

TWO UNCOMMON APHIDOPHAGOUS DIPTEROUS LARVAE:
LEUCOPIS SP. (OCTHIPHILIDAE) AND
APHIDOLETES SP. (CECIDOMYIIDAE)

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In studying the biological control of peach-aphids (*Hyalopterus arundinis* Fab.) and cotton-aphids (*Aphis gossypii* Glover) by syrphid larvae, it was discovered occasionally the existence of two other kinds of larvae in addition to those syrphids already found. Both of these two species look very much like the general syrphid larvae except one has diverging posterior spiracles and another possesses spined posterior end. Due to their separate rearing in the laboratory, some minute flies and gnats were obtained. They belong to the dipterous families Ochthiphilidae and Cecidomyiidae. According to Wu's (1940) Catalogus Insectorum Sinensium, there is only a species, *Leucopis sordida* Becker recorded from Tibet and no information about the genus *Aphidoletes* in China. In acknowledgment, my thanks are due to Dr. H. F. Chu under whose guidance and criticisms this work is tentatively accomplished.

METHOD OF STUDY

In laboratory, larvae were reared isolately in small glass vials accompanied with plant leaves and aphids. Fresh leaves with counted aphids were supplied to feed the larvae and the vials were cleaned everyday. Before the period of pupation soil was usually added. For the purpose of microscopic studies, larvae of different stages were killed by boiling water and then preserved in 75% alcohol solution. All the data contained in this paper are based upon the observations made in May and June, 1949 in Peking.

I. *LEUCOPIS* SP.

The genus *Leucopis* are small flies belonging to the family Ochthiphilidae. Their larvae are predaceous upon aphids, mealy-bugs, and scale-insects. In 1908, Martelli has recorded an undetermined species as a common predator upon the egg of *Filippia oleae* Costa in Italy. Till 1922, Cottam states also an unnamed species in Africa as an effective enemy of *Aphis sorghi* Theo. In 1933, Cherian has studied the life history and immature stages of *Leucopis* sp.

as a predator of aphids in India. Recently, Maple (unpublished MS.) has made an detail study of *Leucopis griseola* Fall and *Leucopis bella* Lw. in North America. These two species, as pointed out by Maple, are very easily to be distinguished both by their physical appearance and their food habits. In their larval stages, the former possesses small spines all over its body segments and is an effective enemy of aphids, while the latter without spines and is a common predator upon the eggs of dactylopine Coccidae. The *Leucopis griseola* Fall is quite similar to the *Leucopis* sp. hereby described. However, it ought to be determined by specialist.

DESCRIPTIONS OF STAGES

The Egg (Pl. XXII, fig. 1)—Length 0.48 mm.; width 0.16 mm.; elongate cylindrical in shape, sharp at one end and bluntly rounded at the other; pearly-white in color and bears some striate markings over the surface of chorion.

The Larva (Pl. XXII, fig. 2)—Length 3.88 mm.; width of the 7th body segment 1.34 mm.; white in color; broadest at the abdominal region, tapering gradually toward the head and bluntly rounded posteriorly. Body 11-segmented, covered with inconspicuous spines; anterior spiracles (Pl. XXII, fig. 4) indistinct; posterior spiracles (Pl. XXII, fig. 3) stalked and widely separated and directed dorsocaudad; dorsum of abdominal segments subdivided into three transverse annulets. Antennae absent; mandible short and hook-like (Pl. XXII, fig. 5), moving vertically.

The Puparium (Pl. XXII, fig. 6)—Length 2.50 mm.; width of the 7th body segment 1.15 mm.; oblong in form and flattened ventrally; reddish-brown in color; body segmentation not very distinct except the anterior three segments; stalked posterior spiracles as in the larva and anterior spiracles not visible.

The Pupa (Pl. XXII, fig. 7)—Length 2.00 mm.; width 0.97 mm.; oblong in form, enclosed within the puparium; head distinct and large; leg sheaths and wing sheaths well developed, almost covering the whole thoracic and abdominal segments.

The Adult (Pl. XXII, fig. 8)—Body length of male 1.75—1.90 mm.; female 2.25—2.65 mm. Small silver-gray flies with four longitudinal brownish black stripes on the dorsum of thorax; postvertical bristles convergent; subcostal vein ends in the costa; clypeus small.

BIOLOGY

Assisted by their clever mothers, which lay eggs singly among the colonies of aphids on the underside of leaves in order the newly hatched larvae can obtain their food without much difficulty. The number of eggs laid either on a plant or on a single leaf is very much likely related directly to the number of the aphids existent. The larvae were found in the colonies of peach-aphids, *Hyaloperus arundinis* Fab. and cotton-aphids, *Aphis gossypii* Glover. According to a rough estimate, a matured larva needs, for its sustenance, 7-8 median-sized aphids everyday. The larva is rather slug-like, with a capacity of changing their body shape. When extended it resembles very much as a measuring-worm. During searching for food, the anterior part of the body is raised up in the air, very much extended and lashed from side to side. When an aphid is touched, the larva punctures with its two or three anterior segments into the body of the capture and usually lift it up in the air. After a process of slowly piercing and sucking by the oesophageal frame-work and hook-like mandibles, only a bare skin of the victim is left and discarded. Before pupation, the larva exudes a considerable quantity of mucilaginous material which darkens quickly and firmly attaches the puparium to the substratum. Puparium is formed on leaf, tree bark, or in soil. At the end of the pupal stage, the adult comes out from the split at the anterior end of the puparium.

II. APHIDOLETES SP.

Genus *Aphidoletes* are small gnats, belonging to the family Cecidomyiidae. Their larvae are predaceous upon aphids, scale-insects and mites. Del Guercio (1919) has listed the genera and species which prey upon aphids in Italy and described their habits. Barnes (1929, '30 and '33) has reviewed the host preferences of this family and gave the habits of many species. Among them, 50 species are aphidophagous. Most numbers of these aphid-feeding species are belonging to the genus *Phaenobremia*. He also gave more than forty species predaceous upon Coccidae, several dozens of species upon living mites and a considerable number of species prey upon gall-inhabiting mites as internal parasites. Davis (1916) has described *Aphidoletes meridionalis* Felt as a common predator upon several gregarious aphid species of North America. Voukassovitch (1932) has studied *Isobremia kiefferi* Vouk., a predator of several species of aphid. It lay eggs in group of four and its larval feeding appear to much more deliberate than in *Aphidoletes meridionalis* Felt. The present

dealing species is quite similar to the *Aphidoletes meridionalis* Felt. However, it needs to be determined by specialist.

DESCRIPTIONS OF STAGES

The Egg (Pl. XXII, fig. 9)—Length 0.31 mm.; width 0.11 mm.; elliptically oval in shape; orange in color; chorion membranous without ornamentation.

The Larva (Pl. XXII, fig. 10)—Length 3 mm.; width 0.68 mm. at 9th body segment; body orange in color, with a sharp feebly developed head and broadest in the abdominal region; posterior end with eight spines arranged into two widely separated circles (Pl. XXII, fig. 11).

The Pupa (Pl. XXII, fig. 12)—Length 2.10 mm.; width 0.65 mm.; orange in color; head small directed ventrad; on the pronotum there are two breathing horns; leg sheaths far exceed the short wing sheaths and reaching the 4th abdominal segment; abdominal segments distinct; antennae almost as long as wing sheaths. Length of cocoon 2.25 mm. and its width 1.00 mm.

The Adult (Pl. XXII, fig. 13)—Body length of male 1.4 mm.; female 1.8 mm.; color grayish with a light pinkish tint on abdomen; head small; antennae moniliform, 14-segmented, each segment longer than wide, prominent with whorls of hairs, circumfila present (Pl. XXII, figs. 14 & 15); wing broad, hyaline and hairy, with three longitudinal veins, but without cross vein; first tarsus greatly reduced.

BIOLOGY

Eggs are laid in clusters on foliage amongst the colony of aphids. After hatching, the larva moves cautiously and quickly thrusting its tongue-like anterior end in and out, much as does of a oethiphilid or a syrphid larva. When an aphid is touched, the larva attacks it by piercing its body from beneath, usually between the legs. After sucking the body fluid of a aphid, the larva leisurely moves to another. This operation continues until it becomes fully engorged. The larvae were found in the colonies of peach-aphids, *Hyalopterus arundinis* Fab. and cotton-aphids, *Aphis gossypii* Glover. According to a rough estimate, a mature larva needs, for its sustenance, 2-3 median sized aphids every day. The mature larva makes a silken cocoon mingled with aphid skins which attaches on the underside of leaf or on ground around the base of plant. Pupation takes place shortly after the cocoon is formed.

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兩種雙翅目食蚜幼蟲

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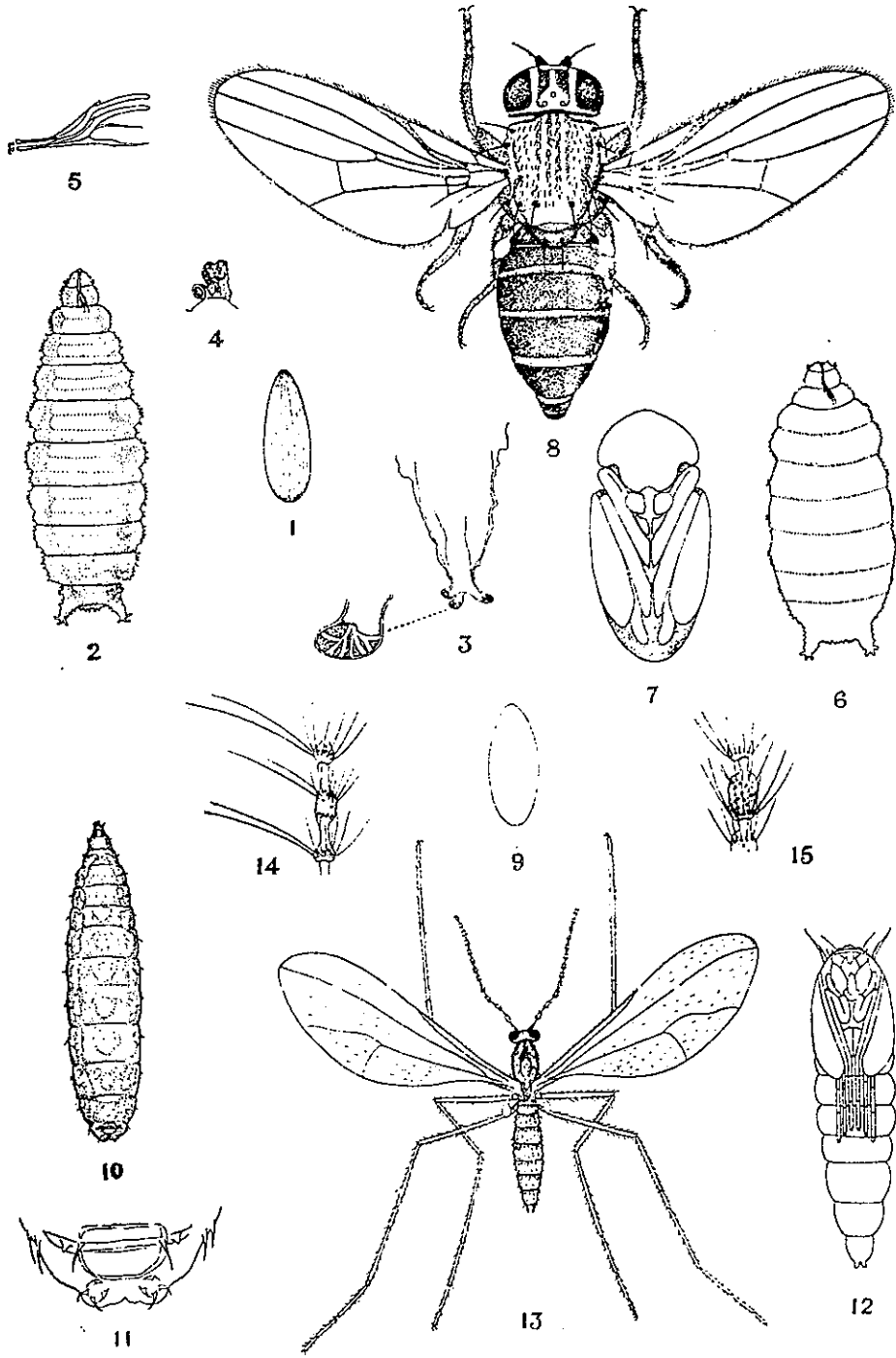
本文所述係兩種食蚜蠅。一種爲 *Aphidoletes* sp. 屬瘿蠅科 (Cecidomyiidae), 另一種爲 *Leucopis* sp. 屬 Ochthiphilidae 科。其幼蟲體皆小, 前者杏黃色, 後者白色, 尾端均有二分離突起爲與食蚜虻幼蟲之顯然不同處。該二分離突起在 *Aphidoletes* sp. 係由八枚肉刺組成; 在 *Leucopis* sp. 則爲後呼吸孔之所在。每幼蟲之食蚜量均低, *Leucopis* sp. 之成熟幼蟲每日可食蚜蟲七八枚, 而 *Aphidoletes* sp. 僅能食二三枚。但每於蚜蟲猖獗時, 他們却能大量的發生, 故其消滅蚜蟲之能力, 亦不容忽視。根據胡經甫先生之中國昆蟲目錄, *Leucopis sordida* 曾在西藏有記錄, *Aphidoletes* 則尙無記錄。

Leucopis sp.

- Fig. 1. Egg.
- Fig. 2. Mature Larva.
- Fig. 3. Posterior spiracle.
- Fig. 4. Anterior spiracle.
- Fig. 5. Cephalopharyngeal skeleton.
- Fig. 6. Puparium.
- Fig. 7. Pupa.
- Fig. 8. Adult, ♀.

Aphidoletes sp.

- Fig. 9. Egg.
- Fig. 10. Mature larva.
- Fig. 11. Posterior end of larval abdomen, dorsal aspect.
- Fig. 12. Pupa.
- Fig. 13. Adult, ♀.
- Fig. 14. Antennal segments of ♂.
- Fig. 15. Antennal segments of ♀.



Liu: Two Uncommon Aphidophagous Diptrous Larvae