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BIOLOGY OF THE COTTON STAINER, DYSDERCUS CINGULATUS FABRICIUS (PYRRHOCORIDAE, HEMIPTERA)[1]

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Dysdercus cingulatus **Fabricius causes stunting of okra fruits and feeding leads to the oozing of exudates which serve as a medium for fungus growth.**

The incubation period lasted 6-9 days in both sexes. There were five nymphal instars. The nymphal period lasted 32-41 days. The total development lasted 40-50 days.

The eggs were laid below the surface of the soil. A female laid an average of 465 eggs with 49.39 per cent hatchability. The first instar nymphs remained underground until the first molt. Both nymphs and adults were gregarious and they were found to cannibalize on weak, dying and dead individuals when ill-fed.

An ectoparasitic mite, Hemipteroseius sp. **was found infesting the postnotum of the adult insects. Two species of spiders were also observed preying on the insect and a parasitic nematode was found inside the abdomen of a female** Dysdercus.

The insects were found to be abundant throughout the year on okra plants, and on crops such as cotton, kapok, kenaf, jute, and some alternate wild host plants under Malvaceae.

The red cotton bug or cotton stainer, *Dysdercus cingulatus* Fabr., is an important pest of cotton and other plants of the family Malvaceae.

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This species, when present in large numbers, can cause serious damage on cotton bolls and okra (*Hibiscus esculentus*) fruits. Although the chief damage on cotton is in the staining of the lint by exudates from injured seeds (Baltazar, 1934) or staining by the adult's excreta, their feeding punctures also serve as entry points for fungus and bacterial boll-rot organism (Whitefield, 1933). In okra, the feeding of these bugs results to stunted and malformed fruits.

In addition to cotton and okra, other host plants recorded in the Philippines include *Aleurites molucanna, Carica papaya, Hibiscus sabdariffa* and seed-heads of lettuce (Jones, 1913; Woodworth, 1921). In India, the pest has been reported on *Eriodendron onfractuosum* and *Crotalaria juncea* (Singh, 1923; Pruthi, 1937). Thailand Department of Agriculture (1965) also lists the following host plants: *Ceiba pentandra, Gossypium herbaceum* and *Sida rhombifolia.*

Certain aspects of the bionomics of the species have been reported from other countries (Mehta, 1930; Srivastava, 1958). This paper reports further observations on the life history, habits, host range, seasonal abundance and natural enemies of the pest in this country.

MATERIALS AND METHODS

Life History. Adults, preferably those in *copula,* were collected from the field and brought to the laboratory for mass rearing in wire breeding cages. Fruits of okra were first given to the insects as food. However, there was 80% mortality during the first generation and this prompted a change of feed. Seeds of kapok (*C. pentandra*) were then provided in place of okra fruits. Moistened fine soil, placed below the kapok seeds, was provided in the breeding cages as the medium for oviposition.

To obtain clean eggs for the life history study, gravid females were confined in wide-mouthed rearing jars containing a piece of wet cotton and kapok seeds. The females readily laid eggs on the surfaces of the jar. Nymphs hatching from these eggs were individually transferred into test tubes which also contained wet cotton and kapok seeds. The nymphs were observed daily for developmental changes. A regular schedule of cleaning of test tubes was instituted to keep the cultures safe from infection by molds.

Morphological studies. Morphological studies were made from fresh as well as from preserved and slide-mounted materials.

Host Plants, Seasonal Abundance, and *Natural Enemies.* Both wild and cultivated plants in the field were observed for the presence of this pest. In the laboratory, any plant suspected to be a host was introduced as food.

A search for possible parasite, predator and pathogen in the field and in the laboratory was done. Eggs were exposed in the field and examined for possible parasites.

A bimonthly survey from July, 1967 to May, 1968 of the kapok trees and okra plants was made to determine relative abundance.

RESULTS AND DISCUSSION

Life History and Habits. Table 1 shows the duration of the different developmental stages of *D. cingulatus.* The data are based from the record of 118 individuals, 64 males and 54 females. The period of the various stages among males closely paralleled those of females although the mean durations for the females tended to be more variable. There were 5 nymphal molts requiring about 44-45 days to reach the final molt from the date eggs were laid. Mean temperature during the study was 24.5°C as computed from daily readings of a max.-min. thermometer.

TABLE 1. Duration (days) of the different developmental stages of Dysdercus cingulatus.

Developmental Period	MALES (64 individuals)		FEMALES (54 individuals)	
	Range (days)	Mean (days)	Range (days)	Mean (days)
Incubation	6- 9	7.83 ± 0.148	6- 9	7.61 ± 0.18
1st nymphal instar	4	4.00	3- 5	4.06 ± 0.02
2nd nymphal instar	4-11	6.63 ± 0.18	5.10	6.39 ± 0.16
3rd nymphal instar	4-10	6.23 ± 0.15	5-16	6.76 ± 0.29
4th nymphal instar	5-12	7.45 ± 0.14	6-10	7.57 ± 0.14
5th nymphal instar	9-15	11.56 ± 0.13	10-17	12.37 ± 0.19
Egg to final molt	40-50	43.70 ± 0.26	41-50	44.76 ± 0.35

Inside the mass breeding cages, and perhaps also in nature, the first instar nymphs remain underground until after the first molt. None was observed to come out to feed on the kapok seeds. Since the first stadium lasts 4 days, the young nymphs were probably feeding on moisture in the soil, if indeed they feed at all. It is significant to note, further, that the eggs as well as the first instar nymphs are very sensitive to dessication. It was observed also that prior to each molt, which occurs any time of the day, the nymphs congregate and stay motionless. The significance of this behavior was not investigated.

Mating pairs roam and feed freely, the direction and locomotion generally determined by the female. Multiple mating is frequent where, in most

cases, copulation may be interrupted and the same members of the pair need not resume the act. Copulation may last for long hours, however. A pair was observed in *copula* continuously for as long as 114 hours. No test was conducted to compare the effects of interrupted (or multiple) and continuous matings on fertility. In *Dysdercus koenigii*, however, Snehamoy *et. al.* (1960) claimed that further matings in multiple mating appeared superfluous.

Table 2 shows the longevity of *D. cingulatus adults.* The males have significantly longer life span than the females. A female lays an average of 465 eggs during her lifetime (Table 3). These were laid in batches of 1 to 12 with averages of 7 batches per individual and 73 eggs per batch. Table 3 shows also the percent hatchability of eggs which is relatively low (49%), perhaps, due to handling injuries.

TABLE 2. Longevity of Dysdercus cingulatus **(final molt to death).**

LONGEVITY (days)	FREQUENCY	
	Males (25 individuals)	Females (25 individuals)
15	1	0
25	2	3
35	1	5
45	1	4
55	2	7
65	3	4
75	4	1
85	2	1
95	1	0
105	3	0
115	2	0
125	1	0
135	1	0
145	1	0
MEAN	78.60 ± 2.2	49.40 ± 3.1

External Morphology

Egg. The eggs are elliptical, with length of 1.39-1.50 mm ($\bar{x} = 1.43 \pm 0.006$) and a maximum breadth of 0.92 ± 1.03 mm ($\bar{x} = 0.97 \pm 0.003$). When newly-laid they are pale yellow and become yellow orange as they approach hatching. Three red spots appear when about to hatch, two on the lateroanterior portion and a faint one on the dorsoposterior area.

First nymphal instar. The newly hatched nymphs (Fig. 1-A) are yellow orange with achromatic legs, antennae and proboscis. The head is slightly

paler than the body and there is a faint red spot on the fifth abdominal tergite. The eyes are red. Twenty-four hours later the general color becomes blood red. The head is heptagonal, narrow in front and broad behind. The antennae are four-segmented, 1.08-1.25 mm long with a mean of 1.13 ± 0.0022. The first and second segments are pyriform and subequal in length. The third is more or less conical and shorter than the former and the fourth is elongate and twice as long as the first. The eyes are piceous and slightly protuberant. The rostrum is four-segmented, hyaline at the tip and reaches as far as the posterior margin of the first abdominal segment. The length ranges from 1.08-1.25 mm with a mean of 1.15 ± 0.009. The thoracic region is red orange with margins of pronotum being blood red. The legs are concolorous with the head except the tarsites which are paler. The femur of the legs are enlarged distally. The tarsus is two-segmented and the tip bearing the claws is hyaline. The abdomen is oval and continuous with the thorax. It has a maximum breadth of 0.97-1.25 with a mean of 1.11 ± 0.002. It is elevated dorsomesally. The opening of the glands at the posterior margin of the tergites are visible. From the head up to the tip of the abdomen the nymph measures from 2.22-2.56 mm with a mean of 2.36 ± 0.014.

Second nymphal instar. (Fig. 1-B). The tylus becomes conspicuously projected anterad unlike the first nymphal instar where it is blunt. The antenna is 2.11-1.42 mm long with a mean of 2.26 ± 0.014 and the shape of the segments are the same as in the adult. It is piceous and red in the joints and marked with the appearance of antennal spines. The rostrum is 2.11-2.53 mm long with a mean of 2.30 ± 0.015. The color of the rostrum is the same as in the adult and reaches as far as the third abdominal segment. The pronotum appears as a flat region, expanded laterally with a narrow whitish anterior margin. The white episternal and epimeral flaps of the thorax appear. The femur gradually broadens distally and the spines are not so visible. After feeding for some time, the adomen enlarges unproportionately with the rest of the body. It attains a maximum breadth of 1.26-1.58 mm with a mean of 1.48 ± 0.014. Three pairs of whitish lateral markings appear on the dorsal side the third, fourth and fifth abdominal segments. White transverse bands appear on the posterior margin of second and third sternites. The anterior abdominal area, and the thorax except the pronotum is red-orange, the rest are red. The nymph is 2.95-3.79 mm long with a mean of 3.31 ± 0.03.

Third nymphal instar (Fig. 1-C). The pronotum becomes divided into three areas, the anterior and the posterior being subequal and narrower than the middle. The anterior area is white while the posterior is concolorous with the head and depressed. This instar is marked by the appearance of the meso- and metathoracic wing pads. The mesothoracic wing pads are almost as large as the pronotum and the lateroposterior margins are black. The metathoracic wing pads are partly overlapped by the former on its anterior margin. The nymph has well developed femoral spines. Additional transverse white bands appear on sternites IV and V. The nymph has the following measurements: antenna, 3.16-4.21 mm long with a mean of 3.70 ± 0.054; rostrum, 2.84-3.58 mm long with a mean of 3.18 ± 0.035; from head to tip of abdomen, 4.11-5.47 mm with a mean of 4.73 ± 0.065; maximum breadth of abdomen, 1.58-2.42 mm with a mean of 2.04 ± 0.038.

TABLE 3. Fecundity and per cent hatchability of Dysdercus cingulatus.

Female No.	No. of Egg Batches	Total No. of Eggs Laid	Ave. No. of Eggs Batch	No. of Eggs Hatched	% Hatchability
1	6	495	83	354	71.51
2	6	548	91	451	82.23
3	5	423	85	184	43.50
4	5	291	58	208	71.47
5	2	174	87	100	57.47
6	6	496	83	341	68.75
7	9	586	65	260	44.37
8	4	325	81	000	00.00
9	9	343	36	192	55.97
10	8	690	86	551	79.85
11	7	466	67	207	44.42
12	1	105	105	65	61.90
13	9	447	50	102	22.81
14	2	82	41	63	76.83
15	7	448	64	71	15.85
16	7	583	83	390	66.90
17	12	855	71	616	72.05
18	9	687	76	369	53.71
19	9	590	66	409	69.32
20	5	386	77	213	55.18
21	9	647	72	8	12.36
22	7	462	66	177	38.31
23	9	769	85	356	46.29
24	7	476	68	113	23.74
25	3	257	86	000	00.00
Average	7	465	73	232	49.39

Fourth nymphal instar (Fig. 1-D). The lateroposterior areas of wing pads become broadened and blackish. The metathoracic wing pads are partly overlapped by the former and the latter extends up to the first abdominal segment. The median scutellum of the mesonotum begins to assume a subtriangular shape and the posterior margins of postepimeron of the mesopleuron becomes white. The first (actually the second since the first is fused with the second) and the sixth abdominal sterma acquires a white transverse band in addition to those in the third instar. The nymph has the following measurements: antenna, 4.42-5.26 mm long with a mean of 4.99 $\pm$ 0.038; rostrum, 3.68-4.53 mm long with a mean of 4.15 $\pm$ 0.035; from head to tip of abdomen, 5.79-7.89 mm with a mean of 6.50 $\pm$ 0.13; maximum breadth of abdomen 2.32-3.16 mm with a mean of 2.82 $\pm$ 0.042.

Fifth nymphal instar (Fig. 1-E). The wing pads extend as far as the third abdominal segment with the mesothoracic wing pads overlapping al-

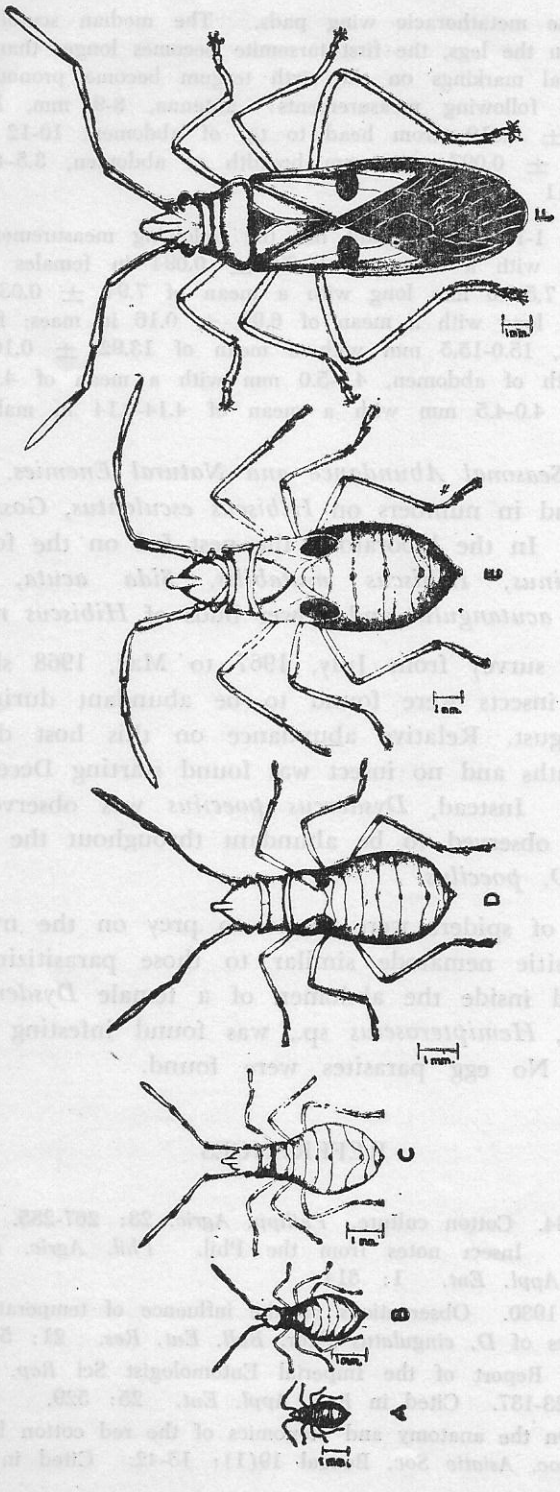

Fig. 1. *Dysdercus cingulatus*, A to E — first to fifth nymphal instars; F — dorsal view of an adult.

most entirely the metathoracic wing pads. The median scutellum becomes well-defined. On the legs, the first tarsomite becomes longer than the second. The white lateral markings on the sixth tergum become pronounced.. The nymph has the following measurements: antenna, 8-9 mm, long with a mean of 6.03 ± 0.019; from head to tip of abdomen, 10-12 mm with a mean of 10.99 ± 0.097; maximum breadth of abdomen, 3.5-4.5 mm with a mean of 4.11 ± 0.044.

Adult (Fig. 1-F). The adult has the following measurements: antenna, 10-11 mm long with a mean of 10.39 ± 0.094 in females and 10.0 in males; rostrum, 7.5-9.0 mm long with a mean of 7.94 ± 0.037 in females and 6.5-7.0 mm long with a mean of 6.92 ± 0.16 in maes; from head to tip of abdomen, 15.0-15.5 mm with a mean of 13.92 ± 0.109 in males; maximum breadth of abdomen, 4.5-5.0 mm with a mean of 4.86 ± 0.054 in females and 4.0-4.5 mm with a mean of 4.14-0.14 in males.

Host range, Seasonal Abundance and Natural Enemies. In the field, the pest was found in numbers on *Hibiscus esculentus, Gossypium* sp. and *Ceiba pentandra.* In the laboratory, the pest fed on the following plants: *Hibiscus cannabinus, Hibiscus mutabilis, Sida acuta, Abutilon indicum, Corchorus acutangulus* and flower buds of *Hibiscus rosa-sinensis.*

A bimonthly survey from July, 1967 to May, 1968 showed that on kapok trees the insects were found to be abundant during the months of July and August. Relative abundance on this host declined in the succeeding 3 months and no insect was found starting December until the middle of May. Instead, *Dysdercus poecilus* was observed. On okra plants they were observed to be abundant throughout the year and were associated with *D. poecilus.*

Two species of spiders were found to prey on the nymphs and the adults. A parasitic nematode similar to those parasitizing the preying mantis was found inside the abdomen of a female *Dysdercus.* Also, an *ectoparasitic* mite, *Hemipteroseius* sp., was found infesting the postnotum of the adults. No egg parasites were found.

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