Indian Agricultural Research Institute
Division of Entomology
New Delhi (India)

S.-I. Farooqi, B. R. Subba Rao & A. K. Sharma

Studies on the parasites of *Orthaga* sp., a pest of *Syzygium fruticosum* Roxb. at Delhi

With 10 plates (Figs. 1—24) and 1 graph

Introduction

Syzygium fruticosum Roxb. (Myrtaceae) is a fruit tree grown in large numbers in almost all the parts of India. A number of pests are reported to attack this tree from South India. The important ones are the caterpillars of few moths belonging to the families Noctuidae, Geometridae, Lasiocampidae, and Lymantridae (Anantanarayanan & Venugopal, 1954). During June 1962 a severe attack of *Orthaga* sp. (Pyralidae) was observed on "Jamun" trees in Delhi in I.A.R.I. area. An allied species viz. *Orthaga exvinacea* Hampson is known to be an important pest of mango in the South (Cherian & Anantanarayanan, 1943).

Large numbers of caterpillars were collected from the field and were kept in the laboratory under observation. From the lot, two primary parasites, one a Braconid (*Phanerotoma* n. sp.) and another an Ichneumonid (*Devorgilla* sp. near *inquinata* Morley), and one hyperparasite, a Perilampid (*Perilampus microgastris* Ferrière) emerged. The biology and bionomics of these parasites thus studied is presented in this paper.

Material and methods

It was observed that the pest was present in the field throughout the year, though in smaller numbers during the winter months. The caterpillars were collected from the trees and were dissected to study the immature stages of the parasites. Early stages were studied by mounting in glycerine-water medium. Gum-chloral was used for the advanced stages in order to study the structures clearly, especially the tracheal system. The head capsules of advanced stages were permanently mounted in canada-balsam. Figures of the immature stages and the head sclerites were drawn with the help of Camera lucida.

Parasitism in the field

Regular dissections of the host, collected from the field were made. Percentages of parasitism, multiparasitism, superparasitism and hyperparasitism as calculated for each month are tabulated below (see table and graph on p. 180).

Description of immature stages

A. *Phanerotoma* n. sp.

The egg (Pl. 1, Fig. 1): The ripe ovarian egg is 0.28 mm. long, with a maximum width of 0.03 mm. The chorion is transparent and lacks surface sculpturing.

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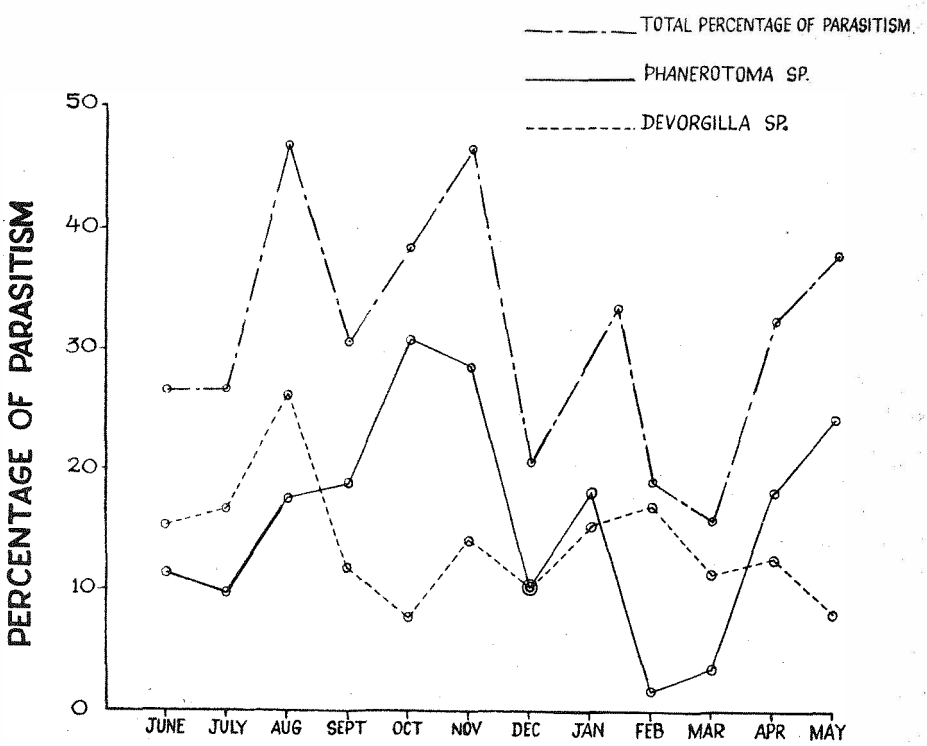
Table and graph

Percentage of parasitism, multi-, super-, and hyperparasitism for different parasites, as they occur during various months of the year

Month	Total % of parasitism	% of parasitism for *Devorgilla* sp.	% of parasitism for *Phanerotoma* n. sp.	% of multi-parasitism	% of super-parasitism by *Devorgilla* sp.	% of hyper-parasitism by *P. microgastris*
June '62	26.86	11.44	15.42	—	—	—
July '62	26.61	9.85	16.76	—	—	2.81
Aug. '62	46.59	17.47	26.21	2.91	—	4.95
Sept. '62	30.76	18.84	11.92	—	—	0.38
Oct. '62	38.45	30.76	7.69	—	—	—
Nov. '62	46.42	28.57	14.28	—	3.57	3.57
Dec. '62	20.50	10.25	10.25	—	—	—
Jan. '63	33.33	15.15	18.18	—	—	—
Feb. '63	18.86	16.98	1.88	—	—	—
Mar. '63	15.91	11.50	3.53	—	0.88	—
Apr. '63	32.40	12.67	18.33	—	1.40	—
May. '63	37.88	8.21	24.21	2.73	2.73	3.65



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The first instar larva (Pl. 1, Fig. 2, 3): The newly hatched larva of *Phanerotoma* n. sp. has a large head which is widest at a point two-thirds of its length from the anterior end. The body segments become narrower towards the posterior end, so much so that the last segment assumes the shape of a short tail. The body is roughly twice as long as the head.

Anterior to the mouth there are two raised oral papillae which are capable of contraction and retraction. The mandibles are long, sickle shaped and sharply pointed. When at rest their edges cross each other. They are not densely sclerotised at this stage and are capable of free and quick movement.

The integument is soft and bears numerous spicules. The three thoracic segments are well defined. Of the remaining segments, only three or four are marked while others are obscure. The tracheal system is absent in this stage.

As the larva grows in size the posterior end becomes broader. The body increases in size, the size of the head remaining the same. At this stage the segmentation becomes well-marked. All the thirteen body segments may be easily counted. A rectal evagination starts developing, which is the future caudal vesicle of the second instar.

The larva soon after hatching measures 0.20 mm. in length and 0.07 mm. in width, whereas a full grown first instar is about 0.32 mm. long and 0.13 mm. wide. The head measures 0.05 mm. in length and 0.07 mm. in width, and the mandibles are 0.03 mm. long.

The second instar larva (Pl. 2, Fig. 4a, b): The second instar larva is somewhat oval in shape. As the body increases in size, the head becomes shorter. The segmentation is very distinct in the early second instar but it becomes faint at a later stage.

The head gets smaller and more sclerotised. Dentition, though not very prominent, appears at the inner edges of the mandibles. The body is thirteen segmented, with the cuticle spiculated. Evagination of the last segment has prominently developed into a vesicle which clearly seems to consist of a single layer of columnar cells.

The tracheal system comprises two longitudinal trunks which extend into the head giving off some short branches, and posteriorly they run almost the entire length of the larva, giving off one dorsal and one ventral branch in each of the 10 abdominal segments. These longitudinal trunks are connected just behind the head by a dorsal commissure. Till now no spiracles are present.

The measurements of the second instar are: length 2.6 mm., width 0.61 mm., width of the head capsule 0.61 and the length of the caudal vesicle 0.48 mm.

The third instar larva (Pl. 2, Fig. 5): It is the mature larva of the parasite. It assumes a cylindrical shape, with both cephalic and caudal ends tapering. The head and the mandibles are well developed and strongly sclerotised (Pl. 2, Fig. 6): Dentition of the mandibles is prominent at this stage.

There are distinctly 13 body segments. Few segments in the middle are larger than others. The cuticle is covered over by numerous spicules. The tracheal system

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is essentially the same as that of the second instar with a difference that now there are 7 pairs of functional spiracles and more branching of the trachae has occured.

The third instar larva measures 3.50 mm. in length and 0.97 mm. at its maximum width.

The pupa (Pl. 3, Fig. 7): The pupa is of the exarate type as in other Hymenoptera. It is enclosed within a white oval cocoon. The host skin may be observed attached to its one side. It measures 3.19 mm. in total length. The head is 0.53 mm. long and 1.10 mm. wide, thorax 1.17 mm. long and 0.94 mm. wide and the abdomen measures 1.49 mm. in length and 0.23 mm. at its maximum width.

The sex ratio: The sex ratio of *Phanerotoma* n. sp. as determined from the adults (Pl. 3, Fig. 8) reared in the laboratory was 1:3.

B. *Devorgilla* sp. near *inquinata* MORLEY

The egg (Pl. 4, Fig. 9): The ripe ovarian egg is 0.24 mm. long, with a maximum width of 0.06 mm. and very slightly curved and tapering towards both ends. The chorion is smooth.

The first instar larva (Pl. 4, Fig. 10): The first instar larva of *Devorgilla* conforms to the typical shape of internally-feeding Ichneumonid type, with strongly sclerotised head and 13 segmented body ending in a long tail.

Head capsule is almost pointed towards the anterior extremity while posteriorly it is as broad as the 1st body segment. Two strongly sclerotised, sharply curved and pointed mandibles are situated near the anterior-most region of the head capsule. They do not bear lateral teeth.

There is no differentiation between thoracic and abdominal segments but all the 13 segments are well defined. The tail is approximately a little less than half the length of the body. At the point from where the tail starts there exists a minute invagination of the integument.

The tracheal system comprises two longitudinal trunks situated throughout the length of the body. Anteriorly the two trunks are connected just below the head capsule by a dorsal commissure. A posterior commissure is also visible in the anterior region of the tail. One pair of loops is formed laterally in each of the 1st and 2nd body segments by the longitudinal trunks. Dorsal and ventral branches are also given of in each segment but they are very small and unbranched. Anteriorly the longitudinal trunks extend into the head capsule giving off various branches. There are no spiracles.

Newly hatched 1st instar larva measures 0.49 mm. in length and 0.09 mm. at its maximum width, whereas the full grown 1st instar attains a length of 0.93 mm. and a width of 0.2 mm.

The second instar larva (Pl. 4, Fig. 11 a, b): In the second instar larva the head and the tail are considerably reduced while the rest of the body increases in size. Roughly, the tail becomes equal to the size of the head. It differs from the first

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instar only by its increased size, reduced tail, more sclerotised head and further branching of the tracheal system. There are still no spiracles.

It measures 1.30 mm. in length 0.48 mm. at its maximum width. The tail is 0.21 mm. long, and the head region is 0.09 mm. long.

The third instar larva (Pl. 5, Fig. 12): The third instar larva is characterised by its large size, presence of a very small tail and more branching of the tracheal system. Both the caudal and cephalic ends are similarly rounded, and are as broad as rest of the body. The head is more sclerotised but its various sclerites are not yet complete.

The measurements of the third instar are: length 3.29 mm. width 1.00 mm., tail 0.05 mm. and head 0.25 mm.

The fourth instar larva (Pl. 5, Fig. 13): The fourth stage of development is assumed by further increase in size. It is oval in shape with both cephalic and caudal ends tapering. The larva becomes opaque and no internal structures may be seen till it is mounted in gum-chloral and kept for about two hours. At this stage it comes out of the host larva and starts spinning a cocoon.

The head structures are almost complete and strongly sclerotised (Pl. 5, Fig. 14). All the body segments are well marked and the tail is totally absent. The integument presents a spiculated texture and bears frequent hairs also. The tracheal system remains the same with only the difference that it becomes much more branched.

It measures 4.86 mm. in length and 1.20 mm. in width. The head region is 0.33 mm. long.

The pupa (Pl. 5, Fig. 15): The pupa is of the exarate type as in other Hymenoptera. At first the cocoon of the pupa is creamy-white but as the pupa gets darker the cocoon also becomes dark in colour: The emergence of the adult occurs through a circular opening at the 'cephalic' end (called 'cephalic' as it lodges the head region of the pupa).

The pupa measures 8.95 mm. in total length. The head is 1.66 mm. long and 0.62 mm. wide, thorax 2.53 mm. long and 0.69 mm. wide and the abdomen measures 4.76 mm. in length and 0.56 mm. at its maximum width.

The sex ratio: As calculated from the reared specimens (Pl. 7, Fig. 16) the sex ratio of *Devorgilla* sp. is 2:1, i.e. out of 41 adults 27 were males and 14 were females.

C. ***Perilampus microgastris*** Ferrière

(A hyperparasite of *Phanerotoma* n. sp. and *Devorgilla* sp.)

The egg (Pl. 8, Fig. 17): The ripe ovarian egg is 0.22 mm. long with a maximum width of 0.04 mm., markedly arched on one side; the chorion is distinctly sculptured. One end of the egg is sharply pointed and the other is rather blunt.

The primary larva (Pl. 8, Fig. 18a, b): The body appears to be straight, slightly broader at the head and tapers towards the posterior end. It is composed of a well defined head and 12 body segments, all more or less semi-transparent.

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The oral region is membranous and partially extrusible. Dorsum of the head capsule presents two rows of spicules near the posterior margin. The upper row usually consists of four granular spicules whereas in the lower row there are usually six spicules slightly pointed and bigger in size. These spicules possess a peculiar bluish sheen on them. The mandibles are simple and deeply sclerotised. Their tips are curved like a hook.

All the 12 body segments are well defined. Those towards the head are broader than those in the posterior region. The sclerotised dark-brown segmental plates cover all but a membranous narrow medium ventral portion of each segment. Due to the presence of intersegmental membranes the body is capable of extreme distension and contraction. More or less in the middle of the dorsum of each segmental plate a row of minute granules followed by a row of bigger spines, similar to those on the head capsule, is present. Each row consists of 12—15 spicules. The posterior ventral margin of each segmental plate appears to be toothed. In contracted position, the segmental plates overlap each other thus giving a wavy appearance to the lateral margin. A fleshy anal sucker is situated at the last segment which enables the planidium to attach itself to the leaf-surface. Long hairs at frequent distances may be observed all over the body, the caudal cerci being the largest attaining a length more than half the total length of the body.

The tracheal system comprises a pair of thin longitudinal trunks running from the anterior to the posterior end, giving out one pair of lateral branches in the region between 1st and 2nd body segment. These lateral trunks bear spiracles at their tips which open in the intersegmental membrane. Anteriorly in the thoracic region the longitudinal trunks are connected by a transverse commissure. The locomotion is effected by means of a looping movement similar to that of a geometrid larva.

These planidia are frequently encountered on the second and third instars of *Phanerotoma* n. sp. or third instar of *Devorgilla* sp. or are found dead, attached to the moulted skins. They may attach themselves to any part on the host integument. A maximum number of 8 planidia was on a third instar larva of *Phanerotoma* n. sp., although never more than one adult is produced per cocoon.

The measurements of the first instar larva are: length 0.19 mm, width 0.05 mm., width of the head capsule 0.02 mm., and length of the caudal spine 0.1 mm.

The second instar larva (Pl. 8, Fig. 19a, b, c): As the primary larva passes into the second instar, all the traces of sclerotised armour disappear. The body becomes more or less pointed at both the ends, although the anterior end still remains slightly broader. Segmentation of the body becomes obliterated probably due to more feeding. The head partially sinks into the depression formed anteriorly due to desclerotisation of the body segments. The mandibles become more strong and hooked. The derm is covered over by means of numerous minute spicules. These spicules are arranged in rows which extend transversely from one side to the other. These rows are in groups each containing 3 or 4 rows. There are 12 such groups. Probably each group corresponds to one body segment.

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Longitudinal tracheal trunks become more thick and give of lateral branches from first to sixth segment. One more pair of spiracles is added in the fourth segment.

Larval measurements are: length 0.70 mm., width 0.32 mm. and the width of the head 0.2 mm.

The third instar larva (Pl. 9, Fig. 20): The third instar larva is characterised by its bigger size, development of 4 pairs of spiracles and thickening of the tracheal system. The head is more sclerotised and is more or less pointed. The grub is narrower towards its caudal end. The distinctly granulated cuticle bears numerous spines which are densely arranged near the caudal extremity.

It measures 0.88 mm. in length and 0.28 mm. in width.

The fourth instar larva (Pl. 9, Fig. 21): As feeding continues the larva grows in size. Both the ends become similarly pointed while the middle portion is broader. The anterior pit-like depression increases in size and the head along with the first segment remains sunk into it. The mandibles are more strongly sclerotised and increase in size also (Pl. 10, Fig. 22). On the dorsal side towards the lateral margins teat-like protuberances arise. These protuberances or lumps are more prominent in the thoracic segments especially in the metathoracic segment. The derm is covered over by numerous microscopic granules or spicules. The fourth instar larva frequently raises its head from the host body and moves about.

The tracheal system becomes much more branched and complicated. It is characterised by the presence of 7 pairs of spiracles in the first 7 segments of the body. The lateral tracheae branch and rebranch into finer tracheae forming a thick network.

Mature fourth instar larva averages 2.16 mm. by 1.44 mm. in size.

The pupa (Pl. 10, Fig. 23): It measures 3.60 mm. in length. The head averages 1.00 mm. by 0.88 mm., thorax 1.86 mm. by 0.90 mm. and the abdomen 0.86 mm. by 1.00 mm. (Adult: Pl. 10, Fig. 24).

Discussion

It is apparent from the field collected material, that both the primary parasites remain more or less active throughout the year though the hyperparasite was noticed only during certain months of the year.

Phanerotoma n. sp. parasitises the eggs and *Devorgilla* sp. attacks the 1st instar larvae of the host. The larval stages of both the parasites are completed just before the pupation of the host. The host takes about 90 days to complete its life cycle and so do the parasites. Thus there are four generations a year, both of the host and of the parasites.

Very little work has been done on the biology of *Phanerotoma* spp., and there are only a few papers dealing with the biology and bionomics of *Nemeritis* sp. and *Idechthes* sp. (as *Devorgilla* was previously known). Daviault (1930) studied the biology of *Nemeritis canescens*, a pupal parasite of *Ephestia kühniella* and reported its developmental period from egg to adult at ordinary temperature in the labor-

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atory as 47 days, and 27—30 days at a constant temperature of 28 °c (82.4 F). *Devorgilla* sp. near *inquinata* differs from *D. canescens*, in being a larval parasite and having a developmental period of about 90 days.

Dohanian (1942) reared *Phanerotoma tibialis* from *Melissapus lateiferenus* Filbert, along with other parasites. According to him none of its parasites has its life cycle better synchronised with that of the host than *Phanerotoma tibialis*. This is true of *Phanerotoma* n. sp. also.

Hosts parasitised by *Phanerotoma* or *Devorgilla* sp. begin to construct a cocoon covered with frass etc. before undergoing pupation, but soon die. In both the cases the parasite grubs pupate within this case as mentioned above. Both in *Phanerotoma* and *Devorgilla* sp. the dead host skin remains attached with the parasite cocoon.

The hyperparasite becomes active when the primary parasite is in the last stages of its development or it has already spun a cocoon. In case where the host is killed by the primary parasite after cocoon-formation and the primary is killed by the secondary when it has spun a cocoon, three cocoons may be observed: first, that of the host, second, that of the primary parasite, and the third and inner-most, that of the hyperparasite.

The biology of a number of species of *Perilampus* has been studied in detail by many workers. Four larval instars were observed during the present studies, whereas in *Perilampus chrysopae* (Clancy, 1946) and *Perilampus hyalinus* (Smith, 1912) only three larval instars are known. However, Parker (1924) found four larval instars in the latter species and Bergold & Ripper (1937) have also described four larval instars in *Perilampus tristis* Mayr. *Perilampus microgastris* resembles *P. tristis* rather than *P. chrysopae* in this respect. The earliest instars of the primary parasites on which the planidia of the hyperparasite were observed were the 2nd instar in the case of *Phanerotoma* and the third instar in the case of *Devorgilla*. A maximum number of six hyperparasitic planidia was observed on a prepupal stage of *Phanerotoma*. However, in all cases so far observed, only one *Perilampus* adult emerged from a host, indicating the elimination of the supernumeraries during development. In a certain number of dissections, the planidia were found within caterpillars which were not parasitesed by either of the primaries.

As far as the biology of *Phanerotoma* n. sp. is concerned, this is the first instance when the biology of a species of this genus has been studied. The larval instars resemble closely those of *Chelonus* sp. (Vance, 1932) and *Ascogaster* sp. (Rosenberg, 1934). In all the dissections there was only one egg or grub of *Phanerotoma* within a single host. Apparently there is no super-parasitism in this species under field conditions, indicating the ability of the females to avoid ovipositing in hosts already parasitised.

Devorgilla canescens (Gravenhorst), a larval-pupal parasite of *Ephestia* sp. and *Plodia interpunctella* (Hbn.) in stored grains and of *Galleria mellonella*, is apparently the only species of *Devorgilla*, the biology of which has been studied so far. (Daviault, 1930; Rietra, 1932).

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Different authors have reported different number of larval instars in the case of *Devorgilla* and its allies i.e. species of genera belonging to the subfamily Porizoninae of Ichneumonidae. RIETRA (1932) reported five larval instars in case of *D. canescens* (GRAVENHORST). TIKAR and THAKRE (1962) have described four larval instars in *Horogenus fenestralis* (HOLMGREN). MILLER and RENAULT (1963) described five larval instars in *Synetaetis tenuifemur* WALLY. This discrepancy appears to be mainly due to the general difficulty of ascertaining the exact number of moults in endoparasites. The basis on which the trasition from one instar to the next is to be fixed, has therefore to be of a morphological nature in case of the endoparasites. In the present studies, the size of the tail, the extent of development of the tracheal system and the degree of sclerotization of head sclerites have been taken as the criteria for the separation of instars. *Devorgilla palmaris* (WALKER) is a parasite of *Tirathaba rufivena* a pest of coconut in Malaya and other countries. CORBETT (1930) has given brief notes on its biology, stating that the development is completed in 24—26 days, and the young host larvae are especially attacked, and the sexes occur in nearly equal numbers. In *Devorgilla* sp. near *inquinata*, the sex ratio is 2:1 and the females mostly attack the young caterpillars. Superparasitism was observed only in four cases: in three there were 2 second instar grubs and in the fourth a first instar grub and an egg. This shows that there is very little superparasitism under field conditions.

Very little multiparasitism between *Phanerotoma* and *Devorgilla* was noticed. In almost all such cases there was one first instar grub of each parasite within the host. In two cases the Ichneumonid grub was more active than the Braconid. The occurrence of such a low percentage of multiparasitism is indicative of very little interspecific competition between the two primary parasites under field conditions.

In addition to *Devorgilla* sp. *Phanerotoma* n. sp. and *Perilampus microgastris*, an unidentified Bethylid, a *Brachymeria* sp., a *Eurotoma* sp. and Tachinid have also been reared. However, their exact relationships with the host have not been established, as the percentage of parasitism was extremely low.

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Summary

In Delhi *Orthaga* sp. is a serious pest of *Syzygium fruticosum*, wild 'Jamun'. A severe attack was observed during June '62 in Delhi in I.A.R.I. area. Three parasites viz (i) *Phanerotoma* n. sp., a primary egg-larval parasite, (ii) *Devorgilla* sp. near *inquinata* MORLEY a larval parasite and (iii) *Perilampus microgastris* FERRIÉRE a secondary parasite of the first two, were reared. The percentage of parasitism by *Phanerotoma* sp. ranged from 1.88 to 26.21, and that by *Devorgilla* sp. from 8.21 to 30.76, while *Perilampus* attacked 0.38 to 4.95 per cent of the grubs of the two primary parasites. Multiparasitism between *Phanerotoma* sp. and *Devorgilla* sp. was about 3.0%. The sex ratio of *Devorgilla* sp. and *Phanerotoma* sp. was 2:1 and 1:3, respectively. A detailed account of the immature stages of all the three parasites is given in this paper.

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Zusammenfassung

In Delhi ist *Orthaga* sp. ein gefährlicher Schädling von *Syzgium fruticosum*, dem wilden „Jamun". Ein starker Befall wurde in Delhi im Juni 1962 im I.A.R.I. Gebiet beobachtet. Drei Parasiten, nämlich 1. *Phanerotoma* n. sp., ein primärer Eier-Larven-Parasit, 2. *Devorgilla* sp. nahe *inquinata* Morley, ein Larven-Parasit, und 3. *Perilampus microgastris* Ferrière, ein sekundärer Parasit der beiden ersteren, wurden gezüchtet. Der Parasitismus lag bei *Phanerotoma* sp. zwischen 1,88% und 26,21% und bei *Devorgilla* sp. zwischen 8,21% und 30,76%, während *Perilampus* 0,38% bis 4,95% der Raupen der beiden primären Parasiten befiel. Der Multiparasitismus von *Phanerotoma* sp. und *Devorgilla* sp. betrug ungefähr 3,0%. Das Verhältnis der Geschlechter war bei *Devorgilla* sp. 2:1 und bei *Phanerotoma* sp. 1:3. Der vorliegende Beitrag gibt eine ausführliche Beschreibung der frühen Entwicklungsstufen aller drei Parasiten.

Резюме

В Дели *Orthaga* sp. является опасным вредителем *Syzygium fruticosum*, дикого „ямуна". В июне 1962 года в Дели в районе I.A.R.I. наблюдалось сульное поражение этим вредителем. Были выведены три паразита: 1. *Phanerotoma* n. sp. — первичный паразут яиц и личинок, 2. *Devorgilla* sp. близ *inquinata* Morley — паразит личинок и 3. *Perilampus microgastris* Ferrière — вторичный паразит обоих первых. Паразитизм *Phanerotoma* sp. колебался между 1,88% и 26,21%, а у *Devorgilla* sp. между 8,21% и 30,76%, в то время как *Perilampus* поражал 0,38%—4,95% гусениц обоих первичных паразитов. Мультипаразитизм *Phanerotoma* sp. и *Devorgilla* sp. составлял 3,0%. Соотношение полов у *Devorgilla* sp. составляло 2:1, а у *Phanerotoma* sp. 1:3. Предлагаемый доклад дает подробное описание незрелых стадий развития всех трех паразитов.

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Explanation of abbreviations

AC	= Anterior commissure	LLT	= Lateral longitudinal trunk
ANT	= Antenna	LP	= Labial palp
CC	= Columnar cell	MD	= Mandible
CE	= Caudal evagination	MP	= Maxillary palp
CH	= Chorion	OP	= Oral papillae
CS	= Caudal setae	PC	= Posterior commissure
CV	= Caudal vesicle	PL	= Pleurostoma
EPS	= Epistomal sclerite	PMP	= Posterior mandibular process
H	= Head	S	= Spine
HYS	= Hypostoma	SMP	= Superior mandibular process
HYSS	= Hypostomal sclerotic spur	SP	= Spiracle
LB	= Labium	SPC	= Spicules
LBS	= Labial sclerite	SPT	= Spiracula trunk
LL	= Loop	SS	= Stipital sclerite

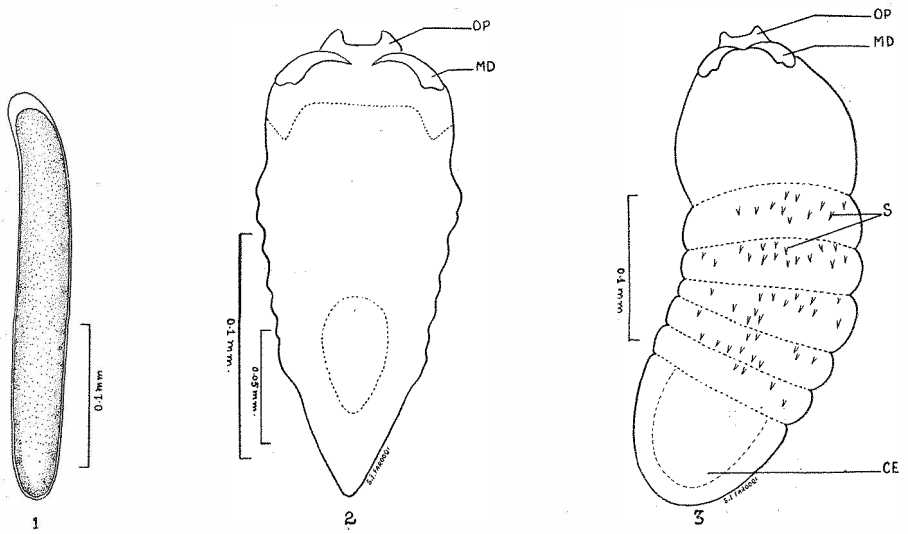

Plate 1. *Phanerotoma* n. sp.:
Fig. 1. Ripe ovarian egg. — Fig. 2. Early first instar larva. — Fig. 3. Late first instar larva

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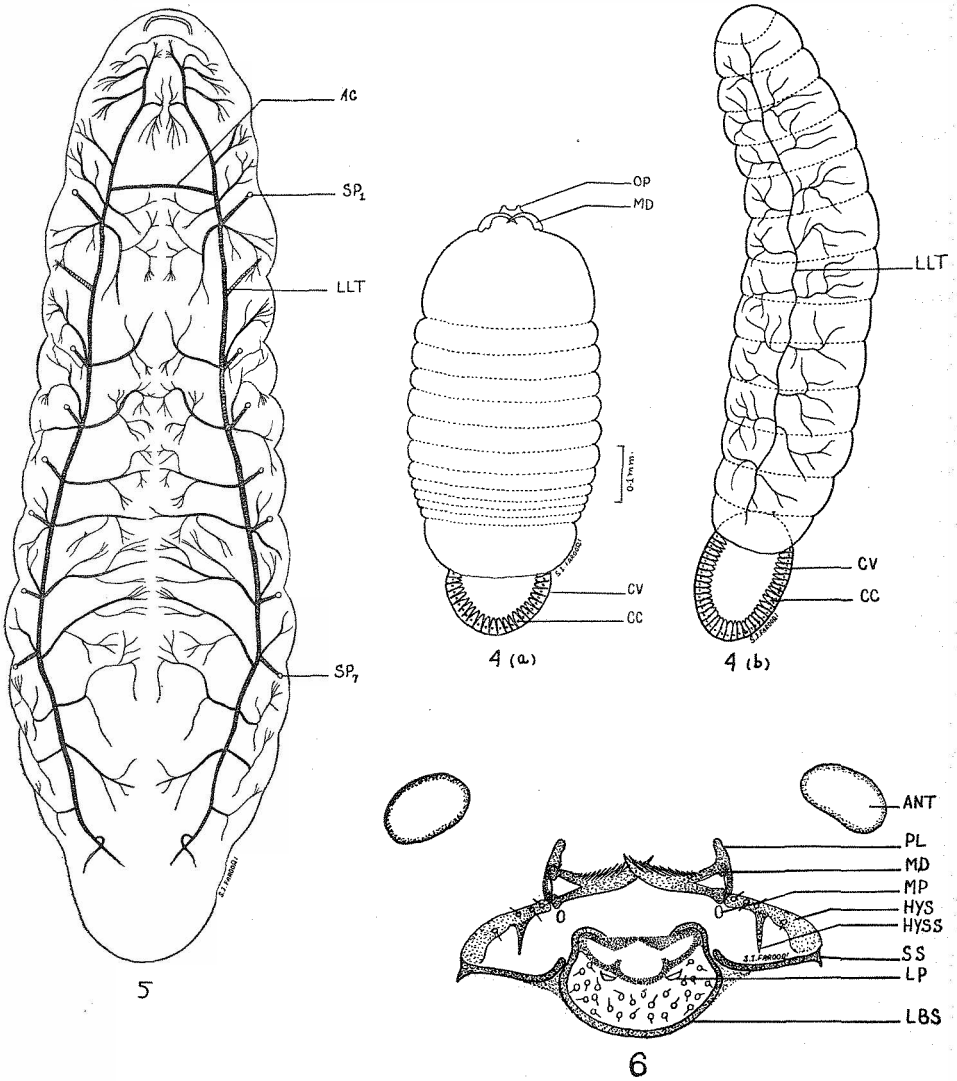

Plate 2

Phanerotoma n. sp.:

Fig. 4a. Early second instar larva

Fig. 4b. Late second instar larva

Fig. 5. Third instar larva

Fig. 6. Head sclerite

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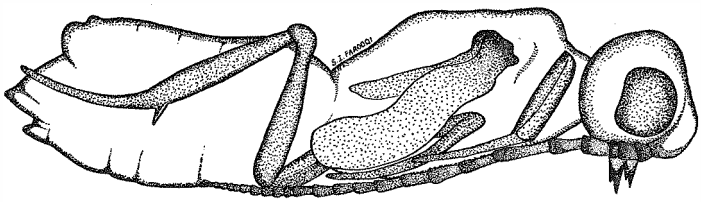

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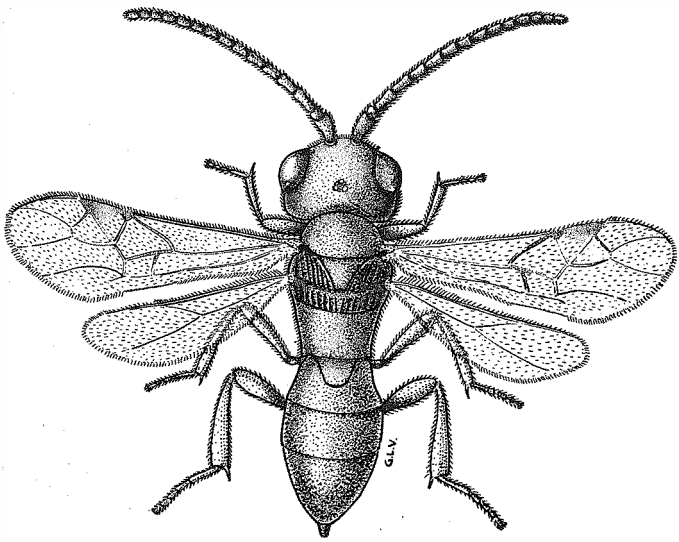

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Plate 3

Phanerotoma n. sp.:

Fig. 7. Pupa
Fig. 8. Adult

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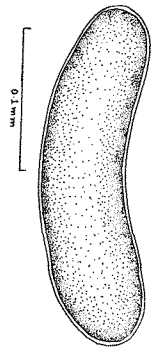

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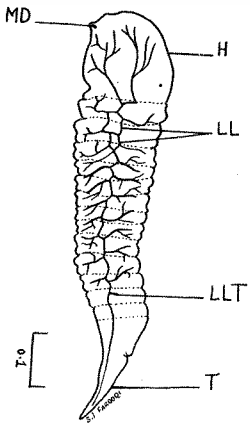

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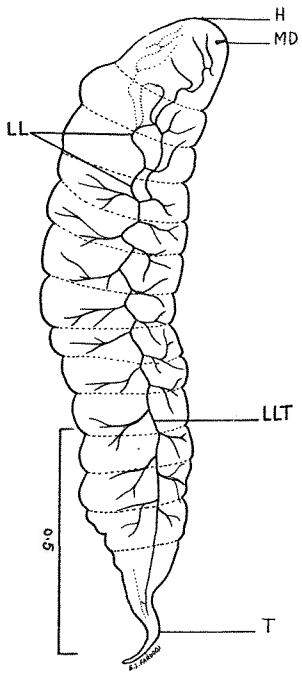

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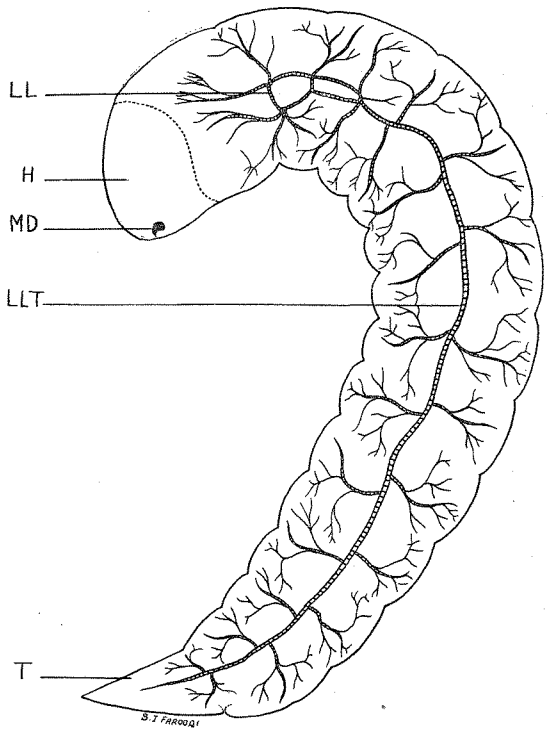

11b

Plate 4

Devorgilla sp.:

Fig. 9. Ripe ovarian egg
Fig. 10. First instar larva
Fig. 11a. Early second instar larva
Fig. 11b. Late second instar larva

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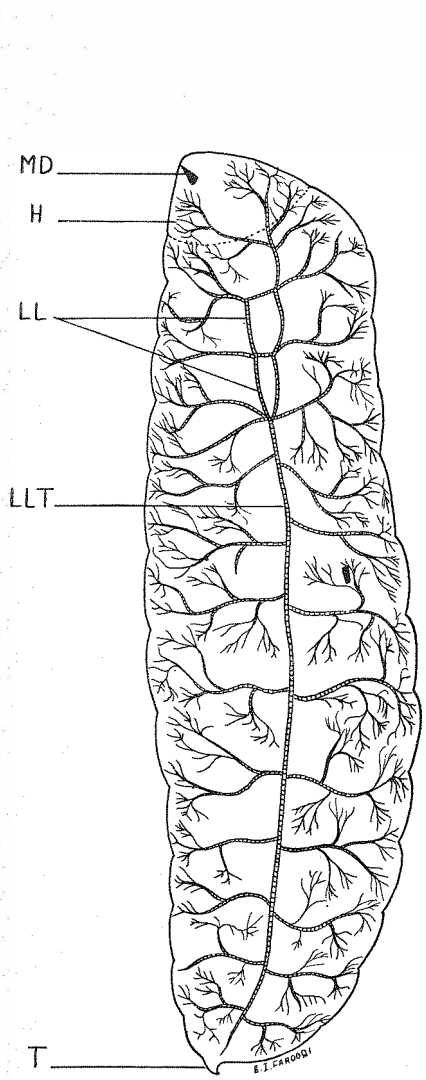

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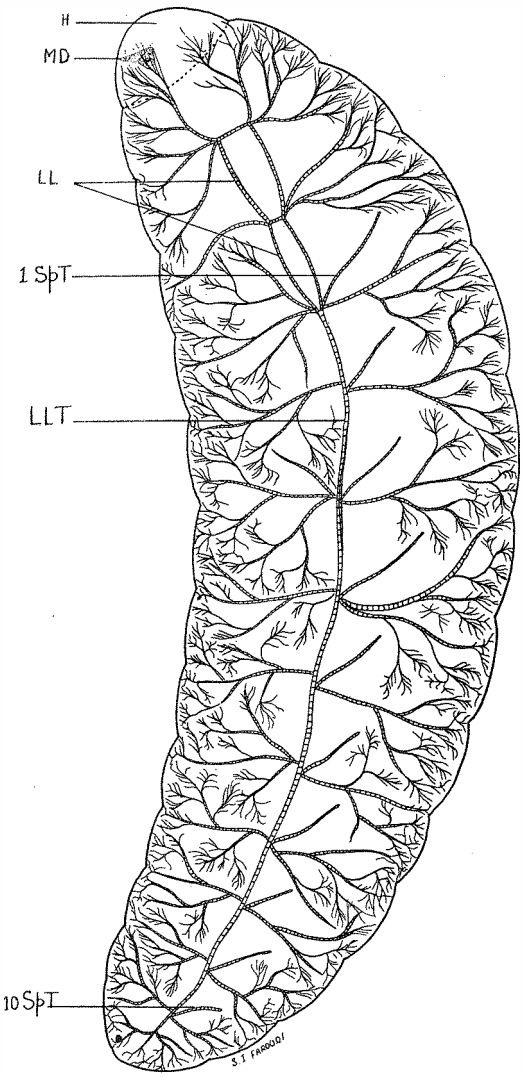

13

Plate 5

Devorgilla sp.:

Fig. 12. Third instar larva
Fig. 13. Fourth instar larva

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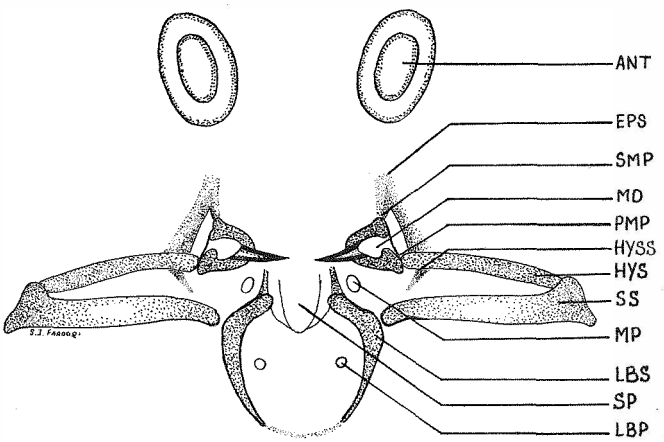

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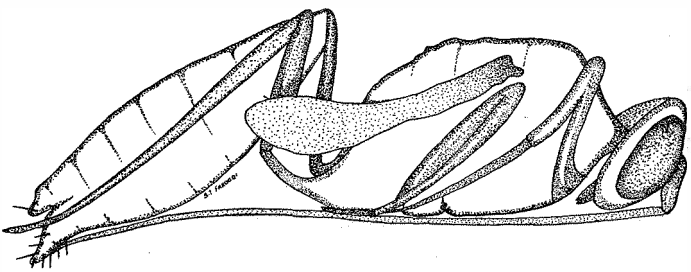

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Plate 6

Devorgilla sp.:

Fig. 14. Head sclerite
Fig. 15. Pupa

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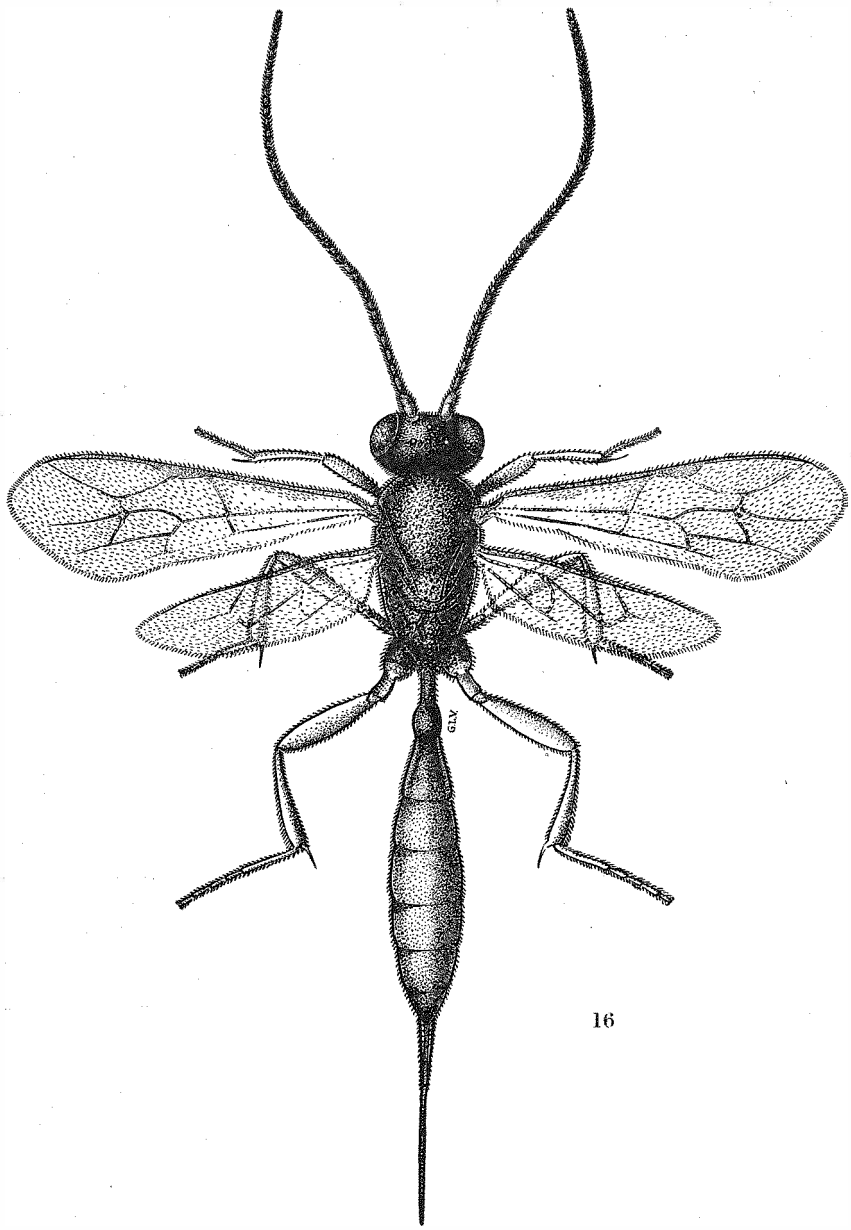

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Plate 7

Devorgilla sp.:

Fig. 16. Adult

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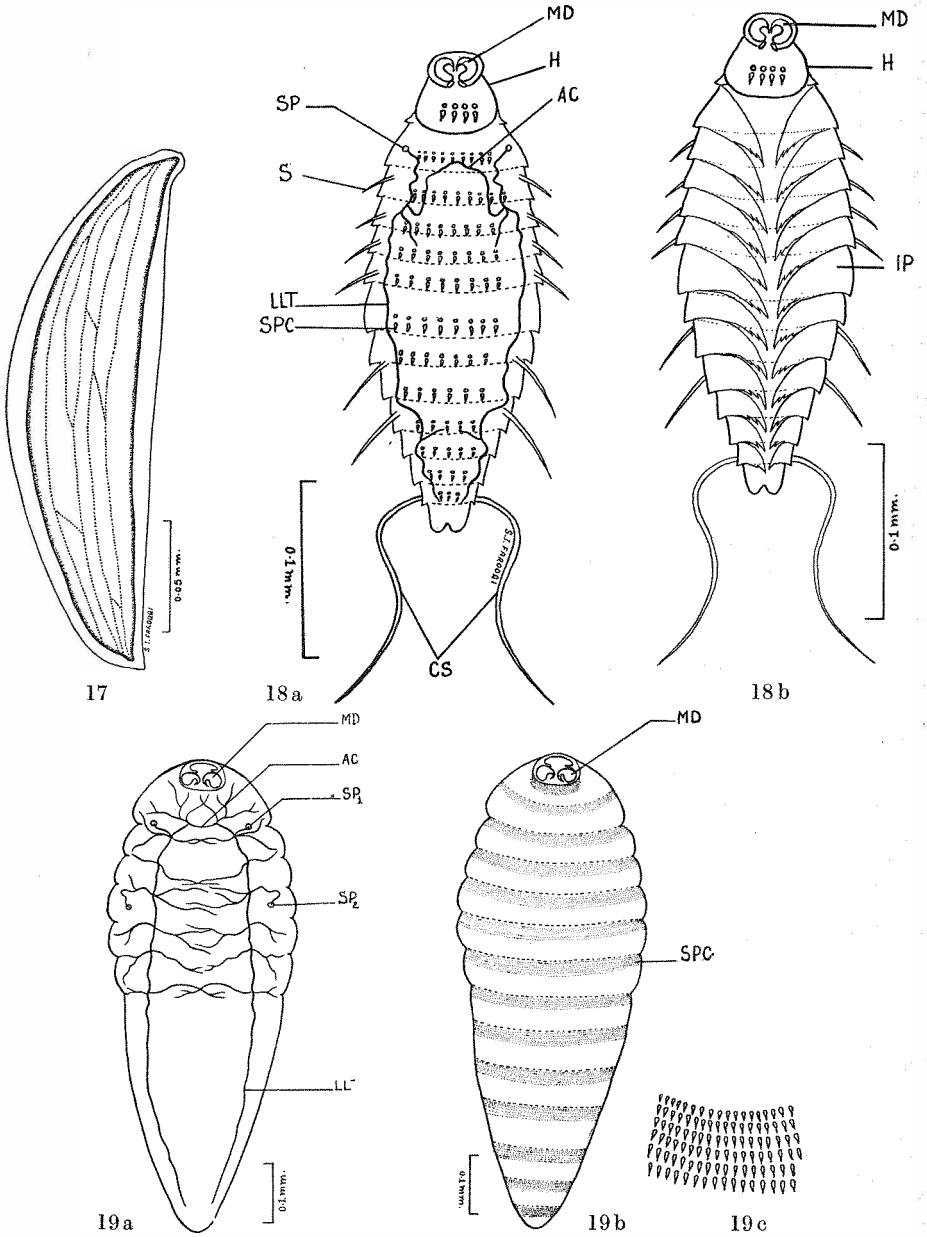

Plate 8. *Perilampus microgastris* Ferriére:
Fig. 17. Ripe ovarian egg
Fig. 18a. Dorsal view of the first instar larva
Fig. 18b. Ventral view of the first instar larva
Fig. 19a. Second instar larva showing the tracheal system
Fig. 19b. Second instar larva showing the texture of the integument
Fig. 19c. Body spicules. (magnified)

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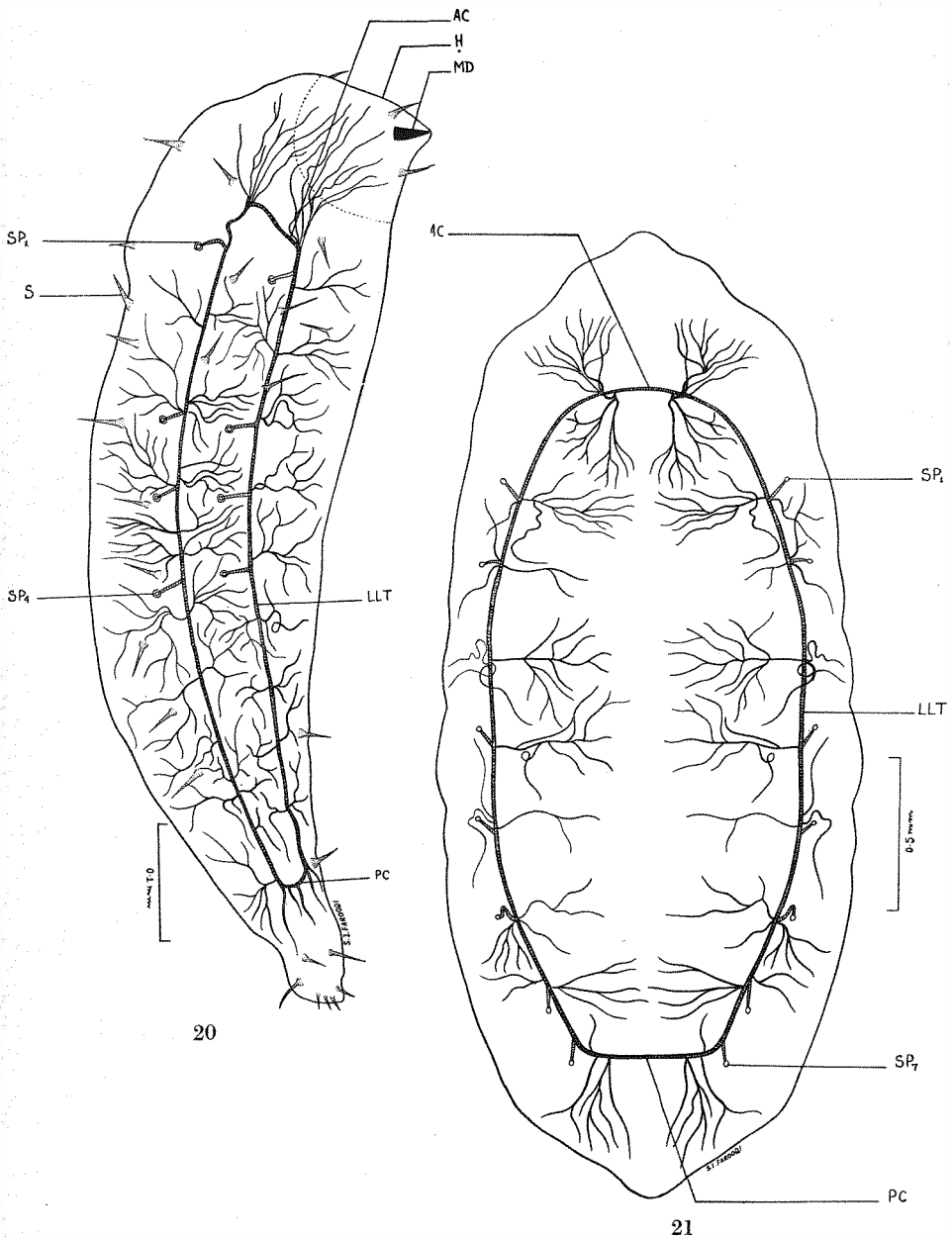

Plate 9

Perilampus microgastris FERRIÉRE:

Fig. 20. Third instar larva
Fig. 21. Fourth instar larva

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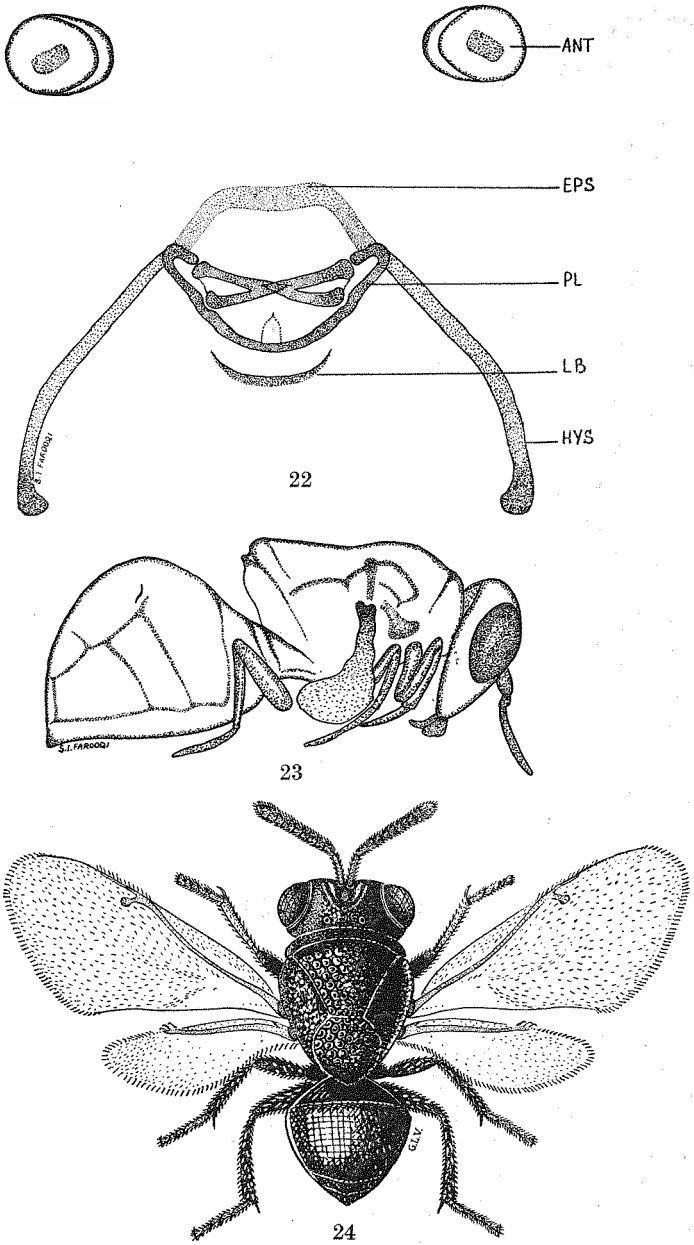

Plate 10

Perilampus microgastris Ferrière:

Fig. 22. Head sclerites of the mature larva
Fig. 23. Pupa
Fig. 24. Adult

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