.5 mm *L. gutuordecimnotata* Boheman, 1855

4.1.3 Genus *Nilgiraspis* Spaeth, 1932

Diagnosis. Body round; length of body 5.30–5.70 mm, width 4.50–5.00 mm. In dorsal view, head not visible, concealed under explanate margin of pronotum. Tarsal claws bearing a comb-like structure at the base. Antenna long; first 5 antennomeres thin, last 6 thick and hairy; second antennomere shortest, third longer than second, shorter than first; last four-antennomeres piceous. Four basal antennomeres smooth and glabrous.

4.1.3.1 *Nilgiraspis andrewesi* (Spaeth, 1914)

(Figs. 17, 30)

Aspidomorpha andrewesi Spaeth, 1914

Diagnosis. Body rounded; length of body 5.30–5.70 mm. Elytra dark brown with a pale yellow transverse band emerging laterally, obliquely passing up to middle of elytra, sometimes extends up to suture; anterior mid elytral disc with a yellow heart shaped region with punctures in it. Elytral explanate margin with lateral anterior as well as posterior corners banded with black.

Description. Body rounded; length of body 5.30–5.70 mm, width 4.50–5.00 mm; length of pronotum 1.40–1.60 mm, width of pronotum 3.10–3.70 mm; length/width ratio of body 1.17; length/width ratio of pronotum 0.45.

Elytra dark brown with a pale yellow transverse band emerging laterally, obliquely passing up to the middle of elytra, sometimes extends up to suture; anterior mid elytral disc with yellow heart shaped region with punctures in it. Elytral explanate margin with lateral anterior as well as posterior corners banded with black. Head, thorax, abdomen and legs uniformly yellow; in a few, abdomen shaded with black.

Eyes oval, gena not distinct. Clypeus longer than wide; clypeal grooves narrow, visible throughout. Labrum emarginated.

Ratio of length of antennomeres I-XI 1: 0.46: 0.66: 0.66: 0.8: 0.66: 0.66: 0.66: 0.73: 0.73: 0.8.

Pronotum impunctate, uniformly pale yellow or with two triangular black markings. Pronotum wider than long, sloping from posterior to anterior. Posterior margin curved, slightly drawn forward in middle, lateral margins rounded, basal margin bisinuate, narrowly lined with black, with a row of marginal setae. Pronotal disc smooth, shiny, portion above head and explanate margin with honeycomb-like structure.

Elytra costate, scutellum impunctate, uniformly yellow, suture lined with red. Elytral disc convex with top of convexity at dorsal conical hump; sides and slope decreasing gradually. Anterior elytral margin crenulated; lined with black. Elytral punctures bold, shallow, in approximately 9 rows; interstriae not prominent; some transverse striae present. Anterior as well as posterior margin of elytral explanate margin lined with black. Explanate margin impunctate with honeycomb-like structure. Surface of elytra shiny. Anterio-lateral corner of explanate margin sharp, humeri bulged. Elytral epipleura with setae. Explanate margin in its widest point less wider than elytral disc.

Prosternal collar narrow, prosternal process with a longitudinal depression mesally: process in its lowest width wider than foretrochanter; posterior portion convex.

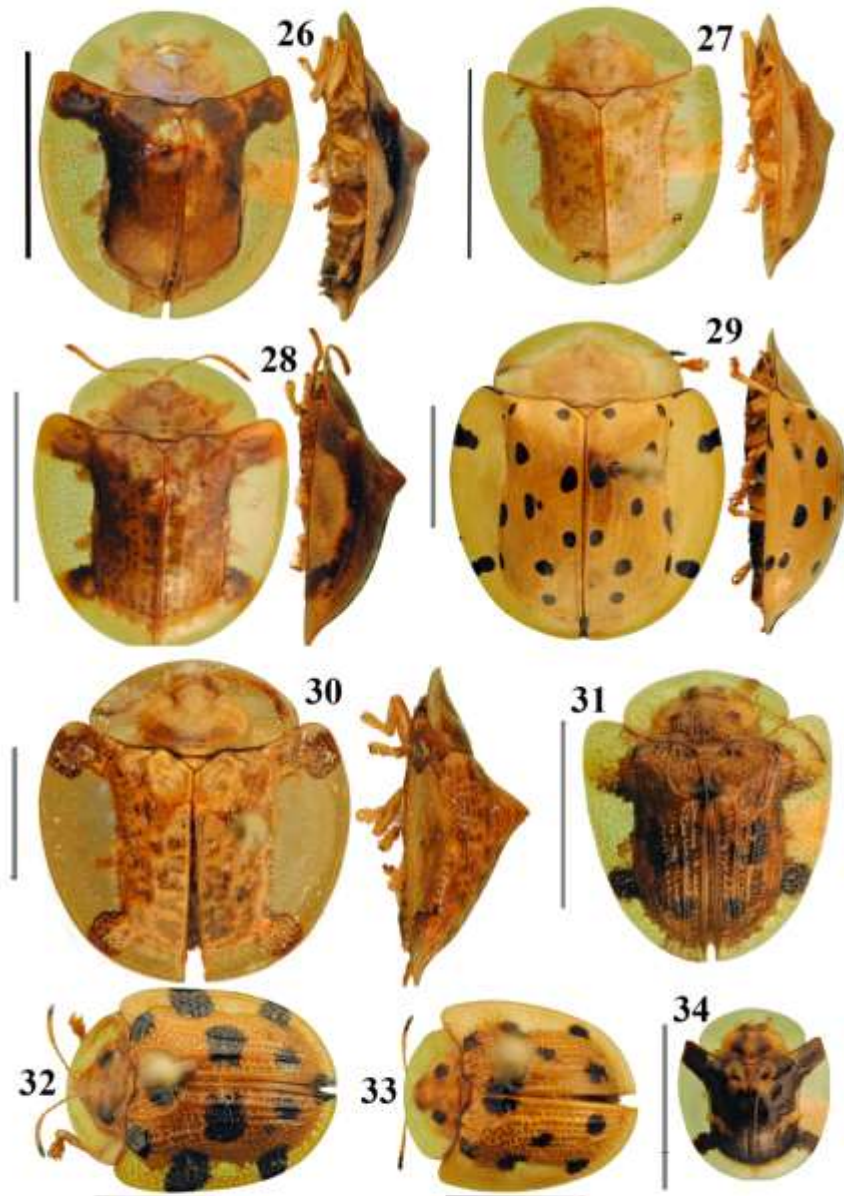
Last tarsomere extending well beyond third. Length of a claw sub-equal to distance separating claws.

Remarks. Occurs at higher elevations and feeds on *Ipomoea nil*.

Material examined. India (15 specimens): **Kerala** 5 ♀ 4 ♂ Pampadumpara / 9° 47' 33.7"N 77° 99' 31"E/ 6.v.2019/ Amritha Hari Coll.; Pampadumpara 1 ♂ 1 sex unspecified same data except date/ 4.vi.2019; Pampadumpara 1 sex unspecified , same data except date 29.v.2019; Pampadumpara 28 m msl 1 ♀ / 9° 47' 33.7"N 77° 99' 31"E/ 8.iii.2017/ Amritha Kumari S Coll.; Palakkad, Nelliampathi: 1 ♀ 5 ♂ 5 sex unspecified/ 30° 30' 43.2"N 76° 54' 43.2"E/ 23.v.2019/ S R H Coll.; Munnar: sex unspecified (1 specimen) / 23.iv.2012/ Prathapan K. D. Coll.

Distribution: China: Yunnan; Thailand; India (Karnataka, Kerala, Tamil Nadu).

Host plants. *Ipomoea nil*. **New record.**



Figs. 26 – 34. Species of Aspidimorphini, habiti. 26. *Aspidimorpha furcata*, dorsal & lateral; 27. *A. fuscopunctata*, dorsal & lateral; 28. *A. tinuncta*, dorsal & lateral; 29. *A. miliaris*, dorsal & lateral; 30. *A. sanctaecrucis*, dorsal & lateral; 31. *Laccoptera nepalensis*, dorsal 32. *L. quatuordecimnotata*, lateral; 33. *L. tredecimpunctata*, dorsal; 34. *Nilgiraspis andresvesei*, dorsal (scale bar = 0.5 cm).

4.2. TRIBE BASIPRIONOTINI

Diagnosis. Head visible externally in dorsal view, metepisternum not entirely fused with metepimeron, antennae short, tarsal claws simple.

4.2.1. Genus *Basiprionota* Chevrolat, 1836

Diagnosis. Large insects; body length 9.31–10.1 mm, width 5.39–7.31 mm; ovate in shape; posteriorly broadened and narrowed in front. Head visible externally in dorsal view, middle of pronotal explanate margin with a mesal depression. Light to dark yellow with dark patches on elytra as well as pronotum. Length of antennae is a secondary sexual character, longer in males, and shorter in females. Prothorax broader than long with bisinuate basal margin. Anterior margins of elytra bisinuate, serrate. Explanate margins of elytra broader at its middle, narrowed anteriorly as well as posteriorly.

Remarks. The genus is reported for the first time from Kerala.

4.2.1.1 *Basiprionota* sp. 1

Diagnosis. Large sized beetles, body length 9.31–10.01 mm, width 5.39–7.31 mm. Body ovate in shape, posteriorly expanded; anteriorly narrow. Head visible externally, through a mesal emargination of explanate margin of pronotum. Base of elytra slightly wider than pronotum. Each elytron with 2 black spots posteriorly; one near suture, other near lateral margin sometimes spreading to explanate margins. Head, legs, ventrites, pale yellow to slightly red. Last antennomere, except narrow basal rim, black, hairy, rest yellow, shiny.

Description. Length of body 9.31–10.01 mm, width 5.39–7.31 mm; length of pronotum 2.23–2.31 mm, width 5.46–5.62 mm; length / width ratio of body 1.72, length/ width ratio of pronotum 0.40.

Body elongate-oval; uniformly pale yellow to slightly red. Each elytron with two black spots posteriorly; one near suture, other near lateral margin sometimes spreading to explanate margins. Head, legs, ventrites, pale yellow to slightly red. Last antennomere, except narrow basal rim, black, hairy, rest yellow, shiny.

Portions of clypeus as well as mouthparts covered by prosternal collar. Clypeus with a longitudinal depression mesally, antennae arising from posterior part of clypeus.

Ratio of length of antennomeres I-XI 1: 0.6: 0.8: 0.9: 0.95: 0.8:0.9: 0.85: 0.8: 0.95: 1.4.

Pronotum smooth, shiny, impunctate; anterior margin with a semicircular emargination mesally, head visible externally; lateral margins rounded; basal margin trisinate, crenulated, narrowly lined with black, with marginal hairs. Disc convex sloping towards sides. Explanate margin impunctate, opaque, slightly depressed anteriorly.

Base of elytra slightly wider than pronotum. Anterior margin trisinate, crenulated, slightly lined with black. Elytral disc punctate, with raised interstriae. Punctures fine shallow, in ill-defined rows. Explanate margin opaque impunctate, in its widest point almost three-fourth the width of one elytron.

Length of prosternal collar almost twice distance between anterior margin of prosternum to forecoxal cavity. Prosternal process with its narrowest width subequal to length of foretrochanter. Prosternal process with a longitudinal depression mesally, posteriorly prosternum convex.

Last tarsomere extending upto third,. Marginal setae of third tarsomere extending well beyond claws. Length of a claw almost equal to distance between them.

Host plants. *Premna latifolia* Roxb. (Verbenaceae) (label data).

Remarks. This species does not agree with any of the described species, especially by elytral markings. More studies are required to establish its exact species status.

Material examined. India: Kerala (2 specimens) Calicut Univ. Botanical Garden/23.vi.2016 / Shameem K. M. Coll. / Ex *Premna latifolia*.

Distribution. India (Kerala).

4.2.2 Genus *Craspedonta* Chevrolat, 1837

Diagnosis. Body oblong in dorsal view; large sized; length of body 12.90–15.00 mm, width 8.00–9.00 mm. Head not completely concealed under explanate margin of prothorax, when viewed dorsally Prothorax narrower than elytra at base, margins strongly reflexed. Tarsal claw without any comb-like structures. Antenna stout piceous, at least at apex; six basal antennomeres with fine punctations; apical

five antennomeres dorso-ventrally flattened with longitudinal striations. First antennomere elongated, next five more or less similar in length, last five thicker, last antennomere longest with pointed apex.

4.2.2.1 *Craspedonta leayana* (Latreille, 1807)

(Figs 12, 14, 36)

Imatidium leyanum Latreille, 1807

Cassida leayana Oliver, 1808

Calopepla flavicollis Gemminger and Harold, 1876

Calopepla nigriventris Weise, 1897

Craspidonta leayana leayana Chen and Zia, 1961

Calopepla leayana insulana Gressitt, 1939

Calopepla atritarsis Pic, 1927

Diagnosis. Body length 12.90–15.00 mm; width 8.00–9.00 mm; oblong in dorsal view. Elytra metallic green with blue-violet margins. Explanate margins very narrow without any honeycomb-like structure, pigmented. Pronotum marked with a characteristic v-shaped depression on mid-anterior margin. Basal margin of prothorax as well as anterior margin of elytra crenulated. Elytra as well as pronotum with punctures.

Description. Body length 12.90–15.00 mm; width 8.00–9.00 mm; length of pronotum 2.60–2.70 mm, width of pronotum 5.30–6.00 mm; length/ width ratio of body 1.60, length/ width ratio of pronotum 0.49.

Elytra metallic green with blue-violet margins. Pronotum unmarked, uniformly yellow to red brown. Head, legs, ventrites yellow to red, except for tarsi, leg articulations, and some regions of thorax tinged with black; abdominal sternites edged with black. Explanate margins very narrow without any honeycomb-like structure. Scutellum uniformly yellow to brown or bordered with brown.

Eyes widely separated inter-ocular space with a deep longitudinal depression. Eyes in its upper portion with, black margins. Head embedded within prothorax up to compound eye.

Ratio of length of antennomeres I-XI 1: 0.6: 0.53: 0.6: 0.53: 0.66: 0.8: 0.66: 0.66: 0.73: 1.4.

Pronotum almost twice as broad as long, trapezoidal, angulate. Disc with a longitudinal depression mesally, externally visible as a line; with scattered fine punctures. Basal margin narrowly lined with black, sinuate with crenulations. In some specimens entire pronotal margins lined with red to black. Anterior margin with a v-shaped depression mesally, lateral margins convex.

Anterior margin of elytra crenate, bisinuate. Elytral punctures deep approximately in 9 rows. Interstriae 2, 4, 6, 8 raised; transverse striae present; marginal rows ill-defined. Distance between adjacent punctures and also between rows variable. Size, shape, and depth of punctures variable; circular, fine near suture to rectangular, large, and deep in middle, humeri bulged. Elytra moderately convex without any dorsal conical hump. Explanate margin punctate; almost same as colour of disc, in greenish forms explanate margins violet. Elytral epipleura without setae.

Prosternal collar not distinct, prosternal process in its narrowest width wider than length of foretrochanter; posterior portion of groove convex.

Tarsi with last tarsomere extending upto third. Claws separated by a distance sub-equal to length of a claw.

Remarks. The genus is represented by six species, of which only one occurs in India.

Material examined. India: Kerala (5 specimens) Padannakkad 12° 30' 27.51"N 74° 59' 17.5"E/ 12.xi.2019/ Vidya Coll.

Host plants. *Gmelina arborea* (Maulik, 1919).

Disribution. China; Laos; Nepal; Thailand; Vietnam. India (Assam, Bengal, Maharashtra, Meghalaya, Darjiling, 'Mumbai', 'Madras'; Nilgiri Hills, Nagaland, Sikkim) Myanmar; (Maulik, 1919; Borowiec and Swietojanska, 2020). **New record for Kerala.**

4.2.3 Genus *Epistictina* Hincks, 1950

Diagnosis. In dorsal view head is visible externally, not completely concealed by explanate margin of prothorax. Body oblong-ovate, base of prothorax and elytra

sub-equal in width. Prothorax with reflexed margins, basal margin of prothorax bisinuate crenulated. Anterior margin of elytra bisinulated with crenulations. Antennae stout, long, hairy. First two antennomeres with constricted base and slightly pale, rest black, cylindrical, last antennomere with blunt end.

4.2.3.1 *Epistictina reicheana* (Guerin, 1844)

(Figs. 9, 10, 11, 37)

Calopepla reicheana Guerin, 1844

Epistictia selecta Boheman, 1850

Epistictia matronula Boheman, 1850

Diagnosis. Body length 7.3–10.31 mm, width 5.00–6.54 mm; oblong in dorsal view, colour yellow to deep red. Pronotum without markings, each elytron with 12 well defined black markings; anteriorly two spots, one on humerus and other near scutellum; 3 spots in a longitudinal line just by side of suture; 3 spots along lateral margins; three small spots in middle; one spot at posterior extreme apex of disc, slightly spreading to suture. Scutellum impunctate, concolorous with pronotum.

Description. Body length 7.30–10.31 mm, width 5.00–6.54 mm; length of pronotum 1.40–1.70 mm, width 3.77–4.62 mm. Length/ width ratio of body 1.46, length/width ratio of pronotum 0.37.

Body yellow to red-brown. Pronotum without markings, each elytron with 12 well defined black markings; anteriorly two spots, one on humeri and other near scutellum; 3 spots in a longitudinal line just besides suture; 3 spots along lateral margins; three small spots in between them; one spot at posterior extreme apex of disc, slightly spreading to suture. Head as well as legs red to brown; ventrites uniformly yellow to brown or variably shaded with black, sometimes edged with black. Scutellum impunctate, same as colour of pronotum.

Eyes elliptical, widely separated. Gena distinct. Head with a longitudinal depression mesally between antennal sockets. Clypeus wider than long, clypeal grooves indistinct. Labrum anteriorly emarginated.

Ratio of length of antennomeres I–XI 1: 0.90: 1.36: 1.18: 1.36: 1.36: 1.36: 1.63: 1.54: 1.54: 2.18.

Pronotum trapezoidal, disc uniformly yellow or with colour gradient, deep red in centre, paler towards periphery. Basal margin narrowly lined with black, with a row of marginal setae, anterior margin concave. Disc punctate, sloping from posterior to anterior. Explanate margins reflexed, yellow to red brown, impunctate, opaque to some with honeycomb-like structure.

Elytral punctures deep; closely spaced; interstriae 2 and 5 raised; distance between adjacent rows almost twice distance between consecutive punctures within a row; punctures very close in middle and towards lateral margins of elytra. Humerus bulged. Elytral disc convex with top of convexity beyond scutellum. Explanate margins narrow, reflexed, impunctate, some with honeycomb-like structures.

Length of prosternal collar subequal to distance between anterior margin of prosternum to forecoxal cavity. Prosternal process with a longitudinal depression mesally, some with a depressed circular spot. Prosternal process in its narrowest width subequal to length of foretrochanter; posteriorly convex.

Last tarsomere extends well beyond third, including marginal setae. Claws separated by a distance subequal to length of a claw.

Remarks. *Epistictina reicheana* resembles *E. viridimaculata*. However, they can be separated based on the maculations on elytra and pronotum. Well defined spots are absent on the pronotum of *E. reicheana* (Fig. 37) while there are two well defined spots in *E. viridimaculata*. There are nine or seven greenish or bluish patches on each elytron of *E. viridimaculata* as against 12 in *E. reicheana*. *Epistictina reicheana* can be separated from *E. weisei* by the entirely castaneous brown dorsum without maculations in *E. weisei* (Fig. 38). *Epistictina reicheana* was observed in epidemic proportions on *Stereospermum colais* at Vellayani.

Material examined. India (19 specimens): **Kerala** (14) specimens, Vellayani (6) 18m msl /8° 25' 47.5"N 76° 59' 8.3"E/11.vii.2018/Amritha Hari Coll.; (5)Vellayani 13.i.2009/ Prathapan K D Coll.; (1) Kalliyad 11° 59' 56.8"N 75° 35' 49.1"E/9.xi.2017/Sangamesh R. H. Coll.; (1) Shendurney WLS / Kattalappara 21.vi.2010 (1) Shendurney WLS/ 09° 51' 45.3"N 77° 12' 06.7"E /19.ii.2011/ Shameem K. M. Coll.,

Host plant. *Stereospermum colais* (Ghate and Ranade, 2002).

Distribution. India (Karnataka, Kerala, Maharashtra, Tamil Nadu); Nepal; Sri Lanka (Borowiec and Swietojanska, 2020).

4.2.3.2 *Epistictina weisei* Spaeth, 1914

(Fig. 38)

Diagnosis. Body oblong, length 7.77 mm, width 5.08 mm; red brown. Elytra, pronotum without any markings. Scutellum impunctate, paler compared to elytral disc. Base of elytra subequal to width of pronotum. Head, legs, ventrites uniformly red brown.

Description. Body length 7.77 mm, width 5.08 mm; length of pronotum 1.61 mm, width 3.77 mm; length/width ratio of body 1.52, length /width ratio of pronotum 0.42.

Body oblong, red brown. Elytra as well as pronotum without markings. Scutellum impunctate, paler in colour compared to elytral disc. Base of elytra subequal to width of pronotum. Head, legs and ventrites uniformly red brown. Antenna stout except basal 2 antennomeres, uniformly black in colour. Last antennomere with blunt ends.

Eyes widely separated. Gena distinct. Clypeus with a longitudinal depression mesally.

Ratio of length of antennomeres I-XI 1:1.3: 1.1: 1.1: 1.3: 1.1: 1.1: 1.1:1.1:1.1:1.1:1.6.

Pronotum rectangular. Disc punctate, anterior margin concave, lateral margins slightly bulged posteriorly. Basal margin bisinuate, lined black with crenulations. Sloping from posterior to anterior. Explanate margins narrow, reflexed, impunctate, red yellow without honeycomb-like structure.

Anterior margin of elytra with crenulations; bisinuate; narrowly lined with black, suture lined with black. Elytral punctures deep, arranged in rows, rows well defined near suture, towards margin punctures closely spaced and rows confused. Interstriae 2, 5 raised. Distance between adjacent rows subequal to almost twice distance between consecutive punctures within a row.

Prosternal process with a longitudinal depression mesally. Posterior portion convex. Length of prosternal collar less than distance between anterior margin of prosternum to forecoxal cavity. Prosternal process in its narrowest width subequal to the length of foretrochanter.

Last tarsomere extending beyond third. Claws separated by a distance subequal to length of a claw.

Remarks. *Epistictina weisei* differs from all other Indian species by the uniformly unicolorous dorsum without maculations or spots (Fig. 38), while all other species have maculations or spots on dorsum.

Material examined. India; Kerala (1 specimen); Mundiyeruma /30.iv.2010/ Prathapan K D Coll.

Host plants. *Stereospermum colais*

Distribution: India ('Bombay', 'Cochin', Nilgiri Hills, N. Kanara) (Borowiec and Swietojanska, 2020).

4. 2.3.2 *Epistictina viridimaculata* (Boheman, 1850)

Epistictia viridimaculata Boheman, 1850

Epistictina parryi Baly, 1863

Epistictina marginata Kirsh, 1875

Epistictina viridimaculata var. *collaris*: Spaeth, 1914

Epistictina viridimaculata var. *trivandrumensis* Maulik, 1919

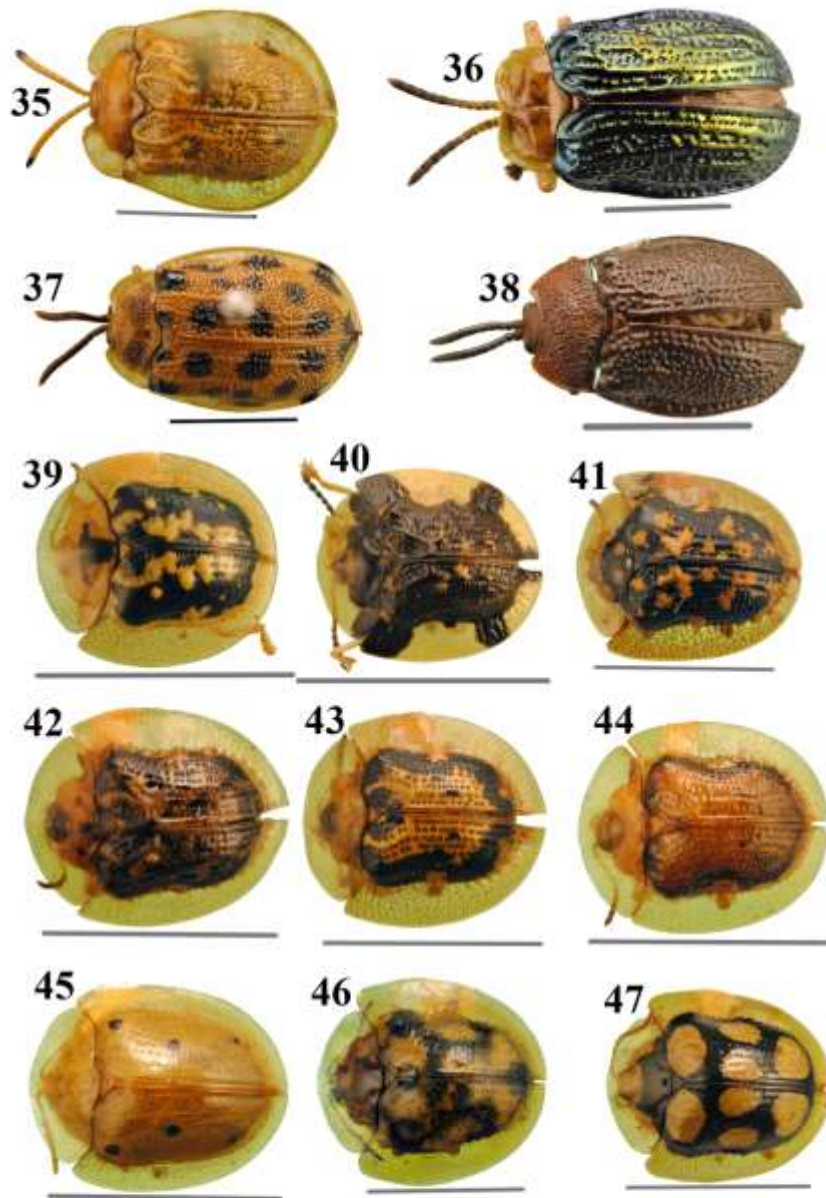
Material examined . Nil.

Host plants. Unknown.

Distribution: *E. viridimaculata*: Nepal; India: *E. parryi*: Assam; *trivandrumensis* India (Kerala: Trivandrum). Burma; Combodia; China; Malaysia; Nepal; Thailand; Vietnam (Borowiec and Swietojanska, 2020).

Key to the species of *Epistictina* of Kerala

1. Pronotum and elytra entirely dark brown (Fig. 38), without spots or patches *E. weisei* (Spaeth, 1914)



Figs. 35 – 47. Dorsal habits of Basiprionotini & Cassidini. 35. *Basiprionota* sp.; 36. *Craspedonta leayana*; 37. *Epistictina reicheana*; 38. *Epistictina weisei*; 39. *Cassida circumdata*; 40. *Cassida devalaensis*; 41. *Cassida nysea*; 42. *Cassida* sp. 1; 43 & 44 *Cassida* sp. 2. 45. *Chiridopsis bipunctata*; 46. *Chiridopsis novemkalankita*; 47. *Chiridopsis sexplagiata* (scale bar = 0.5 cm).

- Pronotum or elytra with spots or patches (Fig. 37)
 2
- 2(1) Pronotum with two spots and each elytron with nine or seven greenish or bluish patches *E. viridimaculata* (Boheman, 1850)
- Pronotum without well-defined spots, each elytron with twelve spots
 *E. reicheana* (Guerin, 1844)

4.3. TRIBE CASSIDINI

Diagnosis. Head not visible externally in dorsal view, metepisternum not entirely fused with metepimeron, antennae filiform, claws simple, with or without comb like structure.

4.3.1 Genus *Cassida* Linnaeus, 1758

Diagnosis. Body convex oval to round 4.50–9.00 mm long. In dorsal view, head completely concealed by explanate margin of prothorax. Outer side of eye without any groove or channel for antennal reception. Antenna shorter than half of body; II antennomere shorter than III; six proximal antennomeres translucent, shiny, slender; apical antennomeres thicker, opaque, pubescent. Prothorax elliptical, transverse, convex sloping from base to apex; basal margin bisinuate. Tarsal claw appendiculate, without a comb-like process at base. Elytra equal to or wider than prothorax at base; convex ; highest point being posterior to scutellum, punctate striate; never strongly costate or rugose.

4.3.1.1 *Cassida andrewesi* Weise, 1897

Materials examined. Nil.

Host plants. Unknown.

Distribution. India (Assam, Karnataka, Kerala, Tamil Nadu, Uttar Pradesh); Nepal (Borowiec & Swietojanska, 2020).

4.3.1.2 *Cassida circumdata* Herbst, 1799

(Figs. 18, 22, 39)

Coptocyclus circumdata Herbst, 1799
Cassida U-fuscum Wiedemann, 1823
Aspidomorpha effuse Boheman, 1854
Coptocyclus trivittata Boheman, 1855
Coptocyclus effuse Boheman, 1856
Metriana circumdata Weise, 1901
Metriana trivittata Weise, 1910
Metriana baeri Spaeth, 1915
Cassida trivittata Weise, 1921
Taiwania circumdata Gressitt, 1934
Cassida cuticula Gressitt, 1938
Cassida effuse Kimoto, 1988
Cassida nilgiriensis Boroweic and Takizawa, 1991

Diagnosis. Body length 4.85–5.46 mm, width 4.08–4.93 mm. Length/width ratio: 1.10, pronotal length/ width ratio: 0.50. Oval in dorsal view; general colour yellow brown, sometimes tinged green, yellow tinged green when live. Pronotum with a black stripe; variable in shape; sometimes absent. Each elytron along its middle with a dark stripe those meet posteriorly forming a ‘u’ shaped marking. Explanate margins of pronotum and elytra with well developed honeycomb structure.

Description. Oval in dorsal view. Body length: 4.85–5.46 mm, width: 4.08–4.93 mm. Pronotal length: 1.62–1.77 mm, pronotal width: 2.93–3.16 mm. Length/width ratio of body 1.10–1.18. length/width ratio of pronotum 0.55–0.56.

General colour yellow brown, tinged green in some cases; yellow tinged green when alive. Pronotum with a pair of black stripes in front of scutellum. Paired stripes diverge apically at right angle. Pronotal stripes highly variable; both merged, diffused or broader to nearly absent or represented by a diffused spot in front of scutellum. Posterior margin of pronotum narrowly black. Pronotum a little broader than long with maximum width across middle. Anterior margin curved medially, lateral corner evenly rounded. Pronotal disc convex medially, sharply declining towards explanate margin, portion above head with well developed honeycomb-like structure. Pronotal disc convex, shiny with minute, shallow punctures. Scutellum black to yellow or

margins dark with yellow centre. Each elytron with a dark stripe along middle meeting posteriorly. Suture black at least in proximal half. Width and prominence of elytral stripe black; sutural stripe vary considerably. Head, antenna, ventral side entirely yellow brown, distal one or two antennomeres tainted black in a few specimens.

Eyes large, gena distinct. Clypeus about as wide as long; clypeal plate apparently depressed in middle. Clypeal grooves fine, distinct clearly visible throughout entire length; run close to ventral margin of eye, converging dorsally forming obtuse angle. Anterior margin of labrum shallowly emarginate.

Length ratio of antennomeres I–XI 1: 0.46: 0.77: 0.77: 0.77: 0.62: 0.69: 0.77: 0.69: 0.85: 1.07.

Body oval, moderately convex ; pronotum and elytra sloping towards periphery. Sexual dimorphism not conspicuous. Scutellum triangular, impunctate, transverse sulcus shallow, angulate. Base of elytra wider than pronotum. Humeri weakly protruding forward, anterior angles rounded. Elytral disc convex, sides and slope strongly declining. In profile, disc with top of convexity in post scutellar area, evenly convex posterior to top of convexity. Punctuation of disc regular, coarse, foveolate. Punctures within a row about 1.5 x distance between rows. Interval 1-3 gently convex. Humeral calli with depression posteriorly and mesally. Marginal row with punctures larger than those on disc, marginal interval well marked. Explanate margin without bold punctures, honey comb structure well developed with thin interstices. Surface of elytra shiny. Elytral epipleura without setae.

Prosternal collar slightly longer than shortest distance between anterior margin of prosternum to forecoxal cavity. Minimum width of prosternal process subequal to length of foretrochanter, posterior margin of prosternal process evenly convex. Prosternal process gently depressed along middle, pre apically with a well demarcated, spindle shaped area.

Tarsi moderately thick, last tarsomere extending to apical margin of marginal setae of tarsomere III; claws extending to apex of marginal setae.

Remarks. Live specimens are yellow tinged with green. The black markings on the pronotum is highly variable and can even be completely obliterated in some individuals. However, *C. circumdata* can be differentiated from all other species by

the unique shape of the pronotal markings as well as the U-shaped dark elytral maculation (Fig. 39). Moreover, raised shiny markings are absent on the elytral disc. In *Cassida* sp. 2, elytra has U-shaped dark elytral maculation (Fig. 43). However, pronotal markings are absent in *Cassida* sp. 2.

Material examined. India: Kerala (22 specimens): 1 ♂ and 5 ♀ Vellayani 18m msl 8° 25' 47.5"N 76° 59' 8.3"E /15.vii.2018/Amritha Hari Coll .; 1 ♀ Vellayani same data except date/24.vii.2019;; 1 ♀ Vellayani same data except 12.ii.2010/ Chriss M. Ipe. Coll.; 1 ♀ Vellayani 18m msl/8° 25' 47.5"N 76° 59' 8.3"E /2.vii.2011/ Rajan Coll.; 1 sex unknown Perumpadavom 15m msl/ 9° 49' 46.3"N 76° 31'19.9"E /8.x.2019/Amritha Hari Coll.; 1 ♀ Perumpadavom 15m msl/ 9° 49' 46.3"N 76° 31'19.9"E /8.i.2019/Amritha Hari Coll.; 1 ♂ Thirurangadi/10.vii.2019/Shameem K. M. Coll.; 1 ♀ Ezhukone 34m 8° 59' 03.45"N 76° 42' 57.89"S/2.vi.2018/ Viswajyothi K.Coll.; 1 sex undetermined Nettukaltheri/1.i.2012. Prathapan &Shameem Coll.; 1 ♂ I sex undetermined Kuttyadi/14.iii.2013/ Shameem coll.; 1Karuvarakundu/19.xi.2011/ Shameem Coll.; and 1 ♀ and 1 ♂ Kannur 12° 01' 60"E 75° 29' 59.99"/19.vii.2016/SRH & AKS Coll.; 1 ♂ Trivandrum Kollayil 119m N 91° 55' 5.1" /31.viii.2013/ Prathapan & Shameem Coll.;

4.3.1.3 *Cassida conspurcata* Boheman, 1854

Material examined. Nil

Host plants. Unknown.

Distribution. India (Kerala: Trivandrum) (Maulik, 1919)

4.3.1.4. *Cassida delesserti* Boheman, 1854

Material examined. Nil.

Host plants. Unknown.

Distribution. India (Kerala, Tamil Nadu) (Borowiec & Swietojanska, 2020).

4.3.1.5. *Cassida devalaensis* Borowiec at Takizawa, 1991

(Fig. 36)

Diagnosis. Body length 4.69 mm, width 4.23 mm. Body small, round, and convex. Pronotum black with yellow marking around head. Elytra black with a pair of pale yellow band on antero-lateral corner. In some specimens apart from this, irregular white bands scattered on elytra. Scutellum triangular, impunctate.

Description. Body length 4.69 mm, width 4.23 mm; pronotal length 1.23 mm, width 3.15 mm. Length / width ratio of body 1.10 , length/width ratio of pronotum 0.39.

Body small, round convex. Pronotum black with yellow marking around head. Elytra black with a pair of pale yellow band on antero-lateral corner. In some specimens apart from this, irregular white bands scattered on elytra. Scutellum triangular, impunctate. Apical five antennomeres black.

Eyes large; gena distinct; clypeus longer than wide. Clypeal plate flat with several small punctures; shiny; microreticulate.

Ratio of length of antennomeres I-XI 1: 0.4: 0.6: 0.6: 0.4: 0.53: 0.66: 0.31: 0.53: 0.73: 1.13.

Pronotum broader than long with maximum width across middle; disc convex, slope declining towards explanate margin. Anterior margin obtusely curved medially; lateral corner evenly rounded basal margin sinuate. Head black; triangular marking above head with honeycomb-like markings. Pronotum smooth, punctate. Explanate margin of pronotum yellow with honeycomb-like structure; lateral corner of explanate margin of prothorax black, triangular.

Elytral disc convex. Sides and slope strongly declining; top of convexity at post-scutellar region. Humeri with a narrow pale band. Elytra rough with strong inundations. Elytral punctures regular; distance between adjacent row more than twice difference between adjacent punctures within a row; marginal punctures larger than those on disc. Explanate margin without punctures with well developed honeycomb-like structure. Elytral surface shiny. Elytral epipleura without setae.

Prosternal collar short; surface of prosternal process flat with expanded apical and basal part.

Tarsi moderately slim, last tarsomere on par with the apical margin of tarsomere III. Claws extent beyond apex of marginal setae of tarsomere III.

Remarks. *Cassida devalaensis* resembles both *C. nysea* and *Cassida* sp. 3 in having black transverse maculation basally on the pronotum. However, major portion of the elytral disc is black with out raised light markings (present in both *C. nysea* and *Cassida* sp. 3; Fig. 44) and the anterior and posterior elytral margins are marked black (absent in both *C. nysea* and *Cassida* sp. 3).

Material examined. India: Kerala (2 specimens) Ponmudi / i. v. 2005 / Prathapan Coll.; Idukki WLS 1100 m msl / 9° 47' 42.0" N 76° 57' 10.2"E / 27.IX.2019 / K. D. Prathapan Coll.

Host plants. *Centratherum tenue* (Asteraceae) (Ghate *et al.*, 2003).

Distribution. India (Kerala, Maharashtra) (Borowiec & Swietojska, 2020).

4.3.2.6 *Cassida nysea* Spaeth, 1926

(Fig. 41)

Diagnosis. Body length 5.90–6.90 mm; triangular in dorsal view. Colour black with unevenly distributed red-brown markings and spots. Pronotum black with a pair of circular brown spots at centre. Dorsal conical hump present behind scutellum; characterized by curved brown markings marking on each elytron together form a raised x-shaped mark. Head, antenna, venter side brown, distal three to four antennomeres black. Scutellum impunctate, evenly black.

Description. Body length 5.9–6.9 mm, width 5.9–6.5 mm; length of pronotum 1.7–1.9mm, width 4.2–3.7mm; length/width ratio of body: 1.1, length width ratio of pronotum: 0.40.

Body large, triangular in dorsal view. Body colour black with unevenly distributed red brown markings and spots. Pronotum black with a pair of circular brown spots at centre. Dorsal conical hump behind scutellum; characterized by curved brownish marking on each elytron together form a raised X-shaped mark. Head, antenna, ventral side brown, distal three to four antennomeres black. Scutellum impunctate, evenly black.

Eyes large, gena distinct. Clypeus as wide as long. Clypeal plate flat, slightly shiny. Clypeal grooves fine, and distinct; clearly visible on whole length; run close to ventral margin of eyes.

Length ratio of antennomeres I-XI 1: 0.61: 0.83: 0.72: 0.61: 0.55: 0.61: 0.55: 0.55: 0.55: 1.

Pronotum broader than long with maximum width across middle. Anterior margin obtusely curved medially, lateral corners rounded. Pronotal disc convex in lateral view, declining sharply towards explanate margin. Disc smooth and shiny, explanate margin and portion above head yellow to pale red with well developed honeycomb-like structure.

Body convex, pronotum and elytra sloping towards periphery. Base of elytra wider than pronotum. Humerus strongly protruding forward, anterior angles acute. Elytral disc convex, sides and slope strongly declining laterally. Maximum height at dorsal conical hump and decreasing gradually. Elytral punctures regular, coarse, foveolate. Distance between two punctures within a row and between rows are more or less same. Red brown markings of elytral disc raised. Marginal row interval well marked, and punctures smaller than those on disc. A pair of spot at margin spread slightly towards explanate margin in its middle. Explanate margins without punctures, with well developed honeycomb-like structure. Surface of elytra shiny. Elytral epipleura without setae.

Prosternal collar longer than shortest distance between anterior margin of prosternal process to front coxal cavity. Prosternal process in its narrowest width subequal to length of foretrochanter.

Tarsi broad with thick setae. Claws extending to apex of marginal setae of last tarsomere.

Remarks. *Cassida nysea* resembles *Cassida* sp. 3 due to the similarity in elytral pattern and black elytra with raised shiny yellow markings. However, *Cassida* sp. 3 has paired longitudinal bands along the middle of pronotum while *C. nysea* has transverse basal maculation. As there is no other character to separate *C. nysea* from *Cassida* sp. 3, more studies may even prove them as conspecific.

Material examined. India: Kerala (3 specimen) Neyyar W. L. San. / 8. II. 2002 / Prathapan K. D. Coll.; Agasthyamalai / 9. II. 2002 / Prathapan Coll.; Agasthyamala / Pongalappara / N 8° 37' 24.4" / E 77° 14' 44.9" 1473 m / 26.iii.2014 / Prathapan K D. & Shameem K. M. Coll.

Host plants. Unknown.

Distribution: India (Tamil Nadu: Kodaikanal, Madura; Mts. Pulneys, Shembaganur) (Borowiec and Swietojanska, 2020). **New record for Kerala.**

4.3.1.7 *Cassida ruralis* Boheman, 1862

Material examined. Nil

Host plants. Unknown.

Distribution. Burma; China; India (Kerala, Meghalaya); Indonesia; Malaysia; Nepal; Taiwan (Borowiec & Swietojanska, 2020).

4.3.1.8 *Cassida socialis* Spaeth, 1926

Material examined. Nil.

Host plants. Unknown.

Distribution. India (Barwag, 'Malabar', Mahe) (Borowiec & Swietojanska, 2020).

4.3.1.9 *Cassida subtilis* Weise, 1987

Material examined. Nil.

Host plants. Unknown.

Distribution. India (Karnataka, Kerala.); Myanmar; Pakistan (Borowiec & Swietojanska, 2020).

4.3.1.10 *Cassida* sp. 1

(Fig. 42)

Diagnosis. Body red yellow, pronotum with a v-shaped black marking and with 2 circular spots on each side. Elytra with variegated black and yellow markings on lateral sides with a broad black band that meets suture posteriorly, centre of disc with black and yellow markings. Suture impunctate, yellow with black margins. Head, ventrites posterior few antennomeres black, legs red yellow.

Description. Body length 5.39–5.77 mm, width 4.31–5.00 mm; length of pronotum 1.54–1.84 mm, width 3.85–3.88 mm. Length/width ratio of body 1.25 length width ratio of pronotum 0.4.

Body red yellow, pronotum with a v-shaped black marking along with 2 circular spots each on its sides. Elytra with variegated black, and yellow markings on lateral sides with a broad black band that meets the suture posteriorly, centre of disc with black and yellow markings. Suture impunctate, yellow with black margins. Head, ventrites, distal antennomeres black, legs red yellow.

Ratio of length of antennomeres I-XI 1: 0.7: 1: 0.8: 0.9: 0.6: 1: 0.7: 0.9: 0.8: 1.5.

Pronotum elliptical broader than long. Anterior margin convex; lateral rounded; basal bisinuate, narrowly lined with black, minutely punctate, shiny, sloping from posterior to anterior. Portion above head, as well as explanate margin with honeycomb-like structure; in some examples portions above head black.

Base of elytra slightly wider than pronotum. Anterior margin bisinuate, crenulated, lined with black. Lateral corners sharp. Elytra convex with top of convexity at post-scutellar area. Elytra punctate, punctures shallow, in regular rows. Distance between adjacent rows twice distance between adjacent punctures. Explanate margin with honeycomb-like structure. Interstriae 2 raised anteriorly along with transverse striae, forms an x-shaped structure in post scutellar area.

Length of prosternal collar less than distance between anterior margin of prosternum to fore coxal cavity. Narrowest width of prosternal process subequal to length of foretrochanter. Posterior portion convex.

Length of a claw equal to distance separating them. Tarsal claws extending slightly beyond third tarsomere.

Remarks. *Cassida* sp. 1 is unique among the species of *Cassida* in Kerala with three black spots on pronotum, arranged in a transverse row.

Material examined. India: Kerala (2 specimens) Silent Valley Nat. Park / Varappara / N 11° 02' 32.8" E 76° 31' 32.1"E / 14. Xi. 2011 759 m / Prathapan K.D. & Shameem K.M. Coll. India: Kerala / Ponmudi / 8° 45' 58.5" N 77° 6' 38.9"E / 01.xi.2017 / Amritha Kumari S. Coll.

Host plants. Unknown.

Distribution. India (Kerala).

4.3.1.11 *Cassida* sp. 2

(Fig. 43)

Diagnosis. Body red yellow; pronotum unmarked, elytra with black bands along lateral sides joining its fellow posteriorly along suture; region below scutellum with black v-shaped markings; two circular spots mesally on each disc. Scutellum impunctate, marked with red to black.

Description. Body length 5.20–5.62 mm, width 4.38–4.54 mm; length of pronotum 1.54–1.77 mm, width 3.38–3.77 mm. Length/width ratio of body 1.16, length width ratio of pronotum 0.41.

Body red yellow; pronotum unmarked, elytra with black bands along lateral sides joining its fellow posteriorly along suture; region below scutellum with black v-shaped markings; two circular spots mesally on each disc. Scutellum impunctate, marked with red to black. Head, legs, ventrites yellow to red; ventrites with black shadings in some specimens.

Eyes large, elliptical. Clypeus longer than broad with some random setae. Clypeal grooves present.

Ratio of length of antennomeres I-XI 1: 0.46: 0.66: 0.66: 0.53: 0.46: 0.66: 0.6:0.66: 0.6: 1.2

Pronotum elliptical, anterior region convex; basal margin bisinuate, narrowly lined with black. Disc with very shallow punctures; sloping from posterior to anterior. Portion above head as well as explanate margin with honeycomb-like structure. Elytral disc punctate, punctures shallow, rectangular, arranged in 9-10 rows, interstriae 2 raised anteriorly, transverse striae from 2 reaches suture; distance between striae variable. Explanate margins transparent, impunctate, with honeycomb-like structures. Body convex, with top of convexity at post-scutellar area. Elytral epipleura without setae.

Prosternal collar length subequal to distance between anterior of prosternum to forecoxal cavity. Width of prosternal process at its narrowest point sub-equal to length of foretrochanter. Posterior portion of process convex.

Claws separated by a distance equal to length of a claw. Last tarsomere extending beyond third.

Remarks. This species is unique among all other species of *Cassida* treated here, in having unmarked pronotum. However, resembles *C. circumdata* in having U-shaped dark elytral pattern and green tinge. The elytral pattern is variable.

Material examined. India: Kerala (3 specimens) / Silent Valley Nat. Park / Mukkali / N 11° 03' 53.3" E 76° 32' 10.9"E / 14.xi. 2011 557 m / Prathapan & Shameem Coll.; (2 specimens) India: Kerala / Agasthyamala / Athirimala / N 8° 37' 04.5" / E 77° 13' 46.7" 1022 m / 25. III. 2014 / Prathapan K. & Shameem K. Coll.

Host plants. Unknown.

Distribution. India (Kerala).

4.3.1.11 *Cassida* sp. 3

(Fig. 44)

Diagnosis. Body red to yellow. Pronotum with a trapezoidal black marking; longitudinal red region mid basally. Elytra black with 7 raised black yellow spots on each; one anteriorly near suture; four spots near suture, first one anteriorly near scutellum, second spot irregular, large, third small, fourth irregular; 2 spots in a line mesally; 1 near to midlateral line. A very minute spot on humeri. Scutellum yellow, impunctate. Head, legs yellow; ventrites black, demarcated by yellow in edges.

Description. Body length 5.00 mm, width 4.46 mm; length of pronotum 1.38 mm, width 3.46 mm; length/ width ratio of body 1.12, length/ width ratio of pronotum 0.40.

Body red to yellow. Elytra and pronotum with black markings. Pronotum with a trapezoid black marking; longitudinal red region midbasally. Elytra black with seven raised black yellow spots on each elytron; one anteriorly near suture; four spots near suture, first one anteriorly near scutellum, second spot irregular large, third small, fourth irregular; two spots in a line mesally; 1 near to midlateral line. A very minute spot on humeri. Scutellum yellow, impunctate. Head, leg yellow; ventrites black demarcated by yellow on edges.

Pronotum elliptical. Anterior margin convex, lateral rounded, basal margin bisinuate. Disc punctate, sloping from posterior to anterior. Explanate margin impunctate, semitransparent with honeycomb-like structure.

Anterior margin of eytra crenulated; basal bisinuate. Elytra punctate, punctures in 9 rows; distance between two rows of punctures greater than distance separating adjacent punctures. Explanate margin semi-transparent with honeycomb-like structure. Elytral epipleura without setae

Clypeus longer than wide; clypeal grooves present. Labrum anteriorly emarginated.

Length of prosternal collar equal to distance separating anterior of prosternum to forecoxal cavity. Narrowest width of prosternal process subequal to length of foretrochanter. Posterior portion of prosternal process convex. Claws extending beyond third. Distance between claws sub-equal to length of claw.

Remarks. Resembles *C. nysea* in having black elytra with shiny yellow raised markings. However, the black maculation in *C. nysea* encompasses a pair of light round spots (absent in *Cassida* sp. 3). As there is no other character to separate these species, examination of a series of specimens is necessary to establish the exact identity of *Cassida* sp. 3. It is also likely that *Cassida* sp. 3 is a colour morph of *Cassida nysea*.

Material examined. India: Kerala (1 specimen) / Silent Valley Nat. Park / Walakkad / N 11° 10' 33.7" E 76° 24' 39.6" / 17.xi. 2011 1101 m / Prathapan K. D.& Shameem K.M. Coll.

Key to the select species of *Cassida* of Kerala

1. Pronotum unmarked, without dark spots or stripes ***Cassida* sp. 2**
 - Pronotum with dark spots, stripes or patches 2
- 2(1) Pronotum with three black spots arranged in a transverse, curved line, rest of surface lighter ***Cassida* sp. 1**
 - Pronotum with black longitudinal stripes medially or black maculations near base 3
- 3 (2) Pronotum proximally with transverse black patch 4
 - Pronotum medially with longitudinal, paired black bands 5
- 4(3) Transverse black patch on pronotum with a pair of light spots medially; elytral disc black with yellow, raised, shiny patches ***C. nysea* Spaeth, 1926**
 - Transverse black area on pronotum without light spots; elytral disc black, without raised, shiny markings.... ***C. devalaensis* Borowiec et Takizawa, 1991**

5(3) Black longitudinal stripe on pronotum reaching middle of disc and then produced into two longitudinal lines, assuming the shape of an anchor; elytral disc with black stripe meeting posteriorly forming a U-shaped pattern *C. circumdata* Herbst, 1799

- Black longitudinal stripe on pronotum proximally produced into horizontal lines; elytral disc entirely black with raised, yellow patches *Cassida* sp. 3

4.3.2 Genus *Chiridopsis* Spaeth, 1922

Diagnosis. In dorsal view head completely concealed under explanate margin of prothorax, claws without a comb-like structure at its base but with an appendix on underside. Channel for reception of antenna present, antenna long, only basal joints lie in channel, two apical joints of antenna passing margin of pronotum; body convex, narrowed posteriorly. Basal 6 antennomeres slender less hairy, five apical thick, more hairy. Prothorax elliptical; basal margin sinuate.

4.3.2.1 *Chiridopsis bipunctata* (Linnaeus, 1767)

(Figs. 23, 45)

Thyreaspis bipunctata Linnaeus, 1767

Cassida sexnotata Herbst, 1799

Thyreaspis sexnotata Hope, 1840

Coptocyclus sexnotata var. *bipunctata* Boheman, 1855

Coptocyclus bipunctipennis Boheman, 1855

Chirida bipustulata Weise, 1896

Diagnosis. Body oval, length of body 5.62–6.62 mm, width 4.77–5.77 mm. Ground colour yellow to yellow tinged with green. Pronotum unmarked to marked with 2 parallel longitudinal black stripes. Elytral disc with 3 black spots. Head, legs uniform yellow abdomen and thorax slightly tinged black. Basal 6 antennomeres shiny, apical 5 hairy; last antennomere piceous at least at apex.

Description. Body oval, length of body 5.62–6.62 mm, width 4.77–5.77 mm; length of pronotum 1.92 mm, width 1.84 mm; length/ width ratio of body 1.17, length/width ratio of pronotum 1.04 mm.

Ground colour yellow to yellow tinged with green. Pronotum unmarked to marked with two parallel longitudinal black stripes. Elytral disc with 3 black spots. Head, legs uniformly yellow, abdomen and thorax slightly tinged black. Basal 6 antennomeres shiny, apical 5 hairy. Last antennomere piceous atleast at apex.

Eyes elliptical, gena distinct, clypeus as wide as long. Labrum emarginated. Pronotum elliptical, broader than long, maximum width across middle. Anterior margin rounded, little convex at middle; lateral margins rounded; basal margin bisinuate, narrowly lined with black. Pronotal disc sloping from posterior to anterior. Portion above head and explanate margin with well developed honeycomb-like structure.

Elytral disc with 9 rows of regular punctures. Distance between adjacent rows almost as twice as distance between punctures with in a row; interstriae not raised. Anterior margin bisinuate, crenulated, narrowly lined with black. Humeri moderately bulged, disc convex with top of convexity behind scutellum. Lateral corners of elytra acute. Explanate margin with well developed honeycomb-like structure.

Prosternal collar with length less than distance between anterior margin of collar to forecoxal cavity. Width of prosternal process at its narrowest point subequal to length of foretrochanter. Prosternal process posteriorly convex.

Last tarsomere extending beyond third. Claws separated by a distance subequal to length of a claw.

Remarks. *Chiridopsis bipunctata* is characterised by yellow dorsum with a pair of small black spots on pronotum and three pairs of such spots on elytra. One or more pairs of these spots can be obliterated or entirely absent. Large spots or maculations are entirely absent. The other two species, *C. novemkalankita* and *C. sexplagiata* are characterised by large spots and maculations on the dorsum.

Material examined. India (13 specimens); Kerala (11specimens): (7specimens) Trivandrum, Vellayani / 8° 25' 47.5"N 76° 59' 8.3"E/ 8.i.2019/ Amritha Hari Coll.; Trivandrum, same data except date / 20.vi.2019.; Trivandrum same data

except date 15.vi.2018.; Kerala Vellayani 2.xi.2011/Rajan Coll.; Thrissur; KAU Campus /20/12/2018/ Amritha Hari Coll.,

Host plants. *Ipomoea* sp. (Takizawa, 1985); *I. batatas*, *I. carnea*, *Quamoclit coccinea* (= *I. coccinea*) (Ghate *et al.*, 2003); *Ipomoea biloba* (= *I. pescaprae*) (Ghate *et al.*, 2004); *Ipomoea aquatica*, *I. batatas*, *I. fistulosa*, *I. violacea*, *Merremia emarginata* (Kalaichelvan *et al.*, 2004).

Distribution. India (Kerala, Karnataka); Sri Lanka; Thailand (Borowiec and Swietojanska, 2020).

4.3.2.2 *Chiridopsis novemkalankita* (Maulik, 1919)

(Fig. 46)

Chirida novemkalankita Maulik, 1919

Chirida mystica Spaeth, 1919

Diagnosis. Body length 6.60–6.80 mm, width 6.00–6.30 mm, maximum width anteriorly, declining posteriorly. Body uniformly yellow to slightly red. Dorsal surface with 9 black spots; one on pronotum; two spots on suture; two spots on lateral anterior and posterior corners of elytra; two transverse spots sometimes reaches suture. Scutellum impunctate. Legs, head and abdominal ventrites uniform yellow to brown.

Description. Body length 6.60–6.80 mm, width 6.00–6.30 mm; length of pronotum 1.92 mm, width 3.9–4.2 mm; length/ width ratio of body 1.1, length / width ratio of pronotum 0.49.

Body round; wider anteriorly, width sharply declining posteriorly. Body uniformly yellow to slightly red. Dorsal surface with 9 black spots; one on pronotum; two on suture; two spots on lateral anterior and posterior corners of elytra; two spots spreading transversally, sometimes reaches suture. Scutellum impunctate. Legs, head and abdominal ventrites uniform yellow to brown. Basal 6 antennomeres thin, shiny, apical 5 thick and hairy. First antennomere long; second round, smallest; third longer than second, shorter than fourth; fifth and sixth subequal, shorter than third and fourth.

Eyes elliptical. Gena distinct. Clypeus raised anteriorly; clypeal groove not distinct; clypeal margins with setae in a few specimens.

Ratio of length of antennomeres I-XI 1: 0.5: 0.7: 0.85: 0.55: 0.5: 0.65: 0.6: 0.6: 0.65: 1.

Pronotum elliptical; wider than long, width almost as twice as length; maximum width across middle. Anterior margin curved, convex at middle; lateral margins rounded; basal margin bisinuate, narrowly lined with black. Pronotal disc uniformly yellow to slightly red; impunctate; smooth and shiny; sloping from posterior to anterior. Basal margin with a row of marginal setae. Explanate margin semi-transparent with honeycomb-like structure to opaque.

Anterior margin of elytra crenate, narrowly lined with black. Elytra convex with top of convexity behind scutellum. Humeri bulged. Elytral disc with fine shallow punctures arranged in well-defined 10 rows; distance between adjacent rows almost twice as distance between consecutive punctures within a row. Explanate margin semi-transparent with honeycomb-like structure, in some opaque. Elytral epipleura with setae.

Length of prosternal collar lesser than distance between anterior margin of collar to forecoxal cavity. Narrowest width of prosternal process wider than length of foretrochanter; posterior portion convex.

Last tarsomere extending beyond third. Claws separated by a distance greater than length of claw.

Remarks. In *Chiridopsis novemkalankita*, dorsum is red yellow with 9 black spots, including one on the pronotum. In *C. sexplagiata*, the elytral pattern is highly variable. Elytral explanate margin is broadest anteriorly in *C. novemkalankita*, while it is broadest medially in *C. sexplagiata*.

Material examined. India; Kerala(6 specimens): 1♀1♂ Idukki WLS 1100 m msl/ 09° 43' 42.0"N 76° 57' 10.2"E / 28.ix.2019/ Prathapan K D Coll. (1) unsexed :Idukki WLS 1100 m msl/ 09° 43' 42.0"N 76° 57' 10.2"E / 28.ix.2019/ Prathapan K D Coll.; (1)Ponmudi/ 3.viii.2010/ Prathapan K D Coll.; Ponmudi 850.5 m (1) sex not specified / 8° 43' 32.6"N 77° 76' 14.3"E/ 2.x.2011/ Prathapan & Shameem Coll.; Ponmudi (1)/7.v.2006 / Prathapan K D Coll.

Host plants. Unknown.

Distribution. India (Karnataka, Kerala, Madras, Tamil Nadu) (Borowiec and Swietojanska, 2020).

4.3.2.3 *Chiridopsis sexplagiata* (Spaeth, 1919)

(Figs. 47, 48)

Chirida sexplagiata Spaeth, 1919

Diagnosis. Body length 6.16-6.93 mm, width 5.40-5.54 mm. Body round to oval in dorsal view. Elytral disc yellow with black markings. Two variants observed; one with 8 yellow spots, demarcated by black borders. On each elytron 2 large round spots anteriorly and posteriorly; 2 small slightly longitudinal spots parallel to each other, in middle. Such specimens with a black stripe basally on pronotum, pronotal stripe variable trapezoidal to crescent-shaped, scutellum completely black. Second form with 3-4 small scattered black markings, pronotum with three small black spots, scutellum edged with black. Explanate margins of elytra as well as pronotum with honeycomb-like structure.

Description. Body length 6.16–6.93 mm, width 5.40–5.54 mm; length of pronotum 1.61–1.92 mm, width 3.61–3.85 mm. Length/ width ratio of body 1.14, length/width ratio of pronotum 0.48.

Body round to oval in dorsal view. Elytral disc yellow with black markings. 2 variations present. One with 8 yellow spots, demarcated with black borders; on each elytron with two large round spots anteriorly and posteriorly; 2 small slightly longitudinal spots parallel to each other, in middle. Such specimens with a black stripe basally on pronotum, pronotal stripe variable, trapezoidal, to crescent-shaped, scutellum completely black. Second form with 3-4 small scattered black markings on each elytron, pronotum with three small black spots, scutellum edged with black. Head, legs uniformly yellow to red. Thoracic as well as abdominal sternites yellow to deep red with black gradients. First 6 antennomeres shiny, thin; last five thick, hairy. First antennomere bulbous and longer; second shortest round, third longer than second, shorter than fourth, last few antennomeres piceous, at least on extreme apex.

Eyes elliptical. Gena distinct. Clypeus as wide as long, anterior portion raised. Clypeal grooves distinct with setae. Labrum emarginated.

Ratio of length of antennomeres I-XI 1: 0.6: 0.8: 0.86: 0.73: 0.66: 0.66: 0.46: 0.46: 0.66: 1.

Pronotum semi elliptical, almost twice as wide as long with maximum width across middle; Sloping from posterior to anterior. Anterior pronotal margin curved, convex at middle; lateral margins rounded, basal margin bisinuate, with a row of marginal setae. Pronotal disc impunctate, smooth, shiny. Explanate margin as well as portion above head with well developed honeycomb-like structure.

Elytral disc convex, top of convexity at post scutellar area. Scutellum impunctate. Elytral punctures regular in 9 rows. Distance between adjacent rows and also between consecutive punctures with in a row variable; marginal rows much closer than those on disc; interstriae not raised. Anterior margin of elytra with crenulations. Explanate margin semi-transparent with well developed honeycomb-like structure. Elytral eipleura with setae.

Length of prosternal collar subequal to distance between anterior margin of collar to frontcoxal cavity. Prosternal process in its narrowest width, wider than length of foretrochanter. Posterior portion of process convex.

Last tarsomere extending beyond third. Claws separated by a distance sub equal to length of a claw.

Remarks. Elytral pattern is highly variable in *C. sexplagiata*. There are two distinct forms (Figs. 47, 48). In the common form (Fig. 47), elytra has eight large yellow circular spots, in a black background. In the second, uncommon color form, the yellow spots coalesce and the black background color appears as irregular small black spots (Fig. 48). The elytral explanate margin is broadest in the middle in *C. sexplagiata*, while it is broadest anteriorly in *C. novemkalankita*. *Chiridopsis sexplagiata* occurs in the higher altitudes of the Western Ghats.

Material examined. India: Kerala (11 specimens): 1♀1 ♂ 2 sex un specified Munnar/23.iv.2012/ Prathapan K D Coll.; (1) sex un specified Munnar/ 13.viii.2011/ Prathapan K D Coll.; 1♀2 sex un specified Eravikulam N.P./10° 08' 22.3"N 77° 03' 26.3"E /8.iii.2014/ Shameem K M. Coll.; 1♀ Pampadum Shola N.P./4.iii.2011/ Prathapan K D Coll.; (1) sex not specified : Eravikulam N.P./10° 08' 22.3"N 77° 03' 26.3"E/ 29.ix.2019/ Prathapan K.D Coll.; (1) sex unspecified

Eravikulam N.P 1659 m /10° 08' 22.3"N 77° 03' 26.3"E/24.iv.2012/ Prathapan K.D Coll.

Host plants. Unknown.

Distribution. India (Kerala, Pondicherry, Shembaganur) (Borowiec and Swietojanska, 2020).

4.3.2.4 *Chiridopsis undecimnotata* (Boheman, 1855)

Material examined: Nil

Host plants. Unknown.

Distribution: India (Kerala, Tamil Nadu) (Borowiec & Swietojanska, 2020).

Key to the species of *Chiridopsis* of Kerala

1. Pronotum without black markings, or with a pair of small round spots; each elytron with three small round black spots (one or more of the round spots may be absent) *C. bipunctata* (Linnaeus, 1767)
 - Pronotum with black maculations; four or more spots on each elytron 2
- 2(1) Dorsum with 11 spots *C. undecimnotata* (Boheman, 1855)
 - Dorsum with nine or fewer spots 3
- 3(2) Elytral explanate margin broadest anteriorly *C. novemkalankita* (Maulik, 1919)
 - Elytral explanate margin broadest in middle *C. sexplagiata* (Spaeth, 1919)

4.3.3 Genus *Oocassida* Weise, 1897

Diagnosis. Body length 5.85–6.54 mm, width 4.08–4.77 mm. Viewed dorsally, head completely concealed under explanate margin of prothorax, body oval. Specialized channel for reception of antenna is present on outer side of eye; antenna short, stout not reaching posterior edge of pronotum; entire antenna lies in channel. First 6 antennomeres less hairy, thinner than the rest; last few antennomeres tinged

with black to uniformly yellow. First antennomere much longer than rest except last; second smallest. Tarsal claws without comb-like structure.

4.3.3.1 *Oocassida cruenta* (Fabricius, 1792)

Cassida cruenta Fabricius, 1792

Cassida unicolor Fabricius, 1801

Thyreaspis obscura Hope, 1840

Cassida corrosa Gemminger and Harold, 1876

Cassida obscura Spaeth, 1914

Oocassida obscura ab. *Unicolor* Spaeth, 1914

Diagnosis. In dorsal view, body oval; light yellow to brown. Elytra with 3 faint red longitudinal lines; one along suture, which is protruded a little into prothorax; one along disc of each elytron. Scutellum impunctate. Mesosternum black. Legs, head as well as abdominal ventrites yellow to red.

Description. Body length 5.85–6.54 mm, width 4.08–4.77 mm; length of pronotum 1.84 mm, width 3.61–3.92 mm; length/width ratio of body 1.43, length/width ratio of pronotum 0.50.

Body light yellow to brown. Elytra with 3 faint red longitudinal lines, one along suture, which is protruded a little into prothorax; one on disc of each elytron. Scutellum impunctate. Mesosternum black. Legs, head, abdomen yellow to red; abdominal ventrites tinted piceous in middle in a few specimens.

Eyes elliptical; gena distinct clypeus as wide as long; clypeal groove distinct throughout its length. Labrum emarginated clypeus with some random setae.

Ratio of length of antennomeres I–XI 1: 0.33: 0.6: 0.4: 0.4: 0.33: 0.33: 0.4: 0.4: 0.53: 1

Pronotum elliptical anterior margin highly convex in middle. Basal margin bisinuate. Disc punctate, smooth shiny, sloping from posterior to anterior. Pronotum wider than long, explanate margins sometimes opaque or with honeycomb-like structures.

Anterior margin of elytra bisinuate, crenate, narrowly lined with black. Elytra highly convex with top of convexity behind scutellum. Humeri bulged, extended laterally. Elytral punctures regular in 9 rows; missing punctures present. Punctures

bold, black inside; interstriae not raised. Explanate margins punctate, narrow brown. Anteriolateral margin sharp. Sometimes honeycomb-like structure visible. Explanate margin opaque or with honeycomb-like structure. Elytral disc shiny.

Length of prosternal collar subequal to distance between anterior of prosternum to forecoxal cavity. Width of process subequal to the length of foretrochanter. Posterior portion convex.

Tarsal claws separated by a distance greater than length of a claw. Last tarsomere extending upto third.

Remarks. *Oocassida cruenta* is a minor pest of ber *Ziziphus mauritiana* in north India (Nair, 1975).

Material examined. India (5 specimens): **Kerala** (2 specimens) sex unspecified Aleppy/ 27.xii.2017/Prathapan K D Coll.

Host plants. *Ziziphus nummularia* (Takizawa, 1985; Sultan *et al.*, 2008)

Distribution. Bangladesh; India (Orissa, Pondicherry, Tamil Nadu, West Bengal); Nepal; Pakistan (Borowiec and Swietojanska, 2020). **New record for Kerala.**

4.3.4 Genus *Silana* Spaeth, 1914

Diagnosis. Body length 6.60–7.70 mm, width 5.30–6.00 mm. Viewed dorsally, body subtriangular, head completely concealed under explanate margin of prothorax. Body highly convex, with a prominent dorsal conical hump. Outer side of compound eye without any special channel for reception of antenna. Basal 6 antennomeres thin, shiny; apical 5 thick, hairy. First antennomere long, bulbous, with an anterior constriction; second shorter than first, longer than third to sixth; last few antennomeres piceous. Tarsal claw without comb-like structure.

4.3.4.1 *Silana farinosa* (Boheman, 1856)

(Figs. 16, 25, 50 – 55)

Cassida farinosa Boheman, 1856

Diagnosis. Body length 6.6–7.7 mm, width 5.3–6 mm, body subtriangular in dorsal view. In live specimens, dorsal surface is covered with white powdery coating; beneath the coating, body chocolate brown; ventral surface, head, and legs light

brown. Pronotal disc with light and dark shades of brown to uniform single colour. Elytral disc with pale raised regions. All margins of pronotum as well as elytra narrowly lined with black. Elytral as well as pronotal disc covered with minute hairs. Scutellum impunctate, colour same as that of pronotum. Abdomen in some with black scattered markings or segments edged with black.

Description. Body length 6.60–7.70 mm, width 5.30–6.00 mm; length of pronotum 1.40–2.07 mm, width 3.50–4.08 mm; length/ width ratio of body 1.2, length/ width ratio of pronotum 0.4.

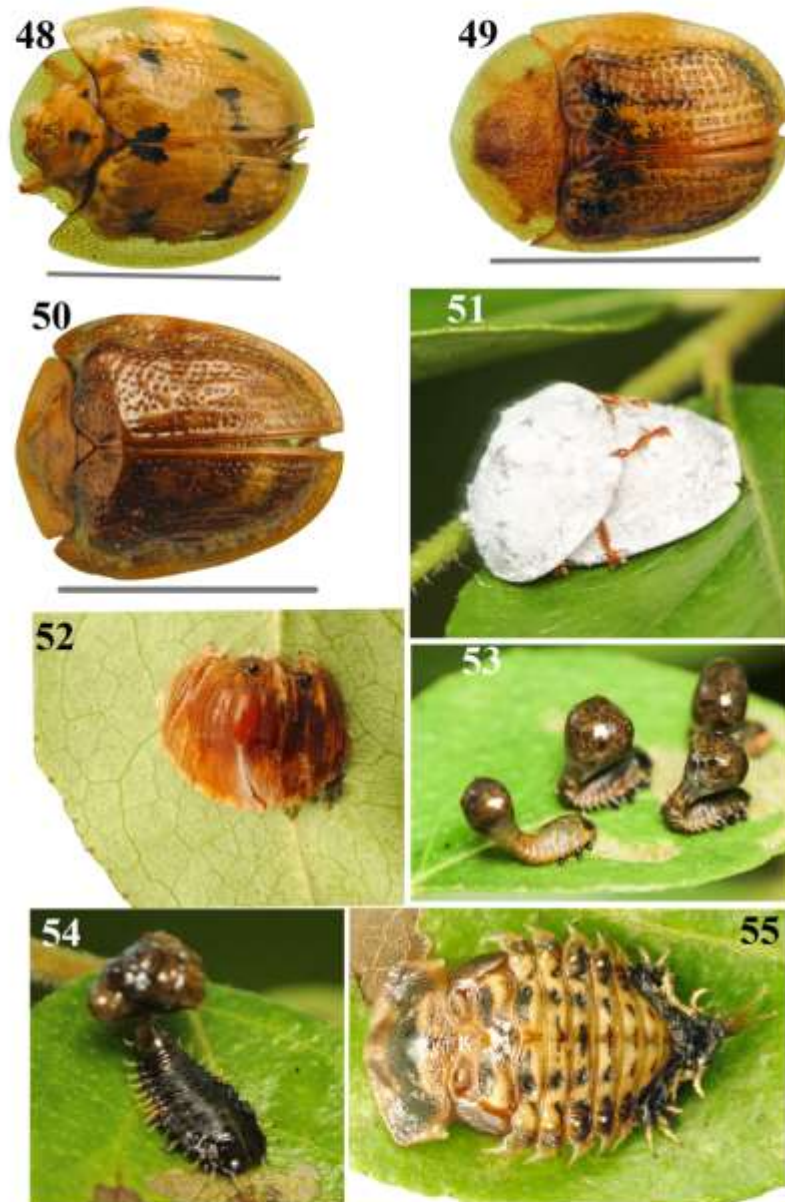
In live specimens, dorsal surface covered with white powdery coating; beneath the coating, body chocolate brown; ventral surface, head, and legs light brown. Pronotal disc with light and dark shades of brown. Elytral disc with pale raised regions. All margins of pronotum as well as elytra narrowly lined with black. Both elytral as well as pronotal disc covered with minute setae. Scutellum impunctate, colour same as that of pronotum. Abdomen in some specimens with black scattered markings or segments edged with black.

Eyes elliptical. Gena distinct. Clypeus as wide as long; clypeal groove distinct throughout its length; clypeus depressed posteriorly. Labrum anteriorly emarginated.

Ratio of length of antennomeres I-XI 1: 0.73: 0.46: 0.66: 0.6: 0.6: 0.73: 0.6: 0.66: 0.73: 1.33

Pronotum pentagonal, anterior margin, forwardly pointed at middle; lateral margin near 90 degree; basal margin bisinuate, narrowly lined with black. Pronotal disc sloping from posterior to anterior. Disc with some raised and depressed regions. Pronotum comparatively lighter in colour compared to elytral disc in some or with light shadings.

Elytral disc punctate, punctures closely placed in ill-defined rows approximately in 10 rows; rows more defined on margin; distance between adjacent rows and between punctures within a row variable; rows separated at a distance greater than distance between adjacent punctures within a row. Anterior margin of elytra bisinuate, antero-lateral corners acute. Elytral disc convex, top of convexity at dorsal conical hump. Elytral explanate margin dark brown, punctate. Disc with some raised light regions. Humeri bulged. Elytral epipleura with setae.



Figs. 48 – 55. Dorsal habitus of: 48. *Chiridopsis sexplagiata*, color morph; 49. *Oocassida cruenta*; 50. *Silana farinosa* (scale bar = 0.5 cm). 51 – 55. Life stages of *S. farinosa*, 51. Adults, in copula; 52. Ootheca; 53. early instar larvae; 54. larva; 55. pupa.

Length of prosternal collar less than distance between anterior margin of collar to forecoxal cavity. Prosternal process with a medial depression. Prosternal process in its narrowest width wider than length of foretrochanter.

Last tarsomere extending up to third. Claws separated by a distance less than length of a claw.

Remarks. *Silana farinosa* is a serious pest of curry leaf, *Murraya koenigi* in Kerala (Premila *et al.*, 2003). All life stages of the beetle were recorded at Vellayani (Figs. 50 – 55).

Material examined. India; Kerala (20 specimens) East Kadungaloor (8 specimen) 8m / 10.1004° N 76.3570° E/ 7.x.2019/ Amritha Hari Coll.; Vellayani (12 specimens) 8.xii.2019/ Amritha Hari Coll.

Host plants. *Ziziphus* sp. (Takizawa, 1980); *Murraya koenigii* (Mohamed and Ahmad, 1996; Premila *et al.* 2003); *Micromelum minutum* (Mohamedsaid, 2006)

Distribution: Ceylon. India (Kerala); Malaysia (Borowiec and Swietojanska, 2020).

4.4. TRIBE NOTOSACANTHINI

Diagnosis. Head externally visible in dorsal view, antennae forms a distinct club, metepisternum fused with metepimeron, mouth parts partially hidden by anterior portion of prosternum, tarsal claws simple, elytra with longitudinal and transverse costae and tubercles.

4.4.1 Genus *Notosacantha* Chevrolt, 1837

Diagnosis. Body length 3.85–5.62 mm; width 3.54–6.13mm. Pronotum with a deep anterior emargination through which head and parts of eyes are visible externally in dorsal view. Base of elytra slightly wider than pronotum. Inter-ocular region with anterior prolongation channelled at middle. Eyes oblong elongate, only a portion visible in dorsal side. Elytral sculpturing prominent, consists of two parallel costae with raised tubercles; third tubercle on first costae always largest called principal tubercle; from principal tubercle transverse costae are given off to suture as well as edges of elytra. Antenna short, not reaching beyond pronotal expansion; first antennomere large, elongate, stout; second small, round, stout; antennomeres 3-6 slender, elongate;

antennomeres 7-11 forms a thick club, pubescent. Tarsal claws without comb-like process.

4.4.1.1 *Notosacantha bertounesquei* Boroweic et Le Tirant, 2013

(Figs. 3, 4, 56)

Diagnosis. Body colour yellow to red yellow. Elytra with black spots on principal tubercle, transverse black band on and behind apical costae, a faint black longitudinal mark on basal tubercle. Scutellum uniformly yellow to red, impunctate. Head, ventries and legs uniformly yellow to red. Disc punctate, with costae and tubercles; principle tubercle twice as wide at base as high but with well-marked angulate top; principle tubercle with 4 distinct radial costae, anterior and posterior branch of dorsal costae, lateral costae and sutural costae.

Description. Body length 5.62–7.31 mm, width 4.62–6.13 mm; length of pronotum 1.30–1.92 mm, width 3.61–5.005 mm; length/width ratio of body 1.15; length/ width ratio of pronotum 0.38.

Body yellow to red yellow. Elytra with black spots on principal tubercle, transverse black band on and behind apical costae, a faint black longitudinal mark on basal tubercle. Scutellum uniformly yellow to red, impunctate. Head, ventries, legs uniformly yellow to red.

Clypeus longer than wide, clypeal groove not distinct. Labrum emarginated anteriorly. Inter-ocular prolongation with truncated apex.

Length width ratio of antennomeres I-XI 1: 0.5: 0.44: 0.55: 0.55: 0.55: 0.5: 0.38: 0.33: 0.27: 0.66.

Pronotum about thrice broader than long. Anterior margin distinctly serrate, basal margin bisinuate, lateral margins rounded. Disc moderately convex, with scattered punctures. Explanate margins almost as wide as elytral disc; with transverse, oval, pore-like structures.

Elytral disc punctate, with costae and tubercles. Dorsal costae slightly interrupted below basal tubercle; humeral costae low, connected with lateral costae; lateral costae prominent, extends up to marginal punctures; Sutural costae incomplete prominent initially, not reaching up to suture; apical costae complete with costa ultima and costa terminalis; furca interna incomplete at the base of principal tubercle.

Basal tubercle small and low; post basal as slight elevation of costae; humeral tubercle low; principle tubercle twice as wide at base as high but with well-marked angulate top; principle tubercle with 4 distinct radial costae, anterior and posterior branch of dorsal costae, lateral costae and sutural costae; apical tubercle low. Elytral punctures in closely placed rows, well defined near suture, ill-defined towards lateral margins. Punctures coarse dark at centre.

Length of prosternal collar less than distance between anterior margin of prosternum to forecoxal cavity. Prosternal process with a longitudinal depression mesally. Narrowest width of prosternum less than the length of foretrochanter. Posterior portion of prosternum convex.

Third tarsomere extending beyond last. Claws small separated by a distance almost half of the length of a claw.

Remarks. *Notosacantha bertounesquei* is the most widely distributed species of *Notosacantha* in Kerala. Colour and elytral sculpture are consistent and useful for identification of the species. Dorsum is red yellow with characteristic black bands and markings: principal tubercle is entirely black while the apical tubercle is covered by a black transverse band (Fig. 56). *Notosacantha bertounesquei* distantly resembles *N. bifenestrella*, however, the general color is dark brown in *N. bifenestrella* (Fig. 57) (red yeallow in *N. bertounesquei*) and the principal tubercle as well as apical tubercle are concolorous with the rest of the disc (Fig. 57) (distinctly black in *N. bertounesquei*).

Material examined. India: Kerala (38 specimens); Ponmudi (5 specimen) /24.xii.2002/ Prathapan K.D. Coll.; same data except date 12.x.2004 ;same data except dtae 18.iv.2010; Silent Valley N.P: (2) Nilikkal Poochippara /22.1.2013/ Shameem K.M Coll.; (5 specimens) Walakkad/19.xi.2011/ Shameem K.M. Coll.:/ Sirendri-Nilikkal /21.i.2013/ Shameem K M Coll.; 10 specimens Varappara / 11° 02' 32.8"N 76° 31' 32.1"E/14.xi.2011/ Prathapan K D & Shameem K M Coll.;3 specimens /Sairandri 20.xi.2011/ Prathapan K D & Shameem K M Coll.; Sairandri /11° 05' 35.8"N 76° 26' 47.7"E/ 15.xi.2011 / Prathapan K D & Shameem K D Coll.; Sairandri –Punnamala 21.xi.2011 Prathapan K D &Shameem K M Coll.; Arippa 8.ii.2004 Prathapan K D Coll.; 11.i.2014 Prathapan K D &Shameem K M Coll.

Host plants. Unknown.

Distribution. India (Kerala) (Borowiec and Swietojanska, 2020).

4.4.1.2 *Notosacantha ? bifenestrella* (Boheman, 1862)

Diagnosis. Body red brown. Scutellum impunctate, same as colour of pronotum. Head, legs, ventrites uniformly pale yellow. Principal tubercle very prominent with swollen base, pointed apex pointed; anterior branch of dorsal costae joins lateral tubercle, and not directly to principal tubercle; principal tubercle consists of three radial costae, sutural costae, lateral costae and posterior branch of dorsal costae.

Description. Body length 4.30 mm, width 3.60 mm; length of pronotum 0.77 mm, width 3.54 mm. Length/width ratio of body 1.19, length/ width ratio of pronotum 0.25.

Body red-brown. Scutellum impunctate, concolorous with pronotum. Head, legs, and ventrites uniformly pale yellow.

Clypeus longer than wide, clypeal groove not distinct. Labrum anteriorly emarginated.

Prothorax uniform yellow; wider than long, almost thrice. Anterior margin serrate, lateral margins rounded, basal margin bisinuate. Disc convex, sloping from posterior to anterior; explanate margins wide semitransparent with pore-like structures.

Elytral disc with almost complete set of costae and tubercles, punctate. Dorsal costae prominent, sharp, raised; humeral branch interrupted in half way; humeral costae prominent up to post humeral tubercle, manages to join lateral costae; lateral costae prominent, reaching marginal punctures; sutural costae sharp, reaching suture; apical costae complete with prominent costae terminalis and costae ultima. Basal tubercle high, swollen; post basal low; principal tubercle very prominent with swollen base, pointed apex; anterior branch of dorsal costae joins lateral tubercle and not directly to principal tubercle; principal tubercle consist of three radial costae, sutural costae, lateral costae and posterior branch of dorsal costae; apical tubercle low; furca interna complete, arises from connection of apical costae and costae terminalis, joins the lateral tubercle not directly to principal tubercle. Punctuations on disc coarse dark in centre, arranged in rows. Explanate margin in its widest point slightly less than

width of elytron. Explanate margins with pore like structures. Elytral epipleura without setae.

Length of prosternal collar subequal to distance between anterior of pronotum to forecoxal cavity. Narrowest width of prosternal process subequal to length of foretrochanter; process with a longitudinal depression mesally; Posterior portion straight.

Third tarsomere extends beyond last. Length of a claw subequal to distance between them.

Remarks. *Notosacantha ? bifenestrella* can be differentiated from *N. bertounesquei* by the black markings and general body colour as discussed under *N. bertounesquei*. In *N. ? bifenestrella* principal tubercle and apical tubercle are concolorous with the elytral disc, while they are distinctly colored black in *N. bertounesquei*. *Notosacantha ? bifenestrella* closely resembles *N. vicaria* by colour and most of the elytral tubercles and costae. However, *N. ? bifenestrella* has three radial costae, where *N. vicaria* has five radial costae.

Material examined. India: Kerala (3specimens): Calicut University Campus/28.ix.2012/ Shameem K Coll.; Thirurangadi/ 14.vii.2013/ Shameem K Coll.; Ponnudi/ 13.ix.2003/ Prathapan K Coll.

Host plants. Unknown.

Distribution: India ('Bombay') (Maulik, 1919); Sri Lanka.

4.4.1.3 *Notosacantha ? maduraensis* Swietojanska, 2006

(Fig. 58)

Diagnosis. Body uniformly black in colour, head, legs, ventrites black. Scutellum concolorous with dorsum, impunctatae. Elytra costate, punctate, tubercles not prominent; anterior as well as posterior branch of dorsal costae, sutural costae as well as lateral costae arising from principle tubercle, thus it has 4 radial costae.

Description. Body length 4.92–5.16 mm, width 4.31–4.69 mm; length of pronotum 1.15–1.31 mm, width 3.62–3.46 mm; length /width ratio of body 1.14 , length/ width ratio of pronotum 0.319.

Body uniform black; head, legs, ventrites black. Scutellum concolorous with dorsum, impunctatae.

Clypeus longer than wide, clypeal grooves not distinct. Anterior margin of labrum emarginated.

Ratio of length of antennomers I-XI 1: 0.4: 0.53: 0.73: 0.66: 0.6: 0.66: 0.4: 0.4: 0.46: 0.66.

Pronotum three times wider than long, almost thrice. Basal margin bisinuate, lateral margin rounded, anterior margin serrate. Pronotal disc punctate, disc convex, sloping from posterior to anterior. Explanate margins punctate.

Base of elytra almost equal to base of pronotum. Dorsal costae interrupted between basal and subbasal tubercles; humeral costae low, reaching lateral costae; lateral costae prominent, reaches up to marginal punctures; sutural costae reaches up to suture. Anterior as well as posterior branch of dorsal costae, sutural costae as well as lateral costae arising from principle tubercle, thus it has 4 radial costae. Apical costa complete, with costae terminalis and costae ultima. Furca interna complete, starts from joining point of furca terminalis, and apical costae later joins lateral costae. Elytral tubercles not prominent, very low. Elytral punctures coarse, arranged in ill-defined rows.

Length of prosternal collar subequal to distance between anterior of prosternum to forecoxal cavity. Prosternal process with a longitudinal depression mesally. Narrowest width of prosternal process sub equal to length of foretrochanter. Last tarsomere extending upto third. Length of claw subequal to distance between claws.

Remarks. Of all the species treated here, *Notosacantha* ? *maduraensis* is the only one with entirely black dorsum (Fig. 58). *Notosacantha* ? *shibathai* has black dorsum, however, it can be differentiated from *N.* ? *maduraensis* by a pair of semitransparent oval spots on the explanate margin of elytra (Fig. 59) (absent in *N.* ? *maduraensis*).

Material examined. Kerala (2 specimens): Eravikulam N. P / 10° 11' 39.8"N 77° 5' 6.3"E/ 23.ii.2018/ K D Prathapan Coll.

Host plants. Unknown.

Distribution. India (Tamil Nadu: Shembaganur, Madura) (Borowiec and Swietojska, 2020). **New report from Kerala.**

4.4.1.4 *Notosacantha nathani* Borowiec et Takizawa, 1998

Material examined. Nil.

Host plants. Unknown.

Distribution. India (Karnataka, Kerala) (Borowiec & Swietojanska, 2020).

4.4.1.5 *Notosacantha ? shibathai* Kimoto, 1981

Diagnosis. Body uniformly black. Explanate margin of elytra with a circular hyaline region in middle. Anterior margin of pronotum lined with yellow. Scutellum impunctate, black colour. Head, ventrites, legs red brown to black. Elytra punctate, costate with tubercles. Principal tubercle low, anterior as well as posterior branch of dorsal costae, sutural costae arising from principal tubercle, thus has 3 radial costae. Post apical tubercle with as slightly raised regions on costae humeral tubercle low with a branch reaching marginal puncture.

Description. Body length 4.46 mm, width 3.46 mm; length of pronotum 1.15 mm, width 2.92 mm; length/ width ratio of body 1.52 ,length/ width ratio of pronotum 0.39.

Body uniformly black. Explanate margin of elytra with a circular hyaline region in middle. Anterior margin of pronotum lined with yellow. Scutellum impunctate, black colour. Head, ventrites, legs red brown to black.

Clypeus longer than wide, with a mesal depression; clypeal groove not distinct. Labrum anteriorly emarginated. Clypeal grooves not distinct.

Ratio of length of antennomeres I-XI 1: 0.85: 0.71: 0.85: 0.71:1: 1.14: 0.71: 0.71: 0.57: 0.85

Pronotum about three times broader than long. Sloping from posterior to anterior; anterior margin serrate; basal angulate, lateral pointed. Explanate margin with pore-like structures.

Elytral disc punctate, costate, with tubercles. Dorsal costae complete; humeral costae present, joins lateral; lateral connects with dorsal costae anteriorly, posteriorly joins the marginal punctures; sutural costae not reaching suture; apical costae with costae interna and costae terminalis; furca interna not present. Principal tubercle low, anterior as well as posterior branch of dorsal costae, sutural costae arising from principal tubercle thus it has 3 radial costae. Post apical tubercle present as slightly

raised regions on costae, humeral tubercle low with a branch reaching marginal puncture. Elytral disc with punctures in ill -defined rows. Explanate margin with a row of marginal punctures.

Length of prosternal collar subequal to distance between anterior of prosternum to the forecoxal cavity. Prosternal process with narrowest width less than length of foretrochanter. Prosternal process with a longitudinal depression mesally. Posterior portion convex.

Third tarsomere extending up to last, marginal setae of third extends beyond last tarsomere, length of a claw almost twice distance between claws.

Remarks. Closely resembles *N. ? maduraensis*, as the dorsum is black. However, it can be separated from *N. ? maduraensis* by a pair of semitransparent oval spots on either side of elytral disc (Fig. 59), which is absent in *N. ? maduraensis* (Fig. 58).

Material examined. India: Kerala: 1 specimens: Bisonvaley Uppala/8.iii.2011/ Shameem K Coll.

Host plants. Unknown.

Distribution: Taiwan (Borowiec and Swietojanska, 2020). **New report for Kerala.**

4.4.1.6 *Notosacantha tenella* Spaeth, 1913

(Fig. 60)

Hoplionota tenella Spaeth, 1913

Notosacantha nilgiriensis Boroweic et Takizawa, 1991

Diagnosis. Body red brown, under side yellow. Explanate margin of elytra with a pale hyaline region in middle. Elytra punctate, costate, with tubercles. Principal tubercle high, with swollen base and narrow tips. Anterior as well as posterior branch of dorsal costae, sutural costae, as well as lateral costae arising from principal tubercle, thus it has 4 radial costae.

Description. Length of body 4.38–5.39 mm, width 3.77–4.46 mm; length of pronotum 1.00–1.07 mm; width 3.38–3.61 mm; length/width ratio of body 1.16, length/width ratio of pronotum 0.29.

Body red brown, under side yellow. Explanate margin of elytra with a pale hyaline region in middle.

Clypeus longer than wide, clypeal grooves not distinct. Depressed mesally. Labrum emarginated, inter-ocular projection truncated at ends. Pronotum with scattered punctures. Anterior margin serrate; lateral rounded; basal bisinuate. Disc convex, sloping from posterior to anterior. Explanate margins wide with pore-like structures.

Elytra punctate, costate, with tubercles. Dorsal costae interrupted between basal and post basal tubercles; humeral branch prominent; humeral costae not prominent, not reaching lateral costae; lateral costae prominent, reaching marginal punctures; apical costae complete with costae terminalis and costae ultima; sutural costae sharp, prominent; furca externa present; furca interna incomplete, starts from joint of costae terminalis and apical costae, interrupted beyond furca externa, not reaching principal tubercle. Basal tubercle raised, swollen at base; post basal low; humeral tubercle low, with a distinct branch reaching marginal punctures; post humeral tubercle low; principal tubercle high with swollen base and narrow tips. Anterior as well as posterior branch of dorsal costae, sutural costae, as well as lateral costae arising from principal tubercle, thus it has 4 radial costae; apical tubercle low, seen as slight elevation of costae. Elytral punctures coarse, arranged in rows. Elytral epipleura without setae.

Length of prosternal collar less than distance between anterior margin of prosternum to forecoxal cavity. Narrowest width of prosternal process sub equal to length of foretrochanter. Posterior region of prosternal process w-shaped.

Last tarsomere extending upto third except marginal setae. Length of a claw sub equal to twice distance between claws.

Remarks. *Notosacantha tenella* is the only species from Kerala with humeral branch of basal tubercle. Closely resembles *N. ? bifenestrella*, however, humeral branch is not developed in *N. ? bifenestrella*. In *N. tenella*, principal tubercle has four radial costae, where as in *N. ? bifenestrella* only three radial costae are present.

Material examined. India: Kerala (7 specimens) Silent Valley National Park; (4 specimens) Sairandhri-Punnamala/21.xi.2011/ Prathapan K D and Shameem K M Coll.; 1 specimen; Punnamala 1444m/11° 7' 4.4"N 76° 28' 23.3"E/ 21.xi.2011/

Prathapan K D and Shameem K M Coll;, (1) 1101 m Walakkad / 11° 10' 33.7"N 76° 24' 39.6"E/17.xi.2011/ Prathapan and Shameem Coll,; 1659m Eravikulam National Park (1) /10° 08' 22.3"N 77° 03' 26.3"E / 24.iv.2012/ Prathapan K D Coll,;

Host plants. Unknown.

Distribution: India (Kerala, Kotagiri, Nilgiri, Tamil Nadu) (Borowiec & Swietojanska, 2020).

4.4.1.7. *Notosacantha ? vicaria* Spaeth, 1913

(Fig. 61)

Hoplionota vicaria Spaeth, 1913

Diagnosis. Body red brown. Head legs and ventrites pale yellow in colour. Radial and apical costae lined with black. Elytral disc costate, punctate, with tubercles. Principle tubercle high with swollen base, pointed apex, five radial costae.

Description. Length of body 4.85–5.39mm, width 4.08–4.85mm; length of pronotum 1.15–1.23mm, width 3.54–4.00mm; length/ width ratio of body 1.18 , length/width ratio of pronotum 0.32

Body red brown. Head, legs, and ventrites pale yellow. Radial and apical costae lined with black.

Prosternum almost 3 times wider than long. Anterior margin serrate, lateral margins rounded, basal bisinuate. Elytral disc convex, sloping from posterior to anterior. Disc scarcely punctate. Explanate margin with pore like structures.

Elytral disc costate, punctate, with tubercles. Dorsal costae slightly interrupted between basal and post basal tubercles, humeral branch not prominent; humeral costae extends only up to post humeral tubercle; lateral costae sharp, prominent, black, reaching marginal setae; sutural costa prominent, black; apical costa complete, with costae terminalis and costae ultima; narrowly lined with black; furca interna complete running from connection of apical costae, and costae terminalis reaches principal tubercle. Basal tubercle small and low, post basal only as a small elevation on dorsal costae. Humeral and post humeral tubercles slightly raised on humeral suture. Principle tubercle high with swollen base, pointed apex. Anterior as well as posterior branch of dorsal costae, sutural costae, lateral costae, furca interna arises from

principle tubercle, thus it has 5 radial costae. Apical tubercle very low. Elytral punctures arranged in ill-defined rows.

Clypeus longer than wide, depressed medially. Clypeal groove not present. Labrum anteriorly emarginated.

Length of prosternal collar subequal to distance between anterior of prosternum to forecoxal cavity. Narrowest width of prosternal process less than length of foretrochanter. Prosternal process with a longitudinal depression mesally. Posterior portion w-shaped.

Last tarsomere extends up to third. Length of a claw twice the distance between them.

Remarks. *Notosacantha ? vicaria* resembles *N. ? bifenestrealla*. However, ridges on principal tubercle and apical tubercle are tinted black in *Notosacantha ? vicaria*, while the same are concolorous with rest of the elytral disc in *N. ? bifenestrealla*. *Notosacantha ? vicaria* is also distinctly larger than *N. ? bifenestrealla*.

Material examined. India: Kerala 6 specimens: (3) Ponmudi /18.iv.2010/ Prathapan Coll.; Ponmudi same data except date 13.ix.2003; 872m Ponmudi 8° 45' 19.9"N 77° 6' 43.7"E /28.v.2011/ Prathapan K D & Shameem K M Coll.; ICRI Campus Myladumpara /22.1v.2013 Prathapan KD Coll.;

Host plants. Euphorbiaceae: *Glochidion ellipticum* (Ghate *et al.*, 2003); Rhizophoraceae: *Carallia brachtiata* (Rane *et al.*, 2000).

Distribution: Sri Lanka; India (Andaman Is., Karnataka, Maharashtra, Tamil Nadu) (Borowiec & Swietojanska, 2020); **Kerala (this work).**

4.4.1.8 *Notosacantha* sp. 1

(Fig. 62)

Diagnosis. Elytral disc green, explanate margins as well as rest of dorsum yellow, legs and ventrites yellow, head dark to yellow. Scutellum brown, impunctate. Elytral disc punctate; costate; without prominent tubercles. Explanate margins of elytra as well as pronotum with pore-like structures. Dorsal costae prominent throughout; principle tubercle very low with four radial costate: anterior and posterior branch of dorsal costae, lateral costae and sutural costae.

Description. Body length 5.08–5.62 mm, width 4.46–4.62 mm; length of pronotum 1.15–1.23 mm, width 3.23–3.61 mm; length/width ratio of body 1.13, length/ width ratio of pronotum 0.318.

Elytral disc green, explanate margins as well as rest of dorsum yellow, legs and ventrites yellow, head dark to yellow. Scutellum brown, impunctate.

Clypeus longer than wide, clypeal groove not distinct. Labrum anteriorly emarginated.

Ratio of length of antennomeres I-XI 1: 0.9: 0.8: 1: 0.9: 0.9: 0.8: 0.8: 0.8: 0.9: 1

Pronotum thrice as wide as long; anterior margin of pronotum serrate, basal margin angulate, lateral margins rounded. Pronotal disc convex, sloping from posterior to anterior; disc with some random punctures. Explanate margins yellow with transverse oval pore-like structures.

Anterior margin of elytra bisinuate. Elytral disc punctate; costate; without prominent tubercles. Dorsal costae prominent throughout; humeral costae low, connected to lateral costae; lateral costae prominent, feeble after joining with humeral costae reaching margins; sutural costae low, apical costae incomplete without costae terminalis and costae ultima, furca interna connected with lateral tubercle. Principle tubercle very low with four radial costae; anterior and posterior branch of dorsal costae, lateral costae and sutural costae. Furca interna well developed. Explanate margins of elytra with pore-like structures. Principiae tubercle present, swollen with truncated tips; apical tubercle slightly raised costae; rest of tubercles not evident. Punctuations on the disc coarse, closely spaced distance between adjacent punctures subequal.

Prosternal process with a longitudinal depression mesally. Length of prosternal collar lesser than distance between anterior margin of collar to the forecoxal cavity. Narrowest width of prosternal process less than length of foretrochanter.

Third tarsomere extends well beyond claws. Tarsal claws separated by a distance subequal to half length of a claw.

Remarks. *Notosacantha* sp. 1 can be differentiated from all other species treated here by the light metallic colour of the elytral disc while the explanate margins are yellow.

Material examined. India : Kerala (1 specimen) / Silent Valley Nat. Park / Walakkad / N 11° 10' 33.7" E 76° 24' 39.6"E / 17.xi. 2011 1101 m / Prathapan K D & Shameem K M Coll.

Host plants. Unknown.

Distribution. India (Karnataka, Kerala).

4.4.1.9 *Notosacantha* sp. 2

(Fig. 63)

Description. Length of body 4.38 mm, width 4.23 mm; length of pronotum 0.84 mm, width 3.54 mm; length /width ratio of body 1.03, length/width ratio of pronotum 0.23.

Body uniform yellow. Head, legs, ventrites pale yellow. Scutellum impunctate, yellow. Elytra costate with almost all set of tubercles. Scutellum impunctate.

Clypeus longer than wide clypeal groove not distinct. Labrum anteriorly emarginated.

Ratio of length of antennomeres I-XI 1: 0.26: 0.26: 0.36: 0.31: 0.36: 0.26:0.26: 0.21: 0.26

Pronotum uniformly yellow, punctate, much wider than long, almost 4 times as broad as long. Disc uniformly yellow with scattered punctures. Anterior margin deeply emarginated. Anterior margin serrate, lateral rounded, basal bisulate. Explanate margins with pore-like structures.

Elytral disc punctate, costate, with complete set of tubercles as well as costae. Dorsal costae prominent raised, complete. Humeral costae low. Lateral as well as sutural costae sharp, raised. Humeral branch of dorsal costae absent. Humeral costae narrowly connected to lateral. Apical costae complete, high sharp connected with costae ultima and costae terminalis. Furca interna not prominent. Basal tubercle high, swollen. Post basal not prominent, lateral costae prominent reaching up to marginal punctures. Principal tubercle swollen. Anterior as well as posterior branch of dorsal

costae, sutural costae, lateral costae arises from principle tubercle, hence with 4 radial costae. Apical tubercle high. Explanate margin with small round pore-like structures.

Length of prosternal collar subequal to distance between anterior margin of prosternum to forecoxal cavity. Posterior portion w-shaped

Last tarsomere extends upto third. Length of a claw twice distance separating them.

Remarks. Dorsum in *Notosacantha* sp.2 is covered with black encrustations, which is an interesting feature common to *Notosacantha* sp.2 and *Notosacantha* sp.3. This species can be differentiated from all others by the pronotal base broader than elytral base (Fig. 63), while it is narrower than or as broad as elytral base in all other species treated here.

Material examined. India: **Kerala** (1 specimen) / Calicut Univ. Campus / 11.ix. 2017 / Shameem K. M. Coll.

Host plants. Unknown.

Distribution. India (Kerala).

4.4.1.10 *Notosacantha* sp. 3

(Fig. 64)

Diagnosis. Ground colour red brown with black powdery crusts on the dorsum as well as venter, sometimes completely covering or partially covering body surface. Head, legs, and ventrites deep red. Elytral disc costate, punctate. Principal tubercle low, swollen, with 3 radial costae.

Description. Length of body 3.85–5.0 mm, width 3.54–4.38 mm; length of pronotum 1.15–1.30 mm, width 2.84–3.85 mm; length/ width ratio of body 1.08, length/ width ratio of pronotum 0.40

Red brown with black powery crusts on dorsum as well as venter, sometimes completely covering or partially covering body surface. Head, legs, ventrites deep red. Clypeus longer than wide, depressed mesally; clypeal grooves not distinct. Interocular prolongation truncated.

Ratio of length of antennomeres I-XI 1: 0.41: 0.33: 0.41: 0.66: 0.41: 0.58: 0.41: 0.41: 0.41: 0.83.

Pronotum about four times wider than long. Sloping from posterior to anterior. Elytral disc costate with very prominent tubercles. Dorsal costae low, interrupted between basal and subbasal tubercles. Humeral branch interrupted midway. Humeral suture low reaches lateral costae. Lateral costate extending to marginal punctures. Sutural costae not reaching suture. Apical costae complete with welldeveloped costae terminalis and costae ultima. Basal and subbasal tubercles low. Humeral and post humeral tubercle very low as slightly raised portions on humeral costae. Humeral tubercle with a branch reaching marginal punctures. Principal tubercle low, swollen, posterior branch of dorsal costae, lateral branch, sutural costae arising from common point in principal tubercle, thus principal tubercle with 3 radial costae. Apical tubercle low. Costae interna incomplete; starts from meeting point of apical costae, and costae terminalis, interrupted midway not reaching lateral or principal tubercle. Apical costae low.

Length of prosternal collar less than distance between anterior of prosternum to forecoxal cavity. Posterior portion straight. Prosternal process in its narrowest width less than length of foretrochanter.

Claws separated by a distance twice as length of a claw.

Remarks. *Notosacantha* sp.3 resembles *N. ?shibathai* due to the black elytral disc and the light spots on either side of the elytra. However, the light markings spread to the elytral margin in *Notosacantha* sp.3 (Fig. 64), while it never reaches elytral margin in *N. ?shibathai* (Fig. 59). Elytral margins are black in *N. ?shibathai*, while the same is light coloured in *Notosacantha* sp. 3.

Material examined. India: Kerala (2 specimens) (1) Silent Valley Nat. Park. / Sairandhri / 20.xi.2011 / Prathapan & Shameem Coll. Ex *Pongamia* ; (1 specimen) India: Kerala / Calicut Univ. Campus / 11.ix. 2017 / Shameem K. M. Coll.

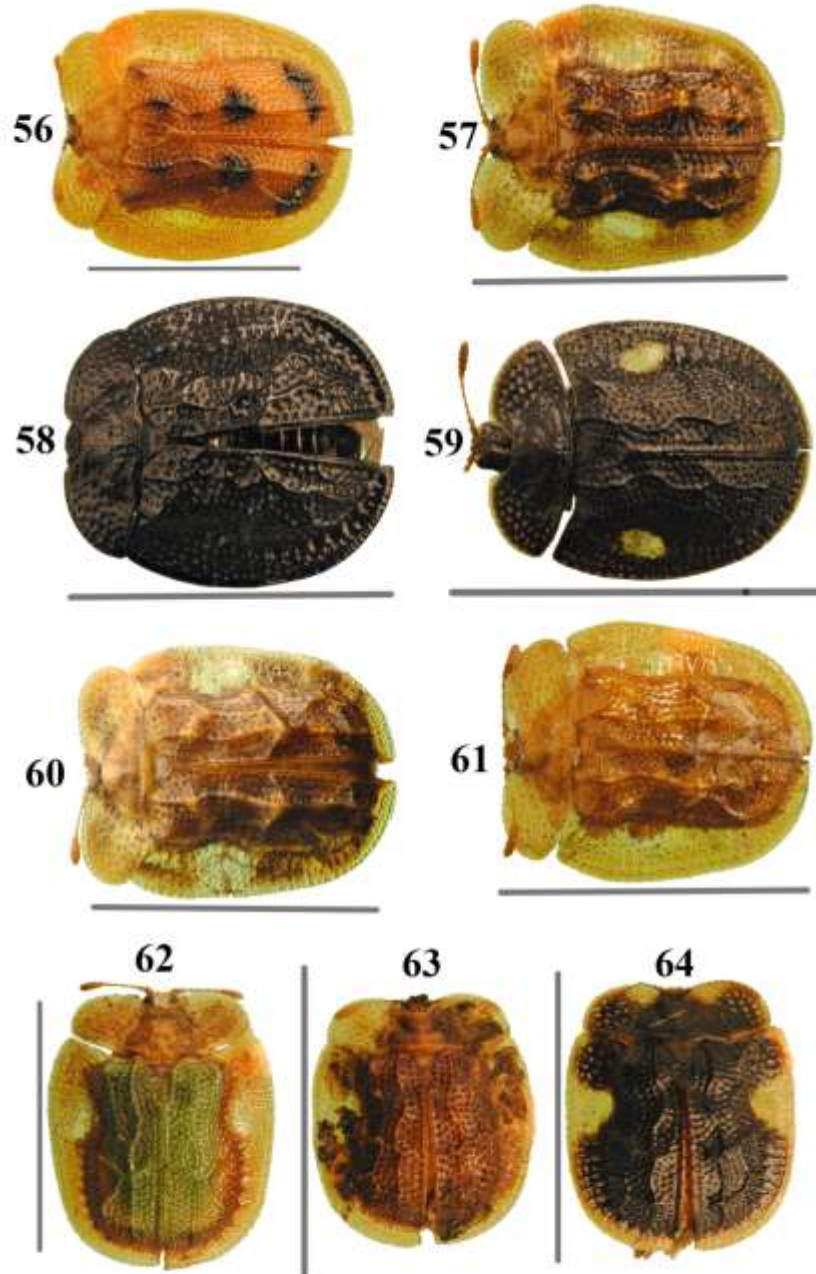
Host plants. Fabaceae: *Millettia pinnata* (L.) Panigrahi (= *Pongamia pinnata* (L.) Pierre) (label data).

Distribution. India (Kerala).

Key to select species of *Notosacantha* of Kerala

1. Elytral disc light metallic green *Notosacantha* sp. 1
- Elytral disc yellow brown, red brown, dark brown or black 2

- 2(1) General colour red-yellow, principal tubercle entirely black, apical tubercle and adjacent area covered by a black transverse band; length 5.6 – 7.4 mm *N. bertounesquei* Boroweic et Le Tirant, 2013
- General colour brown to black; principal tubercle not distinctly black; apical tubercle not covered by black transverse band; length 3.8 – 5.4 mm 3
- 3(2) Body, including venter, entirely black, without light coloured markings *N. maduraensis* Swietojanska, 2006
- Dorsum black to dark brown to light brown, with light coloured markings or entirely light brown, venter light brown4
- 4(3) Dorsum entirely black except a semi-transparent, oval-shaped semi-transparent window in middle of explanate margin on each elytra, this window not reaching lateral margin of elytron *N. shibathai* Kimoto, 1981
- Dorsum black to light brown, margins of pronotum and elytral explanate margins light coloured 5
- 5(4) Basal tubercle with humeral branch *N. tenella* Spaeth, 1913
- Basal tubercle without humeral branch 6
- 6(5) Pronotum at base broader than elytra *Notosacantha* sp. 2
- Pronotum at base as broad as elytral base or narrower 7
- 7(6) Elytral disc black; pronotum black with light coloured anterior portion; frontoclypeus black *Notosacantha* sp. 3
- Elytral disc brown; pronotum concolorous with elytral disc; head entirely brown 8
- 8(7) Body length 4.8 – 5.4 mm; general colour yellow brown ; ridges on principal tubercle and apical tubercle tinted black *N. vicaria* Spaeth, 1913
- Body length 4.3 mm; general colour dark brown; ridges on principal tubercle and apical tubercle concolorous with rest of disc, not distinctly coloured black *N. bifenestrella* (Boheman, 1862)



Figs. 56 – 64. Species of *Notosacantha*, dorsal habiti. 56. *N. bertounesquei*; 57. *N. ?bifenestrella*; 58. *N. ?maduraensis*; 59. *N. ?shibathui*; 60. *N. tenella*; 61. *N. vicaria*; 62. *Notosacantha* sp. 1; 63. *Notosacantha* sp. 2; 64. *Notosacantha* sp. 3 (scale bar = 0.5 cm).

Discussion

5. DISCUSSION

The cassidine fauna of Kerala encompasses 43 species in 11 genera under four tribes. Three of the tribes, Aspidimorphini, Basiprionotini and Notosacanthini, are confined to the Old World, while Cassidini is cosmopolitan in distribution. Of the 43 species recorded here, specimens of only 33 species were studied. Among those studied, seven species could not be identified up to the species level. These could be new species, however, more studies are required to ascertain their identity. Five of the species are doubtfully identified.

The cosmopolitan Cassidini is the largest tribe, represented by 18 species in four genera in Kerala. This is followed by Aspidimorphini (three genera, 10 species), Basiprionotini (three genera, five species) and Notosacanthini (one genus, 10 species).

5.1 TRIBE ASPIDIMORPHINI

Aspidimorphini in Kerala is represented by *Aspidimorpha*, *Laccoptera* and *Nilgiriaspis*. Species of the tribe in Kerala are associated with Convolvulaceae. Members of the genus *Aspidimorpha*, represented by five species, are the largest in size amongst the cassidines of the state. *Laccoptera*, represented by three species in Kerala, is easily recognized by the unique body shape. Species of *Laccoptera* are widely distributed, as most of the Convolvulaceae associated cassidines. *Nilgiriaspis* is a widely distributed monotypic genus, distributed widely in the Oriental Region (Borowiec and Swietojanska, 2020).

5.2 TRIBE BASIPRIONOTINI

Basiprionotini, represented by *Basiprionota*, *Craspedonta* and *Epistictina*, are large tortoise beetles, associated with Verbenaceae and Bignoniaceae in the state. Host plants of *Basiprionota* in Kerala probably are Verbenaceae. Basiprionotini exhibit several adult morphological features of hispines, such as body shape, thick and short antenna, and closely approximated antennal insertions, however, the larval morphology and ecology are typical of cassidines (Maulik, 1919).

5.3 TRIBE CASSIDINI

Cassidini in Kerala comprises the genera *Cassida*, *Chridopsis*, *Oocassida* and *Silana*. *Cassida*, the type genus of the tribe, is the most speciose and most widely

distributed tortoise beetle genus globally (Borowiec and Swietojanska, 2020). The genus in Kerala is represented by 9 named species, in addition to many unknown ones. Species of *Cassida* are known for high intraspecific variability and the uniform structure of the male and female genitalia (Jolivet *et al.*, 2012).

Chiridopsis, represented by two species, could be easily separated based on external characters, especially the unique color patterns. Trophic selections of *Oocassida*, represented by single species, is confined to Rhamnaceae. The genus is easily distinguished by the short antenna, that lies completely within the antennal channel. *Silana* is a monotypic genus, originally described from Sri Lanka and is now widely distributed in the Oriental Region. This genus is unique amongst the Indian cassidines, as the adult is covered with a white, powdery encrustation. Similar powdery coating is present on the adults of the myrmecophilous Neotropical flea beetle *Myrmeconycha* (Konstantinov & Tishechkin, 2017) and the eumolpine genus *Fidia* (Kumari *et al.*, 2020). However, no other information is available on the nature and properties of the powdery coating of the adult.

Cassidini includes several species of *Cassida* infesting sweet potato (Nair, 1978), *Oocassida crutenta* infesting ber (Nair, 1975) and *Silana farinosa*, a serious pest of curry leaf in Kerala (Premila *et al.*, 2003).

5.4 TRIBE NOTOSACANTHINI

Notosacanthini, represented by *Notosacantha* in Kerala, is truly enigmatic. Generally, the larvae of cassidines are external defoliators while those of hispines are leaf miners. However, larvae of Notosacanthini are leaf miners. Members of this tribe are morphologically identical with cassidines during adult stage, while the larvae resemble those of hispines both morphologically and ecologically (Ghate *et al.*, 2003). This tribe could be transitional between cassidines and hispines, however, they are currently being treated under cassidines.

5.5 HOST PLANTS AND DISTRIBUTION

Host plants are known for 23 out of 43 species (53%). Convolvulaceae is the predominant host plant family of tortoise beetles in Kerala, with fifteen species (35%) feeding on members of the family. This is followed by Asteraceae (two species), Rhamnaceae (two species), Amaranthaceae (one species), Bignoniaceae (one species), Euphorbiaceae (one species), Fabaceae (one species), Rhizophoraceae (one species),

Rutaceae (one species) and Verbenaceae (one species). Trophic relations of cassidines of Kerala generally follow that of the Oriental fauna as given by Jolivet and Hawkeswood (1995). Seven cassidine species are recorded as pests of sweet potato – *Aspidimorpha furcata*, *A. fuscopunctata*, *A. miliaris*, *A. sanctaecrucis*, *Cassida circumdata*, *Chiridopsis bipunctata* and *Lacoptera nepalensis*. *Craspedonta lealeyana* on *Gmelina arborea* (Garthwaite, 1939; Beeson, 1941) and *Silana farinosa* on curry leaf, *Murraya koenigii* (Premila *et al.*, 2003) are serious defoliator pests. *Epistictina reicheana* was found to be a destructive pest of *Stereospermum colais* at Vellayani. Appropriate control measures should be developed for the management of pestiferous cassidines.

As many as 15 species are widely distributed throughout south-east Asia, while 15 species are restricted to India, three species are endemic to the Sri Lankan subregion (south India and Sri Lanka), while only a single species, *Notosacantha bertounesquei*, is endemic to Kerala. In general, it was observed that those which feed on members of Convolvulaceae or pestiferous on other plants, are the most widely distributed.

5.6 SPECIES DELIMITATION AND SIBLING SPECIES

The classification and identification of tortoise beetles is largely based on external morphology, which is highly variable and unreliable in separation of sibling species. Members of a few genera, such as *Cassida* are known for high intraspecific variability and the uniform structure of the male and female genitalia (Jolivet *et al.*, 2012). Taxonomy based on external morphology has the innate limitations due to lack of reliable characters. Several currently recognized Indian species of *Cassida* could be species complexes, as shown by Bukejs and Anichchenko (2019) with Latvian species. For example, *Cassida exilis*, populations of which feed on three unrelated families (Lamiaceae, Meliaceae, and Amaranthaceae; Borowiec and Swietojanska, 2020) could be sibling species. Similar instances were observed during the current study also. An unidentified species of *Cassida* (not treated here) was observed on *Alangium salvaefolium* (Alangiaceae) as well as *Tectona grandis* (Verbenaceae) at Vellayani. The populations on the unrelated host plant species were impossible to separate based on external morphological characters, though there is every possibility that these could be good sibling species. Characters of the genitalia, especially the

endophallus of male, is gaining importance in delimitation of sibling species of cassidines (Bukejs and Anichchenko, 2019). However, the genitalic characters are poorly known in Indian cassidines.

Nesterova (2008) has established the value of larval characters in separating sibling species in *Galerucella* (Galerucinae). Larvae of cassidines are better known amongst the leaf beetles, as they are conspicuous and confined to foliage of their host plants. Immature stages of some of the Indian cassidines are known through the works of Takizawa (1980), Rane *et al.* (2000), and Swietojanska *et al.* (2006). Molecular characters too readily offer solutions to the problems of species delimitation, as shown by Jiang *et al.* (2015) in longhorn beetles. Thus, fortification of the taxonomy of tortoise beetles with characters of the genitalia, immature stages and molecular data, will greatly help in species delimitation, especially when external characters of the adults are unreliable and inadequate for species delimitation.

5.7 THE TASK AHEAD

There are many species of cassidines still awaiting naming and description in Kerala. Information on immature stages and host plants is lacking in majority of the species. There are uncertainties in the species status of many cassidines due to over reliance on external morphology. Male and female genitalia, especially aedeagus and spermatheca, are more or less uniform across species in tortoise beetles. However, there are critical characters of endophallus as shown by Bukejs and Anichchenko (2019), which are highly useful in species delimitation. Molecular characters offer great possibilities in the alpha taxonomy as well as higher classification. Integrative taxonomy, with emphasis on morphological and molecular data, characters of immatures as well as biological and ecological information, is required to solve many issues in the classification of cassidines and other leaf beetles. Application of molecular and morphological phylogenetics in the higher classification of leaf beetles is gaining momentum elsewhere (Nie *et al.*, 2019). Workers in India need to imbibe the latest developments in theory and praxis of leaf beetle systematics.

Summary

6. SUMMARY

The present study entitled “Tortoise beetles (Coleoptera: Chrysomelidae: Cassidinae) of Kerala” was carried out at College of Agriculture, Vellayani during 2018 to 2020. A total of 311 specimens from 48 localities in 12 districts, representing different biogeographical and ecological areas in the state were studied. The study revealed the occurrence of 33 species placed in 11 genera classified under four tribes. The cosmopolitan Cassidini is the largest tribe, represented by 18 species in 4 genera, in Kerala. This is followed by Aspidimorphini (3 genera, 10 species), Basiprionotini (3 genera, 5 species) and Notosacanthini (1 genus, 10 species).

The tribe Aspidimorphini in Kerala is represented by *Aspidimorpha*, *Laccoptera* and *Nilgiraspis*. Trophic selections of the entire tribe in Kerala is confined to Convolvulaceae. The genus *Aspidimorpha* in the state is represented by five species viz. *A. furcata*, *A. fuscopunctata*, *A. inuncta*, *A. miliaris* and *A. sanctaeruces*; *Laccoptera* by four species (*L. nepalensis*, *L. quatuordecimnotata*, *L. tredecimpunctata* and *L. sulcata*); and the monotypic *Nilgiraspis* by the widely distributed *N. andrewesi*.

Tribe Basiprionotini, which are large tortoise beetles, represented by three genera (*Basiprionota*, *Craspedonta* and *Epistictina*) in the state, are associated with Verbenaceae and Bignoniaceae. The genus *Basiprionota*, new to Kerala, is represented by an unspecified species. *Craspedonta* of Kerala includes a single species, *C. leayana* feeding on *Gmelina arborea*. *Epistictina* comprises three species (*E. reicheana*, *E. weisei* and *E. viridimaculata*) in Kerala.

Cassidini in Kerala comprises the genera *Cassida*, *Chiridopsis*, *Oocassida* and *Silana*. *Cassida*, the type genus of the tribe, is the most speciose and most widely distributed tortoise beetle genus globally. *Cassida* comprises 12 species in Kerala, viz. *Cassida andrewesi*, *C. circumdata*, *C. conspurcata*, *C. delesserti*, *C. devalaensis*, *C. nysea*, *C. ruralis*, *C. socialis*, *C. subtilis*, *Cassida* sp. 1, *Cassida* sp.2, and *Cassida* sp. 3. *Chiridopsis* in Kerala comprises 4 species viz. *C. bipunctata*, *C. novemkalankita*, *C. sexplagiata* and *C. undecimnotata*. The monotypic *Silana*, represented by *S. farinosa*, is a serious pest of curry leaf *Murraya koenigii*. The only representative of

Oocassida in Kerala, *O. cruenta*, is a pest of ber *Ziziphus mauritiana* (Rhamnaceae) in other states.

Tribe Notosacanthini in Kerala is known by the single genus *Notosacantha* with 10 species viz. *N. bertounesquei*, *N. bifenestrella*, *N. maduraensis*, *N. nathani*, *N. shibathai*, *N. tenella*, *N. vicaria*, *Notosacantha* sp.1, *Notosacantha* sp.2, *Notosacantha* sp.3.

Seven cassidine species, recorded as pests of sweet potato, occur in Kerala. They are *Aspidimorpha furcata*, *A. miliaris*, *A. sanctaecruces*, *A. fuscopunctata*, *L. nepalensis*, *Cassida circumdata* and *Chiridopsis bipunctata*.

One genus (*Basiprionota*) and eight species recorded here are new to Kerala. The species newly reported from the state are *Cassida nysea*, *Craspedonta leayana*, *Nilgiraspis andrewesi*, *Notosacantha bifenestrella*, *Notosacantha maduraensis*, *Notosacantha shibathai*, *Notosacantha vicaria* and *Oocassida cruenta*, of which *Notosacantha shibathai* is new to India as well. Host plants of *Nilgiraspis andrewesi* and *Epistictina weisei* are reported for the first time.

Checklist of tortoise beetles of Kerala

1. *Aspidimorpha furcata* (Thunberg, 1789)
2. *Aspidimorpha fuscopunctata* Boheman, 1854
3. *Aspidimorpha miliaris* (Fabricius, 1775)
4. *Aspidimorpha sanctaecrucis* (Fabricius, 1792)
5. *Aspidomorpha ? inuncta* Boheman, 1854
6. *Basiprionota* sp. 1
7. *Cassida andrewesi* Weise, 1897
8. *Cassida circumdata* Herbst, 1799
9. *Cassida conspurcata* Boheman, 1854
10. *Cassida delesserti* Boheman, 1854
11. *Cassida devalaensis* Borowiec at Takizawa, 1991
12. *Cassida nysea* Spaeth, 1926
13. *Cassida ruralis* Boheman, 1862
14. *Cassida socialis* Spaeth, 1926

15. *Cassida* sp. 1
16. *Cassida* sp. 2
17. *Cassida* sp. 3
18. *Cassida subtilis* Weise, 1987
19. *Chiridopsis bipunctata* (Linnaeus, 1767)
20. *Chiridopsis novemkalankita* (Maulik, 1919)
21. *Chiridopsis sexplagiata* (Spaeth, 1919)
22. *Chiridopsis undecimnotata* (Boheman, 1855)
23. *Craspedonta leayana* (Latreille, 1807)
24. *Epistictina reicheana* (Guerin, 1844)
25. *Epistictina viridimaculata* (Boheman, 1850)
26. *Epistictina weisei*(Spaeth, 1914)
27. *Laccoptera (Sindia) sulcata* (Oliver, 1808)
28. *Laccoptera nepalensis* Boheman, 1855
29. *Laccoptera quatuordecimnotata* Boheman, 1855
30. *Laccoptera tredecimpunctata* (Fabricius, 1801)
31. *Nilgiraspis andrewesi* (Spaeth, 1932)
32. *Notosacantha ? maduraensis* Swietojanska, 2006
33. *Notosacantha ? bifenestrella* (Boheman, 1862)
34. *Notosacantha ? shibathai* Kimoto, 1981
35. *Notosacantha bertounesquei* Boroweic et Le Tirant, 2013
36. *Notosacantha nathani* Borowiec et Takizawa, 1998
37. *Notosacantha* sp.1
38. *Notosacantha* sp.2
39. *Notosacantha* sp.3
40. *Notosacantha tenella* Spaeth, 1913
41. *Notosacantha ? vicaria* Spaeth, 1913
42. *Oocassida cruenta* (Fabricius, 1972)
43. *Silana farinosa* (Boheman, 1856)

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Appendices

Appendix-1

Table 1. Checklist of host plants of cassidines of Kerala (Based on Takizawa, 1980; Ghate *et al.*, 2003; Borowiec and swietojanaska, 2020; and this study)

| Sl No. | Family of Host plant | Species | Species |
|--------|----------------------|-----------------------------|---|
| 1 | Bignoniaceae | <i>Stereospermum colais</i> | <i>Epistictina reicheana</i> <i>Epistictina weisei</i> |
| 2 | Convolvulaceae | <i>Argyreia cuneata</i> | <i>Aspidimorpha sanctaegrucis</i> |
| | | <i>Argyreia elliptica</i> | <i>Aspidimorpha furcata</i> , <i>Aspidimorpha sanctaegrucis</i> <i>Chrididopsis undecimnotata</i> , <i>Laccoptera</i> <i>quatordecimnotata</i> |
| | | <i>Argyreia nervosa</i> | <i>Aspidimorpha furcata</i> <i>Aspidimorpha inuncta</i> |
| | | <i>Calonyction bona-nox</i> | <i>Aspidimorpha miliaris</i> |
| | | <i>Evolvulus alsinoides</i> | <i>Aspidimorpha furcata</i> |
| | | <i>Ipomoea angulata</i> | <i>Aspidimorpha miliaris</i> |
| | | <i>Ipomoea aquatica</i> | <i>Aspidimorphha furcata</i> <i>Aspidimorpha miliaris</i> <i>Aspidimorpha sanctaegrucis</i> <i>Cassida circumdata</i> <i>Chiridopsis bipunctata</i> <i>Cassida devalaensis</i> |
| | | <i>Ipomoea batatas</i> | <i>Aspidimorpha furcata</i> , <i>Aspidimorpha miliaris</i> , <i>Aspidimorpha sanctaegrucis</i> , <i>Cassida circumdata</i> , <i>Chiridopsis bipunctata</i> , <i>Laccoptera nepalensis</i> <i>Aspidimorpha fuscopunctata</i> |
| | | <i>Ipomoea cairica</i> | <i>Aspidimorpha furcata</i> , <i>Cassida circumdata</i> |
| | | <i>Ipomoea carnea</i> | <i>Aspidimorpha furcata</i> , <i>Aspidimorpha miliaris</i> , <i>Aspidimorpha sanctaegrucis</i> , <i>Cassida circumdata</i> , <i>Chiridopsis sp.</i> <i>Lacoptera nepalensis</i> , |
| | | <i>Ipomoea coccinea</i> | <i>Aspidimorpha furcata</i> , <i>Chiridopsis bipunctata</i> |
| | | <i>Ipomoea digitata</i> | <i>Cassida circumdata</i> <i>Aspidimorpha furcata</i> |
| | | <i>Ipomoea excavate</i> | <i>Aspidimorpha furcata</i> |
| | | <i>Ipomoea nil</i> | <i>Nilgiraspis andrewesi</i> |

| | | | |
|----|----------------|--------------------------------|--|
| | | <i>Ipomoea palmate</i> | <i>Aspidimorpha furcata</i> , <i>Aspidimorpha sanctaegrucis</i> , <i>Cassida circumdata</i> , <i>Chiridopsis bipunctata</i> , |
| | | <i>Ipomoea pescaprae</i> | <i>Aspidimorpha miliaris</i> |
| | | <i>Ipomoea pestigridis</i> | <i>Aspidimorpha furcata</i> |
| | | <i>Ipomoea pilosa</i> | <i>Aspidimorpha furcata</i> |
| | | <i>Ipomoea purpurea</i> | <i>Cassida circumdata</i> |
| | | <i>Ipomoea triloba</i> | <i>Aspidimorpha miliaris</i> |
| | | <i>Ipomoea violaceae</i> | <i>Aspidimorpha furcata</i> <i>Aspidimorpha miliaris</i> <i>Aspidimorpha sanctaegrucis</i> , <i>Cassida circumdata</i> , <i>Chiridopsis bipunctata</i> <i>Lacoptera nepalensis</i> <i>Lacoptera</i> <i>quatuordecimnotata</i> |
| | | <i>Merremia emarginata</i> | <i>Aspidimorpha furcata</i> <i>Cassida circumdata</i> <i>Chiridopsis bipunctata</i> |
| | | <i>Merremia tridentata</i> | <i>Aspidimorpha furcata</i> |
| | | <i>Riyea hypocrateriformis</i> | <i>Aspidimorpha sanctaegrucis</i> <i>Lacoptera sulcata</i> |
| | | <i>Rivea sp.</i> | <i>Lacoptera sulcata</i> |
| 3 | Euphorbiaceae | <i>Glochidion ellipticum</i> | <i>Notosacantha vicaria</i> |
| 4 | Rhamnaceae | <i>Ziziphus nummularia</i> | <i>Oocassida cruenta</i> |
| | | <i>Ziziphus sp.</i> | <i>Silana farinosa</i> |
| 5 | Rhizophoraceae | <i>Carallia brachiata</i> | <i>Notosacantha vicaria</i> |
| 6 | Rutaceae | <i>Micromelium minutum</i> | <i>Silana farinosa</i> |
| | | <i>Murraya koenigii</i> | <i>Silana farinosa</i> |
| 7 | Verbenaceae | <i>Gmelina arborea</i> | <i>Craspedonta leayana</i> |
| | | <i>Premna latifolia</i> | <i>Basiprionota sp.1</i> |
| 8 | Asteraceae | <i>Centratherum tenue</i> | <i>Cassida devalaensis</i> |
| | | <i>Blumea balsamifera</i> | <i>Cassida ruralis</i> |
| | | <i>Blumea sinensis</i> | |
| 9 | Amaranthaceae | <i>Achyranthes sp.</i> | <i>Cassida subtilis</i> |
| 10 | Fabaceae | <i>Millettia pinnata</i> | <i>Notosacantha sp.3</i> |

**TORTOISE BEETLES (COLEOPTERA: CHRYSOMELIDAE:
CASSIDINAE) OF KERALA**

by

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Abstract of the thesis

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ABSTRACT

Taxonomic studies on Tortoise beetles (Coleoptera: Chrysomelidae: Cassidinae) of Kerala were made with the objectives of identification of tortoise beetles of Kerala, provide descriptions and diagnosis of tortoise beetle taxa of Kerala and to gather information on host plants and distribution. Three hundred and eleven specimens from 48 locations were studied. The study treated 33 species of cassidines belonging to 11 genera under four tribes. Ten species previously recorded from the state could not be collected or studied. Description and diagnosis of all the taxa studied are provided. Information on distribution and host plants are also given.

The study recognizes 43 species of tortoise beetles, belonging to 11 genera classified under four tribes in Kerala. Of the 12 cassidine tribes, Aspidimorphini, Basiprionotini, Notosacanthini and Cassidini occur in Kerala. Cassidini is the largest tribe represented by 18 species in four genera (*Cassida*, *Chridopsis*, *Oocassida* and *Silana*), followed by Aspidimorphini with 10 species in 3 genera (*Aspidimorpha*, *Laccoptera* and *Nilgiriaspis*). Basiprionotini, which are large tortoise beetles, are represented by five species in three genera viz. *Basiprionota*, *Craspedonta* and *Epistictina*. Notosacanthini, with a single genus *Notosacantha*, includes 10 species in Kerala. One genus (*Basiprionota*) and eight species here recorded are new to Kerala. The species newly recorded for Kerala are *Cassida nysea* Spaeth, 1926, *Craspedonta lealyana* Latreille, 1807, *Nilgiriaspis andrewesi* Spaeth, 1932, *Notosacantha bifenestrella* (Boheman, 1862), *Notosacantha maduraensis* Swietojanska, 2006, *Notosacantha shibathai* Kimoto, 1981, *Notosacantha vicaria* Spaeth, 1913 and *Oocassida cruenta* (Fabricius, 1792), of which *Notosacantha shibathai* is new to India as well.

Trophic selections of cassidines are skewed towards members of Coviculaceae, followed by Asteraceae, Rhamnaceae, Amaranthaceae, Bignoniaceae, Euphorbiaceae, Rhizophoraceae, Rutaceae, Fabaceae and Verbenaceae. Seven cassidine species are reported as pests of sweet potato (*Aspidimorpha furcata*, *A. fuscopunctata*, *A. miliaris*, *A. sanctaecruces*, *Laccoptera nepalensis*, *Cassida circumdata* and *Chiridopsis bipunctata*). *Craspedonta lealyana* on *Gmelina arborea*, *Silana farinosa* on curry leaf, *Murraya koenigii* and *Epistictina reicheana* on *Stereospermum colais* are serious pests.

സംഗ്രഹം

കേരളത്തിലെ ആമവണ്ടുകൾ (കാസ്റ്റിഡിനെ)എന്ന വിഷയത്തിൽ 2018 -2020 കാലഘട്ടത്തിൽ വെള്ളായണി കാർഷിക കോളേജിൽ നടത്തിയ ഗവേഷണ പഠനത്തിന്റെ സംക്ഷിപ്തരൂപം ചുവടെ ചേർക്കുന്നു.

കേരളത്തിലെ കാസ്റ്റിഡിനെ ഉപകുടുംബത്തിൽ ഉൾപ്പെടുന്ന വണ്ടുകളെ തിരിച്ചറിയുക, അവയുടെ വിവരണം രൂപീകരിക്കുക, ഭൂമിശാസ്ത്രപരമായപരമായ വിതരണം, ആഹാര സസ്യങ്ങൾ എന്നീ വിവരങ്ങൾ ശേഖരിക്കുക മുതലായവയായിരുന്നു പഠനത്തിന്റെ മുഖ്യ ലക്ഷ്യങ്ങൾ.

കേരളത്തിലെ 12 ജില്ലകളിൽ നിന്നുമായി 48 പ്രദേശങ്ങളിൽ നിന്നും ലഭ്യമായ 311 വണ്ടുകളെ നിരീക്ഷിക്കുകയും തരംതിരിക്കുകയും ചെയ്തതിൽ നിന്നും നാലു ഗോത്രത്തിലും 11 ജീനസിലും ഉൾപ്പെടുന്ന 33 സ്പീഷിസ് കാസ്റ്റിഡിനെ വണ്ടുകളെ കേരളത്തിൽ നിന്നും തിരിച്ചറിഞ്ഞു. 28 സ്പീഷിസ് കാസ്റ്റിഡിനെ വണ്ടുകൾ കേരളത്തിൽ ഉള്ളതായി മുൻപ് രേഖപ്പെടുത്തിയിട്ടുണ്ട്. ഈ പഠനം കേരളത്തിൽ 43 കാസ്റ്റിഡിനെ വണ്ടുകളുടെ സാന്നിധ്യം സ്ഥിരീകരിക്കുന്നു.

കാസ്റ്റിഡിനി, അസ്സിടിമോർഫിനി, ബേസിപ്രിയോനോട്ടിനി, നോട്ടോസാകാന്തിനി എന്നീ നാല് ഗോത്രങ്ങളിൽ ഉൾപ്പെടുന്ന കാസ്റ്റിഡിനെ വണ്ടുകളാണ് കേരളത്തിലുള്ളത്. ഇവയിൽ സിംഹഭാഗവും കാസ്റ്റിഡിനി ഗോത്രത്തിൽ ഉൾപ്പെടുന്നവയാണ്. കാസിഡ, കൈറിയോപ്ലിസ്, ഊകാസിഡ, സിലാന എന്നീ നാലു ജീനസുകളിലായി 18 സ്പീഷിസ് കാസ്റ്റിഡിനി ഗോത്രത്തിൽ കാണപ്പെടുന്നു. അസ്സിടിമോർഫ, ലക്കോപ്റ്റിറ, നീൽഗിരാസ്സിസ് എന്നീ മൂന്നു ജീനസുകളിലായി 10 കാസ്റ്റിഡിനി വണ്ടുകൾ അസ്സിടിമോർഫിനി ഗോത്രത്തിൽ ഉൾപ്പെടുന്നു. പൊതുവെ

വലിപ്പമുള്ള വണ്ടുകളുടെ ഗോത്രം ആയ ബേസിപ്രിയോനോട്ടിനിയിൽ ബേസിപ്രിയോനോട്ട, ക്രാസ്സിയോണ്ട, എപ്പിസ്റ്റിറ്റിനെ എന്നീ മൂന്നു ജീനസുകളിലായി 5 വണ്ടുകൾ ഉൾപ്പെടുന്നു. നോട്ടോസാകാന്തിനി ട്രൈബിൽ നോട്ടോസാകാന്താ എന്ന ഒരു ജീനസിൽ 10 സ്പീഷിസ് വണ്ടുകളുടെ സാന്നിധ്യം കേരളത്തിൽ ഉണ്ട്. ജീനസ് ബേസിപ്രിയോനോട്ട എന്ന ജീനസും എട്ടു സ്പീഷിസസുകളുടെയും (കാസ്സിയ നിസിയ, ക്രാസ്സപെഡോണ്ട ലെയാന, നിൽഗിരാസ്സിസ് ആൻഡ്രൂവിസി, നോട്ടോസാകാന്താ ബൈഫെനിസ്ട്രേല്ല, നോട്ടോസാകാന്താ മധുരയെൻസിസ്, നോട്ടോസാകാന്താ ഷിബത്തായി, നോട്ടോസാകാന്താ വിസേറിയ, ഊകാസിഡ ക്രൂവെൻറ) സാന്നിധ്യം കേരളത്തിൽ പുതിയതായി കണ്ടെത്തി.

കേരളത്തിലെ കാസ്സിയറിനെ വണ്ടുകൾ കൺവോൾവുലേസിയെ, ആസ്സേരേസിയെ, റാജെസിയെ, അമരാന്തേസിയെ, ബിഗ്നോനിയെസിയെ, യൂഫോർബിയെസിയെ, റിസോഫോറേസിയെ, റൂട്ടേസിയെ, വെർബനേസിയെ, ഫാബേസിയെ എന്നീ കുടുംബങ്ങളിൽപ്പെടുന്ന സസ്യങ്ങളെ ആഹാരമാക്കുന്നു. ഏഴ് സ്പീഷിസ് കാസ്സിയ വണ്ടുകൾ മധുര കിഴങ്ങിലെ കീടമായി കണ്ടെത്തി (അസ്സിടിമോർഫ ഫർക്കേറ്റ, അസ്സിടിമോർഫ ഫസ് കോപംക്റ്റേറ്റ, അസ്സിടിമോർഫ മിലിയാരിസ് , അസ്സിടിമോർഫ സാറെക്രൂസിസ്, ലക്കോപ്റ്റിറാ നെപ്പാളെൻസിസ്, കാസ്സീഡ സർകംഡേറ്റാ, കൈറിയോപ്സിസ് ബൈപക്റ്റേറ്റാ). ക്രാസ്സപെഡോണ്ട ലെയാന, സിലാന ഫാരിനോസ, എപ്പിസ്റ്റിറ്റിന റെജിയാന എന്നീ വണ്ടുകൾ യാഥാക്രമം മെലിനാ ആർബോറിയ (കുംബിൾ), കറിവേപ്പ്, പാതിരി എന്നീ സസ്യങ്ങൾ ഭക്ഷിക്കുന്നു.