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A NEW GENUS, A NEW SUBGENUS AND SEVEN NEW SPECIES OF THYSANOPTERA FROM PORTO RICO

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Cercyothrips. New Genus. Family Thripidae.

Antennae 8-segmented, maxillary palpi apparently only 2-segmented, sense cones on segments 3 and 4 forked, mouth cone broad and heavy reaching nearly across prosternum. Head produced between antennae which are inserted far apart close to the eyes, and are directed somewhat laterally. Cheeks strongly converging posteriorly. Prothorax shorter than the head and without the usual spines at the angles. Anterior and intermediate tibiae unarmed; legs stout. Wings well-developed, with two veins sparsely set with spines. 9th segment of abdomen the longest. Spine on abdominal segments 9 and 10 stout.

This genus suggests *Limothrips* somewhat in the projection of the head between the eyes. The antennae are very similar to those of some species of *Sericothrips*, notably *variabilis*.

Cercyothrips striatus. New Species.

Female:—Measurements of Holotype: Length 0.95 mm.; head, length 0.112 mm., width through eyes 0.163 mm.; prothorax, length 0.103 mm., width 0.155 mm.; mesothorax, width 0.20 mm.; abdomen, greatest width 0.215 mm.

Dimensions of antennal segments in microns:

	1	2	3	4	5	6	7	8
Length	22	36	60	61	49	53	12	18
Width	28	28	20	18	16	15	7	6

General color by reflected light: eyes deep orange, whole body, especially prothorax, heavily tinged with orange, also all femora and tibiae and two basal segments of antennae and segment 6, basal half of segments

3-5, segments 7-8 and tarsi lemon yellow. Color by transmitted light; head, thorax, abdomen, femora, tibiae, and segment 2 of antennae deep brown; tarsi, distal half of segments 3, 4, 5 and segments 6-8 light brown, 7 and 8 lighter than 6, proximal half of segments 3 to 5 gray brown. Wings clear in basal 2/5 and distal 1/5 except over veins, remainder brown, forming a broad band. Posterior wings clear except for dark brown median vein.

Head nearly straight across front to middle of insertion of antennae, thence curving forward very nearly to base of second antennal segment forming a projection between the antennae as broad as basal segment. Eyes not protruding, rather coarsely facetted, minutely pilose, occupying slightly more than half the width of the head and 2/3 its length; with orange pigmentation. Ocelli large, approximate, the posterior pair opposite center of eyes, slightly fore-shortened due to their position on sides of hump, anterior ocellus on front margin of hump and strongly directed forward. Cheeks slightly roughened and converging evenly and strongly to prothorax. Dorsal surface behind ocelli very distinctly though finely transversely striate, and very slightly so in front of anterior ocellus. Spines upon head sparse and minute. Antennae situated rather low on front bearing few spines and those small. Branched sense cones placed as in Frankliniella, but in this specimen they are much enlarged and long. A long transparent sensory hair located on inner margin of six near the middle.

Prothorax very distinctly though finely transversely striate, anterior angles broadly rounding to the middle of the segment, posterior angles slightly rounding, without long spines, although rather low down on each anterior angle, and on posterior angles a single very short spine is visible, remnants of the row on the posterior margin are found in a pair of very short, rather stout spines on each side of meson. Mesonotum and metanotum distinctly and finely striate. Legs short and the fore pair, particularly, quite stout. Femora and tarsi sparsely pubescent. Wings narrow, ring vein heavy, at middle about 1/15 as broad as long, spines on costa and veins small, costa bears 23, fore vein bears 9 spines situated as follows, 3 near base, 4 near middle, 1 at fourth fifth and one near tip; posterior vein bears 3 spines all beyond middle of vein, two being near the middle and the third just within brown area near fourth fifth. Anterior vein runs all the way very near costa. Fringe on costa long, slender and sparse, fringe on posterior margin long, slender and straight.

Abdomen striate on sides of first to 7th segments, constriccted at segments, broadest at about 5th segment, converging evenly from 6th segment to the stout cone-shaped 10th segment. Conspicuous spines only on last three segments, two lateral pair on nine and much shorter median pair on 10 quite prominent and dark brown. The median pair on 9 considerably smaller than those on 10. 8th segment bears a fine comb-like fringe of minute spines on posterior dorsal margin. A dark chitinous thickening extends across dorsum of segments 2 to 8 near anterior margin. 10th segment is entire above.

Described from one female. No food plant given. Collected by Mr. E. G. Smythe, Rio Piedras, Porto Rico, Oct. 7, 1919.

Sericothrips portoricensis, sp. nov.

Female:—Color: Head and prothorax deep brown, pterothorax and 1st abdominal segment orange brown; abdominal segments 2-5 with a longitudinally median tan colored stripe occupying about 1/4 the width of the segments, remainder of segments brown, segment six tan, segments 7-10 dark brown; fore and middle femora tan, hind femora nearly as dark brown as abdominal segments 7-10, tibiae light tan, tarsi lemon yellow; antennal segments 1 and 2 straminious, base of 3 gray, remainder of antennae brown, shading from light lemon on 3rd segment to dark brown on segments 6-8 with bases of 4 and 5 gray brown. Wings deep brown, basal fourth (except scale which is brown) gray, a gray cross band in the fourth fifth; hind wings gray except for dark brown median vein.

Head very short, scarcely 1/4 as long as broad, surface very finely striate; eyes dark blackish brown, occupying slightly more than half the width of head and nearly its entire length, pilose with a few conspicuous hairs, facets large; ocelli equidistant, large, margined inwardly, with very dark orange crescents; post-ocellar spines large and prominent, a few small spines on cheeks, four spines across front below anterior ocellus a little larger than setae between facets of compound eyes; mouth cone long, reaching across prosternum, stout, cone-shaped with sides slightly convex; antennae normal except for the branched sense cones which are especially large and thick.

Prothorax only about half as long as wide, quite thickly covered with fine transversely anastomosing lines, sides convex; each posterior margin bears a very stout long spine a short distance from lateral margain, between these two spines there is a chitinous thickening very close to posterior margin; this chitinous thickening extends cephalad from each spine in an arcuate line about 2/3 across the pronotum, each side line boing joined across the front by a concave thickening; the enclosed pronotal area is somewhat darker than the remainder of the segment and bears two small spines on each side, one at the anterior angle and the other midway the lateral margin; the prothorax bears two pairs of small spines on its anterior margin, the first spine of each pair being about 1/8 the width of the anterior margin from the anterior angle and the second spine about 1/8 this width distant from the first. The mesoscutum is very thickly covered with finely anastomosing lines and bears six small but distant spines, one near each lateral angle, one each side the meson about midway between poterior and anterior margins, the other two spines stand, one on each side about half-way between lateral line through preceding two spines and posterior margin but about twice as far from meson as the preceding; the metascutum is longitudinally striate and bears four spines in its anterior margin somewhat smaller than those on pronotum, metascutetlum smooth. Legs not especially long; wings normal to the genus, at the base about 1/9 as broad as long, at the middle about 1/18 as broad as long. Costa bears about 24 spines, fore vein about 20, and sometimes 2 on hind vein near tip.

Abdomen normal to the genus in shape. The lighter color of 6th segment and the light stripe along meson due partly to the absence of the very fine posteriorly directed dark spines found on segments 7-10 and on darkened posteriors of other segments. Segments 2 to 7 each with a dark chitinous thickening near anterior margin. Spines on last two segments rather short. Tenth segment entire above.

Measurements; length 1.10 mm.; head, length0.04 mm., width 0.16 mm.; prothorax, length 0.114 mm., width 0.204 mm.; mesothorax, width 0.26 mm.; metathorax, width 0.24 mm.; abdomen, width at 4th segment 0.28 mm. Dimensions of antennal segments in microns:

	1	2	3	4	5	6	7	8
Length	26	36	57	57	44.9	53	11	16

Described from 2 females collected at Rio Pedras, Porto Rico, March 25, 1920, by E. G. Smythe.

The chitinous thickening on the pronotum and the color will differentiate this species from other species of the genus.

Anaphothrips bicolor, sp. nov.

Female:—Holotype—Coloration: brown and yellow; head, mesothorax, metathorax, first two and last four abdominal segments, first two and last four antennal segments and second quarter of fore wing brown—the head and last three abdominal segments somewhat darker than thorax, the first antennal segment and second quarter of wing somewhat lighter than thorax. Middle and hind coxae light brown. Remainder of insect grayish yellow except basal fourth of fore wing which is colorless, the apical half which is light gray and the 3rd and 4th antennal segments which are very light yellowish. The eyes tinged with orange pigment, the ocelli are light yellow margined inwardly with very dark orange crescents.

Head a little less than 1/5 broader than long, obtusely angular in front of eyes, cheek very slightly convex, eyes slightly protruding, occupying nearly 2/3 the width of head and fully 1/2 its length; ocelli small, approximate, the posterior pair on line with posterior third of compound eyes. Surface faintly and sparcely transversely striate. Four tiny spines stand in a row across front half-way between anterior ocellus and frontal angle, a row of six similar spines cross the head just behind eyes, and a spine of similar size stands just in front of each posterior ocellus. Mouth cone heavy and blunt, reaching 3/4 across prosternum. Antennal joints rather short, sense cones small.

Prothorax somewhat longer than head, about 2/3 as long as broad, broadest across posterior margin, surface smooth and angles without spines. Mesothorax 1/4 broader than prothorax and without visible spines; metathorax about 1/9 narrower than mesothorax. Legs short and thick, unarmed. Wings broad at base, attaining 8th abdominal segment. First third of costal margin bare, at the middle 1/12 as broad as long. The two longitudinal veins indistinct. Spines on wing tiny and transparent. Costa bears about 20, fore vein with a basal group of 3 spines, 3 spines in the brown wing band and 3 widely separated spines beyond, the last one near

tip; hind vein bears 7 spines which are more widely separated toward tip than toward base of wing.

Abdomen stout. Eighth segment with a comb of spiniferous tubercles on dorsal posterior margin. Last three segments sharply conical. A small spine at posterior angle of 7th segment, a larger one on posterior angle of 8th segment; the 9th bears six long, light brown spines across its posterior margin. The spines on 10th segment nearly as long as those on 9th. 10th segment split open above.

Measurements—holotype:—Length 0.965 mm.; head, length 0.112 mm., width through eyes 0.13 mm.; prothorax, length 0.122 mm., width 0.14 mm.; mesothorax, width 0.20 mm.; metathorax, width 0.179 mm.; abdomen, width at middle 0.236 mm.; length of antennal segments in microns:

	1	2	3	4	5	6	7	8
	16.3	30	32	34	34	44.9	8	13

Described from 4 females collected on cane, Bayamon, Porto Rico, May 5, 1920, by G. N. Wolcott.

LISSOTHRIPS HOOD
PROLISSOTHRIPS NEW SUBGENUS

Head slightly wider than long, quadrate, very slightly narrowed posteriorly; eyes larger than in *Lissothrips* and directed more laterad; antennae as in *Lissothrips*, except that sixth segment is slightly longer than seventh. Mouth cone broad and sharp-pointed at tip, extending only 3/4 across prosternum. Labium broad and broadly rounded. Prothorax very slightly shorter than head, the five pairs of bristles very noticeably expanded at tips and much shorter than in *Lissothrips*. Fore tarsi unarmed. Most of the abdominal spines expanded at tips.

The shorter mouth cone, the shorter and more expanded spines and the quadrate head suggests a genus distinct from *Lissothrips*, but since the only specimen known is a male, I hesitate to give it generic rank, preferring to place it in a subgenus under *Lissothrips*, to which it is so very closely allied.

Lissothrips (Prolissothrips) stratulus sp. nov.

Male:—General color uniform dark brown, with scarcely any shading, except for second antennal segment, which is slightly lighter and the 3rd antennal segment, which is gray.

Head, quadrate, about 1/4 wider than long, cheeks slightly roughened and slightly convex. Eyes directed somewhat laterad, occupying about half the width of the head and 1/3 its length. Ocelli wanting. Post ocular bristles of medium length and markedly expanded at tips. Mouth cone pointed at tip and reaching 3/4 across prosternum, labium broad and broadly rounded, over-reaching the mouth cone.

Prothorax a little shorter than head, measured through coxae 2 1/2 times as broad as long and 1 2/3 times as broad as at anterior margin; bearing five pairs of well-developed spines—not nearly as long as those of *Lissothrips muscorum*—which are markedly expanded at tips. Meso and metathorax about 4/5 as wide as prothorax through coxae. Mesonotum

with a pair of spines with expanded tips at its lateral posterior angles. Anterior margin of mesothorax shouldered at the angles. Legs short and stout. Tarsi unarmed. Wings wanting.

Abdomen scarcely broader than prothorax through coxae. Posterior margin of abdominal segments 2-9 each, with two pairs of bristles of medium length, all expanded at tip, except the ones at lateral angles of 7th and 9th segments, respectively, which are sharp pointed. Tube stout, spines at its tip sharp pointed and scarcely more than half the length of the segment.

Measurements: Length, 0.948 mm.—abdomen somewhat extended; head length, 0.089 mm.; width 0.106 mm.; prothorax, length 0.857 mm.; width on anterior margin 0.122 mm., through coxae 0.204 mm.; mesothorax, width 0.17 mm.; metathorax, width 0.155 mm.; abdomen, width at 3rd segment 0.204 mm. Tube, length about 0.073 mm.; width at base, 0.053 mm.; at tip, 0.024 mm. Length of antennal segments in microns:

	1	2	3	4	5	6	7	8
	18	32	24	27	28	32	28	28

Described from one male taken by F. Sein, from stomach of a lizard, *Anolis stratulus* Cope collected at Santa Catalina, Porto Rico, May 9, 1924. Elevation 1,500 feet.

Gastrothrips fuscicauda, sp. nov.

Female:—Holotype, color: Head, thorax and abdomen very dark brown; all femora, middle and hind tibiae dark brown; fore tibiae brown, fuscus on outer margin; fore tarsi yellowish brown, middle and hind tarsi light brown; first antennal segment brown, the second a little lighter, the third yellowish brown, the fourth colored like the second, fifth to eighth dark brown; tube black.

Head longer than wide, obtusely angular in front, narrowing from middle to base, where it is about 5/6 as wide as at middle; postocular spines alone prominent, light brown and sharp pointed. Mouth reaching about 3/4 across prosternum, constricted near tip, rounded. Labium broad and broadly rounded. Eyes occupy nearly 2/3 width of head through them and not quite 1/3 its length, facets smaller than ocelli. Ocelli rather large, posterior pair situated in front of middle of eyes and contiguous thereto. Anterior ocellus on extremity of head and pointing forward. Antennae normal, 5th to 7th segments stalked, 3rd segment narrow at base—inverted cone-shaped.

Prothorax only half as long as head and only about 1/3 as long as the width through coxae; all spines present, reduced in size, those on anterior margin tiny, those on posterior angles alone prominent, mesothorax about 1/9 broader, and metathorax very little broader than prothorax. Legs rather short and slender, except the fore pair. Fore femora enlarged, about 2/3 as broad as head, fore tarsus armed with a stout tooth about as long as diameter of tarsus. Wings present, but not spread, and the details cannot be seen.

Abdomen stout. Spines prominent alone on last four segments, those on 9th segment being nearly as long as the tube, those at tip of tube about 5/6 as long as tube.

Measurements: Length 2.03 mm.; head, length 0.24 mm.; width at middle 0.224 mm.; prothorax, length 0.129 mm., width through coxae 0.38 mm.; mesothorax, width 0.422 mm.; metathorax, width 0.396 mm.; abdomen, width at 5th segment 0.47 mm. Tube, length 0.19 mm.; width at base 0.129 mm., at tip 0.06 mm.; very slightly constricted at tip. Dimensions of antennal segments in microns:

	1	2	3	4	5	6	7	8
Length	51	60	86	77.6	60	45	?	?
Width	40	35	34	34	34	29	25	17

Described from 1 female collected in Porto Rico from the stomach of a lizard, by Mr. G. N. Wolcott. This species may be easily distinguished from its nearest congener *G. texannus* Hood by its greater size.

Gastrothrips anolis, sp. nov.

Female:—Color, head light brown; thorax and all but 10th abbnominal segment dark blackish brown; tube dark orange; fore femora yellowish brown, fuscus on outer side, middle and hind femora slightly lighter brown than head, with decided fuscus tinge toward bases; fore tibiae lighter brown than head, middle and hind tibiae darker brown than head, but not so dark as abdomen; fore tarsi pale yellow, middle and hind tarsi pale brown; 1st antennal segment deep yellow, 2nd yellowish brown, 3rd light brown with fuscus tinge at base and on sides, 4th dark brown, 5th to 8th dark blackish brown.

Head as wide as long, widest just behind eyes, at the base only 4/5 as broad as just behind eyes; eyes medium, occupying only slightly more than half the width of the head and not quite 1/3 its length, cheeks set with a few small spines; postocular bristles, well developed, yellow; ocelli small, the posterior pair opposite the middle of eyes and contiguous thereto, anterior ocellus on line with front of eyes; mouth cone reaching 3/4 across prosternum, constricted near the tip and pointed, labium broad and broadly rounded; antennae normal, 1st joint cylindrical, 4th-7th stalked.

Prothorax about 4/5 as long as head and twice as broad (through coxae) as long; all the usual spines present, sharp pointed, although the anterior marginals are small. Mesothorax only slightly broader than prothorax, sides nearly parallel, metathorax nearly as broad as mesothorax; legs of medium size, fore femora slightly thickened, fore tarsi unarmed; legs sparsely clothed with long setae.

Abdomen stout, broadest at about 6th segment. Spines well-developed only on last four segments; those on 9th segment being nearly as long as the tube. Tube stout, rugulose, constricted near, but not darkened at tip. Terminal hairs scarcely as long as basal width of tube.

Measurements:—Holotype. Length 1.6 mm.; head, length 0.215 mm., width 0.215 mm.; prothorax, length 0.172 mm.; width through coxae 0.344 mm.,

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mesothorax, width 0.379 mm.; metathorax, width 0.361 mm.; abdomen, width at 6th segment 0.49 mm.; tube, length 0.18 mm., width at base 0.094 mm., width at tip 0.051mm. Dimensions of antennal segments in microns:

	1	2	3	4	5	6	7	8
Length	50	61	81.6	69	67	61	44.9	44.9
Width	44.9	36.7	32.6	35	35	30	23	13

Described from 1 female collected from the stomach of a lizard, *Anolis pulchellus* D. & B. Porto Rico. G. N. Wolcott, collector.

This species may be distinguished from its nearest congener, *G ruficauda* Hood, by the yellow color of the 1st antennal segment and by the light brown head.

Diceratothrips wolcotti, sp. nov.

Female:—General color dark blackish brown; fore femora yellowish brown at tip inside and bases of all femora yellow brown; hind and intermediate tarsi brown, fore tarsi bright yellow brown; antennal segments 1 and 2 and all but tip of 3 yellow brown, remainder of antennae dark brown. Fore wings brown in basal half, fading to gray brown in apical half; hind wing shaded like front wing, but lighter; both wings with two dark brown longitudinal stripes running from near base to about middle of wing; one stripe near anterior margin of wing, the other through the center.

Head 1/4 longer than wide—cheeks slightly convex—narrowed somewhat behind and constricted just before a collar—like thickening very near posterior margin; surface roughened, cheeks set with a few short, stout spines; eyes moderate in size, finely facetted, not pilose; ocelli large, well separated, posterior pair very near inner margins of eyes and standing almost entirely back of middle of compound eye; anterior ocellus in a depression in front and strongly inclined forward. Post ocular bristles long and sharp; the pair of bristles on front laterad of anterior ocellus large and blunt, reaching to middle of 2nd antennal segment, just mesad of each of these bristles may be seen a small bristle about 1/5 as long as its companion. Antennae normal to the genus, twice as long as head. Mouth cone broad and broadly rounded at tip; reaching 3/4 across prosternum.

Prothorax large and heavy, nearly twice as broad through coxae as on anterior margin, anterior margin strongly concave. All the usual bristles present, only those on posterior angles prominent, anterior marginals minute. Meso and metathorax broad and heavy; mesothorax but little wider than prothorax through coxae. Wings broad but short, barely attaining posterior margin of 5th abdominal segment; enlarged toward tip, posterior margin with about 37 accessory hairs near tip. Legs of medium length; middle and hind femora strong, fore femora incrassate with about 3 short spines near the middle within, surface sparsely clothed with smaller spines; middle and hind femora similarly clothed; middle and hind tibiae each with two long setae without, set at end of second fifth and near tip, respectively; fore tarsus with a much shorter seta without just before middle. Fore tarsi with a blunt tooth.

Abdomen well developed, rather long, with long spines at lateral posterior angles of 5 to 9—a single spine on 5 and 6 and a pair on 7 and 8; 9, with the usual circlet, which is nearly as long as tube; spines on tip of tube only about 1/3 as long as tube.

Holotype:—Measurements, length 4.40 mm.; head, length 0.43 mm., width 0.344 mm.; prothorax, median dorsal length 0.224 mm., width through coxae 0.594 mm.; mesothorax, width 0.62 mm.; metathorax, width 0.603 mm.; abdomen, width at 5th segment 0.594 mm.; tube, length 0.49 mm.—about 3 times as long as 9th segment—width at base 0.146 mm., at tip 0.06 mm.; fore femur, width 0.21 mm. Dimensions of antennal segments in microns:

	1	2	3	4	5	6	7	8
Length	51	94.8	224	172	137	103	90	43

Described from two females. Holotype from Cayey, Porto Rico, on leaves of Ingavera, 1923. Paratype from Port Cangrejos, Porto Rico, on cotton boll. G. N. Wolcott collector of both specimens.

Named in honor of Mr. G. N. Wolcott, in recognition of his interest in collecting this order.

This species may be readily separated from its congeners by the coloration of the first two antennal segments and by the long setae on the front lateral of the anterior ocellus.

ANOTHER YEAR OF THE CITRUS APHIS

J. R. WATSON

(Contribution from the Entomology Laboratory, Fla. Ag. Exp. Sta.)

Between April 18 and 20 two days of hot, humid weather caused such a severe epidemic of *Empusa* among the green aphids of citrus (*Aphis spiraecola,* probably identical with *Aphis pomi*), as to bring them under practical control. Altho the aphids are at this date (May 11) again increasing and may injure the "June growth," the season is getting so far advanced that it is not probable that much more damage will be done this year. For several weeks their numbers had been sharply

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decreasing, due to the maturing of the first flush of growth, but after the epidemic of *Emusa* it required considerable search to find enough live aphids to keep our life history work going. It was estimated that 99.9% of the aphids perished in the epidemic. Last year the destruction was even more complete, but did not occur until the middle of June, nearly two months later than this year.

The damage done has been great, in the aggregate much greater than last year. In the territory where the aphis appeared early in the spring of 1924 (in Pinellas, Hillsborough western Polk and southward to Lee County) the general opinion of the growers is that this year's infestation was somewhat less severe than last year's. But the territory severely infested this year has been so much more extensive that the sum total of damage done has been much greater. Undoubtedly the crop of fruit has been much reduced, altho the short crop in prospect for next winter's harvest cannot be entirely laid at the door of the aphids. Certainly the aphids are not responsible for the short grapefruit crop. But the damage does not stop at this year's crop. The destruction of the young growth by the aphids this spring has undoubtedly shortened next year's crop, *i. e.*, the crop to be harvested during the season of 1926-27. This is indicated by the observation that the trees severely injured early in the spring of 1924 put out very little bloom this year and are carrying very little young fruit.

In addition to the loss of fruit and of growth on the young trees, the growers have been put to a heavy expense for insecticides and labor expended in the application of the same. Natuurally, largely due to the inexperience of the growers with this new pest, much of this has been largely wasted. Insecticides have been applied at the wrong time or with insufficient thoroness, and, unfortunately, insecticides of poor quality have been sold.

As a result of this year's experience a number of outstanding facts are apparent.

(1) *The aphids do most damage in the earliest stages of the flush of growth of the citrus, and, consequently, control measures will be most effective at that time.* Half grown foliage, blossoms and young fruit will stand a rather surprisingly heavy infestation of aphids. An experiment carried out at Lake Alfred illustrates this. A number of heavily infested branches bearing very young fruit, blossoms and buds were selected. Half of these

were dipped in a soap and nicotine solution or in a "Derris oil" solution and all aphids killed, and the other half left for a check. These twigs were carefully selected in pairs of practically the same degree of infestation, of similar size and vigor, and carrying about the same number of blossoms and buds. One member of each pair was dipped and the other not dipped. On the dipped twigs an average of 74% of the blossoms set fruit, and on the undipped 62. This difference, considering the small number of twigs, was almost within the limits of probable error. After the petals drop most of the aphids attack the calyx rather than the young orange, altho in this case enough attacked the young fruit to severely roughen it. Experience of last year indicates that as these oranges mature they will largely outgrow the bumps.

The aphids do the most damage when they attack the very young sprouting buds, the "buttons" or "points," as they burst thru the bark. One or two aphids can completely stop the growth of a "button" an eight or a sixteenth of an inch long. These embryonic twigs are often covered with aphids. For this reason control measures should be instituted upon the first appearance of these minute "points" of growth in considerable numbers. Spraying, moreover, is much more effective at this stage of growth than it is later on when there are curled leaves in which the aphids can find protection. Furthermore, in the early stages of the "flush" of growth when the amount of suitable food is on the increase, comparatively few of the aphids develop wings. Hence, if one cleans up his trees at this time they will not be as quickly reinfested. In many cases it has been ten days or two weeks before the infestation again became heavy enough to cause much damage. It is the maturing of the foliage that acts as a stimulus for the development of winged aphids. Moreover, this maturing of growth causes the wingless adults and young to become restless and move about. The dipping experiments on the blossoms mentioned above brought this forcibly to our attention. The aphids on the twigs were counted and a recount a day or two later showed that sometimes as high as 50% of the aphids had disappeared, while many well grown individuals were found on the twigs which had been dipped but a day or two before.

(2) *Whatever measures are taken against the aphids should* be thoro. Under favorable weather conditions an aphid will bring forth six young a day. This means that if the grower kills five-

sixths of the aphids on a tree the one-sixth left will have reproduced the original number in twenty-four hours, leaving out of consideration the number eaten by predators meanwhile. Of course, he has given the aphids more than a twenty-four-hour setback because several days must elapse before the young aphids can start breeding. But if he can kill 95% of the aphids the predators can be depended on to make some impression on the remainder.

The two methods of control which have been most uniformly successful under most weather conditions are dipping and dusting under tents or fumigation.

Dipping is applicable only to young trees, up to two or three years, and then only when the new growth is mostly out on the ends of the branches where it can easily be bent over into a bucket. Effective and perfectly safe dips are a solution of "derris oil," a tablespoonful to a gallon of water, or the same amount of nicotine sulphate plus an ounce or less of soap. If too much soap is used burning may result.

Dusting under tents has been very effective and practical, and an average kill of 99.7% has been obtained. A crew of three men with a battery of from six to ten tents can fumigate an acre an hour if the trees are not over 9 or 10 feet high. Using 3 percent nicotine sulphate lime dust, trees averaging 7 feet in height, cost 8 mills per tree for dust, less than a cent. The saving of dust on young trees, as compared with dusting in the open, almost compensates for the increase in labor cost, and the percentage of kill is much higher. Different types of tents have been designed to accommodate different sized trees. For trees less than a year old, sheeting stretched over a framework made of telephone wire has been satisfactory. A vegetable hamper covered with sheeting would answer. For trees up to a height of five feet, 6-foot "rabbit" wire fencing rolled into a cone makes a satisfactory framework. These tents are set over a tree, which is then dusted throu a hole in the tent. For larger trees, up to 9 feet, a tent made in the form of half a cone, with a framework of ⅝-inch gas pipe, has been found most satisfactory. It does not have to be lifted over a tree, only set up against it. A sheet of cloth with one side only sewed to the framework serves as a flap to close the open end after the tree is dusted. For larger trees tents made after the model of those used in California are best. For smaller trees tents made in the form of a bag stiffened

by an application of parrafin and an iron hoop around the bottom have been very satisfactory and have the advantage of being easily transported.

A dust of calcium cyanide has been successfully used under tents. If, however, too large a dosage is used or the humidity is high, burning may result. Experiments are now in progress, in cooperation with the American Cyanamid Company, to test out the practicability of killing scale insects as well as aphids by this method. Nicotine sulphate dusts can be safely used in any weather and are effective except during a rain or cold, cloudy weather. An exposure of from one to five minutes is sufficient, half a day does no harm. These dusts will also kill rust mites and scale crawlers. Red spiders require a longer exposure. Lady beetles in all stages and syrphus fly larvae usually go thru without injury.

(To be Continued)