

SURVIVAL, DEVELOPMENTAL PERIOD, SIZE AND FECUNDITY OF *SITOTROGA CEREALELLA* OLIV. BRED ON DIFFERENT VARIETIES OF PADDY SEEDS*

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That different varieties of paddy strains show different susceptibilities to attack by *S. cerealella* has been reported (Abraham and Nair 1966). The present paper embodies results of studies made to understand how the different varieties of rice seeds affect the survival, developmental period, size and fecundity of the moth when reared in these different varieties.

Twenty nine varieties of paddy grains were used for these studies, the names of which are given in Table I. All the seeds were cleaned thoroughly, fumigated to destroy any latent infestation and brought to a uniform moisture content of $13.45 \pm 0.41\%$. Three samples of each strain weighing 100 g. each were taken in one pound wide mouthed bottles and ten female and ten male moths introduced into each bottle. The bottles were then closed with muslin held by rubber bands. These moths when dead were removed. The moths of the subsequent generation which emerged were daily removed from the bottles and counted to record the survival of the insect in the different strains. A weighted mean of the

number of days taken for development by all the moths was calculated as the developmental period. To find out the fecundity of the emerging moths, the number of eggs laid by single pairs of moths was observed using Ellington's (1930) method. Number of eggs laid by three pairs was determined for each replication. To compare the size of the moths emerging from each variety, weight of ten moths (female and male) from each replication was recorded,

Results and Discussion

Results are given in Tables 1 & 2 wherein are tabulated the average number of moths emerging from 100 g. of grains (survival), the average developmental period, the weight of 10 female and male moths and the average number of eggs laid per female, all relating to one generation of *S. cerealella* completed in the different varieties of paddy grains. The data were statistically analysed and the findings are given below:—

* From M. Sc. (Ag.) thesis submitted to University of Kerala in 1964.

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TABLE 1

Mean values of the number of grains per gramme for different varieties of paddy grains, number of moths emerging (survival), and developmental period

Sl. No.	Varieties	No. of grains per gramme	No. of moths emerging	Developmental period in days
1	PTB.1	34.50	83.33	31.33
2	PTB.2	35.64	37.33	33.66
3	PTB.4	34.87	71.66	34.66
4	PTB.5	34.50	85.33	33.00
5	PTB.7	37.00	39.00	42.00
6	PTB.8	39.01	76.00	45.66
7	PTB.9	46.81	109.66	37.33
8	PTB.10	37.00	68.66	33.66
9	PTB.12	36.57	52.33	35.66
10	PTB.15	51.31	83.33	36.66
11	PTB.16	54.30	95.33	32.66
12	PTB.18	36.12	81.33	38.33
13	PTB.20	37.80	76.33	33.00
14	PTB.21	38.50	67.33	35.33
15	PTB.22	30.80	48.33	37.66
16	PTB.23	36.40	61.00	37.66
17	PTB.24	40.10	50.33	36.00
18	PTB.25	32.20	66.66	34.33
19	PTB.26	36.40	78.33	34.00
20	PTB.27	33.90	137.33	27.00
21	PTB.31	37.60	64.66	33.00
22	PTB.32	34.80	17.33	29.66
23	PTB.33	39.60	97.00	33.00
24	PTB.34	34.10	26.00	36.66
25	MTU.3	40.15	113.66	40.33
26	GEB.24	50.94	84.00	33.66
27	Japonica (Gimbozu)	42.30	220.33	33.00
28	MO.2	41.01	86.66	40.66
29	CO.25	45.40	142.66	34.00

TABLE 2

Mean values of the size and fecundity of moths emerging from different varieties of paddy grains

Sl. No.	Varieties	Weight of 10 female moths (mg.)	Weight of 10 male moths (mg.)	No. of eggs laid by a single female
1	PTB.1	25.70	11.40	75.80
2	PTB.2	14.00	10.00	75.80
3	PTB.4	15.30	11.00	50.80
4	PTB.5	17.66	11.00	58.20
5	PTB.7	20.00	10.00	31.20
6	PTB.8	14.00	9.00	37.00
7	PTB.9	21.66	11.33	116.70
8	PTB.10	11.66	8.00	39.40
9	PTB.12	14.16	10.76	90.00
10	PTB.15	12.90	9.10	69.66
11	PTB.16	12.73	10.73	62.40
12	PTB.18	17.80	10.46	44.40
13	PTB.20	19.46	15.96	67.00
14	PTB.21	18.96	16.20	44.20
15	PTB.22	15.60	12.30	57.00
16	PTB.23	16.43	11.03	57.80
17	PTB.24	13.73	8.43	57.00
18	PTB.25	17.83	14.33	47.40
19	PTB.26	15.86	10.63	95.80
20	PTB.27	13.93	12.33	74.40
21	PTB.31	13.93	11.96	68.20
22	PTB.32	11.83	10.56	43.40
23	PTB.33	20.16	15.36	71.00
24	PTB.34	23.46	16.66	53.40
25	MTU.3	20.00	15.40	62.00
26	GEB.24	13.56	8.00	50.60
27	Japonica (Gimbozu)	19.00	12.93	110.20
28	MO.2	23.33	19.63	78.20
29	CO.25	17.86	10.43	74.40

Survival:—Results of analysis of variance of the data have shown that the number of moths which complete their life-cycle in the different varieties of paddy seeds is significantly different. With reference to the survival of the insect in the different varieties of grains in the descending order, they can be ranked thus: * (Japonica); (Co.25, PTB.27); (MTU.3, PTB.9, PTB.33, PTB.16); (MO.2, PTB.5, GEB.24, PTB.15, PTB.1, PTB.18, PTB.26, PTB.20, PTB.8, PTB.4, PTB.10, PTB.21, PTB.25, PTB.31, PTB.23); (PTB.12, PTB.24, PTB.22); (PTB.7, PTB.2, PTB.34, PTB.32). Largest survival is seen in the variety Japonica (220.3 moths per 100g.). The varieties Co.25 and PTB.27 also are highly favoured by the moth, with an average survival of 142.66 and 137.33 moths respectively. The varieties MTU.3, PTB.9, PTB.33 and PTB.16 rank next producing 95.33 to 113.66 moths. The least suitable varieties for the survival of the insect are the PTB. varieties 2, 7, 34 and 32 which have given rise to 39.0, 37.33, 26.00 and 17.33 moths respectively. In the remaining varieties the moths show intermediate survival rates. Analysis has also revealed that significant positive correlation exists between number of grains per gramme and number of moths emerging, (coefficient of correlation $r = + 0.8201$) indicating that fine grained varieties are more favourable for the survival of the insect. No correlation is present between survival and size of moths or developmental period.

Developmental period:—There exists highly significant difference between the durations of development of the insect bred on the

different varieties of paddy seeds. The ranking of the different varieties based on the time taken by the insect to complete its life cycle in them, is as follows:—

(PTB.8, PTB.7, Mo.2); (MTU.3, PTB.18, PTB.22, PTB.23, PTB.9, PTB.15, PTB.34, PTB.24, PTB.12, PTB.21, PTB.4, PTB.25, PTB.26, Co.26, GEB.24, PTB.10, PTB.2, PTB.31, Japonica, PTB.33, PTB.5, PTB.20, PTB.16); (PTB.1, PTB.32, PTB.27).

The developmental period is the most prolonged in the varieties PTB.8, PTB.7, and Mo. 2, the average periods being 45.66, 42.00 and 40.33 days respectively and these are significantly higher than the developmental period in the rest of the varieties. The shortest developmental periods ranging from 27 to 31.33 days are seen in varieties PTB.1, PTB.32 and PTB.27 which in themselves are significantly different from the rest in this respect. There appears to be no significant difference in the developmental period among the rest of the varieties. Further, no significant correlation is evident between developmental period on the one hand and fineness of grains, fecundity of moths or survival of moths on the other. There, however, exists positive correlation between developmental period and size of male moths ($r = + 0.410$). Warren (1956) also had observed a similar correlation between the duration of immature stages and weight (size) of *S. cerealella* adults when bred on different varieties of hybrid corn,

Size of female moths:—It is seen in the analysis that the varieties of paddy differ

* The brackets in the rankings given in this paper are used to include the variety or varieties which do not among themselves vary significantly in the character concerned, but which vary significantly from the other bracketted groups.

significantly in regard to the weight (size) of female moths bred on them. The range in the mean weight of female moths is from 1.666 mg. in PTB.10 to 2.570 mg. in PTB. 1. The ranking of the varieties in the descending order based on the size of the moths developing in them is as under:-

(PTB.1, PTB.34, Mo.2, PTB.9); (PTB.33, MTU.3, PTB.7, PTB.20, Japonica, PTB.21, Co.25, PTB.25, PTB.18, PTB.5, PTB.23); (PTB.26, PTB.22, PTB.4, PTB.12, PTB.2, PTB.8, PTB.27, PTB.31); (PTB.24, GEB.24, PTB.15, PTB.16, PTB.32, PTB.10).

Heaviest female moths emerge from PTB strains 1,34 and 9 and Mo. 2 (range 2.570-2.333 mg.). Female moths emerging from PTB.24, GEB.24, PTB.16, PTB.32 and PTB.10 are the smallest (range 1.376 to 1.166mg.). The remaining varieties produce moths of intermediate size.

Size of male moths:—In the case of size of male moths emerging from different varieties also, as in the case of female moths, significant variability is detected, as indicated in the analysis of variance. Ranking of the grains based on this is as below:

(Mo.2); (PTB.34, PTB.21, PTB.20, MTU.3, PTB.33, PTB.25); (Japonica, PTB.22, PTB.27, PTB.31, PTB.1, PTB.5, PTB.9, PTB.23, PTB.4, PTB.12, PTB.16, PTB.26, PTB.32, PTB.18, Co.25); (PTB.7, PTB.2, PTB.15, PTB.8, PTB.24, GEB.24, PTB.10). It will be seen that Mo.2 produces the heaviest male moths weighing on an average 1.963 mg. PTB.7, PTB.2, PTB.15, PTB.8, PTB.24, GEB.24 and PTB.10 form a group of varieties which produce male moths of the least size (range 0.8 mg. to 1.00 mg.). The rest of the strains produce male moths of intermediate sizes.

Significant negative correlation exists between size of moths and fineness of the grains ($r = -0.4321$ for males and $r = -0.4960$ for females). Size of the female moths and fecundity are not correlated.

Fecundity:—Analysis of variance has shown that the fecundity of moths reared on different strains of paddy seeds varies significantly. Based on this the different strains can be ranked in the descending order as given below:-

(PTB.9, Japonica, PTB.26, PTB.12); (Mo.2, PTB.1, PTB.2, Co.25, PTB.27, PTB.33, PTB.15, PTB.31); (PTB.20, PTB.16, MTU.3, PTB.5, PTB.23, PTB.24, PTB.22); (PTB.21, PTB.34, PTB.4, GEB.24, PTB.25, PTB.18, PTB.32); (PTB.10, PTB.8, PTB.7).

The average number of eggs laid per moth reared out from the different varieties is seen to range widely from 31.2 to 116.7. Thus moths reared on PTB.7 and PTB.8 lay 31.2 and 37.0 eggs per moth respectively. Moths reared out from the varieties PTB.9, Japonica, PTB.26 and PTB.12 produce the largest number of eggs (116.7, 110.2, 95.8 and 90.00 eggs per female respectively). The moths reared out of the rest of the varieties produce eggs ranging between the above mentioned two extremes. It has been seen that the varieties which produce high fecundity moths (PTB.12, Japonica, PTB.26) are also highly susceptible to infestation by the insect and those producing low fecundity moths (PTB.7, PTB.8) are highly resistant (Abraham and Nair 1966). Correlation studies also have shown that in general highly significant positive correlation exists between fecundity of moths reared out from different varieties

on the one hand and percentage of infestation (susceptibility to infestation) on the other ($r = +0.362$). Thus the moths which emerge out of susceptible strains of paddy seeds appear to be more prolific than those reared on resistant strains of paddy. This also indicates that the food of the insect during its immature stages governs its fecundity.

Summary

Survival, developmental period, size and fecundity of *Sitotroga cerealella* Oliv. when reared on 29 different varieties of paddy seeds have been ascertained. The varieties under study have been PTB.1, PTB.2, PTB.4, PTB.5, PTB.7, PTB.8, PTB.9, PTB.10, PTB.12, PTB.15, PTB.16, PTB.18, PTB.20, PTB.21, PTB.22, PTB.23, PTB.24, PTB.25, PTB.26, PTB.27, PTB.31, PTB.32, PTB.33, PTB.34, MTU.3, GEB.24, Japonica (Gimbozu), Mo.2, Co.25.

The varieties Japonica, Co.25 and PTB.7 are the most suited for the survival of the insect, 100 g. of each producing on an average 220.3, 142.66 and 137.33 moths respectively; the least suitable varieties are the PTB strains 2, 7, 34 and 32 producing 39.0, 37.3, 26.0 and 17.3 moths respectively; the rest of the varieties ranking in between. The number of moths surviving and the number of grains per gramme are positively correlated.

The time taken for the development of the insect is the most prolonged in varieties PTB.8, PTB.7 and Mo.2, being 45.6, 42.0 and 40.3 days respectively; shortest periods taken for the development are in the varieties PTB.1, PTB.32 and PTB.27 the periods being 31.33, 29.66, and 27.00 days respectively; the other varieties are intermediate in rank. Duration of

development and size of male moths are positively correlated.

Heaviest female moths emerge from the PTB strains 1, 34 and 9 and Mo.2 and the lightest from PTB.24, GEB.24, PTB.16, PTB.32 and PTB.10. Mo.2 produces the heaviest male moth and the PTB varieties 7, 2, 15, 8, 24 and 10 and GEB.24 the smallest. Size of moths and fineness of grain are negatively correlated.

Fecundity is high in moths reared on PTB.9, Japonica, PTB.26 and PTB.12 producing respectively 116.70, 110.20, and 95.80 eggs per moth; it is low in moths reared on PTB.10, 8 and 7 producing 39.40, 37.0, and 31.20 eggs respectively per moth. Fecundity of moths and susceptibility of the paddy strains to the moth infestation are positively correlated.

Acknowledgements

The authors are thankful to Dr. C.K.N. Nair, Principal and Additional Director of Agriculture (Research), Agricultural College and Research Institute, Vellayani, for providing necessary facilities for the work.

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(Accepted 14-8-1968)