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BIOLOGICAL STUDIES ON THE MEALYBUG, *NIPAECOCCUS VIRIDIS* (NEWSTEAD) ON VARIOUS HOST PLANTS

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The biology of the mealybug, *Nipaecoccus viridis* (Newstead) was studied in the laboratory on potted plants of *Clerodendron infortunatum* Goertn (Bhant), *Artocarpus integra* (Thumb) Merrill (Jackfruit), *Citrus* sp. (Citrus) and *Glycine max* Merrill (Soybean). The average developmental periods of male on bhant, jackfruit, citrus and soybean were 18.19, 16.89, 16.86 and 16.23 days respectively, the corresponding periods of female being 16.19, 15.36, 15.46 and 14.62 days. The average preoviposition period, oviposition period and fecundity were 6.33 days, 9.67 days and 235 eggs on jackfruit, 7.33, 8.33 and 176.33 on citrus, 8.33, 7.66 and 78.67 on soybean and 7.67, 6.33 and 66.33 on bhant.

INTRODUCTION

The mealybug, *Nipaecoccus viridis* (Newstead), a polyphagous pest, infests more than 40 species of host plants of which *Citrus* sp., *Gossypium* sp., *Artocarpus integra* (Thumb) Merrill are important. It is distributed in Oriental, Palearctic and Ethiopean regions. Ali (1956 & 1957) studied on its bioecological aspects on citrus both in laboratory and in field whereas Ghosh & Ghose (1988) studied its biology on potato tuber throughout the year in laboratory. The present investigation has been carried out to study the variation in the development of two sexes as well as preoviposition, oviposition periods and fecundity of female while feeding on different host plants like *A. integra* (jackfruit), *Glycine max* (soybean), *Citrus* sp, (citrus) and *Clerodendron infortunatum* Goertn. (bhant).

MATERIALS AND METHODS

The experiment was carried out in the laboratory at 24.4 - 30.0^{0}C temperature and 71 - 96% R.H. on potted plants of jackfruit, soybean, citrus and bhant. Some ovisacs were taken from the culture of *N. viridis* and placed on the young leaves of these host plants. The ovisacs were removed after 24 hrs, leaving the newly hatched nymphs. Daily observations were made on number of moulting of each nymphal instar of male and female. To study the preoviposition, oviposition periods and fecundity, the adult females were left undisturbed till the formation of the ovisac and egg laying. The eggs were counted daily upto the death of the mother. The data thus obtained was satistically analysed.

RESULTS AND DISCUSSION

The first instar nymphs, the sexes of which could not be distinguished, completed their development at the age of 8.82 ± 0.89 days on bhant, 8.21 ± 1.15 days on jackfruit, 7.64 ± 0.95 days on citrus and 7.37 ± 1.23 days on soybean (Table I), which were always higher than the other nymphal instars. Ghosh & Ghose (1988) recorded this period of this species on potato tubers as 9.35 ± 1.81 days which was also higher in comparison to other nymphal instars. So, here, this finding is in agreement with the general feature of the mealybugs supporting the views of others on *Planococcus citri* (Risso). *P. viridis* Nied. and *Saccharicoccus sacchari* (Cockerell) (El-Minshaway *et al.*, 1974), on *Rastrococcus spinosus* (Robinson) (Ullah *et al.*, 1992) and *on P. minor* (Maskell) (Maity *et al.*, 1998; Sahoo *et al.*, 1999) where the first instar nymph usually

Table I : Duration of different nymphs of *N. viridis* (Newstead) on different host plants.

Stage of insects	Particulars	Age of inoculating (in days)			
		Jackfruit	Citrus	Soybean	Bhant
I Instar nymph	n	24	45	133	34
	Range	6 - 10	6 - 10	6 - 10	7 - 10
	Mean ± S.D.	8.21 ± 1.15	7.64 ± 0.96	7.31 ± 1.23	8.82 ± 0.89
II Instar female nymph	n	14	38	97	16
	Range	11 - 15	11 - 15	10 - 14	11 - 15
	Mean ± S.D.	12.21 ± 1.21	12.37 ± 1.11	11.60 ± 1.34	13.06 ± 1.34
III Instar female nymph	n	14	37	96	16
	Range	14 - 18	14 - 18	13 - 17	14 - 18
	Mean ± S.D.	15.36 ± 1.29	15.46 ± 1.06	14.62 ± 1.26	16.19 ± 1.18
II Instar male nymph	n	9	7	32	16
	Range	12 - 14	12 - 14	10 - 13	13 - 15
	Mean ±S.D.	12.78 ± 0.79	12.57 ± 0.73	10.88 ± 0.89	14.19 ± 0.53
III Instar male nymph	n	9	7	32	16
	Range	14 - 16	14 - 16	13 - 16	15 - 17
	Mean ± S.D.	14.89 ± 0.74	14.71 ± 0.88	13.84 ±0.71	16.25 ± 0.56
IV Instar male nymph	n	9	7	30	16
	Range	16 - 18	16 - 18	15 -18	17 - 19
	Mean ± S.D.	16.89 ± 0.87	16.86 ± 0.83	16.23 ± 0.76	18.19 ± 0.63

n = Number of individuals; S.D. = Standard Deviation.

Table II : Comparison on nymphal development of *N. viridis* on different host plants.

Stage of Insect	't' values for comparison					
	Jackfruit V/s Citrus	Jackfruit V/s Soybean	Jackfruit V/s Bhant	Citrus V/s Soybean	Citrus V/s Bhant	Soybean V/s Bhant
I Instar nymph	2.20*	3.30**	2.28*	1.15	5.62**	8.11**
II Instar female nymph	0.45	1.61	3.87**	2.45*	1.67	3.01**
III Instar female nymph	0.28	2.05*	1.84	3.59**	2.23*	4.66**
II Instar male nymph	0.52	4.44**	5.55**	4.68**	6.02**	13.41**
III Instar male nymph	0.47	3.89**	5.19**	2.81**	5.09**	11.83**
IV Instar male nymph	0.07	2.21*	4.32**	4.64**	4.24**	8.83**

* = Significant at 5% level; ** = Significant at 1% level.

passed through longest duration. It is also revealed from Table II that the developmental period of first instar on jackfruit and bhant was signifcantly higher than those on soybean and citrus. However, the difference between soybean and citrus was insignificant and between jackfruit and bhant was significant.

The progress of development and moulting of female nymphs is now discussed. The average age of completion of female nymphal development was maximum of 16.19 ± 1.18 days on bhant and minimum of 14.62 ± 1.26 days on soybean, the age on jackfruit and citrus being 15.36 ± 1.29 and 15.46 ± 1.06 days, respectively (Table I). However, on potato tubers this period was 20.53 ± 1.67 days (Ghosh & Ghose, 1988). So the present study suggests that the host plants have some

Table III : Preoviposition period, oviposition period and fecundity of the female of *Nipaecoccus viridis* (Newstead) on different host plants.

Particulars	Host Plants			
	Jackfruit	Citrus	Soybean	Bhant
Preoviposition period				
Range	6 - 7	7 - 8	8 - 9	7 - 8
Mean ± S.D.	6.33 ± 0.52	7.33 ± 0.47	8.33 ± 0.47	7.67 ± 0.47
Oviposition period				
Range	6 - 12	5 - 10	6 - 7	5 - 8
Mean ± S.D.	9.67 ± 2.62	8.33 ± 2.36	7.66 ± 1.25	6.33 ± 1.25
Fecundity				
Range	56 - 395	53 - 261	45 - 105	45 - 92
Mean ± S.D.	235 ± 139.05	176 ± 89.21	78.67 ± 25.30	66.33 ±19.43

influence on the nymphal development of female of *N. viridis*. Similar observations were made by Gaaboub *et al.* (1979) on *P. citri*, Ullah *et al.* (1992) on *R. spinosus* and *Maity et al.* (1998) *on P. minor* who found that the biological aspects vary considerably according to the rearing hosts. The average female nymphal duration of *P. citri* was 21.30 (13 - 32) days on potato tuber and 20 (15 - 27) days on pumpkin fruit; that of R. spinosus was 30 (28 - 32) days on mango, 28.2 (25 - 31) days on lemon and 27 (26 - 28) days on guava; and that of P. minor was 18.8 (16 - 23) days on potato tuber, 23.12 (20 - 28) days on pumpkin fruit and 34.51 (28 - 45) days on taro. Moreover, it is revealed from Table II that the female development on soybean differs siginificantly from other host plants. Differences between jackfruit with citrus and bhant were non-significant.

In pseudococcids, the prepupal and pupal stages (III & IV Instars) of male are devoid of mouthparts and so the host plants have little scope to influence the development of male nymphs. In the present study in *N. viridis*, the duration of feeding stages (I & II Instars) were 14.19 ± 0.52 days on bhant, 12. 78 ± 0.79 days on jackfruit, 12.57 ± 0.73 days on citrus and 10.88 ± 0.89 days on soybean whereas the total developmental period were 18.19 ± 0.63, 16.89 ± 0.87, 16.86 ± 0.83 and 16.23 ± 0.76 days, respectively (Table I). So the total developmental period was shorter on soybean and longer on bhant both of which differs significantly from other host plants. However, no significant difference exists in the developmental period when feeding on jackfruit and citrus (Table II). It is interesting to note that the periods between II and IV moulting were more or less same on all plants except soybean where non-feeding stages took more time for development, the reason of which is not clearly understood.

It is also revealed that the males take more time than the females to complete their nymphal development irrespective of host plant. But Ali (1957) noted longer developmental period in female (19.2 days) than the male (14.8 days) in this species on citrus. However, different results have been recorded in different species of pseudococcids. In *P. minor*, Maity *et al.* (1998) observed that the males took longer time than the females for development whereas Chowdhury & Ullah (1986) and Sahoo *et al.* (1999) observed more time in females. Longer nymphal developmental period in male was also observed in *R. spinosus* (Ullah *et al.*, 1992), in *Planococcus lilacinus* (Cockerell) (Chowdhury & Ullah, 1986) and that in female *in Rhizoecus amorphophalli* Bactren (Mukhopadhyay & Ghose, 1991).

The preoviposition period of *N. viridis* ranged from 6 - 9 days but the average period was maximum (8.33 ± 0.47 days) on soybean and minimum (6.33 ± 0.52 days) on jackfruit (Table III). The oviposition period ranged from 5 - 12 days. The maximum and minimum being 9.67 ± 2.62 days on jackfruit and 6.33 ± 1.25 days on bhant respectively. Similarly, maximum (56 - 395) and minimum (45 - 92) fecundity were observed on jackfruit and bhant, respectively. However, Ghosh & Ghose (1988) observed oviposition period of 10 - 17 days with fecundity of 1097 eggs in this species on potato tubers.

Finally, it is concluded that the feeding on soybean has accelerated the nymphal development of both sexes but that on bhant has delayed it. Other two hosts, citrus and jackfruit, were intermediate in this respect. However, due to high fecundity rate on jackfruit heavy infestation of *N. viridis* is observed on this plant in nature.

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