

**THE LIFE HISTORY AND CONSUMPTION HABITS OF  
CYRTORHINUS LIVIDIPENNIS REUTER  
(HEMIPTERA: MIRIDAE)<sup>1</sup>**

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The life history and consumption habits of *Cyrtorhinus lividipennis* Reuter were studied using the different stages of *Nephotettix virescens* (Distant).

The incubation period of eggs ranged from 6 to 9 days ( $7.56 \pm 0.64$  days), usually 6 days. The durations of nymphal stadia are as follows: first stadium, 2-4 days ( $2.93 \pm 0.58$  days), usually 3 days; second stadium, 2-4 days ( $3.06 \pm 0.57$  days), usually 3 days; third stadium, 3-5 days ( $3.96 \pm 0.57$  days), usually 3 days; and fourth stadium, 3-4 days ( $3.60 \pm 0.51$  days), usually 3 days. The longevity of males ranged from 7 to 25 and of females from 5 to 21 days.

The predator nymph consumed an average of 7.45 host eggs or 1.35 host nymphs per day for a period of 14 days. The adult male predator consumed an average of 10.41 eggs or 4.69 nymphs or 2.45 host adults per day for a period of 10 days, while the female consumed 10.01 eggs or 4.75 nymphs or 2.25 adults per day for a period of 10 days.

*Cyrtorhinus lividipennis* Reuter is a predator of the brown planthopper, *Nilaparvata lugens* (Stal) and the green leafhopper, *Nephotettix virescens* (Distant), two of the most destructive insect pests of rice.

It has been currently observed that when leafhoppers and planthoppers are abundant, generally no crops may be harvested. The usual chemical method of control has not always prevented crop damage but to some extent may have even magnified the problem through the development of insect resistance to the chemicals and the elimination of the hopper's natural enemies. Except for a few observations from IRRI, there has been no intensive study in the Philippines concerning the role of *C. lividipennis* in controlling planthoppers and leafhoppers and various factors associated with the effectiveness of the predator as a control agent.

Though widely distributed, *C. lividipennis* has not yet been collected above 2,000 feet (Woodward, 1957).

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*C. lividipennis* (Usinger, 1939) has been known from the East Indies since 1884. However, its predatory habit was not discovered until 1920. Although belonging to a predominantly phytophagous subfamily, Orthotylinae, of the great plant feeding family Miridae, it has somehow shifted to an exclusively predatory life piercing the eggs of leafhoppers and sucking out their juices. *C. lividipennis* occurs in the Oriental and the Pacific (Great Nicobars, Formosa, Java, Ceylon, Sumatra, Burma, Japan, Guam, Philippine Islands, and China (Usinger, 1939). It feeds on *Sporobolus* grass, *Peregrinus maidis* (Ashmead), *Nilaparvata lugens* (Stal) (Usinger, 1939; Hinckley, 1963) and *Sogatella furcifera* Horvath (Hinckley, 1963).

Bae and Pathak (1969) observed *C. lividipennis* populations feeding on brown planthopper eggs. They multiplied so rapidly that in about ten days the planthopper nymphal population declined. In the laboratory, *C. lividipennis* was caged with nymphs of *N. lugens* and *N. virescens* and killed a majority of both pest species (IRRI, 1971).

Concerning the effect of insecticides on *C. lividipennis*, it was found susceptible to diazinon (IRRI, 1971). It was also observed that the population was low in areas treated with Methyl Parathion (IRRI, 1972). On the other hand, the control test on *N. lugens* on rice treated with 60% Mecarbam showed that *C. lividipennis* was unaffected (MacQuillan, 1968).

The vital role that *C. lividipennis* plays in pest management programs has necessitated studies concerning its life history and food consumption habits.

The experiment was conducted in the Department of Entomology, University of the Philippines at Los Baños, from 1974 to 1975.

## MATERIALS AND METHODS

*Preparation of the host plant.* Rice seeds (C-4 variety) were sown in a clay pan. After two weeks, seedlings were transplanted in fifty pots (4-inch diameter) with six seedlings per pot. To insure a continuous supply of rice plants, staggered sowing was done at two-week intervals.

*Culture of host insect.* Adults of the green leafhopper, *N. virescens*, were collected from the field and confined in small cages (18.5 x 19.25 x 20 inches) containing three-week old rice plants. The oviposited rice plants were transferred to another cage where the eggs were allowed to hatch. Host plants on which the green leafhoppers fed were changed to maintain fresh food for the hoppers.

*Culture of the predator.* Field-collected adults of *C. lividipennis* were maintained in the green house for mass production. Adults were caged with the different stages of green leafhopper which served as host insect. Rice plants on which the leafhoppers fed were changed regularly.

*Life history and habits.* The life history of *C. lividipennis* was studied in the laboratory. Pairs of adult predators were placed in several cut glasses (diameter — 1.4 inches; height — 2 inches) for the female to oviposit on. Newly laid eggs were transferred into petri dishes lined with moist filter paper. Newly hatched nymphs were transferred individually in cut glasses provided with host nymphs feeding on 1% sucrose solution. Observations were made on incubation period, duration of instars, and longevity of the insects.

The predatory efficiencies of nymphs and adults were determined. Three set-ups were employed for the predator nymphs. For the first, second, and third set-ups, leafhopper eggs, nymphs, and adults were introduced, respectively, as food of the predator. Twenty individuals were utilized for each set-up. For the first set-up, leaf sheaths containing leafhopper eggs were excised from the rice stem about two inches long, placed in small vials with water and contained inside 48-ounce bottles. A nymph predator was introduced before the bottle was finally covered with nylon mesh cloth. The predator was provided with twenty host eggs every other day. The eggs that were fed upon by the predator changed from light yellow to blackish brown. Determination of the number of eggs fed upon by the predator was based on the dark-colored eggs. For the second set-up twenty host nymphs were used for every cut glass. Dead nymphs were removed after each observation and were replaced to maintain a total of twenty nymphs. For the third set-up fifteen adult green leafhoppers were introduced into each cut glass where a nymph predator was confined. Adult predators were given similar feeding treatments. The cut glasses were changed every other two days. The transfer of insects from one cut glass to the other was accomplished using an aspirator.

Different stages of *C. lividipennis* were described using live specimens and temporary mounts. Observations, measurements, and illustrations of the different stages of the predator were made using compound and binocular microscopes and slide projector.

## RESULTS AND DISCUSSION

### Life History

The developmental period and longevity of *C. lividipennis* are presented on Tables 1 and 2, respectively.

*Egg.* The incubation period ranged from 6 to 9 days ( $\bar{x} = 7.56 \pm 0.64$  days) usually 6 days.

*Nymphal stages.* The first stadium ranged from 2 to 4 days ( $\bar{x} = 3.93 \pm 0.58$  days) usually 3 days, the second stadium from 2 to 4 days ( $\bar{x} = 3.06 \pm 0.57$  days) usually 3 days, the third stadium from 3 to 5 days ( $\bar{x} = 3.95 \pm 0.57$

TABLE 1. Developmental period of *C. lividipennis* (Based on 30 individuals for each period).

Period	Range (days)	Usual (days)	Mean (days)
Incubation	6 - 9	6	7.56 ± .64
First instar	2 - 4	3	2.93 ± .58
Second instar	2 - 4	3	3.06 ± .57
Third instar	3 - 5	3	3.96 ± .57
Fourth instar	3 - 4	3	3.60 ± .51

TABLE 2. Longevity of the adults of *C. lividipennis* (Based on 60 adults).

Longevity (days)	Frequency	
	Male	Female
5		1
6		0
7	1	2
8	1	2
9	1	1
10	0	1
11	1	1
12	1	0
13	2	1
14	2	2
15	1	2
16	2	4
17	4	3
18	3	4
19	3	1
20	0	3
21	2	2
22	2	
23	1	
24	2	
25	1	

days) usually 3 days, and the fourth stadium from 3 to 4 days ( $\bar{x} = 3.60 \pm 0.51$  days) usually 3 days.

*Adult stage.* The longevity for females ranged from 5 to 21 days and the males from 7 to 25 days. The adults died when starved from two to three days.

### Habits

*Feeding.* Inside the cage, the nymph and adult predators were found in association with the green leafhoppers. The predator approached the host before it grasped the latter's abdomen with its forelegs and probed its beak into the host tissue. The same behavior was displayed by the predator inside the cut glasses.

*Consumption rate.* The average food consumption per day of *C. lividipennis* is presented on Table 3. For a period of 14 days, the predator nymph consumed 7.45 host eggs if fed with eggs alone and 1.35 host nymphs if fed with nymphs alone. The nymphs which were provided with adult leafhoppers died after two or three days. This may be attributed to the active flight behavior of the leafhoppers, preventing the predators from catching more prey.

TABLE 3. Average leafhopper eggs, nymphs, and adults consumed by *C. lividipennis* per day.

<i>C. lividipennis</i> Stages of	Eggs	<i>Nephotettix virescens</i> Nymphs	Adults
Nymph <sup>a</sup>	7.45	1.35	—
Adult:			
Male <sup>b</sup>	10.41	4.69	2.45
Female <sup>b</sup>	10.01	4.75	2.25

<sup>a</sup> 20 individuals observed for 14 days

<sup>b</sup> 20 individuals observed for 10 days

The male adult predator consumed 10.41 host eggs or 4.69 host nymphs or 2.45 host adults per day for a period of 10 days while the female consumed 10.01 host eggs or 4.75 host nymphs or 2.25 host adults per day for a period of 10 days. The results show that more host eggs were consumed compared to host nymphs and adults. The immobility of leafhopper eggs may explain this difference. When it comes to nymphal and adult feeding, the predator has to move and catch the prey one at a time. The active flight behavior of leafhoppers sometimes prevented the predator from catching its prey.

*Mating.* Mating was observed in the afternoon between 2 and 3 o'clock on the leaves. A slight disturbance often made the pair separate.

*Oviposition.* Adult females when about to lay moved sluggishly and stayed near the base of the plant. Eggs were laid either singly or in groups within the leaf sheath. They were deposited perpendicularly with the micropylar end attached to the leaf tissue.

Usinger (1946) observed the eggs of *C. lividipennis* protruding from the leaf surface of corn, capped with small disks. They were laid along the mid-ribs of leaves among the delphacid eggs, especially those of the corn leaf-hopper, *Peregrinus maidis* (Ashmead). Although most common on corn this bug was found abundant on sugarcane and rice.

A single female bug laid as many as 30 eggs with an average of 13.5 throughout its life. All females observed died shortly after laying.

### Description of Different Stages

*Egg.* The short, stout egg is ellipsoid with the micropylar end curved and the distinctly black opercular region more sharply angled (Fig. 1). The newly laid white eggs turned greenish and a distinct red spot near the opercular region became discernible before hatching. Egg length varied from 0.64 mm to 0.75 mm ( $\bar{x} = 0.69 \pm 0.04$  mm) and width from 0.13 to 0.20 mm ( $\bar{x} = 0.17 \pm 0.01$  mm)

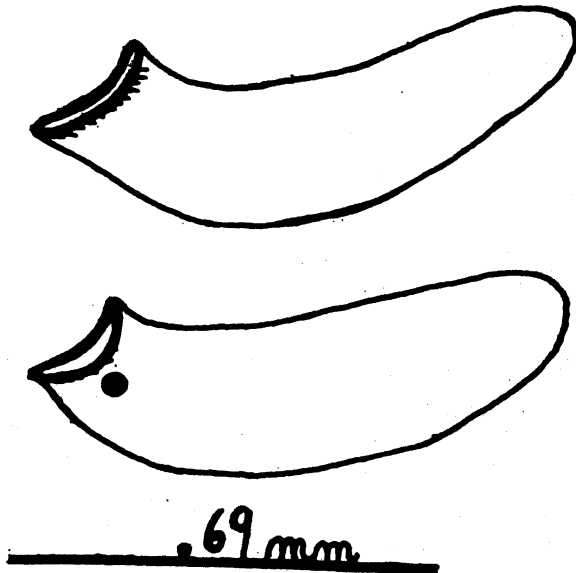


Fig. 1. Free-hand line drawing of the eggs of *C. lividipennis*.

*First-instar nymph.* The yellowish green first instar-nymph is larva-like (Fig. 2a). It possesses a pair of 4-segmented antennae. The second segment is about three times longer than the first segment. The second, third, and fourth segments are almost of equal length but with the last segment rather stout. Antennae are light brown with the anterior portion of each segment darkly colored. The legs are green from coxa to femur and brown from tibia to tarsus. The nymphal length varied from 0.53 to 0.75 mm ( $\bar{x} = 0.71 \pm 0.04$  mm) and width from 0.15 to 0.27 mm ( $\bar{x} = 0.18 \pm 0.03$  mm).

*Second-instar nymph.* The light green second-instar nymph has an elongated body (Fig. 2b). The antennae and legs are larger and longer than those of the first instar. The prothorax is about three times wider than its length. At this stage the initial hypodermal thickening at the tergal margins of meso- and metathorax starts to bulge. The second instars varied from 1.0 to 1.25 mm long ( $\bar{x} = 1.16 \pm 0.0001$  mm) and from 0.30 to 0.46 mm wide ( $\bar{x} = 0.36 \pm 0.04$  mm).

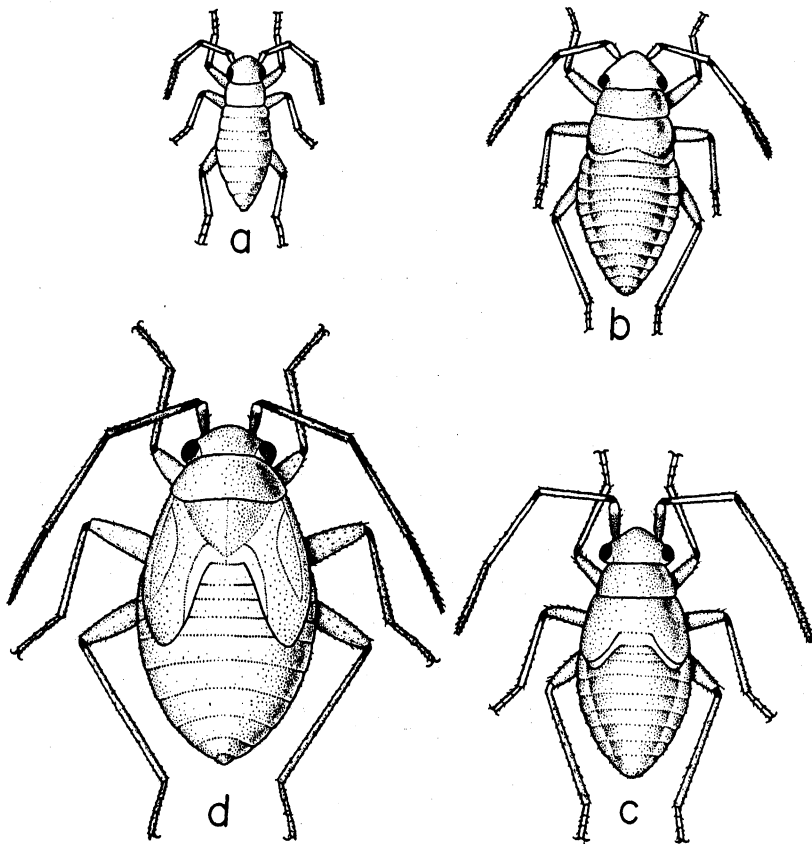


Fig. 2. Nymphal stages of *C. lividipennis*. a, first instar, b, second instar, third instar, d, fourth instar.

*Third-instar nymph.* The third-instar nymph is similar to but darker than the second instar. The hypodermal thickening is enlarged and flattened, assuming a wing-like shape (Fig. 2c). The nymphs varied from 1.0 to 2.00 mm long ( $\bar{x} = 1.8 \pm 0.0002$  mm) and from 0.48 to 0.67 mm wide ( $\bar{x} = 0.56 \pm 0.005$  mm).

*Fourth-instar nymph.* The green fourth-instar nymph has an elongated body with the scutellum almost developed. The wing pads have developed into forewings and hindwings with the forewings narrower and longer than the hindwings (Fig. 2d). The nymphs varied from 0.75 to 2.25 mm long ( $\bar{x} = 2.09 \pm 0.0001$  mm) and from 1.0 to 1.25 mm wide ( $\bar{x} = 1.01 \pm 0.00005$  mm).

*Adult female.* The female has an elongated, green body. The second antennal segment is as long as the basal width of the pronotum which is bell-shaped and the basal margin almost flattened. The hemelytra are extended beyond the apex of the abdomen. The females varied from 2.5 to 3.24 mm long ( $\bar{x} = 3.04 \pm 0.00002$  mm) and from 0.75 to 1.5 mm wide ( $\bar{x} = 1.1 \pm 0.00002$  mm).

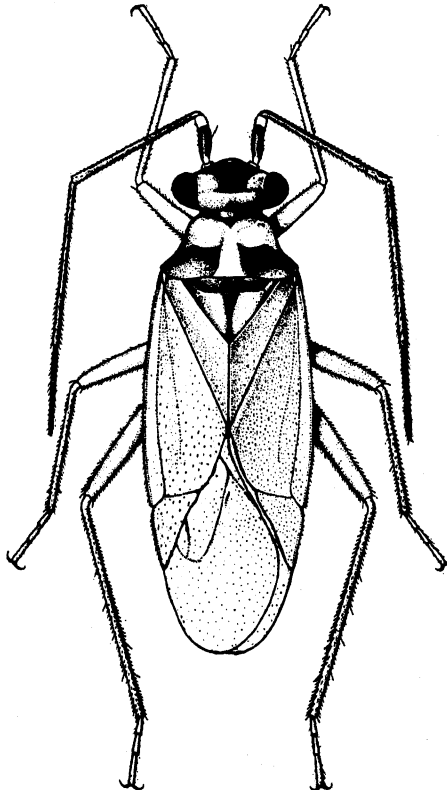


Fig. 3. Male adult of *C. lividipennis*, general habitus.



*Adult male.* The male (Fig. 3) is similar to the female, varying from 2.5 to 3.0 mm long ( $\bar{x} = 2.28 \pm 0.0002$  mm) and from 0.75 to 1.0 mm wide ( $\bar{x} = 0.86 \pm 0.0001$  mm).

In both sexes the antennae are blackish brown with the anterior portion of each segment lightly colored. Fine setae beset the antennae, legs, wings, and body. The hemelytra are dark green, the membrane having two closed cells at the base. The hindwings are membranous and slightly shorter than the forewings. The legs are similar to those of the nymphs in color.

Usinger (1934) described the head as having a more or less distinct pattern formed by broad pale areas contiguous with inner margin of the eyes on either side and sometimes meeting at the center, always joined along posterior area, elevated before the neck. The general color was much paler, ochraceous to green with fuscous or black marks limited mainly on anterior portion of the head, sides of posterior lobe of pronotum, and middle of scutellum.

#### SUMMARY AND CONCLUSION

*Cyrtorhinus lividipennis* Reuter fed on different stages of *Nephotettix virescens* (Distant).

The incubation period ranged from 6 to 9 days ( $\bar{x} = 7.56 \pm 0.64$  days), usually 6 days. The first stadium ranged from 2 to 4 days ( $\bar{x} = 2.93 \pm 0.58$  days) usually 3 days, the second stadium from 2 to 4 days ( $\bar{x} = 3.06 \pm 0.57$  days) usually 3 days, the third stadium from 3 to 5 days ( $\bar{x} = 3.96 \pm 0.57$  days) usually 3 days, and the fourth stadium from 3 to 4 days ( $\bar{x} = 3.60 \pm 0.51$  days) usually 3 days. The longevity of males ranged from 7 to 25 days and the females from 5 to 21 days.

For a period of 14 days the predator nymph consumed an average of 7.45 host eggs if fed with host eggs alone or 1.35 host nymphs if fed with host nymphs alone per day. The adult male predator consumed 10.41 host eggs or 4.69 host nymphs or 2.45 host adults per day for a period of 10 days while the adult female predator consumed 10.01 host eggs or 4.75 host nymphs or 2.25 host adults per day for a period of 10 days.

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