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STUDIES ON THE LIFE HISTORY OF *RANATRA FILIFORMIS* FAB. (HEMIPTERA : NEPIDAE)

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(With 10 Text-figures)

Introduction

Information relating to the bioecological aspects of aquatic Hemiptera in India has been limited to the species *Ranatra filiformis* (Nowrojee, 1911), *Sphaerodema rusticum* (Presswala & George, 1936), *Ranatra elongata* (Rao, 1932) and *Sphaerodema annulatum* (Hati & Ghosh, 1963). The larvae and adults of *R. filiformis* cause much harm in fish nurseries by destroying fingerlings. On the other hand they are beneficial to man by predating mosquito larvae. So an understanding of the life history of *R. filiformis* is essential for assessing the beneficial as well as the harmful aspects of these insects. So the study of the life history of *R. filiformis* has been attempted by collecting specimens from the field and rearing from egg to the adult in the laboratory. The principal in the external morphology of the different instars and the characters helpful in distinguishing the various instars are described in detail. Growth rates were studied using standard statistical methods (Snedecor & William, 1975).

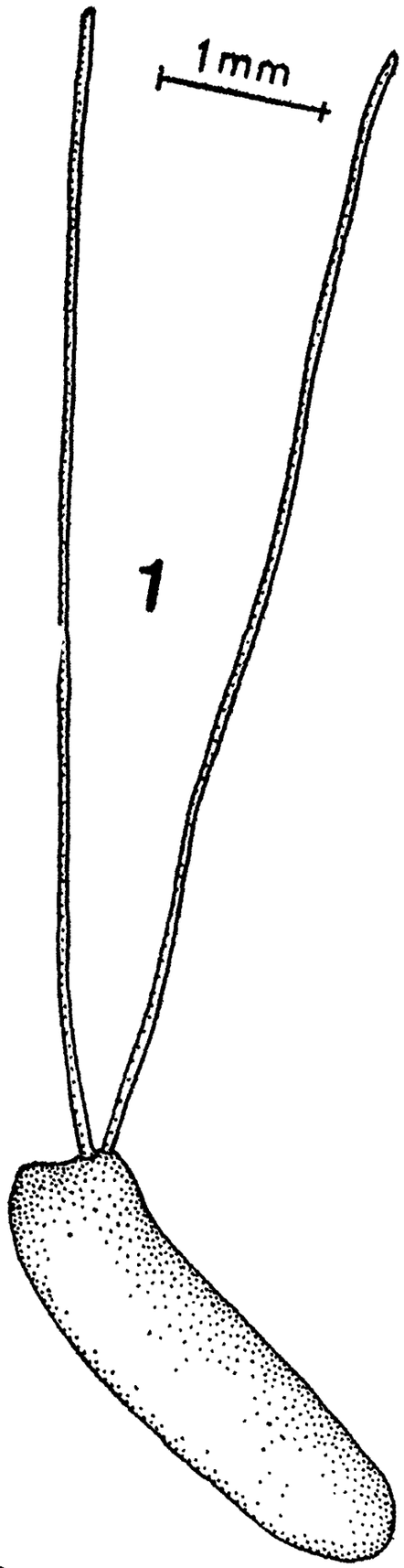
Materials and Methods

Adults of *R. filiformis* collected from Chakai canal 4 km west of Trivandrum city were kept in large glass troughs containing mud, water and aquatic vegetation. After oviposition the eggs were collected along with the ovipasited stem of the water plants and kept in another trough containing water. The hatched nymphs were isolated and reared separately until the final moult. Mosquito larvae, small fish fry and tadpoles were given as food. The data were subjected to statistical analyses. The correlation analysis was used to find out the nature of relationship between instar and the body measurements.

Observations and Results

Breeding record : The study was started with ten nymphs, five survived the third instar, four eventually reached the final instar. Breeding record of one of the nymphs is presented in Table I. Life cycle was gradual. Various stages are

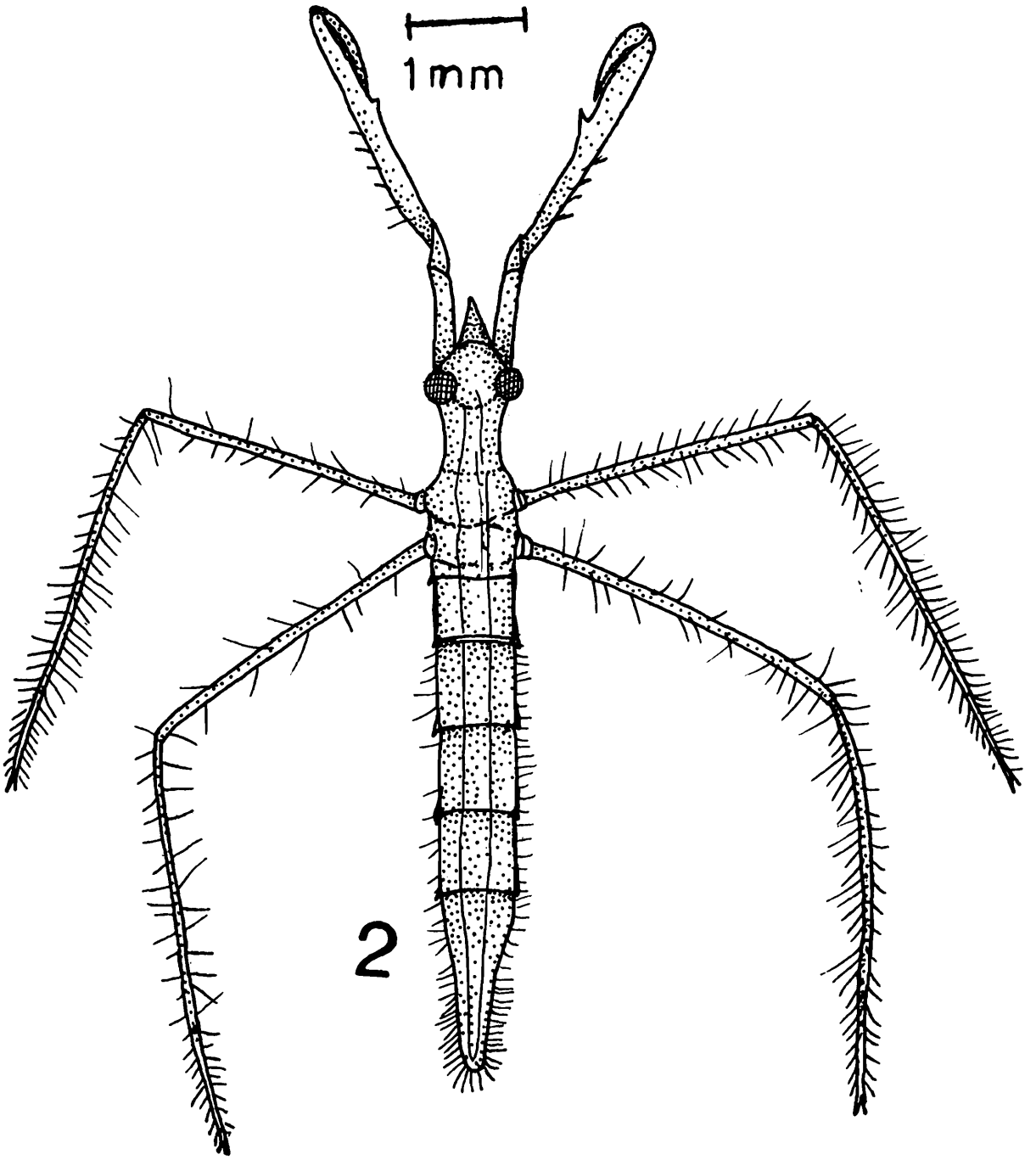
Egg→Nymph→4 instars→Imago.
Egg (Text-fig. 1)



Ranatra filiformis Fab.
Text-fig. 1. egg.

TABLE I. Breeding record of *Ranatra filiformis* Fab.

Stage	Date of entry	Duration (in days)
Eggs	20th April, 1978	9
Nymph	29th April ,,	7
I instar	6th May ,,	11
II instar	17th May ,,	9
III instar	26th May ,,	9
IV instar	4th June ,,	13
Emergence	17th June ,,	—
Total number of days from oviposition to emergence=		58 days

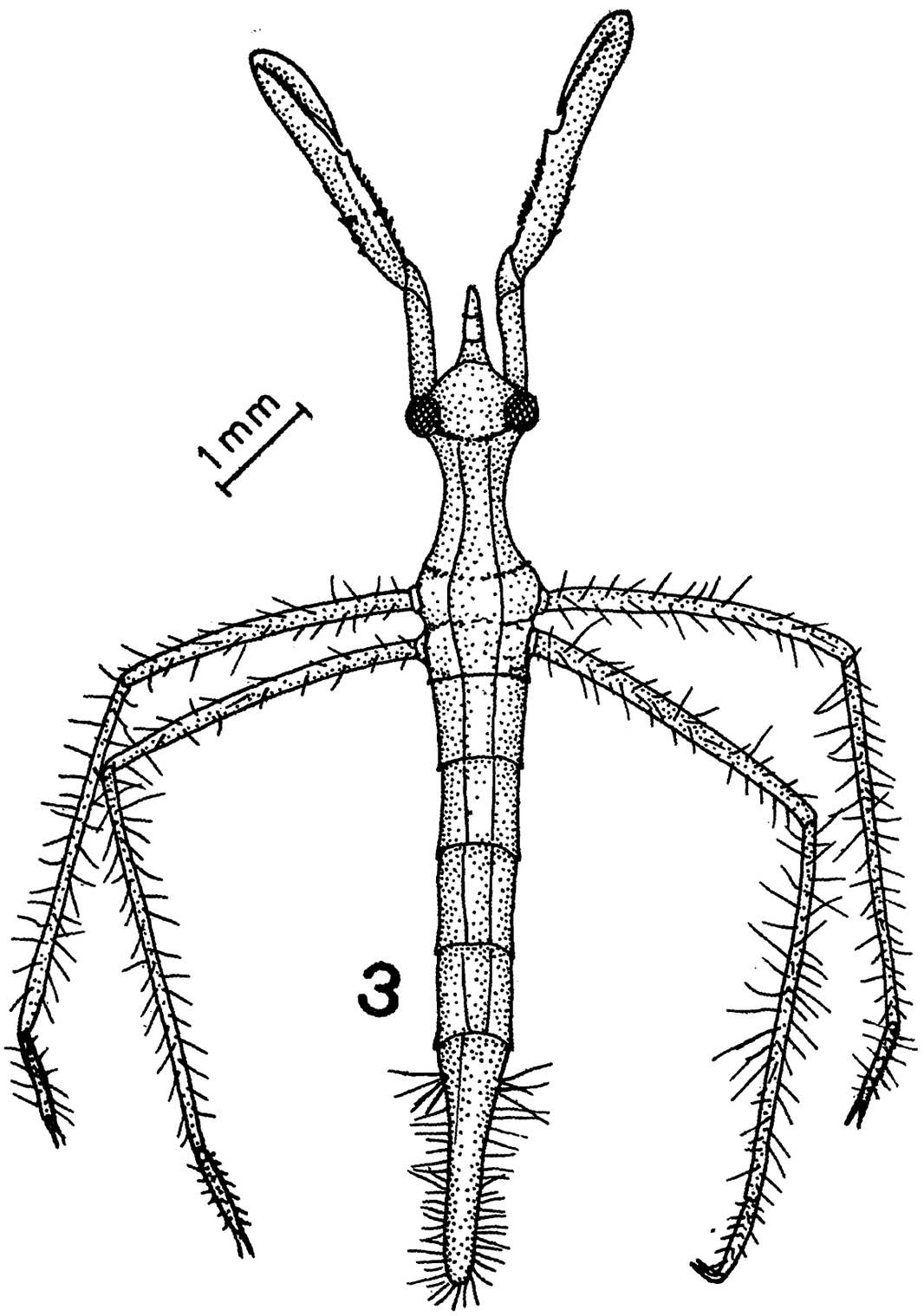


Ranatra filiformis Fab.

Text-fig. 2. nymph.

Length : 2.5 mm (excluding the length of the filament which is 6 mm) width : 0.5 mm. Elongated and cylindrical provided with a pair of apical filaments ; whitish in colour turning creamy white later on. The number of eggs laid by a single female was 22 ± 0.45. The incubation period lasted 7-9 days.

Nymph (Text-fig. 2)



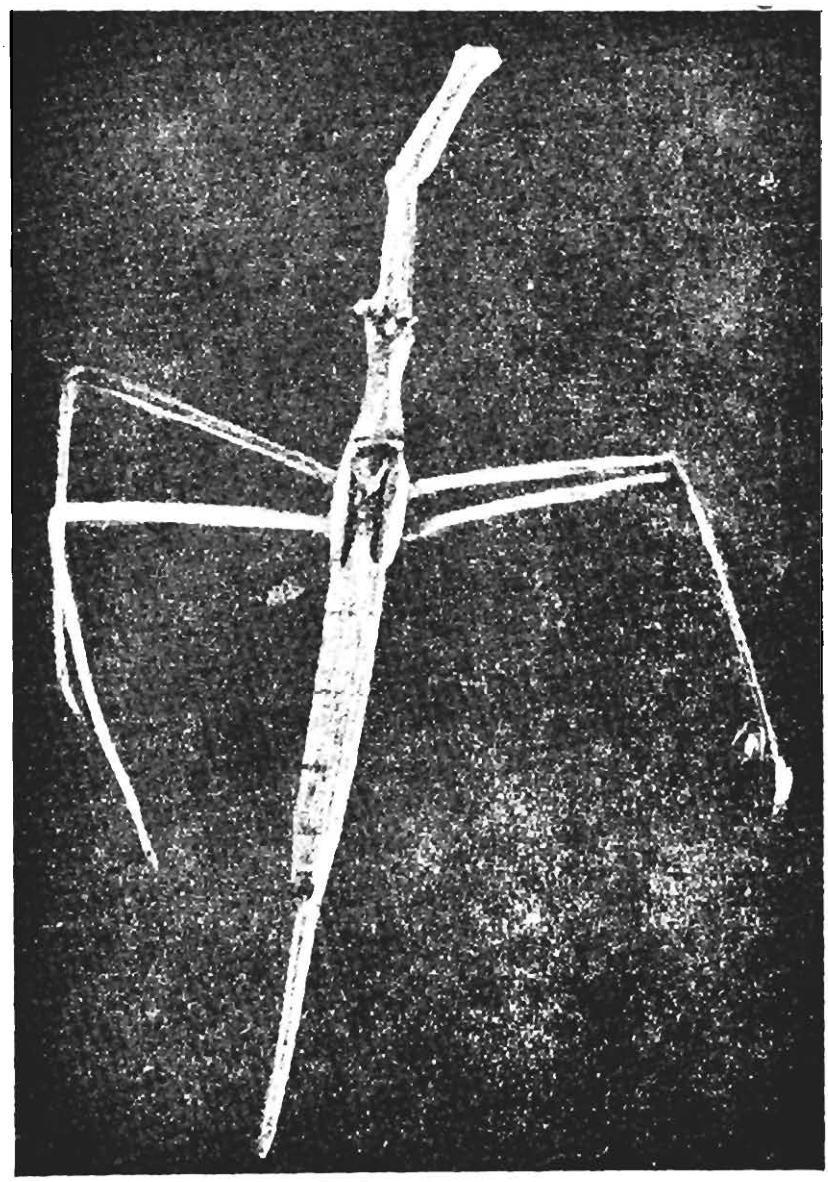
Ranatra filiformis Fab.

Text-fig. 3. I instar nymph.

Length : 6 mm ; rostrum : 0.5 mm ; respiratory siphon : 1 mm ; duration 7 days. Small, long, slender and a miniature of the adult. Pale yellowish at the time of hatching, turning yellowish brown later on. Head prognathous ; rostrum three-segmented and pointed forwards ; ocelli absent, eyes rounded and prominent ; antennae hidden ; anterior legs raptorial without claws. The tibia and tarsus may be folded back against the femur. Mid and hind legs bearing paired claws are adapted for walking. Abdominal segments are broader posteriorly and the postero-lateral margins with angular projections. Respiratory shipon single and short, legs and the anal siphon beset with a number of hairs, banded with brown markings.

I instar (Text-fig. 3)

Length : 7.5 mm ; rostrum : 0.75 mm ; respiratory siphon : 1.5



Ranatra filiformis Fab.

Text-fig. 4. IVth instar nymph.

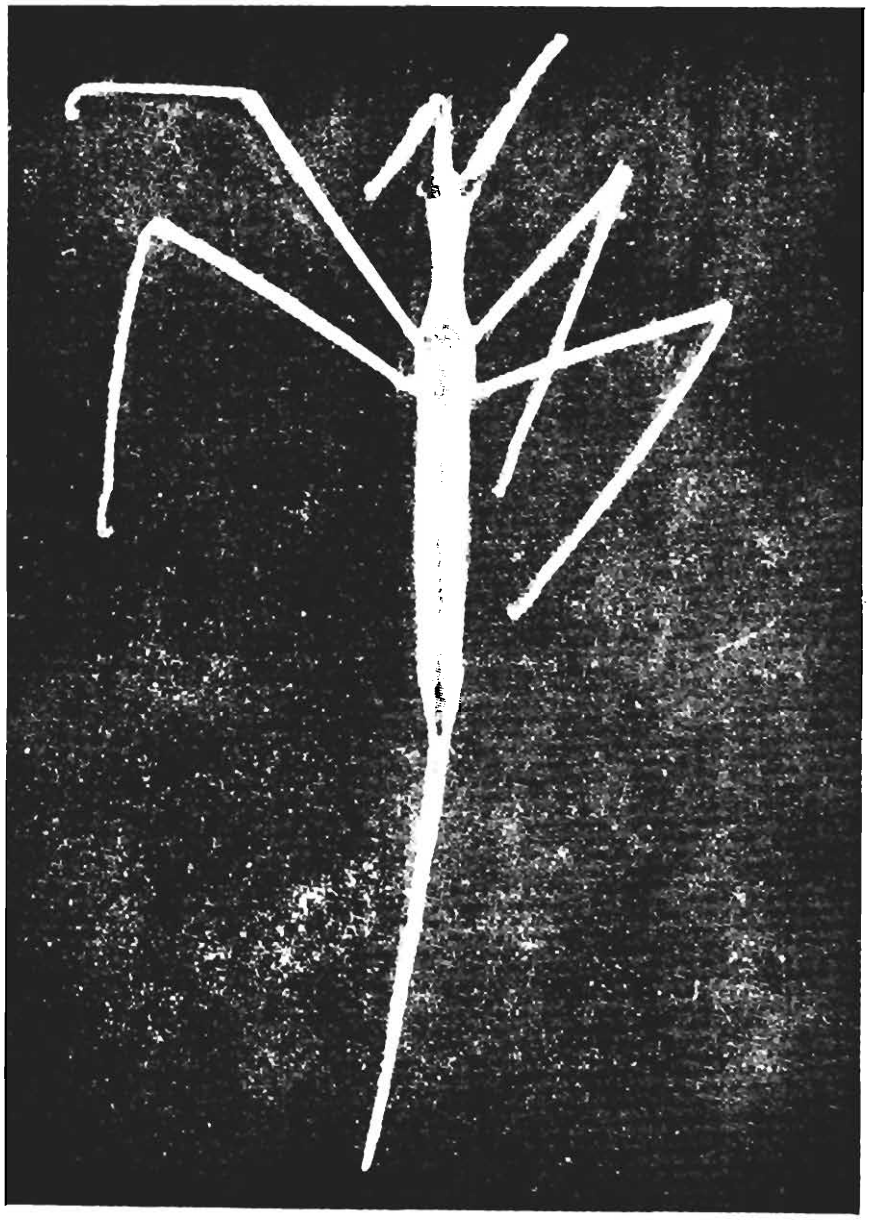
mm ; maximum width : 1.5 mm across the thorax ; duration 11 days. Body slender, elongated and yellowish brown in colour. Wing buds rudimentary. All the other characters just as the nymph throughout the four instars with minor differences.

II instar

Length : 17.75 mm ; rostrum : 1 mm ; respiratory siphon : 4 mm ; maximum width ; 2 mm across the thoracic region ; duration 9 days. Pale yellowish just after moulting but turns to straw yellow later on. Tibiotarsi of the mid and hind legs beset with small spines.

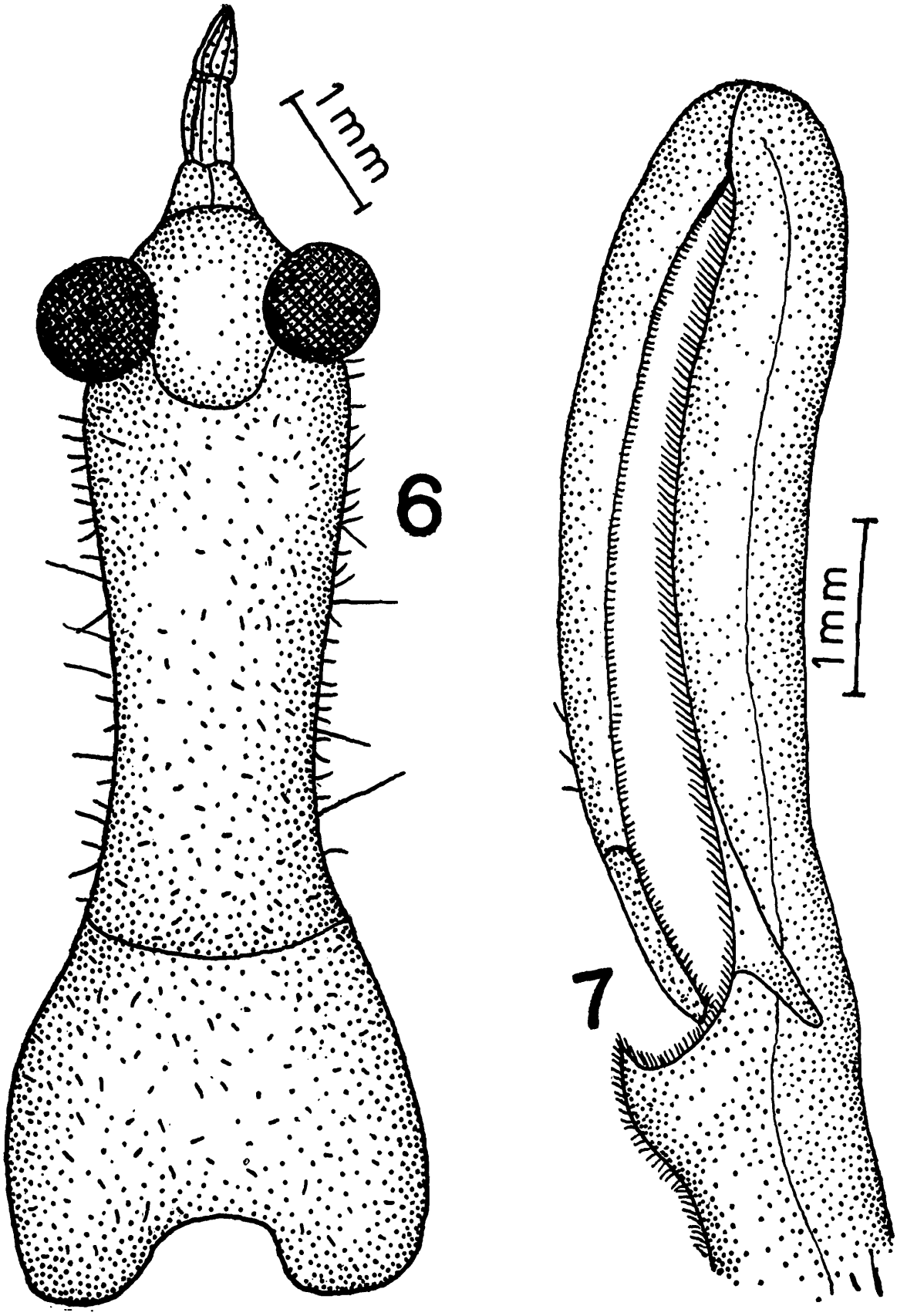
III instar

Length : 23.75 mm ; rostrum : 1.5 mm ; respiratory siphon : 5.5 mm ; duration 9 days. The tip of the respiratory siphon fringed with regularly arranged hairs on the lateral sides.



Ranatra filiformis Fab.

Text-fig. 5. adult.



Ranatra filiformis Fab.

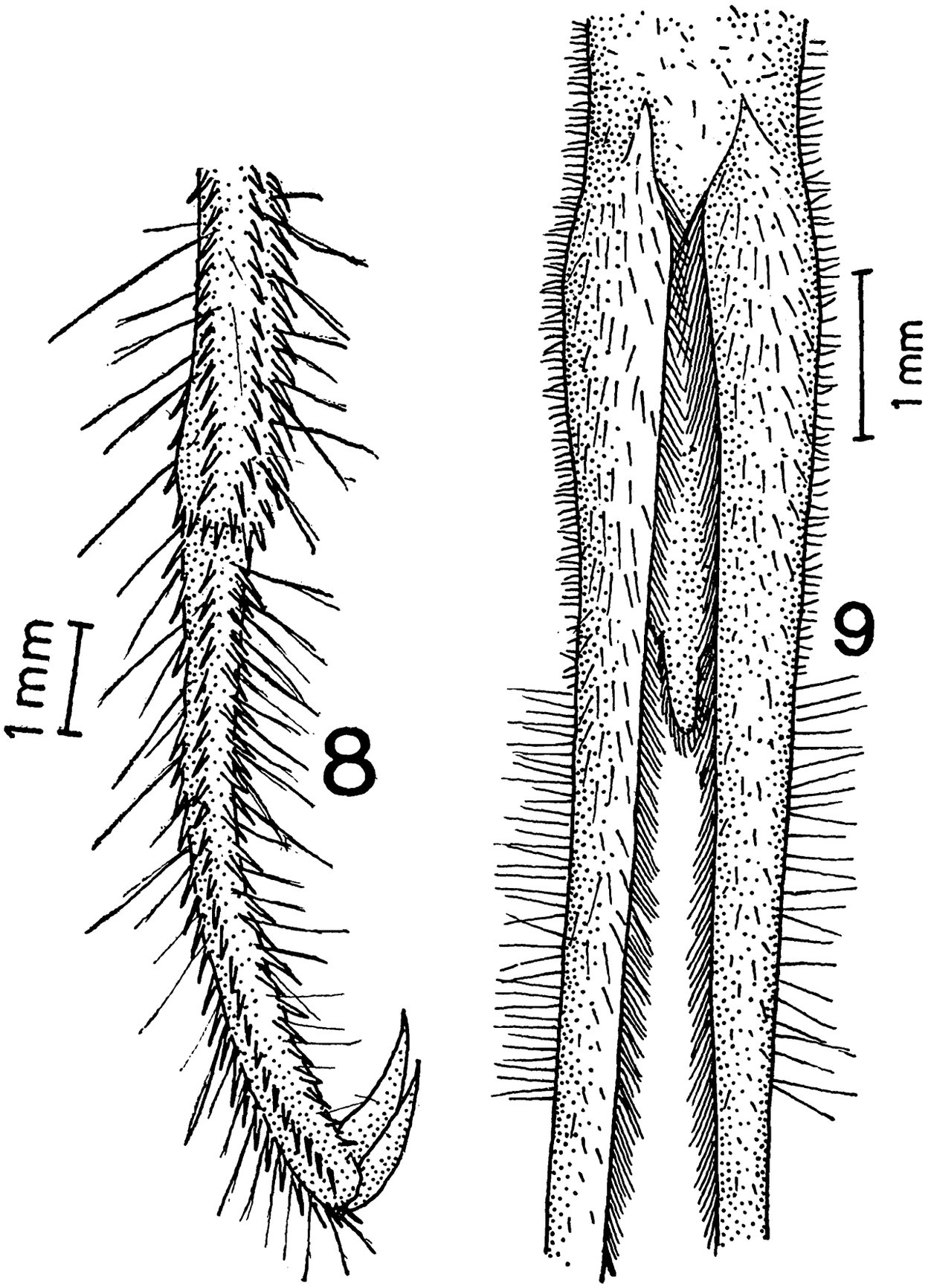
Text-figs. 6. head with prothorax. 7. anterior part of the foreleg.

IV instar (Text-fig. 4)

Length : 28 mm ; rostrum : 1.5 mm ; respiratory siphon : 6.5 mm ; maximum width : 3 mm, duration 13 days.

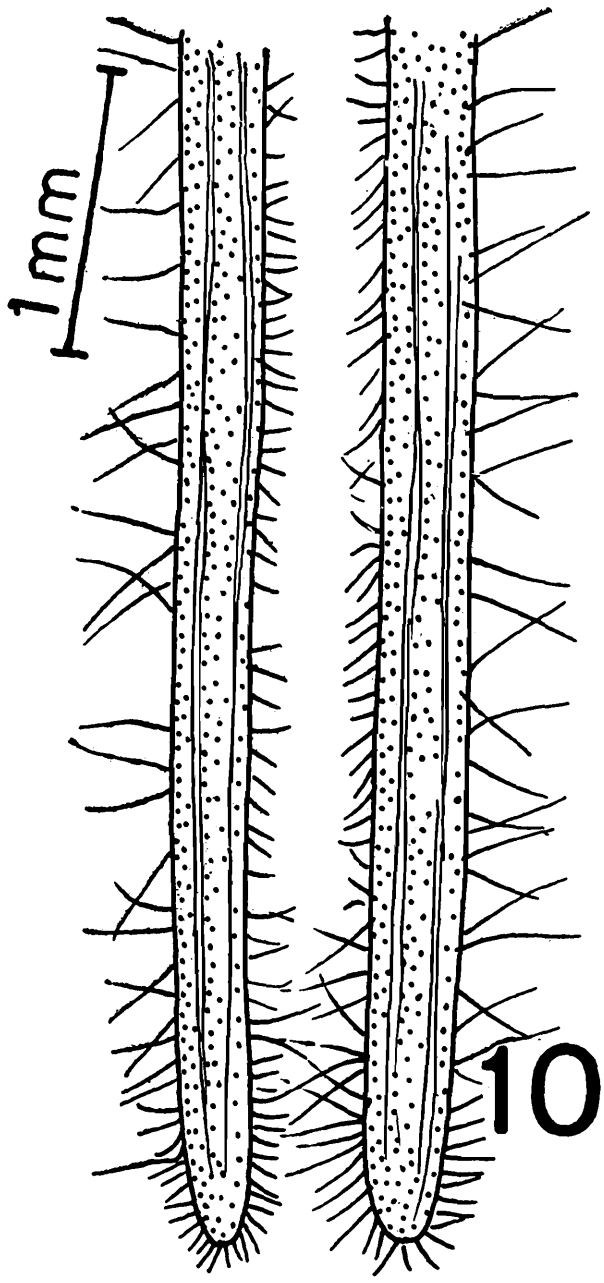
Adult (Text-figs. 5-10)

Length : 42.34 mm ; rostrum : 2 mm : respiratory filaments : 16.67 mm ; maximum width : 3.17 mm. Straw yellow in colour. Legs banded



Ranatra filiformis Fab.

Text-figs. 8. hind tibiotarsus. 9. posterior end of the abdomen showing the proximal part of the caudal filament.



Ranatra filiformis Fab.

Text-fig. 10. distal end of the caudal filament.

with brown markings. Head prognathous. Mouth parts are greatly modified to form a three-jointed, piercing and sucking beak or rostrum inserted near the anterior end of the head. Eyes large, rounded and prominent ; ocelli absent ; antennae hidden. Prothorax free, slender and elongated. Meso and metathorax are united. The forelegs are prehensile without claws, the femur of which is longer, stouter and the tibiotarsus folded beack against the femur to work as a scissor. Mid and hind legs long and slender, adapted for walking. Tarsi single segmented with paired claws. Tibiotarsi beset with a double row of simple spines arranged laterally and fringed with hairs. Abdomen slender, elongated and cylindrical. Paired wings (fore wings modified to form the hemelytra) folded back over the abdomen. Membranes

TABLE II. Measurements of various organs of the different stages of *Ranatra filiformis* Fab. Each value represents the mean of 6 individuals ± S. L.

Stage	Body length	Head		Thorax		Abdomen	
	mm	Length mm	Width mm	Length mm	Width mm	Length mm	Width mm
Nymph	6.00±0.056	0.25±0.002	0.50±0.005	1.25±0.006	0.75±0.005	3.00±0.057	0.75±0.004
I instar	7.75±0.013	0.50±0.008	1.00±0.068	1.50±0.016	1.25±0.004	3.50±0.010	1.00±0.026
II instar	17.75±0.002	0.75±0.006	1.50±0.006	3.50±0.004	2.00±0.052	8.50±0.003	1.50±0.006
III „	23.75±0.002	1.00±0.045	1.75±0.003	5.00±0.068	2.50±0.026	11.00±0.068	2.00±0.026
IV „	28.00±0.139	1.25±0.012	2.00±0.045	6.25±0.013	3.00±0.026	12.50±0.013	2.50±0.009
Adult	42.34±0.089	1.50±0.016	2.33±0.008	8.17±0.009	3.17±0.008	14.00±0.052	2.67±0.005

TABLE II (*Concluded*)

Stage	Rostrum mm	Respiratory siphon mm	Foreleg mm	Midleg mm	Hind leg mm
Nymph	0.50±0.037	1.00±0.025	2.00±0.077	4.80±0.004	5.00±0.057
I instar	0.75±0.007	1.50±0.068	4.50±0.009	6.90±0.044	7.00±0.037
II instar	1.00±0.068	4.00±0.026	10.00±0.068	14.70±0.058	15.00±0.062
III „	1.25±0.005	5.50±0.026	12.00±0.100	17.80±0.063	18.00±0.068
IV „	1.50±0.037	6.50±0.058	14.00±0.045	20.00±0.052	20.50±0.036
Adult	2.00±0.045	16.67±0.002	17.00±0.037	26.40±0.089	26.67±0.007

of the hemelytra reticulately veined. Posterior end of the abdomen bears two long, slender, non-retractile caudal filaments with hairs all over it. Each of these has a groove on the median surface and when fitted together the filaments constitute a respiratory tube which is a striking feature of the family. At intervals its tip is placed at the surface film so that the oxygen in the tracheal system may be replenished.

BIOMETRIC STUDIES

For studying the growth rate of *R. filiformis* observations were made on the different instars. The measurements of body length, head length and width, thorax length and width, abdomen length and width, length of rostrum, respiratory siphon, fore leg, midleg and hind leg were taken. The measurements were based on the average of six individuals (Table II). In order to find out the nature of relationships the correlation coefficients between the instars and the different body dimensions were worked out, after converting the latter to their logarithms. x=stage and y=log of body measurements. All the correlation coefficient values obtained are significant ($P<0.05$) (Table III).

Regression equation was calculated by the formula $y=bx+a$ where b is the growth rate. The regression equations between the instars

TABLE III. Correlation coefficients and regression equations between stages and the different body measurements of *Ranatra filiformis* Fab.

Body measurements	Growth rate (Regression coefficients)	Correlation coefficients	Regression equations
Body length	0.1727	0.9772	Y=0.1727 X +0.6232
Head length	0.1488	0.9676	Y=0.1488 X +0.3534
Head width	0.1232	0.9360	Y=0.1232 X +0.6999
Thorax length	0.1740	0.9745	Y=0.1740 X + 0.0716
Thorax width	0.1248	0.9540	Y=0.1248 X +0.8380
Abdomen length	0.1462	0.9421	Y=0.1462 X +0.3608
Abdomen width	0.1165	0.9807	Y=0.1165 X +0.7883
Rostrum length	0.1146	0.9917	Y=0.1146 X +0.6236
Respiratory siphon length	0.2331	0.9795	Y=0.2331 X −0.2237
Fore leg length	0.1301	0.9232	Y=0.1301 X +0.6315
Mid leg length	0.1134	0.9073	Y=0.1134 X +1.1690
Hind leg length	0.1461	0.9609	Y=0.1461 X +0.6075

X=Stage and Y=log of body measurements.

and the different body dimensions are given in Table III. In all cases the instars and the logarithms of different body dimensions were linearly related.

Discussion

The present study reveals that in Kerala the incubation period of *R. filiformis* is 7-9 days. The nymph lasted for 7 days. The first and the final instar nymphs had a longer duration.

The egg of *Ranatra* has been the subject of investigation by many authors. Petit (1902) attributed a protective function to the filaments against predators. The mode of oviposition in plant tissues by *R. quadridentata* was described by Bueno (1906) and Holmes (1907).

The incubation period and the post embryonic duration varies from species to species and even for the same species in different places. An incubation period of 4 days was reported by Nowrojee (1911) for *R. filiformis* while Hoffmann (1930) reported a period of 9-10 days for the same species at Canton. In Madras the incubation period was 6-12 days (Rao, 1977).

For incubation and post embryonic development of *R. filiformis* in Delhi (Nowrojee, 1911) about 34 days are needed which may be due to the warm climatic conditions prevailing in April when the studies were conducted. Thirty five days are required for *R. chinensis* and 42.5 days for *R. filiformis* (Hoffmann, 1930). Similar observations were made by Rao (1977) for *R. filiformis* at Madras. But, he noticed that the the eggs laid during rainy months took a longer time to hatch, while those laid in summer took less time. Venkatesan (1981) while studying the influence of temperature and salinity variations on the aquatic bug *Diplonychus indicus* reported that males are less susceptible to changes in these parameters.

In the present study even though the studies were conducted during the warm month of April, the eggs took an average of 58 days whereas it was only 38 days at Delhi during the same month. At Delhi the temperature is comparatively higher in April than at Trivandrum during this month.

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SUMMARY

The life history of the nepid *Ranatra filiformis* has been studies by collecting specimens from the field. The insects were reared from egg to the adult in the laboratory. The nymph hatched out from the egg passed through four instars to become the adult. Breeding record is presented. The principal changes in external morphology in different instars are given with full illustrated descriptions. *R. filiformis* took 58 days for the attainment of adulthood. The growth rates are statistically interpreted.

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