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PYRIFORM SCALE CONTROL ON AVOCADOS

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Infestations of the pyriform scale, *Protopulvinaria pyriformis* (Ckll.), were reported by Wolfe, et al (1949), as, " . . . marring the fruit appearance due to the sooty-mold fungus which develops in the honeydew secreted by this insect." Observations in recent years indicate continued increasing amounts of sooty-mold, more than in former years. Fruit blemishes are currently of more importance than formerly owing to higher standards of grading the fruit for market. Oil emulsion sprays occasionally used for scale control are effective but "shock" the trees and are sometimes injurious to new foliage, especially if the applications are followed by unusually high or low temperatures. Parathion and malathion have been used successfully for pyriform scale control but definitive data appear lacking on the effectiveness of the treatments. Three different concentrations of malathion wettable powder, a malathion emulsion and a water-base parathion were used as given in Table 1, and compared with an unsprayed check.

PROCEDURE

The 22-year-old trees of the Lula variety at the Sub-Tropical Experiment Station in Block 5 were plotted to give one, two or three trees for each treatment in each of four replications. Spray applications were made at irregular intervals depending somewhat on the time at which the scale infestations appeared abundant or to have approached equalization on trees in the different treatments. Dates of spray applications were August 1, 1955, September 13, 1955, April 4, 1956, and July 26, 1956. These sprays were applied with a regular grove sprayer and averaged from eight to ten gallons per tree per application, depending on the size of the tree. Fifty leaves, from various parts of a tree, from each treatment and from each replication, were collected as samples to determine treatment effects. Living pyriform scales, crawler and sedentary forms, were counted on the 50 leaves. Count days were August 20 and November 1, 1955, April 6, July 19, and August 27, 1956, March 27, and June 27, 1957.

RESULTS

The results are summarized in Table 1 and Figures 1 and 2. Treatment materials and amounts used per 100 gallons of water are listed and the results are tabled as mean number of scales per leaf on the day counted. Separations by Duncan's multiple range test showed that the means from the following treatments were significantly different from the others as follows:

1. Unsprayed leaves possessed significantly more scale insects than leaves from any other treatment.
2. Parathion was significantly more effective than malathion.
3. Malathion wettable powder treatments were similar, but six pounds was more effective than four pounds and four pounds was more effective than two pounds.

Statistical analyses by the analysis of variance showed significant mean square values for certain factors; these are listed in order from higher to lower values as follows:

1. Days on which counts were made,
2. Treatments,
3. Replications.

Significant interactions were found in which data on count days varied by treatment and by replication; interaction between treatments and replications, however, was no greater than might have occurred by chance.

TABLE 1. RESULTS OF SPRAY TREATMENTS AS MEAN NUMBER OF SCALES PER LEAF ON THE DIFFERENT COUNT DAYS AND PERCENTAGE CONTROL OF ALL TREATMENTS OVER ALL COUNT DAYS.

	Insecticide formulation amount/100 gal. water					
Date	Parathion	Malathion				Check
Counted	4 lbs./gal. water base ½ pt.	25% W.P. 6 lbs.	Emul., 1 lb. tech.	25% W.P. 4 lbs.	25% W.P. 2 lbs.	
			1955			
Aug. 20	5.5	14.6	13.0	16.1	15.6	28.9
Nov. 1	1.9	1.7	1.7	1.7	3.3	19.8
			1956			
April 5	0.5	0.3	0.2	0.5	1.3	4.9
July 19	0.7	0.8	0.6	0.7	1.5	4.9
Aug. 29	0.1	0.3	0.1	0.1	0.4	3.1
			1957			
March 27	1.0	0.6	1.0	0.8	1.9	3.8
June 27	17.5	12.2	17.5	15.5	15.9	32.1
Avg. % control	67	62	58	56	53	—
Avg. No. scales per leaf	—	—	—	—	—	13.9

The variation of data among count days is an expected occurrence since counts were made at different days after spraying and in different seasons. A study was made to determine any relationship of the effect of time after treatment as based on percentage control. This is given in figure 1. Rapid control is indicated in figure 1 to 34 days after a treatment when maximum control was obtained. A slight reduction is indicated in the percentage control trend between 34 and 205 days after which the reduction assumes a more rapid trend. Control by parathion was very slightly higher in all cases except that after 336 days it was seven per cent less.

It is generally found that if dosages are plotted graphically as logarithms and if the percentages of control are plotted as probits straight line rela-

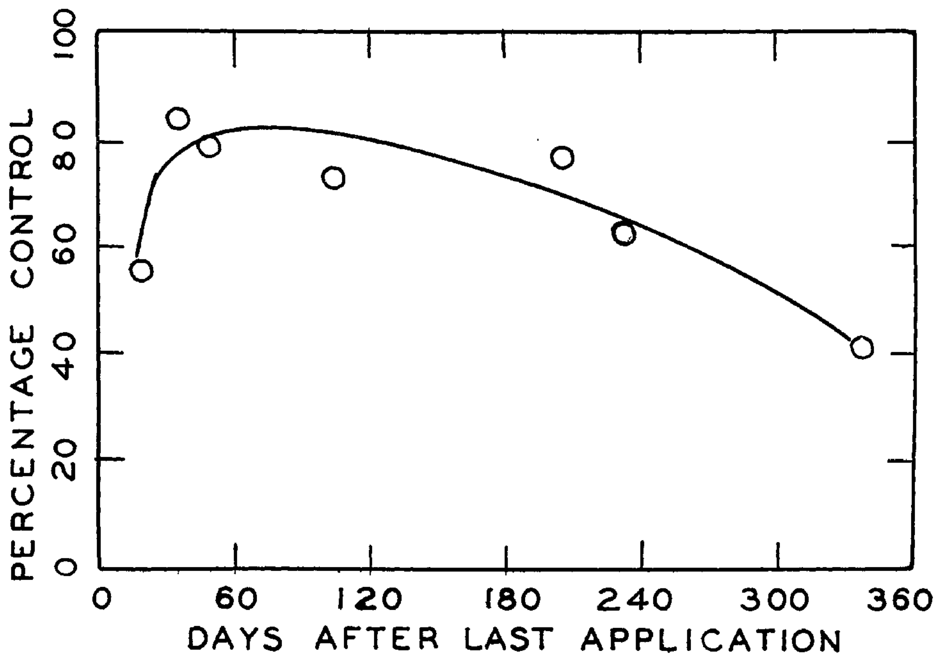

Fig. 1.—Percentage control at various times after spray application (curve drawn free-hand).

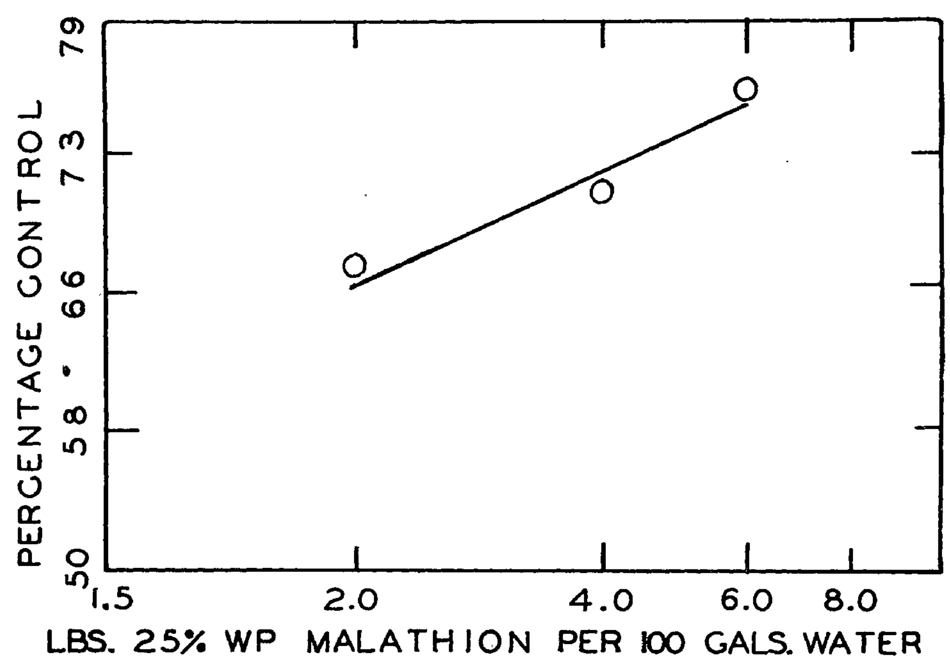

Fig. 2.—Log-probit relationships of malathion dosages and percentages of control (regression formula—expected probit = 5.56 + 0.57 (log of dosage)).

tionships are seen. Log-probit relationships of the three concentrations of malathion and the percentage control results are shown in figure 2. A regression line was determined by linear regression calculations and shows a slight departure from perfect linearity. A comparison between malathion wettable powder and an emulsion formulation shows a slightly greater effectiveness in favor of the emulsion. By graphic determination one pound of the technical toxicant in emulsion formulation is equivalent to one pound and two ounces of toxicant in wettable powder form.

Summary

Parathion and malathion sprays were used over a period of two and one-half years in experimental plots for control of the pyriform scale on avocados. Leaf samples were collected from the experimental trees at irregular intervals following the spray applications. Summarization of the data showed that one pound of 15% wettable powder of parathion was more effective than two, four or six pounds of 25% wettable powder of malathion or of one pound of technical malathion in emulsion form. Scale infestations were significantly reduced by all treatments.

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TESTS WITH ORGANOPHOSPHORUS COMPOUNDS AS HOUSE FLY LARVICIDES IN POULTRY HOUSES

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Although house flies showing a high resistance to malathion have been found in some Florida poultry houses (Labrecque and Wilson, 1957), interest in the use of the organophosphorus compounds as fly larvicides has continued. Fly control is especially difficult in poultry houses maintaining caged layers, where the laying flock, as well as the younger chickens, are confined in individual screen cages about three feet above the ground. It is customary to allow the manure to collect for months at a time, and the cones that are formed under each cage soon reach a height of two or more feet. If the manure remains dry in the cones, there is little fly breeding, but when it becomes moist both the house fly (*Musca domestica* L.) and a soldier fly (*Hermetia illucens* L.) become established. In a short time the larvae break down and liquefy the entire cone, creating an increasingly serious fly problem.

Previous tests with organophosphorus larvicides as emulsion sprays or dusts have met with varying success. It has been found that, under Florida conditions, even a small quantity of water causes an almost immediate liquefaction of the manure (Wilson *et al.*, 1957). Dusters cause panic among the hens by the noise and billowing clouds of dust, which create a respiratory hazard as well; scattering the dust by hand is tedious and does not entirely eliminate the dust cloud. Tests were conducted to determine whether small quantities of deodorized kerosene sprays would provide equally effective control without the disadvantages of emulsions and dusts. The amounts of kerosene used in these tests would not have any adverse effect if the manure were later used as fertilizer.

Five organophosphorus compounds were tested as larvicides against natural populations of house flies breeding in manure under caged poultry in the Orlando area. Solutions in deodorized kerosene were made with commercial emulsifiable concentrates containing 25 per cent of Diazinon, 24.4 per cent of technical Dow ET-57 (sampled as ET-14), or 43.7 per cent of Trithion, and with technical Dipterex and malathion. Sufficient acetone was added to the Trithion and Dipterex to produce stable solutions. Duplicate tests were run at dosages of 150 gm. of insecticide in one and two gallons of kerosene per 1,000 square feet, and with 300 gm. in two gallons.

All applications were made with a three-gallon compression sprayer using a flat fan nozzle (Hudson No. 1540-5). Sufficient pressure was maintained to insure uniform coverage.

Larval density was evaluated by collecting a teaspoonful of manure from ten different locations where the infestations appeared heaviest, spreading them on a plywood board, and counting the larvae. The effectiveness of the treatments was determined from the difference in total counts made before and 2, 7, 14, and 21 days after treatment. The results are shown in table 1.

TABLE 1.—CONTROL OF HOUSE FLY LARVAE IN POULTRY MANURE WITH ORGANOPHOSPHORUS COMPOUNDS APPLIED IN SOLUTIONS IN DEODORIZED KEROSENE.

Dosage per 1,000 square feet		Pretreat-	Percent control after—		
Grams of insecticide	Gallons of kerosene	ment count	2 days	7 days	14 days
Diazinon					
150	1	292	34	88	0
		1,000+	100	100	0
	2	841	100	100	47*
		46	81	0	—
300	2	1,000+	100	100	74*
		93	88	0	—
Dipterex					
150	1	1,000+	100	100	0
		561	100	0	—
	2	1,000+	100	41	10*
		1,000+	66	0	—
300	2	1,000+	100	78	0
		1,000+	100	0	—
Dow ET-57					
150	1	1,000+	100	91	0
		1,000+	100	44	0
	2	1,000+	100	0	—
		712	98	13	0
300	2	840	100	86	45*
		1,000+	0	—	—
Trithion					
150	1	1,000+	94	0	—
		392	61	0	—
	2	1,000+	100	66	0
		1,000+	100	0	—
300	2	1,000+	92	69	0
		1,000+	97	0	—
Malathion					
150	2	873	0	—	—
		525	0	—	—
300	2	1,000+	99	0	—
		1,000+	57	0	—
Deodorized kerosene (check)	2	1,000+	72	0	—
		1,000+	0	—	—

* No control after 21 days.

There was little over-all difference between treatments at one and two gallons per 1,000 square feet, although at the higher rate a more nearly uniform coverage was possible. Dosages of 300 gm. of insecticide per 1,000 square feet were not more consistently succcessful than 150 gm.

All the insecticides gave good control after two days in one or more tests, and all failed after a week in some tests. Diazinon was the most effective larvicide after one week, giving complete control in half the tests. Deodorized kerosene alone was not effective.

The results in some of these tests with kerosene solutions were equal to those obtained in previous tests with heavy applications of emulsions (Wilson *et al.*, 1957), and there was no liquefaction of the manure. Less successful results were obtained in some locations where resistance to phosphorus compounds was developing. Diazinon was less consistently effective than in the previous tests with dusts.

Summary

Diazinon, Dipterex, Dow ET-57 (sampled as ET-14), Trithion, and malathion were applied in small quantities of kerosene to poultry manure as fly larvicides. At 150 and 300 grams per 1,000 square feet all gave good control after two days in one or more tests, and all failed to give control after a week in some tests. Diazinon was the most effective larvicide after one week. There was no liquefaction of the manure.

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STUDIES ON THE MATING FLIGHTS OF THE EPHEMEROPTERA I.

THE MATING FLIGHTS OF *EPHORON ALBUM* (SAY) AND *STENONEMA CANADENSE* (WALKER)

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During the evenings of July 23 and 24, 1956, the author was fortunate in being able to observe the mating flights of *Ephoron album* (Say) and *Stenonema canadense* (Walker). They occurred at the same locality—a highly commercial area of the waterfront along the Mississippi River in Rock Island, Illinois. The exact area was a rocky bank approximately 100 feet in length. In both instances the sun had just begun to set. On July 23 the sky had scattered clouds, but the air was warm and still; while on July 24, large thunderheads were beginning to appear and a gentle breeze had commenced to blow. The time of the first observation on July 23 was 7:20 p.m.; on July 24 it was 7:15 p.m.

The first flight to be observed on both evenings was that of *Ephoron album;* the males were seen to fly from the water to the rocky bank, where they shed their subimagal pellicle. On July 24th some time was spent observing this phenomenon. The mayflies would fly from the water and alight on the rocks or anything available (including people). A firm grasp on the substrate was necessary before the process could begin. In some cases a specimen was seen alighting in several places before it found a substrate which suited it. Then followed a period of from ten to fifteen seconds in which the specimen gently shook its wings, evidently to separate the imagal wings from the subimagal pellicle. After this, the thorax was slowly arched and the wings folded against the body, thereby commencing the release of the forewings and forelegs. The long forelegs appeared to be greatly compressed within the short subimagal ones. Soon the meso- and metathoracic legs were free and the insect began to crawl forward. The subimagal skin was not cast off the head, the pronotum, and mesoscutum, although it was shed from the remaining parts of the body. The posterior portion of the abdomen was freed at the same time as the posterior portion of the wings. A few seconds were then taken to release the genitalia. The time period from the first arching of the thorax to the freeing of the genitalia varied from forty to fifty seconds. The mayfly then flew off with the cast pellicle of the abdomen and wings, which had remained in one piece, still attached to the caudal filaments and trailing behind like a white banner. The time element from first alighting to the resumption of flight was almost invariably one minute.

Soon after flight was resumed, the pellicle dropped off or, in many cases, the mayfly and pellicle fell into the water. Likely this was due to the fact that no time was spent in hardening the wings; the soft veins were unable to support the weight of the body, and so the insect fell. However, the insect, once fallen, did show a remarkable ability to break through the surface tension of the water and to regain flight. Possibly this was due to the buoyancy of the cast skin. Others, of course, met immediate death.

It should be noted that these observations do not agree with those of B. D. Burks (1953, 33) for *E. leukon* Williamson; for this species he states that the moulting occurs while in flight as the subimagal legs are nonfunctional. Perhaps this is a result of a difference in the ecology of the species concerned or it may be that Burks was deceived by the fact that the subimagal pellicle, once shed, often remains attached to the caudal filaments.

Having shed the subimagal pellicle, the males began their vigilant flight above the water. There was no recognizable flight pattern, which is characteristic of so many species. Instead, the males flew back and forth about one to four feet above the water, usually staying in an area about twelve feet in diameter. Their flight was not like that of other mayflies—unsteady and jerky—but rather more like that of the dragonflies—strong and steadfast. They showed remarkable ability to make swift turns; there was very little faltering. On many occasions a male was seen to grasp another specimen; in seven cases these couples were caught and found to consist of two males. No couples of male and female were captured, although several were seen. Other females were seen on the rocks on the bank, but they were much less numerous than the males. These observations tend to confirm the views of Spieth (1940, 385) that the method of recognition for this species is tactile rather than visual.

At 8:00 p.m. on July 23, a few specimens were still flying, although most of them had disappeared. Collecting at lights in the commercial areas of Rock Island, Illinois, and Davenport, Iowa, was then commenced. Specimens were seen there until 9:30 p.m. when collecting stopped. Even at that time, many specimens were found that were dead. This is due to the fact that, as the meso- and metathoracic legs of the males and all of the legs of the females of this genus are aborted and vestigial, it is nearly impossible for these insects to attach themselves to an object for a considerable length of time. Thus, they remain in flight throughout most of their winged life and soon die of exhaustion. Accordingly the swarms of July 24th were not composed of the same insects as those of July 23rd. Also, many females attracted to the lights were seen with the two egg rolls protruding, doomed to die without ovipositing and possibly even without mating.

On July 24th the characteristic flights along the bank lasted much longer. There were still many specimens flying at 8:00 p.m. However, toward the latter part of the evening at about ten feet from shore several swarms were seen rising and falling in rhythm; this never lasted more than a few seconds, for then they would resume their characteristic swift and searching flight. These swarms were flying under very adverse conditions of strong winds and sprinkling rain, which may account for the somewhat different actions. On both evenings birds, bats, and fish were seen consuming large numbers of this species.

The second mating flight to be observed was that of *Stenonema canadense* (Walker). On both nights this took place above the flight of *Ephoron album.* It is possible that the two successive swarms were composed of the same general emergence of specimens, although this is not definitely known. Because the flights on the two nights were quite different, they will be described separately.

The swarm of July 23rd was first observed at 7:30 p.m. These mayflies were flying from three to twenty feet above the surface of the water in a more or less compact swarm, which was about thirty-five feet in length and twenty feet wide. The males flew with a fluttering flight in almost one spot, usually staying in an area about six inches in diameter; the abdomen drooped downward, the body thereby forming an arch. At times they would suddenly break away from their steadfast flight, fly back and forth for a few seconds, and once again resume their steady fluttering. This they always did facing into the wind.

On many occasions females were seen flying into the swarm at a very rapid rate; they were grasped by the males from below and the two would sometimes fly about in the swarm for a few seconds; they would then fly out over the river, where, most likely, the female began oviposition. In several instances unmated males were seen trying to capture a female in copulation, even giving the pair a chase; other times the two specimens would suddenly break away after only a few seconds in copulation. At 7:50 p.m. the swarms suddenly dispersed, leaving not a single specimen flying.

On the evening of July 24th, the strong wind hampered the flight of these medium-sized mayflies. I believe the mating flight of the previous night to be the characteristic one and the latter to be aberrant due to the wind. The steady, fluttering flight was still present and all specimens again faced into the wind; however, in their flight they were consistently forced backwards upstream by the strong breeze. They would often form a loop while in flight, suddenly going down, forward a bit, then rise and continue backwards—all the time facing downstream. Many variations of this were seen, even with successive loops. In many instances, the males would abandon their steady flight, fly forward in successive rises and falls (which would vary in length from one to three feet even in the same flight) and then resume their regular fluttering. Sometimes a specimen would rise, grasping another male or female. The entire swarm never acted as an organized unit; the flights were a mixture of individual preferences. In three instances, *Stenonema* males were seen to grasp *Ephoron* males, all of which still had their subimagal pellicles dangling from their caudal filaments. In each instance, they soon left the larger insect to itself.

At 7:50 p.m. the wind grew suddenly stronger (Beaufort scale No. 4). This greatly disturbed the swarm. Waves from passing boats seemed to have no visible effect, however. At 7:55 p.m. the combined action of wind and sprinkling rain stopped all activity; otherwise it would probably have continued for quite some time.

Summary

The mating flights of *Ephoron album* (Say) and *Stenonema canadense* (Walker) have been recorded in detail. Both flights were found to be typical for the genera considered, but varied on occasions according to the ecological conditions present at the time of flight. Also, the moulting of the subimagal pellicle in *E. album* has been described.

Acknowledgments

The author would like to express his appreciation to the following people:— Mr. Gene R. Forret, Davenport Public Museum, for his assistance in the field work; Mr. Robert V. Kennedy, University of Illinois, and Dr. Lewis Berner, University of Florida, for their helpful criticism of the manuscript.

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A NORTH AMERICAN COLOTRECHNUS (ZANONIA) (HYMENOPTERA: PTEROMALIDAE)

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During the last 25 years specimens of a curious chalcidoid have been received in the U. S. National Museum for identification. Most of the specimens were from Florida. This species could not be placed with certainty in any of the families of the Chalcidoidea, although it had the habitus of a torymid. It therefore has been identified as "? unknown genus of Torymidae [or Callimomidae]" by several taxonomists who have worked in the U. S. National Museum.

This form, however, lacks two of the most salient characters of the family Torymidae. It does not have an exserted ovipositor, and the cerci are not exserted and located at the apex of the ninth abdominal tergite (*see* Burks, 1940, Proc. U. S. Natl. Mus. 88 : 333, fig. 14h), but are reduced to a pair of flat discs which have migrated anteriorly well into the ninth abdominal tergite.

This so-called torymid has two apical spurs on the hind tibia, the femora are stout, the parapsidal grooves are virtually absent, the scutellum has a pair of sublateral, longitudinal grooves, the axillae are produced far forward of the anterior margin of the scutellum, the marginal vein of the forewing is long and somewhat thickened, the stigmal vein is enlarged and nearly sessile, and the setae on the forewing are arranged in rows along the paths of the obsolete veins, much as in the eulophid genus *Euderus*. The antenna has two ring segments, six funicle segments which are broader than long, and a three-segmented club which is only slightly separated from the funicle. The gaster is narrow and acuminate, with the ninth tergite considerably extended, enclosing the elongate ovipositor. This form would logically be placed in the Cleonymini of the Pteromalidae, following the classification used in the *Hymenoptera of America North of Mexico* (Peck *in* Muesebeck *et al.*, 1951, U. S. Dept. Agr. Monog. 2, pp. 534-568).

As it seemed unlikely that a chalcid having such an array of distinctive generic characters would still be undescribed, a search was made through the literature for a described genus having these characters. This search finally led to the genus *Zanonia* Masi (1921, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, 9 : 184), described for *Z. viridis* Masi, from Bengazi, Libya. Our North American form agrees in all generic particulars with *Zanonia*. I have not seen a specimen of *Z. viridis*, but Masi's excellent description and figures make the identity of *Zanonia* quite clear.

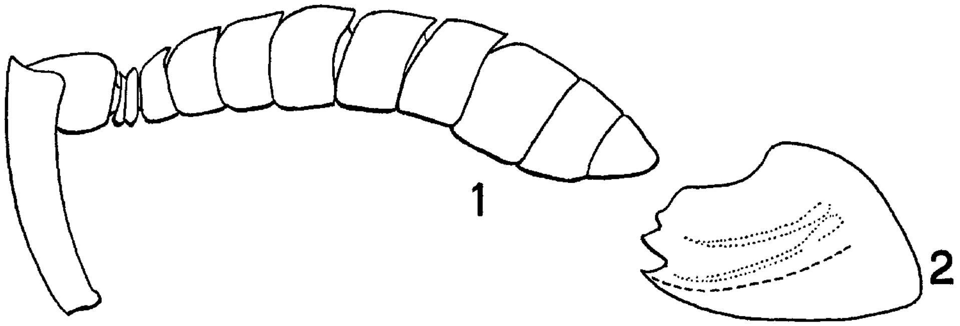
Once the genus *Zanonia* had been located, it was possible to trace its subsequent history. The year following the description of *Zanonia*, Masi had the opportunity to study specimens of *Colotrechnus subcoeruleus* Thomson, the type species of the European genus *Colotrechnus* Thomson, and concluded that *Zanonia* and *Colotrechnus* were very closely related (1922, Bol. Soc. Ent. Ital. 54 : 111). Recently Delucchi (1956, Zeit. f. Agnew. Ent. 39 : 233) has gone one step farther and has synonymized *Zanonia* under *Colotrechnus*. I am not sure that this is justified, principally because I examined a specimen of *Colotrechnus subcoeruleus* [det. Ruschka] when I was attempting to identfy our so-called torymid, and I had decided they were not congeneric because of the different wings and antennae. In *Colotrechnus* the marginal vein of the forewing is only one-third as long as the submarginal, and the wing disc bears a large, rounded shaded area; in *Zanonia* the marginal vein is one-half as long as the submarginal, and the wing is hyaline. In *Colotrechnus* the funicle segments are slender and elongate, all longer than wide, while the funicle segments in *Zanonia* are short and compact, all wider than long.

The classification of the Pteromalidae is at present in such a chaotic state, however, that an attempt to resurrect the genus *Zanonia* would only contribute to the confusion. Consequently, I propose to treat *Zanonia* as a subgenus of *Colotrechnus*, so that its distinctive characters will not be lost sight of. The North American species to be described below is much more closely related to *Zanonia viridis* Masi, from Africa, than it is to *Colotrechnus subcoeruleus* Thomson, from Europe.

Colotrechnus (*Zanonia*) *ignotus*, new species

Agrees with *viridis* Masi in that the scutellum bears one pair each of lateral and apical bristles, the gaster is almost or quite twice as long as the thorax, the posterior margin of the basal two gastral tergites each has a small, rounded, posterior projection at the meson, and the width of the malar space is one-third as great as the height of the compound eye; *viridis* and *ignotus* differ in that the propodeum and basal gastral tergite of *viridis* are a metallic golden color, while these areas are dark metallic blue-green in *ignotus;* in *viridis* the wing veins are yellow, while they are white in *ignotus;* and in *viridis* the antennal scape is slightly produced at the middle of the inner anterior margin, while this margin is entire in *ignotus.*

FEMALE.—Length 2.0-2.6 mm. Head (except for malar space), pronotum, and mesoscutum very dark metallic green; scutellum, propodeum, and dorsum of gaster dark metallic blue-green; malar space of head, pleura and sternum of body, coxae, femora, and tibiae very dark metallic blue; palpi black; antennae very dark brown to black, scape and pedicel usually with metallic green sheen; wings hyaline, venation white; basal three segments of each tarsus white, fourth segment usually tan, apical segment black.



Colotrechnus (*Zanonia*) *ignotus*, n. sp., Fig. 1, antenna of female; Fig. 2, mandible of female.

Antennae inserted slightly below center of face, dorsal to level of ventral margins of compound eyes; scape short, not reaching level of anterior ocellus; pedical and flagellum (figure 1), short and compact, all segments of funicle wider than long; length of malar space one-third as great as height of compound eye; length of ocellocular line twice as great as diameter of lateral ocellus, and one-half as great as length of postocellar line; surface of scrobe cavity and supraclypeal area between and below antennal bases smooth and shining, rest of head minutely shagreened and with sparse, very short and fine pubescence; eyes with extremely minute, silvery pubescence; mandible (figure 2) with two acute and one broad, shouldered tooth.

Head broader than pronotum and as broad as thorax just anterior to tegulae; thoracic notum with minute alveolate sculpture, this sculpture finer on scutellum than on praescutum; mesoscutum with sparse, short, appressed pubescence; scutellum with one pair of lateral and one pair of apical bristles, otherwise bare; ventral side of costal cell of forewing with a row of short bristles extending entire length of cell near its anterior margin and a row of longer bristles posterior to this row in apical half of cell; submarginal vein with 10 to 14 dorsal bristles; marginal vein one-half as long as submarginal and three and one-third times as long as stigmal; postmarginal vein one-fifth as long as submarginal; legs stout, hind coxa enlarged and lengthened and approximately triangular in cross-section; femora enlarged, subflattened, with margins noncarinate; hind femur with a single, longitudinal row of bristles on outer side; tibiae subflattened, slightly broadened apically.

Propodeum smooth, very short on meson and lacking paraspiracular carinae; spiracles large, ovate, touching anterior propodeal margin; area just lateral to propodeal spiracles with dense, long setae; gaster elongate-acuminate, twice as long as thorax; first gastral tergite (abdominal tergite III) basally smooth, becoming slightly reticulate at posterior margin; following tergites with minute, alveolar reticulation; posterior margins of first and second gastral tergites each with a rounded, posterior production at meson, posterior margins of tergites 3-6 straight; tergite 4 with a single cross-row of bristles located near base, posterior half of tergite 5 setose, entire exposed surface of tergite 6 setose; tergite 7 with denser but shorter setae; cercus bearing 3 long bristles.

MALE.—[Available specimens in very poor condition.] Length 1.3 mm. Head and body almost black, with less intense metallic coloration than in female. Length of malar space one-fourth as great as height of compound eye; length of ocellocular line and maximum diameter of lateral ocellus equal; gaster ovate, shorter than thorax.

Type locality.—Marion Co., Florida.

Types.—U.S.N.M. No. 63913.

The type, allotype, and 34 ♀ and 1 ♂ paratypes are deposited in the U. S. National Museum collection; 10 ♀ and 1 ♂ paratypes are deposited in the collection of the Florida State Plant Board, Gainesville, Fla.

Described from 45 ♀ and 3 ♂ specimens, as follows: Type ♀, allotype ♂, and 23 ♀ and 1 ♂ paratypes, Marion Co., Fla., Apr. 8-17, 1956, some specimens taken sweeping *Erigeron quercifolius*, R. A. Morse; 1 ♂ paratype, Waco, Tex., Oct. 10, 1956, in airplane trap at 200′ alt., P. A. Glick; 1 ♀ paratype, Glades Co., Fla., Dec. 6, 1955, sweeping weeds, R. A. Morse;

2 ♀ paratypes, Lake Co., Fla., Apr. 8, 1956, R. A. Morse; 1 ♀ paratype, Gainesville, Fla., May 24, 1956, on *Melilotus alba*, R. A. Morse; 1 ♀ paratype, Highlands Co., Fla., Oct. 3, 1956, on *Bidens pilosa*, R. A. Morse; 4 ♀ paratypes, Homestead, Fla., Mar. 1, 1956, H. V. Weems, Jr.; 3 ♀ paratypes, Key Vaca, Fla., Dec. 28, 1955, on *Bidens pilosa*, H. V. Weems, Jr.; 3 ♀ paratypes, Stock Isl., Dec. 27, 1954, on *Flaveria linearis*, H. V. Weems, Jr.; 1 ♀ paratype, Florida City, Fla., Dec. 31, 1951, H. V. Weems, Jr.; 1 ♀ paratype, Key West, Fla., Dec. 29, 1954, on *Flaveria linearis*, H. V. Weems, Jr.; 1 ♀ paratype, Key Largo, Fla., Dec. 6, 1954, H. V. Weems, Jr.; 1 ♀ paratype, Key Largo, Fla., Dec. 6, 1954, H. V. Weems, Jr.; 1 ♀ paratype, Ukiah, Calif., Mar. 31, 1931, sweeping grass, C. C. Wilson; 1 ♀ paratype, Oracle, Ariz., Aug. 26, 1934, 4500′ elev., Ian Moore; 1 ♀ paratype, Wayne Co., N. C., June 15, 1955, H. V. Weems, Jr.

The host of *Colotrechnus* (*Zanonia*) *ignotus* is unknown.

STUDIES ON CORN EARWORM CONTROL IN THE EVERGLADES [1]

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The corn earworm, *Heliothis zea* (Boddie), is the most damaging insect that attacks sweet corn in Florida. This is especially true as most of the corn is sold as fresh corn under the grade of U. S. Fancy. Among other requirements, a U. S. Fancy ear must show no evidence whatever of corn earworm attack to the ear itself or even within the silk channel. No vegetable pest requires a more intensive spray program than that necessary to control this pest. Everglades growers spray or dust at least every other day from the time the first silks appear within a planting, until all the silks are dry. Where large acreages of corn are involved, the same sprayer or duster may be operated 24 hours a day. The author's primary objective in corn earworm control studies on sweet corn is to find ways to reduce the number of necessary insecticide applications, and, at the same time, maintain a high degree of corn earworm control. To date the fulfillment of this objective has not been accomplished.

Spray applications were made with a high-clearance, self-propelled sprayer built at the Everglades Experiment Station [2]. A Myers jumbo nozzle fitted with a No. 3 disc was used on each side of the sweet corn row. The nozzles were at approximately the same height as the silks, and at a right angle to the stalks. The spraying pressure was 200 pounds per square inch. For all trials, Golden Security variety of sweet corn was planted in rows that were three feet apart and thinned to give a 12-inch spacing within the row. Budworm and disease control was accomplished with DDT-parzate sprays until the time of silking. Experimental insecticide applications were begun the day after the first silks appeared and continued until all silks were dry. In each experiment a randomized complete block design employing four replications was used. A 100-ear sample was examined in each plot to determine the percentage of ears that were free of earworm injury. Before analysis of variance was conducted, these percentages were transformed to angles (arc sin $\sqrt{\%}$).

Comparison of control programs that either are recommended or are in common use in the Everglades: This test is probably the first in which all of the corn earworm control programs in common use in the Everglades have been compared in one experiment. With the exception of the DDT wettable powder spray each of the programs in the trial are recommended in Everglades Experiment Station Mimeo 55-11 [3]. According to station recommendations the DDT-mineral oil emulsion should contain 2.5 gallons of a white mineral oil to each 50 gallons of spray but due to error the mineral oil was used at the rate of 1.25 gallon to each 50 gallons of emulsion. Dusts were applied with Niagara Cyclo Junior hand dusters at approximately 30 pounds per acre.

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[1] Florida Agricultural Experiment Stations, Journal Series No. 639.

[2] Harrison, D. S., and C. S. Yager. 1957. A hi lo all-purpose sprayer. Agricultural Engineering (In Press).

[3] Hayslip, Norman C., and W. H. Thames, Jr. 1955. Protecting the ears of sweet corn from insect damage in the Everglades area. Everglades Station Mimeo Report 55-11.

TABLE 1. COMPARISON OF CORN EARWORM CONTROL PROGRAMS IN COMMON USE IN THE EVERGLADES.

Treatments	Intervals Between Applications (Hours)	Pounds of Active Ingredient per Acre	Worm-free Ears	
			Angle* **	Percent
5% DDT + 1% Parathion dust	48	1.5 + 0.3	70.51	89
2% parathion dust	48	0.6	72.54	91
10% DDT dust	48	3.0	73.97	92
DDT EC (2 lbs./gal.)	48	2.0	76.64	95
5% DDT + 1% parathion dust	24	1.5 + 0.3	78.36	96
DDT EC + mineral oil	48	2.0 + 1.5 gal.	78.48	96
DDT 50% WP	48	2.0	80.81	98
DDT 50% WP	24	2.0	83.02	99
10% DDT dust	24	3.0	84.04	99
2% parathion dust	24	0.6	84.73	99
Untreated check †	—	—	—	49

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

† Untreated check plots were not included in the analysis.

The plants were silking during the latter half of April and examinations for earworm injury were made on May 2. Dusts containing 10 percent DDT or two percent parathion gave a significantly higher percentage of worm-free ears when applied at 24-hour intervals than when applied at 48-hour intervals (Table 1). The difference between the 24 and 48-hour intervals was not significant for a dust containing five percent DDT plus one percent parathion. No significant differences occurred among the percentages of worm-free ears given by DDT wettable powder sprays at 24 and 48-hour intervals. A DDT wettable powder spray applied at 24-hour intervals gave a significantly higher percentage of worm-free ears than any 48-hour interval dust application. Otherwise there were no significant differences between dusts and sprays as to degree of earworm control obtained. There were no significant differences among the results given by the different DDT sprays.

Toxaphene-DDT and toxaphene-parathion mixtures: Table 2 shows the results of a comparison of parathion, toxaphene, DDT, a toxaphene-DDT mixture, and a toxaphene-parathion mixture for earworm control on corn that was in silk during late April and was harvested on May 2. When used at the same rate per acre as an emulsion, toxaphene was inferior to DDT for earworm control. The addition of 0.5 pound of DDT to two pounds of toxaphene per acre did not increase control. The addition of two pounds of toxaphene to 0.25 pound of parathion per acre did not increase the effectiveness of parathion. DDT and parathion were about equally effective.

TABLE 2. CORN EARWORM CONTROL WITH EMULSIONS OF TOXAPHENE, PARATHION, DDT, AND TOXAPHENE COMBINATIONS.

Insecticide and pounds of active ingredient per acre	Worm-free Ears	
	Angle* **	Percent
Toxaphene (2.0) + DDT (0.5)	61.82	78
Toxaphene (2.0)	62.03	78
Parathion (0.25)	72.57	91
Toxaphene (2.0) + Parathion (0.25)	73.68	92
DDT (2.0)	76.64	95
Untreated check †	——	49

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

† Untreated check plots were not included in the analysis.

DDT, toxaphene, and DDT-toxaphene emulsions were applied at 4-day intervals to silking sweet corn during late May and early June for earworm control. At one or two pounds per acre, toxaphene failed to increase the effectiveness of DDT (Table 3). Two pounds of DDT without toxaphene gave significantly better control than one pound of DDT plus toxaphene. Two pounds of DDT plus toxaphene was not significantly better than one pound of DDT plus toxaphene. Alone at two pounds per acre, toxaphene gave significantly less earworm control than any DDT or DDT-toxaphene treatment.

TABLE 3. TOXAPHENE, DDT, AND TOXAPHENE-DDT EMULSIONS FOR CORN EARWORM CONTROL.

Insecticide	Pounds of Active Ingredient per Acre	Worm-free Ears	
		Angle * **	Percent
Toxaphene	2	37.66	37
Toxaphene + DDT	2 - 1	49.30	57
Toxaphene + DDT	1 - 1	50.18	59
Toxaphene + DDT	1 - 2	50.62	60
Toxaphene + DDT	2 - 2	53.57	65
DDT	2	57.69	71
Untreated check †	——	——	6

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

† Untreated check plots were neither randomized within this experiment nor included in the analysis. Value taken from check plots in an adjacent experiment.

DDT, DDT-oil, endrin, sevin, thiodan, and guthion emulsions: Emulsions were applied at 4-day intervals during May to compare three dosages of endrin, sevin, thiodan, and guthion with DDT (2 pounds), and DDT-oil (2 pounds + 2.5 gallons) emulsions. All emulsions were applied at the rate of 50 gallons per acre.

Endrin at 1.6 pounds per acre gave a degree of control that was not significantly different from that given by either DDT or DDT-oil. Endrin at 0.8 pound per acre gave a percentage of worm-free ears that was significantly less than that obtained with DDT-oil but not DDT. The 1.6 pound dosage of endrin was significantly more effective than the 0.8 and 0.4 pound levels. The 0.8 and 0.4 pound dosages were not significantly different (Table 4).

TABLE 4. COMPARISON OF ENDRIN DOSAGES, DDT, AND DDT-OIL FOR CORN EARWORM CONTROL.

Insecticide	Pounds of Active Ingredient per Acre	Worm-free Ears	
		Angle * **	Percent
Endrin EC (1.6 lbs./gal.)	0.4	57.89	72
Endrin EC	0.8	62.30	78
DDT EC (2 lbs./gal.)	2.0	67.16	85
Endrin EC	1.6	69.00	87
DDT EC + mineral oil	2.0 + 2.5 gals.	74.36	93
Untreated check †	—	——	40

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

† Untreated check plots were not included in the analysis.

TABLE 5. COMPARISON OF SEVIN DOSAGES, DDT, AND DDT-OIL FOR CORN EARWORM CONTROL.

Insecticide	Pounds of Active Ingredient per Acre	Worm-free Ears	
		Angle * **	Percent
Sevin EC (1 lb./gal.)	0.5	57.93	72
Sevin EC	1.0	63.30	80
Sevin EC	2.0	66.94	85
DDT EC (2 lbs./gal.)	2.0	67.30	85
DDT EC + mineral oil	2.0	75.63	94

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

Sevin at one and two pounds per acre, and DDT, were not significantly different in corn earworm control (Table 5). The DDT-oil emulsion gave significantly better control than the other treatments. Both DDT and the two pound dosage of sevin were significantly better than the 0.5 pound dosage of sevin.

TABLE 6. COMPARISON OF THIODAN DOSAGES, DDT, AND DDT-OIL FOR CORN EARWORM CONTROL.

Insecticide	Pounds of Active Ingredient per Acre	Worm-free Ears Angle * **	Worm-free Ears Percent
Thiodan EC (2 lbs./gal.)	0.5	51.24	61
Thiodan EC	2.0	64.88	82
Thiodan EC	1.0	64.94	82
DDT EC (2 lbs./gal.)	2.0	66.72	84
DDT EC + mineral oil	2.0 + 2.5 gals.	73.56	92

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

The percentages of worm-free ears given by thiodan at one and two pounds per acre and DDT were not significantly different, but were significantly higher than that for thiodan at 0.5 pound (Table 6). DDT-oil emulsion was significantly the most effective treatment.

The DDT-oil emulsion was significantly better than guthion at 0.75 or 0.38 pound per acre (Table 7). DDT was significantly better than guthion at the 0.38 pound level. The 1.5 pound dosage of guthion was significantly better than the 0.38 pound dosage.

TABLE 7. COMPARISON OF GUTHION DOSAGES, DDT, AND DDT-OIL FOR CORN EARWORM CONTROL.

Insecticide	Pounds of Active Ingredient per Acre	Worm-free Ears Angle * **	Worm-free Ears Percent
Guthion EC (1.5 lbs./gal.)	0.375	60.41	76
Guthion EC	0.75	68.14	86
Guthion EC	1.5	70.97	89
DDT EC (2 lbs./gal.)	2.0	72.77	91
DDT EC + mineral oil	2.0	77.42	95
Untreated check †	——	——	49

* Percentages were transformed to angles (angle = arc sin $\sqrt{\%}$) before conducting analysis of variance.

** Means joined by the same line are not significantly different; Means not joined by the same line are significantly different.

† Untreated check plots were not included in the analysis.

Discussion

Although experiments reported in this paper have not indicated a better corn earworm control program, they have shown some interesting side lights. When care was taken to apply as many gallons of wettable powder spray as DDT emulsion, the wettable powder spray gave a degree of control about equal to that given by the emulsion. DDT wettable powder sprays have never been recommended for corn earworm control in Florida, but most of the sweet corn growers in the Everglades who spray are using wettable powders in preference to DDT emulsifiable concentrates. This is apparently because emulsifiable concentrates are more expensive, and also because some growers have experienced spray burn with emulsions. The author observed spray injury to sweet corn ears from DDT-oil emulsions but not from DDT emulsion when used alone.

The addition of toxaphene to parathion or DDT emulsions did not increase corn earworm control. In fact, it appeared that admixture with toxaphene slightly decreased the degree of control given by DDT in emulsions.

Considering both the degree of control obtained and the cost of the insecticides, neither endrin, sevin, thiodan, nor guthion show promise for corn earworm control. At the higher dosages each gave a degree of control comparable to that given by DDT but as these are comparatively new insecticides, the cost per pound of actual toxicant will probably be much greater than that for DDT.

THE MEDITERRANEAN FRUIT FLY IN FLORIDA—PAST, PRESENT, AND FUTURE[1]

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The Mediterranean fruit fly, a serious pest of peaches, citrus, and other tropical fruits, and a limited number of vegetables, has tuice invaded the State of Florida. So far as is known the only area in the world from which this pest has been eradicated has been Florida. The present program can not be considered completed at this time insofar as eradication is concerned; however, there is every reason to believe that eradication will be accomplished. No specimens have been found in Florida since the recovery of a single adult fly on August 7, 1957, in Hillsborough County, 37 days after the last previous capture. This is the longest fly-free period since the program began last year.

The insect assuredly was eradicated in its first invasion in 1929, with specimens being found for a period of a little over 15 months and eradication declared complete in the 18th month.

There are some similarities between the 1929-30 campaign and the 1956-57 campaign. The first invasion was noted when maggots were discovered in grapefruit in April, 1929. Likewise, the second invasion came to light with the discovery of "Medflies", again in grapefruit, and also in April, but in 1956. One big difference between the two invasions was that the first was found in Orlando and throughout predominately rural sections of central Florida; whereas, the second infestation was found in Miami and in other heavily populated metropolitan areas, such as St. Petersburg and Tampa, as well as in rural citrus-growing areas. It is believed that the Medfly, regardless of the means of control used, would be more difficult to eradicate from urban than from rural areas due to the many problems encountered in eradication treatments in heavily populated sections.

Federal and State appropriations in the first campaign amounted to approximately $7,000,000; whereas, approximately $10,000,000 had been expended by the end of June, 1957, on the second eradication attempt. At the peak of the eradication campaign, there were approximately 6,000 employees engaged in the first fight as compared with less than 800 on the state and federal payrolls in the 1956-57 campaign.

During the first campaign a maximum of 12,645 traps was used as compared with 50,267 in 1957. Much more effort was devoted to fruit cutting as a means of detection in the first campaign than in the second. The fruit fly was found in 20 counties in 1929 and in 28 counties in 1956.

Road blocks were used in both campaigns; however, they were much more stringent in the 1929 outbreak and were manned by the National Guard, which, as far as is known, is the only instance wherein the National Guard participated in enforcing plant quarantines. The road blocks in the 1956-57 campaign were discontinued as soon as heavy infestations had been cleaned up in the metropolitan areas, and in lieu thereof a patrol system

[1] From a talk presented at the 40th Annual Meeting of the Florida Entomological Society, September 11, 1957.

was used to regulate the movement of host material from infestations in rural areas.

During the first campaign, large quantities of citrus fruit were destroyed. Despite the restrictions placed on the movement of all Florida host material to other states, and to at least 13 foreign countries, the insect managed to get out of Florida and was found in 17 shipments in seven different states. In one case in North Carolina the fly apparently had gone through the various stages of development and an adult was taken in a small grocery store. During the present campaign, on the other hand, no Medflies have been found in other states and the movement of most of the Medfly hosts was provided for through the use of authorized fumigation and/or insecticidal treatments so that crops could be shipped to any point in the United States and to a number of foreign countries under proper certification.

In the 1929 campaign the principal means of eradication consisted of host fruit removal; whereas, in the present campaign host fruits were not destroyed, but instead insecticidal bait sprays with supplemental surface treatments were the principal eradication tools. It is true, however, that bait sprays of a different type were applied by ground sprayers to a limited extent in the 1929 fight. In the 1956-57 campaign principal emphasis was placed on aircraft applying the eradication treatments, and bait sprays were applied one or more times to 799,757 acres. The repeat treatments to this acreage to date has totaled in excess of 6,727,887 acres. At the present time one single engine aircraft is carrying on the entire spray program covering 2,200 acres in Polk and Hillsborough Counties in comparison to the 350,000 acres treated during a single week at the peak of the campaign. It is anticipated at this time, barring further finds, that the last aerial bait sprays will be applied in Polk County on September 23 and in Hillsborough County on October 8. The last area under quarantine, barring further finds, will be released from all regulations on November 5 with regulations only being in effect in limited areas in Polk and Hillsborough Counties after the 26th of this month.

In looking toward the future we first should recognize the fact that Mediterranean fruit flies, as well as other species of fruit flies, are continually being intercepted at air and ship ports of entry by Plant Quarantine inspectors. For that reason the State of Florida is continually being exposed to possibility of infestations slipping by this first line of defense. It is absolutely essential, therefore, that an adequate detection program be continued on a permanent basis in order to locate any infestations that may be introduced in their incipient stage. This detection program should, of course, give primary consideration to areas where specimens will most likely be introduced such as ship ports, international air ports, and military installations. Fortunately, on the basis of current research data, it will be possible in such a continuing trapping program to use a single trap with a multiple lure and be on the lookout for the melon, Oriental, and Mediterranean fruit flies. To date a different type of trap would have to be used in inspections for the Mexican fruit fly.

The advancements possible in the eradication treatments between the 1929 and the 1956 campaign were brought about through an intensive research program. Eradication of the 1956-57 infestation would have been all but impossible if the 1929-30 procedures were all that were available.

It is believed to be imperative that research work be continued in efforts to still further increase the efficiency of survey and control techniques as well as commodity treatment procedures. There should be a continued, close, working relationship between research personnel and the agencies responsible for detection in order that the most effective procedures would be used in the survey work.

In addition to a continued research program on the Medfly, a similar program should be continued in connection with research on the other fruit flies as well as other foreign pests. It is only in this way that we will be able to cope with them if and when they arrive.

We should expand to the fullest extent possible our cooperative working arrangements with foreign countries in order that introductions of the Medfly to additional areas would come to our attention promptly. Likewise, we should give foreign countries technical assistance in dealing with current infestations.

A NEW SPECIES OF XENOCHIRONOMUS FROM FLORIDA (DIPTERA: CHIRONOMIDAE)

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An extensive pattern of light-traps is operated throughout Florida for routine sampling of mosquitoes. In addition, a series of light-traps was operated in the vicinity of the new Jim Woodruff Dam on the Apalachicola River in northwestern Florida as part of a study of the effects of impoundment on the mosquito populations of the area. Both of these endeavors have contributed greatly toward a knowledge of the chironomid fauna of Florida.

Thus far four species of the genus *Xenochironomus* have been identified from Florida. Of these, one appears to be undescribed.

This species is named in honor of the late Dr. J. Speed Rogers, teacher and friend.

Xenochironomus rogersi, n. sp.

HOLOTYPE MALE. Wing 3.3 mm. long, leg ratio 1.6, antennal ratio 2.7. Head yellowish brown; palpi light brown; antenae, except two basal segments, dark brown with dark brown plume.

Mesonotum yellow-brown, sometimes tinged with green; the vittae ochraceous; the postnotum dark brown to black in center, narrowly fuscous at margins.

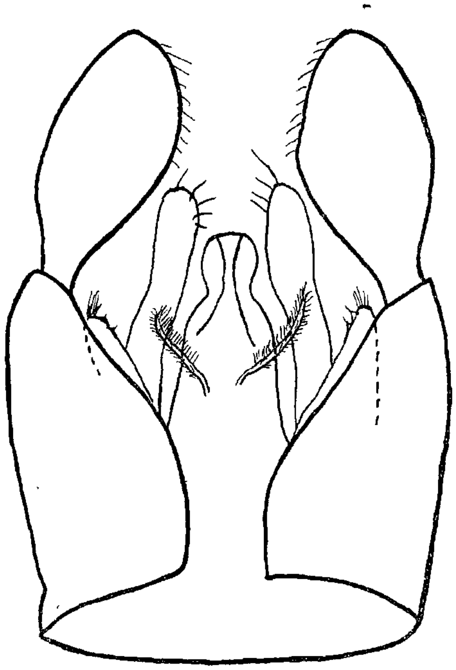

Fig. 1.—Male genitalia, *Xenochironomus rogersi.*

Wings tinged with dusky brown, the wing veins brown; cross vein no darker than other veins. Knob of halters yellowish, sometimes tinged with green.

First abdominal segment brown, except for a narrow v-shaped lighter area at center basally; segments 2 to 5 yellow-brown with apical third of each segment dark brown; remaining segments mostly dark brown.

Legs yellow-brown; apex of fore femur, all of fore tibia and tarsi dark brown, almost black. Knees and all tarsi of middle and hind legs dark brown. No beard on fore tibia and tarsi.

Genitalia: (Fig. 1.) The very broad short dististyles and the feathery projections on the anal point are distinctive.

FEMALE: Yellowish, with three blackish-brown stripes on the mesonotum; the central stripe about 2.0 as long as broad, beginning at the anterior end and extending back for 0.25 the length of the mesonotum; the lateral stripes each about 4.0 as long as broad and extending from the posterior end forward for about 0.65 the length of the mesonotum. Each stripe is broadest anteriorly and narrows to a point apically. Otherwise similar to the male except for the usual sexual differences.

SPECIMENS EXAMINED: The holotypic male, Winter Park, Florida, 8 May, 1956; 4 males, 3 females, Winter Park, Florida, 8 May, 1956, 19 July, 1956, 14 August, 1956, 3 September, 1956; 1 male, Tampa, Florida, 31 May, 1956; 1 male, Port Mayaca, Florida, 4 February, 1955.

The species herein described appears to be quite close to *X. dorneri* (Malloch) (1915) of which only the female was described. The male is not the same, however, as that described by Townes (1945) from Barro Colorado Island, Canal Zone, as "*X. dorneri ?*". The female may be the same as that Townes described from LaBelle, Florida. The females are so similar in this genus that it is almost impossible to identify them to species.

We are indebted to Dr. Paul Arnaud, United States National Museum, for aid in determining the taxonomic status of this species. The type has been deposited in this museum.

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A CATALOGUE OF THE LARVAEVORIDAE OF FLORIDA [1]

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The Larvaevoridae (Tachinidae), or parasitic flies, comprise a large and cosmopolitan family. It consists of some 300 genera and 5000 species, of which 190 genera and 1500 species occur in North America (Essig, 1942). The Florida species range in size from tiny three millimeter *Chaetostigmoptera crassinervis* (Walton) to the large spiny *Juriniopsis adusta* (Wulp) which is 18 millimeters in length.

Adult Larvaevoridae are nectar feeders, and some have been reported attracted to honeydew secretions of other insects. Some plants that have a decidedly offensive odor to man are attractive to them.

The larvae typically are parasitic within the bodies of other insects. One has been reported from a sowbug, a terrestrial crustacean, and a few have been recorded from other arthropods. The greatest number of species parasitize larvae and pupae of the Lepidoptera. Certain members of other orders, including Coleoptera, Orthoptera, Hemiptera, Dermaptera, Hymenoptera and Diptera, are parasitized to a much lesser extent.

PHYLOGENETIC POSITION

The taxonomic position of the Larvaevoridae is usually given as being near the Sarcophagidae, to which they are related. Various authors have placed this family either in the superfamily Oestroidea or Muscoidea, or have grouped it along with the Hypodermatidae, Oestridae, Cuterebridae, Calliphoridae and Sarcophagidae in the superfamily Tachinoidea (Enderlein, 1936).

The group, or restricted parts of it, has had several family names, including Tachinidae, Echinomyidae, Phasiidae, and Megaprosopidae. The name used in this paper is the one in current usage.

REARING PROCEDURES

It was necessary to rear host insects in the laboratory to secure host records. Whenever a certain host species became prevalent, 25 to 100 larvae were collected. Mature larvae were selected for rearing as many species are not parasitized until their last instar. Also, this materially cut down the labor of feeding and caring for them. The caterpillars or other host insects were hand-picked and placed in a large paper bag with a quantity of their host plant, and the top of the bag was twisted tightly. These containers make light, easily handled transportation cages.

Transference to rearing jars was done immediately after each collecting trip. Rearing containers consisted of two screened cages and wide-mouthed, gallon jars for the larger operations, and pint jars for individual rearing.

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[1] Based, in part, on a thesis submitted as partial fulfillment of the requirements for the degree of Master of Science.

[2] Present address, 705 Cherry St., College Station, Texas.

The plant material was washed if dusty or dry. Cotton batting was wrapped around the ends of the stems, which were then placed in a small jar of water. After the rearing container was filled to a depth of two or three inches with clean, fresh, moist sand, the food material in its container was firmly embedded in the sand. Then the larvae were introduced. Finally, about two thicknesses of cheesecloth were tied over the mouth of the jar and a label with all collection data was attached.

After the initial setting up of the rearing jars, fresh water was added to the plant material daily. As most of the larvae had voracious appetites, it was necessary to gather fresh food every other day.

At intervals of three to five days, all plant refuse and fecal pellets were removed, or the larvae were moved to clean cages. After all the larvae had entered the ground or had spun cocoons, all plant material was removed. A twisted paper towel or other vertical support was placed in the cage to provide a resting place for adult hosts and parasites. Larvaevoridae, like the Lepidoptera, must assume a vertical position to expand their wings. In order to allow them time to dry and harden, the flies were killed in late afternoon of the same day they emerged.

After the adults hosts and parasites stopped emerging, the sand was sieved. Any remaining pupae were cleaned with a camel's hair brush and transferred to clean sand or vermiculite for storage.

Collecting and Preserving Procedures

Since adult larvaevorids are nectar feeders, the most profitable collecting sites are areas of blooming shrubs and flowers. *Viburnum*, *Melilotus alba* and butterfly bush in spring, and *Solidago* sp., *Bidens pilosa* and *Polygonum hydropiperoides* in fall yielded the greatest variety of specimens. Midmorning is the most favorable time for collection. The Ormiini, parasites of nocturnal Orthoptera, are often taken at lights. Ultraviolet light promises to be a good method of collecting seldom seen species which are not attracted to incandescent or neon lights.

Adults were killed in a chloroform tube and pinned immediately if possible. When there were reared specimens that could definitely be associated with a puparium, this was pinned in a capsule beneath the adult which emerged from it. In mass rearings, puparia were preserved in alcohol.

In order to study details of larval mouth hooks, cuticle and spiracles, it was necessary to mount them on slides. The procedure, modified from Dr. A. N. Tissot's aphid-mounting technique, is as follows:

> Prick larva in several places near anterior end. Partially sever last segment from body. Place in five percent, cold potassium hydroxide overnight or in hot solution for twenty to thirty minutes. Using a blunt instrument remove body contents by pressing gently from anterior to posterior end. Wash in water by alternately pressing and releasing integument. Transfer to the following solutions in order, allowing the larval skin to remain in each about thirty minutes.

acetic alcohol (10% acetic acid in distilled water and 95% alcohol 1 to 1)
70% alcohol
95% alcohol
95% alcohol, clove oil 5 to 1
95% alcohol, clove oil 1 to 1
pure clove oil

Place a drop of Canada balsam on slide. Arrange the larva in balsam on the slide, turning the last segment spiracles up, the skin flattened and mouth hooks protruding or extracted. Apply glass cover slip. After several days, when the slides are dry, labels can be affixed.

FLORIDA LARVAEVORIDAE

Previous contributions to a knowledge of Florida Larvaevoridae include the study of specimens collected by Mrs. A. T. Slosson, mostly from the Biscayne Bay area. C. W. Johnson's two lists in 1895 and 1913 cited many records of Larvaevoridae. H. L. Dozier's ecological study in 1920 added more host records.

The following list alphabetically lists records of over 200 species of Larvaevoridae from Florida. These records include specimens from my own collection, and the collections of the Entomology Departments of the Florida Agricultural Experiment Station, the State Plant Board of Florida, and the University of Florida College of Agriculture. Published records from the literature are also included.

Records from sources other than my own are quoted in original form and content, except that the most recent name of the parasite has been cited.

Information under each species is as complete as possible, giving in order locality, date, collector, catalog number, and host. Records from the literature follow the same order, with the author and literature citation last.

Footnotes followed by the initials C.W.S. are comments by C. W. Sabrosky, mostly from personal correspondence. Notes and comments in brackets are my own.

Unless otherwise indicated specimens from the above named collections were identified by C. W. Sabrosky.

Abbreviations

The following abbreviations are used in the catalog.

U.V.—ultraviolet

P—C. N. Patton catalog numbers

AES—Entomology Department, Florida Agricultural Experiment Station

SPB—Entomology Department, State Plant Board of Florida

CED—Entomology Department, College of Agriculture, University of Florida

Achaetoneura Brauer and Bergenstamm

A. aletiae (Riley)

Gainesville, Fla., 10/12/53 to 10/30/53, C. N. Patton, P-200B. Thirteen specimens reared from cage of 50 *Estigmene acrea* (Drury) larvae.

Gainesville, Fla., 11/18/53, C. N. Patton, P-202. Parasite larva emerged from larva of *Megalopyge opercularis* (A. & S.) on above date, pupated in soil, and adult emerged 11/30/53.

Gainesville, Fla., 4/10/54, C. N. Patton, P-220A. Six flies reared from 500 larvae or pupae of *Malacosoma americana* (F.).

Poe Springs, Fla., 9/23/54, C. N. Patton, P-225B. One specimen reared from over 50 larvae of *Megalopyge pyxidifera* (A. & S.).

?Gainesville, Fla., 8/26/30, AES 7242. Reared from the Bella moth. [*Utethesia bella* (L.)]

Ocala, Fla., 12/22/31, A. N. Tissot, AES 7786. Reared from *Xanthopastes timais* Cramer, larvae taken from *Hymenocallis crassifolius*. det. J. M. Aldrich.
Gainesville, Fla., 10/13/39, A .N. Tissot, AES 8544. Reared from larvae or pupae of *Mocis repanda* (F.).
Gainesville, Fla., 11/24/34, W. P. Hunter. Reared from larvae of *Urbanus proteus* L.
St. Petersburg, Fla., 11/26/55, C. N. Patton, P-286. About 30 flies reared from over 200 larvae and pupae of *Syntomeida epilais* Walker.
Gainesville, Fla., 9/28/55, C. N. Patton, P-262A. Reared from *Datana ministra* (Drury) larvae. Flies emerging 10/11/55.

A. sp., probably *archippivora* (Williston)
Clearwater, Fla., 6/1/53, L. S. Maxwell, AES 10245B. Reared from larvae or pupae of *Laphygma frugiperda* (A. & S.) on St. Augustine grass.

A. sp. nr. *cuculliae* Webber
Gainesville, Fla., 4/6/48, A. N. Tissot, AES 9940B. Reared from *Estigmene acrea* Drury larvae and pupae collected in a lupine field.

A. frenchii (Williston) complex[3]
Gainesville, Fla., 9/9/55, C. N. Patton, P-256. Parasites of *Datana integerrima* G. & R. collected on 8/12/55 on *Hicoria tomentosa*.
Oleno State Park, Fla., 9/8/55, C. N. Patton, P-257. Parasites of *Datana ministra* (Drury), two lots collected on *Hicoria tomentosa* on 8/14/55.

A. sp. nr. *laniiferae* Webber
Eagle Lake, Fla., 10/30/48, Mrs. Maude Cowden, AES 9609. Parasites of *Eupseudosoma involutum* var. *floridanum* Grote. Two host larvae sent in on above date. One larva found dead 11/6/48, and two days later, two fly puparia were found in the soil. Flies emerged 11/17/48.

A. piperi Townsend
Gainesville, Fla., 10/10/53, C. N. Patton, P-211. Taken on *Bidens pilosa*. det. H. J. Reinhard.

A. rileyi (Williston)
Gainesvlile, Fla., 11/3/37, K. V. Wheeler. Ex orange dog pupa.
Gainesville, Fla., 1940, D. B. Fogarty, CED. Ex *Papilio cresphontes* Cramer.

A. schizurae Townsend
Gainesville, Fla., April 13-14, H. L. Dozier. (Dozier, 1920 : 372).

Acroglossa Williston

A. hesperidarum Williston
Inverness, Fla., March 10, 22, Robertson. (Johnson, 1913 : 74).

Acronarista Townsend

A. mirabilis Townsend
Palm Beach, Fla., Dyar. (Townsend, 1908 : 85, orig. desc.).

Actia Robineau-Desvoidy

A. americana (Townsend)
Gainesville, Fla., 5/29—6/5/55, L. A. Hetrick, P-273A. U.V. light trap.

Admontia Brauer and Bergenstamm

A. sp.
Alachua Co., Fla., 4/12/38, CED.

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[3] "I believe that what has been called '*frenchii*' may be a complex requiring further study."—C. W. S.

Admontiopsis Townsend

A. tarsalis (Coquillett)
Gainesville, Fla., 4/13/55, L. A. Hetrick, P-271. U.V. light trap.

Aphira Robineau-Desvoidy

A. ocypterata Townsend
Florida, Mrs. Slosson. (Johnson, 1913 : 72).

Archytas Jaennicke

A. apicifer (Walker)
Gainesville, Fla., 3/20/55, C. N. Patton, P-237. Reared from pupa of *Pseudaletia unipuncta* (Haworth), pupated within host pupa.
Gainesville, Fla., 11/22/53, C. N. Patton, P-209. On *Bidens pilosa.*

A. aterrimus (Robineau-Desvoidy)
Gainesville, Fla., 4/10/54, C. N. Patton, P-220. Ninety-seven flies reared from over 500 *Malacosoma americana* F. pupae. The parasite pupa was located in the anterior end of the host pupa. Adult flies emerged about 9 A.M., and were most active at night.

A. convexiforceps Brooks
Miami, Fla., Nov. 11-21, Townsend. (Brooks, 1949 : 23, orig. desc.).

A. lateralis (Macquart)
Gainesville, Fla., April 13-14, H. L. Dozier. Most abundant parasite reared from *Malacosoma americana* F. (Dozier, 1920 : 372).
Gainesville, Fla., 1940, Fogarty, AES. Ex *Malacosoma americana* F.

A. marmoratus (Townsend)
Sabrosky (1955) refers published Florida records of *A. incerta* (Meigen) to this species, with which he synonymizes *A. piliventris* (Meigen), stating that *A. incerta* occurs only in South America.
Tallahassee, Fla., 9/23/54, AES 105272B. From *Laphygma frugiperda* (A. & S.) collected on badly damaged hegari.
Goulds, Fla., 4/2/42, AES 10483. Reared from a pupa of (probably) *Prodenia latifascia* Wlk., collected on above date; fly emerged 4/27/42. det. M. T. James, 1945.
Gainesville, Fla., 7/31/53, AES 10320B. Reared from *Laphygma frugiperda* (A. &. S.) collected on millet. Flies emerged 8/15 and 8/16.
Gainesville, Fla., 9/12-18/55, L. A. Hetrick, P-279L. U.V. light trap.

A. metallicus (Robineau-Desvoidy)
Ocala National Forest, Fla., 10/24/54, C. N. Patton.
Otter Creek, Fla., 10/1/55, C. N. Patton, P-261C. On *Polygonum hydropiperoides.*

A. rufiventris Curran
Sebring, Fla., 6/26/53, H. V. Weems.
Alachua Co., Fla., 10/20/49, H. A. Denmark.

Belvosia Robineau-Desvoidy

B. bifasciata (Fabricius)
Blue Springs, Fla., 11/9/54, C. N. Patton, P-227. Reared from *Anisota* sp. nr. *rubicunda* (F.). Parasites pupate inside host pupae.

B. borealis Aldrich
Highlands Hammock State Park, Fla., 3/27/51, H. V. Weems. On *Cornus stricta.*

B. slossonae Coquillett
Otter Creek, Fla., 10/1/55, C. N. Patton, P-261D. On *Polygonum hydropiperoides.*

B. townsendi Aldrich
Otter Creek, Fla., 10/1/55, C. N. Patton, P-261A. On *Polygonum hydropiperoides.*

Beskia Brauer and Bergenstamm

B. aelops (Walker)
Gainesville, Fla., 9/16/17, J. R. Watson, AES 1939.
Alachua Co., Fla., 10/20/40, CED.

Biomya Rondani

B. angustifrons Reinhard
Gainesville, Fla., 5/29—6/5/55, L. A. Hetrick, P-273B. U.V. light trap.

B. aurigera (Coquillett)
Gainesville, Fla., 7/30—8/3/55, L. A. Hetrick, P-277E. U.V. light trap, 3 spm.

B. georgiae (Brauer and Bergenstamm)
Gainesville, Fla., 7/30—8/3/55, L. A. Hetrick, P-277A. U.V. light trap, 27 spm. [Other dates yielded only a few spm.]

Blepharipeza Macquart

B. inermis (Bigot)
Charlotte Harbor, Fla., Mrs. Slosson. (Johnson, 1895 : 332).

Bonnetia Robineau-Desvoidy

B. comta (Fallen)
Leesburg, Fla., 4/19/42, AES 10485. Reared from a larva of *Feltia subterranea* (F.) which died 5/2/42. The next day, a fly puparium was found. Adult emerged 5/13/42. det. M. T. James, 1945.

Bucentes Latrielle

B. geniculata (DeGeer)
Inverness, Fla., Feb. 12-Mar. 22, Robertson. (Johnson, 1913 : 71).

Carcelia Robineau-Desvoidy

C. amplexa (Coquillett)
Key West, Fla., 7/15/18, E. L. Gehry, SPB 3373. Nine flies from one pupa of *Megalopyge opercularis* (A. & S.). det. R. T. Webber.
Key West, Fla., 12/7/29, R. G. Milner. Ex *Megalopyge opercularis* (A. & S.). det. Merrill.

C. diacrisiae Sellers
Gainesville, Fla., 5/6/55, C. N. Patton, P-242B. One fly reared from larva of *Estigmene acrea* (Drury).

C. flavirostris (Van der Wulp)
St. Petersburg, Fla., SPB 8361. Ex *Megalopyge opercularis* (A. & S.), reared from pupae. det. R. T. Webber.
Key West, Fla., 7/15/18, SPB. Ex *Megalopyge opercularis* (A. & S.). Adults emerged 9/11/21. [The lapse of three years is impossible; the adults undoubtedly emerged in 1918.]

C. formosa (Aldrich and Webber)
Gainesville, Fla., 1933, CED. Ex *Automeris io* (F.).
Gainesville, Fla., 4/27/29, AES 10652. *Automeris io* (F.).

C. lagoae (Townsend)
Gainesville, Fla., 3/5/54, L. A. Hetrick, P-217. Four adults emerged from cocoon of *Megalopyge opercularis* (A. & S.).
Jacksonville, Fla., 5/4/54, W. F. Lyons, AES 10476. Five specimens emerged from a cocoon of *Megalopyge opercularis* (A. & S.) received on 12/9/53.

C. reclinata (Aldrich and Webber)
Gainesville, Fla., 10/12/53 to 10/30/53, C. N. Patton, P-200A. Five adults reared from cage of 50 *Estigmene acrea* (Drury) larvae.
Gainesville, Fla., 1/7/54, C. N. Patton, P-213. Six parasites from a single larva of *Ecpantheria deflorata* F., pupated 12/23/53, emerged 1/7 to 1/10/54.

Palatka, Fla., 12/9/53, C. N. Patton, P-205. Mature larva of *Ecpantheria deflorata* F. collected on 11/1/53, appeared freshly molted. Eight parasite larvae pupated in soil, about 12/5/53. Adults emerged 12/9/53 to 12/12/53.

Gainesville, Fla., 10/27/54, C. N. Patton, P-231. Seven flies reared from a single larva of *Estigmene acrea* (Drury).

C. sp.
Gainesville, Fla., 11/6/38, AES 8314B. Parasites of hag-moth larvae or pupae. Of the 14 pupae, only one perfect adult emerged. [*Phobetron pithecium*?]

Cenosoma Van der Wulp

C. signifera Van der Wulp
Highlands Hammock State Park, Fla. 3/29/51, H. V. Weems.

Ceracia Rondani

C. dentata (Coquillett)
Georgetown, May 10, 1894, C. W. Johnson. (Johnson, 1895 : 334).
Biscayne Bay, Fla. (Johnson, 1913 : 73).

C. (n. sp.?) near *dentata* Coquillett
Gainesville, Fla., 9/26—10/5/55, L. A. Hetrick, P-281. U.V. light trap, 1 spm.

Ceratomyiella Townsend

C. angusticornis (Townsend)
Inverness, Lake Worth, Mar. 3-19, Mrs. Slosson. (Johnson, 1913 : 73).
Miami, Fla., Oct. 8 and 15, Townsend. (Reinhard, 1934c : 16).

Chaetogaedia Brauer and Bergenstamm

C. analis (Van der Wulp)
Otter Creek, Fla., 10/1/55, C. N. Patton, P-261H. On *Polygonum hydropiperoides.*
Alachua Co., Fla., 3/15/35, CED.

gen. sp. nr. *Chaetogaedia*
?Gainesville, Fla., 8/10/30, H. E. Bratley, AES 7260. Parasite of *Litoprosopus* sp., larva collected on Washingtonia palm. Fly emerged 10/6/30.

Chaetoglossa Townsend

C. nigripalpus Townsend
Inverness, Fla., Feb. 23, Robertson. (Townsend, 1892b : 126).

C. picticornis Townsend
South Florida, Feb. 16, Apr. 4, Robertson. (Townsend, 1892b : 126).

C. violae Townsend
Inverness, Fla., Feb. 16, Mar. 26, Robertson. (Townsend, 1892b : 126).
Florida. (Johnson, 1913 : 72).

Chaetophleps Coquillett

C. n. sp.[4]
Gainesville, Fla., 7/18/38, R. J. Wilmot, AES 8522. Four larvae emerged from a roach, *Periplaneta americana* (L.).
Gainesville, Fla., 9/19-23/55, L. A. Hetrick, P-280G. U.V. light trap. 1 spm.

Chaetophlepsis Townsend

C. townsendi (Smith)
Miami, Fla., Oct. 27, Townsend. [♂ holotype] and
Ft. Meade, Fla., Aug. 30, 1919. [♀] (Reinhard, 1952 : 16).

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[4] "Poor condition, all wings broken, but apparently a new species. Very few records from cockroaches of any kind."—C. W. S.

Alachua Co., Fla., 11/7/38, H. Hixon.
Gainesville, Fla., 9/19-23/55, L. A. Hetrick, P-280H. U.V. light trap. 1 spm.
Gainesville, Fla., 10/6-14/55, L. A. Hetrick, P-282H. U.V. light trap. 3 spm.

Chaetostigmoptera Townsend

C. crassinervis (Walton)
Gainesville, Fla., 9/19-23/55, L. A. Hetrick, P-280F. U.V. light trap. 1 spm.

Cholomyia Bigot

C. inaequipes Bigot
Gainesville, Fla., 9/19-23/55, L. A. Hetrick, P-280A. U. V. light trap. 3 spm.
Gainesville, Fla., 10/6-14/55, L. A. Hetrick, P-282A. U.V. light trap. 5 spm.

Chrysotachina Brauer and Bergenstamm

C. alcedo (Loew)
Gainesville, Fla., 9/2/54, C. N. Patton, P-224. Six flies reared from between 30 and 40 larvae of *Urbanus proteus* L. Four more pupae were attacked by a fungus and were discarded.
Gainesville, Fla., 10/6-14/55, L. A. Hetrick, P-282C. U.V. light trap. 2 spm.

Cistogaster Latreille

C. immaculata Macquart
"This species ranges from Alberta to Quebec in Canada, Illinois to Texas east to the Atlantic Coast in the United States." (Brooks, 1945 : 230). [Fattig also recorded it from Georgia.]

Cnephalomyia Townsend

C. floridana Townsend
White Springs, Fla., Oct.-Nov., Townsend. (Johnson, 1913 : 73).
Miami and White Springs, Fla., Oct.-Nov., 1908, Townsend. (Townsend, 1912 : 113. orig. desc.).

Copecrypta Townsend

C. ruficauda (Van der Wulp)
Lake Worth, Fla., Mrs. Slosson. (Johnson, 1913 : 74).

Cryptomeigenia Brauer and Bergenstamm

C. sp.
Gainesville, Fla., 5/15-20/55, L. A. Hetrick, P-274D. U.V. light trap. 1 spm.

Cuphocera Macquart

C. hirsuta (Townsend)
Alachua Co., Fla., 3/5/55, H. V. Weems. At *Melilotus alba.*

Cylindromyia Meigen

C. binotata (Bigot)
Gainesville, Fla., 5/5/55, C. N. Patton.

C. fumipennis (Bigot)
Otter Creek, Fla., 10/1/55, C. N. Patton, P-261N. On *Polygonum hydropiperoides.*
Avon Park, Fla., 3/26/54, F. W. Mead, SPB.

Doryphorophaga Townsend

D. australis Reinhard
Gainesville, Fla., 6/30/37, CED. Ex potato beetle.

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[5] "Described from Ohio and Texas and recorded from Long Island, N. Y."—C. W. S.

D. sedula Reinhard [5]
Gainesville, Fla., 4/20-23/55, L. A. Hetrick, P-272. U.V. light trap. 1 spm.

Epidexia Townsend

E. pulverea (Coquillett)
Florida. (Coquillett, 1897 : 115. orig. desc.) [as *Masicera*]

E. (n. sp.?)
Alachua Co., Fla., 10/31/?.

Epidexiopsis Townsend

E. orbitalis Townsend
Miami, Fla., Oct. 28, 1908. (Townsend, 1916a : 308. orig. desc.).

Euantha Van der Wulp

E. liturata (Olivier)
Alachua Co., Fla., May 7, 1938, H. Hixon.
Alachua Co., 1027, 1938, CED. [This might mean 10/27/38].

Eucelatoria Townsend

E. armigera (Coquillett)
Gainesville, Fla., 3/19/42, A. N. Tissot, AES 10482. Reared from a larva of *Agrotis ypsilon* (Rothm.). The larva died on 3/23 and two days later, two fly puparia were found. Flies emerged 4/6 and 4/7/42. det. M. T. James, 1945.

E. comosa Van der Wulp
Florida. (Ingram, Jaynes, and Lobdell, 1939 : 657).

E. rubentis (Coquillett)
Gainesville, Fla., 8/11/55, C. N. Patton.
Gainesville, 9/1/55, C. N. Patton.
Gainesville, Fla., 7/30-8/3/55, L. A. Hetrick, P-277B. U.V. light trap. 7 spm.

E. sp. (? dark *rubentis* Coq.)
Gainesville, Fla., 3/20/55, C. N. Patton, P-236. Two dozen larvae of *Pseudaletia unipuncta* (Haw.) collected on above date. Flies emerged: 2 on 4/6/55, 1 on 4/7/55, 1 on 4/11/55.

Eucordyligaster Townsend

E. minuscula (Van der Wulp)
Gainesville, Fla., 10/3/53, C. N. Patton. Resting on azaleas.
Highlands Hammock State Park, Fla., 3/15/52, H. V. Weems.

Euphasiopteryx Townsend

E. dominicana (Townsend)
Biscayne Bay, Fla., Mrs. Slosson; Hollywood, Fla., March 2, 1939, W. Benedict. (Sabrosky, 1953 : 295).

E. ochracea (Bigot)
Gainesville, Fla., 9/17/38, R. J. Wilmot, AES 8343.
Florida—Belleair, Ft. Drum, Ft. Myers, Hollywood, Morrison Field, and So. Miami. (Sabrosky, 1953 : 299).

Euthera Loew

E. tentatrix Loew
Worthington Springs, Fla., 7/18/47, P. W. Calhoun, AES 9311. Reared from an adult bug—*Euschistus servus* Say, collected on cotton. Fly emerged 7/27/47.
Gainesville, Fla., 7/20-23/55, L. A. Hetrick, P-276B. U.V. light trap. 1 spm.

Gainesville, Fla., 9/12-18/55, L. A. Hetrick, P-279C. U.V. light trap. 1 spm.

Eutheresia Townsend

E. sp.
Gainesville, Fla., 10/6-14/55, L. A. Hetrick, P-282J. U.V. light trap. 1 spm. det. H. J. Reinhard.

Eutrichopoda Townsend

E. abdominalis Townsend
Panama City, Fla. (Sabrosky, 1950 : 336).

Exopalpus Van der Wulp

E. n. sp. nr. *smithi* (Van der Wulp)[6]
Alachua Co., Fla., 4/17/38.

Exorista Meigen

E. mella (Walker) (*larvarum* of American authors)
Gainesville, Fla., 5/22/55, C. N. Patton, P-244. Sixteen flies reared from the pupae of *Estigmene acrea* (Drury). One or two is the usual number from one host pupa, but I have seen three. Parasite larvae emerge from host pupae and pupate in soil.
Live Oak, Fla., 5/20/55, C. N. Patton, P-246. Fourteen flies emerged from cage of 33 *Estigmene acrea* (Drury) larvae and pupae.
Marianna, Fla., 5/19/51, W. W. Glenn, AES 9991. Two specimens reared from about 6 hosts—*Apantesis phyllira* Drury.
Gainesville, Fla., 4/12/48, A. N. Tissot, AES 9941A. Reared from *Estigmene acrea* (Drury), larvae collected in lupine fields. [See AES 9488. Out of 6 parasitized larvae, 24 larvaevorids were reared, the above species and *Gymnocarcelia ricinorum* (Tns.).]
Live Oak, Fla., 4/6/51, AES 9892. About 17 flies reared from larvae? of *Apantesis phyllira* Drury. Only 1 moth obtained from some 20 larvae.

Frontiniella Townsend

F. parancilla Townsend
Crestview, Fla., 8/1/47, F. W. Barber, AES 9930. Reared from pupae of *Tetralopha scortealis* (Led.). Fly puparia formed within pupae of the moths.

Gaediopsis Brauer and Bergenstamm

G. flavipes Coquillett
Otter Creek, Fla., 10/1/55, C. N. Patton, P-261K. On *Polygonum hydropiperoides.*

Genea Rondani

G. aurea James
Monticello, Fla., 7/26/14, A. I. Fabis. Bred from *Tetralopha subcanalis* Wlk. (James, 1943 : 112. orig. desc.).

Goniomima Townsend

G. luteola (Coquillett)
Pelican Lake and Belle Glade, Fla., May 3, 1955, D. D. Questal. From *Leucania* sp. on sugar cane.

Guerinia Robineau-Desvoidy

G. simulans (Meigen)
Gainesville, Fla., spring, 1954, C. N. Patton, P-233. Parasites of a small sawfly on *Fraxinus* sp.

[6] "This is the species recorded as *Nemoraea smithi* in Johnson's 'Diptera of Florida' (1913). If one from Mexico is correct as *smithii*, the Florida species is slightly different."—C. W. S.

Gymnocarcelia Townsend

G. ricinorum Townsend
Gainesville, Fla., 10/12/53, C. N. Patton, P-200C. Eleven specimens reared from cage of 50 *Estigmene acrea* (Drury) larvae.
Gainesville, Fla., 11/22/53, C. N. Patton, P-201. Four parasite larvae emerged from a single isolated prepupa of *E. acrea* (Drury).
Gainesville, Fla., 4/9/48, G. W. Dekle, AES 9939. Eight flies reared from single larva of *Estigmene acrea* (Drury).
Gainesville, Fla., 5/15/55, C. N. Patton, P-243. Twenty-nine flies reared from larvae of *Estigmene acrea* (Drury).
Live Oak, Fla., 5/17/55, J. E. Brogdon, P-245. Twenty-four flies reared from 33 larvae of *Estigmene acrea* (Drury).

Gymnoerycia Townsend

G. rubra Townsend
Miami, Fla., 11/16/08, Mrs. Townsend. (Townsend, 1916a : 313. orig. desc.).

Houghia Coquillett

H. septipennis Coquillett
Gainesville, Fla., 9/12-18/55, L. A. Hetrick, P-279J. U.V. light trap. 1 spm.
Gainesville, Fla., 9/19-23/55, L. A. Hetrick, P-280K. U.V. light trap. 1 spm.

Juriniopsis Townsend

J. adusta (Van der Wulp)
Gainesville, Fla., 10/5/55, C. N. Patton, P-267. Three empty puparia found in larval skin of *Ecpantheria deflorata* F.

J. floridensis Townsend
Sebring, Fla., 6/26/53, H. V. Weems.

Leschenaultia Robineau-Desvoidy

L. leucophrys (Wiedemann)
Gainesville, Fla., 3/31/38, A. N. Tissot, AES 8147A. Reared from larvae of *Estigmene acrea* (Drury).
Gainesville, Fla., 4/27/44, AES 10231. Reared from larvae or pupae of *Euchaetias egle* Drury collected on climbing milkweed. det. CNP.

Leskiella James

L. brevirostris James
Florida. (James, 1943 : 97. orig. desc.).

Leskiomima Brauer and Bergenstamm

L. cinerea James
Orlando, Fla., Jan., 1930, D. J. Nicholson. (James, 1943 : 101. orig. desc.).
Alachua Co., Fla., 2/13/54, SPB.

L. tenera (Wiedemann)
Monticello, Fla., J. B. McGill. Reared from *Acrobasis juglandis* (LeB.) larvae. (James, 1943 : 102).

Leskiopalpus Townsend

L. depilis (Coquillett)
Everglades National Park, Fla., 12/28/51, H. V. Weems.
Alachua Co., Fla., 4/29/36. Reared from fern roller.
Lake County, Fla., 11/1/53, SPB.

(*To be Continued*)

FURTHER NOTES ON PUBLIC HEALTH SERVICE QUARANTINE ENTOMOLOGY

JOHN E. PORTER [1]

Beginning early in the 14th century, the city of Venice required all ships desiring trade with its people to remain at anchorage for forty days prior to docking. The word quarantine (derived from the Italian *quarantina*, meaning forty) has come, since this time, to connote not 40 days of isolation but rather a system or type of scientifically established restrictions involving in some cases, embargoes and in others, treatments and inspections of peoples, cargoes and/or carriers.

Only in comparatively recent times have entomological quarantines achieved recognized standing. Representatives of various European countries, in 1881, agreed upon certain measures to limit the area of destruction occasioned by the importation from America of the grape phylloxera.

California, in 1886, was the first of our states to take action to prevent the introduction of agricultural pests and plant diseases from foreign countries or other states. The Federal Plant Quarantine Act of 1912 established regulations covering international commerce.

Public Health entomology since 1900 has operated to control insect vectors of disease arriving at United States ports in ships. The establishment of codified federal regulations in 1941 gave a definite entity to the public

TABLE 1.—ORDERS OF INSECTS COLLECTED FROM AIRCRAFT—MIAMI, FLORIDA JULY 1, 1956, THROURH JUNE 30, 1957.

Order	Number or Families	Number of Specimens
Thysanura	1	1
Ephemeroptera	1	11
Odonata	1	1
Orthoptera	6	125
Isoptera	1	1
Dermaptera	2	4
Psocoptera	1	4
Thysanoptera	1	1
Hemiptera	11	65
Homoptera	7	115
Coleoptera	25	217
Trichoptera	1	2
Lepidoptera	13	324
Diptera	34	7567
Hymenoptera	13	191
Totals:	118	8629

[1] Entomologist, U.S. Quarantine Station, Miami Beach, Florida, Division of Foreign Quarantine, Public Health Service, U.S. Department of Health, Education, and Welfare.

TABLE 2.—MOSQUITOES RECOVERED FROM AIRCRAFT, MIAMI INTERNATIONAL AIRPORT—MIAMI, FLORIDA, JULY 1, 1956, THROUGH JUNE 30, 1957.

Species	Alive	Knocked Down	Dead
Culicidae	—	—	5
Aedes sp.	3	1	78
A. sp. (prob.) *euiris*	—	—	1
A. sp. (prob.) *tortilis*	—	—	3
A. albifasciatus	—	—	2
A. obturbator	—	—	1
A. sollicitans	2	—	18
A. taeniorhynchus	88	18	728
A. tortilis	—	—	2
Aedomyia squammipennis	—	—	1
Anopheles sp.	—	—	10
A. (*Nyssorhynchus*) sp.	—	—	4
A. sp. (prob.) *albimanus*	—	—	3
A. sp. (prob.) *crucians*	—	—	1
A. sp. (prob.) *grabhamii*	—	—	1
A. sp. (prob.) *quadrimaculatus*	—	—	1
A. albimanus	1	—	10
A. albitarsis	—	—	1
A. crucians	—	—	9
A. grabhamii	1	—	11
A. quadrimaculatus	1	—	1
A. neomaculipalpus	—	—	1
A. vestitipennis	—	—	1
Culex sp.	23	—	79
C. (*Melanoconion*) sp.	4	—	57
C. sp. (prob.) *nigripalpus*	1	—	—
C. sp. (prob.) *quinquefasciatus*	2	—	6
C. sp. (prob.) *tarsalis*	2	—	1
C. nigripalpus	9	—	4
C. pilosus	—	—	1
C. quinquefasciatus	163	47	94
C. tarsalis	2	2	1
Culiseta sp.	—	—	3
Mansonia sp.	1	—	21
M. flaveolus	—	—	3
M. indubitans	—	—	10
M. titillans	1	—	17
Psorophora sp.	—	—	3
P. ciliata	—	—	1
P. confinnis	1	—	21
P. pygmaea	—	—	4
Totals:	305	68	1219

health quarantine entomology program. The details of this program were published in the June, 1957, issue of the FLORIDA ENTOMOLOGIST.[2] Briefly, the U. S. Public Health Service has pioneered the development and improvement of aircraft disinsectization to destroy vectors of disease (and also some potential agricultural pests). It is responsible for establishing the federal regulations we follow governing in-flight spraying of aircraft and the inspection of airplanes after their arrival at United States airports, along with the entomological surveillance of these airports.

The Public Health Service maintains certain inspectional and control facilities against *Aedes aegypti* mosquitoes in southern United States. This entails searching and spraying of aircraft and ships arriving from yellow fever suspect or endemic ports along with the control of mosquito breeding at airport and in the dock areas.

The reports of insect recoveries made by our sanitary inspectors at the various airports of entry have proved to be useful data for analysis by authorities throughout the world, interested in the possible threats to their countries of insects "hitch-hiking" aboard airplanes.

Some of our recent findings, as shown in the Tables 1-4, indicate to some extent the variety of insects found aboard planes and ships.

It can be seen from these tables that insects of all kinds are capable of being transported by aircraft and ships. Many insects arrive in Miami in a condition satisfactory for further propagating the species and would possibly do so if our inspectors did not apply terminal disinsectization in most instances. Thus, there is a necessity to maintain a continuing alertness and defense against these potential threats of disease and destruction.

TABLE 3.—ORDERS OF INSECTS RECOVERED FROM SHIPS, MIAMI, FLORIDA *

Order	Number of Families	Number of Specimens
Thysanura	1	5
Collembola	1	1
Ephemeroptera	1	3
Orthoptera	3	8150
Dermaptera	2	61
Psocoptera	1	31
Thysanoptera	1	1
Hemiptera	6	79
Homoptera	3	11
Coleoptera	17	173
Lepidoptera	5	53
Diptera	22	6603
Hymenoptera	7	7618
Totals:	70	22789

* Data taken from inspection records of Miami Quarantine Station, November, 1945 - May, 1946; May, June, August and September, 1950, and July 17, 1957.

[2] Porter, John E., 1957. The development of public health Service quarantine entomology and its program in South Florida. Fla. Entom. 40(2): 45-49.

TABLE 4.—MOSQUITOES RECOVERED FROM SHIPS, MIAMI, FLORIDA *

Species	Alive	Dead
Culicidae	—	4
Aedes sp.	1	1
A. aegypti (larvae)	2	—
A. aegypti	8	1
A. sollicitans	3	1
A. taeniorhynchus	15	30
Anopheles sp.	—	1
Anopheles sp., prob. *albimanus*	—	1
A. albimanus	—	2
A. crucians	—	1
Culex sp.	1	15
C. nigripalpus	—	1
C. quinquefasciatus	42	11
Totals:	72	69

* Data taken from inspection records of Miami Quarantine Station, November, 1945 - May, 1946; May, June, August and September, 1950, and July 17, 1957.

A BOX TURTLE FATALITY APPARENTLY CAUSED BY SARCOPHAGA CISTUDINIS LARVAE: On February 10, 1957, a specimen of *Terrapene carolina* was collected near Gainesville, Florida. Examination of its neck region revealed two large and two small wounds surrounded by several large swellings each packed with fly larvae, thirty-five of which were removed from the wounds and reared to adults. Approximately 36 larvae remained in the swellings. These larvae later left the wounds and pupated. The adults were identified as *Sarcophaga cistudinis* Ald.[1] The turtle was cared for in captivity for four and one-half weeks, at which time it died. Apparently the damage caused by the larvae (total number of larvae counted was 71) was extensive enough to cause the death of the turtle. Wayne King and James V. Griffo, Jr., Department of Biology, University of Florida.

[1] Identification made by Mr. W. L. Downes, Entomological Research Service, U.S.D.A., Beltsville, Maryland.