

## NOTES ON PARASITES OF TEPHRITID FLIES

Some of the recently introduced opiine parasites of the oriental fruit fly were recovered from fruits collected in December in 10 of 15 liberation areas on Oahu in which *Opius longicaudatus* (Ashmead) and *O. persulcatus* (Silvestri) were released earlier. *O. longicaudatus* was seen ovipositing in guava, banana, star apple and breadfruit at five release points: Kaalaea, Luluku, Mokuleia, Nuuanu and Woodlawn. Adults were reared from guava, tangerine, strawberry guava and false kamani. Adults of *longicaudatus* were relatively numerous at Kaalaea, Luluku and Woodlawn. On a number of fruits four to six females were observed ovipositing simultaneously. *O. persulcatus* was recovered only from guava collected about one-fifth of a mile from the point of liberation in Luluku Valley.

GORDON B. MAINLAND. January 10.

Encouraging recoveries of *Opius longicaudatus* were made on Oahu during the first quarter of 1949. Twenty recoveries were made from fruit in the vicinity of parasite release points, and at two others females were observed ovipositing. In addition, *longicaudatus* was recovered at Foster Garden, the University substation at Poamoho and on the University campus. The parasite no doubt migrated into Foster Garden and Poamoho from release points, while those on the campus were probably progeny of laboratory escapes. Apparently *longicaudatus* is spreading; at Kaalaea and Luluku it has spread at least one-quarter of a mile from release points; at Waimea it has spread one mile up the valley, and at Poamoho it has apparently moved four miles from the nearest release point near Haleiwa.

Evidently fruit size and ripeness influence the percentage of parasitization. From a collection of coffee berries from Waimea Valley, 74 per cent of the *Dacus dorsalis* puparia yielded *O. longicaudatus*, while in the common guava parasitization varies from about 2 per cent in fruit beginning to ripen on the tree, to 50 per cent in soft fruit on the ground. On the University campus parasitization in Surinam cherries was 59 per cent in 192 fruits from the ground, and 24 per cent in 152 ripe fruits from the tree. To date *longicaudatus* seems to be more abundant in fairly wet areas at low elevations than in drier regions or in moist areas at higher elevations. At Woodlawn nine females were observed on a single medium-sized guava.

*Opius persulcatus* was recovered at Foster Garden and at Luluku, in addition to recoveries by the Board of Agriculture & Forestry from its Makiki grounds, and from the Duncan Tract. Two adults were reared from fruit from Luluku, and 13 from Foster Garden. It was the only parasite reared from small *Zizyphus jujuba* fruits from the latter site. No authenticated recoveries of *Opius incisi* Silvestri have yet been made.

GORDON B. MAINLAND. April 11.

Specimens of what was considered *Opius longicaudatus*, reared from the oriental fruit fly, were sent to C. F. W. Muesebeck for checking. On March 31 he reported that the specimens were *Opius comperei* (Viereck), and stated that this species was previously represented in the National Museum collection only by the type and paratype from India. A larger lot of this *Opius* was thereupon sent Mr. Muesebeck for further checking. It consisted of a series reared from *D. dorsalis* at various localities on Oahu, a series from a mass-rearing culture maintained by the Board of Agriculture & Forestry (including the original imported female and her first progeny), and a series from material collected by Krauss at Kuala Lumpur, Malaya. On May 6 Mr. Muesebeck reported that all the Hawaiian specimens agree with *comperei*, whereas the material from Kuala Lumpur was mostly *longicaudatus*. Later, on May 26, Mr. Muesebeck wrote that the original female from Kuala Lumpur matches the type of *O. comperei* perfectly, but that the first generation progeny are the same as *longicaudatus*. "I have come to the conclusion," he writes, "after pretty careful study of all available material, that I cannot satisfactorily distinguish two species there. I believe we must consider *comperei* a synonym of *longicaudatus*, even though the type specimens covered by the two names are quite different, especially in the color of the legs."

D. ELMO HARDY. May 9.

The following is a summary of fruit fly parasite shipments made during the past year. Eighty-five shipments containing 339,092 fruit fly puparia were received from Mr. Krauss in Malaya between June 10, 1948, and May 18, 1949. The first 75 shipments were from Kuala Lumpur and vicinity, the last ten from Singapore Island. The great majority, 303,625 puparia, were of *Dacus dorsalis* from carambola, *Solanum* spp., chilli, *Eugenia* sp. and mango. These produced the following adult parasites:

<i>Opius persulcatus</i> .....	13,905
" <i>incisi</i> .....	2,615
" <i>longicaudatus</i> .....	587
<i>Pachycrepoideus dubius</i> .....	625
<i>Tachinaephagus</i> (spp.) .....	442
<i>Syntomosphyrum indicum</i> .....	299
<i>Spalangia philippinensis</i> and S.sp., near <i>simplex</i> .....	189
<i>Trybliographa</i> sp. } .....	
<i>Pseudeucoila</i> sp. } cynipids .....	19
<i>Pilinotrix</i> sp. } .....	
<i>Galesus</i> sp. .....	7

Thus 18,688 oriental fruit fly parasites comprising 13 species were obtained from Malaya within the past 11 months.

These shipments also produced three other species of Tephritidae and their parasites, as follows: 83 *Opius fletcheri*, 40 *Spalangia* spp., and 4 *Tachinaephagus* issued from approximately 26,000 melon fly puparia from cucumber, *Luffa cylindrica* and various mixed cucurbits. 33 cynipids and 4 *Tachinaephagus* sp. emerged from 8,158 puparia of *Dacus* (*Chaetodacus*) *umbrosus* infesting *Artocarpus polyphema*, while 989

puparia of *Dacus* (*Zeugodacus*) *caudatus* from *Lagenaria vulgaris* were unparasitized.

Mr. Krauss then moved to Australia where he is now stationed at Cairns, Queensland. His first two shipments arrived the latter part of June, containing 7,549 puparia from fruits of *Solanum auriculatum*, *Planchonella* sp., *Endiandra tooram* and banana. The emerging flies consist of several species of *Dacus* according to Dr. Hardy, including the Australian "*dorsalis*" which differs from true *dorsalis* as found in Hawaii and elsewhere. These have already produced five different species of *Opius* as yet unidentified, which are being tested on the three species of fruit fly in Hawaii. Additional shipments are arriving at the rate of about two each week.

Early in May Mr. Gardner at Hoboken, N. J., received a quantity of fruit fly puparia collected by Messrs. McGough and Skinner from various cucurbits at Pietermaritzburg, Natal Province, Union of South Africa. These were reared at Hoboken and the emerging parasites sent to Honolulu. Two shipments totalling 97 *Opius* (apparently 2 species, not yet identified) and 128 *Tetrastichus* (probably *T. giffardianus*) arrived May 20 and June 1, with 84 *Opius* and 66 *Tetrastichus* still alive. These are also being tested on the local fruit flies.

The first three shipments from India arrived during June. These contained 10,600 puparia of an unknown tephritid collected from *Berberis vulgaris* by Messrs. Bianchi and Newell near Ranikhet, United Provinces, in northern India. Unfortunately, this appears to be a single-brooded species and the puparia are in diapause; various methods of breaking the diapause are being tried.

D. W. CLANCY. July 11.

During May Dr. Mainland observed numerous females of *Opius tryoni* Cameron, a parasite of the Mediterranean fruit fly, ovipositing in wild guavas infested with *Dacus dorsalis*, near Kaneohe, Oahu. Although several large recovery collections were made at this location, including the same fruits on which he had seen the parasites working, he was not able to rear any *tryoni*. Since *Ceratitis* has become extremely rare in this area, the occurrence of its parasite in large numbers was puzzling. It was noted however, that a heavy growth of lantana was present, infested by the gall fly, *Eutreta xanthochaeta* Aldrich, which recently (Bien. Rpt. Hawaii Agr. Expt. Sta., 1946-48:77; Proc. Haw. Ent. Soc. 13:319, 1949) has been reported as a host of *O. tryoni*. We confirmed these records by collecting 115 galls which later produced both insects. *O. tryoni* was also commonly seen ovipositing in guavas at other places, generally near lantana and vervain (*Verbena litoralis*) bearing *Eutreta* galls. A total of 76 adult *O. tryoni* (69 females) were then collected in the field and caged with several lots of guavas heavily infested with *Dacus dorsalis* in an attempt to propagate this species on the oriental fruit fly. However, only two *O. tryoni* were obtained from 820 puparia, indicating that *D. dorsalis* is not normally a host of this parasite even though it is readily attacked in nature.

*Opius tryoni* rather closely resembles *O. longicaudatus*, with which it is often associated in the field; in fact, females of both species have been seen ovipositing in the same ripe guava. All recoveries of *longicaudatus*, particularly those based on field observations only, should therefore be carefully checked in order to avoid possible misidentification.

D. W. CLANCY. August 8.

Pamakani (*Eupatorium glandulosum*) occurs over a wide range of ecological conditions on Maui, and in all areas examined there the introduced tephritid gall fly, *Procecidochares utilis* Stone, occurs with it. However, the fly is conspicuously more abundant in some localities than in others; along the leeward slopes of Haleakala there are areas where the pamakani is very heavily galled and appears to be actually killed by the fly. In hope of getting concrete information on the abundance of the fly throughout the island, and on the cause of its scarcity in many localities, during field work on the ecology and biological control of the various fruit flies, observations and collections of pamakani stem galls were made at various localities on Maui during the past summer. Nine collections were made in July and sent to the University at Honolulu for rearing. In the following list of recoveries made, the figures in the extreme righthand column, "Per cent parasitized," are based on the number of adult flies and parasites obtained from the individual lots.

Collection point	No. of <i>P. utilis</i>	No. of Micro- bracon terryi	No. of Eury- toma sp.	No. of Eu- pelmus sp.	Per cent Parasitized
Waihou .....	273	5	22	1	9.3
Ulupalakua Ranch..	120	23	49	0	41.7
Kipahulu .....	18	2	67	13	84.0
North Hana A.....	6	1	2	14	73.0
North Hana B.....	17	2	8	0	37.0
South Keanae .....	75	4	22	0	26.5
Keanae .....	34	0	14	0	29.2
Iao Valley .....	104	8	54	15	42.5
Olinda .....	121	216	78	21	72.2

*Microbracon terryi* Bridwell was determined by Mr. Muesebeck, and *Eurytoma* and *Eupelmus* by Mr. Gahan. From the South Keanae material one *Opius tryoni* also was reared.

The low parasitization at Waihou, where the pamakani is heavily galled and dying out, is interesting, as is the high parasitization in some localities where the fly is relatively scarce and the pamakani luxuriant. More collections were made at some of the same localities during the first week of October, and further observations and studies are planned to throw more light on the possible importance of the parasites in preventing the gall fly from becoming abundant in certain localities.

HENRY A. BESS. October 10.

It has been rather generally assumed that *Opius longicaudatus* will oviposit only in larger host larvae—from about one-half to full-grown—as do most other species of *Opius* that have been investigated. Recently,

however, we obtained a number of adult *longicaudatus* from *Dacus dorsalis* larvae dissected from field-collected kamani (*Terminalia*) nuts as first instars and reared to maturity on agar media. In order to verify this we then exposed separate agar cultures of first, second and third instar oriental fruit fly larvae to ovipositing female *longicaudatus* for 24-hour periods. Oviposition occurred with equal readiness in each series, and there was no significant difference in the number of progeny obtained according to host instar attacked. The ability of *longicaudatus* to parasitize first instar larvae may have considerable economic significance. At this stage the larvae are just under the skin of the fruit and therefore most vulnerable to attack, especially in larger fruits such as mangoes and avocados where most of them soon penetrate beyond reach of the parasites.

In August several lots of infested peaches from Maui were obtained from Miss Inada of the University of Hawaii Agricultural Experiment Station for experimental parasitization tests. These yielded a total of 383 *Ceratitis capitata*, 27 *Opius longicaudatus* and only 4 *Dacus dorsalis*, indicating that *longicaudatus* may have developed as a parasite in the Mediterranean fruit fly rather than *D. dorsalis*, its normal host. This possibility was therefore checked by exposing pure Med-fly cultures in agar media to *longicaudatus*. Oviposition was readily obtained and a number of adult *longicaudatus* issued from these tests—definite proof that this species can successfully parasitize *C. capitata*.

Increasing numbers of *Opius persulcatus* have been reared during the past two months from a wide variety of fruits collected at various points on Oahu. These fruits were used in breeding tests with other foreign parasite species, and the *persulcatus* records are, therefore, incidental. We have reared *persulcatus* from guava, rose apple, kamani, strawberry guava, mountain apple and passion fruit, generally in numbers considerably below those of *O. longicaudatus*, although several lots actually yielded more *persulcatus* than *longicaudatus*. Both species have been observed in the field ovipositing in the same fruits. In the original shipments from Malaya, *persulcatus* was always far more numerous than *longicaudatus*—with a ratio of about 23 to 1. It will, therefore, be interesting to see how these species ultimately compare in effectiveness here after populations become stabilized.

D. W. CLANCY. October 10.

Examination of Mr. Krauss' shipments of fruit fly parasites from Australia reveals that some species, earlier considered different, represent the same parasite from different host fruits or different localities. Reduced to five species, three of these prove to be new species (*Opius deeralensis*, *O. perkinsi* and *O. froggatti*, described by Mr. Fullaway in this issue of these "Proceedings," pp. 65-67), while two are considered forms of species previously described: *Opius longicaudatus* (Ashmead) and *O. fletcheri* Silvestri. Of the parasites imported to control fruit flies in Hawaii, the species identity and distribution appears to be as follows:

*Opius longicaudatus* is perhaps the same as *O. formosanus* Fullaway; from the Philippines, Malaya, Australia, Formosa, the Marianas, New Guinea and India.

*Opius persulcatus* (Silvestri) is the same as *O. javanus* Fullaway, and possibly the same as *O. arisanus* Sonan; from the Philippines, Malaya, Australia, Formosa (?), Java and India.

*Opius fletcheri* is possibly the same as *O. incisi* Silvestri and *O. fijiensis* Fullaway; from India, Malaya, Australia, New Guinea and Fiji.

D. T. FULLAWAY. December 12.