TABLE 2

Percentage of plants showing R, MR, and S reactions in F_2 population and F_3 lines of the crosses of mutants of Vijaya*

F_2/ F_3	R (0-2.0†)	MR (2.1-6.0)	S (6.1 and above)
Vijaya (Control)	0.0	0.0	100.0
F_2			
159-9 × 129-15	15.4	77.7	7.0
185-34 × 187-2	19.0	80.3	0.7
(159-9 × 129-15) (185-34 × 187-2)	28.0	68.5	3.7
F_3 lines			
1	88.5	11.5	0.0
3	77.8	22.2	0.0
6	84.2	15.8	0.0
14	66.7	33.3	0.0

* R—Resistant; MR—Moderately resistant; S—susceptible. † Lesion length in cm.

lesion length in their plant population towards resistance as a result of accumulation of resistant genes. It is evident that the improvement for the resistance achieved through pyramidisation in the families is of greater magnitude (table 2). It indicates that the approach of pyramidisation could help to achieve effective resistance to bacterial leaf blight.

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STUDIES ON THE BIOLOGY OF A PREDATOR, *CARDIASTETHUS* SP. (HEMIPTERA: ANTHOCORIDAE) FOUND IN THE GALLERIES OF *NEPHANTIS SERINOPA* MEYR. (LEPIDOPTERA: XYLORICTIDAE)

U. C. ABDURAHIMAN, U. V. K. MOHAMED AND O. K. REMADEVI
Department of Zoology, University of Calicut, Calicut 673 635, India.

THE pirate bugs (Anthocoridae) exercise an important check on aphids, scale insects, thrips and other small insect pests[1]. Barber[2] has given an extensive account of *Orius* (*Triphleps*) *insidiosus* (Say), and its role in the control of the corn earworm, *Heliothis obsoleta* (F). Rao *et al.*[3] reported from S. India an anthocorid bug, *Triphleps* sp. as a predator of the eggs of *Nephantis serinopa* Meyrick, the caterpillar pest of coconut. The present authors report for the first time a species of *Cardiastethus* being present in different parts of Kerala, as predators on the eggs and early larval stages of *N. serinopa*.

Eggs are cylindrical with one end oval and the other end having a rounded operculum. The chorion is hard. Newly laid eggs are white and measure 0.54 mm long and 0.20 mm wide. After about a day, eggs turn pink. The incubation period is 4-5 days. Upon hatching the operculum is opened to one side and the first instar nymph emerges.

Total duration for the 5 nymphal instars is on an average 18-22 days. The details of each stage are given in table 1. The nymphs are pink with 3rd, 4th and 5th abdominal segments bearing red spots dorsally. Upon their emergence, the nymphs start actively feeding on the haemolymph of the prey.

The newly emerged adults are at first light red and then gradually turn deep brown. The female (figure 1) is larger than the male, her abdomen wider and longer, with the apex projecting a little beyond the posterior margin of the wing membranes. Females measure 1.50 to 2 mm in length and 0.50 to 0.70 mm in width.

Predatory behaviour

The immature stages as well as the adults are predaceous. Eggs and first instar larvae of *N. serinopa* are pierced (figure 2) and the fluid contents removed leaving the host desiccated and shrunken. Feeding time lasts from 5 to 15 min depending on the stage of the prey. While feeding the rostrum is withdrawn at intervals and inserted at fresh points. It was found, how-

TABLE 1

Description and duration of each nymphal stage of Cardiastethus sp.

Instar	Measurement in mm Length	Width	Characters	Duration in days
I	0.63	0.26	Body slightly pink; No wing pads	3–4
II	0.82	0.33	Body deep pink; No wing pads	2–3
III	1.11	0.34	Body deep pink with 3 abdominal spots, wing pads begin to develop	2–3
IV	1.39	0.49	Wing pads short reaching abdominal tergite	2–3
V	1.64	0.60	Wing pads extending to the mid region of the abdomen	4–5

ever, that this species shows no specificity in host selection and will feed on the eggs and larvae of *Corcyra cephalonica* Staint. (Pyralidae), *Tribolium castaneum* (Herbst) (Tenebrionidae), *Bracon brevicornis* Wesm. (Braconidae) and *Parasierola nephantidis* Mues. (Bethylidae) as well. Individuals are also found to be cannibalistic. The adults live an average of 1 month, but many survive 2 to 3 months depending on the availibity of the food.

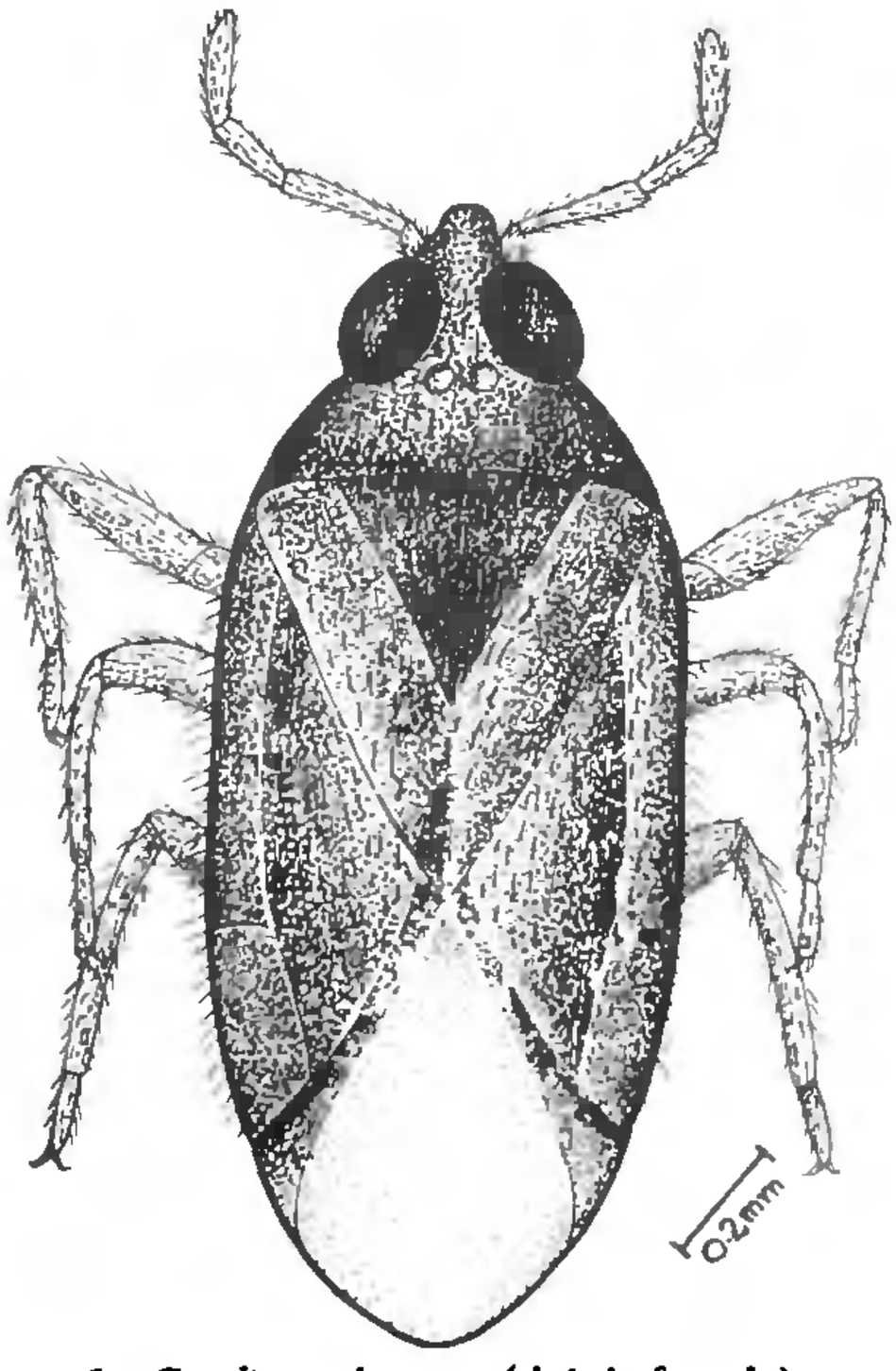

Figure 1. *Cardiastethus* sp. (Adult female)

Figure 2. *Cardiastethus* sp. feeding on the first instar larva of *N. serinopa*.

Reproduction

Oviposition occurs throughout the life of mature females at a rate of one or two eggs per day. In the laboratory, eggs are laid on the coconut leaf strips or on cotton plugs in culture tubes. Eggs were never laid on the sides of the glass tube. Female lays about 17-20 eggs, all of them deposited close to one another.

This species of *Cardiostethus* potentially is an important predator of the eggs and early stage larvae of the coconut pest, *N. serinopa*. Unfortunately because of its polyphagous nature, it will also prey on the immature stages of the important larval ectopara-

sites like *B. brevicornis* and *P. nephantidis* of the same pest. At this time it is not certain whether its predacious tendencies toward *N. serinopa* outweigh the harm done by preying on certain larval ectoparasites.

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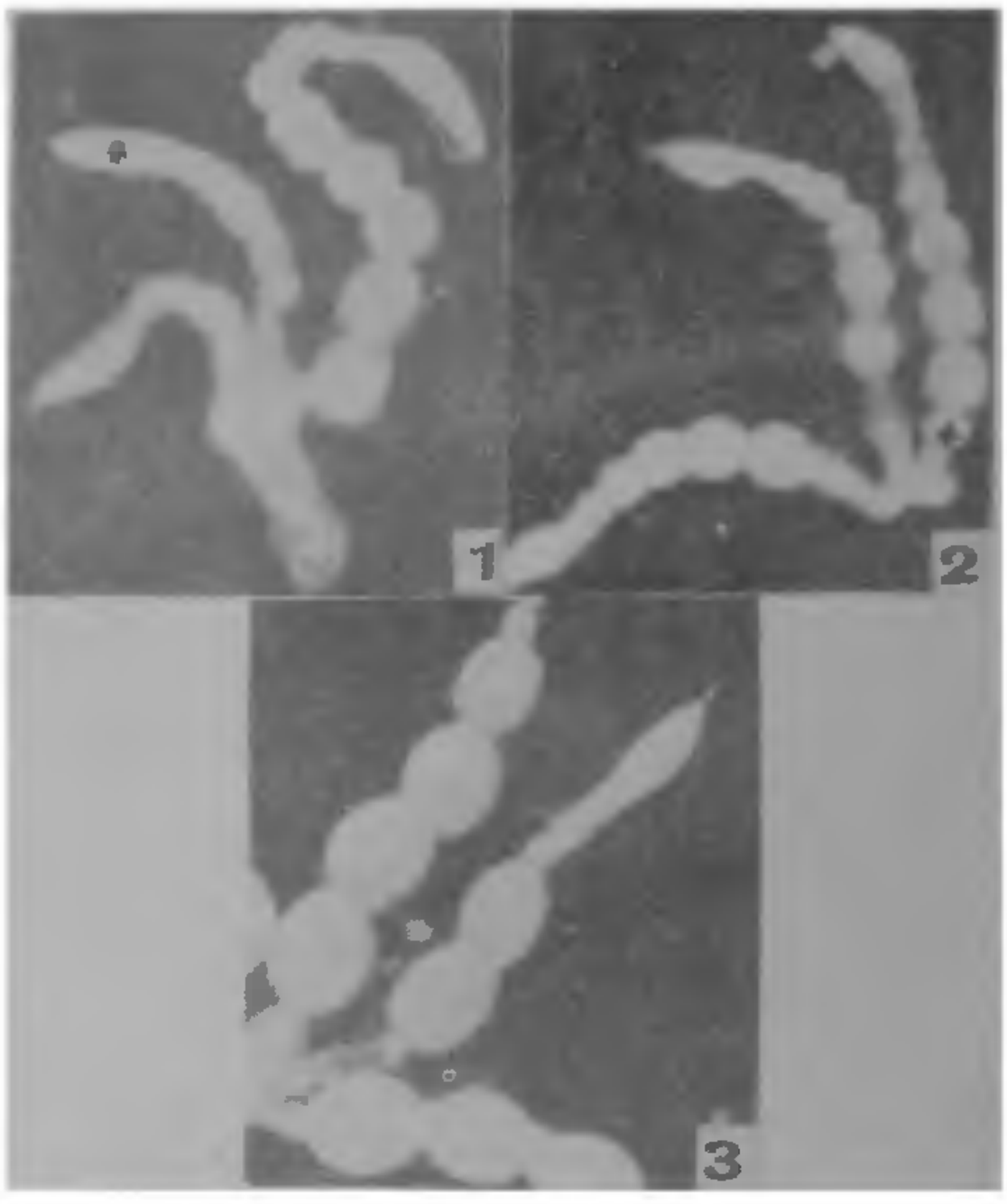
EFFECT OF A JUVENILE HORMONE ANALOGUE, HYDROPRENE ON THE FEMALE REPRODUCTIVE ORGANS OF THE RED COTTON BUG, *DYSDERCUS KOENIGII* (F)

D. REVATHY, S. S. THAKUR, B. KISHEN RAO AND G. MARUTHI RAM
Department of Zoology, University College of Science, Osmania University, Hyderabad 500 007, India.

THE juvenile hormone analogues inhibit reproduction if they are applied prior to imaginal ecdysis[1]. Nevertheless, in the adult insects the juvenoids were shown to inhibit the development of the oocytes in the ovarioles[2-5]. Moreover they bring about morphogenetic abnormalities in reproductive organs[6,7]. In the present communication we report the activity of the juvenoid, Hydroprene on the ovaries of the red cotton bug, *Dysdercus koenigii* (F).

The rearing method of the red cotton bug was mentioned elsewhere[8]. Freshly moulted adult females were given a topical application of 1μl/sp (1μg) of the juvenoid hydroprene. The juvenoid was dissolved in acetone. The test insects were dissected on the 5th day after treatment.

In most of the ovaries, the number of oocytes was reduced to 1–5. In many cases, oosorption was a common feature, and in some inhibition of vitellogenesis was observed. The germarium region was also deformed.



Figures 1–3. Ovarioles of the treated adults dissected on the fifth day after the treatment. (× 15) **1.** Note the inhibition of vitellogenesis and deformed germarium (arrow). **2.** Note the oosorption in the basal oocyte (arrow). **3.** Note the reduced number of oocytes in the vitellarium region

The juvenile hormone induces vitellogenesis in several groups of insects[9,10]. The application of the juvenoid to the adult females was shown to cause ovicidal effect in *Pyrrhocoris apterus*[11]. Rohdendorf and Sehnal[3,5] showed that in *Thermobia domestica*, the administration of juvenoid to the adult females caused derangements such as resorption of the mature oocytes, inhibition of vitellogenesis and reduced number of oocytes. This was supported in the cotton stainer, *Dysdercus cingulatus* with the paper factor[7]. Our present investigation is in agreement with the above findings.

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