

## NOTES ON PARASITES OF FRUIT FLIES

The apparent establishment in Honolulu, of *Opius watersi* Fullaway, a parasite of *Dacus cucurbitae* Coquillett, was reported last year ("Proceedings," 14 [2]:232, 1951). Twenty-five females of this braconid were liberated near a *Momordica* vine on the University of Hawaii campus, August 12, 1950. Apparently conditions were favorable, for *watersi* adults were later recovered in each of the monthly collections of *Momordica* fruits from September through December. Moderate numbers of the parasite were recovered in September and October, but by November and December its numbers began to decrease, and the January collection yielded no *Opius*. Fifty per cent of the parasites in both the November and December collections were in diapause. Very few of the *Opius* which have gone through diapause in the laboratory have broken dormancy in less than three months. This fact increases the hazard of predatory action by ants and of other mortality factors to which the parasite is subject in nature. The record of *Opius watersi* in the field has dimmed the optimism with which this species was once regarded as an effective addition to the complex of enemies of the melon fly.

P. E. MARUCCI, March 12, 1951.

Of some 40 species of *Opius* found in over two years of entomological exploration, until now only two have been able to parasitize the melon fly. These are *Opius fletcheri* Silvestri, already established in Hawaii as the result of earlier work, and *O. watersi* Fullaway, from northern India. A third parasite of the melon fly is now in hand; this is an undescribed species designated as "North Borneo *Opius* No. 4"<sup>1</sup>. It was reared from tephritid puparia from *Luffa acutangula* collected in British North Borneo by Frank E. Skinner. It is a striking, large, black and red species of the *longicaudatus* type; it prefers large 3rd instar larvae for oviposition, but will oviposit in the smaller stages when forced to. It breeds readily in the laboratory on *Dacus cucurbitae*, and a large colony is established with sufficient adults already produced to begin field liberations. On May 2, 265 adults were sent to Hawaii for release on wild *Momordica balsamina*, and 760 were released at Waimanalo, Oahu on May 7 and May 14.

P. E. MARUCCI, May 14, 1951.

During late March and early April fruit fly-infested guavas collected on Hawaii, Maui and Molokai were sent to Honolulu where they were held in the University of Hawaii insectary. The records of parasitization of the *Dacus dorsalis* larvae recovered from these fruits are tabulated below:

<sup>1</sup> This species is described as *Opius angaleti* by D. T. Fullaway on p. 411 of this issue of the "Proceedings."

Island and Date of Collection	Number of Collections	Percentage Parasitization by Species			Total Parasitization
		<i>O. vandenboschi</i>	<i>O. longicaudatus</i>	<i>O. oophilus</i>	
Molokai					
March 28 .....	3	7.3	0	31.6	38.9
Maui					
March 28 & 30...	12	25.0	1.1	37.8	63.9
Hawaii					
April 2-5 .....	24	18.3	0.3	23.3	41.9

Note—No specimens of *Opius incisi* Silvestri were recovered from these collections.

The most important development revealed by these data is the rise to predominance of *Opius oophilus* Fullaway on each island. Records obtained in the fall of 1950 on these same islands showed *O. vandenboschi* Fullaway<sup>2</sup> to be the predominant parasite at that time. The rapid increase in importance of *O. oophilus* on these outer islands parallels the development which took place earlier on Oahu. Percentage parasitization in the Maui and Molokai collections was essentially the same for the spring collections as during the fall. However, the degree of parasitization on Hawaii was significantly lower in April than in October. This drop appears to have been correlated with a very sharp increase in guava infestation in the spring. It is felt that the lag in parasitization on Hawaii will be only temporary and that the percentage will increase again in the next several months.

ROBERT VAN DEN BOSCH, May 14, 1951.

Pupal parasitism of the oriental fruit fly occurred at two localities on Oahu during May. The first recovery consisted of eight *Spalangia* adults from host puparia in husks of ball kamani (*Calophyllum inophyllum*) fruits, collected at Kaaawa on May 31. Mr. Fullaway considers the species to be *Spalangia simplex* Perkins.

The second case of pupal parasitism was from puparia sifted from soil under a mock orange bush (*Murraya*) on the University of Hawaii campus. These puparia, collected May 22, produced 89 *Opius*, 4 *Dirhinus*, 3 *Spalangia* and 6 *Dacus dorsalis*. The *Dirhinus* was tentatively identified by Mr. Fullaway as *D. giffardii* Silvestri, while the *Spalangia* appears to be *simplex*.

Both species of pupal parasites have been established in Hawaii for many years. Their recovery from *D. dorsalis* is not surprising since *Spalangia* and *Dirhinus* are known to have a variety of hosts. Although they appear to be of minor importance in the biological control of *dorsalis*, they are welcome as additional mortality factors working against this pest.

ROBERT VAN DEN BOSCH, July 9, 1951.

\* During the past summer three recently introduced *Opius* parasites of *Dacus dorsalis* belonging to the *longicaudatus* group have been recovered

<sup>2</sup> This new name for *Opius javanus* Fullaway, preoccupied, is published on p. 413 of this issue of the "Proceedings." It is the species formerly designated locally as "presumably *O. persulcatus*."

in the Hawaiian Islands for the first time. On August 10, 1951, 2 males of *Opius formosanus* Fullaway were bred from mango from North Kohala, Hawaii. On August 12, 1 male and 1 female of *O. compensans* (Silvestri) were bred from kamani (*Terminalia*) from Waikane, Oahu. The following recoveries were made of a species as yet undescribed, known as "New Caledonia *Opius* No. 2":

July 31, 1951	Nuuanu, Oahu	ex <i>Achras sapote</i>	1 female; 4 males
August 24	No. Kohala, Hawaii	ex mango	2 females; 1 male
September 12	Waikane, Oahu	ex <i>Terminalia</i>	1 male
September 13	Kula, Maui	ex peach	8 females; 4 males

The peaches from Kula yielded adults of both the oriental fruit fly and the Mediterranean fruit fly; from all other host fruits only *D. dorsalis* was bred.

[Recoveries of all three of the above species continued through October and November, according to Q. C. Chock of the Board of Agriculture and Forestry. The color differences which separate the closely related *Opius* of the *longicaudatus* group are so slight, or so variable, that, among taxonomists best qualified to identify them, differences in opinion exist as to the validity of some of the species.—Ed.]

MABEL CHONG, December 10, 1951.

Probably the greatest disappointment after three years' intensive search for natural enemies of fruit flies in many parts of the world, has been the apparent failure to establish in Hawaii additional parasites of the melon fly, *Dacus cucurbitae*. Although many thousands of melon fly puparia were received from explorers in Malaya, India, Ceylon, Formosa, the Philippines, Borneo, Thailand, south China and Africa, only three species of larval parasites, other than the already established *Opius fletcheri*, were successfully bred on melon fly in Hawaii. These were *Opius watersi* from India, the cynipid, *Trybliographa daci* Weld from Malaya and Australia, and more recently *Opius angaleti* Fullaway<sup>3</sup> from North Borneo.

The subsequent mass production and liberation of *O. watersi* raised hopes that an effective melon fly parasite had been found at last. However, the only evidence of its possible establishment was obtained in the fall of 1950 when 46 adults were reared from infested *Momordica balsamina* fruits collected on the University of Hawaii campus following the liberation nearby of 25 adult females in August. These findings are recorded in notes presented before the Society in January and November, 1950 ("Proceedings," 14:229, 232, 1951) and on March 12, 1951. A final series of collections totalling 208 heavily infested *M. balsamina* fruits was made at the same location from January to October, 1951, but *O. watersi* had apparently failed to overwinter and was not recovered. We are unable to account for the lack of success with this promising melon fly parasite in Hawaii.

<sup>3</sup> Described on p. 411 of this issue of the "Proceedings."

The failure of *Trybliographa daci* was less surprising because this species is not normally a parasite of *D. cucurbitae*, and could be propagated on that host only with difficulty. Also liberations were directed primarily against *Dacus dorsalis* rather than the melon fly.

The introduction of *Opius angaleti* from North Borneo was noted by Mr. Marucci on May 14, 1951 (see above). Approximately 7,000 adults (851 females) of this parasite were propagated on melon fly larvae in the laboratory and turned over to the Territorial Board of Agriculture and Forestry for further increase and liberation. However, the ratio of female progeny declined rapidly and only 1,745 adults were liberated on Oahu and Hawaii in May, before breeding stocks were lost. It now appears that in North Borneo *O. angaleti* may actually have parasitized *Dacus nubilus* Hendel and *Callantra smieroides* Walker, since its presence was correlated with that of the former species in quarantine rearings, indicating probable forced breeding and imperfect adaptation to melon fly as a host.

Although one or more of these species may yet appear in Hawaii, the chances of their establishment here now seem remote.

D. W. CLANCY, December 10, 1951.

The parasitization of the Mediterranean fruit fly in the laboratory by the introduced parasites (*Opius* spp.) of the oriental fruit fly, and their apparent adaptation to this host in nature, has already been reported ("Proceedings," 14 [1]:27, 1950; 14 [2]:234, 1951). Additional evidence was obtained by P. E. Marucci of the U. S. Bureau of Entomology and Plant Quarantine, during the past summer that these opiines were attacking *Ceratitis capitata* (Wiedemann) on the island of Lanai where this species became the dominant fruit fly following large-scale insecticide applications.

Since puparia from mixed fruit fly infestations in the field cannot be definitely segregated as to species, we attempted to secure more accurate data on parasitization by making field exposures of laboratory-infested fruits containing pure cultures of *Dacus dorsalis* and *Ceratitis capitata*. These fruits were paired and suspended for several days at different locations in one-half inch mesh wire baskets, and then brought into the laboratory.

The oriental fruit fly oviposited to some extent in the fruit containing Mediterranean fruit fly infestations during its exposure in the field. The records from the fruits later found to contain infestations of both flies were not included in the tabulations of data. The Mediterranean fruit fly did not infest any of the fruits during their periods of field exposure.

Three series of field exposures totalling 24 paired, infested papayas and peaches were made during August in the Tripler Hospital area, and at Kapahulu, Manoa Valley, the University of Hawaii and Kalihi, all in Honolulu, with the following results:

Species	Exposure Dates	No. puparia reared	Parasitized						Total	Per Cent
			<i>Ceratitis capitata</i>	<i>Dacus dorsalis</i>	<i>Opius longicaudatus</i>	<i>Opius incisi</i>	<i>Opius oophilus</i>	<i>Opius "persulcatus"</i> <sup>1,4</sup>		
<i>Ceratitis capitata</i>	Aug. 2-6* Aug. 6-9† Aug. 9-15*	179 396 702	46 88 283	...	9 40 18	0 8 22	8 0 4	2 0 3	19 48 47	29.2 35.3 14.2
Totals		1,277	417	...	67	30	12	5	114	21.5
<i>Dacus dorsalis</i>	Aug. 2-6* Aug. 6-9† Aug. 9-15*	2,134 2,106 1,021	...	1,255 1,599 414	77 271 207	66 54 98	25 14 5	11 0 2	179 839 312	12.5 17.5 43.0
Totals		5,261	...	3,268	555	218	44	13	830	20.3

\* In ripe papayas.

† In ripe peaches.

Although Mediterranean fruit fly populations in these tests were considered lower than those of *D. dorsalis*, both species were parasitized to about the same extent under identical field conditions. *O. longicaudatus* (Ashmead) and *O. incisi* Silvestri were reared in the same relative abundance from each fruit fly host, indicating an apparent lack of selection or specificity for these two parasites under the conditions of the experiment. The percentages of parasitization of *Ceratitis* by *O. oophilus* and *O. "persulcatus"*<sup>4</sup> were considerably higher than for *D. dorsalis*, but these differences are of doubtful significance because of the small numbers of parasites involved in the *Ceratitis* study. This is the first record of *O. incisi* from the Mediterranean fruit fly, and its abundance, particularly on the University campus and at Kalihī, was surprising.

These studies clearly indicate the potential importance of the introduced Malayan opines as parasites of *Ceratitis capitata*, and also suggest their possible utilization against still other species of fruit flies elsewhere in the world.

D. W. CLANCY, December 10, 1951.

<sup>4</sup>This is the species to which Fullaway has given the name *Opius vandenboschi*, on p. 413 of this issue of the "Proceedings."