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SOME ASPECTS OF THE BIOLOGY AND ECOLOGY OF *ZYGINA RUBRONOTATA* A PEST OF FALSA *(GREWIA ASIATICA)* IN PAKISTAN*

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Zygina rubronotata (Distant) is a serious pest of the fruit plant falsa *(Grewia asiatica)* in some areas of lower Sind in Pakistan. Studies made on different aspects of the biology and ecology of the species showed that it is usually found on falsa from September to February, with peak population during December. The life span of the species from September to February for a male ranged from 5 to 15 ($\bar{X}$ 9) days, and for females from 13 to 42 ($\bar{X}$ 27.2) days. The newly emerged adults mated and female started laying eggs within 4–6 days. In the life history studies, the average life of female, incubation period of eggs, duration of first, second, third, fourth and fifth nymphal instars were, 12.8, 7.1, 2.8, 2.5, 2.1, 1.7 and 1.4 days respectively. The oviposition period of a female was 4 – 14 ($\bar{X}$ 8) days, and the eggs laid were 16 – 44 ($\bar{X}$ 31.33).

The leafhopper affects the foliage of plants by sucking the nutrients as well as attracting growth of fungus *Phakopsora grewiae* (brown dust) in the vicinity of feeding punctures. From early September, the destruction of foliage progressively increased from almost nil to a complete 'defoliation' (99% damage) by the end of February. The studies have been supported with data in 4 tables, and illustrated with 5 figures.

INTRODUCTION

Z. rubronotata has been known since Distant's [2] description of the species from Kodaikanal, India. Mahmood [3] reported the species from Pakistan under the name *Qadria rubronotata.* The host and food plants of the species were not known untill Ahmed [1] reported it from Mirpur Khas, Pakistan as a pest of the fruit plant falsa *(Grewia asiatica).* The biology and ecology of *Z. rubronotata* has not been studied todate. The present workers recorded the species from Karachi, and studied its life history, abundance and damage caused to the host plant.

MATERIAL AND METHODS

(i) About 40 young plants of falsa were grown in pots for rearing *Z. rubronotata.* Equipment and methods used by Jabbar and Ahmed [3] for life history studies of leafhoppers were used during this study.

(ii) To study the abundance of *Z. rubronotata* during the entire period of infestation, 10 plants of falsa growing in natural conditions were carefully scrutinized at 15 days interval. At every observation, 10 heavily infested leaves on each plant were selected for making counts of adults and nymphal instars. Maximum and minimum temperatures of the day of observation were also recorded.

(iii) To determine the sex ratio in natural populations, collections were made with an aspirator at random intervals. Each sample thus collected was separately counted and the number of males and females recorded.

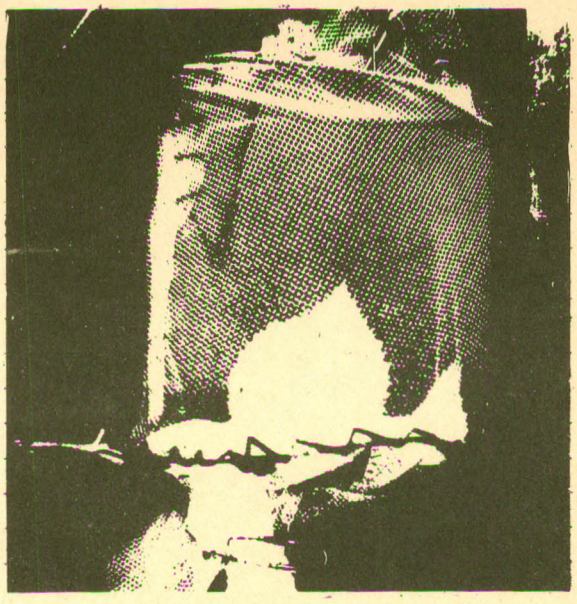

Fig. 1 Sleeve cage used for determining life span of leafhopper.

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Table 1. Fecundity of *Zygina rubronotata* (female) on falsa leaves (1977-78).

Female hatched on	Mated on	Oviposition started on	Total life (day)	Oviposited for (day)	Total eggs laid
25.X	27.X	29.X	10	6	30
31.X	3.XI	5.XI	14	9	38
31.X	2.XI	5.XI	19	14	44
28.XII	31.XII	2.I	15	10	40
31.XII	2.I	4.I	9	5	16
18.I	22.I	24.I	10	4	20
	Average		12.8	8.0	31.3

(iv) The total life span of *Z. rubronotata* was studied by releasing newly emerged adult males and females in specially designed sleeve cages (Fig. 1) on naturally growing plants in the field. The leafhoppers were observed daily in the sleeve, and the sex of those that died recorded. The experiment was continued untill all adults in the sleeve cages died.

(v) To study the longevity without feeding of *Z. rubronotata,* adult males and females, mated and unmated, newly hatched and ovipositing females, as well as newly hatched nymphal instars 1 to 5, these were caged on a paper slips in minicages (Fig. 2). These tests were replicated 10 times.

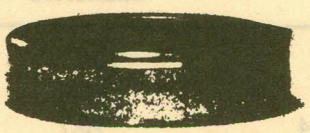

Fig. 2. Plastic minicage used for determining longevity of leafhopper without feeding.

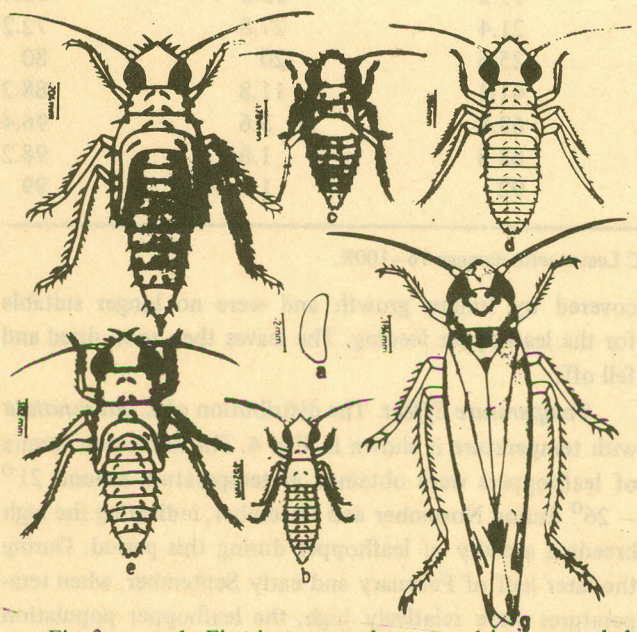

Fig. 3. a egg,b First instar nymph,c second instar nymph,d third instar nymph,e fourth instar nymph,f fifth instar nymph,g adult (male).

Table 2. Life history of *Zygina rubronotata* on falsa leaves at Karachi 1977–78.

Life history stage	Duration range (day)	Average period (day)
Egg (incubation period)	6–8	7.1
Ist instar nymph	2–4	2.8
2nd instar nymph	2–4	2.5
3rd instar nymph	2–3	2.1
4th instar nymph	1–3	1.7
5th instar nymph	1–2	1.4
Total nymphal period	8–13	10.5
Total development period	14–20	17.7
Total life span (male)	5–15	9.0
Total life span (female)	13–42	27.2

RESULTS

Life History. Studies were made on the fecundity of six mated females, life span of eleven males and eleven females, and life histories of thirty-two individual specimens of *Z. rubronotata* on falsa leaves. The results are presented in Tables 1 and 2.

Abundance of Z. rubrontata. The abundance of *Z. rubronotata* was studied at a plantation of falsa near Karachi University Campus, from early September 1977, when the leafhopper recovered from a relatively scarce occurrence during spring and summer, to late February when it became rare after a gradual decline in its population. Total catches of each of the nymphal stages as well as adults in each of the 12 samples made at 15 days interval are given in Table 3.

Table 3 shows that the number of leafhoppers was

Table 3. Total number of *Z. rubronotata* on 10 leaves of falsa with date at Karachi University Campus 1977–78.

Date	Total number of *Z. rubronotata*						
	Ist instar	IInd instar	IIIrd instar	IVth instar	Vth instar	Adult	Total population
10.IX. 77	15	4	1	–	–	–	20
25.IX. 77	66	43	20	7	5	7	148
10. X. 77	151	91	59	25	16	30	372
25. X. 77	300	164	117	30	39	64	714
9.XI. 77	434	272	161	112	71	97	1147
24.XI. 77	519	308	176	103	72	106	1284
9.XII. 77	564	372	185	113	75	122	1431
24.XII. 77	428	271	158	84	59	92	1092
8. I. 78	283	206	111	59	51	85	795
23. I. 78	200	124	96	52	34	68	574
7. II. 78	107	70	42	14	7	48	288
22. II. 78	47	25	3	2	3	15	95
Total	3114	1950	1129	601	432	734	7960

Table 4. Average damage by 'brown dust' to falsa leaves in Karachi 1977.

Dates of observation	Categories of damage and leaf (%)				
	A	B	C	Unaffected	Total affected
10.IX. 77	–	–	–	100	–
25.IX. 77	.4	–	–	99.6	.4
10.X. 77	6.8	2.1	.4	90.7	9.3
25.X. 77	13.4	8	3.2	75.4	24.6
9.XI. 77	23.4	14	8.2	54.4	45.6
24.XI. 77	36.4	18.8	11.2	33.6	66.4
9.XII. 77	25.8	25	21.4	27.8	72.2
24.XII. 77	24.2	30.2	25.6	20	80
8.I. 78	25.4	21.4	41.4	11.8	88.2
23.I. 78	11.6	15	69.8	3.6	96.4
7.II. 78	4.2	10.2	83.8	1.8	98.2
22.II. 78	2	5	92	1	99

A Leaves with damage up to 25%, B Leaves with damage 26–75%, and C Leaves with damage 76–100%.

insignificant during early September. Numbers increased rapidly and the trend of increasing population was maintained untill it reached a peak in early December. From the later half of December, the pupulation again started declining gradually. It is also apparent that the total counts of first instar nymphs were very high in the samples. Mortality in successive instars resulted in very low number of 5th instar nymphs and adults. New leaves on the plants started appearing in July and continued till the middle of September. Afterwards the leaves increased in size and the infestation increased accordingly. By the end of February the leaves were extensively damaged, almost completely covered by fungus growth and were no longer suitable for the leafhopper feeding. The leaves then soon dried and fell off.

Temperature Effect. The distribution of *Z. rubronotata* with temperature is shown in Fig. 4. The maximum counts of leafhoppers were obtained at temperature around 21° – 26° during November and December, indicating the high breeding activity of leafhopper during this period. During the later half of February and early September, when temperatures were relatively high, the leafhopper population was relatively very low and the breeding activity almost negligable. It appears that the distribution and activity of

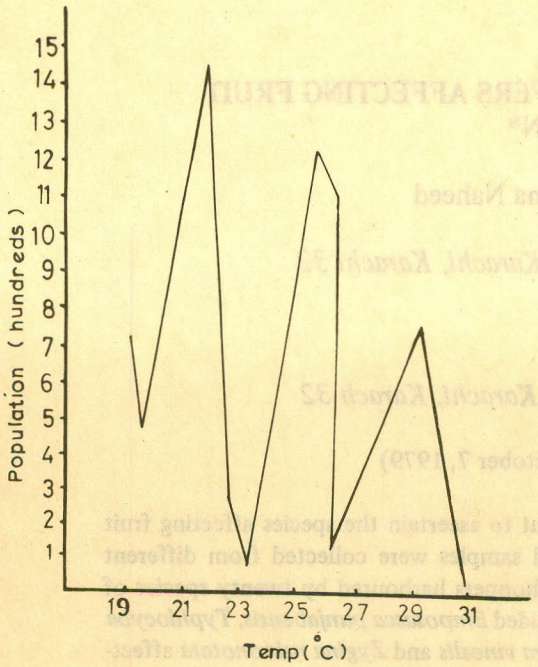

Fig. 4. Distribution of *Z. rubronotata* on falsa leaves with temperature at Karachi.

Z. rubronotata is intimately related with temperature cum winter season.

Longevity Without Feeding. Longevity without feeding of *Z. rubronotata* adults as well as its nymphal stages was checked at different temperatures and has been given in Fig. 5. Almost uniformly the survival period was high at 16° and lower at higher temperature. It is obvious that when contact with the host plant is lost, the young nymphs cannot survive for long periods.

Z. rubronotata *and a Fungal Disease of Falsa.* During studies of *Z. rubronotata* on falsa, it was discovered that a fungus *Phakopsora grewiae* commonly known as 'brown dust' grew rapidly on the leaves, in the vicinity of leafhopper feeding punctures. Assessment of foliage damage by 'brown dust' was made at 15 days interval from September 1977 to February 1978. Out of 100 leaves observed each time, percentage of leaves falling into various damage categories by 'brown dust' are given in Table 4.

The 'brown dust' appeared soon after September, and steadily increased. Leaves kept free from leafhopper attack

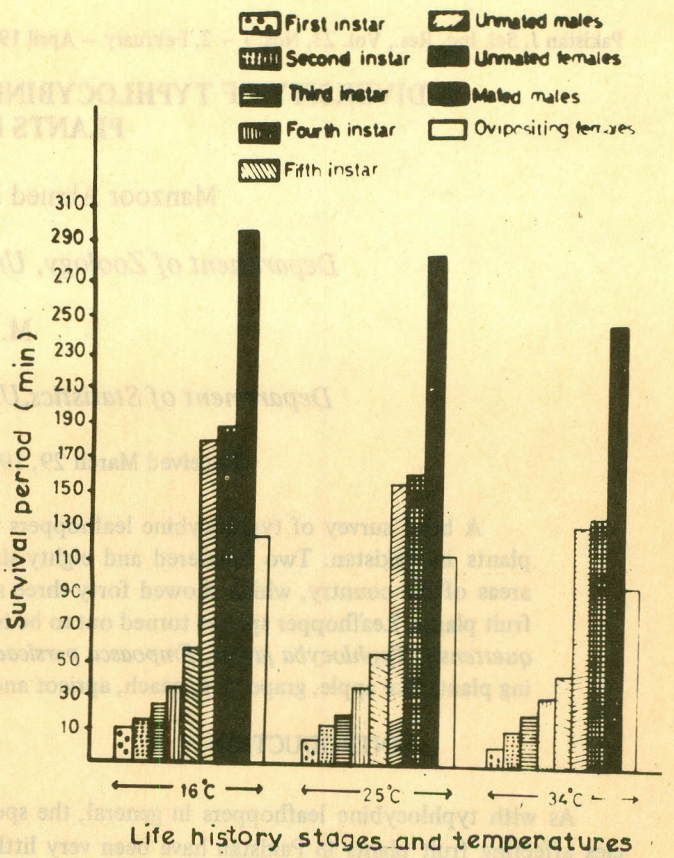

Fig. 5. Longevity without feeding of different life stages of *Z. rubronotata.*

were relatively free of 'brown dust' damage.

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