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EFFECT OF RADIOPHOSPHORUS (P^{32}) ON LIGHT RESPONSE OF *AEDES AEGYPTI* (L.) LARVAE

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Radioisotopes have been used with great success in tracing particular elements. The need for effective markers in ecological studies has led to the use of radioactive materials as markers of individual animals in dispersal studies, measurement of population densities, and behavior examinations. Tagging with radioisotopes rather than conventional pigments and dyes has definite advantages. Pigments may rub off, fade, or be eliminated during molting. Examination of large groups of insects for specially colored individuals can be a tedious task. Radioisotopes administered internally either by feeding or injection provide an internal tag that will not rub off and that permits rapid counting of large populations.

There are several disadvantages to the use of radioisotopes. Toxicity to individuals can be a problem if a high level of radiation is present since it will not only reduce the number of labelled insects but also cause errors in interpretation of results. Another possible disadvantage is change in behavior of the labelled insect contrasted with the unlabelled one.

The recent monograph by O'Brien and Wolfe (1964) includes the most comprehensive review of work utilizing radioisotopes in entomology. Studies on foraging intensity of honey bees by Lee (1965) utilized P^{32} and I^{131}. A dose of 1 mc of P^{32} per colony (1 mc/2 quart solution) produced a significant effect on distribution of foragers from the hive. An effect was also shown with a 1.5 mc dose of I^{131}. Hassett and Jenkins (1949) reared larvae of *Aedes aegypti* (L.) in water containing 1 μc P^{32}/ml and produced adults having counts up to 10,000 per minute. Third and fourth instars were successfully tagged, younger larvae were too sensitive, and pupae absorbed too little phosphorus. The effects of tagging with P^{32} were studied by comparing stage, age, and P^{32} concentrations. Since concentrations of P^{32} greater than 1 μc/ml were harmful from the standpoint of life history, it was hypothesized that higher concentrations also affected behavior.

Although careful studies of life cycles, longevity, and reproduction have been made, there appear to be no significant reports on behavior of tagged mosquitoes. The purpose of this study was to determine if varying levels of radiophosphorus (P^{32}) had any effect on the light response of tagged *A. aegypti* larvae.

MATERIALS AND METHODS

Aedes aegypti larvae were chosen because they are characteristically negatively phototaxic. Prior to each of three replications, 400 mechanically separated third instar larvae were obtained from the laboratory colony at the USDA Laboratory for Insects Affecting Man and Animals, Gainesville, Florida. One hundred larvae were manually separated into a 400 ml glass beaker for each of the four treatments. Each beaker contained 250 ml. of distilled water.

The four treatments were H_2O, 0.1 μc P^{32}/ml, 5 μc P^{32}/ml, and 1 ml of 0.5 N H_3PO_4. The desired amount of P^{32} (P-32-P-Processed, Carrier Free, as PO_4 in weak HCl, a 0.5 N solution) was calculated and added to two treatments. The volumes added for the 0.1 μc/ml dosage were 25, 28, and 30 μ liters. Those for the 5 μc/ml dosage were 1250, 1370 and 1540 μ liters. Prior to each of the three replications, correction was made for radiodecay. The P^{32} was produced and assayed by Union Carbide which operates the Oak Ridge National Laboratory, Oak Ridge, Tenn., under contract to the Atomic Energy Commission. The larvae were kept in the radioactive solution for 24 hours. At the end of this period they were transferred to fresh water. Each group was fed about 25 mg of crushed dog food.

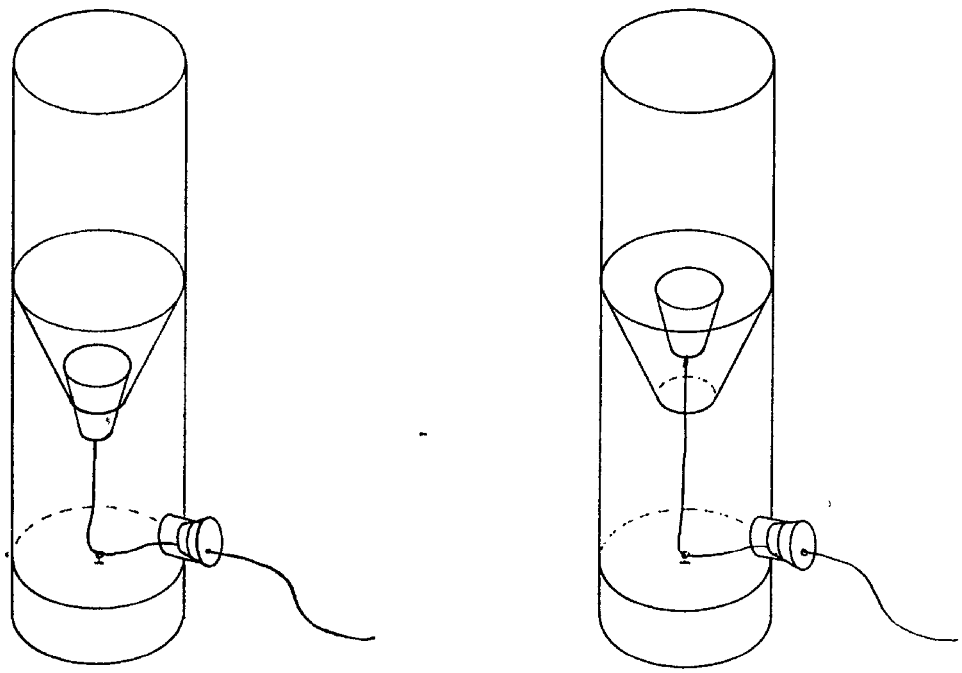

Fig. 1. Cylinder-funnel apparatus. A. Funnel plug in closed position. B. Funnel plug in open position.

For observing response to light, a cylinder equipped with a trap funnel was used (Fig. 1). The cylinder and funnel were made of cellulose acetate and were then mounted on a 6-inch plastic freezer dish. The cylinder was 18 inches deep and the bottom of the funnel was 12 inches from the top. The funnel plug was a truncated cone of plastic, the top of which was ringed with a ½-inch strip of sponge rubber to provide a good seal. The floating plug was manipulated with a string through the drain plug.

At the beginning of the observation the cylinder, which was lighted from below, was filled with water and the funnel was plugged. The larvae were poured from a beaker into the top of the cylinder. All of the treatments were tested in a random sequence. After the larvae quieted, the funnel plug was floated up and the bottom light turned out. A pause of a few seconds was allowed and the top light was turned on for 20 seconds. The funnel was again plugged at the end of this timing. Fig. 1 shows the plug positions during the test. Each treatment was conducted in a dark laboratory with the investigator well away from the apparatus. Water and mosquitoes from the top of the apparatus were siphoned off. The drain plug was pulled and the water and mosquitoes in the bottom of the apparatus were collected. The larvae from the top and bottom were counted.

For counting of radioactivity, eight larvae were taken from the top and bottom of each replication, placed in 2-inch aluminum planchets, and dried under infra-red lamps. A Packard Scaler-Ratemeter, Model 150, with a Nuclear Chicago Geiger-Mueller tube having a 1.4 mg/cm^2 mica window was used for counting. Counts were taken at one-half inch from the tube surface.

Results and Discussion

The data for the three replications are given in Table 1. The larvae, top and bottom, from each of the treatments, were counted for radioactive content to determine if there was any variation in the level at which they had absorbed the isotope. The paired t test on these data showed no significant difference between the radioactivities of the larvae in the top in relation to those in the bottom. Also tested was the dosage variation in tagging levels throughout the replications. No significant difference was found.

TABLE 1.—Larvae Observed in Top and Bottom for Each Replication.

	Check		H_3PO_4		.1 $\mu c/ml$		5 $\mu c/ml$	
Replication	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
1	30	70	22	78	41	59	67	33
2	29	71	27	73	47	53	65	35
3	30	70	29	71	43	57	69	31
Average	29.6	70.3	29.3	74	43.6	56.3	67	33

Comparison of the check in relation to the H_3PO_4 showed no significant difference between these treatments.

For analysis with respect to light response the data were tested by a chi-square with an orthogonal comparison of the treatments. The results of this analysis are given in Table 2.

TABLE 2.—Analysis in Relation to Various Levels of Radiophosphorus.

	d.f.	x^2	P
Check vs. others	1	23.40	.001
H_3PO_4 vs. others	1	70.89	.001
0.1 $\mu c/ml$ vs. 5 $\mu c/ml$	1	33.23	.001

This study indicates that a concentration of radiophosphorus .1 $\mu c/ml$ or greater, affects the light response of *A. aegypti* larvae. Since the effect of phosphorus alone was considered as well as radiophosphorus, the radioactivity must have caused the variation in response and not the phosphorus.

Since radioisotopes are being used so commonly as labelling tools, it is important to understand that their use might alter behavioral patterns and lead to unreliable information. A behavioral change in the larvae of *A. aegypti* does not mean there would be a behavioral change in the adult, but it does open the area to further study.

Tagging mosquitoes for the release-recapture method of population sampling requires that the adults merely be radioactive enough to be detected. This may allow use of concentrations of isotopes below the deleterious levels. Many tagging techniques require the use of very high concentrations of radioactive material. For this reason, the reactions of the specific insect to the chosen radioisotope should be thoroughly studied with relation to behavior and life history prior to any organized research use.

I am indebted to B. G. Dunavant, Assistant Director of Nuclear Sciences, and Gordon Renshaw, Nuclear Technician, for permitting the use of the radiation laboratory facilities and equipment. I also express my gratitude to William Yearian for his suggestions and valuable statistical assistance.

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WIREWORM CONTROL EXPERIMENTS ON POTATOES AND CORN IN SOUTH FLORIDA [1]

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Wireworms became a very serious problem on potatoes in south Florida, beginning about 1940 and they remained serious until the use of chlordane began about 1949. Chlordane, aldrin, and heptachlor were used successfully for about a decade on the species *Melanotus communis* Gyll. Now, however, these insecticides are not as effective as in previous years. A *Conoderus* sp., possibly *C. falli* Lane, is currently present in the shallower marl and rockland soils, and may be spreading to the deeper soils. More complete drainage of the area and a series of seasons with less than average rainfall may have changed conditions to permit the *Conoderus* sp. to live and develop in the deeper marl soils. Where *Conoderus* sp. is involved it is not unexpected that a control problem exists since Reid and Cuthbert (1956) and Norris (1957) reported the species was resistant to the chlorinated hydrocarbons.

The Perrine marl soils which are used for potato production are very finely divided calcareous particles, and range in depth from a few inches to several feet. They overlie oolitic limestone and range in pH from about 7.8 to 8.3. Such high alkalinity may accelerate decomposition of many otherwise effective insecticides.

PREVIOUS WORK

Experiments initiated in 1946-47 (Wolfenbarger, unpublished data) indicated that 65 pounds of DDT per acre gave 50% reduction of wireworm injuries. The soil fumigants D-D and EDB gave less than 60% control. Benzene hexachloride offered promise of control but contaminated the tubers. In 1947-48, chlordane and lindane were first tested; also, cleanly cultivated plots, and plots planted to sesbania, velvet bean, buckwheat, and sesbania mixed with velvet beans as cover crops gave measures of control. Chlordane and aldrin (the latter first used in 1948-49), however, gave the most effective results. Preplanting soil treatments were more effective than post-harvest (spring) applications. It was found that although fertilizer-insecticide combinations were effective, broadcast methods were more effective. These recommendations were practiced by growers who reported few or no wireworm injuries until 1961. In 1962, 1963, and 1964, wireworm injuries again reduced the grade of some lots of potatoes.

Some differences are recognized in control of wireworms affecting corn and potatoes. Wireworms begin feeding on sprouted corn, and within a few days to a month after planting have killed or damaged the plants. Although wireworms damage sprouting potatoes and feed on the seedpieces, the most damaging part of the feeding is on the new potatoes. Such feeding is done on developing tubers and extends until harvest. Control

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[1] Florida Agricultural Experiment Stations Journal Series No. 1927.
[2] Grateful acknowledgement is made to Edith W. Strohm for much assistance in this work.

TABLE 1.—EFFECTS OF INSECTICIDAL TREATMENTS ON WIREWORM INJURY TO POTATOES, 1963-1964.

Material	Formulation lbs./A	Method of application	Injured tubers, %
Phorate, 10G*	30	With tubers at planting*	5.1 a**
Geigy GS-13005, 5G	60	In row	36.5 b
Di-Syston, 10G	20	In row	60.9 c
Bayer 37289, 10G	30	Broadcast	61.3 cd
Aldrin, 5G	80	Broadcast	63.9 cd
Phorate, 10G	20	Broadcast	65.1 cd
Heptachlor, 10G	40	Broadcast	66.0 cd
Diazinon, 10G	20	In row	67.9 cd
Chlordane, 40G	12½	Broadcast	72.1 cd
Kepone, 2% on cornmeal	150	Broadcast	73.4 cd
R-2788, 4E	1 qt.	Drench	75.3 cd
Parathion, 10G	20	In row	76.3 cd
N-2790, 4E	1 qt.	Drench	77.8 d
Check	—	—	75.5 cd

* Results were obtained from four samples obtained from grower-treated areas near the test plots.

** Values followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

TABLE 2.—WIREWORM CONTROL MEASURED IN TERMS OF LIVING CORN PLANTS.

Material	Formulation lbs./A	Method of application	No. plants/100 feet of row
Phorate, 10G	20	In row	134.8 a
Kepone, 2G	100	Broadcast	123.3 a
Geigy GS-13005, 5G	40	In row	122.3 ab
Di-Syston, 10G	20	In row	119.0 ab
Di-Syston, 6E	2 qts.	Drench, over row	118.0 ab
Bayer 38156, 10G	20	In row	115.8 ab
Diazinon, 10G	20	In row	112.5 ab
Shell SD 8530, 5G	50	In row	110.3 ab
Phorate, 10G	10	In row	110.3 ab
Stauffer N-2790, 10G	20	In row	107.5 ab
Stauffer N-2788, 4E	2 qts.	Drench	105.3 ab
Stauffer N-2790, 4E	2 qts.	Drench	99.5 ab
Diazinon, 4E	2 qts.	Drench	99.0 ab
Bayer 37289, 10G	30	In row	87.5 ab
Check	—	—	73.5 b

of wireworms on corn must occur before or immediately after the seed is planted. Control of wireworms affecting potatoes need not begin until a few weeks after planting and protection must be maintained until harvest. Corn is not planted as deeply as potatoes and may be protected by shallow application as contrasted with potatoes.

Methods and Materials

Tests were made usually in commercial plantings in cooperation with growers. Plots ranged in size from single rows 100 feet long to four rows each 25 feet long. There were four replications of each treatment. In the broadcast method, insecticides were scattered by hand over the plots, then worked in the top 2½ inches of soil with disk or tiller. Granulated materials applied in the row were placed in a furrow about 2½ inches wide and 2 inches deep, and covered. By the drench method, emulsion or wettable powder formulations were applied in 1 foot wide bands with a sprinkling can with water at the rate of 500 gallons per acre. Seed was planted the next day or soon thereafter in the above methods. Phorate was omitted from the Experiment Station tests because it was used by the grower all around the test plots. The grower applied granulated phorate with the seed pieces at planting time. Planting was done in November or early December by the grower. Cultivating and spraying were done according to grower practices and were the same over all plots. Sample tubers, 100 or more from each plot, were harvested by hand digging in February or March, and washed for examination. Corn plants were counted periodically to a month after planting, although the data presented in Table 2 were taken a month after planting.

Proprietary materials used in the tests are as follows:

Geigy GS-13005 — 0,0-dimethyl-S-[5-methoxy-1,3,4-thiadiazol-2(3H)-on-3-yl-methyl] dithiophosphate
Di-Syston®—0,0-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
Bayer 37289—O-ethyl 0-2,4,5-trichlorophenyl ethylphosphonothioate
Stauffer R-2788—O-ethyl-S-p-tolyl-ethylphosphonodithioate
Stauffer N-2790—O-ethyl-S-phenylethylphosphonodithioate
Kepone®—decachlorooctahydro-1,3,4-mentheno-2H-cyclobuta [*cd*] pentalen-2-one
Shell SD 8530—3,4,5-trimethylphenyl methylcarbamate
Isolan®—1-isopropyl-3-methyl-5-pyrazolyl dimethylcarbamate
Telodrin®—1,3,4,5,6,7,8,8-octachloro-1,3,3a,4,7,7a-hexahydro-4,7-methanoisobenzofuran.

Results

In the 1962-63 season, broadcast and in-the-row applications gave results indicating no or indefinite control. Broadcast and disked-in applications of the following amounts per acre gave results which were little different from the checks: diazinon, 10G, 40 lb.; phorate, 10G, 30 lb.; heptachlor, 4E, 1 gal.; Di-Syston 10G, 30 lb.; Kepone, 5% on corn meal, 50 lb.; parathion, 10G, 20 lb.; aldrin, 4E, 1 gal.; Isolan 2½G, 160 lb.; and Telodrin 5G, 120 lb. Chlordane formulations of 40W, 40G, and 8E applied to give 6 lb. technical material per acre gave mean values of control that were essentially equal, and were significantly less than the check mean.

Fewer broadcast treatments and more in-the-row treatments were made in the 1963-64 season. Results of wireworm tests on potatoes are given in Table 1.

Thirty pounds of 10G phorate per acre, applied in the furrow with the seed pieces, gave the most satisfactory control. Aldrin, chlordane, and heptachlor, previously satisfactory in control, were comparatively ineffective, and are unsatisfactory in grower practices.

Parathion never controlled wireworms in the experiments, possibly because it was decomposed by the highly alkaline soils.

Results of wireworm control on corn are given in Table 2. More corn plants grew in soil treated with phorate and Kepone than with any other treatment, although there were no significant differences between treatments. Chemically treated plots had more plants than the untreated ones.

SUMMARY

The chlorinated hydrocarbons aldrin, chlordane, dieldrin, and heptachlor are ineffective, so other insecticides are needed for control of wireworms. Phorate, an approved material at 3 pounds technical material per acre on potatoes and 1 pound on corn (although more material would give better control), is currently recommended for wireworm control. In order to be effective, however, it must be placed in the furrows with the seed or seed pieces.

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FOUR NEW PHYTOSEIIDAE (ACARI: MESOSTIGMATA) FROM FLORIDA [1]

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Two of the phytoseiids described in this paper belong to the genus *Cydnodromus* Muma, 1961. This genus has 6 pairs of dorsal setae, 3 pairs of median setae, 8 pairs of lateral setae, most of them short and simple, 2 pairs of sublaterals setae on the interscutal membrane, 3 pairs of sternal setae and 3 pairs of preanal setae. Leg IV may have 1 or no macrosetae (Muma 1961). Most of the species that belong to this genus are found in litter or on low growing plants but are found occasionally on plants several feet above ground level. Living mites are off-white to very light tan and small in size. Most phytoseiids are thought to be predaceous, but the food habits of these 2 species are unknown.

Two of the species belong to the genus *Amblyseius* Berlese, 1914. This genus has 6 pairs of dorsal setae, 3 pairs of median setae, 8 pairs of lateral setae, some elongate and weakly plumose, 2 pairs of sublaterals setae on the interscutal membrane, 3 pairs of sternal setae, and 2 or 3 pairs of preanal setae. Leg IV has 3 macrosetae (Muma 1961). The species in this genus may be found in litter, on low growing plants, and on plants several feet above ground level. The food of these species is unknown, but they are probably predaceous on small arthropods. The live mite is medium size and off-white in color.

The modified Garman system of setal designation, except in the case of the median setae, is used in this paper. If a pair of setae on the middle third of the dorsal scutum, L_5 of authors, lies distinctly mesad to a pair of marginal lateral setae, it is considered median; if only 1 pair of setae is present or it is not distinctly mesad, it is considered lateral. The above characters refer to females; data on males are incomplete for many species.

All drawings and measurements were made with a phase contrast compound microscope at 1200 magnifications for leg IV and 800 magnifications for all other illustrations.

Cydnodromus vagus new species

(Fig. 1)

Cydnodromus vagus is similar to *C. gracilis* (Muma) but differs in the shape of the spermatheca and spermatodactyl.

FEMALE HOLOTYPE: Dorsal scutum smooth, 322.4 μ long and 139 μ wide at L_4, with 8 laterals, 3 medians, and 6 dorsal pairs of setae. All setae smooth. Peritreme extends forward nearly to D_1. Sternal shield longer than wide, smooth, and with 3 pairs of setae and 2 pairs of small pores. Metapodal scuta elongate, narrow, and slightly curved. Ventrianal shield slightly reticulated with 3 pairs of setae. Basitarsus of leg IV bears a distinct macroseta. Spermatheca with cervix bell-shaped and atrium long and slightly knobbed.

MALE: Unknown.

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[1] Contribution No. 43, Entomology Section.

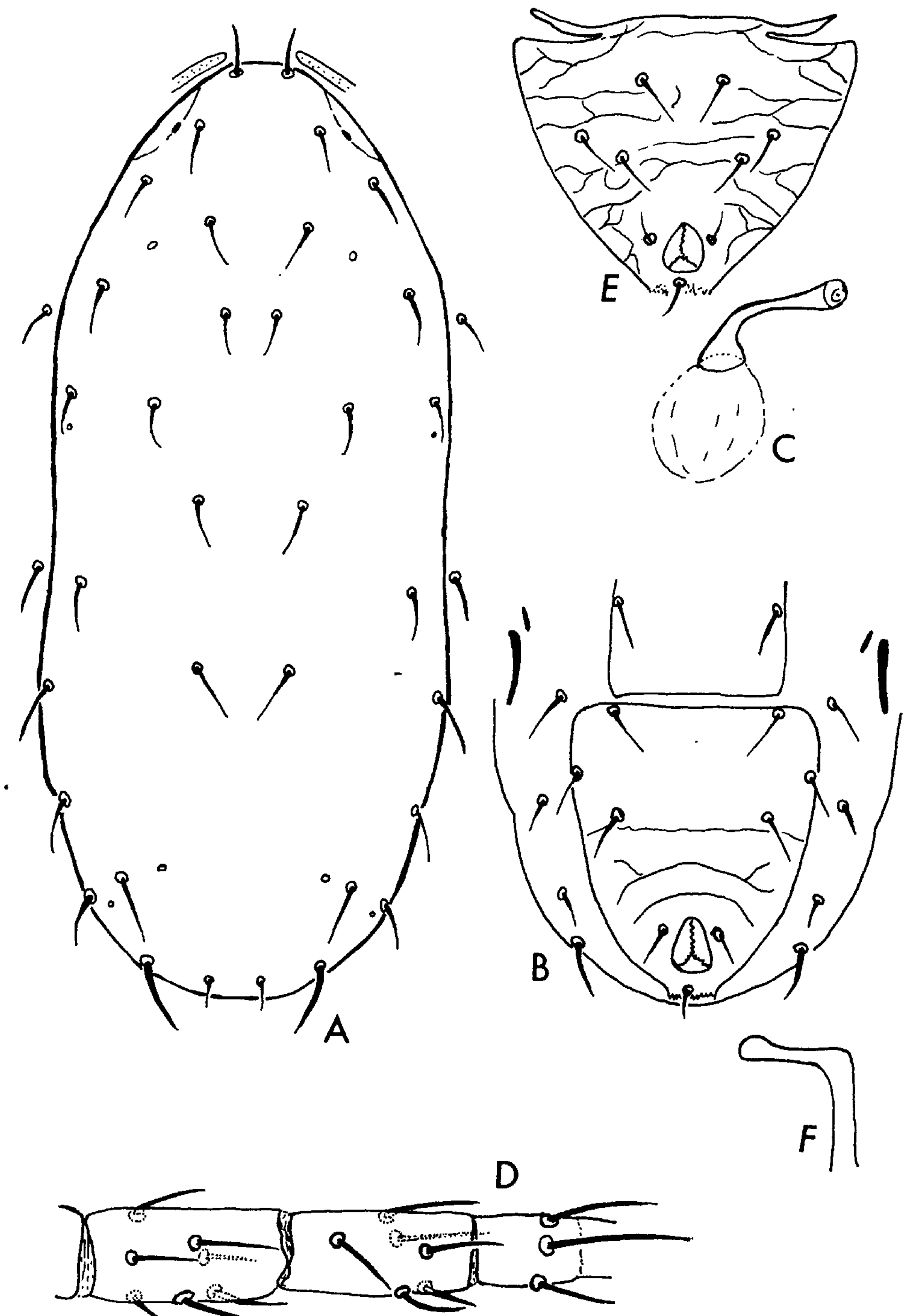

Fig. 1. Female *Cydnodromus vagus*, n. sp. A. Dorsal scutum. B. Ventrianal scutum with metapodal scuta. C. Spermatheca. D. Leg IV. E. Male ventrianal scutum. F. Spermatodactyl.

Holotype: Welaka, Fla., 8 April 1964 (H. A. Denmark), on *Lyonia ferruginea*; type no. 3114 in the U. S. National Museum.

Paratypes: Welaka, Fla., 8 April 1964 (H. A. Denmark), one female on stagger bush, *Lyonica ferruginea*, and one female in litter of *Pinus* sp. and *Gordonia lasianthus*. Twenty-four females, 27 males (one designated as the allotype), and nine nymphs at Quincy, Fla., 12-13 April 1964 (H. A. Denmark), from Bermuda grass sod. All paratypes in the Florida State Collection of Arthropods, Gainesville.

Cydnodromus mumai new species

(Fig. 2)

This species is closely related to *C. paspalivorus* De Leon from which it may be distinguished by the proportionately longer L_1, L_2, L_3, L_7, L_8, M_3 and the macroseta on basitarsus IV.

FEMALE HOLOTYPE: Dorsal scutum distinctly reticulated, 337.5 μ long and 150.0 μ wide at L_4, with 8 lateral, 3 median, and 6 dorsal pairs of setae and at least 7 small pores. All setae shorter than the distance between them and simple except L_8 which is longer and serrate. Scapular setae 1 and 2 short, simple, and on the membrane; S_1 longer than S_2. Longitudal reticulations extend from D_3 to a point halfway between D_5 and M_3. Peritreme extends forward nearly to D_1. Fixed digit chelicerae with 7 teeth and *pilis dentilis*. Sternal shield much longer than wide, reticulated, and areolae formed by the reticulations much longer than wide, and 3 pairs of setae; ventrianal shield reticulated with 3 pairs of setae and a pair of small pores. Metasternal scutum and metapodal scuta as shown. Basitarsus of leg IV bears a distinct macroseta. Spermatheca with cervix bowl-shaped and atrium short and knobbed.

MALE: Dorsal scutum 269.9 μ long, 130.8 μ wide at D_4; reticulated and with pores as in female. Ventrianal shield with 3 pairs of preanal setae and 6 small pores. Spermatodactyl as illustrated.

Holotype: Female, St. Petersburg, Fla., 17 Nov. 1958 (C. E. Bingaman), on *Arecastrum romanzoffianum* fronds; type no. 3115 in the U. S. National Museum.

Paratypes: One female, St. Petersburg, Fla., 17 Nov. 1958 (C. E. Bingaman), on *Arecastrum romanzoffianum* fronds, and one male, Arcadia, Fla., 29 Oct. 1958 (G. P. Lamb), on *Arecastrum romanzoffianum* fronds, both in the Florida State Collection of Arthropods, Gainesville.

This mite is named in honor of Dr. Martin H. Muma.

Amblyseius digitulus new species

(Fig. 3)

This species resembles *A. dillus* (De Leon), but differs in that L_8 and M_3 are longer and only slightly serrate, and the spermatheca is distinct in having a cleft atrium. Both spermatheca are illustrated in Fig. 3.

FEMALE HOLOTYPE: Dorsal scutum reticulated, 330 μ long, 203 μ wide at L_4, with 8 laterals, 3 medians, and 6 dorsal pairs of setae. All setae smooth except L_8 and M_3 are slightly serrated. Peritreme extends forward to D_1. Sternal slightly wider than long, smooth, with a pair of pores, and 3 pairs of setae. Metapodal scutum as illustrated. Ventrianal scutum

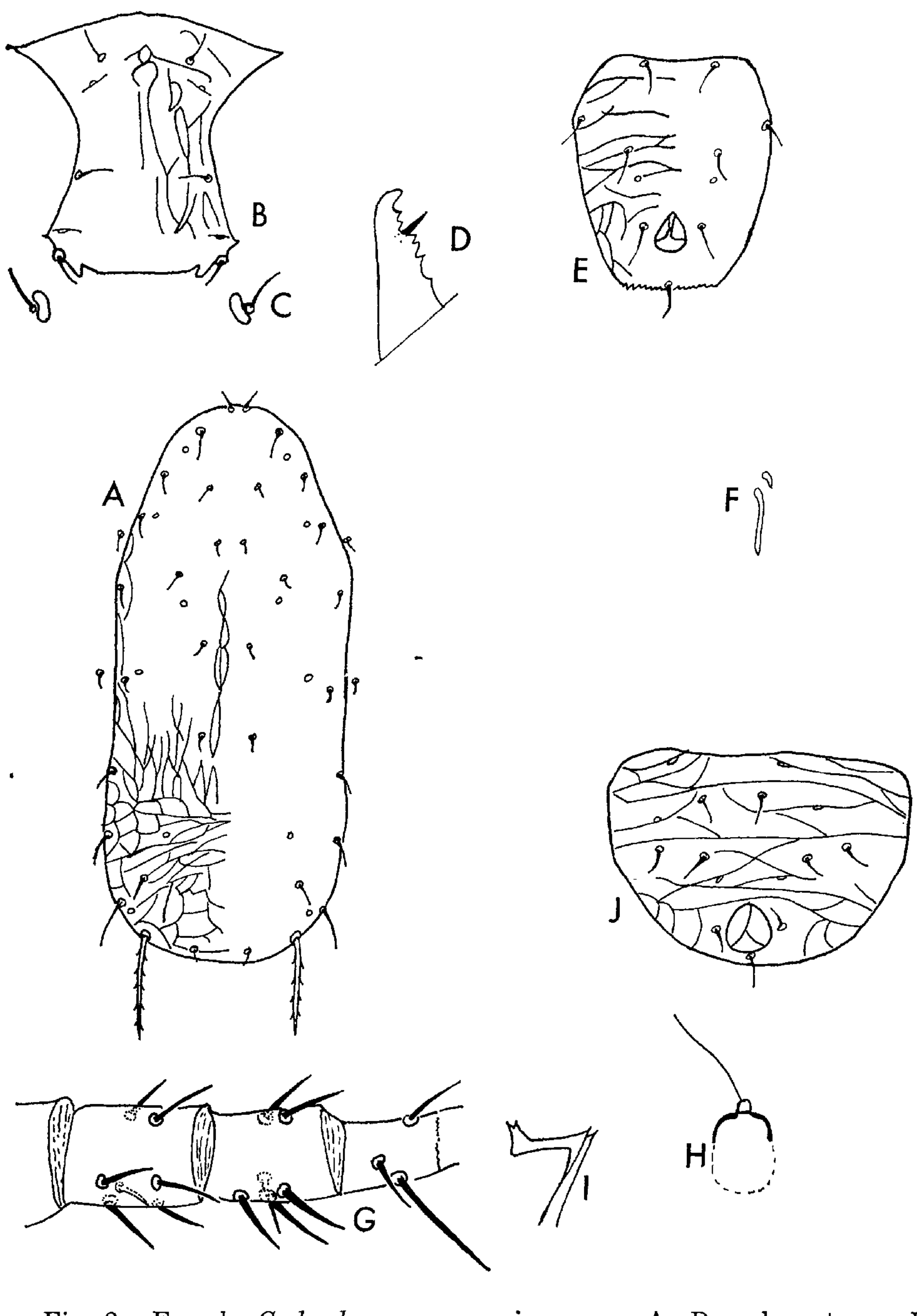

Fig. 2. Female *Cydnodromus mumai*, n. sp. A. Dorsal scutum. B. Sternal scutum. C. Metapodal scuta. D. Fixed digit chelicerae. E. Ventrianal scutum. F. Metasternal scuta. G. Leg IV. H. Spermatheca. I. Spermatodactyl. J. Male ventrianal scutum.

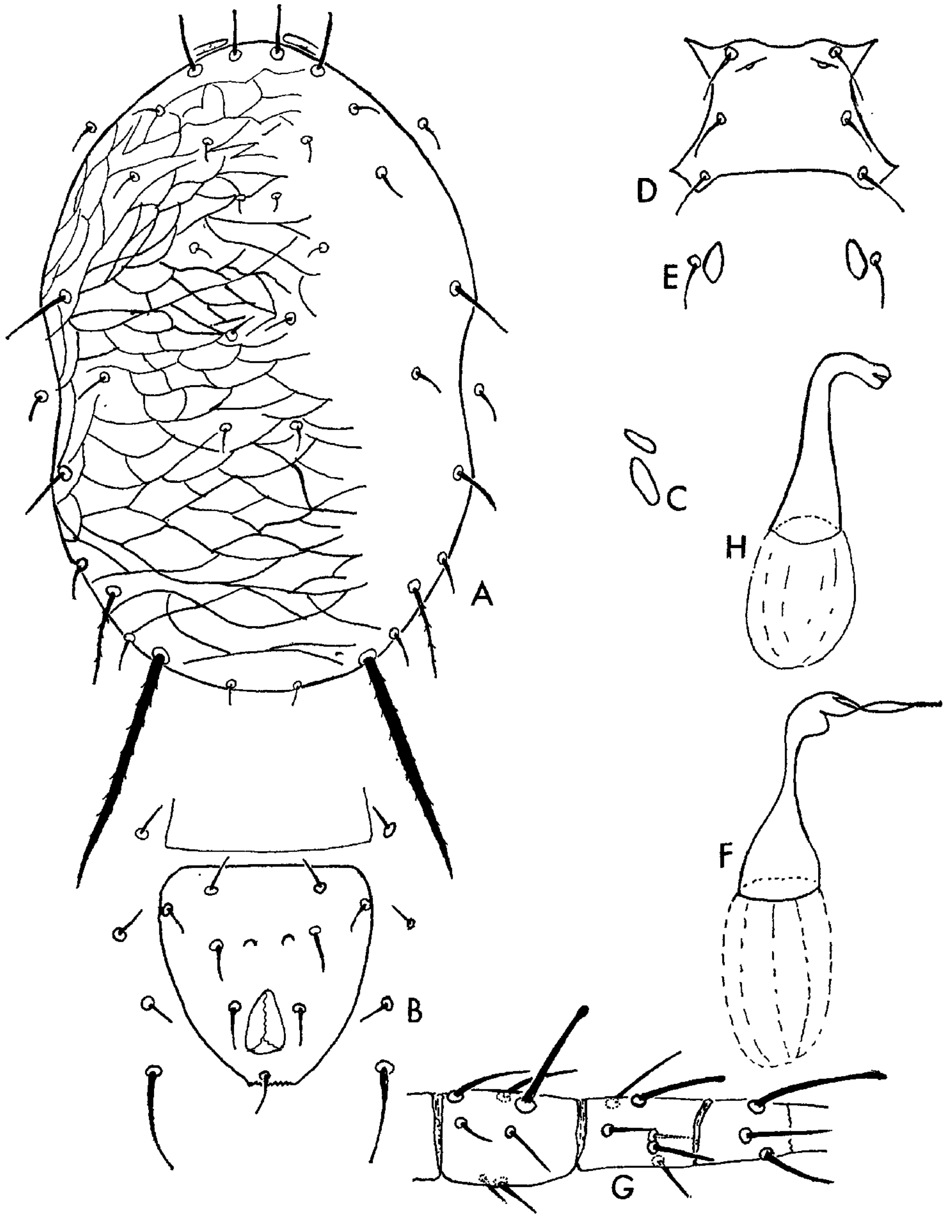

Fig. 3. Female *Amblyseius digitulus,* n. sp. A. Dorsal scutum. B. Ventrianal scutum. C. Metapodal scuta. D. Sternal scutum. E. Metasternal scuta. F. Spermatheca. G. Leg IV. H. Spermatheca of *Amblyseius dillus* (De Leon).

smooth with a pair of pores and 3 pairs of setae. Leg IV has macrosetae on the genu, tibia, and basitarsus. Spermatheca bell-shaped with elongated atrium enlarged and cleft at distal end.

MALE: Unknown.

Holotype: Female, 2 miles south of Winter Garden, Orange County, Fla., 2 April 1963 (H. A. Denmark), on Bermuda grass, *Cynodon dactylon;* type no. 3116 in the U. S. National Museum.

Paratypes: Two females, 2 miles south of Winter Garden, Orange County, Fla., 2 April 1963 (H. A. Denmark), on Bermuda grass; one female, 6 miles north of Polk City, Polk County, Fla., 7 May 1963 (H. A. Denmark), in *Paspalum notatum* sod; in the Florida State Collection of Arthropods, Gainesville.

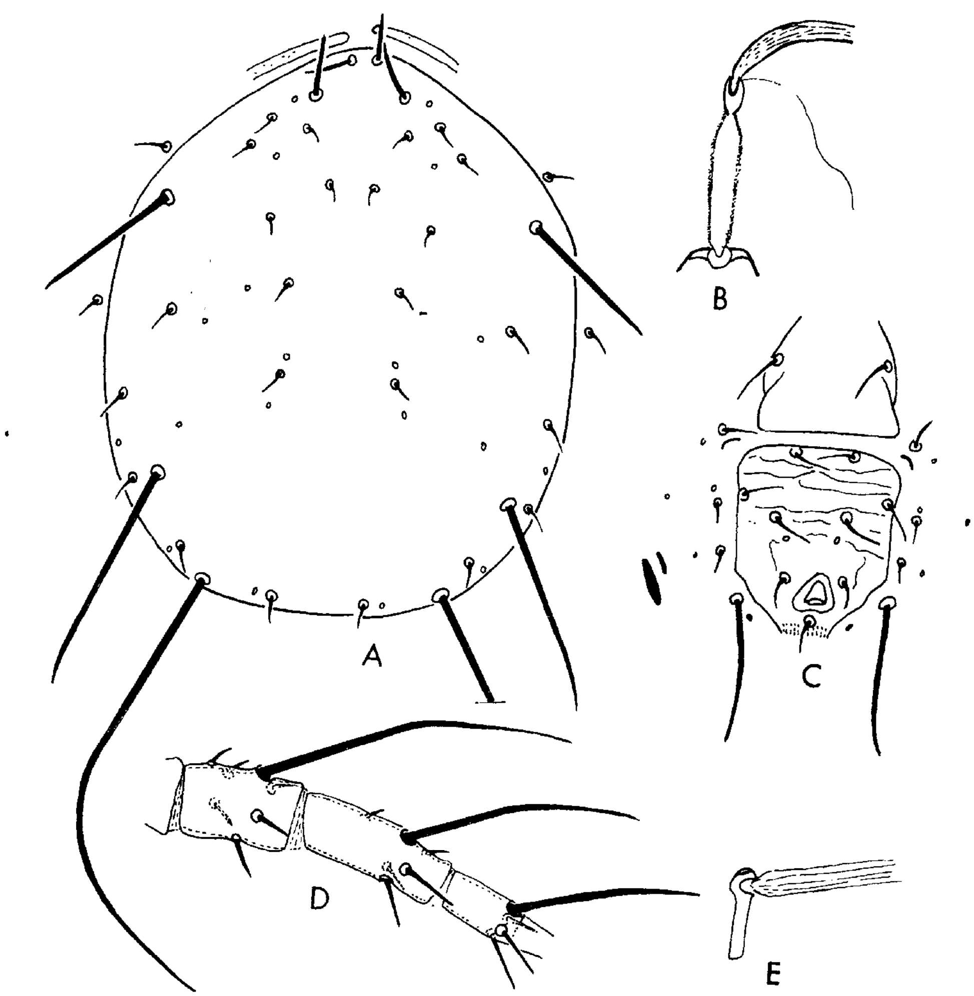

Fig. 4. Female *Amblyseius rhabdus*, n. sp. A. Dorsal scutum. B. Spermatheca. C. Ventrianal scutum. D. Leg. IV. E. Spermatheca of *Amblyseius aerialis* Muma.

Amblyseius rhabdus new species
(Fig. 4)

This species is similar to *Amblyseius aerialis* (Muma) but differs by having L_2 and L_3 approximately the same length. L_2 is longer than L_3 in *aerialis*. D_2, D_3, D_4, and M_1 minute in *aerialis*, but longer in *rhabdus*. The spermathecae are quite distinct for these two species.

FEMALE HOLOTYPE: Dorsal scutum smooth, 365 μ long and 266 μ wide at L_4, with 8 laterals, 3 medians, 6 dorsals, 2 sublaterals, and 9 pores. All setae smooth except M_3 and L_8 are slightly serrate. L_1 longer than D_1, all other setae approximately the same size except L_4, L_8, and M_3 are long and thick. Peritreme extends anteriorly to D_1. Chelicerae with movable digit without teeth, fixed digit with 10 or eleven teeth and *pilis dentilis*. Sternal scutum approximately as wide as long slightly creased with 3 pairs of setae and 2 pairs of pores. Metasternal plate elongate, each with a seta. Two pairs of metapodal plates. Ventrianal shield slightly longer than wide, creased with 3 pairs of preanal setae and one pair of pores. Leg IV with macrosetae on the genu, tibia, and basitarsus. Spermatheca with rod shaped cervix and flared base; major duct broad and minor duct appearing as a thin black thread attached at atrium.

Holotype: Female, Gainesville, Fla., 1 Oct. 1964 (H. A. Denmark), in sod of St. Augustine grass, *Stenotaphrum secundatum*; type no. 3113 in the U. S. National Museum.

Paratypes: One female and 5 nymphs, Gainesville, Fla., 1 Oct. 1964 (H. A. Denmark), in sod of St. Augustine grass, *Stenotaphrum secundatum*; one female 4 miles north of Polk City, Polk County, Fla., 9 Jan. 1962 (M. H. Muma), in cup of *Sarracenia* sp.; in the Florida State Collection of Arthropods, Gainesville.

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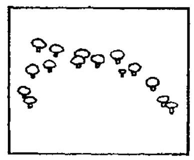

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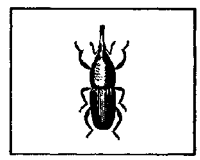

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FLORIDA'S 1964 CITRUS HONEY CROP[1]

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The devastating damage to citrus trees caused by extremely low temperatures in December 1962 resulted in a near failure of the 1963 citrus honey crop (Robinson 1963). It has been generally believed that citrus nectar flows are adversely affected for two years following severe freeze damage to the trees, and many Florida beekeepers were quite pessimistic about the chances of making a good citrus honey crop in 1964. There was some evidence to support this belief, since the 1958 and 1959 citrus honey crops were rather poor after the trees in many areas had been damaged by freezes during the winter of 1957-58. The pessimism proved to be unjustified, and 1964 turned out to be a banner year for citrus honey production.

The average production of citrus honey for the last five years by colonies in the Experiment Station apiary located near Clermont, Fla., is shown in Fig. 1. In 1964 the 35 colonies in the apiary had an average production of 128.4 lb. per colony. This figure is almost 50% greater than the previous highest yield of 86 lb., record in 1961. Although the blooming period of the groves in the Clermont area lasted a total of 39 days, over 90% of the honey was produced during the last half of this period. Flowers opened very slowly during the first two weeks of bloom when fairly low temperatures were experienced. Later, when the weather moderated, the flowers opened very quickly, and the nectar flow was unusually heavy. This period of heavy nectar flow lasted for 21 days, during which time the colonies made gains averaging 111.4 lb. In one 48 hour period between 8:00 AM, 18 March, and 8:00 AM, 20 March, one group of colonies had an average gain of 42 lb. Most of the other colonies in the apiary made gains of 30 to 35 lb., and the least productive colony in the apiary gained over 23 lb.

The 1964 citrus nectar flow was not only exceptional in regard to the amount of nectar secreted, but the quality of the honey produced from the nectar, as measured by its color and moisture content, was the best of any citrus honey produced in the last twelve years (Table 1).

The data regarding the moisture content of citrus honey for the period of 1953-1962 was obtained from information published by Haynie (1962). The Pfund scale values were derived by converting the data published by Haynie (1962) as to the percent light transmission of citrus honey produced in the same years. Data for the year 1964 were collected by the author. This information shows that only in 1961 was the color of citrus honey nearly as light as that produced in 1964. However, the 1964 honey had almost 3% less moisture than the 1961 honey. Florida honeys are seldom light enough to be graded water white (Pfund value of 7 or less), yet 9 of 17 samples tested from the 1964 crop were in this grade. One honey sample produced by the colonies near Clermont showed a Pfund reading below zero, which is about as clear as any honey can be.

[1] Florida Agricultural Experiment Stations Journal Series No. 2029.

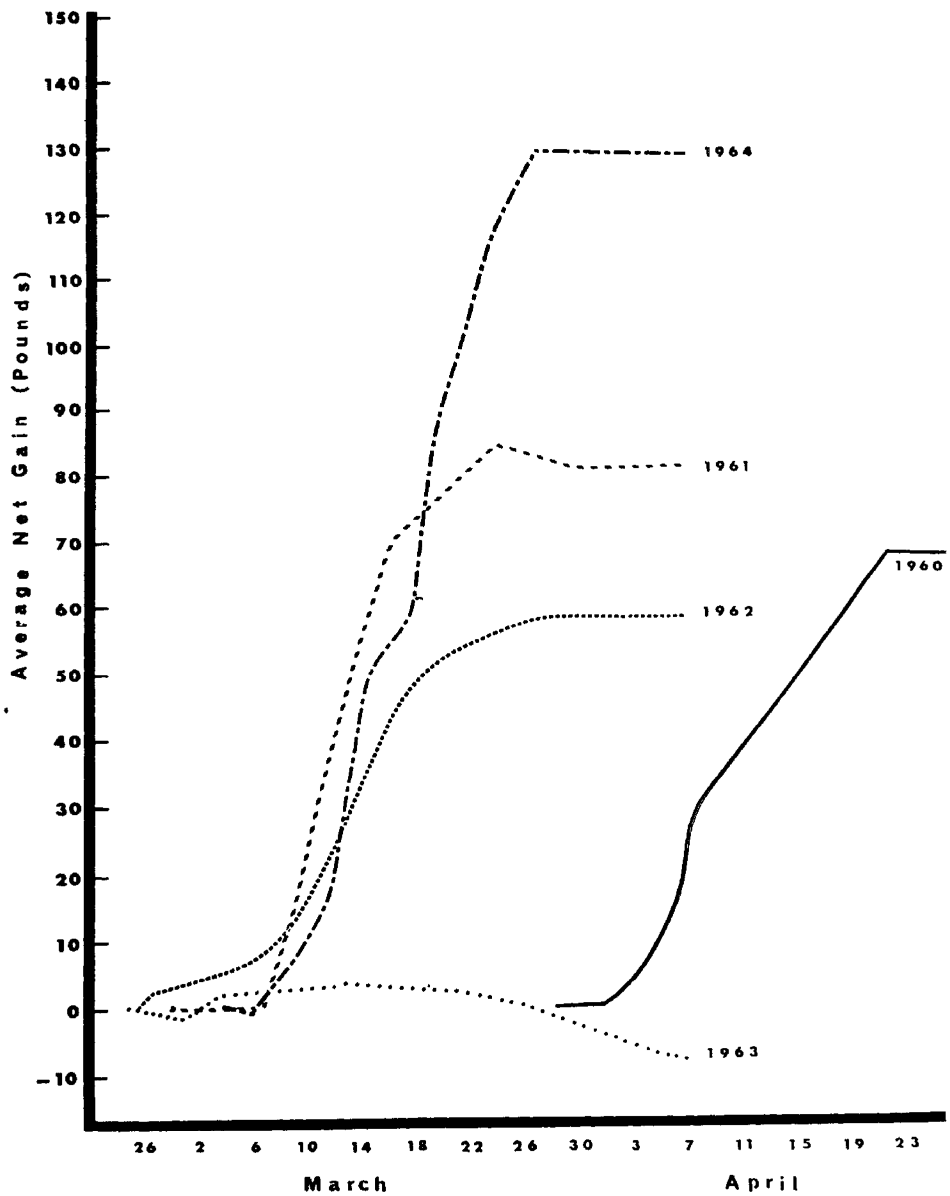

Fig. 1. Citrus honey production by colonies near Clearmont, Fla.

TABLE 1. COLOR AND MOISTURE CONTENT OF CITRUS HONEY SAMPLES (1953-1964).

Year	Pfund Reading	USDA Color Standard	Percent Moisture
1953	18.5	White	—
1954	44.5	Extra Light Amber	18.1
1955	34.5	Extra Light Amber	16.7
1956	30.5	White	18.8
1957	41.0	Extra Light Amber	18.5
1958	24.5	White	18.6
1959	35.0	Extra Light Amber	17.4
1960	19.5	White	18.1
1961	10.5	Extra White	18.4
1962	30.0	White	18.8
1963	—	—	—
1964	10.0	Extra White	15.7

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INSECTICIDES AND INSECTICIDE-OIL COMBINATIONS FOR CORN EARWORM, BOLL WEEVIL, AND COWPEA CURCULIO CONTROL [1]

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The cowpea curculio, *Chalcodermus aeneus* (Boh.), boll weevil, *Anthonomus grandis* (Boh.), and corn earworm, *Heliothis zea* (Boddie), are major pests in the Lower Rio Grande Valley. These insects are controlled by frequent applications of highly toxic insecticides. Because it is suspected that a tolerance may exist or develop in the near future, experiments were conducted during the 1963-64 season to determine (1) whether insecticide-oil combinations were more effective against these pests than insecticides alone; (2) whether the methods of applying these insecticides and insecti-side-oil combinations would affect control of these insects and; (3) whether other insecticides would control these insects.

Dogger (1955) showed that isoparaffinic oils do not increase effectiveness of toxaphene + DDT for bollworm and boll weevil control on cotton. Wolfenbarger and Schuster (1963) and Wolfenbarger (1964) found Bidrin, Bayer 25141, and Guthion to be effective against the cowpea curculio.

METHODS AND MATERIALS

Six experiments were conducted during 1963-64. Plots in all experiments were 1 row wide (38 inches between rows) and 30 to 50 feet in length arranged in randomized block design with four replications. An oil-water-insecticide combination and an aerosol were used to apply the insecticides in various experiments. The oil-water-insecticide combinations were applied at 40 to 80 gallons per acre with a carbon dioxide powered sprayer at 40 psi using three nozzles per row. The aerosols (very fine mist) were applied with a Soloport® pack back gasoline powered airblast spray at ½ to 2 gallons per acre through two adjustable nozzles per row.

Two emulsifier systems, designated as unstable and stable emulsion systems, were used with the oil-water-insecticide combinations applied with the CO_2 powered sprayer. The unstable emulsion system had a 1% concentration of B-1956 (modified phthalic glycerol alkyd resin). The stable emulsion system used an amine soap, and was stable during the entire period of the spray application.

Experiments were conducted for control of the cotton boll weevil and cotton bollworm on cotton. In 1963, the plots were established to evaluate toxaphene + DDT, Guthion + DDT, and methyl parathion + DDT alone and in combination with various oil fractions (Tables 2, 3, 4). The oil fractions were naphthenic, paraffinic, and isoparaffinic in structure. The amine soap emulsifier system was used in these evaluations. The specifications of the oils are summarized in Table 1. The oils were applied at the rates at 1.5, 3.0, and 4.5 gallons per acre.

[1]Technical Contribution 4848 Texas Agricultural Experiment Station, Lower Rio Grande Valley Research and Extension Center, Weslaco.

[2] Oils used in these evaluations were supplied by Humble Oil & Refining Co., who partially supported this project.

[3] Present mailing address: USDA, ARS, Ent. Res. Div., P. O. Box 1033, Brownsville, Texas.

TABLE 1.—SPECIFICATIONS OF VEGETABLE SPRAY OILS USED IN EXPERIMENTS, WESLACO, 1963-1964.[2]

	Oil		
	IP	N	P
Gravity, API°	42.5	30.2	35.0
Molecular weight	27.0**	32.0**	32.0**
Viscosity @ 100°C	51.1	76.6	76.0
Unsulfonated residue	93.0	95.6	91.6
Distillation 40-50	529–535*	407–415	443–450
5-90	49–59	86–87	76–78

* At 10 mm.
** Approximate.

TABLE 2.—INSECTICIDE-OIL COMBINATIONS FOR BOLL WEEVIL AND CORN EARWORM CONTROL ON COTTON, WESLACO, 1963.

		Percent increase in control		
	Actual	Squares		Bolls
Material*	(Lbs + gals/A)	weevil	worm	worm
Toxaphene + DDT	3.0+1.5	16	57	22
Toxaphene + DDT + IP	3.0+1.5+1.5	22	14	33
Toxaphene + DDT + IP	3.0+1.5+3.0	24	0	22
Toxaphene + DDT + IP	3.0+1.5+4.5	16	14	44
Toxaphene + DDT + N	3.0+1.5+1.5	17	43	33
Toxaphene + DDT + N	3.0+1.5+3.0	24	0	33
Toxaphene + DDT + N	3.0+1.5+4.5	21	57	56
Toxaphene + DDT + P	3.0+1.5+1.5	30	43	66
Toxaphene + DDT + P	3.0+1.5+3.0	11	71	44
Guthion + DDT	1.0+1.0	27	29	33
Guthion + DDT + IP	1.0+1.0+1.5	16	14	22
Guthion + DDT + IP	1.0+1.0+3.0	11	43	11
Guthion + DDT + IP	1.0+1.0+4.5	24	29	33
Guthion + DDT + N	1.0+1.0+1.5	30	43	33
Guthion + DDT + N	1.0+1.0+3.0	25	29	44
Guthion + DDT + N	1.0+1.0+4.5	13	57	33
Guthion + DDT + P	1.0+1.0+1.5	19	43	56
Guthion + DDT + P	1.0+1.0+3.0	19	0	22
Guthion + DDT + P	1.0+1.0+4.5	24	43	56
Methyl parathion + DDT	0.5+1.0	14	0	44
Methyl parathion + DDT + N	0.5+1.0+1.5	11	0	44
Methyl parathion + DDT + P	0.5+1.0+1.5	22	43	44
Check**		63	7	9

* Mean of 11 applications.
** Mean % damaged.

TABLE 3.—SUMMARY OF EFFECTS OF INSECTICIDE-OIL COMBINATIONS; COTTON, WESLACO, 1963.

	Mean percent damaged squares						Mean percent damaged bolls		
	IP		P		N		IP	P	N
Insecticide	weevil	worm	weevil	worm	weevil	worm	worm	worm	worm
Toxaphene + DDT	50	6	48	3	50	5	6	4	5
Guthion + DDT	52	5	50	, 5	49	4	7	5	6
Methyl parathion + DDT	—	—	49	4	57	7	—	5	5
Mean	51	6	49	4	53	5	7	5	5

TABLE 4.—SUMMARY OF EFFECTS OF DIFFERENT RATES OF OILS; COTTON, WESLACO, 1963.

	Mean percent damaged squares						Mean percent damaged bolls		
	1.5 gal./A.		3.0 gal./A.		4.5 gal./A.		1.5 gal./A.	3.0 gal./A.	4.5 gal./A.
Oil	weevil	worm	weevil	worm	weevil	worm	worm	worm	worm
IP	51	6	52	6	51	6	7	8	6
N	51	5	48	6	53	3	6	6	5
P	48	4	47	5	53	3	4	5	5

In 1964, plots were established to evaluate oils representing a naphthenic, paraffinic, and isoparaffinic oil fraction at 3.0 gallons per acre in combination with toxaphene + DDT at 3.0 + 1.5 lbs. active ingredient per acre (Table 5). The insecticide-oil combinations were compared to toxaphene + DDT insecticide combinations of 3.0 + 1.5 and 6.0 + 3.0 lbs. per acre. The data for both rates are summarized because no differences existed between the rates or control of either insect. These treatments were compared to an untreated check and toxaphene + DDT alone in four tests. In three tests, insecticide-oil-water sprays were applied at 56 gallons per acre. All treatments were applied with the CO_2 powered sprayer. The fourth test was designed to evaluate an aerosol application at ¾ gallon per acre. Treatments were evaluated by examining 50 squares or bolls per plot for boll weevil feeding or oviposition scars and bollworm larval feeding damage. Open boll counts on 50 plants per plot were made once as a relative index of yield.

TABLE 5.—SUMMARY OF EFFECTS OF DIFFERENT SPRAY SYSTEMS; COTTON, WESLACO, 1963.

		Percent increase in control					
		Oil-water			Aerosol		
Material	Actual (Gal/A)	weevil	worm	Open** bolls	weevil	worm	Open** bolls
Oil-Insecticide*							
IP	1.5	7	25	0	41	82	26
N	1.5	0	50	7	24	72	17
P	1.5	9	50	0	29	82	24
Insecticide*		0	25	6	41	91	29
Check†		44	4	182	17	11	257

* Mean of 10 applications.
** Mean open bolls per 50 plants.
† Mean percent damaged squares or bolls.

Sweet corn plots were established in the fall of 1963 and the spring of 1964 for corn earworm control. In the fall 1963, four insecticides and two emulsifier systems for each of 3 oil fraction-DDT combinations, at equal rates, were used. The three fractions represented paraffinic, naphthenic, and isoparaffinic type oils. The 1964 experiments were established to use insecticides, aerosol application of oil-DDT combinations, and oil-water-insecticide combinations. Two oil-water-insecticide emulsifier systems were used as in the fall 1963 experiment. The treatments (Tables 6, 7) were evaluated as described by Wolfenbarger (1964).

TABLE 6.—INSECTICIDES, DDT- AND NALED-EMULSIFIER SYSTEM, AND DDT SPRAY SYSTEMS FOR CORN EARWORM CONTROL ON SWEETCORN, WESLACO, FALL 1963, SPRING 1964.

Material	Emulsion system	Spray system	Actual (Lbs.+ gal./A.)	Percent worm-free ears Fall 1963*	Percent worm-free ears Spring 1964**
DDT			1.0	8	
DDT			2.0		54
DDT			4.0		62
DDT+IP	Unstable	Oil-water	2.0+1.5	5	
DDT+IP	Unstable	Oil-water	1.0+3.0		60
DDT+N	Unstable	Oil-water	2.0+1.5	2	
DDT+N	Unstable	Oil-water	1.0+3.0		41
DDT+P	Unstable	Oil-water	2.0+1.5	12	
DDT+P	Unstable	Oil-water	1.0+3.0		49
DDT+IP	Stable	Oil-water	2.0+1.5	13	
DDT+IP	Stable	Oil-water	1.0+3.0		46
DDT+N	Stable	Oil-water	2.0+1.5	24	
DDT+N	Stable	Oil-water	1.0+3.0		44
DDT+P	Stable	Oil-water	2.0+1.5	25	
DDT+P	Stable	Oil-water	1.0+3.0		59
DDT		Aerosol	2.0		25
DDT		Aerosol	4.0		41
DDT+IP		Aerosol	2.0+1.5		24
DDT+N		Aerosol	2.0+1.5		39
DDT+P		Aerosol	2.0+1.5		39
Monsanto 40294			1.0	30	
Monsanto 40294			2.0		41
Monsanto 40294			4.0		53
Monsanto 40273			1.0	23	
Monsanto 40273			2.0		72
Monsanto 40273			4.0		63
Naled			4.0		48
Naled+N	Stable	Oil-water	4.0+1.5		20
Naled+P	Stable	Oil-water	4.0+1.5		13
Check			——	9	16

* Four applications.
** Three applications.

TABLE 7.—SUMMARY OF EFFECTS OF EMULSION AND SPRAY SYSTEMS AND OF TYPES OF OIL; SWEETCORN, WESLACO, FALL 1963, SPRING 1964.

	Percent worm-free ears	
Emulsion and spray system	Fall 1963	Spring 1964
Oil-water		
stable	21	52
unstable	6	50
Aerosol		
DDT	—	32
oil-DDT	—	31
Oil-fraction		
IP	9	43
N	13	41
P	19	49

In 1963-1964, insecticides and insecticide-oil combinations were used for cowpea curculio control on southernpeas. Two emulsifier systems of the water-oil-toxaphene combinations were evaluated and compared with toxaphene alone in both tests. During the spring of 1964, aerosol applications of toxaphene-oil were made at the rate of 1.5 gallons per acre. Guthion and methyl parathion were applied at 4 different rates and 1 to 4 times. In both experiments, applications were initiated at first blossom. The treatments were evaluated as described in Wolfenbarger & Schuster (1963) and Wolfenbarger (1964), and the data (Tables 8, 9) are presented as larvae per 100 pods.

The chemical formula of the proprietary insecticides used in these evaluations are:

Bidrin®—3-(dimethoxyphosphinyloxy)-N, N-dimethyl-cis-crotonamide

Giegy 13005—O,O-dimethyl-S-O (S-methoxy-1,3,4-thiodianzol-2(3H)-on-3-yl-methyl)-dithiophosphate

Guthion®—O,O-dimethyl S-4-oxo-1,2,3-benzotriazin-3(4H)-ylmethyl phosphorodithioate

Monsanto 40273—O-(p-nitrophenyl)-O-propyl methylphosphonothionate

Monsanto 40294—O-(p-nitrophenyl)-O-phenyl methyl phosphonothioate

Shell Development 9129—crotanamide, 3-hydroxy-N methyl dimethyl phosphate.

TABLE 8.—RATES AND NUMBER OF APPLICATIONS OF INSECTICIDES, INSECTICIDE-OIL-WATER, AND AEROSOL APPLICATIONS FOR COWPEA CURCULIO CONTROL ON SOUTHERNPEAS, WESLACO, FALL 1963, SPRING 1964.

Materials	Method of application	Number of appli- cations	Actual (Lbs. + gal./A.)	Percent increase in control	
				Fall	Spring
SD 9129		4	1.0		100
Bidrin		4	0.5	29	88
Naled		4	2.0	14	
Naled		4	2.0		0
Phosphamidon		4,4*	1.0	0	0
Phosphamidon		4	2.0		75
Monsanto 40294		4	1.0		50
Monsanto 40273		4	0.75	43	
Monsanto 40273		4	1.0		100
Monsanto 40273		4	2.0	71	
Toxaphene		4,4	3.0	0	0
Toxaphene+IP	Stable	4,4	3.0+1.5	29	0
Toxaphene+N	Stable	4,4	3.0+1.5	14	75
Toxaphene+P	Stable	4,4	3.0+1.5	14	88
Toxaphene+P	Unstable	4	3.0+1.5	43	
Toxaphene+IP	Aerosol	4	3.0+1.5		0
Toxaphene+N	Unstable	4	3.0+1.5	14	
Toxaphene+N	Aerosol	4	3.0+1.5		63
Toxaphene+P	Unstable	4	3.0+1.5	0	
Toxaphene+P	Aerosol	4	3.0+1.5		50
Parathion		4,4	2.0	57	100
Giegy 13005		4	2.0		100
Methyl parathion		2	0.5		50
Methyl parathion		4	0.5		88
Methyl parathion		2	1.0		63
Methyl parathion		4	1.0		88
Methyl parathion		1	1.5		75
Methyl parathion		2	1.5		0
Methyl parathion		3	1.5		100
Methyl parathion		4	1.5		100
Methyl parathion		4	2.0	43	
Guthion		1	1.0		0
Guthion		2	1.0		0
Guthion		3	1.0		75
Guthion		4	1.0		88
Check**			——	7	8

* Number of applications applied in the fall and number of applications applied in the spring.

** Mean larvae per 100 pods.

TABLE 9.—SUMMARY OF EFFECTS OF EMULSION AND SPRAY SYSTEMS AND OF TYPES OF SOIL; SOUTHERNPEAS, WESLACO, FALL 1963, SPRING 1964.

Emulsion and spray system	Larvae per 100 pods	
	Fall	Spring
Oil-water		
stable	6	7
unstable	6	—
Aerosol	—	6
Oil		
IP	5	11
N	7	3
P	7	6

RESULTS AND DISCUSSION

The results in all experiments are expressed as per cent increase in control over the untreated check or as indicated in the summaries in Tables 3, 4, 7, and 9. The data in Table 2 show that the 1.5 and 3.0 gallons per acre rates of paraffinic oil-DDT- + Toxaphene combination gave control of the boll weevil and corn earworm which was superior to the use of DDT + toxaphene alone. This insecticide-oil combination gave better control than all other treatments and the check. The rate of oil (Table 4) in the insecticide-oil combination did not increase insect control. The data (Table 5) show that all aerosol applied insecticide and insecticide-oil combination applications increased corn earworm and boll weevil control over the oil-insecticide-water applied combinations. The oil-water-insecticide combinations or insecticide combinations were ineffective in controlling the boll weevil.

Data in Table 6 show that Monsanto 40273 and Monsanto 40294 gave the best corn earworm control on sweet corn and were equal to or superior to DDT at the 1 lb. per acre rate. Monsanto 40273 was superior to DDT at the 2 lb. rate but equal in effectiveness at the 4 lb. rate. DDT was equal or superior to Monsanto 40294 at 2 and 4 lbs. per acre. DDT-oil-combinations were not as effective as DDT alone at equal rates, when applied as an aerosol spray at the rate of 1 and 2 gallons per acre. The stable emulsion system was generally superior to the unstable emulsion system (Table 7). The water applications of the oil-insecticide combinations were superior to the aerosol applications of oil-insecticide sprays. The oil fraction possessing a predominance of paraffinic type molecules gave the best corn earworm control compared to the naphthenic or isoparaffinic type oils (Wolfenbarger 1964). Naled and the naled-oil combinations were ineffective for corn earworm control.

The data in Table 8 show that parathion, methyl parathion, Monsanto 40273, Giegy 13005, Guthion, SD9129, and Bidrin were the most effective insecticides for cowpea curculio control. Phosphamidon at the highest rate offered promise for curculio control. Three and 4 applications of Guthion were superior to 1 and 2 applications for cowpea curculio control. Three and 4 applications of methyl parathion at each of 3 rates were superior to 1 or 2 applications. There were no differences between 4 applications of methyl parathion at 0.5, 1.0, or 1.5 pounds per acre. Toxaphene and naled were ineffective for cowpea curculio control. The use of stable and unstable emulsion systems, aerosol applications, and oil had small effects on control (Table 9).

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NOTES ON SOME SPECIES OF ECTOPSOCINAE IN THE WESTERN HEMISPHERE (PSOCOPTERA: PERIPSOCIDAE)[1]

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The following notes include a new synonymy for *Ectopsocus pumilis* (Banks), synonymic notes on *Ectopsocopsis cryptomeriae* (Enderlein), records of three species of Ectopsocinae previously not known to occur in the Western Hemisphere, and distributional records of two others. Two of the species, *Ectopsocus maindroni* Badonnel and *Ectopsocopsis cryptomeriae* (Enderlein) are recorded for the first time from the United States, thus raising the number of species of Ectopsocinae known to occur in the United States to seven. Three of these were recorded by Mockford (1959), and references to the other four are included herein. Of general interest is a corrected identification of the form which has been called *Ectopsocus pumilis* (Banks). This species, exceedingly common in eastern United States, has now been shown to be *Ectopsocopsis cryptomeriae* (Enderlein). The name *pumilis* applies to another species.

Ectopsocus maindroni Badonnel (1935: 81)

A bibliography on this species is given by Thornton (1962: 299). The species has not previously been recorded in the Western Hemisphere. On several occasions it has been found by U. S. Department of Agriculture plant quarantine inspectors on materials entering the United States from Mexico, South America, and the West Indies.

Material examined from various localities in the American tropics agrees with the Hong Kong material described by Thornton (1962) in possessing fine hairs on the margin of the hindwing between the branches of Rs.

RECORDS: United States: *Florida*—Grassy Key (Monroe Co.); Lower Matecumbe Key (Monroe Co.); Miami (field collection); Miami (plant quarantine interception from Surinam); Vero Beach. *Texas*—San Antonio (plant quarantine interception from unspecified locality in Mexico).

Mexico: *Veracruz*—23 miles north of Alvarado, Highway 180.

Jamaica: Locality not specified. Puerto Rico: Maricao Insular Forest. Venezuela: Maracay. British Guiana: Georgetown (Botanical Gardens). French Guiana: Cayenne (Botanical Gardens and strand at Mont Joli).

Field records other than that in Jamaica are by the author. Most of the latter collections were made by beating foliage of trees and shrubs which generally bore some dead leaves. To my knowledge, none of the field collections in the Western Hemisphere have been made at a distance of more than 20 miles from the seacoast.

[1] Collecting involving the author's Mexican records was supported by National Science Foundation Grant No. 19263. Collecting involving records from Brazil, British Guiana, French Guiana, Puerto Rico, Surinam, Trinidad, and Venezuela was supported by a travel grant from the American Museum of Natural History, New York City.

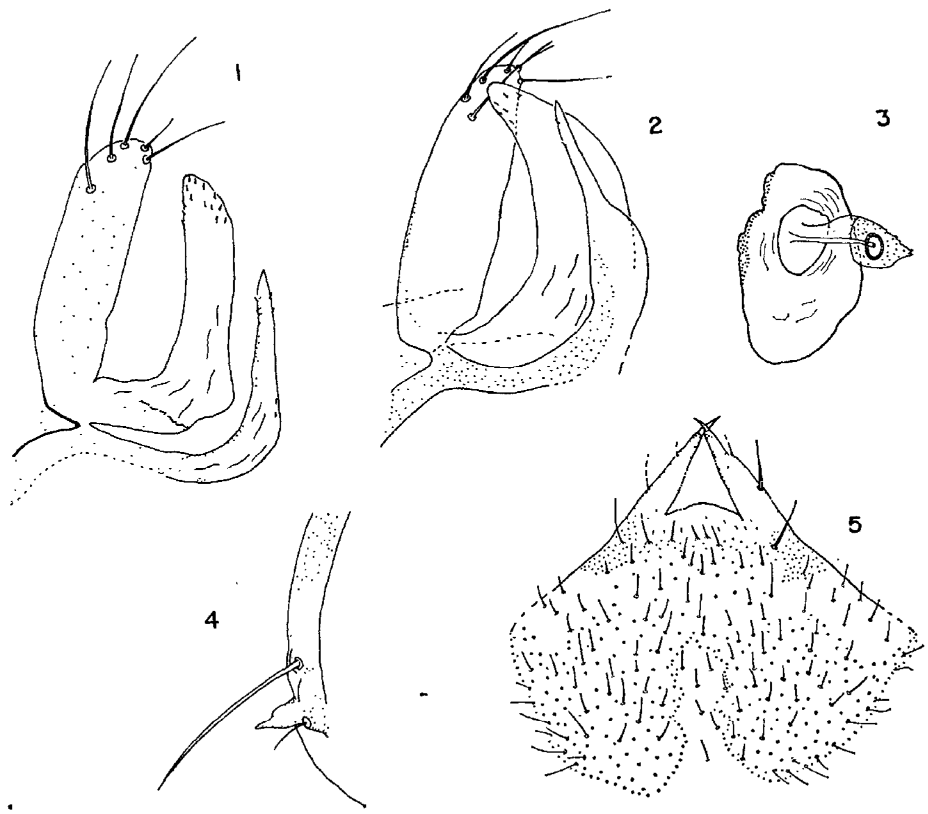

Fig. 1-5. *Ectopsocus pumilis* (Banks). Fig. 1. Gonapophyses of holotype, x330. Fig. 2. Gonapophyses, specimen from Gainesville, Fla., x330. Fig. 3. Sclerite of orifice of spermatheca, holotype, x200. Fig. 4. Free margin of paraproct with process, holotype, x400. Fig. 5. Subgenital plate of holotype, x150. Magnifications are those at which the drawings were made. Reduction is x0.53.

Ectopsocus ornatus Thornton (1962: 308)

This species has been recorded previously only from Hong Kong. A single female was taken by U. S. Department of Agriculture officials in San Juan, Puerto Rico, on vegetables originating at an unspecified locality in Puerto Rico.

The following measurements and ratios were recorded for this specimen: IO/D (Pearman method), 3.36; IO/D (Badonnel method), 2.34; body length, 1.62 mm; forewing length, 1.55 mm; distal hind tarsal segment, 0.091 mm; ratio proximal/distal hind tarsal segments, 2.32; antennal length, 1.14 mm; basal flagellar segment, 0.258 mm; hindwing length, 1.20 mm; hind femoral length, 0.38 mm; hind tibial length, 0.58 mm; proximal hind tarsal segment, 0.212 mm; second flagellar segment, 0.152 mm; ratio basal/second flagellar segments 1.70.

All of the above measurements fall within the range for the species given by Thornton, or are so close to the limits of the range that their degree of accuracy (to 0.015 mm) cannot clearly delimit them from it. The IO/D figure of 4 stated by Thornton (presumably using the method of Pearman described by Ball 1943) seems decidedly larger than that stated above, but there is no information by which to determine whether my figure falls within or without the range for the Hong Kong material.

The genitalia differ from those figured by Thornton in that the third valvulae (outer lobes of the gonapophyses of the ninth segment) bear, in addition to the three long outer hairs, only seven shorter hairs, rather than ten.

Wing markings differ from those illustrated by Thornton in that the pterostigma has a clear border in its apical third, and the medial stem just distal to its junction with Rs has a clear posterior border for a short distance.

A few hairs are visible on the radial margin of the forewing at 440X, but at lesser magnifications these are not visible.

Ectopsocus pumilis (Banks)

Peripsocus pumilis Banks (1920: 313) (*nec Ectopsocus pumilis* (Banks) Chapman, 1930).

Ectopsocus ghesquierei Ball (1943: 11), new synonymy.

An examination of the holotype, a female, in the Museum of Comparative Zoology, Cambridge, Mass., has shown that this is not the species which Chapman (1930) and all subsequent North American authors have assumed it to be. Such an error is certainly excusable in view of the fact that there is nothing diagnostic in Banks' description of the species, and it was very likely impossible for Chapman to make a potash preparation of the type. Subsequent authors, including myself, have simply followed Chapman's determination.

A comparison of the subgenital plate (Fig. 5) of this species with that of *E. ghesquierei* Ball (Ball 1943, Fig. 6) shows a virtual identity in form, details of pigment distribution, and ciliation. The type of *E. pumilis* lacks a definite submarginal row of macrochaetae paralleled by a line across the subgenital plate, but another specimen examined (from Gainesville, Fla., approximately 130 miles from the type locality) shows a row of six macrochaetae in the same position as that shown in *E. ghesquierei* and an internal line slightly anterior to the position of that shown in *E. ghesquierei.*

The tubercle on the edge of the paraproct and the surrounding hairs (Fig. 4) of the *E. pumilis* specimens agree with Ball's figure (1943, Fig. 7) as well as with his description of these features in *E. ghesquierei.* The gonapophyses show a few slight differences (compare my Fig. 1 and 2 with Ball's Fig. 8). The terminal ciliation of the third valvula is subject to a slight amount of variation. Ball illustrates a wide juncture between the second and third valvulae. Although this does not exist in the specimens which I have examined, the membrane of the second valvula is very thin in this region, and it would be easy to mistake an underlying structure or a wrinkle in the cuticle for the edge of the valvula. In fact, Ball's figure leaves some doubt about what the joining line between the two valvulae actually does represent.

Measurements on the type of *E. pumilis* are as follows: forewing length, 1.30 mm; posterior tibial length, 0.52 mm; IO/D 2.7 (Badonnel Method); width of head between eyes, 0.32 mm.

Although there are minor differences between these measurements and those presented by Ball for *E. ghesquierei,* they can scarcely be regarded alone as delimiting distinct species.

In view of the above considerations, I regard these two species as the same, and the name *Ectopsocus ghesquierei* Ball falls into the synonymy of *E. pumilis* Banks.

RECORDS: United States: *Florida*—Gainesville; Monticello (type locality). *Texas*—San Antonio (plant quarantine interception from Marilia, Sao Paulo, Brazil).

DISCUSSION: The species was recorded (under the name *E. ghesquierei*) by Ball (1943) from several localities in the Congo (type locality, Eala). A new Congo locality was added by Badonnel (1946). Pearman (1960) recorded the species from Tanganyika, where it was collected on *Rattus rattus.* Thornton (1962) recorded it from Hong Kong, where it was taken in stored breakfast cereal in a private house. The latter author also cited a personal communication from Mr. C. Tsutsumi of its collection in stored products in Japan. The specimens from Gainesville, Fla., were collected on a leather suitcase covered with mold in an apartment. The series consists of thirty adult females and two nymphs. Males have never been collected.

Thornton (1962: 298) states that the Hong Kong specimens differ from those described by Ball in having the abdomen banded and in that the ocelli are bordered in reddish. Although it was not possible to study these characters on the type of *E. pumilis* due to its condition, the specimens from Gainesville, Fla., agree with Ball's material in these respects.

It would appear that the species has been spread rather readily by human commerce and that it is probably not native to Florida. The complete absence of males in collections suggests the possibility of parthenogenesis.

Ectopsocus titschacki Jentsch (1939: 120)

Although Jentsch states in the original description that the type material was apparently from Venezuela, no definite localities have been recorded for the species in the Western Hemisphere. Ball (1943: 11) indicated the presence of the species in the Belgian Congo. Badonnel (1949: 44) recorded it from the Ivory Coast and described the male.

RECORDS: Brazil: *Para*—Belem. British Guiana: Georgetown. French Guiana: Cayenne. Puerto Rico: Mayaguez; Rio Piedras. Surinam: Paramaribo. Trinidad (WI): Piarco; Simla.

The above records represent field collections of the author. In addition, the species was taken in plant quarantine at Mobile, Ala., on material originating in Panama. The species is relatively common in the regions indicated above in dry leaves on branches in disturbed habitats such as botanical gardens and edges of cities.

Ectopsocus vachoni Badonnel (1945: 44)

Badonnel (1962: 223-224) has demonstrated the synonymy of this species with *E. dimorphus* Mockford and Gurney, and has cited distribution records from Morocco, France, Great Britain, southern United States, and Argentina. Later (1963) the same author cited records from Chile. I have taken the species from a number of Mexican localities.

RECORDS: Mexico: *Nuevo Leon*—Presa de la Boca; Galeana. *San Luis Potosi*—approximately 19 miles south of San Luis Potosi (city).

Ectopsocopsis cryptomeriae (Enderlein)

Ectopsocus cryptomeriae Enderlein (1907: 100).

Thornton (1962: 294) has given a synonymy of this species complete to its time and has indicated the likelihood of its synonymy with the species described by Chapman (1930) as *Ectopsocus pumilis* (Banks), but, as shown above, this is not the true *E. pumilis* (Banks). In fact, there appear to be no differences between the species described by Chapman and the true *E. cryptomeriae* Enderlein, as described in detail by Thornton (1962), so that they must be regarded as the same. In the following references to the species, the names indicated were used.

Ectopsocus pumilis (Banks):

Chapman, P. J. 1930: 380-383, pl. XIX, figs. 4, 11, 12.
Ball, A. 1931: 188, pl. VI, figs. 1-6.
Sommerman, K. M. 1942: 259 (rearing technique).
Sommerman, K. M. 1943: 53-64, pl. VI (life history).
Gurney, A. B. 1950: 153 (proposed common name, review of habits).
Mockford, E. L. 1950: 199-200 (distribution).
Mockford, E. L., and A. B. Gurney. 1956: 364 (distribution).

Ectopsocopsis pumilis (Banks):

Badonnel, A. 1955: 185.
Mockford, E. L. 1961: 136 (distribution).

This species was originally described from Japan (type locality, Kanagawa). It is frequently encountered in United States Department of Agriculture plant quarantine inspections of material from Japan. In view of this and the fact that there are no other known North American species of its genus, it would seem likely that this species is not a native of North America but may have been introduced in commerce from the Old World. The species occurs throughout eastern United States from Florida and Texas in the South to central Illinois and southern New York in the North. It is established in the Monterrey region of northern Mexico (personal observation).

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A NEW SPECIES OF *KELERIMENOPON* (MENOPONIDAE, MALLOPHAGA) FROM THE PHILIPPINE ISLANDS

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The genus *Kelerimenopon* was erected in 1942 by Conci for *K. sanfilippoi,* described at that time for specimens taken off *Pitta rufiventris* (Cabanis and Heine). Hopkins and Clay (1952) included in the genus: (*Colpocephalum ciliatum* Piaget 1880; *Menopon griseum* Piaget, 1885; *Colpocephalum longipes* Piaget, 1880; and *Colpocephalum minor* Piaget, 1880. They commented "There is greatest doubt about the group of hosts infested by this genus, but some indications that the true hosts may be Megapodidae (see Clay, 1949, Ann. Mag. Nat. Hist., (12), 2: 830). All the material is of very doubtful provenance (almost all of it from museum skins) and the genus is alleged to occur on almost as many groups of hosts as there are known species."

Three distinct groups of species are presently represented in the genus. The species found on hosts of the genus *Pitta* have abdominal pleurites II-VI with inner vertical projections.

The species found on hosts of the family Megapodidae have abdominal pleurites II-V with inner vertical projections, and abdominal pleurites VI-VIII with inner horizontal projections. The species in this group are: *M. griseum, C. ciliatum,* and *C. minor.*

The species found on hosts of the Psittaciformes have abdominal pleurites without inner projections. The only described species in this group is *C. longipes.*

There are many other differences between the groups, which suggest that they are not congeneric. The species found on the host genus *Pitta* are referred to *Kelerimenopon s. str.*, and probably the genus should be limited to these species. Detailed discussion of the groups found on the Megapodidae and the Psittaciformes is deferred until more freshly-collected material becomes available.

Kelerimenopon thompsoni new species

(Fig. 1-3)

HOLOTYPE MALE: External morphology and chaetotaxy as shown in Fig. 2. Male genitalia (less sac) as shown in Fig. 3. Total length, 1.32 mm.

ALLOTYPE FEMALE: External morphology and chaetotaxy as shown in Fig. 1. Total length, 1.70 mm.

Discussion: This species is closest to *K. sanfilippoi* Conci, 1942; but is separated from it by differences in chaetotaxy, the male genitalia, and size. *K. thompsoni* has at least three long setae on each lateral margin of the preocular region of the forehead, while *K. sanfilippoi* has only one in these locations. The gular region has four long setae on each lateral mar-

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gin in *K. thompsoni*, and three in *K. sanfilippoi*. The parameres of *K. sanfilippoi* are slender distally, with a short thick base, in *K. thompsoni* they are slender throughout their length.

The male and female of *K. sanfilippoi* have a total length of 1.00 mm and 1.44 mm respectfully; being considerably smaller than *K. thompsoni*.

Type host: *Pitta sordida* (P. L. S. Müller).

Type material: Holotype male, allotype female, and paratypes of both sexes were collected by Max Thompson on Balabac Island, Philippines, 19 April 1962 (Bishop Museum Number PI-2508). Holotype and allotype are deposited in Entomological Collection of the Bishop Museum. Paratypes have been distributed to other leading museums.

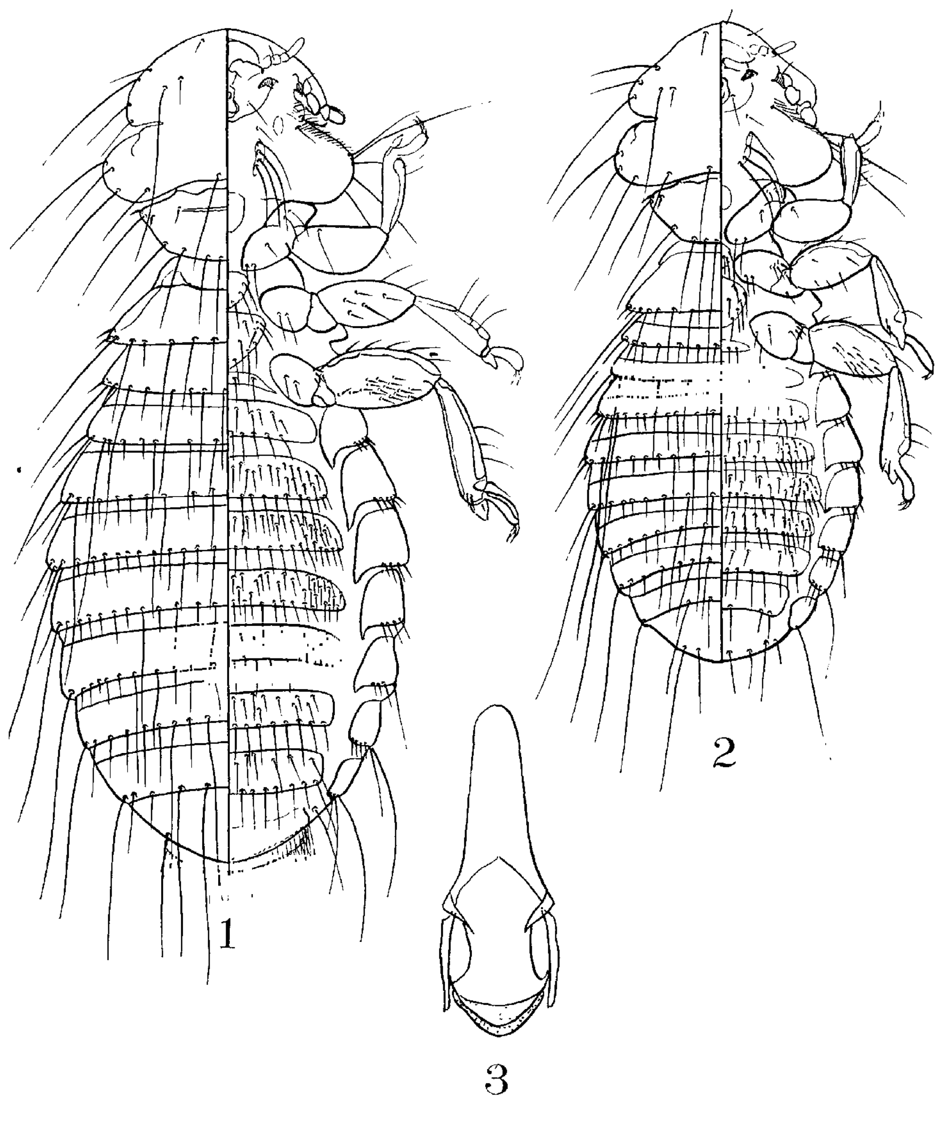

Fig. 1-3. *Kelerimenopon thompsoni*, n. sp. Fig. 1. Dorsal-ventral view of female. Fig. 2. Dorsal-ventral view of male. Fig. 3. Male, genitalia.

ACKNOWLEDGEMENTS

Dr. Theresa Clay, British Museum, has been of great assistance in providing data on the Piaget species, and on undescribed species of *Kelerimenopon s. lat.* in the British Museum.

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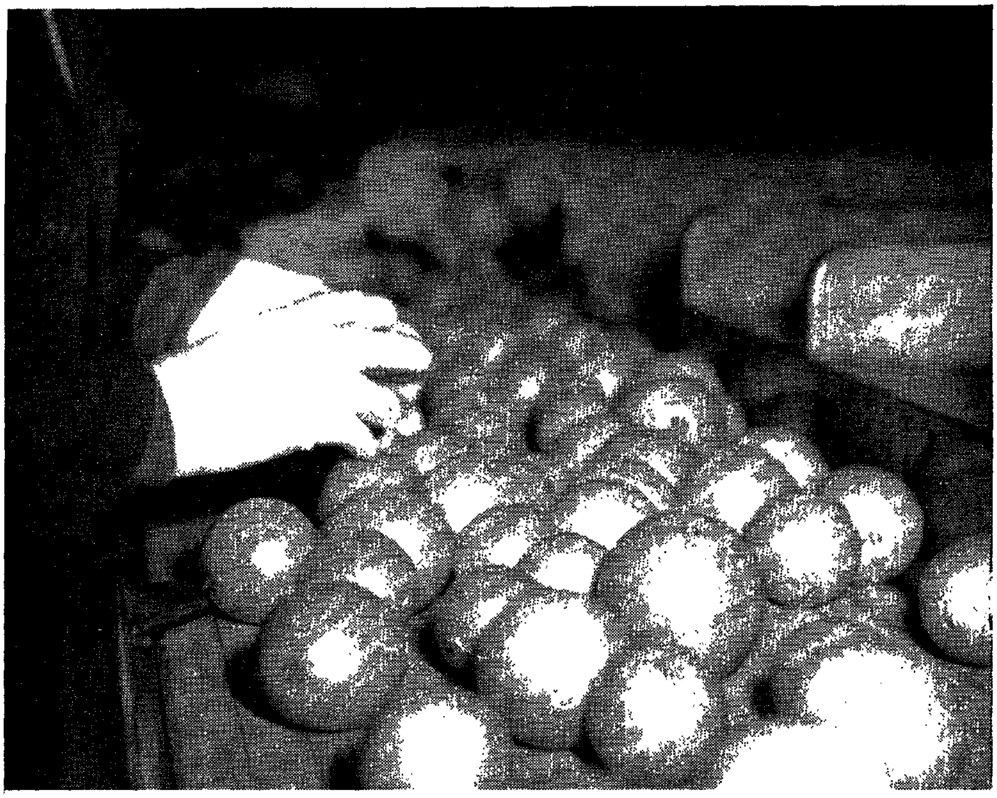

PHYTOSEIID MITES FROM PUERTO RICO WITH DESCRIPTIONS OF NEW SPECIES (ACARINA: MESOSTIGMATA)[1]

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Many species of phytoseiids prey on phytophagous mites and a large amount of work has been done on the group because of their possible importance as biological control agents. Except for the records of *Phytoseiulus macropilis* (Banks) and *Amblyseius evansi* Chant, however, the phytoseiids that occur in Puerto Rico are unknown. This paper deals with the species I collected when on the island between 23 Aug. and 5 Sept. 1963.

Twenty-three species were collected, 14 of which are new to science. Of the 9 described species, 6 also occur in Florida, and 1 each in Mexico, Trinidad, and Tortola (a small island east of Puerto Rico). These 9 species are listed below in this order with collection localities and plants on which they were found:

Amblyseius (*Amblyseialus*) *largoensis* Muma: Santurce on *Cocos nucifera, Mangifera indica, Calophyllum antillanum,* and *Hura crepitans;* Ponce on *Spondias dulcis;* Salinas on *Cordia sebestina.*

Amblyseius (*Typhlodromips*) *dentilis* (DeL.): Santurce on *Ipomoea polyanthis.*

Iphiseius quadripilis (Banks): Santurce on *Laguncularia racemosa;* Rio Piedras on a meliaceous tree.

Phytoseiulus macropilis (Banks): Santurce on *Desmodium tortuosum.*

Galendromus annectens (DeL.): Santurce on *Hura crepitans*; Ponce on *Guazuma ulmifolia.*

Typhlodromina conspicuua (Garm.): Coamo on *Sterculia apetala* and *Tetrazygia eleagnoides;* Juanadias on *Hura crepitans;* Cayey Mt. (elev. about 1800 ft.) on *Cordia sulcata.*

Typhlodromina adjacentis (DeL.): Coamo on *Colubrina reclinata;* Cayey Mt on *Myrcia splendens, Cordia alliodora,* and *Polypodium phyllitida;* El Yunque (elev. about 2500 ft.) on *Myrcia deflexa.*

Phytoseius (*Pennaseius*) *bennetti* DeL.: Rio Piedras on *Congea tomentosa;* Cayey Mt on *Osmia odorata.*

?*Amblyseius* (*Amblyseius*) *herbicolus* Chant: Santurce on *Tabebuia* sp.; Rio Piedras on *Faramea occidentalis, Lagerstroemia speciosa, Lantana involucrata, Psidium guajava,* and *Palicourea riparius;* Sabana on *Andira inermis.* Setae L5 and L6 of these specimens show considerable variation in length. In some, on one side L5 is as long as L6, on the opposite side L5 is shorter than L6; in some L5 is scarcely shorter than L6 (10:12) and in others L5 is distinctly shorter than L6 (8:13).

In the descriptions, I have followed Garman (1948) when designating setae of the body as his system for the phytoseiids is simple and brief; for the macrosetae of the legs, I have used the symbols employed by Athias-Henriot (1957). In several of the new species, the ventral cuticula of the

[1] Cost of excess engravings paid for by a grant from The Pinellas Foundation, Inc., St. Petersburg, Florida.

specimens either stretched greatly or tore apart in the mounting process; in drawing these specimens the 3 principal shields are shown in their approximately normal position, but the platelets and setae of the ventrolateral area have probably been drawn much closer to each other than is normal for them. The descriptions and drawings are of holotype females unless otherwise indicated, and measurements are in microns. Leg measurements are from base of coxa to claw end of pretarsus and tarsal measurements include the pretarsus. The cervices of the spermathecae are all drawn to the same scale and the lengths given for them include the atria.

Typhloseiopsis funiculatus, new species
(Fig. 1)

Typhloseiopsis funiculatus is readily distinguished from *T. theodoliticus* DeL. by having the ventrianal shield fully developed, and from the species placed in this genus by Schuster and Pritchard (1963) by having L2-L4 minute. The male is unknown.

FEMALE: Dorsal shield practically smooth, 317 long, 190 wide with setae arranged as shown in Fig. 1. Lengths of setae as follow: L1 36, L2 8, L3 7, L4 8, L5 34, L6 9, L7 7, L8 66; D1 23, D2-D6 7; M2 36; S1 12; VL1 43. Sternal shield with 3 pairs of setae, but posterior margin not clear; ventrianal shield 94 long, 74 wide (near anterior margin); only 1 metapodal shield, 20 long. Chelicerae poorly oriented, fd about 27 long and apparently with 2 teeth near tip, md apparently with 3 teeth. Legs too bent to measure; tarsus I 122, IV 141; sgeI 16, II 23, III 28, IV 53, sti 29, st 49. Cervix about 18 long.

Holotype: Female, Coamo, P. R., 28 Aug. 1963 (D. De Leon), on *Gymnanthus lucida.*

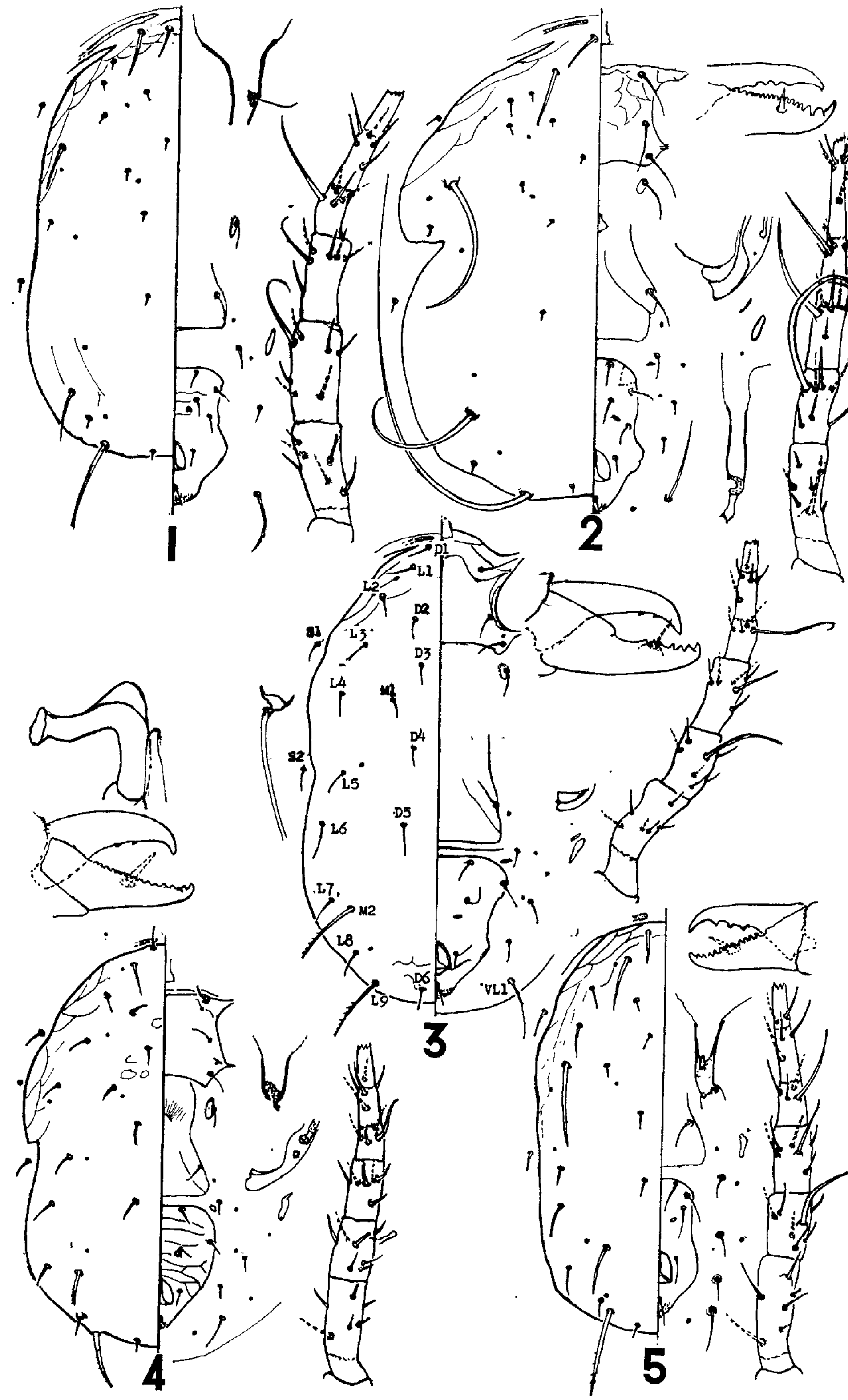
Typhloseiopsis regularis, new species
(Fig. 2)

Typhloseiopsis regularis is distinct from all other mites in this group in having a notch in the dorsal shield behind L6 and a very long L8.

FEMALE: Dorsal shield smooth, 332 long, 271 wide with setae arranged as shown in Fig. 2. Lengths of setae as follow: L1 42, L2 4, L3 10, L4 5, L5 105, L6 7, L7 7, L8 about 330; D1 30, D2-D6, 5-7; M2 110; S1 10, S2 8; VL1 63. Ventrianal shield 110 long, 72 wide (at level of anus); primary metapodal shield 20 long. Fd of chelicerae 28 long. Leg I 416, II 345, III 357, IV 462; tarsus I 160, IV 190; leg I- sge 60, sti 58, st 52 (proximal), 54 (distal); leg II- sge 47, sti 36, st 36; leg III- sge 58, sti 42, st 36; leg IV- sge about 125, sti about 75, st 54. Cervix 18 long.

PLATE I

Fig. 1. *Typhloseiopsis funiculatus*, n. sp. Dorsal and ventrianal shields, part of leg IV, and cervix. Fig. 2. *Typhloseiopsis regularis*, n. sp. Dorsal and ventral shields, chelicerae, part of leg IV, and cervix. Fig. 3. *Amblyseius* (*Typhlodromips*) *caobae*, n. sp. Dorsal and ventral shields, chelicerae, part of leg IV, and cervix. Fig. 4. *Amblyseius* (*Typhlodromips*) *caribbeanus*, n. sp. Dorsal and ventral shields, chelicerae, part of leg IV, cervix, and spermatodactyl. Fig. 5. *Amblyseius* (*Typhlodromalus*) *yunquensis*, n. sp. Dorsal and ventrianal shields, chelicerae, part of leg IV, and cervix.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Holotype: Female, Cayey Mountain, P. R., 28 Aug. 1963 (D. De Leon), on *Mangifera indica*. *Paratypes*: 1 female, 2 nymphs collected with holotype.

Amblyseius (*Typhlodromips*) caobae, new species
(Fig. 3)

Amblyseius (*T.*) *caobae* resembles *A.* (*T.*) *scyphus* Schuster and Pritchard in having a cup-shaped cervix and differs from it chiefly in the shape of the ventrianal shield and in having 3 macrosetae on leg IV. The male is unknown.

FEMALE: Dorsal shield practically smooth, 300 long, 168 wide with setae arranged as shown in Fig. 3. Lengths of setae as follow: L1 18, L2 16, L3 18, L4 21, L5 22, L6 26, L7 22, L8 21, L9 49; D1 16, D2 16, D3 15, D4 15, D5 26, D6 14; M2 49; VL1 40. Ventrianal shield 90 long, 86 wide. Primary metapodal shield 19 long. Fd of chelicerae 31 long. Leg I 264, II 223, III 220, IV 296; tarsus I 87, IV 108; no macrosetae on legs I-III; sge 34, sti 22, st 44. Cervix 7 long.

Holotype: Female, Rio Piedras, P. R., 24 Aug. 1963 (D. De Leon), on *Swietenia mahagoni*.

Amblyseius (*Typhlodromips*) *caribbeanus*, new species
(Fig. 4)

Amblyseius (*T.*) *caribbeanus* is readily distinguished from all others in this group by the position of the pores of the ventrianal shield.

FEMALE: Dorsal shield smoothish with a few cicatrix-like markings, 285 long, 199 wide. Lengths of setae as follow: L1 21, L2 12, L3 14, L4 17, L5 17, L6 18, L7 16, L8 14, L9 39; D1 19, D2 12, D3 14, D4 14, D5 17, D6 8; M2 24; VL1 25. Ventrianal shield 90 long, 83 wide (the preanal pores range in shape from circular to crescentic and in the holotype the pore on the left side is crescentic, the one on the right circular); primary and accessory metapodal shields apparently coalesced, 17 long. Fd of chelicerae 28 long (the drawing in Fig. 4 is of a paratype specimen). Leg I 272, II 230, III 226, IV 285; tarsus I 89, IV 99; no macrosetae on legs I-III; sge 9, sti 14, st 28. Cervix about 10 long.

MALE: Resembles female; dorsal shield 242 long, 145 wide. Spermatodactyl with foot 20, shank 20 long.

Holotype: Female, El Yunque, P. R. (elev. about 2500 ft.), 26 Aug. 1963 (D. De Leon), on *Psychotria bertierana*. *Paratypes*: 1 male, 1 female on *Clusia gundlachii*, locality and date as for holotype; 1 female, Croabas, P. R., 26 Aug. 1963, on *Rhizophora mangle*.

Amblyseius (*Typhlodromalus*) *yunquensis*, new species
(Fig. 5)

Amblyseius (*T.*) *yunquensis* resembles *A.* (*T.*) *primulae* (Chant) from southern Florida, but is readily separated from it by the greater lengths of L1 and L4. The male is unknown.

FEMALE: Dorsal shield practically smooth, 277 long, 165 wide, with setae arranged as shown in Fig. 5. Lengths of setae as follow: L1 38, L2 13, L3 21, L4 54, L5 11, L6 20, L7 17, L8 9, L9 59; D1 26, D2-D6 8-10; M2 33; VL1 36. Sternal shield not clear, but with 3 pairs of setae; ventrianal shield 96 long, 51 wide; primary metapodal shield 16 long, accessory shield almost obsolete. Fd of chelicerae 29 long. Leg I 344, II 278, III 274, IV 393; tarsus I 118, IV 172; sgeI 24, II 24, III 21, IV 52, sti 30, st 57. Cervix 15 long.

Holotype: Female, El Yunque, P. R., 26 Aug. 1963 (D. De Leon), on *Clibodium erosum.*

Amblyseius (*Typhlodromalus*) *congeae*, new species
(Fig. 6)

Amblyseius (*T.*) *congeae* resembles *A.* (*T.*) *peregrinus* Muma; it differs from that species in having L2 and L4 much longer and in the shape of the cervix.

FEMALE: Dorsal shield 290 long, 168 wide, smooth, but with scattered "cloudy" areas; setae arranged as shown in Fig. 6. Lengths of setae as follow: L1 43, L2 18, L3 29, L4 61, L5 14, L6 32, L7 14, L8 10, L9 64; D1 28, D2 12, D3 11, D4 14, D5 15, D6 8; M2 51; VL1 40. Sternal shield not clear, but with 3 pairs of setae; ventrianal shield 100 long, 58 wide (near anterior end); primary metapodal shield 18 long. Fd of chelicerae 28 long. Leg I 353, II 289, III 293, IV 429; tarsus I 112, IV 174; sgeI 29, II 25, III 24, IV 52, sti 31, st 57. Cervix about 15 long.

MALE: Resembles female; dorsal shield 232 long, 156 wide. Spermatodactyl 21 long.

Holotype: Female, Rio Piedras, P. R., 24 Aug. 1963 (D. De Leon), on *Congea tomentosa*. *Paratypes*: 4 females, 1 male collected with holotype; 2 females on *Clerodendron* sp., Rio Piedras, 3 Sept. 1963.

Amblyseius (*Typhlodromalus*) *rapax*, new sepecis
(Fig. 7)

Amblyseius (*T.*) *rapax* very closely resembles *A.* (*T.*) *limonicus* Garman and McGregor as redescribed by Schuster and Pritchard (1963); it differs chiefly in size, in the relative lengths of the setae of the dorsal shield, in having a pore near M1, in dentition of chelicerae, and in the size of the spermatheca. The male is not known.

FEMALE: Dorsal shield 310 long, 181 wide, with setae of the following lengths: L1 38, L2 11, L3 9, L4 63, L5 11, L6 14, L7 12, L8 10, L9 72 (weakly serrate); D1 26, D2-D4 7, D5 11, D6 9; M1 8, M2 11; VL1 40. Peritreme ends at a point almost in front of D1. Ventrianal shield 101 long, 54 wide (near anterior end); primary metapodal shield 20 long, accessory not found. Fd of chelicerae 32 long. Leg I 380, IV 407; tarsus I 132, IV 190 (pretarsus 51); sgeI 36, II 28, III 33, IV 58, sti 37, st 76 (all tips tapering to slender points). Cervix about 20 long.

Holotype: Female, Rio Piedras, P. R., 24 Aug. 1963 (D. De Leon), on *Lantana involucrata*. *Paratypes*: 1 female collected with holotype; 2 females, on *Cordia alliodora*, Cayey Mountain, 28 Aug. 1963.

Amblyseius (*Euseius*) *ho*, new species
(Fig. 8)

Amblyseius (*E.*) *ho* closely resembles *A.* (*E.*) *hum* Pritchard and Baker; it differs from that species chiefly in the relative lengths of the anterolateral setae.

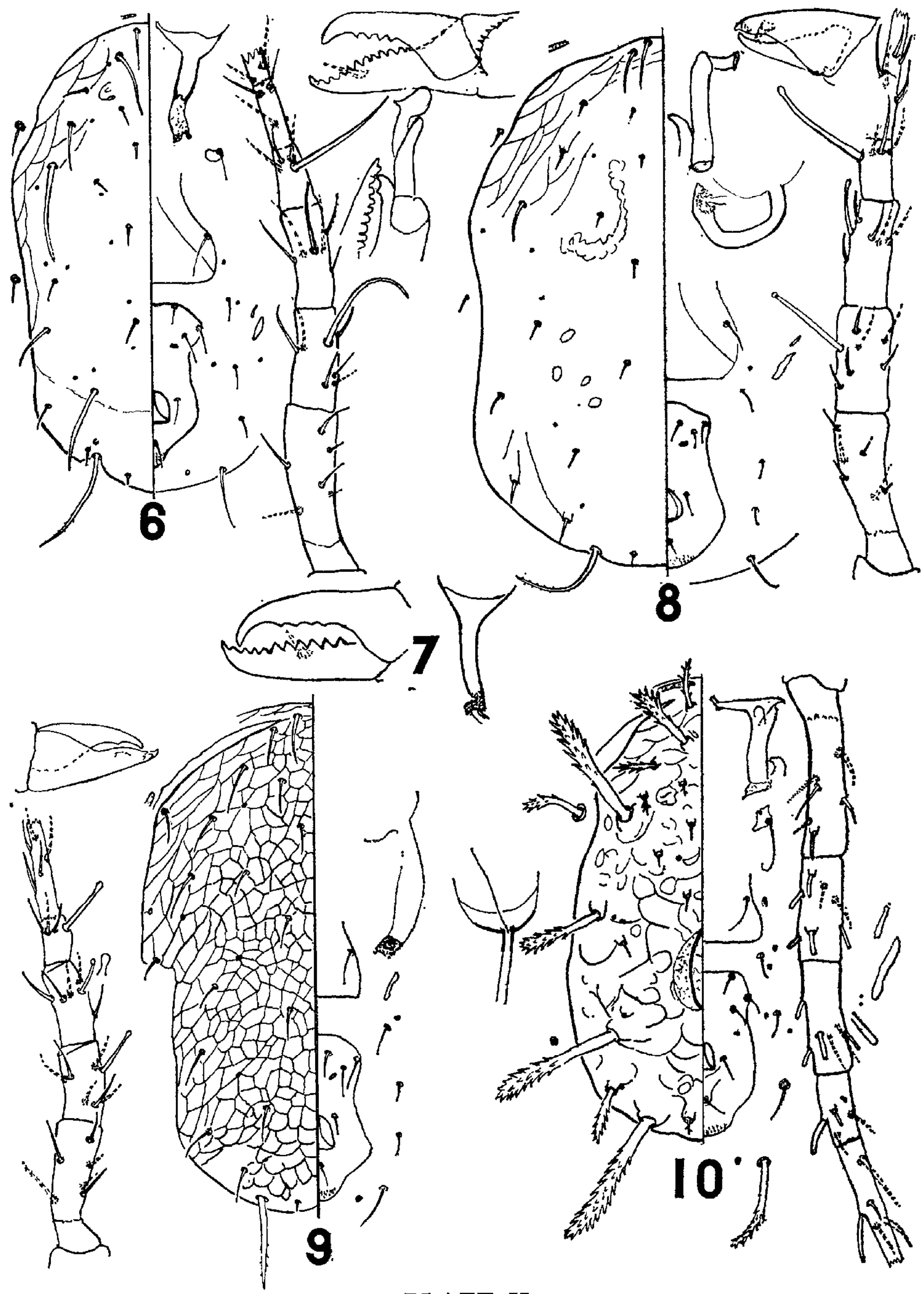

PLATE II

Fig. 6. *Amblyseius* (*Typhlodromalus*) *congeae*, n. sp. Dorsal and ventrianal shields, chelicerae, part of leg IV, cervix, and spermatodactyl. Fig. 7. *Amblyseius* (*Typhlodromalus*) *rapax*, n. sp. Chelicerae and cervix. Fig. 8. *Amblyseius* (*Euseius*) *ho* n. sp. Dorsal and ventrianal shields, chelicerae, part of leg IV, cervix, and spermatodactyl. Fig. 9. *Amblyseius* (*Euseius*) *subalatus*, n. sp. Dorsal and ventrianal shields, chelicerae, part of leg IV, and cervix. Fig. 10. *Nothoseius borinquensis*, n. sp. Dorsal and ventrianal shields, part of leg IV, cervix, and spermatodactyl.

FEMALE: Dorsal shield 320 long, 232 wide with setae and markings as shown in Fig. 7. Lengths of setae as follow: L1 25, L2 11, L3 14, L4 25, L5 9, L6 13, L7 14, L8 15, L9 59; D1 28, D2 7, D3 8, D4 11, D5 11; M2 11; VL1 26. Sternal shield not clear; ventrianal shield 97 long, 72 wide; primary metapodal shield 22 long. Fd of chelicerae 23 long apparently with 2 small teeth near tip (drawing from a paratype specimen). Legs too bent to measure; tarsus IV 166 long; sgeI 21, II 24, III 28 (tips of all 3 setae bluntly pointed), sge IV 42, sti 26, st 49 (tips of all 3 setae capitate). Cervix 22 long.

MALE: Resembles female; dorsal shield 244 long, 181 wide. Spermatodactyl with foot 7 long, shank 17 long.

Holotype: Female, Coamo, P. R., 28 Aug. 1963 (D. De Leon), on *Colubrina reclinata*. *Paratypes*: 1 female, 2 males collected with holotype; 1 female on *Tetrazygia eleagnoides* and 1 male on *Osmia ordorata,* same date and locality as for holotype.

Amblyseius (Euseius) subalatus, new species

(Fig. 9)

Amblyseius (E.) subalatus is distinct from any other member of this group in having S2 on the dorsal shield and in having the dorsal shield abruptly narrowed at S2. In the type specimen S1 also appears to be on the dorsal shield as indicated in the drawing; in the paratype specimen the position of the setae is not clear, but they appear to be situated just off the dorsal shield. The male is unknown.

FEMALE: Dorsal shield 253 long, 166 wide with setae arranged as shown in Fig. 9. Lengths of setae as follow: L1 20, L2 23, L3 25, L4 27, L5 20, L6 21, L7 21, L8 21, L9 49; D1 25, D2 18, D3 17, D4 21, D5 18, D6 7; M1 21, M2 21; S1 22, S2 21; VL1 28. Ventrianal shield 78 long, 52 wide; metapodal shield 14 long, no accessory shield seen and several of the other usual platelets absent. Fd of chelicerae 21 long. Leg I 277, II 216, III 222, IV 333; tarsus I 100, IV 130; sgeI 10, II 11, III 14 (these setae about as long and scarcely coarser than the other setae of respective segments and all tapering to sharp points), IV 25, sti 19, st 29. Cervix 23 long.

Holotype: Female, Juanadias, P. R., 28 Aug. 1963 (D. De Leon), on *Citherexylon fruticosum*. *Paratype*: 1 female collected with holotype.

Nothoseius, new genus

Phytoseiid mites with dorsal shield bearing 4 anterolaterals, 4 posterolaterals, 2 median, and 5 dorsal setae (D5 absent) arranged as shown in Fig. 10; S1 on interscutal membrane in female, on dorsal shield in male, S2 absent in both sexes; some setae of dorsal shield greatly enlarged and strongly serrate. Female with a somewhat transparent crescent-shaped body attached by anterior and posterior ends at mid-line of dorsal shield. Ventral surface with characters of family. Legs long and slender. No other genus has this combination of characters.

Type of genus: *Nothoseius borinquensis*, new species.

Nothoseius borinquensis, new species
(Fig. 10)

FEMALE: Dorsal shield 288 long, 165 wide, not fully covering body and with VL1 on dorsal surface of body posterior of dorsal shield; setae of dorsal shield arranged as shown in Fig. 10. Lengths of setae as follow: L1 38, L2 25, L3 15, L4 91, L5 56, L6 11, L7 32, L8 98; D1 33, D2 9 (serrate), D3 10, D4 9, D5 (absent), D6 10 (serrate); M1 10, M2 79; S1 37; VL1 67. Crescent-shaped body 45 long, the anterior end attached on mid-line at a point about even with setae L6 (in the holotype and 1 paratype the body lies on the left of the mid-line, in 2 others on the right of the mid-line). Sternal shield with 3 pairs of setae, posterior margin not clear. Ventrianal shield 105 long, 56 wide; primary metapodal shield 26 long. Chelicerae not clear, fd about 27 long with about 8 small teeth, md with about 4 small teeth. Leg I 299, II 271, III 254, IV 413; tarsus I 95, IV 163 (pretarsus 22); no macrosetae on legs I-III; sge 13, sti 13, stb 17, sta 22. Cervix 7 long.

MALE: Resembles female, but lacks crescent-shaped body; dorsal shield 226 long, 153 wide. Spermatodactyl with foot 12 long, shank 14 long.

Holotype: Female, Salinas, P. R., 28 Aug. 1963 (D. De Leon), on *Rhynchosia reticulata*. *Paratypes*: 2 females, 1 male, collected with holotype; 2 females, 2 males, Cayey Mountain, 28 Aug. 1963, on *Cordia sulcata*. The female appears to be oviviparous as one of them contained an egg with an almost fully developed larva.

Amblyseius (Ricoseius) *loxocheles*, new sub-genus and new species
(Fig. 11)

This mite does not fit any of the established sub-genera because it has 3 pairs of setae lateral of the ventrolateral setae and leg IV with a macroseta on tibia only. The long setae of the dorsal shield, many of which are capitate, and the very heavy chelicerae are also distinctive. *Ricoseius* is proposed as a name for mites with these general characters with *A* (*R.*) *loxocheles* as type.

FEMALE: Dorsal shield smooth 326 long, 266 wide, with setae arranged as shown in Fig. 11. Setae of the following lengths: L1 80, L2 49, L3 130, L4 157, L5 63, L6 98, L7 85, L8 162, L9 140; D1 35, D2 50, D3 50, D4 157, D5 162, D6 9; M1 32, M2 168; S1 60, S2 77; VL1 107; seta anterolateral of metapodal shield 80, setae lateral of VL1; anterior seta 73, posterior seta 140. Sternal shield with posterior margin not clear, but apparently as indicated by dashed line in drawing; ventrianal shield 139 long, 76 wide (at about level of anus); only 2 pairs of ventrilateral setae; primary metapodal shield 25 long, accessory shield absent. Fd of chelicerae 30 long 11-12 very small teeth. Leg I 387, II 320, III 326, IV 420; tarsus I 132, IV 153; genua I-III each with a capitate seta 19, 15, and 20 long respectively; the 2 large capitate setae of genu IV 25 and 22 long (the proximal seta the longer), capitate seta of tibia 20 long, sti 42, the 2 capitate setae of basitarsus 22 long. Cervix 38 long.

Holotype: Female, Cayey Mt., P. R., 28 Aug. 1963 (D. De Leon), on *Cordia alliodora*.

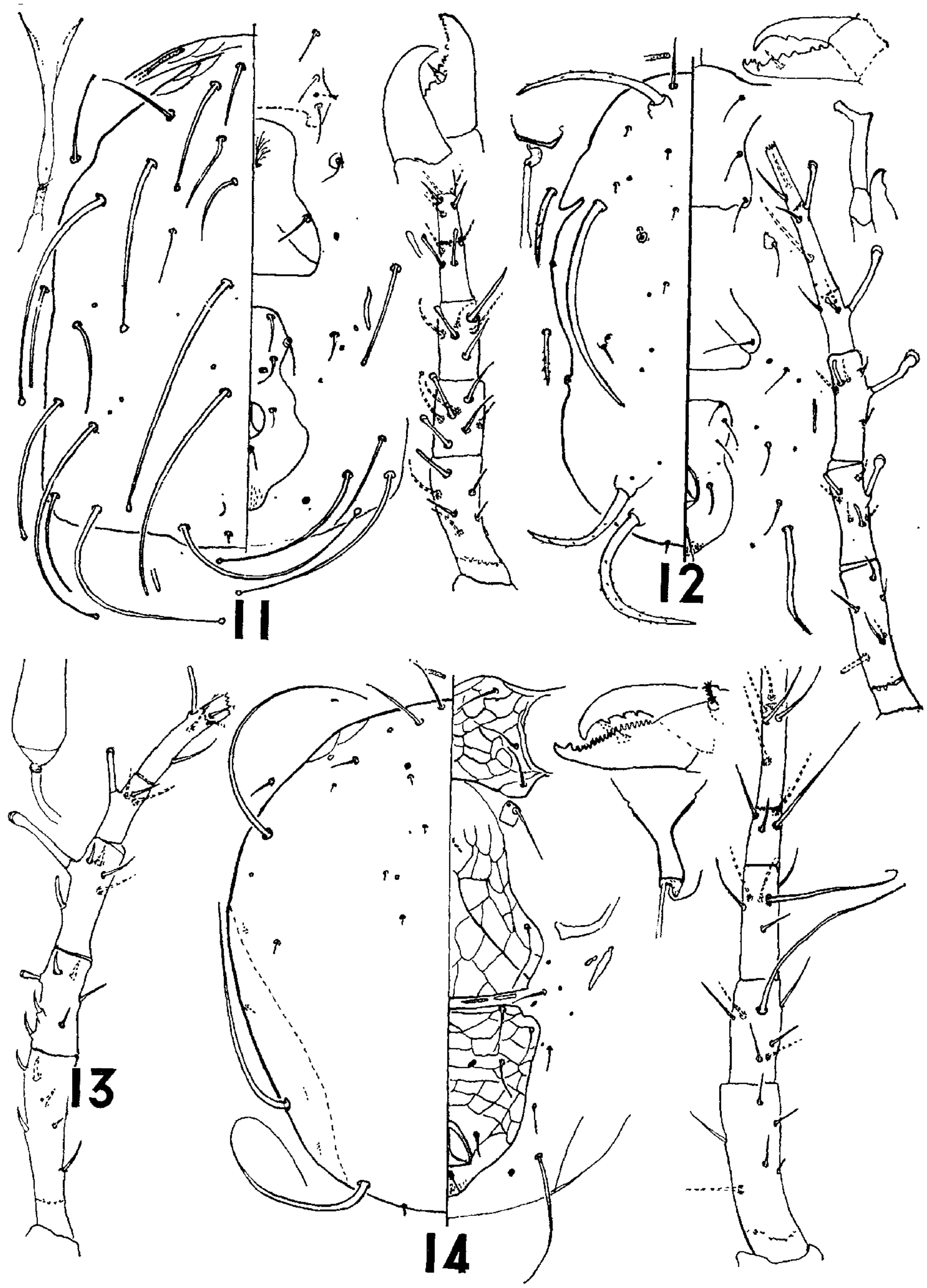

PLATE III

Fig. 11. *Amblyseius* (*Ricoseius*) *loxocheles*, n. sp. Dorsal and ventral shields, chelicerae, part of leg IV, and cervix. Fig. 12. *Paraphytoseius santurcensis*, n. sp. Dorsal and ventral shields, chelicerae, part of leg IV, cervix, and spermatodactyl. Fig. 13. *Phytoseius* (*Phytoseius*) *woodburyi*, n. sp. Part of leg IV and cervix. Fig. 14. *Amblyseiulus inflatus*, n. sp. Dorsal and ventral shields, chelicerae, part of leg IV, and cervix.

Paraphytoseius Swirski and Shechter

Paraphytoseius Swirski and Shechter, 1961. Israel J. Agr. Res. 2: 113. Type: *P. multidentatus* Swirski and Shechter, by original designation and monotypy.

Ptenoseius Pritchard and Baker, 1962. Hilgardia 33: 295; Schuster and Pritchard, 1963. Hilgardia 34: 198. Type: *P. horrifer* Pritchard and Baker, by original designation and monotypy. *New synonymy.*

Paraphytoseius santurcensis, new species
(Fig. 12)

Paraphytoseius santurcensis resembles *P. multidentatus* Swirski and Shechter very closely; it differs from the description and drawing of that species in having a notch on the margin of the dorsal shield near L4, the dorsal shield with 10 pairs of pores, the large setae longer, and genu IV with 2 short, rod-shaped setae.

FEMALE: Pale white as if immature; dorsal shield smooth 288 long, 170 wide with setae arranged as shown in Fig. 12. Lengths of setae follow: L1 98, L2 9, L3 11, L4 132, L5 9, L6 109; D1 36, D2 7, D3 5, D4 9, D5 (absent), D6 5; M2 81; S1 52, S2 36; VL1 85. Ventrianal shield about 105 long, 58 wide (near anterior margin) (a paratype specimen has 2 pairs of preanal setae); primary metapodal shield 27 long, no accessory shield observed. Fd of chelicerae 22 long. Leg I 339, II 287, III 284, IV 490; tarsus I 108, IV 199; no macrosetae on legs I-III; sge 31, sti 40, stb 49, sta 36. Cervix of spermatheca 7 long (drawing from paratype).

MALE: Resembles female; dorsal shield 204-230 long, 136 wide (3 males). Spermatodactyl with foot 6 long, shank about 11 long.

Holotype: Female, Santurce, P. R., 5 Sept. 1963 (D. De Leon), on *Hibiscus tiliacea. Paratypes*: 3 males, 6 females collected with holotype; 1 female on *Hura crepitans*, other data as for holotype.

These mites were common on *H. tiliacea* with 10 or more per leaf (the leaves are large—about 7 inches across) and no other mites were seen on the leaves. A pair appeared to be mating with the male on the back of the female for a period of about 30 seconds and then the male left the female; before this period the male clung to the female, struggled to get on her back and appeared to be aggressive, after this period the male ignored her. With the pairs of *Amblyseius* and *Phytoseius* that I have seen and thought were mating the male was beneath the female and ventral side up.

Phytoseius (*Phytoseius*) *woodburyi*, new species
(Fig. 13)

Phytoseius woodburyi resembles *P. macropilis* (Banks) as redescribed by Chant and Athias-Henriot (1960), differing from their description chiefly in the relative lengths of the setae of the dorsal shield and in the size and shape of the macrosetae. The male is not known.

FEMALE: Dorsal shield 280 long, 147 wide with setae of the following lengths: L1 32, L2 14 (smooth), L3 29, L4 10 (smooth), L5 117, L6 73, L7 74; D1 31, D2-D4 7, D5 (absent), D6 7 (all "D" setae smooth); M2 88; S1 44; VL1 45 (all setae pectinate except as indicated). Ventrianal shield

91 long, 36 wide (near anterior end) with 3 pairs of preanal setae; metapodal shield 33 long, about 3.5 wide, accessory shield missing. Fd of chelicerae 23 long, dentition not clear, but apparently with 2 sub-apical teeth, md with 1 tooth. Legs too bent to measure; tarsus IV 161 long; no macrosetae on legs I-III; sge 8, sti 44, stb 21, sta 24. Cervix about 5 long.

Holotype: Female, Cayey Mountain, P. R., 28 Aug. 1963 (D. De Leon), on *Acroclididium salicifolium*. The mite is named in honor of Dr. R. O. Woodbury, Botanist, Agricultural Experiment Station, Rio Piedras, who kindly identified practically all of the plants from which mites were collected.

Amblyseiulus inflatus, new species

(Fig. 14)

Amblyseiulus inflatus resembles *A. rosellus* (Chant), but the long setae are much longer, the peritreme is normal, and the genital shield is enlarged posterolaterally. The male is unknown.

FEMALE: Dorsal shield smooth, slightly brownish, moderately sclerotized, 369 long, 290 wide with setae arranged as shown in Fig. 14. Lengths of setae as follow: L1 46, L2 21, L3 7, L4 159, L5 10, L6 10, L7 8, L8 8, L9 175; D1 42, D2-D6 5 (D5 absent); M2 175; S1 21; VL1 90. Ventrianal shield 127 long, 119 wide; primary metapodal shield 31 long. Fd of chelicerae 48 long. Leg I 513, II 374, III 382, IV 510; tarsus I 183, IV 200; sgeI 49, II 45, III 65, IV about 125, sti 87, st 85. Cervix 20 long.

Holotype: Female, Sabana, P. R., 30 Aug. 1963 (D. De Leon), on *Clidemia strigosa*.

The types and paratypes of the new species are in the author's collection.

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EFFECT OF SOME FUNGICIDE MIXTURES ON SOD WEBWORMS IN SOUTH FLORIDA TURFGRASSES

HUEY I. BORDERS
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A new fungicide mixture was observed to control tropical sod webworms in No-Mow bermudagrass, Everglades-1 bermudagrass, Tifgreen bermudagrass, and Bitter Blue St. Augustinegrass in South Florida.

The initial observation was made on 11 June 1964, following the termination of a test of fungicides for control of *Helminthosporium-Curvularia* infection of Tifgreen bermudagrass which was conducted at the University of Florida Plantation Field Laboratory, Ft. Lauderdale, Florida. The treatments could not be rated for disease control because the grass was eaten off by tropical sod webworms, *Pachyzancla phaeopteralis* Guenee, in all plots except those sprayed with PFL-64, which is a mixture of 3 parts 50% Captan (M trichloromethyl thiotetrahydrophthalimide), 2 parts 53% Tribasic copper sulfate, and 2 parts 75% PCNB (pentachloronitrobenzene), and those treated with Experimental Turf Fungicide-64, a mixture of 3 parts 65% Thiram (tetramethylthiuramdisulfide), 2 parts 53% Tribasic copper sulfate, and 2 parts 75% PCNB.

Both these mixtures had been applied at the rate of 7 lb. per 100 gallons of water per 1000 sq ft of turf. No sod webworms were found in the grass in any of the replications of either of these treatments. There was an average count of 20 webworms per sq ft of turf in all replications of the other 13 treatments in the test. The color, ground cover, and over-all appearance of the PFL-64 plots were outstanding, and the grass in the Expt. Turf Fungicide-64 plots was almost as good.

To check on these observations, five additional tests were run on webworm infested plots of No-Mow bermudagrass, Everglades-1 bermudagrass, and St. Augustinegrass. Single spray applications of PFL-64 at dosage rates of 1¼, 1¾, 3½, and 7 lb. of PFL-64 per 1000 sq ft of turf were applied. Expt. Turf Fungicide-64 was not tested further as it was difficult to keep in suspension and to apply.

At all dosage rates, sod webworms were controlled for from four to six weeks. A single application of PFL-64 at 1¼ pounds per 1000 sq ft on each of the three bermudagrasses, gave protection from sod webworms for six weeks. At all dosage rates the grasses showed signs of new growth within three or four days after treatment, and recovery continued throughout the periods of observation.

Individual components and combinations of two components of PFL-64 were tested but did not give as effective control as did the complete mixture.

Further study of the effect of PFL-64 at smaller dosage rates is necessary in order to learn the minimum effective dosage of this mixture for the control of sod webworms in South Florida turfgrasses.

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