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BIOLOGY AND ECOLOGY OF *ZYGINA BINOTATA* (DISTANT) (TYPHLOCYBINAE: CICADELLIDAE) A PEST OF KACHNAR, *BAUHINIA VARIEGATA* IN PAKISTAN*

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Recently a number of typhlocybinae leafhoppers have been discovered to infest the plant life of Pakistan. *Zygina binotata* (Distant) is a pest of kachnar, *Bauhinia variegata* Linn. throughout Pakistan. The present investigations on the biology, life history, and ecology of *Z. binotata* on kachnar have been made in Karachi. The leafhopper on average lives for 13.2 days, lays 26.22 eggs and completes its life cycle in 23.24 days at 29° – 33.5°. The leafhopper is common from April to December, but its peak infestation is from August to October.

INTRODUCTION

During the last few years a number of leafhoppers of crops, woody as well as fruit and vegetable plants have been described from Pakistan. Of these, the plant kachnar, *Bauhinia variegata* Linn. (Fam: Caesalpiniaceae) useful as a medicinal as well as ornamental plant is usually heavily infested by *Zygina binotata*. The leafhopper feeds on leaves of the plant, giving them first a mottled appearance, and then rendering them dry and dead. This is the result of large scale removal of nutrients from the mesophyll cells. During September and October the reproduction rate of the leafhopper is tremendously increased, and the process of 'defoliation' is quickened.

Distant [3] described the species as *Empoasca nara binotata* from Calcutta (India). Ahmed [1] collected the species from Faisalabad (Pakistan) and published the new combination *Zygina binotata* (Distant). Ahmed [2] also collected it from Bangladesh. Recently the species appeared in the form of heavy infestations on kachnar plants grown on the Campus of Karachi University. As the biology of erythroneurine leafhoppers is very little known, it was considered useful to investigate it.

MATERIAL AND METHODS

About 60 potted plants of kachnar were grown in our

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laboratory to make them readily available for leafhopper studies. Fifth instar nymphs were brought from the field, and upon attaining adulthood on plants in glass chimneys were confined in pairs on a leaf in a polythene sleeve. After mating each pair was allowed to remain on a leaf for oviposition for 24 hr, and then transferred to a next similar leaf. This practice was continued till the female died. Each leaf was marked with the date that the mated pair spent on it. The first instar nymphs hatching out of eggs were kept in lid-type minicages where they developed to subsequent instars.

Field observations of the leafhoppers were all taken fortnightly on kachnar plants growing in the premises of the University. Records of daily temperature and humidity were also maintained.

RESULTS

Life History. The results of experimental rearing of 78 adults in semilaboratory conditions are presented in Table 1.

It appears from Tables 1 and 2 that in summer temperatures when this study was undertaken at Karachi, the life cycle of *Z. binotata* is completed in 23.24 days, though the nymphal period takes only 12.38 days. It is not much different from the life cycle on wheat of *Zyginidia quyumi* (Ahmed), the only other erythroneurine species studied in Pakistan. The total nymphal period of *Z. quyumi*, as stated by Jabbar and Ahmed [4] is completed in 14.5 days, but the entire life cycle is 20.9 days in early summer. The life cycle of *Z. quyumi* on maize, however, takes a little longer at Abbottabad, during September, where the maximum

Table 1. Fecundity and life span of *Z. binotata* on kachnar in Karachi.

Pair No.	Female lived (day)	Female oviposited for (day)	Total eggs laid	Average temp °C
1	15	8	38	31.7
2	10	4	17	33
3	11	4	20	33.5
4	10	4	18	30.5
5	13	4	8	29.5
6	14	4	13	29.5
7	7	3	10	29.5
8	27	22	94	29
9	11	5	18	29
Mean	13.2	6.44	26.22	30.5
S.D.	± 5.732	± 6.003	± 26.836	

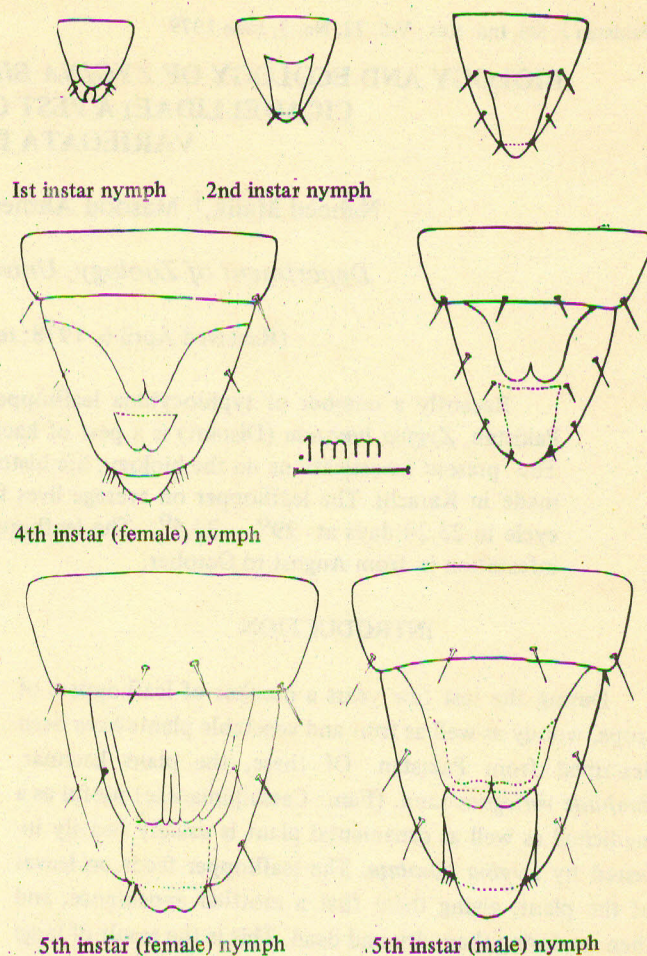
Table 2. Developmental stages and mortality of *Z. binotata* on kachnar in Karachi.

Developmental stages	Mean duration (day)	Mortality (%)
Egg	10.7	—
Ist instar	2.98	30.4
IInd instar	2.2	16.8
IIIrd instar	2.2	14.2
IVth instar	1.98	15.7
Vth instar	3.2	18.75
Total nymphal period	12.38	—
Total life history	23.24	—

temperatures do not exceed 30° and are usually around 27°. There, the nymphal period is completed in 16.3 days and total life history in 27.4 days.

The total life span, fecundity, period of oviposition and nymphal mortality vary considerably in the two species. In the case of *Z. quyumi* the total life of females ranged from 12 to 79 days (\bar{X} = 29 days) at Faisalabad and 44 days at Abbottabad. Fecundity ranged from 20 to 129 eggs (\bar{X} = 60 and \bar{X} = 106.5 respectively for Faisalabad and Abbottabad). Similarly the oviposition period in case of *Z. quyumi* ranged from 4 to 48 days (\bar{X} = 22.5). Nymphal mortality was 52.5% as compared to 66% in *Z. binotata*, being 30.4, 16.8, 14.2, 13.7 and 18.75% respectively in 1st, 2nd, 3rd, 4th and 5th instars in laboratory rearing.

Nymphal Development. Oval-shaped eggs are laid on the undersurface of leaves and inserted below the epidermis in punctures made with the ovipositor, on lateral sides of the midrib or side veins. First instar nymphs hatch in 10–12 days (\bar{X} = 10.7) and then pass through five instars

Fig. 1. *Zygina binotata*. Morphological development of genital segments in nymphal instars.

to reach maturity. There is a gradual increase of length from .425 in the first instar to 2.6 in female and 2.4 mm in male adults. Spines are present on the dorsum of head, thorax and abdomen in all the nymphal instars, but not in adult. First rudiments of wings appear in the second instar, and of sexual differentiation in the fourth instar. In the female fourth instar the eighth and ninth sternites bear each a pair of plate-like structures representing two pairs of valvulae. In the fifth instar all the three pairs of valvulae become distinct. In the male 4th instar nymph there is only one pair of plate-like structures on the eighth abdominal sternum. In the fifth instar the plate like structures become broadened, and overgrow the ninth sternum to give rise to the single pair of male plates (Fig. 1).

General Remarks. Mating takes place within 5–6 days of the emergence of adults, provided the temperature at the time of mating is above 24°. During mating the two individuals come at a tail to tail position, and remain in coitus for 1–2 hr. Eggs are laid singly, sometimes in rows, at the rate 1–9 eggs/day, and one egg per puncture. On average, the males are short-lived (\bar{X} = 13.2 days) as compared

to females (\bar{X} = 15.0 days).

The leafhoppers feed on the undersurface of leaves and normally do not attack any other part of the plant. The signs of damage appear as 'stippings' or rounded whitish spots on the upper surface of leaves, indicating the cells killed due to the removal of their contents. In cases of heavy infestation the entire leaf-area is killed. The leaves then dry off and fall. Although the injury is basically mechanical, excessive nymphal and adult faecal matter deposited on the leaves is also conducive to fungal growth. From the 2nd instar onward the nymphs become successively more active and can jump from leaf to leaf thus affecting the whole foliage.

The leafhopper *Z. binotata* is common in Karachi on

the host plant *Bauhinia variegata* from April to December, but its heavy infestation appears from August to October. Ahmed [2] has concluded that the heaviest infestation of the leafhopper *Z. binotata* in Bangladesh occurs in December.

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