

Opius oophilus Fullaway, an Egg-Larval Parasite of the Oriental Fruit Fly¹ Discovered in Hawaii²

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In December of 1949 a number of glossy black opiine parasites were recovered from oriental fruit fly larvae reared from guava (*Psidium guajava* L.) fruits collected at Waikane, windward Oahu. At first these specimens were believed to be a melanistic form of one of the oriental fruit fly parasites⁴ that had been well established in the Territory for about a year. However, recovery of the black *Opius* in increasing numbers during the following months caused speculation that it might be a distinct species. Critical examination and comparison of specimens of the Waikane *Opius* and *Opius* sp. revealed distinct differences between them, and it was concluded that they were different species. D. T. Fullaway (1951), after carefully studying the Waikane *Opius*, found it to be a new species and describes it under the name *Opius oophilus*, on page 248 of this issue of the "PROCEEDINGS."

O. oophilus was apparently shipped to the Territory and liberated as *Opius* sp. Its area of origin is not definitely known, but it probably came from Malaya in collections made by N. L. H. Krauss.

COMPARISON OF *O. OOPHILUS* AND *OPIUS* SP.

In both sexes of *O. oophilus* the head is always entirely red. The general body color is glossy black, and the legs are yellowish. In most females the pronotum and scutellum are also red, and the terminal segments of the abdomen are yellowish. The slender ovipositor is black and bears rows of fine pale setae. The venter of the female abdomen is distinctly paler than the dorsum in freshly emerged specimens, but the contrast is not so pronounced in older individuals. Males are typically black-bodied although the pronotum is sometimes lightly marked with red. The abdomen is black on both the dorsal and ventral surfaces.

The typical *Opius* sp. female has an orange abdomen except for the first tergite, which is black. The thorax may be entirely black, but in many individuals the pronotum is reddish. The head in some specimens

¹ *Dacus dorsalis* Hendel.

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⁴ This parasite has been called *Opius persulcatus* (Silvestri) by workers in Hawaii. However, its taxonomic status is doubtful and it is questionable whether the *O. persulcatus* of Silvestri is yet established in the Territory; consequently, it will be referred to as *Opius* sp. in this paper.

is entirely reddish whereas in others the occiput is black. Males of *Opius* sp. are superficially similar to those of *O. oophilus* but are easily distinguished because the occiput is black and the venter of the abdomen whitish-yellow. Some males are strongly marked with orange on the dorsum of the abdomen. In both sexes the black areas are duller than in *O. oophilus*.

Important morphological differences exist in the ovipositors and eggs of the two species. In general aspect the ovipositor of *O. oophilus* is much more slender and delicate than that of *Opius* sp. The valves in the former are narrower than those of the latter, thus giving the ovipositor its slender appearance (figs. 1 and 2). In addition, the valves of *O. oophilus* are less densely clothed with setae than those of *Opius* sp. The tip of the ovipositor shaft in *O. oophilus* is smooth and scalpel-like while in *Opius* sp. it is swollen and serrate (figs. 3 and 4.) This difference may have adaptive significance since *O. oophilus* oviposits in eggs, while *Opius* sp. attacks active larvae. Correlated with the differences in the ovipositors are remarkable differences in the eggs of the two species. The egg of *O. oophilus* is about $340\ \mu$ long by $60\ \mu$ wide at the widest point, and is somewhat reniform, while the egg of *Opius* sp. is about $700\ \mu$ in length, $95\ \mu$ wide at its greatest width, and is strongly tapered at one end (figs. 5 and 6).

STATUS OF *O. OOPHILUS* IN HAWAII

During the first half of 1950, *O. oophilus* spread rapidly on Oahu and increased in abundance so swiftly that by July it had become the dominant oriental fruit fly parasite on the island. During the last five months of the year parasitization by this species averaged about 64 per cent in host larvae in guava fruits collected at scattered places over Oahu. Combined parasitization by the three other oriental fruit fly parasites⁵ in the same collections averaged only about 12 per cent. Parasitization has also been high in Surinam cherries (*Eugenia uniflora* L.), false kamaní (*Terminalia catappa* L.) and mangoes (*Mangifera indica* L.). In addition, specimens have been recovered from coffee (*Coffea arabica* L.), orange (*Citrus sinensis* (L.)), passion fruit (*Passiflora* sp.), and papaya (*Carica papaya* L.). *O. oophilus* has also been recovered on Hawaii, Maui, Molokai, and Lanai and is rapidly increasing in abundance on these islands.

BIOLOGICAL STUDIES

Studies on the biology of *O. oophilus* have revealed that it attacks its host in the egg stage and acts as an egg-larval parasite, emerging from the host puparium. This habit apparently has never been observed before among fruit fly parasites. Bess *et al.* (1950) reported *Opius* sp. to be a parasite of first instar oriental fruit fly larvae, and when *O. oophilus* was first reared from field collected host larvae of this stage it was assumed to have a similar habit. However, in May 1950, *O. oophilus* females were observed probing in fruit fly oviposition punctures in papaya fruits, and

⁵ *Opius longicaudatus* (Ashmead), *Opius incisi* Silvestri, and *Opius* sp.

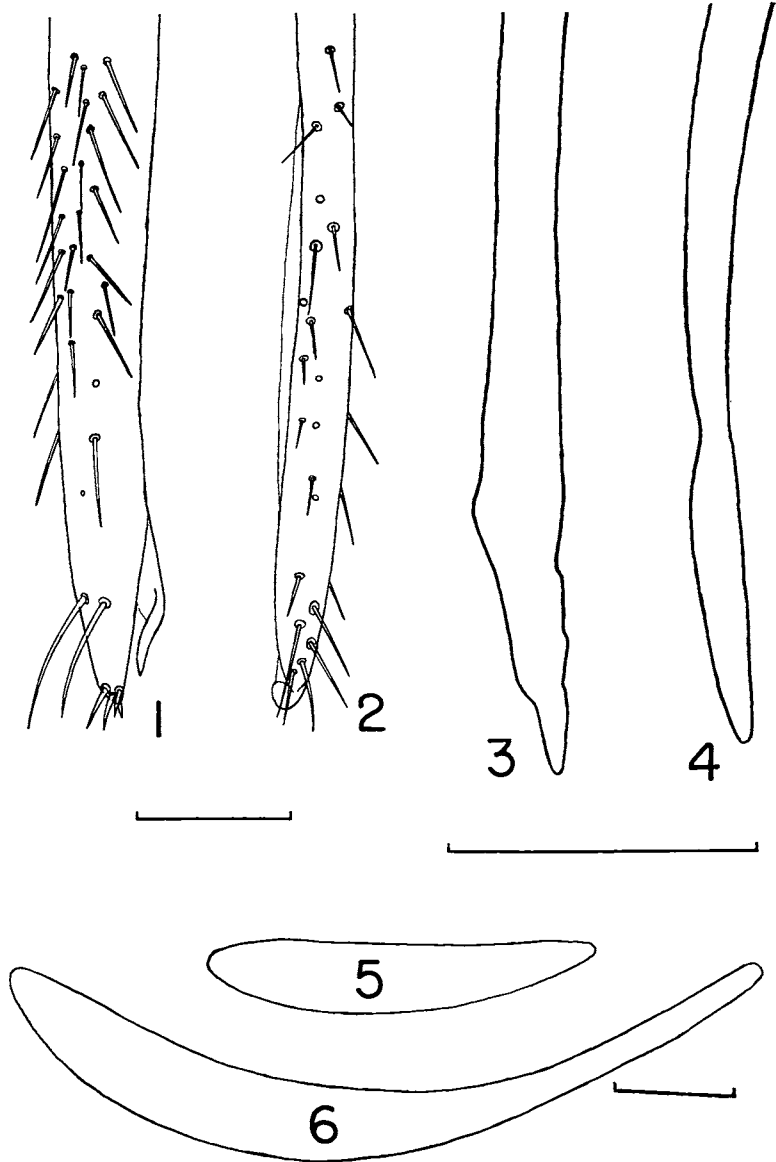


Fig. 1. *Opius* sp., distal portion of ovipositor valve. Fig. 2. *O. oophilus*, distal portion of ovipositor valve. Fig. 3. *Opius* sp., head of ovipositor shaft. No. 4. *O. oophilus*, head of ovipositor shaft. Fig. 5. *O. oophilus*, egg. Fig. 6. *Opius* sp., egg. Scale 100 micra.

close examination of the egg punctures revealed only fruit fly eggs to be present. When these eggs were dissected many of them were found to contain parasite eggs. Rearings from this same batch of eggs produced 59 female and 38 male *O. oophilus* and 86 oriental fruit fly adults. Additional dissections and rearings have confirmed the egg-larval habit. Furthermore, *O. oophilus* is now being mass bred on oriental fruit fly eggs in the University of California's Honolulu insectary.

Fruit fly eggs are susceptible to attack from the time they are deposited until time of hatching, a period of about two days in the field. The parasite eggs may hatch either before or after eclosion of the host larva, depending upon the time of attack. Superparasitism is common and as many as three eggs or larvae have been dissected from a single host egg.

The discovery of this egg-larval parasite of the oriental fruit fly raises the possibility that similar parasites of other fruit flies may exist in other parts of the world. Utilization of parasites of this type might aid materially in the biological control of various tephritid species which are important pests in many countries.

ADULT BEHAVIOR.—In searching for host eggs the female moves over the fruit in quick, short dashes. The antennae are spread and directed downward on to the fruit surface, and when a fruit fly egg puncture is found they are drawn closely together. After a brief examination of the potential oviposition site by the female the abdomen is raised and the ovipositor shaft is thrust down through the puncture into the cavity containing the host eggs. The abdomen and ovipositor may be raised several times before oviposition takes place. If no host eggs are found after a short period of probing, the female leaves. When egg laying has commenced, the female slowly rotates about the oviposition site as she moves the ovipositor from egg to egg. She may remain at a single puncture for an hour or more, systematically parasitizing the eggs in the cavity.

O. oophilus females are very aggressive. Many times they have been found battling each other over fruit fly egg punctures. Females have actually been observed to wait near an ovipositing fruit fly and then attack the egg puncture immediately following departure of the fly. In one case a fly returned to an egg puncture, battled with a parasite attacking the eggs, and then resumed oviposition.

Insectary observations indicate that *O. oophilus* females do not limit their egg laying activity to the daylight hours. Workers at the University of California fruit fly laboratory early noted that ovipositing females were very active during the night. Observations by the authors have corroborated this fact. Although this phenomenon has not as yet been observed in the field, it is logical to assume that the same behavior probably occurs under natural conditions.

LARVAE.—Detailed studies of the morphology of the larvae have not been made, but at least three instars have been recognized and there probably is a fourth. The primary larvae are very active and have large curved mandibles. The first moult apparently takes place when the host is in the late second instar. In the later instars the parasite larvae are sac-like, sluggish, and bear small mandibles.

SEX RATIO.—Of 11,426 *O. oophilus* adults recovered from field infested guava fruits during the past year, 6,821 were females and 4,605 males. This is a ratio of 1.5:1 in favor of females. Available figures indicate that the sex ratio of *Opius* sp. is about 1.8:1 and that of *Opius longicaudatus* (Ashmead) about 1:1. These figures may possibly be influenced by season, climatic conditions, host density, etc., but they probably represent the ratios found under average field conditions.

CONCLUSION

O. oophilus is still spreading over the Territory, and its peak of effectiveness no doubt has not been reached on all of the islands. However, if the pattern of spread and increase that has taken place on Oahu is followed, it will soon become the dominant species throughout the Territory. There is no question that much benefit has already been derived from this parasite and it will probably continue to play an important role in the biological control of *D. dorsalis* in Hawaii.

LITERATURE CITED

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