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as second-class matter August 2, 1913, at the Post Office at Albany, N. Y., under the act of August 24, 1912

Published fortnightly

No. 547 ALBANY, N. Y. JULY 15, 1913

New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

Museum Bulletin 165

28TH REPORT OF THE STATE ENTOMOLOGIST

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1912

ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1913

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UNIVERSITY OF THE STATE OF NEW YORK

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New York State Education Department
Science Division, February 15, 1913

Hon. Andrew S. Draper LL.D.
Commissioner of Education

SIR: I have the honor to transmit herewith the manuscript and accompanying illustrations of the annual report of the State Entomologist, for the fiscal year ending September 30, 1912, and I recommend the same for publication as a bulletin of the State Museum.

Very respectfully
JOHN M. CLARKE
Director

STATE OF NEW YORK
EDUCATION DEPARTMENT
COMMISSIONER'S ROOM

Approved for publication this 19th day of February 1913

Commissioner of Education

University of the State of New York Bulletin

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Museum Bulletin 165

28th REPORT OF THE STATE ENTOMOLOGIST 1912

Dr John M. Clarke, Director of Science Division

I have the honor to present herewith my report on the injurious and other insects of the State of New York for the year ending September 30, 1912.

The past season was remarkable because of the superabundance of the common apple tent caterpillar in the Hudson and Mohawk valleys and on the borders of the Adirondacks. The pests were so numerous that most of the wild cherries on the roadside were defoliated and many orchards severely injured. There were reports of local damage here and there by the allied forest tent caterpillar; in several sections extended tracts were stripped of foliage. There is at least a fair probability of the insect being more abundant another season and possibly causing serious injury locally. The green maple worm, so numerous last year, attracted no attention the past season.

Petroleum compounds as insecticides. Dead and dying trees in several Greene county orchards which had been sprayed the preceding fall with a commercial preparation of petroleum, led to a careful study of the cases and the behavior of the trees through the season. A comparison was also made between the condition of these trees and injury of earlier years following applications of petroleum. We were unable to note any material difference between the two and, furthermore, observed a marked restriction of the damage to trees or even portions of trees which had received the application. A detailed discussion of our findings is given below, and after a careful study of the various phases of the matter we were forced to conclude that a certain measure of

risk attaches to the application of mineral oils or preparations of the same to trees in a dormant condition.

Fruit tree pests. The experiments of the last three years against the codling moth have been continued in the orchard of Mr Thomas Albright, New Baltimore, and very satisfactory returns obtained. The check or unsprayed tree produced only 38.95 per cent of sound fruit, while other trees of the same variety, less than 100 feet away, yielded over 97, and in some instances, more than 98 per cent of worm-free apples. The results obtained in this experiment and those of earlier years were checked by a careful study of representative trees in the orchards of Messrs W. H. Hart, Poughkeepsie, and Edward Van Alstyne, Kinderhook. These latter were sprayed under strictly commercial conditions with no expectation at that time of their being subjected to a test later. The results in these commercial orchards were exceedingly gratifying. The northern spies belonging to Mr Hart produced an average of over 98 per cent of sound fruit, while the greenings and Baldwins on the Van Alstyne place gave an average of over 96 per cent of worm-free apples. The results of the past four years' experiments go far to show that under normal crop conditions one thorough and timely spraying for the codling moth should result in producing from 95 to 98 per cent of sound fruit. These tests are of great practical value to the fruit grower, since they afford a reliable basis for correctly estimating the value of spray applications.

The pear thrips, a minute insect which blasted or nearly destroyed the pear crop in a few orchards in the Hudson valley, was studied with special reference to conditions favoring injury, and the efficacy of spraying with a tobacco preparation demonstrated. The insect, potentially a very dangerous form, is discussed in this report. The work of the pear midge was investigated and a number of extremely desirable photographs of the larva and its work secured.

Gipsy moth. The danger of injury by this notorious pest was emphasized by the discovery of a small colony, practically restricted to a city block at Geneva. A personal examination of the locality showed that the infestation was probably of three or four years' standing. The chances are at least fair that the insect was introduced in that locality with nursery stock, though no undoubted evidence as to the source of the infestation has been adduced. We may expect the discovery of similar colonies from time to time, and for a period at least, no effort should be spared to

exterminate such outlying infestations, as this policy is much cheaper and decidedly more advantageous to the general welfare than the adoption of repressive measures with the inevitable slow spread of the insect and shortly the greatly increased cost of controlling the pest incident to its being distributed over an extended area. Such measures are also advisable, since checking the normal spread is most advantageous for the development of introduced parasites, a number of which have already been established in this country.

The recent enactment of a national plant quarantine act, recommended by the Entomologist and his associates in other states, is an important step in advance and should prove of great service in restricting the spread of this and other injurious insects as well as preventing the introduction of dangerous pests.

Brown-tail moth. This species has attracted comparatively little attention the past season, though it has become established in the northwestern corner of Massachusetts and it is only a question of time before it will make its way into this State. The danger of this pest being introduced on nursery stock grown in infested sections still exists and should not be overlooked simply because a portion of the State is contiguous to infested territory. The winter nests are so characteristic that there should be little difficulty in identifying the insect and at the outset prevent its becoming excessively abundant.

Grass and grain pests. White grubs have been extremely numerous in portions of Albany, Columbia and Rensselaer counties, at least. They were so abundant in many places as practically to kill the grass over areas half an acre or more in extent. The roots were almost entirely destroyed and in many fields much of the sod was, as a consequence, torn loose where a horse rake was used. The outbreak was taken advantage of to study in representative spots, the work of the grubs, their habits and natural enemies, with special reference to methods of control. A detailed account of our investigations is given in this report.

The Hessian fly caused serious losses in the wheat-growing section of western New York, destroying entire fields and, in many cases, reducing the yield by 50 per cent. A personal investigation was made of the injury for the purpose of ascertaining any peculiarities in its inception and determining the probabilities of serious damage another year. A number of parasites were reared from infested wheat stems collected in representative areas. An extended discussion of this insect is given on a subsequent page.

The fall army worm, another grass and grain pest, was excessively abundant in the vicinity of New York City, seriously injuring lawns, destroying millet and corn and feeding upon a variety of grasses. This outbreak was also investigated and a detailed account of the insect has been prepared.

Shade tree pests. The widespread and severe injuries of earlier years by the elm leaf beetle in the Hudson valley in particular, amply justified extended observations the past season. It was found that the exceptional damage in 1911 resulted in a feeble growth and weakened trees the past season. The early portion of the spring was unusually cool and moist, and largely as a result of these conditions we believe injury by this pest was not so severe as last year. There was a marked irregularity in the work of the beetle, some trees in a locality and in certain cases some localities being almost exempt from injury, while in others the damage was relatively severe. A portion of this may be explained, possibly by more thorough spraying. Experiments were conducted with sweetened and unmodified arsenate of lead for the purpose of ascertaining if any material advantage was to be gained by the addition of a cheap sugar or molasses. There was no marked difference between the two series and our earlier work with poisons was confirmed in large measure.

The false maple scale continues abundant in the vicinity of New York City and was a subject of considerable correspondence during the summer. The cottony maple scale was also responsible for a number of complaints.

Forest pests. The hickory bark beetle has continued its destructive operations in the vicinity of New York City. The abundance of this pest and the hearty cooperation of Mr J. James de Vyver, Mount Vernon, made possible a series of tests for the purpose of finding some method which could be relied upon to destroy the insect after the beetles had entered the trees. Studies in the field showed that in some localities many of the grubs died within a few weeks after hatching and before they were able to cause material injury. A detailed discussion of this work, together with investigations upon the biology of the pest and its natural checks, is given on a subsequent page.

Many of the white pines in the vicinity of Albany have been killed in recent years by bark borers. A study of the conditions showed that in all probability this attack was the outcome of extreme droughts and very low winter temperatures. Persons

having trees which were attacked by these pests have been advised to cut and burn all infested pines prior to the opening of another season.

Hosts of Ambrosia beetles belonging to the genus Platypus attacked freshly sawn, sappy mahogany in the yard of a veneer cutting company near New York City and inflicted severe loss besides causing grave apprehensions. An investigation showed that the insects originated from a shipload of logs from Panama. The infested material was removed and the few insects remaining soon disappeared.

The destructive work of the locust leaf miner, noticed in our preceding report, was studied the past season and additional information secured in relation to its habits and methods of control. The most severe injury, as in 1911, resulted from the feeding of the beetles.

The woolly bark louse of the white pines has been the occasion of several complaints during the past season, and an investigation showed that in some instances at least, large trees were seriously weakened, if not destroyed, by this insect.

A previously unknown though sparse colony of the periodical Cicada was located at Geneseo as an outcome of the interest aroused by the appearance of the enormous brood last year.

Flies and mosquitos. There has been a general interest in controlling the house fly and preventing the superabundance of mosquitos. Both of these insects have been the subject of correspondence, and a number of bulletins giving directions for remedying undesirable conditions have been distributed.

An unusual departure was the working out of the life history of a common blowfly, Phormia regina Meign., and a flesh fly, Sarcophaga georgina Wied., under controlled conditions. These two insects, though exceedingly common, were comparatively unknown except in a very general way. The details of this investigation, undertaken for the purpose of solving a specific problem, are given more fully in this report.

Gall midges. This large group of small flies has continued to receive attention. We have succeeded in identifying the wheat midge of Fitch, which proved to be an undescribed species, discovered and described a second form recorded as living in heads of American wheat, and reared another. The last was identified through the cooperation of European entomologists as Thecodiplosis mosellana Gehin. In addition, a number of new gall

midges have been reared from various food plants and described. The outbreak by the Hessian fly, noted above, and an abundance of the pear midge in the vicinity of Albany afforded opportunity for additional studies of two economic forms.

Lectures. The Entomologist, as in past years, has delivered a number of lectures upon insects, mostly economic forms, before various agricultural and horticultural gatherings. This work enables him to become personally acquainted with the problems of various localities and has been greatly facilitated by a chart showing the results secured in codling moth experiments of recent years.

Publications. A number of brief, popular accounts of the more injurious species of the year were widely circulated through the agricultural and local press. The important publications, aside from the report for last year, are: *The Elm Leaf Beetle and the White Marked Tussock Moth* (Museum Bulletin 156), *Control of Insect Pests in Institutions, The Identity of the Better Known Midge Galls, The Fundamentals of Spraying* and several papers describing new species of gall midges. A list of the more important publications is given on a subsequent page.

Collections. There have been material additions to the collections through the efforts of members of the office staff, and also by exchange and donation. Through the courtesy of Dr Otto Nüsslin of Karlsruhe, Germany, we received an excellent series of European bark beetles. Mr Henry Bird of Rye, generously donated an admirable lot of reared stem borers belonging to Hydroecia or closely allied genera, a number of these forms being almost unrepresented outside Mr Bird's exceptionally fine collection. The work of arranging and classifying the museum collections has continued whenever opportunity offered. Mr Young did considerable miscellaneous work upon the beetles or Coleoptera, giving special attention to the flea beetles, Halticini of the Chrysomelidae and to the June beetles, Lachnosterna and its immediate allies of the Scarabaeidae. An excellent series of genitalic mounts was made in this latter group.

The value of the collections has been greatly increased by microscopic preparations. Specimens of the Scolytidae received from Doctor Nüsslin and noted above were put in balsam mounts. There were, in addition, two hundred such preparations of gall midges, mostly from reared material, and a number of scale insects, some previously unrepresented in the collections, which were similarly treated. The value of this material is much enhanced when placed

in such preparations, since the latter are permanent in character and, in most of the species mounted, necessary for the identification of the insect.

The series of plant groups designed to serve as an embellishing and instructive feature of the enlarged exhibit now in preparation is practically completed. There has been special collecting for this exhibit.

The more ample facilities of the new quarters bring added responsibilities in the opportunity they offer of making the State collection of insects, both exhibit and reference, thoroughly representative. The magnitude of such a task is appreciated by very few. The Entomologist recently assembled, with the cooperation of recognized authorities in various groups, the best obtainable figures as to the number of American insects. The data is tabulated below.

Hymenoptera	10 000	Orthoptera	950
Coleoptera	11 255	Neuroptera and Pseudoneuroptera	2 000
Diptera	9 100	Thysanoptera	118
Siphonaptera	115	Other small orders	500
Lepidoptera	6 622		
Hemiptera	3 328		43 988

A recent catalog of the insects of New Jersey, a state with a considerably smaller area and lacking the climatic and other diversities of New York, lists over 10,000 species. It seems to us conservative to place the probable number of insect species existing in this State at twice that figure. A thoroughly representative collection of New York forms should therefore contain well toward 20,000 native species, and since each has at least four well-marked stages, some 80,000 different forms. Many species and a great number of the stages are unknown. There is ample to occupy a well-equipped corps of entomologists for many years, not to mention the much additional labor involved in assembling and maintaining greatly enlarged entomological exhibits.

Nursery inspection. The nursery inspection work conducted by the State Department of Agriculture has resulted in the office being requested to make numerous identifications and also recommendations in regard to the policy which should be pursued by the State. Many of the specimens submitted for name were in poor condition, and as they may represent any stage in insect development and frequently originate in a foreign country, such determinations are

laborious and time-consuming. The correct identification of such material is, however, very important, since the disposition of large shipments of nursery stock must depend, in considerable measure, upon our findings.

Miscellaneous. In cooperation with the Division of Visual Instruction, an excellent and somewhat extended series of photographs, mostly of injurious or common insects, has been secured. This material was all taken in connection with other collecting, it only being necessary to pose the specimen for the photographer.

General. The work of the office has been materially aided, as in past years, by the identification of a number of species through the courtesy of Dr L. O. Howard, chief of the bureau of entomology, United States Department of Agriculture, and his associates. Several correspondents have aided in securing valuable specimens and many have rendered efficient service by transmitting local data respecting various insects. It is a pleasure to note that there has been, as in the past, most helpful cooperation on the part of all interested in the work of the office.

Respectfully submitted

EPHRAIM PORTER FELT
State Entomologist

October 15, 1912

INJURIOUS INSECTS

CODLING MOTH

Carpocapsa pomonella Linn.

Practical field work with the codling moth was continued the past season and the results of the previous three years of work very satisfactorily confirmed. The spraying of 1912 was confined to young and moderate sized Ben Davis trees on the farm of Thomas Albright, New Baltimore. A power sprayer was used and an effort made to do thorough work, yet the applications were by no means excessive. A check or unsprayed tree produced only 38.95 per cent of sound fruit, while those in the immediate vicinity and sprayed as described above, yielded from 97.53 to 99.53 per cent, or an average of 98.69 per cent, of worm-free apples. The other plot similarly treated comprised larger trees and produced from 95.17 to 98.77 per cent, or an average of 97.26 per cent, of sound fruit. Considering that this spraying was done under adverse conditions and the yield of individual trees by no means excessive, the results are all that could be expected. These returns were checked by examinations of the yields from representative trees in the orchards of W. H. Hart, Poughkeepsie, and of Edward Van Alstyne, Kinderhook. These trees were sprayed last spring in the ordinary practical manner and with no expectation that any of the trees would later be selected for test purposes. In the orchard of Mr Hart, his northern spy trees produced from 97.87 to 98.77 per cent, or an average of 98.23 per cent, of sound fruit. Mr Van Alstyne's trees, composed of Baldwins and greenings, yielded from 95.12 to 97.50 per cent, or an average of 96.20 per cent, of worm free apples. None of these trees were sprayed more than once during the season with a poison, and the applications were made within the week or ten days necessary to secure the best results. It should be recalled, in this connection, that our earlier work has shown that sprayings made about three weeks after the blossoms fall are only about one-half as effective as the applications after the dropping of the blossoms and before the calyx cup is closed.

Life history and habits. Before giving the details of the experimental work, it may be well to outline the life history of this pest, since a knowledge of its habits is essential to satisfactory control work. The apple worm or codling moth, as is well known, winters in a tough, silken cocoon, usually located under the rough bark of trees. With the appearance of warm weather in the spring, which in New York State means late April and early May, the caterpillars transform within their silken retreats to brown, apparently lifeless pupae, and a week or ten days after the blossoms fall the moths commence to emerge and continue to appear throughout the greater part of June. The minute, whitish eggs are deposited largely upon the leaves, though a number may be found on the young fruit. They hatch in about a week and, as a consequence, the young apple worms of the first brood may be entering the small fruit from early in June, approximately three weeks after the blossoms fall, to nearly the end of the month or even later. The caterpillars require about four weeks to complete their growth, at which time they desert the fruit, wander to a sheltered place, sometimes excavate an oval cell in the wood or bark and spin a cocoon. They transform once more to pupae and in about two weeks, namely the last of July or in August another brood of moths may appear. These in turn deposit eggs which hatch in due time and the young larvae usually enter the side of the fruit. Two broods appear to be the rule in the northern fruit-growing sections of the United States, though some investigators claim a third in the southwest.

Experimental work. May 29th two lots of trees were sprayed on the farm of Thomas Albright, New Baltimore; 2 pounds of arsenate of lead (15 per cent arsenic oxid) being used to 50 gallons of water and 1 gallon of a lime-sulphur wash to 40 gallons of spray. A straight discharge variable nozzle was used on one line of hose, while the other was equipped with two angle Friend nozzles, the extensions in each case being about 8 feet long.

Plot 1 comprised five moderate sized Ben Davis trees just back of the house and southwest of the barn. These trees are about 18 feet high with a spread of 20 to 25 feet and were well loaded with young apples, except tree C, one-half of which bore practically no fruit. The blossoms had mostly fallen, only a few remaining

here and there. The trees were sprayed about ten o'clock in the morning, there being a high wind and some 70 gallons of mixture was applied to the five trees. There was considerable dripping and more spray material was used than really necessary, owing to the wind.

An examination of conditions on August 16th showed little of special significance and not enough apples on the ground to warrant picking up the fruit. On September 17th the fallen apples were picked up and classified, and again nothing particularly significant noted. The remainder of the fruit was secured October 14th. The data relating to all the trees is tabulated below:

Plot 1 Thomas Albright orchard, New Baltimore, N. Y. Variety, Ben Davis. 1912

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
A	Sept. 17	Drops	89	78	.....	11	.....	.....	.....	11	6	.....
	Oct. 14	Drops	80	74	.....	6	.....	.....	.....	6	3	.....
	Oct. 14	Picked	2991	2952	.....	39	.....	.....	5	34	16	.....
			3160	3104	98.22	56	1.78	.....	5	51	25	.....
B	Sept. 17	Drops	235	219	.....	16	.....	2	.....	14	10	.....
	Oct. 14	Drops	86	81	.....	5	.....	1	1	3	3	.....
	Oct. 14	Picked	2366	2281	.....	85	.....	3	.....	82	18	1
			2687	2581	96.06	106	3.94	6	1	99	31	1
C	Sept. 17	Drops	33	27	.....	6	.....	.....	.....	6	4	.....
	Oct. 14	Drops	76	71	.....	5	.....	.....	2	3	4	1
	Oct. 14	Picked	1257	1215	.....	42	.....	3	4	35	17	.....
			1366	1313	96.12	53	3.88	3	6	44	25	1
D	Sept. 17	Drops	66	51	.....	15	.....	1	.....	14	12	.....
	Oct. 14	Drops	81	74	.....	7	.....	.....	.....	7	7	.....
	Oct. 14	Picked	1012	978	.....	34	.....	2	2	30	9	1
			1159	1103	95.17	56	4.83	3	2	51	28	1
E	Sept. 17	Drops	106	102	.....	4	.....	.....	.....	4	4	.....
	Oct. 14	Drops	67	65	.....	2	.....	.....	.....	2	2	.....
	Oct. 14	Picked	2593	2565	.....	28	.....	2	2	24	8	.....
			2766	2732	98.77	34	1.23	2	2	30	14	.....
Grand total..			11138	10833	97.26	305	2.74	14	16	275	123	3

It will be seen by referring to these data, that the yield of the five trees in this plot was fairly uniform, though trees C and D

produced only 1366 and 1159 apples, respectively, the others approximating 3000. The variation in percentage of sound fruit is not great and the average for the entire plot is excellent. It will be noted that a very large proportion of the wormy fruit, namely 291 out of the total 305, were side wormy, only 30 being end wormy and more than half of this latter number, namely 16, being both end and side wormy.

Plot 2 comprised seven small Ben Davis trees located in a lot north of the house next to the woods and west of a small creek. These trees are 15 to 16 years old, 10 to 17 feet high and about 30 feet apart. The check tree was in the southeastern portion of the plot, next the small creek and in a position where thorough spraying was not easy. The wind continued high and about five gallons of spray were used for each tree, the treatment being continued until there was considerable dripping. The spraying was followed by a heavy shower in the afternoon and rain during the night. This plot was moderately well laden with fruit, and our subsequent data show that there was a fairly uniform yield, except possibly in the case of the check tree.

An examination of this plot on August 16th showed there had been some spotting of the foliage by the work of a Hemipteron. It was estimated at that time that the check tree would produce 50 per cent of wormy apples and there was observed in this tree an apple tent caterpillar's nest, something not seen upon those which had been sprayed. There was nothing particularly significant about the trees at the time the fruit was picked on October 14th. It is barely possible that the tree selected as a check was not entirely representative, since its position was such that the spraying of the previous year could hardly have been as thorough as in the case of the other trees. There is also a possibility that certain wormy apples may have been swept down the stream from trees above. We believe both of these factors are comparatively insignificant, though they may have had an influence upon the yield. The tabulation of the data secured from this plot and the check tree is given on the following page.

Plot 2 Thomas Albright orchard, New Baltimore, N. Y. Variety, Ben Davis. 1912

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
A	Sept. 17	Drops	24	19	.....	5	.....	1	.....	4	5	.....
	Oct. 14	Drops	7	5	.....	2	.....	1	.....	1	1	.....
	Oct. 14	Picked	1828	1799	.....	29	.....	3	5	21	13	.....
			1859	1823	98.07	36	1.93	5	5	26	19	.....
B	Sept. 17	Drops	19	18	.....	1	.....	.....	.....	1	1	.....
	Oct. 14	Drops	8	7	.....	1	.....	.....	.....	1	1	.....
	Oct. 14	Picked	1036	1033	.....	3	.....	.....	.....	3	1	.....
			1063	1058	99.53	5	.47	.....	.....	5	3	.....
C	Sept. 17	Drops	32	30	.....	2	.....	.....	.....	2	2	.....
	Oct. 14	Drops	7	6	.....	1	.....	.....	.....	1	.....	.....
	Oct. 14	Picked	998	994	.....	4	.....	.....	.....	4	2	.....
			1037	1030	99.33	7	.67	.....	.....	7	4	.....
D	Sept. 17	Drops	19	14	.....	5	.....	.....	1	4	5	.....
	Oct. 14	Drops	10	8	.....	2	.....	1	1	.....	1	.....
	Oct. 14	Picked	1827	1788	.....	39	.....	3	5	31	10	.....
			1856	1810	97.53	46	2.47	4	7	35	16	.....
E	Sept 17	Drops	16	15	.....	1	.....	.....	.....	1	1	.....
	Oct. 14	Drops	9	9	.....	.....	.....	.....	.....	.....	.....	.....
	Oct. 14	Picked	1219	1204	.....	15	.....	3	1	11	7	1
			1244	1228	98.71	16	1.29	3	1	12	8	1
F	Sept. 17	Drops	11	11	.....	.....	.....	.....	.....	.....	.....	.....
	Oct. 14	Drops	3	2	.....	1	.....	.....	.....	1	1	.....
	Oct. 14	Picked	1157	1150	.....	7	.....	.....	.....	7	2	.....
			1171	1163	99.32	8	.68	.....	.....	8	3	.....
G	Sept. 17	Drops		.....	.....	.....	.....	.....	.....	.....	.....	.....
	Oct. 14	Drops	9	8	.....	1	.....	.....	.....	1	1	.....
	Oct. 14	Picked	1790	1778	.....	12	.....	1	.....	11	5	.....
			1799	1786	99.28	13	.72	1	.....	12	6	.....
Grand total..			10029	9898	98.69	131	1.31	13	13	105	59	1
						Check tree						
	Sept. 17	Drops	124	12	.....	112	.....	35	51	26	68	5
	Oct. 14	Drops	42	3	.....	39	.....	6	26	7	22	.....
	Oct. 14	Picked	712	327	.....	385	.....	171	161	53	103	.....
			878	342	38.95	536	61.05	212	238	86	193	5

It will be seen by referring to the above table that the yield of none of these trees was excessive, they producing from 1037 to 1859 apples or a total of 10,029. The percentage of worm-free fruit

varied from 97.53 to 99.53 with an average of 98.69. As in the preceding plot, the side wormy apples largely predominate, there being a total of 118, while the end wormy amounted to but 26, half of these being both end and side wormy.

The contrast between this data and that obtained from the check tree is striking. The latter produced only 38.95 per cent of sound fruit, 450 of the 536 wormy apples being end wormy, while the relatively small number of 324 were side wormy, 238 of the latter being both end and side wormy. It will be seen that the check trees practically reverse the relations obtaining between end and side wormy and that the major proportion of the protection from codling moth injury is due to the destruction of the caterpillars before they enter the blossom end.

Tests in commercial orchards. It was deemed advisable, in connection with the experiments described above, to check up results by comparison with those obtained in commercial orchards. The spraying in the two selected was made with no foreknowledge that any such data would be used, and the results could therefore be hardly better than most practical orchardists might hope to obtain.

The first of these practical tests was in a young orchard belonging to Mr W. H. Hart of Arlington, near Poughkeepsie and close to Briggs station on the Hopewell branch of the Central New England Railroad. The orchard is on a moderately high hill, the trees are thrifty, about 18 years old, 30 feet apart and from 17 to 19 feet high. The trees selected were all nothern spies and an effort was made to secure only those which were fairly representative of the orchard, which latter, it may be stated, is in excellent condition and represents an advanced type of orchard management. The trees were sprayed, we are informed, May 24th or 25th when the blossoms had fallen just enough so that there was no danger of poisoning bees. Mr Hart used 7 pounds of Grasselli's arsenate of lead and 4 gallons of a homemade concentrated lime-sulphur wash to 150 gallons of water. This latter sufficed for the treatment of 50 to 70 trees. Those selected for the test were somewhat larger than the average and probably received about 2¾ gallons each. The fruit was picked October 18th and everything upon the trees and under them carefully classified.

W. H. Hart orchard, Poughkeepsie, N. Y., October 18, 1912. Variety, spy

TREE	DATE	TOTAL FRUIT		CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
A	Oct. 18	Drops	363	348	.....	15	.....	.....	.....	15	3	.....
	Oct. 18	Picked	1344	1338	.....	6	.....	.....	.....	6	2	.....
			1707	1686	98.77	21	1.23	.....	.....	21	5	.....
B	Oct. 18	Drops	887	837	.....	50	.....	4	2	44	17	1
	Oct. 18	Picked	1890	1881	.....	9	.....	.....	.....	9	5	.....
			2777	2718	97.87	59	2.13	4	2	53	22	1
C	Oct. 18	Drops	158	149	.....	9	.....	.....	.....	9	4	.....
	Oct. 18	Picked	715	710	.....	5	.....	.....	.....	5	1	.....
			873	859	98.40	14	1.60	.....	.....	14	5	.....
Grand total..			5357	5263	98.23	94	1.77	4	2	88	32	1

It will be seen by referring to the above tabulation that from 97.87 to 98.77 per cent of all the fruit, or an average of 98.23 per cent was worm free. The end wormy, it will be noted, were extremely few, only six occurring upon one tree and two of these being side wormy. This very high percentage of sound fruit can hardly be attributed to an enormous yield, since it will be noted that no tree produced over 2800 apples, while one bore but 873, there being no very material variation in the percentage of wormy apples between the two.

The second of these practical tests was in the orchard of Mr Edward Van Alstyne at Kinderhook and was restricted to three rather small greening trees and two moderate sized Baldwins located in the portion of the orchard where we had conducted experimental work in earlier years. The trees were selected for the purpose of securing as nearly as possible a fair representation of the average conditions obtaining, both as to yield and infestation. Mr Van Alstyne informs us that the trees were sprayed the last week in May, just after the petals had fallen, with 3 pounds of arsenate of lead to 50 gallons of water and a lime-sulphur wash testing 25° on the Baumé scale and diluted 1 to 25. This spraying was done, as was the case of Mr Hart, with no foreknowledge that any practical test would be made later. The greenings were picked October 10th and the Baldwins October 30th and everything upon the trees and under them carefully classified.

Edward Van Alstyne orchard, Kinderhook, N. Y., 1912

TREE	DATE		TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT						
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Exit 1	Exit 2
Greening:												
A	Oct. 10	Drops	546	493	.....	53	.....	3	3	47	26	2
	Oct. 10	Picked	1997	1926	.....	71	.....	.....	6	65	4	.....
			2543	2419	95.12	124	4.88	3	9	112	30	2
B	Oct. 10	Drops	69	54	.....	15	.....	2	3	10	4	.....
	Oct. 10	Picked	1556	1517	.....	39	.....	4	1	34	4	.....
			1625	1571	96.68	54	3.32	6	4	44	8	.....
C	Oct. 10	Drops	60	57	.....	3	.....	.....	.....	3	2	.....
	Oct. 10	Picked	540	528	.....	12	.....	.....	.....	12	1	.....
			600	585	97.50	15	2.50	.....	.....	15	3	.....
Baldwin:												
A	Oct. 30	Drops	3321	3176	.....	145	.....	8	6	131	45	6
	Oct. 30	Picked	1666	1625	.....	41	.....	2	6	33	27	2
			4987	4801	96.27	186	3.73	10	12	164	72	8
B	Oct. 30	Drops	1466	1408	.....	58	.....	3	2	53	21	1
	Oct. 30	Picked	738	721	.....	17	.....	1	4	12	6	2
			2204	2129	96.59	75	3.41	4	6	65	27	3
Grand total..			11959	11505	96.20	454	3.80	23	31	400	140	13

It will be seen by reference to the above tabulation that the greenings produced from 600 to 2543 apples per tree, and from 95.12 to 97.50 per cent of worm-free fruit. The two Baldwin trees yielded 2204 and 4987 apples, respectively, 96.59 and 96.27 per cent being wormless. The very large number of drops on these latter trees (*a* produced 6 barrels of dropped fruit and 4 barrels of picked fruit, while *b* yielded 3 barrels of dropped fruit and 2 of picked apples) is explained by the fact that the picking was greatly hindered by a spell of rainy weather accompanied by more or less wind and, as a result, a very large proportion of the apples lay on the ground. The five trees as a whole yielded from 95.12 to 97.50 per cent of sound fruit or an average of 96.20 per cent. This is a somewhat lower average than that for the Poughkeepsie orchard and is probably explainable in part by the occurrence of interplanted trees of other varieties and a slight crowding and larger size which prevented to some extent the very thorough work obtaining at Poughkeepsie. It will be seen by reference to this table that only 54 apples were end wormy, 31 of these being both end and side wormy, while 431 were side wormy. The obvious

inference is that most of the reduction in infestation was due to the thorough spraying of the upturned blossom ends and the consequent destruction of nearly all worms attempting to enter the fruit at this point.

A DISCUSSION OF RESULTS

The work in the Hudson valley has now extended over four seasons in orchards belonging to four different parties in as many distinct localities, and in each instance the spraying equipment and force on the place was used, the experimenter simply selecting representative trees and insisting upon thorough, though not excessively thorough work. Baldwins, greenings, northern spy and Ben Davis were well represented in the experimental trees selected. The diversity of season, location, equipment and men, and the different varieties prevent these experiments being classed as local or exceptional. They show what the practical fruit grower can and should obtain as a result of systematic spraying in regions where codling moth conditions are practically identical with those obtaining in the Hudson valley.

A study of the habits of the codling moth shows three well-defined periods when applications of poison may be more or less effectual.

The first comprises a week or ten days after the dropping of the white petals or bloom and during which the green calyx lobes remain open and the young apples upright in such a condition that the calyx cavity can be more or less filled with poison.

The second period is about three weeks after blossoming and is the time when the young codling moth larvae or apple worms hatch, begin feeding and enter the fruit.

The third period is the latter part of July or early August and is of special importance because the larvae of the second brood, or young apple worms, are then hatching and feeding on the leaves or entering the fruit.

Yields of unsprayed or check trees. The product of the unsprayed or check trees may be the basis for comparison in all experimental work, and special pains were therefore taken throughout the series to secure for this purpose trees which were representative of average conditions and so located that there would be very little or no interference with the experimental plots. Owing to various limitations it was impractical to have our check plots of the same size as those sprayed, though otherwise conditions were practically identical.

Tabulation of yields from unsprayed or check trees

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
Check...	1	1909	3251	2366	72.73	885	27.27	312	302	271	.....
Check...	2	1909	7015	5127	73.08	1888	26.92	674	630	584	.....
Check...	1	1910	711	202	28.41	509	71.59	186	240	82	.....
Check...	2	1910	2000	593	29.65	1407	70.35	700	324	383	.....
Check...	1	1911	5337	4540	85.06	797	14.94	379	166	252	.....
Check...	2	1911	14670	9860	67.21	4810	32.79	2048	949	1813	.....
Check...	2	1912	878	342	39.95	536	61.05	212	238	86	.....
Grand total.....			33868	23030	67.99	10832	32.01	4511	2849	3471	21.73

It will be seen that the check plots during this four-year period gave an average percentage of sound fruit amounting to 67.99, the yield in individual plots varying from 28.41 to 85.06 per cent. The smaller yields of good fruit, it should be noted, occurred on trees producing relatively few apples. The average percentage of end wormy fruit for these plots is 21.73, a marked contrast, as will be seen later, to what was obtained from the sprayed trees. The returns from the unsprayed trees may be briefly summarized as follows: Approximately one-third of the fruit was wormy and nearly two-thirds of the wormy apples were entered at the end, in other words, were end wormy. The importance of this data will be more fully demonstrated as we consider the returns from the various plots.

Results obtained from spraying during the first period. This treatment is given within a week or ten days after the blossoms drop, preferably as soon as possible thereafter and before the calyx lobes have closed. Since the codling moth larvae or apple worms do not hatch till a week or ten days after the close of this period, namely, about three weeks after blossoming, we are unable to see that the second treatment prior to the closing of the calyx cup, as ordinarily recommended, materially affects the situation so far as the codling moth is concerned, provided the first application has been thorough. This is evident when it is remembered that all that can be done by spraying during the period is to place the poison where it will be eaten by the caterpillars or apple worms, to appear later, as they attempt to enter the blossom end. The additional

amount placed upon the foliage if a second spraying be given during this period, as will be seen shortly, is of comparatively small value in destroying codling moth larvae.

Summary of four years' work with one spray for the codling moth

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
1.....	1.....	1909	30177	29818	98.81	359	1.19	33	18	308	.....
4.....	1.....	1909	20313	20017	98.55	296	1.45	31	6	259	.....
1.....	2.....	1909	21264	21042	98.96	222	1.04	23	18	181	.....
4.....	2.....	1909	9852	9683	98.27	169	1.73	19	13	137	.....
7.....	2.....	1909	19091	18617	97.52	474	2.48	51	32	391	.....
1.....	1.....	1910	1839	1664	90.48	175	9.52	16	21	138	.....
1.....	2.....	1910	8135	6677	82.08	1458	17.92	160	27	1271	.....
1.....	1.....	1911	16638	16515	99.26	123	.74	19	12	92	.....
1.....	2.....	1911	20802	20401	98.07	401	1.93	28	14	359	.....
1.....	1.....	1912	11138	10833	97.26	305	2.74	14	16	275	.....
2.....	2.....	1912	10029	9898	98.69	131	1.31	13	13	105	.....
Grand total.....			169278	165165	97.56	4113	2.44	407	190	3516	.353

The above tabulation shows that one spray during this period produced from 82.08 to 99.26 per cent of sound fruit or an average of 97.56 per cent for the four years, when comparisons are made between an equal number of plots in each year. In explanation it should be stated that the figures for several plots in 1909 were omitted simply to give a more nearly equivalent value to the returns obtained for the four-year period. Attention should be called to the low percentages of 1910, a season remarkable for the unusual destructiveness of the second brood and one presenting infrequent conditions which were further accentuated by the small yield of that year. Excluding the data for 1910, the lowest percentage of sound fruit obtained from one spraying was 97.52. It is worthy of note that only a little over 1/3 of 1 per cent (.353 per cent) of the wormy apples were end wormy. This, compared with the proportion of end wormy on the unsprayed trees, which latter amounts to 21.73 per cent, shows that the great reduction in wormy fruit was due to the destruction of the caterpillars or apple worms attempting to enter the apples at the blossom end, and indicates in a striking manner the importance of this early spray. The contrast is more evident if we raise the yield of the check or unsprayed trees to approximately that of the sprayed trees and the other data pro

rata so as to present a fair comparison. In the following tabulation we have assumed that 400 apples would fill a barrel. This is an approximate figure and equally fair for both the sprayed and the unsprayed trees.

Comparative results of one spray during four seasons

TREATMENT	TOTAL FRUIT		TOTAL CLEAN		WORMY APPLES					
					End wormy			Side wormy		
	No.	Bbls.	No.	Bbls.	No.	Bbls.	Per cent	No.	Bbls.	Per cent
Sprayed	169278	423	165165	412¾	407	1	.353	3516	8¾	2.19
Unsprayed	169340	423½	115150	287¾	22555	56¼	21.73	17355	48¼	18.37
Difference	62	¼	50015	125	22148	55¼	21.377	16839	39½	16.18

The contrast between sprayed and unsprayed fruit is evident at once from a scrutiny of the above figures. A yield of about 423 barrels should, if the trees are well sprayed but once, produce 412¾ barrels of sound apples, while unsprayed trees bearing an equal amount of fruit, would yield but 287¾ barrels of worm-free apples, a difference of 125 barrels. A comparison of the end wormy apples shows at once where most of the efficacy lies, there being but one barrel of end wormy fruit on the sprayed trees, while the others produced 56¼ barrels of such apples, a difference of 55¼ barrels. There is a marked, though not such a great contrast in the yield of side wormy apples. The sprayed trees, it will be seen, produced but 8¾ barrels of such fruit, while the unsprayed trees yielded 48¼ barrels, a difference of nearly 40 barrels. The same contrasts are also shown in the number of apples and the percentages of the various grades.

Results obtained from spraying during the second period. This treatment is given about three weeks after the blossoms fall and is applied at that time because the young caterpillars are then just beginning to feed and enter the fruit. Theoretically, making no allowances for peculiarities in habits, this spraying should give the best results, while as a matter of fact, returns indicate an efficiency approximately one-half that of the early treatment. Spraying at this time was done only in 1910 and 1911. The results are tabulated on the following page.

Results of one spray applied late

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
3.....	2.....	1910	7594	4355	57.35	3239	42.65	1485	326	1428	.....
4.....	1.....	1911	8969	8393	93.57	576	6.43	186	95	295	.....
4.....	2.....	1911	16815	13113	77.98	3702	22.02	1422	578	1702	.....
Grand total and per cent.			33378	25861	77.47	7517	22.53	3093	999	3425	12.26

The three plots receiving one late application during 1910 and 1911 gave an average percentage of sound fruit of only 77.47, there being a range for individual plots from 57.35 to 93.57. The average percentage of sound fruit is approximately midway between that obtained from one spraying and the yield of the check trees, namely, 77.47. The average benefit accruing from this one spray is approximately 10 per cent of the entire yield. The large percentage of end wormy, namely, 12.26, shows that this treatment lacks efficiency because of the failure to destroy caterpillars entering at the blossom end of the apples.

Results obtained from two sprayings. This means a treatment during the first period, that is within a week or ten days after the blossoms fall, and another spraying in the second period, namely, about three weeks after the blossoms drop.

Results obtained from two sprayings

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
2.....	1.....	1909	10316	10206	98.93	110	1.07	4	7	99	.....
5.....	1.....	1909	19275	19084	99.01	191	.99	10	9	172	.....
2.....	1.....	1910	2846	2756	96.84	90	3.16	6	1	83	.....
2.....	2.....	1910	7316	6105	83.45	1211	16.55	127	10	1074	.....
2.....	1.....	1911	19994	19903	99.54	91	.46	5	3	83	.....
2.....	2.....	1911	34019	33510	98.50	509	1.50	53	54	402	.....
Grand total and per cent.			93766	91564	97.65	2202	2.35	205	84	1913	.308

The six plots receiving two sprayings during 1909–11 produced from 83.45 to 99.54 per cent of sound fruit or an average of 97.65,

the end wormy fruit being less than ⅓ of 1 per cent (.308 per cent). The average gain in sound fruit resulting from this second application, if compared with the average percentage of worm-free apples obtained during the four-year period, amounts to only .09 per cent and this was accompanied by only a slight reduction in the percentage of end wormy apples.

Results obtained from three sprayings. These applications were distributed so that one was given in each of the above designated periods, namely, one within a week or ten days after the blossoms fell, the second about three weeks after the dropping of the bloom and the third the latter part of July. The second was designed to catch the young caterpillars of the first brood just as they were beginning feeding, while the third was directed against the young apple worms of the second brood.

Results obtained from three sprayings

PLOT	SERIES	YEAR	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT					
				Total	Per cent	Total	Per cent	End wormy	End and side wormy	Side wormy	Per cent end wormy
3	1	1909	9680	9582	98.99	98	1.01	8	10	80	.....
6	1	1909	7710	7633	99	77	1	6	3	68	.....
3	1	1911	20926	20830	99.54	96	.46	17	2	77	.....
3	2	1911	31119	30852	99.14	267	.86	60	23	184	.....
Grand total and per cent			69435	68897	99.22	538	.78	91	38	409	.185

It was unfortunate that in 1910 no plot received these three applications and, as a consequence, the average percentage for this treatment is somewhat higher than it should be. Even with this omission which, in a measure, is undoubtedly favorable to the three applications, the average percentage is 99.22, a gain for the third treatment representing only 1.57 per cent. It will be noted that there is a slight reduction in the average percentage of end wormy apples, this being approximately ⅕ of 1 per cent (.185 per cent).

COMPARATIVE SUMMARY

The following tabulation of comparative yields from the experimental plots during the first three years (1909—11) will prove instructive, since those from the plots sprayed three times, sprayed late and checks have been raised pro rata to make up for a deficiency

in the number of plots or a reduced number of trees in the plots and the figures thus indicate fair comparative values. We have not included in this the returns from one spray during 1912, since there would be no material gain were this done as the figures are very nearly the same, and furthermore such inclusion would result in a disproportionate representation of trees receiving but one application. The figures in the tabulation given below for the plots sprayed three times are undoubtedly somewhat higher than they should be because there were none sprayed three times in 1910, a year when the second brood of the codling moth was extremely abundant and excessively injurious.

Comparative tabulation of yields for 1909-11

NUMBER OF SPRAYS	TOTAL FRUIT	CLEAN FRUIT		WORMY FRUIT			
		Number	Per cent	Total	Total end wormy	Total side wormy	Total end and side wormy
1	98855	96117	97.23	2738	389	2459	110
2	93766	91564	97.65	2202	289	1997	84
3	104151	91863	99.22	807	272	596	50
1 late	66756	51722	77.47	15034	8184	8848	1998
Checks	98952	68064	68.78	30888	20730	17988	7833

Comparative savings as a result of spraying 1909-11

TREATMENT	WORMY APPLES ELIMINATED		GAIN		END WORMY ELIMINATED		GAIN	
	No.	Bbls.	No.	Bbls.	No.	Bbls.	No.	Bbls.
1 spray	28150	70¼	.....	.....	20341	50¾	.....	.....
2 spray	28686	71½	536	1¼	20441	51	100	¼
3 spray	30081	75	1395	2¾	20458	51	17	1/16
1 spray, late	15854	39½	.....	.....	12546	31¼	.....	.....

A study of the above data brings out the relative value of the various sprays in a somewhat different manner. Taking the check or unsprayed trees with their 98,952 apples or approximately 247¼ barrels as the standard, we find that one spraying in the first period reduces the number of wormy apples by 28,150 (70¼ barrels) or end wormy alone by 20,341 apples (50¾ barrels). The one late spraying three weeks after blossoming, takes 15,854 apples (39½

barrels) from the wormy column and but 12,546 apples (31¾ barrels) from the end wormy. The two sprays, one given just after blossoming and the second about three weeks later, reduced the number of wormy apples by 28,686 (72½ barrels) and the end wormy by 20,441 (51 barrels). This latter is not very different from the returns given by the first timely application, and in connection with the data for one late spray, shows at once that the latter is comparatively inefficient, so far as controlling codling moth is concerned. The three treatments, one spraying just after blossoming, a second about three weeks later and a third the latter part of July, eliminate from the wormy column 30,081 apples (75 barrels) and from the end wormy 20,458 apples (51 barrels).

It will be seen by referring to the above tabulation that the second spraying resulted in a gain of only 1¼ barrels, while three sprayings produced an additional gain over the two of but 2¾ barrels or a total gain over that secured from one application, of 4¾ barrels. The one late spraying eliminated only 39½ barrels from the wormy column, a saving of approximately 4/7. The above comparisons are based on approximate yields of an equal number of trees, and in all instances except in the case of the trees receiving the one late application, the total product of each plot was approximately 100,000 apples or 250 barrels. The above tabulations all show that by far the greater benefit resulting from spray operations accrues from the one treatment given within a week or ten days after the blossoms fall, and that the gains following subsequent sprayings are relatively insignificant. We do not undertake to imply thereby that one thorough timely spraying will control the codling moth satisfactorily in all sections of the country, though we believe that the possibilities of one treatment have habitually been underrated.

Single spray experiments by others. It may be claimed by some that the above returns from one spray are exceptional and can not be duplicated under other conditions. Prof. A. L. Quaintance of the federal bureau of entomology has recently compiled figures showing returns from one application and experiments conducted by him in different states over a period of several years. He finds that the average of the percentages of sound fruit from one spraying is 90.64 as compared with 96.19, the average of the percentages of sound fruit on the demonstration plots receiving from three to five applications in one season. The unsprayed trees in his experiments give an average of 57.79 per cent of worm-free apples.

He finds a considerably greater variation in the percentage of sound fruit from plots receiving one spraying than from those given three to five sprayings, this being particularly marked, as would be expected, under unusual seasonal conditions, such as injury to the fruit by hail storms. Substantiating this work of the federal bureau it is worthy of note that Professor Gossard of Ohio obtained 91.60 per cent of worm-free apples, while the check trees produced but 45.80 per cent of sound apples, and Professor Rumsey of West Vriginia, 97.40 per cent of worm-free apples (the unsprayed trees yielding only 65.9 per cent of sound fruit) as a result of one thorough spraying. These results are certainly not very different from those we obtained in the Hudson valley.

Both Professor Quaintance and Professor Rumsey also made observations upon the efficiency of this spray in the control of the plum curculio on apples, and Professor Quaintance summarizes the situation as follows: "It would therefore appear from the foregoing that for the control of the codling moth and plum curculio under eastern conditions a single thorough spraying is about as efficient as a schedule of treatment requiring three or more applications."

Control of the second brood. We have purposely emphasized the importance of thorough spraying within a week or ten days following blossoming, preferably in the earlier part of this period, because data available show that we must depend largely on this treatment for the control of the second brood of apple worms appearing the latter part of July, during August and September, and making small holes in the apples, especially where they touch each other or a leaf. Careful field studies by A. G. Hammer of the federal bureau of entomology showed that during 1909 second brood codling moth larvae at Northeast, Pa., began entering the fruit August 5th, were most abundant the latter part of that month and early in September, the last being observed about the 20th. Approximately the same conditions may be expected in western New York, though an abnormal season may result in the appearance of many young larvae unusually late, as appears to have been the case last fall in certain sections of New York State. These late appearing larvae should not be confused with the lesser apple worm, an insect recently discovered in the State and one comparatively harmless so far as we have been able to ascertain.

Referring once more to the comparative summary given above, an increase of 100 end wormy apples will be noted between plots

sprayed twice and those sprayed once, accompanied by an increase of 562 side wormy apples; in other words, each apple worm successfully evading the first spray appears to have produced approximately 5.6 side wormy fruit later. Similarly, a difference of 217 end wormy and 1963 side wormy will be noted between plots sprayed three times and those sprayed once, there being a ratio of 1 to 9 between the increase of end and side wormy. Now, if we bear in mind the importance of the first application in reducing the end wormy (this comprises about two-thirds of the total wormy fruit on unsprayed trees) from 20.95 to .349 or .353 per cent (the former an average of three years' work with one spray, the latter the return from four years' work), we can hardly escape the conclusion that the very best way of controlling the second brood is to spray most thoroughly for the first. Some six years ago Professor Ball of Utah estimated that under conditions obtaining in that state, two sprayings during the first period mentioned above, namely, within a week or ten days after the blossoms fall, are worth six to sixteen times as much as three late ones. This ratio is approximately true for our conditions, though considerable variation may be expected from year to year. Checks in the fruit from hail storms, sun scald, or burning by insecticides or fungicides afford easy and safe points of entrance for second brood larvae and have a material bearing upon the production of sound fruit. All having practical experience with this pest know only too well how quickly the young apple worms take advantage of these opportunities. The development of such conditions as those just mentioned or the somewhat common occurrence of wormy apples in early July would be ample justification for a treatment the latter part of that month or early in August for the purpose of destroying second brood apple worms before they can enter the fruit.

Conclusions. A study of the data collected during the past four years justifies the conclusion for the Hudson valley at least, that in normal seasons when the crop is abundant or fairly abundant, one thorough early spraying within a week or ten days after the blossoms fall and preferably early during that period, should result in the production of 95 to 98 per cent of sound fruit. A slight gain will accrue from a second treatment about three weeks later, and additional returns may be secured from a third spraying the latter part of July. The benefit from the latter two is comparatively small, so far as the codling moth is concerned, though ample to meet the cost of the poison and, in many instances, probably the expense of

treatment. There is no question as to the advisability of using poison in the later sprayings wherever there is sufficient fungous disease to warrant treatments for this purpose.

A small crop almost invariably means a larger percentage of wormy fruit, and if the prospects are even fair for good prices, the third spraying (the latter part of July) would at least justify itself because of the additional protection from possibly severe injury by the second brood. The treatment three weeks after the blossoms fall may be advisable, especially if the first application is not thorough for some reason or other.

Fungous diseases are of comparatively little importance in the Hudson valley. Many of our fruit growers have obtained fair results with one treatment, and the above data, we believe, show the reason why such is the case. Comparatively few have appreciated the importance of one thorough treatment at the proper time. With the information given above, we believe that our Hudson valley fruit growers can ascertain for themselves whether more than one spraying is advisable. There is no reason why the progressive fruit grower should not watch developments, and if wormy apples seem to be somewhat common in early July, protect himself against further possible injury by thorough spraying the latter part of that month and thus destroy many of the second brood larvae before they can enter the fruit. This supplemental treatment will hardly be necessary more than once in three or four years, unless a light crop and high prices justify efforts to produce the largest possible quantity of sound fruit. These results, while especially applicable to the Hudson river valley, should prove helpful in other regions, even though conditions may be somewhat different, since they emphasize the importance of thorough work during the first period. Other sprayings are more or less supplementary in nature and their relative value should be clearly recognized by the orchardist.

HESSIAN FLY

Phytophaga destructor Say

There is perhaps no important insect pest where nicer discrimination and a closer balancing of varied factors is necessary to the production of a profitable crop than in the case of the Hessian fly. This pest is very susceptible to climatic conditions; dry weather results in long periods of practical inactivity, while rains and the accompanying succulent growth are most favorable to the pest.

The character of the soil, drainage, fertility and tilth, the variety of wheat and the time of sowing all modify injury by this tiny midge with its remarkable adaptability.

The truth of the above was abundantly evident during the extremely severe outbreak of 1901 and the less extended damage of the past season. The wet spring of 1912 resulted in succulent growth most favorable for the development of maggots. To make matters worse, dry weather at the time the preceding crop was harvested, promoted shelling and subsequent moisture resulted in abundant volunteer wheat and a resultant large fall brood of flies, the descendants of these causing most of the injury in 1912.

Signs of infestation. The first indication of attack is found in the darker color of the leaves and a tendency among the young plants to stool freely. The broader lower leaves and the absence of a central shoot, it having been killed, are also characteristic of infested fields. As the attack advances the affected plants turn yellow or brown and die, and the maggots may be found at the base of the leaves near the ground. The spring brood attacks tillers or laterals which were unharmed in the autumn, dwarfing and weakening the stem so that the grain usually lodges before ripening or else fails to develop fully.

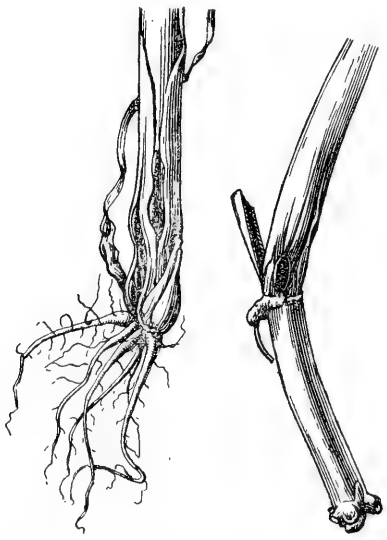

Fig. 1 Base of infested wheat stem showing "flax-seeds" or puparia under the leaf sheaths (original)

Causes of the outbreak. Extreme dryness at the time of the wheat harvest in 1911 promoted shelling and resulted in an unusually large crop of volunteer wheat, which latter was greatly favored by late summer rains. Reference to the weather reports of this locality shows that in July 1911 Le Roy was favored with a precipitation amounting to 2.86 inches, most of this occurring between the 15th and the 25th. There was an additional precipitation of nearly an inch in early August, followed by almost three-fourths of an inch in mid-August and nearly two inches the latter part of that month, while in September there were nearly three inches in the early part of the month and at least fair rains near the

middle and the latter part, the total for September amounting to 4.39 inches. Such conditions are obviously well adapted to the early starting and vigorous growth of volunteer wheat and would result in the production of an abundant succulent tissue and thus produce a condition almost ideal for the development of this pest. There may easily have been a supplemental brood on many areas prior to the appearance above ground of the regularly sown wheat. This extra brood would mean a more severe infestation in the fall and consequently serious damage in the spring. It would appear as though the elements had combined to bring about an abundant crop of volunteer wheat, practically an extended sowing of a trap crop, which latter had not been plowed under early enough so as to destroy the pests and prevent further damage.

Losses in 1912. Winter injury should not be overlooked at the outset. Mr F. C. Walker of South Byron stated that ice remained on some of his fields from February through March and killed most of the grain. The writer saw many low wet spots throughout the region where grain had evidently been killed during the winter. Some growers held winter injury responsible for from one-half to all the loss. The writer is hardly prepared to accept such a high estimate for sections where the Hessian fly was rather numerous. There were places where this insect was abundant and its presence practically ignored. Severe damage appeared to be confined largely to Genesee county, though reports of injury were received from Livingston county, and the pest was observed somewhat abundant in Orleans county. We are unable to learn of extended injury in Erie or Niagara counties, including sections severely affected in 1901.

Erie county. At East Lancaster and east of Crittenden a very poor stand of wheat was observed from the train. Mr Gilbert Ayers of the latter place considers winter injury to have been responsible for most, if not all the damage.

Genesee county. Mr W. E. Harding, of Linden, reports, under date of July 3d, that at first he was inclined to believe there was no injury, but on further investigation learned that there was considerable damage. Later he estimated the crop for 1912 at 13 bushels an acre, the normal yield being 25 bushels, and stated that over 90 per cent of the fields were infested. He estimated the loss in the town at 40 per cent at least, and adds that one field of six acres showed no injury by the fly, though it was seriously damaged by ice and water, while in another of seven acres the yield was

cut down 15 per cent by the Hessian fly and there was practically no injury by ice. Mr R. H. Hill, also of Linden, placed the yield at 15 bushels an acre, the normal yield being 20 bushels and the percentage of infested fields 75. He estimated the loss at 25 per cent.

Mr William Embt, of Linden, estimates the yield at 13 bushels an acre, a marked contrast to the normal yield which he places at 27 bushels. He states that all the wheat in that section was infested and estimates the loss at $20,000.

Mr J. Lathrop, of Morganville, under date of June 24th, reports the wheat crop as an entire failure in that vicinity, on account of the extreme cold weather of last winter when the fields were covered with ice, the little wheat escaping winter killing being damaged by the Hessian fly. There appeared to be no exemption as to variety or time of sowing. Later, Mr Lathrop states that from 34 acres of wheat he obtained only 115 bushels of grain and adds that the yield for the year will not be above 6 bushels an acre, the normal being 20. He estimates the loss for the town at 46,600 bushels and states that all the fields were infested.

Mr John R. Simmons, of Morganville, placed in mid June the loss at from one-half to three-fourths of the crop, number 6 and Klondike being the varieties affected. He estimates the yield in Genesee county at no more than 5 bushels to the acre with a possibility of total failure.

Mr C. N. Green, of South Byron, reported the yield at 8 to 10 bushels an acre, the normal being 20 to 25 bushels. He states that 80 per cent of the fields were infested and adds that their greatest trouble was not with the Hessian fly but the hard winter. He is of the opinion that if the wheat had come through the winter in good condition it would not have been destroyed by the fly.

Mr G. W. Miller, of South Byron, placed the loss the latter part of June at 60 to 75 per cent, the white wheat (number 6) being the variety affected. There was not, in his estimation, any apparent restriction of injury due to the character of the soil or the elevation. The latter part of September he estimated the yield at 8 bushels an acre, the normal being 20, reported 100 per cent of the fields infested and a loss for the town of 50,000 bushels.

Mr J. F. Rose, reporting in early June, estimated the injury at 25 per cent, all kinds being affected, though number 6 suffered most. The date of sowing apparently had no influence on the amount of injury. In September Mr Rose placed the yield at from

1 to 2 up to 20 bushels an acre, an average possibly of 8 to 10, the normal yield being 25 to 30. He reported all fields as being infested and estimated the loss at 25,000 bushels.

Mr H. W. Tyler, of South Byron, in early July estimated the injury at 20 per cent, which he found was confined mostly to number 6 and Klondike. He states that the injury was less apparent on the better soils. The latter part of September he reports a yield on his place of 16 bushels an acre, the normal being 30, and adds that 99 per cent or more of the fields were infested. He is of the opinion that the reduced yield was due as much to winter injury as to fly and estimates the average yield for the locality the past season at 10 bushels an acre.

Mr F. C. Walker, of South Byron, reported the yield the latter part of September at 8 to 10 bushels an acre, the normal being 25 to 30, and adds that 99 per cent of the fields were infested. In his judgment, only half a crop was secured and he states that the dry season of last year resulted in an abundant shelling and a large amount of volunteer wheat, in which latter the Hessian fly probably bred abundantly last fall.

An examination by the writer of a number of fields in Byron the latter part of June showed an extremely poor stand of wheat. Many had been plowed prior to our visit, while the grain in others would average only from 10 to 50 per cent of what it should, and of this more or less was liable to lodge or fail to produce a full crop. The large field belonging to Mr F. C. Walker was apparently looking well, yet an examination resulted in finding many infested stalks which will either fail to produce full heads or else are very likely to lodge. The wheat field of Mr C. N. Green was one of the best examined and yet there was a probability of a reduction of from 25 to 40 per cent in the crop.

Livingston county. John McNaughton, of Caledonia, placed the loss the latter part of June at from 10 to 20 bushels an acre, all varieties in his section being affected. No subsequent report or additional data have been received from this county.

Monroe county. Observations from the train and near Churchville and at Cold Water showed several very poor fields, most of the injury being due to winter killing though some may have resulted from attack by Hessian fly.

Niagara county. Mr Ralph Darrison, of Lockport, stated that he had talked with several farmers and none reported trouble with the Hessian fly.

Onondaga county. Mrs A. M. A. Jackson, of Warner, finds little evidence of the fly and no serious injury. We have been unable to learn of material loss in this county.

Orleans county. An examination of local wheat fields showed that from 25 to 75 per cent of many had been destroyed, 5 or 6 puparia being found at the base of some stalks. There were in these fields some rust, some smut and undoubtedly winter killing in low places. The latter was held by some to be responsible for most of the injury, though we are of the opinion that the work of the Hessian fly was greatly underestimated. Several poor wheat fields were also observed in Orleans county east of Albion, some of the damage, as in other places, being undoubtedly due to winter injury.

Mr Clark Allis, of Medina, reports some fields of wheat as being hardly worth harvesting on account of winter injury rather than damage by Hessian fly. We saw no evidence the latter part of June in that section of serious damage to wheat by insects.

Ontario county. Mr W. T. Case, of West Bloomfield, reports wheat "used up" in the western part of the county and much damage to barley. He can recall but one other occasion when it was so bad as this year though a few fields of Dawson's golden chaff escaped and produced a good crop.

Seneca county. Mr M. C. Brokaw reports in June the appearance of Hessian fly in gold coin wheat and adds that he is unable to estimate the damage due to insects and that wheat at best will make only a fair crop. Mr B. R. Hewlett, of Interlaken, estimates the yield at 20 bushels an acre, the normal being 30, and the percentage of infested fields ranging from 10 to 27.

Wayne county. Mr E. W. Catchpole, of North Rose, states that there was not enough wheat grown in that section to give a satisfactory estimate, though the injury was variously placed at 10 to 15 per cent more than usual.

Wyoming county. Mr P. A. Kemp, of Wyoming, states that the Hessian fly has caused considerable damage in the town of Middleburg, the most of it apparently being confined to the portion bordering on Bethany in Genesee county. He adds that Messrs A. C. and N. M. Ewell estimate the loss in Middleburg at several thousand dollars. These gentlemen, in a later communication, place the yield at 10 to 20 bushels an acre and the loss at 5, the normal being 20 to 25. They estimate that 75 per cent of the fields were infested and the loss at 33⅓ per cent. Some wheat fields appear

to be somewhat more seriously damaged than others. Mr Henry D. Flach, of Attica, reports considerable damage in that section of the county though not all fields were injured; the loss in some amounted to 30 per cent.

Food plants. The Hessian fly was early recognized as a pest of wheat, rye and barley, and despite the fact that there are occasional records of its occurrence in timothy and other grasses and grains, there is no authentic evidence of its living in anything else except the grains named above and quack or witch-grass, Agropyron repens. This restriction in food plants is of considerable importance, since it materially simplifies the problem of control.

Life history. There are two generations in this latitude normally, though supplemental ones may occur. The adult fly deposits from 100 to 150 eggs, according to Marchal, placing them between the ridges on the upper surface of the blades of young wheat. Midges of the spring brood occasionally thrust their eggs beneath the sheaths of the lower leaves.

The flies may occur any time after wheat is up and possibly *between* killing frosts. The eggs hatch in about four days and the maggots then make their way down the leaf to the base of the sheath. They do not burrow but lie next the stem and absorb nourishment from the adjacent soft tissues which gradually become depressed and give way as the insect develops. The maggots are usually found in the fall close to the roots of winter wheat and at or beneath the surface of the soil, while in the spring they are more common about the second or third joints. The larval transformations occupy about twenty days, though their duration is much affected by weather conditions. The length of the pupal stage is exceedingly variable and greatly modified by the precipitation. Cold or heat and dryness tend to lengthen, and heat and moisture to shorten the duration of the different stages, especially the pupal. The winter is passed in the flaxseed or pupal stage, the spring brood of flies emerge in April or May and in turn deposit eggs on the more luxuriant leaves and another life cycle may be completed in about thirty days.

Number of generations. The short life cycle permits a number of broods in one season and apparently there may be as many generations as weather and food conditions permit. We may expect constant breeding during the growing season if continued damp

weather enables wheat, barley and rye to grow luxuriantly. During midsummer, as a rule, only a little volunteer wheat is in a condition for the larvae to live on, though this was very different with barley in 1901, when continued moist weather, after the spring brood had developed to pupae, brought out hosts of flies. Eggs were laid in large numbers in the barley, especially the late sown, and in early July many fields in Genesee county were badly infested. The maggots were near the ground in the latest barley, and in that early sown occurred 10 to 12 inches above the surface, showing that the insect lives by preference in soft growth and inferentially that it thrives only indifferently in the older, harder growth. The relation between a rank, succulent growth and injury was further shown in a hilly patch of wheat. The grain on the gravelly, comparatively dry knolls was nearly immune, while in the more moist gullies the stalks of wheat were very scattered. The resistance of so-called "fly proof" wheats depends in large measure upon the relative hardness or maturity of the stalks at the time the flies appear and deposit eggs.

Emergence of flies. This is an exceedingly important matter because successful methods of preventing injury depend upon a correct understanding of the habits of the flies. The flight of the Hessian fly is dependent on weather conditions. The following rules will assist materially in forecasting probabilities:

1 The flies may remain an indefinite period in the "flaxseed" or pupal stage during dry weather.

2 "Flaxseeds" or pupae are very likely to develop flies in large numbers during damp, warm weather.

3 Adults are killed by heavy frosts though this is not true of larvae and "flaxseeds" or pupae, and hence flies may appear and deposit eggs *between* killing frosts.

4 Under certain conditions some of these insects may spend nearly a year in the flaxseed stage.

5 Recently emerged flies must, in all probability, deposit eggs shortly upon succulent grain.

The above rules show that egg-depositing flies may appear at any time during the growing season, provided weather conditions are favorable, though naturally we would expect them to issue in large numbers only at the first favorable period after a large brood had attained the "flaxseed" or pupal stage. Thus, as our springs are usually warm and moist, this means that ordinarily most of the flies will emerge the latter part of April or early May. Then

there must be a sufficient period for the completion of a life cycle before another brood of flies can appear, and if at that time and for a considerable period thereafter the weather be hot and dry, comparatively few or no flies will appear till conditions change.

We know that early sown wheat is very apt to become badly infested in the fall, while late sown grain frequently escapes. In the first instance the young wheat is in a succulent condition and receives a deposition of eggs before or between killing frosts, while in the other case it escapes. If the flies emerge early and there is no grain available, the most of the insects perish and the infestation is very slight or negligible. Weather conditions must always be considered in sowing winter wheat. The general rule may be stated as follows: Moist, warm weather in early fall will permit the safe sowing of wheat at a relatively early date, but when the fall is dry delay sowing till the latest possible date. The normal or average date when wheat can be sown in New York without danger of its becoming infested with Hessian fly is about September 20th.

Parasites. The parasites of the Hessian fly are of much value in controlling this pest. The easiest way to determine the parasitism in a field is to take infested stalks and rear the insects. A net-covered jelly tumbler or fruit jar, taking care to avoid close covers and the resulting molds, will answer very well as a breeding cage. An examination of the "flaxseeds" late in the season after the parasites have emerged under natural conditions will give some idea of the relative numbers which have been killed by these beneficial insects. Sometimes fully 90 per cent are destroyed by parasites, and occasionally entomologists have experienced difficulty in obtaining midges from infested wheat because parasites were so abundant.

A representative sample of infested wheat was taken from the field of Mr F. C. Walker, of Byron, and the insects reared. It was found that 119 puparia were parasitized, 11 diseased and 37 in a normal condition. In other words, 70 per cent of the "flaxseeds" were parasitized, 8 per cent diseased and less than 12 per cent were in a condition to produce flies. The two most abundant parasites were Merisus destructor Say and Tetrastichus carinatus Forbes, numerous samples of both being reared. In addition, one specimen of Eupelmus allyni French, a species of Tetrastichus, one of Callimone, one of Pleurotropis and a Pteromalid were obtained. These determinations were made by Mr J. C. Crawford through the courtesy of Dr L. O. Howard and

are interesting since they show just what forms were present in the wheat fields last summer.

In addition to the parasites mentioned above, there is a wingless species known as Boeotomus subapterus Riley, which was not obtained and appears to be exceptionally efficient in Missouri. Platygaster herrickii Pack. is recorded as a common parasite and a European species, Entedon epigonus Walk., should be of assistance in checking this pest. Pteromalis pallipes Forbes is another species which preys upon the Hessian fly.

An abundance of parasites means very few midges later and comparative immunity from injury in all probability. Wheat stubble or chaff containing numerous parasitized "flaxseeds" should never be burned, since this may result in more real damage than if nothing be done.

Preventive and remedial measures. *Late sowing.* The most important preventive is to delay sowing till after the flies have deposited their quota of eggs and perished. This means in New York State delaying sowing, as a rule, till September 20th or a little later. It will be seen by referring to a preceding paragraph that the precipitation in August and September may have an important influence in determining the time when the flies will appear. Rains in late summer and early fall mean an early emergence of the flies, and if the moisture does not come too soon, a correspondingly early disappearance. Should the rains be early enough to permit the development of a supplementary brood on volunteer plants before the main wheat crop is up, there may be a large increase in the number of flies attacking the grain. It requires, under the most favorable conditions, only about 30 days to produce a generation, hence this danger is far from theoretical.

Resistant varieties. Experience in 1900 and 1901 in western New York showed that varieties such as number 8, Dawson's golden chaff, white chaff, Mediterranean, red Russian, prosperity and democrat withstood attack very successfully, while the beardless, weak-stemmed white wheat known as number 6 was very seriously injured and, in many cases, totally destroyed. Resistance is only comparative and a wheat immune in one locality may be rather seriously affected in another. The only safe way is to sow resistant varieties even though the non-immune wheats are better producers.

Good culture. Culture counts for much in growing a good crop of wheat. The field should be thoroughly prepared and the land put

in excellent condition before sowing. The aim should be to produce a growth of firm straw and plants vigorous enough so that if attacked they will tiller abundantly and thus prevent a serious decrease in yield. Badly drained soil with its accompanying succulent weak growth appears to be quite favorable to the fly.

Trap strips. There is no question as to the value of trap strips, especially in seasons when the Hessian fly is excessively abundant. This pest becomes numerous only when conditions are favorable, and it should not be difficult for the well-posted wheat grower to anticipate, in considerable measure, the probability of injury and to judge as to the desirability of sowing trap strips. These latter should be sowed early (approximately August 25th to September 10th in New York State) so as to attract the flies and induce the deposition of eggs before the main crop appears above ground. The infested wheat should then be turned under deeply so as to prevent the subsequent development of the insects. It is not necessary to have the trap strip on the sides of the wheat field, though such a location is preferable, as the chances of attracting most, if not all the flies, are better.

Burning stubble and chaff. The burning of stubble has been recommended by a number of writers, but in New York State at least, the common practice of seeding with wheat makes this inadvisable. Such an objection would not hold in regard to burning chaff from the thrashing machine and this might well be done in case the wheat is at all infested by the Hessian fly. This measure would also prove of service in controlling the allied wheat midge.

Plowing under stubble. The early plowing under of infested stubble before the flies emerge is advisable if it can be done without additional expense.

Destruction of volunteer wheat. This latter is a prolific source of breeding in some seasons and should be turned under wherever possible before the flies appear. In some instances it might be feasible to use a portion of the volunteer wheat as trap strips.

Rotation of crops. This is excellent agricultural practice and should be of service in reducing ravages by the wheat midge, especially if care is taken to locate the wheat fields of successive years at some distance from each other.

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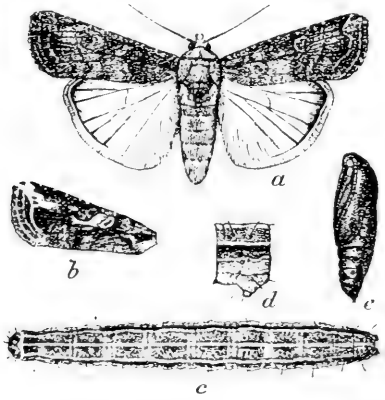
A detailed account of this insect, with an extended bibliography is given in the report of the Entomologist for 1901 (N. Y. State Mus. Bul. 53) pages 705–30. The more recent literature has been listed by Paul Hayhurst in the Journal of Economic Entomology, 1909, 2:231–34.

FALL ARMY WORM

Laphygma frugiperda Sm. & Abb.

This sporadic pest attracted notice the past season for the second time in recent years on account of injury by the larvae to lawns. The earlier outbreak occurred in Buffalo in 1900, the caterpillars destroying the grass of lawns by cutting it off just below the ground. Several reports of injuries to lawns were received last fall from persons in New York City, while Mr Roy Latham, of Orient Point, stated that the caterpillars were very abundant under date of September 11th, occurring in corn, Hungarian and wild crab grass. The latter he considered a source of the pest and stated that acres of lawn and Hungarian had been ruined. The last part of September he reported thousands of caterpillars on corn, there being at that time many very young ones.

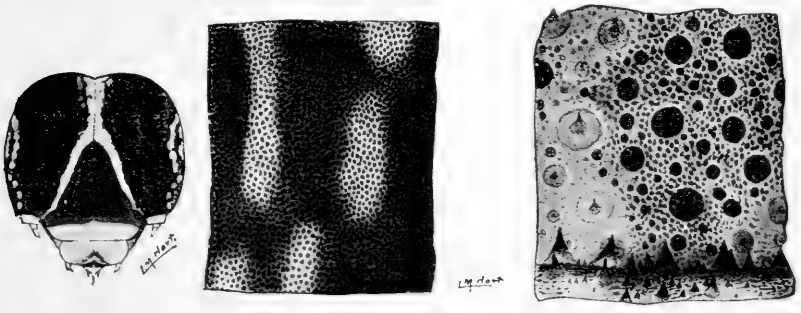
Characteristics of outbreaks. The work of the fall army worm is most easily recognized because it usually occurs much later than that of the true army worm. It feeds by preference upon a variety of grasses and, under certain conditions at least, seems to display a marked preference for lawns. This latter habit has not only been observed in New York State but also in Illinois and West Virginia. The caterpillar responsible for this trouble is smaller and more slender than the true army worm, Heliophila unipuncta Haw., and is peculiar in the somewhat narrower, nearly black head with a more or less distinct, inverted, Y-shaped mark in front bordering the eyes and extending down to the mouthparts.



Description. The moth is allied to that of the true army worm, Heliophila unipuncta Haw., though quite different in coloration, since there is no minute, white spot on the forewings. These in the fall army worm are rather dull grayish brown, with indistinct, oval, lighter markings as illustrated in the accompanying figure.

Fig. 2 Fall army worm. *a*, Moth, the plain, gray form; *b*, forewing of mottled form; *c*, larva extended; *d*, abdominal segment of larva; *e*, lateral view of pupa; *d*, twice natural size, others enlarged one-fourth. (After Chittenden, U. S. Div. Ent., Bul. 29, 1901)

The full-grown larva, as stated above, resembles that of the true army worm and may be best distinguished therefrom by the narrower head with its inverted Y-shaped mark well shown in the accompanying illustration.



a *b* *c*

Fig. 3 Fall army worm. *a*, Head of larva; *b*, *c*, surface of larval skin showing microscopic markings. (After Forbes, 23d Rep't, Ins. Ill. 1905)

The following descriptions of a half-grown larva and a full-grown one were drafted from living material.

Larva, half grown. Length one-half inch. Head shining black dorsally, the genae yellowish; clypeus fuscous yellowish and bordered on each margin by a distinct whitish line which is produced posteriorly over the head and forms a well-defined median line extending nearly to the posterior extremity. Labrum yellowish, labial palpi dark brown, antennae short, dark. Cervical shield shining black with distinct median and sublateral white lines. Body with the dorsal submedian areas a variably mottled chocolate brown and yellowish brown. This area is margined by a yellowish white lateral line. Laterally there is a broad stripe of dark chocolate brown variably marked with whitish and light brown and margined ventrally with a yellowish white stigmatal line. There is an indistinct substigmatal line, the substigmatal and ventral area being a variable yellowish brown; dorsally and laterally there are the usual series of large, shining, dark brown spiracles bearing short, black hairs; suranal plate shining black; truelegs shining black, prolegs fuscous yellowish.

A lighter specimen of about the same size, evidently recently molted, shows little of the characteristic markings described above, the head being yellowish transparent, the cervical shield and tubercles mostly light brown. The lighter longitudinal lines are only faintly indicated.

Full-grown larva. Length one and one-half inches. Head dorsally, yellowish, obscurely mottled with dark brown, the genae light brown, with irregular fuscous markings; clypeus fuscous yellowish, margined with a dull white which is produced posteriorly as a median line; labrum brownish transparent. Antennae light brown, prothoracic shield mostly dark brown, variably mottled with fuscous yellowish and with whitish median and sublateral lines. General color of the dorsal surface of the body a light brown variably and obscurely mottled with fuscous yellowish, the median and sublateral dull whitish lines rather obscure, the tubercles large, dark brown and the suranal plate mostly greenish yellow, the setae short, stout, fuscous, the lateral stripe a variable dark brown mottled obscurely with yellowish and reddish and margined ventrally with a broad, irregular, dull whitish stripe with distinct reddish mottlings; ventral surface mostly yellowish green, in some specimens the greenish predominating, variably mottled with yellowish white; truelegs mostly pale yellowish, apically reddish brown, prolegs pale yellowish green.

Another larva presents the same general appearance, differing mostly in exhibiting indistinct, submedian, purplish stripes about half the width of the lighter dorsal stripe described in the preceding form. The lateral area is also somewhat darker and more distinct.

Another light colored larva shows a distinct dominance of green in the thoracic and anterior abdominal segments, the dorsal and lateral lines hardly showing.

Detailed technical descriptions of the egg and larva have been given by Mr Chittenden in Bulletin 29, n.s., Division of Entomology, United States Department of Agriculture, pages 16–18, 1901.

Food plants. The original food plants of this species are with little question various grasses. The caterpillars display a marked preference for our small grains, such as wheat, rye, oats and millet, and are frequently abundant in some other field crops, such as alfalfa, clover etc., the injury to the different plants depending somewhat upon their immediate availability; that is, the outbreaks by the fall army worm undoubtedly, as in the case of the true army worm, begin with certain foci determined probably by the deposition of a considerable number of eggs upon preferred food plants. It is inevitable, when the latter are devoured, that the larvae should spread in the search of additional provender, and with such a general feeder as this species, there is usually comparatively little difficulty in securing something palatable and, as a consequence, severe injury may be inflicted upon a considerable variety of plants.

An examination of available literature shows that this species has been recorded as subsisting upon the following plants: alfalfa, apple, asparagus, barley, buckwheat, beans (velvet), cabbage, chick-pea (Cicer arietinum), clover, cockle-bur, corn, cotton, cow-pea, cucumber, grapes (gnawing stem and causing dropping of fruit) grasses (blue, Bermuda, creeping-bent, crab), hollyhock, kale, lamb's quarters, millet, oats, orange, peach, peas, pigweed, potatoes, purslane, rice, rye, sorghum, spinach, sugar beet, strawberries, sweet potatoes, Teosinte (Euchena mexicana) tobacco, tomato, turnip and wheat.

Life history. The life history of this insect has not been thoroughly worked out, though we know that several generations may occur in one season, that larvae are more likely to be injurious in the late fall, and that moths may be easily reared from such larvae. Adults were obtained the latter part of September or early in October from caterpillars transmitted to the office about the middle of September. Doctor Chittenden is of the opinion that the insects probably hibernate as pupae, with a smaller percentage possibly wintering as moths. He considers that all egg masses deposited late in the fall produce larvae, only a few of which may survive the winter. Transformation to the pupa occurs in oval cells from a quarter to not more than an inch and a quarter below the surface. Doctor Forbes observed three successive generations in central Illinois. This insect is a southern form, probably migrates northward annually, and may be unable to survive the climatic extremes of its more northern habitat.

Distribution. This species has been recorded from Maine to Kansas and Nebraska and even California, and is more abundant in the semitropical portion of the United States. It is a native of both North and South America, ranging from Brazil across Central America to the West Indies and must be regarded as normally a subtropical form.

Natural enemies. The caterpillars are preyed upon by various birds, there being records of sparrows and flickers feeding upon the pests.

The red-tailed Tachina fly, Winthemia quadripustulata Wied., is well known as a parasite of this species as well as of the caterpillars of the true army worm. An allied form, Frontina frenchii Will., has also been reared and there are several records of Hymenopterous parasites of doubtful identity living at the expense of this caterpillar. Chelonus texanus

Cress., interesting because of its ovipositing in the egg and the parasite developing in the larva of its host, is a very efficient check in the Southern states at least.

Ground beetles, especially species of Calosoma, undoubtedly feed upon the caterpillars, one of the common and efficient forms being the fiery ground beetle, C. calidum Fabr.

Remedial measures. The adoption of preventive or remedial measures must depend very largely upon conditions. Restricted outbreaks upon lawns can doubtless be controlled most efficiently by early and thorough spraying with an arsenical poison, using about 2 pounds of arsenate of lead (15 per cent arsenic oxid) to 50 gallons of water. If there are local reasons why a poison of this character should not be employed, many of the caterpillars could doubtless be destroyed by liberal, and if necessary, repeated applications of a kerosene emulsion, the standard formula diluted with 9 parts of water. It would be well if this latter were employed on lawns, to follow the application of the kerosene emulsion with a copious drenching of water. In some instances the use of a poisoned bait such as succulent clover dipped in Paris green water, or even a poisoned bran mash may be advisable. These latter, if used, may well be distributed just before dusk in order that they may remain fresh and attractive for the longest possible time.

Invasions from adjacent fields may be prevented by the use of mechanical barriers such as furrows, boards with strips of tar and other means employed for checking similar movements of the true army worm caterpillars.

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ELM LEAF BEETLE

Galerucella luteola Müll.

The season of 1911 was marked by exceptionally severe and widespread devastation by the elm leaf beetle. The damage was so serious that elm-shaded communities were most easily recognized in midsummer by the brown, dead foliage. The same condition prevailed in many roadside groups of trees. Numerous elms, unable to produce a second crop of leaves, had no opportunity to recuperate before the rigors of winter still further reduced their vitality. Some died while many others put forth a feeble leafage in 1912 only to have that nearly destroyed by midsummer. These trees are now in an extremely weakened condition and many may succumb during the winter. The tall elms with few branches and deficient foliage are the first to show the effects of elm leaf beetle attack. Moreover, they were not so easily protected by spraying

and should therefore receive special attention if it is desirable to preserve them. The range of this pest is still extending as shown by the receipt of specimens from Ellenville and Gloversville, localities not previously known to be infested.

Beetle work in 1912. The season opened with every indication that extended and severe injury would result. Numbers of the beetles began feeding early and on June 5th their work on elms at Nassau was much more conspicuous than it had been for some years. Many of the leaves on the lower branches were badly riddled and those in the tops of the trees showed no perforations. The indications then were favorable for exceptionally severe damage. Egg masses were just being deposited, those observed being moderate to large size and containing from five to about thirty-five eggs. A period of relatively cool weather occurred the second week in June. The official records of the weather bureau state that in New York lower temperatures were recorded during that month than any previous June since the weather service was established. The maximum temperature at the Albany station dropped from 80° to 85° F. during the first few days in June to 70° and even 63°, the minimum falling as low as 41° on the 8th. Our studies of this insect in 1898 show that this markedly cool weather came at about the beginning of the ten-day period when the beetles should deposit approximately half of their entire quota of eggs. As a consequence of these abnormal conditions, oviposition was checked and the hatching of eggs greatly delayed with a corresponding backwardness in the feeding of the grubs. An examination of conditions at Nassau on June 24th showed that comparatively few egg masses had been deposited and there was little evidence of work by young larvae. Only a few about one-quarter grown were discovered. The same conditions appeared to prevail in Albany and up to that time, so far as our observations went, comparatively few eggs were found. On July 3d most of the grubs on Manning boulevard, Albany, were only about one-quarter grown, a few being half grown. On July 7th a few full-grown grubs were observed at Nassau, though a number of smaller larvae were still feeding. At Mount Vernon many grubs were only half grown July 10th, though pupae were rather numerous on a few trees and some recently transformed beetles were observed.

The season was also peculiar in the uneven character of the injury. The elm leaf beetle is well recognized as a local species. The season of 1911, as stated above, was marked by an unusually

widespread defoliation. The beetles appeared to winter in excellent condition and one would expect similar general injury the following year. There was severe damage in 1912 in most localities where the beetle was very injurious the preceding year, but it was much more restricted and was not readily explainable by any local conditions. Some trees had the foliage practically skeletonized while others, though unsprayed, were but slightly damaged. A portion of this sporadic injury is doubtless explained by spraying or the lack of it, though even this factor does not account satisfactorily for all cases. The relative vigor of the trees also had an influence as pointed out above.

The elms of Catskill were very badly affected, especially just west of the main business street and particularly in the vicinity of the court house on Broad street and at the corner of Williams and Spring streets. Some of the trees were nearly bare July 19th, others had over half the foliage, while the remainder of the leaves were brown and nearly lifeless. Here and there elms could be seen which were in a fairly good condition. Some of these, we were informed, had been sprayed. There was comparatively little injury at a distance from the business center. The above was one of the most striking instances of damage observed the past season. At Mount Vernon a number of trees had brown, dead foliage, and the same was true of other communities in that general section, such for example as Tarrytown, Port Chester and New Rochelle. There was more or less injury here and there in cities and villages along the Hudson valley. There was rather severe injury in the village of Kinderhook, due to no spraying, and the same was true, though to a less extent, of the trees on the side streets of Lansingburg. There was mostly very severe injury to the elms at Valley Falls and some scattering damage to roadside and field trees.

The general condition of the elms at Hoosick Falls showed a marked improvement over that of last year, due largely to spraying. Elms which had been thus treated, whether on the street or on private grounds, were mostly in excellent condition, while the unsprayed trees on back streets, in back yards and especially in the section across the river from the main portion of the town, exhibited a marked contrast. The elms of Albany are in a much better condition than the preceding year, due to more thorough work in spraying. One of the perplexing elements of the situation is that many of the elms in Watervliet, though unsprayed, exhibit comparatively little injury. The trees of Mechanicville hardly show

the effects of the beetle, and here, likewise, we were unable to learn of any spraying. Waterford elms, as a result of vigorous agitation, were sprayed for the first time this year and those treated show a marked benefit as a consequence. The elms of Stillwater were very severely damaged in 1911, and the past season injury was confined mostly to the outskirts of the village and to trees on private property, many having been sprayed as a result of an earlier agitation. The systematic spraying of elms has been continued at Saratoga and Glens Falls and, we have been given to understand, has been started in Fort Edward. The village of Ticonderoga sprayed its trees for the first time and those responsible for the work are convinced that it has been a material benefit.

Experiments with elm leaf beetle. It was thought that possibly a sweetening added to the poison might materially enhance its effectiveness, as has been reported for the related parent of the grapevine root worm, Fidia viticida Walsh. Small American elm leaves were sprayed May 15th with arsenate of lead (12½ per cent arsenic oxid) used at the rate of 4 pounds to 50 gallons of water, and other leaves were treated with the same poison to which was added a cheap grade of molasses used at the rate of 6 pints to 50 gallons of water. Another branch was sprayed with clear water, all being kept until the moisture had evaporated. The application was to the under as well as to the upper surface of the leaves, and in the case of the poisoned foliage at least, was rather abundant, though the amount present was not in excess of that frequently observed upon trees sprayed under field conditions. The application was made with a hand atomizer. Beetles which had been kept in a pasteboard box for the preceding five days were placed in jars with the above treated leaves at 2.45 p. m. These insects must have been moderately hungry and thirsty, though these conditions would hardly have been more severe than those obtaining in many houses where the insects winter. Four beetles were in each jar and for a time appeared well satisfied to walk about on the damp sand in the bottom of the jar, this being particularly so in the one containing leaves sprayed with sweetened poison. The sand was possibly a little more moist in the jar containing foliage sprayed with the unsweetened arsenate of lead and there seemed to be a little more poison on these leaves than on the others.

Arsenate of lead plain. One beetle dropped from the leaves at 3.45 and appeared sick, since it lay upon its back with spasmodic

twitching of the forelegs. Another dropped at 4.30 and the remaining two at 4.50, all being dead the following morning.

Arsenate of lead sweetened. The first beetle dropped at 4.05 showing feeble evidences of life, a second at 4.45 and at 5 p. m. the other two were alive. The next morning a third was dead in the jar, the fourth remaining upon the foliage. It was alive at 10 a. m. May 17th and at 9 a. m. the 18th.

The insects confined in the jar with unpoisoned foliage continued in a vigorous condition till the 20th, even though the leaves were badly shriveled.

These experiments were duplicated, the only difference being that the sand was covered with blotting paper and the beetles placed directly upon the leaves at 2.15 p. m. May 16th.

Arsenate of lead plain. One beetle had dropped at 4.20, the others being alive at 5 p. m. The next morning another was dead, a second on the sand and moving a little, motion ceasing at 9.45. The last remained on the foliage and was alive on the 20th, being dead at 9 a. m. the 21st.

Arsenate of lead sweetened. At 3.30 p. m. one had dropped, at 3.35 another, and a third at 4.05, the fourth being alive at 5 p. m. and dead at 8.45 a. m. the following morning.

Two other beetles from the same lot as the preceding were put in a jar with a blotter saturated with the sweetened poisoned spray at 10.30 a. m. May 18th. They appeared to be imbibing the mixture and were found dead on the 20th.

The above experiments were conducted with beetles which had not fed since the preceding fall and were presumably very hungry. The results show that the insects succumb to poison quickly under such conditions, and that in some situations it may well pay to begin spraying as soon as the insects commence feeding, though it is doubtful if the results secured would warrant the general adoption of this plan.

Tests conducted by the writer over a decade ago showed that beetles collected from elm foliage and confined in jars containing leaves sprayed with poison, fed very little for a day or two, eventually being forced by starvation to devour the distasteful food, all finally succumbing within a week or two. These results are markedly different from those detailed above, and the experiments of 1899 were duplicated in part last spring and substantially the same data obtained. Arsenate of lead was used at the rate of 4 pounds to 50 gallons of water and the spray allowed to dry before

the beetles were placed upon the leaves. There was very little feeding the first day, more the second and eventually the insects succumbed as recorded in 1899. The important point is that elm leaf beetles will feed upon poisoned foliage only when compelled by hunger and, as a consequence, thorough spraying is necessary if one would secure satisfactory results.

Results of spraying for elm leaf beetle in New York State. We have repeatedly stated that well-sprayed trees should keep their foliage green and vigorous throughout the season. Furthermore, trees weakened from injury by this insect should be able to regain their vigor in large measure. Systematic spraying for this pest has been in progress in some New York communities for over ten years, and it may be instructive to review the situation and see what has been accomplished. There is no question but that these annual applications have been of material service in protecting the trees. This is quite different from admitting that the spraying has in all cases been satisfactory. The defects in treatment as ordinarily practised were especially apparent in 1911, because the extreme drought of that season served to emphasize the work of the beetle and led many to question the efficacy of the application. The Entomologist at that time examined the trees in several communities and was forced to conclude that the unsatisfactory results were due to poor work. The foliage of many trees here and there and that of most of the lower branches were in relatively good condition, while numerous trees had much of the foliage badly browned, this being especially true of the upper branches in the taller trees. Too many have tacitly assumed that any kind of spraying would give results, whereas, as shown by experiments detailed above, nothing but the most thorough work will result in keeping the trees in full vigor.

The elm leaf beetle, as is well known, first became well established in the lower portion of the Hudson valley. There are a number of cities and villages in that section where elms, especially the Scotch and English elms, are conspicuous by their absence. A very large proportion of such trees have succumbed to this pest in the city of Troy since 1895. The writer has watched this process of destruction in Albany and vicinity for over fifteen years. The earlier portion of this period was marked by extensive local injuries to European elms which were subsequently approximated only in 1911 when the beetle was so generally destructive to American elms. It was a time when the necessity of spraying was

not generally appreciated. Systematic work against this insect began in the city of Albany about 1900 and was shortly thereafter undertaken in Troy under private auspices. The spraying of earlier years was with a moderate power outfit and a nozzle which would throw only a short distance, consequently much climbing was necessary if the trees were thoroughly sprayed. The ultimate outcome was that most of the poison was applied to the foliage of the lower limbs, while the tops were nearly untouched, and in years when the treatment, for some cause or other, was so late as to be comparatively ineffective, most of the leaves were destroyed on many trees. Furthermore, there have been times when the application to the lower limbs, even when timely, was not sufficiently thorough. The result of this policy has been a progressive weakening of many trees with the death of numerous elms here and there. Practically all those affected should have remained in full vigor for a generation or two, aside from the relative few which may have succumbed to adverse urban conditions, such as leaky gas pipes, poor insulation of wires, the cutting of roots, etc. None of these trees can be replaced in less than twenty-five years and most of them represent active growth for half a century.

A clearer idea of the condition may be gained by a few concrete examples. A canvass of the trees in Washington park, Albany, in August 1911 showed that over ninety elms of the approximately 275 in that recreation area had been severely injured by this pest. The foliage of all these trees had been badly browned, many of the leaves had dropped or there was a considerable amount of dead wood. This was in a section where elms should find most satisfactory conditions for growth, aside possibly from a slightly polluted atmosphere. The area lying between the Capitol and Madison avenue, Eagle and Lark streets is another striking illustration of these unfortunate conditions. In June 1912 ten dead elms were observed on Hamilton street between Lark and Eagle streets, a distance of only five blocks. There were four dead trees on South Hawk street within two blocks of Hamilton street and four dead or practically dead elms on three sides of the block in which the Albany Medical College stands. The last named block appears to have been exceptionally unfortunate, since the preceding year three stumps of what were magnificent trees were to be seen on Lancaster street, and three similar ones just around the corner on Eagle street. Most of the elms noted above have perished as a result of repeated injuries by the elm leaf

beetle. This wholesale destruction can hardly be characterized as less than inexcusable and, in the estimation of some, might well be termed criminal negligence. It should be stated that the above conditions are not representative of all sections of the city, though they are typical of certain regions and important in that they give a concrete idea of what may be expected in other communities if the elm leaf beetle is allowed to multiply unchecked or is fought in a more or less desultory manner. It should be further noted that the lamentable conditions on Hamilton street and vicinity, noted above, are in an area which has been sprayed more or less thoroughly, mostly the latter, we fear, for over a decade. This injury is not the result of one season's neglect but is the cumulative effect of severe injury, in spite of spraying for a series of years. We would also add in this connection that the spraying in Albany during 1912 has given materially better results.

The selection of a spray outfit for community work is a somewhat difficult matter. Elms, even large trees, can be thoroughly sprayed with a hand outfit, provided the pump is of a good type, there is plenty of hose, the tree is climbed and the distribution is thorough. Work with a hand outfit is slow, costly and can be recommended only when comparatively few trees are to be sprayed. There are a number of light power sprayers equipped with engines of 1½ to 4 or 5 horse power which have been extensively used in shade tree work. These are generally provided with plenty of hose and much climbing is usually obligatory, especially if a nozzle delivering a fine spray is employed. The latter is ideal, though on account of the large amount of labor necessary in order to bring the nozzle sufficiently close to the foliage, spraying in this manner is costly. This has resulted in the gradual change from the fine spray to the coarse spray, and from that to a modified solid stream and eventually to a solid stream. The latest development along this line has been the large outfit with a 10 horse power engine capable of delivering the insecticide at the mouth of a nozzle one-quarter of an inch in diameter or thereabouts at a pressure of 200 pounds. The nozzle generally used with this equipment is about six feet long and is capable of throwing the insecticide to the top of the tallest trees even when the operator is standing upon the ground. This outfit makes possible the very rapid treatment of many trees and greatly reduces the cost of application, which amounts to only ten to twenty cents a tree. Experience has shown that this high pressure stream breaks

up into fine particles and gives a much better distribution than we would at first expect. More poison is used than with the smaller type of nozzle, and on narrow streets in particular, more or less drifting of the spray and consequent annoyance or even damage is almost inevitable. This can be mitigated to a considerable extent by skill on the part of the nozzleman. This type of sprayer was designed in particular for woodland work and is almost equally valuable on wide streets and park areas. Further experience is necessary before recommending it unqualifiedly for the average city street. A serious objection, especially in small communities, is the expense of the equipment, such an outfit costing about $1200. Some villages have partially solved the problem by using the lighter outfit and a smaller solid stream nozzle adjusted to the limited capacity of the engine. This arrangement reduces climbing greatly and, so far as tried, has given very good results.

WHITE GRUBS AND JUNE BEETLES

Lachnosterna species

The extremely severe injury to grassland, corn, potatoes and strawberries last spring was, with very little question, the outcome of a great abundance of May or June beetles in 1911. The large, brown or dark brown, blundering beetles partly defoliated many forest trees and were so numerous then as to make nuisances of themselves by invading lighted rooms. The insects soon disappeared but evidently not till after millions of eggs had been deposited in the grasslands as shown by severe and extended injuries caused by the grubs. Collections made in May and June 1911 show that Lachnosterna grandis Sm., L. fusca Froh., L. hirticola Knoch and L. hirsuta Knoch were the species most abundant, while the usually rare Polyphylla variolosa Hentz. was reported very common at Schenectady.

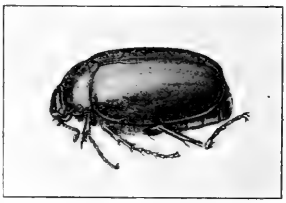

Fig. 4 A common May or June beetle, Lachnosterna fusca, natural size (original)

Characteristics. Our native species are brown or dark brown, stout beetles ranging from one-half of an inch long in L. tristis Fabr. to an inch long in L. grandis. Our more common form is L. fusca Froh., a species of average size and measuring about three-quarters of an inch in length. A study of this genus shows there is a large number of very similar species which are separable only with difficulty. The light brown Polyphylla variolosa Hentz. is more slender than the typical Lachnosterna and easily recognized by the light yellowish brown, irregular mottlings. A common and closely allied form is the spotted grapevine beetle, Pelidnota punctata Linn., easily recognized by its brick red color and the strongly contrasting six circular spots on the wing covers. The goldsmith beetle, Cotalpa lanigera Linn., is another allied form readily distinguished by its similarity in structure and the brilliant golden color. There

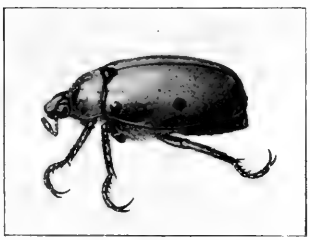

Fig. 5 Spotted grapevine beetle (original)

is, in the southern part of the State, another ally of the June beetles known as the fig eater, Allorhina nitida Linn., peculiar because of its dull greenish color, the wing covers being usually margined with yellowish brown, and on account of the peculiar locomotion of the larvae; these latter turn on their backs and travel rapidly by a series of undulating movements which are made very effective by the short, stout dorsal spines.

New York species. The following species of Lachnosterna have been recorded from New York State: L. glaberrima Blanch., L. gracilis Burm., L. gibbosa Burm., L. crassissima Blanch., L. micans Knoch, L. fusca Froh., L. arcuata Sm., L. dubia Sm., L. grandis Sm., L. marginalis Lec., L. fraterna Harr., L. nova Sm., L. knochii Gyll., L. rugosa Mels., L. hirsuta Knoch, L. balia Say, L. nitida Horn, L. hirticula Knoch, L. ilicis Knoch, L. crenulata Froh., and L. tristis Fabr. That the above list is not exhaustive is evidenced by the thirty-one species recorded from New Jersey, presumably as a result of special collecting which has not been possible in this State.

White grubs. The term white grub is more than generic, since it is applied indiscriminately to a large number of Coleopterous larvae found under grass sod and in decaying organic matter. These larvae resemble each other in a general way and it is not surprising that they should be confused in the popular mind. The white grubs of the entomologist comprise an aggregation of forms normally living on grass roots and referable, as shown by rearing the adults, to several genera. Unfortunately, our knowledge of the immature stages is such that beyond a few general characteristics it is impossible to identify the various species of Lachnosterna as larvae. Large, stout, white, curled grubs, half an inch to an inch in length, with brown heads, and living on grass roots or those of closely allied plants in this latitude, are mostly referable

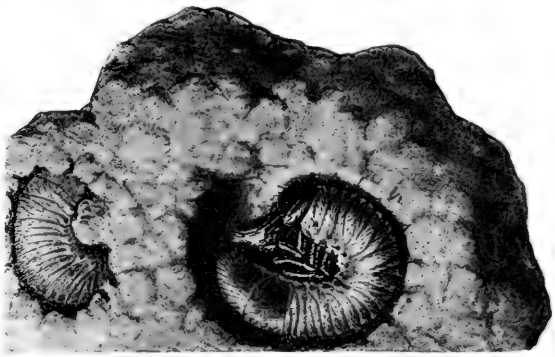

Fig. 6 White grubs in earthen cells (original)

to the genus Lachnosterna. Even the recently hatched grubs present practically the same characteristics as the nearly full-grown individuals so numerous occasionally under sod which has been killed by these pests. The principal difference is that the smaller grubs are whiter, owing to the fact that there is proportionately less dark vegetable matter within the small body.

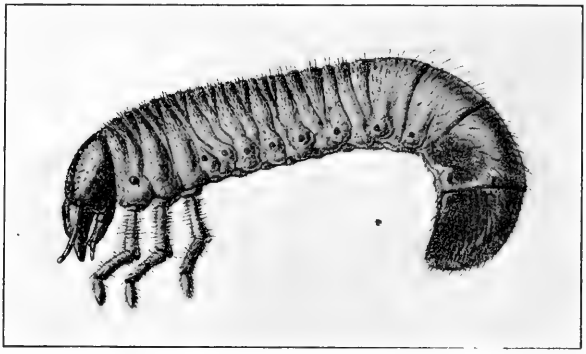

Fig. 7 White grub or larva of May or June beetle, enlarged (original)

Injuries in 1912. Many pastures and meadows as well as certain cultivated crops in Albany, Columbia and Rensselaer counties at least, were very severely damaged the past season by white grubs, and similar injury was reported from portions of Washington county. The pests were so prevalent in the southern part of Rensselaer county that most of the grass roots were cut off over considerable areas; in some instances grass on half an acres or even larger fields was totally destroyed, the sod being torn up wherever the horse rake was used. Such conditions were common in the towns of Schodack, Nassau and Kinderhook, to mention only a few localities where personal investigations were possible. Similar injury was reported by William H. Wanzer from Slingerlands near Hurstville in Albany county. The grubs not only devoured all the grass roots but frequently attacked those of nearby shrubs and trees, while rose bushes in one area were so badly eaten that the plants were readily torn from the ground. Mr B. D. Van Buren informs us that on his farm at Niverville the roots of a recently set apple tree were so badly eaten that it was easily pulled up. Corn planted on infested sod land was destroyed, and in one such locality a sample digging in October resulted in finding thirteen living grubs in an area of

about one square foot, while we were informed that in July some boys collected over twenty grubs in one hill of corn. Adjacent to this area the pulling of corn stalks in the field resulted frequently in exposing two or three nearly full-grown grubs just at the base of a stalk and within an inch or two of the surface. Reports of injuries to strawberries and potatoes were also received.

An investigation of the damage in several localities showed that, as a rule, most of the injury was in spots where there was more moisture and presumably better grass. The affected areas were generally near the foot of a gentle rise and frequently in a small gulley. It appeared as though the beetles, when ovipositing in 1911, had been attracted to the denser patches of grass and oviposited therein very freely. In August many grubs were to be found just under the sod in cells one or two inches below the surface, as many as five to seven or eight occurring in one square foot. Investigation about the middle of October showed that comparatively few of the grubs were near the surface and that most of them were from seven to ten inches below. This was especially marked in grassland and by no means so evident in corn fields.

Life history. The extended life cycle of white grubs and the fact that a large proportion of their existence is subterranean, makes it very difficult to work out the life history of the various species in detail. This difficulty is further accentuated by the possible occurrence of several closely allied forms at the same time, the grubs being practically indistinguishable one from the other. The parent insects, as their common name indicates, appear in May or June and remain abroad about four weeks. The beetles feed upon the leaves of a considerable variety of plants and display a marked preference for poplar, willow, oak, chestnut, elm and apple, though they may also work upon the foliage of quite a number of trees and shrubs. The eggs, which hatch in about four weeks, are deposited in grassland, and in the case of the beetles appearing in 1911 there was an obvious selection of the richer, more luxuriant spots. The slowly developing grubs feed upon the roots of various grasses and allied plants. At the end of the first season the young grub may be only about a quarter of an inch long, while at the close of the second season the grubs are about a half to three-quarters of an inch long and present the familiar appearance of the depredator so commonly found at the roots of strawberry and other more highly prized cultivated plants. The grubs, whether small or large, burrow down into the earth on the

approach of cold weather and remain until the following spring. In July of the third summer they construct oval cells and change to pupae, the latter transforming to beetles the following August or September and the perfect insects appearing during May and June of the next year.

Natural enemies. White grubs are most acceptable prey to pigs and also that much avoided and generally abused animal known as the skunk. Both dig in badly infested fields and swine are generally credited with being exceedingly efficient destroyers of these pests. They will frequently root up and devour practically all the grubs in badly infested areas to which they have access.

Crows are well-known enemies of the white grub. Mr William H. Wanzer of Slingerlands reported that in his locality these birds had discovered the infested areas and were digging out and devouring the grubs in grass and potato fields. Similar operations have been observed in Illinois, while studies by Dr F. E. L. Beal in 1894 showed that crows ate either beetles or grubs in every month from March to October inclusive. Blackbirds are also reported as feeding upon the grubs.

A common parasite of the white grub in Illinois is known as Tiphia inornata Say. The cocoon of this species is oval, brown and about three-quarters of an inch long. It is easily recognized by the slight neck or constriction at one extremity. These cocoons were found in small numbers in one infested field in Schodack. Another large parasite known as Myzine sexcincta Fabr. also preys upon the white grubs and forms a cocoon similar to that of the Tiphia noted above, though differing in their greater smoothness and lacking the loose, fluffy coating of silk. This species, according to recent investigations, appears to be fully as efficient a parasite as the Tiphia. Another parasitic Hymenopteron which has been reared from white grubs is Ophion bifoveolatum Brulle. The genus Ophion is rather common in New York State and there is no reason for thinking that other species may not prey at least occasionally upon the white grub.

A number of parasitic flies also depend in considerable measure for sustenance upon white grubs. A bee fly, Sparnopolius fulvus Wied. has been reared in Illinois from white grubs, and the same is true of the peculiar Pyrgota undata Wied., a species which unfortunately seems to be not very abundant in New

York State. A large white maggot about an inch long and possibly a species of Erax was abundant in what had been badly infested sod at East Schodack, the maggots being in the proportion of four to one of the white grubs. This insect appears to be a very efficient natural enemy. There are doubtless a number of other insects which live at the expense of white grubs and which have not been reared, owing to the fact that parasitized white grubs are very apt to be overlooked in making examinations of the soil.

The peculiar white grub fungus, Cordyceps ravenelii Berkl., was found upon the farm of Mr W. S. Miller, East Greenbush. Infected grubs are easily recognized by the slender, hornlike processes arising from beneath the head and frequently attaining a length three to four times that of the grub. These growths are at first green and later they turn brown. Mr Miller states that infected grubs were easily found over a considerable area.

Preventives and remedies. The extended life cycle of these insects and their practical restriction to grasslands make it apparent that systematic rotation of crops is one of the most important preventive measures that can be employed. It does not follow from the above that new seedings may not be occasionally attacked, as was the case last year, since numerous beetles emerging from old meadows in some instances deposited numerous eggs in recent seedings and, as a consequence, serious damage developed the following year. A rotation of crops which does not allow land to remain in sod for more than two or three years, if generally followed in a neighborhood, will result in reducing the danger of injury from these pests to a minimum. Such a method of farm management is also advisable from the general agricultural standpoint.

The danger of planting corn, potatoes or strawberries upon recently turned sod, especially if the latter is infested by white grubs, should be more generally recognized. The severe damage frequently following such practice is due to the great restriction in the number of plants per acre and the inevitable concentration of the grubs upon the small amount of food available. There is no evidence to show that the larvae or white grubs migrate to any extent through the soil. They may make their way for a distance of possibly one or two rods but hardly farther. Grassland badly infested with white grubs should, if plowed, be sowed with some such crop as rye which would grow with sufficient vigor to withstand any reasonable injury and produce a crop, or if an ordinary

hoed crop must be planted on such land, use an extra amount of seed and feed liberally, supplementing this with good cultivation in order to enable the crop to withstand successfully the probable injury

There is no practical method of destroying white grubs in the soil, aside possibly from giving pigs the run of the field prior to planting time. Experience has shown the practicability, in the case of recently set strawberry fields, of digging out and destroying the grubs working at the base of individual plants. This latter is somewhat costly and is practical only after the injury has developed to such an extent that one can detect affected plants. It can be advised only in cases where it is impractical to avoid such conditions.

Numerous white grubs in a lawn or in a garden where values are relatively high can be destroyed by the use of a dilute kerosene emulsion, say 1 part of the standard formula to 9 parts of water. A liberal amount of the spray should be applied and then followed by a thorough soaking with a garden hose in order to wash the emulsion down, bring it into contact with the grubs and eventually carry it beyond the reach of most of the root fibers. Carbon bisulphid has also been advised for the destruction of grubs about plants. This material, if employed, should be used with care and be preceded by a few experiments to determine the possibilities under given conditions, since the danger of injuring vegetation would depend in considerable measure upon the texture of the soil and the amount of moisture present.

HICKORY BARK BORER

Eccoptogaster quadrispinosa Say

The destructive work of the hickory bark borer in the Hudson valley, begun some three years ago, has been continued the past season. A number of dying trees were observed in the immediate vicinity of New York City, while many others have been seriously infested during the past season. A personal examination of conditions at Tivoli showed that similar conditions prevailed in that section.

Signs of infestation. The preliminary signs of injury, such as wilting leaves and dead twigs during July and early August, are exceedingly important because they indicate the presence of a destructive pest before matters have passed the remedial stage. The attack, as characterized above, simply indicates that the beetles are about to enter the tree and that if affected twigs are numerous, the pests may destroy the hickory. Examination of injured trees in the fall or during the winter may show particles of brown or white sawdust in the crevices of the bark, and in the case of some trees, a few to many circular holes appearing as though they had been made by number 8 buckshot. The recognition of this sawdust is a decided advantage, since the dark brown or black, rather stout, cylindric beetles about one-fifth of an inch long invariably start their galleries under a protecting scale of bark and the sawdust mentioned above is therefore the only external evidence of injury. Such trees are more dangerous to the welfare of adjacent living hickories than others which may be fairly peppered with numerous exit holes. The external evidence cited above should be followed up by cutting down to the sapwood. The exposure there of longitudinal galleries one to one and one-half inches long, about one-eighth of an inch in diameter and with numerous fine, transverse galleries arising therefrom and gradually spreading out somewhat fan-shaped, is conclusive evidence as to

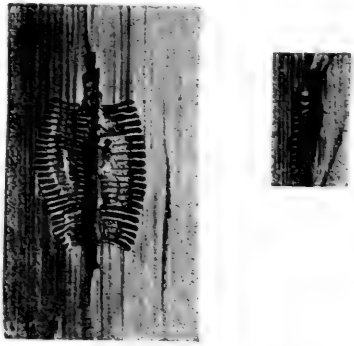

Fig. 8 Hickory bark beetle. The smaller figure shows the gallery of the adult and the egg notches, the larger the galleries of young larvae (original)

the identity of this pest. In very early stages of the attack the longitudinal gallery described above, with a series of minute notches for the reception of eggs on either side, may be all that can be found. Only a little experience is necessary before one can recognize the characteristic galleries of this borer. They are almost invariably to be found somewhere upon infested trees, since an attack is rarely discovered before at least some of the grubs have commenced working across the bast fibers.

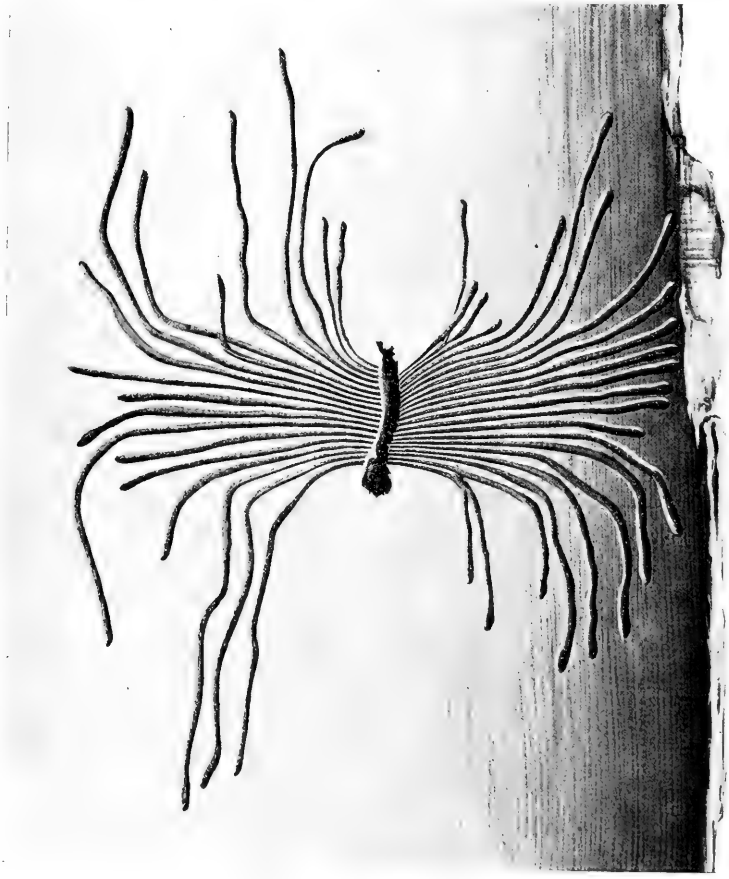

Fig 9 Hickory bark beetle, galleries made by the adult and the full-grown larvae (original)

Life history and habits. The life history of this borer may be summarized as follows: The beetles appear from the last of June till the last of July and may be found in New York State up

to the middle of August. Observations at Bronxville on July 10th showed numerous dead leaves and tips of branches upon affected trees. The beetles were then just beginning to enter the bark. On August 5th a number of beetles were still working in the leaf stem, others were entering the bark and some had evidently become well established. The beetles bore the young twigs and burrow in the terminal buds and green nuts, evidently for food, and in this manner frequently cause the wilting of leaves and the death of twigs. Later they attack the bark of the trunk and the larger branches, each female making a vertical gallery an inch or more in length, along the sides of which she deposits in small notches, 20 to 40 or 50 eggs. These galleries of the adults are usually very regularly placed, their position apparently being determined in large measure by the long cracks in the rougher bark of the trees. The eggs soon hatch and the grubs work in the tissues, at first at nearly right angles to the primary galleries and later the borers turn in either direction till they run nearly parallel with the wood and produce a rather characteristic fan-shaped series of galleries. The burrows of the grubs or larvae rarely cross each other. On October 1st most of the larval galleries observed were from one-half to three-quarters of an inch long and the grubs about one quarter grown. They winter in a partly grown condition, transform to pupae the last of May and the beetles begin to appear about a month later. There is no evidence to show that more than one generation occurs in New York State, at least.

Experimental work. The following field work was conducted at Bronxville in cooperation with Mr J. James de Vyver of Mount Vernon.

Barcurol. A 10 per cent solution of this proprietary material was applied July 12th to certain hickory trees which were examined August 5th. It was then evident that this compound had a distinct hardening effect upon the outer bark of the tree though there was no penetration by the beetles, a fact confirmed by subsequent observations October 1st. An examination of a few burrows made by the beetles prior to the application showed that the discoloration of the inner bark was confined to the immediate vicinity of the galleries and occurred to an almost equal extent on untreated trees. The brown tissues in the latter instance extended to within about an inch of where living grubs were working. Another tree treated with a 50 per cent solution of this material was examined August 5th and it was seen that the application had destroyed the borers.

Kerosene emulsion. One tree was painted with an undiluted stock kerosene emulsion July 25th. An examination on October 5th showed very little penetration of the bark in the vicinity of the galleries and no living insects were to be found in the burrows started prior to the treatment. Some beetles were entering the bark at the time of our examination and were evidently not deterred therefrom by the earlier application.

A 50 per cent kerosene emulsion was sprayed upon another tree the same date, and observation on August 5th showed that the insects were destroyed in the burrows and that there was also some penetration of the adjacent tissues. The outer bark did not seem to be affected in the least.

Scalecide. A 20 per cent solution of this proprietary compound was applied to infested trees September 7th and an examination on October 1st showed living grubs in four out of five burrows. In one case the larvae had made their way to a distance of two inches from the gallery made by the female. This had a thicker bark than the one treated with Barcurol or carbolic acid and the comparison was therefore not exactly fair. It is likewise probable that the treatment was made too late in the season to give the best results, since the grubs were evidently some distance from the female gallery and therefore mostly out of reach of the application.

Carbolic acid. This was prepared by diluting a gallon of soft soap with an equal amount of hot water and stirring therein a pint of crude carbolic acid (½ pint refined), allowing it to set over night and then adding 8 gallons of soft water. This solution was applied to trees on September 7th, and examination on October 1st showed discolored areas on each side of the main gallery for a distance of about three-quarters to one and one-quarter inches. There were very few or no grubs found alive and the adjacent tissues were healthy and apparently uninjured. This treatment was made to a thinner barked tree than the one treated with scalecide and the grubs were therefore somewhat more accessible.

Black leaf 40. A few trees were treated with this material used at the rate of 1 to 200 and adding thereto 3 pounds of soap to each 50 gallons of water. The trees were sprayed September 7th. An examination on October 1st showed the presence of some living larvae under the rather thick bark. This treatment, as in the case of others given at this date, was too late for us to expect the best results, and in this particular instance was limited to trees with a thick bark, the latter rendering the penetration by the insecticide more difficult.

The above experiments, while by no means conclusive, give sufficient data to warrant a continuance of the work, particularly with a preparation of oil or carbolic acid for the purpose of destroying the beetles or the recently hatched grubs before they have had an opportunity to bore any distance from the egg chambers. This treatment, it should be stated, can be recommended only for specially valued trees on lawns or in parks. It is possible that a spray with a whale oil soap solution, a lime-sulphur wash or even a thick whitewash just before the beetles begin to enter the bark of the trunk would prove of considerable service in preventing attack and be nearly as effective as the treatments tested above. This problem can be settled only by further experimental work.

Mr Henry Bird, of Rye, informs us that in his opinion the treatment of infested trees after oviposition seems feasible in certain cases. He found that spraying with a strong whale oil soap solution just before the females began to enter the trees, seemed to drive away the insects and prevent infestation. This, he states, proved to be the case with one large tree which during the month of July, was infested by hundreds of beetles feeding upon the leaf petioles. He found spraying with arsenate of lead of no service and a similar report was received from Mr de Vyver, though the treatment by the latter was, in our opinion, too late to be of material service. Mr Bird found from experience that treatment of individual galleries was less laborious than he had supposed. He personally went over several trees between the 20th and 23d of August in an area where the insects were abundant, the trees being 40 feet high and having between 200 and 300 galleries in the bark. He used a small squirt can oiler and about a quart of gasolene to the tree, only enough being injected to destroy the females or the eggs. This treatment he found caused no appreciable injury to adjacent tissues. His work with this oil was limited to moderate sized trees a foot or more in diameter and some thirty-five years old. It would undoubtedly be more difficult to treat larger trees in this manner, though in the case of highly valued hickories one could hardly class this method as impractical.

Preventive measures. It is well known that plants are more susceptible to the attack of various insects when in an unthrifty condition. It is probable that the excessive droughts and extremely low winter temperatures of recent years have had an

important effect upon many trees, lowering their vitality and presumably making conditions more favorable for insect attack. This unfortunate condition may be accentuated in certain localities as, for example, in southeastern Westchester county, by the abundance of canker worms or other leaf feeders, since repeated destruction of the foliage would weaken the trees and, in the case of developing leaves, might cause serious injury without attracting much attention. Mr Henry Bird believes that he has detected a connection between successive attacks by canker worms and injury by the hickory bark beetle.

Another factor which may be more important than many realize, is forest fires or burnings. It is unfortunately the practice in some communities to burn over pasture and woodlands rather freely in the mistaken notion that benefit accrues. It is true that such procedure is followed by a more vigorous growth of grass and is generally accompanied by the destruction of leaf mold or humus, not to mention the killing of numerous small trees and injuring some of the larger ones. Moreover, this humus is a most important ingredient in maintaining the fertility of the soil and also of much service in protecting the roots of trees from excessively low temperatures, and by conserving moisture mitigates in considerable measure, the severity of droughts. The greater exposure to extreme temperatures and the additional severity of droughts following the annual practice of burning, may well result in reducing the vitality of the trees and bringing about a condition favorable to attack by borers. Such procedure is at least indefensible from the standpoint of the forester and should be condemned and avoided wherever possible.

Generally speaking, we may expect the least trouble from injurious insects where normal forest conditions prevail and the trees as a whole are in a thriving condition. All practical measures which result in the removal of sickly and dying trees and provide better conditions for those allowed to remain will, in a general way, reduce the liability of serious injury by insects.

Remedial measures. A serious infestation, indicated by dying trees or branches, can be controlled only by cutting out all badly infested trees or portions of the same and destroying the bark before the following June in order to prevent the grubs then in the trees from maturing and changing to beetles which might another season continue the work in previously uninfested trees. It is particularly important to locate hickories which have died

wholly or in part the past summer, because it is these trees which contain living grubs. General cooperation over an extended area, in the cutting out of infested trees and burning of the bark as outlined above, will do much to check this deadly enemy of hickories. It is a method which has been tried in some sections with marked success and is more practical on large holdings than where the cooperation of numerous owners must be secured. This destruction of the insects does not prevent the utilization of the wood and timber commercially, provided the bark is destroyed within the above given time limits. Slabs from sawlogs and firewood with the bark on should all be burned during the winter. If it is impractical to work up the logs and burn the slabwood, the borers can be destroyed by a prolonged submergence in water or by removing only the bark and burning that.

The possibility of protecting trees which have been entered the past season, is discussed under experimental work. Such treatment can never be advised for ordinary woodland conditions.

PEAR THRIPS

Euthrips pyri Daniel

The pear thrips is a slender, dark brown insect only about one-twentieth of an inch long and with very delicate, narrow, long-fringed wings (Plate 3). It appears with the opening of the leaf buds and when numerous may literally blast the developing blossoms and destroy the crop. This new pest was discovered in California in 1904, has been under investigation in that region for the past eight years, and was found in the Hudson valley by Professor Parrott in 1911. Evidence at hand renders it very probable that this insect has been in New York State for some time and that the mysterious failures of the pear crop in recent years attributed to "blossom blight" or some obscure cause may have been due to the work of this minute enemy.

Widely distributed in the Hudson valley. Early in May we found the pear thrips in an apple orchard near Ravena and very abundant in a pear orchard at Coeymans Hollow. Specimens were also received from Grapeville several miles distant. The insect is generally distributed about Germantown and was very abundant in the orchard of Spencer Brothers at Hudson. It has also been found back of Poughkeepsie and at Milton, Marlborough and Newburgh.

Injuries. Personal examinations at Geneva and Hudson in company with Professor Parrott, showed a nearly total destruction of the fruit buds in a number of orchards. The young leaves had assumed a characteristic spoon shape, the tips were browned or black, while the blossom buds were partially wilted masses of browning tissue. Some 200 seckel pear trees in the orchard of Spencer Brothers were full of just such fruit buds, the loss amounting to about 400 barrels of fruit.

A local pest. Though widely distributed in the Hudson valley, this insect is a local pest which may be very injurious in one orchard or even a portion of an orchard and hardly noticeable elsewhere. The restricted character of the outbreak was very well shown in the orchard of Spencer Brothers. Here a large block of vigorous seckel pear trees, some 200 in number, had practically all the bloom destroyed, while Kieffers, lying west of the seckels and also down on the hillside, were comparatively unaffected. Those east of the seckel block and farther up the hill had most of the blossoms in the upper part of the tree destroyed. It would seem from this as though

these insects drift with the wind and were probably carried from the seckels to the Kieffers by light breezes which would naturally sweep up the hill.

A marked restriction, though not on such an extended scale, was likewise observed in an orchard at Coeymans Hollow and also in that of Mr William Albright about two and one-half miles from New Baltimore Station. In the latter instance injury was particularly marked in a hollow and extending part way up on a knoll, while those on the knoll and beyond were not seriously affected though the pest was to be found even there in small numbers.

Description. The fruit growers will recognize this insect most easily by its operations as characterized above, nevertheless, for an accurate determination, especially in the case of outbreaks at a distance from known infested areas, the microscopic characteristics of the adult must be recognized and on this account we reproduce below the excellent original description:

Female. Length, 1.26 mm; width of mesothorax, .32 mm; general color, dark brown. Head about as long as broad; cheeks convexed; anterior margin broad, acutely angular; back of head transversely wrinkled, and bearing a few minute spines. Eyes medium, black, with light borders rounded or oval in outline, coarsely faceted, hairy. Ocelli yellow, margined inwardly with reddish brown crescents, widely separated, posterior ones contiguous, with light borders around eyes; one very long slender spine on each side midway between ocelli. Mouth cone pointed, tipped with black; maxillary palpi three-segmented. Antennae eight-segmented, approximate, slightly over twice the length of head. Length of segments: 33, 43, 55, 52, 35, 50, 8, 10. Antennae brown, except segment 3, which is yellow. Spines pale, conspicuous, special sense organs on segments 3 and 4.

Prothorax longer and wider than head; bears many prominent spines, the one at each anterior angle, and the two at each posterior angle are longest. Color, yellow-brown; faintly cross-striated.

Mesothorax approximately as wide as antennae are long; front angles obtusely rounded; metanotal plate bears four spines close to front edge, middle pair equal in size and prominence to those at the angles of prothorax, the others are small; pterothorax yellow-brown, transversely wrinkled.

Wings present, extending slightly beyond abdomen, about twelve times as long as wide, pointed at ends; surface of wings thickly covered with minute brown spines; both longitudinal veins and costa of forewings thickly set with quite long, brown-colored spines, placed regularly on costa and hind vein; costa has from 29 to 33 spines, forevein 12 to 15, and hind vein 15 to 16; veins not prominent; costal fringe of forewings about twice as long as costal spines.

Legs moderately long, scarcely thickened; femora and all except

the terminal part of tibia brown; terminal part and tibia and tarsi yellow, a double row of twelve strong spines on the inner side of hind tibia, several inconspicuous spines on fore and middle pairs.

Abdomen about two and one-half times as long as width of mesothorax, cylindrical to eighth segment, then abruptly pointed. Spines on sides and around tip of abdomen dark brown, conspicuous; those on last two segments are long and approximately equal. Color of abdomen dark brown, connective tissue yellow.

The young closely resemble the adult structurally, though there is a variation in size, and this stage is also characterized by the absence of wings.

Life history. Investigations on both sides of the continent show that this pest winters in the soil, appearing upon the trees as the young leaves push from the buds, and feeds by preference upon the more tender and essential parts of the fruit buds. The slender, dark brown thrips may be found crawling between the partly opened leaves and working their way to the base of clusters of fruit buds. This habit of sheltering themselves among the growing tissues materially lessens the efficacy of spray applications. Buds thickly infested with thrips become sticky, the blossom buds assume a brown, blasted appearance, the bud scales drop in unusual numbers, while affected blossom clusters gradually shrivel and fall. The stems of the young fruits are also injured, frequently resulting in an early dropping. The affected leaves are small, more or less crinkled, and with a characteristic spoon-shaped development. This condition may be true of extended areas, limited to a few trees here and there in an orchard, or confined to portions of trees and, in the latter instance, result in a very uneven setting of fruit (see plates 1, 2).

The microscopic eggs are deposited in minute slits in leaf and blossom stems. The whitish, red-eyed young soon appear and feed like the darker parents, on the tender leaves for about two weeks, drop to the ground and remain in the soil unchanged till fall. The insects produce small wounds on the foliage, the affected tissues drop out or break and seriously injured leaves are, as a consequence, badly perforated and quite ragged in appearance.

Food plants. This minute enemy attacks a variety of deciduous fruits, having been recorded from apple, apricot, cherry, fig, grape, peach, pear, plum, prune, quince and the English walnut. The principal damage, as indicated by the common name, is to the pear.

Distribution. This insect was first discovered in California, has been recorded from a number of localities in the Hudson valley and at Geneva, and also reported from England. Its minute size and

the probability of its being carried in soil with young trees, greatly favors the dissemination of the pest and will undoubtedly result shortly in its general distribution, even if it has not already become established in most of the more important fruit-growing regions.

Preventive measures. An examination of conditions in the orchard of Mr William Albright near New Baltimore resulted in our learning that several years before, this pear orchard had been affected in a similar manner, and that the injury at that time, as well as that of last spring, occurred during seasons when the orchard had not been cultivated early in the spring. An examination of infested orchards at Coeymans Hollow, at Germantown and at Hudson showed that without exception the injury occurred on a heavy soil where early and thorough cultivation was presumably difficult or impossible. The pear thrips appears to be absent from orchards on the lighter, sandy soil of Kinderhook. It may be only a coincidence, yet the fact that this delicate insect winters in the soil and has been in at least one instance seriously injurious to orchards which were not cultivated till late, suggests that in early cultivation, where practical, we may find a feasible method of preventing injury and avoid the relative costly repeated sprayings necessary where the insect is numerous.

Remedial measures. The appearance of hosts of thrips in the early spring and their rapid work upon the developing leaves and fruit makes promptness an essential in the control of the pest. Experience has shown that the thrips, when abundant, may practically destroy a crop in a few days and, furthermore, that most of those which can be reached by a spray succumb readily to the use of a tobacco extract such as black leaf 40 employed at the rate of ½ pint to 100 gallons of water to which was added 2 pounds of soap. Mr William Albright sprayed with this solution about 11.30 in the morning, shortly before it began to rain. It rained until about 2 p. m., and an examination thereafter showed numerous dead or dying thrips. The best results will be secured when this insecticide is applied as a coarse forcible spray, the nozzles being adjusted so as to throw the material down into the clusters of leaves and blossom buds. In the case of bad infestations, namely, where 10 to 15 thrips may be found in a single blossom cluster, a second spraying may be necessary the following day and a third possibly after the petals drop, for the purpose of destroying the young before they desert the trees and enter the soil.

The most effective spraying is while the buds are swollen and before they have opened sufficiently to produce crevices in which the thrips may find shelter and after the blossom clusters have separated so as to expose the thrips sheltering among the stems of the young fruit.

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QUEEN BLOW FLY

Phormia regina Meign.

A study of the queen blow fly was undertaken for the purpose of obtaining data which could be used as a basis for estimating the period a human body had lain exposed to the elements in midsummer. We found so little definite in available literature concerning the biology of the blow fly, and especially the duration of the various stages, that it was necessary to work out the life history before attempting a moderately accurate estimate of the age of certain maggots taken from the corpse. It was supposed at the inception of the work that the so-called common blow fly, Calliphora erythrocephala Meign. was the more prevalent species at Nassau, the place where these investigations were conducted. Our experiments resulted in rearing only the above named species, kindly determined by Mr C. W. Johnson of the Boston Society of Natural History, and a flesh fly, which latter will be discussed subsequently. There seems to be comparatively little known concerning this blow fly. Mr G. N. Hough records this species as very common everywhere in this country, though it appears to be rare in Europe. Aldrich lists it from such widely separated localities as New Jersey, Montreal and New Mexico. It is worthy of note in this connection that Mr J. H. Paine reared this species in larger numbers from city garbage in Boston, Mass., than either the common house fly or the bluebottle fly, Lucilia sericata, though it should be noted that Phormia was present in fewer lots and that by far the most came from one lot, concerning which there seems to be no special record except that no house flies were obtained and the material was collected in August.

Methods. The head of a recently killed calf was procured about 6 p. m. August 1st, and on account of the low temperature prevailing for that season, no ova were deposited upon the head that evening. It was exposed throughout the next day which was moderately cool, in a place protected from larger animals, and at 5 p. m. there were hundreds of eggs about the mouth and in the hair at the base of the horns. Several flies were observed in the immediate vicinity. This was the source of the material upon which the following notes are based, since flying insects were excluded after this primary infestation. Observations were made and material collected about 7 a. m. and 6 p. m. during most of the

period. The temperature conditions prevailing at the time the following observations were made are tabulated below, together with a transcript for the corresponding period of the official weather bureau records at Albany for the purpose of comparison.

Temperature records

DATE		ALBANY		NASSAU [1]	
Month	Day	Max.	Min.	Max.	Min.
August	1	74	57	....	64
	2	76	52	....	....
	3	71	58	....	....
	4	72	56	65	56
	5	76	52	69	50
	6	78	52	72	62
	7	77	54	70	58
	8	79	61	68	58
	9	79	67	69	66
	10	79	69	71	67
	11	85	68	81	78
	12	84	69	90	72
	13	87	68	86	71
	14	86	70	91	69
	15	82	62	89	72
	16	71	55	83	64
	17	72	48	77	51
	18	65	59	79	62
	19	76	60	63	63
	20	81	65	80	67
	21	73	58	83	60
	22	83	62	....	....
	23	73	60	....	....
	24	77	59	....	*a*68
	25	88	68	*b*76	....
	26	84	67	88	66
	27	77	57	86	67
	28	72	51	87	48
	29	74	54	87	58
	30	68	47	75	45
	31	64	43	75	45
September	1	64	54	68	45
	2	65	58	63	59
	3	68	59	67	58
	4	78	64	68	59
	5	78	64	81	61
	6	80	67	80	64
	7	82	64	80	62
	8	82	60	85	62
	9	80	60	82	59
	10	80	54	83	53
	11	83	58	82	54
	12	70	50	83	52
	13	75	54	83	52
	14	72	63	79	53
	15	81	68	71	63
	16	73	52	83	62
	17	70	57	72	46

[1] Records from August 1st to 11th inclusive are based on morning and evening readings and therefore do not represent the true maximum and minimum, though approximating thereto.
a This is a minimum record for the preceding two days during which readings were not taken.
b This is a maximum record for the preceding three days during which readings were not taken.

Biology. Hundreds of eggs were noted at 5 p. m. August 2d and the next morning. Though the night was cool, hatching was in progress and at 6 p. m. the same day most of the eggs had hatched and the young maggots, about 2 mm long, were collected

in a slight depression on the cut surface of the head. These conditions persisted unchanged except that the maggots became possibly a little more active with the progress of time till the morning of August 6th when there were many second stage maggots about 3.5 mm long and some first stage maggots about 3 mm long. The difference in size between these two stages was so slight that the change from one to the other occurred without attracting particular notice. The night of the following day, August 7th, the second stage maggots were some 6 mm long and perceptibly larger. There was also observed one larger third stage maggot having a length of about 13 mm. The following morning, August 8th, four or five large third stage maggots were observed, and by night one-third of them had similarly changed. The following morning, August 9th, most of the maggots visible, namely, some seven-eighths, were in the third stage and moving actively over the cut surface of the head. The maggots at this time were distinctly negatively heliotropic and when kept in darkness showed little tendency to burrow into the tissues. They collected in a hemispheric mass an inch or more in depth on the upper cut surface and remained so long as it was kept dark, scattering only with the admission of light. This negative heliotropism was mare marked as the larvae developed and by the time they attained full size there was a speedy scattering on admission of light, even though the mass of maggots when exposed to illumination had a depth of an inch or more and covered the ten or twelve square inches of surface. The following day, August 10th, no small maggots were observed and all were evidently nearly full grown and ready to desert the carrion, such migration occurring the following morning. The maggots remained for several days in the upper layers of adjacent moist soil, being so numerous for a time as to transform this part into a heaving, animated mass. The larvae began to become sluggish prior to pupation on the morning of August 13th, and that night puparia were numerous though there were still many full-grown larvae. Phormia larvae persisted in decreasing numbers till August 16th, and on the 25th numerous adults were obtained. The insects continued to emerge in large numbers for several days.

The duration of the various stages is approximately as follows: eggs, 12 to 24 hours, much depending upon temperature conditions.

The first larval stage lasted about three days, probably being somewhat prolonged by the rather low temperatures prevailing. The second stage persisted two to three days, while the period of

active feeding in the third stage was limited to about three days, though the transformation to puparia did not occur till three days later.

Description. *Egg.* Length 1.5 mm, elongate, elliptic, tapering slightly toward one extremity. The eggs are deposited in agglutinated masses of varying number.

Larva, general characters. White, narrowly conical, the posterior extremity subtruncate, length 2 to 13 mm.

First stage. Length 2 to 3 mm, diameter .3 mm, tapering slightly to the anterior segments, which latter taper sharply, the segmentation distinct and marked with a series of transverse bands of short, dark, chitinous points on each body segment. The cephalo-pharyngeal skeleton is very characteristic in this stage. The mandibular sclerites are slender, nearly rectilinear, and at the anterior extremity there may be found a pair of stomal plates, each with six minute teeth; dental sclerite rudimentary; hypostomal sclerite slender, slightly curved; lateral pharyngeal sclerite with a long, rectilinear anterior process, the main part being a broad dorso-ventral bar of chitin produced posteriorly at both the dorsal and ventral angles as a tapering and relatively narrow process. The dorsal sclerite is slender, strongly looped and unites the two lateral pharyngeal plates (plate 4, figure 1); posterior spiracles (plate 5, figure 1) with one well-developed, narrowly oval orifice and apparently a rudimentary second.

Second stage. Length 3.5 to 6 mm, diameter about 1 mm. General characters as in the preceding stage. Cephalo-pharyngeal skeleton: mandibular sclerites moderately heavy, somewhat decurved and irregular; dental sclerite moderately heavy, short, broadly triangular; hypostomal sclerite shortened, heavy, irregular and united with its fellow by a moderately broad dorsal process; lateral pharyngeal sclerite consisting of a broad dorso-ventral plate with a curved, tapering process on the anterior ventral angle; a short, broad, truncate process posteriorly on the dorsal angle and a longer, tapering process posteriorly on the ventral angle, the dorsal sclerite rather broad and strongly arched (plate 4, figure 2); structure of anterior spiracle indistinct; posterior spiracles (plate 5, figure 2), each with two slightly curved, well-chitinized orifices.

Third stage. Length 13 to 17 mm, diameter about 3 mm. General structure about as in the preceding stages. Cephalo-pharyngeal skeleton: mandibular sclerites stout, heavily chitinized, strongly decurved; dental sclerite small, broadly triangular; hypostomal sclerite short, irregular; lateral pharyngeal sclerite broad, with a long,

slender, slightly curved process at the anterior ventral angle, a broad subtruncate process posteriorly along the ventral line and a longer, broad process from the posterior-dorsal portion, the distal part of the latter tapering suddenly to a subacute apex; dorsal sclerite short, slender (plate 4, figure 3); anterior spiracle distinct, broad, with ten or eleven radially arranged orifices; posterior spiracles, each with three rather broad, heavily chitinized, subparallel orifices (plate 6, figure 2). The subtruncate posterior portion has a well-developed truncate lobe on the ventral surface and a distinct, cup-shaped dorsal cavity guarding the spiracles and margined with irregular and rather minute, fleshy lobes.

Puparium. Length 9 to 9.5 mm, diameter 3 to 4 mm. Color light brown, turning to a dark brown, almost black. The anterior extremity is narrowly rounded and somewhat constricted subapically, each segment with a double transverse band of chitinous points; posterior extremity contracted subapically and easily recognized by the submedian spiracles located in a somewhat illy defined depression margined with irregular, short, broad, chitinous tubercles.

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GEORGIAN FLESH FLY

Sarcophaga georgina Wied.

A number of this large, grayish, yellowish or red-tailed flesh fly were reared in association with Phormia regina Meign. and provisionally identified by Mr C. W. Johnson of the Boston Society of Natural History.

One of the earliest notices of this form is by Harris, who characterizes the species as one of our largest viviparous flesh flies which appears toward the end of June and continues till the middle of August or perhaps later. It has been recorded by the late Doctor Smith as common throughout the state of New Jersey and is listed by Aldrich from Georgia, Massachusetts and British America. It has been reported as parasitic by Prof. C. M. Webster on grasshoppers in Wyoming. The record states that the maggots of this species were abundant in a mass of "dead disintegrating and decaying bodies" of Melanoplus differentialis Thos.

The discussion of methods and conditions under Phormia apply equally well to this species, except that the presence of the larvae were not observed till considerably later and manifestly when conditions were quite different.

Biology. On August 12th, a time when the disintegration of the carrion was in an advanced condition, a very few small, and at that time supposed to be first stage maggots, were observed on the calf's head in association with full-grown Phormia larvae. The following day it was noticed that there was a fairly good colony of Sarcophagid larvae clustering as before and evidently the product of a recent and presumably accidental ovi or larviposition. The next day, August 14th, most of these young larvae were small though a few appeared to be in the second stage, a transformation which was more marked August 15th. On the afternoon of the 16th there were many small, probably second stage maggots and one very large, probably third stage maggot, the latter being more abundant the following morning and on the 18th. August 19th at 6 p. m. nearly one hundred of these large larvae had escaped from the bucket containing the carrion and had established themselves just below the surface of the loose soil near a door sill where there was moderate protection from light. These larvae displayed a much greater activity in wandering than was the case with the

earlier reared Phormia larvae. The maggots were placed in a fruit jar containing earth and remained moderately active and in the larval condition till the 25th, at which time a few recent puparia were found. Most of the maggots were then at the bottom of the soil in the jar and not on the surface, as was the case with many of the Phormia larvae. The Sarcophagid larvae transformed slowly to puparia and no flies were reared till September 15th, others appearing on the 16th and 17th.

Summarizing, an examination of material shows that the first stage had nearly passed before the maggots were observed. The second larval stage lasted about four days and the third three days, the prepupal condition persisting for about six days and the insects remaining in puparia 22 to 23 days.

Description. *First stage.* Length 2 mm, diameter .3 mm, whitish, slender, hardly tapering anteriorly, subtruncate posteriorly, the segmentation distinct and marked with a series of transverse bands of short, dark, chitinous points. The cephalo-pharyngeal skeleton is very similar to that of Phormia, the mandibular sclerites are slender, nearly rectilinear; the stomal plates rather large, the teeth irregular; hypostomal sclerites slender, slightly curved, lateral pharyngeal sclerite transverse, broad, and with tapering dorsal and ventral processes posteriorly, the former being somewhat longer; the dorsal sclerite is slender, strongly lobed and unites the two lateral pharyngeal plates; posterior spiracles apparently with two weakly chitinized openings.

Second stage. Length 5 to 6 mm, diameter .6 to 1 mm, whitish, slender, tapering slightly to the anterior extremity. Cephalo-pharyngeal skeleton: mandibular sclerites heavy, rather strongly decurved, basal portion broadly triangular; dental sclerite short, stout, strongly curved, free; hypostomal sclerite moderately short, stout, and united with its fellow by a broad, chitinous bar; lateral pharyngeal sclerites, anterior portion broadly transverse, subrectangular and with long ventral and dorsal processes posteriorly, the latter somewhat longer and more tapering; posterior spiracles each with two, moderately chitinized, orifices. Cuticular chitinization mostly equally bidentate.

Third stage. Length about 16 mm, diameter 2½ to 3 mm, whitish, slender and tapering from the obliquely truncate posterior extremity to a slender apex. Cephalo-pharyngeal skeleton: mandibular sclerite stout, decurved, the basal portion with a triangular lobe ventrally; dental sclerite short, irregular; hypostomal

sclerite short, irregularly triangular; lateral pharyngeal sclerite broad, the anterior portion with a length greater than its width and with broad, irregular processes posteriorly at the dorsal and ventral angles, that at the dorsal angle somewhat longer and more tapering (plate 7, figure 3); anterior spiracles yellowish brown, expanded and opening in about 18 small, radially arranged orifices (plate 7, figure 2); posterior spiracles (plate 7, figure 1) with three narrow, somewhat radially grouped orifices located in a distinct cup-shaped depression, much more marked than in Phormia and guarded by a series of fleshy tubercles and ventrally with a median lip, the latter with fleshy processes at the lateral angles.

Puparium. Length 9.5 mm, diameter 4 mm, color light brown, turning to a dark brown. The anterior extremity tapers rather sharply and is subtruncate, while the posterior extremity tapers gradually to a deep, cup-shaped depression surrounded by an irregularly tubercled wall.

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THE USE OF OILS ON DORMANT TREES

Spraying dormant trees with oils, especially mineral oils, is one of the more recent developments of insect control work. The late Dr J. B. Smith, late state entomologist of New Jersey, was one of the foremost advocates of this practice and at one time took the position that petroleum was "harmless to the most tender varieties and the youngest trees." It should be added that later this pronouncement was modified to "a reasonably safe, economic and effective material." Injury was noted following petroleum applications, and shortly the miscible oils were placed on the market and used probably much more generally than was the case with petroleum, either pure or in mechanical emulsions. The great advantage of the miscible oils is that they make possible a nearly uniform emulsion of known strength and there has been much less apparent injury following their use. The ideal in these latter is a stable emulsion which can be kept indefinitely, diluted to any desired strength and which will destroy scale and other insects without injuring the tree or plant. Some enthusiasts have almost gone so far as to assert that injury could not follow the use of even large percentages of some of the miscible oils.

Safety a prime essential. A fruiting orchard represents a considerable investment, and we believe that most fruit growers rightly consider the safety of the trees of more importance than the destruction of an insect pest or the prevention of possible injury. The remedy should not be worse than the disease and the treatment should most certainly not jeopardize the investment. We are unwilling to sanction, even by implication, the use of compounds which may result in material injury and, in some cases, disaster to the orchard.

Injury by petroleum. The writer's experience with petroleum and mechanical emulsions of petroleum in 1900 to 1903 inclusive, shows that serious injury might result in the latitude of Albany, especially if the application was made in the fall or in the spring if followed immediately by a spell of humid weather. One fall treatment resulted in such penetration and discoloration of the inner bark that grave fears were entertained for the safety of the trees. A similar condition developed in the spring when the spraying was followed by several days of foggy weather.

Others have noted deleterious effects following the application of petroleum to various trees in widely separated sections of the

country. This is so generally recognized that an exhaustive discussion of the evidence seems entirely unnecessary. It should suffice to note in passing, that most competent observers who have studied the effects of petroleum upon trees, emphasize the variability of the results and attribute much of this to climatic conditions prevailing at the time of spraying and for some days thereafter.

Signs of injury by petroleum. Spraying dormant trees with petroleum, pure or emulsified, may retard their development in the spring. This may be comparatively slight and followed by enlarged lenticels, a discoloration, death and cracking of the outer layers of the bark and be accompanied the first season by abnormally large, dark green leaves. The last has frequently been regarded as an evidence of benefit though it apparently results from overstimulation and may be followed, if there be successive annual treatments with oil, by smaller and eventually undersized pale foliage.

Applications followed shortly by adverse climatic conditions, such as a severe winter or several humid days immediately after spraying, may cause an extremely late starting of growth with destruction of buds, limbs, or even large portions of the tree. There is then apparently more penetration by the oil which, in extreme cases, may kill the vital tissues to the sapwood or even below. The inner bark turns dark brown, may remain sappy under certain conditions for a considerable period and have a sour or acid odor. Trees thus affected may have limbs girdled near the middle with a dead inner bark and die gradually toward each extremity, or dead branches may show a similar, well-marked, girdled or dead area at the base, while badly affected limbs exhibit localized injury to the inner bark on portions most exposed to the spray or in connection with external rough places, which latter greatly facilitate the absorption of oil. Young fruit trees may have the bark badly blistered in the late spring and early summer, the underlying tissues being soft and evidently unhealthy. The death of affected trees or portions of the same may occur the following spring, drag through the summer or be deferred for a year or more. Even the buds fail to develop in some instances, while in other cases the leaves may push out and attain a length of half an inch or more before dying. In other cases the leaves may attain full size and the tree succumb slowly in midsummer, the extent and the rapidity of the withering probably being dependent

in considerable measure upon climatic conditions. The vigor of the roots and the lower portion of the trunk, which latter frequently escapes injury probably because of the thicker bark hindering penetration of vital tissues, is shown by the numerous sprouts on the lower part of badly affected trees. This new growth may be moderate in character or extremely vigorous, much depending upon the vitality of the tree and the number of sprouts developing.

Miscible oils. An emulsion is defined as "a mixture of liquids insoluble in one another, where one is suspended in the other in the form of minute globules." There is no hint of a chemical change, the oil is simply more finely divided and, as a consequence, more evenly distributed through the preparation. It is still oil and possesses the properties of oil, as is readily seen on the disintegration of the familiar kerosene emulsion. The term "miscible oil" has been employed in economic literature to designate emulsions or preparations of oils, usually petroleum, mixing readily with water. A number of these have been placed on the market under various trade names. Experience has demonstrated the utility of a general designation for this class of products. The commercial emulsions are usually more stable, that is, they disintegrate less readily than the homemade kerosene emulsion. They contain oil in practically an unchanged condition so far as chemical and physiological properties are concerned, and may be expected to produce effects upon plants corresponding to the amount applied, other conditions being uniform.

Injury by miscible oils. Many have been repeatedly assured that miscible oils, especially certain commercial preparations, can be applied to plants without injury. One manufacturer states that it is "absolutely impossible" for his product "to injure a tree where the simplest directions are followed." Miscible oils can and have been used under conditions which would seem almost to preclude the possibility of injury. Nevertheless, we believe there is a risk in employing these materials, largely because of our ignorance of the physiological condition of the tree and the kind of weather which may follow the spraying, both of which appear to be important factors. In addition some varieties seem to be much more susceptible to injury of this character than others. Our observations upon petroleum, noted above, appear to indicate much greater danger of penetration during the winter season, a time when the pressure of sap is greatly lessened. A sudden drop in

temperature in the spring checks the flow of sap and, following an application of oil, is very liable to result in greatly increased penetration by the insecticide, sometimes with disastrous results. It is very likely that the apparent immunity of different varieties depends in considerable measure upon seasonal variations in the pressure of the sap, due to an early or late ripening of the wood and possibly to differences in the penetrability of the bark.

Record of injury following applications of a miscible oil. The following records are not intended to be exhaustive and are made public simply to establish the fact that serious injury may follow the use of oil preparations upon dormant trees.

In June 1911 our attention was called to the serious condition of many hard maples in Mount Vernon, sprayed the preceding spring with a miscible oil. Some of the trees most infested by insects, it is stated, were sprayed March 24th and again May 20th. There were some 2136 hard and soft maples which received this application. The soft maples were practically unharmed, while many of the hard maples, in fact all marked as having been sprayed, which we examined June 20th, showed evidence of recent serious injury, many being practically dead. This was true of small trees three inches in diameter, as well as of maples some eight inches in diameter, all, with very few exceptions, appearing as though they had been in full vigor the preceding season. Trees on one side of the street or on one block were affected, while unsprayed trees of the same variety on the opposite side of the street or on adjacent blocks were in normal condition. In some instances the damage was limited to limbs most easily reached by the usual type of spraying outfit. We were unable to find sufficient evidence of injury by insect pests or damage following general adverse conditions to account for the sudden death of so many trees in a closely restricted area. Additional details of our findings at that time are given in the report for last year (27th report of the State Entomologist, New York State Museum Bulletin 155, pages 88–92).

Personal observations during July and August of last season (1912) showed that practically all the trees noted as being badly injured the preceding year, had been removed and replaced by small trees. We were informed that 449 maples had been reset. Furthermore, some of the trees less seriously injured in 1911 showed dead limbs or patches of dead bark, and the prospect is

fair that more of such trees will die or parts of large limbs break off in a year or two. Our attention was also called to several large sugar maples now dead, which were marked as having been sprayed the preceding year and had not been removed last year because it was supposed that they had not been seriously affected by the application. An examination of a number of representative trees here and there only served to confirm our findings of the preceding season and to exonerate injurious insects from direct responsibility in the wholesale destruction of sugar maples. The local character of the injury and the difficulty of attributing the trouble to malnutrition, overcrowding or other general adverse conditions is strongly illustrated by small to moderate sized hard maples standing in front of numbers 125, 151 and 157 Cottage avenue. The lower limbs of each of these trees had evidently died the preceding year and had been removed, although the maples stood in thrifty lawns some distance from the street and where conditions were most favorable for a vigorous growth.

After we had made examinations of the Mount Vernon maples and reached certain conclusions, we learned of similar injury following the application of a miscible oil a few years earlier to sugar maples in the vicinity of Philadelphia. There were about 100 trees sprayed, sugar maples and Norway maples alternately, and at least 75 per cent of the former, we are informed, died soon after the treatment. Those conversant with the conditions in this latter case attribute the injury to the application of oil.

The sensitiveness of the sugar maple to oil and the possibility of the rapid death following treatment therewith, is evidenced by a photograph taken by the late Professor Slingerland in July 1903 and kindly placed at our disposal by his successor, Prof. G. W. Herrick. The photograph shows several dead sugar maples and the original record is as follows: "Effect of kerosene bands on maple trees. Maple trees treated with a band of kerosene in 1902 in front of fraternity house on Seneca street (W. H. Sage home). Taken in July 1903. Trees practically dead." A band saturated with kerosene is quite different from a trunk sprayed with petroleum or miscible oil. Nevertheless it is possible to conceive of conditions under which enough oil, either pure or as an emulsion, might be left upon the trunk after the evaporation of water or other emulsifying fluids and bring about a condition nearly identical with that produced by oil-saturated bands.

The unfortunate developments on sugar maples, following the

application of a miscible oil, find their counterpart in the case of certain fruit trees. The early history of the use of miscible oils in New York State contains several instances of severe, though somewhat restricted injury following treatment. In one instance young trees were dipped when the temperature was below 40° F. The buds were killed and the stock ruined. In another case a number of trees died after a fall application followed by a heavy, wet snow which remained on the trees for a day or two and undoubtedly promoted penetration by the oil.

The most extended injury following spraying with a miscible oil came to our attention last June. An apple orchard at Athens, set twelve years ago, was sprayed Thanksgiving week or the one following in 1911 with a miscible oil used at the rate of 4 gallons to 50 gallons of water, and about 160 trees, mostly Baldwins, were dead or in a dying condition at the time of our examination (plate 3, figure 2). There was severe and general injury to a considerable proportion of the orchard thus treated. Nine-tenths of the apple trees in one representative section were dead or nearly so. One tree said to have been sprayed with the wind from the north had most of its branches on that side killed. The restriction of the injury on other badly affected trees was such as might be expected if the damage were caused by spraying. Furthermore, dying limbs were girdled by dead inner bark near the middle or at the base, the affected tissues being dark brown, sappy and with a sour or acid odor. Many of the twigs had a reddish brown bark with some discoloration of the wood. The buds on some of the limbs failed to start, while many had only sufficient vigor to develop leaves about one-quarter the normal size. Later in the summer, with the approach of drought conditions, some of the badly affected trees and most severely injured branches succumbed. About the middle of July there was an abundant development on the dead wood of a fungus identified by State Botanist Peck as Naemospora croceola Sacc., a species which subsists only on dead bark. Numerous vigorous shoots appeared on the trunk and the larger limbs of the badly affected trees in early summer, and by fall had made a fair to extremely good growth, thus eliminating the probability of root injury. Trees most severely affected were practically free from San José scale or other insect pests which might have been a possible cause of the trouble. A number of smaller trees just to the west of one part of the badly affected area were sprayed at the same time, the insecticide being used at the rate of 3 gallons to 50

gallons of water and here there was little or no injury. Numerous other trees in the same general region and growing under practically identical conditions, excepting that they were not sprayed with the above mentioned insecticide, were in a vigorous condition (see plates 8 and 9).

Many trees on an adjacent farm were also sprayed with the same insecticide and at about the same time, it being used in this instance, however, at the rate of 3 gallons to 50 gallons of water. A few of these trees were seriously injured. One large spy tree escaped with injury to the outer branches, those in the center being so well protected that they probably received little of the application. A large Gravenstein was badly affected on one side and it was stated that this tree was sprayed with a south wind and the injury was practically confined to the south side of the tree.

Another person in the immediate vicinity used the same material at the rate of 3 to 50, spraying at about the same time and treating many pear trees and a number of apple trees. Many of the Baldwins, in particular, died and a number of the pear trees showed unmistakable evidence of severe injury. Our attention was called to several young pear trees having extended blistered areas, and examinations later in the season showed that in some cases this was followed by death of the affected bark, and in one instance at least, by the death of the tree.

An orchard badly infested by San José scale was also sprayed in this neighborhood and there was much less injury to the trees and marked benefits so far as destroying the scale is concerned.

More disastrous conditions were noted in a Baldwin orchard some two miles distant and set nineteen years before. This orchard was sprayed with the same miscible oil, used at the rate of one gallon to 15 gallons of water, the application being made early in December, probably the 10th to the 13th inclusive. Practically all the trees sprayed at this time, over one hundred, were in a nearly ruined condition and most of them were subsequently cut down by the owner. The line of injury was very sharply defined. Trees in wet places which could not be reached on account of the soft condition of the land, and others which were not sprayed because the engine broke down, escaped without injury. Even here there were one or two trees sprayed from but one side and showing injury only on the treated portion. An examination of the dying limbs and trunks of the affected trees showed a discoloration of the inner bark and irregular spotting of vital tissues practically as noted above (see plate 8, figure 1).

We deem it advisable, in this connection, to reproduce the records of the local weather bureau, kindly placed at our disposal by the authorities.

Climatological data at Athens 1911

MONTH	DAY	TEMPERATURES		PRECPT.	CHARACTER OF DAY
		Max.	Min.		
November	26	40	28	.04	Cloudy
	27	47	28	....	Clear
	28	56	36	T	Cloudy
	29	53	33	....	Cloudy
	30	38	23	....	Clear
December	1	44	29	....	Clear
	2	40	30	T	Cloudy
	3	40	26	....	Cloudy
	4	34	18	T	Clear
	5	28	12	....	Cloudy
	6	43	21	....	Clear
	7	44	21	....	Clear
	8	41	25	....	Partly cloudy
	9	45	28	T	Cloudy
	10	51	34	....	Cloudy
	11	60	44	....	Partly cloudy
	12	60	50	....	Cloudy
	13	59	40	....	Partly cloudy
	14	40	27	....	Cloudy
	15	39	33	.38	Cloudy
	16	40	35	.30	Cloudy
	17	43	38	.10	Clear
	18	40	30	....	Partly cloudy
	19	31	26	....	Clear
	20	32	17	....	Clear

Subsequently we learned of injuries very similar to the above in Dutchess county. The application of a miscible oil was made the last week in November and some twenty greening and northern spy trees, set ten or twelve years before, were dead by midsummer, and as many more showed evidence of more or less injury. The damage was confined, we are informed, to trees sprayed one afternoon when the sky was overcast. An examination of samples received from the affected trees showed conditions practically the same as those described above for the Athens orchards. The bark was variably cracked on a limb from a tree in a dying condition and showed here and there well-marked dead areas with greener tissues on either side. There was the familiar enlargement of the lenticels and an unhealthy, brownish condition of the inner bark. The samples were just being entered by the fruit tree bark beetle, Eccoptogaster rugulosa Ratz.

The above applications to fruit trees in Greene county were made with modern apparatus and, so far as we were able to ascer-

tain, for the sole purpose of controlling San José scale in a satisfactory manner. We are assured by the various parties that the manufacturer's directions were carefully followed. A fruiting apple tree may be conservatively valued at $25 and upward, so that the death of one hundred trees means a loss which can hardly be estimated at less than $2500, a sum most fruit growers would miss. The possibility, we do not say probability, of such extended injury should make the fruit grower careful as to what spray material he applied.

Contributory causes. Several adverse factors have been mentioned in the above discussion, and it is only fair to attempt correctly to estimate their value, even though these inimical conditions are unavoidable in most cases. A blanket of wet snow or several days of foggy weather following spraying hinder evaporation and favor injury on account of the increased penetration likely to result. A long winter with vital activities at a minimum is undoubtedly favorable to penetration, and the same is true of a cold spell in the spring, checking growth and prolonging the period of least resistance on the part of the tree. Some trees have a thicker outer bark than others, and this dead tissue is of much value in preventing oil entering the vital tissues beneath. Variability in the thickness of this outer bark occurs not only in trees of different species but even those of the same kind. Observations go far to show that other things being equal, the thin-barked trees or branches succumb first.

It may be that excessively low winter temperatures favor penetration by oils and thus increase injury. We know that under certain conditions the vitality of trees may be destroyed by extreme cold. This is well known as winter injury and is occasionally a serious factor. It is conceivable that less severe weather might reduce the vigor of a tree to such an extent that penetration by oil and consequent injury would be greatly facilitated. Extreme winter weather is to be expected and unless there is noticeable winter injury to the same variety of trees in the section, we believe low temperatures can not be held responsible to any material extent for dying or dead trees presenting practically identical conditions and which, without exception, had been previously sprayed with an oil preparation or other insecticide known to be dangerous under certain conditions to plant life.

The fact that serious injury followed the application of oil to sugar maple trees, while spraying at the same time caused little or

no injury to soft maples, suggests that the time of application may be extremely important in the case of some trees. The soft maple begins growth in the spring earlier than the sugar maple, and it is very possible that the marked variation in results was due largely to the difference of vital activities then obtaining.

Conclusions. The use of oils or oil preparations on dormant trees has been followed in several cases by severe injury.

Trees, as living organisms, respond to climatic and cultural conditions and as a consequence their power of resisting penetration and injury by oils undoubtedly varies with the season and probably from year to year.

Since certain weather conditions promote injury by oils, it appears impossible to be sure that deleterious effects may not follow spraying dormant trees with an oil or oil preparation.

Fall treatment with an oil appears to be more hazardous than spring applications.

Other things being equal, we believe there is less danger of penetration by oil and consequent injury if the applications are made in the spring shortly before active growth begins and presumably offers greater obstacles to entrance by oil or quickly replaces destroyed and necessary vital tissues.

NOTES FOR THE YEAR

An interesting case of myiasis interna was reported from Kingston. The infestation presumably arose from canned sardines which had probably been left exposed for a time, since four out of six boxes examined contained eggs or larvae within the body cavities of the fish. This is more probable than to assume that the infestation occurred prior to the sealing of the cans. From the material sent us the common house fly, Musca domestica Linn., was reared.

The following brief accounts relate to some of the more injurious or interesting species coming to our attention during the year.

FRUIT TREE INSECTS

Fruit tree bark beetle (Ecoptogaster rugulosa Ratz.). This common pest, a small, brownish black beetle, about one-sixteenth of an inch long, displays a marked preference for sickly or dying limbs of peach, plum, pear and apple in about the order named. The feeding holes made by the beetles in peach bark frequently bleed freely and as a result there may be numerous masses of gummy matter adhering to a rather large portion of the trunk or limb. The beetle makes a gallery about an inch long, deposits eggs on either side and the grubs hatching therefrom make irregular, obliquely transverse galleries for a distance of about half an inch or more, the full-grown grub changing to a pupa at the extremity of the boring and emerging through a circular orifice. The pests are frequently so abundant as fairly to destroy the inner bark and outer sapwood, and on deserting the tree the numerous circular exit holes give the bark an appearance of having been riddled with fine shot. It is on this account frequently termed the shot-hole borer. There are at least two generations annually.

Fig. 10 Work of fruit tree bark beetle, the upper part showing one gallery (original, enlarged)

This pest is best controlled by promptly cutting and burning all sickly or infested limbs. It is very bad orchard practice to allow trimmings to lie around, since brush

piles may easily produce thousands of the beetles and, when abundant, the pests may attack comparatively vigorous trees.

Apple tent caterpillar (Malacosoma americana Fabr.). Numerous complaints were received of the excessive abundance of this common pest upon wild and chokecherry trees in particular, though its conspicuous nests were rather abundant in apple trees here and there. This condition was reported from Long Island localities and various places in the Hudson valley, from Utica, Herkimer and Rome in the central part of the State, and from such Adirondack localities as Glens Falls, Lake George, Ausable Forks, Malone, and Ogdensburg. The pests were so numerous in southern Rensselaer county as to defoliate most of the roadside wild cherry trees and many of the unsprayed apple trees, not excepting in some instances almost entire orchards. The caterpillars were so abundant that they would frequently strip adjacent vegetation before attaining maturity. In some instances ropes of silk leading to the nests were to be observed on the trunks of the trees. The injury was so great in some places that parties feared it would be followed by the death of the trees. This is far from the case with both wild cherry and apple, as was evidenced by the development of a good second crop of leaves subsequently.

The caterpillars complete their growth the latter part of May or early in June, deserting the trees and spinning the familiar whitish cocoon in almost any available shelter. The moths fly from about the middle of June till the middle of July and deposit their dark brown egg belts on the smaller twigs. The eggs usually remain unhatched until the following spring. An examination of local conditions at Nassau shows that there are an unusually large number of eggs upon the trees at the present time, and as a consequence serious injury is probable another season. This caterpillar is easily distinguished from the related forest tent caterpillar by the broad, white stripe down the middle of the back and the large, silken webs invariably constructed in the forks of the trees. The outbreak described above is one of the irregularly periodic oscillations of insect life and may continue for another year or two.

The ravages of this pest are greatly facilitated by farmers generally allowing wild cherry trees to grow along roadsides and fences. The keeping of the brush cut in all such places would not only relieve the adjacent land of an unnecessary drain but prove an important factor in controlling this common pest. It is perhaps

needless to add that thorough and early spraying with a poison, such as arsenate of lead, for the control of the codling moth will prevent serious injury by the apple tent caterpillar.

Resplendent shield bearer (Coptodisca splendoriferella Clem.). Oval, whitish or yellowish, flattened objects less than 1/8 an inch long, may frequently be observed in midsummer, during the winter or in early spring upon the branches and trunks of apple trees. These are the cases of this insect, a species which is widely distributed and occasionally abundant though rarely injurious. It was commonly present last August in the orchard of Mr J. P. Van Ness, East Greenbush. The small caterpillars of this insect mine the apple leaves and form an irregular, dark colored blotch upon the foliage. The full-grown caterpillar cuts away the upper and lower walls of its mine, fastens them together to form a secure retreat and then crawls slowly to branch or trunk, the affected leaf having a somewhat characteristic oval hole, both extremities of which are usually pointed. The adult is about three thirty-seconds of an inch long. The head is nearly concealed by a dense tuft of golden scales, while the brown antennae are trimmed with silvery white scales. The latter are also numerous on the thorax and the base of the wings, though here they have a golden reflection. The distal part of the wing is remarkable for its striking coloration, there being irregular areas covered with golden yellow scales, a transverse band broken near the middle of silvery white scales and margined on either side with dark brown scales. On the posterior margin of the wing and extending nearly to its tip as well as near the apical middle part of the wing there are relatively large areas covered with rich dark brown scales. The posterior margin of the wing and the extremity are fringed with long, pearly gray scales. The hind wings are a rich deep gray margined with a long, yellowish brown fringe. The legs are clothed with silvery and light brown scales. There are two broods yearly, the moths appearing in May and again in July and August. This insect, though small, is preyed upon by a parasite. We have yet to observe a case where this species was sufficiently numerous to cause material injury and remedial measures are therefore inadvisable.

Apple leaf miner (Tischeria malifoliella Clem.). The trumpet-shaped mines of this common apple insect were exceedingly abundant in mid-August in the orchard of Mr J. P. Van Ness of East Greenbush. This insect is common though rarely numerous enough to cause material injury. The owner informs us

that there had been no spraying since 1900, at which time an effort was made to destroy forest tent caterpillars with a contact insecticide. The work of this apple enemy is easily recognized by its trumpet-shaped mine which commences as a glistening spot where the egg was laid, continues for a short distance as a narrow line, gradually expanding and then suddenly widens into an irregular expanded portion. The mine is on the upper side of the leaf and when old, turns brown and is scarcely seen from the under surface. It is inhabited by a greenish, footless, active caterpillar. The upper and lower walls of the mine are densely lined with silvery white silk forming a winter retreat for the larva, which latter transforms in the spring to the pupa at one end of the mine and in a short time forces its way partly out through the upper surface of the mine and then the moth emerges.

This species appears on the foliage so late in the season that comparatively little injury is caused and, as a rule, remedial measures are unnecessary. One method of controlling this insect in case of necessity is to burn the fallen leaves which, as stated above, contain larvae or pupae, and thus reduce the number of insects another season. Spraying the foliage in summer with 10 to 15 per cent kerosene emulsion has also proved of value in destroying the larvae in their mines.

Palmer worm (Ypsolophus ligulellus Hüb.). The small, pale green or yellowish green, active, striped caterpillars of this species aroused much interest in 1900 because of their extreme abundance in orchards in Genesee county. This insect ordinarily escapes attention and, prior to the above mentioned outbreak, had scarcely been noticed subsequent to 1853. Palmer worm larvae were rather generally present the latter part of June 1912 in orchards in and about Byron and were found in small numbers upon apple trees at Nassau. Apples with freshly eaten irregular holes were noted near caterpillars, and one was found in a position which suggested that it had just been feeding upon the fruit.

The full-grown caterpillar is about half an inch long and is then usually of a pale green or yellowish green color with a dusky, subdorsal line. The head may be either yellowish or blackish. Though there is considerable variation in color the larva is not difficult to recognize, since it is very active and drops much in the same manner as does the canker worm when disturbed. Leaves partly skeletonized by this insect soon turn brown, curl and present an unsightly, ragged appearance. It is interesting to note that the

increasing numbers of this species correspond with the greater abundance of the forest tent caterpillar, Malacosoma distria Hübn. This latter insect, it may be recalled, was extremely abundant and injurious about 1900 and reports received for the past season indicate that it is again becoming numerous.

Palmer worm caterpillars appear to be somewhat resistant to arsenical poisons, though this may be explained in part possibly by their feeding upon leaves or portions of leaves likely to be missed when spraying. Furthermore, comparatively little of the insecticide adheres to the fruit, and once under the skin the caterpillar has nothing to fear from poisons. There are good reasons for believing that thorough spraying with arsenate of lead for the control of the codling moth will at least prevent the Palmer worm from becoming sufficiently abundant to cause serious injury.

Pear midge (Contarinia pyrivora Riley). This European pest became established in this country about 1877 and has been known as a pear enemy in the vicinity of Albany for a number of years. Its injuries are extremely local and usually confined to a small number of trees, as will be seen from the following record. An examination of a beurre bosc pear tree about three days after the blossoms had fallen resulted in finding young larvae at the base of the pistils or in adjacent cavities which they had excavated. The larvae were semitransparent and only about 1 mm long. The infested fruit could be easily distinguished at that time by its being about one-half larger than the normal pears and decidedly more globular. Mr Thomas Albright of West Coxsackie states that the midge had seriously injured the fruit on this tree for a number of years and also had been more or less destructive on adjacent trees. The pear tree favored by the midge showed a large percentage, possibly 75, infested by the midge larvae. It is located near a fence and in sod, while others which were much less seriously affected were in cultivated land. It is possible that the lack of cultivation may be an important factor in enabling the midge larvae to hibernate successfully. On May 27th the larger size and more globular shape (plate 10, figures 1, 2) of the infested pears was still apparent though the fruit was beginning to be slightly lopsided, a development prior to its

Fig. 11 Section of beurre bosc pear showing crevice beside pistils (original)

cracking and the escape of the larvae. The maggots at this time were more than twice the size they were six days before, ranging from 1.25 mm to about 2 mm in length. They were yellowish white and appear much more active than earlier. The breastbone was quite distinct, the anterior margin being well chitinized.

Doctor Schmidberger, who studied this insect in Europe, states that he found midges laying eggs as soon as the white petals showed between the lobes of the calyx, the petals being pierced by the long ovipositor. Only four days, according to his observations, were necessary between deposition of eggs and the finding of young larvae in the fruit. An examination of a young pear shows that the eggs can be deposited near the middle of the developing fruit if the female midge simply reaches down between the pistils and the thickened fleshy walls of the small pear. Mr Albright states that the beurre bosc, Bartlett and seckel pears are injured in about the order named, and an examination shows that the former two have a somewhat larger cavity at the base of the pistils. The larvae doubtless begin work at the bottom of the cavity and with comparatively little effort make their way into the developing fruit upon which they subsist. June 3d a few of the beurre bosc pears received from Mr Albright were in fair condition, several were in such a state that a little pressure resulted in rupture, while in one or two the decay had advanced so far as to involve and discolor a portion of the external walls. It was only a question of a few days before many of the affected pears would rupture and the larvae escape. The full-grown maggots were at this time about 3 mm long, moderately stout, whitish or whitish orange and with a well-developed breastbone. The subsequent escape of the maggots from the infested fruit depends much upon climatic conditions, being greatly hastened by rain which results in the speedy cracking of the infested fruit. Specimen pears received from Mr Albright June 6th showed a black discolored area on one side and in a few instances this extended nearly around the pear, and in

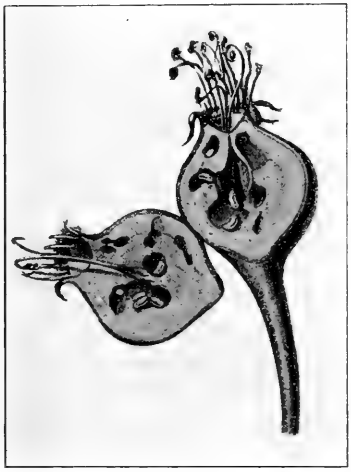


Fig. 12 Section of pear injured by pear midge (original)

one case included the entire fruit. The larvae were full grown and a number had deserted the pears.

Owing to the local habits of this midge and the ease with which the infested fruit can be recognized, it is probable that one of the best and most effective methods of keeping this insect in control would be the early picking and destruction of the infested pears. This would involve no loss, since the fruit attacked by the midge can not develop. The only expense would be that attendant upon the collection and destruction of the young pears, a comparatively small item in the case of young trees and one which would doubtless become quite insignificant if this treatment was systematically followed year after year.

FOREST INSECTS

Forest tent caterpillar (Malacosoma disstria Hübn.). Reported injuries by this insect in 1911 led us to notice the species briefly and call attention to the possibility of its becoming more numerous this season or within a year or two. Some twenty acres of standing oak were defoliated at Bridgehampton, according to P. B. Matthews, while Messrs Isaac Hicks & Son reported under date of June 6th injury to oak on the Godfrey place in Old Westbury. The characteristic larvae were somewhat abundant though not destructive at Nassau. Specimens were received the latter part of June from A. E. Norman, Fillmore, Allegany county, while a number of reports were received from Adirondack localities. Prof. C. L. Williams observed the insect, though not excessively abundant, in the vicinity of Glens Falls. Mr A. N. Robson recorded it as present in increasing numbers at Lake George. There was serious injury to forest trees, probably by this species, at Ausable Forks according to George Chahoon, and the same was presumably the case at Jay, since Mr F. O. Bartlett reported extended defoliation, a portion of which was probably due to this species, since it was recorded as numerous in that locality the preceding year. Miss Bertha L. Paddock, Franklin Academy, Malone, observed the caterpillars feeding upon maple, mountain ash and hornbeam.

It would appear from the tenor of reports received from widely separated localities, that this insect is becoming more abundant, and it is possible that there may be extended injury another season. The probability of severe injury can be accurately forecast by examining hard maple twigs in particular and noting the relative abundance or scarcity of egg masses. This can be done easily from

the ground if one has good eyesight, though a powerful field glass is of material service. As noted elsewhere, egg masses of the apple tent caterpillar are unusually abundant in one section and it would not be surprising if investigations showed the same was true of the forest tent caterpillar. Apple trees in the vicinity of forests are particularly likely to be injured in case there is an outbreak. An early spraying with arsenate of lead, using at least 2 pounds to 50 gallons of water, would be advisable under such conditions for the purpose of destroying the hosts of young caterpillars before material injury results.

Locust leaf miner (Chalepus dorsalis Thunb.). Serious injury by this species was observed at Syosset and in that vicinity in August and September 1911, the beetles confining their operations largely to trees less than 30 feet high. An allied form, the rosy Hispa, C. nervosa Panz., was associated with and, in certain localities at least, more abundant than the parent of the locust leaf miner. The depredations of last season were continued this year, though in early July there was practically no injury by the beetles. Full-grown larvae of the locust leaf miner were then common in locust leaves and a few adults were observed. There were no signs of the allied C. nervosa. Early in August a totally different condition of affairs prevailed. The leaves of many of the larger trees, especially the apical ones, were brown, a condition due almost entirely to the feeding of the beetles. The latter were extremely abundant, two, four, six and even eight occurring on individual leaflets, the larger number being in the more sheltered situations. The small trees were more seriously affected than the larger ones, and from reports received subsequently it was evident that serious injury was inflicted. The extensive feeding at this season is evidently followed by the beetles going into hibernation, since there seems to be but one generation annually in this section. A more detailed account of this insect is given in our preceding report, New York State Museum Bulletin 155, pages 59-63. Serious injury by this insect was also recorded at Locust Valley by the Rev. William M. Cook.

It is evident from observation of local conditions that thorough spraying with an arsenate of lead the latter part of July or early in August, at the time the beetles begin feeding upon the foliage, would result in protecting the trees from serious injury. This treatment can be advised only for the more highly prized trees on lawns or possibly along roadsides.

Bronze birch borer (Agrilus anxius Gory). The destructive work of this pest at Lansingburg, northern Troy, was recorded last year and observations the present season show that the tops of the infested trees have succumbed. Furthermore, this borer is well established in the southern part of Troy and in Washington park, Albany. It is probably becoming well distributed in this section, and the history of white birches in recent years in the western part of the State may be shortly duplicated in the Hudson valley.

The signs of injury are well marked and are first evidenced by the thin foliage and dying condition of the upper branches. A more detailed examination may result in finding well-marked annular ridges around some of the smaller branches, frequently accompanied by reddish or rusty brown spots here and there on the white bark, indicating the operation of a borer beneath. This can be confirmed by cutting into the tree, especially where there are ridges and disclosing in the inner bark or sapwood a flattened, usually more or less sinuous channel. The only practical method of controlling this insect is to cut out and burn all affected wood prior to early May, since the beetles appear the latter part of that month or early in June and may then attack other trees. A more detailed account of this insect is given in the writer's report for last year.

Pine bark borer (Ips pini Say). This medium size to small bark borer is one of the most destructive of these forms in this section. An examination of conditions in the outskirts of Schenectady resulted in finding many dead white pines here and there in groves. They almost invariably had succumbed to attacks by this bark borer and the operations of its allies. The dead pines seen here and there had been killed earlier, while some showing needles were nearly dead and still others were found to be very badly infested though there was no appreciable change in the character of the foliage. The latter trees had the inner bark fairly riddled the last of August with the longitudinal galleries of the beetles and the irregular transverse expanding burrows of the grubs. Practically the only external evidence of the injury at that time was inconspicuous particles of brown or white sawdust thrown out by the beetles as they were entering the trees, and an occasional pitch tube. The latter is about a quarter of an inch high and in diameter and is made by the beetle bringing out particles of pitch and piling them around the point of entrance. The presence of pitch tubes is indisputable evidence of the beetles attacking living

trees. At this time there were under the bark many grubs, numerous pupae and a few recently transformed beetles. Some of the beetles were about ready to desert the tree and it was evident that most of the others would leave the trunk within a week or two and attack some adjacent tree. Observations in 1900 showed that about eight weeks were necessary to complete the life cycle, so there was a fair chance of the recently emerging beetles attacking other trees and their progeny attaining maturity before they would be obliged to suspend activities because of approaching cold weather.

There has been a material increase in injuries to trees by bark borers during the past decade or more. Hundreds of pines, most of them magnificent specimens, have succumbed to these insidious enemies in the near vicinity of Albany. It is probable that the excessive droughts and extremely low winter temperatures of recent years have had an important effect upon many trees and resulted in lowering their vitality and probably making conditions more favorable for insect attack. These changes have, furthermore, been accentuated in suburban sections by the cutting out of many trees and the sudden exposure of previously shaded trunks to full sunlight. These factors have probably had an important effect upon insects habitually preying upon the trees.

The recognition of the causes may make it possible, in some measure at least, to avoid trouble in the future. It is obviously impossible to bring about speedy changes in climatic conditions, nevertheless the general adoption of a program which would result in the reforestation of areas now producing very little or nothing, should eventuate in welcome changes. Well-distributed, thrifty forest areas would tend to reduce the violence of our floods, mitigate the extremes of temperatures and conserve much needed moisture for the midsummer months. This would result in better growing conditions for our trees and enable them in turn to resist more successfully their insect enemies.

There is no practical method of destroying this bark borer if it has become well established in the tree, unless possibly in the case of highly prized pines standing upon lawns or private grounds. The important fact to recognize is that infested trees are not only doomed but may produce millions of beetles which will speedily attack others in the vicinity. The preservation of pines now remaining must depend in large measure upon the recognition of bark borer injury at an early stage and the prompt destruction, preferably by burning, of at least the bark with its contained insects. All should understand that the most dangerous pines, so

far as adjacent trees are concerned, are those which show little or no discoloration of the foliage and very few exit or "shot holes," since these are the trees which contain the largest number of destructive borers. Pines which died the preceding year or earlier, while infested more or less by other borers, are not a menace to living trees. Furthermore, if satisfactory results are to be obtained by cutting out and destroying infested pines, it is essential that there should be cooperation on the part of all, since the bark borers fly readily for considerable distances.

Platypus punctulatus Chap. Numbers of this Central American borer were taken last August on Panama logs which had been shipped around the Horn and were then in the lumber yard at Astoria. The beetles were coming out in large numbers and attacking freshly sawn sappy mahogany in the yards, running longitudinal and, in some instances, vertical galleries into the wood. It was estimated that the injury in early August was as high as $200 a day. Another Ambrosia beetle, namely, Xyleborus torquatus Eich., was also taken in some numbers on the mahogany logs. With the above were associated species of Aulonium bidentatum Fabr., Xuthia brevipes Sharp and Palorus melinus Herbst. The Scolytids were kindly identified by Doctor Hopkins through the courtesy of Doctor Howard, while the other Coleoptera were determined by Doctor Schwarz, both of Washington.

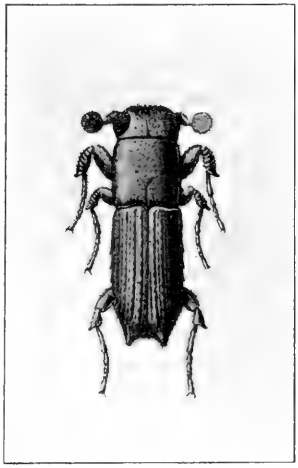


Fig. 13 Dorsal view of Platypus punctulatus, x 7½ (original)

Pine bark aphid (Chermes pinicorticis Fitch). Early in July our attention was called to some eight or nine large pine trees in the western end of Albany. These pines were very badly infested by this bark louse, the upper portion of the trunk and the under side of the larger limbs being nearly covered with the white cottony excretion. One tree was dead, probably having succumbed to earlier attacks, while a second was in a dying condition. An examination of the latter showed that various borers had begun work under the thicker bark, and that in all probability the tree would die before the end of the season. It is possible that these trees, as in the case of park trees observed in earlier years, may

have had their vitality reduced somewhat by unfavorable conditions, not exempting very severe droughts and extremely low winter temperatures. These, however, must be considered only as predisposing factors, since the primary injury appears to have been caused by this insect. The conditions observed the past season have been duplicated in earlier years in Albany and vicinity. This aphid is also injurious to pine seedlings and has been observed on balsam. Fortunately it is very liable to attack by our various species of ladybeetles which are undoubtedly of material assistance in keeping it in control.

The aphid winters as yellowish brown eggs well protected by a copious, waxy secretion, the young appearing in the latitude of Albany from the middle to the latter part of May. The full-grown female is dark grayish purple and about one-thirty-second of an inch long.

It is very probable that this pest can be controlled satisfactorily by a forcible spray of cold water which would wash off large numbers of the insects. Experiments have shown that thorough spraying with a kerosene emulsion, the standard formula probably diluted with 9 parts of water, was very effective when the application was made in May. It is probable that a whale oil soap solution, using 1 pound to 4 gallons of water would be equally satisfactory. In either event the spray should be coarse and forcible so as to drive the insecticide through the woolly protective matter and bring it into contact with the underlying insect.

MISCELLANEOUS

Hawthorn sawfly (Trichiosoma tibialis Steph.). A cocoon of this European species was received April 10, 1911 through the State Department of Agriculture. The specimen was removed from Crataegus which had been imported from Holland. The adult was reared and the provisional identification confirmed. A badly crushed cocoon, apparently of the same species and taken from rose sticks imported from England, was transmitted for identification by the Commissioner of Agriculture November 27, 1912.

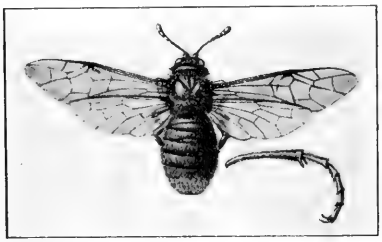


Fig. 14 Hawthorn sawfly (original)

This insect is closely allied to the native elm sawfly, Cimbex americana Leach, a species which is rather common in New York State and is found especially

upon elm and willow. This European sawfly is about half the size of the Cimbex referred to above and may be recognized by its nearly uniform, black color and the dull rufous tarsi. The body is about three-quarters of an inch long, the wing spread one and one-half inches; the head, thorax and the base of the abdomen are thickly and irregularly clothed with rather long, tawny hairs. The general characteristics of the adult are shown in the accompanying figure.

The cocoon is about three-quarters of an inch long, subcylindric, with rounded ends, the posterior usually being narrowly so. The walls of this cocoon are composed of yellowish or tawny, matted silk more or less covered with foliage. The insect escapes by forcing off a lid at the broadly rounded anterior extremity.

The young larva, according to Cameron, has a black head and a green body, the color usually being concealed by a powdery, whitish excretion. The full-grown larva is bright greenish yellow with a darker dorsal line. The yellowish head has a large, brownish orange mark on the vertex. The legs are pale whitish green, the claws brown and the spiracles reddish. The skin is covered with minute warts and sparsely dusted with a white powder.

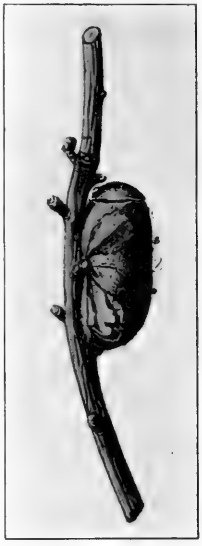


Fig 15 Cocoon of hawthorn sawfly (original)

The hawthorn is given as the preferred food plant, though judging from the synonomy it also occurs upon birch. We have followed Gillanders in the use of tibialis as the specific name, though Cameron assigns this, together with leucorum Westw. and crataegi Br. & Zad. as synonyms of betuleti Klug. Owing to this species being restricted in its food plants to species of relatively small economic value, it is hardly likely that it could become, even if established, a serious pest in America.

Neuroterus saltatorius Hy. Edw. A white oak leaf bearing numerous specimens of this interesting gall, a globose, unilocular swelling less than 1 mm in diameter and on the under side, was received under date of July 24, 1912 from Mr R. M. Taylor, instructor in pathology, Michigan Agricultural College, Ann Arbor, Mich. Mr Taylor called attention to the snapping or jumping habit of the galls, and careful listening enabled us to detect a low snapping or crackling, evidently due to the activity of the insect within the gall. This was easily demonstrated at a distance of an inch or

two from the ear, and in spite of the fact that the specimens had been in press a week before they were forwarded. Mr Taylor also stated that these galls, when laid upon the table, jumped around more or less as a result of larval activities. The single chamber in the gall, according to Mr Taylor, contains a large, white, legless larva, its anterior extremity being attached to the inner wall. This species has been reported from New York State, though the identity of the eastern gall with the Californian deformity originally described by Mr Edwards is questioned (see William Beutenmueller, Amer. Mus. Nat. Hist. 1910, 28:125).

Two-spotted ladybeetle (Adalia bipunctata Linn.). This small ladybeetle was extremely abundant on a Norway maple at Nassau, which appeared to be only moderately infested with Chaitophorus aceris Linn. Scattering colonies of this plant louse were to be seen upon most of the lower leaves at least, and the grubs of this ladybeetle were commonly found, there being on July 7th, two or three partly grown grubs or pupae on most of the lower leaves. The injury by the plant louse was so reduced that there was practically no dropping of leaves in spite of the extremely dry weather of the last three weeks or thereabouts. This ladybeetle was also abundant though not quite so evident on apple and cherry trees, both of which were somewhat infested by plant lice.

This beneficial form was likewise quite abundant June 10th at Mount Vernon. One sugar maple was seen with seven or eight pupal skins or pupae on one leaf. A Norway maple in Washington Park, Albany, observed the 11th, had many of these beneficial insects upon the leaves, one, two or more grubs on individual leaves being not uncommon.

Two-spotted Anomala (Anomala binotata Gyll.). A specimen of this southern form, listed as occurring in New Jersey and Indiana, was taken in Albany from a box of presumably New Jersey strawberries. This species has not been recorded from New York State, though it may possibly occur in the extreme southern or southwestern section. This record is of interest mainly as an illustration of the effect commerce may have upon the distribution of insects.

Mosquito control. The interest in this phase of applied entomology continues, the shore communities being especially active. The village of Rye, as a result of the excessive abundance of salt

marsh mosquitos in 1911, contracted with a company for the thorough drainage of the salt meadows and such upland territory as afforded natural breeding places for mosquito larvae. The work on the salt meadows, we are informed by a local correspondent, proved particularly effective and throughout the entire village mosquitos were very scarce during the season. The scanty rainfall of the early summer was also of service in that breeding pools remained small, and though the drainage work was not completed until September, a marked decrease in the number of mosquitos was observed. The expense of this work was $4250. This was met in part by subscription, the village contributing $2000 from the tax budget.

Other shore communities in New York State have obtained striking benefits as a result of systematic drainage, which latter involves a moderate annual expenditure for the maintenance of the ditches in good condition. The value of this work, owing to the migratory habits of the common salt marsh mosquito, is greatly increased if it be made general throughout a section where such breeding conditions obtain. The pioneer work of communities along this line can not be indorsed too highly and should serve as a marked stimulus to those adjacent. There is no question as to the practicability of eliminating almost entirely the mosquito nuisance, even in the immediate vicinity of salt marshes. The village of Lawrence, with salt marshes almost contiguous on three sides of the residential section, is a striking example of what may be accomplished by systematic and thorough work. The material benefits accruing from such undertakings will become more evident with the progress of time and we confidently expect that within a few years mosquito-ridden salt marshes and the almost intolerable mosquito nuisance will be found only near a few unprogressive communities.

Cotton moth (Alabama argillacea Hübn.) The remarkable flight of this insect in 1911 was duplicated in considerable measure the present season, though in some localities the moths were not so numerous as a year ago. The first record of the season we have is September 18th, based on an observation made by Mr E. P. Van Duzee at Buffalo. Mr Bird reports the largest number at Rye, Westchester county, from October 8th to 12th. The moths were seen by a number of competent observers in widely separated sections of the State between October 10th and 12th and later. The fresh, unrubbed condition of the insects was noted by several,

and this, in connection with the nearly simultaneous appearance of thousands in localities remote from any known food plant, would seem explainable only by the moths rising in hosts from the cotton fields and drifting hundreds of miles in the upper air before alighting.

Detailed records from New York localities are given below:

Richmond county. Mr William T. Davis records the appearance of some moths October 11th, and on the 12th stated that they were quite abundant about the lights at St George Ferry Landing on Staten island.

Westchester county. Mr Henry Bird states that the moths appeared in the largest numbers October 8th to 12th, though at no time did they appear to be so numerous as last year. He first observed a few scattering moths October 3d, their numbers increasing daily up to the 11th, at which time they appeared to be present in maximum numbers. They displayed a marked preference for well-ripened Concord grapes, a little jarring of the trellis being sufficient to flush a cloud of moths from the vines, to which they would promptly return. Most of the specimens were in perfect condition and in shady woodlands he observed them flying considerably during the day. The local flight, as observed by Mr Bird, was of short duration and extended but a few yards. The last examples observed at Rye were seen on October 15th.

Orange county. Mr Bird states that at Middletown numbers were observed on October 14th and he was informed that they had been more numerous for two or three days previous. They seemed to be more abundant than at Rye and were in evidence until the 22d.

Otsego county. Prof. I. P. Bishop of Buffalo advised us that he learned of the appearance of the cotton moth in thousands about October 10th at Index. The moths were reported as being so numerous that it was necessary to sweep them from the slippery railroad tracks.

Ontario county. Prof. P. J. Parrott of the Geneva station states that the cotton moths were exceedingly abundant at Geneva October 10th and 11th, being so numerous as to collect in the gutters to the depth of about three to four inches near the coke and gas works on the eastern side of the city. He also adds that they appeared on the same dates at Canandaigua.

Monroe county. The moths were extremely abundant at Rochester, according to press reports based upon an identification by Prof. P. J. Parrott of Geneva.

Genesee county. Press dispatches record the appearance of millions of these moths at Batavia before daylight on October 12th. They were so numerous that merchants were credited with having "swept them from the sidewalks and sides of their stores in basketfuls."

Chenango county. Mr Harry J. Mosher, New Berlin, October 11th, forwarded specimens which appeared in great numbers. Mr Miller states that they were seen about five o'clock in the morning, as near as he could ascertain. "Earlier risers found underneath an arc light at the very center of the village, on the ground, a solid mass of these millers or moths, several inches in depth and covering a space at least a rod across. The adjoining buildings and trees were also literally brown with them."

Wyoming county. Mr M. S. Baxter reports the presence of the moths at Warsaw.

Livingston county. Prof. G. W. Bailey of the State Normal School, Geneseo, forwarded a moth under date of October 9th, with the statement that he saw from fifteen to twenty under an arc lamp. He reports that on October 11th thousands of the insects were found on Main street, they were being swept from windows and walks, and a great number were observed resting on trees, windows and even in the street. He adds that they were practically limited to two lights at the south end of the town, only a few occurring at four other lights farther up town. The specimens seemed to be in perfect condition.

Erie county. The first cotton moths observed in Buffalo were seen by Mr E. P. Van Duzee on September 18th. They were most abundant October 11th, when many windows of the down-town stores were well covered with the insects. Mr Van Duzee had never seen so many of this species before. Mr M. S. Baxter, 75 State street, Rochester, also reported an abundance of this moth in Buffalo on October 10th. Prof. I. P. Bishop of the State Normal School, Buffalo, reported the appearance of this moth at Buffalo October 11th, stating that as many as one hundred could be counted upon a window. Mr Bishop found the flight limited in considerable measure to certain sections of the city, namely, Main street from the harbor to North street with stray individuals farther north and for two blocks either side of Main street for the greater part of the same distance; near the harbor, west of Main street and on Exchange street near the New York Central and Erie stations; in the vicinity of Niagara street and the city line, and also in the northwest part of the city. A few, he states, were reported from Depew.

City Forester H. B. Filer reported the appearance of large numbers of the moths on the afternoon of October 10th, the insects being present in large numbers the following day, the next two days and disappearing for the most part by the 13th and 14th. He states that they seem to come with a southeast wind along with a rain storm, and were so numerous that the gutters of the lower part of Main street were literally covered with dead insects.

Niagara county. Mr M. F. Burke, assistant inspector of the State Department of Agriculture, observed this moth to be very numerous in the city of Lockport at about the same time it was so extremely abundant in Buffalo, namely October 10th to 12th.

Albany county. A few specimens of this moth were observed on the office window October 12th and the presence of the moth was reported from other parts of Albany. The specimens seen were in perfect condition.

Schenectady county. Mr Richard Lohrmann saw the first specimen at Schenectady on September 18th, the next on the 23d, swarms appearing October 7th to 12th, and the last individual was noted on October 17th. The shop windows of the General Electric Light Company were covered with the moths, though not very many were noted about the street lights.

Otsego county. Specimens were received October 15th from Oneonta through the courtesy of Mr G. G. Atwood of the Department of Agriculture.

Saratoga county. Mr H. T. Wakely of Corinth states that the cotton moth made its appearance there in thousands on the evening of October 11th. They were abundant on the 12th and ceased flying on the 13th though one was taken alive on the 16th.

Clinton county. Prof. G. H. Hudson of the State Normal School has kindly placed at our disposal his records relative to the earlier appearance of the cotton moth at Plattsburg. The data are tabulated below:

1886 September 28, 4 specimens
1886 September 29, 1 specimen
1891 October 7, 1 specimen
1891 October 13, 1 specimen
1893 September 19, 1 specimen
1893 September 20, 1 specimen
1893 September 22, 1 specimen
1893 September 23, 2 specimens
1893 October 10, 1 specimen

Professor Hudson adds that he has not been able to look for the insect since 1893, though he believes it to be a rather regular visitor. Apparently it was not abundant in that section last October.

The flight of the cotton moth was closely followed in some localities by the appearance of numerous specimens of the lime tree winter moth, Erannis tiliaria Harr., a species mistaken by some for the cotton moth. This latter form was reported by Mr E. P. Van Duzee as unusually abundant at Buffalo on October 22d. It was numerous around the electric lights of Schenectady in the week of October 10th, according to Richard Lohrmann. Numerous specimens were also observed about the same time in different sections of Albany. The same phenomenon, though perhaps not to such a marked extent, was noted by Henry Bird at Rye.

Southern captures. In connection with the record given above relating to the large flights of the cotton moth, Alabama argillacea Hübn., we deem it advisable to place on record the capture by Mr Henry Bird at Rye of the following three species of southern Noctuids: Autographa oxygramma Geyer, Anomis erosa Hübn. and Anticarsia gemmatilis Hübn. Mr Bird states from observations covering a period of twenty-eight years, that he has not previously noted these insects in that locality.

Periodical Cicada (Tibicen septendecim Linn.). The appearance of a large brood of this insect in 1911 aroused much interest, and as an indirect outcome, we received from Prof. G. A. Bailey June 11, 1912, a report that he had found several nymphs of this insect emerging from the ground on Major Wadsworth's estate at Geneseo. Subsequently adults were forwarded and there can be no question as to the identity of the insect. Professor Bailey states that the few observed occurred within a narrow radius in a piece of second growth timber. There is a record of a colony of brood 12, the one which appeared in such large numbers in the Hudson valley in 1911, in the northern part of Pennsylvania and not so very distant from Geneseo. Should the insects noted above belong to this brood they must be considered as stragglers, otherwise it is necessary to associate them with brood three, no colony of which has been recorded nearer New York State than central-western Ohio and the northern portion of West Virginia. This seems to be a weak colony, since we have been unable to obtain any information respecting the earlier appearance of the insect in that section.

The occurrence of belated individuals is amply substantiated by records kindly placed at our disposal by Mr W T Davis of New Brighton, who found periodical Cicadas on Staten island in 1895 and again in 1912. They were likewise found the past season by Mr Davis at West Point. In all cases they were undoubtedly belated individuals from the brood which appeared in such large numbers in 1894 and 1911. Mr Davis has also collected specimens of this brood in 1893 and 1910, one year in advance of the normal time for emergence. Mr Henry D. Lewis of Annandale informs us that no belated individuals were observed by him in 1912, though he had seen them following earlier appearances of this insect.

Juniper bug (Pentatoma juniperina Linn.). This large, green, reddish or pinkish margined stinkbug is comparatively rare in New York State. It was found in unusual numbers on small pines at North Chatham May 11, 1912, eight to ten occurring on individual trees only three to four feet high. The insects did not seem to be feeding. They had evidently recently emerged from hibernation and were associated with specimens of Brochymena and Euschistus.

Mite migration. An interesting specimen of Helobia punctipennis Meign., a small fly only about three-sixteenths of an inch long, was taken at Albany June 25, 1911. The abdomen of this specimen bore six relatively large mites, several of them ranged one behind the other in a regular series. This mite was submitted to Doctor Howard for determination and identified by Mr Banks as a Gamasid belonging to the genus Seius and probably undescribed. Mr Banks points out that these mites were probably upon the fly for migratorial purposes and were not parasitic, despite the fact that mites are frequently observed upon insects and commonly supposed to be parasitic.

PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the Entomologist during the year 1912. The titles,[1] time of publication and a summary of the contents of each are given. Volume and page numbers are separated by a colon.

Dying Hickory Trees. Auburn Advertiser, November 3; Buffalo Commercial, Middletown Argus, New York Tribune, November 5; Geneva Times, Lockport Union-Sun, Ossining Citizen, Watertown Standard, Schenectady Star, Amsterdam Recorder, November 6; Glens Falls Times, Catskill Mail, Rome Sentinel, November 7; Greenwich Journal, Yonkers News, Oxford Times, November 8; Phoenix Register, Peekskill Union, Norwich News, Perry Record, November 9; Cortland Standard, Randolph Register, Rensselaer Eagle, Tioga County Record, November 10; Saratoga Eagle, Yonkers Gazette, November 11; Kingston Freeman, November 17; Catskill Examiner, Pelham Sun, Brooklyn Times, November 18; Washington County Post, November 24, 1911

The characteristic work of the hickory bark borer, Eccoptogaster quadrispinosa Say, is described and the destruction of infested wood during the winter advised.

Codling Moth. New York State Department of Agriculture, Bulletin 28, 1911, pages 237–50 (issued December 14, 1911). Reprinted as Circular 40

A summarized discussion of Carpocapsa pomonella Linn. and methods of control in the light of recent experiments.

New Species of Gall Midges. Economic Entomology Journal, 1911, 4:546–59

The following new species are described: Leptosyna quercus [quercivora], Asphondylia eupatorii, A. thalictri, Uleella [Bruggmaniella] mexicana, Contarinia spiraeina, Dicrodiplosis coccidarum, D. gillettei, Mycodiplosis carolina, M. coccidivora, M. cucurbitae, M. spinosa, Youngomyia quercina, Y. vernoniae, Hyperdiplosis fungicola, Parallelodiplosis clarkeae, Cecidomyia cerasiphila, C. hopkinsi, Itonida cucurbitae, I. spiraeina, I. taxodii, I. pugionis, I. cincta and I. canadensis.

[1] Titles are usually given as published. In some instances articles appearing in a number of papers have been given different titles by the various editors.

The Seventeen-year Locust. American Year Book, 1911. 1912, pages 498–99

Summary account of the 1911 appearance of the periodical Cicada, Tibicen septendecim Linn.

The Identity of the Better Known Midge Galls. Ottawa Naturalist, 1912, 25:164–67, 181–88

Lists some of the earlier described species of Lasioptera, Neolasioptera, Asteromyia, Rhabdophaga and Dasyneura.

Biology of Miastor and Oligarces. Science, February 16, 1912, 35:278–80

A summarized account giving the American distribution, recognition characters and observations on the biology and natural enemies.

Bronze Birch Borer. Garden Magazine, February, 1912, 15:36

A summary statement of injuries with a discussion of control measures for Agrilus anxius Gory.

Control of Insect Pests in Institutions. Journal Home Economics, February, 1912, 4:16–26

A general discussion of the more important household insect pests with special reference to their control in institutions.

Shade Tree Prospects. Middletown Times, Albany Times Union, New York Tribune, March 11; Glens Falls Times, Knickerbocker Press, March 12; Syracuse Journal, Greenwich Journal, March 13; Washington County Post, March 22; Schenectady Gazette, March 30; Troy Press, April 4, 1912

The serious injury by the elm leaf beetle, Galerucella luteola Müll., the preceding year is briefly characterized and thorough spraying urged.

Fight Against Codling Moth. Rural New Yorker, March 16, 1912, 71:355, 393, 395

Summary account of experimental work and methods of controlling this pest.

Save the Trees. Troy Budget, March 17, 1912, page 24

A general discussion of the shade tree situation with special reference to methods of controlling the elm leaf beetle.

Save the Hickories. Troy Times, March 30; Glens Falls Times, April 1; Utica Herald Dispatch, April 2; Ogdensburg Journal, Auburn Advertiser, Lockport Journal, Poughkeepsie Union, Amsterdam Recorder, April 3; Warwick Advertiser, Ithaca

Journal, April 4; Binghamton Press, Poughkeepsie Eagle, Syracuse Herald, April 5; Albany Sunday Telegram, April 7; Hudson Falls Herald, Schenectady Gazette, April 11; Cortland Standard, April 17; Catskill Recorder, Suffern Recorder, April 19, 1912

The characteristic work of the hickory bark borer, Eccoptogaster quadrispinosa Say, is described and the prompt destruction of infested trees urged.

Early Leaf Feeders. Knickerbocker Press, April 4; Utica Observer, April 6, 1912

The work of the early leaf feeders, such as the apple tent caterpillar, the canker worms, the bud moth and the case-bearers, is briefly described and remedial measures advised.

Spraying Apples. Utica Press, Knickerbocker Press, April 11; Utica Observer, Albany Argus, April 12; Watertown Herald, Yonkers Herald, Rome Sentinel, April 13; Binghamton Herald, Troy Times, April 15; Orange County Record, Yates County Chronicle, Cortland Standard, April 17; Washington County Post, Plattsburg Press, April 19; Poughkeepsie Eagle, April 20; Hoosick Falls Democrat, Penn Yan Express, April 24; Cobleskill Index, April 25; Catskill Recorder, Waterloo Observer, April 26; Hudson Falls Herald, May 2; Ithaca Journal, May 3; Warwick Dispatch, May 8; Oswego Gazette, May 9, 1912

The results from one thorough spraying with arsenate of lead are summarized and arsenate of lead, 2 pounds to 50 gallons of water and a pressure of 125 to 150 pounds or more, advised.

New West Indian Gall Midges. Entomological News, April 1912, 23:173–77

The following species are described: Uleella [Bruggmaniella] pisoniae, Mycodiplosis pulvinariae, Arthrocnodax meridionalis and Hyperdiplosis producta.

Practical Methods in Controlling the Codling Moth. Western New York Horticultural Society Proceedings, 1912, pages 74–82

A summary discussion of the results obtained in 1909–11.

Spraying for Codling Moth. New York State Fruit Growers' Association Proceedings, 1912, pages 190–97

General summary of experimental work in 1909–11, with special reference to Hudson valley conditions.

Recent Experiments with the Codling Moth. Economic Entomology Journal, 1912, 5:153–59

A summary discussion of experimental work.

Lasiopteryx manihot n. sp. (Diptera) Canadian Entomologist, 1912, 44:144

Original description of a species reared from Cassava, Manihot utilissima.

Pear Thrips. Albany Journal, May 4; Catskill Mail, May 6, 1912

Injuries by this pest are noted and spraying with a tobacco soap preparation advised.

Plant Lice—A Warning. Troy Times, Ossining Citizen, Middletown Times, Utica Herald Dispatch, May 4; Knickerbocker Press, Times Union, Yonkers Herald, May 6; Schenectady Star, Oneonta Star, May 7; Warwick Dispatch, Penn Yan Express, May 8; Fonda Democrat, Utica Press, May 9; Suffern Recorder, Madison County Times, Penn Yan Democrat, Randolph Register, Oneida Dispatch, Rensselaer County Standard, Catskill Recorder, Poughkeepsie Eagle, May 10; Saratoga Eagle, May 11; New York Tribune, May 13; Watkins Review, May 15; Hudson Gazette, May 16; Hudson Falls Register, May 23, 1912

A warning notice advising early and prompt spraying before aphids become excessively abundant.

Control of Elm Leaf Beetle. Schuylerville Democrat, May 15, 1912

A somewhat extended discussion of the fundamentals involved in the satisfactory control of this insect.

Spraying Elms. Albany Journal, Troy Record, May 21; Troy Press, Saratoga Sun, Times Union, Knickerbocker Press, May 22; Catskill Mail, Hudson Register, May 23; Troy Times, Catskill Enterprise, May 25, 1912

Thorough spraying of the elms is urged and at least 4 pounds of arsenate of lead to 50 gallons of water advised.

Spraying Apparatus. Schenectady Star, May 28, 1912

A brief discussion of the cost and relative advantage of various types of spraying apparatus. Villages and municipalities should obtain as good results spraying as tree protecting firms. Arsenate of lead is advised as the best poison.

Insects and Shade Trees. The American City (New York) May 1912, 6:731–32

A summary discussion of the shade tree problem in the northeastern United States.

Forest Tent Caterpillar. Albany Journal, June 3; Schenectady Star, Glens Falls Times, Troy Record, Newburg News, June 4; Middletown Argus, Albany Argus, June 5; Keeseville News, Rensselaer County Standard, June 7; Fort Plain Free Press, June 11; Port Jervis Gazette, June 12; Warwick Advertiser, Fulton County Democrat, June 13; Catskill Recorder, June 14; Utica Advocate, June 15; Binghamton Herald, June 19; Warrensburg News, Massena Observer, June 20, Owego Gazette, June 27, 1912

A warning notice in regard to possible depredations by this insect.

27th Report of the State Entomologist on Injurious and Other Insects of the State of New York. New York State Museum Bulletin 155, pages 1–198, plates 27 (issued June 13, 1912)

Contents

Diarthronomyia californica n. sp. Pomona College Journal of Entomology, 1912, 4:752

Description of a midge reared from subconic leaf galls on Artemisia californica.

Observations on the Identity of the Wheat Midge. Economic Entomology Journal, 1912, 5:286–8

Prodiplosis fitchii and Itonida tritici are described as new. A detailed description is given of Thecodiplosis moselana Gehin.

Anthrenus verbasci. Economic Entomology Journal, 1912, 5:297

Records the continued breeding of this insect in dried corn for a period of ten years.

Priority vs Nomina Conservanda. Science, July 5, 1912, 36:17–18

A general discussion with special reference to the Itonididae. Adherence to the strict law of priority is urged.

The Fundamentals of Spraying. New York State Department of Agriculture Bulletin 37, pages 1413–20, 1912

A summary discussion of materials and methods.

Elm Leaf Beetle and White-marked Tussock Moth. New York State Museum Bulletin 156, pages 1–35, plates 8, 1912 (issued July 11, 1912)

Contents

New Itonididae. New York Entomological Society Journal, 1912, 20:102–7

The following new species are described: Campylomyza truncata, Corinthomyia gracilis, Johnsonomyia cincta, Asynapta americana, Camptomyia aestiva, Porricondyla vernalis, P. dietzii, P. porrecta, Dasyneura eugeniae and Youngomyia pennsylvanica.

Itonida inopis O. S. Economic Entomology Journal, 1912, 5:368–69

A general biologic account with descriptions of all stages.

White Grubs. Knickerbocker Press, August 16; Kinderhook Courier, August 22, 1912

A brief record of severe injury in southern Rensselaer and northern Columbia counties, with observations upon their habits and methods of control.

Scraping Trees. Guide to Nature, August 1912, 5:13

The common practice of scraping the rough bark from shade trees is considered of practically no benefit.

Damage By White Grub and the Chinch Bug. Albany Evening Journal, October 2; New York Farmer, October 10, 1912

A summary account of injury by the white grub, with suggestions for reseeding, and a notice of an outbreak by the chinch bug, Blissus leucopterus Say.

Some Large Problems in Economic Entomology. Cornell Countryman, October 1912, No. 1, pages 3–7

A general discussion of entomological problems, with special reference to the need of national quarantine and the desirability of protecting shade and forest trees from insect depredations. Data are given regarding the number of insects, their varied stages and food habits and the difficulties attendant upon the recognition of the numerous forms.

Observations on Uleella Rübs. Entomological News, 1912, 23: 353–54

The characters of the adults of this genus are established and U. pisonifolia described in both sexes, together with the gall, larva and pupa.

New Gall Midges or Itonididae. New York Entomological Society Journal, 20:146–56, 1912

Several midges are recorded from spiders' webs and the following species described: Coccidomyiaerii Oligotrophus betheli, Janetiella coloradensis, Asteromyia grindeliae, Lasioptera verbenae, L. diplaci, Asphondylia diplaci, A. enceliae, Thecodiplosis zauschneriae, Clinodiplosis araneosa, Coquillettomyia knabi and Karschomyia townsendi.

Scientific notes. Economic Entomology Journal, 5:398, 403, 411, 1912

Brief notes on outbreaks by white grubs (Lachnosterna species), fall army worm, Laphygma frugiperda Sm. & Abb. and the locust leaf miner, Chalepus dorsalis Thunb.

Arthrocnodax occidentalis n. sp. Economic Entomology Journal, 5:402, 1912

Original description of a midge reared from red spider, Tetranychus.

ADDITIONS TO THE COLLECTIONS, OCTOBER 18, 1911–OCTOBER 15, 1912

The following is a list of the more important additions to the collections:

EXCHANGE

There were received from Dr Otto Nüsslin, Zoologisches Institut, Karlsruhe, Germany, two or more specimens of each of the following species:

Eccoptogaster scolyta Fabr., E. ratzeburgi Janson, E. carpini Ratz., E, multistriata Marsh, Hylastes ater Payk., Dendroctonus micans Kugl., Myelophilus piniperda Linn., M. minor Hartig., Hylesinus crenatus Fabr., H. fraxini Panz., H., vittatus Fabr., Polygraphus polygraphus Linn. Crypturgus cinereus Herbst., Ips sexdentatus Boern., I. acuminatus Gyllh., I. curvidens Germ., I. laricis Fabr., Pityogenes chalcographus Linn., P. bidentatus Herbst. and Xyleborus saxeseni Ratz.

There were received from Prof. J. M. Aldrich, Moscow, Idaho: Ephydra hians Say, adults pupae and larvae; E. gracilis Pack, adults; E. subopaca Lw., adults; E. millbrae Jones, adults; Caenia bisetosa Coq., adults.

DONATION

Hymenoptera

Thalessa atrata Fabr., black long sting, adult, June 17, G. C. Lewis, Lockport

Apanteles congregatus Say, cocoons and adults, July 29, Arthur Dummett, Mount Vernon. Same, cocoons on Ampelophaga myron Cram., August 7, E. W. De Long, Crown Point

Cynips strobilana O. S., lobed oak gall, October 12, W. L. McAtee, Pickens, Miss.

Andricus seminator Harr., wool sower, gall on white oak, June 21, C. C. Laney, Rochester. Same, June 24, Miss Ruth H. Sherman, Glens Falls

Neuroterus saltatorius Hy. Edw., galls on white oak, July 24, R. M. Taylor, Ann Arbor, Mich.

N. umbilicatus Bass., oak button gall on Quercus michauxii, October 12, W. L. McAtee, Pickens, Miss.

Cimbex americana Leach, elm sawfly, larva on elm, September 20, Miss E. S. Blunt, New Russia

Tremex columba Linn., pigeon tremex, adult, September 11, A. G. Woodard. Through State Conservation Commission

Caliroa cerasi Linn., pear slug, larvae on pear, August 12, E. C. Brooks, Athens

Kaliofenusa ulmi Sund., elm leaf miner, larva on elm, June 13, A. N. Robson, Lake George. Same, June 15, Neil Rutledge, Greenwich. Same, June 19, W. L. Devereaux, Syracuse. Same, larvae and work on elm, June 24, J. G. Ward, Cambridge

Trichiocampus viminalis Fall., larvae, August 29, Harry Vail, New Mulford

Coleoptera

Eccoptogaster quadrispinosa Say, hickory bark beetle, work on hickory, February 9, W. J. Matheson, Huntington. Same, larvae and work, March 12 and June 17, H. W. Merkel, New York City. Same, work, June 22, E. H. Anderson, Scarsdale. Same, adults and work, July 1, J. J. de Vyver, Mount Vernon. Same, work, July 30, F. P. Dwyer, Yonkers

E. multistriata Marsh, imported elm bark borer, work, adults and larvae, October 5, J. W. Chapman, Dorchester, Boston, Mass.

Pissodes strobi Peck, white pine weevil, work on pine, July 11, Ferruccio Vitale, New York City

Thricolepis simulator Horn, gray, bark-eating weevil, adult on apple, May 2, Thomas Cunningham, Vancouver, B. C.

Pomphopoea sayi Lec., Say's blister beetle, adults on wild cherry, May 31, C. J. Herrick, Elsmere

Coptocycla ? clavata Fabr., larva on morning glory, July 9, G. H. Hawley, Castleton

Galerucella luteola Müll., elm leaf beetle, adults, April 18, M. H. Gardner, Brewster. Same, May 10, Mrs W. H. Crittenden, Cornwall. Same, eggs on elm, June 14, J. T. Young, Watervliet. Same, adults, larvae and pupae on elm, July 11, A. Gaskell, Ellenville. Same, larvae and work on elm, July 16, L. A. Tate, Gloversville. Same, work on elm, August 5, W. M. Cook, Oyster Bay

Glyptoscelis alternata Cr., leaf beetle, adult on apple, May 2, Thomas Cunningham, Vancouver, B. C.

Elaphidion villosum Fabr., oak and maple pruner, larva and work on oak, July 24, Mrs J. O. Rooney, Scarsdale

Monohammus confusor Kirby, sawyer, adult, July 10, Chatham Courier, Chatham. Same, adult on pine, July 17, Mrs George Wend, Albany

Lachnosterna, June beetle, larva in grass sod, August 11, Mrs Matthew Bender, jr, Niverville. Also from W. M. Woodward, North Chatham

Psephenus lecontei Lec., larva, September 25, R. M. Moore, Rochester

Dermestes vulpinus Fabr., leather beetle, all stages, March 26, W. G. Van Name, Albany

Megilla maculata DeG., spotted ladybeetle, adults, December 13, Charles Bernstein, Rome

Diptera

Thecodiplosis ananassi Riley, galls on cypress, September 12, W. L. McAtee, Marksville, La.

Caryomyia caryae O. S., gall on hickory, July 22, G. L. Dale, Mount Kisco. Same, July 24, Mrs J. O. Rooney, Scarsdale

Caryomyia persicoides Beutm., on hickory, July 24, Mrs J. O. Rooney, Scarsdale

Contarinia pyrivora Riley, pear midge, larvae on pear, May 27, Thomas Albright, New Baltimore

Asphondylia betheli Ckll., male, female, larva and pupa on Opuntia, April, C. F. Baker, Claremont, Cal. Same, gall, male and female on Cactus, May 22, E. Bethel, Denver, Col.

Simulium sp., blackfly, larvae, June 19, W. D. Rhines, Linlithgow

Eristalis tenax Linn., bee fly, larvae, August 27, Charles Bernstein, Rome

Musca domestica Linn., housefly, larvae from cases of Myiasis interna, September 9, J. R. Gillett, Kingston

? Agromyza sp., adult on Wisteria buds, March 23, E. O. Amundsen, San Diego, Cal.

Lepidoptera

Polygonia ? comma Harr., hop merchant, eggs on hop, June 5, Principal, Schoharie High School, Schoharie. Through State Department of Agriculture

Euvanessa antiopa Linn., spiny elm caterpillar, larva on elm, June 25, Mrs I. D. F. Delafield, Greenport. Same, July 1, J. A. Sweigert, Comstock

Sphecodina abbotii Swain, larva on woodbine, July 10, J. H. Dodge, Rochester. Same, July 29, Arthur Dummett, Mount Vernon

Ampelophaga myron Cram., grapevine hog caterpillar, larva on grape, August 7, E. W. De Long, Crown Point

Samia cecropia Linn., Cecropia moth, cocoon, December 28, H. Gaut, Glen Cove

Telea polyphemus Cram., American silk worm, eggs, June 6, Mrs A. M. A. Jackson, Warner

Callosamia promethea Dru., Promethea moth, cocoons, May 10, Miss M. R. Wilbor, Old Chatham. Same, larvae on lilac, August 5, Mrs Martha W. Martin, Albany

Diacrisia virginica Fabr., Virginia ermine moth, adult, June 20, A. E. Worman, Fillmore. Through State Conservation Commission

Arctia caja Linn., garden tiger moth or woolly bear of Europe, larva, October 26, L. F. Strickland, Lockport. Through State Department of Agriculture

Alypia octomaculata Fabr., eight-spotted forester, larva on woodbine, July 10, C. C. Woolworth, Castleton

Laphygma frugiperda Sm. & Abb., fall army worm, larvae and pupae on lawn, September 11, Robert Mostow, New York City; Roy Latham, Orient Point; Samuel Parsons, New York City, also September 21

Agrotis ypsilon Rott., black cutworm, larva, June 10, T. F. Niles, Chatham

Mamestra picta Harr., zebra caterpillar, larvae on pear, July 16, F. E. Rogers, Oswego

Papaipema appassionata Harvey, P. necopina Grt., P. frigida Sm., P. sciata Bird, P. inquaesita G. & R., P. maritima Bird, P. rigida Grt., P. marginidens Gn., P. moeseri Bird, P. duplicata Bird, P. cerussata Grt., P. duovata Bird and Apamea erepta, var. graminea Bird. Contributed by Henry Bird, Rye, August 14

Alabama argillacea Hübn., cotton moth, adults, October 9, G. W. Bailey, Geneseo. Same, October 11, H. J. Mosher, New Berlin. Same, October 13, I. P. Bishop, Buffalo

Catocala sp., caterpillar, June 19, A. H. Green, Shushan

Datana integerrima Grt. & Rob., black walnut worm, larvae on English walnut, August 5, M. T. Richardson, New York City. Same, caterpillars, August 22, C. H. Smith, Mohegan Lake

Schizura concinna Sm. & Abb., red-humped apple caterpillar, larvae on apple, July 9, J. W. Wiltse, North Chatham

Tolype laricis Fitch, larch lappet moth, larva, August 8, J. H. Dodge, Rochester

Malacosoma americana Fabr., apple tent caterpillar, larvae, June 12, T. L. Coventry, Utica. Same, larvae on oak, June 19, P. B. Matthews, Bridgehampton. Through State Department of Agriculture. Same, adult, July 7, Whitcomb of the Commonweal, Greenwich. Same, cocoons, July 13, George Chahoon, Ausable Forks

M. disstria Hübn., forest tent caterpillar, larvae, June 10, Isaac Hicks & Son, Westbury. Same, larvae, June 20, A. E. Worman, Fillmore. Through State Conservation Commission

Erannis tiliaria Harr., basswood inch worm, larvae on elm and basswood, June 8, G. C. Vosburgh, Moravia

Thyridopteryx ephemeraeformis Haw., bagworm, larvae on purple beech, August 2, Miss Helen A. Brown, Brooklyn

Sibine stimulea Clem., saddleback caterpillar, September 3, G. R. Felten, Cementon. Same, larva on blackberry, September 24, J. B. Mulholland, Kingston

Zeuzera pyrina Linn., leopard moth, work on hickory, October 26, Isaac Hicks & Son, Westbury. Same, larva, December 24 and 27, E. T. Mulligan, New York City. Through State Department of Agriculture. Same, larva, March 17, Miss Mary L. Lobdell, Woodhaven

Mineola indigenella Zell., leaf crumpler, larval cases, February 24, C. L. St John, Canajoharie

Ephestia cautella ? Walk., larvae and adults on English walnuts, November 20, Ogden Stevens, Albany

Evetria ? frustrana Comst., caterpillar on pine, August 30, W. F. Smith, Valhalla

E. ? comstockiana Fernald, pitch twig moth on pine, June 12, H. T. Fernald, Amherst, Mass.

Tmetocera ocellana Schiff., bud moth, larvae in pear buds, May 8, R. Scofield, Coeymans

Tortrix fumiferana Clem., spruce bud moth, larvae on spruce, June 3, G. E. Emmons, Schenectady

Coleophora caryaefoliella Clem., larvae and work on hickory, July 13, F. M. Weld, New York City

Bucculatrix canadensisella Cham., birch leaf skeletonizer, molting cocoons, August 29, Cadwallader Evans, Stellarton, Nova Scotia. Also, larvae, cocoons and work on birch, September 18

Phyllonoryter hamadryella Clem., oak blotch leaf miner, mines on oak, July 29, David Harrison, Staatsburgh. Same, work on oak, August 5, Miss Anne R. Wier, Garrison

Gracilaria near violacella Busck, larvae on azalea, March 7, D. Clark's Sons, Fordham Heights, New York City. Through State Department of Agriculture

Neuroptera

Corydalis cornuta Linn., horned Corydalis, adult, July 1, I. L. Nixon, Rochester

Thysanoptera

Euthrips pyri Dru., pear thrips, adults on apple, May 1, G. E. Ward, Ravena

Hemiptera

Tibicen septendecim Linn., seventeen-year cicada, adult and pupal case, June 14, G. A. Bailey, Geneseo

Cicada ? linnei Grossb., harvest fly, adult, August 26, J. H. Dodge, Rochester

Phylloxera caryaecaulis Fitch, hickory gall aphid, old galls on hickory, October 26, A. B. Buchholz, Geneva. Through State Department of Agriculture

Chermes pinicorticis Fitch, pine bark aphid, adults on pine, July 5, H. N. Armer, Ballston Spa. Through State Conservation Commission. Same, July 12, W. P. Judson, Broadalbin. Same, August 8, M. F. Duhamel, Poughkeepsie

Hormaphis hamamelidis Fitch, witch-hazel cone gall, galls on witch-hazel, August 5, A. M. Baker, Oneonta

Pemphigus populi-transversus Riley, gall and young on poplar, June 18, Mrs R. S. Banks, Albany

Schizoneura americana Riley, woolly elm leaf aphis, young on elm, June 18, C. E. Olsen, Maspeth. Same, adults and young on elm, June 21, Miss Alice C. Hareford, Watertown. Same, adults and work on elm, July 18, A. R. Fuller, Malone

S. lanigera Hausm., woolly apple aphis, young on apple, November 8, Mrs S. H. Niles, Coeymans. Same, nymph on apple, August 26, J. A. Delehanty, Albany

Chaitophorus aceris Linn., work and young on Norway maple, July 6, D. T. Marshall, Hollis. Same, nymphs on Norway maple, July 11, W. W. Gibson, Watervliet

Callipterus ulmifolii Mon., elm leaf aphis, adults on elm, July 1, R. S. Waterman, Ogdensburg

Mindarus abietinus Koch., work on balsam, July 1, G. L. Barrus, Paul Smiths

Aphis nasturtii Kalt., adults and nymphs on nasturtium, October 3, Roy Latham, Orient Point

Gossyparia spuria Mod., elm bark louse, males and females on elm, May 29, J. G. Brock, Binghamton

Eriococcus borealis Ckll., adults, October 7, T. D. A. Cockerell, Boulder, Col.

Phenacoccus acericola King, false maple scale, males on maple, June 11, Samuel Hessberg, Albany

Trionymus violascens Ckll. (part of type), adult on Agropyron, October 2, T. D. A. Cockerell, Glenwood Springs, Col.

Pseudococcus citri Risso, mealy bug, adult, July 20, C. E. Olsen, Maspeth

Pulvinaria vitis Linn., cottony maple scale, adults and young on soft maple, July 6, D. T. Marshall, Hollis

Lecanium sp., Lecanium scale, adult and young on Tecoma radicans, November 1, Tioga County. Through State Department of Agriculture. Same, adults on oak and chestnut, June 8, E. E. Carpenter, Morris

Asterolecanium variolosum Ratz., golden oak scale, adult, June 14, Woodlawn Cemetery, New York City. Through State Conservation Commission

Toumeyella liriodendri Gmel., tulip tree scale, young on tulip tree, February 12, J. H. Livingston, Tivoli. Same, adults on tulip, July 29, A. G. Harris, North Pelham. Same, July 29, Miss Annis E. Thomson, Yonkers

Eulecanium ? canadense Ckll., adults on elm, May 27, S. M. Clark, Warrensburg

E. ? persicae Fabr., peach scale, adults and eggs on crimson rambler rose, June 17, Silvanus Van Aken, Port Ewen. Same, July 2, Mrs Robert Lown, Idlewild

Chionaspis furfura Fitch, scurfy scale, eggs, March 5, J. Heavey, Buffalo

Chionaspis americana Johns., elm scurfy scale, egg on elm, February 6, J. J. Levison, Brooklyn

C. pinifoliae Fitch, pine leaf scale, egg on Austrian pine, February 6. J. J. Levison, Brooklyn. Same, adults on pine, September 16, Mrs Harriet A. Duff, Kinderhook

C. spartinae Comst., grass scale, on Spartina glabra alterniflora, November 11, Roy Latham, Orient Point

Diaspis carueli Targ.-Tozz., juniper scale on juniper, May 16, Rochester. Through State Department of Agriculture

Aspidiotus pernicious Comst., San José scale, young, March 5, J. Heavey, Buffalo. Same, May 24, C. L. Williams, Glens Falls

A. ancylus Putn., Putnam's scale, half grown, April 19, D. D. Stone, Oswego

Chrysomphalus aonidum Linn., rubber scale insect., adults on rubber plant, April 22, Roy Latham, Orient Point

Lepidosaphes ulmi Linn., oyster shell scale, egg on willow, December 28, H. Gaut, Glen Cove. Same, eggs, March 5, J. Heavey, Buffalo. Same, old scales on apple, May 11, Fred Henkes, Watervliet. Through State Department of Agriculture. Same, young, June 22, Levi Hasbrouck, Ogdensburg. Same, adults on white birch, July 20, C. E. Olsen, Maspeth

Parlatoria theae Ckll., adult on Japanese maple, April 25, from Schenectady. Through State Department of Agriculture

Haematopinus piliferus Beurm., sucking dog louse, adults on dog, April 8, Miss Lillian C. Overton, Albany

Blissus leucopterus Say, chinch bug, adults and young, September 26, C. L. St John, Canajoharie

Acholla multispinosa DeG., spined assassin bug, nymph, August 13, Edwin Buchman, Valley Falls

Cimex lectularius Linn., bedbug, adult, May 12, G. J. Briggs, Macedon

Lygus pratensis Linn., tarnished plant bug, work on dahlia, July 17, C. L. Williams, Glens Falls

Poecilocapsus lineatus Fabr., four-lined leaf bug, adults on currant, June 19, L. F. Strickland, Lockport

Benacus griseus Say, giant water bug, adult, June 10, Roy Latham, Orient Point

Orthoptera

Diapheromera femorata Say, walking-stick, adult, August 20, Arthur Dummett, Mount Vernon

Thysanura

Lepisma domestica Packard, silver fish, adult, October 25, J. E. Stagg, Buffalo. Through State Department of Agriculture

Acarina

Eriophyes pruni Schoene, plum mite, galls on plum, July 22, G. E. Osterhout, Windsor, Col.

Phyllocoptes quadripes Shimer, bladder maple gall, galls on soft maple, June 11, G. W. Herrick, Ithaca. Same, June 24, H. N. Babcock, Elmira

APPENDIX

A STUDY OF GALL MIDGES

The gall midges comprise an immense family of small flies or Diptera known as the Itonididae or Cecidomyiidae, represented in America by about 900 known species, approximately half having been reared from the deformities or galls they produce or matter upon which they live. The species referable to this family may be recognized by the tibiae being unarmed apically, the coxae not produced, and the wings usually with but three or four long veins and no crossveins. Extreme forms may have six or seven long veins and one crossvein or, as a result of reduction, the wing veins may be nearly absent.

There are in this family a number of important insect pests, such as the Hessian fly, Phytophaga destructor Say; the wheat midge, Itonida tritici Felt; the pear midge, Contarinia pyrivora Riley; the clover midge, Dasyneura leguminicola Lintn.; the violet gall midge, Phytophaga violicola Coq.; the rose midge, Dasyneura rhodophaga Coq.; and the grape blossom midge, Contarinia johnsoni Sling. In addition to these there are a number of other potentially injurious midges, not to mention European species, which may become established in this country at almost any time and cause serious losses in somewhat the same way as did the Hessian fly in earlier years.

Our knowledge of American gall midges was in a very unsatisfactory condition in 1895. The following discussion of the Lestremiinae and Heteropezinae comprises a systematic descriptive account of these groups.

LESTREMIINAE

The members of this subfamily are almost invariably medium to small, dark brown or black species, easily distinguished from all other Itonididae by the five tarsal segments, the metatarsus being longer than the following segment, and the presence of the fourth long vein, which latter may be either forked as in Lestremia or simple and obsolescent as in Campylomyza. The antennae may be moderate as in Lestremia and Campylomyza or extremely short as in Tritozyga and Microcerata. The circumfili, so characteristic of the higher groups, are entirely wanting in this

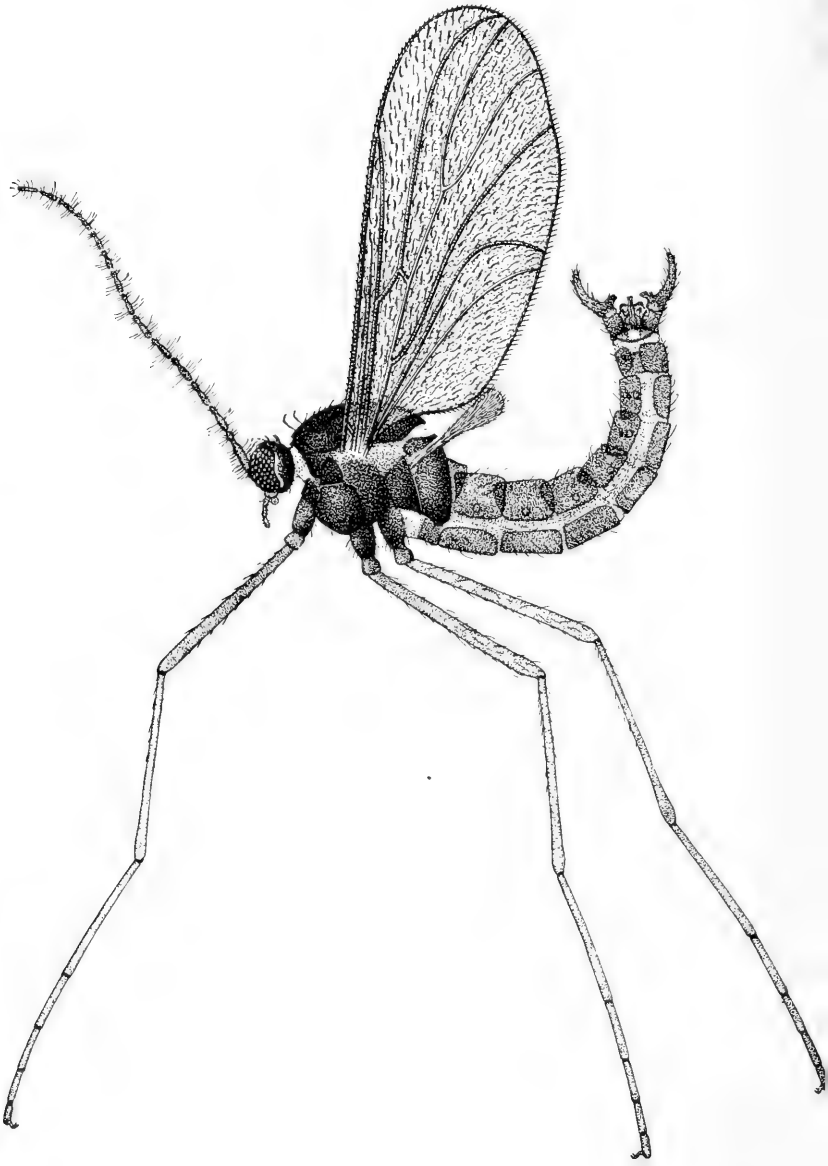


Fig. 16 C a t o c h a a m e r i c a n a, side view, enlarged. (original)

subfamily. The members of this group appear to depend to a considerable extent upon the olfactory organs. Many of the species falling in this division subsist in the larval stage on dead or decaying vegetable matter.

This group is a connecting link with the Mycetophilidae from which it is most easily distinguished by the absence of tibial spurs and the moderate development of the coxae.

Lestremiinariae

The members of this tribe are separable from all other Itonididae by the forked fourth vein and by the generalized character of the antennae. These organs may be moderately well developed as in Lestremia and Catocha, or greatly reduced as in Tritozyga and Microcerata.

Key to living genera

a Antennae at least moderately developed, with 11–16 segments, the second not decidedly enlarged

b Costa continuous and extending beyond the apex of the wing..... Catocha Hal.

bb Costa not attaining the apex of the wing, practically disappearing at its union with the third vein.....Lestremia Macq.

aa Antennae greatly reduced, only 8–10 or 11 segments

b Second antennal segment greatly enlarged; flagellate segments very short

c Fork of the fourth vein with the two branches even..... Microcerata Felt

cc Fork of the fourth vein with the branches irregular..... Tritozyga H. Lw.

bb Second antennal segment normal

c Flagellate segments not greatly reduced.....Neptunimyia Felt

cc Flagellate segments sessile, with a length only a little greater than the diameter.....Neocatocha Felt

Catocha Haliday

Macrostyla Winn.

1833 **Haliday, A. H.** Ent. Mag., 1:156

1840 **Westwood, J. O.** Introduct. Class. Ins. Syn., p. 127

1846 **Rondani, Camillo.** Nouvi Ann. Sci. Nat. Bologna, ser. 2, v. 7; separate, p. 7 (Furcinerva)

1846 **Winnertz, J.** Stett. Ent. Zeit., 7:20 (Macrostyla)

1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:177

1864 **Schiner, J. R.** Fauna Austriaca Dipt., 2:412

1870 **Winnertz, J.** Vehr. z.-b. Ges. Wien., 20:27–28

1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 17

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:143

1892 **Theobald, F. V.** Acct. Brit. Flies, p. 51, 87
1895 **Kieffer, J. J.** Soc. Ent. Fr. Bull. p. 319
1897 ———— Syn. Cecid. Eur. & Alg., p. 52
1900 ———— Soc. Ent. Fr. Ann. 69:438, 443 (Furcinerva)
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 308–9
1911 ———— N. Y. Ent. Soc. Jour., 19:31

The species referable to this genus are easily recognized by costa being continuous and extending beyond the tip of the third vein, which latter unites with the margin at the apex of the wing. The fourth vein is forked, the cell usually being much shorter than in Lestremia. The antennae differ greatly from those of Lestremia, being in the male of C. americana (figure 17) distinctly binodose, while in the case of C. slossonae the segments are long, slender and distinctly stemmed. There are 16 antennal segments in the two known American species. Type C. latipes Haïid. Europeans forms are recorded as having 14 to 16 antennal segments in the male and 10 to 12 segments in the female. The genitalia of our American species are of a quite different type from that found in Lestremia.

Nothing is known concerning the life history of American forms. Kieffer states that the larvae of the European C. muscicola Kieff. occur on mosses. It is probable that these forms are sylvan as in the case of Lestremia and allied genera. Our species are doubtless boreal in habitat.

Key to species

a Length 4 mm; antennae binodose, terminal clasp segment long, appendiculate basally.....americana Felt, C. 929
aa Length 4 mm, antennae uninodose, terminal clasp segment short.....barberi n. sp.
aaa Length 1.5 mm; antennae uninodose.....slossonae Felt, C. 931

Catocha americana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 309

This species, received for study through the courtesy of the United State National Museum, was taken at Franconia, N. H., by that well-known collector, Mrs A. T. Slosson.

Male. Length 4 mm. Antennae nearly as long as the body, thickly haired, dark brown; 16 segments, the third with the basal enlargement somewhat produced, the fourth and following, each slightly binodose, the basal subcylindric enlargement with a length nearly four times its diameter (figure 17). Palpi; the first

segment, irregularly subquadrate, with a length fully twice the diameter, the second about two-thirds the length of the first, the third more than twice the length of the second and the fourth a little longer than the third. Mesonotum dull black, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum and

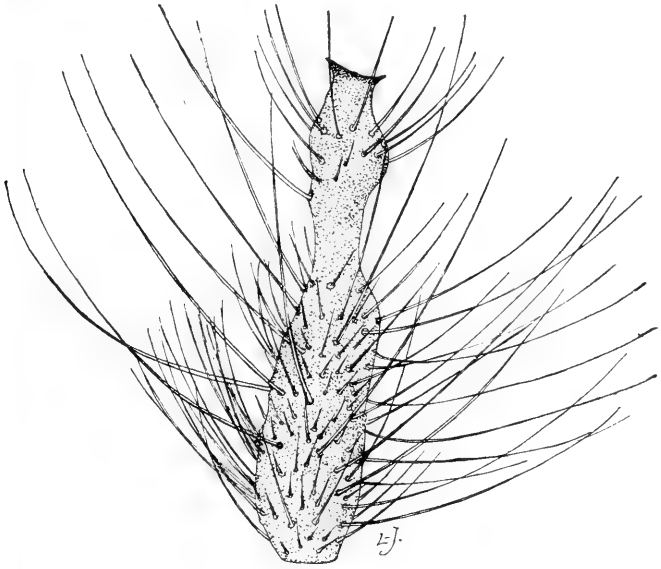


Fig. 17 Catocha americana, sixth antennal segment of male, much enlarged. (original)

abdomen dark brown. Wings hyaline, costa light brown; membrane thickly clothed with fine hairs; venation shown in fig. 16. Halteres fuscous yellowish. Legs dark yellowish brown; claws stout, with a series of three or four stout teeth basally, the pulvilli hardly extending beyond the base of the claws. Terminal clasp segment long, appendiculate basally. Type Cecid. 929.

Catocha barberi n. sp.

Two midges belonging to this species were taken flying in the woods during cold weather, the temperature being below 30° F., near Crab Lake, Vilas county, Wis., by Mr H. S. Barber, in December 1907.

Female. Length 4 mm. Antennae one-quarter longer than the body, sparsely haired, dark brown; 16 segments, the fifth with a slender stem over twice the length of the subglobose basal enlarge-

ment, the latter with a thick whorl of long, slender setae near the middle; terminal segment reduced. Palpi; first segment narrowly oval, with a length two and one-half times its diameter, the second to fourth subequal, sparsely setose and with numerous transverse rows of short, stout spines. Head and thorax probably dark brown. Abdomen light brown. Wings hyaline. Halteres pale yellowish, the legs a variable yellowish brown; claws stout, strongly curved, the pulvilli rudimentary. Type in U. S. National Museum.

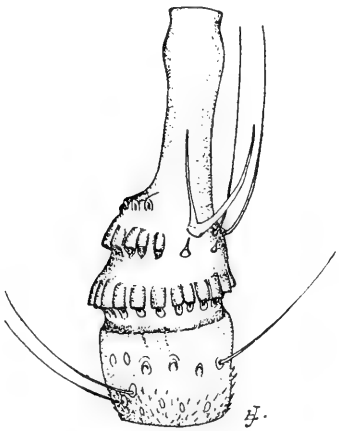


Fig. 18 Fifth antennal segment of Catocha slossonae, enlarged. (Original)

Catocha slossonae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 309

This form, received through the courtesy of the United States National Museum, was taken by Mrs Slosson at Franconia, N. H.

Male. Length 1.5 mm. Antennae as long as the body, sparsely clothed with long hairs; 16 segments; the fourth with a smooth stem about as long as the subcylindric basal enlargement; near the middle a crenulate whorl of long, slender setae, apically several circular orifices and long, trilimbate processes. Palpi; the first segment presumably short, stout, subrectangular, the second rather stout, with a length about two and one-half times its diameter, the third stout, subrectangular and with a length about three-fourths greater than its diameter, the fourth tapering distally, a little longer and more slender than the third. Mesonotum shining dark brown, the submedian lines very sparsely haired. Scutellum reddish brown, postscutellum a little darker. Abdomen dark brown, the genitalia fuscous yellowish. Wings hyaline, costa light brown. Halteres yellowish transparent, slightly fuscous apically. Legs light fuscous yellowish; claws rather long, stout, the concavity finely denticulate, the pulvilli longer than the claws. Type Cecid. 931.

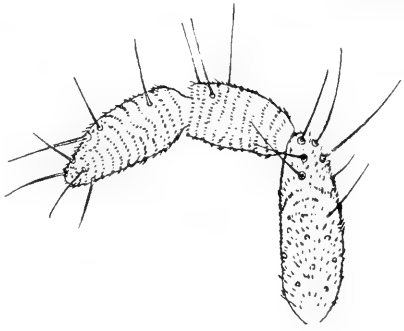


Fig. 19 Palpus of Catocha slossonae, enlarged. (Original)

Lestremia Macq.

1826 **Macquart, J. M.** Dipt. Nord. de la France, 1, 123
1826 **Meigen, J. W.** Syst. Beschr., 5:308
1834 **Macquart, J. M.** Hist. Nat. Ins. Dipt., 1:157
1840 **Westwood, J. O.** Introduct. Class. Ins. Syn., p. 127
1844 **Loew, H.** Stett. Ent. Zeit., 5:324 (Cecidogona)
1846 **Rondani, Camillo.** Nouvi Ann. Sci. Nat. Bologna, ser. 2, v. 6; separate, p. 7 (Furcinerva), 10 (Mimosciara)
1856 ———— Dipt. Ital. Prodr., 1:198 (Yposatoea)
1860 ———— Atti Soc. Ital. Sci. Nat. Milano, 2:287 (Molobraca)
1862 **Osten Sacken, C. R.** Dipt. N. Am. Mon., 1:178
1864 **Schiner, J. R.** Fauna Austriaca Dipt., 2:413
1870 **Winnertz, J.** Vehr. z.-b. Ges. Wien, 20:30
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 17
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales, Proc., 3:144
1892 **Theobald, F. V.** Acct. Brit. Flies, p. 52, 87
1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 52
1900 ———— Soc. Ent. Fr. Ann. 69:437, 442 (Mimosciara), 443 (Cecidogona, Furcinerva)
1904 **Meunier, F.** Soc. Sci. Brux. Ann. 28:9, 31
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 308, 310
1911 ———— N. Y. Ent. Soc. Jour., 19:31

This genus is easily recognized by the characteristic fork of the fourth vein, by costa not attaining the apex of the wing, and by the antennae being well developed, those of the male having 16 and those of the female 11 segments. Certain European species are credited with having 15 antennal segments in the male and 12 in the female. The antennal segments in the female are short, subcylindric or subconical and in some species at least, ornamented distally with thick rows of short, stout, chitinous sensory processes. The male antennae are provided with a distinct stem nearly as long or longer than the basal enlargement, which latter is ornamented by one or more crenulate whorls from the base of which arise long, curved setae. The genitalia are very characteristic. Type L. cinerea Macq.

Nothing is known concerning the life history and habits of members of this genus, aside from the fact that they are most abundant in the vicinity of forests. Kieffer states that the European L. leucophaea Meign. occurs in decaying beech wood and it is very probable that our American forms breed largely in rotting ligneous tissues.

Lestremia leucophaea Meign. occurs in America according to Coquillett,[1] having been taken in the White mountains by Mrs Slosson. This identification is open to question, since the species of this genus resemble each other superficially very closely.

Key to species

a Antennal segments 11; females
b Abdomen reddish brown
c Scutellum dark brown; basal segment of ovipositor with a length fully twice its width; terminal segment small, narrowly oval and distinctly shorter than the basal segment.....
elongata Felt, C. 933
cc Scutellum yellowish brown; basal segment of ovipositor broadly triangular, its length not more than one-half greater than its width; terminal segment nearly as long as the basal one, narrowly oval.....barberi Felt, C. 934
bb Abdomen fuscous yellowish
c Length 3 mm
d Terminal segment of ovipositor orbicular; claws minutely denticulate.....sylvestris Felt, a1642
cc Length 1.5 mm
d Fourth palpal segment one-quarter longer than the third; basal segment of the ovipositor one-half longer than broad.....
sambuci Felt, C. 743
dd Fourth palpal segment twice the length of the third; basal segment of ovipositor a little longer than broad.....
kansensis Felt, C1261

aa 16 antennal segments; males
b Stems of antennal segments two-thirds or three-quarters the length of the subcylindric basal enlargement
c Dorsal plate short, broad, triangularly emarginate, the 4 palp segments successively longer.....pini Felt, C. 562
cc Dorsal plate broad, tapering, roundly emarginate, the third and fourth palp segments not longer than the preceding.....
acerifolia Felt, C. 71
bb Stems of antennal segments as long as the basal enlargement
c Basal clasp segment with a conspicuous setose basal lobe internally.....solidaginis Felt, C. 700, 633, 691
cc Basal clasp segment with no well-developed basal lobe internally
d Fourth palpal segment as long as the third
e Scutellum fuscous yellowish; dorsal plate not convolute, nearly truncate distally.....setosa Felt, Sc. 22
dd Fourth palpal segment one-half longer than the third
e Abdomen dark brown; scutellum reddish brown; dorsal plate convolute, broadly rounded distally and margined posteriorly with moderate setae.....spiraeina Felt, C. 274
ee Abdomen dark yellowish brown; scutellum yellowish brown; dorsal plate obliquely truncate distally and margined posteriorly with stout, divergent setae.....
franconiae Felt, C. 930, 937

[1] 1896 Ent. News, 7:263

bb Antennal stem one-quarter longer than the basal enlargement

c Abdomen dark reddish brown; scutellum yellowish brown; basal enlargement of antenna with 2 crenulate whorls and with a length about twice its diameter; terminal clasp segment bidentate apically.....dyari Felt, C. 935

cc Abdomen dark brown; scutellum dark reddish brown; basal enlargement of antenna with one crenulate whorl and with a length a little greater than its diameter; terminal clasp segment acute distally.....vernalis Felt, C. 1260

Lestremia elongata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This species, received through the courtesy of the United States National Museum, was taken on the Argus mountains in May 1891.

Female. Length 3 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 11 segments, the fourth with a very short stem, irregularly cylindric, with a length about one-half greater than its diameter; other segments somewhat produced, the terminal one with the basal portion broadly oval and separated from the short, stout apical part, by a distinct constriction. Palpi; the first segment stout, with a length fully three times its diameter and a conspicuous sensory organ internally, the second two-thirds the length of the first, more slender, the third a little longer and more slender than the second, the fourth more than twice the length of the third, more slender. Mesonotum dull brown, the submedian lines sparsely haired. Scutellum and postscutellum dark brown. Abdomen reddish brown. Wings hyaline. Halteres pale yellowish. Coxae and femora dark reddish brown, tarsi fuscous yellowish. Ovipositor short, the terminal lobes biarticulate, the basal lobe with a length fully twice its diameter, expanding and truncate distally, the terminal lobe small, narrowly oval, both thickly setose. Type Cecid. 933.

Lestremia barberi Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This species, loaned for study by the United States National Museum, was taken August 8th by H. S. Barber at Las Vegas, N. M.

Female. Length 2.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown; 11 segments, the fourth with a length about one-half greater than its diameter, the terminal segment produced, strongly constricted near the distal third, irregularly rounded apically. Palpi; the first segment, with a length about two and one-half times its diameter, somewhat expanded distally and with a conspicuous sensory organ on its internal face, the second about as long as the first, stout, irregularly subrectangular, the third one-quarter longer than the second, more slender, the

fourth one-half longer than the third, more slender, dilated apically, eyes large, black. Mesonotum dark brown. Scutellum yellowish brown, postscutellum dark brown. Abdomen reddish brown. Wings hyaline. Halteres yellowish transparent. Legs dark yellowish brown. Ovipositor short, biarticulate, the basal lobe irregularly and broadly subtriangular, the terminal lobe nearly as long as the basal one, narrowly oval, both thickly setose. Type Cecid. 934.

Lestremia sylvestris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102; separate p. 5–6 (Catocha)

1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken September 23, 1906 in a forest hut at Davidson's River, N. C.

Female. Length 3 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown, basally pale yellowish; 11 segments, the fifth with a stem one-quarter the length of the basal enlargement. Palpi; the first segment somewhat curved, swollen and thickly clothed distally with stout, capitate setae, the second segment one-half longer than the first; the third and fourth each nearly twice the length of the second; face pale yellowish, eyes large, dark brown. Mesonotum dark brown, submedian lines dark yellowish, narrow, uniting posteriorly in a median dark yellowish area. Scutellum pale yellowish orange, postscutellum dark brown. Abdomen yellowish brown, incisures and pleurae pale salmon, terminal segments pale yellowish. Wings hyaline; halteres whitish transparent. Coxae pale yellowish, femora semi-transparent, tibiae and tarsi fuscous yellowish; claws with a series of minute teeth along the concavity. Ovipositor short, lobes orbicular, thickly setose. Type Cecid. a 1642.

Fig. 20 Fifth of Lestremia sylvestris, enlarged. (Original)

Lestremia sambuci Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101–2; separate, p. 5 (Catocha)

1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken August 6, 1906 at Albany on elder, Sambucus canadensis.

Female. Length 1.5 mm. Antennae one-third the length of the body, sparsely haired, dark brown, fuscous yellowish basally; 11 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length thrice its diameter. Palpi; the first segment broadly rounded, subquadrate, the second as long

as the first, subquadrate, the third more slender, one-half longer and the fourth one-quarter longer than the third; face fuscous yellowish, eyes fuscous. Mesonotum reddish brown, submedian lines indistinct. Scutellum and postscutellum a fuscous reddish yellow. Abdomen fuscous yellow, membrane and pleurae lighter; ovipositor

Fig. 21 Palpus of Lestremia sylvestris, enlarged. (Original)

slightly fuscous. Wings hyaline. Halteres yellowish basally, fuscous apically. Legs dark fuscous yellowish, the first tarsal segment as long as the following segments; claws apparently finely dentate. Ovipositor short, terminal lobes broadly subquadrate, slightly constricted basally, thickly setose. Type Cecid. 743.

Lestremia kansensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species was taken in Douglas county, Kansas, by Mr E. S. Tucker in May.

Female. Length 1.5 mm. Antennae extending to the third abdominal segment, thickly haired, light brown, yellowish basally; 11 segments, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length a little over twice its diameter; terminal segment with a length about four times its diameter, distal part slender, irregularly fusiform, apically with a fingerlike process. Palpi; the first segment short, stout, narrowly oval, second segment slender, with a length one-half greater than the first, the third one-half longer than the second and more slender, the fourth about twice the length of the third, slender. Mesonotum

dark brown. Scutellum and postscutellum yellowish brown. Abdomen fuscous yellowish, sparsely haired, ovipositor slightly fuscous. Wings hyaline. Halteres yellowish transparent. Coxae, femora and tibiae a variable yellowish brown; tarsi light reddish brown, the distal tarsal segments darker; claws simple, the pulvilli almost rudimentary. Ovipositor short, the terminal lobes biarticulate. Type Cecid. 1261.

Lestremia pini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 103; separate, p. 7
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken July 16, 1906 on pine, Pinus, at Albany, N. Y.

Male. Length 1.5 mm. Antennae probably as long as the body, sparsely haired, dark brown; 16 segments, the fifth with a stem

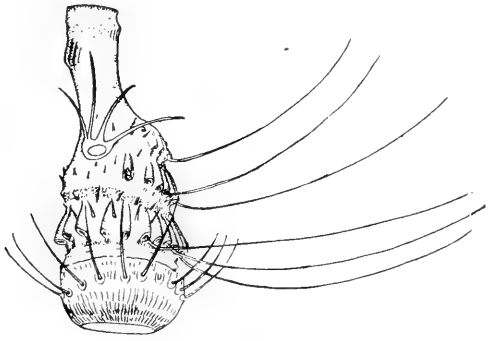


Fig. 22 Fifth antennal segment of Lestremia pini, enlarged. (Original)

three-fourths the length of the basal enlargement, which latter has annular constrictions at the basal fourth, near the middle and at the distal fourth; terminal segment prolonged basally, the stem short, narrowly conical. Palpi; the first segment short, subquadrate, the second longer, broadly oval, the third nearly twice the length of the second, stout, the fourth one-half longer than the third, slender distally, the fifth one-half longer than the fourth, slender. Mesonotum dark brown, sparsely white haired. Scutellum light brown, postscutellum yellowish brown. Abdomen grayish brown, the terminal segments darker. Wings hyaline. Halteres whitish transparent. Coxae, femora and tibiae whitish transparent, tarsi fuscous; claws with three or four long teeth. Genitalia; dorsal plate short, broad, broadly incised; ventral plate apparently fused with the preceding. Harpes long, slender, widely separated. Type Cecid. 562.

Lestremia acerifolia Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 5 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken May 21, 1906 on soft maple, Acer, at Albany, N. Y.

Male. Length .4 mm. Antennae longer than the body, sparsely haired, dark brown; 16 segments, the fifth with a stem two-thirds the length of the obpyriform basal enlargement; terminal segment produced, irregularly subconic. Palpi; the first segment long, stout, subelliptic, the second twice the length of the first, slender, the third two-thirds the length of the second, the fourth a little shorter than the third. Mesonotum dark brown, the light submedian lines setose. Scutellum yellowish brown, postscutellum darker. Abdomen light brown. Wings hyaline. Halteres yellowish transparent. Legs mostly dark brown; claws pectinate. Genitalia; dorsal plate broad, tapering, roundly emarginate, the lobes broadly rounded; ventral plate indistinct. Harpes stout, tapering, the extremities approximate and slightly curved; style slender, distally with a pair of recurved, chitinous teeth. Type Cecid. 71.

Lestremia solidaginis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102; separate, p. 6 (Catocha)
1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was captured sweeping grass, sedge or Solidago at Newport, N. Y., July 25, 1906. It was also reared August 6, 1906, from a jar containing whorled loosestrife, Lysimachia quadrifolia, the latter probably an accidental occurrence.

Male. Length .75 mm. Antennae nearly as long as the body, thickly haired, dark brown; 16 segments, the fifth with a stem as long as the cylindric basal enlargement; terminal segment produced, constricted at the basal and apical thirds, an apical knob. Palpi; the first segment short, quadrate, the second broadly oval, the third a little longer, subrectangular, the fourth one-fourth longer and more slender, the fifth one-half longer than the fourth, more slender. Mesonotum dark brown. Scutellum dark carmine, postscutellum lighter. Abdomen fuscous yellowish, distal segments somewhat darker. Wings hyaline, costa dark brown. Halteres pale yellowish. Legs pale fuscous yellowish, tarsi dark brown; claws simple. Genitalia; basal clasp segment short, broad, with a rather conspicuous rounded setaceous lobe basally; dorsal plate narrowly rounded; ventral plate broad, deeply and narrowly emarginate, the lobes narrowly rounded. Harpes tapering, curving, subacute; style long, slender, acute. Type Cecid. 700.

Lestremia setosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species was taken July 24, 1906 on maple at Albany, N. Y.

Male. Length 2 mm. Antennae as long as the body, sparsely haired, light brown, yellowish basally; 16 segments, the fifth with a stem as long as the pyriform basal enlargement; terminal segment produced, constricted near the distal third and apical fourth. Palpi; the first segment, short, stout, irregularly subquadrate, the second a little more slender, one-half longer, subrectangular, the third about twice the length of the second, more slender, the fourth about as long as the third, more slender; face yellowish. Mesonotum olive brown, the submedian lines broad, yellowish, poorly defined. Scutellum fuscous yellowish, postscutellum yellowish. Abdomen a light fuscous brown. Genitalia fuscous yellowish, sparsely clothed with fuscous setae. Wings subhyaline. Halteres yellowish basally, slightly fuscous apically. Legs a pale fuscous yellowish; claws simple, the pulvilli shorter than the claws. Genitalia; dorsal plate long, broad, broadly emarginate, the lobes broadly rounded. Harpes long, broad, convolute, roundly truncate; style long, slender, narrowly rounded. Type Sc. 22.

Lestremia spiraeina Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102; separate, p. 6 (Catocha)

1908 ———— N. Y. State Mus. Bul. 124, p. 311

This species was taken June 15, 1906 on spirea at Albany, N. Y.

Male. Length 1.5 mm. Antennae as long as the body, thickly haired, dark brown, yellowish basally; 16 segments, the fifth with a stem as long as the subglobular basal enlargement; terminal segment produced irregularly, subconical, slightly constricted at the basal fourth, near the middle and at the apical fourth. Palpi; first segment subquadrate, prolonged, the second shorter, stouter, the third twice the length of the second, more slender, the fourth one-half longer than the third, slender; eyes small, black. Mesonotum dark brown, with indistinct submedian yellowish lines, sparsely setose. Scutellum reddish brown, slightly fuscous apically, sparsely setose; postscutellum reddish brown. Abdomen dark brown, rather thickly setose. Genitalia fuscous yellowish. Wings hyaline, costa and subcosta dark brown. Halteres yellowish transparent. Legs a nearly uniform pale straw, the articulations carmine; tarsi slightly darker, the first segment as long as the four following; claws stout, the concavity denticulate. Genitalia; dorsal plate broad, narrowly incised, the lobes irregularly rounded; ventral plate long, broad, triangularly emarginate, the lobes divergent, truncate. Harpes triangular, obtusely spined basally, tapering and approximate apically; style slender, narrowly rounded. Type Cecid. 274.

Lestremia franconiae Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species, loaned by the United States National Museum for study, was taken by Mrs A. T. Slosson at Franconia, N. H.

Male. Length 1.75 mm. Antennae as long as the body, sparsely haired, dark brown; presumably 16 segments, the fourth with a stem as long as the fusiform basal enlargement. Palpi; the first segment subrectangular, with a length nearly three times its diameter and with a conspicuous sensory area distally, the second nearly twice the length of the first, more slender, the third almost twice as long as the second, more slender, and the fourth one-half longer and more slender than the third; eyes large, black. Mesonotum reddish brown. Scutellum light yellowish brown, postscutellum darker. Abdomen a dark yellowish brown; genitalia yellowish. Wings hyaline; halteres yellowish transparent. Legs a pale yellowish brown, the tarsi slightly darker; claws simple, the pulvilli distinctly shorter than the claws. Genitalia; dorsal plate long, broad, deeply and triangularly emarginate, the lobes widely divergent, broad, somewhat excavated. Harpes long, slender, swollen near the distal third, tapering, narrowly rounded; style stout, tapering, narrowly rounded. Type Cecid. 930.

Lestremia dyari Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This form, loaned for study by the United States National Museum, was taken June 7th at Caslo, B. C., by Dr H. G. Dyar.

Male. Length 1.75 mm. Antennae as long as the body, sparsely haired, dark brown, yellowish basally; 16 segments, the fourth with a stem one-fourth longer than the subcylindric basal enlargement, which latter has a length twice its diameter; terminal segment with the basal portion produced, the distal stem rudimentary. Palpi; the first segment, with a length three times its diameter, the second a little longer than the first, more slender, the third about twice as long as the second, more slender, the fourth a little longer and more slender than the third. Mesonotum dark brown, the submedian lines pale yellowish. Scutellum yellowish brown, postscutellum reddish brown. Abdomen dark reddish brown, sparsely clothed with fine hairs, genitalia dull orange. Wings hyaline, costa light brown. Halteres yellowish transparent. Coxae, femora and tibiae fuscous yellowish, tarsi dark brown; claws stout, the concavity finely denticulate, the pulvilli shorter than the claws. Genitalia; dorsal plate long, broad, broadly and roundly emarginate, the lateral angles produced; ventral plate apparently absent. Harpes long, slender, tapering, narrowly rounded; setose; style stout at base, tapering, narrowly rounded. Type Cecid. 935.

Lestremia vernalis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 311

This species was taken in April at Wichita, Kansas, by Mr E. S. Tucker.

Male. Length 1.5 mm. Antennae a little longer than the body, thickly haired, dark brown; 16 segments, the fifth with a stem one-fourth longer than the subglobose basal enlargement, which latter has a length a little greater than its diameter, terminal segment reduced, narrowly oval, obtuse. Palpi; the first segment long, rather stout, subrectangular, the second as long and more slender than the first, the third one-half longer and more slender than the second, the fourth twice the length of the third, more slender. Mesonotum dark brown, the submedian lines inconspicuous. Scutellum and postscutellum dark reddish brown. Abdomen dark brown. Genitalia dark reddish brown. Wings hyaline, costa dark brown. Halteres yellowish basally, light brown apically. Coxae, femora and tibiae fuscous yellowish, the segments irregularly brownish at the extremities; tarsi mostly light brown, the distal segments darker; claws simple, the pulvilli shorter than the claws. Genitalia; dorsal plate long, broad, broadly emarginate, the lobes separated, broadly rounded. Harpes apparently fused to form one large, convolute organ; style long, slender, broadly rounded. Type Cecid. 1260.

Microcerata Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 309
1911 ———— N. Y. Ent. Soc. Jour., 19:32

This genus includes a number of small forms remarkable on account of the greatly reduced antennae. These organs in the male are composed of but 8 to 11 short segments, the second being greatly enlarged, subglobose and in general appearance much resembling those of the Campylomyzine genus Micromyia. The genitalia also differ from those of Lestremia. The one female known has very small antennae composed of 10 joints, the second being somewhat enlarged. This insect has been described as M. perplexa and appears to be closely related to M. diervillae and may possibly be the female of this species. Type Micromyia corni Felt.

Nothing is known concerning the life history and habits of members of this genus, though it is presumable that they are analogous to those of allied forms. It is very probable that the various species breed in decaying vegetable matter.

Key to species

a Antennal segments 8
b Fourth palpal segment more than twice the length of the third; harpes broadly rounded apically.....johnsoni Felt, C. 802
bb Fourth palpal segment nearly twice the length of the third; harpes subacute apically.....cockerelli Felt, C. 932
aa Antennal segments 9
b Wings small, narrow, subcosta uniting with the margin before the basal half; palpi quadriarticulate.....corni Felt, C. 459
bb Wings rather large, broad, subcosta uniting with the margin at or beyond the basal half
c Scutellum dark brown, the legs a variable fuscous; palpi triarticulate, stout.....diervillae Felt, C. 490
cc Scutellum dark reddish brown, the legs a variable yellowish brown; palpi quadriarticulate, slender.....spinosa n. sp., C. 1295
aaa Antennal segments 10
b Length 1.5 mm, body dark brown; female....perplexa Felt
bb Length 1.25 mm, body dark brown; male....borealis n. sp., C. 1374
aaaa Antennal segments 11
b Scutellum yellowish brown; abdomen fuscous brown texana n. sp., C. 1294

Microcerata johnsoni Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This form was taken August 2, 1891 by Prof. C. W. Johnson at Philadelphia, Pa.

Male. Length 1.75 mm. Antennae sparsely haired, pale yellowish; 8 segments, the fourth and following segments each somewhat more produced than the preceding, the sixth to the eighth with few or no subapical appendages. Palpi; the first segment, short, stout, subrectangular; the second a little longer, stouter, the third one-half longer than the second, more slender and the fourth more than twice the length of the third. Mesonotum dark brown, almost black. Scutellum, postscutellum and abdomen dark brown. Wings hyaline, costa reddish brown. Halteres yellowish basally, slightly fuscous apically. Legs a nearly uniform fuscous yellowish, tarsi slightly darker. Metatarsus more than two and one-half times as long as the following segment, the distal tarsal segment with a sparse subapical row of long, stout setae; claws rather long, stout, slightly curved, with a rather conspicuous tooth dorsally at the basal third and the concavity with several long, slender denticulations; pulvilli longer than the claws, thickly setose. Genitalia; basal clasp segment long, slender, terminal clasp segment swollen at the base, with several short, stout apical and subapical spines; dorsal plate broad, short, broadly and slightly emarginate; ventral plate apparently wanting. Harpes well separated, tapering, broadly rounded; style long, stout, tapering, broadly rounded. Type Cecid. 802.

Microcerata cockerelli Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

This species, placed at our disposal through the courtesy of the United States National Museum, swarmed at Mesilla, N. M., in August and was collected by Prof. T. D. A. Cockerell.

Male. Length 1.75 mm. Antennae short, sparsely haired, dark brown; 8 segments, the fourth flattened basally and apically, with a length three-fourths its diameter, tapering, the other segments successively shorter, the terminal one fusiform, with a constriction

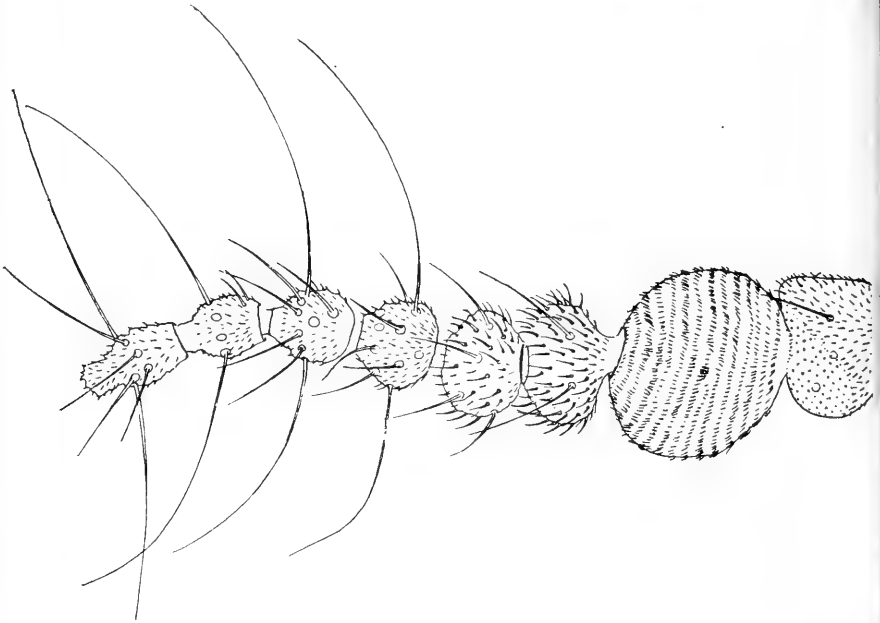


Fig. 23 Antenna of male Microcerata johnsoni, enlarged. (Original)

near the distal fourth. Palpi; the first segment stout, the second a little longer and more slender, the third one-half longer and more slender than the second and the fourth nearly twice the length of the third. Body dark brown. Wings hyaline, costa light brown. Legs light fuscous yellowish; claws stout, slightly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment long, slender, slightly curved, roundly truncate; terminal clasp segment long, tapering, the apex obtuse, spined; dorsal plate long, broad, broadly and roundly emarginate, the lobes divergent; ventral plate long, broad, tapering, irregularly rounded. Harpes long, slender, subacute; style long, slender, acute. Type Cecid. 932.

Microcerata corni Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 102–3; separate, p. 6 (Micromyia)
1908 ———— N. Y. State Mus. Bul. 124, p. 310

This species was taken at Albany, N. Y., July 6, 1907 on Cornus.

Male. Length 1.5 mm. Antennae short, sparsely haired, dark brown; 9 segments, the fourth subglobose, with a length less than its diameter; terminal segment nearly three times the length of the preceding. Palpi; the first segment short, quadrate, the second as long as the first, slightly stouter, the third about as long as the second, more slender, the fourth nearly twice the length of the third. Mesonotum dark brown, the submedian lines with pale setae. Scutellum and abdomen dark brown, the latter nearly naked and with a distinct reddish tint distally. Wings hyaline, costa dark brown. Halteres pale orange basally, dark orange distally. Legs dark reddish, the tarsi dark brown; claws simple. Genitalia; basal clasp segment long, slender, obliquely truncate; terminal clasp segment stout, long, tapering, the apex spined; dorsal plate apparently simple, broad, tapering, narrowly rounded; ventral plate apparently similar. Harpes broad, stout, narrowly rounded; style long, slender. Type Cecid. 459.

Microcerata diervillae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 103; separate, p. 6–7 (Micromyia)
1908 ———— N. Y. State Mus. Bul. 124, p. 310

This species was taken at Karner, N. Y., June 5, 1907 on bush honeysuckle, Diervilla trifida.

Male. Length 1.5 mm. Antennae short, sparsely haired, dark brown; 9 segments, the third pyriform, the fourth with a very short stem; terminal segment produced, nearly twice the length of the preceding, pyriform. Palpi; the first segment stout, with a length twice its diameter, the second narrowly oval, a little shorter, the third one-half longer than the second, more slender. Mesonotum dark brown. Scutellum, postscutellum and abdomen dark brown, the latter slightly yellowish distally. Wings hyaline, costa light brown. Halteres fuscous yellowish. Legs a variable fuscous, the posterior tarsi tinged with carmine; claws simple, the pulvilli longer than the claws. Genitalia; basal clasp segment long; terminal clasp segment short, stout, the apex recurved; dorsal plate broadly rounded; ventral plate broad, incised, the lobes narrowly rounded. Harpes long, stout, tapering; style long, slender, narrowly rounded. Type Cecid. 490.

Microcerata spinosa n. sp.

This species was taken at dark in an oat field at Plano, Texas, in May 1907 by Mr E. S. Tucker.

Male. Length .75 mm. Antennae as long as the head, composed of 9 segments, the fifth pyriform; terminal segment somewhat produced, fusiform, with a length about twice its diameter. Palpi long, the first and second segments subequal, subrectangular, the third one-half longer, more slender and the fourth twice the length of the third; eyes large, black. Mesonotum dull dark brown.

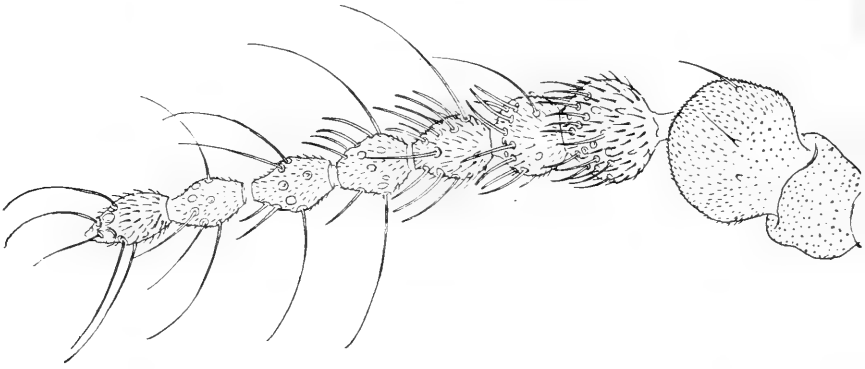


Fig. 24 Antenna of Microcerata spinosa, enlarged. (Original)

Scutellum dark reddish brown, postscutellum a little darker. Abdomen dull dark brown, the genitalia fuscous yellowish. Wings rather large, hyaline, costa yellowish brown. Halteres yellowish transparent. Legs a variable yellowish brown, the tarsi a little darker; claws simple, pulvilli large. Genitalia; basal clasp segment long, slender, tapering distally; terminal clasp segment rather long, swollen basally and tapering slightly to an obtuse, curved, thickly haired apex; dorsal plate tapering, broadly rounded and thickly setose apically; ventral plate tapering to a narrowly rounded apex; style long, slender, acute distally. Type Cecid. 1295.

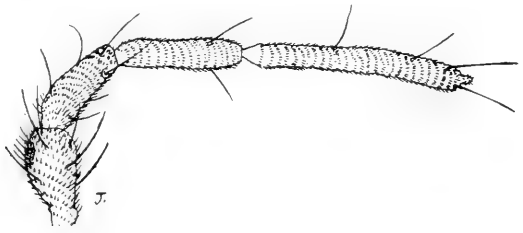


Fig. 25 Palpus of Microcerata spinosa, enlarged. (Original)

Microcerata perplexa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 310

The female representing this species was taken on the office window July 19, 1907, and was presumably reared from some material in the office.

Female. Length 1.5 mm. Antennae short, sparsely haired, dark brown, 10 segments, the fourth with a length about three-fourths its diameter, greatly dilated near the basal third and roundly tapering to the broad apex; terminal segment produced, strongly constricted near the distal third and broadly rounded. Palpi; the first segment long, expanded distally and with a conspicuous sense organ on the internal distal third, second segment nearly as long as the first, more slender, the third one-half longer and more slender than the second, the fourth one-half longer and more slender than the third. Entire body nearly uniform dark brown. Wings hyaline, costa dark brown. Halteres presumably fuscous. Legs presumably a fuscous brown; claws simple, the pulvilli a little shorter than the claws. Ovipositor short, the terminal lobes indistinctly triarticulate, the basal segment indistinct, the second broadly rounded, the third irregularly oval. Type Cecid. 1375.

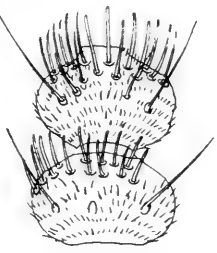


Fig 26. Fourth and fifth antennal segments of *Microcerata perplexa*, enlarged. (Original)

Microcerata borealis n. sp.

This species was taken by Mr D. B. Young at Speculator, N. Y., July 27, 1909.

Male. Length 1.25 mm. Antennae extending to the base of the anterior coxae, sparsely haired, dark brown; 10 segments, the fifth subglobose, slightly pyriform, with a length slightly greater than its diameter. Terminal segment subcylindric, with a length two and one-half times its diameter. Palpi; the first segment stout, rectangular, with a length twice its diameter, the second a little longer, swollen distally, the third a little shorter than the second, narrowly triangular, the fourth one-half longer than the second, irregular, compressed. Thorax and abdomen a nearly uniform dark brown. Wings hyaline, costa light brown. Halteres yellowish brown; coxae dark brown; femora, tibiae and tarsi a dark yellowish brown; claws long, evenly curved, the pulvilli as long as the claws. Genitalia; basal clasp segment long, tapering; terminal clasp segment rather stout, recurved apically; dorsal plate long, tapering, narrowly rounded; ventral plate divided, the lobes divergent, roundly truncate and thickly setose; style long, slender. Type Cecid. 1374.

Microcerata texana n. sp.

This species was taken at Plano, Texas, July 1907 by Mr E. S. Tucker.

Male. Length 1.25 mm. Antennae hardly extending to the base of the abdomen, thickly haired, fuscous brown, composed of 11

segments, the fifth pyriform; the stem one-fourth the length of the enlargement, the tenth and eleventh segments fused though separated by a distinct stem. Palpi probably quadriarticulate, stout, the first segment subrectangular, slightly swollen distally, the second a little longer, rather stout, the third probably longer than the second, more slender. Mesonotum dark brown, the submedian lines sparsely haired and irregularly tuberculate. Scutellum yellowish brown, postscutellum and abdomen fuscous brown, genitalia dark fuscous yellowish. Wings hyaline, costa yellowish brown. Halteres yellowish transparent, legs a variable yellowish or yellowish brown, the distal tarsal segments somewhat darker; claws probably simple. Genitalia; basal clasp segment rather stout, with a distinct lobe basally and tapering to a subtruncate apex; terminal clasp segment rather stout at base and tapering to a subacute, thickly setose apex; dorsal plate rather long, broad, broadly rounded and thickly setose apically; ventral plate long, slender, subtruncate distally; style long, slender, acute apically. Type Cecid. 1294.

Tritozyga H. Lw.

1862 **Loew, H.** Monog. Dipt. N. Amer., 1:177, 178–79
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 18
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:44, 143
1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 53
1900 ———— Soc. Ent. Fr. Ann., 69:447–48
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This peculiar North American form was made the type of a new genus by H. Loew, who refrained from bestowing a specific name because of the mutilated condition of the specimen. Through the courtesy of Mr Samuel Henshaw it has been possible to study the type, now in the Museum of Comparative Zoology at Cambridge, Mass. This species is more closely related to the author's Microcerata than to any other known genus. It is easily separated from Microcerata by the uneven fork of the fourth vein, the posterior branch being a nearly straight continuation, while the anterior branch arises at nearly a right angle and describes a broadly S-shaped curve before uniting with the margin. This character alone suffices to distinguish it from all other Itonididae. The fourth, fifth and sixth veins are distinctly heavier than in Microcerata, the last having a somewhat sinuous course. The antennae are composed of but 9 segments, the second being somewhat enlarged and the terminal segment, evidently composed of 3 rather closely fused, distinctly produced and with a length fully six times its diameter. The palpi are plainly stouter than in Microcerata.

Tritozyga sackeni Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This unique form represents a valid species, and though mutilated it seems preferable to bestow a specific name and publish the characters so far as they can be determined, particularly as this procedure fixes the identity of the genus beyond all question and removes the danger of another synonym being added to an already overburdened nomenclature.

Male. Eyes black; occiput brown. Antennae short, with 9 segments, the basal ones pale yellowish, the distal brown; first segment small, subglobose, the second distinctly enlarged, ovate, the third subcylindric, with a length three-fourths its diameter, the fourth with a length a little greater than its diameter, the fifth about the same length as the fourth, with a scattering subbasal whorl of rather short, curved setae; subapically, on the posterior face there is an irregular group of oval, tuberculate elevations, possibly a special sense organ. Terminal segment evidently composed of three closely fused segments, with a length fully six times its diameter and whorls of stout setae similar to the subbasal one above described near the basal fourth, the middle and the distal fourth of this compound segment. Palpi yellowish, probably quadriarticulate, the first probably with a length one-half greater than its diameter, the second short, the penultimate cylindric, with a length about four times its diameter, the terminal as long as the preceding, slightly dilated apically and with a few coarse setae; three small ocelli. Mesonotum dark brown. Scutellum yellowish, sparsely setose. Wings hyaline, length 1.5 mm; costa dark brown, rather densely haired; subcosta uniting with the anterior margin near the basal third, the third vein apparently united with subcosta near the basal fourth and joining the anterior margin near the distal third; both this and subcosta heavy, dark brown and sparsely haired. The fourth vein rather distinct, slightly curved, its posterior branch an almost direct continuation of the basal portion, while the anterior branch arises at a nearly right angle, and after describing a broadly S-shaped curve, unites with the anterior margin near the distal fifth; fifth vein nearly straight, joining the posterior margin at the distal fourth, the sixth vein stout, irregularly curved and uniting with the posterior margin near the basal half. Halteres probably yellowish, the stem long, curved, the distal portion spatulate. Coxae yellowish; femora, tibiae and tarsi yellowish brown, the latter with five segments, the first longer than the second, the claws probably simple. Type in the Museum of Comparative Zoology.

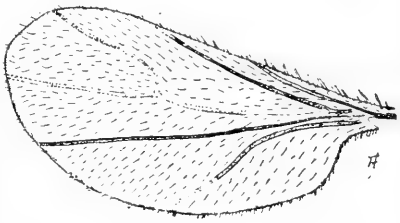


Fig. 27 Wing of Tritozyga sackeni, enlarged. (Original)

Neptunimyia Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:237

This genus represents a unique form intermediate in development between Lestremia and the highly reduced antennal structures of Microcerata and Tritozyga. It is more closely allied to the former though easily separated therefrom by the normal second antennal segment, the digitate antennal appendages and the stoutly pectinate claws. The type species is N. tridens n. sp.

Neptunimyia tridens Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:237–38

This most interesting female was reared April 17, 1911, from a jar containing maple leaves infested last year with the larva of Cecidomyia ocellaris O.S. It is possible that the

Fig. 28 Fifth antennal segment of Neptunimyia tridens, enlarged. (Original)

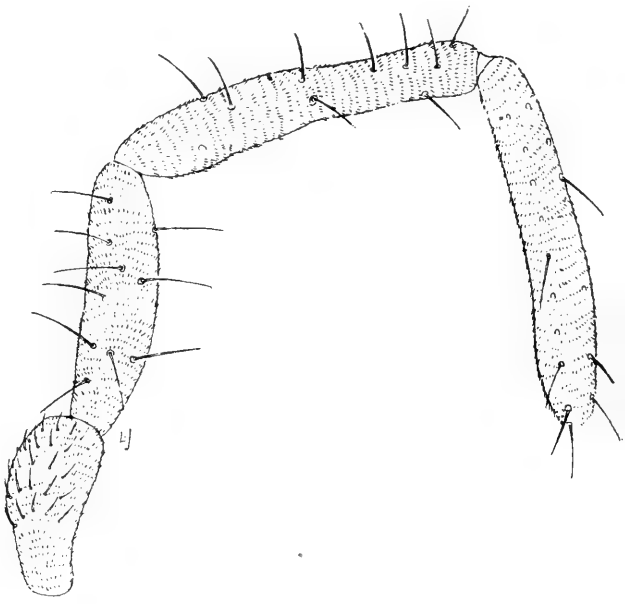


Fig. 29 Palpus of Neptunimyia tridens, enlarged. (Original)

insect developed from the very slight amount of decaying organic matter brought in with the sand. We are unwilling to believe that it is the parent insect of the semitransparent larvae producing in midsummer the numerous ocellate galls on soft maple leaves. Paridris nigricornis Brues was reared from this jar and may be a parasite of C. ocellaris O.S.

Neocatocha Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:236

This remarkable form has the venation of Catocha and the greatly reduced antennae of Microcerata, from which latter it is easily distinguished by the normal second antennal segment. The short, sessile, flagellate antennal segments and the characteristic venation serve to separate this genus from Neptunimyia. Type N. marilandica.

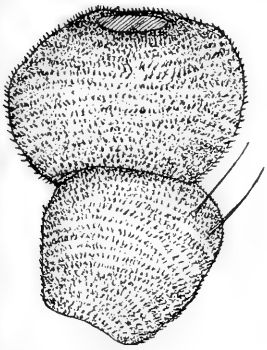


Fig. 30 First two antennal segments of Neocatocha marilandica, enlarged. (Original)

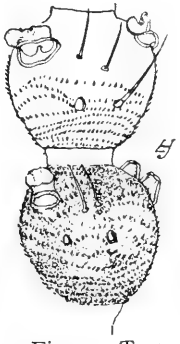


Fig. 31 Two flagellate antennal segments of Neocatocha marilandica, enlarged. (Original.)

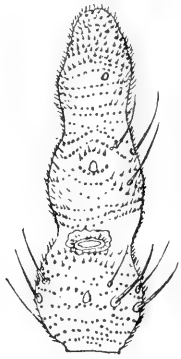


Fig. 32 Distal antennal segment of Neocatocha marilandica, enlarged. (Original)

Neocatocha marilandica Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:236–37

One female was taken by Dr W. L. McAtee on Plummers island, Maryland, March 24, 1907.

Female. Length 1.75 mm. Antennae short, dark brown; 8 segments, the first and second normal, the fifth sessile, subglobose, with a length slightly greater than its diameter, irregularly and sparsely clothed with short setae and subapically with a whorl of probably four short, stout, fleshy appendages; terminal segment compound, composed of three closely fused, and with a length about four times its greatest diameter. Palpi; first segment irregularly quadrate, the second and third subequal, each with a length 2 and one-half times the diameter, the fourth a little longer, more slender. Eyes moderate, black, coarsely granulate; ocelli present. Mesonotum dark reddish brown. Scutellum yellowish brown, postscutellum slightly darker. Abdomen mostly dark yellowish brown. Wings hyaline.

Halteres yellowish brown. Legs mostly dark yellowish brown; claws moderately stout, strongly curved, simple, the pulvilli as long as the claws. Ovipositor short, the lobes triarticulate, the distal segment suborbicular. Ventrally, on the ninth segment, there is a pair of submedian, fuscous, pyriform appendages. Type C. 1390.

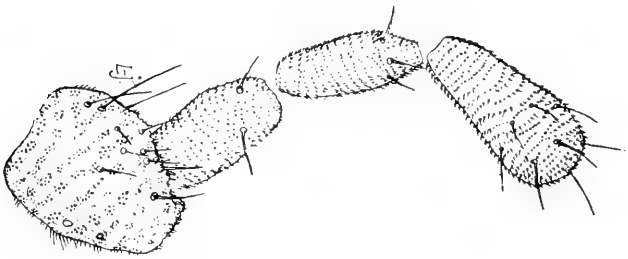


Fig. 33 Palpus of Neocatocha marilandica, enlarged. (Original)

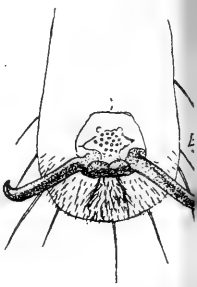


Fig 34 Claws Neocatocha m rilandica, larged. (Original

Neocatocha spinosa n. sp.

This remarkable female was found in the National Museum collection labeled "with specimens sent by A. R. Barber, December 16, 1873."

Female. Length 2 mm. Antennae extending nearly to the base of the abdomen, sparsely haired, yellowish brown; 10 segments, the fifth with a short stem one-fourth the length of the oval basal enlargement, which latter has a length fully one-half greater than its diameter, a sparse basal whorl of long, stout setae and subapically a partial whorl of thickly set, short, stout, curved spines; terminal segment reduced, with a length one-half greater than its diameter, narrowly rounded apically. Palpi; first segment short, subquadrate, the second with a length twice its diameter, the third a little longer than the second, the fourth one-half longer than the third, dilated apically. Ocelli present. Thorax dark brown. Abdomen yellowish brown, the terminal segments dark brown. Ovipositor short, triarticulate, the distal segment narrowly oval, thickly setose. Wings hyaline, irridescent. Halteres and legs yellowish brown, the distal tarsal segments darker. Claws stout, evenly curved, simple, the pulvilli about one-third the length of the claws. Type Cecid. 1415.

Lithomyza Scudd.

1877 **Scudder, S. H.** U. S. Geol. Geog. Surv. Terr. Bul. 3, p. 746
1890 ———— Tert. Ins. N. Amer., U. S. Geol. Geog. Surv. Terr. Rep't, v. 13, p. 600–01
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This genus was erected by Scudder for a single specimen found in the Chagrin Valley, White River, Colorado. It is evidently closely allied to Lestremia. The illustration of the wing shows that subcosta unites with the margin near the basal third. The first branch of media, which in Lestremia has disappeared, joins costa a little beyond the middle. The second branch of media joins the margin a little before the apex and is united to subcosta by a short, well-defined crossvein, evidently the vein present throughout the Lestremiinariae, Campylomyzariae and Epidosariae. The third and fourth branches of media which, for convenience sake we have designated in this work the fourth vein, is forked as in Lestremia; the fifth and sixth veins are free. The short nine-jointed antennae indicate a close affinity with Tritozyga O.S. and Microcerata Felt. Type Lithomyza condita Scudd.

This genus, if correctly placed, is the most generalized Cecidomyiid known and must be regarded as a connecting link between this group and the Mycetophilidae.

CAMPYLOMYZARIAE

This tribe is easily separated from the Lestremiinariae by the simple, nearly obsolescent fourth vein.

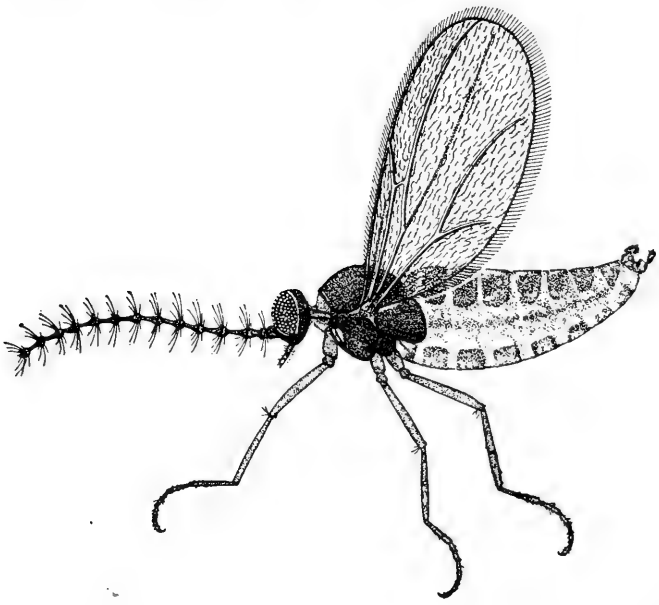


Fig. 35 Cordylomyia coloradensis, enlarged. (Original)

The typical genus, Campylomyza Meign., was erected in 1818, four species, C. flavipes, C. bicolor. C. atra and C.

aceris being named. Kieffer in 1896, holding that the genus as characterized by Meigen comprised a group, designated C. munda Winn. as the type. An examination by the writer, of specimens in Meigen's collection deposited in the Natural History Museum of Paris, representing the four species originally assigned to this genus, showed that the specimens are in such poor condition that they can hardly be used to advantage in establishing the identity of the generic type. The form designated by Kieffer as the type of the genus, namely, C. munda Winn., unfortunately has not been characterized with sufficient fulness so that it can be separated from allied forms. Under the conditions, we are compelled for the present to treat Campylomyza Meign. as a supergenus, referring thereto forms which can not be readily assigned to some of the more recent genera. Owing to the paucity of our reared material in this group, we have been unable to make a critical study of the generic characters, though the little data we have obtained in this manner would seem to justify the existence of the recently established genera.

Key to genera

a Wingless, or if wings are present, the fifth vein simple
b Claws with long, parallel teeth, the pulvilli very short..... Strobliella Kieff.
bb Claws denticulate, the puvilli absent .....Wasmanniella Kieff.
aa Winged, fifth vein forked
b Third vein usually well separated from costa and frequently uniting therewith at or beyond the apex
c Flagellate antennal segments globose, stemmed in both sexes and ornamented only with whorls of long hairs
d Fourth vein present
e Palpi tri- or quadriarticulate
f Wings normal, slender, antennal segments, male 14, female 11. Joannisia Kieff.
ff Wings broad, not twice as long as wide, antennal segments, female 12 .....Projoannisia Kieff.
ee Palpi biarticulate, the male with 14 and the female with 13 antennal segments, the claws strongly bent, dilated subapically.....Peromyia Kieff.
dd Fourth vein wanting
e Antennal segments stemmed.....Trichopteromyia Will.
ee Antennal segments sessile, the second enlarged, globose; palpi triarticulate.....Ceratomyia Felt
cc Flagellate antennal segments cylindric, subsessile; male with 12, female with 9 antennal segments; fourth vein rudimentary, obsolete distally.....Mycophila Felt

bb Third vein rarely extending to the apex of the wing; flagellate antennal segments subsessile in the female, ornamented with crenulate whorls or other structures more complex than irregular whorls of simple hairs

c Antennae very short, the male with 10 to 11, the female with 6 to 8 subsessile segments, the second greatly enlarged..... Micromyia Rond.

cc Antennae not very short, the male with 14, the female with 11 to 22 antennal segments, the second not greatly enlarged..... Campylomyza Meign.[1]

d Flagellate antennal segments with a more or less distinct collar subapically

e Claws denticulate, the pulvilli well developed..Prionellus Kieff.

ee Claws simple, the pulvilli short or rudimentary..Aprionus Kieff.

dd Flagellate antennal segments with a subapical whorl of stemmed disks; claws with a minute subapical tooth....Monardia Kieff.

ddd Flagellate antennal segments with reniform processes subapically, claws bent at right angles, dilated subapically..... Bryomyia Kieff.

dddd Flagellate antennal segments with subapical whorls of short, stout, usually recurved spines.....Cordylomyia Felt

ddddd Flagellate antennal segments with series of whorls of short, stout, curved spines.....Corinthomyia Felt

Strobliella Kieff.

1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 51
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 22, fig. 9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

This genus, as characterized by Kieffer, has five simple long veins, the anterior border of the wing not being interrupted and passing gradually into the posterior margin. The palpi are quadriarticulate and the tarsal claws are provided at the basal half with long, parallel teeth; the pulvilli are very short. The illustration of the wing shows that this genus is closely allied to Campylomyza, the third vein uniting with costa at the apex, the fifth and sixth veins being simple; subcosta joins the anterior margin near the basal half, while the crossvein appears unusually long. Type S. intermedia Kieff.

Wasmanniella Kieff.

1897 **Kieffer, J. J.** Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 11, 12
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

Members of this genus, according to Kieffer, may be recognized by the denticulate claws, the absence of pulvilli and by the subglobose, stemmed antennal segments. Each of the flagellate segments

[1] Owing to the unsatisfactory characterization of Campylomyza Meign., it is tentatively given rank as a supergenus. See above.

has a whorl of hairs and a subapical whorl of 4 hyaline, hooked appendages. The female is remarkable on account of the absence of wings. The larvae live under the leaf sheath of Scirpus silvaticus. It was impossible, from a study of the type kindly placed at my disposal by Professor Kieffer, to add to the above. Type and sole species W. aptera Kieff.

Joannisia Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., p. 175
1896 ———— Mis. Ent., 4:7
1897 ———— Syn. Cecid. Eur. & Alg., p. 48
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 312
1909 ———— Ent. Soc. Cent. 39th Rep't, p. 44
1911 ———— N. Y. Ent. Soc. Jour., 19:32

The antennae have 11 segments in the female and 14 in the male Joannisia, the flagellate segments with a subglobular enlargement ornamented only with irregular whorls of simple setae and a smooth, cylindric stem distally (figure 36). The venation is

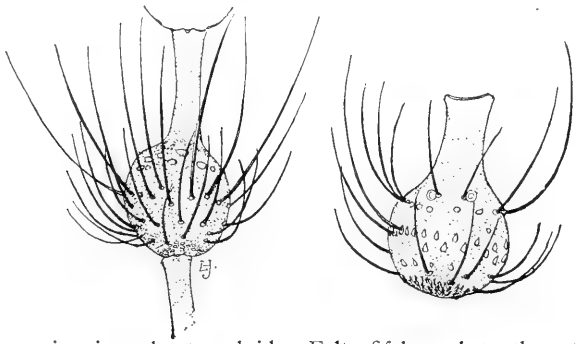


Fig. 36 Joanissia photophila Felt, fifth and tenth antennal segments of male, much enlarged. (Original)

very characteristic, since the third vein is well separated from costa, runs nearly parallel thereto and unites with the margin at or well beyond the apex; the fourth vein is simple, the fifth forked. The terminal clasp segment of the male is slender, curving and tapering to an acute apex in all species known to us, except in J. neomexicana.

One American species, J. pennsylvanica Felt, received through the courtesy of Prof. H. A. Surface, has been reared by Mr B. H. Farr of Reading, Pa., from decaying peony roots. Aside from this, nothing is known concerning the life history of our native forms. Kieffer has reared several European species from

decaying wood, from tufts of moss and also from a mold covering a fungus. It is very probable that our American species live under similar conditions, particularly as they are most numerous in the vicinity of forests or where there is an abundance of decaying vegetable matter. The generic type is J. aurantiaca Kieff.

Key to species

a 11 antennal segments, females
b Abdomen dark brown, unicolorous, palpi triarticulate..... flavopedalis Felt, C. 687
bb Abdomen dark reddish brown, fuscous distally, palpi quadriarticulate.....carolinae Felt, C. a1619
aa 14 antennal segments, males
b Terminal clasp segment slender, tapering to an acute point
c Legs thickly haired
d Postscutellum reddish brown.....
e Terminal antennal segment reduced, oval..... photophila Felt, C. 747, 748, 753, 472
ee Terminal antennal segment produced, with a knob apically ... pennsylvanica Felt, Cecid. a1928
dd Postscutellum fuscous yellowish.....flavoscuta Felt, C. 653
cc Legs sparsely haired.....carolinae Felt, C. a1619
bb Terminal clasp segment stout, broadly rounded apically
c Mesonotum dark brown, scutellum and abdomen a little lighter.... neomexicana n. sp., C. 891

Joannisia flavopedalis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313

This female was taken at Newport, N. Y., July 25, 1906.

Female. Length .5 mm. Antennae probably nearly as long as the body, sparsely haired, dark brown, 11 segments; fifth subglobose; terminal segment with the basal portion slightly produced, narrowly oval. Palpi; the first segment somewhat enlarged, subglobose, the second rather slender, one-half longer, the third somewhat irregular, nearly twice the length of the second. Eyes rather small, black; ocelli present. Head, thorax and abdomen apparently a nearly uniform dark brown, ovipositor pale yellowish. Wings hyaline, costa dark brown, subcosta joining the margin just before the basal half. Legs pale yellowish, the articulations variably tinged with dark carmine; distal tarsal segments reddish brown; metatarsus a little longer than the following segment; claws very long, slender, strongly curved, simple; pulvilli nearly as long. Ovipositor short, the terminal lobes triarticulate, the basal subquadrate, the second a little longer, dilated distally, the third narrowly oval, all sparsely setose; minor lobe long, slender, narrowly rounded. Type Cecid. 687.

Joannisia carolinae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 4 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 313

This species was taken on a window in a woodland hut at Davidson's River N. C., September 23, 1906.

Male. Length .4 mm. Antennae twice the length of the body, light brown; 14 segments, the fifth with a stem one-fourth longer than the subglobose enlargement; terminal segment suboval. Palpi; the first segment very broad, short, second broadly oval, the third narrowly oval and the fourth smaller. Mesonotum reddish brown. Scutellum, postscutellum and basal abdominal segments dark reddish brown, distal abdominal segments dull black. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal half; halteres yellowish basally, fuscous apically. Legs nearly uniform fuscous yellowish, sparsely haired, posterior metatarsus slender, more than twice the length of the following segment; claws strongly curved, almost at right angles, simple; pulvilli slender, nearly as long as the claws. Genitalia; basal clasp segment stout, broad, truncate, with an internal chitinous spine; terminal clasp segment broad at base, tapering. Dorsal plate rather broad, evenly rounded.

Female. Length .5 mm. Antennae a little longer than the body, light brown; 11 segments, the fifth with a stem two-thirds the length of the globular basal enlargement; terminal segment suboval. Palpi; the basal segment large, suboval, the others regularly decreasing in size. The colorational and structural characters of the thorax and its appendages practically as in the male. Ovipositor short, terminal lobes biarticulate, the basal subquadrate, the distal suboval. Type Cecid. a1619.

Joannisia photophila Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 313

This species is evidently one of our most common forms as it was taken on the office window at Albany during July and August, and also captured in a trap lantern at Poughkeepsie August 7, 1906.

Male. Length .5 mm. Antennae nearly as long as the body, thickly haired, dark brown; 14 segments, the fifth with a stem one-fourth longer than the globose enlargement, terminal segment ovate, thickly and irregularly clothed with long hairs. Palpi; the first segment quadrate, about one-half longer than broad, the second irregularly oval, broad, the third narrowly oval, as long as the

second, the fourth one-half the length of the preceding, oval. Mesonotum dark reddish, submedian lines indistinct. Scutellum and postscutellum reddish brown. Abdomen dark brown, somewhat fuscous posteriorly. Wings hyaline, costa dark brown, halteres dark reddish. Legs fuscous yellowish, distal tarsal segments reddish brown; claws medium, strongly curved, simple; pulvilli nearly as long as the claws. Genitalia; basal clasp segments stout, broad, truncate and apparently with a large, curved, chitinous process extending behind the median plates and nearly touching a similar process arising from the opposite segment; terminal clasp segment swollen basally. Dorsal plate smooth, broadly rounded, short, ventral plate similar. Type Cecid. 747.

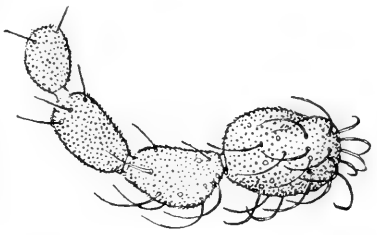


Fig. 37 Palpus of Joannisia photophila, enlarged. (Original)

Joannisia pennsylvanica Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:476

This species was submitted for study by Prof. H. A. Surface, who states that it was reared from decaying peony roots by Mr B. H. Farr of Reading, Pa.

Joannisia flavoscuta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313

This form was taken on a window at Nassau, N. Y., July 24, 1906.

Male. Length .5 mm. Antennae a little longer than the body, thickly haired, dark brown; 14 segments, 5th with stem one-fourth longer than the globose enlargement; terminal segment suboval. Palpi; the first segment broadly oval, the second nearly as long, narrowly oval, the third a little shorter, more slender, the fourth shorter and more slender. Mesonotum dark brown, submedian lines indistinct. Scutellum reddish brown, postscutellum dark fuscous yellowish. Abdomen nearly uniform dark brown. Wings hyaline, costa dark brown. Halteres yellowish transparent basally, fuscous apically. Legs mostly a fuscous yellowish, tarsi variably tinged with carmine; claws long, slender, strongly curved near the middle, simple. Genitalia; basal clasp segment short, stout, with a conspicuous chitinous tooth internally, obliquely truncate; terminal clasp segment short, stout, greatly swollen at the base. Dorsal plate short, broadly rounded, ventral plate a little wider, longer, broadly rounded. Type Cecid. 653.

Joannisia neomexicana n. sp.

This species was taken at Pecos, N. M., August 25th, by Prof. T. D. A. Cockerell.

Male. Length .75 mm. Antennae brown, about twice the length of the body, thickly haired; 14 segments, the fifth with a stem one-fourth longer than the globose enlargement; terminal segment dumbell-shaped, the basal swelling somewhat greater than the distal one, the two broadly united. Palpi apparently missing. Mesonotum dark brown. Scutellum and abdomen a little lighter. Wings hyaline, costa light brown. Legs a variable yellowish, the distal tarsal segments slightly fuscous; claws long, slender, strongly curved, minutely denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, truncate; terminal clasp segment short, stout, slightly swollen near the middle. Type Cecid. 891.

Projoannisia Kieff.

1912 **Kieffer, J. J.** Neue Gallm.-Gatt. p. 2

This form is allied to Joannisia, has unusually broad wings and the third vein is nearer the rudimentary fourth than to costa. The antennal segments are 12, subsessile, the stem being about one-fourth the length of the pyriform basal enlargement, the latter with subapical, heavy, curved special sense organs not appearing in typical Joannisia. The simple claws are only slightly bent and about twice the length of the pulvilli. The ovipositor is very short. Type Joannisia latipennis Kieff.

Peromyia Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., p. 175
1896 ———— Mis. Ent., 4:7, 11
1897 ———— Syn. Cecid. Eur. & Alg., p. 48
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 22, fig. 12; pl. 24, fig. 1, 2
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:32

The antennal segments in this genus are subglobose, the segments (male 14, female 13) with long stems in both sexes. The palpi are biarticulate. The claws are bent at almost right angles and greatly swollen at the distal third. The anterior border of the wing extends a little beyond the third vein. The pulvilli are long. The third vein curves distally and joins the margin near the rudimentary fourth vein. The basal clasp segment of the male is stout, truncate, the terminal clasp segment short, stout, curved subapically, greatly swollen and obtusely rounded distally. Ovipositor quadriarticulate. Through the courtesy of the authorities we were allowed to study the excellent microscopic preparations of this genus in the Berlin Natural History Museum.

Neurolyga Rond., 1846, appears to be close to Peromyia Kieff, and the latter may prove to be identical therewith.

The pupa of the typical species is somewhat remarkable on account of its slender form and especially because of the 3 lateral triangular appendages arising from the first to third segments. The ventral abdominal surface is thickly studded with chitinous points, while the dorsum is ornamented with short, stout, chitinous spines. Type P. leveillei Kieff. No American forms have been recognized.

Trichopteromyia Will.

1896 **Williston, S. W.** Ent. Soc. London Trans., p. 255
1901 **Kieffer, J. J.** Suite Syn. Cecid. Eur. & Alg., p. 16–17
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

This West Indian genus is evidently allied to Campylomyza Meign. and may be distinguished therefrom, as indicated by the describer's illustration of the wing, by the absence of the rudimentary fourth vein; subcosta unites with the margin at the basal third, the third vein at the apex and the fifth just beyond the basal half, its branch near the basal third. The female antenna, as illustrated, presents much the same form as that of Joannisia with which this genus may be closely allied. Type T. modesta Will.

Mycophila Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

This genus is evidently related to Joannisia Kieff., though readily separable therefrom by the small number of antennal segments and by the rudimentary fourth vein being obsolete distally. Type M. fungicola Felt.

Mycophila fungicola Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

This species was reared from young mushrooms collected by H. Cecil Evans at San Rafael, Cal., September 7, 1897. Mr Pergande, of the Bureau of Entomology, Washington, D. C., states that the flies are red, the abdomen paler, marked with narrow, pale dusky bands, the thorax is dusky or blackish above, eyes black. Antennae and legs pale dusky and with a yellowish tinge.

Larvae. Length .75 mm., rather stout, broadly rounded posteriorly, nearly so anteriorly, pale orange. Head subrectangular with a diameter about one-half that of the body, antennae apparently uniarticulate, rather long, stout, with a length about five times the

diameter, at the distal fifth tapering suddenly to an acute apex. No breast bone is apparent, the surface of the body is smooth.

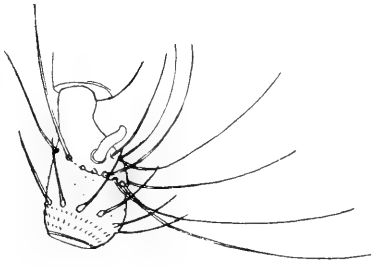


Fig. 38 Fifth antennal segment of male of Mycophila fungicola, enlarged. (Original)

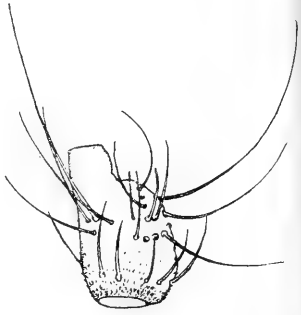


Fig. 39 Fifth antennal segment of male of Mycophila fungicola, other side, enlarged. (Original)

Female. Length .6 mm. Antennae extending to the second abdominal segment, sparsely haired, fuscous yellowish; 9 segments, the first broadly obconic, the second subglobose, the third produced, fusiform, free, the fifth with a length about twice its diameter, subcylindric, tapering; subbasal whorl of setae thick, long, curved; subapical band finer; distally there are apparently four broad, chitinous lobes; terminal segment produced, the basal portion broadly oval, the distal smaller, almost subglobose. Palpi indistinct. Ovipositor short, biarticulate, the basal sclerite long, broad, quadrate, tapering distally, the terminal sclerite broadly oval, both sparsely setose, minor lobe long, obliquely truncate, sparsely setose. Other characters as in the male, see citation.

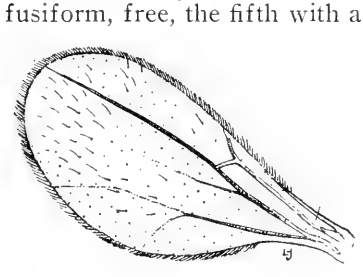


Fig. 40 Wing of Mycophila fungicola, enlarged. (Original)

Ceratomyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33

Allied to Micromyia Rond. on account of the greatly enlarged second antennal segment, though easily separated therefrom by the absence of the fourth vein. The latter character indicates a relationship with Trichopteromyia Will. from which it may be separated by the greatly reduced antennal segments with only 6 short, sessile segments.

Ceratomyia johannseni Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:33–4

This interesting species was received from Ocotlan, Mexico, through Dr O. A. Johannsen under date of December 12, 1910. See above citation for a detailed description.

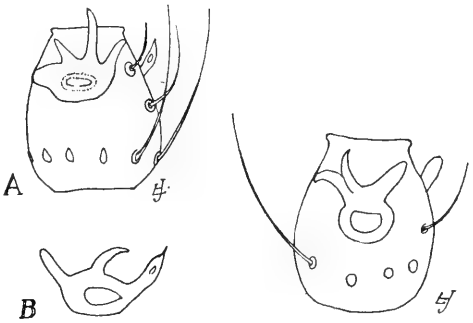


Fig. 41 Fifth antennal segment of female Mycophila fungicola; *b*, tridigitate process; *c*, fifth segment from other antennae, enlarged. (Original)

Micromyia Rond.

1840 **Rondani, Camillo.** Memoira II a per serv. alla Ditterolog. Ital. Parma, 23
1846 ———— Nouv. Ann. Sc. nat. Bologna, ser. 2, p. 369, 373
1864 **Schiner, J. R.** Fauna Austriaca Dipt., p. 411–12
1870 **Winnertz, J.** Vehr. z.-b.-Ges. Wien, 20:27
1876 **Bergenstamm, J. E. & Löw, Paul.** Syn. Cecidomyidarum, p. 18
1892 **Theobald, F. V.** Acct. Brit. Flies, p. 86
1896 **Kieffer, J. J.** Misc. Entomol., 4:24
1897 ———— Syn. Cecid. Eur. & Alg., p. 50
1900 ———— Soc. Ent. Fr. Ann., 69:441
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:34

This genus was erected by Rondani in 1840 for certain small forms presenting the general appearance of Campylomyza and easily distinguished therefrom by the 10 or 11 antennal segments of the male and the 8 of the female, they being sessile in both sexes; the second greatly enlarged, and having a diameter more than twice that of the third. The antennal setae of the male are unusually long, being three to four times as long as the segment. The palpi are quadriarticulate, the first segment rudimentary, the others nearly normal, the third in the female greatly expanded apically. Subcosta joins the anterior margin near the middle, the third vein before the apex and is united to subcosta by a distinct cross vein; the fourth vein is simple, indistinct and joins the posterior margin; the fifth

at the distal third, its branch at the basal third. Terminal clasp segment long, stout, rounded apically.

The above is based on previous accounts and a study of specimens identified by Winnertz in the British Museum of Natural History and a good series in the Winnertz collection at the University of Bonn. Type M. l u c o r u m Rond. No American species are known.

Campylomyza Meign.

1818 **Meigen, J. W.** Syst. Beschr., 9:101, 1
1840 **Westwood, J. O.** Introduct. Class. Ins. Syn., p. 126
1846 **Rondani, Camillo.** Nouv. Ann. Sc. Nat. Bologna, S. 2; separate p. 13 (Neurolyga)
1864 **Schiner, J. R.** Fauna Austr. Dipt., 2:411
1870 **Winnertz, J.** Vehr. z.-b. Ges. Wien, 20:9–10
1876 **Bergenstamm, J. E., and Löw, Paul.** Syn. Cecidomyidarum, p. 17
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:133–34
1892 **Theobald, F. V.** Acct. Brit. Flies, 1:51, 86
1896 **Kieffer, J. J.** Misc. Entomol., 4:24
1897 ———— Syn. Cecid. Eur. & Alg., p. 50
1900 ———— Ent. Soc. Fr. Ann., 69:437, 442 (Neurolyga)
1908 **Meunier, F.** Soc. Sci. Brux. Ann., 28:8
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 312, 313
1911 ———— N. Y. Ent. Soc. Jour., 19:34

The unsatisfactory condition of this genus is briefly outlined in the above discussion of the tribe characteristics. We have provisionally given the genus supergeneric rank pending a satisfactory determination and description of the type species and have assigned thereto forms not readily grouped with more recently established genera, one or more of which may prove to be synonyms of Meigen's genus. Type C. f l a v i p e s Meign.

The first American species described is Say's C a m p y l o m y z a s c u t e l l a t a which was very briefly characterized in 1823.[1]

The types are not extant and it would be very difficult to establish the identity of this species though Mr Ainslee[2] records this species swarming on wooden uprights in a timothy and clover meadow.

Campylomyza

a 13 antennal segments
  b Length .75 mm; abdomen brown; fifth antennal segment with a stem one-third the length of the basal enlargement.....
    v i t i n e a Felt, C. 759

[1] 1823 Say, Thomas. Acad. Nat. Sci. Phila. Jour., 3:17; 1883 Say, Thomas. Compl. Writ., 2:44

[2] 1908 Ainslee, C. N. Ent. Soc. Wash. Proc., 10:16–17

aa 14 antennal segments

b Fifth antennal segment with a stem one-half the length of the basal enlargement

c Length 1 mm; abdomen fuscous yellowish; antennal segments asymmetrical, the middle claw denticulate.....
producta Felt, C. 726

cc Length 1.5 mm; abdomen yellowish brown; antennal segments symmetrical; middle claw not denticulate.....
pomifolia Felt, C. a379

bb Fifth antennal segment with a stem three-quarters the length of the basal enlargement

c Terminal clasp segment short, stout; pulvilli present

d Length .75 mm; abdomen dark brown; terminal clasp segment greatly swollen near the middle, the fourth palpal segment slender, twice as long as the preceding.....
pomiflorae Felt, C. 11, 12, 13, 15

cc Terminal clasp segment long, more or less flattened; pulvilli absent

d Length .75 mm; abdomen dark brown; basal enlargement of fifth antennal segment with a length fully twice its diameter, the fourth palpal segment twice the length of the third, the base of the terminal clasp segment not greatly flattened and dilated.....cerasi Felt, C. 18

dd Length 1 mm; abdomen dark brown; basal enlargement of fifth antennal segment with a length about one-half greater than its diameter, the fourth palpal segment one-half longer than the third, the terminal clasp segment broad at base and strongly flattened.....gibbosa Felt, C. 162

bbb Fifth antennal segment with a stem fully as long as the basal enlargement

c Length 1 mm; abdomen pale reddish brown; fifth antennal segment with a stem one-quarter longer than the basal enlargement; terminal clasp segment swollen, with a length five times its diameter.....flavoscuta Felt, C. 117

cc Length 1 mm; abdomen dark reddish brown, terminal clasp segment stout, roundly quadrate apically, palpi quadriarticulate...
truncata Felt, C. 1404

ccc Length .4 mm; abdomen dark brown; fifth antennal segment with a stem as long as the basal enlargement; terminal clasp segment stout, elongate, ovoid, palpi quadriarticulate.....
modesta Felt, C. 147

cccc Length 1.25 mm; abdomen dark brown; fifth antennal segment with a length one-quarter greater than the basal enlargement; palpi triarticulate; terminal clasp segment stout, much produced, not dilated.....texana Felt, C. 1258, 888

aaa 15 antennal segments, the fifth with a stem one-fourth longer than the basal enlargement

b Length 1 mm; abdomen dark brown; mesonotum black.....
carpini Felt, C. 107

Campylomyza vitinea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul 110, p. 98; separate, p. 2
1908 ———— N. Y. State Mus. Bul. 124, p. 314

This species was taken about grape, Vitis, or ash, Fraxinus, August 14, 1906, at Albany, N. Y.

Male. Length .75 mm. Antennae shorter than the body, sparsely haired, brown; 13 segments, the fifth with a stem one-third the length of the pyriform basal enlargement, the terminal two segments

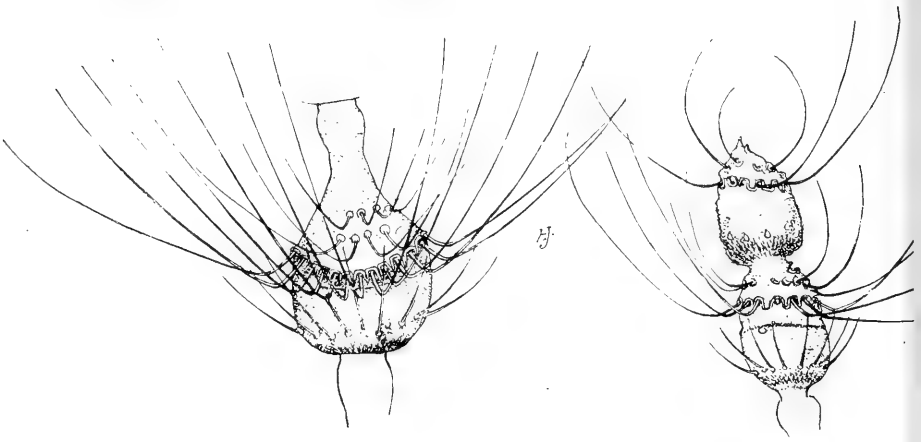


Fig. 42 Fifth and distal two antennal segments of male Campylomyza vitinea, enlarged. (Original).

partly fused. Palpi; the first segment long, swollen distally, the second slender, as long as the first, the third a little shorter. Mesonotum dark brown. Scutellum and abdomen brown, genitalia darker. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal third. Halteres, femora and tibiae pale, tarsi darker; claws medium, curved at nearly right angles, denticulate. Genitalia; basal clasp segment stout, subtruncate; terminal clasp segment stout, short, broadly rounded. Type Cecid. 759.

Campylomyza producta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315

This form was taken on a window at Nassau, N. Y., July 31, 1906.

Male. Length 1 mm. Antennae extending to the fourth abdominal segment, thickly haired, dark brown, 14 segments; the fifth with a stem one-half the length of the subcylindric enlargement, which latter tapers distally; terminal segment narrowly oval. Palpi;

the first segment somewhat elongate, enlarged, narrowly oval, the second more slender, longer, subrectangular, the third lanceolate and slightly shorter than the second, the fourth nearly twice the length of the third, more slender. Mesonotum dark brown, sub-

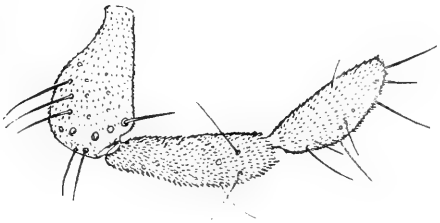


Fig. 43 Palpus of Campylomyza vitinea, enlarged. (Original)

median lines ornamented with short, yellowish setae; scutellum dark brown apically, postscutellum yellowish, dark brown laterally. Abdomen fuscous yellowish, genitalia brown, tipped with dull orange. Wings hyaline, costa dark brown. Halteres semitransparent basally, pale yellowish apically, coxae, femora and tibiae mostly pale semitransparent; femoro-tibio articulations and most of the tarsi pale orange; claws long, stout, the midpair minutely denticulate; pulvilli rudimentary. Genitalia: basal clasp segment short, broad, obliquely truncate; terminal clasp segment long, stout; irregular. Dorsal plate very broad, broadly rounded. Ventral plate broad at base, tapering, broadly rounded. Style long, slender. Type Cecid. 726.

Campylomyza pomifolia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315

A number of the small flies belonging to this species were taken on the under side of apple leaves, Pyrus malus at Nassau, N. Y., May 6, 1902.

Male. Length 1.5 mm. Antennae extending to the middle of the abdomen, sparsely haired, light brown, 14 segments; the fifth with a stem one-half the length of the subcylindric enlargement, which latter has a length nearly twice the diameter and tapers slightly, apically a pair of short stemmed disks; terminal segment somewhat reduced, narrowly ovate. Palpi; the first segment rather stout, subquadrate, the second one-half longer, more slender, the third reduced basally, as long and a little more slender than the second, the fourth one-half longer than the third, all rather thickly clothed with rather coarse setae. Halteres long, the distal portion prolonged. Legs probably a fuscous yellowish; claws long, strongly curved, simple; the pulvilli as long. Genitalia: basal clasp segment stout,

obliquely truncate; terminal clasp segment long, stout, strongly constricted basally, broadly rounded. Dorsal plate long, broad, truncate. Ventral plate indistinct. Harpes short, stout, the ventral free portion broadly expanded, with irregular, angular projections anteriorly and posteriorly. Near the harpes are a pair of short, stout, strongly curved processes. Style short, narrowly rounded. Type Cecid. a379.

Campylomyza pomiflorae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3
1908 ———— N. Y. State Mus. Bul. 124, p. 315
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44

This species appears to be a very common, early spring form, since it was taken in numbers May 14, 1906, flying about the flowers of shadbush, Amelanchier canadensis, and also about the flowers of wild cherry, Prunus pennsylvanica, at Karner, N. Y.

Male. Length .75 mm. Antennae nearly as long as the body, thickly clothed with long hairs, dark brown; 14 segments, the fifth with a stem two-thirds the length of the subcylindric basal enlargement, apically a pair of oval, stemmed disks; terminal segment obconical, sometimes fused with the preceding, the apex scarcely produced. Palpi; the first segment rather long, broadly swollen distally and with a sensory organ on the internal distal surface, second more slender, as long as the first, the third a little longer than the second, slightly stouter, the fourth one-half longer than the third. Thorax and abdomen dark brown or black. Wings hyaline, iridescent, reddish at the insertion, anterior veins brown, subcosta uniting with the margin at the basal half; halteres whitish transparent. Legs brownish yellow, tarsi light yellow, tip of posterior tibiae, anterior tarsi and the terminal segments of the middle and posterior tarsi variably tinged with reddish; claws slender, simple. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment slender at base, broadly expanded distally, thickly setose apically. Dorsal plate broad, short, broadly rounded, ventral plate inconspicuous. Harpes with a convolute basal portion, a distal acute spine pointing in a latero-posterior direction and a submedian, recurved, fusiform, chitinous process extending anteriorly; style long, slender, irregularly curved. Type Cecid. 11.

Campylomyza cerasi Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 4
1908 ———— N. Y. State Mus. Bul. 124, p. 316

This species was taken May 15, 1906 in the vicinity of wild cherry, Prunus pennsylvanica, wild raspberry, Rubus sp., and various bushes at Nassau, N. Y.

Male. Length .75 mm. Antennae as long as the body, sparsely haired, dark brown, annulate with lighter; 14 segments, the fifth with a stem three-fourths the length of the irregular, subcylindric enlargement; terminal segment slender, subconical. Palpi; the first segment short, stout, broadly rounded, second more slender, one-half longer, the third subequal, the fourth one-half longer than the third. Head, thorax and abdomen dark brown. Wings subhyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs light brown with indistinct reddish markings at the articulations between the coxae and femora, the latter and tibiae, on the apex of the tibiae and with more or less suffused reddish tints on the tarsi; claws stout, slightly swollen near the middle, strongly curved, simple. Genitalia; basal clasp segment short, stout, ventral margin apparently produced as a recurved setose lobe; terminal clasp segment stout, curved. The dorsal plate apparently very broad, broadly and roundly excavated, the lobes widely separated, convolute laterally, irregularly and broadly rounded. Type Cecid. 18.

Campylomyza gibbosa Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 3
1908 ———— N. Y. State Mus. Bul. 124, p. 316

This species was taken June 7, 1906 on spruce, Picea canadensis, at Lake Clear, N. Y.

Male. Length 1 mm. Antennae longer than the body, dark brown, sparsely haired; probably 14 segments. Palpi; the first segment very much enlarged, broadly rounded, the second one-fourth longer than the first and slender, the third stouter, about two-thirds the length of the second and the fourth slender and a little longer than the second. Head, thorax and abdomen dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs pale straw, irregularly tinged with carmine, especially near the articulations; claws medium, strongly curved, pectinate. Genitalia; basal clasp segment very short, stout, truncate; terminal clasp segment longer than the basal clasp segment, greatly swollen basally, broadly rounded. Dorsal plate very broad, deeply emarginate, the lobes broadly rounded; ventral plate narrow, tapering, broadly rounded, sparsely haired. Harpes short, stout, irregularly convolute, with marginal conical projections; style short, stout, curved, narrowly rounded. Type Cecid. 162.

Campylomyza flavoscuta Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 97; separate, p. 1
1908 ———— N. Y. State Mus. Bul. 124, p. 313

This species was taken in general collecting at Albany, N. Y., June 4, 1906.

Male. Length 1 mm. Antennae about as long as the body, sparsely haired light brown, probably 14 segments, the fifth with a stem one-fourth longer than the enlargement, which latter has a length twice its diameter. Palpi missing. Mesonotum yellowish brown. Scutellum reddish brown, postscutellum yellowish. Abdomen pale reddish brown. Wings hyaline, costa brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs a nearly uniform pale fuscous yellow, first tarsal segment as long as the three following; claws slender, strongly curved, simple. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment small, swollen basally and tapering gradually to an obtuse point. Dorsal plate apparently very broad; ventral plate indistinct. Harpes apparently smooth, flattened, broadly rounded distally, the free ends approximate. Type Cecid. 117.

Campylomyza truncata Felt

1912 **Felt, E P.** N. Y. Ent. Soc. Jour., 20:102

Allied to the preceding and collected April 19, 1910 by Dr W. G. Dietz, Hazelton, Pa.

Campylomyza modesta Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3
1908 ———— N. Y. State Mus. Bul. 124, p. 316

This species was taken June 7, 1906 on balsam, Abies balsamea, at Lake Clear, N. Y.

Male. Length .4 mm. Antennae probably twice as long as the body, sparsely haired, light brown; probably 14 segments, the fifth with a stem about one-fourth longer than the subglobular basal enlargement. Palpi probably quadriarticulate. Mesonotum dark brown. Scutellum, postscutellum and abdomen nearly concolorous. Wings subhyaline, costa dark brown, subcosta uniting with the margin at the basal half, base of wing reddish; halteres fuscous basally, yellowish fuscous apically. Legs a nearly uniform yellowish straw, tarsi tinged with carmine; claws slender, strongly curved, simple; pulvilli a little shorter than the claws. Genitalia; basal clasp segment stout, broadly rounded, truncate; terminal clasp segment stout, nearly oval. Dorsal and ventral plates indistinct; style short, stout. Type Cecid. 147.

Campylomyza texana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316

This species was taken at Plano, Texas, in November 1907 by Mr E. S. Tucker and apparently the same form was captured October 22d by Prof. T. D. A. Cockerell at Boulder, Col.

Male. Length 1.25 mm. Antennae longer than the body, sparsely haired, dark brown; 14 segments, the fifth with a stem one-fourth longer than the subcylindric enlargement; terminal segment reduced, tapering to an acute apex. Palpi; the first segment short, stout, narrowly oval, with a large, irregularly oval sensory pit near the basal internal angle, second segment a little longer, more slender, the third longer and more slender than the second. The entire body a nearly uniform very dark brown. Wings hyaline, costa light brown, subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, light fuscous apically. Legs a light yellowish brown, the distal tarsal segments somewhat darker; claws long, slender, strongly curved, slightly denticulate, the pulvilli a little shorter than the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment thickly haired, long, stout, slightly expanded and broadly rounded; dorsal plate short, stout, triangularly emarginate, lobes somewhat separated and broadly rounded, other organs apparently fused into an irregularly subquadrate process having conspicuous prolongations distally at the median and lateral angles. Type Cecid. 1258.

Campylomyza carpini Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 4
1908 ———— N. Y. State Mus. Bul. 124, p. 314

This species was taken on ironwood, Carpinus caroliniana, at Albany, N. Y., June 1, 1906.

Male. Length 1 mm. Antennae as long as the body, thickly haired, dark brown; 15 segments, the fifth with a stem one-fourth longer than the pyriform enlargement; the terminal two segments much reduced, narrowly fused, the fifteenth ovoid. Palpi; the first segment suborbicular, broad, the second twice the length of the first, elliptical oval, the third more slender, a little longer. Mesonotum black with submedian lines of fine hairs. Scutellum dark brown with sparse apical setae. Abdomen dark brown. Wings hyaline, costa and subcosta reddish brown, the latter uniting with the anterior margin at the basal half; halteres yellowish transparent. Legs pale grayish, tarsi variably tinged with reddish; claws stout, strongly curved, simple. Genitalia; basal clasp segment long, relatively slender, obliquely truncate; terminal clasp segment stout, short, with a long, apical tooth. Dorsal and ventral plates not easily distinguished. There appear to be a pair of suboval appendages within, much resembling the terminal clasp segment, though these structures may be a convolute portion of the very broad dorsal plate; if so, the ventral plate is a narrow, subtriangular process narrowly rounded distally; style slender, projecting anteriorly. Type Cecid. 107.

Prionellus Kieff.

Prionota Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., p. 176
1895 ———— Soc. Ent. Fr. Bul., p. 318, 319
1896 ———— Mis. Ent., 4:7, 15
1897 ———— Syn. Cecid. Eur. & Alg., p. 49
1900———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 3; pl. 22, fig. 10
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:34

This genus was originally defined by Kieffer as recognizable by the subconical, subsessile antennal segments of the female and with the tip of costa nearer the second than the third vein. The palpi are quadriarticulate, the claws denticulate and the pulvilli well developed. Later, Kieffer states that the claws are arched and not or hardly dilated, while the antennal segments of the male are eccentric, with a stem about three-fourths the length of the basal enlargement and with crenulate whorls as well as whorls of hairs, the third vein extending to the apex of the wing. The basal clasp segment is stout, lobed internally, while the terminal clasp segment is stout

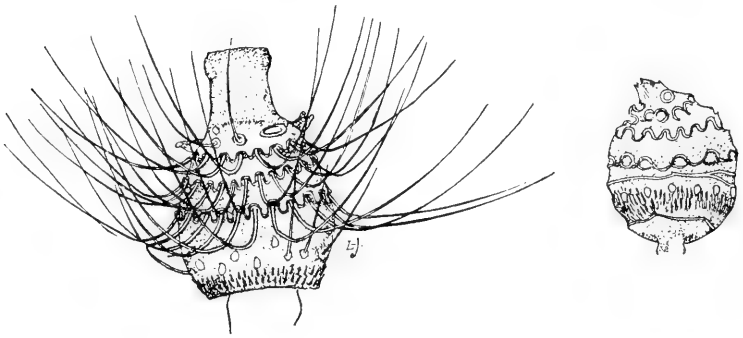


Fig. 44 Fifth and terminal antennal segments of Prionellus graminea, enlarged. (Original)

at the base, greatly expanded distally, swollen and broadly rounded apically. The female antennae are subconic or subovoid, with a very short stem and bearing subapically a broad, chitinous collar. The thickened anterior border of the wing extends almost to the fourth vein. Type Prionota pini Kieff. A number of American species have been provisionally referred to this genus.

Key to species

a 12 antennal segments, subsessile; females
b Chitinous collar incised
c Length 1 mm; abdomen dark yellow; fifth antennal segment with a length one-quarter greater than its diameter, the fourth palpal segment one-half longer than the third..defectiva Felt, C. 715
bb Chitinous collar intact, not incised
c Wings long, narrow
d Length 1 mm; abdomen brownish yellow; fifth antennal segment with a length twice its diameter, the fourth palpal segment twice as long as the third.....silvana Felt, C. 883
dd Length 1 mm; abdomen dark brown; fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment one-half longer than the third.....
monilis n. sp., C. 1296
cc Wings medium or small
d Length 1 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-third greater than its diameter, the fourth palpal segment one-half longer than the third.....
simulator Felt, C. 885
aa 13 antennal segments, sessile; females
b Chitinous collar rudimentary; fifth antennal segment with a length one-quarter greater than its diameter
c Length 1.5 mm; abdomen dark brown; fourth palpal segment one-quarter longer than the third.....longipennis Felt, C. 733w
bb Chitinous collar well developed; fifth antennal segment with a length one-half greater than its diameter
c Wings long, slender
d Fifth tarsal segment of the posterior leg with a length one and one-half to twice its diameter
e Length 1 mm; abdomen dark brown; fourth palpal segment one-half longer than the third; terminal lobe of the ovipositor broadly oval.....tsugae Felt, C. 166
dd Fifth tarsal segment of the posterior leg with a length 2 to 3 times its diameter
e Length 1.5 mm; abdomen dark brown; fourth palpal segment one-half longer than the third, dilated; terminal lobe of the ovipositor orbicular .....
boulderensis Felt, C. 886, c928, ? C. 1378
ee Length 2 mm; abdomen fuscous yellowish; fourth palpal segment one-half longer than the third, slender; terminal lobe of the ovipositor broadly oval. .....dilatata Felt, C. 1109
cc Wings broad
d Length 2.5 mm; abdomen dark reddish brown; fourth palpal segment twice as long as the third.....
latipennis Felt, C. a1457
aaa 14 antennal segments, stemmed; males
b Fifth antennal segment with a stem one-third the length of the basal enlargement

c Length 1.5 mm; abdomen dark brown; subcosta uniting with costa at the distal third; fourth palpal segment one-quarter longer than the third.....graminea Felt, C. 5

cc Length .75 mm; abdomen dark brown; subcosta uniting with costa at the basal third; fourth palpal segment with a length twice the third.....leguminicola Felt, C. 121

bb Fifth antennal segment with a stem three-quarters the length of the basal enlargement

c Length .75 mm; abdomen dark brown; wings narrow, the fourth palpal segment with a length twice the third.....hesperia Felt, C. 714

cc Length 1 mm; abdomen black; wings broad; fourth palpal segment with a length twice that of the third.....latipennis Felt, C. a1457

bbb Fifth antennal segment with a stem as long as the basal enlargement

c Length 1.5 mm; abdomen fuscous yellowish; fourth palpal segment with a length one-half greater than the third; basal clasp segment with an internal lobe.....dilatata Felt, C. 1109

cc Length 1.25 mm; abdomen fuscous; fourth palpal segment with a length one-half greater than the third; basal clasp segment without a lobe.....montana n. sp., C. a1951

Prionellus defectiva Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on hemlock, Tsuga canadensis, at Newport, N. Y., July 27, 1906.

Female. Length 1 mm. Antennae extending to the fourth abdominal segment, thickly haired, dark brown, 12 segments; fifth subglobose, terminal segment slightly prolonged, narrowly rounded distally. Palpi; the first segment somewhat enlarged, subglobose, the second short, stout, subquadrate, the third a little longer, the fourth one-half longer than the third. Mesonotum dark brown, submedian lines sparsely haired, indistinct. Scutellum dark brown, postscutellum and abdomen dark fuscous yellowish, distal segments dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin near the middle. Halteres yellowish transparent; legs mostly fuscous yellowish, the tarsal articulations variably tinged with deep carmine; distal tarsal segments brown; metatarsus more than twice the length of the following segment; claws stout, strongly curved, denticulate; pulvilli as long as the claws. Ovipositor short, the terminal lobes triarticulate, the distal segment broadly oval. Type Cecid. 715.

Prionellus silvana Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken August 11, 1903 by Mr R. P. Currie at an altitude of 8000 feet on the Kokanee mountain, B. C.

Female. Length 1 mm. Antennae scarcely extending to the base of the abdomen, sparsely haired, reddish brown; 12 segments, the fifth obpyriform, with a length one-half greater than its diameter; terminal segment produced, slightly constricted near the distal third at the chitinous collar. Palpi; the first segment short, stout, irregularly ovoid, the second stout, with a length about one-half greater than its diameter, the third about one-half longer than the second, more slender, the fourth about twice as long as the third, greatly dilated. Mesonotum rather dark reddish brown. Scutellum and postscutellum lighter. Abdomen brownish yellow. Wings long, narrow, hyaline, costa a light brown, subcosta uniting with the anterior margin near the basal half. Legs a variable light yellowish; claws long, slender, strongly curved, with 4 or 5 long denticulations; pulvilli as long as the claws. Ovipositor short, the terminal lobes triarticulate, the third segment broadly oval. Type Cecid. 883.

Prionellus monilis n. sp.

This species was reared in November 1907 by Mr E. S. Tucker from a cage sown with oats.

Female. Length 1 mm. Antennae extending to the third abdominal segment, thickly haired, dark brown; 12 segments, the fifth with a length one-third greater than its diameter; terminal segment greatly produced, constricted and evidently composed of two closely fused. Palpi; first segment stout, broadly oval, the second narrowly oval, the third a little longer, more slender, the fourth one-half longer than the third. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum and postscutellum brown. Abdomen dark brown, the basal segments yellowish brown. Wings hyaline, costa light brown, subcosta joining the margin at the basal half, the third vein near the apex. Halteres yellowish transparent. Legs a variable fuscous yellowish, the distal tarsal segments brownish; claws strongly curved, denticulate, the pulvilli longer than the claws. Ovipositor short, the lobes triarticulate, the third segment broadly oval, all sparsely haired. Type Cecid. 1296.

Prionellus simulator Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken June 26, presumably 1903, by Mr R. P. Currie at Kaslo, B. C.

Female. Length 1 mm. Antennae hardly extending to the base of the abdomen, thickly haired, yellowish brown; 12 segments, the fifth subsessile, subcylindric, with a length about one-third greater than its diameter; terminal segment somewhat produced and tapering to a rounded apex. Palpi; the first segment greatly expanded distally, pyriform, the second a little longer, slender, narrowly rounded apically, the third a little longer and more slender than the second,

the fourth one-half longer than the third, somewhat dilated. Mesonotum dark brown. Scutellum, postscutellum and abdomen fuscous yellowish, the latter dark brown distally. Wings hyaline, costa dark brown, subcosta uniting with the anterior margin near the basal half. Legs a fuscous yellowish; claws long, rather slender, strongly curved, finely denticulate, pulvilli longer than the claws. Ovipositor short, triarticulate; the third segment broadly oval. Type Cecid. 885.

Prionellus longipennis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on an office window August 2, 1906 at Albany, N. Y.

Female. Length 1.5 mm. Antennae extending to the base of the abdomen, thickly haired, brown, 13 segments; the fifth subsessile, pyriform; terminal segment somewhat reduced, nearly pyriform. Palpi; the first segment enlarged, subglobose, the second smaller, nearly oval, the third one-half shorter, broadly oval, the fourth a little longer, slender, elliptical. Mesonotum dark brown, submedian lines indistinct. Scutellum dark reddish brown, postscutellum light reddish brown. Abdomen dark brown, the distal segments darker, and with the incisures and pleurae pale orange, the sclerites not sharply defined. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal third. Halteres yellowish basally, fuscous apically, the legs a nearly uniform light brown, shaded with fuscous distally, tarsal segments dark brown; claws stout, curved, denticulate; pulvilli wanting. Ovipositor short, the lobes biarticulate, basal segment irregular, subquadrate, the distal one narrowly oval. Type Cecid. 733.

Prionellus tsugae Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 5 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken June 7, 1906 on hemlock, Tsuga canadensis, at Lake Clear, N. Y.

Female. Length 1 mm. Antennae extending to the base of the abdomen, thickly haired, dark brown; 13 segments; fifth subcylindric, with a length one-half greater than its diameter, terminal segment subcylindric, tapering roundly to a slightly produced apex; Palpi; the first segment, pyriform, greatly enlarged distally, the second and third subequal, suboval, the fourth one-half longer than the third. Mesonotum dark brown, submedian lines with pale hairs. Scutellum yellowish brown. Abdomen dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal

half; halteres probably whitish transparent. Legs a nearly uniform dark straw, terminal segments slightly darker; claws stout, strongly curved, serrate. Ovipositor short, the basal segment subquadrate, the second broadly oval. Type Cecid. 166.

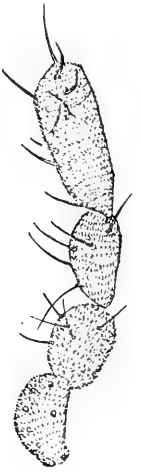


Fig. 45 Palpus of Prionellus tsugae, enlarged. (Original)

Fig. 46 Distal tarsal segments of Prinellus tsugae, enlarged. (Original)

Prionellus boulderensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken by Prof. T. D. A. Cockerell at Boulder, Col., October 15th. Apparently the same species was taken for the United States National Museum at Corvallis, Ore., May 18, 1896.

Female. Length 1.5 mm. Antennae extending to the second abdominal segment, thickly haired, reddish brown; 13 segments, the fifth with a length one-half greater than its diameter, the distal fourth, tapering; terminal segment somewhat reduced, tapering to a short, stout, rounded knob. Palpi; the first segment short, stout, broadly oval, with a conspicuous sensory organ on its internal face, the second about as long as the first, rather stout, rounded distally, the third a little longer and more slender than the second, the fourth about one-half longer than the third, somewhat dilated; body a nearly uniform dark brown. Wings hyaline, costa light brown; subcosta uniting with the margin just beyond the basal half. Legs dark fuscous yellowish, the tarsal segments somewhat lighter; claws long, strongly curved, denticulate, the pulvilli as long as the claws. Ovipositor short, triarticulate, the third segment broadly oval. Type Cecid. 886.

Prionellus dilatata Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 149 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 316 (Campylomyza)
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44 (Campylomyza)

This species was reared by the late Dr M. T. Thompson of Clark University, Worcester, Mass., from a vial containing decaying vegetable matter and seeds.

Male. Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish; 14 segments, the fifth with a stem as long as the subglobose basal enlargement; terminal segment reduced, pyriform. Palpi; the first segment short, stout, irregularly oval, the second a little longer, more slender, the third slightly longer than the preceding and the fourth one-half longer than the third, strongly flattened; face fuscous yellowish. Mesonotum dark

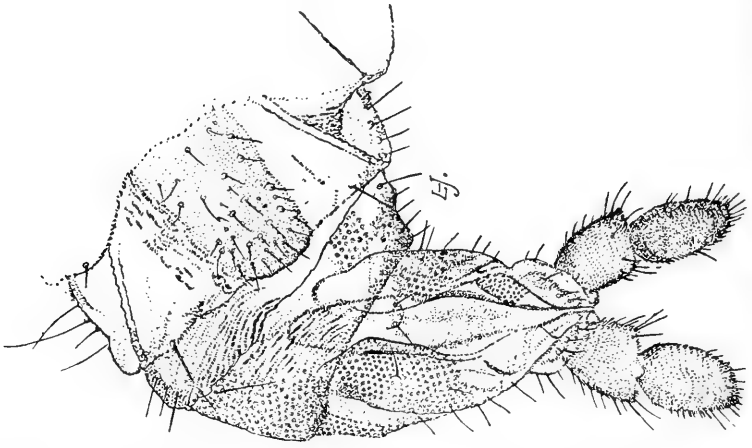


Fig. 47 Distal abdominal segments and ovipositor of Prionellus tsugae, enlarged. (Original)

brown. Scutellum yellowish, postscutellum fuscous yellowish. Abdomen a variable fuscous yellowish. Wings hyaline, costa light brown, subcosta uniting with the anterior margin near the middle. Halteres pale yellowish. Legs a nearly uniform light fuscous yellowish; claws long, strongly curved, denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment broad, truncate and with a long, roundly triangular lobe at the internal distal angle; terminal clasp segment short, stout, greatly dilated, subtriangular; dorsal plate narrow, tapering, narrowly rounded. Harpes stout, the distal margin bearing a pair of long, stout, recurved, teeth.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, light fuscous yellowish; 13 segments, the fifth subsessile, subcylindric; with a length one-half greater than

its diameter, the distal two segments closely fused, obtusely rounded apically. Palpi; the first segment short, stout, irregularly oval, the second a little longer, much more slender, the third longer and slightly stouter than the second, the fourth one-half longer and more slender than the third; face light fuscous yellowish. Mesonotum a fuscous yellowish. Scutellum a little lighter, postscutellum fuscous yellowish. Abdomen a light fuscous yellowish. Wings hyaline, costa pale straw, subcosta uniting with the margin near the basal half. Halteres yellowish transparent. Legs pale yellowish, the distal tarsal segments darker; claws long, strongly curved, denticulate, the pulvilli as long as the claws. Ovipositor short, triarticulate, the third segment broadly oval. Type Cecid. 1109.

Prionellus latipennis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

The male and female of this species were taken on a small pine, probably Pinus rigida, at Karner, N. Y., April 27, 1907. They were observed pairing, consequently there can hardly be any question as to their belonging to the same species.

Male. Length 1 mm. Antennae nearly as long as the body, thickly haired, dark brown; 14 segments, the fifth with a stem two-thirds the length of the subcylindric basal enlargement; terminal segment narrowly oval, subacute distally. Palpi; the first segment broadly oval, with a rather conspicuous sense organ internally, the second a little longer, narrow, subquadrate, the third a little shorter, more slender than the second, the fourth about twice the length of the preceding, more slender; face fuscous, eyes large, black. Mesonotum shining black, sparsely and irregularly clothed with short, yellowish hairs. Scutellum a dark reddish brown, postscutellum and abdomen nearly shining black, sparsely clothed with fine, yellowish hairs. Wings hyaline, costa reddish brown, subcosta uniting with the margin at the middle. Halteres nearly uniform fuscous yellowish. Legs fuscous yellowish, the incisures variably tinged with deep red, the distal tarsal segment reddish brown; claws long, strongly curved, denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment long, stout, tapering; terminal clasp segment rather long, almost pediceled, broadly rounded and with an enlargement near the distal third; dorsal plate broad, tapering, broadly rounded. Harpes short, stout, approximate, with an acute, chitinous spine posteriorly and a semicircular, dark, chitinous thickening dorsally.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, thickly haired, dark reddish brown; 13 segments, the fifth subsessile; terminal segment prolonged, subcylindric, tapering to an obtuse apex. Palpi; the first segment stout, broadly rectangular with a conspicuous sense organ internally, second a little longer, more slender, the third as long as the second, more

slender, the fourth fully twice the length of the preceding, slightly enlarged at the distal third; face fuscous. Mesonotum black, sparsely and irregularly clothed with short, yellowish hairs. Scutellum reddish brown, postscutellum very dark brown. Abdomen sparsely clothed with fine, yellowish hairs, dark reddish brown, the incisures pale fuscous yellowish. Wings hyaline, costa light brown, subcosta uniting with the margin near the middle. Halteres pale orange basally, pale yellowish distally. Legs a nearly uniform dark brown; claws long, slender, strongly curved, denticulate, the pulvilli longer than the claws. Ovipositor short, triarticulate, the third segment suborbicular. Type Cecid. a1457.

Prionellus graminea Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98; separate, p. 2 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This dark brown male was swept from grass etc. at Karner, N. Y., April 27, 1906.

Male. Length 1.5 mm. Antennae two-thirds the length of the body, sparsely haired, dark brown; 14 segments, fifth with a stem one-fourth the length of the subglobular enlargement; terminal segment subglobular, acute apically. Palpi; the first segment, sub-

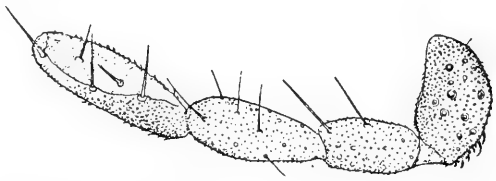


Fig. 48 Palpus of Prionellus graminea, enlarged. (Original)

quadrate, slightly enlarged distally, second and third subequal, the latter a trifle longer, the fourth one-half longer than the third. Head and thorax black or dark brown. Abdomen dark brown, pleurae and incisures yellowish brown. Wings hyaline, slightly fuscous, tinted with reddish basally, costa dark brown, subcosta uniting with the margin at the distal third; halteres semitransparent. Legs yellowish transparent or reddish; claws stout, strongly curved, pectinate. Genitalia; basal clasp segment short, stout, truncate; terminal clasp segment short, stout, broadly rounded. Dorsal and ventral plates indistinct. Harpes very broad, slightly expanded, deeply emarginate and with the internal angles produced. Style short, broad, tapering, narrowly rounded. Type Cecid. 5.

Prionellus leguminicola Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98; separate, p. 2 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was swept from red clover, Trifolium pratense, at Albany, N. Y., June 4, 1906.

Male. Length .75 mm. Antennae extending to the second abdominal segment, sparsely haired, reddish brown; 14 segments, the the fifth with a stem one-third the length of the subcylindric basal enlargement; terminal segment obtusely rounded apically. Palpi; the first segment large, subquadrate, slightly swollen distally, the second shorter, subglobular, the third a little longer, suboval, the fourth twice the length of the preceding, subrectangular; face dark brown. Mesonotum dark brown. Scutellum and postscutellum reddish brown. Abdomen dark brown or black. Wings hyaline, costa pale straw basally, dark brown apically, subcosta uniting with the margin at the basal third; halteres whitish transparent. Femora and tibiae brownish straw color, lighter ventrally, tarsi a pale straw color, terminal segment darker; claws stout, strongly curved, those on the second and third pairs of legs denticulate. Genitalia; basal clasp segment short, stout, truncate; terminal clasp segment short, greatly swollen at the distal third. Dorsal plate broad, broadly rounded. Harpes strongly chitinized, broad, tapering to a heavy, chitinized, apex with an acute prolongation laterally, one posteriorly on the median line and another internally and posteriorly; style slender, broadly rounded. Type Cecid. 121.

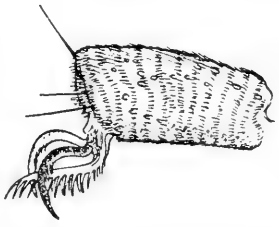


Fig. 49 Distal tarsal segment of Prionellus leguminicola, enlarged. (Original)

Prionellus hesperia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This form was taken on hemlock, Tsuga canadensis, at Newport, N. Y., July 27, 1906.

Male. Length .75 mm. Antennae nearly as long as the body, sparsely haired, dark brown, 14 segments; the fifth with a stem three-fourths the length of the pyriform basal enlargement, rather stout, bladelike chitinous processes arise from apical oval pits; terminal segment slightly reduced, the distal portion long, slender, fusiform. Palpi; the first segment slightly enlarged, subglobose, the second longer, irregularly rectangular, the third one-half longer than the second, broader, the fourth nearly twice as long as the third and broader. Head, thorax and abdomen a nearly

uniform dark brown or black. Mesonotum shining. Wings hyaline, costa dark brown, subcosta uniting with the margin just before the basal half. Halteres pale yellowish; legs mostly pale yellowish transparent, the tarsal articulations variably tinged with carmine; the distal segments darker; metatarsus of the fore and middle legs scarcely twice the length of the following segment; claws rather slender, strongly curved, denticulate; the pulvilli as long as the claws. Genitalia: basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, stout, constricted at the base, narrowly rounded. Dorsal plate broad, broadly rounded. (Plate 12, figure 3.) Type Cecid. 714.

Prionellus montana n. sp.

This small form was taken by Prof. T. D. A. Cockerell at Boulder, Col., April 25, 1909.

Male. Length 1.25 mm. Antennae a little longer than the body, thickly haired, fuscous; 14 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment somewhat reduced, narrowly rounded. Palpi; first segment stout, subquadrate, the second a little longer, more slender, the third longer than the second, more slender, the fourth one-half longer than the third, slender. Thorax and abdomen a nearly uniform fuscous, the latter sparsely haired. Wings hyaline, costa fuscous, subcosta uniting therewith beyond the basal half, the third vein at or a little beyond the apex. Halteres yellowish. Legs a fuscous yellowish, the fourth and fifth tarsal segments a variable brown; claws long, stout, very strongly curved, minutely denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment greatly dilated, subtriangular, the apex slightly recurved; dorsal plate broad, broadly rounded apically, ventral plate apparently slightly bilobed. Harpes conspicuous, dilated, heavily chitinized. Type Cecid. a1951.

Aprionus Kieff.

1894 **Kieffer, J. J.** Soc. Ent. Fr. Bul., 176
1895 ———— Soc. Ent. Fr. Bul., p. 318, 319
1896 ———— Mis. Ent., 4:7, 17
1897 ———— Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann. v. 69, pl. 17, fig. 1, 2; pl. 23, fig. 15; pl. 24, fig. 5, 7, 12
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour. 19:34

This genus, as originally defined, has the antennal segments subconical, subsessile in the female, the thickened portion of costa approaching nearer the fourth than the third vein. Palpi quadriarticulate, claws simple, the pulvilli wanting. Later it was stated that the claws were arched and not or hardly dilated, while the

palpi were tri- to quadriarticulate. The eccentric antennal segments are ornamented with hyaline lamellae in addition to crenulate whorls, while the third vein joins costa at the apex. The rudimentary pulvilli do not extend beyond the middle of the claws. The lobes of the ovipositor are triarticulate. Kieffer states that this genus differs from Prionellus by the simple character of the claws and the short or rudimentary pulvilli.

The nymph of A. miki Kieff., as illustrated by the author, is extremely interesting. There are the usual pair of slender, cephalic appendages, the smooth dorsum of the thorax is ornamented with two lines of stout setae arising from small tubercles, while the dorsum of the abdominal segments appears to be regularly marked with transverse rows of short, stout, chitinous points, the posterior margin being ornamented with a sparse row of short, stout, chitinous setae and the posterior angles of segments 2 to 8 bearing long, filiform appendages, each having a length about twice that of the segment. The terminal segment is produced as a pair of stout, subconic appendages, the lateral and internal angles of each bearing a short, stout spine. Type Apriona bidentata Kieff. No American species have been recognized.

Monardia Kieff.

1894 **Kieffer, J. J.** Mis. Ent., 4:7, 22
1895 ———— Soc. Ent. Fr. Bul., p. 318, 319
1897 ———— Syn. Cecid. Eur. & Alg., p. 50
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 4, 9; pl. 18, fig. 3; pl. 23, fig. 6; pl. 24, fig. 6
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

The North American members of this group are most easily recognized by the subapical whorls of mushroomlike appendages, termed stemmed disks, on the antennal segments. Kieffer states that members of this genus may be distinguished by the minute subapical tooth of the claws, a character which in our experience appears to be so insignificant or evanescent as to prove of comparatively slight service. The type of this genus is M. stirpium Kieff.

The members of this group present considerable variations in the number of antennal segments, especially in the female, they ranging from 11 in M. gilletti Felt to 22 in M. articulosa Felt. The known males have 14 or 16 stemmed antennal segments. The palpi may be either tri- or quadriarticulate. The wings present the typical venation of Campylomyza. The pulvilli may be as long as the claws or rudimentary. Near the posterior extremity of the abdomen the females have a pair of submedian, ventral, globular or trumpet-shaped glands. The ovipositor is short and indistinctly

tri- or quadriarticulate. The male genitalia are stout with a short, swollen terminal clasp segment. The one reared American species, M. lignivora Felt, was obtained from the fungous affected heartwood of a pine, the larvae undoubtedly using the rather stout breast bone to erode irregular cavities in the affected wood.

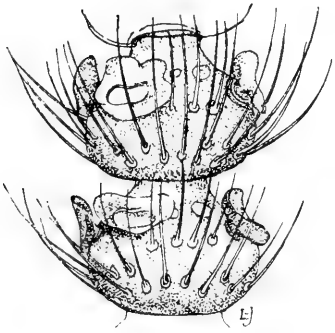


Fig. 50 Fifth and sixth antennal segments of female Monardia lignivora, enlarged. (Original)

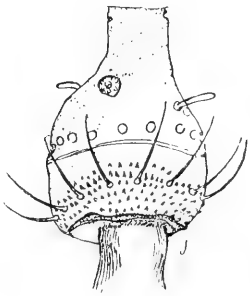
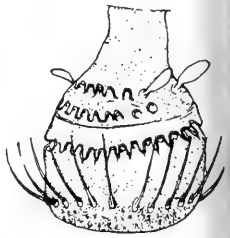


Fig. 51 Fifth antennal segment, views from opposite sides, of Monardia lignivora, ma enlarged. (Original)



Key to species

a 11 antennal segments, subsessile; females

b Length 1.2 mm; abdomen fuscous yellowish; fifth antennal segment with a length equal to its diameter, the third palpal segment one-third longer than the second.....gilletti Felt, C. 1239a

aa 12 antennal segments, subsessile; females

b Length 2 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-quarter greater than its diameter, the third palpal segment one-quarter longer than the second.....
toxicodendron Felt, C. 122

bb Length .75 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-quarter greater than its diameter; fourth palpal segment with a length one-half greater than the third.....
alexanderi n. sp., C. 1370

aaa 14 antennal segments

b Antennal segments subsessile

c Length 2 mm; abdomen fuscous yellowish; fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment as long as the third.....
pinicorticis Felt, C. 799

bb Fifth antennal segment with a stem one-third the length of the basal enlargement; males; subcosta uniting with costa at the basal third

c Length 1.5 mm; abdomen reddish brown; terminal clasp segment plainly pyriform.....karnerensis Felt, C. 29

cc Length 1 mm; abdomen dark brown; terminal clasp segment only slightly enlarged apically.....populi Felt, C. 115

bbb Fifth antennal segment with a stem one-half the length of the basal enlargement; subcosta uniting with costa at the basal half

c Length .75 mm; abdomen dark brown; fourth palpal segment twice the length of the third....balsamicola Felt, C. 145

bbbb Fifth antennal segment with a stem three-quarters the length of the basal enlargement; male; subcosta uniting with costa just beyond the basal half

c Length 1.5 mm; abdomen reddish brown; fourth palpal segment with a length one-half greater than the third.....
barlowi Felt, C. 798

bbbbb Fifth antennal segment with a stem as long as the basal enlargement

c Length 1.25 mm; abdomen dark brown; fourth palpal segment with a length one-half greater than the third.....
tuckeri Felt, C. 1259

aaaa 16 antennal segments

b Length 1.3 mm; abdomen dark reddish; fifth antennal segment with a stem one-third the length of the basal enlargement, the third palpal segment only a little longer than the second; male..
lignivora Felt, C. a1614

aaaaa 21 antennal segments, subsessile; female

b Length 2.5 mm; abdomen dark red; fifth antennal segment with a length one-half greater than its diameter, the fourth palpal segment a little longer than the third.....
lignivora Felt, C. a1614

aaaaaa 22 antennal segments, subsessile; female

b Length 2.5 mm; abdomen light brown; fifth antennal segment with a length three-quarters its diameter; fourth palpal segment with a length one-half greater than the third.....
articulosa Felt, C. 884

Monardia gilletti Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on a window at Albany, N. Y., September 11, 1907.

Female. Length 1.2 mm. Antennae extending to the base of the abdomen, thickly haired, light brown; 11 segments, the fifth pyriform, with a length less than its diameter; terminal segment produced, broadly rounded. Palpi; the first segment short, stout, roundly subquadrate, the second a little longer and more slender, the third one-third longer than the second, more slender. Mesonotum dark brown. Thorax dark brown. Abdomen fuscous yellowish. Wings hyaline, costa yellowish brown, subcosta uniting with the anterior margin near the basal third. Halteres fuscous yellowish. Coxae and legs a variable fuscous yellowish; claws long, slender, strongly curved, simple, the pulvilli about as long as the

claws. The venter of the seventh segment with submedian, subglobose organs, the ovipositor short, triarticulate; terminal segment narrowly oval. Type Cecid. 1239a.

Monardia toxicodendron Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98; separate, p. 1–2 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on poison ivy, Rhus toxicodendron, at Albany, N. Y., June 4, 1906.

Female. Length 2 mm. Antennae hardly extending to the base of the abdomen, thickly clothed with whitish hairs, dark brown;

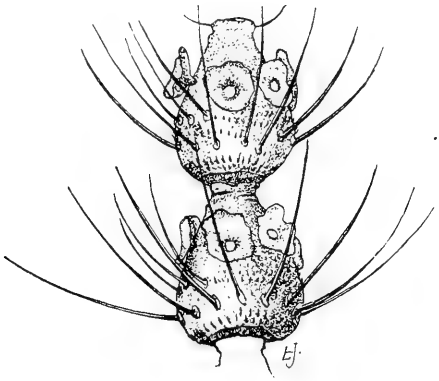


Fig. 52 Seventh and eighth antennal segments of Monardia toxicodendron, enlarged. (Original)

12 segments, the fifth pyriform; terminal segment much shortened, obliquely rounded distally. Palpi; the first segment subglobular, second one-half longer, lanceolate, the third one-quarter longer,

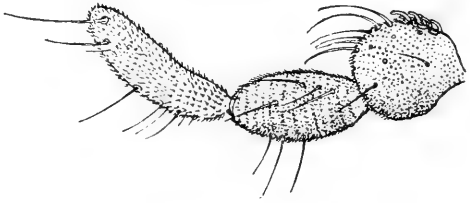


Fig. 53 Palpus of Monardia toxicodendron, enlarged. (Original)

more slender. Mesonotum dark brown, the posterior median area yellowish brown, submedian lines ornamented with pale hairs. Scutellum and postscutellum pale reddish yellow, the former with

sparse yellowish hairs. Abdomen pale fuscous yellowish, terminal segment and ovipositor dark brown or black. Wings hyaline, costa pale straw, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs a nearly uniform pale straw

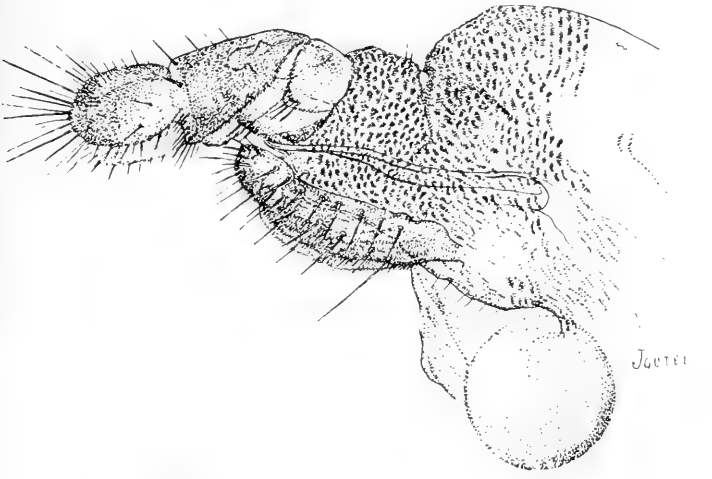


Fig. 54 Apex of abdomen showing ovipositor of Monardia toxicodendron, enlarged. (Original)

yellow; claws slender, strongly curved, simple. On the venter of the eighth abdominal segment, a pair of irregular, trumpet-shaped, fuscous organs. Ovipositor short, triarticulate, terminal lobe suboval. Type Cecid. 122.

Monardia alexanderi n. sp.

This species was taken by Mr C. P. Alexander on Sport island, Sacandaga river, N. Y., July 25, 1909.

Female. Length .75 mm. Antennae extending to the base of the abdomen, sparsely haired, deep red; 12 segments, the fifth with a length one-quarter greater than its diameter, the eleventh and twelfth segments narrowly fused, the latter somewhat reduced. Palpi probably quadriarticulate, the penultimate narrowly oval, with a length three times its width, the terminal segment one-half longer. Mesonotum dull black. Scutellum and postscutellum apparently concolorous. Abdomen fuscous yellowish. Costa pale straw, subcosta uniting therewith near the basal half. Halteres whitish transparent. Legs mostly pale straw, the tarsi variably tinged with reddish, the distal segments darker; claws strongly curved, slightly swollen subapically; pulvilli as long as the claws; ventral glands globose. Ovipositor short; terminal segment narrowly oval, with a length three times its width. Type Cecid. 1370.

Monardia pinicorticis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44 (Campylomyza)

This species was reared from the galleries of a Scolytid in pine, Pinus sp., taken at Riverton, N. J., April 14, 1901 by Prof. C. W. Johnson.

Female. Length 2.5 mm. Antennae hardly extending to the base of the abdomen, sparsely clothed with fine hairs, light brown; 14 segments, the fifth pyriform, with a length one-half greater than its diameter; terminal segment reduced, acute apically. Palpi; the first segment rather long, broadly oval, the second a little shorter, narrow, the third considerably shorter and more slender than the preceding and the fourth more slender and nearly as long as the third. Mesonotum and scutellum reddish brown, the former sparsely and evenly clothed with fine, yellowish hairs, postscutellum dark brown. Abdomen fuscous yellowish, sparsely clothed with fine, yellowish hairs. Wings hyaline, costa light brown, subcosta uniting with the margin near the middle of the wing. Halteres and legs mostly fuscous yellowish, the distal tarsal segments somewhat darker. Metatarsus more than twice the length of the preceding segment. Claws short, stout, strongly denticulate, pulvilli rudimentary. Ovipositor short, triarticulate, the third segment short, broadly oval. Type Cecid. 799.

Monardia karnerensis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 101; separate, p. 5 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This reddish brown species was taken at Karner, N. Y., May 16, 1906.

Male. Length 1.5 mm. Antennae half the length of the body (probably broken) sparsely haired, dark brown; probably 14 segments, the fifth with a stem one-third the length of the subcylindric basal enlargement. Palpi; the first segment subquadrate, stout, the second as long, broadly oval, the third a little longer and the fourth one-half longer than the third. Mesonotum dark brown with submedian lines sparsely clothed with setae. Abdomen reddish brown. Wings subhyaline, the veins brown, subcosta uniting with the margin at the basal third; halteres yellowish transparent. Legs semitransparent with irregular, reddish bands on the tarsi and at the tip of the tibiae, particularly on the mid and posterior legs; claws strongly curved, pectinate. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, greatly swollen distally. Dorsal plate broad, tapering, broadly rounded; ventral plate indistinct. Harpes broad at base, curving

to a heavy, apical process with an acute, outward curved point distally and anteriorly a heavy, slender, chitinous spine, and slightly laterally a flattened, broadly rounded lobe parallel with the spine and nearly as long; style short, slender, the apex broadly rounded. (Plate 12, figure 1.) Type Cecid. 29.

Monardia populi Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 98–99; separate, p. 2 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was taken on the large-toothed poplar, Populus grandidentata, at Albany, N. Y., June 4, 1906.

Male. Length 1 mm. Antennae extending to the second abdominal segment, dark brown, sparsely long haired; 14 segments, the fifth with a stem one-third the length of the subcylindric enlargement; terminal segment obconic, the apex slightly produced. Palpi; the first segment stout, broadly expanded distally, the second more slender, one-half longer, the third a little longer than the second, the fourth one-half longer than the third. Mesonotum dark brown. Scutellum and postscutellum a little lighter. Abdomen dark brown, very sparsely clothed with fine, yellowish hairs. Wings hyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres whitish transparent. Legs a nearly uniform light slaty brown, claws stout, strongly curved, pectinate. Genitalia; basal clasp segment stout, obliquely truncate; terminal class segment stout, greatly expanded distally. Dorsal plate broad, broadly rounded. Harpes stout, expanded distally, the posterior margin slightly excavated, the internal angle produced as a short, acute spine; style stout, short, slightly expanded, broadly and roundly excavated. (Plate 13, figure 1.) Type Cecid. 115.

Monardia balsamicola Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 99; separate, p. 3 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was taken on balsam, Abies balsamea, at Lake Clear, N. Y., June 7, 1906.

Male. Length .75 mm. Antennae nearly as long as the body, dark brown, sparsely long haired; 14 segments, the fifth with a stem one-half the length of the subglobular basal enlargement; terminal segment subconical. Palpi; the first segment subglobular, second as long as the first, suboval, the third a little more slender, as long as the second, the fourth more than twice the length of the third. Mesonotum, scutellum, postscutellum and abdomen nearly uniform dark brown. Wings hyaline, costa light brown, subcosta

uniting with the margin at the basal half; halteres whitish transparent. Legs nearly uniform straw brown; claws stout, strongly curved, pectinate. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment greatly enlarged and broadly rounded. Dorsal plate about one-half the width of the entire segment, broadly rounded. Harpes stout, subtriangular basally, broadly and roundly excavated laterally at the posterior third, apically broadly rounded internally and with a conspicuous beak at the external posterior angle. (Plate 12, figure 2.) Type Cecid. 145.

Monardia barlowi Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316 (Campylomyza)

This species was taken May 2, 1904 by Prof. John Barlow at Kingston, R. I. Apparently the same species has been taken at Aweme, Manitoba, N. W. T., and at Hazleton, Pa.

Male. Length 1.5 mm. Antennae extending to the third abdominal segment, thickly long haired, dark brown; 14 segments, the fifth with a stem three-fourths the length of the subcylindric basal enlargement; terminal segment reduced, irregularly obtuse distally. Palpi; the first segment short, stout, irregularly oval, the second a little longer, subrectangular, the third a trifle longer, more slender, the fourth one-half longer than the third, more slender. Mesonotum dark brown, submedian lines sparsely clothed with fine, yellowish hairs. Scutellum dark brown. Abdomen reddish brown, rather thickly clothed with yellowish hairs. Wings hyaline, costa light brown, subcosta uniting with the margin just beyond the basal half. Halteres and legs a nearly uniform fuscous yellowish, the distal tarsal segments somewhat darker; claws short, stout, strongly curved, denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, a conspicuous lobe at the internal distal angle, terminal clasp segment narrowed and prolonged at the base, swollen distally, broadly rounded; dorsal plate broad, broadly rounded. Harpes apparently consisting of two subrectangular, irregular plates with the internal and distal margins, the latter strongly excavated, heavily chitinized. Type Cecid. 798.

Monardia tuckeri Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316 (Campylomyza)

This species was taken in November 1907 at Plano, Texas, by Mr E. S. Tucker.

Male. Length 1.25 mm. Antennae longer than the body, sparsely haired, dark brown; 14 segments, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, tapering, obtuse. Palpi; the first segment short, stout, irregularly oval, the second as long as the first, slender, the third a little longer and stouter than the second, the fourth one-half longer and more slender

than the third. Entire body a nearly uniform dark brown. Wings hyaline, costa light brown; subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, light fuscous apically. Legs a light yellowish brown, the distal tarsal segments somewhat darker; claws long, slender, strongly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, the internal distal angle produced as a long, roundly tapering process; terminal clasp segment short, stout, greatly dilated near the basal third, broadly rounded. Dorsal plate long, stout, broadly rounded. Harpes short, broad, each with a pair of long retrorse spines; style long, slender, subacute. Type Cecid. 1259.

Monardia lignivora Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 100; separate, p. 4 (Campylomyza)
1908 ———— N. Y. State Mus. Bul. 124, p. 314, 315 (Campylomyza)
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44 (Campylomyza)

Many larvae and a number of adults of this interesting form were taken September 21, 1906 in the fungus-affected heartwood of an 18 inch hard pine, Pinus rigida, at Davidson's River, N. C. The tree had been cut into the 20th of the preceding July for the purpose of observing the progress of a fungus affection. This undoubtedly gave the gnats an opportunity to enter and at the time of their discovery they had worked their way among the spongy tissues. The flies had probably oviposited in crevices and galleries a considerable distance from the cut surface. Larvae, pupae and adults were found in the affected wood at least three inches above the cut and fully two inches behind the deepest part. The affected wood, either as the result of fungous attack or because of the operations of the Cecid larvae, was quite spongy and contained numerous lenticular cavities. It was well charged with pitch. The Dipterous larvae appeared to erode the smooth surface of the wood, even that apparently hard and sound and, as a result, produced quantities of very fine, yellowish wood powder. Full-grown larvae to the number of fifteen to twenty were taken in a smooth channel about 6 mm in diameter and 5 cm long. Other larvae occurred singly and the same was true of pupae. Exuviae or pupal skins were so numerous on portions of the cut surface as to literally cover it, especially the more spongy portions.

Larva. Length 6 mm, slender, light salmon. Head small; antennae stout, apparently uniarticulate; breastbone stout, well developed, tridentate, the median tooth largest, the shaft slender, slightly expanded distally. Skin nearly smooth; the segments posteriorly with transverse rows of minute spines as in Miastor larvae. Terminal segment broadly rounded. (Plate 13, figure 4.)

Pupa. Length 5 mm. The head and thorax are reddish or dark brown, the abdomen a light salmon.

Exuviae. Length 3.5 mm, pale whitish; antennal cases short, stout; cephalic horns very slender; wing cases extending to the second abdominal segment; leg cases to the third and fourth abdominal segments. Abdomen dorsally, thickly ornamented with minute, chitinous points; posterior extremity reduced, narrowly rounded.

Male. Length 1.3 mm. Antennae extending to the fourth abdominal segment, sparsely long haired, light brown; 16 segments, the fifth pyriform, with a stem one-third the length of the enlargement; terminal segment reduced. Palpi yellowish, the first segment subglobular, second and third subequal, subquadrate, the fourth one-half longer than the preceding. Mesonotum black, sparsely clothed with short, fine, silvery hairs, laterally with a few long, black hairs, submedian lines indistinct. Scutellum and postscutellum dark brown. Abdomen dark red, the dorsal sclerites slightly ferruginous, sparsely clothed with short setae. Genitalia very dark brown. Wings subhyaline, costa dark brown, subcosta uniting with the margin at the basal third; halteres fuscous basally, yellowish apically. Legs a nearly uniform fuscous yellowish, claws heavy, slightly curved, simple. Genitalia; basal clasp segment broad, short; terminal clasp segment short, swollen at the middle. Dorsal plate large, triangular, tapering; ventral plate smaller, angulate, deeply emarginate, the lobes widely separated, acute and with conspicuous lateral prolongations at the basal half.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, densely yellow-haired, yellowish brown; 21 segments, the fifth subsessile, nearly disc-shaped. Palpi yellowish, the first segment short, subquadrate, second and third subequal, elongate oval, the fourth a little longer. Color practically as in the male. Ventrally near the middle of the eighth abdominal segment, there is a pair of submedian irregular, trumpet-shaped organs. Ovipositor triarticulate, terminal lobe orbicular. Type Cecid. a1614.

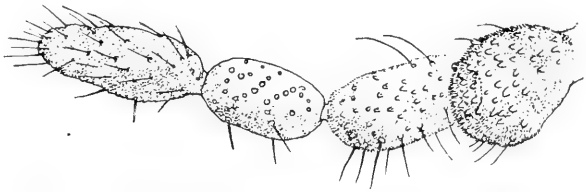


Fig. 55 Palpus of Monardia lignivora, enlarged. (Original)

Monardia articulosa Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This unique species from the United States National Museum, was taken in the White mountains by Morrison.

Female. Length 2.5 mm. Antennae extending to the base of the abdomen, thickly haired, reddish brown; 22 segments, the fifth subsessile, subglobose; terminal segment produced, a knob apically. Palpi; the first segment, somewhat produced, pyriform, the second

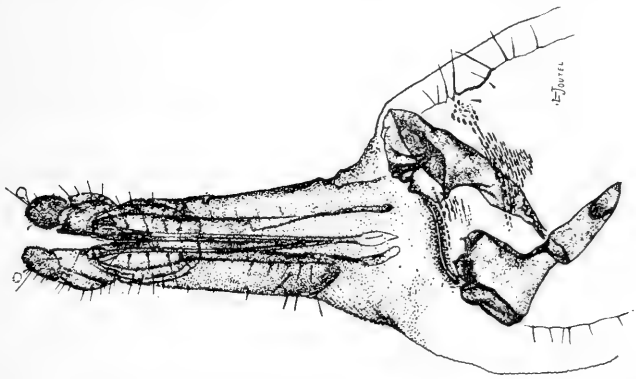


Fig. 56 Apex of abdomen, showing submedian ventral organs and ovipositor of Monardia lignivora, enlarged. (Original)

stout, narrowly oval, the third a little longer than the second, more slender, the fourth one-half longer than the third, more slender. Mesonotum dark brown. Abdomen light brown. Wings rather long, broad, hyaline, costa dark brown, subcosta uniting with the margin near the basal third. Coxae and femora fuscous yellowish, tarsi light yellowish; claws long, slender, strongly curved, simple, the pulvilli nearly as long as the claws. Ovipositor short, the venter of the seventh segment with a pair of submedian, subglobose organs; terminal lobes triarticulate; the third segment long, tapering to a narrowly rounded apex. Type Cecid. 884.

Bryomyia Kieff.

1896 **Kieffer, J. J.** Mis. Ent., 4:7, 15
1895 ———— Soc. Ent. Fr. Bul., p. 318
1897 ———— Syn. Cecid. Eur. & Alg., p. 49
1900 ———— Soc. Ent. Fr. Ann., v. 69, pl. 17, fig. 6
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

Members of this genus have the claws bent at right angles and distinctly enlarged near the distal third. The pulvilli are very long, straight, and the flagellate antennal segments are each provided with a long stem in both sexes. The typical species has 10 segments in the female and 14 in the male, those of the latter eccentric and ornamented with crenulate whorls. The terminal antennal segments of the female, as illustrated by Kieffer, are subconical, with several irregular subbasal whorls of short, stout setae and subapically a pair of stout, chitinous, reniform appendages on either

side of the segments. The palpi are quadriarticulate and the anterior border of the wing is continued to a point near the fourth vein. The terminal clasp segment of the male is short, swollen and obtuse apically. Type B. bergrothi Kieff. Representatives of this genus are not known to occur in America.

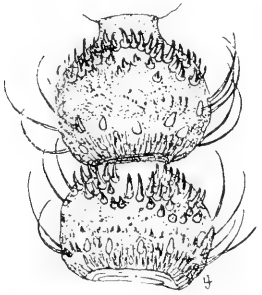


Fig. 57 Fourth and fifth antennal segments of Cordylomyia brevicornis, enlarged. (Original)

Cordylomyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

This genus is represented by a series of species with short antennae and is most easily recognized, especially in the female, by the subapical, frequently thick whorls of short, stout, occasionally recurved spines. These organs are less apparent in the male, though rudiments of a whorl may be seen in at least one species placed in this group. The type of this genus is C. coprophila Felt.

Key to species

a 11 subsessile antennal segments; females
b Subcosta uniting with the margin at the distal third
c Length 2 mm; abdomen fuscous yellowish, unicolorus; fifth antennal segment subglobose, short haired..bryanti Felt, C. 796
cc Length 1 mm; abdomen fuscous yellowish, reddish basally; fifth antennal segment pyriform, rather slender, long haired.....sylvestris Felt, C. a1620
ccc Length 1.5 mm; abdomen reddish brown; antennal segments stout luna Felt, C. 547
bb Subcosta uniting with the margin at the basal half
c Fifth antennal segment cylindric, with a length three-fourths its diameter
d Length 2 mm; eleventh antennal segment about the same length as the tenth; fourth palpal segment slender.....brevicornis Felt, C. 725, 756, 882, 889, 1229
dd Length 2.5 mm; eleventh antennal segment nearly twice the length of the tenth, strongly constricted near the middle; fourth palpal segment swollen apically.....tumida n. sp., C. 1216
cc Length 1 mm; fifth antennal segment cylindric, with a length one-fourth greater than its diameter..coprophila Felt, C. 890
ccc Length 2 mm; fifth antennal segment cylindric, with a length twice its diameter.....coloradensis n. sp., C. 1386, 1387
aa 12 antennal segments, subsessile; females

b Length 1 mm; scutellum reddish brown; abdomen fuscous yellowish ..... versicolor Felt, C. 617

bb Length 2 mm; scutellum dark brown; abdomen fuscous yellowish ..... americana n. sp., C. 887

bbb Length 1.25 mm; scutellum and abdomen dark brown..... kasloensis Felt, C. 881

aaa 14 antennal segments, male

b Fifth antennal segment with a stem three-fourths the length of the basal enlargement, length 1.25 mm; abdomen a variable brown.....coprophila Felt, C. 890

bb Fifth antennal segment with a stem one-fourth longer than the basal enlargement; length 1.5 mm; abdomen dark brown..... coloradensis n. sp., C. 1386, 1387

Cordylomyia bryanti Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313 (Campylomyza)

This species was taken August 18, 1905, at Little River, Newfoundland, by Mr Owen Bryant.

Female. Length 2 mm. Antennae scarcely extending to the base of the abdomen, thickly fine haired, dark brown; 11 segments, the fifth subglobose, subsessile; terminal segment produced, constricted at the distal third, subacute apically. Mesonotum dark reddish brown, the submedian lines sparsely clothed with fine hairs. Scutellum apparently yellowish brown. Abdomen a fuscous yellowish, sparsely clothed with very fine, yellowish hairs. Wings hyaline, costa reddish brown, subcosta uniting with the margin at the distal third. Halteres yellowish basally, fuscous brown apically. Legs a nearly uniform fuscous yellowish, the distal tarsal segments darker; claws long, stout, strongly curved, minutely denticulate, the pulvilli longer than the claws; ovipositor short, the terminal lobes triarticulate, the third segment narrowly oval. (See plate 11, figure 5.) Type Cecid 796.

Cordylomyia sylvestris Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 97; separate, p. 1 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 313 (Campylomyza)

This species was taken on the window of a woodland hut at Davidson's River, N. C., September 23, 1906.

Female. Length 1 mm. Antennae extending to the base of the abdomen, sparsely haired, yellowish; 11 segments, the fifth pyriform; the last segment compound. Palpi; the basal segment subpyriform; the second and third subequal, the fourth as long as the two preceding. Face fuscous. Mesonotum reddish brown, submedian lines indistinct. Scutellum lighter, postscutellum dark brown. Abdomen dull yellowish with the basal segment reddish,

the distal ones dark brown. Wings hyaline, costa dark brown, subcosta uniting with the margin at the apical third. Halteres yellowish basally, fuscous apically. Legs fuscous yellowish, first tarsal segment longer than the following two, others successively shorter; claws heavy, strongly curved, finely serrate. Ovipositor moderately long, terminal lobes consisting of a subquadrate basal segment and an orbicular distal one. Type Cecid. a1620.

Cordylomyia luna Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 313 (Campylomyza)

This species was taken on a hotel window at Westfield, N. Y., July 11, 1906.

Female. Length 1.5 mm. Antennae very short, sparsely haired, dark brown, 11 segments; the fifth subsessile, subcylindric, with a length three-fourths its diameter; the eleventh segment constricted near the middle and with a broad, rounded process apically. Palpi; the first segment short, subglobose; the second narrowly lanceolate, the third a little stouter, subequal, the fourth nearly twice the length of the third, curved distally. Mesonotum dark brown, submedian lines lighter, sparsely haired. Scutellum and postscutellum dark brown. Abdomen a nearly uniform reddish brown, sparsely clothed with fine setae. Wings hyaline, costa dark brown, subcosta uniting with the margin near the middle. Halteres fuscous brown, legs a nearly uniform dark fuscous yellowish, the distal tarsal segments dark brown; metatarsus more than twice the length of the following segment; claws stout, strongly curved, simple; the pulvilli longer than the claws. Ovipositor short, triarticulate, the third segment nearly orbicular. Type Cecid. 547.

Cordylomyia brevicornis Felt

1907 **Felt, E. P.** N. Y. State Mus. Bul. 110, p. 97; separate, p. 1 (Campylomyza)

1908 ———— N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species appears to be a very common and widely distributed form, since it was taken in July and August 1906 on a window at Nassau, N. Y., and appears to have been collected by H. G. Dyar at Kaslo, B. C. There are specimens in the National Museum from Jacksonville, Fla.

Female. Length 2 mm. Antennae one-fourth the length of the body, thickly haired, reddish brown; 11 segments, the fifth subcylindric, the length hardly equaling the diameter. Palpi; the first segment subglobular, second and third segments narrowly oval, subequal, fourth nearly twice the length of the third. Mesonotum dark brown, submedian lines indistinct. Scutellum and postscutellum dark reddish brown. Abdomen reddish brown, membrane and

pleurae dark salmon, ovipositor dark brown. Wings hyaline, costa reddish brown, subcosta uniting with the margin at the basal half; halteres pale reddish brown. Legs dark reddish brown, tarsi

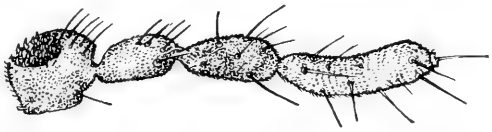


Fig. 58 Palpus of Cordylomyia brevicornis, enlarged. (Original)

lighter, distal segments dark brown; claws moderate, strongly curved, minutely denticulate. Ovipositor moderately long, terminal lobes triarticulate. Type Cecid. 756.

Cordylomyia tumida n. sp.

This species was taken on a window at Albany, N. Y., June 25, 1907.

Female. Length 2.5 mm. Antennae not extending to the base of the abdomen, thickly haired, dark brown; 11 segments, the fifth subsessile, subglobose, with a length three-fourths its diameter; terminal segment produced, slightly constricted near the middle, obtuse apically. Palpi; the first segment irregularly subglobose, second one-half longer than the first, much more slender, the third a little shorter and stouter than the second and the fourth fully twice as long as the third, strongly flattened and somewhat expanded distally. Mesonotum dark brown, the submedian lines indistinct. Scutellum reddish brown, postscutellum a little darker. Adbomen brown, the incisures and pleurae a variable orange or yellowish. Wings hyaline, costa light brown, subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, fuscous apically. Legs fuscous yellowish, the tarsi variably tinted with carmine; claws long, slender, strongly curved, finely denticulate, the pulvilli longer than the claws. Ovipositor short, triarticulate, the basal segment subquadrate, the second subtriangular, the third irregularly orbicular. Described from an alcoholic specimen. Type Cecid. 1216.

Cordylomyia coprophila Felt

1909 **Felt, E. P.** Ent. Soc. Ont. 39th Rep't, p. 44 (MS) (Campylomyza)
1911 ———— N. Y. Ent. Soc. Jour., 19:35

This small species was reared from manure at Washington, D. C., January 28, 1882.

Male. Length 1.25 mm. Antennae longer than the body, thickly haired, light brown; 14 segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length about three-fourths its diameter; a thick subbasal whorl

of setae and on the apical half, 3 crenulate whorls, the distal 2 rudimentary; apically an irregular group of stout, curved, chitinous spines; terminal segment reduced, narrowly oval. Palpi; the first segment stout, with a length about twice its diameter, the second about three-fourths the length of the first, narrowly oval, the third a little longer and more slender and the fourth longer, strongly flattened, dilated. Mesonotum dark brown. Scutellum reddish brown. Abdomen a variable brown, the segments narrowly margined posteriorly with dark brown. Wings hyaline, costa light brown, subcosta joining costa near the basal half, the third vein just before the apex, the fourth just beyond the apex; the fifth unites with the posterior margin near the distal third, its branch at the basal third; crossvein at the distal third of subcosta. Legs fuscous yellowish; claws long, stout, strongly curved, simple, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment stout, slightly swollen near the middle, very broadly rounded apically; dorsal plate short, broad, broadly rounded. Harpes with an apical group of 5 or 6 short, stout, recurved spines. (Plate 13, figure 3.)

Female. Length 1 mm. Antennae thickly haired, fuscous yellowish; 11 segments, the fifth subsessile, the enlargement cylindric, with a length one-fourth greater than its diameter; subbasal whorl sparse, the subapical band of setae short, scattering, covering the distal half; terminal segment produced, slightly constricted near the middle, broadly rounded apically. Mesonotum dark brown. Scutellum fuscous yellowish, postscutellum dark brown. Abdomen fuscous yellowish, dark brown distally. Legs light yellowish brown. Ovipositor short, the terminal lobes probably triarticulate. Type Cecid. 890.

Cordylomyia versicolor Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 314 (Campylomyza)

This species was taken on tick trefoil, Desmodium grandiflorum, at Albany, N. Y., July 17, 1906.

Female. Length 1 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, fuscous basally; 11 segments, the fifth pyriform; the last two segments fused, the distal one subfusiform. Palpi; the first segment stout, rather long, swollen distally, the second a little longer, more slender, the third fusiform; face dark brown. Mesonotum dark brown, submedian lines indistinct. Scutellum reddish brown, postscutellum and abdomen fuscous yellow, the latter dark brown apically, sparsely clothed with pale yellowish hairs. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal third; halteres yellowish basally, fuscous apically. Legs a nearly uniform straw brown; claws long, strongly curved, apparently with a short, stout tooth basally. Ovipositor short, the terminal lobes with a stout basal subquadrate portion and a distal narrowly oval lobe. Type Cecid. 617.

Cordylomyia americana n. sp.

This species was taken at Boulder, Col., October 15th by Prof. T. D. A. Cockerell.

Female. Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, at least 9, probably 12 segments, the fifth subsessile, subcylindric, with a length one-half greater than its diameter. Palpi; the first segment greatly swollen, broadly rounded, the second a little shorter than the first, narrowly oval, the third a little longer than the second and the fourth nearly twice the length of the third, rather strongly flattened. Mesonotum dark brown. Abdomen a fuscous yellowish green, darker distally. Wings hyaline, costa light brown, subcosta uniting with the margin just before the middle. Legs a variable fuscous yellowish; claws long, slender, strongly curved, minutely denticulate, the pulvilli as long as the claws. Ovipositor short, the terminal lobe short, stout, triangular, narrowly rounded distally. Type Cecid. 887.

Cordylomyia kasloensis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. p. 314 (Campylomyza)

This species was taken by Mr R. P. Currie June 11, presumably 1903, at Kaslo, B. C.

Female. Length 1.25 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown; 12 segments, the fifth pyriform, with a length three-fourths the diameter. Palpi; the first segment short, stout, greatly dilated apically, pyriform, the second one-half longer than the first, slender, the third a little longer and more slender than the second. Body a nearly uniform dark reddish brown. Wings hyaline, costa dark brown, subcosta uniting with the anterior margin near the basal half. Legs fuscous yellowish, tarsi darker; claws long, slender, strongly curved, simple, pulvilli as long as the claws. Ovipositor short, triarticulate, the basal segment irregularly ovoid, the second elongate, triangular, the third broadly oval. Type Cecid. 881.

Cordylomyia coloradensis n. sp.

This species was taken on a window in October 1910 by Prof. T. D. A. Cockerell at Boulder, Col.

Male. Length 1.5 mm. Antennae a little longer than the body, sparsely haired, dark brown; 14 segments, the fifth with a stem one-quarter longer than the pyriform enlargement, which latter has a length a little greater than its diameter; terminal segment conical, with a length twice its diameter, not fused with the preceding. Palpi; the third segment with a length about three times its width, the fourth one-half longer. Mesonotum, scutellum, postscutellum and abdomen a nearly uniform dark brown. Costa light brown,

subcosta uniting therewith at the basal half. Halteres yellowish transparent. Coxae dark brown; femora, tibiae and tarsi mostly fuscous yellowish, the distal tarsal segment darker; claws stout, strongly curved, notched subapically, the pulvilli nearly as long as the claws. Genitalia; basal clasp segment stout, obliquely truncate; terminal clasp segment long, broadly rounded, dorsal plate short, broadly emarginate, the lobes subtruncate. Harpes stout, bidentate.

Female. Length 2 mm. Antennae extending to the second abdominal segment, rather thickly haired, reddish brown; 11 segments, the fifth subsessile, with a length about twice its diameter; eleventh segment distinctly constricted beyond the middle, evidently composed of two, the distal portion being narrowly oval. Palpi; first segment greatly swollen, irregularly oval, the second with a length over twice its width, the third as long as the second, subtruncate distally, the fourth one-half longer than the second. Mesonotum dark brown. Scutellum reddish brown, postscutellum concolorous. Abdomen sparsely haired, fuscous yellowish, the ovipositor slightly fuscous. Costa dark brown. Halteres yellowish transparent, slightly fuscous apically. Coxae dark brown; femora and tibiae fuscous straw, the second, third and fourth tarsal segments lighter, the fifth reddish brown, the eighth abdominal segment ventrally with a pair of submedian, subglobose bodies. Ovipositor short, triarticulate, the third segment orbicular. Type Cecid. 1386, 1387.

Corinthomyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:35

This group represents a form of specialization most easily recognized by the series of subequal whorls of stout, curved setae on the subsessile, flagellate segments, differing very greatly from the typical crenulate whorls so commonly present in Campylomyzine males. The venation is typical of Campylomyza. The pulvilli are as long as the claws. Males only are known. The type species is Campylomyza hirsuta Felt.

Key to species

a Fifth antennal segment with a length one-half greater than its diameter

b Length 1.25 mm; abdomen reddish brown; 6 short, stout whorls hirsuta Felt, C. 729

bb Length 1.5 mm; abdomen reddish brown, 4 to 5 short, stout whorls gracilis Felt, C. 1406

bbb Length 2 mm; abdomen reddish brown; 7 short, stout whorls..... cincinna n. sp., C. 1220

aa Fifth antennal segment with a length three-fourths greater than its diameter

b Length 1 mm; abdomen dark brown; 5 short, stout whorls..... currei Felt, C. 881a

Corinthomyia hirsuta Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species was taken on an office window at Albany, N. Y., August 1, 1906.

Male. Length 1.25 mm. Antennae shorter than the body, sparsely haired, dark brown, 14 segments; the fifth with a stem one-fourth the length of the subglobose enlargement, subbasal whorl thick, 6 nearly equidistant whorls of stout, strongly curved setae; terminal segment reduced, pyriform. Palpi; the first segment subglobose with a conspicuous sense organ subbasally, the second a little longer, subrectangular, the third somewhat longer, slender at the base, the fourth one-half longer than the third. Mesonotum dark brown, submedian lines indistinct. Scutellum and postscutellum dark reddish brown. Abdomen dark brown. Wings hyaline, costa light brown, subcosta uniting with the margin at the basal half. Halteres pale yellowish basally, fuscous apically; legs mostly a uniform light brown; claws long, slender, strongly curved; pulvilli a little longer. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment strongly constricted at the base, greatly enlarged and broadly oval distally. Dorsal plate apparently very long, broad, broadly and irregularly rounded. Type Cecid. 729.

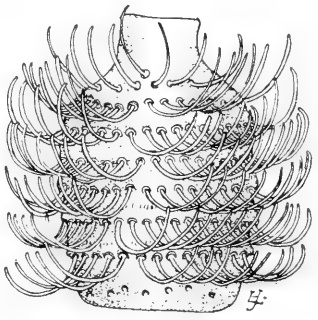


Fig. 59 Fourth antennal segment of Corinthomyia cincinna, enlarged. (Original)

Corinthomyia gracilis Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:102–3

This species was taken at Hazelton, Pa., May 18, 1910 by Dr W. G. Dietz. Type Cecid. 1405.

Corinthomyia gracilis Felt

This species was taken on an office window at Albany, N. Y., July 5, 1907.

Male. Length 2 mm. Antennae nearly as long as the body, sparsely haired, dark brown; 14 segments, the fifth subsessile, with a stem one-fifth the length of the subcylindric basal enlargement, which latter has a length one-half greater than the diameter; seven equidistant, thickly set, crenulate whorls; terminal segment prolonged, with a length fully twice its diameter. Palpi; the first segment short, stout, broadly oval, with a distinct sense organ internally, the second more slender, one-half longer, the third a little longer than the second and the fourth one-half longer than the third,

dilated apically; face thickly clothed with grayish setae. Mesonotum dark brown, shining. Scutellum reddish brown, postscutellum a little darker. Abdomen brownish yellow, genitalia fuscous. Wings hyaline, costa light brown; subcosta uniting with the anterior margin near the basal half. Halteres yellowish basally, fuscous apically. Legs a fuscous straw; claws rather long, slender, strongly curved, the concavity finely denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment short, stout, greatly swollen near the distal fourth, obtusely rounded apically. Type Cecid. 1220.

Corinthomyia currei Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 315 (Campylomyza)

This species, studied through the courtesy of the United States National Museum, was taken at Kaslo, B. C., by Mr R. P. Currie.

Male. Length 1 mm. Antennae extending to the fourth abdominal segment, thickly haired, dark brown; 14 segments, the fifth with a smooth stem one-fourth the length of the subcylindric basal enlargement, which latter has a length three-quarters greater than its diameter, 5 crenulate whorls; terminal segment slightly produced, narrowly rounded apically. Palpi; the first segment narrowly oval, the second stout, one-half longer, the third about as long as the second, more slender, the fourth one-half longer than the third, somewhat dilated. Body a nearly uniform dark brown. Wings hyaline, costa reddish brown, subcosta uniting with the anterior margin at the basal half. Legs fuscous yellowish; claws long, slender, strongly curved, finely denticulate, the pulvilli longer than the claws. Genitalia; basal clasp segment short, stout, obliquely truncate; terminal clasp segment with a short, narrow neck, greatly swollen apically, the inner face flattened, greatly dilated and produced basally to form a distinct angle; dorsal plate long, extremely broad, the posterior margin produced mesially. (Plate 13, figure 2.) Type Cecid. 881a.

HETEROPEZINAE

This subfamily comprises a number of exceedingly peculiar forms, some of them most remarkable on account of the great degree of specialization by reduction. Members of this heteromorphic group may be separated from the Itonididinae by the absence of circumfili, and from the Lestremiinae by the great reduction in venation, there being at most, four (rarely over three) long veins. The metatarsus may be longer than the following segment, while the number of tarsal segments may be reduced to two. Certain species have quinquearticulate tarsi and the wing membrane thickly clothed with rather broad, striate scales. Others have the wing membrane hyaline and clothed with short, erect hairs, quite distinct from the

long, appressed ones found in the Itonididinae. The ocelli are wanting. The Heteropezinae, like the Lestremiinae, appear to depend to a considerable extent upon the olfactory organs.

Nothing was known concerning the life history of our American species till the writer studied several forms. Miastor americana Felt was reared from under bark, in an incipient stage of

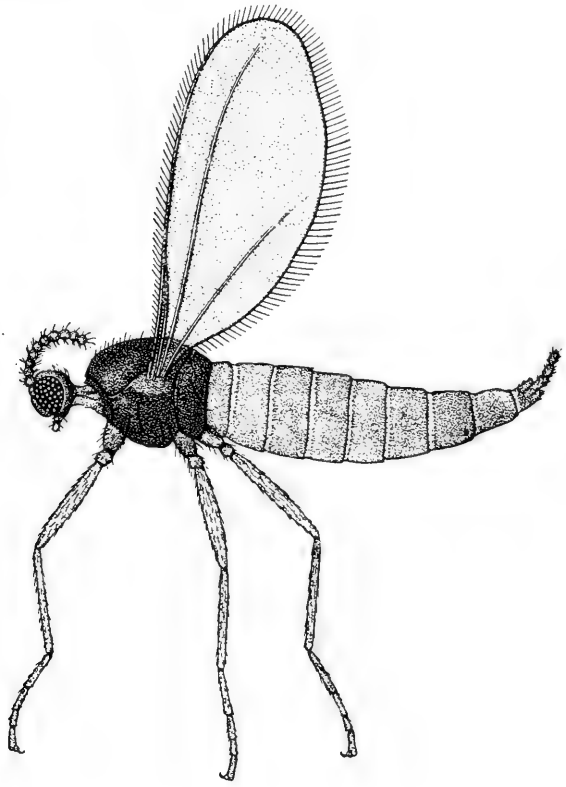


Fig. 60 Miastor americana, side view, enlarged. (Original)

decay from a variety of trees and proves to be rather common and widely distributed in New York State. The larvae of Oligarces ulmi Felt were found abundantly under the decaying bark of elm and numerous midges were reared. Leptosyna quercivora Felt was reared from partially rotten bark of red oak. Epimyia carolina Felt was taken in a woodland hut where there was an abundance of decaying vegetable matter in the vicinity. Two species of Brachyneura have been reared under conditions which

lead us to believe that they may live in galls (possibly as inquilines). The larvae of certain species are extremely interesting biologically, since they reproduce by pedogenesis and are, moreover, very amenable to laboratory conditions.

Key to genera

a Metatarsus longer than the second segment
b Tarsi quadriarticulate
c Three long veins
d Palpi quadriarticulate (amber).....Meunieria Kieff.[1]
dd Palpi triarticulate.....Palaeospaniocera Meun.
ddd Palpi biarticulate.....Miastor Mein.
cc One long vein, wings very narrow.....Neostenoptera Meun.
bb Tarsi triarticulate, 2 long veins
c Antennal segments cylindric.....Heteropeza Winn.[2]
cc Antennal segments globose (amber).....Monodicrana H. Lw.[1]
aa Metatarsus shorter than the 2d segment
b Tarsi quinquearticulate
c Wing membrane finely haired
d Third vein extending to the apex of the wing
e Palpi biarticulate.....Frirenia Kieff.
f Fifth vein forked.....Haplusia Karsch
ff Fifth vein simple.....Johnsonomyia Felt[3]
ee Palpi triarticulate, wings acuminate.....Meinertomyia Felt
eee Palpi uniarticulate, wings acute apically.....Leptosyna Kieff.
dd Third vein not extending to the apex of the wing
e Palpi biarticulate.....Frirenia Kieff.
ee Palpi triarticulate.....Epimyia Felt
cc Wing membrane scaled
d Fifth vein forked, palpi quadriarticulate (amber).....
Ledomyiella Meun.
dd Fifth vein simple
e Four simple long veins, palpi biarticulate, antennal segments stemmed in the female.....Kronomyia Felt
ee Three simple long veins, palpi triarticulate.....
Brachyneura Rond. (Spaniocera Winn.)
bb Tarsi biarticulate.....Oligarces Mein.

[1] Location provisional.

[2] Messrs Kunstler and Chaine in Comptes Rendus Hebdomadaires des Séances et Mémoires de la Société de Biologie, 1902, v. 54, p. 535, give the characters of a form reared from bananas as follows: Tarsi biarticulate, the first segment longer than the second; wings with two or three long veins, the two first branched; palpi quadriarticulate. It was referred to the Heteropezinae, though no name was proposed and is presumably related to Heteropeza Winn. and Monodicrana H. Lw.

[3] The Australian Necrophlebia Skuse and Chastomera Skuse are apparently closely related to this American genus and are provisionally associated therewith.

Meunieria Kieff.

1904 **Kieffer, J. J.** Soc. Sci. Brux. Ann., v. 28, pt. 2, separate, p. 42
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This genus was erected by Kieffer for a species from amber designated by Meunier as *Miastor du succin.* It is separated from Miastor by the quadriarticulate palpi. No American forms are known.

Palaeospaniocera Meun.

1901 **Meunier, Fernand.** Soc. Sci. Brux. Ann., pt. 2, 25:191–92
1904 ———— Soc. Sci. Brux. Ann., 28, pt. 2, separate, p. 37
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This genus was erected for an amber species, characterized by having 3 simple long veins, the tarsi quadriarticulate, the metatarsus being more than twice the length of the second segment, which latter is longer than the third and fourth combined. The antennae are composed of 13 cylindric segments, the thirteenth being plainly produced. The body is elongate, ovoid, the thorax slightly gibbous; palpi apparently composed of only 3 segments and the one lobe of the ovipositor plainly evident.

Miastor Mein.

1864 **Meinert, F. R.** Naturhist. Tidsskr., ser. 3, III, 42
1870 **Winnertz, Joh.** Vehr. z.-b. Ges. Wien, 20:5
1876 **Bergenstamm, J. E. & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 15
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:58
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:403
1894 **Kieffer, J. J.** Wien Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 54
1900 ———— Soc. Ent. Fr. Ann., 69:448
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316
1911 ———— N. Y. State Mus. Bul. 147, p. 84
1911 ———— N. Y. Ent. Soc. Jour., 19:36

Members of this genus have the wing membrane finely haired, the 3 long veins simple, the metatarsus quadriarticulate, the first segment being longer than the second. Palpi biarticulate. The generic type is M. metraloas Mein. The genus is probably worldwide or nearly so in its distribution.

Miastor americana Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 5
1908 ———— N. Y. State Mus. Bul. 124, p. 286
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44
1911 ———— Science, 33:302–3

1911 ———— Can. Ent., 43:134–35; same in Science, 33:538; Econ. Ent. Jour., 3:296; Ent. News, 22:227; N. Y. Ent. Soc. Jour., 19:200–1
1911 ———— N. Y. State Mus. Bul. 147, p. 82–104
1911 ———— Econ. Ent. Jour., 4:414
1911 **Wheeler, W. M.** N. Y. Ent. Soc. Jour., 19:201

Prior to 1910 this species was known only through one female taken at Highland June 18, 1907. The interesting larvae of this remarkable form have subsequently been found in the decaying bark of maple, chestnut, oak, birch, beech and hickory at Highland, Tivoli, Nassau and Lake Placid, N. Y., indicating a considerable range for this species. The writer's experience justifies the belief that these insects are rather common under bark, in the incipient stages of decay. Miastor larvae have also been found in Connecticut and Indiana. A variable number of pedogenetic generations may occur in the fall and spring, the appearance of the adult midges being presaged by the development of a breastbone in the larvae, the formation of a prepupa and pupation. An extended discussion of pedogenesis as observed in this species, accompanied by descriptions of the larva and female, may be found in the writer's report for 1910. Stages not previously characterized are described below.

Prepupa. (Pl. 14, fig. 1) Length 1.75 mm. This stage is easily recognized by the apparent contraction and withdrawal of the body contents from the two extremities. The second to fifth segments become greatly enlarged, semitransparent, and on examination under a high power may be seen to contain the developing thoracic segments and their appendages. The head is much less prominent, being partially withdrawn into the anterior body segments. The well-developed breastbone is frequently visible, though occasionally obscured and is shed with the prepupal exuvium. The posterior extremity is also semitransparent and in the male distinctly bilobed.

Pupa. Length 1.5 mm; anterior extremity broadly rounded, semitransparent, the thoracic region somewhat larger, the thoracic horns long, slender, curved, the abdomen gradually tapering to a rather obtusely rounded, bilobed extremity. The posterior portion of the thoracic region and most of the abdomen whitish, the latter with a distinct orange tint in the subapical segment; terminal segment somewhat swollen, semitransparent, bilobed. Antennal, wing and leg cases semitransparent, the two latter extending to about the second abdominal segment and all, together with the eyes, gradually becoming infuscated till nearly black just prior to the appearance of the imago. The female pupa may have a length of 2 mm, the abdomen being longer, slender, and when viewed by transmitted light may show 4 or 5 large eggs.

Exuvia. Whitish transparent, the dorsum of the abdominal segments with minute, chitinous points, the structures otherwise practically as in the pupa.

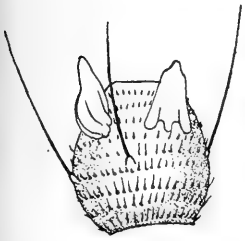


Fig. 61 Fifth antennal segment of Miastor americana, greatly enlarged. (Original)

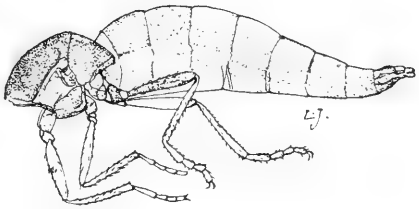


Fig. 62 Side view of thorax, legs and abdomen of Miastor americana. (Original)

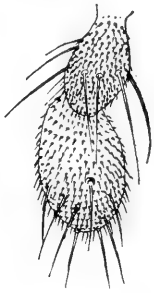


Fig. 63 Palpus of Miastor americana, greatly enlarged. (Original)

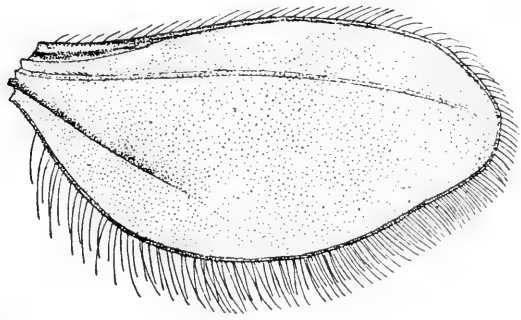


Fig. 64 Wing of Miastor americana, greatly enlarged. (Original)

Male. Length 1 mm. Antennae hardly extending to the base of the thorax, sparsely haired, yellowish or yellowish red; 11 segments, the fifth narrowly oval, with a length one-third greater than its diameter, a sparse whorl of stout setae near the middle and subapically a whorl of several irregular, narrowly triangular processes extending about to the basal fourth of the following segment; terminal segment oval, with a length one-third greater than its diameter. Palpi; first segment subquadrate, second segment oval, both sparsely setose. The vertex and eyes fuscous. Mesonotum yellowish brown. Scutellum brownish red, postscutellum reddish orange. Abdomen deep red; genitalia fuscous. Wings hyaline, costa yellowish basally, the distal half reddish; the feeble subcosta uniting with costa at the basal third, the third vein obsolescent

distally, joining the margin at the apex of the wing; fifth vein simple, obsolete distally. Coxae, femora and tibiae fuscous yellowish, the tarsi tinged with red; claws rather long, evenly curved, simple, the pulvilli about half the length of the claws. Genitalia; basal clasp segment short, stout, obliquely truncate apically; terminal clasp segment short, stout, swollen subapically and with a heavy, chitinous spur at the internal distal angle; dorsal plate apparently short, triangularly emarginate, the lobes broadly rounded and sparsely setose; ventral plate apparently moderately long, stout, broadly rounded and sparsely setose apically; style short, stout, narrowly rounded distally.

Life history. Reproduction by pedogenesis occurs in the fall and early spring, and under certain conditions apparently throughout warm weather, though adults are usually produced from the latter part of May to August. Under favorable conditions it appears probable that pedogenesis may continue indefinitely. A larval generation occupies about 3 to 3½ weeks, much depending upon moisture, food and temperature. The transformations to the adult are preceded by the development of a distinct breastbone, this usually occurring in early May. The change is soon followed by the appearance of the prepupa, characterized by a marked swelling and transparent condition of the anterior body segments of the larva, and in 2 or 3 days by the development of the pupa, a stage lasting about 6 days. The small midges appear in immense numbers during the late morning hours, namely from about 9 a. m. until noon, swarming over the sides of the jar and behaving much like minute ants. There is comparatively little tendency to take wing. The development of adults may continue for several days and the midges may appear in smaller numbers for a period of several weeks. The large eggs, well formed in the abdomen of recently transformed females, are presumably deposited shortly and another succession of larval generations begun.

Natural enemies. Miastor is commonly preyed upon by the pinkish larvae of Lestodiplosis, and it is probable that Itonida pugionis Felt has similar habits. The larger predaceous maggots of Lonchaea polita Loew and a species of Medetrus were commonly found in the vicinity of Miastor colonies and were not infrequently the only available evidence of the earlier presence of midge larvae. Pseudotephritis vau Say was repeatedly reared from bark infested by Miastor larvae. In some instances the Pseudotephritis larvae occurred in clusters. These larvae may be predaceous enemies of the smaller Miastors.

Neostenoptera Meun.

1901 **Meunier, Fernand.** Soc. Sci. Brux. Ann., pt. 2, 25:201 (Stenoptera)
1904 ———— Soc. Sci. Brux. Ann. 28, pt. 2, separate, p. 5
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This genus was erected for a remarkable form found in copal from Africa. It is easily recognized by the extremely narrow, long-fringed wings having but one long vein, which latter unites with the anterior margin near the basal third. The tarsi are quadriarticulate, the metatarsus being nearly as long as the 3 following segments. The head is small, distinct, the palpi invisible. The antennae are apparently composed of 12 segments, the flagellate ones having an elongate, oval, basal enlargement ornamented near the middle with a closely set whorl of long, stout setae apparently resembling those of Johnsonomyia Felt. The stem of the fifth antennal segment is as long as the basal enlargement. Halteres very long. Type Stenoptera kiefferi Meun.

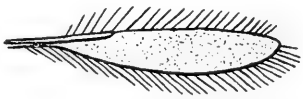


Fig. 65 Wing of Neostenoptera kiefferi, after Meunier

Heteropeza Winn.

1846 **Winnertz, J.** Stett. Ent. Zeit., 7:13–14
1870 ———— Vehr. z.-b. Ges. Wien, 20:4
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 16
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:57
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:401
1894 **Kieffer, J. J.** Wien Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 54
1900 ———— Soc. Ent. Fr. Ann., 69:444
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36
1911 ———— N. Y. State Mus. Bul. 147, p. 84

This genus may be recognized by the 2 simple long veins of the wings terminating at the basal third of the anterior and posterior margins respectively (the wing tip is narrowly rounded, hardly acute); the 3 tarsal segments, the first being the longest, and the 4 palpal segments. Antennal segments in the female 10, sessile, cylindric, and with a length three-fourths the diameter, thickly haired; in the male 11, stemmed; ocelli absent. Ovipositor one-fourth the length of the abdomen, somewhat thickened, the lobes slender, setose. Type H. pygmaea Winn.

Only two species are known, the European H. pygmaea having been reared from the bark of rotting trees, and H. transmarina Schin. recorded as bred from small excrescences on the leaves of Callistemon.

Monodicrana H. Lw.

1850 **Loew, H.** Dipt. Beitr., 4:11–12
1900 **Kieffer, J. J.** Ent. Soc. Fr. Ann., 69:444
1904 **Meunier, Fernand.** Soc. Sci. Brux. Ann., 28, separate, p. 9, 33
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:36

This amber species has been doubtfully referred to the Itonididae, apparently being most closely allied to Heteropeza. Kieffer states that this species has a length of 1.1 mm, the borders of the wings being ciliate and the membrane not hairy; that the moniliform antennae have the funicle composed of 8 globose segments and an oval terminal segment. The tarsi are quadriarticulate. The type is M. terminalis H. Lw.

Haplusia Karsch

1877 **Karsch, F. A. F.** Revis. de Gallmucken, p. 15
1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr., 37:328, 368–69
1896 **Kieffer, J. J.** Wien. Ent. Zeit., 15:91
1900 ———— Soc. Ent. Fr. Ann., 69:448
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 84

This genus was erected for a unique female having at least 11 and possibly 14 antennal segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length three times its diameter and has a short, rather thick basal, and a thick extended distal whorl of long, curved setae; circumfili absent. The palpi are quadriarticulate. The wings have 3 long veins; subcosta with a rudimentary vein at the basal fourth somewhat as in Diallactes. A rudimentary crossvein appears to unite its distal third to the third vein, the latter joining the wing margin probably well beyond the apex. The fifth unites with the margin at the distal third, its branch apparently at the basal half. The fork is therefore very short. The first tarsal segment is short, while the fifth tapers to the small, simple claws with rudimentary pulvilli. The ovipositor is rather short, triarticulate, the terminal segment slender, tapering and sparsely setose.

The above characters are drafted from the type species, H. plumipes Karsch, now in the Berlin Museum of Natural History and very nicely mounted in balsam, thanks to the skill of Professor Rubsaamen. We agree with him in referring this form to the Heteropezinae.

Tetradiplosis Kieff. & Jörg.

1910 **Kieffer, J. J. & Jörgensen, P.** Centrbl. Bakt. Parsit. Insektk., 27:421–23
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

This Argentine genus is tentatively referred to the Heteropezinae because of the total absence of circumfili. It appears to be allied

to the South American Haplusia Karsch from which it is easily separated by the unidentate claws.

Antennae with 14 segments, the cylindric fifth with a length about twice its diameter and a stem not longer than wide. Palpi quadriarticulate, the segments short. Wings long; the supernumerary vein extends beyond the middle of subcosta, which latter unites with costa at the middle of the wing. There appears to be a distinct crossvein, the third vein joining the margin beyond the apex of the wing. Tarsi quinquearticulate; claws fuscous, toothed, the two portions nearly equal and strongly bent; pulvilli wanting. Ovipositor not produced, with 2 gradually tapering lamellae, each about three times as long as broad. The larva is remarkable because of the 6 small, triangular teeth internally on the diverging subtriangular major lobes of the breastbone; shaft well developed. Reared from a stem gall on Prosopis alpataco. Type T. sexdentatus Kieff. & Jörg.

Johnsonomyia Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417
1911 ———— N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 84

This genus was erected for several small forms apparently allied to Colpodia Winn. A closer study of the species, however, shows that circumfili are absent and compels us to refer this genus to the Heteropezinae. The short first tarsal segment, the antennal and alar structures indicate a relationship to Haplusia Karsch, from which it is easily separated by the simple fifth vein. This is a remarkable synthetic form, since the arrangement of the long setae on the antennal segments closely approximate that of the peculiar crenulate whorls in Campylomyza, while the venation alone would lead one to refer it at once to the Epidosariae. Type J. rubra Felt.

This genus appears to be related to the Australian Chastomera Skuse, though the latter is remarkable because of the third vein being widely distant from subcosta.

Key to species

a Abdomen reddish brown, length 4 mm, the fifth antennal segment with a stem one-half longer than the basal enlargement..... rubra Felt, C. 826

aa Abdomen dark brown and yellowish, length 4 mm, the fifth antennal segment with a stem as long as the basal enlargement..... fusca Felt, C. 1237

aaa Abdomen reddish yellow, wings indistinctly banded, length 5 mm, the fifth antennal segment with a length three-fourths the basal enlargement.....cincta Felt

Johnsonomyia rubra Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417

This interesting form and type of the genus was taken at Montpelier, Vt., June 26, 1906 by Prof. C. W. Johnson.

Male. Length 4 mm. Antennae as long as the body, thickly long haired, dark brown; 16 segments, the fifth with a stem one-half longer than the subcylindric basal enlargement, which latter has a length twice its diameter, a subbasal whorl of short, stout, slightly curved setae, near the basal third a thick whorl of closely set, long, strongly curved setae arising from conspicuous tubercles; subapically there is a scattering whorl of similar long setae; terminal segment with the basal portion slightly produced, the stem much reduced, rudimentary. Palpi; the first segment short, stout, subquadrate, the second fully twice the length of the first, expanding distally, the third a little stouter, about as long as the second, the fourth shorter and more slender than the third, the fifth nearly twice the length of the fourth, all sparsely clothed with coarse setae; face fuscous yellowish, eyes rather large, black. Mesonotum dark reddish brown. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen rather thickly clothed with yellowish hairs, reddish brown. Genitalia fuscous yellowish. Wings hyaline, costa reddish brown. Halteres yellowish basally, fuscous apically. Legs a fuscous yellowish, the distal three tarsal segments yellowish white; claws probably simple. Genitalia; basal clasp segment short, stout, slightly rounded externally, somewhat excavated internally, nearly truncate distally; terminal clasp segment very short, stout, greatly swollen basally and tapering distally to a conspicuous, prolonged, denticulate, chitinous process. (See plate 11, figure 6.) Type Cecid. 826.

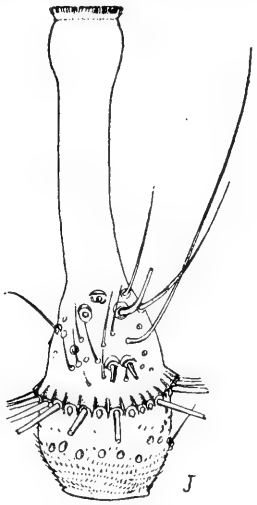


Fig. 66 Fifth antennal segment of Johnsonomyia rubra, enlarged. (Original)

Johnsonomyia fusca Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 417

This species was taken at Albany, N. Y., August 9, 1907.

Male. Length 4 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish; 16 segments, the fifth with a stem as long as the suboval basal enlargement, which latter has a length about twice its diameter, with a conspicuous whorl of long,

stout setae near the middle and numerous setae of variable length clothing the face of the enlargement; terminal segment produced, with a length about five times its diameter and at the distal fourth

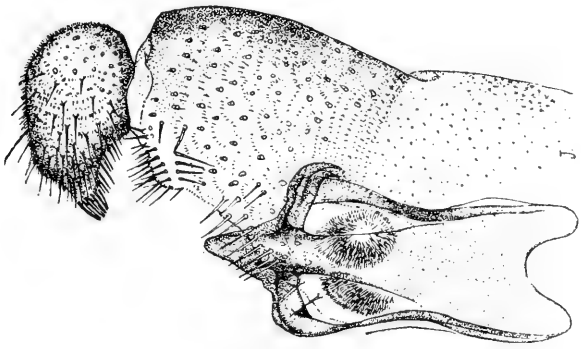


Fig. 67 Portion of male genitalia of Johnsonomyia rubra, enlarged. (Original)

a distinct constriction. Palpi; first segment stout, incrassate, with a length three times its diameter, the second as long as the first, rectangular, the third a little shorter than the second, the fourth slender, with a length more than twice the third. Mesonotum shining brown, the submedian lines rather thickly haired. Scutellum dark brown, postscutellum yellowish brown. Abdomen a variable dark brown and yellowish brown, the dorsum of the first segment and that of the fourth to eighth fuscous yellowish; genitalia fuscous. Wings hyaline, costa dark brown, venation practically as in J. rubra, though the wing is markedly smaller. Halteres yellowish, fuscous subapically; pleurae and coxae a variable fuscous yellowish; femora, tibiae and the 2 basal tarsal segments a dark fuscous yellowish, almost black, the tip of the second tarsal segment, the third and fourth white, the fifth yellow tinted apically; claws rather long, stout, slightly curved, simple, pulvilli rudimentary. Genitalia; basal clasp segment short, stout; terminal clasp segment very short, greatly swollen and with a long, chitinous tooth apically. (Plate 11, figure 7.) Type Cecid. 1237.

Johnsonomyia cincta Felt

1912 **Felt, E. P.** N. Y. Ent. Soc. Jour., 20:103

A large, strikingly colored midge taken on the Polochic river, Guatemala, February 22, 1912, by Messrs Barber and Schwarz.

Chastomera Skuse

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:112
1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr., 37:333
1900 **Kieffer, J. J.** Soc. Ent. Fr. Ann., 69:448
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

This Australian genus was erected for the reception of a female having 16 stemmed antennal segments and 4 palpal segments. Like Haplusia, the third vein unites with the margin well beyond the apex and is joined to subcosta by a long distinct crossvein; the fifth vein is simple, uniting with the posterior margin near the basal half. The type species, C. b e l l a Skuse, is characterized as having almost pyriform flagellar segments, the stem being nearly as long as the basal enlargement, the latter with numerous whorls of hairs, the basal whorl much longer than the rest.

Necrophlebia Skuse

1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc. S. 2, 3:111, pl. 2, fig. 10
1892 **Rubsaamen, E. H.** Berl. Ent. Zeitschr., 37:332 (quotes Skuse)
1900 **Kieffer, J. J.** Ent. Soc. Fr. Ann., 69:449 (quotes Skuse)
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37

The female of this Australian genus has the antennae about half the length of the body. There are 14 segments, each with a stem one-half the length of the subcylindric basal enlargement, which latter has 2 sparse whorls of hairs. Palpi quadriarticulate. The illustration shows the wing to be rather broad, subcosta uniting with costa well before the basal half, a distinct, somewhat oblique crossvein, the third a little beyond the apex, while the simple fifth joins the posterior margin near the basal half. This genus appears to be closely related to Johnsonomyia Felt. The 2 genera agree in major characters and it is possible that further study may prove our American forms cogeneric with this Australian species. Type N. v o l i t a n s Skuse.

Meinertomyia Felt

1870 **Meinert, F. R.** Naturhist. Tidsskr., ser. 3., 6:463 (Pero)
1876 **Bergenstamm, J. E. & Löw, Paul.** Syn. Cecidomyidarum, p. 24 (Pero)
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 15 (Pero)
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:328, 369 (Pero)
1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201 (Pero)
1898 ———— Synop. Cecid. Eur. & Alg., p. 54 (Pero)
1900 ———— Soc. Ent. Fr. Ann., 69:448 (Pero)
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus may be recognized by the 3 long veins and the finely haired membrane of the acuminate wings, in connection with the 5 tarsal segments, the metatarsus being shorter than the preceding. It is separated from Leptosyna Kieff. by the triarticulate palpi. Pero Mein. is preoccupied by Pero H. Schf.

Type and sole species P e r o f a s c i a t a Mein., the larvae of which occur under the bark of hornbeam and reproduce by pedogenesis. European.

Leptosyna Kieff.

1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201, 209–11
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus has 3 simple long veins, the third attaining the tip of the wing, the wing membrane finely haired, tarsi, quinquearticulate, the metatarsus shorter than the second segment. It may be separated from Meinertomyia Felt by the uniarticulate palpi. Antennal segments in the female 12, in the male 13. Type L. acutipennis Kieff.

Leptosyna quercivora Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:546 (L. quercus)
1912 ———— N. Y. State Mus. Bul. 155, p. 123 (new name)
1913 **Kieffer, J. J.** Marcellia, 11:235 (L. quercicola)

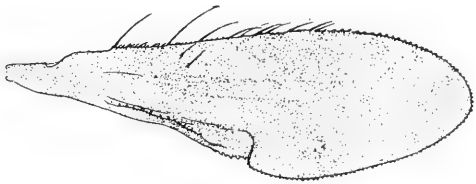


Fig. 68 Wing of Leptosyna quercivora, enlarged. (Original)

This slender, yellowish midge was reared April 20, 1911 from partially rotten bark of red oak, Quercus rubra, collected at Nassau, N. Y., the preceding fall on account of its being infested

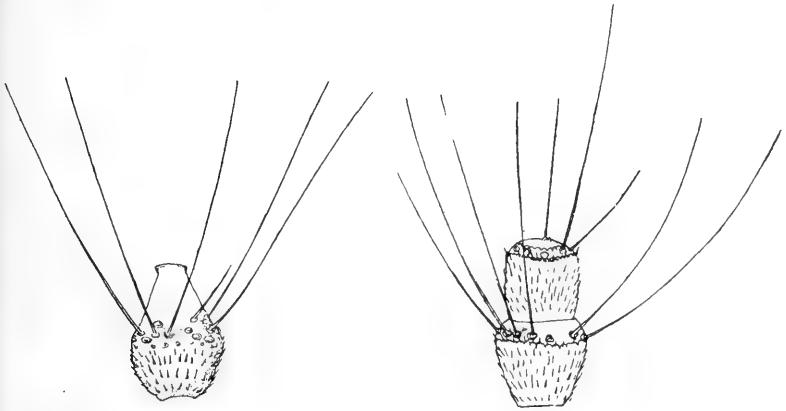


Fig. 69 Seventh and distal two antennal segments of Leptosyna quercivora, enlarged. (Original)

with yellowish Sciara larvae. The larva of this midge was not seen. This species is closely allied to L. a m e r i c a n a from which it is most easily separated by the relatively longer twelfth and thirteenth antennal segments, these latter having a length two and one-half times the diameter, the distal being knobbed. See the above citation for a description of the male.

Leptosyna americana n. sp.

The specimen referred to this genus was captured in a trap lantern at Nassau, N. Y., May 27, 1908.

Male. Length .75 mm. Antennae extending to the second abdominal segment, sparsely haired, fuscous yellowish; 13 segments, the first somewhat produced, obconic, the second short, subglobose, the third and fourth distinct, the fifth with a stem as long as the subcylindric basal enlargement, which latter has a length one-half greater than its diameter and is adorned subapically with a thick whorl of long, stout setae, the twelfth and thirteenth segments are rather closely fused, the latter truncate apically. Palpi apparently uniarticulate. Mesonotum dark reddish brown. Scutellum, postscutellum and abdomen fuscous yellowish or yellowish orange. Wings hyaline, subcosta uniting with costa at the basal third, the third vein at the apex and the simple fifth at the distal third. Halteres yellowish transparent. Legs light fuscous yellowish; tarsi slightly darker, presumably five-segmented. Genitalia; basal clasp segment stout, truncate; terminal clasp segment stout, strongly curved, apically with a heavy, recurved, process; dorsal plate long, broad, deeply and triangularly emarginate, the lobes roundly truncate; ventral plate long, nearly divided, the lobes long, slender, tapering, narrowly rounded. (Plate 13, figure 5.) Type Cecid. 1341.

Frirenia Kieff.

1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:204, 206–9
1904 **Meunier, F.** Soc. Sci. Brux. Ann., 28:9
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:37
1911 ———— N. Y. State Mus. Bul. 147, p. 85

Members of this genus may be recognized by the 3 simple long veins, the third disappearing before the tip of the wing, the membrane sparsely clothed with fine hairs, and the 5 tarsal segments, the first being shorter than the second, in connection with the biarticulate palpi. Antennal segments 13, subcylindric and with short stems in both sexes. Male genitalia; basal clasp segment stout, subtriangular; terminal clasp segment rather long, stout, with a distinct, chitinous process at the internal distal angle; dorsal plate short, broad, deeply and roundly emarginate, the lobes roundly triangular; ventral plate rather long, broad, truncate apically; ovipositor short, the lobes consisting of three subequal segments. Type F. t e n e l l a Kieff. No American species are known.

Epimyia Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus is erected for a remarkable species evidently somewhat allied to Frirenia Kieff. The third vein unites with the anterior margin near the distal fourth, while the simple fifth joins the posterior margin at the basal half. Palpi triarticulate, the claws simple

Fig. 70 Fifth antennal segment of Epimyia carolina, enlarged. (Original)

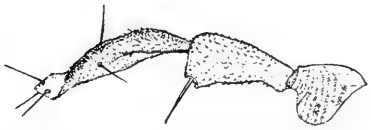


Fig. 71 Palpus of Epimyia carolina, enlarged. (Original)

and the genitalia of the male remarkably complex. The abundant vestiture and neuration of the wing indicate a relationship to Brachyneura Rond. though the absence of the characteristic scales on the membrane and the peculiar genitalia show that it has little in common with Brachyneura vitis Felt. The female is unknown. Type and sole species Epimyia carolina Felt.

Epimyia carolina Felt

1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38

The single specimen known was taken on the window of a woodland hut at Davidson's River, N. C., September 23, 1906.

Ledomyiella Meun.

1904 **Meunier, Fernand.** Soc. Sci. Brux. Ann., v. 28, pt. 2, p. 33
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38

This genus appears to be a rather common form in amber. It may be separated from Brachyneura Rond. by the metatarsus being shorter than the second segment and by the fork of the fifth long

vein. Tarsal segments five. Antennal segments 14, cylindric, sessile in the female, stemmed in the male; palpi quadriarticulate, the venation about as in Brachyneura aside from the forked fifth vein noted above. Type L. succini Meun. No American species are known.

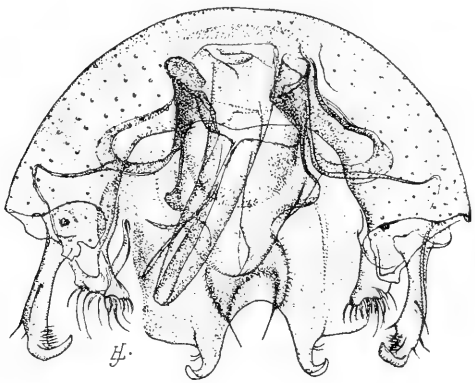


Fig. 72 Male genitalia of Epimyia carolina, enlarged. (Original)

Kronomyia Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:476

The unique form noticed below is evidently allied to Brachyneura Rond., though readily separated therefrom by the 4 long veins, the fifth and sixth being simple, and the totally different an-

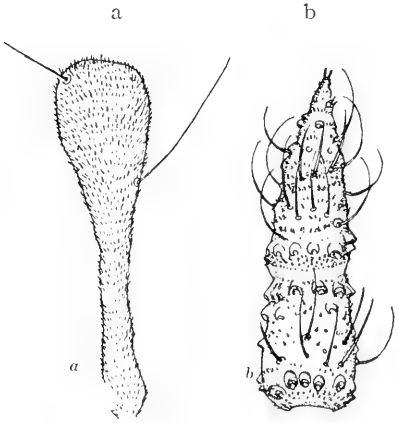


Fig. 73 *a* Palpus; *b* distal antennal segment of Kronomyia populi, enlarged. (Original)

Fig 74 Claw of Kronomyia populi, enlarged. (Original)

tennal structure. The antennae in the female of this species have but 12 segments, the apical evidently composed of 2 closely fused

reduced segments, the other flagellate ones with a short stem and a short, stout basal enlargement ornamented with a basal whorl of long, stout setae and a thick band of short, curved setae. The biarticulate palpi with the greatly produced, capitate terminal segment and the peculiar ovipositor, all serve to differentiate this species from allied genera. Type K. p o p u l i n. sp.

Kronomyia populi Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:476–77

This peculiar form was reared May 5, 1911 from a whitish larva found in punky poplar wood at Nassau, N. Y., April 12, 1911. Only one larva was observed and this presented the general appearance of a small Oligarces larva just after it had escaped from the mother larva in early spring. See the above citation for a description of the female; also plate 13, figure 6.

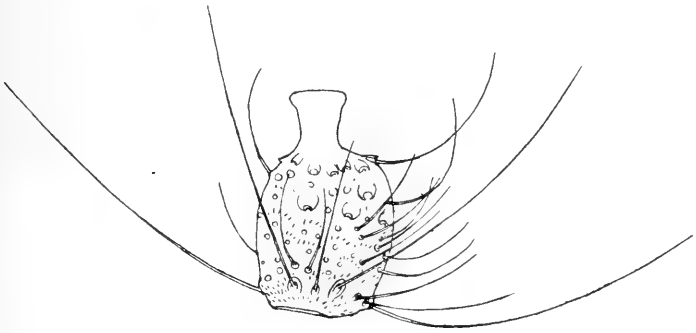


Fig. 75 Fifth antennal segment of K r o n o m y i a p o p u l i, enlarged. (Original)

Brachyneura Rond.

1846 **Rondani, Camillo.** Nouvi Ann. Sc. Nat. Bolog., ser. 2, VI; separate, p. 13
1853 **Winnertz, J.** Linn. Ent., 8:190 (Spaniocera)
1862 **Osten Sacken, C. R.** Dipt. N. Am., 1:175
1876 **Bergenstamm, J E., & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, A. F. A.** Revis. der Gallmucken, p. 15
1888 **Skuse, F. A. A.** Linn. Soc. N. S. Wales Proc., 3:42, 146
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:401–?366?
1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 55
1900 ———— Soc. Ent. Fr. Ann., 69:439, 447
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 316, 317
1911 **Felt, E. P.** N. Y. Ent. Soc. Jour., 19:38
1911 ———— N. Y. State Mus. Bul. 147, p. 85

Members of this genus are easily recognized by their general resemblance to Lasioptera in connection with the densely scaled, usually fuscous wing membrane. The two are readily separated by the fact that the antennal segments in Brachyneura are much longer than in Lasioptera and, moreover, never possess the characteristic circumfili almost invariably found in the Itonididinae. The antennae are composed of 12 segments. There are 3 simple long veins. The tarsi are quinqearticulate. Type B. fusco-grisea Rond.

Two American species of this genus have been reared, one B. eupatorii was bred presumably from an oval swelling on thoroughwort, Eupatorium perfoliatum, the other species, B. vitis, was reared from a jar containing the familiar Lasioptera vitis gall on grape, Vitis sp., and presumably came from this plant.

Key to species

a Fifth antennal segment with a length twice its diameter; scutellum yellowish

b Antennae with 11 segments, femora and tibiae dark brown. Bred ? from Lasioptera vitis gall.....vitis Felt, C. a1165d

bb Antennae with 12 segments; femora and tibiae silvery grey. Bred from thoroughwort, Eupatorium perfoliatum..... eupatorii Felt, C. a1349

aa Fifth antennal segment with a length three times its diameter, scutellum black, legs uniform fuscous or black..americana Felt, C. 734

Brachyneura vitis Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 317
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44

This species was reared July 13, 1907 from a jar containing the familiar Lasioptera vitis galls on grape, Vitis sp., and presumably came from this plant.

Male. Length .5 mm. Antennae nearly as long as the body, sparsely haired, dark brown; 11 segments, fifth subcylindric, with a stem one-fourth the basal enlargement, which latter has a length about twice its diameter, and is thickly clothed with short, narrow, appressed scales; terminal segment produced, tapering to a narrowly rounded apex. Palpi; the first segment short, stout, subquadrate, the second and third apparently stout, each with a length about three times its diameter. Mesonotum black. Scutellum, postscutellum and basal abdominal segment apparently fuscous yellowish, the remainder of the abdomen dark brown, sparsely haired. Wings hyaline, costa dark brown; membrane thickly clothed with fine hairs. Halteres yellowish transparent. Legs a variable dark brown; claws unidentate, pulvilli shorter than the claws. Genitalia;

basal clasp segment long, slender, roundly truncate; terminal clasp segment short, swollen basally; dorsal plate long, broad, deeply and triangularly emarginate; ventral plate long, narrow, deeply and broadly emarginate; style stout, nearly uniform. Type Cecid. a1165d.

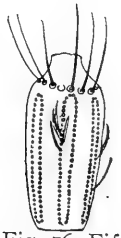


Fig 76 Fifth antennal segment of Brachyneura vitis, enlarged. (Original)

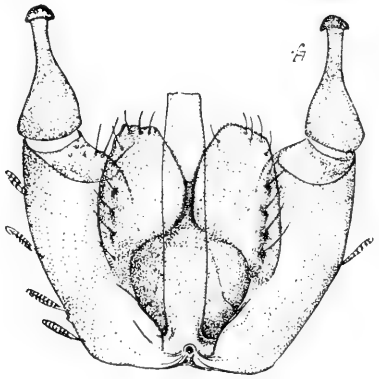


Fig. 77 Male genitalia of Brachyneura vitis, enlarged. (Original)

Brachyneura eupatorii Felt

1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 317
1909 ———— Ent. Soc. Ont. 39th Rep't, p. 44

The female was reared September 14, 1907, possibly from a gall on thoroughwort, Eupatorium perfoliatum, taken at Poughkeepsie, N. Y. The swelling on the stem was about 6 mm in diameter and contained 6 yellow larvae occupying cocoons massed in the center of the cell.

Female. Length 1.2 mm. Antennae shorter than the body, densely clothed with scales, presumably dark brown, the basal segments creamy white; 12 segments, the fifth with a length about twice its diameter; terminal segment slightly produced, with a length three times its diameter and apically with a short, stout, knoblike appendage. Palpi; the first segment short, stout, irregular, the second subrectangular, with a length about three times its diameter, slightly expanded distally, the third as long as the second, slender, tapering at both extremities. Face creamy white, eyes large, black, with fine, white points. Mesonotum dark fuscous, the submedian lines narrowly whitish. Scutellum yellowish, clothed with silvery hairs. Abdomen black, except where the whitish ground color appears; membrane and pleurae pale yellowish, ovipositor whitish apically. Wings black, costa black, thickly clothed with scales. Halteres black, whitish at the base, the pedicel unusually short and curved. Coxae pale yellowish; femora and tibiae

silvery gray, the posterior tarsi silvery gray, the 2 distal segments black, the anterior and mid tarsi darker; claws unidentate, pulvilli shorter than the claws. Ovipositor short, the terminal lobes broadly oval. Type Cecid. a1349.

Brachyneura americana Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 5
1908 ———— N. Y. State Mus. Bul. 124, p. 286

The single female representing this species was taken August 2, 1906 on the office window in Albany, N. Y., and was presumably reared from material brought into the office.

Female. Length 1 mm. Antennae extending to the base of the abdomen, thickly clothed with narrow scales, black; 12 segments, the fifth subcylindric, the enlargement, with a length nearly three times its diameter; terminal segment produced, slender, distally tapering to a narrowly rounded apex. Palpi; the first segment short, stout, somewhat rounded, the second more than twice the length of the first, more slender, the third a little longer and more slender than the second. Mesonotum very dark brown, sparsely ornamented with yellowish hairs. Scutellum black with yellowish hairs basally, postscutellum and abdomen dark brownish black. Wings subhyaline, the membrane thickly clothed with narrow fuscous scales, costa black. Halteres fuscous yellowish basally, black apically. Legs mostly a uniform fuscous or black, the second and third segments of the posterior tarsi fuscous yellowish; claws long, unidentate, the pulvilli as long as the claws. Ovipositor short, the lobes short, narrowly rounded. Type Cecid. 734.

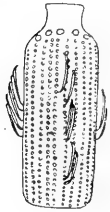


Fig. 78 Fifth antennal segment of Brachyneura americana, enlarged. (Original)

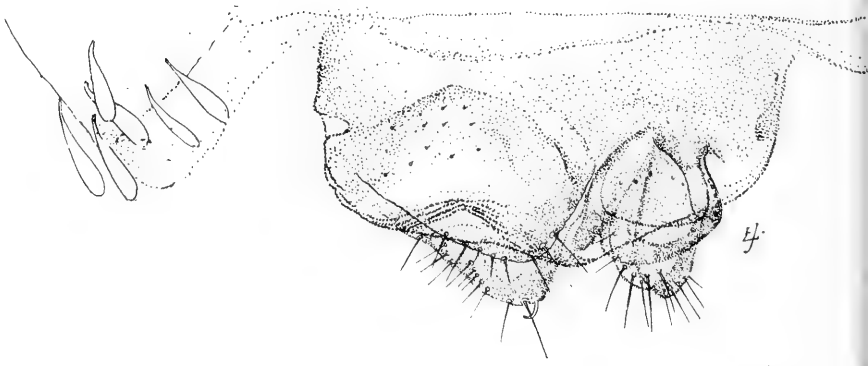


Fig. 79 Ovipositor of Brachyneura americana, enlarged. (Original)

Oligarces Mein.

1865 **Meinert, F. R.** Naturhist, Tidsskr., ser. 3, III, 238
1876 **Bergenstamm, J. E., & Löw, Paul.** Syn. Cecidomyidarum, p. 24
1877 **Karsch, F. A. F.** Revis. der Gallmucken, p. 16
1892 **Rubsaamen, E. H.** Berl. Ent. Zeit., 37:401.
1894 **Kieffer, J. J.** Wien. Ent. Zeit., 13:201
1898 ———— Syn. Cecid. Eur. & Alg., p. 53
1900 ———— Soc. Ent. Fr. Ann., 69:448
1908 **Felt, E. P.** N. Y. State Mus. Bul. 124, p. 317
1911 ———— N. Y. Ent. Soc. Jour., 19:38
1911 ———— N. Y. State Mus. Bul. 147, p. 85

This genus was erected by Meinert in 1865 with O. paradoxus as the type and sole species. Members of this genus may be recognized by the finely haired wing membrane and the 2 or 3 simple veins in connection with the biarticulate tarsi, the first segment being shorter than the second. The mouth parts are rudimentary or wanting.

Oligarces noveboracensis Felt

1907 **Felt, E. P.** New Species of Cecidomyiidae II, p. 5
1908 ———— N. Y. State Mus. Bul. 124, p. 286

This species was taken on a window at Albany, N. Y., July 15, 1907 and was presumably reared from material brought into the office.

Female. Length 1 mm. Antennae extending to the second abdominal segment, pale yellowish; 13 segments, the fifth and following sessile, cylindric, with a length about one-fourth greater than the diameter; terminal segment reduced, narrowly rounded apically and irregularly clothed with long, chitinous spines. Palpi apparently wanting, eyes small, brown, ocelli absent; face yellowish. Mesonotum light brown, pleurae pale orange. Scutellum and postscutellum light fuscous yellowish. Abdomen pale yellowish, the basal and distal segments pale orange, the ovipositor pale white. Wings long, narrow, hyaline, costa pale yellowish, subcosta uniting with the anterior margin at the basal third, the third vein near the basal half, the fifth indistinct distally, joining the posterior margin at the basal half, its branch at the basal fourth, entire margin thickly clothed with long, rather stout hairs. Halteres yellowish transparent. Legs pale yellowish white. Coxae short, irregular; femora long, stout, fusiform, tibiae a little longer, with weak spines apically, tarsi biarticulate, the first segment about three-fourths the length of the slender second. Claws short, stout, slightly curved; pulvilli rudimentary; venter of eighth abdominal segment with submedian, subquadrate appendages. Ovipositor short, indistinctly triarticulate, the third segment long, narrowly oval. Type Cecid. 1226.

Oligarces ulmi Felt

1911 **Felt, E. P.** Econ. Ent. Jour., 4:477–78

The larvae of this species were found at Nassau, N. Y., March 18, 1911 in the thick, partly decaying bark of an old elm, Ulmus, cut some two or three years ago. They were so inconspicuous and concealed in the tissues that there was some doubt for a time as to there being anything living in the bark, though one or two exuviae led us to believe that larvae might be present. The infested bark was brought into a warm room March 20th and on the 22d a number of whitish transparent young appeared. By the 27th there were literally thousands upon the inside of the breeding jars, crawling freely upon the glass. Many perished while others doubtless reestablished themselves in the bark. These larvae do not appear very amenable to laboratory methods, since we were unable to obtain adults from a small piece of bark containing hundreds of larvae clamped to a microscopic slide and kept in a small box. The few placed in water under a cover-glass soon escaped.

The first pupa was observed April 18. When discovered it was standing at an oblique angle, being supported by the presumably glutinous posterior extremity, since at this stage there are no clasping organs. The pupa soon turned and twisted, released its hold and was shortly lying at a totally different angle upon the moist surface of the wood. The pupal period probably extends over two or three days. The pupae evidently work themselves partly out of the wood before disclosing the adult. The first imagoes were found April 24th, females occurring in increasing numbers until about the 26th, at which time males became very numerous and continued so to the 29th. The adult flies emerge almost entirely between 10 a. m. and noon. They display a marked preference for the light, crawl freely, and when abundant run about in much the same manner as a swarm of winged ants. They crawl easily upon the surface of a glass cage though they frequently drop. Very little can be seen of the midges except at the hours above named, even when they are allowed to remain in the cage from day to day. It is probable that the eggs are deposited shortly after the females emerge. An individual may contain one to four ova, each with a length about three-fourths that of the abdomen. One female dropped in alcohol extruded two eggs which remained attached to the extremity of the abdomen (plate 14, figure 4).

The colony we discovered was practically free from natural enemies, since only one Lestodiplosis larva was observed in the material collected and no adults reared.

Egg. Length .4 mm, diameter .08 mm, extremities rounded. The egg is white and granular.

Mother larva. Length 2.5 mm, moderately stout, tapering toward each extremity, a dull yellowish white, the color harmonizing so closely with the decaying inner bark of elm as to be detected with difficulty. Head rather short, broad; the antennae short, stout, uniarticulate; transverse bands of spines on the distinct body segments rudimentary or wanting, the margins of the incisures of both extremities frequently rather strongly chitinized; the posterior extremity is rather stout, bilobed, the lobes rather broadly and irregularly rounded and with minute tubercles; the skin is nearly smooth. An overwintering mother larva may contain 8 or 10 practically fully developed young.

Young larva. Length 1.5 mm, moderately stout, white or whitish transparent, the posterior extremity sometimes with a darker reflection, due possibly to the black bark upon which the specimen was resting. Head long, triangular, the anterior third rather heavily chitinized, except the extreme apex; antennae moderately long, tapering, biarticulate; skin nearly smooth, transverse bands of spines, rudimentary or wanting; posterior extremity obtuse, bilobed, the lobes irregularly rounded and minutely tuberculate.

Pupa. Length 1 mm, moderately stout, eyes reddish brown, the thorax pale yellowish; abdomen yellowish orange; thoracic horns long, slender; antennal cases stout, extending to the base of the wing pads, the wing and leg cases extending to about the third abdominal segment; abdomen smooth, the fourth to ninth segments free and successively tapering, flexible; the posterior extremity broadly rounded and in the male, slightly bilobed. At the humeral angles there is a pair of irregularly oval, fuscous or reddish brown spots.

Exuviae. Whitish transparent, the dorsum of the abdominal segments with irregular rows of minute, chitinous points.

Female. Length 1.2 mm. Antennae short, very sparsely haired, brownish yellow; 10–12 subsessile segments, the fifth with a length about one-fourth greater than its diameter, broadly pyriform, with a few long, stout setae subbasally and an irregular whorl of long, chitinous spines subapically; terminal segment reduced, narrowly oval. Palpi apparently wanting. Face fuscous yellowish; eyes light brown. Mesonotum dark brown, the submedian lines fuscous yellowish. Scutellum reddish brown, postscutellum and abdomen pale yellowish or reddish orange, frequently slightly fuscous apically, the ovipositor fuscous yellowish. Wings long, narrow; fringe long. Halteres yellowish transparent. Legs a somewhat variable reddish yellow, the tarsi somewhat darker; first tarsal

segment with a length about one-third that of tibia, the second tarsal segment with a length one-fourth greater than the first; claws stout, slightly curved, the pulvilli rudimentary. Abdomen slender and containing one to three large eggs, each with a length about three-fourths that of the abdomen; the eighth segment ventrally with submedian, irregularly pyriform appendages. Ovipositor short, indistinctly triarticulate, the third segment with a length two and one-half times its diameter. For a description of the male, see the above citation. Type Cecid. a2136.

EXPLANATION OF PLATES

PLATE 1

[227]

Pear thrips

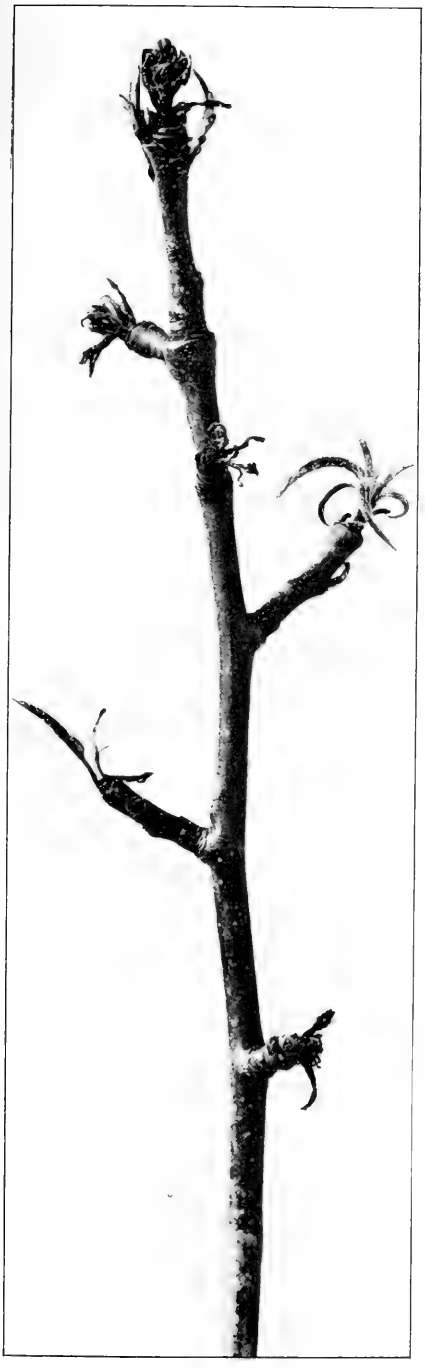
Euthrips pyri Daniel

1 Twig showing nearly total destruction of blossom buds and rudimentary leaves

2 A similar branch with the leaves partly unfolded

Plate 1

1



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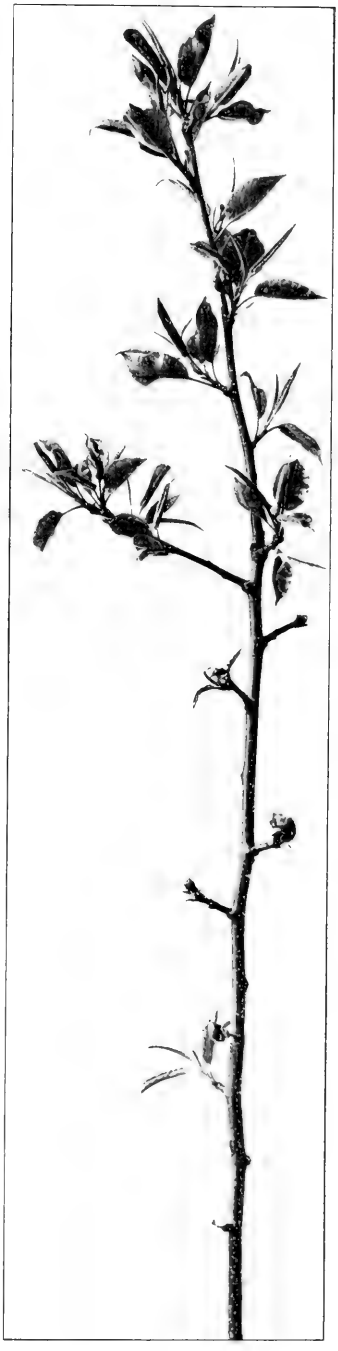


Pear thrips work

PLATE 2

[229]

Pear thrips

Euthrips pyri Daniel

1 Cluster of buds in a condition favorable to attack by pear thrips
2 Fruit stem with buds seriously affected
3 A twig showing one cluster of buds somewhat enlarged by the thrips and several clusters of leaves illustrating the rolling and spoon-shaped deformity produced by this insect

Plate 2

1

2

3

Pear thrips work

PLATE 3

[231]

Pear thrips

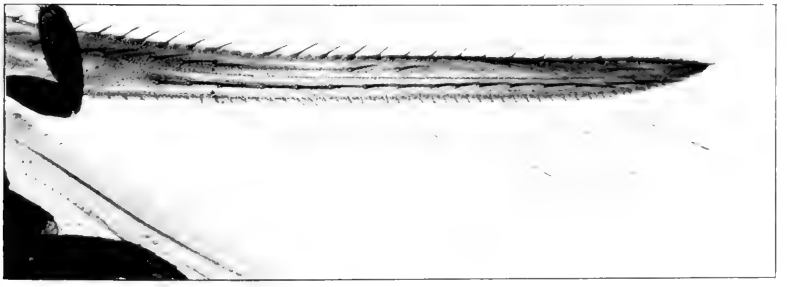
Euthrips pyri Daniel

1 Female thrips, greatly enlarged (x 40)
2 Wing of female (x 80)

Plate 3

1

2



Pear thrips

PLATE 4

[233]

Queen blow fly

Phormia regina Meig.

1 Anterior extremity of first stage maggot, showing the cephalo-pharyngeal skeleton and the transverse bands of chitinous points (x 100)

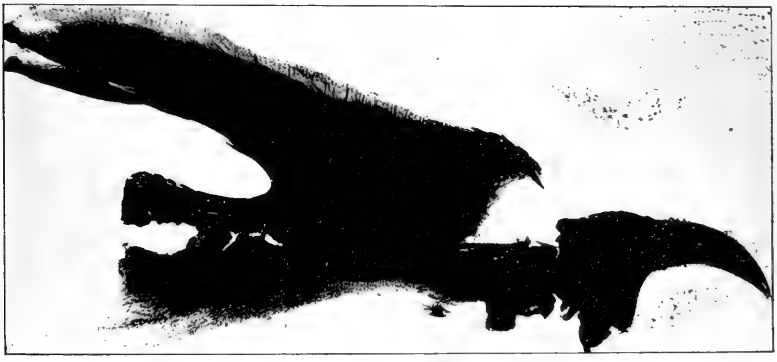
2 Anterior portion of second stage maggot, showing cephalo-pharyngeal skeleton (x 100)

3 Cephalo-pharyngeal skeleton of third stage maggot (x 66)

Plate 4

1

2



3

Queen blowfly larvae

PLATE 5

[235]

Queen blow fly

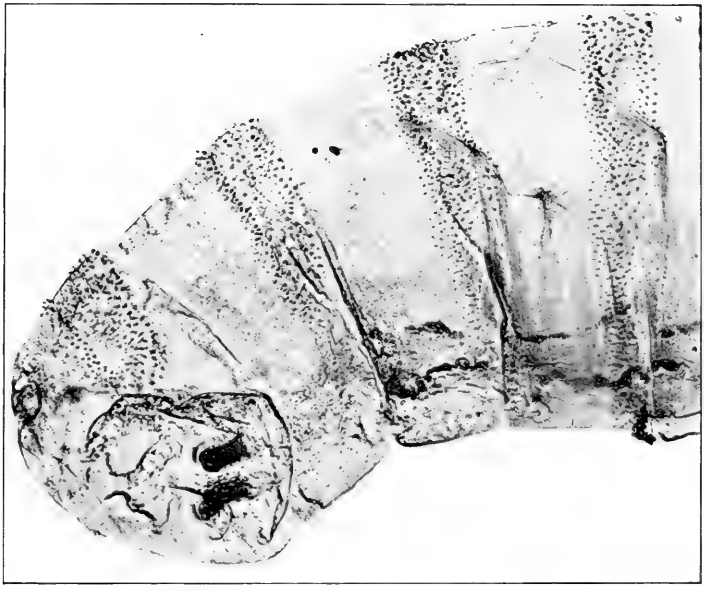
Phormia regina Meig.

1 Posterior extremity of first stage maggot, showing the posterior pair of spiracles and the transverse bands of chitinous points (x 100)

2 Posterior spiracles of second stage maggot (x 200)

Plate 5

1



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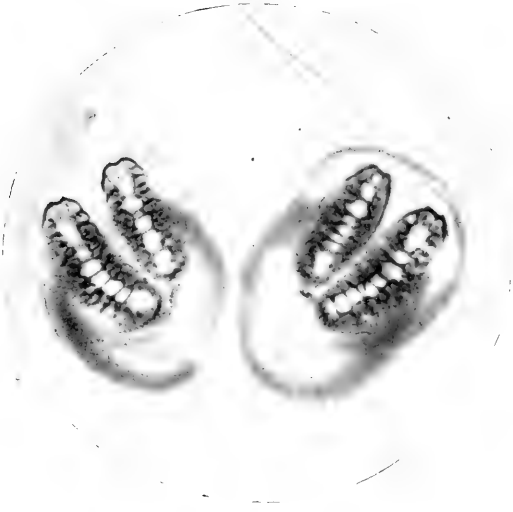


Queen blowfly larvae

PLATE 6

[237]

Queen blow fly

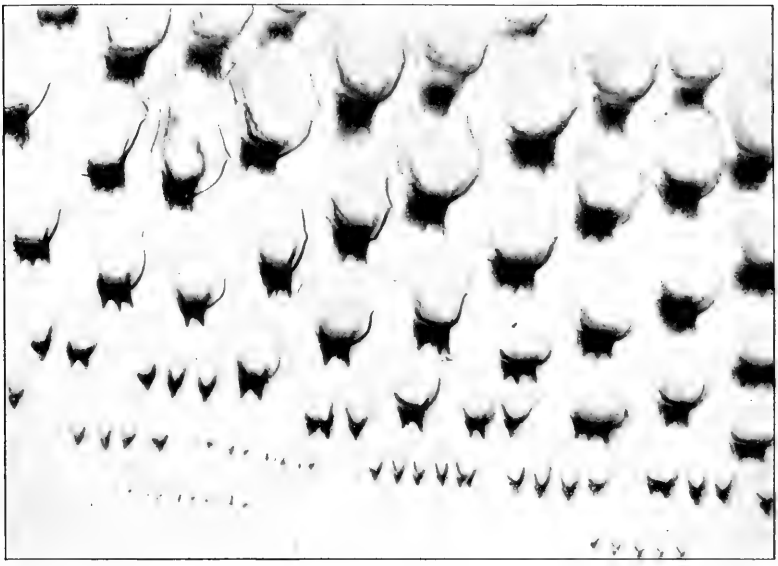
Phormia regina Meig.

1 Portion of transverse band of chitinous points, greatly enlarged (x 200)

2 One posterior spiracle showing three orifices, each with a series of mostly transverse bars (x 200)

Plate 6

1



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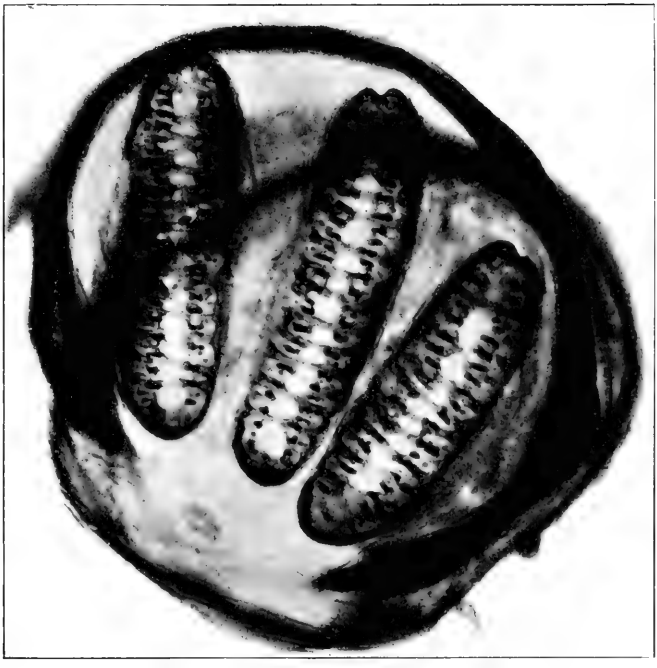


Queen blowfly larvae

PLATE 7

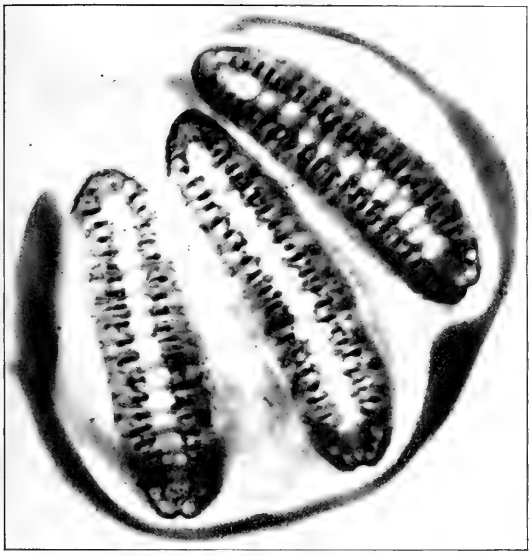
[239]

Georgian flesh fly

Sarcophaga georgina Wied.

1 Posterior spiracle showing three orifices and numerous anastomosing, oblique, chitinous bars (x 200)
2 Anterior spiracle showing the radially arranged orifices (x 100)
3 Cephalo-pharyngeal skeleton (x 80)
4 Portion of male genitalia (x 50)

1 Plate 7



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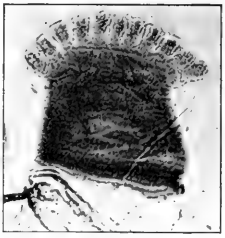

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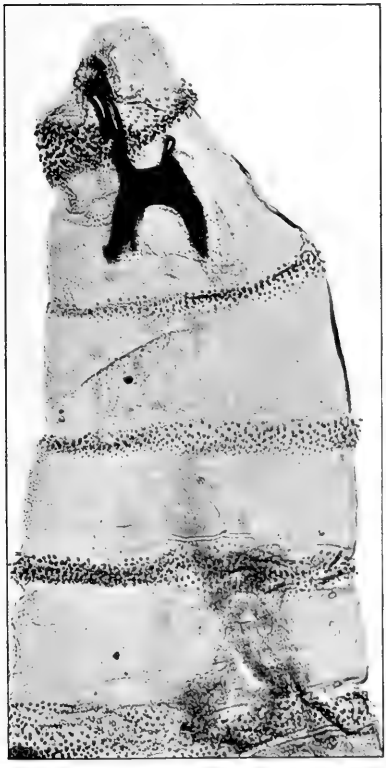

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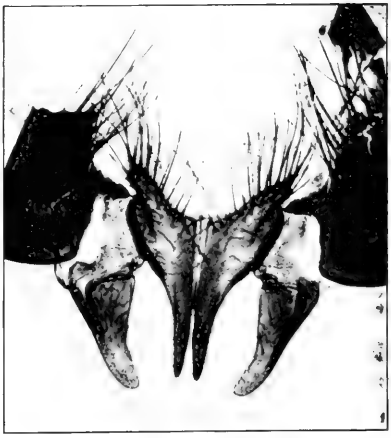


Georgian flesh fly

PLATE 8

[241]

Effects following the application of a miscible oil

1 View in Baldwin orchard set 19 years. Over 100 trees were in a dying condition following spraying the preceding fall. Photographed June 10, 1912

2 View in orchard of peach and apple trees set 12 years. Many of the apple trees are in a dying condition and were sprayed the preceding fall with a miscible oil. Photographed June 10, 1912

Plate 8

1

2

Effects following the application of miscible oil

PLATE 9

[243]

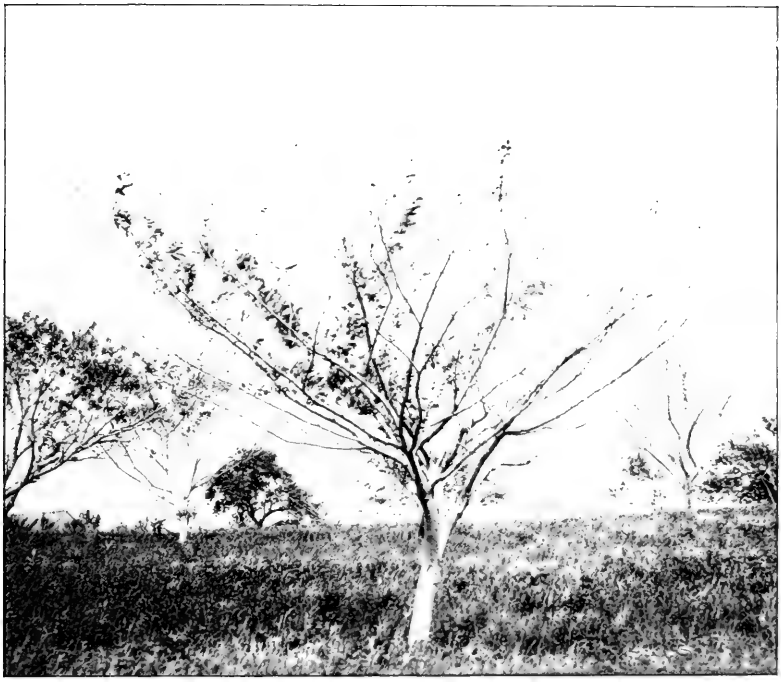
Effects following the application of a miscible oil

1 King tree sprayed in November 1911 with a miscible oil. One-half of this tree is dead. Photographed June 10, 1912

2 A view of the base of the same tree, more enlarged. Note the darker spots on the portion of the large limb from which the outer bark had been cut away, they being especially marked at the second fork on the base of a limb which was entirely dead. Photographed June 10, 1912

Plate 9

1



2

Effects following the application of miscible oil

PLATE 10

[245]

Pear midge

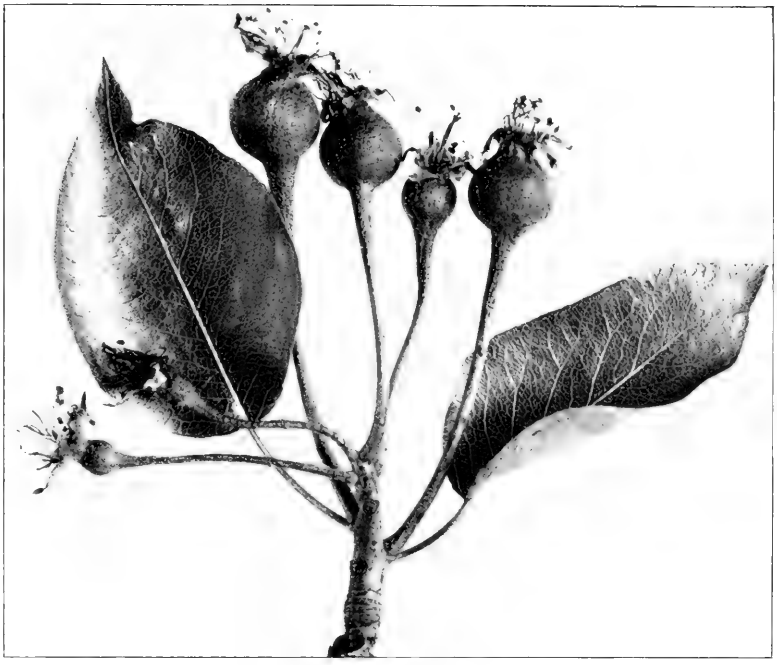
Contarinia pyrivora Riley

1 Cluster of pears showing four upright ones, three at least being abnormally swollen and globular, as a result of infestation by maggots

2 Similar pears opened to show the condition of the infested fruit

Plate 10

1



2

Pear midge work

PLATE 11

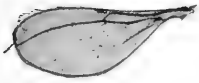
[247]

Gall midge structures

1 Joannisia carolinae Felt (x 20)
2 Campylomyza vitinea Felt (x 20)
3 Campylomyza producta Felt (x 20)
4 Prionellus longipennis Felt (x 20)
5 Cordylomyia bryanti Felt (x 20)
6 Johnsonomyia rubra Felt (x 15)
7 Johnsonomyia fusca Felt, male genitalia (x 180)

Plate 11

1



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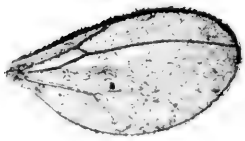

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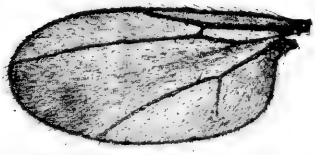

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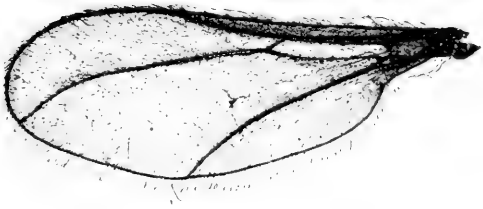


7

Gall midge structures

PLATE 12

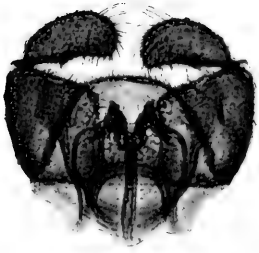
[249]

Gall midge genitalia

1 Monardia karnerensis Felt, male (x 260)
2 Monardia balsamicola Felt, male (x 260)
3 Prionellus hesperia Felt, male (x 260)
4 Campylomyza producta Felt, male (x 260)
5 Campylomyza pomifolia Felt, male (x 260)
6 Campylomyza pomiflorae Felt, male (x 260)

Plate 12

1



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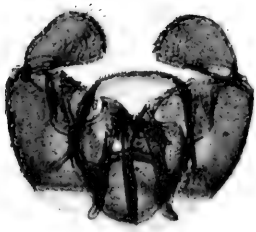

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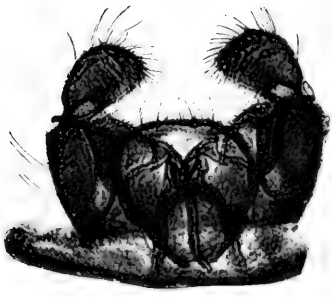

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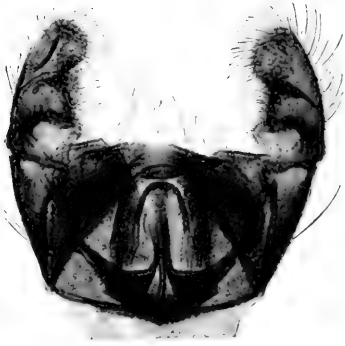

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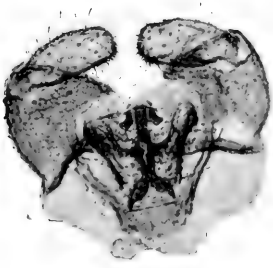

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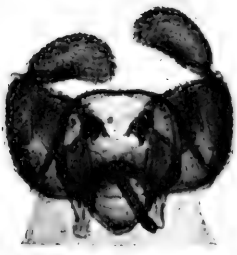


Gall midge genitalia

PLATE 13

[251]

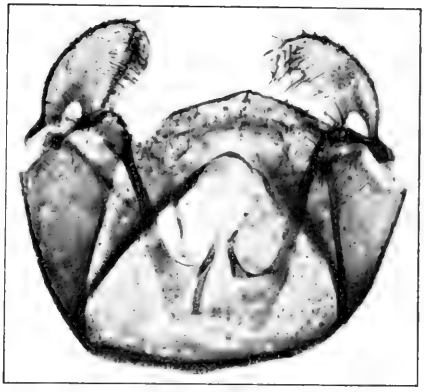
Gall midge anatomy

1 Monardia populi Felt, male genitalia (x 260)
2 Corinthomyia currei Felt, male genitalia (x 260)
3 Cordylomyia coprophila Felt, male genitalia (x 195)
4 Monardia lignivora Felt, anterior portion of larva, showing the tridentate breastbone (x 50)
5 Leptosyna americana Felt, male genitalia (x 260)
6 Kronomyia populi Felt, posterior extremity of female (x 125)

Plate 13

1

2



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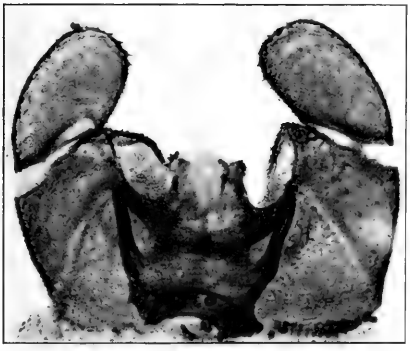

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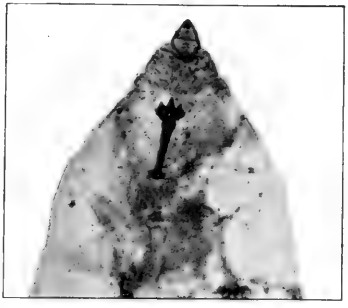

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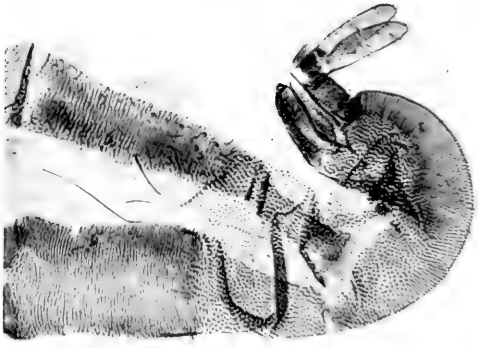


Gall midge anatomy

PLATE 14

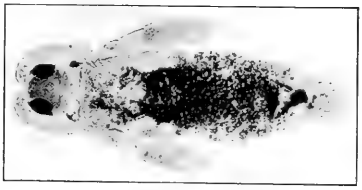
Miastor and Oligarces

1 Prepupa of Miastor
2 Pupa of Oligarces
3 Oligarces ulmi Felt, male
4 Oligarces ulmi Felt, female, showing eggs protruding from abdomen

Plate 14

1

2



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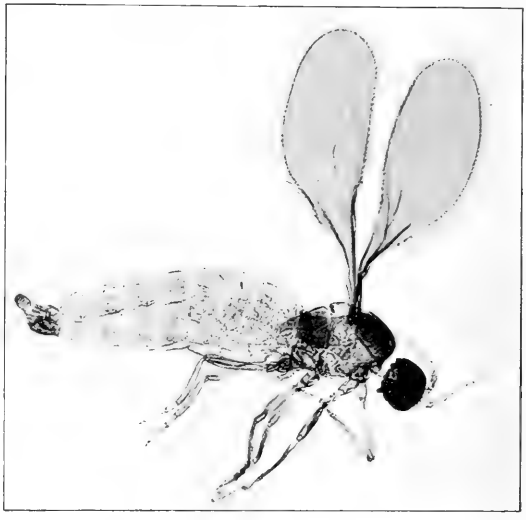

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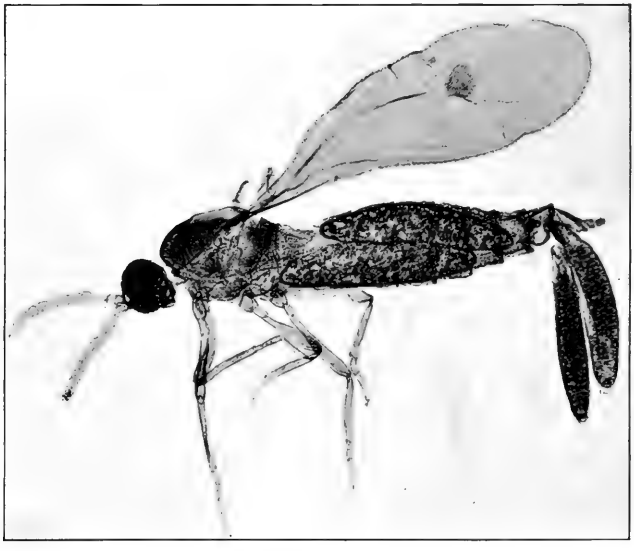

Miastor and Oligarces

INDEX

ERRATA

Page 119, line 7 from the bottom, for arancosa read araneosa
Page 208, line 7 from the bottom, for Lonchae read Lonchaea