

Description, life-history and habits of *Stethoconus praefectus* (Distant) (Heteroptera : Miridae), predacious on *Stephanitis typicus* Distant (Heteroptera : Tingidae), a pest of coconut palm

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Received: May 6, 1971

ABSTRACT

Nymphs and imago of *Stethoconus praefectus* (Distant) recorded from Kerala for the first time feed on nymphs and adults of *Stephanitis typicus* Distant, a pest of coconut foliage. The redescription of imago given here relates to the external morphology of the head, thorax and abdomen. Description of the immature stages and details of its life-cycle and habits are reported for the first time. There are 5 nymphal instars. The life-cycle occupies a period of 16.6 ± 0.61 days, with an incubation period of 7.1 ± 0.53 and total nymphal period of 9.6 ± 0.95 days. There is a slight preponderance of females in the field. Males live for 2-20 days and females for 12-45 days. The pre-oviposition period is 4.25 ± 0.67 and the post-oviposition period is 3.2 ± 1.72 days. A single female lays on an average 2.1 ± 0.5 eggs a day. A single metamorphosing nymph devours 62.3 ± 6.0 host nymphs. An adult on an average sucks 5.2 ± 0.94 hosts a day.

Distant (1909) erected the genus *Apolodotus* and described the type species *praefectus*. Carvalho (1952) renamed it *Stethoconus praefectus* and listed it (1958) in his catalogue of the miridae of the world. Mathen *et al.* (1967) observed it feeding on the nymphs and adults of *Stephanitis typicus* Distant. The predacious nature of the bug prompted us to study the extent of the influence it can possibly exert on the population of *Stephanitis typicus* Distant, which has a dual role in coconut cultivation as a pest on foliage (Corbett, 1932; Nirula, 1955; Mathen, 1960) and as a vector of the root (wilt) disease of coconut palm in Kerala (Nagaraj and Menon, 1956; Shanta *et al.*, 1964). The results of our study are reported in this paper.

MATERIALS AND METHODS

The insects were reared in the laboratory. The mouth of the jar was covered with muslin cloth tied tightly with twine around the neck. Through the open knob below was introduced a coconut

leaflet whose base was dipped in water kept in glass-jar placed below the inverted bell-jar on wooden stand. The predator and the prey were introduced through the open knob and closed with cloth-covered cotton-plug. Nymphal instars were studied in small Petri-dishes in which cut pieces of coconut leaflets, supplied afresh every day, served as food for the known number of host nymphs introduced at 24-hr intervals. Studies on the rate of feeding, longevity and oviposition of adults were conducted in glass-vials 7.5 cm \times 2.5 cm.

RESULTS AND DISCUSSION

Imago

Head: In the top view, the head is nearly half as long as broad; light-yellow with brownish tinge, behind each eye a black triangular depression at centre of occiput; irregularly sculptured with a few scattered broad punctae; sparsely pubescent with long silvery-white hairs; perpendicularly deflected, at the anterior longitudinally impressed behind eyes in the middle, and narrowed to base (Fig. 1 A, C).

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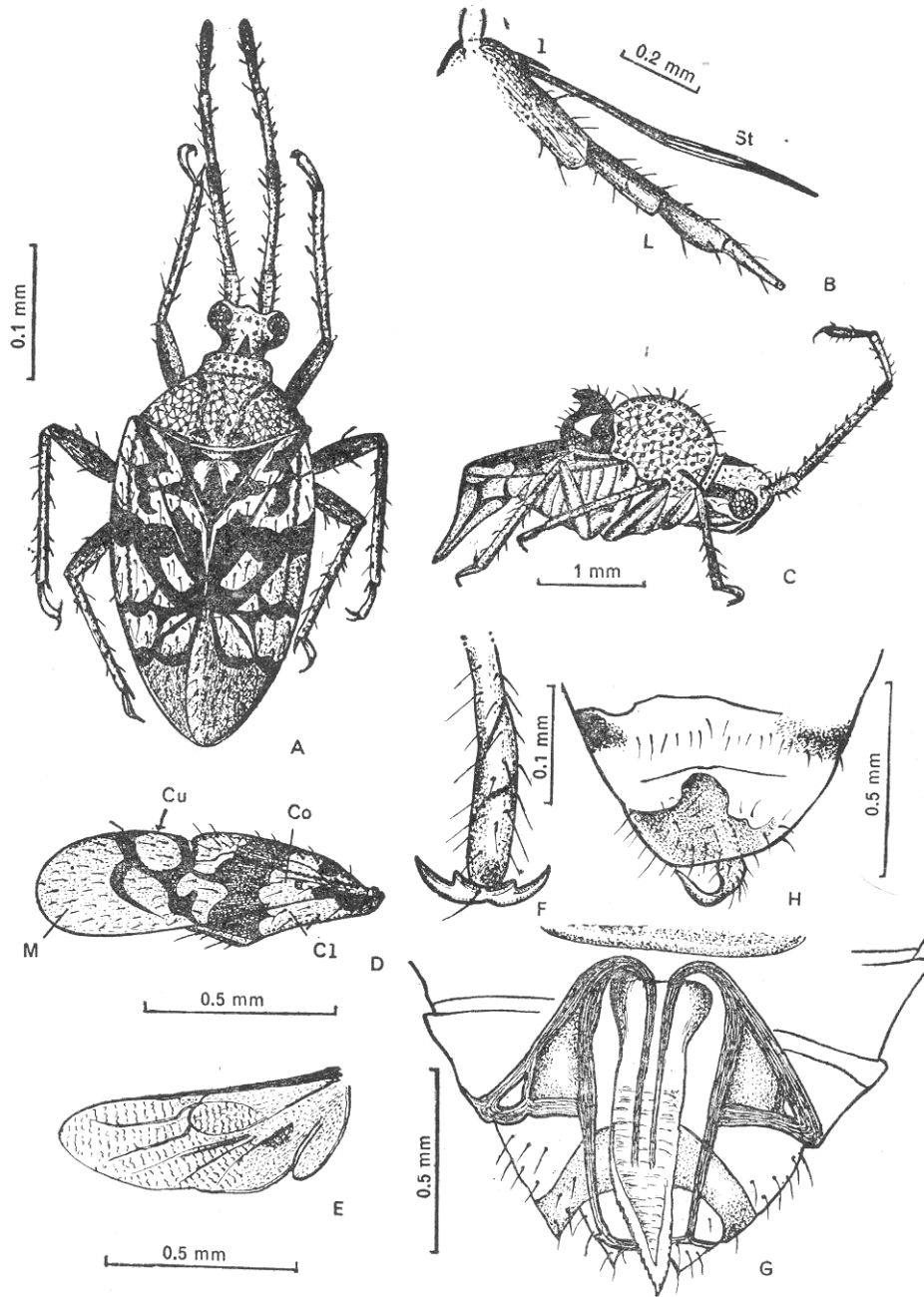


fig. 1. *Stethoconus praefectus*. A, imago; B, rostrum: *l*, labrum; *L*, labium; *st*, stylets; C, imago (lateral view); D, fore-wing (hemelytra): *cl*, clavus; *co*, corium; *cu* cuneus; *M*, membrane; E, hind wing; F, hind tarsus and claws; G, posterior abdomen of female showing ovipositor; H, posterior abdomen of male showing exserted aedeagus.

EYES: Small, but prominent and bulging, bare, black, placed at apex of head and longly removed from base; inter-orbital distance very broad, twice the width of eye.

ANTENNAE: Uniformly hirsute; each inserted on a papilla-like projection slightly above the middle of face very near to the inner orbital border; 4-jointed; first joint thick, black, very slightly more than as long (Distant: about half as long) or half as wide as head; second joint moderately thick, more than twice as long as the first, ochraceous with apical one-third dark-reddish-brown to black; third joint two-fifths the second; fourth joint more than half the third, with apex somewhat tapering and slightly swollen at the middle; third and fourth joints slender, pale-yellow, together three-fifths of the second (Fig. 1 A).

ROSTRUM: Sparsely beset with filamentous setae, the few at the terminal end more distinct; reddish brown; reaching up to the anterior margin of mesocoxa; labium 4-jointed; basal joint swollen; first and second joints subequal; third joint three-fourths the second; fourth joint somewhat longer than the third and slightly less than second; second joint wider at the distal end; third joint slightly bulging in the middle; fourth joint dagger-like with its apex darker than the rest; stylets strongly developed, slightly darker than the rest of proboscis; labrum lip-like, transparent white, one-third as long as the basal joint of the labium (Fig. 1 B).

Thorax: **PRONOTUM.** Pronounced, arched from side to side and from apex to base, basal margin somewhat wavy, very strongly narrowed from base to head, lateral margins straightly oblique; length slightly more than half the breadth at base with a narrow anterior collar behind which are 2 transverse constrictions enclosing an area which is centrally carinate and contains a smooth callosity on each side, width at cervical collar one-third the width at base, centrally with 2 indistinct foveae running from front to back where they coalesce and have a line-like raised mark between them in the anterior area; coarsely rugoso-reticulately sculptured

with large and deep punctae; ochraceous except for darker punctae, darker anterior cervical collar and darker posterior raised median and lateral patches; very few scattered setae (Fig. 1 A, C).

MESONOTUM: Covered over by pronotum; thrice as broad as long; brown except for 2 dumb-bell-shaped dark patches, one on either side of median line toward the base; mesosternum broad with well-developed median line.

SCUTELLUM: Gibbous prominent, black except for 2 ochreous patches, 1 on either side of the central elevated area, lateral carina very distinct and converged to a sharp point at the apex of scutellum, lateral margins straightly oblique, scattered setae; arched from side to side and front to back, behind produced into a beak, hind margin arched toward the beak, irregularly, finely, rugulosely sculptured; three-fifths as long as pronotum or two-thirds as long as wide at base (Fig. 1 C).

METANOTUM: Laterally depressed, covered over by scutellum at centre and wings at sides; spiracle round.

LEGS: Of moderate length; brown, coxae and femora darker; tarsi 3-jointed; claws paired (Fig. 1 F), widely curved, somewhat slender, with a blunt tooth at base; arolium absent; hind coxa one and a half times as long as wide at the broadest end, sparsely provided with slender setae, more toward apical end; trochanter slightly more than half the coxa, very few setae, more toward the base; femur nearly of uniform width, equal to twice the coxa and trochanter combined, very few long setae; tibia slender and slightly curved, about one and one-third the femur and more than 5 times the tarsi, fine filamentous hairs, short linear spines and prominent setae at apical end; first tarsus nearly one and a half times the second, third nearly twice the second, claw less than two-thirds the last tarsus, tarsi with fine filamentous hairs.

WINGS: Hemelytra thrice as long as broad, costal margin a little convexly dilated, corium as long (Distant: half as long) as head and pronotum together; subhyaline with blackish spots, the two largest forming a transverse fascia near

the middle, nearly as long as posterior tibia (Distant: corium and cuneus together as long as posterior tibia), cuneal fracture profound, cuneus one-third the corium, clavus black with a large dull ochraceous spot near the middle, membrane pale-hyaline, longitudinally passing through the abdominal apex; corium, cuneus and clavus covered with setae, with more prominent ones toward distal ends, membrane with very fine minute setae, ridge differentiating, embolium incomplete but distinct; (Fig. 1 D); hind wing hyaline, distal end showing a wavy pattern, lustrous in angular views, shorter than hemelytra (Fig. 1 E).

Abdomen: Abdomen covered over by elytra; dorsally depressed; 10 tergal and 8 sternal plates distinct, pubescent, especially at the terminal end; brown except for 2 large lateral ochreous patches on the ventral side, 1 on either side of the median line; broader in female; ovipositor (Fig. 1 G) well developed and finely serrated at the distal end, accommodated in median sternal groove reaching up to the fourth abdominal sternite; aedeagus small, curved (Fig. 1 H). There is no marked sexual dimorphism except for the wider abdomen in the female. Length of body from head to tip of abdomen in the male is 2.11 ± 0.093 , and in the female 2.3 ± 0.154 ; from head to tip of wing in the male 3.03 ± 0.085 , and in the female 3.14 ± 0.237 mm (mean of 10 measurements) (Distant: adult 3.5 mm).

Original description has been freely quoted and supplemented with details and sketches. The differences in measurements observed have been indicated then and there. These and the slight variations in colouration are not considered by us as important enough to erect a new species.

Egg

The egg is operculated, elongate-oval, opaque and white. Its size varies from 0.58 to 0.71×0.17 to 0.21 mm at the widest part with an average (mean of 10 measurements) of $0.65 \pm 0.048 \times 0.19 \pm 0.014$ mm (Fig. 2 A). The operculum (Fig. 2 B) is gelatinous when the egg is freshly laid. It, however, hardens soon. Within 24 hr a central black circular

portion is differentiated from a peripheral white ring. The operculum completely covers the egg. At one end the operculum carries a beak (Fig. 2 A, B, F), a right-angular fringed projection, probably protective in function. The operculum measures on an average $0.15 \pm 0.01 \times 0.09 \pm 0$ mm on outer side and $0.10 \pm 0.01 \times 0.05 \pm 0$ mm on inner side.

Nymphal instars

First-instar nymph: The newly hatched nymph is transparent white, contrasting strongly against the green background of the coconut leaf, but soon takes a yellowish tinge as it starts sucking the body fluid of the host. Antennae except the basal two-thirds of penultimate joint and femora closely pigmented orange-red, thorax and abdomen sparsely so, prominent red, circular, central deep-orange red spot on the third abdominal tergum; body demarcated into head, thorax and abdomen, thoracic segmentation indistinct, abdominal segments behind the seventh drawn out into a compact, narrow, upwardly turned 'tail', pigmented orange-red; head and thorax together longer than abdomen; eyes broad, red patches far apart from one another on the antero-lateral aspects of the head; antennal joints uniformly thick, terminal joint lamellate; labium with terminal joint longest, reaching up to metacoxa; basal tarsus differentiated from distal part, claw simple with wider base; body setaceous, average length 0.85 mm (Fig. 2 C).

MOULTING: Ecdysis takes place by a dorsal median longitudinal split in the cephalothoracic region. The exuvium remains as a single piece and has the characteristic pigmentation and colouration of the concerned instar.

Second-instar nymph: Translucent white with pale-yellow hue and orange-red pigmentation, median abdominal red spot prominent; segmentation distinct, abdomen longer than head and thorax combined; eyes differentiated from the red patches; antennal joints uniformly thick, terminal joint less lamellate; labium reaching up to mesocoxa; abdominal tergites with red spots across them; average length of body 1.53 mm.

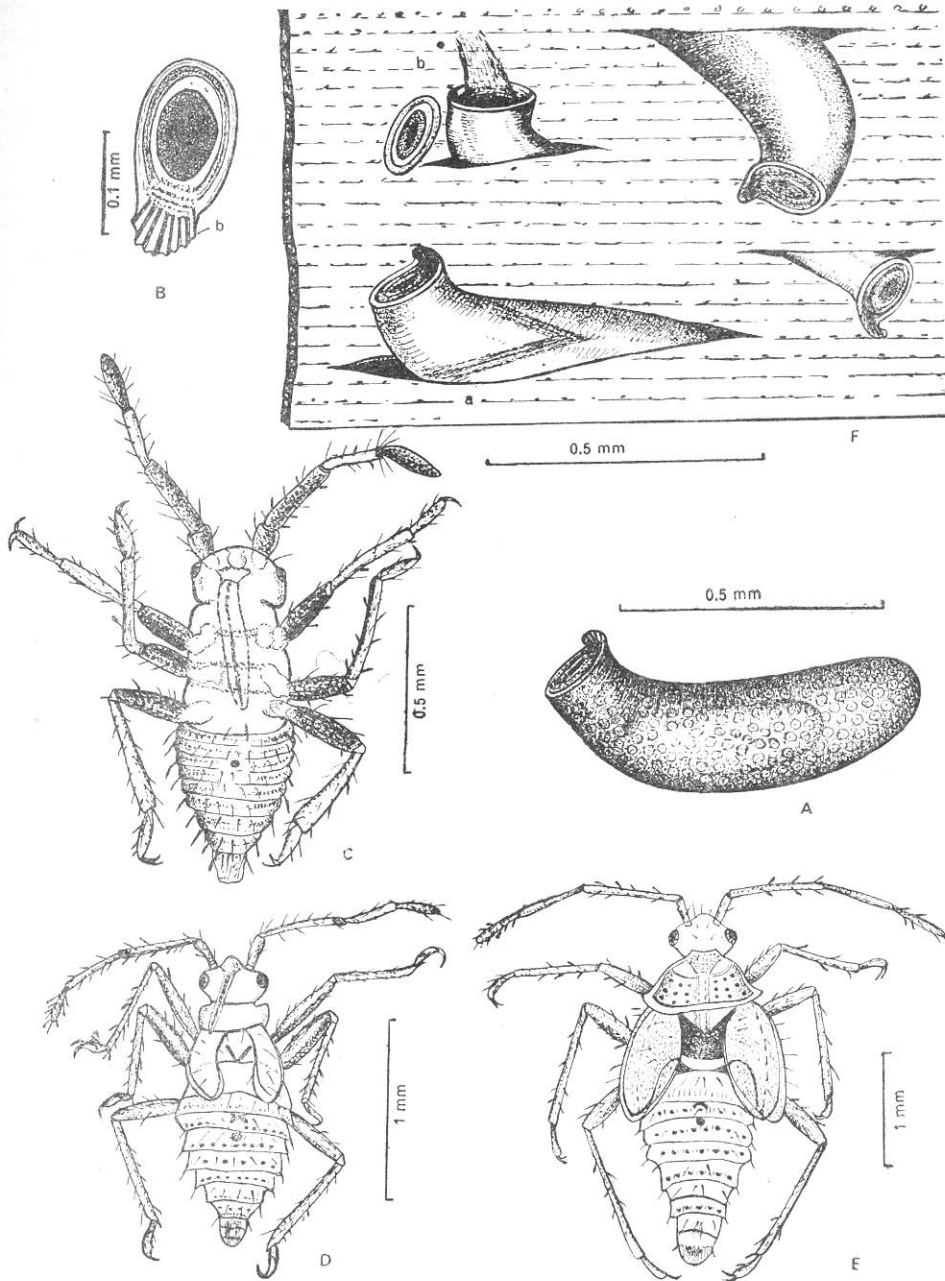


Fig. 2. *Stethoconus praefectus*. A, naked egg dissected out of leaf tissue; B, operculum, inner view: b, beak; C, first-instar nymph; D, third-instar nymph; E, fifth-instar nymph; F, eggs *in situ*: a, egg about to hatch showing V-shaped streak; b, hatched egg, chorion remains a collapsed tube.

Third-instar nymph: Opaque white with orange-red pigmentation, replaced by brown tinge; median abdominal spot prominent, brown; eyes laterally bulging, ommatidia well formed; terminal antennal joints slender; pronotum and scutellum differentiated; wing buds appear and extend up to the posterior margin of the third abdominal segment in the last phase of the instar; spots across abdominal tergites more prominent, brown, and arranged in transverse rows except in the sixth segment; 10 abdominal tergites distinct, tail brown; basal tooth of claw well developed; average length of body 1.91 mm (Fig. 2 D).

Fourth-instar nymph: Milk-white with deep-brown to black antennae and femora; eyes prominent; pronotum distinctly developed, white, punctate, setaceous; scutellum well formed, pigmented brown; wing buds pigmented brown, reaching hind margin of the fourth abdominal segment; brown circular spot of third abdominal tergum less prominent, second tergum with reddish-brown median crescent, transverse rows of abdominal tergal spots very prominent; average length of body 2.43 mm.

Fifth-instar nymph: Body milk-white, reddish-brown to black colouration of earlier instars replaced by black; pronotum and scutellum very prominent, with black and ochreous patches; punctate; wing buds with better pigmentation; cuneus, corium and membrane distinct, reaching up to behind the fifth abdominal segment in the last phase of the instar; transverse abdominal tergal spots very prominent; tarsus black; tail of abdomen less narrowing and streamlining itself as posterior extremity of abdomen; average length of body 3.02 mm (Fig. 2 E).

The important metamorphic changes are the colouration and pigmentation of body, more distinct segmentation, general increase in the size of body, modifications of pronotum and scutellum, better development of eyes in each instar, transformation of the third and fourth joints of antennae from their thick and lamellate condition to slender form, and the appearance in the third instar of wing-buds and their growth and differen-

tiation into the characteristic form of imago through the fourth and fifth instars.

Life-history

The life-history is completed within 15–17 days with an average of 16.6 ± 0.61 days (Table 1). The eggs hatch more commonly in 7 days with a range of 6–8 days and mean of 7.1 ± 0.53 days. The viability of eggs was 93.8 per cent. Hatching took 25–30 minutes. About 24 hr before eclosion, there appears a V-shaped brick-red streak on the concave side of the egg, corresponding to the position of the folded limbs and antennae (Fig. 2 F, a). The operculum is lifted with the head, and the body is gradually forced out little by little. The legs kept folded on the ventral side of the body are stretched out. When a small portion of the posterior end of the abdomen is still within the egg-shell, the emerging nymph, till now nearly at right angles to the horizontal egg, curves over to the leaf surface, holds it by its legs and pulls out the abdomen. The operculum lies aside, the vitelline membrane remains a collapsed tube (Fig. 2 F, b) protruding from the chorion, which itself is left behind intact as a glassy transparent empty tube.

The nymphal period ranged from 8 to 11 days with a mean of 9.6 ± 0.95 days (Table 1), the more common duration being 9 and 10 days. There are 5 nymphal instars, occupying on an average 1.7, 2.3, 1.5, 1.4 and 2.8 days respectively. The differences in duration of incubation period and the various nymphal instars do not alter the period of total life-cycle, because when the period of incubation increases the nymphal duration decreases, and vice versa. There was no appreciable variation in duration of life-cycle in relation to the sex of the adults emerged (9 females and 6 males).

The total number of host nymphs sucked by a single predator nymph during its metamorphosis varied from 54 to 74, with an average of 62.3 ± 6.0 . During the 5 nymphal instars, the average consumption of *Stephanitis* nymphs per day per predator nymph was, respectively, 5.6, 6.1, 7.3, 7.9 and 6.7 (Table 1). Though food was taken in an increasing

Table 1. Life-history of *Stethoconus praefectus* (Distant)

Stage	n	Range	Mode			Mean	SD±
			Number	Freq- ency	Per cent		
Incubation period (days)	145	6-8	7	102	70.3	7.1	0.53
Nymphal stadia (days)	I	1-2	2	10	66.7	1.7	0.47
	II	2-3	2	11	73.3	2.3	0.44
	III	1-2	1	8	53.3	1.5	0.50
	IV	1-2	1	9	60.0	1.4	0.49
	V	2-3	3	12	80.0	2.8	0.40
Total	15	8-11	9, 10	5	33.3	9.6	0.95
Total life-cycle (days)	15	15-17	17	10	66.7	16.6	0.61
Average host nymphs sucked per day by the different instars	I	3.5-8	4, 7	4	26.7	5.6	1.39
	II	3-8.5	7	7	46.7	6.1	1.25
	III	5-14	6, 7	4	26.7	7.3	1.75
	IV	4-14	7	4	26.7	7.9	2.33
	V	3.7-9	9	4	26.7	6.7	1.87
Total preys consumed per metamorphosing nymph	15	54-74				62.3	6.00

n, number of observations; SD, standard deviation; maximum, temperature 30-34.4°C, minimum temperature 18.9-23.3°C; relative humidity 58-90 per cent (AM), 63-100 per cent (PM).

ratio from the first to the fourth instars, the number of preys consumed during the last instar was lower than that during the preceding instar, because the last stage of the metamorphosing nymph is more related with the essential changes of transformation into imago than with the growth or increase in the size of the body.

Habits

The nymphs run swiftly when disturbed; the adults are agile and quick fliers. Both the nymphs and imago suck the nymphs and adults of the prey. The rostrum is introduced into any part of the host and the body fluid is sucked; the prey is released only after the entire body fluid has been drained. The sucked nymph is easily distinguished from the moult by the dorsal longitudinal split characteris-

tically present in the latter. The adults breed throughout the year; eggs are laid singly and isolated on the lower surface of the coconut leaflet, without preference to any part of the lamina. Each egg is inserted into the leaf tissue in a furrow made by the ovipositing female with the aid of the strongly developed serrated ovipositor (Fig. 1 G). The furrow is parallel to the mid-rib of the coconut leaflet. Part of the egg is exposed. The visible portion of the egg varies in length in different insertions (Fig. 2 F). The eggs of its host are laid side by side, but completely inserted within the leaf tissue and located by their operculum only. Rarely, however, eggs were noticed on the moults of host nymphs adhering to the lower epidermis. Such eggs did not hatch, but dried up consequently. The

Table 2. Longevity, fecundity, pre- and post-oviposition periods and rate of predation of *Stethoconus praefectus* (Distant)

Observation	n	Range	Mode	Mean	SD
Preoviposition period (days)	8	3-5	4	4.25	0.67
Average number of host nymphs sucked by single adult per day	10	3.9-6.9	4	5.20	0.94
Longevity of adults (days): Male	9	2-20		9.0	5.41
Female	10	12-45		26.5	12.13
Fecundity (average eggs laid by single female per day)	4	1.35-2.67		2.1	0.50
Post-oviposition period (days)	5	1-6		3.2	1.72

n, number of observations; SD, standard deviation.

average number of eggs laid by a single female per day was 2.1 ± 0.5 (Table 2). The number of eggs laid by a female during the first week after fertilization was much higher than those laid afterward. A preoviposition period of 4.24 ± 0.67 and a post-oviposition period of 3.2 ± 1.72 days was distinct (Table 2). The males lived for 2-20 days, and the females for 12-45 days. The average number of host nymphs sucked by a single adult per day was 5.2 ± 0.94 . The females consumed slightly larger number of preys than the males. Though the daily consumption per adult per day was less than that in its nymphal stages, the total number of prey destroyed by the adult was more because of the longer period of adulthood. The sex ratio of 184 adults was male: female = 1 : 1.14.

Stethoconus praefectus (Distant) devours a considerable number of nymphs and adults of *Stephanitis typicus* Distant both in the nymphal and imago stages. It is an active and swift flier, has a life-cycle shorter than that of its host, and is easy to breed and multiply under laboratory conditions. It breeds all through the year, and in the field there is a slight preponderance of the females. All these render the mirid an ideal predator. Therefore the occurrence in nature of *Stethoconus praefectus* warrants caution against indiscriminate use of insecticides for the control of *Stephanitis typicus*, its host, a pest of the coconut foliage.

ACKNOWLEDGEMENTS

Thanks are due to the Director, Central Plantation Crops Research Institute, Regional Station, Kayangulam, for the facilities; and to Dr M. G. Ramdas Menon, Indian Agricultural Research Institute, New Delhi, for assigning the mirid to its present taxonomic status.

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