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JOHN M. CLARKE Director
EPHRAIM PORTER FELT State Entomologist

Bulletin 97
ENTOMOLOGY 24

20th Report of the State Entomologist

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1904

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STATE OF NEW YORK

EDUCATION DEPARTMENT

New York State Education Department
Science Division Jan. 19, 1905

Hon. Andrew S. Draper
Commissioner of Education

SIR: I beg to transmit herewith for publication the report of the State Entomologist for the year 1904.

Very respectfully yours
JOHN M. CLARKE
Director

State of New York
Education Department
COMMISSIONER'S ROOM
Approved for publication Jan. 19, 1905.

A. S. Draper
Commissioner of Education

New York State Education Department

New York State Museum

John M. Clarke Director
Ephraim Porter Felt State Entomologist

Bulletin 97

ENTOMOLOGY 24

20th REPORT OF THE STATE ENTOMOLOGIST 1904

To John M. Clarke, Director of Science Division

I have the honor of presenting herewith my report on the injurious and other insects in the State of New York for the year ending Oct. 15, 1904.

General entomologic features. The season of 1904 is notable because of the remarkably small amount of injury to agricultural crops. Plant lice and pear psyllas, Psylla pyricola Forst., which were so abundant in 1903, hardly attracted attention last season. The pernicious or San José scale insect has become firmly established in certain localities in the State, and the best method of controlling it in commercial orchards is an urgent problem. The elm leaf beetle, Galerucella luteola Müll., has been remarkable for its scarcity and the same is true of a considerable number of the more common pests injurious to garden and field crops. Even the grape root worm was much less numerous in Chautauqua vineyards than in 1903.

Office work. This has been continued as in preceding years, and aside from the natural lack of inquiries due to the paucity of insect life, indicates a most gratifying interest in our work. The determination of scale insects for the commissioner of agriculture, in connection with the nursery inspection work conducted by his department, has made some demands on the office. The first assistant, Mr C. M. Walker, severed his connection with this office Jan. 1, and Mr D. B. Young was promoted to his position. Mr Ivan L. Nixon, a graduate of the Kansas State Agri-

cultural College, was appointed assistant Ap. 1, and has been mostly engaged in field investigations of the grape root worm in Chautauqua county. Correspondence indicates a continued and healthy interest in our work, the slight decrease easily being accounted for by causes mentioned above. 1522 letters, 881 postals, 280 circulars and 1757 packages were sent through the mail during the past year.

Special investigations. The investigations of the grape root worm, Fidia viticida Walsh, have been continued and the results and conclusions of last year's work largely confirmed. Our studies show that by far the most effective method of controlling this species in badly infested vineyards, particularly those where vines are making a rapid growth, is by the employment of beetle catchers, the utility of which was abundantly demonstrated last year. Experiments with arsenical poisons indicate considerable protection if the applications be very thorough.

Investigations of methods of controlling the San José scale, Aspidiotus perniciosus Comst., particularly with lime-sulfur washes, have been vigorously pushed and our earlier results confirmed. It is particularly gratifying to state that we have discovered a new and much easier method of preparing a wash, which appears to be just as efficient as more expensive compounds. A third instalment of the beneficial Chinese lady beetle, Chilocorus similis Rossi, was obtained in early July through the courtesy of Prof. Wilmon Newell, state entomologist of Georgia, and established in an infested orchard at Kinderhook. It was expected that they would multiply rapidly, as had those obtained in preceding years, but for some cause or other there was very little breeding and no lady beetles were to be found on the trees in the fall. It is possible that they spread to other sections and that the species has become established in that vicinity. Scale insects are abundant enough there to maintain the lady beetles, and the species has certainly been given sufficient opportunity to establish itself in this latitude and to demonstrate its value as an aid in controlling the dangerous San José scale.

The studies on aquatic insects, begun by Dr James G. Needham in 1901, have been continued as opportunity offered and an extensive monographic account of the stone flies of the State is now in preparation.

The investigations of mosquitos have been continued and our results are embodied in a bulletin of 164 pages, illustrated by over 300 original drawings or photomicrographs, giving the life history

and describing the immature stages of over 40 species, 12 being characterized as new. The assistant entomologist, D. B. Young, has rendered valuable aid in the collecting, breeding and care of specimens incident to this work.

The office has fortunately been able to avail itself of the services of Prof. Herbert Osborn of Ohio, a well known specialist on leaf hoppers or Jassidae. He has done some special collecting in the State and embodied his results in an annotated catalogue, listing about 175 species, which is reproduced in our report. Mr E. P. VanDuzee of Buffalo, a skilful entomologist and well known authority on Hemiptera, has collected in the Adirondacks and Catskills, and the value of his work is greatly enhanced by an annotated catalogue accompanying his collections, reproduced in our report. His work has added over 1600 specimens representing over 300 species, six of which were previously unknown, to our collections.

Publications. The principal publications of the entomologist, to the number of 67, are listed under the usual head. The more important of those issued during the year, are the following: *Grapevine Root Worm* (Museum bulletin 72), *Monograph of the Genus Saperda* (Museum bulletin 74) by the entomologist and L. H. Joutel of New York, and the *19th Report of the State Entomologist* (Museum bulletin 76). *Mosquitos or Culicidae of New York State* (Museum bulletin 79) was practically completed during the time covered by this report, but owing to delays of one kind or another it was not issued till the latter part of October.

There is in press an important monographic account of the *May Flies and Midges of New York*, by Messrs Needham and Johannsen, and the extensive quarto memoir on *Park and Woodland Insects* is still unpublished.

Collections of insects. Large additions have been made to the state collections during the past season, particularly in the Culicidae, which received special attention during the season of 1904. We now have over 1800 pinned specimens of New York Culicidae representing about 40 species, a goodly majority of the latter having been reared from one or more isolated larvae, thus establishing beyond doubt the specific identity of the two stages. In addition, the 108 specimens representing 63 species, received from Prof. F. V. Theobald, a world-wide authority on Culicidae, brings the total number of species in the collection up to 99, which is increased slightly by the larvae of several others from which adults have not been reared. The usefulness of this collection has been greatly enhanced by the preparation of over 600 micro-

scopic slides showing the minute structures of the different species, and also by over 400 photomicrographs made from these mounts. This mounted and photographed material constitutes a permanent collection which will be of inestimable value in future studies of this economically important and extremely interesting group.

Many specimens have been added to the general collection, particularly in the Hymenoptera and Diptera, and special progress has been made in classifying these important families. The exhibit collection has received a number of valuable additions and in all of our collecting, the needs along this line have been recognized. The exchange system inaugurated in 1903, has been continued with mutually satisfactory results, a most interesting collection of aquatic larvae being received from Dr F. Meinert of Copenhagen, Denmark, and a valuable series of Coccidae from Mr J. G. Sanders of the Ohio State University, Columbus O. Other exchanges of minor importance have been arranged and more are contemplated. The office supervised the preparation of a collection of insects which was exhibited at the Louisiana Purchase Exposition, by the Forest, Fish and Game Commission. It comprised about 250 species, the life history and habits of 140 being represented in greater or less detail. This collection attracted considerable attention and was the object of very favorable comments.

Nursery certificates. Owing to the continued reluctance of the Virginia authorities to accept nursery inspection certificates not indorsed by an official entomologist, we have continued to show our approval of this work by indorsing certificates issued by the commissioner of agriculture, whenever the same was requested. The following is a list of firms to whom these nursery certificates were issued in the summer and fall of 1904: Allen L. Wood, Perry Nursery Co., Herrick Seed Co., First National Nurseries, Brown Bros. Co., T. W. Bowman & Son, Chase Bros. Co., Western New York Nursery Co., Irving Rouse, Ellwanger & Barry, H. S. Taylor & Co., Graham Nursery Co., Allen Nursery Co., W. H. Salten, Green's Nursery Co. and Brown Bros., all of Rochester; T. S. Hubbard & Co., George S. Josselyn, Wheelock & Clark, F. E. Schifferli, Foster & Griffith, Lewis Roesch, all of Fredonia; Bryant Bros., G. A. Sweet, Stark Bros., Sheerin's Wholesale Nursery Co., The Rogers Nurseries, all of Dansville; Jackson & Perkins Co., Knight & Bostwick, both of Newark; R. G. Chase Co., G. B. Willard, Sears, Henry & Co., W. & T. Smith Co., Reliance Nursery

Co., all of Geneva; E. Moody & Sons, D. F. McCarthy, both of Lockport; F. R. Pierson Co., Tarrytown; Lake View Nursery Co., Sheridan.

Voluntary observers. The work of the voluntary observers has been continued. Their reports have largely a negative value this season, owing to the unusually few insect depredations on crops of agricultural importance. A number of valuable statements have been placed on record and we fully expect, as the years continue, that these records will prove of considerable service in throwing light on the oscillations of insect life.

Acknowledgments. Special acknowledgments are due at this time to Dr L. O. Howard, chief of the Bureau of Entomology, United States Department of Agriculture, and to his staff, particularly to Messrs Coquillett and Dyar, who have been very kind in furthering our investigations on mosquitos. Mention should also be made of Dr J. B. Smith, state entomologist of New Jersey, who generously donated for study, examples of rare species.

Respectfully submitted

EPHRAIM PORTER FELT

State Entomologist

Office of the State Entomologist

Albany, Oct. 15, 1904

INJURIOUS INSECTS

Grape root worm

Fidia viticida Walsh

The following observations and experiments are a continuation of those begun in 1902 and continued through 1903. They were carried out under our personal supervision by Assistant Ivan L. Nixon, who was in the field continuously for about two months. The general results of the season's work may be considered as strikingly confirming our earlier experiments and conclusions, and better than this, in adding one more link to the evidence showing that this serious insect pest can be controlled if energetic measures are promptly adopted. Our thanks are due to Messrs D. K. Falvay and E. A. Skinner of Westfield, who kindly placed portions of their vineyards at our disposal for experimental purposes, and also to Mr E. W. Skinner of Portland, for the same courtesy.

Attention is called to the fact that we have attempted to give a precise idea of conditions so far as observations could determine, preferring that to more ambiguous statements which may be influenced by personal judgment. There is no guesswork for example, about the number of insects actually taken from a vine when jarred into a beetle catcher and carefully counted, while an estimate is always open to question. It will also be noted that within practical limits every possible means of estimating actual conditions has been taken advantage of and our field observations confirmed wherever possible, by laboratory experiments. Others have laid considerable stress on the number of egg clusters found on a vine, and could we be sure of counting all deposited in a season, this method affords an ideal way of estimating the activity of the beetles. Unfortunately, the period of egg-laying extends over two months, and it is hardly practical to determine the total number of egg clusters normally laid on a vine, because the earlier ones hatch before the later ones are deposited and the traces of old egg clusters are so slight that they can be easily overlooked. Several observations can hardly be made on the same vine, because the stripping of the bark, necessary to detect the egg clusters, removes shelters and leads the beetles to deposit their eggs elsewhere. Several counts at intervals of a week or 10 days are necessary to the accurate estimation of the total number of eggs deposited on selected vines, since experience shows that the proportion of eggs on sprayed and unsprayed vines changes as the season advances, and if this variation be disregarded, accurate conclusions can not be drawn.

It is not easy to find grubs about the base of the roots, and undoubtedly there is more or less error in attempting to estimate results by this means, still the grubs cause the injury and, on this account, are of prime importance and an estimation of adults, eggs or other stages, is really an attempt to count the grubs. A direct estimation is therefore less liable to error. This method enables us to calculate all the insects under one vine because examinations can be delayed till all the grubs are large enough to be easily detected. Furthermore, this method is almost the only one of estimating the number of insects about a vine during the greater portion of the year. We wish to emphasize the fact that definite figures are given as to the number of beetles on vines in the sprayed and unsprayed areas, and it will be seen that the section selected was sufficiently infested to give a fair test of the value of arsenical poisons. This latter is an essential in experimental work, and unless insects are present in large numbers, unreliable results may be obtained.

Scarcity of root worms. In our search for suitable experimental areas last spring, we experienced great difficulty in finding a place where the insects were sufficiently abundant and the vines at the same time in good condition. Our investigations indicated that for some reason or other, grape root worms were relatively much less abundant than the year before and subsequent observations have tended to support this view. The insects have been exceedingly numerous in a few localities but generally speaking there appears to have been a marked decrease in numbers for some cause or other. Possibly the extremely cold weather may have killed some of the grubs but this hardly seems an adequate explanation. This species is more or less local in habit and therefore a general estimate as to the abundance of the insect is difficult to make without very abundant data, and on the same account it is almost impossible to forecast where it will be present in large numbers another season.

Observations on life history. *Larvae.* The date when the grubs transform to the pupa or "turtle stage," is of considerable importance and consequently our observations of the two preceding years have been checked by those made in 1904. The first pupae observed in 1902, were met with at Ripley June 7, and a great majority of the insects had transformed by June 23. The season of 1903 was more advanced and 90% of the insects on light, sandy loam were in the pupa or "turtle" stage May 29. The first pupae observed in 1904, were met with June 2 on light, sandy soil, and

by the 8th most had transformed to this stage. It will be seen by the above that there is a range of 10 days or two weeks between the transformations of these insects from year to year, and as previously established, an almost equal difference in time between the change on light and on heavy soil; consequently it is necessary for vineyardists who plan to destroy large numbers of the pests by cultivation, to watch closely the development of the insects not only in the vineyard as a whole but in some cases in various portions of it on account of the marked influence on their development exerted by various soils.

Beetles. Our observations of 1903 were largely confirmed by those of 1904. The first beetles observed abroad in 1902, which was a remarkably late season, were met with July 2, while in 1903 a few were taken June 19. The past season was later than the preceding one and none were observed prior to June 29 and in most vineyards comparatively few were met with till early in July. Our cage experiments in 1903 showed that over 92% of the beetles appeared within two weeks after the first were taken and practically none after July 21; in other words, out of 506 bred from under two vines, 477 emerged by July 21. This record is closely paralleled by that obtained in 1904, when 155 beetles, 87% of the entire number, were taken within the first two weeks after the insects began to appear in the cage.

Record of cage experiments 1904

	1 CHECK Beetles counted, none removed		2 ARSENATE LEAD 1 lb to 10 gal.		3 ARSENATE LEAD 1 lb to 10 gal.	4 POISONED BORDEAUX MIXTURE	5 BEETLES COLLECTED	
	VINE 1	VINE 2	VINE 1	VINE 2			VINE 1	VINE 2
GRUBS PLANTED	100, May 24	100, May 26	100, May 26	100 June 1	100, June 2	100, June 2	Small, 20, May 26; 10, June 4; 20, June 9; 13, June 13; 7, June 15; 8, June 16; 15, June 17. Large, 14, June 13; 11, June 15. Total 118	100 large, June 9
DATE								
July 5	.....		.....		.....	.....	3 beetles	
6	.....		.....		.....	.....	33 "	
7	52 beetles		Sprayed 1		Sprayed 1	Sprayed 1	28 "	
9	83 "		.....		.....	.....	21 "	
11	109 "		Sprayed 2		.....	.....	36 "	
13	141 "		.....		Sprayed 2	Sprayed 2, few signs of feeding, no dead beetles	17 "	
15	147 "		Sprayed 3		.....	.....	17 "	
18	120 "		.....		Sprayed 3, no dead beetles	Sprayed 3	6 "	
20	100 "		Sprayed 4, no dead beetles.		No dead beetles, feeding on protected leaves	No dead beetles, feeding on protected leaves	7 "	
23	25 live, 4 dead beetles		Sprayed 5		.....	.....	5 "	
27	.....		.....		.....	.....	3 "	
Aug. 1	.....		.....		.....	No dead beetles	3 "	
2	5 live, no dead beetles, 12 egg clusters		No beetles, 4 egg clusters		1 live, no dead beetles, no egg clusters		Total...179	
8	1 live beetle		No dead beetles		No dead beetles	No dead beetles	No beetles	

This is a slightly smaller per cent than that observed last year, but the cage in which this experiment was tried was planted with a large number of quarter to half grown grubs. An examination in the spring showed that the two vines in cage 5, which we used for this test, were practically free from grubs and as a consequence it was restocked with 140 large grubs and over 60 small ones, making a total of 218. 179 beetles were obtained from these grubs on or before Aug. 1, indicating that some, at least, of the partly grown grubs must have attained full size very rapidly, transformed and emerged within a comparatively short period. It would therefore appear as though the beetles found in the vineyard during the latter part of the season and even into September or October, are in all probability those which have enjoyed a prolonged adult existence of two or more months, rather than belated individuals from the small grubs so frequently met with in early spring. The appearance of beetles above ground, as previously pointed out, is a matter of considerable importance whatever method is adopted for the control of the insect. The period elapsing between pupation and the emerging of the beetles, is a comparatively uniform one and consequently cultivation for the destruction of the pupae should be at a time when most of the insects are in this helpless condition. It is equally important to destroy the majority of the beetles either by collecting or with poison, before they have deposited many eggs, and as shown by our observations of last year, this can be done provided many are collected or killed within 7 to 10 days after they first appear, and then the majority of the remaining beetles destroyed within the next week or 10 days.

Our records regarding the relative abundance of beetles are also confirmed by observations in cage 1, which was planted with 200 full grown grubs [*see* record of cage experiments]. This cage was a check one and the insects were counted as closely as possible at more or less frequent intervals from July 7 onward. It will be observed by referring to the record, that more insects were seen July 13 and 15, within a week or 10 days after they first appeared, than at any other time.

Eggs. The extended observations on the oviposition habits of this species in 1903 hardly required duplication and it is perhaps sufficient to state that no evidence was met with to show that our conclusions in this respect were in the least erroneous. It will be sufficient in this connection to point out the salient features of our earlier studies. In the case of one female we found

that over one fourth of the total number of eggs were laid during the last 10 days after oviposition began, and that nearly one half of the entire number (over 900) were deposited within the first three weeks. These figures were strikingly substantiated by a tabulation of the egg deposits of a number of beetles in various cages, showing that 45% of the entire number were deposited within the first two weeks and that 73% were laid during the month of July; in other words, by far the greater number of eggs are deposited under normal conditions during the first two weeks after the beetles begin to lay or during the first 3 or 3½ weeks of their existence, and consequently it is important to destroy them as early in this productive period as possible.

Value of beetle catchers. Our work in 1902 proved that a hand beetle catcher, of which the so called Hough beetle catcher may be taken as a type, could be used to advantage in small vineyards, though it is a somewhat laborious and slow method of controlling the insect. The larger horse machine, made for us and tried for the first time in 1903, demonstrated the practicability of this method of capturing the beetles. Our three catchings with a few minor ones in early July, resulted in taking over 150,000 beetles from an experimental area of about five acres, and at the close of the summer we estimated that the number of insects had been reduced about 98%. The work of 1904 has been a continuation of that begun in 1902 and further prosecuted last year. We were anxious, among other things, to ascertain if the conclusions of 1903 would be justified by the conditions found in 1904. Sample diggings in the experimental area in the fall of 1903 resulted in obtaining no grubs from three vines, one only from each of three, and two only from two others, indicating that there were very few which had more than 12 or 15 grubs, and that in all probability the number to each vine would hardly exceed 8 or 9. There was a chance that there might be a material difference between conditions in the fall and those of early spring, consequently sample diggings for grubs were made in the spring of 1904, and they may very justly be compared with what was found in the experimental area we selected in the spring of 1903. Similar diggings over the experimental area in the earlier year, gave from 8 to 50 or more grubs, or as calculated, from 60 to 400 or more to a vine, and in one case it was estimated that there were fully 1000 under a single vine. The following table of grubs taken in the Falvay vineyard in 1904, reveals a very striking difference.

Record of grubs taken in Falvay vineyard 1904

ROW	May 24	June 1	2	3	9	10	11	13
8	4							
13							0	
14	2							
15	0					1	0,0	
16							0	
17							0	
18						2	0,0,2	
19		2,7,10				1		
20		0,7,20,0,6			1,7,1	2		
21	15,17	6,3,5,5			1,0	0	0	
22			4,53,8,7,4		2		0	0
23	10		7,4,5,1		1		2	0,0,1
24	2		1,3,0				1,0	
25	3,6	2,3,1,8						1
26	1,6	4,2,3						
27				9,3,0,4,4				
28				0,2,4,0,0,4				
30				0,0,0,1				
31	2							
32	0							
36	1							
39	3							
45	3							

It will be observed that in comparatively few cases only, were more than eight grubs found under a vine, and in the one case where 53 were taken from under one, these were obtained only after extended diggings under the entire vine, whereas all of our sample diggings in the spring of 1903, did not, as a rule, comprise more than a quarter of an arc and even then were limited to a small area in the immediate vicinity of the stem. Most of the sample diggings in the spring of 1904, averaged larger than those of the preceding spring, and in the case where 15 and 17 respectively were found in row 21, May 24, one third to one half of the entire area in the near vicinity of the stem was excavated in search of the grubs taken. It will also be observed that in a great many instances none were found, showing a striking difference as compared with the year before.

The efficacy of last year's collecting with a horse machine, was further tested by operating the same apparatus over the experimental area in the season of 1904. Three collectings, as in the preceding year, were made; the first July 1 and 2, the second about the 12th, and the third from the 16th to the 19th. The total collections on each of these dates amounted respectively to 5312, 2003 and 1925, a total of only 9240, which should be compared with the 154,900 taken from the area the preceding year. It should be remembered, however, that these figures do not represent the actual decrease in the number of insects destroyed, because the survivors of our operations in 1903, had an opportunity to

multiply and consequently while we captured about 94% less insects, the actual reduction was considerably more, as allowance should be made for a normal increase.

Table of beetles taken with Morehouse catcher 1904

Rows	1st collecting July 1, 2	2d collecting July 12	3d collecting July 16-19
1-18	738	.....	357
19-24	311	253	105
25-30	526	325	191
31-37	669	523	205
38-50	1 340	512	508
51-61	1 467	390	390
62-63	261	.....	169
Totals	5 312	2 003	1 925

Grand total 9240, a reduction of 94%

The operations of 1904 showed that under certain conditions considerable shelling of the grapes was likely to result unless great care was exercised in jarring. The relief, as the result of cultivating and collecting, is so great that wherever a vineyard is badly infested with beetles, there can hardly a question arise as to the advisability of sacrificing, if need be, a few grapes for the sake of practically freeing an infested area from such a dangerous enemy of the vines.

Experiments with arsenical poisons. It is very difficult to secure reliable data on the efficacy of poisons for controlling this insect. The beetles do not succumb quickly and therefore we do not find many dead on the ground at any one time, which would be conclusive evidence of their being destroyed by poison. Secondly, the beetles exhibit a marked preference for unsprayed foliage and in search therefor frequent concealed, unsprayed leaves and probably, when flying about the vineyard as they do more or less, work from the poisoned to the unpoisoned vines. Naturally those finding themselves on wholesome foliage, are inclined to remain there and as a consequence large areas uniformly infested with a great many beetles, are necessary for satisfactory results. It is obviously unfair to compare sprayed rows with closely adjacent unsprayed ones because the activity of the beetles would naturally lead them to fly more when on sprayed vines and less on untreated ones,

which are much more to their liking, consequently there is a strong tendency to collect on near-by unsprayed foliage whenever possible. This makes comparisons between sprayed and unsprayed vines side by side or even within two or three rows of each other of slight value, and has rendered it very difficult to find conditions suitable for an exhaustive test of poisons. Another important adverse factor is the liability of the insects forsaking the experimental area, not because there is poison on the vines but for some unknown reason. A number of such cases have been brought to our notice and conclusions must therefor be reached with extreme caution.

The results obtained with these materials in 1902, were exceedingly unsatisfactory and it was then thought that the very unfavorable weather afforded at least a partial explanation therefor. The experiments were continued in 1903, and a series of plots for testing the relative merits of arsenate of lead, paris green and poisoned bordeaux mixture in connection with cultivating for the destruction of pupae and collecting of the beetles, were planned. The spraying operations were conducted as outlined but owing to the likelihood of there being large numbers of eggs deposited in the sprayed areas, at the last moment it was decided to collect over the same and thus save the vineyard from serious injury it could ill afford, as it had suffered severely the preceding year. The areas infested with root worms, were carefully examined in the spring of 1904, for the purpose of finding if possible, thrifty growing vineyards, moderately to rather badly infested with beetles, and after an extended search one was selected near the center of Westfield, known as the Cowden vineyard, and another in Portland, belonging to E. W. Skinner. Grubs were abundant in both in early spring, but for some reason or other comparatively few beetles emerged or were to be found later in the Cowden vineyard at Westfield, and consequently most of our experimental work with arsenical poisons, was limited to Portland. The experimental area consisted of about one acre of nearly level vineyard and comprised 10 rows, the southern portion being more infested than the northern. June 30 this experimental area was sprayed very thoroughly indeed; four barrels of spray and 15 pounds of arsenate of lead were used. Two nozzle extensions with hose of different lengths were employed, one with two and the other with three cyclone nozzles. One man gave particular attention to the upper portion of the row and the other following behind to the lower, the spraying being repeated on the opposite side of the row and thus the foliage was covered as thoroughly as possible with

poison. An examination in the vineyard at the time showed that the beetles were abundant, having recently emerged, and as many as 20 were observed on a vine, and in one instance nine were seen within a small area of about 9 inches, the insects resting on the top wire and adjacent stems. There was considerable feeding in the vineyard at the time of treatment, which latter had been delayed somewhat because of the grapes being in bloom. A second spraying was given in the same manner July 6. At this time much feeding was observed and numbers of the beetles were pairing. The following table gives in a summarized form the conditions as observed in the experimental area and the section adjacent thereto, which was used as a check.

Table of spraying experiments at Portland 1904

		BEETLES CAPTURED					EGG CLUSTERS FOUND				GRUBS FOUND	
	Date	July 6		July 11	July 14	July 20	July 25	July 29	Aug. 5	Aug. 8	Oct. 3	
	Rows	North end	South end								North end	South end
Sprayed	1	.....	27	.....	18	.....	.....	.....	.....	.....	1	2
	2	.....	55	.....	46	11	.....	.....	.....	.....	3	4
	3	.....	.....	6,9,13,19	22	14	.....	.....	.....	.....	...	0
	4	.....	.....	5,8,13,22	15	14	2,2,0,2,1	.....	.....	.....	2	3
	5	5,16,6	33,46	14,25,9,9	19	5	3,3,2	.....	1,4,5,3,6	.....	4	4
	6	.....	58	23,24	25	17	.....	.....	.....	7,3,2,5,6,4	3	7
	7	15	.....	.....	23	19	.....	.....	.....	.....	...	5
	8	8,11	.....	25,20,24	23	16	.....	5,2,3,1,3,4	.....	.....	5	6
	9	.....	.....	39,15	29	5	.....	.....	.....	.....	...	4
	10	.....	55,54	.....	25	10	.....	.....	.....	.....	4	5
Unsprayed	11	.....	79,79	.....	51	14	.....	.....	.....	.....	5	6
	12	.....	.....	18,34,31	60	14	.....	.....	.....	.....	...	6
	13	.....	.....	31,30,30, 57,49	42	15	.....	.....	.....	.....	6	7
	14	.....	.....	.....	53	9	.....	.....	.....	.....	5	9
	15	.....	53,95,32. 24,27,15	.....	58	12	.....	.....	8,10,9,13, 11	.....	6	8
	16	.....	.....	.....	43	13	14,6,5,5,20	.....	.....	.....	4	....
	17	.....	.....	77,38	51	15	.....	18,9,9,19, 13,15	.....	.....	7	....
	18	.....	.....	40,32	40	.....	.....	.....	.....	.....	...	.....
	19	.....	.....	.....	34	.....	.....	.....	.....	.....	...	6
	20	.....	.....	.....	49	.....	.....	.....	.....	.....	...	8

It will be observed on referring to the two columns under date of July 6, that the beetles were decidedly more abundant in the southern than in the northern end of the plat, as previously stated. The separate figures given in each space refer to the number of beetles, egg clusters or grubs taken on or under individual vines, and when more than one is given, it means that several in the same row were examined. The experimental area was carefully watched from time to time, and at more or less regular intervals a Hough beetle catcher was used to collect the beetles from single vines in order to ascertain the number present in various portions of the treated and untreated areas. It is interesting in this connection to compare the average number of beetles on vines about the middle of the sprayed and unsprayed areas; in other words, on rows 3 to 7 in the sprayed area and rows 14 to 18 in the unsprayed section. In the former there were, July 6, 45.66 per vine; July 11, 12.8; July 14, 21.2 and July 20, 13.8. These figures should be compared with the following from the unsprayed area. July 6 there was an average of 41.66 per vine; on the 11th 57.5; on the 14th 49 and on the 20th 12.25. It will be seen that the numbers were approximately equal on the first and last named dates, and the considerable discrepancies observed on the 11th and 14th are probably to be explained in a large part by the effect of the poison applied June 30 and July 6. Still the above data hardly allows us to accurately estimate the total number of beetles destroyed. July 6 there were signs of considerable eating on both sprayed and unsprayed rows, it being specially evident on the latter. We consider this somewhat unreliable evidence as to the amount of protection afforded, since the beetles on sprayed vines feed to a considerable extent on sheltered leaves and in places hidden from observation, evidently in an attempt to find foliage free from poison. An examination July 8, nine days after the first spraying and two after the second, resulted in finding the remains of 9 dead beetles under about 15 vines in the southern section of the vineyard. There were a great many living, apparently healthy insects on the vines, and there appeared to be no marked inclination to forsake the sprayed area. The jarring of a typical vine in row 6, resulted in the capture of 35 beetles, and another in row 13 in taking 61 beetles. July 11 the remains of 7 or 8 dead beetles were found after an extended search under about 15 vines, and on the 16th it required two hours to find two dead insects under a number of vines, indicating plainly that comparatively small numbers were killed by the poison. An examination July 21 resulted in taking

11 beetles from a sprayed vine and 12 from a similar one in the unsprayed area, and at that time there appeared to be just as many beetles on the sprayed as on the unsprayed area.

A study of the egg clusters taken on vines in both the sprayed and unsprayed areas, is interesting and considerable variation in the numbers will be observed. Comparisons of the numbers of egg clusters taken from vines in the middle of the treated and untreated areas (rows 3–7 and 14–18), show that in the sprayed section July 25 there was an average of .7 of a cluster per vine; on the 29th an average of 3, and Aug. 5 an average of 4.8 clusters per vine, whereas in the unsprayed area there was, July 25, an average of 5 egg clusters per vine; on the 29th an average of 12⅛ clusters per vine, and Aug. 5 an average of 10.5 egg clusters per vine. Averaging each of these we find that during the entire period there was an average of 2.82 egg clusters per vine on the sprayed area and of 9.16 on the unsprayed area[1]. This appears like a very substantial reduction in eggs, and were it borne out later by an examination for grubs around the roots, we would be inclined to accept it at its face value. Unfortunately such is not the case, and for some reason or other, if the above figures are correct, there had been a greater mortality among the eggs deposited on the unsprayed than among those deposited on the sprayed vines, as examinations in October, extending across the entire area, show that on the southern portion of the vineyard we had an average of 4.75 grubs per vine on the sprayed area and of 7.4 grubs on the unsprayed area, indicating a reduction of less than 50% on the worse infested section. A comparison of vines on the northern portion of the experimental plots, where the beetles were not present in such large numbers, shows that there was an average of 2.2 grubs under the sprayed vines, and of 5.5 grubs under unsprayed vines, indicating a decrease of a little over 50%. Considering the entire data, we find an average of 3.47 grubs under the vines on the sprayed area, and one of 6.45 grubs under the unsprayed vines. It will be seen that in the case of both beetles and eggs, the relative proportion of each on the sprayed area increases with the advance of the season, and that consequently it is almost impossible by a single examination to correctly estimate the value of the spraying. Reliable data apparently can be obtained only by digging about the vines in order to estimate

[1]The percentage reduction, 86 % does not differ widely from that obtained about the same time by Messrs Slingerland and Johnson, namely 93-95 %. The significant feature is that these percentages are true for only a limited period and the real protection from spraying is considerably less. [*See* C. U. Exp. Sta. Bul. 224, p. 67]

the number of grubs, which as previously pointed out, are the destructive agents the grower wishes to eliminate from his vineyard.

It is interesting in this connection to refer to the mortality and egg records of beetles from the experimental areas. This was another effort to learn by indoor observation, more of what was actually taking place outdoors, and the general plan was to catch beetles at approximately regular intervals, taking some from both the sprayed and unsprayed areas, and feeding a portion of those from the former on sprayed foliage and the remainder on unsprayed leaves.

Mortality and egg record of beetles from experimental areas 1904

	Date of capture	Number taken	July 9	July 11	July 13	July 16	July 19	July 20	July 23	July 25	July 27	Aug. 1	Aug. 6	Aug. 12	Aug. 17
From sprayed fed sprayed	July 6	15	3 dead	3 dead	2 dead	2 dead 1 missing	2 dead	all dead							
	July 8	15		2 dead	4 dead	2 dead	4 dead	2 dead				all dead			
	July 11	11			2 dead	3 dead		all dead							
	July 14	16				6 dead	9 dead	all dead							
	July 25	11									6 dead	all dead			
From sprayed fed unsprayed	July 6	19				eggs	2 dead		1 dead			5 dead	2 dead	4 dead	4 dead 3 living
	July 8	15			eggs		1 missing		2 dead; eggs	1 dead; eggs		eggs	4 dead; eggs	all dead	
	July 11	10			1 dead	3 dead	3 dead			eggs	eggs		eggs	all dead	
	July 14	16				4 dead	6 dead	3 dead				eggs	eggs	all dead	
	July 25	11									1 dead	4 dead	4 dead	1 dead	1 living

From unsprayed fed unsprayed	July 6	35			5 eggs	2 dead; eggs	2 dead	2 dead		1 dead	1 dead	5 dead	5 dead	all dead	
	July 8	23			5 eggs	eggs	1 dead	2 dead	1 dead		eggs	3 dead	4 dead; eggs	6 dead	2 dead 4 living
	July 11	20				eggs			2 dead; eggs			2 dead; eggs	1 dead; eggs	8 dead	2 dead 5 living
	July 14	22				2 dead; eggs	1 dead	2 missing	eggs			eggs	2 dead; eggs	5 dead	7 dead 3 living
	July 25	15											1 dead; eggs	4 dead	6 dead 4 living

Reference to the table shows that beetles taken on the sprayed area and fed on sprayed foliage, all died within a comparatively short time, specially those captured about the middle of July and later. Those taken on the sprayed foliage and fed on unsprayed leaves, lived a considerably longer time, deposited more or less egg clusters, and in general compared very favorably with those taken on unsprayed foliage and fed leaves that had not been poisoned. These records were made by Mr Nixon, and he states that those fed on sprayed foliage appeared to die as much from starvation as from the poison, and this seems very probable, since we know that in vineyards the beetles exhibit a marked preference for unpoisoned leaves. This latter table in connection with the field experiments, clearly shows that some of the beetles can be destroyed by arsenical sprays, and if the vines are kept covered with poison a considerable degree of protection results. It is difficult to state the precise amount, but from data at hand we are inclined to place it at from 50 to 60%, possibly more. Much depends on the thoroughness with which the work is done, and in the case of very rapidly growing vineyards like Mr Falvay's, in which we experimented last year, the protection would probably be much less. This is borne out by reference to our beetle catcher records [*see* p. 371], where it will be observed that fully as many beetles were taken on the rows treated in 1903 with arsenical poisons, namely numbers 25 to 61, as from any other section of the experimental area. A single application of poison was made in this instance and under such conditions it can hardly be considered as having checked the insect to a marked degree. Sprayings should be made at intervals of not over four or five days after the beetles become abundant, and if three can be made at four day intervals it is very likely that much greater protection will be obtained than if only two were made at five or six day intervals.

Restoration of injured vineyards. One of the most serious troubles with this pest, has been that considerable if not a large proportion of the injury is inflicted before the vineyardist is aware of the danger. Watchfulness will, to some extent, obviate the trouble but in many cases the pest becomes abundant before the owner knows of its presence and much damage is caused at the outset. Our experiments in Mr D. K. Falvay's showed that it was possible for the roots to be badly scored by the grubs and yet the vines recover with comparatively little loss of vitality, provided remedial measures are promptly adopted. The roots

in that vineyard were badly wounded in the spring of 1903, and had the pest been allowed to breed in abundance through that summer, we are quite confident that a large proportion of the vines would have been almost ruined because they were not in a condition to withstand another attack. The prompt removal of a very large number of the insects allowed the vineyard to recuperate. We have been observing from season to season other vineyards where the insect has appeared in destructive numbers and caused considerable loss, practically making it impossible to secure any crop for several years. Such vines, having been cultivated and fertilized liberally, appear to be returning, though slowly, to a nearly normal condition, and in another year or two it may be expected, unless they are again injured by large numbers of the pests, that full crops may be secured. The principal factors in restoring a vineyard suffering from root worm attack, is first to see that it is largely freed from the insects and then assist the vines to regain strength by good cultivation, liberal fertilizing, and specially by trimming severely, so that a large amount of the vine's energy will not be absorbed in making useless wood. The process of restoration may occupy two, three or possibly four years, dependent very largely on the severity of the initial injury and also on the care and cultivation given. It is much more satisfactory and profitable to check this insect before serious damage has been caused.

Recommendations. There is no doubt as to the value of cultivation for the destruction of pupae, and wherever the beetles are at all abundant we would advise as heretofore, that vineyardists plan if possible to have a ridge of firm earth at the base of the vines either in the fall or early spring, and to remove the same with a horse hoe or other implement when the great majority of the insects are in the "turtle" or pupal stage, which is normally from the first to the middle of June.

This measure may well be supplemented by destroying beetles, either by the employment of a beetle catcher or with an arsenical spray. The use of the former is preferable in all vineyards where the insects are very abundant and particularly where the vines are growing vigorously. The latter may be employed with safety wherever the vineyard is not badly infested, and particularly on vines not growing rapidly. This is specially advisable where the berry moth is at all prevalent, because there is no doubt but that the poison kills over half of these insects, and this benefit should be taken into account when deciding on the method of destroying

the beetles. It should be remembered, however, that if poisons are employed the application should be most thorough, and it is probable that an outfit capable of developing a high pressure and delivering an extremely fine, mistlike spray, would give better results than one where the spray is coarser and consequently does not drift in among the leaves to so great an extent.

Our observations show that it is much better to fight this insect at the outset and prevent serious injury to a vineyard, rather than to take chances and spend three to five years in getting the vines back into fairly good condition.

Gipsy moth

Porthetria dispar Linn.

This introduced pest is well known by reputation throughout the United States, and owing to the discontinuance of exterminative measures in 1900, by the commonwealth of Massachusetts, the insect has been allowed to breed more or less undisturbed in many sections and as a consequence has become exceedingly abundant. This condition of affairs, while primarily affecting the residents of the infested districts, is of much importance to those outside because the danger of the pest spreading into other sections is vastly increased. The injuries in 1903 and 1904 were so severe that there was a strong agitation in favor of the resumption of exterminative or repressive measures, particularly if the general government could be induced to take up the work. The secretary of agriculture, Hon. J. Lewis Ellsworth, has been a prime mover in this matter because he and the members of the State Board of Agriculture are in a position to appreciate the gravity of the situation. Several conferences were called during the summer of 1904, and a number of interested parties visited the infested section in order to gain a better idea of actual conditions. The entomologist, in company with Mr G. G. Atwood of the Department of Agriculture, and several others, went over a portion of the infested section July 20. The party started at Malden, driving from there to Oak Grove, over into Melrose, then to Medford and back to Malden, some two hours and a half being spent in the worst infested portions. Generally speaking, most of the street trees and those in private yards showed little evidence of injury by the pest, though occasionally a small orchard or a few trees which had evidently been neglected were seriously hurt. The most destruction was in woodlands, where conditions render it much more difficult to

control the insect, and in the vicinity of Malden it is stated that an oak forest of some 2000 acres, practically cleared of the moth when the work was suspended in 1900, was completely defoliated, and from what was seen the statement is entirely credible. Many acres of woodland were stripped practically clean of foliage and in several places a large number of trees had succumbed, and other areas were observed where the forest growth had evidently been cleared off because of previous injuries by the gipsy moth larvae. Many males and females were observed at the time of our visit, together with numerous egg clusters, though some larvae were present in certain places and there were many pupae. Large numbers of the infested trees were literally plastered about the base with moths and egg clusters, and adjacent stones and other objects were similarly ornamented.

The present distribution of the gipsy moth, so far as known, includes practically all of the territory given in the latest maps published by those engaged in the work, and in addition, colonies are known to occur in Billerica and Newton, which seem to be the westernmost points, and in Bridgewater and Scituate, the southernmost extension of the insect with the exception of the colony in and about Providence R. I. A most serious aspect of the situation is, that some of the worst infested localities are in the vicinity of railroads, and Prof. A. H. Kirkland reports finding eggs on freight cars. These eggs, as is well known, remain unhatched over winter and there is no knowing where the insect may establish itself another spring. It would in all probability be in the vicinity of a railway station. Aside from this source of spread there is great danger in moving boxes, barrels and almost any material near trees inhabited by the pest, because these eggs masses, while conspicuous, are deposited in all manner of places and unless one is familiar with their nature they could easily be overlooked. The situation is such as to greatly increase the chances of the insect being brought into the State, and on that account all are advised to be specially watchful for its advent, and in any case where there is the least suspicion as to the identity of insects found, to send them to this office rather than to allow false reports of the occurrence of the gipsy moth to be given out. These latter simply occasion undue alarm without any benefit resulting therefrom. This species may appear in New York State within a year or two though we hope that its introduction may be deferred for a decade or more.

Description. The eggs of this insect are deposited usually in round or oval patches on a piece of bark and then covered with buff colored scales from the underside of the female's abdomen. A completed egg mass looks very much like a small oval section of a sponge. These masses may be found on stones, in tin cans and in fact on almost any fixed object near at hand, preferably on the under surface, particularly of limbs, fence rails, window sills, etc. The egg itself is nearly globular, pale yellowish or salmon-colored, about $\frac{1}{20}$ inch in diameter, and there are usually 400 to 500 of these in a cluster, though occasionally 1000 occur in one mass. The young caterpillar is slightly over $\frac{1}{10}$ inch long just after it emerges from the egg. It has a black head, the body is brownish yellow and well clothed with long hairs. There is on either side of the segment next the head, a prominent haired tubercle, which gives the young caterpillar in particular, a peculiar broad-headed appearance. The markings become plainer as it increases in size, and when full grown it is from 2 to $2\frac{1}{2}$ inches long or about the size of our common tent caterpillar or the forest tent caterpillar. It may then be recognized by the eight bluish tubercles or swellings in a double line on the anterior dorsal portion of the body, and the 12 reddish ones in a double line on the posterior dorsal part of the caterpillar. In addition, there are four bluish tubercles or elevations just behind the head. The general color of the full grown caterpillar is brownish yellow with dark brown, in some cases almost black markings. The somewhat conical, dark brown pupa ranges from $\frac{3}{4}$ to $1\frac{1}{2}$ inches long and is usually found lying among a few threads spun on bark, stone or other support and securely attached to these filaments by its terminal spine.

The moths differ very greatly. The male is a slender, olive brown, black marked insect with beautifully feathered antennae and a wing spread of about $1\frac{1}{2}$ inches. It flies in the late afternoon and early evening. The female is much heavier and lighter colored. She has a wing spread of about 2 inches and is white or buff white with more or less distinct wavy, black markings. The abdomen is tipped with buff. The female does not fly though she apparently has well developed wings.

Recommendations. Investigate anything that arouses a suspicion that it may be the gipsy moth, but be in no undue haste to identify the insect. It will be much more satisfactory to submit specimens to an entomologist than to arouse unnecessary fears.

The habits of the insect are such that it can be controlled comparatively easily in orchards and on cultivated trees, and we would by all means advise repressive if not exterminative measures wherever it becomes established in small numbers at some distance from large colonies. Such points of infestation should be made known as soon as discovered, in order that adequate steps may be taken to prevent unnecessary spreading.

A more detailed account of this species, together with colored illustrations of its various stages, is given in the *16th Report of the State Entomologist 1900.*

Brown tail moth

Euproctis chrysorrhoea Linn.

The brown tail moth, unlike its introduced associate, the gipsy moth, spreads rapidly because both sexes fly readily, and though it was not discovered in this country till nearly 10 years after the gipsy moth was detected, it has already spread over a much larger area. This species was also a subject of observation when the territory infested by the gipsy moth was inspected last July. Many of the peartrees in Malden, Medford and vicinity were partially or entirely defoliated by the caterpillars, and at the time of our visit several tents of the young insects were seen, showing that another brood had begun its operations. The moths had been flying in immense numbers only a week or 10 days before, being so abundant as to arouse general interest and provoke lengthy notices in some of the leading city papers. This species now occurs as far west as Worcester and Westminster, Mass. It has also invaded New Hampshire and a colony has been established for some years at Kittery Me. This species is not only a destructive leaf feeder, exhibiting marked preference for the pear, but the irritating hairs from the caterpillars are exceedingly annoying, producing a very uncomfortable rash which, in some cases, is so severe as to cause illness.

Description and habits. The eggs are laid in July in masses composed of from two to three hundred and are usually placed on the underside of the leaves, where they are covered with brown hairs from the tip of the female's abdomen. They hatch in a short time and the young feed during the rest of the season on the surface of the leaves, a few only being required to skeletonize them. The caterpillars begin to make the nest or tent in which they hibernate, while still young. It is constructed on the twigs and is made by drawing together a few leaves, lining them with silk and inclosing them with a mass of silken threads. These tents are so firmly secured to the twigs that they can not be removed without considerable force. There is no danger of confusing the tents of this species with those

of our apple tent caterpillar, Malacosoma americana Fabr., since those of the latter are in the fork of the branches, while the tents of the brown tail moth are at the tips of the branches and securely attached thereto by broad bands of silk. The apple tent caterpillar rarely attacks pear, while this food plant is a favorite with the brown tail caterpillars. The web nests or tents of the fall web worm, Hyphantria textor Harris, occur on the trees at the same time as those of the brown tail moth, but they are of an entirely different character, inclosing as they do all of the leaves on the tips of one or more branches and never being firmly attached to the twig. The caterpillar of the brown tail moth ranges from 1 to 1¼ inches in length. The pale brown head is mottled with dark brown and has reddish brown hairs scattered over its surface. The body is dark brown or black with numerous fine, dull orange or greenish spots over the surface, which are most pronounced on the second, third and fourth segments. Long, reddish brown, finely barbed hairs arise from all the tubercles and white branching hairs from the upper side of the lateral tubercles on segments 4-12 inclusive. These white hairs form elongated, white spots along each side and are one of the most striking characteristics of this caterpillar. The subdorsal and lateral tubercles on segments 4-12 inclusive, are covered with fine, short spines of uniform length. There is a bright red, retractile tubercle on top of the 10th and also one on the 11th segment. The moths have a wing spread of about 1¼ inches, are pure white with a satiny luster on the fore wings and a conspicuous reddish brown tuft at the tip of the abdomen. Sometimes there are a few black spots on the fore wings. The antennae are white and fringed with pale yellowish hairs. This species has been treated at some length and illustrated in its various stages in the *18th Report of the State Entomologist*, pages 94–99.

Remedies. It is impossible to exterminate this species, but it may be kept in check by cutting off and burning the hibernating nests in winter, at which time they are readily detected. The species is also amenable to spraying with an arsenical poison, and on account of the severe irritation resulting from the hairs blown from cocoons, it is by all means advisable to prevent this insect from becoming abundant.

Experiments in controlling the San Jose scale
Aspidiotus perniciosus Comst.

The field experiments begun by this office in 1900, were continued in part during the season of 1904 and data secured which has greatly increased our belief in the efficacy of lime-sulfur washes for the

control of the San José scale. There is still considerable diversity as to the best formula and method of preparation, and much attention has been given to this phase of the subject because a slight saving in either material or time amounts to a great deal in the aggregate, when allowance is made for the large amount of spraying necessary. There is in New York State a great demand for a reliable wash which can be prepared very quickly and particularly for one which does not require the prolonged boiling of a large amount of liquid. Such a wash may be prepared with the aid of caustic soda, which material appears not only to facilitate the solution of the sulfur but the heat generated by it also aids in hastening chemical combination between the sulfur and the lime. This process was first brought to notice by the late Prof. V. H. Lowe of the State Agricultural Experiment Station at Geneva, and further work has been done with it by Prof. P. J. Parrott, his successor. Some preliminary laboratory experiments with ordinary washing soda in place of the caustic soda were somewhat surprising to us, and so far as both laboratory and field experiments go, we have had much better success in securing a combination between lime and sulfur with the use of this material than when the caustic soda was employed. Washing soda or sal soda has the advantage over caustic soda in that it may be obtained almost anywhere, requires no special care in handling prior to its use, and is a material with which most people are familiar. The spring experiments with this wash conducted in 1904, indicate a high degree of efficiency, apparently equal to that of a lime-sulfur wash prepared in any other way.

Laboratory experiments with lime-sulfur combinations

It has been very difficult for the entomologist to secure much information regarding the chemical behavior of lime and sulfur when boiled together, either by themselves or in association with salt, caustic soda or other materials supposed to facilitate chemical combination. This led us to experiment with a few of the more common materials, first in the laboratory to ascertain their behavior there, and then in the field to see if the work on a small scale would be borne out by operations with larger amounts. The following observations on experiments in a small way are placed on record, since they may prove of service to others interested in solving these problems and specially because they form a basis for our work on a larger scale.

Laboratory experiments with lime-sulfur combinations

Wash	Lime	Sulfur	Soda bicarbonate	Soda sulfid	Water	Length boil	Color	Character precipitate	Color liquid	Precipitate after 24 hours
1	2 oz	1 oz	1 oz		1 qt	15 min.	Brick-red	Very fine	Orange	No crystals
2	1¼ oz	1 oz	½ oz		1 qt	30 min.	Brick-red (lighter)	Fine	Brick-red	Numerous brick-red crystals
3	1¼ oz	1 oz	½ oz		1 qt	30 min.	Brick-red	Flaky, coarse	Brick-red	Brick-red crystals in greenish precipitate
4	1¼ oz	1 oz	1 oz		1 qt	30 min.	Orange	Very fine, a few flakes	Brick-red	Numerous brown crystals in rather coarse precipitate
5	2 oz	1 oz	1 oz		1 qt	15 min.	Red	Fine, few sulfur flakes	Pale brick-red	Fine
6	¼ oz	1 oz	1 oz		1 qt	15 min	Deep orange	Fine, somewhat flaky	Deep red	Fine
7	2 oz	1 oz	1½ oz		1 qt	15 min.	Deep orange	Less flaky, more perfect than no. 6	Deep red	As before
8	2 oz			2 oz	1 qt	15 min.	Slate color	Coarse, heavy	Colorless	As before
9	¼ oz	⅜ oz		⅜ oz	1 qt	15 min.	Green then orange			

Wash 1. Prepared Ap. 1, 1904. Water was brought to a boil, lime put in, and as soon as the slaking was well begun, the soda carbonate was added, followed immediately by the sulfur. Chemical action began at once and a change in color from white to orange, to red, to brick-red, was observed. At the end of 15 minutes a deep brick-red color showed that considerable combination had taken place. The solution was good, strongly alkaline, and on being allowed to settle, a clear orange-colored liquid was left. The precipitate is very fine with no tendency to crystallize, even on the 5th.

Wash 2. Prepared Ap. 2. Water was brought to a boil, lime put in and the carbonate of soda added as above, and also the sulfur. Chemical action began at once and the color changed from white to purplish orange, orange-red and then to a brick-red, though not so deep as that noted above. The combination was slower and a less amount apparently, combined and dissolved and the precipitate was coarser. On being allowed to settle a brick-red colored liquid was left, and on the 4th numerous brick-red crystals were observed throughout the body of the precipitate and the same was true on the 5th.

Wash 3. Prepared Ap. 2. Water was brought to a boil, the carbonate of soda added, followed by the sulfur. It was stirred five minutes and the lime then added. A flaky precipitate was formed on the addition of the lime which was not dissipated by boiling. The solution contained many flakes at the end of 30 minutes. Colors were apparently about the same as in no. 1. On the 4th many very light flaky particles were observed near the top of the nearly brick-red liquid, and numerous brick-red, needle-shaped crystals were observed in the somewhat greenish, rather coarse precipitate at the bottom. This condition continued on the 5th. Combination was not nearly so satisfactory as when the lime, soda carbonate and sulfur were added in the order given.

Wash 4. Prepared Ap. 2. The lime was added to the almost boiling water, and as soon as slaking began, carbonate of soda was put in, followed immediately by the sulfur. Chemical action began at once and was slower than in no. 1, 30 minutes boiling being required for an approximately equal combination. The solution then was orange in color, very similar to no. 1, although showing a few more flakes and being a little coarser. On the morning of the 4th the brick-red colored liquid above was fully as darkly colored as in no. 1, but numerous brown, needle-shaped crystals had formed throughout the rather coarse precipitate, as in the case of

nos. 2 and 3. It differed from the latter, however, in having practically none of the light flaky precipitate noted above.

Wash 5. Prepared Ap. 4. The lime was added to almost boiling water, and when the slaking began, the carbonate of soda was put in, followed immediately by the sulfur. The chemical action was rather slow and the sulfur dissolved somewhat slowly. At the end of 15 minutes a considerable combination had been effected, though there were a few flakes of sulfur. Examination on the morning of the 5th showed that the precipitate was fine and the clear liquid above was a pale brick-red. Combination was perhaps not quite equal to that of wash 1.

Wash 6. Prepared Ap. 4. Water was not quite as warm when the lime was added, as in the previous combination and consequently slaking was much slower. The carbonate of soda was added and sulfur immediately thereafter. The chemical action was much slower, the solution more flaky and of a deeper red color than in no. 5. Examination the 5th showed that the colored liquid above was slightly darker in color, while the precipitate seemed to be as fine as that in no. 5.

Wash 7. Prepared Ap. 4. The lime was added to boiling water and slaking began immediately. Carbonate of soda was then put in and followed at once by sulfur. Chemical action was prompt and an orange color was obtained much sooner than in either nos. 5 or 6. At the end of 15 minutes there were less flaky particles and the wash was more perfect than no. 6, though the color was about the same. Examination on the morning of the 5th showed practically no changes.

Wash 8. Prepared Ap. 4. Water was brought to a boil, the lime added, and after it was well slaked the sodium sulfid was put in. A dirty bluish green or slate-colored solution was formed. The precipitate is somewhat coarser than that in either washes 1, 5, 6 or 7 and appeared to settle much more rapidly, leaving above a clear colorless liquid. If the color is any indication, there was practically no combination between the lime and the sulfur in the sodium sulfid.

Wash 9. Prepared Ap. 4. The lime was added to the water when it was nearly boiling and allowed to slake; sulfur was then put in, and in about 30 seconds the sodium sulfid was added. The color appeared in a very short time, a purplish tinge was noted, which changed to green, and after six minutes boil to orange which remained in evidence during the entire 15 minutes. An examination on the 5th showed that this precipitate was hardly

as coarse as that in no. 8, and the clear liquid above has a distinct brick-red color, due probably to the presence of calcium sulfid, indicating some combination.

Wash 10. Prepared Ap. 4. This is the same as no. 9, except that boiling was continued for 30 minutes, and examination on the 5th showed little difference in the fineness of the precipitate, though the clear liquid above was somewhat darker.

Wash 11. Prepared Ap. 4. This is the same as solution no. 9, except that boiling was continued for 50 minutes, and there was practically no difference to be discerned between this and solution no. 10.

Wash 12. Prepared Ap. 4. This is the same as solution no. 9, except that boiling was continued for one hour and 30 minutes, and there seems to be practically no difference in the appearance of this solution and no. 9 or its other modifications. These later boilings necessitate the addition of water sufficient to make up the loss by evaporation, but otherwise conditions were identical. There were no signs of crystallizing in other than washes 2, 3 and 4.

Field experiments with lime-sulfur washes 1904

Wash	Lime	Sulfur	Caustic soda	Sulfid of soda	Sal soda	Water	Length boil	Color
1	25 lb	20 lb				50 gal.	½ hr	Brick-red
2	25 lb	20 lb				50 gal.	1½ hr	Brick-red
3	25 lb	12 lb				50 gal.	½ hr	Red
4	25 lb	12 lb				50 gal.	1½ hr	Brick-red
5	30 lb	15 lb	4			50 gal.	Not any	Orange red
6	30 lb	15 lb	4			50 gal.	1 hr	Brick-red
7	30 lb	15 lb				50 gal.	1 hr	Brick-red
8	30 lb	15 lb				50 gal.	½ hr	Red
11	14 lb	6 lb		6 lb		50 gal.	15 min.	Gray green
12	14 lb	11 lb		11 lb		50 gal.	15 min.	Dark pea-green
14	25 lb	20 lb			12½ lb	50 gal.	15 min.	Brick-red
16	25 lb	20 lb			12½ lb	50 gal.	None	Brick-red
17	25 lb	20 lb			18 lb	50 gal.	None	Dark orange red

Field experiments with lime-sulfur washes

The experiments begun last year in a peach orchard at Warwick, were continued in 1904, owing to the fact that the trees were still rather uniformly infested with a small amount of scale and therefore presented almost ideal conditions for experimental work. The spraying began Ap. 13 but it was not completed till the 18th, owing to inclement weather, high winds and other adverse conditions. The 13th was a bright day and in the morning not much wind, but in the afternoon a stiff breeze rose and prevented spraying. The morning of the 14th there was a snow storm, and shortly after 9 o'clock spraying began but was stopped again at 11 on account of brisk winds. The following days were more or less unfavorable at times and as a consequence portions of the trees had to be resprayed. The preceding table gives most of the formulas employed and in brief the method of preparation together with other observations.

Wash 1 composed of 25 pounds of lime and 20 pounds of sulfur to 50 gallons of water, was boiled ½ hour. This wash, if well made, contains very little sediment. The water should be nearly boiling hot when the lime is added, the sulfur should follow the lime immediately, and it is necessary to agitate or stir vigorously and continuously till the lime is all slaked. A dark brick-red color is easily obtained within the allotted time. This wash was applied Ap. 13 to rows 8 and 9, and a second treatment given on the 15th in order to insure thoroughness.

July 22 no living scale insects were found on the treated rows and on Sep. 23 no living scale was observed on the foliage and very little on the trees.

Wash 2 is composed of 25 pounds of lime and 20 pounds of sulfur to 50 gallons of water, the lime being added to several pails of nearly boiling water, the sulfur put in at once, and boiling continued actively for 1½ hours. The long boiling appeared simply to deepen the brick-red color. This wash was applied April 13 to rows 2 and 3, and on account of the wind these rows were resprayed the 15th and thoroughly covered with the solution.

An examination July 22 resulted in discovering very few living scales. The trees were in a vigorous condition and the presence of the wash was quite evident. A further examination on Sep. 23, indicated that the application had been very successful, as no scale was seen on the foliage and very little on the trees.

Wash 3 composed of 25 pounds of lime and 12 pounds of sulfur to 50 gallons of water, was prepared in the same manner as wash 1

and the only difference observed between the two was a slightly lighter color as compared with wash 1. This wash was applied only to the lower end of rows 25 and 26.

July 22 no living scale insects were detected and the trees were vigorous and healthy. Sep. 23 very few living scale insects were observed; the treatment was fairly satisfactory.

Wash 4 composed of 25 pounds of lime and 12 pounds of sulfur to 50 gallons of water, was prepared in the same manner as wash 2, the boiling being continued an hour and a half. The only difference noticed was a slightly increased color. This mixture was applied to the lower ends of rows 27 and 28.

July 22 no living scale insects were found and the conditions were practically the same as those observed in the case of wash 3. Sep. 23 there were very few living scale insects, otherwise the treatment was fairly satisfactory.

Wash 5 composed of 30 pounds of lime, 15 pounds of sulfur and 4 pounds of caustic soda, was prepared by bringing 5 or 6 pails of water nearly to a boil. It was placed in a barrel, the lime added, followed at once by the caustic soda and sulfur in the order named. It was then thoroughly agitated with a hoe till chemical action had ceased sufficiently to permit of the barrel being covered with burlap. The reaction started slowly, at no time was it very violent, and less than two quarts of water was sufficient to keep it from overflowing. It was necessary to strain this compound twice before it could be sprayed, on account of the large amount of sediment. The color changed from orange to orange-red and the liquid after settling was an orange-red color; then came a sediment a little lighter than pea-green and at the bottom a deeper shade. This mixture, after stirring, appeared a brownish red color. The sediment was very gummy or sticky. This wash was applied Ap. 18, to rows 21 and 22.

July 22 no living scale insects were observed and the trees were vigorous and healthy. On Sep. 23 it was seen that this wash was very nearly the same as wash 8, there being a very small amount of living scale insects on the trees.

Wash 6 composed of 30 pounds of lime, 15 pounds of sulfur and 4 pounds of caustic soda, was practically a repetition of wash 5, except that it was boiled one hour, resulting in a little darker color. This mixture was applied Ap. 18 to rows 29 and 30.

July 22 no living scale insects were found on these rows and the conditions were practically the same as with washes 3 and 4. The trees appeared to be in excellent condition. Sep. 23 a very few

living scale insects were observed, otherwise the treatment was very satisfactory.

Wash 7 composed of 30 pounds of lime and 15 pounds of sulfur to 50 gallons of water, was prepared in the same way as wash 4, except that the boiling was continued for only an hour. No difference between the two was detected. It was applied Ap. 13 to rows 23 and 24.

July 22 small numbers of living scales were detected on the trees which were healthy and vigorous, and on Sep. 23 a very small amount of living scale was observed, otherwise the treatment was very satisfactory.

Wash 8 composed of 30 pounds of lime and 15 pounds of sulfur to 50 gallons of water, was boiled ½ hour. This wash was prepared the same way as wash 3 and there was no noticeable difference. It was applied to rows 19 and 20.

July 22 no living scale insects were found and on most of the trees, which were vigorous, the wash was still plainly visible. There was a small amount of living scale on two nearly dead trees which had not been previously treated. Sep. 23 it was seen that most of the trees were very clear of the scale, except a few rough barked ones, which probably sheltered some of the insects so they were not hit by the application.

Wash 9 composed of 1 pound of caustic soda to 6 gallons of water, was prepared by simply dissolving the caustic soda in a small amount of hot water, which was then diluted to the requisite quantity. It proved to be very caustic and whenever any of the spray fell on the hands or face, a stinging sensation was felt. This solution was applied Ap. 15 to rows 16 and 17, 7½ pounds of caustic soda being used to 45 gallons of water.

July 22 the trees treated with this solution were apparently quite vigorous, though there was more scale found on them than on those treated with wash 11. The check row, which stands next these two rows, was badly infested by scale insects and indications of breeding were abundant, the young being observed crawling on the limbs. The leaves on the check row were markedly smaller than those on the trees treated with this wash, and a number on the check row had turned color as if the trees were unable to support the foliage. An examination Sep. 23 showed that these trees were nearly as badly infested as those of the check row. This undoubtedly was due in part to spreading from the check row but at the same time there was abundant evidence showing that this solution has comparatively little value as a de-

stroyer of San José scale. Our object in experimenting with this mixture was simply to be in position to answer more definitely inquiries regarding this wash which, it may be remembered, was extensively boomed by certain agricultural papers last spring as one of the most effective applications for the destruction of San José scale. Experiments had been previously tried by others in different parts of the country, and the above results are simply confirmatory thereof.

Wash 10 was composed of two ounces of mercuric chlorid to 50 gallons of bordeaux mixture, the latter containing 5 to 8 pounds excess of lime. This wash was prepared by adding all the ingredients to boiling water, and while the chemical action seemed to be perfect it was difficult to strain. It was a dark slate color. This wash was applied Ap. 18 to 7 trees each on the upper end of rows 19 and 20.

July 22 there was a large number of living scale on the trees which, though not badly injured, showed less growth and were not as vigorous as others, and on Sep. 23 it was seen that these trees were only a very little better than the check row.

Wash 11 composed of 14 pounds of lime, 6 pounds of sulfur and 6 pounds of sulfid of soda, was prepared by bringing 5 or 6 pails of water nearly to a boil, the lime added, followed at once by the sulfur. The mixture was thoroughly stirred till the lime was slaked, then the sulfid put in, which latter operation was followed by further chemical action. Boiling was continued 30 minutes and a grayish green color obtained. This mixture was applied Ap. 15 to rows 14 and 15.

Observations July 22 resulted in finding some living scales on these trees, and this was confirmed Sep. 23, at which time a small number of young scale insects were observed on the foliage and young twigs, otherwise the results were as good as in the case of washes 1 and 2.

Wash 12 composed of 14 pounds of lime, 11 pounds of sulfur and 11 pounds of sulfid of soda to 50 gallons of water, was prepared on the afternoon of the 13th, but owing to trouble with the spray apparatus, was not applied till the following morning. There was very little crystallization though reheating was probably necessary. The wash was prepared by bringing 5 or 6 pails of water nearly to a boil, the lime was added, followed immediately by the sulfur. This was stirred thoroughly till the lime was slaked, then the sulfid was put in, which was followed by further chemical action. Boiling was continued for 30 minutes and the compound at this

time was a dark pea-green. There was greater chemical action than in the case of wash 11. This wash was applied Ap. 14 to rows 10 and 11, and a second treatment was given on the 15th in order to insure thoroughness.

July 22 no living scales were found nor any evidence whatever of breeding, and on Sep. 23 no living scale insects were seen on the foliage and very little on the trees, indicating that the treatment had been very successful.

Wash 14 composed of 25 pounds of lime, 20 pounds of sulfur and 12½ pounds of carbonate of soda to 50 gallons of water, was prepared by adding the lime, carbonate of soda and sulfur in the order named, to a few pails of almost boiling water in a small kettle, and then boiled 15 minutes. The chemical action was very violent and on account of the small size of the kettle some was lost by overflow in spite of repeated additions of cold water in an effort to keep the mixture within bounds. The compound changed rapidly in color from orange to brick-red and there was considerable sediment. The second lot was made in a larger kettle and the result was a more intimate combination and less than a teacupful of sediment. This wash was applied Ap. 13 to rows 4 and 5, and on account of the wind they were resprayed Ap. 15.

An examination July 22 resulted in finding no living scale insects on the treated trees, which were apparently vigorous and had made a growth of from 4 to 8 inches. These good results were confirmed by an investigation Sep. 23, when no young scale insects were seen on the foliage and very little on the trees.

Wash 16 composed of 25 pounds of lime, 20 pounds of sulfur and 12½ pounds of soda carbonate to 50 gallons of water, was prepared by placing 5 pails of water in a cask, and the lime, carbonate of soda and sulfur added in the order named. The mixture was continuously agitated with a hoe, and only 2 quarts of water were necessary to prevent it from boiling over. As soon as the action had ceased sufficiently, the barrel was covered with burlap and allowed to stand 30 minutes. There was very little sediment, less than a teacupful, and the combination appeared to be as perfect as in the case of wash 14. The color was a brick-red, about the same as in wash 14. This was applied Ap. 14, to rows 12 and 13, and a second treatment given the 15th.

July 22 no living scale insects were observed on the trees, which were vigorous and had made some growth, and Sep. 23 no living scale insects were seen on the foliage and very little on the trees, indicating that the treatment had been a satisfactory one.

Wash 17 composed of 25 pounds of lime, 20 pounds of sulfur and 18 pounds of soda carbonate to 50 gallons of water, was prepared as follows: about 5 pails of water were brought to a boil and placed in a wooden barrel, and the lime, soda carbonate and sulfur added in the order named. The action was more violent than in the case of wash 16, and it was necessary to add cold water to the mixture three or four times in order to prevent overflowing. There was also a little more sediment and the color was darker, being a dark orange-red. This wash was applied Ap. 13 to rows 6 and 7, and a second treatment was given on the 15th on account of the windy weather the preceding day. On making up the wash a second time boiling hot water was employed as before and thorough stirring resulted in only a teacupful of sediment being left. It was allowed to stand in the barrel 45 minutes.

An examination July 22 resulted in finding no living scale on the trees and the presence of the wash was still evident. Sep. 23 no living scale was detected on the foliage and very little was found on the trees, indicating that the treatment had been very satisfactory.

Wash 18 composed of 1 pound of lime, 1 pound of soda carbonate to each 4 gallons of water, was prepared by adding the lime to a small amount of boiling water and then the carbonate of soda; stirring was continued till chemical action was completed. There was practically no sediment and the liquid possessed striking caustic properties, though it did not burn like wash 1. This preparation was applied Ap. 18 to the five uppermost trees on rows 14 and 15, and also to eight of the uppermost trees on rows 16 and 17.

July 22 it was found that there were a large number of living scale insects on these trees and breeding was quite apparent. Sep. 23 the condition of these trees was a very little better than the check row.

Observations. It will be seen by reference to the above records, that practically all of the lime-sulfur combinations reported on, were successful. In fact it was very difficult to detect any material difference between the various washes, and we are confident that a relative wide range in the proportions of the various substances is permissible, though undoubtedly one formula will gradually come into use on account of its efficiency and because of various economic considerations. We have decided, after a comparison of experiments and consultation with Prof. P. J. Parrott of the State Experiment Station at Geneva, to recommend a formula calling for 20 pounds of lime, 15 pounds of sulfur, no salt and at

least 30 minutes active boiling. This is very nearly the minimum amount of material which can be used safely, and we believe it hardly advisable to indorse the employment of a large amount of lime for the purpose of doing away with the necessity of boiling the mixture. Experiments with a caustic soda solution and with bordeaux mixture to which 2 ounces of corrosive sublimate were added, to 50 gallons, confirmed our belief in the comparative inefficacy of either of these washes. It may be remembered that this caustic soda wash was extensively advertised by certain agricultural papers, as one of the best methods of controlling the San José scale, in spite of the fact that earlier experiments by entomologists of good standing had shown that it was of comparatively little value. This material at best is a very caustic mixture and its employment under any circumstances, hardly advisable. One of the remarkable things about the matter was, that the wash was recommended by a party who appeared to have no standing, and as subsequent communications seemed to show very little idea of how the solution was actually made, yet his statements were accepted at face value and a great many, we fear, were induced to try this, and were probably greatly disappointed.

Last fall another method of preparing a lime-sulfur wash was extensively noticed in agricultural papers and is substantially as follows: make a paste of 20 pounds of sulfur with 2 gallons of boiling water and about 40 pounds of lime in a barrel, slaking the same with 12 gallons of boiling water, immediately adding the sulfur paste. Cover with an old blanket and allow it to cook 20 minutes, stirring occasionally with a garden hoe or other implement to keep the lime from settling, then dilute with warm water to 60 gallons and add 15 pounds of coarse salt, stirring a few minutes till it is dissolved. This method was brought to notice by Mr A. N. Brown of Delaware, who stated that the mixture gave excellent results and obviated the necessity of a prolonged boiling. This formula calls for the use of considerable boiling water and also for a large excess of lime, and while it may be efficient in most careful hands, we prefer, if boiling is dispensed with, to advocate the employment of either the sal soda lime-sulfur wash or the caustic soda wash. It is only fair to state that we observed a number of trees in Columbia county, which were treated last spring with a wash prepared as directed by Mr Brown, with fairly satisfactory results. The work was done by a very careful man who followed directions literally, and he probably obtained the best results possible. We also know of certain experiments which have

given fairly good results. We consider the large amount of lime employed disadvantageous because the excess appears to increase the tendency of the dried wash to scale off or peel.

A check row was left in this orchard in 1903, and in the spring of 1904, 18 of these trees were dead. The difference between them and others treated with various washes in 1903, was very striking. The insects bred rapidly during the latter end of the season of 1903 and consequently there were large numbers of scale insects, which evidently weakened the trees so that they were not able to survive the severe cold weather of last year. This was true not only of the trees on the check row, but also of some others on the western side of the orchard which had never been treated prior to 1904, and though they were sprayed in the course of our work last spring, our observations have been confined almost entirely to the trees which had been sprayed the previous year, because the badly infested ones which had not been treated were in about the same condition as those in the check row and consequently not adapted to experimental purposes.

It is interesting in this connection to place on record another instance of the value of the lime-sulfur wash in controlling peach leaf curl. In the Warwick orchard above mentioned, the different sprays were applied in rows running crosswise to the varieties, and it happened that the rows treated with the caustic potash solution included the last few trees of two rows of Elbertas, whereas all of the remainder were sprayed with one or the other of the various lime-sulfur combinations. The latter trees showed no indication of this disease throughout the season, whereas the Elbertas sprayed with the caustic potash solution were affected by this trouble to some extent, indicating that even if the caustic potash destroyed the scale, which our experiments show that it does not, the lime-sulfur wash is decidedly more valuable in checking the leaf curl.

Recommendations. Despite some evidence to the contrary, we believe that, for New York State at least, the best material for controlling the San José scale is a lime-sulfur wash provided it is properly made, and in this connection it is well to add that one can not be too careful in securing excellent lime because its quality has considerable to do with the efficiency of the wash.

Formulas

1 { 20 lb. of lime
15 lb. of flowers of sulfur
50 gal. of water; boil actively at least 30 minutes

2 { 20 lb. of lime
15 lb. of flowers of sulfur
4-6 lb. of caustic soda
50 gal. of water

3 { 20 lb. of lime
15 lb. of flowers of sulfur
10 lb. of sal soda
50 gal. of water

(1) This wash has been prepared very successfully by us, by simply slaking the lime in several pails of hot water in a kettle over a fire, adding the sulfur at once and continuing the boiling actively for at least 30 minutes, stirring at the outset till the lime had thoroughly slaked and the sulfur was moistened with the water, and repeating the stirring occasionally to prevent the material from caking on the bottom of the kettle. After 30 minutes boiling a deep brick-red color should be obtained. The mixture can then be dipped from the kettle and strained either through burlap or wire screening (ordinary mosquito netting will do), poured into the spray barrel and the necessary amount of cold water added to bring the whole up to 50 gallons. Some prefer to wet the sulfur with hot water before adding it, but in our experience this has been unnecessary.

(2) In making this wash the lime is slaked preferably with warm water, and while the reaction is in progress the sulfur, which has previously been made into a thin paste, is added and thoroughly mixed with the slaking lime. The caustic soda is then added and water supplied as needed, the whole being stirred thoroughly. After the chemical action has ceased, the mixture may be diluted to the requisite amount, preferably with hot water.

(3) This new wash may be prepared as follows: put 5 or 6 pails of hot water in a wooden barrel, preferably a thick pork or oil barrel, add the lime, quickly following that with the sulfur and sal soda, and stir actively till the slaking is practically completed. It may be necessary to add cold water at intervals to keep the mixture from boiling over. After the rapid bubbling or boiling is practically completed, cover the open barrel with burlap and

allow it to stand 30 minutes or more. This method of preparation gives an excellent compound so far as deep color and little sediment is concerned, provided it is properly prepared, and one of the essentials in making it, appears to be thorough stirring at the outset in order to intimately mix the lime, sal soda and sulfur. A deep red or even pea-green color should be secured if the material is well mixed. Strain and dilute with cold water to 50 gallons. This wash sprays nicely, and in the experiments commenced last spring, has given as good results in killing San José scale as any of the lime-sulfur washes. It has several advantages. It requires no boiling and the sal soda is a common material, easily handled and obtainable in almost every locality. It is also a little cheaper than the amount of caustic soda advised in preparing a similar quantity of wash. This material has been used but one season, and owing to its apparent merits we decided to put the formula in the hands of several of our associates. It was unfortunately sent out late, consequently not all could give it a thorough trial, but Professor Lochhead of the Ontario Agricultural College, states that in his hands it was just as successful as other lime-sulfur washes, and others obtained from good to excellent results in spite of their inability to give it a thorough trial. It is certainly a promising combination and one which should be tested more thoroughly another spring.

It would hardly be advisable to use either the caustic soda or sal soda washes just at present as fall sprays, since Professor Parrott of the State Agricultural Experiment Station at Geneva, has observed more twig injury where a caustic soda wash was used than where the ordinary boiled lime-sulfur wash was employed, and as our wash is practically a caustic soda wash (the caustic soda being obtained from the sal soda), it is advisable to be cautious about applying this material in the fall, though further experiments may show very little or no injury resulting from such treatment.

It is perhaps wise in this connection to reiterate the absolute necessity of thoroughness in treatment if the San José scale is to be controlled by spraying. Our best orchardists have found it advisable to take advantage of the wind so far as possible and wherever practical to go over the trees twice, the second time when the wind is in a different direction from what it was during the first treatment. Another factor which has perhaps not been duly emphasized, is the necessity of having good lime. It should be a lime that will slake vigorously, and the more heat generated,

the greater the likelihood of there being an intimate combination between the sulfur and the lime. Attention to minor details such as stirring, so as to prevent the lime and other chemicals forming comparatively inert masses at the bottom of the receptacle, is of considerable importance, since it is well known that the character of a chemical combination is materially affected by physical conditions. It is essential to mix these materials as intimately as possible and the difference between an efficient and comparatively useless wash may, in some cases, be attributed to variation in the method of preparation, even if the materials used be of the highest quality.

NOTES FOR THE YEAR

The following observations relate to the more important or interesting species brought to notice during the year.

Fruit tree insects

Fruit tree bark beetle (Scolytus rugulosus Ratz.) This rather common enemy of peach and plum trees in particular, has been the cause of several inquiries during the season of 1904, though in no instance has it been so injurious in New York State as it was a few years ago. It is a species which normally confines its attacks to diseased or dying trees, and only occasionally does it enter healthy ones. The infested branches should be cut off and burned as soon as discovered, in order to destroy the insects under the bark and prevent their spreading to other trees. Occasionally it may be possible to kill the borers under the bark by spraying the infested branches and trunk with crude petroleum, but such applications must be made with great care and, as a rule, they are not advisable.

Red-humped apple caterpillar (Schizura concinna Abb. & Sm.). This larva is one of our most striking caterpillars on account of its coral red head and the prominent hump of the same color on the first abdominal segment. The full grown caterpillar is about 1¼ inches long, black, with a series of rather conspicuous, yellowish, dorsal and sublateral lines, between which lie a series of white lateral lines. The full grown caterpillar bears prominent black tubercles on its body, they being specially well developed on the thoracic and first abdominal segments, on which latter they form conspicuous conical processes on the top of the swollen red portion of the segments described above. The moth is a rather inconspicuous creature with dark brown fore wings

grayish on the outer margin, a dot near the middle, a spot near each angle and several longitudinal streaks along the hind margin, all dark brown. The female deposits her eggs in clusters on the underside of leaves during the month of July; they hatch shortly, and the young caterpillars at first consume only the under surface of the leaf, leaving the upper unbroken, but as they increase in size the entire leaf is devoured. These interesting caterpillars are social in habit, remaining in rather compact groups when not feeding, and attain maturity in this latitude during August or early September. Their gregarious habit frequently results in one or more branches being entirely stripped. This species has but one brood in the North but in the South there are said to be two generations. It is seldom abundant and while displaying a marked preference for apple, also occurs on plum, cherry, rose, thorn and pear. Like other leaf-feeding species, this pest can be easily controlled by thorough spraying with an arsenical poison such as paris green, london purple or arsenate of lead, and in orchards where spraying is the rule, it very rarely causes trouble, particularly if the more adhesive arsenate of lead is employed.

Fall apple leaf miners. There are several species of small leaf miners which affect apple foliage in the fall, one of which makes a rather elongated mine on the under surface of the leaf, eating out the soft tissues completely, so that the upper surface presents a honeycombed or spotted appearance due to the veins and veinlets which are thicker than the upper epidermis. This species is found on appletrees during September and even in October and as late as early November. It has been termed the unspotted tentiform miner of the apple and is designated scientifically as Ornix geminatella Pack.

There is another leaf miner which works in apple foliage in a very similar way and at the same time, which is known as the spotted, tentiform miner, Lithocolletes blancardella Fabr. The work of this insect may be distinguished from the one mentioned above, by the spotted character of the upper surface of the mine caused by the small larva eating a little in one place and then moving to some other part of the mine to eat a little in another. This species transforms to the pupa within the mine, remaining there over winter, the moth emerging in the spring, while the larva of Ornix geminatella pupates in the edge of a turned up leaf, the adult appearing in the spring.

Still another species, the trumpet miner, Tischeria malifoliella Clem., occurs on apple leaves at this time,

making a 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. This mine is on the upper surface of the leaf and when old becomes a brown, trumpet-shaped area scarcely noticeable from the under surface. It is inhabited by a greenish, footless, active caterpillar. The upper and lower surface of the mine is densely lined with silvery white silk, making a winter retreat for the larva, which in the spring transforms 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 the moth appears. This is one of our common fall apple leaf miners and like the other two, rarely causes much injury because of its late appearance in the orchard.

All of these species appear on the foliage so late in the season that comparatively little injury is caused and, as a rule, no remedial measures are necessary. It is difficult in any event to control them by ordinary means, since the insects feed on the inner tissues of the foliage and consequently can not be reached by arsenical poisons or applications of contact insecticides. About the only way to destroy them, in case it is necessary, is to burn the fallen leaves which, as stated above, contain larvae or pupae and thus reduce the number of leaf miners another year.

Shade tree insects

Elm leaf beetle (Galerucella luteola Müll.). This species has been remarkable for its scarcity during the past season and the only thing worthy of special note is its establishment in considerable numbers in the village of Glens Falls. This is, so far as known to us, the northernmost locality where it occurs in abundance.

White marked tussock moth (Hemerocampa leucostigma Abb. & Sm.). This common and sometimes very destructive enemy of shade trees, has been present in small numbers on horse-chestnuts in particular, in the city of Buffalo, but in no instance have we known of its causing very serious injury. It is so easily controlled either by spraying or removing the conspicuous egg masses from the tree, that there is little excuse for allowing it to cause much damage.

Fall webworm (Hyphantria textor Harr.). This species was generally present in small numbers throughout the

State and, as a rule, did not cause damage enough to warrant repressive measures being adopted.

Woolly elm leaf louse (Schizoneura americana Riley). This woolly plant louse was met with in considerable numbers on the leaves of American elms at Saratoga Springs and Nassau. It frequently produces considerable deformity and curling of the foliage, the leaves sometimes forming large, irregular, distorted masses. In most cases single leaves are partly curled so that one side forms a cavity under the other half, the concavity being filled with plant lice and peculiar masses of powder-covered honeydew. The species was so abundant on some small trees, that the whitened particles of honeydew fell on foliage beneath and gave it the appearance of being spotted with a dilute whitewash. The growth of such infested trees is undoubtedly checked considerably.

Garden insects

Violet sawfly (Emphytus canadensis Kirby). This species is well known as a violet pest, and about the middle of June our attention was called to its depredations on pansies at Nassau. Investigations resulted in finding three or four of the dark colored larvae at the base of several plants. They had fed to such an extent that the pansies were unable to make a satisfactory growth. This species can undoubtedly be controlled by spraying the foliage with an arsenical poison, a proceeding hardly advisable in the case of most flowering plants. It is possible to find most of the sawfly larvae by digging about the roots of the plants, where they take refuge during the day, and this is probably the best method of checking the insect where the number of plants to be protected are relatively few.

Cucumber flea beetle (Crepidodera cucumeris Harr.). This minute, black, hopping flea beetle about $\frac{1}{16}$ inch long, is more or less abundant each year. Last season it appeared to be unusually numerous and inflicted considerable injury on tomato and potato plants, particularly on the latter, before the tomato plants had been set out. Thorough spraying with a poisoned bordeaux mixture is one of the most effective methods of controlling this species. Dusting the plants with plaster of paris, ashes etc., is of some value and is particularly to be recommended for tomato vines, specially after the fruit has begun to develop.

Stalk borer (Papaipema nitela Guen.). The work of this species is quite characteristic and has attracted consider-

able attention in different sections of the State on account of the injuries inflicted on tomatoes and corn in particular. The light brownish, white striped caterpillar works in the center of thick stalked plants and usually causes wilting followed by death of the portion above its burrow. It is a difficult species to control because the larva lives within the stems of plants and consequently can not be reached by arsenical poisons. About the only thing that can be done is to destroy the infested stalks with the contained larvae before they escape, wherever this is practical. Clean culture, particularly that resulting in the destruction of thick stalked plants growing in the vicinity of crops attacked by this insect, should result in reducing its numbers considerably.

Dark-sided cutworm (Agrotis messoria Harr.). This dingy colored, stout caterpillar about 1¼ inches in length, was the occasion of several complaints during the summer. It is a common frequenter of gardens and injures cabbages, potatoes, corn and various other plants. One of the simplest methods of controlling this pest is to examine the ground close to plants which have suffered from its attack; usually a little digging will disclose the depredator, and then it is only a moment's work to destroy the pest. Digging out by hand is somewhat laborious, and yet, if carefully done, is one of the most satisfactory methods of fighting cutworms. They may also be controlled to a considerable extent by the use of a poisoned bait, taking fresh clover or lettuce, dipping it in strong paris green water and then placing the same between or in the vicinity of infested plants. The cutworms are said to prefer this bait to growing plants. Sometimes it is possible to sow between rows, a little turnip or other seeds, so that the few cutworms will find abundant food in the secondary crop without destroying the one you wish to grow. They can also be killed by using a poisoned bran mash composed of paris green and bran or middlings, either mixed dry or enough water may be employed to make a soft mash. This material is very dangerous to have in gardens, particularly if chickens are kept.

Buffalo tree hopper (Ceresa bubalus Fabr.). This little species frequently causes more or less injury to small twigs of young trees and shrubs, but it is only occasionally that its injuries to herbaceous plants attract notice. Our attention was called by Dr O. C. Alexander of Albany, to the work of the nymphs of this insect. The young hoppers established themselves on the stems of the common balsam (Impatiens) and sucked the juices therefrom to such an extent that the plant was unable to support itself,

and the part above the point of injury lopped over and eventually died. An examination of young taken in the act, showed that it was very probably this species.

Pea louse (Nectarophora pisi Kalt.). Injuries by this species are more or less apparent from year to year and watchfulness for its appearance is advisable. This little enemy of the pea has caused considerable injury in recent years, and some knowledge of its life history and habits is a decided advantage in attempts so control it. It lives not only on ordinary garden peas, but also infests sweet peas, red and crimson clover, as well as vetches and tares. The insect hibernates on clover, particularly crimson clover, where that is grown, and probably on other food plants. The few overwintering individuals appear on peas, begin to multiply rapidly, and as the season advances become more and more abundant and cause a corresponding amount of injury. The above suggests that it is well to sow peas in fields rather distant from such leguminous plants as this species can live on, so as to delay the attack as much as possible. It also follows that early peas are much more exempt from injury than later varieties, and in sections where this pest is at all abundant, growers have largely abandoned the later kinds. This dreaded pest is controlled to a certain extent by a number of natural enemies, such as lady beetles, syrphid or flower flies, lace-winged flies, soldier beetles etc., but ordinarily these are not abundant enough to materially reduce the numbers of the pest. A fungus disease is sometimes a valuable aid, particularly in warm and humid weather. We would advise first, a growth, so far as possible, of early varieties away from other plants on which the species may winter, and secondly, good cultivation to hasten the development of the crop. Rotation is advisable, because a field in peas is likely to be infested the following year. In addition, it may be necessary at times to spray thoroughly with a contact insecticide such as the standard kerosene emulsion diluted with about 12 parts of water, or a whale oil soap solution. The latter, however, is said to be less efficient than the former. Spraying is expensive, and something may be accomplished by brushing the lice from the vines and then covering them with a cultivator. It might even be possible to devise an automatic brush, which could be attached just ahead of the cultivator, and thus, with no additional labor, bury many of the insects and at the same time cultivate the crop.

Miscellaneous

Owl beetle (Alaus oculatus Linn.). This is the largest of our native snapping beetles, measuring as it does from a little over 1 inch to 2½ inches in length. It is black, usually well sprinkled with irregular, white markings and may be recognized at once by the conspicuous white bordered, eyelike spots on the prothorax, markings which give the beetle its specific and common names. It is sometimes called the eyed elater. This species is brought to notice frequently with inquiry as to its life history and habits, and the following brief notes are appended for this reason.

The larva of this giant snapping beetle is about 2½ inches long, nearly ½ inch in breadth, flattened, reddish yellow in color, and is frequently found in decaying appletree wood. Formerly it was supposed to live on decaying wood. The late Dr Lugger in writing on this insect, makes the significant observation that all larvae he had reared would have perished had they not been provided with live insects which they soon found and devoured. If this be true, this species is not only interesting but decidedly beneficial. This beetle is a prominent representative of a very large family, all of which possess the power of projecting themselves suddenly into the air to a considerable hight, by the use of a peculiar apparatus on the ventral surface. A stout spine on the thorax extends back into a socket in the abdomen, and by bending its body the beetle can raise this spine and rest it on the edge of the socket and then, with a sudden muscular exertion, spring it back into the cavity. The result is that the beetle produces a peculiar snapping, rather startling sensation when held inverted in the hand, and smaller species belonging to this family are able to project themselves into the air to a hight several times their length. This is not true, however, of the form under consideration. This device has apparently no other use than to enable the beetle to regain its feet, as otherwise it is nearly helpless whenever it falls on its back.

Larder beetle (Dermestes lardarius Linn.). This oval, black beetle has been the cause of complaint in several instances, and may be easily distinguished by the rather broad, somewhat indistinct yellowish band on the anterior portion of the wing covers. It measures about .3 of an inch in length, and the brownish larva when full grown is about ½ inch long, dark brown and rather sparsely clothed with stiff, brownish hairs, which are as long or longer than the body. This species feeds mostly on dried animal matter of various kinds, such as bacon, dried meats and

hams, also on cheese, peltry, skins, horns, hoofs of dead animals, and even feathers, insects in museums, mounted birds and animals. It has also been recorded as devouring beeswax. It will not ordinarily eat clothing unless it is badly saturated with fatty animal matter. The most obvious method of protection from injury is to exclude the beetles from buildings where materials subject to attack are stored, and in case this is impractical, fumigation at intervals with carbon bisulfid should result in destroying most of these pests. An even more effective substance is hydrocyanic acid gas prepared by bringing diluted sulfuric acid in contact with cyanid of potassium. This latter material is exceedingly poisonous and should be handled only by those fully conversant with its nature. Neither the carbon bisulfid nor the hydrocyanic acid gas will injure skins, though we would not care to use the latter where dried meat was infested or any moist product likely to be used for food.

Cecidomyia hirtipes O. S. A very interesting solidago gall was found by the assistant entomologist, D. B. Young, at Elizabethtown N. Y., the later part of August. The outer portion closely resembled the partly open husks of a hickory nut, the inner cavity normally occupied by the nut being filled with a peculiar, stringy, fibrouslike growth, at the base of which dipterous pupae were observed. This curious deformation is evidently caused by the larvae attacking the plant early in its growth, and the tissues which would normally develop into a stout stem, become much thickened and form a somewhat globular gall which appears to rupture late in the season. A large fuscous, winged Cecidomyid was bred from this gall in early September, and on consulting literature it was found to be the species described by Osten Sacken under the above name. He states that it forms a rounded gall at the tip of stunted stalks of solidago, sometimes nearly an inch in diameter, smooth, brownish on the outside, solid inside, containing several larvae in compartments. It would seem from his description as though our split gall was something abnormal. The following description made from recently emerged individuals varies in slight particulars only, from that given by Osten Sacken.[1]

Description. Antennae yellowish, the apical eight or nine segments bright red, 22 segments in all, each with a basal whorl of dark brown hairs. Eyes black, rather coarsely granulated, deeply emarginate. Prothorax very narrow, black, with median area black, laterally reddish brown; mesothorax with a broad, median,

[1] Monogr. Diptera N. Am. pt 1, 1862, p. 195.

dark brown stripe, fuscous laterally and with equally broad, submedian stripes; anterior lateral portion reddish yellow. Scutellum pale reddish yellow, crowned with rather coarse, black hairs. Halteres: basal portion slightly yellowish, apical part trumpet-shaped, fuscous. Abdomen bright red, sparsely clothed dorsally with rather coarse, black hairs and with lateral patches of the same on each segment, giving the appearance of a broken, lateral row; ventral surface slightly lighter. Legs: anterior coxae reddish yellow, posterior reddish with irregular, fuscous markings; femora thickly clothed with black hairs, with some yellowish red. Tibiae entirely and tarsi partly clothed with jet-black hairs, the latter with a yellowish band near the distal portion of the first segment. Wings broad, thickly clothed with rather coarse, fuscous hairs; basal portion of costal vein almost black, subapical portion reddish, the same being true of the subcostal vein.

Length about ¼ of an inch.

Male similar to female, except that it is somewhat darker, the abdomen being more thickly clothed with long hairs, forming thicker, lateral tufts. Legs darker.

Beneficial insects

Chinese lady beetle (Chilocorus similis Rossi). A third shipment of these interesting little beetles was obtained last June, through the kindness of Prof. Wilmon Newell, state entomologist of Georgia, and established in a badly infested orchard at Kinderhook. Unfortunately we were unable to find larvae or signs of breeding, as had been the case with earlier shipments in the years of 1902 and 1903, and it is possible that most of the insects availed themselves of their freedom and spread to other trees. It is to be sincerely hoped that some of them have found conditions to their liking, bred freely, and that the species will become established in this section and prove of considerable service in controlling the San José scale insect. It certainly seems as though three introductions in successive years, would afford ample opportunities for these beetles to demonstrate their utility.

VOLUNTARY ENTOMOLOGIC SERVICE OF NEW YORK STATE

The work of the last five years has been continued by various observers in different sections of the State, and a number of valuable observations added to our previous records. The season of 1904 has been remarkable because of the comparatively small amount of

damage caused by the more common agricultural pests. Aside from the work of the striped cucumber beetle, the black flea beetle, the onion maggot, stalk borer and San José scale, there has been comparatively little injury to general agricultural crops. The season of 1903 was remarkable because of the unprecedented abundance of certain plant lice, particularly of species occurring on appletrees, and also on account of the extremely destructive work of the pear psylla (Psylla pyricola Forst.), a species which so seriously weakened thousands of trees in the Hudson river valley in particular, that they were unable to survive the unusually severe winter. These pests have hardly attracted the notice of agriculturists during the past season, and on referring to the following reports it will be observed that most of them are significant because of their negative character. Relatively few observers reported and those, as a rule, only at irregular intervals, indicating most clearly that insect depredations attracted comparatively little notice. The general sparsity of insect life may be attributed in part to the unusually severe winter, since the temperature went far below the normal on several occasions, and if it be true that insects can be frozen but once and survive, the severe weather of last winter was certainly sufficient to kill a very large proportion of the more exposed hibernating forms. The effect of winter on insect life is one of considerable importance, particularly if the future should demonstrate that a study of meteorological data would enable us to forecast with reasonable accuracy, the probability of severe injury by various insect pests. Such information can be acquired only through observations extending over a series of years and in various portions of the country, and it is gratifying to state that arrangements have already been made for such observations in New York and several of the New England states.

Cattaraugus county [C. E. Eldredge, Leon]—A small brown scale insect, the cherry scale (Lecanium cerasifex Fitch) has appeared in some numbers on peartrees but has not caused serious damage.—*May 31*

Cattaraugus county [F. A. Fitch, Randolph]—Last season the peartrees blighted very seriously (this probably refers to pear psylla attack, which was exceedingly common throughout the State). Tent caterpillar (Malacosoma americana Fabr.) nests are less numerous than usual at this time of the year. A few cabbage butterflies (Pieris rapae Linn.) have been observed.—*May 28.* Potato beetles (Doryphora 10-lineata Say) are quite numerous and mosquitos are in full force. Tent caterpillars

are scarce. Currant worms (Pteronus ribesii Scop.) have commenced operations, and black flea beetles (Crepidodera cucumeris Harr.) are at work on tomatoes. Scarcely any plum curculios (Conotrachelus nenuphar Hrbst.) have been observed. Cold, wet weather seems to have checked the development of insects. Many peartrees have blighted; this is probably due to their inability to withstand the severe winter after being badly injured by pear psylla (Psylla pyricola Forst.) the preceding year.—*June 18.* Striped cucumber beetles (Diabrotica vittata Fabr.) appeared in some numbers on squash vines.—*June 23.* Other insects have not attracted attention by their abundance.—*June 26.* Fall webworms (Hyphantria textor Harr.) have been much more abundant than usual. Cabbage butterflies are not as thick as they were last year. Other insects have not been abundant enough to cause trouble during the past season.—*Sep. 8*

Cayuga county [Purley Minturn, Locke]—A worm, probably a species of cutworm, has been eating cabbage plants off just at the top of the ground.—*July 8.* Apparently, insects are remarkably scarce in that section, as no other reports were received.

Genesee county [J. F. Rose, South Byron]—No complaints of canker worms (Paleacrita vernata Peck) have been received. Tent caterpillars (Malacosoma americana Fabr.) are very scarce. A long ride along highways fringed with wild cherries and bordered by many orchard trees, resulted in the discovery of only three nests. Rosebushes are as usual infested with plant lice. A few currant worms (Pteronus ribesii Scop.) have appeared and the currant stem sawfly (Janus integer Nort.) has begun its operations. A farmer reports plowing up potato beetles (Doryphora 10-lineata Say) in lively condition.—*May 31.* Striped cucumber beetles (Diabrotica vittata Fabr.) appeared first June 9 and became numerous the 12th. The first squash bugs (Anasa tristis DeGeer) were met with June 12. The cabbage stem maggots (Phorbia brassicae Bouché) are very destructive; they left only one out of 23 early cabbage plants, in spite of the fact that the plants were treated with fine salt. Cankerworms and tent caterpillars are not abundant. Potato bugs are numerous on early potatoes and some egg clusters have been deposited. There are very few plant lice on fruit trees.—*June 13.* Fall webworms (Hyphantria textor Harr.) were first observed July 2. Plant lice of various kinds continue scarce. We hear no com-

plaints of the pear psylla (Psylla pyricola Forst.) Striped cucumber beetles are numerous. The asparagus beetle (Crioceris asparagi Linn.) is not very plenty.—*July 14.* There has been far less than the usual number of potato beetles. Only one squash bug was observed. The second crop of fall webworms appears to be developing. A few plant lice (probably Megoura solani Thos.) were observed on potatoes. They appear to be quite numerous in some fields, and on account of the prevalence of potato blight, have had comparatively little opportunity to multiply.—*Sep. 14*

Greene county [O. Q. Flint, Athens]—The greatest insect injury noticeable hereabouts, is that to Bartlett peartrees, which was caused by the pear psylla (Psylla pyricola Forst.) last year. The trees were so weakened that many of them were unable to survive the winter. The injurious insects were much less numerous than usual at this time of year. Tent caterpillars (Malacosoma americana Fabr.) and elm leaf beetles (Galerucella luteola Müll.) are remarkably scarce, we having observed only one or two nests of the former, so far this spring.—*May 30.* The common pests are much scarcer than usual and climatic conditions have been generally unfavorable to the development of insect life. Pear psylla injury is the most evident of any insect damage, and as a result of last season's work, many orchards will be cut down. The pest has been somewhat abundant this summer, though most of the injury appears to have been inflicted the previous season. The elm leaf beetle has been much less numerous than for a number of years.—*Sep. 27*

Herkimer county [George S. Graves, Newport]—Tent caterpillars (Malacosoma americana Fabr.) nests were first observed May 16. Currant worms (Pteronus ribesii Scop.) are unusually abundant and abnormally early. The currant aphis (Myzus cerasi Fabr.) is rapidly increasing in numbers. The box elder is badly affected by a plant louse (Chaitophorus negundinis Thos.)—*May 26.* Potato beetles (Doryphora 10-lineata Say) were first noticed about May 15, and eggs were observed June 2. Black flea beetles (Crepidodera cucumeris Harr.) are attacking and perforating the potato leaves as fast as they appear above ground. Striped cucumber beetles (Diabrotica vittata Fabr.) were first observed June 7.

Young oyster shell scales (Lepidosaphes ulmi Linn.) were very abundant June 4.—*June 9.* A few wooly aphids (Schizoneura lanigera Haus.) were observed June 10 on appletrees, and the potato beetles were abundant June 11 for the

first time this season. Tomato foliage was badly riddled June 8 by the small, black flea beetle, and on the 12th turnip leaves were badly eaten by some insect (possibly the black-headed turnip worm, Evergestis rimosalis Guen.). Most fruit and shade trees are exceptionally free from insect pests.—*June 16.* The potato stalk borer (Papaipema nitela Guen.) is reported as causing considerable injury in fields about Canastota. Potato beetle grubs were observed June 20. Rose beetles (Macrodactylus subspinosus Fabr.) were observed on elm June 24, and a number of plant lice (probably Callipterus ulmifolii Mon.) were met with on the foliage. Currant worms are reported as exceedingly destructive and the hornfly (Haematobia serrata Rob.-Desv.) is said to be abundant. Cucumber leaves are somewhat skeletonized, probably by the striped cucumber beetle.—*June 25.* A second brood of currant worms is appearing in large numbers and a great many rose beetles are about. Potato beetles are not so plentiful as usual. A few potato beetle grubs were observed eating bean leaves that touched their normal food plant.—*July 1.* The rose leaf hopper (Typhlocyba rosae Harr.) has been causing some injury. Grasshoppers are relatively scarce and the plant lice on box-elder are not abundant.—*July 7.* The first nest of fall webworms (Hyphantria textor Harr.) was observed Aug. 1. Horn flies are not very numerous. Farmers claim that the depredations of the potato beetle have been unusually prolonged. The elm flea beetle (Disonycha triangularis Say) does not appear to be as destructive as usual.—*Aug. 4.* An unusual number of potato beetles were observed Aug. 12, in a highway adjacent to a potato field, probably deserting the field because of the unsatisfactory condition of the food plant. The elms have, after all, been seriously injured by the flea beetle. The work was probably later in the season or else not evident as early as usual.—*Sep. 28.* Nests of a peculiar tortricid (Thiodia signatana Clem.) were observed on the leaves of certain maples.—*Oct. 6*

Montgomery county [S. H. French, Amsterdam]—Insect pests of various kinds have attracted very little attention during the past season, the rose leaf hopper (Typhlocyba rosae Harr.) being the principal offender. We have found washing them off with a powerful stream of water from a hose, about as satisfactory as any method of control.—*May 23*

Orange county [J. M. Dolph, Port Jervis]—The potato stalk worm (Papaipema nitela Guen.) has been causing some injury in this section. Insect pests are scarcer than usual.—*June 27*

Dutchess county [H. D. Lewis, Annandale]—Cankerworms (Paleacrita vernata Peck.) are reported as being quite destructive in the northeastern portion of the county. The weather has been moderately dry and insects have not been abundant. Many peartrees injured last year by the pear psylla (Psylla pyricola Forst.) are dying, probably as a result of the injury combined with the excessive cold of last winter. Insect pests have been unusually scarce.—*July 25*

Orleans county [Virgil Bogue, Albion]—There has never been a time when there has been less injury from insect attack than the present. Colorado potato beetles (Doryphora 10-lineata Say) have hardly been seen till within the last few days and then only in very small numbers. Pear psylla (Psylla pyricola Forst.) and plant lice (Aphis mali Fabr.) which were so destructive last year, have not appeared this season. Cherries are comparatively free from worms (this is probably the cherry fruit fly, (Rhagolatis cingulata Loew.). Insect-eating birds have largely deserted us except the robins, and they looked lean and lank before the cherries commenced to ripen.—*July 3*

Queens county [C. L. Allen, Floral Park]—Pea aphids (Nectarophora pisi Kalt) appeared May 15, but have not been very destructive. Peartrees have not suffered from pear psylla (Psylla pyricola Forst.) or any other insect. San José scale (Aspidiotus perniciosus Comst.) appears to be on the increase. Potato beetles (Doryphora 10-lineata Say) have appeared in considerable numbers, and tent caterpillars (Malacosoma americana Fabr.) while present, are not very troublesome.

Richmond county [David Muirhead, West New Brighton]—Plant lice appeared on young peachtrees, plums, and on raspberry and blackberry shoots about May 20, and the webs of the grapevine plume moth (Oxyptilus periscelidactylus Fitch) appeared May 23, and seemed to be more abundant in sunny spots near the edge of a trellis. Larvae of the cabbage butterfly (Pieris rapae Linn.) were observed the same day and the butterflies are abundant.—*June 4.* Larvae of the 8-spotted forester (Alypia octomaculata Fabr.) appeared May 23, and the work of the tobacco thrips (Thrips tabaci Lind.) was observed June 6. The grape gall fly (Lasiopteravitis O. S.) is somewhat prevalent. White marked tussock moths (Hemerocampa leucostigma Abb. & Sm.) are present in small numbers. No larvae of the Colorada potato

beetle (Doryphora 10-lineata Say) have appeared. Tobacco thrips are causing considerable injury and cabbage butterfly larvae are fairly abundant. Caterpillars of the 8-spotted forester are rather rare, and the same is true of the swellings produced by the grape gall fly.—*June 11.* Colorado potato beetles were first observed June 12, and they do not appear to be at all numerous.—*June 18.* San José scale (Aspidiotus perniciosus Comst.) is rather abundant in this section and has caused a great deal of injury. Colorado potato beetles are not numerous and cabbage butterfly larvae are scarce. The tobacco thrips seems to have disappeared from cabbage and lettuce.—*June 25*

Rockland county [S. B. Huested, Blauvelt]—Pear psylla (Psylla pyricola Forst.) does not appear to be very abundant this year. Bartlett trees appear to have nearly all died, and though this may be due to neglect, the severe psylla injury of last year in connection with the unusually cold weather during the winter, is ample cause for most deaths. Plant lice have not appeared but tent caterpillars (Malacosoma americana Fabr.) have been abundant. Plant lice are much less numerous than last year.—*June 3*

Warren county [C. L. Williams, Glens Falls]—Pear psylla (Psylla pyricola Forst.) and plant lice were first observed in relatively small numbers in early June. June beetles (Lachnosterna sp.) have been much less abundant than last year. Cold weather seems to have delayed the appearance of rose beetles (Macrodactylus subspinosus Fabr.), as only an advanced scout or two has appeared up to date.—*June 6.* The rose beetles appeared 10 days later than last year and are not quite so destructive. The potato stalk borer (Papaipema nitela Guen.) is causing some damage in corn fields. Plant lice are increasing somewhat in numbers. Honeydew is very abundant on white elm, probably indicating many elm aphids (Callipterus ulmifolii Mon.). The elm leaf beetle (Galerucella luteola Müll.) has become well established in one or more quarters of the village. Rose beetles are not as abundant as last year.—*July 5.* Larvae of the elm leaf beetle are full grown and traveling on the tree trunks.—*July 19*

Westchester county [Frank R. Calkins, Ossining]—Black flea beetles (Crepidodera cucumeris Harr.) were first observed on tomato plants June 8, and on the 10th had eaten out large portions of the foliage. Larvae of the white marked tussock

moth (Hemerocampa leucostigma Abb. & Sm.) and black blister beetles (Epicauta pennsylvanica DeGeer) were observed in large numbers—*June 11*. This is rather early for the latter to be numerous. Several kinds of plant lice are more plentiful than last year, specially on hard maples. Elm leaf beetles (Galerucella luteola Müll.) are very numerous but their attacks are confined largely to the tops of the trees, many of which have the foliage skeletonized. Tent caterpillars (Malacosoma americana Fabr.) are plentiful, though not so abundant as last season. The onion fly (Phorbia ceparum Bouché) is causing considerable injury.—*June 13*. Cabbage butterflies (Pieris rapae Linn.) appeared in numbers for the first time June 20, and striped cucumber beetles (Diabrotica vittata Fabr.) June 25. Elm leaf beetles are increasing in numbers and destructiveness. The common house fly (Musca domestica Linn.) is not very common as yet. The 2-spotted lady beetle (Adalia bipunctata Linn.) is to be seen in some numbers.—*June 27*

Wyoming county (W. H. Roeper, Wyoming)—Tent caterpillars (Malacosoma americana Fabr.) appeared in some numbers for the first time May 20, they being less numerous than usual. The bud moth (Tmetocera ocellana Schiff.) is at work but not causing a great deal of damage. Cankerworms (Paleacrita vernata Peck) are at work in small numbers on apple-trees. The pear psylla (Psylla pyricola Forst.) has not appeared in destructive numbers as yet.—*June 13*. There have been very few insects present in sufficient numbers to cause an appreciable amount of damage.—*July 27*

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the entomologist during the year 1904. 67 are given with the title[1], place, time of publication and a summary of the contents of each. Volume and page number are separated by a colon, the first superior figure indicates the column, and the second the exact place in the column in ninths; e. g., $68:948^{36}$ means volume 68, page 948, column 3, beginning in the sixth ninth, i. e. about two thirds of the way down.

Grapevine Root Worm. Grape Belt, Oct. 20, 1903, p. 1

Results obtained by collecting beetles and spraying for Fidia viticida Walsh. Value of poison for grapeberry moth, Polychrosis botrana Schiff.

[1]The titles are given as published, and in some instances they have been changed or supplied by the editors of the various papers.

Dust Sprays. Country Gentlemen, Nov. 5, 1903, 68:948[36]

Method of preparing dust spray and range of usefulness.

Mosquitos. Brooklyn Daily Eagle, Nov. 8, 1903, p. 12

Summary of recommendations for control.

Sprays for San José Scale. Country Gentleman, Nov. 12, 1903, 68:972[42]

Summary of results in 1903, with lime-sulfur wash, whale oil soap solution and crude petroleum against Aspidiotus perniciosus Comst.

Insects Affecting Forest Trees. For., Fish and Game Com. 7th Rep't 1901, p. 449–531, pl. 16.

Issued Nov. 1903. Also issued separately.

Accounts based on original observations are given of the following species:

Insects affecting the pine: turpentine bark beetle, Dendroctonus terebrans Oliv.; coarse writing bark beetle, Tomicus calligraphus Germ.; southern tomicus, Tomicus cacographus Lec.; pine bark beetle, Tomicus pini Say; Tomicus caelatus Eich.; Pityogenes species; Pityophthorus species; ribbed rhagium, Rhagium lineatum Oliv.; Pytho americanus Kirby; pine sawyer, Monohammus confusor Kirby; Xyloterus bivittatus Kirby; Gnathotrichus materiarius Fitch; white ants, Termes flavipes Kollar; white pine weevil, Pissodes strobi Peck; Pales weevil, Hylobius pales Herbst.; Magdalis perforata Horn.; Magdalis alutacea Lec.; pitch tip moth, Pinipestis zimmermani Grote; Nantucket pine moth, Retinia [Evetria] frustrana Scudd.; pitch pine Retinia, Retinia [Evetria] rigidana Fern.; pitch twig moth, Retinia [Evetria] comstockiana Fern.; pitch-inhabiting midge, Diplosis resinicola Osten-Sacken; pine bark Chermes, Chermes pinicorticis Fitch; spittle insects: Aphrophora saratogensis Fitch; Aphrophora parallela Say; Aphrophora quadrangularis Say; Le Conte's sawfly, Lophyrus lecontei Fitch; light-loving grapevine beetle, Anomala lucicola Fabr.; pine Chrysomela, Glyptoscelis pubescens Fabr.; imperial moth, Basilona imperialis Drury; pine leaf miner, Gelechia pinifoliella Chamb.; pitch-pine needle gall fly, Diplosis pini-rigidae Pack.; pine leaf scale insect, Chionaspis pinifoliae Fitch; Chrysobothris floricola Gory; Chrysobothris pusilla Bap. & Gory; Chrysobothris dentipes Germ.; pine flower cricket, Oecanthus pini Beut.

Insects affecting the spruce: destructive spruce bark borer, Polygraphus rufipennis Kirby; Cryphalus striatulus Mann.; Dryocoetes species; Xyloterus politus Say; Monarthrum mali Fitch.

Insects affecting the balsam: balsam bark borer, Tomicus balsameus Lec.; large black carpenter ant, Camponotus herculaneus Linn.

Insects affecting arbor vitae: Phlaeosinus dentatus Say.

Insects injurious to oaks: yellow striped oak caterpillar, Anisota senatoria Abb. & Sm.; buck or Maia moth, Hemileuca maia Drury; Cacoecia fervidana Clem.; Serica trociformis

Burm.; Stictocephala inermis Fabr.; Thelia acuminata Fabr.; Thelia monticola Fabr.; Telamona godingi Van Duz.; Archasia galeata Fabr.; two marked tree hopper, Enchenopa binotata Say; dog day cicada, Cicada tibicen Linn.; oak fig gall, Biorhiza forticornis Walsh; acorn weevil, Balaninus nasicus Say.

Lime-Sulfur Washes. Country Gentleman, Dec. 3, 1903, 68:1054[22]

Comments on methods of preparing wash without boiling, and criticisms of the so-called "lime-oil" wash.

Grapevine Root Worm [Fidia viticida Walsh]. N.Y. State Mus. Bul. 72. 1903. p. 1–51, 13 pl.

Issued Dec. 10, 1903. Republished largely in *Grape Belt*, p. 7, in issues for Feb. 9, 23, Mar. 8, 15, Ap. 5, 12, May 6, 17; also republished in part in *Jamestown Journal*, Feb. 10, 1904, p. 5.

Contents

Destroying Bees. Country Gentleman, Feb. 25, 1904, 59:176[43]

Carbon bisulfid advised for their destruction in a wall space.

Winter Insects in New York. Argus [Albany] Mar. 9, 1904, p. 4

Records taking a number of insects, beetles, flies, bugs and caterpillars in ice, the capture of Anopheles punctipennis Say on snow, and refers to other records of insects occurring in winter.

Insect Pests to Crops and Trees. Troy Record, Mar. 22, 1904, p. 5

Summary of losses caused by introduced insects, with notice of threatening species, a brief enumeration of injurious forms and reference to several recently introduced beneficial species.

Scale Insects. Mass. Fruit Growers Ass'n, 9th An. Meeting 1903, p. 24–31

Issued Mar. 1904. Discussion of remedies with special reference to crude petroleum emulsion and lime-sulfur wash for San José scale, Aspidiotus perniciosus Comst.

Appletree Bark Louse. Country Gentleman, Mar. 31, 1904, 69:296[42]

Identification and methods of controlling Lepidosaphes ulmi Linn.

New York State's Part in Mosquito Extermination. 1st Anti-Mosquito Convention Proc. 1903. 1904, p. 52–55

A brief summary of local conditions about New York city, with consideration of the advisability of the State undertaking investigations.

Recent Work upon the Grapevine Root Worm. Western N. Y. Hort. Soc. Proc. 1904, p. 48–51

Summary account of recent work against Fidia viticida Walsh; see Museum Bulletin 72 for details.

Appletree Bark Louse. Country Gentleman, Ap. 14, 1904, 69:345[12]

Identification and remedies for Lepidosaphes ulmi Linn.

Insects and Fungus. Country Gentleman, Ap. 14, 1904, 69:345[14]

San José scale, Aspidiotus perniciosus Comst., the fruit tree bark beetle, Scolytus rugulosus Ratz., other insects, and a quince fungus are briefly noticed.

Scale and Bark Louse. Country Gentleman, Ap. 14, 1904, 69:357[12]

Methods of controlling San José scale, Aspidiotus perniciosus Comst., with mention of the scurfy bark louse, Chionaspis furfura Fitch.

Pea Louse. Country Gentleman, Ap. 21, 1904, 69:369[17]

Methods of controlling Nectarophora pisi Kalt.

Cause and Control of Insect Depredations. Soc. Promotion Agric. Sci. Proc. 25th An. Meeting 1904, p. 73–83; also issued as a separate, Ap. 22

General discussion of methods of controlling insects and of insecticides employed.

A Quarter Century Record. Soc. Promotion Agric. Sci. Proc. 25th An. Meeting 1904, p. 84–90; issued as a separate, Ap. 22, also in Country Gentleman, June 2, 1904, 69:525

Brief résumé of progress in entomology in the past 25 years.

White Flower Cricket. Country Gentleman, Ap. 28, 1904, 69:392[23]

Identifies and characterizes injury by Oecanthus niveus DeG., and gives preventive measures.

Mosquitos as a Menace to Health. Albany Evening Journal, Ap. 28, 1904, p. 14

Brief general résumé of the importance of mosquitos and methods of controlling them.

Remedies for San José Scale. U. S. Dep't Agric. Div. Ent. Bul. 46. 1904, p. 52–54

Experiments with crude petroleum and lime-sulfur combinations in particular against Aspidiotus perniciosus Comst.

Observations in 1903. U. S. Dep't Agric. Div. Ent. Bul. 46, 1904, p. 65–69

Observations on apple aphids, Aphis mali Linn., cherry aphis, Myzus cerasi Fabr., Diplotaxus liberta Germ., codling moth, Carpocapsa pomonella Linn., pear psylla, Psylla pyricola Forst., San José scale, Aspidiotus perniciosus Comst., asparagus beetle, Criocerus asparagi Linn., cabbage maggot, Pegomyia brassicae Bouché., saw-toothed grain beetle, Silvanus surinamensis Linn., elm leaf beetle, Galerucella luteola Müll., and white marked tussock moth, Notolophus [Hemerocampa] leucostigma Abb. & Sm.

Wasps Disappearing. Country Gentleman, May 26, 1904, 69:489[22]

Probably local, species uncertain because of no description.

Pear Psylla. Country Gentleman, May 26, 1904, 69:492[26]

Note of warning and remedies for Psylla pyricola Forst.

Ants in Lawn. Country Gentleman, June 2, 1904, 69:512[23]

Methods of killing ants in their nests.

Wire Worms. Country Gentleman, June 2, 1904, 69:513[12]

Remedial measures for Drasterius elegans Fabr. in gardens, where it was eating seed potatoes.

Watch the Insect Pests. New York Farmer, May 26, 1904, p. 1

Requests information about pear psylla, Psylla pyricola Forst. and plant lice.

Monograph of the Genus Saperda. N. Y. State Mus. Bul. 74. 1904. p. 1–8, 14 pl. (7 col.) by E. P. Felt and L. H. Joutel.

Issued June 7.

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Blue-Banded Milliped. Country Gentleman, June 9, 1904, 69:537[13]

Identified, remedies for Julus caeruleocinctus Wood.

New York Entomologic Service. Country Gentleman, June 9, 1904, 69:544[45]

Summaries of reports.

In the Chautauqua Grape Belt. Country Gentleman, June 9, 1904, 69:544[49]

Present conditions with observations on experimental work against the grape root worm, Fidia viticida Walsh.

Insect Depredations. Country Gentleman, June 9, 1904, 69:549, 573

Injuries due to devoting large areas to single crops, to improving plants for food and indirectly making them more attractive to insects, continuous growing of a crop on the same field. Methods of control are clean culture, rotation of crops, encouraging natural enemies. Several of the more important insecticides are briefly discussed under preventive measures, followed by a general summary.

Cultivation for the Destruction of Fidia. Grape Belt, June 14, 1904, p. 7

Advises cultivation shortly after the 13th or 14th on light soil for destruction of Fidia viticida Walsh.

Owl Beetle. Country Gentleman, June 16, 1904, 69:560[46]

Characteristics and habits of beetle and larva of Alaus oculatus Linn.

New York Entomologic Service. Country Gentleman, June 16, 1904, 69:561[27]

Summary of reports from voluntary observers.

Driving Away Bees. Country Gentleman, June 16, 1904, 69:571[22]

Methods of driving out and killing bees established in house walls.

New York Entomologic Service. Country Gentleman, June 23, 1904, 69:584[44]

Summary of reports.

Sugar Maple Borer. Country Gentleman, June 23, 1904, 69:597[11]

Remedial measures and observations on cutting out grubs of Plagionotus speciosus Say.

A Julus. Country Gentleman, June 23, 1904, 69:597[22]

Remedies for Julus caeruleocinctus Wood.

Time to Get Out Beetle Catchers. Grape Belt, June 28, 1904, p. 7

Advice relative to the operation of beetle catchers and spraying for Fidia viticida Walsh.

New York Entomologic Service. Country Gentleman, June 30, 1904, 69:606[45]

Summary of reports.

Importance of Laboratory and Field Work in Economic Entomology. Reprint from 17th An. Conv. Ass'n Am. Agric Coll. &Exp. Sta. Proc. U. S. Dep't Agric. Exp. Sta. Bul. 142

Observations on the importance of correlating and checking results by employing field as well as laboratory cages.

Record Devices. Reprint from An. Conv. Ass'n Agric. Coll. & Exp. Sta. Proc. U. S. Dep't Agric. Exp. Sta. Bul. 142

Describes an accession system and method of filing correspondence.

Elm Gall. Country Gentleman, July 7, 1904, 69:626[43]

Cockscomb elm gall, Colopha ulmicola Fitch, is identified and remedial measures indicated.

Cut Worms. Country Gentleman, July 7, 1904, 69:626[44]

Remedies for the dark sided cutworm, Paragrotis messoria Harr.

San José Scale. Country Gentleman, July 7, 1904, 69:626[45]

Summer treatment for Aspidiotus perniciosus Comst.

House Centipede. Hudson Register, July 14, 1904

Brief general account of Scutigera forceps Raf.

Cabbage Worms. Country Gentleman, July 21, 1904, 69:666[46]

Early use of arsenical poisons advised, supplemented later, where necessary by pyrethrum and hellebore.

A Sawyer. Country Gentleman, July 21, 1904, 69:667[47]

Brief popular notice of Monohammus confusor Kirby.

19th Report of the State Entomologist on Injurious and Other Insects of the State of New York 1903. N. Y. State Mus. Bul. 76. Issued July 25, 1904

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Larder Beetle. Country Gentleman, Aug. 4, 1904, 69:706[48]

Habits and methods of controlling Dermestes lardarius Linn.

Report of the Committee on Entomology. N. Y. State Fruit Growers Ass'n, 1904, p. 28–29

Summarized statement of experiments against San José scale, Aspidiotus perniciosus Comst., and the grape root worm, Fidia viticida Walsh.

Insect Pests of the Year. N. Y. State Fruit Growers Ass'n 1904, p. 136–39

General observations on plant lice, pear psylla, Psylla pyricola Forst., San José scale, Aspidiotus perniciosus Comst., and the grape root worm, Fidia viticida Walsh, with special reference to methods of control.

San José Scale in New York. Rural New Yorker, Aug. 6, 1904, 63:589[11]

Summary account of conditions and methods of controlling Aspidiotus perniciosus Comst.

Beetles-Lice. Country Gentleman, Aug. 18, 1904, 69:747[15]

Brief notice of spotted grapevine beetle, Pelidnota punctata Linn. with remedies for plant lice.

Carrion Beetles. Country Gentleman, Aug. 25, 1904, 69:769[12]

Identifies and gives habits of Necrophorus americanus Oliv.

Remedies for the San José Scale. The Canner & Dried Fruit Packer, Aug. 25, 1904, v. 19, no. 6, p. 32–34

Summarized account of methods of controlling Aspidiotus perniciosus Comst.

Importance of Isolated Rearings from Culicid Larvae by E. P. Felt & D. B. Young. Science 20:312–13

Describes Culex cinereoborealis, C. lazarensis, C. abserratus and C. fitchii.

Killing Ants. Country Gentleman, Sep. 8, 1904, 69:817[34]

Carbon bisulfid advised and method of application described.

Oak Potato Gall. Country Gentleman, Sep. 8, 1904, 69:817[35]

Gall and adult of Neuroterus batatus Fitch briefly described and remedy given.

False Caterpillar. Country Gentleman, Sep. 15, 1904, 69:841[13]

Brief general notice of Hylotoma pectoralis Leach on birch from Quebec.

Appletree Caterpillar. Country Gentleman, Sep. 15, 1904, 69:841[32]

Brief descriptive account of the red-humped apple caterpillar, Schizura concinna Abb. & Sm.

Hickory Leaf Gall. Country Gentleman, Sep. 29, 1904, 69: 887[23]

Brief descriptive notice of Cecidomyia persicoides O.S.

Fall Apple Leaf Miners. Country Gentleman, Oct. 13, 1904, 69:993[34]

Brief general accounts with remedial measures of the following: unspotted tentiform miner, Ornix geminatella Pack., spotted tentiform miner, Lithocolletes blancardella Fabr., and the trumpet miner, Tischeria malifoliella Clem.

Catalogue of the Entomologic Exhibit of the New York State Museum at the Pan-American Exposition. N. Y. at the Pan-Am. Exposition 1901–2, p. 273–354

Contents. Introductory, p. 273; Contents, p. 280; Fruit tree insects, p. 285; Vine and small fruit insects, p. 289; Garden insects, p. 291; Grass and grain insects, p. 295; Household insects, p. 297; Insects affecting stored food products, p. 300; Beneficial insects, p. 301; Scale insects, p. 304; Forest insects, p. 308; Shade tree insects, p. 312; Work of gall insects, p. 315; Bee and wasp family (Hymenoptera), p. 316; Beetles (Coleoptera), p. 320; 2-winged flies (Diptera), p. 330; Butterflies and moths (Lepidoptera), p. 333; Caddice flies (Trichoptera), p. 340; True bugs (Hemiptera), p. 341; Grasshoppers, locusts (Orthoptera), p. 343; Protective mimicry, p. 346; New York beauties, p. 347; Technical collection, p. 348; Framed photographs, p. 351; Winged frames, p. 351; Publications, p. 353.

CONTRIBUTIONS TO COLLECTION OCT. 16, 1903–OCT. 15, 1904

Hymenoptera

Megachile sp., leaf cutter bee, work on rose, Oct. 26, **O. Q. Flint,** Athens N.Y

Formica pennsylvanica DeG., black ant, work on spruce, Feb. 5, **William B. Young,** Lake Placid N. Y.

Neuroterus batatus Bass., oak potato gall on oak, Sep. 1, through *Country Gentleman,* Westport Mass.

Tremex columba Linn., pigeon tremex, adult on maple, Sep. 15, **J. E. Sanford,** Fredonia N. Y.

Harpiphorus tarsatus Say, larvae on Cornus, July 28, **F. E. Dawley,** Syracuse N. Y.

Coleoptera

Scolytus rugulosus Ratz., fruit tree bark beetle, work in plum, Ap. 8, **Helen Blydenburgh,** Smithtown L. I.

Madarus undulatus Say, Nov. 2, **J. R. de la Torre Bueno,** Van Cortlandt Park, N. Y.

Otiorhynchus sulcatus Fabr., adult on strawberry, June 24, **Thomas Cunningham,** Vancouver B. C.

O. ovatus, Linn, adult on strawberry, June 24, **Thomas Cunningham,** Vancouver B. C.

Hemantus floralis Linn., adult, Sep. 12, **Richard Lohrmann,** Herkimer N. Y.

Bruchus pisorum Linn., pea weevil, adults, Oct. 28, **Mrs Wendell Dorn,** Pattersonville N. Y.

Phyllotreta vittata Fabr., adult on radish, July 1, **G. S. Graves,** Newport N. Y.

Haltica ignita Ill., adult on elm, June 27, **G. S. Graves,** Newport N. Y.

Galerucella luteola Müll., elm leaf beetle, pupae and larvae on elm, July 19, **C. L. Williams,** Glens Falls N. Y.

Graphops pubescens Melsh., Nov. 2, **J. R. de la Torre Bueno,** Van Cortlandt Park N. Y.

Saperda populnea Linn., oviposition scars on twigs, July 25, **Dr L. Reh,** Hamburg, Germany.

Centrodera decolorata Harr., adult on beach, July 1, **G. S. Graves,** Newport N. Y.

Hylotrupes bajulus Linn., adult, June 28, **Helen R. Burns,** Yonkers N. Y.

Osmoderma scabra Beauv., adult on pear, June 15, **Mrs A. Lansing,** Albany N. Y.

Dorcus parallelus ? Say, larva on appletree, Oct. 17, **G. S. Graves,** Newport N. Y.

Sitodrepa panicea Linn., drug store beetle, adult, Aug. 24, **Warren L. Bradt,** Albany N. Y.

Drasterius elegans Fabr., larvae on potatoes, May, **C. B. Bassett,** Beerston N. Y.

Alaus oculatus Linn., owl beetle, adult, June 8, **J. Hannam Clark,** Cold Water N. Y.

Cryptophagus sp., beetles on dried, moldy squashes, Feb. 15, **C. H. Peck,** Menands N. Y.

Silvanus surinamensis Linn., saw-toothed grain beetle, adult in house, July 12, **R. D. Palmateer,** Waterford N. Y.

Necrophorus americanus Oliv., American carrion beetle, adult, Aug. 18, through *Country Gentleman*, Fair Haven N. J.

Lebia grandis Hentz., Nov. 2, **J. R. de la Torre Bueno,** Van Cortlandt Park N. Y.

List of larvae received from **Dr F. Meinert,** Copenhagen, Denmark. Dytiscidae: Hyphydous ovatus L., H. hyalinus DeG.? Laccophilus minutus Fabr.?, Cremidotus caesar Duftrchm., Haliplus ruficollis DeG., Ilybius fenestratus Fabr., Deronectes (Hydroporus) depressus Fabr.

Diptera]

Gastrophilus equi Fabr., horse bot fly, egg on hairs of a boa, May 3, **P. L. Huested,** Blauvelt N. Y.

Pegomyia vicina Lintn., beet leaf miner, larva on beet, June 28, **George T. Powell,** Lenox Mass.

Erax bastardii Macq., robber fly, adult, July 28, **J. E. West,** Poughkeepsie N.Y.

Culex melanurus Coq., larvae, **H. G. Dyar,** Washington D.C.

C. aurifer Coq., larvae and adults, **H. G. Dyar,** Washington D.C.

C. triseriatus Say, larvae, **H. G. Dyar,** Washington D.C.

C. dupreei Coq., larvae, **H. G. Dyar,** Washington D.C.

C. restuans Theo., larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

C. sylvestris Theo., larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

C. jamaicensis Theo., larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

C. dyari Coq., larvae, **H. G. Dyar,** Washington D.C.

C. atropalpus Coq., larvae and adult, **H. G. Dyar,** Washington D.C.

C. discolor Coq., larvae, **H. G. Dyar,** Washington D.C.

C. sollicitans Walk., male and larvae, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

Theobaldia incidens Thomson, larvae, **H. G. Dyar,** Washington D.C.

Psorophora ciliata Fabr., adults and larva, Nov. 2, **J. R. de la Torre Bueno,** Staten Island N.Y.

Sciara ocellaris O. S., larvae on maple, June 4, **P. L. Huested,** Blauvelt N.Y.

Lasioptera vitis O. S., larvae on grape, June 8, **David Muirhead,** New Brighton N.Y.

Cecidomyia persicoides Clem., hickory leaf gall on hickory, Sep. 23, **A. Zabriskie,** Barrytown N.Y.

?Cecidomyia verrucicola O. S., adult on Tilia, July 23, **G. S. Graves,** Newport N.Y.

C. pellex O. S., larvae in ash galls, May 30, **O. Q. Flint,** Athens N. Y.

List of larvae received from **Dr F. Meinert,** Copenhagen, Denmark: Thalacrocera replicata L., Trichocera maculipennis Meig., Mochlonyx culiciformis DeG., Corethra plumicornis Fabr., Dixa aprilina Meig., Corethra pallida Fabr., Chironomus venustus Fries., Tanypus sp., Ceratopogon bipunctatum Gmel., C. circumdatum Staeg., Miastor metraloas Mein.

Siphonaptera

Ceratopsyllus serraticeps Gerv., cat and dog fleas, Aug. 16, **G. S. Kidder,** Port Henry N. Y.

Lepidoptera

Anosia plexippus Linn., adult on Asclepias, July 25, **Frances McCarty** Albany N. Y.

Sphecodina abbotii Swians, larva, July 5, **J. J. Smith,** Albany N.Y.

Phlegethontius quinquemaculata Haworth, Sep. 30, **H. O. Bassett,** Schenectady N.Y.

Ceratomia amyntor Hubn., hawk moth, caterpillar on elm, Aug. 16, **Mrs Abraham Lansing,** Albany N.Y.

Antherea yama-maia Guer., Japanese silk worms, larvae on scrub oak, May 31, **L. H. Joutel,** New York.

Philosamia cynthia Drury, Ailanthus worm, cocoon, June 10, **H. C. Hearman,** Lansingburg N.Y.

Tropaea luna Linn., luna moth, adult on walnut, June 14, **Rev. A. M. Kling,** Eminence N. Y.

Halisidota caryae Harr., hickory tussock moth, larvae, Aug. 12, **Raymond Watson,** Lockport N.Y.

Alypia octomaculata Fabr., 8-spotted forester, larva on grape, June 8, **David Muirhead,** New Brighton N.Y.

Agrotis messoria Harr., dark sided cutworm, larvae, June 3, **K. L. Palmatin,** Catskill N.Y. Same, June 28, **B. F. Haskell,** Portland Me.

Papaipema nitela Guen., stalk borer in tomato, June 28, **J. M. Dolph,** Port Jervis N.Y. Same in corn, June 29, **D. F. Meskil,** Highlands N.Y.

Schizura concinna Sm. & Abb., red-humped appletree caterpillar, larvae on apple, Sep. 7, **W. H. Gifford,** Onondaga county N.Y.

Malacosoma americana Fabr., tent caterpillar eggs on apple, Ap. 8, **Helen Blydenburgh,** Smithtown L.I.

Megalopyge opercularis Sm. & Abb., rabbit moth, cocoon on maple, Aug. 2, **Chester L. Whitaker,** Somerville Mass.

?Zeuzera pyrina Linn., leopard moth, work? on ?Norway maple, Nov. 24, **Ferdinand Fish,** Brooklyn N.Y.

Cossus centerensis Lint., larvae on Populus deltoides Marsh, July 26, **S. C. Bradt,** Albany N.Y.

Thiodia signatana Clem., on maple, Sep. 23, **Mrs Williamson,** Onteora N.Y.

?Gelechia obliquistrigella Chamb., red spruce bud worm, larvae on red spruce, Oct. 23, **C. R. Pettis,** Saranac Inn N.Y.

Lithocolletis hamadryadella Clem., oak leaf miner, larvae on oak, Aug. 8, **Mrs Isabella M. Banks,** New Hamburg N.Y.

Neuroptera

Corydalis cornuta Linn., hellgramite fly, adult, June 27, **Albert Spencer,** Albany N.Y.

Chaulioides pectinicornis Linn., comb-horned fish fly July 26, **O. Q. Flint,** Athens N.Y.

Hemiptera

Zaitha fluminea Say, waterbug, adult bearing egg mass, July 18, **O. Q. Flint,** Athens N.Y.

Lygus pratensis Linn., Nov. 2, **J. R. de la Torre Bueno,** Van-Cortlandt Park, N.Y.

Ceresa bubalus Fabr., Buffalo tree hopper on apple, Oct. 3, **Frank H. Knox,** Troy N.Y.

Smilia misella Lec., adult on San José scale, Nov. 24, **E. S. Miller,** Germantown N.Y.

Trioza tripunctata Fitch, bramble flea louse, adult on wild blackberry, Sep. 1, **Cyrus R. Crosby,** Penn Yan N.Y.

Pachypsylla celtidis-mamma Riley, jumping plant louse, gall on hackberry leaf, Celtis, Aug. 2, **O. Q. Flint,** Athens N.Y.

Phylloxera caryaecaulis Fitch, hickory gall aphis, galls on hickory, Ap. 6, **G. T. Powell,** Ridgefield Ct.

Schizoneura americana Riley, elm leaf woolly aphis, June 8, **F. W. Wells,** Saratoga Springs N.Y. Same, nymphs on elm, July 6, **A. T. Sutcliffe,** Chippewa Bay N.Y.

Pemphigus imbricator Fitch, on beech, Oct. 29, **G. S. Graves,** Newport N.Y.

Aleyrodes vaporariorum West., on fuchsia, Jan. 12, **Mrs W. H. Harrison,** Lebanon Springs N.Y.

Chermes pinicorticis Fitch, plant louse on balsam, Sep. 3, **John T. Sackett,** South Amenia N.Y.

Pulvinaria innumerabilis Rathv., on maple, June 30, through **James H. Stoller** [Schenectady N.Y.] Riverhead N.Y.

Lecanium? cerasifex Fitch, cherry Lecanium, adult on pear, May 31, **C. E. Eldridge,** Leon N.Y.

Coccus hesperidum Linn., house Lecanium, adults on fern, Mar. 18, **Mrs E. H. Mairs,** Irvington N.Y.

Eulecanium nigrofasciatum Perg. on maple, Nov. 25, **P. L. Huested,** Highland Falls N.Y.

E. tulipiferae Cook, tulip scale, young on tulip, Feb. 15, **P. L. Huested,** Milton N.Y. Same, adult on tulip, July 9, **Truman H. Baldwin,** Nyack N.Y.

Chionaspis corni Cooley, adults on Cornus sanguinea Feb. 6, **B. D. VanBuren,** Geneva N.Y. Same, adult on Cornus, Feb. 23, **Thos. Cunningham,** Vancouver B.C.

C. pinifoliae Fitch, pine leaf scale insect on pine, Dec. 9, **G. L. Flanders,** Rochester N.Y. Same, on pine, Oct. 12, **G. G. Atwood,** Albany N.Y.

C. furfura Fitch, scurfy bark louse on crab apple, Ap. 6, **J. O. Carleton,** New York city.

Chrysomphalus aonidum Linn., adults on rubber plant, Dec. 7, **C. H. Peck,** Menands N.Y.

Aulacaspis pentagona Targ., West Indian peach scale on flowering cherry, Ap. 28, **T. F. Niles,** Chatham N.Y.

A. rosae Bouché, rose scale, adult on blackberry, Dec. 14, **Ohio State Dep't Agric.**

Aspidiotus ancylus Putn., Putnam's scale insect, adults on Cornus florida, Dec. 12, **N. Y. State Dep't Agric.,** Flushing N.Y.

A. forbesi Johnson, cherry scale on pear?, Ap. 16, **Fred T. Wiley,** Geneva N.Y.

A. perniciosus Comst., San José scale, adults, on crab apple, Ap. 6, **J. O. Carleton,** New York city. Same on currant, Ap. 8, **Helen Blydenburgh,** Smithtown Branch L.I. Same on currant, Ap. 20, **S. B. Huested,** Blauvelt N.Y. Same on Japan weeping cherry, imported directly from Japan, Ap. 23, **G. G. Atwood.** Same on apple, peach, currant and laburnum, May 13, **Miss M. J. Tyers,** Dobbs Ferry N.Y. Same on peach, May 21, **S. F. Skidmore,** East Hampton L.I. Same, June 28, **H. Steers,** Larchmont N.Y. Same, all stages on crab apple, July 11, **David Muirhead,** West New Brighton N.Y. Same on currant, July 15, **G. T. Powell,** Ghent N.Y. Same, all stages on pear, Aug. 1, **David Muirhead,** West New Brighton N.Y. Same, all stages on pear, Aug. 5, **Mrs Edwin H. Mairs,** Irvington N.Y. Same, on plum, Sep. 17, **Myron S. Wheeler,** Berlin Mass.

Lepidosaphes ulmi Linn., appletree bark louse, eggs on silver maple, Ap. 9, through **Country Gentleman,** Wallkill N.Y. Same, on horse-chestnut, Ap. 22, **T. L. Memikheim,** New Dorp N.Y. Same on willow, June 2, **J. W. Hand,** Easthampton L.I. Same on apple, Sep. 15, **E. Spaulding,** Greenville N.Y.

List of Ohio Coccidae received from **Mr J. G. Sanders** of the Ohio State University Columbus O., June 13, 1904: Chionaspis corni Cooley, on Cornus amomum, June 30, 1903, at Cedar Point, Erie co., O.; C. pinifoliae (Fitch), on Pinus strobus and P. virginiana,

Mar. 2, 1903, at Columbus O.; C. gleditsiae Sanders (Cotypes) on Gleditsia triacanthos, Mar. 11, 1903, at Columbus O.; C. longiloba Cooley, on Populus deltoides (cottonwood) Ap. 14, 1904, at Painesville O.; C. salicis-nigrae Walsh, on Salix sp., May 10, 1903, at Columbus O.; C. americana Johns., on Ulmus americana, Feb. 16, 1904, at Columbus O.; Chrysomphalus obscurus Comst., on Quercus alba, Mar. 15, 1904, at Columbus O.; Aspidiotus juglans-regiae Comst., on Tilia americana, Ap. 4, 1904, at Columbus O.; Aspidiotus piceus Sanders, (Cotypes) on Liriodendron tulipifera, July 7, 1903, at Painesville, Lake co., O.; Eulecanium fletcheri Ckll., on Juniperus virgiana, Oct. 14, 1903, at Columbus O.

Orthoptera

Oecanthus niveus DeG., white flower cricket, eggs on plum, Ap. 20, **W. L. Martin,** Middlebrook Va.

Hippiscus tuberculatus Beauv., coral-winged locust, nymph on snow, Mar. 16, **H. A. Van Fredenberg,** Port Jervis N.Y.

Diapheromera femorata Say, walking stick, adult, Aug. 17, **Miss Grace Smith,** Albany N.Y. Same, adult, Sep. 26, **Miss Rhoda Thompson,** Ballston Spa N.Y.

Tenodera sinensis, Chinese mantis, adult on grapevine, Nov. 19, **F. W. Hopper** Philadelphia Pa.

Ephemeridae

Palingenia bilineata Say, May fly, adult, July 28, **J. E. West,** Poughkeepsie N.Y.

Trichoptera

Hydropsyche morosa Hag., caddice fly, adult, June 14, **Miss M. B. Sherman,** Ogdensburg N.Y.

Acarina

Phytoptus acericola Garm., gall mite, gall on sugar maple, July 12, **Edwin Buchman,** Valley Falls N.Y.

P. abnormis Garm., gall mite, adult on linden, July 23, **G. S. Graves,** Newport N.Y.

Myriapoda

Scutigera forceps Raf., house centipede, Nov. 21, **J. N. Dolph,** Port Jervis N.Y.

Julus caeruleocinctus Wood, blue-banded milliped, Oct. 17, **G. S. Graves,** Newport N.Y. Same, June 2, **T. A. Cole,** Madison county.

APPENDIX

INSECT EXHIBIT AT THE LOUISIANA PURCHASE EXPOSITION

The office supervised the preparation of a small collection of insects which was exhibited by the Forest, Fish and Game Commission, in the New York section of the Forestry Building and

was awarded a silver medal in group 112. This collection was designed to show the life history and habits in particular of the more injurious species affecting valuable forest trees, and one tray was given to characteristic insects of the Adirondacks. Special effort was made to depict, so far as possible the life history, habits and methods of work of those forms of economic importance and to show whenever practicable the natural enemies of value in keeping these species in control. A brief catalogue of the exhibit is given below.

CATALOGUE

Insect galls

This collection, occupying two nearly perpendicular trays and representing the work of 53 species, was devoted to the peculiar vegetable deformities produced by insects, since these forms are always of great popular interest.

Galls of sawflies

Tenthredinidae

1 **Willow apple gall**
Pontania pomum Walsh

4-winged gall flies
Cynipidae

2 **Spiny bullet gall**
Rhodites bicolor Harr.

3 **Mealy rose gall**
Rhodites ignota O.S.

4 **Rose root gall**
Rhodites radicum O. S.

5 **Spiny rose gall**
Rhodites spinosa Ashm.

6 **Seedy blackberry gall**
Diastrophus cuscutaeformis O. S.

7 **Furrowed blackberry gall**
Diastrophus nebulosus O. S.

8 **Oak apple**
Amphibolips confluentus Harr.

9 **Larger empty oak apple**
Amphibolips inanis O. S.

10 **Scrub oak gall**
Amphibolips ilicifoliae Bass.

11 **Oak plum gall**
Amphibolips prunus Walsh

12 **Horned oak gall**
Andricus ?cornigerus O. S.

13 **Gall of wool sower**
Andricus seminator Harr.

14 **White oak club gall**
Andricus clavula Bass .

15 **Small oak apple**
Andricus singularis Bass.

16 **Oak petiole gall**
Andricus petiolicola Bass.

17 **Oak-woolly gall**
Andricus lana Fitch.

18 **Woolly oak gall**
Andricus operator O. S.

19 **Gouty oak gall**
Andricus punctatus Bass.

20 **Spiny oak gall**
Cynips prinoides Beutm.

21 **Pine cone gall**
Cynips strobilana O. S.

22 **Oak leaf seed gall**
Cynips decidua Bass.

23 **Oak hedgehog gall**
Acraspis erinacei Walsh

24 **Oak fig gall**
Biorhiza forticornis Walsh

25 **Hairy oak leaf gall**
Biorhiza hirta Bass.

26 **Oak bullet gall**
Holcaspis globulus Fitch

27 **Rough bullet gall**
Holcaspis duricoria Bass.

28 **Oak leaf bullet gall**
Dryophanta polita Bass.

29 **Oak potato gall**
Neuroterus batatus Fitch.

30 **Oak button gall**
Neuroterus umbilicatus Bass.

31 **Noxious oak gall**
Neuroterus noxiosus Bass.

32 **Leaf oak gall**
Cynips ?frondosa Bass.

33 **Blueberry gall**
Solenozopheria vaccinii Ashm.

TWO-WINGED GALL FLIES

Diptera

34 **Hickory onion gall**
Cecidomyia holotricha O. S.

35 **Hickory pill gall**
Cecidomyia persicoides O. S.

36 **Willow cone gall**
Cecidomyia strobiloides O. S.

37 **Oak pill gall**
Cecidomyia pilulae Walsh.

38 **Balsam leaf gall**
Cecidomyia balsamicola Lintn.

39 **Willow twig gall**
Rhabdophaga salicis Schrk.

40 **Small solidago gall**
Trypeta polita Loew.

41 **Large solidago gall**
Trypeta solidaginis Fitch

TRUE BUGS

Hemiptera

Psyllid galls

Psyllidae

42 **Hackberry nipple gall**
Pachypsylla celtidis-mamma Riley

Galls of plant lice

Aphididae

43 **Witch-hazel cone gall**
Hormaphis hamamelidis Fitch

44 **Spiny witch-hazel gall**
Hormaphis spinosus Shimer

45 **Cockscomb elm gall**
Colopha ulmicola Fitch

46 **Poplar leaf stem gall**
Pemphigus populitransversus Riley

47 **Basal leaf gall**
Pemphigus populicaulis Fitch

48 **Vagabond gall**
Pemphigus vagabundus Walsh

49 **Phylloxera galls**
Phylloxera vitifoliae Fitch

50 **Hickory stem gall**
Pemphigus caryaecaulis Fitch

51 **Larch aphid gall**
Chermes abietis Linn.

MITES

Acarina

Gall mites

Phytoptidae

52 **Fusiform maple gall**
Phytoptus acericola Garman

53 **Linden mite gall**
Phytoptus abnormis Garman

Forest insects

The species affecting forest trees in particular, are numbered 54 to 97 inclusive and were contained in three horizontal trays, occupying one side of the case. This section was devoted principally to representing the biology of the members of this important group and to displaying the work of various forms.

54 **Large black ant**
Camponotus pennsylvanicus Cress.

Specimen from heart of dead spruce, cut by William B. Young, on east shore of Lake Placid, Dec. 1903; 187 rings were counted and the tree was probably over 225 years old.

55 **Large carpenter bee**
Xylocopa virginica Drury.

Wood borers

56 Xiphydria provancheri Cr.

57 **Pitch pine twig tortrix**
Retinia comstockiana Fern.

58 **Pitch tip moth**
Pinipestis zimmermani Grote

59 **Bronze birch borer**
Agrilus anxius Gory.

90 **Blue pine borer**
Callidium antennatum Newm.

61 **Maple tree pruner**
Elaphidion villosum Fabr.

62 Obrium rubrum Newm.

63 **Painted hickory borer**
Cyllene pictus Drury.

64 **Locust borer**
Cyllene robiniae Forst.

65 **Common oak clytus**
Xylotrechus colonus Fabr.

66 Neoclytus erythrocephalus Fabr. (Associated species)

67 Tomoxia bidentata Say (Associated species)

68 **Ribbed rhagium**
Rhagium lineatum Oliv.

69 Pytho americanus Kirby

70 **Pine sawyer**
Monohammus confusor Kirby

71 **Pine sawyer**
Monohammus scutellatus Say

72 **Tickler**
Monohammus titillator Fabr.

73 **White pine weevil**
Pissodes strobi Peck

74 **Willow snout beetle**
Cryptorhynchus lapathi Linn.

Bark and wood borers

Scolytids

75 Monarthrum mali Fitch

76 Gnathotrichus materiarius Fitch

77 Pityogenes sp.

78 Pityogenes sp.
79 Pityogenes sp.
80 Pityogenes consimilis Lec.
81 Pityophthorus minutissimus Zimm.
82 Pityophthorus sp.
83 Xyloterus politus Say
84 Xyloterus bivittatus Kirby
85 Cryphalus striatulus Mann.
86 Dryocoetes eichhoffi Hopk.
87 Dryocoetes sp.
88 Xylocleptes sp.
89 Tomicus calligraphus Germ.
90 Tomicus cacographus Lec.
91 Tomicus pini Say
92 **Balsam bark beetle** Tomicus balsameus Lec.
93 Tomicus caelatus Eich.
94 Scolytus quadrispinosus Say.
95 **Spruce bark beetle** Polygraphus rufipennis Kirby
96 Phloeosinus dentatus Say
97 **Turpentine beetle** Dendroctonus terebrans Oliv.

Shade tree insects

It is difficult to draw a sharp distinction betwen forms affecting forests and those depredating on our shade trees. Some insects, hardly injurious in the forests, are very destructive to shade trees and on that account it has been deemed advisable to exhibit some of these species and their allies under one head. Like that representing forest insects, the exhibit of shade tree pests is very largely biologic and was represented by numbers 98 to 140, occupying three horizontal trays and a nearly vertical one of the exhibit case.

98 **Pigeon tremex** Tremex columba Linn.
99 **Lunate longsting** Thalessa lunator Fabr.
100 **Maple tree borer** Plagionotus speciosus Say
101 **Poplar borer** Saperda calcarata Say
102 **Elm bark borer** Saperda tridentata Oliv.
103 **Elm snout beetle** Magdalis barbita Say
104 **Dark elm bark borer** Hylesinus opaculus Lec.
105 **Carpenter moth** Prionoxystus robiniae Peck
106 **Leopard moth** Zeuzera pyrina Fabr.
107 **17 year cicada** Cicada septendecim Linn.

Leaf feeders

108 **American sawfly** Cimbex americana Leach
109 **Mourning cloak** Euvanessa antiopa Linn.
110 **Elm leaf beetle** Galerucella luteola Müll.
111 **Spined soldier bug** Podisus maculiventris Say (Enemy of above)
112 **Four-horned sphinx** Ceratomia amyntor Geyer
113 **Cecropia moth** Samia cecropia Linn.

114 **Promethea moth**
Callosamia promethea Drury
115 **Imperial moth**
Basilona imperialis Drury
116 **Fall webworm**
Hyphantria cunea Drury
117 **Hickory tussock moth**
Halisiodota caryae Harr.
118 **White marked tussock moth**
Notolophus leucostigma Abb. & Sm.
119 Pimpla conquisitor Say (Natural enemy)
120 Tachina mella Walk. (Natural enemy)
121 **Bagworm**
Thyridopteryx ephemeraeformis Haw.
122 **Birch leaf Bucculatrix**
Bucculatrix canadensisella Chamb.
123 **Cottonwood leaf beetle**
Lina scripta Fabr.
124 **Ocellate red-spot**
Sciara ocellaris O. S.
125 **Catalpa cecidomyid**
Cecidomyia sp.
126 **Birch aphid**
Callipterus betulaecolens Fitch
127 **Larch sawfly**
Lygaeonematus erichsonii Hartig.
128 **Leconte sawfly**
Lophyrus lecontei Fitch
129 **Fir sawfly**
Lophyrus abietis Harr.
130 **Pitch-inhabiting midge**
Diplosis resinicola O. S.
131 **Pine tube builder**
Eulia politana Haw.
132 **Luna moth**
Tropaea luna Linn.
133 **Buck or maia moth**
Hemileuca maia Drury
134 **Yellow striped oak caterpillar**
Anisota senatoria Abb. & Sm.
135 **Oak webworm**
Archips fervidana Clem.
136 **Forest tent caterpillar**
Malacosoma disstria Hübn.
137 Pimpla conquisitor Say (Natural enemy)
138 Pteromalus vanessae How. (Natural enemy)
139 Theronia fulvescens Cress.
140 Tachina mella Walk.

Adirondack insects

This is a small collection occupying one of the nearly perpendicular trays and composed of over 100 species; namely, numbers 141 to 245. This portion of the exhibit, as will be seen by the list appended below, represents the more characteristic forms of the various orders.

BEETLES

Coleoptera

141 Cicindela 6-guttata Fabr.
142 Alaus oculatus Linn.
143 Corymbites vernalis Hentz.
144 Chalcophora fortis Lec.
145 Dicerca divaricata Say
146 Buprestis maculiventris Say

47 Melanophila fulvoguttata Harr.
148 Chrysobothris femorata Fabr.
149 Calopteron reticulatum Fabr.
150 Ellychnia corrusca Linn.
151 Dorcus parallelus Say
152 Ceruchus piceus Web.
153 Passalus cornutus Fabr.
154 Copris anaglypticus Say
155 Aphodius fimetarius Linn.
156 Geotrupes egeriei Germ.
157 Pelidnota punctata Linn.
158 Eurphoria inda Linn.
159 Osmoderma scabra Beauv.
160 Trichius affinis Gory
161 Dichelonycha elongata Fabr.
162 Parandra brunnea Fabr.
163 Orthosoma brunneum Forst.
164 Prionus laticollis Drury
165 Phymatodes dimidiatus Kirby
166 Clytanthus ruricola Oliv.
167 Cyrtophorus verrucosus Oliv.
168 Desmocerus palliatus Forst.
169 Leptura canadensis Newm.
170 Leptura proxima Say
171 Leptura vittata Germ.
172 Saperda vestita Say
173 Chrysomela bigsbyana Kirby
174 Cratoparis lunatus Fabr.

BUTTERFLIES AND MOTHS

Lepidoptera

175 Anosia plexippus Linn.
176 Argynnis aphrodite Fabr.
177 Brenthis bellona Fabr.
178 Polygonia interrogatonis Fabr.
umbrosa Lintn.
179 Polygonia faunus Edw.
180 Eugonia j-album Boisd. & Lec.
181 Vanessa atalanta Linn.
182 Basilarchia arthemis Drury
183 Basilarchia archippus Cram.
184 Cyaniris ladon Cram.
185 Pontia rapae Linn.
186 Eurymus philodice Godart.
187 Papilio turnus Linn.
188 Papilio troilus Linn.
189 Smerinthus jamaicensis Dru.
190 Paonias excaecatus Sm. & Abb.
191 Ceratomia undulosa Walk.
192 Marumba modesta Harr.
193 Ctenucha virginica Charp.
194 Automeris io Fabr.
195 Anisota rubicunda Fabr.
196 Estigmene acraea Dru.
197 Apantesis virgo Linn.
198 Alypia octomaculata Fabr.
199 Homohadena badistriga Grote
200 Mamestra adjuncta Boisd.
201 Euthisanotia grata Fabr.

202 Plusia balluca Geyer.
203 Euchalcia contexta Grote
204 Autographa talcigera Kirby
205 Autographa rectangula Kirby
206 Autographa u-aureum Guen.
207 Catocala relicta Walk.
208 Catocala cara Guen.
209 Catocala amatrix Hübn.
210 Catocala unijuga Walk.
211 Catocala parta Guen.
212 Catocala cerogama Guen.
213 Catocala polygama Guen.
214 Ellida caniplaga Walk.
215 Caripeta divisata Walk.
216 Ennomos magnarius Guen.
217 Xanthotype crocataria Fabr.

FLIES

Diptera

218 Chrysops vittatus Wied.
219 Chrysops niger Macq.
220 Therioplectes microcephalus O. S.
221 Pangonia tranquilla O. S.
222 Tabanus atratus Fabr.
223 Tabanus reinwardtii Weid.
224 Tabanus coffeatus Macq.
225 Tabanus lineola Fabr.
226 Anthrax alternata Say
227 Spilomyia fusca Loew.
228 Temnostoma aequale Loew.
229 Xylota curvipes Loew.
230 Helophilus similis Macq.
231 Sericomyia militaris Walk.
232 Sericomyia chrysotoxoides Macq.
233 Eristalis tenax Linn.
234 Eristalis dimidiatus Wied.
235 Echinomyia algens Wied.

TRUE BUGS

Hemiptera

236 Cicada tibicen Linn.
237 Podisus cynicus Say
238 Ceresa diceros Say
239 Phymata wolfii Stal.
240 Coenus delia Say
241 Belostoma americannum Leidy.

DRAGON FLIES, ETC.

Neuropteroid

242 Gomphus scudderi Selys.
243 Corydalis cornuta Linn.
244 Chauliodes rastricornis Ramb.
245 Polystoechotes punctatus Fabr.

Group of forest insects

This natural group occupied a central glass box and contained 31 species of insects or representations of their work on their food plants; namely, white birch, red oak, elm and maple. There

were 11 species of beetles, 15 of butterflies and moths, 2 of the bee family and 3 of the bug family on the plants or on the ground at their base. The list of the species follows:

Coleoptera

Pales weevil
Hylobius pales Hbst.
Magdalis perforata Horn.
Metachroma marginata Cr.
Pine Chrysomela
Glyptoscelis pubescens Fabr.
Light-loving grapevine beetle
Anomàla lucicola Fabr.
Chrysobothris dentipes Germ.
C. floricola Gory.
C. pusilla Bap. & Gory.
Large flat-headed pine borer
Chalcophora virginiensis Drury
Small flat-headed pine borer
Chalcophora liberta Germ.
Callidium antennatum Newm.

Lepidoptera

Spiny elm caterpillar
Euvanessa antiopa Linn.
White marked tussock moth
Notolophus leucostigma Abb. & Sm.
Forest tent caterpillar
Malacosoma disstria Fabr.
Pitch twig moth
Retinia comstockiana Fern.
Salt marsh caterpillar
Estigmene acraea Drury
Black and red woolly borer
Isia isabella Abb. & Sm.
Luna moth
Tropaea luna Linn. (cocoons)
Promethea moth
Calosamia promethea Drury (cocoons)
Cecropia moth
Samia cecropia Linn. (cocoons)
Lithocolletes aceriella Clem. (work)
Incurvaria acerifoliella Fitch (work)
Catocala relicta Walk.
Catocala cara Guen.
Catocala concumbens Walk.
Catocala piatrix Grote.

Hemiptera

Elm bark louse
Gossyparia ulmi Geoff.
Cottony maple scale
Pulvinaria innumerabilis Rathv.
Pine leaf scale
Chionaspis pinifoliae Fitch
Pine Chermes
Chermes pinicorticis Fitch

Hymenoptera

Pine sawflies
Lophyrus abietis Harr.
L. lecontei Fitch

Neuropteroid

Chrysopa species

COLORED PLATES

A series of colored plates were exhibited on the top of the case in two double-faced frames. These plates illustrated the biology and habits of the following species:

Scale insects affecting trees

Three plates illustrating different stages of the appletree bark louse, Lepidosaphes ulmi Linn., the San José scale, Aspidiotus perniciosus Comst., the European fruit scale, Aspidiotus ostreaeformis Curtis, and the scurfy bark louse, Chionaspis furfura Fitch, were included in this group. They are respectively plate 1, 2, 3 and 4 of Museum bulletin 46.

Insects affecting forest trees

This included three plates published in the *7th Report of the Forest, Fish and Game Commission.*

Insects affecting white pine [Plate 13]

1 Nearly full grown larva of imperial moth Basilona imperalis Drury
2 Masses of the pine bark louse Chermes pinicorticis Fitch
3 Pupal cells of white pine weevil, Pissodes strobi Peck under bark of pine log
4 Burrows of larvae of same in bark
5 Portion of dead shoot killed by the insect, showing the circular exit holes, the borings of the insect in upper part and the shrunken area extending down on the affected portion of the twig
6 Pupal cells of white pine weevil within the wood, showing method of exit and also a few exit holes in the shrunken affected bark
7 Adult weevil, Pissodes strobi Peck, enlarged
8 Le Conte's sawfly, Lophyrus lecontei Fitch, larvae in resting position, showing below the stubs of devoured foliage
9 Pine leaf scale insect, Chionaspis pinifoliae Fitch

Insects affecting oak [Plate 16]

1 Egg mass of Anisota senatoria Abb. & Sm. on underside of oak leaf
2 Egg shells of same on partly eaten leaf
3 Shrunken larvae of same infested by parasite on leaf stalks showing the characteristic feeding of the insect
4 Nearly full grown larvae of same
5 Recently hatched larvae feeding side by side and showing the skeletonizing in the earlier stages

6 Male, natural size
7 Female depositing eggs
8 Full grown larva of buck moth, Hemileuca maia Drury
9 Male of same
10 Egg mass of same
11 Cacoecia fervidana Clem., enlarged
12 Nest of same, composed of partly eaten, curled leaves
13 Serica trociformis Burm. on leaf, natural size
14 Same enlarged
15 Two spotted tree hopper, Enchenopa binotata Say
16 Another peculiar tree hopper, Archasia galeata Fabr.
17 Another tree hopper, Thelia acuminata Fabr.
18 Dog day cicada or harvest fly, Cicada tibicen Linn. in its resting position
19 Acorn weevil, Balaninus nasicus Say, natural size
20 Same enlarged

Insects affecting hard pine [Plate 12]

1 Pitch mass of pitch twig moth Retinia comstockiana Fern., with pupal shell protruding therefrom in one case; the other shows old and recent pitch
2 Pitch mass of pitch inhabiting midge, Diplosis resinicola Osten Sacken
3 Shoot infested with Nantucket pine moth larva, Retinia frustrana Scudd., showing the abortive growth
4 Pitch pine needle gall fly, Diplosis pini-rigidae Pack., showing needles deformed by this insect
4a Work on needles of the previous year
5 Needles affected by the pine leaf miner, Gelechia pinifoliella Chamb., note the brown tips of the affected needles
6 A pine sawfly larvae, Lophyrus abietis Harris in natural position on the needles; below are stubs of eaten needles
6a Cocoon of same at base of pine needles
7 Pine Chrysomela, Glyptoscelis pubescens Fabr., much enlarged
8 Pales weevil, Hylobius pales Herbst., much enlarged
9 Chrysobothris pusilla Bap. & Gory, much enlarged
10 Chrysobothris floricola Gory, enlarged
11 Chrysobothris dentipes Germ., much enlarged
12, 13 and 14 Varieties of the light-loving grapevine beetle, Anomala lucicola Fabr., a species which is very abundant on hard pines
15 Pilophorus crassipes Uhl., much enlarged
16 Magdalis alutacea Lec., much enlarged
17 Magdalis perforata Horn, much enlarged
18 Lace-winged fly, Chrysopa species
18a Cocoons of same on needles

Insects affecting shade trees

This group was represented by six plates:

1 A plate illustrating in detail the life history and habits of the white marked tussock moth, Notolophus leucostigma Abb. and Sm., and the forest tent caterpillar, Clisiocampa disstria Hübn. [Pl. 1 of author's paper on *Insects Injurious to Forest Trees*, published in the *4th Annual Report of the Commissioners of Fisheries, Game and Forests*].

2 A plate illustrating in detail the life history and habits of the gipsy moth, Porthetria dispar Linn. [Pl. 1 of *16th Report of the State Entomologist*].

3 A plate illustrating in detail the life history and habits of the elm leaf beetle, Galerucella luteola Müll., and the bag or basket worm, Thyridopteryx ephemeraeformis Haw. [Pl. 1 of author's paper on *Insects Injurious to Elm Trees*, published in the *5th Annual Report of the Commissioners of Fisheries, Game and Forests*].

4 A plate illustrating the life history and habits of the sugar maple borer, Plagionotus speciosus Say, the twig girdler or tree pruner, Elaphidion villosum Fabr., and the cottony cushion scale, Pulvinaria innumerabilis Rathv. [Pl. 3 of the author's paper on *Insects Injurious to Maple Trees*, published in the *4th Report of the Commissioners of Fisheries, Game and Forests*].

5 A plate illustrating in detail the life history and habits of the brown tail moth, Euproctis chrysorrhoea Linn. [Pl. 1 of *18th Report of the State Entomologist*].

6 A plate illustrating in detail the life history and habits of the elm borer, Saperda tridentata Oliv., elm snout beetles, Magdalis armicollis Say and M. barbita Say, and the elm bark louse, Gossyparia ulmi Goff. [Pl. 3 of author's paper on *Insects Injurious to Elm Trees*, published in the *5th Annual Report of the Commissioners of Fisheries, Game and Forests*].

STUDIES IN CULICIDAE

The Culicidae in both adult and larval stages present many interesting modifications which are reflected to a greater or less extent in their life history and habits. The latter are frequently of considerable economic importance and therefore a knowledge of the former is exceedingly desirable. The following studies have for their object a better understanding of the group and more particularly a clearer delimitation of species because recently there has been in more than one instance a sad confusion of distinct forms. Experience has shown the difficulty of drawing specific lines even when one was sure that he was dealing with two forms. It sometimes occurs in this group that widely divergent adults produce very similar larvae and conversely that easily separable larvae transform to adults which can be distinguished from each other only with great difficulty. These vexatious problems can be solved satisfactorily only by careful rearing and thorough study of all the

characters presented in both larval and adult stages. Dry material has value in this work, though better preparations can be obtained from recently killed insects, and it has been our aim to rear, so far as possible, all of our native species and thus obtain the clearest possible idea of their characteristics in both adult and larval stages. The following observations are made public at this time because they should prove of considerable service to others engaged in similar investigations, and particularly because they deal with a comparatively unworked field.

The material on which these studies are based, has been derived from a number of sources. The most important contribution of exotic forms was obtained through the kindness of Prof. F. V. Theobald of England, a recognized authority on this group. Representatives of additional species have also been received from Dr Andrew Balfour of Khartum Egypt, Dr M. Grabham of Kingston Jamaica, and of Philippine forms from C. S. Ludlow, Surgeon General's Office, Washington. A large proportion of native material has been obtained by collecting and rearing, though we are deeply indebted to the kindness of Dr H. G. Dyar of Washington, Dr J. B. Smith of New Jersey, Dr W. E. Britton of Connecticut, Prof. Glenn W. Herrick of Mississippi, Prof. V. L. Kellogg of California and H. J. Quayle, also of California, for adults or larvae from different sections of the country. Special mention should also be made of Mr J. Turner Brakeley of Hornerstown N. J., who very kindly sent examples of several rare and extremely interesting species.

LARVAE

The larvae of this group are of peculiar interest because most repressive or exterminative work must be directed against them, and the ability to recognize species in the immature stage is frequently of the greatest value in determining the most satisfactory method of treating a mosquito-breeding area. Environment is of considerable value in determining mosquito larvae, since certain species exhibit decided preferences in breeding places, some being found only in or near brackish or salt water, others only in fresh water, a few in foul water, some in warm, fresh water, while others prefer cool spring-fed pools, tree holes or holes in rocks and other diverse places. The larvae as a rule subsist on decaying vegetable matter and algae, though certain species, notably Psorophora, Corethra, Eucorethra and Sayomyia are carnivorous, and the first named in particular, is probably of considerable economic importance, since these predaceous larvae undoubtedly devour large numbers of the smaller pestiferous mosquitos.

Structural characters are of great importance in separating the larvae of this entire group. Occasionally color is of considerable service, yet it is always of secondary importance, since it is largely influenced by environment. The general shape of the head, the form of the antennae, and the position of the antennal tuft are all of considerable service in identifying species. The cephalic setae and the arrangement and character of the hairs on the body are also of some value.

The most prominent and peculiar structure is found in the air tube, or, as it is termed by some, the siphon. This structure exhibits a wide diversity in development, being entirely absent in Sayomyia, very short in the Anophelinae, rudimentary in Corethra and with widely varying proportions in the Culicinae. The general form and size of this important organ is of considerable value in identifying species and the presence or absence of setae, including the modified peculiar pecten at the base of the air tube, afford excellent characters for the separation of larvae. The hair tufts on the dorsal or anterior portion of the air tube vary considerably. The air tube of Wyeomyia smithii Coq. is remarkable because of the irregularly disposed setae occurring on all sides. Culicada trichurus Dyar may be easily distinguished by the anterior or dorsal series of hairs on the air tube, while species belonging to Culiseta are at once recognizable by the unique prolongation of the posterior pecten into a series of fine hairs extending nearly to the tip of the air tube. The minor modifications of the more normal pecten teeth are also of considerable service in the recognition of species. Many forms have one or several teeth widely separated from the basal, nearly continuous row of teeth found in others.

The most interesting and valuable structure for classificatory service, though unfortunately a somewhat inconspicuous one, is found in the peculiar patch of spines or spinelike scales designated as the comb. This is normally a lateral organ of the eighth segment just beneath the air tube. It is usually triangular in form and may be composed of from five to nearly 100 individual scales or spines. These are usually attached to the unmodified skin, though occasionally they arise from the posterior border of a chitinized plate or are even attached to a somewhat chitinized band. In either of the two latter cases they are arranged in a single or double row. The spines or scales themselves differ widely in structure, some being simply thornlike in form, others with setaceous margins and some with large apical and smaller subapical spines. A greater divergence

from the thornlike tip is seen in those with scales tipped with a nearly uniform series of ciliate or setaceous processes. The comb of Psorophora is exceedingly peculiar in that the posterior margin of stout, trispinose scales partially incloses an area thickly clothed with much finer scales, each with its posterior margin finely serrate like the teeth of a comb. There are considerable variations in the number of scales on certain species, and in most forms having a large number of scales in the comb, there is frequently a great difference in structure between the component scales, the greatest divergence from the type form being observed at the dorsal or ventral angles of the patch. The Anopheline larvae are remarkable because of the highly specialized comb. It is subdorsal and consists of a basal plate bearing a series of posterior, sometimes pectinate teeth, a structure widely different from that presented by other Culicidae.

The degree of chitinization of the anal or ninth segment is frequently of considerable value in identifying species and there is considerable variation in the ventral tuft. This is greatly developed in certain forms and almost rudimentary in others. A most interesting structure occurs on this segment in Megarhinus larvae; namely, a rudimentary spiracle indicating plainly a former terrestrial habit. Corethrinae larvae have this segment very weakly chitinized and the larvae of Sayomyia may at once be recognized by the peculiar ventral hooks attached to the posterior extremity.

Key for the identification of mosquito larvae

Identification of mosquito larvae is of importance in all work designed to control these species, and this is particularly true of localities where prevention of disease is the main object. This being the case, we have taken the opportunity of revising and extending our recently prepared table for the separation of larvae, in the hope that it will prove of service to those engaged in control work of one kind or another.

a Air tube long, at least four times as long as the diameter of its base
  b Air tube very long, slender, slightly constricted in the middle; antennae white banded.....Little black mosquito, Culex territans
  bb Air tube very long, stout, tapering uniformly
    c Comb scales 60, pecten teeth three to four branched.....Unbanded marsh mosquito, Culex salinarius
    cc Comb scales about 80, pecten apparently simple..... Culicella dyari
    ccc Comb scales narrow, spinelike, about 20 in a row, resembling a grating.....Culicella melanurus
  bbb Air tube about five times the width of its base
    c Pecten pale, divided into three to five long, slender processes

d Antennal tuft before the middle.....
White dotted mosquito, Culex restuans

dd Antennal tuft at outer third

e Antennae not white banded, air tube somewhat fusiform; terminal spines of comb scales fine.....
House mosquito, Culex pipiens

ee Antennae usually conspicuously white banded, air tube tapering

f Air tube not over four times as long as wide, terminal spines of comb scales coarse.....Culex tarsalis

ff Air tube over four times as long as wide, terminal spines of comb scales fine.....Culex secutor

cc Pecten teeth pale, divided into two nearly equal processes.....
Deinocerites cancer

ccc Pecten teeth almost black, about 20 in number, with small basal dentitions; comb scales about 25

d Pecten rows continuous, the large apical spine of the comb scales being from one third to one half the length of the entire structure
Culicada fitchii

dd Pecten with several isolated apical teeth

e Lateral hairs of first abdominal segment double, detached teeth of pecten well spaced.....Culicada abfitchii

ee Lateral hairs of first adbominal segment single, apical pecten teeth only a little detached.....Culicada vittata

aa Air tube moderate in length, from about two to four times longer than its greatest diameter

b Air tube decidedly fusiform

c Antennae long, anal segment long; comb consisting of six or seven subequal spines.....Janthinosoma musica

cc Antennae moderate, apical portion black; anal segment short, wider than long, with four pecten teeth on the basal half of the air tube
Grabhamia jamaicensis

bb Air tube greatly enlarged at the base, linear apically and crowned with a circle of recurved spines
Taeniorhynchus perturbans (young)

bbb Air tube tapering uniformly and bearing irregularly placed, large setae along its entire length; comb scales 10 in a single row
Wyeomyia smithii

bbbb Air tube without pecten; no comb scales

c Conspicuous air reservoirs in the thoracic and seventh abdominal segments; larvae aquatic.....Corethra

cc No conspicuous air reservoirs; air tube bearing several long apical setae.....Corethrella brakeleyi

bbbbb Air tube with pecten, more or less tapering; comb scales present

c Seventh abdominal segment with a large dorsal plate, comb consisting of a double row of slender spined scales attached to the posterior edge of a chitinous plate; air tube without pecten
Pneumaculex signifer

cc Seventh abdominal segment without dorsal plate

d Comb scales not more than 10

e Comb scales quadrate, with a very long median spine and shorter lateral ones

f Comb scales 5-8 attached to a slight band; pecten teeth 5-8 dividing into 2-4 very long, slender processes
Grabhamia discolor

ee Comb scales rather broadly spatulate at the base, few, arranged in a curved line

f Comb scales five, pecten teeth 7-9, minutely serrate near the middle.....Protoculex serratus

ff Comb scales six, pecten teeth 12-16, stoutly toothed near the middle.....Culicada abserratus

fff Comb scales 8-10 in a curved line; 12 pecten teeth with short basal spines.....Culicada dupreei

ffff Comb consisting of eight simple, spinelike processes attached to the posterior margin of a large lateral plate; air tube slightly curved; pecten with basal portion thick, margins and apical parts nearly transparent, serrate.....
.....Uranotaenia sapphirina

dd Comb scales ranging from 10-24

e One or more pecten teeth widely separated from a continuous row

f Two rows of slight tufts of hair on the dorsum of the air tube; comb scales 14-16, usually four pecten teeth widely separated from the remainder of the row.....
Northern gray mosquito, Culicada trichurus

ff No such dorsal tufts on the air tube

g Air tube slender, tapering equally, the continuous pecten extending only to the basal fifth of the air tube; pecten teeth 2-3, toothed; comb scales 10-14 (Smith 18-20).....
.....Swamp mosquito, Ecculex sylvestris

gg Air tube slender, tapering slightly, the continuous pecten, each usually with a single tooth, extending to the basal fourth; two or three somewhat flattened, isolated pecten teeth extending beyond the middle, the tufts near the apical third; comb scales 12 nearly in a single row .....
..... Aedes fuscus

ggg Air tube stouter, slightly swollen, continuous pecten extending to the basal third, 15-18, with 2 isolated pecten teeth 1-2 toothed; comb scales 14 in a somewhat irregular triangular patch, spatulate, each with a rather stout terminal spine;.....Culicada impiger

ee Pecten in a continuous row, distal teeth not widely separated

f Comb scales narrow, elongate, tapering, 12 in an irregular double row, finely setose apically.....
.....Culicada triseriatus

ff Comb scales 16, elongate, base slightly elliptic, sides and apex evenly spined.....Culicada varipalpus

fff Comb scales with a distinct spatulate base and large apical spine

g Comb scales 14-22, the minor spines nearly as long as the median one.....Culicada trivittatus

gg Comb scales in a triangular patch, about 16, each with one or two very short, subapical spines.....
.....Culicelsa auroides

ggg Comb scales in a curved line, about 15 and with a patch of much finer, comblike scales anteriorly; a large species 1½ inches long...Giant mosquito, Psorophora ciliata

ddd Comb scales 25 or more

e Antennal tuft before or at the middle

f Pecten pale, prolonged into setae; comb scales digitately divided

g Chitinized parts very dark, stout.....
.....Theobaldia incidens

gg Chitinized parts lighter and weaker

h Comb scales about 60, pecten teeth with one or two basal processes.....Culiseta absobrinus

hh Comb scales 40, pecten teeth with two or three basal processes.....
Culiseta consobrinus (C. magnipennis)

ff Pecten not as above

g Tuft of antenna reduced to a single hair; comb scales about 46, in five rows, several pecten teeth widely separated from the remainder.....Culicada atropalpus

gg Tuft of antennae normal

h Comb scales with a moderate apical spine, narrowly spatulate at base

i Comb scales 28-64; mouth brush moderate; tip of antennae dark.....
Woodland pool mosquito Culicada canadensis

ii Comb scales 25; mouth brush large.....
.....Culicada pullatus

hh Comb scales each with a stout apical spine, broadly spatulate at base

i Air tube about three times as long as its greatest diameter; antennae moderately long with a slight swelling near the base, 25-50 comb scales and 16-24 pecten; head immaculate.....
Brown wood mosquito, Culicada subcantans

ii Air tube about twice as long as its greatest diameter; antennae shorter, without a swelling near the base; spines and scales as above; head maculate.....
Brown salt marsh mosquito, Culicada cantator

hhh Comb scales with 4-6 stout, nearly equal apical spines, somewhat spatulate at base.....

i Comb scales about 60 in number.....
.....Culicada lazarensis

ii Comb scales about 30; pecten teeth 19.....
.....Culicada curriei

ee Antennal tuft beyond the middle

f Comb scales about 80, in a triangular patch of 10 rows, pecten apparently simple.....Culicella dyari

ff Comb scales 25-30, pecten small, 14-20, minutely toothed
.....Golden mosquito, Culicelsa aurifer

aaa Air tube very short, not more than 1½ to 2 times as long as broad
b Pecten teeth dentate on both sides, comb with 16-24 scales; head maculate...Small salt marsh mosquito, Culicelsa taeniorhynchus
bb Pecten teeth dentate on one side only
c Antennal tuft normal
d Comb scales 28-40, pecten teeth about 14; head generally immaculate....Salt marsh mosquito, Culicada sollicitans
dd Comb scales five, pecten teeth 7-9, minutely serrate near middle .....Protoculex serratus
cc Antennal tuft reduced to a single hair
e Pecten extending nearly to the apex of the air tube; comb scales about 46, with subequal terminal spine.....Culicada atropalpus
ee Pecten extending to the middle of the air tube; comb scales 10, each with a large median tooth and smaller lateral ones.....Yellow fever mosquito, Stegomyia fasciata
bbb Pecten simple, with stout spines; comb a single row of 12 simple spines, stellate hairs on the body.....Howardina walkeri
bbbb Pecten absent; comb represented by a large plate with two long barred setae posteriorly; larvae about ¾ inch long.....Megarhinus portoricensis
aaaa No air tube or a very short one
b Next to the last segment with a flat dorsal area in which may be seen two spiracles
c Medium size species, floating just below the surface of the water; comb consisting of a tooth-bearing plate
d Comb teeth of equal length.....Anopheles barberi
dd Comb teeth of two sizes, long and short
e Comb teeth with large branches between them.....Cellia albipes
ee Comb teeth with only fine obscure pectinations
f Secondary teeth of the comb less than half as long as the primary ones..Anopheles crucians, A. maculipennis
ff Secondary teeth of the comb over half as long as the primary ones...Anopheles punctipennis, A. franciscanus
cc Large species with no comb; mandibles strongly developed; floating just below the surface of the water, limited to cold northern pools.....Eucorethra underwoodi
bb Last segment usually with hooks, no spiracles apparent and no signs of an air tube; larvae almost transparent, the only color being the black eyes and pigmented air sacs in the thoracic and seventh abdominal segments.....Phantom larvae, Sayomyia

DESCRIPTIONS OF NEW OR INSUFFICIENTLY CHARACTERIZED SPECIES

Culicelsa auroides n.sp.

Several larvae of this species were taken at Elizabethtown N. Y., and were at first supposed to be the young of C. aurifer Coq. A close study, however, showed marked structural differences between

the two in the larval stage, though the adults present a very similar appearance. It is therefore described as a new form.

Female. Proboscis dark brown, about two thirds the length of the body. Palpi short, dark brown, third segment about one third the length of the stout uniform fourth segment; fifth rudimentary. Antennae a little shorter than the proboscis. Basal segment yellowish brown, fuscous internally and with an inconspicuous patch of whitish scales dorsally and internally; other segments dark brown with medium basal whorls and thinly clothed with short golden setae. Occiput thickly clothed with curved, golden yellow scales and with numerous erect, golden yellow, fork scales posteriorly. Mesonotum with a conspicuous median stripe of rich brown scales, becoming yellowish, thinner and obsolete posteriorly. A short, sublateral line of the same color occurs on the posterior third; other portions of mesonotum rather thickly clothed with golden yellow scales. Pleura thickly clothed with silvery white scales. Scutellum rather thickly clothed with long, golden yellow scales and with a conspicuous median and smaller lateral apical groups of long, golden yellow setae; postscutellum smooth, dark brown. Halteres, apical portion slightly fuscous, basal semitransparent, whitish. Abdomen dark brown with distinct basal yellowish white bands, slightly prolonged laterally. Terminal lobes fuscous. Ventral surface suffused with yellowish white scales. Coxae brownish yellow, rather thickly clothed with whitish scales; legs brown, unbanded. Femora and tibiae yellowish white ventrally; tarsi dark brown, tarsal claws unidentate. Wings with costa and first longitudinal vein thickly clothed with purple brown scales, subcosta and other veins more sparsely ornamented; fringe a purplish gray. Petiole of first submarginal cell about two thirds the length of the cell; that of the second nearly as long as its cell. Posterior cross vein a little over its own length from the mid cross vein.

Described from a freshly bred, isolated specimen obtained May 12 in the larval stage at Elizabethtown N. Y. The larva presents some marked differences, particularly in the shape of the antennae at least, from that of the typical aurifer received from Mr Brakeley of Hornerstown N. J.

Larva about $\frac{3}{8}$ inch long. Antenna brown, slightly fuscous apically, stout, slightly swollen at the base, gently curved and tapering gradually to a somewhat blunt apex. Tuft at the basal third consisting of about four apparently simple hairs. Tip with one long segmented apical process, a shorter, much more slender one, a stout, long process and a considerably stouter, short one. Surface, specially apically, ornamented with rather large, stout, somewhat isolated, chitinous spines. Labial plate broadly triangular with about 25 rather fine teeth. Comb consisting of a somewhat triangular patch of about 16 scales, each with a spatulate, enlarged base, coarsely and rather sparsely setose on the sides and with a stout subapical and a rather long apical spine, the latter as long or longer than the body of the scale. Air tube stout, about three times as

long as broad, slightly swollen at the basal third and tapering gradually to the tip. Pecten consisting of two rows of closely set, stout, dentate spines, 20 to 24 in each, with a compound hair just beyond the tip of each and at about the middle of the air tube, each tooth usually with one large and two or three smaller denticulations, basal portion about one half the length of the longer terminal spine. Chitinous ring of ninth segment about two thirds as long as broad, inclosing the entire segment, barred area short. Dorsally there is a long, simple caudal seta.

This larva presents a striking resemblance to that of the typical C. aurifer larvae from New Jersey. A close examination, however, shows that marked differences are presented by the antennae, the tuft being at the basal third in this form instead of beyond the middle, as in the true aurifer. There are more teeth in the labial plate and an examination of the comb scales reveals a considerable difference between the lateral serrations at the base which, in this form, have the two subapical teeth on either side of the central spine considerably stouter than the preceding ones, whereas in the true aurifer there is no such marked difference. The teeth of the pecten are more closely set and in aurifer the base of each pecten tooth is a little stouter and usually possesses more serrations. The chitinous ring of the ninth segment incloses the segment in this form and does not in aurifer.

Culex fitchii Felt & Young

This medium sized species is a very characteristic form and well colored examples may be easily recognized by examining the mesonotum which is ornamented with rich brown submedian vittae bordered laterally by a broad area clothed with loose, curved, silvery scales. It flies from about the middle to the latter part of May, and its larvae occur in association with a number of early spring forms. It, like the adult, is very characteristic and may be recognized by its long, uniformly tapering air tube with the continuous, closely placed row of jet-black pecten at its base. This larva appears to be confined very largely to open grassy pools such as are found along roadsides or in meadows, where it may be taken in association with the larvae of C. subcantans, C. abfitchii, C. trichurus, C. impiger, Aedes fuscus, Corethra karnerensis and C. cinctipes.

This species is later in appearance than such early spring forms as C. cantans, C. cinereoborealis and C. abfitchii, all of which fly before adults of this species begin to appear. Culicada impiger and Aedes fuscus are fully as early, though their breeding period is more prolonged and the two latter

forms are consequently found much later in the season. This larva is a very difficult one to rear. Abraded adults present a strong resemblance to Culiciada subcantans and C. abbotchii. Males of this species are easily separated from the two last named, since the basal clasp segments bear a conical tuberculate process thickly set with numerous long, stout setae, a structure practically absent in Culiciada abbotchii, and one that is represented only by a rudimentary lobe and a conspicuous slightly curved, chitinous spine in Culiciada subcantans.

Female. Proboscis about two thirds the length of the body, dark brown, rather thickly flecked almost its entire length with silvery white scales. Palpi dark brown, flecked with white scales, particularly at the base of the segments. Basal segment of antennae reddish brown with a minute internal patch of white scales; other segments dark brown with sparse basal whorls of long, dark setae and a scanty clothing of fine, yellowish hairs. Occiput with a conspicuous median group of hairs at the juncture of the eyes and with a broad median stripe of silvery white scales, and somewhat indistinct patches of brown scales. Numerous erect, white and black, fork scales posteriorly. Laterally the posterior portion of the head is thickly clothed with yellowish white scales involving a small dark patch. Mesonotum with broad, submedian vittae of thick, dark brown scales becoming grayish and obsolete posteriorly. Sublaterally there is a somewhat irregular area of silvery yellow scales, the central posterior portion shaded with dark brown scales and on the lateral anterior angles there are conspicuous patches of dark brown scales. Pleura rather sparsely and irregularly clothed with silvery white scales. Scutellum sparsely clothed with yellowish white scales and with a conspicuous median and smaller lateral groups of long, golden yellow setae; postscutellum smooth, light brown. Halteres with the apical portion slightly fuscous, basal part yellowish transparent. Abdomen dark brown with distinct basal bands, slightly prolonged medially, very narrow laterally, or sublaterally, in some specimens distinctly prolonged laterally, of silvery white scales, those of the sixth and seventh segments occupying half and three fourths respectively, of the dorsal area; eighth segment nearly naked, the tip of the terminal lobes dark brown. Ventral surface rather thickly clothed with yellowish white scales except for a more or less obsolete broken median black line and a brown patch at the lateral posterior angles of each segment. Coxae pale yellowish, sparsely clothed with whitish scales. Femora largely light yellow with more or less irregular flecking of dark brown scales. Tibiae much darker than the femora. Apex brown, articulation yellow. Tarsi dark brown, those of the posterior legs with broad distinct basal bands on the second, third and fourth segments, which are narrower and nearly uniform on the mid and fore tarsi. Basal bands of the first tarsal segments ill defined. Claws unidentate, concave surface of teeth finely serrate. Wings with the costa thickly

clothed with dark brown scales interspersed with numerous yellowish ones; subcosta and first and second longitudinal veins more sparsely clothed with similar scales; fringe pearly gray. Petiole of first submarginal cell about two thirds the length of the cell, that of the second as long as its cell. Posterior cross vein a little over its own length from the mid cross vein.

Described from a freshly reared specimen.

Male. Proboscis about two thirds the length of the body, dark purple. Palpi dark brown, the third segment capitate and with a broad basal and a median white band, a lateral whitish patch of scales apically, with a rather sparse ventral tuft and with two short, stout, subapical setae; this segment one third longer than the combined nearly equal fourth and fifth segments, the fourth with a broad, well defined, white basal band, the fifth with a rudimentary basal band of the same color, more slender than the fourth and extending its own length beyond the proboscis. Antennae, basal segment dark brown with a conspicuous internal patch of white scales, densely clothed with grayish yellow plumes basally. Segments 13 and 14 about half the length of the entire organ, 14 being three fourths the length of 13. Occiput rather sparsely ornamented with silvery yellow, curved scales and rather numerous erect white and a few black, fork scales posteriorly. The lateral posterior margin of the head is clothed with a rather thick patch of silvery white scales. Mesonotum with broad, submedian, dark brown stripes becoming silvery yellow and obsolete posteriorly, sublaterally a rather broad, yellowish white stripe and at the anterior lateral angles more or less conspicuous brownish spots. Pleura rather sparsely clothed with silvery white scales. Scutellum sparsely clothed with yellowish white scales and with large, median and conspicuous lateral apical tufts of long, golden yellow scales; postscutellum smooth, light brown. Halteres with the apical portion more or less fuscous, basal whitish transparent. Abdomen dark brown with distinct, rather broad basal yellowish white bands slightly produced laterally, those on the fifth and sixth segments covering the anterior half and that on the seventh most of the segment; the eighth sparsely clothed with silvery white scales. Basal clasp segment dark brown. Ventral surface rather sparsely suffused with silvery white scales, with a somewhat broken median stripe of brown scales. Coxae yellowish brown; legs banded, dark brown; the femora and tibiae well flecked with yellowish white scales, their ventral surface yellowish. Tarsi with well marked basal bands, those on segments 1 to 4 of the hind legs broad, those of the fore and mid legs on segments 2 to 3, narrow, bright, that of the fourth of the mid legs and the fifth of the hind legs narrow or rudimentary. Claws of anterior and middle legs unequal (the shorter simple), the longer claw of the middle leg being nearly straight. Wings with the costa clothed with dark brown scales, first and second longitudinal veins more sparsely ornamented with light brown scales mixed with yellowish ones; fringe pearly gray. Petiole of first submarginal cell about the same length as the cell, that of the second about one third longer. Posterior cross vein about its own length from the mid cross vein.

Described from two freshly bred specimens presenting marked colorational differences from C. abfitchii.

Culicada abfitchii Felt

This is one of the large early spring forms found breeding in considerable numbers in open grassy pools, the adults beginning to appear about the time that Culicada subcantans has ceased to emerge. Examples of this species are separated with difficulty from the last named form and may be recognized most readily by their slightly later appearance and by the somewhat definite, narrow, silvery, sublateral lines between the submedian and lateral brownish areas of the mesonotum. There is also a difference in the male genitalia, there being no conspicuous basal enlargement or stout chitinous spine at the base of the first clasp segment in this species, whereas in C. subcantans there is a rudimentary lobe bearing a stout, chitinous spine. The larva of this form is about the same size as that of C. subcantans. It may be easily distinguished therefrom by the longer, tapering air tube and the smaller number of slender comb scales. This larva is in turn readily differentiated from that of Culicada fitchii by its stouter air tube, and in particular by the two isolated, well separated teeth terminating the pecten. There is also a marked though more minute difference in the comb scales of these two species. The large apical spine of the comb in this form is from one half to two thirds the length of the entire structure, whereas in C. fitchii the apical spine is only from about one half to one third the length of the scale.

Life history. This species probably winters in the egg, the larvae hatching very early in the spring. There is but one generation, as this species is not met with after the middle to the latter part of May. The larvae are confined very largely to grassy pools, occasionally breeding therein in considerable numbers, though more frequently occuring rather sparingly. They exhibit a marked tendency to shelter themselves under overhanging grass, and random dips in pools apparently uninhabited, have repeatedly been fruitful in securing larvae of this species. It is a difficult form to rear and owing to its close resemblance to C. subcantans, it has undoubtedly been confused with that species. The larvae are found in association with the very early spring forms, Culicada trichurus, C. abfitchii and the slightly later species, C. fitchii, C. canadensis, C. impiger, Corethra karnerensis and C. cinctipes.

Female. Proboscis straight, about two thirds as long as the body, light brown, flecked with numerous white scales near the middle, particularly on the underside, dark brown apically. Palpi short, dark brown; base of third and fourth segments narrowly and irregularly ringed with white scales, third about one half as long as the fourth, which bears a moderate rudimentary subglobular fifth segment. Antennae, basal segment light brown,

slightly fuscous internally and with a conspicouus patch of white scales; other segments dark brown except the basal ones and with sparse basal whorls of dark brown hairs and a rather thick clothing of somewhat long, whitish hairs. Occiput thickly clothed with golden yellow scales and numerous upright white and black fork scales posteriorly, a median tuft of yellowish white scales at the juncture of the eyes, another a little behind the same, and a well defined larger lateral stripe of white scales inclosing a black patch. Under surface of the head rather thickly clothed with yellowish white scales. Mesonotum thickly clothed with golden brown scales, there being a well defined submedian stripe narrowly bordered by a line of scattering silvery scales, which latter are also sparingly present in the sublateral stripes. Submedian brown stripes obsolete posteriorly, where there is a sparse clothing of silvery white or yellowish scales. Pleura sparsely clothed with small patches of silvery white scales. Scutellum sparsely clothed with golden yellow scales, with a conspicuous median and a pair of submedian groups of long, golden yellow bristles; postscutellum smooth, dark brown. Halteres slightly fuscous apically, whitish transparent basally. Abdomen dark brown with distinct basal bands of yellowish white scales much prolonged laterally and somewhat so mesially, the latter being more pronounced on the fourth, fifth and sixth segments. Sixth segment slightly and seventh almost suffused with yellowish white scales; eighth sparsely clothed. Apex of terminal lobes dark brown. Ventral surface suffused with yellowish white scales. Coxae yellowish brown, clothed with irregular patches of whitish scales. Legs dark brown flecked with yellowish white scales and distinctly banded. Ventral surface of femora and tibiae yellowish white, the latter with a distinct yellowish apical band. Basal band of first tarsal segment rather indistinct, that of the second, third and fourth usually broad and well defined on all the legs. Posterior legs with a well defined basal band on the last tarsal segment, indistinct or wanting on the mid and fore legs. One specimen has the fourth tarsal segment of the second and third pair of legs entirely white, the third being brown. Tarsal claws apparently unidentate. Wings clothed with dark brown scales with many yellowish white ones interspersed; fringe pearly gray. Petiole of first submarginal cell about two thirds the length of the cell, that of the second about as long as the cell. Posterior cross vein more than its own length from the mid cross vein.

Described from freshly bred specimens from Nassau, Ap. 8, 1905.

Male. Proboscis about two thirds the length of the body, brown with numerous whitish scales near the middle, dark brown at the apex. Palpi extending beyond the proboscis, a rather broad, yellowish band near the apex of the third segment, much of the fourth and considerable of the fifth being yellowish white or whitish, the other scales dark brown. Extreme base of the third and tip of the second segment yellowish; plumes moderate in length, yellowish with gray apexes; third segment capitate with several short, stout, subapical setae and about one fourth longer than the combined fourth and fifth segments, the latter two about equal.

Antennae moderate, densely clothed with grayish plumes, largely yellowish at the base. Basal segment globose, dark brown, with a rudimentary internal patch of white scales; segments 13 and 14 longer than all the others, the distal a little shorter than the 13th. Occiput rather sparsely clothed with golden yellow scales intermingled with numerous upright black fork scales. Mesonotum rather thickly clothed with golden yellow scales, obsolete or very sparse posteriorly. There is a narrow sublateral line of whitish scales along the posterior third; laterally the scaling is much thinner. Pleura with a few small scattering patches of white scales. Scutellum with a small median patch of yellowish white scales, a median apical group of long, golden yellow setae and a pair of smaller lateral groups; postscutellum smooth, yellowish brown. Extreme apex of halteres fuscous, other portions yellowish white. Abdomen dark brown with very broad, somewhat diffuse basal bands of whitish or yellowish white scales somewhat prolonged laterally. Seventh and eighth segments sparsely covered with yellowish or yellowish white scales. Basal clasp segments dark brown, sparsely clothed with long hairs. Ventral surface suffused with golden yellow scales. Coxae yellowish brown, irregularly and sparsely clothed with whitish scales. Legs dark brown, rather thickly flecked with yellowish white scales and with broad bands on the second to fourth tarsal segments of the mid and posterior legs, the bands of the first and fifth tarsal segments and those of the anterior legs narrow or indistinct. Claws unidentate, those of the fore and middle legs unequal. Wings with costa thickly clothed with dark brown scales, others sparsely ornamented with dark brown and yellowish scales intermixed. Fringe pearly gray. Petiole of first submarginal cell about the same length as the cell, that of the second one third longer. Posterior cross vein less than its own length from the mid cross vein.

Described from a freshly bred specimen taken at Nassau, May 8, 1905.

Culicada abserratus Felt & Young

This species appears to be a somewhat common spring inhabitant of rather cool, elevated forest pools. It was first characterized from several larvae and one poorly developed bisexual individual. It has been possible since to breed a good series of both sexes and detailed descriptions are given herewith.

Female. Proboscis nearly uniform dark purple, about two thirds the length of the body. Palpi dark brown, slightly darker apically. Third segment about two thirds the length of the somewhat dilated fourth, fifth rudimentary subglobular. Basal segment of antenna globose, dark brown, with a minute internal patch of white scales; other segments dark brown with sparse basal whorls and a scanty clothing of fine setae. Occiput rather sparsely clothed with golden yellow scales with upright yellow fork scales posteriorly and a few black fork scales laterally. Mesonotum thickly clothed with golden yellow scales and with rather

conspicuous dark brown submedian vittae becoming obsolete posteriorly. Pleura rather sparsely clothed with silvery white scales. Scutellum dark brown with a scanty median patch of yellowish white scales, a scanty median apical group of golden yellow setae and smaller lateral groups of the same character; postscutellum smooth, dark brown. Halteres with the extreme apex dark brown, basal portion silvery white. Abdomen dark brown with distinct basal bands nearly obsolete on the median line and well produced laterally, these on the fifth and sixth segments extending to the posterior fourth. Seventh segment scantily and somewhat irregularly clothed with silvery white scales. Eighth segment naked, dark brown, terminal lobes almost fuscous. Ventral surface sparsely clothed with silvery white scales, nearly absent on the median line; venter of eighth segment naked. Coxae brownish, sparsely clothed with silvery white scales; legs unbanded, dark brown. Ventral surface and tip of femora yellowish; claws unidentate. Wings with the costa clothed with very dark brown scales, the other veins somewhat sparingly ornamented with brownish scales; fringe pearly gray. Petiole of first submarginal cell about two thirds the length of the cell, that of the second about as long as its cell. Posterior cross vein more than its own length from the mid cross vein.

Described from a freshly reared specimen taken at Nassau, May 10, 1905.

Male. Proboscis uniformly dark purple, about two thirds the length of the body. Palpi unicolorous, dark purple, about as long as the proboscis and with moderate purplish plumes; third segment slightly capitate, about half as much longer as the third and fourth combined, the latter somewhat dilated at the apical third. Antennae about two thirds the length of the palpi, dark purple with thick, purplish plumes shaded with gray; 13th and 14th segments subequal, about as long as all the others combined. Occiput rather sparsely and uniformly clothed with silvery yellow scales and with numerous black, erect, fork scales posteriorly. Mesonotum rather thickly and uniformly clothed with golden yellow scales becoming white and sparse posteriorly. Pleura rather thickly and irregularly clothed with large patches of silvery white scales. Scutellum with a rather thick median patch of yellowish white scales, a conspicuous apical group of golden yellow bristles and smaller lateral ones of the same color; postscutellum smooth, dark brown. Halteres, apical portion slightly fuscous, basal yellowish transparent. Abdomen dark purplish with conspicuous fine lateral hairs and distinct basal yellowish white or white bands. The latter is somewhat irregular, slightly prolonged laterally specially on the sixth and seventh abdominal segments; eighth nearly covered with silvery yellow scales. Basal clasp segments dark purple and ornamented with several conspicuous brown setae. Ventral surface purplish brown, sparsely clothed laterally with silvery white scales. Coxae yellowish brown, sparsely clothed with silvery white scales. Legs dark brown, unbanded; femora

and tibiae with some shading of yellow and largely yellowish ventrally. Claws unidentate, those of the fore and mid legs unequal. Wings with costa and first and second longitudinal veins rather thickly clothed with dark brown scales; fringe grayish purple. Petiole of first submarginal cell about as long as the cell, that of the second a little longer. Posterior cross vein about its own length from the mid cross vein.

Described from several freshly bred specimens taken at Nassau, May 10, 1905.

Corethra fuliginosus n. sp.

Female. Proboscis very short, pale yellowish. Palpi fuscous yellow, about three times as long as the proboscis with the third and fifth segments subequal, fourth shorter. Antennae about one half the length of the body, pale yellowish; basal segment subglobular, fuscous internally, others brownish with sparse basal whorls and a scanty clothing of pale yellowish hairs. Occiput rather thickly clothed with purplish brown hairs. Pronotal lobes prominent with lateral tufts of stout hairs. Mesonotum with a narrow median line of short, black hairs and a nearly smooth, subdorsal brown area, narrowing posteriorly. Sublaterally the mesonotum is clothed with long, dark brown hairs, becoming longer posteriorly except for a rather broad sublateral naked space posteriorly. Pleura nearly naked. Scutellum prominent with numerous long, brown apical setae; postscutellum smooth, yellowish with dark brown inverted V. Halteres, basal portion yellowish transparent, apical fuscous. Abdomen a uniform fuscous, sparsely clothed with long, yellowish hairs, ventral surface a fuscous yellow. Coxae pale yellowish. Legs nearly uniform yellowish fuscous. Wings with the costa thickly clothed with dark brown scales, other veins rather thickly ornamented with light brown or straw yellow scales; fringe purplish gray. Petiole of first submarginal cell about one third the length of the cell; that of the second about as long as the cell. Posterior cross vein less than its own length from the mid cross vein.

Described from a freshly bred specimen taken at Nassau N. Y., June 12, 1905.

MORPHOLOGY AND PHYLOGENY

The culicid antennae are normally composed of 14 segments with possibly a rudimentary 15th apparent in a few species. The first segment is subglobular in both sexes and in the female the succeeding ones are relatively simple, each with a basal whorl of stout hairs and usually moderately to thickly clothed with very short, fine hairs. The male antennae have the basal whorl present in the female except that the individual hairs are somewhat more slender and much longer. This sex is recognized at once in all but a very few, by the very long, fine hairs or plumes occurring on segments 2 to 12 inclusive. These latter appear to be nothing but the

very highly developed fine hairs clothing the female antennae. The 13th and 14th segments in the male are much produced, each with a basal whorl of stout setae, and in the case of the 13th with a thick group of plumed hairs. The greater part of this segment is comparatively naked, being clothed only with rather short, sparse hairs. The 14th is sparsely clothed with short hairs. The antennae of Deinocerites are remarkable because of the greatly prolonged second segment in both sexes, it being three times the length of the following segments in the female and on account of all the segments being similarly clothed in both sexes. The male is at once recognized by its having the third to seventh segments also much produced though each shorter than the preceding one. The antennae of Corethrella are peculiar in that the female possesses on segments 2 to 14, a scattering secondary whorl about the middle of each, while in the male there is a distinct basal whorl with a thick vestiture of slightly shorter, finer hairs extending to the apical fourth of each segment. Sayomyia presents a more generalized

FIG. 1 Deinocerites cancer, antennae of male and female, showing all but the basal segment and illustrating the peculiar elongation of segments two to seven in the male and the enormous extension of the second segment in the female, greatly enlarged (Original)

FIG. 2 Corethrella brakeleyi, male and female antennae, much enlarged (Original)

condition in that the antennae are composed of 15 nearly equal segments, each presenting approximately the same characteristics as the other groups. The segments of the male antennae are thickly plumose, approximately equal. They differ from those of the other groups in that the plumes all rise from the thick basal whorl on segments 2 to 14 inclusive, a sparse basal whorl somewhat like that of the female occurring at the base of the 15th segment.

The palpi consist of five segments in both sexes of most Culicidae, except in the females of certain Culicinae, where the rudimentary fifth appears to be wanting, and in some Aedeomyinae where there has been an even greater consolidation of segments. These organs are approximately equally developed in both sexes of the Corethrinae, the first and second segments usually being fused, the others distinct and subequal. The Culicinae present striking differences between the sexes. The palpi of the female having the first and second segments nearly fused, the divisions being indicated only by slight constrictions and usually the partial absence of chitin. The third and fourth segments are well developed, subequal, and the fifth is rudimentary and, in some species, absent. The males have the first and second segments almost completely fused as in the case of the female; the third is enormously produced with a pseudoarticulation near its middle, while the fourth and fifth are well developed, subequal.

Theobald, in his exceedingly valuable work on *Culicidae of the World*, states that in Culex the female palpi are short and three or four jointed, whereas in the male they are long and three jointed, adding that constrictions at the base give the female the appearance of having four or five jointed palpi, and the male as possessing a five jointed organ. The study of the more generalized forms has convinced us that there are, except as stated above, five segments in these organs, and while in most work it may be impractical to count the basal segments, we prefer to apply the same number to homologous segments in the different groups. This procedure gives one a more just appreciation of morphologic changes and has no serious disadvantage, since after some experience, there is very little danger of misapplying the numerals.

Wings. The wings of Culicidae vary widely in character, as has been previously pointed out. Differences in venation are easily seen and frequently prove of considerable service in identifying species, particularly the relative distance between the mid cross vein and posterior cross vein and the proportions obtaining between the two fork cells and their petioles. The male wing is usually recognized by its much longer petioles, sparse scales and the absence of oblique scales along the greater portion of the posterior margin. The scales clothing the wings of these insects vary exceedingly, ranging from almost linear in Sayomyia and Corethra to the lanceolate ones of Anopheles or the very much dilated scales of Uranotaenia. The latter is remarkable for the great diversity in its wing scales. The wing clothing of most Culicids is easily divided into two classes—the long and the short scales, the longer ones being slender, frequently strap-shaped and, as a rule, extending some distance on each side of the veins, while the short scales are

FIG. 3 Culicada fitchii palpus of male and female showing the normal condition for the two sexes, much enlarged (Original)

more or less broadly triangular and generally closely appressed to the vein. The striking variations in scale characters are very well shown by reference to plate 1, figures 2, 3, which illustrates some of the more unique exotic forms supplementing the illustrations of these organs published in Museum Bulletin 79. The wing of our native Theobaldia incidens Thom., [pl. 3, fig. 1], illustrates a marked tendency toward segregation of scales, which is shown even better in the enlargement reproduced at plate 3, figure 3. The Australian Mucidus alternans Westw. [pl. 1, fig. 2], is another instance of segregation and the peculiar dilated scales are well shown at plate 1, figure 4. The South American Mansonia titillans Walk., has a very striking wing [pl. 1, fig. 1], which is clothed with numerous closely set, dilated, asymmetric scales, some of which are shown much enlarged at plate 1, figure 3. The tendency toward dilated wing scales appears in widely separated individuals, as for example Aedeomyia squammipenna Arrib., the wing of which [pl. 2, fig. 1], presents a peculiar mottled appearance, easily explained when we examine an enlargement thereof [pl. 2, fig. 3]. The rather highly specialized African Eretmapodites quinquevittatus Theo., has a narrow, long wing [pl. 2, fig. 2], with a very peculiar arrangement of the scales shown enlarged at plate 2, figure 4. The extreme in wing elongation is exhibited by the South American Sabethes remipes Wied. [pl. 3, fig. 2], and the general character of its wing scales are well brought out at plate 3, figure 4.

These striking variations in wing structure appear to be rather closely correlated with variations in other organs and are of considerable value in systematic work. The marked divergencies in wing clothing or scales appears to be more erratic and of comparatively little aid in indicating lines of descent though frequently of great value in the recognition of species.

Genitalia. The male genital organs in the Culicidae present remarkable diversities and afford most excellent characters for the grouping of allied species. The large conspicuous lateral organs have been termed the clasps. They are composed of two segments, a large basal one which presents considerable modification in form and bears, particularly in Culex as at present restricted, very characteristic appendages near the apical third, and near the base more or less peculiar chitinous spines usually on an elevation or tubercle. The term claspette is employed to designate certain peculiar and very significant organs occurring

on the ventral surface of this basal segment. Ordinarily the claspette is represented by one or more spined tubercles, but in the extremely generalized Protoculex serratus Theo., this organ is represented by a conspicuous basal spined lobe and a longer, acute one near the apex of the basal segment. This suggests that a still more generalized form may possess clasps and their ventral counterpart, the claspette, more largely developed, and it is possible that in some forms they are approximately equal. There is an approach to this in Wyeomyia smithii Coq. The basal clasp segment consists of two nearly equal chitinous processes connected only by a thin membrane apically and by no means firmly joined basally. The peculiar divided terminal segment is plainly compound and may have been produced by the fusion of two comparatively simple processes. This conception affords a ready explanation for the persistance throughout the group of more or less prominent tubercular elevations on the ventral surface of the clasp segment, and if our interpretation be correct, the degree of development along certain lines at least, will be accurately indicated by this organ.

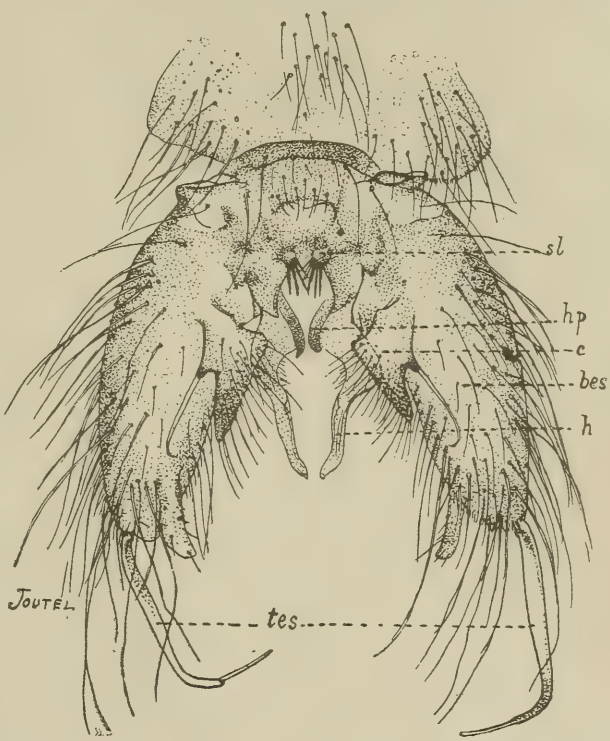

Fig. 4 Protoculex serratus, ventral aspect of male genitalia: *tes*=terminal clasp segment; *bes*=basal clasp segment; *h*=harpes; *hp*=harpago; *c*=claspette; *sl*=setaceous lobes, much enlarged (Original)

The terminal clasp segment is much more slender than the basal one and in some species is very elongate and arcuate. This is particularly true in the Anophelinae. The large majority of forms have at or near the apex of the terminal clasp segment, a more or less developed spine, apparently the rudiment of a ventral second segment and analogous to the claspette of the basal segment. This spine is absent in some forms and double in others. This terminal segment presents considerable morphologic differences and in some forms bears striking appendages, notably in the case

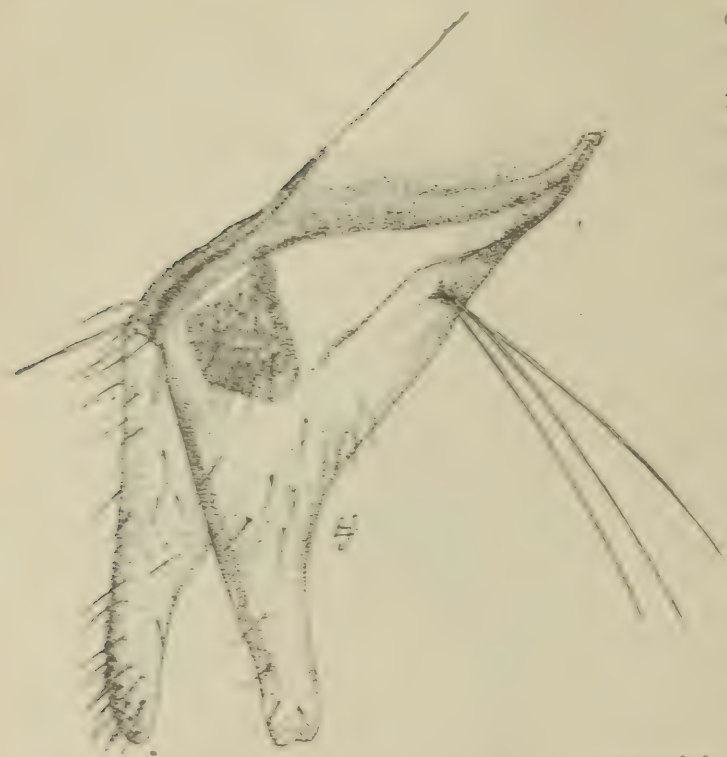

FIG. 5 Wyeomyia smithii, basal clasp segment of the male genitalia, showing its peculiar bifurcate apex, much enlarged (Original)

of the African Taeniorhynchus aurites Theo. [pl. 16, fig. 2]. This structure is very grotesque in Wyeomyia smithii Coq. Another striking modification is seen in our native Grabhamia jamaicensis Theo.

The harpes, lying just within the clasps and originating near their base, are normally next in size. They may easily be recognized in the Culicinae by the pronounced angle frequently present near the more or less perfect fusion of their two segments or pseudosegments. These organs are ventral, submedian, with bases approximate. They are, if we have correctly homologized the parts, highly specialized in the Anophelinae, in which group they are linear, approximate and usually bear several divergent, spiny apical processes. These organs are remarkably diverse in structure and in Culex, as now restricted, are divided. The terminal falcate blade so conspicuous in Culicada appears to arise from near the base of the setaceous proximal portion. This latter is smooth and usually with its apex crowned with a dense series of stout, chitinous spines, very characteristic of Culex, and presumably occurs in all species, though in certain forms, owing to the lack of material we have been unable to identify them with certainty. Their recognition in the less specialized Aedeomyinae is

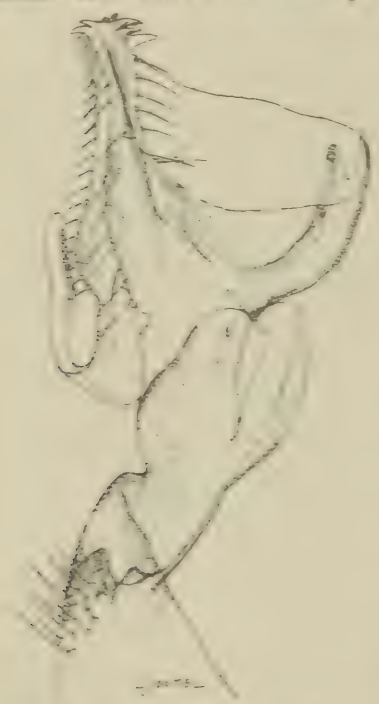

FIG. 6 Wyeomyia smithii, male genitalia showing the apex of the basal clasp segment bearing the extremely complex terminal clasp segment, much enlarged (Original)

very difficult and they appear to be wanting in many of the Corethrinae.

The harpagones are a pair of smaller clasping organs lying above the harpes and within the base of the clasps. They are usually strongly curved, terminated by a stout, somewhat recurved hook and are attached to the rudimentary eighth segment in some cases at least. These organs in the Anophelinae, if we have correctly homologized the parts, and in certain Culicinae, bear conspicuous

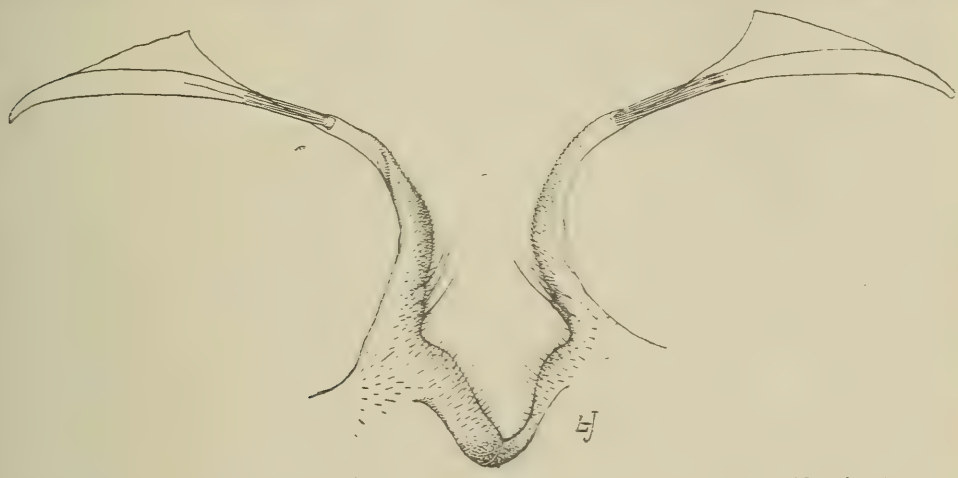

FIG. 7 Culicada subcantans, harpes, much enlarged (Original)

terminal chitinous spines. They are usually divided in Culex proper and in certain species there appear to be more than the normal number of organs on account of this peculiarity. This tendency is well illustrated in Culex annulioris Theo., C. concolor Rob. & Desv. and C. tigripes Grand. This process seems to have gone farther than in our native species, so that without the evidence afforded by these exotic forms it would be difficult to properly homologize the parts.

FIG. 8 Aedes fuscus, dissected eighth segment showing the attachment thereto of the setaceous lobes and the harpagones, much enlarged (Original)

The unci, as we have identified them, consist of a pair of processes on the ventral margin and present considerable variations in structure. These organs are readily seen in most of the Culicinae, while

in the Anophelinae they appear to be absent or else their function is usurped by the largely developed tergum which extends back and protects the smaller organs. These structures are weakly chitinized in some species and in others are much stouter and in certain forms are provided with peculiar series of chitinous teeth. This appears quite characteristic of the genus Taeniorhynchus, being particularly well developed in T. brevicellulus Theo. and T. aurites Theo.

The setaceous lobes are peculiar structures apparently belonging with the preceding organs of the ninth segment, but in reality a part of the rudimentary eighth segment. They are in most Culicinae simple, chitinous lobes bearing a series of stout, chitinous spines. In some instances these latter are very stout. A few Culicinae possess submedian groups of similar chitinous spines on the seventh abdominal segment, as in Culiseta absobrinus Felt. C. consobrinus Walk. and Taeniorhynchus perturbans Walk.

FIG. 9 Culicada abserratus, hermaphrodite antenna showing segmentation characteristic of the female, with the greatly elongated plumes of the male and illustrating a peculiar compound hair occurring on the third segment. Smaller ones are also found on more distal segments much enlarged (Original)

Hermaphrodites. These abnormal forms are rare in the insect world, and a study of the modifications presented is of considerable interest, particularly in groups presenting secondary sexual characters in various organs. Mosquitos are specially interesting in this respect because well defined sexual characteristics are found in the palpi, antennae, wings, claws and terminal abdominal appendages. Owing to the fact that most hermaphrodites in this group resemble either one sex or the other closely, they are rarely detected till after death, and, as a consequence, it is almost impossible to give attention to more than the external characteristics, since internal structures are badly distorted by drying before the unique character of the specimen is recognized. We are not aware of any hermaphrodite mosquitos being described before. A brief characterization of the two following forms will doubtless prove of interest, since they present some peculiar modifications.

Culicada abserratus Felt. The head of this specimen presents a well marked lateral division, the right side being male, the left female. The male antenna appears to be practically normal for that sex, while the other shows a marked male influence in the enormous prolongation of the basal whorls of each segment and particularly in the greatly extended 14th and 15th segments. The male or right palp appears to be normal for that sex, while the left or female palp shows a decided tendency toward the male form in that the terminal or fifth segment is as long as either the third or fourth, while in the normal female this segment is reduced to a mere rudiment. Unfortunately the wings from the two sides of this specimen were not carefully labeled when mounted. What is probably the wing from the right side, is a little narrower than the other. The submarginal cells have slightly longer petioles, the posterior cross vein is somewhat more remote from the mid cross vein and the scaling is also distinctly thinner, all characters indicating a male influence in the right wing, though this organ has the oblique fringe scales, so characteristic of the female, well developed along the posterior margin. The left wing presents practically every character of the normal female. This identification of the wings is borne out by an examination of the legs, the right fore leg presenting a distinctly male character in that the claws are decidedly unequal. The mid and posterior claws are equal and the same is true of all three of the legs from the left side.

FIG. 10 Culicada abserratus, hermaphrodite palpus showing the fifth segment nearly the same size as the third and fourth, a distinct tendency toward the condition found in the opposite sex, much enlarged (Original)

The most striking modification is seen in the abdominal appendages, the clasp, terminal clasp segment and harpes of the right side being well developed and distinctly male. The right harpago appears to be present, though it has become fused with another organ, possibly a rudimentary female lobe. The setaceous lobes, also characteristic of the male, are both well developed. Most of the organs on the left side are rudimentary and may be possibly regarded as very much reduced male appendages or probably distorted female lobes.

It will be seen by reference to the above that this specimen is largely male on its right half, with a sinister preponderance of female characters.

FIG. 11 Culicada abserratus, genitalia of an hermaphrodite.

Culicada pullatus Coq. The right antenna of this specimen is characteristically male, while the left is plainly female with male tendencies shown in the enormous prolongation of the basal whorls of each segment and the somewhat slightly produced 13th and 14th segments. Both palpi are plainly male. The right wing has the sparse scale clothing of the male, with the posterior cross vein remote from the mid cross vein, the absence of oblique fringe scales and a greatly produced anal angle; the left wing is narrower than the other, with an even greater distance between the posterior and mid cross veins and the submarginal cells, with possibly slightly longer petioles than in the other wing. The left wing presents a marked female characteristic in the presence of oblique fringe scales near the posterior margin, and it is possible that these structures were along the greater length of the wing and have been lost by abrasion. The fore and mid legs of the right side present a striking male modification in the very obvious inequality between the claws, a character present in almost equal degree in the fore leg of the left side and nearly absent in the claw of the right mid leg. The wings and legs of the two sides it will be seen, plainly indicate an intermingling of the characters of the two sexes. The posterior abdominal appendages are remarkable in that they are obviously female and apparently entirely normal for this species.

It will be seen by reference to the above that there is a partial lateral division and a plain anteroposterior sexual modification in that the head is largely male, while the posterior extremity is apparently entirely female.

ANOPHELINAE

A study of the genitalia of a number of species placed in this subfamily, shows it to be a natural group possessing marked structural characteristics as follows. The terminal clasp segment is extremely elongate, slender and arcuate. The harpes are remarkably modified in most of the species studied, being approximate, slender and tipped with several divergent, acute spines. This is true of all the species studied except the exceedingly peculiar Jamaican Cycloleppteron grabhamii Theo., which diverges remarkably from other members of the group in its extremely highly specialized ovate wing scales. The Anopheline harpagones are peculiar in being composed of a broad, usually subtriangular basal part bearing several stout spines in sharp contradistinction to the characters presented by these organs in the Culicinae. The Jamaican and South American Cellia albipes Theo., is another divergent form in that the third longitudinal vein terminates at the cross veins, whereas in other species studied by us it continues beyond. The larva of this form also presents some striking peculiarities, among which may be mentioned the absence of the slender apical setae on the antennae, though the two stout conic processes are present as in most Anopheline larvae. The larvae as a whole comprise specialized forms widely divergent from the ordinary culicid type. The young of this group are easily recognized by the extremely short air tube and the peculiar platelike comb with its posterior fringe of stout sometimes serrulate spines.

FIG. 12 Culicada pullatus, hermaphrodite antenna showing a distinct elongation in the four terminal segments and with the long plumes characteristic of the male, much enlarged (Original)

Anopheles punctipennis Say. *Genitalia, male.* Basal clasp segment stout, evenly rounded, apical segment long, slender, arcuate and bearing a small stout spur. Claspette a rather large basal lobe bearing two stout spines, the inner being larger. At the apical third there is another conspicuous stout spine. Harpes slender, fused and tipped with two clusters of about three uneven spines. Harpagones, basal portion subtriangular, apical portion tuberculate and bearing several stout, chitinous spines, the two outer being near together and larger than the more widely separated, smaller

inner ones. Tergum slender, greatly extended beyond the harpes and harpagones. Lobes of eighth segment stout, slightly tapering, obliquely pointed, naked processes.

Anopheles maculipennis Meig. *Genitalia, male.* Basal clasp segment stout, evenly rounded. Terminal clasp segment slender, arcuate, bearing a short, stout apical spine. Claspette a moderately developed basal lobe bearing two, long chitinous spines. There is also a large, chitinous spine at the inner apical third of the basal lobe. Harpes slender, fused, with two apical groups of three stout spines. Harpagones, basal portion irregularly triangular, apical portion consisting of an outer long, slender, fingerlike process and a pair of inner chitinous, acute spines, the inner one of the pair being longer than the other. Tergum slender, extending beyond the harpes and harpagones. Lobes of eighth segment slightly capitate with naked, acute tips.

Cellia albipes Theo. *Genitalia, male.* Basal clasp segment rather slender, apex broadly rounded. Terminal clasp segment long, slender, arcuate, slightly enlarged at both extremities, the apex bearing a rather stout spine. Claspette represented by a conspicuous basal lobe and a larger one near the middle, the former bearing one and the latter two large chitinous spines with acute, recurved tips. Harpes long, slender, fused, apex broadly rounded, expanded. Harpagones with base broadly expanded, somewhat triangular, the apical portion bearing a pair of stout, slightly curved, chitinous processes with acute tips. Tergum slender, greatly extended beyond the harpes. Lobes of eighth segment indeterminate. [Pl. 4, fig. 1]

Cycloleppteron grabhamii Theo. *Genitalia, male.* Basal clasp segment stout, with a rather broadly rounded apex. Terminal clasp segment long, slender, arcuate, base and apex slightly enlarged, the latter bearing a short, stout apical spur. Claspette a bilobed basal elevation on the first clasp segment, each lobe bearing a large, chitinous spine with an acute, recurved tip The basal clasp segment also bears a prominent chitinous spine at the internal third. Harpes very slender, approximate, each with a pair of acute, spinelike processes at its apex. Harpagones, basal portion broad, triangular, apical part a slender, acute, chitinous spine. At the extreme base there is a tubercular elevation bearing a conspicuous spine, possibly a lobe of the harpagones, though it may prove to be one of several minor basal spine-bearing elevations on the first clasp segment. Tergum large, fused and extending beyond the harpes and the harpagones. Lobes of eighth segment slender, smooth, fingerlike, with apex rounded. [Pl. 4, fig. 2]

Nyssorhynchus jamesii Theo. *Genitalia, male.* Basal clasp segment stout with a rather broadly rounded apex. Terminal clasp segment long, slender, arcuate, base and terminal portion slightly enlarged, the latter bearing a rather small, stout terminal spine. Claspette apparently represented by a single stout, curved ventral spine. Harpes very slender, approximate, each with about three divergent, acute processes. Basal portion of harpagones broadly rounded and bearing at the apex a stout, fingerlike, chit-

inous process with rounded extremity, evidently composed of several chitinous spines fused together. Internally there are several stout, chitinous spines. Unci long, very slender, fused and extending beyond the harpes and harpagones. Lobe of eighth segment broad, short, smooth, with apex obliquely rounded.

Pyretophorus costalis Loew. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a broadly rounded apex. Terminal clasp segment very long, slender, arcuate, basal portion enlarged and with a small, stout apical tooth. Claspette much reduced, apparently represented only by a rather irregular ventral group of large, chitinous spines. Harpes approximate, linear, each with three or four acute, serrate, triangular, divergent processes. Basal portion of harpagones subquadrangular, excavated internally, with a rather stout, recurved tooth. On the apical external margin there is a stout, slightly curved, chitinous process rounded apically evidently composed of several fused, chitinous spines. Close beside this there is a small, chitinous spine and a larger and a smaller one internally. Tergum large, membranous and extending beyond the harpes and harpagones. Lobes of eighth segment indeterminate. [Pl. 5, fig. 1]

CULICINAE

Psorophora ciliata Abr. *Genitalia, male.* Basal clasp segment stout, slightly rounded and tapered posteriorly. Terminal segment excurved, with subapical outer and terminal inner spine; inner convex margin armed with a series of stout, spine-tipped teeth. Claspette inconspicuous. Basal segment of harpes incurved, nearly acute at tip and bearing many terminal and subterminal, recurved hairs, and with a subapical, falcate appendage externally, the basal portion when in normal position, forming an almost complete circle. Harpes regularly curved and crowned exteriorly with a series of stout teeth. Unci nearly approximate, parallel, convolute, one corner being folded back and forming a broad, retrorse spine. Setaceous lobes of ninth segment rudimentary.

Janthinosoma musica Say. *Genitalia, male.* Basal clasp segment stout, tapering, with a well defined apical lobe; middle of teiminal segment enormously dilated, apex bearing a short, stout, sprne. Claspette represented by a rudimentary lobe. Harpes long, slender, slightly incurved and with a conspicuous internal brush of long hairs on the apical third, and at the extreme tip a pair of somewhat spatulate, sucker-disklike appendages, which appear to be composed in part of a delicate, convoluted, broad strip of chitin. Harpagones broad, with a stout, terminal, recurved spine and several smaller chitinous spurs. Unci approximate, tapering, with the acute tips appressed. Setaceous lobes of ninth segment rudimentary.

Janthinosoma lutzii Theo. *Genitalia, male.* Clasp and claspette very similar to those of the preceding species. The harpes differ mainly in the shorter, internal brush of long hairs and also by a more marked discrepancy in the pair of apical organs, each of which distinctly shows a loose spiral of tapering, chitinous tissue.

Harpagones very similar to those of the preceding species. Unci shorter and apparently fused and projecting from under the dorsal plate, which latter bears mesally a series of stout spines along its posterior margin. [Pl. 5, fig. 2]

Grabhamia Theo. This genus was erected by Theobald,[1] and in listing the species referred thereto he names first dorsalis Meig., and in his account of species gives first place to jamaicensis. Correspondence developed the fact that he considered this latter species the generic type and accordingly we adopted it.[2] Dr Dyar[3] took dorsalis Meig. as the type of Grabhamia and erected a new genus Feltidia with jamaicensis as its type. Under the conditions we prefer to accept Theobald's subsequent designation of the type as authoritative and consider Feltidia a synonym of Grabhamia, retaining Culicada Felt as a valid genus.

Grabhamia jamaicensis Theo. *Genitalia, male.* Basal clasp segment stout, tapering slightly and with a well defined apical lobe. Terminal segment enormously dilated in the middle and with a short, stout, apical spur. Claspette a rather prominent lobe bearing about six stout, broad, chitinous processes and located about the middle on the basal segment. Harpes apparently absent; harpagones[4] stout, curved, with a prominent retrorse spine and several stout apical teeth. Unci approximate, slightly convolute, with rounded apexes. Setaceous lobes slightly developed, each consisting of a long, dark, chitinous ridge each side of the median line, margined posteriorly with numerous very fine spines.

Grabhamia discolor Coq. *Genitalia, male.* Basal clasp segment short, stout, apex rounded and with a slight indication of an apical lobe. Terminal segment enormously dilated in the middle and with a short, stout, apical spur. Claspette a prominent lobe bearing several stout, chitinous processes located just before the middle of the basal clasp segment. Harpes apparently absent; harpagones curved, with a rather prominent, slightly recurved hook and several stout, apical spurs. Unci approximate, tapering to a rounded tip. Setaceous lobes of ninth segment similar in character, though less developed, than in G. jamaicensis. [Pl. 6, fig. 1]

Desvoidea panalectros Theo. *Genitalia, male.* Basal clasp segment stout, conic, tapering gradually to a rounded apex. Terminal clasp segment stout, arcuate and with a series of stout spines along the inner margin of the apical two thirds. Claspette represented by an inconspicuous basal fold bearing two stout chitinous spines. Harpes apparently represented by a pair of rather stout, broad, flattened processes, tapering gradually to a rounded apex. Harpagones short, stout, terminating in an acute, recurved, blunt spine. Unci closely appressed, somewhat curved with both ventral and dorsal margin and apex strongly serrate. Setaceous lobes indeterminate. [Pl. 6, fig. 2]

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[1] 1903 Theobald, F. V. Monograph of the Culicidae or Mosquitos, 3:243.
[2] 1904 Felt, E. P. N. Y. State Mus. Bul. 79, p. 391*b*.
[3] 1905 Dyar, H. G. Ent. Soc. Wash. Proc. 7:48
[4] Further study leads us to believe that the harpes, rather than the harpagones, are the missing organs. *See* N. Y. State Museum Bulletin 79, p. 391*b*.

Desvoidea obturans Walk. *Genitalia, male.* Basal clasp segment stout, conic, tapering gradually to a rounded apex. Terminal clasp segment rather stout, strongly curved and with a series of stout spines occurring along the inner margin of the apical half. Claspette an inconspicuous basal lobe bearing several stout spines. Harpes rather stout, tapering to a somewhat rounded apex. Harpagones short, stout, terminating in a stout, recurved spine. Unci approximate with dorsal, ventral and apical margins strongly serrate. Setaceous lobes indeterminate.

The genus Desvoidea presents some extraordinary characters in the genitalia. The terminal clasp segment is remarkable because of the series of stout, chitinous spines along a considerable proportion of its inner margin and the unci are unique in that they appear to be composed of a series of fused, stout, chitinous processes, giving the free margins a strongly serrate character.

Mucidus alternans Westw. *Genitalia, male.* Basal clasp segment stout, gently rounded exteriorly to a more or less rounded or oblique apex. Terminal clasp segment strongly curved, slender and bearing a stout, rather long apical spine. Claspette a rather conspicuous basal lobe bearing a number of coarse setae and one or more stout, chitinous spines. Harpes long, slender, basal portion short, apical part strongly curved, terminating in an acute point. Harpagones rather long, slender, terminating in a stout, recurved spine. Unci approximate, slender, with a broadly rounded apex. Setaceous lobes apparently rudimentary, though the stout setae normally occurring, are present. [Pl. 7 fig. 1]

Culicelsa taeniorhynchus Wied. *Genitalia, male.* Basal clasp segment stout, rather long, slightly tapering to a somewhat rounded apex. Terminal segment slightly swollen in the middle and with a long apical spur. Claspette a prominent internal lobe at the basal third, bearing numerous long setae. Harpes long, basal portion setaceous, incurved; apical naked and with a prominent retrorse, exterior spine. Harpagones regularly curved, ending in an acute, external spine. Unci broad, approximate, with rounded apex. Setaceous lobes of ninth segment slightly developed, each bearing a number of stout spines.

Culicelsa aurifer Coq. *Genitalia, male.* Basal clasp segment rather stout, with distinct apical lobe, and at its extremity a peculiar, thick tuft of long scales or hairs. Terminal segment slender, slightly swollen in the middle and with a long, stout apical spine. Claspette a prominent internal process near the middle, bearing a falcate, chitinous spine. Harpes long, slightly curved inwardly, basal portion setaceous, apical part terminating in a large bladelike structure with a short, external retrorse spine. Harpagones curved, with an external terminal spine and a number of peculiar, short, external setae about their middle. Unci long, slightly separated, the apex subacute. Setaceous lobes well developed, each crowned with about six long, stout spines.

Female. Lobes about four times as long as broad, tapering abruptly beyond the middle. Apex rounded, with a few somewhat stout hairs. Ventral plate about two thirds the width of a lobe, deeply emarginate apically.

Culicada canadensis Theo. *Genitalia, male.* Basal clasp segment stout, slightly tapering and rounded apically and with a small apical lobe. Terminal segment rather slender, curved, and with a slender, long, apical spine. Claspette a conspicuous, setaceous lobe at the basal third. Harpes with basal portion stout, slightly enlarged at distal third, where there are several stout, internal spines; apical portion slender, tapering gradually to a rounded point and strongly bent outwardly at the basal fourth. Harpagones stout, strongly curved and ending in a stout, recurved spine. Unci broad, approximate, rounded apically. Setaceous lobes approximate, moderate in size and bearing about eight stout, chitinous spines.

Female. Lobes rather stout, nearly five times as long as broad, gently rounded exteriorly to a somewhat acute point. Apex with a number of somewhat stout hairs. Ventral plate as wide as a lobe, extending to basal third and slightly emarginate apically.

Culicada subcantans n. sp. *Genitalia, male.* Basal clasp segment stout, sides nearly parallel, tapering somewhat distally and with a well developed distal lobe. Terminal segment slender, slightly swollen near the middle and with a long, slender, apical spine. Claspette a slight basal lobe bearing a very long curved, chitinous spine and a few large setae. Harpes with the proximal portion stout, and at the basal third several large, internal spines; distal portion a very long, slender, halbert-like blade, with a slightly recurved, acute tip. Harpagones evenly rounded, terminating in a stout, recurved tooth and with several smaller teeth. Unci approximate, rather broad, apex acute. Setaceous lobes well developed and bearing numerous large, chitinous spines. [Pl. 7, fig. 2]

Female. Lobes stout, about four times as long as broad, gently rounded exteriorly to a rather broadly rounded apex bearing a number of stout setae. Ventral plate as broad as a lobe, extending slightly beyond the basal third; apically, strongly emarginate and with a slightly sinuate lateral margin.

Culicada cantans Meig. *Genitalia, male.* Basal clasp segment rather stout, slightly broader apically and distinctly lobed. Basal portion with a conspicuous triangular internal lobe on the ventral margin. This is clothed with coarse setae and tipped with a brush of long hairs, those from the lobe of one side intermingling with those from the lobe on the other. A pair of very characteristic long setae arises from just before the apex of the basal segment. Terminal segment slender, slightly curved, swollen near the middle and bearing a long, slender, rather stout apical spine. Claspette represented by a dark, triangular elevation at the base of the triangular lobe described above. A stout, curved spine arises at its larger lateral end and many smaller fine setae spring from along

the entire length of its crest. Harpes, basal portion finely setose, extreme base broadly expanded; terminal portion smooth, falcate, irregularly curved. Harpagones stout, strongly curved, tapering in a large, recurved, chitinous tooth. Unci short, tapering rather quickly to nearly oblique points. Setaceous lobes well developed and bearing six or more stout setae. [Pl. 8, fig. 1]

Described from a specimen kindly contributed by Dr F. Meinert of Copenhagen, Denmark, who states that it was from Staeger's old collection.

A male of this species kindly sent us by Dr F. Meinert of Copenhagen, Denmark, shows that the above named American species noticed by Dr Smith and the writer, under the name of Culex cantans Meig., is a different species. There is considerable similarity between the genitalia of our American species and the European form, yet they are readily separated by the conspicuous linear, oblique, setaceous lobe at the base of the first clasp segment and in particular by the conspicuous prolongation of the inner ventral wall into a tapering process with rounded extremity, which nearly meets the one arising on the opposite segment. The narrow setaceous lobe previously mentioned has a peculiar curved spine at its lateral extremity, and its posterior margin is thickly clothed with stiff setae. The ventral surface of the conspicuous basal lobe is also thickly clothed with setae and its apex bears a thick brush which intermingles with that arising from the process on the opposite side.

Culicada fitchii Felt. *Genitalia, male.* Basal clasp segment stout, slightly prolonged, obliquely truncate apically. Terminal segment slender, slightly curved at the distal fourth and bearing a long apical spine. Claspette represented by a conspicuous conical basal lobe thickly clothed with rather coarse setae, there being no stout, chitinous spines. There is also a conspicuous rounded subapical lobe on the basal clasp segment. Harpes with the basal portion hairy, long, gently curved, the apical part smooth, bladelike, somewhat expanded near the middle and strongly curved. Harpagones stout, curved, ending in a stout, recurved, chitinous spine. Unci apparently fused, slender, rounded exteriorly and terminating in a pair of somewhat rounded, slightly separated points. Setaceous lobes moderately developed each bearing about five stout, chitinous spines. [Pl. 8, fig. 2]

Female. Lobes stout, about four times as long as broad, slightly swollen near the middle, curving gradually to a somewhat rounded apex bearing a few slightly stouter setae. Ventral plate about as wide as a lobe, extending beyond the basal third; apically, slightly emarginate; lateral margin somewhat oblique.

Culicada abfitchii Felt. *Genitalia, male.* Basal clasp segment moderately long, stout, apex narrowly rounded and bearing two very large, stout setae and numerous smaller ones. Terminal clasp

segment rather slender, strongly curved at the apical third and bearing a long, slightly curved apical spine. Claspette an inconspicuous tubercular setose basal enlargement with a stout, chitinous spine at its ventral margin. There is also a large, setaceous subapical lobe on the ventral segment. Harpes quite long, the setose basal portion extending to the middle of the basal clasp segment; apical portion smooth, bladelike and usually with a pronounced angle on its posterior edge. Harpagones stout, curved and terminating in a stout, recurved, chitinous spine. Unci fused, expanded anteriorly, gently tapering posteriorly to obliquely rounded dentate apexes separated by a broadly excavated space. Setaceous lobes well developed and bearing six or seven stout, chitinous spines.

The structure of these organs appears to be somewhat variable in this species, this being particularly true of the claspette, which appears to be rudimentary in some individuals and also of the terminal portion of the harpes, which is apparently quite variable in length. [Pl. 9, fig. 1]

Female. Lobes scarcely four times as long as broad, wider at the basal third and rounding gently therefrom to the somewhat acute apex bearing a few stout setae. Ventral plate as wide as a lobe, deeply emarginate apically and with a sinuate lateral margin.

Culicada annulifera Lud. *Genitalia, male.* Basal clasp segment moderately stout, gently curved with broadly rounded apex. Terminal clasp segment slender, gradually curving at the apical third to a long, rather stout terminal spine. Claspette a conspicuous tuberculate basal lobe bearing numerous stout setae. There are also two stout subapical setae internally. Harpes slender, basal portion setaceous, apical naked, slender and tapering to an extremely acute tip. Harpagones stout, slightly expanded at the apex and with an almost recurved, acute apical spine. Unci slender, approximate, tapering to an acute apex. Setaceous lobes well produced, with five or six stout apical spines.

Culicada confirmatus Theo. *Genitalia, male.* Basal clasp segment stout, long, with a broadly rounded apex. Terminal clasp segment rather stout, slightly swollen near the middle and with a long, stout terminal spine. Claspette an inconspicuous basal setaceous lobe bearing a very large, chitinous spine somewhat swollen near the base and tapering gradually to a very fine, recurved point. Harpes with basal portion setose, slender, apical part smooth, falcate and with a slight, recurved, blunt tip. Harpagones stout, curved and with a strongly recurved, acute tip. Setaceous lobes well developed, each with about eight stout, chitinous spines. Unci slender, approximate, rounding gradually to an acute apex. [Pl. 9, fig. 2]

Culicada cantator Coq. *Genitalia, male.* Basal clasp segment stout, rather long, with conspicuous apical lobe. Terminal segment slender, curved, and with a long, rather stout apical spine. Claspette a rather conspicuous, basal setaceous lobe bearing one very long, stout, recurved spine, a shorter and numerous smaller ones. Harpes with basal portion rather stout, setaceous, a few

larger internal setae at basal third; apical portion strongly curved, somewhat falcate, apex acute and slightly recurved. Harpagones curved, stout, with a recurved, acute tip. Unci rather broad, approximate at base, acute distally. Setaceous lobes well developed, moderately separated, each with numerous stout, chitinous spines.

Female. Lobes stout and over three times as long as broad, curving gently from the basal third to the somewhat acute, rounded apex bearing a few stout setae. Ventral plate extending to the middle of the lobes, slightly emarginate apically.

Culicada sollicitans Walk. *Genitalia, male.* Basal clasp segment stout, tapering slightly to a rounded apex. Terminal segment rather slender, slightly swollen near the middle and with a stout, rather long, apical spine. Claspette a setaceous basal prominence. Harpes with basal portion rather stout, setaceous, and with a conspicuous, subapical process and spine; distal portion smooth, falcate, with the rounded point recurved. Harpagones stout, curved, with an acute, recurved spine. Unci broad, slightly tapering posteriorly to a nearly obtuse apex. Setaceous lobes moderate, distinctly separated, each with several stout, chitinous spines.

Culicada currei Coq. *Genitalia, male.* Basal clasp segment stout, tapering slightly to a rounded apex. Terminal segment rather slender, slightly swollen near the middle and with a stout, rather long apical spine. Claspette a setaceous basal process. Harpes, basal portion rather stout, setaceous and with a small subapical setaceous process. Distal portion smooth, irregularly falcate, being decidedly broader near the middle of its length. Tip strongly recurved, nearly acute. Harpagones stout, curved, with an acute, recurved spine. Unci broad, rounding to a nearly obtuse apex. Setaceous lobes well developed and crowned with 4-6 stout, chitinous spines. [Pl. 10, fig. 1]

Culicada atropalpus Coq. *Genitalia, male.* Basal clasp segment stout, gently rounded to a rather narrow apex. Terminal clasp segment slender, arcuate, with a rather stout, long, apical spine. Claspette a rather small basal lobe bearing numerous stout setae. Harpes with basal portion setaceous, a stout seta near the distal fourth; apical portion gently curved, bladelike, with a slightly recurved, acute tip. Harpagones stout, curved, with a strong, recurved hook. Unci broad, approximate, distal portion rounded. Setaceous lobes apparently wanting.

Culicada triseriatus Say. *Genitalia, male.* Basal clasp segment stout, gently rounded to a slender apex. Terminal segment short, rather stout, slightly curved and with a long, rather stout, apical spine. Claspette apparently wanting. Harpes with basal portion setaceous, a rather prominent spine near distal fourth; apical portion bladelike, gently curved to an acute point. Harpagones strongly curved, with a stout, recurved terminal spine. Unci broad, fused, with rounded apex. Setaceous lobes small, with two or three stout, chitinous spines.

Culicada trichurus Dyar. *Genitalia, male.* Basal clasp segment stout, arcuate, with distinct terminal lobes. Distal segment rather slender, slightly swollen, at basal third, curved, and with a long, rather stout, terminal spine. Claspette a distinct, basal, triangular, setaceous lobe bearing several very long, stout spines. Harpes with basal portion strongly curved, thickly setaceous; apical part smooth, very irregular, apparently convoluted apically and terminated by a very long, slender spine. Harpagones stout, curved, with a strong, recurved spine. Unci slender, somewhat separated and tapering, with the apex oblique, serrate, and the acute tip with a prominent tooth. Setaceous lobes well developed, widely separated and bearing numerous stout, chitinous spines.

Female. Lobes a little over three times as long as broad, curving on both sides to the somewhat broadly rounded apex bearing a few stout setae. Ventral plate a little broader than a lobe, reaching about to the middle, very slightly emarginate apically. This organ has a somewhat characteristic series of transverse rows of moderately stout setae besides the larger apical and subapical ones observed in most species.

Culicada impiger Walk. *Genitalia, male.* Basal clasp segment stout, slightly curved, with a distinct apical lobe. Terminal segment rather stout, slightly swollen at basal third and with a long, rather stout apical spine. Claspette a basal, internal lobe bearing a pair of long, stout, curved spines. Harpes with basal portion stout, setose, with two large, internal spines and a larger, terminal one; terminal portion subapical, smooth, basal part simple, bearing a terminal, falcate structure with an acute, recurved tip. Harpagones stout, curved, with a strong, recurved hook, also conspicuous internal setae. Unci contiguous and broad at base, apical portion distant, obliquely rounded and terminated by an acute spine. Setaceous lobes medium, bearing numerous stout, acute spines.

Female. Lobes a little over three times as long as broad, tapering or curving gradually from near the base to the rather broadly rounded apex bearing a few stout setae. Ventral plate as wide as a lobe, extending to the basal third and deeply emarginate apically.

Culicada lazarensis Felt & Young. *Genitalia, male.* Basal clasp segment stout, slightly curved and with a distinct apical lobe. Terminal segment slender, curved, and with a stout, long apical spine. Claspette a conspicuous basal lobe bearing numerous small setae. Harpes, basal portion setaceous, with several stout, internal spines at basal third; apical part simple and bearing a rather broad, nearly straight, falcate blade with an external recurved hook. Harpagones stout, curved, and with a strong, recurved hook. Unci approximate, broad at base and tapering apically to widely separated, rounded tips. Setaceous lobes large, well separated and bearing numerous strong spines.

Culicada pullatus Coq. *Genitalia, male.* Basal clasp segment slightly curved, with strongly developed apical lobe. Terminal segment rather stout, slightly swollen at the basal third and with a

long, rather slender, apical spine. Claspette a conspicuous basal lobe bearing a very large, stout spine with a recurved tip. Harpes, basal portion setaceous, proximal strongly angulate; apical part smooth, simple, bearing a broad, bladelike structure with an acute, recurved tip. Harpagones stout, curved apically, and with a strong, recurved apical tooth and one or two smaller, subapical teeth. Unci broad at base, contiguous; apical margin oblique, terminating in an acute tooth. Setaceous lobes distant, bearing about five or six stout, chitinous spines. [Pl. 10, fig. 2]

Culicada abserratus Felt & Young. *Genitalia, male.* Basal clasp segment stout, rather long, slightly expanded apically and with four or five very long, stout, subapical setae and numerous smaller ones. Terminal clasp segment rather long, strongly curved at apical third and bearing a long, slender, apical spine. Claspette represented by a conspicuous subquadrangular basal lobe tipped with numerous long setae and a conspicuous subapical lobe, the latter clothed with short setae. Harpes with a long, slender, simple, hairy basal segment, the apical portion smooth, bladelike, considerably expanded near its base and tapering to a rounded point. Harpagones short, strongly curved, ending in an acute, nearly recurved, chitinous spine. Unci slender, approximate, rounding posteriorly to acute, somewhat distant tips. Setaceous lobes very long, bearing four or five stout, acute, chitinous spines, one or two markedly stouter than their fellows. [Pl. 11, fig. 1]

Female. Lobes nearly five times as long as broad, tapering or curving gradually from near the base to the somewhat acute apex bearing a number of stout setae. Ventral plate nearly as wide as a lobe, extending to the basal third and slightly emarginate apically.

Culicada dupreei Coq. *Genitalia, male.* Basal clasp segment rather stout, tapering slightly to a rounded apex. Terminal segment rather stout, slightly swollen at basal third and with a long, slender, apical spine. Claspette represented by a basal, setaceous elevation bearing several very long spines. Harpes with basal portion strongly curved and coarsely setose, specially apically; terminal portion subapical, simple and bearing a slightly curved, falcate structure. Harpagones stout, curved, with a strong, recurved apical tooth. Unci rather broad, approximate, with rounded distal margin. Setaceous lobes well separated, moderate in size and with two or three conspicuous spines. [Pl. 11, fig. 2]

Ecculex sylvestris Theo. *Genitalia, male.* Basal clasp segment broad, proximal slender, slightly rounded distally. Terminal segment rather stout, slightly expanded, and on account of the rather stout, subapical spine, furcate distally. Claspette apparently unrepresented. Harpe a strap-shaped, setaceous process with numerous long, apical setae. Harpagones flattened, curved, with a slightly recurved, stout, apical spine. Unci approximate, slender, strongly curved, divided apically and ending in three or four stout, recurved spines. Setaceous lobes rudimentary, bearing a few medium setae.

Culicella dyari Coq. *Genitalia, male.* Basal clasp segment stout, tapering to a rather narrow, rounded apex. Terminal segment stout,

tapering gradually and with a short, stout, apical spine. Claspette a prominent basal lobe bearing a conspicuous, stout, apical spine. Harpes apparently absent; harpagones strongly recurved, each with a large and a small tooth. Unci prominent, broad, fused, terminating posteriorly in a rounded, perforated process. Setaceous lobes not produced, bearing about seven stout setae.

Culicella melanurus Coq. *Genitalia, male.* Basal clasp segment stout, tapering to a rounded apex. Terminal segment slender, tapering slightly and with a rather short, stout, apical spur. Claspette a rather conspicuous basal lobe bearing a number of stout setae. Harpes apparently absent; harpagones curved, strongly recurved, each with a larger and two smaller, recurved teeth. Unci broad, separated anteriorly, posteriorly rounded, inner edges appressed though not fused. Setaceous lobes not produced, each bearing a number of stout spines.

Female. Lobes broadly rounded, apparently attached dorsally, with the nearly circular margin of the free end ventral. Tergum produced beyond the lobes, broadly rounded. Posterior margin of the seventh abdominal segment fringed with a series of very stout, long spines.

Theobaldia annulata Meig. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a rather broadly rounded apex. Terminal clasp segment slightly enlarged at the base, rather strongly curved and with a short, stout apical spine. Claspette a rather conspicuous basal lobe bearing a number of stout setae and several strong apical spines. Harpes stout with broadly expanded base, the apical portion dilated, strongly spined and ending in one or two stout, chitinous spurs. There is a peculiar sensory organ on the neck of the harpes or just before its distal expansion. It is an oval, elevated area with a number of clear spots, from each of which arises a stout seta. Harpagones wanting. Unci stout, rather slender, somewhat acute apically. Setaceous lobes slightly developed and bearing numerous long, rather slender setae. [Pl. 12, fig. 2]

Theobaldia incidens Thom. *Genitalia, male.* Basal clasp segment stout, somewhat elongate, obliquely truncate to a rather acute apex. Terminal clasp segment rather slender, tapering gradually from the slightly expanded base and bearing a rather long, slender apical spine. Claspette with a rather conspicuous basal lobe bearing two stout apical setae. There is, in addition, a somewhat prominent subapical setaceous process armed with several stout setae, suggesting the very characteristic group of apppendages in Culex proper. Harpe elongate, slender, with apex slightly expanded and divided into two major apical teeth and one or two smaller subapical ones. The peculiar sensory organ observed in T. annulata Meig. is more strongly developed in this species, being a conspicuous oval or subglobular elevation crowned with numerous stout setae. Harpagones wanting. Unci approximate, convolute, ventral margin broadly rounded and tapering to a truncate posterior edge with a conspicuous spine laterally. Setaceous lobes weakly developed, each with about seven rather slender, weak spines. [Pl. 12, fig. 1]

Theobaldia spathipalpis Rond. *Genitalia, male.* Basal clasp segment stout, tapering rapidly to a rather broadly rounded apex. Terminal clasp segment rather slender, slightly expanded at the apex and bearing two short, stout, chitinous spines. Claspette represented by a somewhat conspicuous basal lobe bearing a number of stout, apical setae. Harpe an irregular, angular organ with a somewhat enlarged, spined base and a spatulate, smooth apex. Harpagones very stout with the apex expanded, subtriangular, the base of the apical enlargement coarsely granulate, the apex a smooth acute spine. Unci probably nearly approximate, the apex somewhat enlarged and rather coarsely setose. Setaceous lobes indeterminate in the preparation. [Pl. 13, fig. 1]

Culiseta absobrinus Felt. *Genitalia, male.* Basal clasp segment very stout, broad, tapering rapidly to a rounded apex, and with an inner, subapical, tubercular, setaceous patch. Terminal segment enlarged at base, tapering gradually to apex, which bears a stout, short, apical spine. Claspette a conspicuous, sub-basal lobe bearing several large and numerous smaller setae. Harpes, though apparently absent, are represented by a very inconspicuous, thin structure closely appressed to the inner face of the basal clasp segment. It is setose like the clasp segment and bears at its apex several prominent setae. Harpagones stout, recurved, with several conspicuous, subapical and two or three apical teeth. Unci broad at base, narrowing posteriorly to oblique, rounded extremities. Setaceous lobes slightly produced, separate, each bearing 6 to 10 stout setae. Posterior margin of preceding segment heavily chitinized and with two submedian rows of short, stout, evenspines.

Culiseta consobrinus Walk. *Genitalia, male.* Basal clasp segment broad at base tapering rapidly to a rounded apex, and bears subapically a small, tubercular, setose elevation on its inner face. Terminal segment slightly enlarged at its base, where there appears to be a sensory organ rather stout, tapering gradually to a nearly acute point, which appears to be destitute of an apical spine. Claspette a conspicuous, setose, basal lobe bearing at its apex two very stout spines. Harpes probably much as in C. absobrinus; harpagones strongly curved and with a subapical and stout, recurved apical tooth. Inner face with a number of conspicuous, apparently sensory hairs. Unci slender, separate, with one large tooth near the middle, tapering gradually to a prominent subapical spine and ending in a recurved spur. On either side of the unci and just anterior to the setaceous lobes of the eighth segment there are a pair of peculiar organs, which appear like anastamosing bands of chitin. Setaceous lobes separated, moderately developed and thickly crowned with numerous irregular spines. There is no indication of a row of stout spines along the posterior border of the preceding segment, as in C. absobrinus Felt.

Culex diversus Theo. *Genitalia, male.* Basal clasp segment stout, broadly rounded and ending in a subconical internal lobe. Terminal clasp segment subapical, swollen near the base and along the middle, strongly curved and slender along the apical fourth and

with a long, stout, crooked terminal spine. Claspette possibly represented by a patch of long, thick setae near the middle of the basal segment. Harpes stout, short, the broadly rounded apex crowned with a number of stout, curved, chitinous spines. Harpagones rather slender, slightly curved and with a stout, acute, recurved apical spine. Unci approximate, slender, tapering slightly to the nearly truncate, serrate posterior edge. Both the harpes and harpagones are unusually small compared with the clasp segments. Setaceous lobes indeterminate.

This species, judging from the general characters presented by the wing, should be closely allied to Theobaldia or Culiseta.

CULEX

This genus as now restricted to the Pipiens group, is fairly homogeneous, the various members showing marked similarities in both adult and larval characteristics. Some of the species approach each other so closely as to make it exceedingly difficult to separate them satisfactorily in both adult and larval forms, though differences in one stage or the other or considerable divergence in habits is ample evidence of the validity of the various species. The male Culex is characterized by the rather slender, sparsely plumed palpi usually with the terminal and a portion of the fourth segment extending beyond the tip of the proboscis. The wings exhibit a rather generalized type in the very long fork cells and relatively short petioles thereof. The male genitalia are rather complex in type, rendering it very difficult to satisfactorily homologize the various parts. The claspette is very characteristic in most forms, having a well marked spatulate organ in association with a subapical group of more or less varied, slender, chitinous spines. It may eventually prove best to limit the genus strictly to those forms having a well developed spatulate organ, but in the absence of more striking differences, it seems advisable for the present to include in this group all forms having the characteristic subapical group of spines so well developed in Pipiens. The harpes diverge widely from those of other Culicinae, in that the chitinous, falcate blade is basal or nearly so, whereas in most of the other forms it is apical. The harpagones show a marked tendency to division, giving the appearance of additional organs. The female genitalia usually consist of a simple pair of more or less orbicular lobes.

The larvae are all long tubed forms and resemble each other very closely, though in most species excellent characters for their separation may be found in the varying proportions of the air tube. The pecten at its base is valuable in recognizing species. There are also useful variations in the antennae, particularly in the position

of the tuft. The comb is very similar in the different species and is of comparatively little service in separating the larvae.

Culex pipiens Linn. *Genitalia, male.* Basal clasp segment stout broadly rounded to an oblique apex. Terminal clasp segment large at its base, strongly curved and tapering to a blunt point bearing a stout apical spine. Claspette a subapical group of three stout spines, a smaller group of several stout spines and a well developed spatulate organ. Harpes divided, the major limb stout with a large apical group of stout, strong spines, the minor limb weak, about one fourth the length of the major, falcate with a blunt apex. Harpagones long, slender, strongly curved near the apical third. Unci approximate, slender with posterior extremity broadly excavated, one lobe broadly rounded, the other acute. Setaceous lobes moderately well developed, each with about 16 long, moderately stout setae.

Culex fatigans Wied. *Genitalia, male.* Basal clasp segment stout, broadly rounded to an obliquely truncate apex. Terminal clasp segment stout, strongly curved and tapering to a rather blunt apex bearing a rather stout apical spine. Claspette a subapical group composed of two large and a smaller spine and another group with one large and two smaller spines arising at the base of the spatulate organ. Harpes short, stout, crowned with a thick group of stout, chitinous spines. Harpagones stout, strongly curved near the apical third and with an acute tip. Unci slender, approximate, with a rounded apex. Setaceous lobes poorly developed, each with about six slender, long setae.

The harpes and harpagones are both probably divided as in other closely related forms, but the preparation from which the description was drawn is such that these points can not be demonstrated.

Culex restuans Theo. *Genitalia, male.* Basal clasp segment stout, slightly curved, apex rounded. Terminal clasp segment rather slender, strongly curved, with a fine obtuse point bearing a small apical spine. Claspette subapical, consisting of three stout, closely set, chitinous processes slightly curved apically, a fourth one with a slender recurved point and a characteristic spatulate organ at the base of which are several stout setae. Harpes rather stout, and crowned apically with a series of thickly set, dark brown, stout, chitinous spines and at its base there is a rather conspicuous curved, chitinous process about one half its length. Harpagones bifurcate, the dorsal limb curving mesally to a blunt point. The ventral limb stout, curving dorsally to an acute tip. Unci broad, convolute, tapering posteriorly to an oblique point. Setaceous lobes median, nearly approximate, broadly rounded, bearing a few rather slender setae.

Culex territans Walk. *Genitalia, male.* Basal clasp segment stout, curved, obliquely truncate. Terminal clasp segment rather slender, tapering, with a rather long, slender, articulate terminal spine. Claspette subapical, consisting of a pair of stout, slightly curved, chitinous processes, each with an apical filament and a

closely set distal group of about three shorter, stout setae. Harpes long, rather slender, curved apically and adorned with a series of long, fingerlike teeth. Harpagones fused to form a somewhat keel-like organ with the lateral portion prolonged distally, broadly rounded and tipped with a series of short, stout spines. Unci approximate, slender, excavated posteriorly, with acute dorsal and ventral prolongations. Setaceous lobes small, abruptly rounded, bearing a number of rather fine setae.

Culex tarsalis Coq. *Genitalia, male.* Basal segment of clasp stout, curved, nearly obliquely truncate at apex. Claspette subapical, composed of three stout, closely set, tapering spines with recurved tips and a well defined, spatulate organ, the latter with two curved bristles arising from near its base. Apical segment rather stout, curved, tapering, with a small terminal articulate spine. A rather inconspicuous lobed process bearing short, stout, chitinous teeth, appears to be the basal portion of this organ. Harpes stout, broad, bearing apically a thick mass of stout, nearly black, chitinous spines. Basal portion with a strongly curved, tapering process. Harpagones short, stout, with a prominent ventral, somewhat folded lobe, its apex rounding to a somewhat acute tip, the main portion bearing at its apex two long, stout, dark brown, chitinous teeth and a shorter, intermediate spur. Unci approximate, slender, tapering to acute points. Setaceous lobes slightly developed, rounded, bearing a series of rather long, curved setae.

Culex cylindricus Theo. *Genitalia male.* Basal clasp segment rather stout, rounding gradually to a rather acute apex. Terminal clasp segment stout, tapering gradually to a blunt point bearing a pair of rather stout apical spines. Claspette represented by a subapical group composed of two stout spines with recurved points, a slightly longer, more slender one with a smaller group of three smaller, slender spines with recurved points and a well developed spatulate organ. Harpes stout with a thick, tranverse apical group of stout, chitinous spines, the inner blunt, the outer acute. Harpagones stout, recurved, acute. Unci and setaceous lobes indeterminate in the preparation.

Culex annulirostris Skuse. *Genitalia, male.* Basal clasp segment stout, gently rounded to a rather acute apex. Terminal clasp segment much enlarged at base, tapering rapidly near the middle to a rather acute tip bearing a pair of stout apical spines. Claspette a subapical group composed of three large and three smaller spines and an acute tipped spatulate organ. Harpes divided, the main limb stout with its apex crowned with a thick group of stout spines. Minor limb smaller, strongly curved, falcate with an acute apex. Harpagones slender, divided into a series of about four more or less curved, acute, stout, chitinous processes. Unci slender, approximate, prolonged in a bifurcate Y-shaped apex, the outer limb stout, acute, the inner linear. Unci indeterminate in the preparation.

Culex annulioris Theo. *Genitalia, male.* Basal clasp segment moderately stout, rounding gradually to a somewhat acute apex. Terminal clasp segment enlarged at base, strongly curved at apical third and bearing a short, stout terminal spine. Claspette a subapical group consisting of two very stout, chitinous spines with strongly curved acute tips, a more slender one close beside them, and slightly removed another small group of about six spines and a spatulate organ, the tip of the latter appearing unusually acute. Harpes nearly divided, the main branch stout, strongly curved and with a thick apical tuft of stout, chitinous spines. Minor limb strongly curved, sickle-shaped and with an acute apex. Harpagones short, stout, terminating in a series of strongly curved, stout, chitinous spines. Unci slender, probably approximate, gradually rounding to an acute apex. Setaceous lobes weakly developed, each with about six slender, curved setae.

FIG. 13 Culex annulioris, harpe, much enlarged, showing the smooth, basal, arcuate, chitinous process (Original)

Culex tigripes Grand. *Genitalia, male.* Basal clasp segment rather expanded at the extreme base, moderate, tapering gradually to a narrowly rounded apex. Terminal clasp segment stout, tapering and curving strongly to a slender apex bearing a short, stout apical spine. Claspette a conspicuous subapical process bearing three stout, chitinous processes and three smaller ones but with no trace of a spatulate organ. Harpes divided, the major limb rather stout with a broadly expanded apex crowned with a thick group of stout, chitinous spines. Minor limb about one fourth the length of the major, strongly curved and with a blunt apex. Harpagones broadly expanded at the base, terminating in a long, slender, blunt, chitinous spine and with a group of short, stout, chitinous spines near the base of the long one. Unci slender, probably approximate, tapering gradually to a broadly rounded apex. Setaceous lobes weakly developed and with about eight long, slender setae.

FIG. 14 Culex tigripes, harpago, illustrating the peculiar basal, chitinous processes, much enlarged (Original)

Culex concolor Rob.-Desv. *Genitalia, male.* Basal clasp segment stout, subconical with a broadly rounded apex. Terminal clasp segment rather stout, somewhat enlarged basally and with a rather long, stout apical spine. Claspette a subapical conical internal process bearing four simple, stout, chitinous spines and so far as can be determined with no trace of a spatulate organ. Harpes divided, the main limb long, slender, crowned with a thick group of stout, chitinous spines. Minor limb rather short, stout and at

nearly right angles. Harpagones enlarged at base, strongly angulate near the middle and with one very large, stout, chitinous spine and numerous minor ones. These latter appear much like long, fused, chitinous processes. Unci slender, tapering to a broadly rounded apex. Setaceous lobes indeterminate in the preparation.

FIG. 15 Culex concolor, a portion of the harpes and harpago with the peculiar basal, chitinous processes, much enlarged (Original)

This species is closely allied to C. tigripes Grand., both presenting a most interesting stage, showing the partial division of the harpagones. In these two species the main chitinous spur is well marked and the numerous smaller ones at its base are so well divided that it is easy to see the connection between these and the same spurs more strongly developed in such species as C. annulirostris Skuse.

Culex viridiventer Giles. *Genitalia, male.* Basal clasp segment very stout, broad, with a broadly rounded apex. Terminal clasp segment rather long, tapering gradually in a double S-shaped curve to an acute apex. This segment is remarkable because of the series of irregular, coarse setae along the middle of the ventral margin. Harpes stout, terminated by a dense series of coarse, chitinous spines, the outer ones blunt, the inner acute. Harpagones rather slender, tapering to an acute tip. Unci approximate, tapering rapidly to an acute tip and remarkable because of the series of stout, chitinous teeth along the middle of the ventral margin and the pair of stout teeth side by side near the base. Setaceous lobes weakly developed and bearing a series of fine, long, curved setae. [Pl. 14, fig. 1]

FIG. 16 Culex viridiventer, terminal clasp segment, much enlarged (Original)

This species presents remarkable features in the serrations of the terminal clasp segment and the very pronounced ones on the unci, reminding one somewhat of similar structures occurring in Megarhinus. It might well be referred to a new genus and we refrain from erecting one because of our unfamiliarity with the Indian fauna.

Culex pulcriventer Giles. *Genitalia, male.* Basal clasp segment enormously dilated, oval and with a peculiar internal patch of long, halbertlike scales. Terminal clasp segment with the basal portion somewhat enlarged, slender and with a stout, curved apical spine. Harpes very broadly dilated, excavated and somewhat spoon-shaped. Harpagones stout, curved, with an acute, recurved apex. Unci slender, rounding gradually to a rather acute apex. The setaceous lobes appear to be represented by a pair of large, inflated organs densely clothed exteriorly with numerous long, fine setae. [Pl. 14, fig. 2]

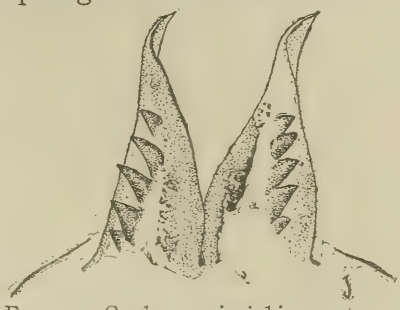


FIG. 17 Culex viridiventer, unci, showing the unique series of teeth, much enlarged (Original)

This species diverges widely from the normal type of Culex or other allied American genera and it might well be referred to a new genus. We refrain from erecting one because of our unfamiliarity with the Indian fauna.

Melaniconion atrata Theo. *Genitalia, male.* Basal clasp segment stout, tapering rapidly to a rather broad apex. Terminal clasp segment rather stout, basal portion greatly enlarged, apical portion slender and bearing a stout, subapical spine. Claspette represented by a conspicuous subtriangular apical lobe and an inner prominence bearing two stout, chitinous spines, the larger on a well defined stalk. Harpes rather distant, stout, terminating in a series of six or seven stout, chitinous spines. Harpagones rather stout, ending in an acute point. Unci slender, approximate with a broadly rounded apex. Setaceous lobes indeterminate. [Pl. 15, fig. 1]

TAENIORHYNCHUS

The study of male genitalia of the species at hand is not without interest, particularly as the forms we have been able to secure, appear to have considerable in common. One of the most striking generic characteristics of this group, is the enormous straight, thickened, chitinous process terminating the claspette. Harpes apparently absent. Harpagones with prominent apical teeth varying in number from three to about five. The numerous fine teeth along some portions of the margin of the unci, are another feature apparently peculiar to this remarkable group of insects. The setaceous lobes are fairly well developed and the seventh segment bears submedian groups of stout chitinous spines.

This genus presents some interesting diversities in the structure of the male genitalia. The terminal clasp segments are normally stout, curved, simple, but in the African species, Taeniorhynchus aurites Theo., these organs are remarkable because of the enormous, rounded, bladelike posterior lobe and the unique compound hairs on its posterior border [pl. 16, fig. 2.] The

Asian Taeniorhynchus brevicellulus Theo. [pl. 16, fig. 1] is a remarkable specialized member of this genus judging from the exceedingly grotesque harpagones, still its other features agree in the main with those stated above, and we see no reason why it should be given a different position than that assigned by its describer.

The genus Taeniorhynchus is evidently closely related to Theobaldia and Culiseta, and it may be regarded as a more specialized form of this group. The slender spines of the claspette in Theobaldia, have become thickened and fused in Taeniorhynchus, and the denticulations of the harpes in the first named genus are much more pronounced and segregated in this. The presence of submedian groups of stout, chitinous spines on the eighth segment, also indicates a close affinity with the above named genus. This is borne out by an examination of wing characters. The large, somewhat broad scales of Theobaldia and Culiseta are represented in Taeniorhynchus by much dilated ones and there is also a marked similarity in venation.

Taeniorhynchus perturbans Walk. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a broadly rounded apex. Terminal segment greatly swollen at the middle and also at the apical third, at which latter it tapers gradually to a small, stout, terminal spine. Claspette a conspicuous lobe bearing a very thick, straight spine and another smaller, tapering one. Harpagones stout, slightly excurved and strongly recurved, ventral margin fringed with a series of thin teeth, which are most highly developed at the distal extremity. Unci curved, nearly approximate, tapering gradually to a rather obtuse, serrate extremity. Dorsal margin remarkable because of the series of fine teeth along the anterior two thirds. Setaceous lobes moderate, bearing three to five stout spines. Seventh segment with a pair of submedian groups of three to six stout spines. [Pl. 15, fig. 2]

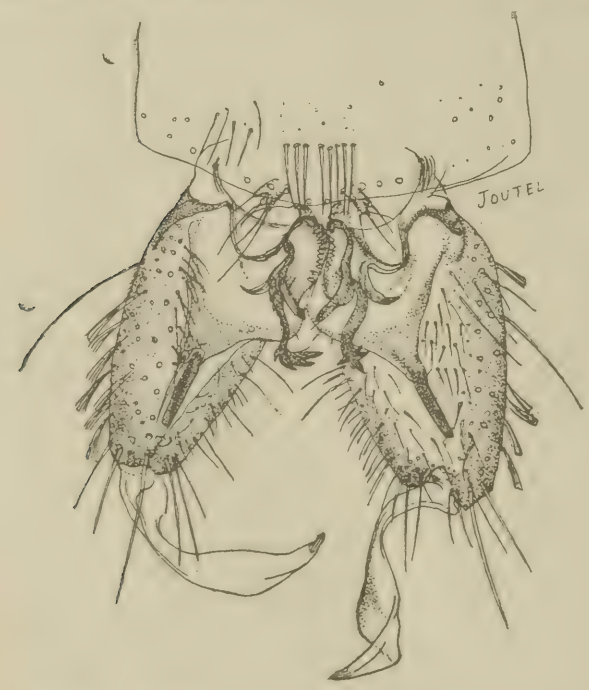


FIG. 18 Taeniorhynchus perturbans, ventral aspect of male genitalia, greatly enlarged (Original)

Female. Lobes composed of two segments, basal minute, terminal broadly dilated, obliquely truncate. Tergum broadly rounded, ventral plate rounding posteriorly to a median incision.

Taeniorhynchus brevicellulus Theo. *Genitalia, male.* Basal clasp segment very stout, broadly rounded to a blunt apex. Terminal clasp segment enlarged at the base and extremity, strongly curved and bearing a short, stout apical spine. Claspette a conspicuous basal lobe bearing a stout, chitinous spine. Harpagones very stout, enlarged posteriorly and unique because of the two or three stout, recurved, chitinous processes, giving the organ an appearance not unlike that of a bird's beak. Unci approximate, broadly rounded exteriorly, tapering gradually to blunt, approximate apexes, each crowned ventrally with a series of fine, stout, chitinous teeth. Setaceous lobes approximate, well developed, each with four or five stout apical spines. [Pl. 16, fig. 1]

Taeniorhynchus aurites Theo. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a broadly rounded apex. Terminal clasp segment stout, strongly bent at the basal third, also at the apical fourth and with a stout, short, terminal spine. This segment is remarkable because of the very large spatulate appendage near its middle with a conspicuous group of compound branching hairs arising from near its base. The spatulate appendage and the extremity of the segments is also rather thickly clothed with stout, somewhat curved hairs. Claspette a conspicuous basal lobe bearing a very thick, stout, terminal spine with a much smaller one beside it. Harpagones stout, strongly curved at the apical fourth and bearing several large teeth along its rounded extremity and terminated by a pair of very stout, chitinous, recurved teeth. Unci somewhat curved, nearly approximate, expanded at the apical fourth and thence gently rounded to acute, recurved, approximate points. Ventral surface with the apical portion armed with a series of irregular, stout teeth. Setaceous lobes with the eighth segment produced and marked only by a series of stout, transverse spines along the posterior margin of the segment. [Pl. 16, fig. 2]

Stegomyia fasciata Fabr. *Genitalia, male.* Basal clasp segment very broad, subtriangular, broadly rounded internally, gently so externally. Terminal clasp segment rather stout, slightly swollen at distal third, tip abruptly narrowed and bearing a rather stout terminal spine. Claspette a conspicuous internal subapical setaceous lobe bearing several stout angulate chitinous spines and a great many stout setae. Harpes apparently wanting. Basal lobe of harpagones stout, apical portion subtriangular, the latter irregular, consisting of a long, slightly recurved main limb and a smaller, thick inner one. Unci slightly convolute, terminating in a rounded dentate apex. [Pl. 17, fig. 1]

Stegomyia scutellaris Walk. *Genitalia, male.* Basal clasp segment stout, gradually tapering to a broadly rounded apex. Terminal segment rather long, slender, slightly expanded at the base, more so at the tip and with a very short, stout subapical spine. Claspette apparently represented by a thin basal lobe densely

setose along its margin. Harpes divided, the main limb stout, crowned apically with a dense group of very stout, chitinous spines. The minor limb nearly as long, slender, somewhat falcate, apex acute. Harpagones stout, longer than harpes, terminating in a rather blunt, chitinous spur. Unci indeterminate.

Stegomyia notoscripta Skuse. *Genitalia, male.* Basal clasp segment stout, conical, tapering gradually to a rounded apex. Apical segment rather stout, very short and bearing a long, slender terminal spine. Claspette apparently wanting. Harpes, basal portion naked except at the extreme base; apical part curved, falcate, tapering to an acute point. Harpagones stout, terminating in a stout, recurved spine. Unci slender, approximate, with a broadly rounded apex. Setaceous lobes moderate, each with three or four stout, chitinous spines.

The genitalia in this species are peculiar in that the basal clasp segments are thickly clothed with stout, broad scales. Stegomyia fasciata is evidently the type of this genus, and as its genitalia diverge remarkably from the above described form, the latter should be referred to a new genus. It is much closer related to Culicada than to Stegomyia and might well be referred to that genus.

Pneumaculex signifer Coq. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a narrowly rounded apex. Terminal segment rather stout, slightly curved, somewhat expanded at the base and with a long, rather stout apical spine, the latter with a stout apical tooth and four or five more slender, ventral teeth. Claspette a rather conspicuous basal lobe bearing several stout, chitinous spines. There are also two stout, chitinous spines arising direct from the venter of the basal clasp segment near the apex of the claspette. Harpes moderate, somewhat inflated near the middle and tapering to three stout, chitinous spines. Harpagones divided, composed of two stout, recurved, chitinous processes, the posterior limb larger than the anterior. Unci approximate, fused, swollen at the base, slightly contracted posteriorly and with three rather small subapical chitinous spines, posterior margin broadly rounded. Setaceous lobes apparently absent. [Pl. 17, fig. 2]

Protoculex serratus Theo. *Genitalia, male.* Basal clasp segment rather stout, slightly curved, narrowly truncate apically. Terminal clasp segment rather slender, slightly swollen near the middle and abruptly curved near the tip and with a long, slender apical spine. Claspette a distinct, nearly free basal bladelike process bearing on its outer edge near the middle a stout, irregularly curved, acute chitinous spine. At the apex of the basal clasp segment there is a long, subacute, bladelike process. Basal portion of harpes enlarged, somewhat triangular, apical portion smooth, irregularly curved, with a rounded apex. Harpagones stout, strongly curved, with an acute, recurved apical spine. Unci approximate, outer margin curved, tapering to an acute point. Setaceous lobes moderate, each slightly divided and bearing about four long, stout, chitinous spines. [Fig. 4 and pl. 18, fig. 1]

AEDEOMYINAE

We have allowed several very divergent forms to remain under this subfamily head for the time being, largely because of insufficient material in this exceedingly interesting group. Deinocerites cancer Theo. possesses many features in common with Culex proper, and diverges widely from the abnormal Aedes fuscus O. S. associated therewith. There is little in common between the latter and Uranotaenia. The unique Wyeomyia smithii Coq. is an even more divergent type presenting more generalized features.

DEINOCERITES

This genus is an abberrant, synthetic Culicid, unique not only on account of antennal characters but also in the genitalic structures of both male and female. The antennae of the female are remarkable in having the second segment greatly prolonged, equal in length to the three following and clothed with scales. The male antennae are greatly produced, the second to the seventh segment being prolonged, the second about the length of the two following and the others gradually decreasing in length to the eighth. The second, third and the basal portion of the fourth segment are sparsely clothed with scales. This entire organ in the male is longer than the body. It is not plumose as in most Culicids, though the hairs covering segments 2 to 7, like those on segment 2 of the female, are a little longer and there is little evidence of the sparse basal whorl of longer setae so characteristic of most Culicids and evident in this species on the other antennal segments [Fig. 1]. The palpi are composed of four segments in each sex, with the fifth probably represented by a minute apical prolongation. The fourth segment in the male is about one half longer than the third and somewhat larger in the female. These two segments are nearly equal in length though the fourth is somewhat more dilated.

Deinocerites cancer Theo. *Genitalia, male.* Basal clasp segment stout, broadly rounded apically. Terminal clasp segment stout, slightly curved, excavated internally, somewhat enlarged apically, externally clothed with numerous short hairs and bearing in an apical notch a pair of curved, clawlike spines. Claspette represented by a subapical internal lobe bearing two stout, chitinous, curved, fingerlike processes, a large chitinous spine and several smaller ones. Harpes short, broad, stout, basal processes crowned with a series of close-set, blunt, chitinous teeth and bearing a number of rather stout, subapical setae. Minor limb nearly independent, a very long, stout, chitinous process about two thirds the length of the basal clasp segment, with the basal portion somewhat enlarged. Harpagones with a long, curved, blunt apical spine, the basal portion broadly expanded, somewhat convolute, with its rounded margin crowned with a series of stout, slightly

curved, chitinous spines and its ventral margin terminated by a stout, recurved hook. Unci long, slender, approximate, broadly rounded posteriorly. Setaceous lobes probably absent.

FIG. 19 Deinocerites cancer, ventral aspect of male genitalia, much enlarged (Original)

Female. The female genitalia of this species diverge very widely from the ordinary type. There are a dorsal pair of subtriangular, articulated processes, each bearing two long nonarticulated, stout, curved, blunt, chitinous processes. Tergum small, deeply excavated mesally. Venter of eighth segment produced as a pair of stout, chitinous, nonarticulate lobes, the ventral posterior margin crowned with a series of stout, chitinous spines arising from conspicuous tubercules.

Aedes fuscus O.S. *Genitalia, male.* Basal clasp segment stout, subconical. Terminal segment subapical with a very large, rounded basal lobe and the slender tip with a pair of blunt, divergent processes. There are no traces of a terminal articulated spine. Claspette a conspicuous subtriangular, ventral prolongation of the inner basal wall. Harpes very slender, semitransparent at base, more strongly chitinized and brownish apically, bifurcate. Lateral limb about one third longer than the median branch, each rather thickly clothed with fine setae and ornamented with several lateral and a long conspicuous terminal spine. Harpagones stout, recurved, tapering to a rather acute, obscurely dentate point. Unci narrow, approximate, ventral limb slightly excurved to a nearly acute point, dorsal limb stouter, incurved to an acute point. Setaceous lobes stout, rounded apically and with numerous long, rather weak spines. These latter organs are more or less concealed by the overlying appendages of the preceding segment. [Pl. 18, fig. 2]

Female. Lobes about four times as long as broad, somewhat contracted at the base and tapering rapidly from the basal third to the rather acute, almost unarmed tips. Ventral plate not as wide as a lobe and extending to the posterior half, strongly emarginate apically. Posterior margin of eighth segment armed with a series of long, stout spines.

Uranotaenia sapphirina O. S. *Genitalia, male.* Basal clasp segment stout, subconical. Terminal clasp segment stout, nearly straight and tapering rapidly near the tip to a nonarticulate spine. Interior face of apical portion denticulate and with a small spine. Claspette probably represented by a slight setaceous process near the middle of the basal segment. Harpes slender, slightly constricted at the apical fourth and with a dark brown, slightly curved and enlarged apex. Harpagones stout, constricted just beyond the middle and ending in a pair of divergent blunt processes. Unci stout, approximate with a number of diverging apical chitinous processes.

Uranotaenia socialis Theo. *Genitalia, male.* Basal clasp segment very broad with the apex broadly rounded. Terminal clasp segment stout, nearly straight and tapering rapidly near the tip to a moderate, acute apical spine. Claspette probably represented by a slight setaceous process near the middle of the basal segment. Harpes stout, broad, apparently with three stout subapical teeth on each side, apex blunt. Harpagones stout, tapering and bearing one stout subapical and two apical curved, chitinous processes. Unci slender, approximate, broadly rounded posteriorly.

The parts are so minute and the material so scanty that it was impossible to make a preparation showing all the details in a satisfactory manner and it may be necessary to revise the above with more material at hand.

Wyeomyia smithii Coq. *Genitalia, male.* Basal clasp segment rather stout, curving gradually to a broadly rounded apex, and with a small basal, setaceous lobe, the claspette. This segment is unique since its distal portion is composed of two equal lobes very slightly connected posteriorly. Terminal segment remarkable, composed of an irregular main limb terminated by several conspicuous teeth and ornamented along its inner margin with a series of rather stout spines. Near the middle arises a fingerlike process thickly armed with a brush composed of oblique fine retrose spines. On the opposite side of the central limb there is a large falcate process, the inner surface armed with several stout spines. This arm is connected with the central limb by a broad sheet of probably chitinous tissue forming a sort of pocket. Harpagones, much smaller than the harpes, both consisting of a broad basal platelike structure rounding abruptly to a short, stout, bladelike segment armed with a conspicuous spine, and with its apex obliquely truncate. Unci broad, platelike, fused mesally to form a keel-like structure. Setaceous lobes rather small, each bearing four or five long, stout setae.

Female. Lobes broadly rounded, apparently attached dorsally, the nearly circular ventral margin free. Tergum broadly rounded

at apex, strongly expanded at the base and extending beyond the lobes.

Megarhinus portoricensis Von Roder. *Genitalia, male.* Basal clasp segment stout, subtriangular, tapering to a narrowly rounded apex. Terminal segment rather slender, base slightly enlarged, tip slender, bearing a rather long, acute terminal spine. Claspette represented by a simple, broadly rounded basal setaceous lobe. Harpes long, excavated externally and terminated by a stout, chitinous spine and a series of minute denticulations. Harpagones slender, closely appressed, ventral edge with a series of minute teeth. Unci fused, slender, ending in acute points. Setaceous lobes moderately well developed, thin, bearing numerous long, rather slender setaceous spines. Seventh segment with a transverse row of very long slender spines across the posterior third, evidently a generalized type of the submedian groups of spines observed in some other genera. [Pl. 19, fig. 1]

CORETHRINAE

The Corethrinae are a fairly homogeneous subfamily, despite the wide differences in larval structures, though there is a substantial agreement in habits, all being aquatic and predaceous. Corethrella appears to be the more generalized of the various genera, there being comparatively slight differences between the antennae in the two sexes [fig. 2]. Those of the female are remarkable because of the rudimentary whorl of hairs near the middle of each segment, and those of the male are unique on account of the long, fine hairs continued to the apical fourth. The wings of both sexes are substantially alike, both possessing the oblique scales along the margin, a character almost universally limited to the female. The claws are simple in both sexes, though those of the fore- and mid-legs of the male are

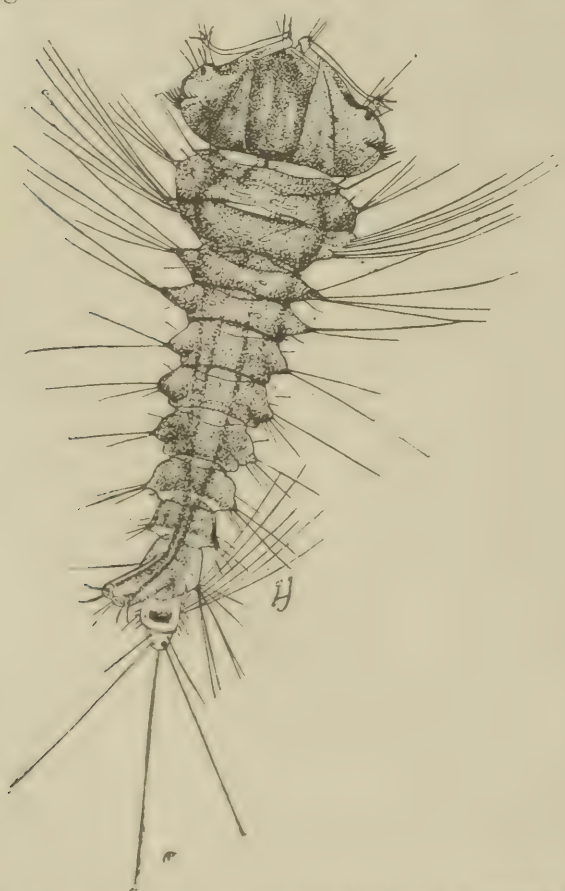


FIG. 72. Corethrella brakeleyi, dorsal view of larva showing the peculiar head structures and the paired separate spiracles of the air tube, much enlarged (Original)

larger. Eucorethra is somewhat more highly specialized, the antennae being markedly different in the two sexes and with oblique scales present along the posterior margin of the female wing and absent in that of the male. The species of Corethra exhibit well marked sexual differences and may be instantly recognized by the unique, very short first tarsal segment. The Sayomyias present a somewhat general resemblance to the Corethras, though they are easily distinguished on account of the first tarsal segment being longer than the others. The male genitalia of these genera agree substantially in possessing relatively simple clasp segments and with a single pair of subsidiary organs, probably the harpes.

FIG. 21 Corethrella brakeleyi, ventral aspect of larval head, much enlarged (Original)

The larvae of this group present marked structural differences. That of Corethrella is exceedingly peculiar and may be considered a divergent synthetic form. The head is armed laterally with oblique rows of stout spines not seen in any other culicid larva, and the rather broad, stout air tube is peculiar because its tracheae are simple and open in well separated spiracles at the extremity of the tube. The larva of Eucorethra likewise has independent tracheae and on account of its surface-feeding habit possesses a short air tube and in a general way resembles a giant Anopheles larva, though with no trace of the characteristic comb of the latter. Corethra larvae are interesting because they possess a rudimentary air tube with well marked tracheal dilations or air reservoirs in the enlarged thoracic and eighth abdominal segments. The Sayomyia larvae are most peculiar. They have no vestige of an air tube and are remarkable because of their extreme transparency, the only color being the dark mouth parts, the black eyes and pigmented air sacks in the thoracic and eighth abdominal segments. The larval mouth parts of this genus are very different from those of the other genera associated therewith.

Eucorethra underwoodi Undw. *Genitalia, male.* Basal clasp segment very stout, broad, apex obliquely rounded. Terminal segment stout, somewhat curved with a number of stout setae on its basal portion, apical part slightly enlarged and bearing a short, stout, articulate spine. Harpagones probably represented by short, stout, distant, quadrangular processes. Unci long, slender, largely retracted, apical portion irregularly convolute, quill-like, terminated in a somewhat acute tip.

Corethrella brakeleyi Coq. *Genitalia, male.* Basal clasp segment stout, slightly concave interiorly, broadly rounded exteriorly to a somewhat narrow apex bearing long, strongly arcuate terminal segments, the latter ending in an acute point but with no indication of a terminal spine. Claspette apparently represented by a stout, chitinous spine at the basal third of the large clasp segment. Harpes approximate, long, slender, tapering gradually to a fine, rounded apex. Harpagones, unci and setaceous lobes apparently absent. [Pl. 19, fig. 2]

Female. Lobes composed of a smaller anterior segment and a larger broadly rounded posterior one. Tergum broadly rounded posteriorly, ventral plate tapering obliquely to a narrow truncate margin and with a stout seta at the posterior angles.

Corethra cinctipes Coq. *Genitalia, male.* Basal clasp segment stout, rounded exteriorly, anterior margin nearly straight, obliquely truncate. Terminal segment rather stout, somewhat curved and slightly enlarged apically; tip with a small, acute, articulate spine. Harpes absent. Harpagones approximate, stout, with a slight ventral and dorsal curve, terminating in a stout, decurved, bluntly rounded point.

Corethra lintneri Felt. *Genitalia, male.* Basal clasp segment gently rounded exteriorly, with interior margin nearly straight, apical portion obliquely rounded. Terminal segment rather stout, somewhat curved and slightly enlarged apically, tip bearing a small articulate spine. Harpes absent. Harpagones stout, somewhat irregular, terminating in an acute, slightly recurved, chitinous spine.

Female. Base of lobes sublateral, widely separated, expanding posteriorly to an obliquely truncate apex.

Corethra karnerensis Felt. *Genitalia, male.* Basal clasp segment gently rounded exteriorly; interior margin slightly curved, apex rather broadly rounded. Terminal segment rather stout, slightly enlarged at both extremities and with a moderate, acute apical spine. Harpes absent. Harpagones stout, somewhat irregular, terminating in an acute, slightly recurved, chitinous spine.

Female. Lobes almost approximate, very broad, scarcely longer than wide and with numerous long, coarse setae.

Corethra fuliginosus n. sp. *Genitalia, male.* Basal clasp segment stout, slender with a broadly rounded apex. Terminal clasp segment very long, slightly expanded at the base, more so distally and with a rather stout, acute apical spine. Harpes apparently absent. Harpagones short, stout, slightly recurved, broadly rounded apically. Tergum obliquely truncate posteriorly.

Sayomyia trivittata Loew. *Genitalia, male.* Basal clasp segment stout, tapering gradually to a rather broadly rounded apex. Terminal clasp segment long, slightly expanded at the base, tapering to a blunt, simple apex. Claspette and harpes apparently absent. Harpagones stout, irregularly swollen near the middle and terminating in a stout, rather obtuse, recurved tip.

Sayomyia hudsoni Felt. *Genitalia, male.* Basal clasp segment stout, rather short, broadly and slightly rounded apically. Terminal segment stout, slightly curved, tapering gradually to a rounded apex with no terminal spine. Claspette and harpes apparently absent. Harpagones with basal portion rather slender, apical half enormously dilated, the posterior margin broadly rounded, anterior margin extending at its lateral extremity into a prominent beak, giving the apical portion of the organ an appearance not unlike a bird's head with the beak pointing anteriorly. Ventral surface ornamented with a series of stout, chitinous spines. Unci indeterminate. Setaceous lobes widely separated, thin, prolonged posteriorly and bearing several stout setae.

Sayomyia albipes Johans. *Genitalia, male.* Basal clasp segment rather slender, long, with broadly rounded apex. Terminal segment slightly curved, tapering gradually to a rather broadly rounded apex. Claspette and harpes absent. Harpagones, basal portion broad, oblique, apical furcate, enlarged, the longer limb strongly curved, the shorter apparently an excavated spur.

Sayomyia rotundifolia Felt. *Genitalia, male.* Basal clasp segment rather stout, long, broadly rounded at apex. Terminal clasp segment rather stout, slightly curved, tapering to a bluntly rounded tip with no apical spine. Claspette and harpes apparently wanting. Harpagones stout, apical half furcate, consisting of two strongly recurved limbs, the larger with a prominent, slightly curved spine near its middle.

JASSIDAE OF NEW YORK STATE

BY HERBERT OSBORN

A comprehensive list of the Jassidae of New York State seems specially warranted because so large a number of species occurring in the United States have been described from that State, owing to the work of Dr Fitch and Mr Van Duzee and, moreover, the fact that its fauna is fairly representative for the eastern United States. The present report is based on previous lists or descriptions by Fitch, Van Duzee, Felt, Southwick, Slingerland and others; the material submitted to the writer by these parties or examined in the collections at Cornell University and the New York State Museum and personal collections in the summer of 1904, when the writer had the opportunity to visit different parts of New York State, examining collections and collecting new material in the vicinity of Buffalo, Ithaca, Albany, Salem, Long Island and Staten Island. Representative sections of the State were thus covered and with the material previously accumulated or reported, covers, it is believed, quite thoroughly the Jassid fauna of the State. Furthermore, collections by Mr E. P. Van Duzee in the Adirondack region extends the area covered still more thoroughly.

The economic importance of the Jassidae was recognized by Dr Fitch in his various writings and he described a large number of the species as injurious to forest trees, grasses, etc. The importance of these insects is not yet fully appreciated owing to the nature of their work but they will undoubtedly become more fully recognized as farmers become aware of the more insidious sources of loss to their various crops. Attention has been called elsewhere to the destructive effect of these insects in pastures and meadows but observations during the past summer in the pastures and lowlands of New York indicated less loss of this sort than has frequently been noted in other localities. This may have been in part due to the season, the constant moisture affording opportunity for the crop to grow continuously. In some cases the hillside pastures were pretty badly infested and the growth of the crop evidently much reduced, also in low ground, marshy pastures, certain species swarmed in such numbers that the vegetation must have been drained to a serious extent.

It may be noted that the mode of feeding in the group consists in puncturing the tissues of various plants, sucking the juices and thus draining their vitality though not necessarily causing the

death of the plant or any considerable portion of it. The drain, however, if the insects are plentiful is constant for pretty much the entire season and there can be no question that a large part of the growth is devoted to the nutrition of these insects.

In the following list we have endeavored to include all the species known to occur in the State with notes on their abundance, food plants, distribution, life history, and habits; in short, the essential facts related to their effect on different crops and furnishing the basis for further detailed study of such species as may seem to demand more thorough investigation.

I am under special obligation to Dr E. P. Felt for the opportunity to study these insects in various parts of the State and get together the material for this paper and for his interest in its publication. Mr Van Duzee has furnished me with numerous records and specimens and given me free access to his collection. Professor Comstock placed the Cornell collections at my disposal. The authorities of the American Museum afforded me free opportunity to examine collections there. Prof. C. B. Davenport placed the facilities of the Cold Spring Harbor laboratory at my disposal and Mr J. R. De la Torre Bueno has furnished me with many specimens from the vicinity of New York.

I was particularly glad to be able to collect at Salem, the locality where Dr Fitch lived and did much of his entomological work. The collections there brought to light include a large proportion of species which he had described and these have been of particular value and interest as a basis of recognition for his species and for comparison of specimens from other localities.

Of the New York species of Jassidae 12 were described by Say all of which are satisfactorily referred. 30 were described by Fitch and 28 definitely placed by types or descriptions. Eight have been described by Uhler, 28 were described by Van Duzee, others by Osborn and Ball, Fallen, Gillette, Linnaeus, Fabricius, Provancher and others. There are very few that may now be considered in question.

All the species in this group known to Dr Fitch comprised 45. Van Duzee's list of Buffalo Hemiptera includes 93 species. The number brought into the present list all of which are based on authentic records or specimens in hand is about 175. Doubtless there are some species to be added—that are known for New Jersey or Maryland, Maine and Canada but I believe it safe to say that the list presents a fairly complete presentation of the Jassidae of the State.

The group Jassidae in its wider sense, or the superfamily Jassoidea of Van Duzee, includes insects distinguished by having antennae setaceous, situated in front of the eyes, the pronotum well developed, scutellum triangular, wings generally opaque but with distinct nervures and the tibiae with a double row of spines on the dorsal side and without a circlet of spines on apex. The group as so defined includes four well marked families distinguished by shape of head and position of antennae.

A synopsis of these families and genera somewhat modified from the scheme proposed by Mr Van Duzee is offered below. The changes suggested are in part due to the description of new genera proposed since Mr Van Duzee's valuable key was published 10 years ago, partly to different value placed on some of the characters used in generic separation which the examination of material in the new species and genera seems to confirm. Thus, I have revised the grouping of genera under Deltocephalini to include Scaphoideus and adapted his Athysanini to the inclusion of several new genera. These changes while not solving all the difficulties apparent in these complicated groups are believed to permit a more natural grouping than is possible under the old system.

Synopsis of families, Jassoidea

A Elytral veins branching on the disk, forming fork inclosing anteapical cells.

a Head very short, vertex sloping or rounding on to the front and ocelli on front. . . . . Bythoscopidae

aa Head more or less prominent, the ocelli located on the disk of the vertex . . . . . Tettigonidae

aaa Head produced or rounded, ocelli on margin between vertex and front . . . . . Jassidae

AA Elytral veins branching at base and passing without fork to the apical cells. Ocelli usually wanting . . . . . Typhlocybidae

Genera represented in New York

Superfamily **Jassoidea**

Family *Bythoscopidae*

Bythoscopus
Idiocerus
Pediopsis
Agallia

Family *Tettigonidae*

Subfamily TETTIGONINAE

Aulacizes
Oncometopia
Tettigonia
Helochara

Diedrocephala
Draeculacephala
Eucanthus
Subfamily GYPONINAE
Xerophloea
Gypona
Penthimia
Family *Jassidae*
Subfamily ACOCEPHALINAE
Strongylocephalus
Acocephalus
Spangbergiella
Parabolocratus
Paramesus
Subfamily JASSINAE
Platymetopius
Deltocephalus
Scaphoideus
Athysanus
Driatura
Athysanella
Goniagnathus
Eutettix
Phlepsius
Thamnotettix
Chlorotettix
Jassus
Paracoelidia
Cicadula
Gnathodus
Family *Typhlocybidae*
Alebra
Dicraneura
Empoasca
Eupteryx
Typhlocyba

Family BYTHOSCOPIDAE

Genus BYTHOSCOPUS Germ.

Bythoscopus variabilis Fitch

♀ Athysanus variabilis Fitch. Homop. N. Y. State Cab. 1851. p. 60; reprinted in Lintner. 9th Rep't. 1893. p. 400; N. Y. State Agric. Soc. Trans. 1858. 18: 853

Bythoscopus variabilis Walk. Homop. 1851. 3: 876; Van Duzee, Am. Ent. 1890. 6: 223; Psyche, 5: 390; reprinted in Lintner. 9th Rep't. 1893. p. 410

♂ Athysanus abietis Fitch. Homop. N. Y. State Cab. 1851. p. 60; reprinted in Lintner. 9th Rep't. 1893. p. 400

Bythoscopus variabilis Van Duzee. Buf. Soc. Nat. Hist. Bul. 4, p. 144

The type[1] specimens are well preserved and leave no question as to the identity of the species. A very full series including representatives of 13 varieties is contained in the Fitch material in the National Museum.

Reported from Buffalo on birch [Van Duzee, Buf. Hemip. p. 144]. Evidently generally distributed.

Bythoscopus sobrius Walk.

Bythoscopus sobrius Walk. Homop. 1851. 3: 874; Fitch, reprinted in Lintner. 9th Rep't. 1893. p. 400; N. Y. State Agric. Soc. Trans. 1858. 18: 853

Bythoscopus sobrius Van Duzee. Buf. Soc. Nat. Hist. Bul. 4, p. 195.

Recorded by Van Duzee for Colden, Lancaster.

[1] There is an interesting question regarding the types of Fitch's species and one which it seems rather difficult to settle. The paper on Homoptera published in the New York State Cabinet Catalogue in 1851 includes the numbers arranged serially according to the species described. These numbers agree with numbered specimens which were deposited in the State Cabinet of Natural History, which specimens have since remained in the custody of the Museum. So far as preserved they are unquestionable examples of these species as indicated by Dr Fitch himself and whether termed "types" or not they must be considered as equivalent to types in their authority. Dr Fitch's private collection which included examples of species that he described was broken up but the Homoptera were finally purchased by the United States National Museum and specimens of Jassidae bearing Fitch's labels which have for Fitch's species been marked with type labels, stand now in the National Museum collection.

They do not, however, bear numbers which correspond with the published catalogue so that it has appeared to me that the published evidence would favor the Albany specimens as the types. Mr Schwarz tells me, however, that Fitch's descriptions were drawn from specimens numbered to correspond with numbers in his notebooks and that these numbers are the most positive basis of recognition of the specimen from which the original description was drawn. Such numbers occur on the Psyllidae and specimens in some other groups but on examination with this point in view it turned out that the Jassids, at least for all species examined, do not contain a Fitch number.

It is to be noted that in certain species, as for instance Idiocerus lachrymalis, the Albany series is complete for not only typical forms but for all of the described varieties, whereas the Washington series includes an example of but one form. On the other hand, for Bythoscopus variabilis the Washington series is by far the most complete including representatives for the described varieties whereas the Albany collection includes but one (?) form, all the varieties having been omitted or subsequently lost. Fortunately so far as observed, there is close agreement between these specimens in the two collections, a fact which would be expected from Dr Fitch's well known care and hence the question of the validity of the type specimen becomes less important.

It appears to me, however, that on the whole it would be best since the Albany species bear definite numbers agreeing with the published descriptions to consider these as types and the other specimens as cotypes. It at least seems the rational course to pursue for such specimens in the National Museum as, while bearing labels written by Dr Fitch, do not possess numbers which would identify them as the particular specimens from which the descriptions were written.

Bythoscopus cognatus Van Duzee

Bythoscopus cognatus Van Duzee. Am. Ent. 1890. 6: 224

Bythoscopus cognatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 195

Van Duzee's record for this species at Lancaster, 1904 records for Lake Placid and Phoenicia and a specimen from Albany are the only ones which have come to notice for the State.

Bythoscopus fenestratus Fitch

Athysanus fenestratus Fitch. Homop. N. Y. State Cab. 1851. p. 60; Fitch, reprinted in Lintner. 9th Rep't. 1893. p. 400; N. Y. State Agric. Soc. Trans. 1858. 18: 853

Bythoscopus fenestratus Walker. Homop. 1852. 4: 1162

Pediopsis fenestratus Van Duzee. Can. Ent. 1889. 21: 9

Type in the New York Museum is faded but the hyaline spots of wing arranged in accord with cells is evident. Specimen in the National Museum has only elytra and wings remaining but shows clearly five hyaline cells in disk and anteapical area of elytra.

Bythoscopus pruni Prov.

Bythoscopus pruni Prov. Pet. Faune Ent. Can. 1890. 3: 290; Van Duzee, Am. Ent. 1890. 6: 226

Bythoscopus pruni Van Duzee. Buf. Soc. Nat. Hist. Bul. 5, p. 195

Van Duzee records for Buffalo "one spec." and reports it for Lake Placid. Specimens in hand from Albany. National Museum material includes representative of typical form and varieties a, b, d and e. The color is brownish, the cells subhyaline specially in varieties a and b. It is smaller than fenestratus.

Bythoscopus minor Fitch

Bythoscopus minor Fitch. Homop. N. Y. State Cab. 1851. p. 60; Fitch, reprinted in Lintner. 9th Rep't. 1893; p. 400; N. Y. Agric. Soc. Trans. 1858. 18: 583

Bythoscopus minor Walk. Homop. 1851. 3: 876; Van Duzee, Am. Ent. 1890. 6: 227; Psyche. 1890. 5: 390; reprinted in Lintner. 9th Rep't. 1893. p. 410

Bythoscopus minor Van Duzee. Buf. Soc. Nat. Hist. Bul. 4, p. 195

Recorded for Buffalo and reported for Lake Placid by Van Duzee.

Bythoscopus nigrinasi Fitch

Athysanus nigrinasi Fitch. Homop. N. Y. State Cab. 1851. p. 61; reprinted in Lintner. 9th Rep't. 1893. p. 401

Bythoscopus nigrinasi Walker. Homop. 1852. 4: 1162; Van Duzee, Am. Ent. 1890. 6: 228; Psyche, 1890. 5: 390; reprinted in Lintner. 9th Rep't. 1893. p. 410

"June to August. Abundant everywhere on hornbeam" [Van Duzee, Buf. Hemip. p. 195].

Bythoscopus distinctus Van Duzee

Bythoscopus distinctus Van Duzee. Am. Ent. 1890. 6: 224
Bythoscopus distinctus Van Duzee. Buf. Soc. Nat. Hist. Bul. 5, p. 195

Given by Mr Van Duzee for Buffalo and vicinity.

Bythoscopus fagi Fitch

Athysanus fagi Fitch. Homop. N. Y. State Cab. 1851. p. 61; Fitch, reprinted in Lintner. 9th Rep't. 1893. p. 401
Bythoscopus fagi Walk. Homop. 1852. 4: 1162; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Specimens which I have referred to this species are of a uniform deep brown color, somewhat larger than fenes altus. The type appears to be lost.

Pediopsis trimaculata Fitch

Pediopsis trimaculata Fitch. Homop. N. Y. State Cab. 1851. p. 60
Bythoscopus trimaculata Walk. Homop. B. M. 1852. 4: 1162
Pediopsis insignis V. D. Review, Am. Ent. 1889. 5: 171
Pediopsis trimaculata Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 116

Recorded for Highland [Felt coll.], Gowanda, Hamburg [Van Duzee, Buf. Hemip. p. 195].

Pediopsis viridis Fitch

Pediopsis viridis Fitch. Homop. N. Y. State Cab. 1851. p. 59; reprinted in Lintner. 9th Rep't. 1893. p. 399

Reported for Karner [N. Y. State Mus.]. I took it at Hamburg, July 8, 1904, from Salem, Aug. 14, 1904, and Van Duzee reports it for Lake Placid.

Type in Fitch collection in New York State Museum, is a female and our specimens agree except that the type has faded. Also reported for Buffalo [Van Duzee, Buf. Hemip. p. 195].

A frequent insect on willows though it will escape attention unless beaten from the twigs as its color blends perfectly with that of the leaves.

Pediopsis canadensis Van Duzee

Pediopsis florescens Van Duzee. Am. Ent. Review. 1889. p. 173
Pediopsis canadensis Van Duzee. Can. Ent. 1890. 22: 111

Reported for Lancaster [Van Duzee, Buf. Hemip. p. 195] and Lake Placid.

Pediopsis bifasciata Van Duzee

Pediopsis bifasciata Van Duzee. Am. Ent. Review. 5: 173
Pediopsis trimaculata Van Duzee. Am. Ent. Review. 5 172

Pediopsis bifasciata Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 118

Aside from the New York record by Van Duzee under the name trimaculata, I have seen specimens from Karner in the New York collection and secured others at Salem that I believe must be placed here though they vary from typical examples. Occurs on cottonwood and poplar.

Pediopsis suturalis O. & B.

Studies of N. Am. Jassoidea. Pr. Dav. Acad. Nat. Sc. 7: 67.

Reported for Colden N. Y. (VanDuzee, collecter) in original description.

Pediopsis reversalis O. & B.

Studies of N. Am. Jassoidea. Pr. Dav. Acad. Nat. Sci. 7: 69.

Collected at Colden N. Y. by Mr E. P. VanDuzee.

Pediopsis basalis Van Duzee

Pediopsis basalis Van Duzee. Am. Ent. Review. 1889. p. 171; Cat., p. 260; Prov., Pet. Faune Ent. Can. 1890. 3: 295

Pediopsis fumipennis G. & B. Hemip. Colorado, p. 73

Reported for Buffalo [Van Duzee, Buf. Hemip. p. 195] and Lake Placid.

This is a fairly distinct species and fully characterized by the describer. The dark color of the base of clavus is the most striking character.

Pediopsis virescens var. graminea Fabr.

Body slender, sides parallel. Color, light green, a bright black spot at tip of vertex and one on base of hind tibia.

Length of female, 4.5 mm to tip of elytra.

Head strongly produced, vertex very narrow. Front broad, sutures indistinct, pronotum subangular anteriorly, deeply concave posteriorly. Elytra weak, transparent; nervures distinct.

Color. Light green. Head and wings somewhat yellowish. Extruded portion of ovipositor orange. A bright round black spot at apex of vertex and base of hind tibia. Eyes embrowned.

Genitalia. Female, last ventral segment narrowing posteriorly, indented posteriorly. Pygofer broad, not reaching tip of ovipositor.

Two specimens, females, collected on willow at Fitch Point, near the Fitch home, Salem N. Y., Aug. 14, 1904.

They agree so perfectly with the descriptions of var. graminea of the European species virescens that it seems safe to so refer it.

This is the first instance of any European species of this genus being found in America.

Idiocerus pallidus Fitch

Idiocerus pallidus Fitch. Homop. N. Y. State Cab. 1851. p. 59

Bythoscopus pallidus Walker. Homop. 4: 1162

Idiocerus obsoletus Walker. Homop. 1851. 3: 873

Collected in Buffalo during July and August [Van Duzee, Buf. Hemip. p. 194].

I took it also at Hamburg and Van Duzee reports it for Lake Placid.

This also occurred pretty abundantly on willows at Salem. The types are wanting in New York collection. The National Museum collection contains a specimen of the typical form and of varieties "a" and "b." Specimens collected at Fitch Point, Salem that agree with the description and come from Fitch's locality have the pallid greenish color, the spots on vertex and a length of 5.5 mm.

Idiocerus nervatus Van Duzee

Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 194; Cat., p. 261

Reported for Albany [N. Y. State coll.] Staten Island and Lancaster [Van Duzee].

Idiocerus alternatus Fitch

Idiocerus alternatus Fitch. Homop. N. Y. State Cab. 1851. p. 59
Bythoscopus alternatus Walk. Homop. 1851. 3: 876
Idiocerus alternatus Van Duzee. Can. Ent. 1889. 21: 8; Psyche, 5: 388
Idiocerus alternatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5; p. 194

The Fitch type in New York State collection somewhat faded, is easily identifiable. The National Museum collection contains 6 specimens, one with original Fitch label and varieties a. b and c, none of them however with numbers to connect them with manuscript or published description. They agree with the specimens generally recognized under this name and which have been fully described in recent papers.

A common species over a wide range of country, occurring on willows. I secured specimens at Fitch Point, Salem, also at Hamburg.

Idiocerus suturalis Fitch

Idiocerus suturalis Fitch. Homop. N. Y. State Cab. 1851. p. 59
Bythoscopus suturalis Walk. Homop. 1852. 4: 1162
Idiocerus suturalis Van Duzee. Can. Ent., 21: 8; Psyche, 5: 388
Idiocerus suturalis Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 194

I found it fairly common on willows at Salem and took it also at Hamburg. Van Duzee reports it for willow, poplar and birch. A specimen from Karner is in the New York State collection and Van Duzee reports it for Lake Placid and Phoenicia.

There is no type specimen in the New York State collection but in the National Museum there is a specimen with label, "Idiocerus suturalis Fitch, New York" evidently in Fitch's handwriting. The label "Fitch type" has been added in recent years. This specimen has the dusky sutural border without an interruption.

Idiocerus suturalis var. **lunaris** Ball

Occurs with the typical form on willows. Van Duzee reports it for Lake Placid and I took it commonly at Salem and elsewhere.

Idiocerus crataegi Van Duzee

Can. Ent. 1890. 22: 110; Buf. Soc. Nat. Sci. Bul. 5, p. 194

Collected at Buffalo on thornbushes [Van Duzee]. Apparently less widely distributed than some of the other species.

Idiocerus lachrymalis Fitch

Idiocerus lachrymalis Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; Van Duzee, Can. Ent. 1889. 21: 8; Psyche. 1890. 5: 388

Bythoscopus lachrymalis Walk. Homop. 1851. 4: 1161

Abundant at Salem on poplar. I secured a large series of this species from a little patch of scrubby poplars on the crest of a hill near Salem on Aug. 14. They agree perfectly with the well preserved types in the New York State Museum and fit the Fitch description which for this species is quite distinctive. Mr Van Duzee secured it at Lake Placid and Phoenicia and has heretofore reported it for Lancaster and Hamburg. A single specimen in the National Museum is representative for the typical form, while the New York State collection includes representatives for the varieties under numbers and letters precisely as given in the published description.

Idiocerus maculipennis Fitch

Idiocerus maculipennis Fitch. Homop. N. Y. State Cab. 1851. p. 59

Bythoscopus maculipennis Walk. Homop. 1852. 4: 1161

Idiocerus maculipennis Van Duzee. Psyche, 5: 388

Idiocerus maculipennis Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 194

Collected in July and August on thorn [Van Duzee] and at Mosholu [Bueno]. Fitch's description is represented now by fragments of broken specimens in the National Museum. A full recent description is given in a paper on the Genus Idiocerus [Osborn and Ball. Dav. Acad. Nat. Sci. Proc. 7: 73].

Idiocerus provancheri Van Duzee

Idiocerus provancheri Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 194

Bythoscopus clitellarius Prov. Pet. Faune Ent. Can. 1890. 3: 288

Idiocerus provancheri Van Duzee. Can. Ent. 1890. 23: 111

Collected at Buffalo and Lake Placid [Van Duzee] and Severence [N. Y. State coll.]. Occurs on different species of Crataegus.

Idiocerus verticis Say

Jassus verticis Say. Acad. Nat. Sci., Phila. Jour. 1831. 6: 308

Bythoscopus verticis Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 465

Idiocerus verticis Van Duzee. Psyche. 1890. 5: 389

I took at Salem one specimen which agrees much better with this species than with alternatus. Previous records place the species west of the Mississippi river.

Genus AGALLIA Curtis

Agallia 4-punctata Prov.

Bythoscopus 4-punctatus Prov. Nat. Can. 1872. 4: 376
Agallia 4-punctata Van Duzee. Am. Ent. 1889. 5: 167
Agallia 4-punctata Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 196

Records for Poughkeepsie [N. Y. State coll.], Ithaca [Cornell coll.], Buffalo [Van Duzee], Forest Park, June 7, 1902 [Bueno].

I collected it at Cold Spring Harbor and Jamaica; Van Duzee at Lake Placid in 1904.

Agallia sanguinolenta Prov.

Bythoscopus sanguinolentus Prov. Nat. Can. 1872. 4: 376
Agallia sanguinolenta Van Duzee. Am. Ent. 1889. 5: 166
Bythoscopus siccifolius Uhler. U. S. Geol. & Geog. Sur. Bul. 2, p. 359
Agallia siccifolia Van Duzee. Can. Ent. 1889. 21: 9; Buf. Soc. Nat. Sci. Bul. 5, p. 196

Generally distributed over the State as well as elsewhere over the United States. Records for Ithaca [Cornell Univ.], Buffalo [Van Duzee], Karner [N. Y. State coll.], Mosholu, Oct. 1, 1902. [Bueno].

I collected it at Eagle Bridge, Nassau, Jamaica and Cold Spring Harbor, and Mr Van Duzee reports it for Lake Placid, Phoenicia, Staten Island and Jamaica.

Agallia novella Say

Jassus novellus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 309
Agallia novellus Van Duzee. Can. Ent. 21: 8; Buf. Soc. Nat. Sci. Bul. 5, p. 196

Reported for Buffalo Van Duzee, Buf. Hemip. p. 196.

Recorded for Buffalo and reported in 1904 for Lake Placid and Phoenicia but doubtless well distributed over the State.

Agallia constricta Van Duzee

Can. Ent. 26: 90; Osborn and Ball, Dav. Acad. Nat. Sci. Proc. 7: 52

Aside from the record of Long Island given in the review of this genus by Osborn and Ball, I have specimens collected at Cold Spring Harbor in August 1904, and Mr Van Duzee reports it for Staten Island. Its distribution is evidently to the southward and Long Island is probably about its northern limit.

Family TETTIGONIDAE

Genus ONCOMETOPIA

Oncometopia undata Fabr.

Proconia undata Fabr. [For full synonomy *see* Van Duzee's *Catalogue*]

The general range for this species is stated by Van Duzee as New Jersey to Michigan and south to Florida and Mexico. Only one record "Oswego" given on a specimen in the N. Y. State Museum collection has come to notice for the State.

Oncometopia lateralis Fabr.

Cicada lateralis Fabr. Ent. Syst. sup. p. 524
Cicada marginella Fabr. Syst. Rhyng. p. 96
Cicada costalis Fabr. Syst. Rhyng. errata following p. 314
Oncometopia lateralis Ball. Ia. Acad. Sci. Proc. 8: 44

This is a northern form and the only trustworthy record I know for the State is from Mr Van Duzee who reports it for Lake Placid. I have specimens from Montreal Can. and it may be expected to occur over the northern part of the State.

Genus AULACIZES

Aulacizes irrorata Fabr.

Cicada irrorata Fabr. Ent. Syst. 1794. 4: 33
Cicada nigripennis Fabr. Ent. Syst. 1794. 4: 32
Aulacizes rufiventris Walk. Homop. 1851. 3: 796
Aulacizes guttata Uhl. Stand. Nat. Hist.; Van Duzee, Cat. [nec. Sign.]
Aulacizes pollinosa Fowl. Biol. Homop. 2: 218, pl. 15, fig. 18

A specimen secured at Cold Spring Harbor. One also in the American Museum, New York city and credited to "N. Y." and it was very likely secured at some point near the city. This is also a southern species but its distribution extends a little farther north than that of the preceding species.

Genus TETTIGONIA

Tettigonia bifida Say

Tettigonia bifida Say. Acad. Nat. Sci. Phila. Jour. 1831. 4: 313
Tettigonia tenella Walk. Homop. 1851. 3: 770
Tettigonia fasciata Walk. Homop. 1851. 3: 780
Tettigonia bifida Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 175; Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 196

Reported for Ithaca. [Cornell Univ.]. Keene Valley, [N. Y. State coll]. New York city, Sep. 2, 1902. [Bueno]. Phoenicia, Buffalo. [Van Duzee].

A fairly common species and examples were taken during my trip at Hamburg, Salem, Cold Spring Harbor and Jamaica. It occurs in wooded localities and is found on grasses and other low herbaceous plants.

Tettigonia gothica Sign.

Tettigonia gothica Sign. Ann. Soc. Ent. Fr. 1854. p. 345
Tettigonia hieroglyphica, in reference from Eastern states [nec. Say].
Tettigonia similis Woodw. Ill. State Lab. Bul. 3. 1887. p. 25

Keene Valley, Karner, Clinton Heights. I took it at Salem, Nassau, and Oyster Bay. Mr Van Duzee at Lake Placid, Phoenicia and Kingston.

As Ball has pointed out this species must have been the basis for records of hieroglyphica in localities east of Illinois.

It is light reddish or grayish green, the head with several lines on the vertex doubled on each other and nearly parallel with median line, and prominent spot at apex black. Length 5.5 mm to 6 mm.

It occurs in great numbers in the undergrowth along the margin of thickets and may be collected by thousands in almost any suitable locality.

The larva is light yellow with a dark stripe on each side, a broad median stripe light, narrowing at tip of vertex and on last segment of abdomen. Eye black anteriorly and posteriorly with vertical yellow band including black dot. Beneath with eyes light greenish yellow, tips of tarsi black. Collected on hill near Salem N. Y., on Aug. 15, 1904.

Tettigonia tripunctata Fitch

Tettigonia tripunctata Fitch. Homop. N. Y. State Cab. 1851. p. 55
Not Tettigonia tripunctata Sign. Monogr. 175; Fowler, Biol. p. 253

In collections at Ithaca [Cornell Univ.], Albany, Mosholu and Phoenicia.

This is so distinct and well marked a species that it has never been in doubt and the types are still in fair state of preservation. The whitish color with light brown stripes and three conspicuous black dots on the head at once characterize it. While not an abundant species in collections it is pretty generally distributed and I secured specimens during August at Salem, Jamaica and Staten Island and Mr Barber has sent a specimen from Cold Spring Harbor.

DIEDROCEPHALA Spinola

Diedrocephala coccinea Forst.

Cicada coccinea Forst. Nov. Sp. Ins. 1781. p. 96
Tettigonia quadrivittata Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 312
Tettigonia picta Walk. Homop. 1851. 3: 158
Tettigonia teliformis Walk. Homop. 1851. 3: 764
Diedrocephala coccinea Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 177
Tettigonia quadrivittata Fowl. Biol. Homop. 1900. 2: 276, pl. 18, fig. 22

New York, Mosholu, Buffalo, Ithaca, Albany, Salem, Poughkeepsie, Wilmington, Saranac Inn, Lake Placid, Keene Valley, Forest Park. I took it at Hamburg, Nassau, Salem, Eagle Bridge,

Oyster Bay, Jamaica and Staten Island, mostly adults but a few larvae during 9th to 22d of August. Buffalo, "especially on blackberry bushes" [Van Duzee].

One of the most beautiful of the Tettigonids, having brilliant yellow color with bright red and blue or green stripes. An abundant species over the entire eastern United States and occurring on a variety of forest plants. The larvae are yellow with dark wing pads and found in July and August.

DRAECULACEPHALA Ball

Draeculacephala mollipes Say

Tettigonia mollipes Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 312
Tettigonia innotata Walk. Homop. 1851. 3: 770
Tettigonia antica Walk. Homop. 1851. 3: 771
Tettigonia producta Walk. Homop. 1851. 3: 772
Tettigonia acuta Walk. Homop. 1851. 3: 773
Acopsis viridis Prov. Nat. Can. 1872. p. 352
Diedrocephala mollipes Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 176
Tettigonia mollipes Fowl. Biol. Homop. 1900. 2: 273, pl. 18, fig. 15
Aulacizes lineata Fitch. Mss.
Draeculacephala mollipes Ball. Ia. Acad. Sci. Proc. 8

Hamburg, Buffalo [Van Duzee], New York [Fitch], New York city [Bueno], Albany Karner, Poughkeepsie [N. Y. State Mus.], Ithaca [Cornell Univ.], Phoenicia [Van Duzee].

I took it at Hamburg, Nassau, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Staten Island and it may be expected in all parts of the State.

An almost universal species, occurring in grasses and often in such numbers as to be an undoubted source of injury.

Draeculacephala angulifera Walk.

Tettigonia angulifera Walk. Homop. 3: 771
Diedrocephala angulifera Van Duzee. Ent. News. 5: 156
Diedrocephala sp. Southwick. Science. 19: 318
Draeculacephala angulifera Ball. Ia. Acad. Sci. Proc. 8: 69

Aside from records of "New York" given by both Van Duzee and the record by Mr Southwick, I know of no records for the State.

The species is larger than mollipes with a shorter, blunter vertex.

Draeculacephala novaeboracensis Fitch

Aulacizes novaeboracensis Fitch. Homop. N.Y. State Cab. 1851. p. 56
Tettigonia prasina Walk. Homop. 1851. 3: 768
Diedrocephala mollipes Prov. Pet. Faune Ent. Can. 1889. 3: 266
Diedrocephala novaeboracensis, Osborn & Ball. Ia. Acad. Sci. Proc. 1897. 4: 177, 189

Keene Valley, Lake Placid, Piseco lake, Nassau and Cold Spring Harbor.

I found it abundant at Salem in low sedgy localities and these specimens agreed perfectly with the Fitch specimens.

The types are well preserved.

Helochara communis Fitch

Helochara communis Fitch. Homop. N. Y. State Cab. 1851. p. 56
Tettigonia herbida Walk. Homop. 1851. 3: 769.

Swept at Salem, Aug. 15, 1904, in large numbers on swampy land. Adults and larvae also taken at Eagle Bridge and New York State Museum records show it for Albany, Nassau, Karner, Buffalo, Phoenicia, Kingston, Staten Island, etc. The types though faded are unmistakable.

This is a very widely distributed species and is certain to be found in every locality in the State where grassy swamp land is present. It doubtless serves to reduce the growth of the grass where it occurs since it frequently swarms in immense numbers but as it works on places having an abundance of moisture, the effects of the drain are not specially noticeable.

Eucanthus acuminatus Fabr.

Cicada acuminata Fabr. Ent. Syst. 1794. 4: 36, 40
Euacanthus orbitalis Fitch. Homop. N. Y. State Cab. p. 57
Euacanthus acuminatus Osborn & Ball. Ia. Acad. Sci. Proc. 4: 182

This insect has a wide distribution in Europe and America and no essential differences can be detected between the Old World form and ours described by Fitch under the name orbitalis. Van Duzee reports it for Lake Placid.

Xerophloea viridis Fabr.

Cercopis viridis Fabr. Ent. Syst. 1794. 4: 13, 50
Xerophloea grisea Germar. Zeits. F. G. Entom. I, 1901, 1839.
Xerophloea virescens Stal. Öfvers Vet. Akad's Förh. 1854. p. 30, 94
Xerophloea viridis Fabr. Stal., Hemip. Fabriciana. 2: 59
Parapholis peltata Uhler. U. S. Geol. & Geog. Sur. Bul. 1877. 3: 461
Xerophloea peltata Uhler. Stand. Nat. Hist. 1884. 2: 248
Xerophloea viridis Osborn & Ball. Ia. Acad. Sci. Proc. 4: 179

I have received specimens from Mr Bueno taken at Mosholu, July 26, 1902, and Mr Van Duzee reports it for Kingston.

It appears to be recorded so far only for the southern part of the State.

Xerophloea major Baker

Xerophloea major Baker. Psyche, 3: 285

A specimen referred here has been received from Mr J. R. de la Torre Bueno, collected at Mosholu near New York city; also a male and female from Cold Spring Harbor from Mr H. G. Barber.

Gypona octo-lineata Say

Tettigonia octo-lineata Say. Compl. Wr. 2: 257
Gypona striata Burmeister. Gen. Ins. pl. 16, no. 9
Gypona flavilineata Fitch. Homop. N. Y. State Cab. p. 57
Gypona quebecensis Provancher. Nat. Can. 4: 352
Gypona cana Burm. Gen. Ins. pl. 16, no. 10
Gypona flavilineata. Spangberg. Spec. Gyponae, p. 8

Reported for Mosholu, July 26, 1902 [Bueno], Keene Valley, Hamburg, Hope [N. Y. State Mus.].

A widely distributed and extremely variable species. Some of the forms seem fairly constant and have been named as distinct species with what propriety is still a matter of dispute. Salem, Hamburg, Jamaica, Karner.

Gypona bipunctulata Woodw.

Gypona bipunctulata Woodworth. Ill. State Lab. Nat. Hist. Bul. 3. 1887. p. 30(♀)

Gypona nigra Woodworth. Ill. State Lab. Nat. Hist. Bul. 3. 1887. p. 31 (♂)

Reported for Mosholu, Staten Island [Bueno].

Gypona melanota Spang.

Gypona melanota Spang. Spec. Gyponae. 1878. p. 23

Reported for Staten Island [Bueno].

This may be a melanotic form of bipunctulata Woodw. in which case this name has priority.

Gypona scarlatina Fitch.

Gypona scarlatina Fitch. Homop. N. Y. State Cab. 1851. p. 57; reprinted in Litner. 9th Rept. 1893. p. 397; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 197

This has been a rare species in recent years judging by the small number of specimens that have passed through my hands. Van Duzee mentions it for Buffalo as "Occasional on hickory trees through July and August."

Gypona rugosa Spangb.

Gypona rugosa Spangb. Spec. Gyponae, p. 6

One specimen swept from whortleberry bushes in pine barrens near Oyster Bay, Aug. 18, 1904, is referred to this species on the strongly rugose character of the elytral veins. The species was originally described from Mexico and the female measurements given as 9 mm for body, 12 mm with elytra. This specimen is smaller, 8 mm for body and 10 mm to tip of elytra.

Gypona geminata n. sp.

Similar to octolineata but without distinct stripes. Head shorter, color deep green, length of female 8.5-9 mm, male 8 mm.

Vertex twice as wide as length at middle, front nearly round or very faintly parabaloid, the ocelli situated at middle and as far from each other as from eye. Front depressed, clypeus scarcely longer than wide; pronotum nearly twice as long as vertex, hind border concave, surface whitish transversely striate except on anterior border; anterior femora beneath and outer portions of tibiae with series of strong setae. Scutellum of deep curved line; elytra opaque, clavus not reticulate but with series of punctures parallel to the veins, corium reticulate beyond apex of clavus. Costal border whitish.

Color deep green, slightly tinged with orange but without definite orange or red stripes; ocelli and eyes bright red, beneath uniformly green, tarsal claws embrowned.

Genital segment of female narrowed to apex, slightly longer laterally than preceding segment, posterior border concave, simple. Male valve not visible, plates slender, bluntly pointed, extending to tip of pygofer.

Specimens of this species were beaten from pinetrees at Oyster Bay, Long Island. They differ distinctly from octolineata and I have been unable to refer them to any described species and have therefore stated the distinctive characteristics under above name.

Genus PENTHIMIA Germ

Penthimia americana Fitch

Penthimia americana Fitch. Homop. N. Y. State Cab. 1851, p. 57; reprinted in Lintner. 9th Rep't. 1893. p. 397
Penthimia vicaria Walk. Homop. 1851. 3: 841 (♂)
Penthimia picta Prov. Nat. Can. 1872. 4: 352
Penthimia americana Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 197

This insect is noteworthy on account of its strong resemblance to species of the family Cercopidae. The color varies from red to black. It is seldom found in abundance but probably occurs in all parts of the State. Hickory, maple and other trees or shrubs are its food plants.

Family Jassidae

Genus STRONGYLOCEPHALUS Flor.

Strongylocephalus agrestis Fall.

Cicada agrestis Fallen. Acta. Holm. 1806. 27: 23
Selenocephalus agrestis Burm. Gen. Ins. 1. 1840. pl. 12
Strongylocephalus agrestis Flor. Rhynch. Livl. 1861. 2: 210
Strongylocephalus agrestis Van Duzee. Buf. Soc. Nat. Hist. Bul. 5, p. 197 (1894).

This is evidently very rare in New York as the only record of its occurrence is based on a single specimen collected by Mr Van Duzee "from a swampy meadow at East Concord, May 18, 1889."

Genus ACOCEPHALUS Germ.

Acocephalus striatus Linn.

Acocephalus striatus Linn. *See* Walker. Homop. 3: 848 for synonymy; Edwards. Lond. Ent. Soc. Trans. 1888. p. 19; Puton, Cat. Hemip. Palae. 1886. p. 79.
Acocephalus nervosus Schrank. Uhler. Stand. Nat. Hist. 1884. 2: 247

This is an Old World species and is credited to New York by Mr Van Duzee but without specific locality. I have specimens from Maine and it is recorded also for Canada.

Acocephalus flavostriatus Donov.

A. flavostriatus Donov. Brit. Ins. 1799
A. rivularis Germar. Mag. Ent. 1821. p. 89
A. flavostrigatus Sign. Essai sur le Jassides, p. 39

I took one specimen at Eagle Bridge, Aug. 13, 1904, and Mr Van Duzee has sent me a specimen which he secured at Phoenicia, Aug. 25, 1904.

It is a European species not hitherto recorded for America though I have a specimen from Dr C. M. Weed, collected at Woodstock Vt.

Acocephalus albifrons Linn.

Acocephalus albifrons Linn.
Tettigonia mixta Say. Acad. Nat. Sci. Phila. Jour. 1825. 4: 341; reprinted in Compl. Wr. 2: 258; Walker, Homop. 1852. 4: 1157 (mention)
Acocephalus mixtus Van Duzee. Psyche, 1890. 5: 390; Southwick, Science. 1892. 19: 318

This is another species distributed in both the old and new world but which has stood under separate names for the two regions.

It is quite dark and nearly black for the female, the male lighter brown with whitish or transparent spots in the elytra.

It has been recorded for New York city by Southwick and Buffalo by Van Duzee and collected at Salem [H. O.] Hamburg and Phoenicia [Van Duzee] and Cold Spring Harbor [Barber].

Genus XESTOCEPHALUS Van Duzee

Xestocephalus pulicarius Van Duzee

Xestocephalus pulicarius Van Duzee. Buf. Soc. Nat. Sci Bul. 5. 1894. p. 215.

Aside from the localities mentioned in the original description, Buffalo and New York city, this species has been collected at Jamaica and Phoenicia, in August.

It is doubtless generally distributed over the State in suitable localities where its food plant, Carex vulpinoidea, is present.

Xestocephalus fulvocapitatus Van Duzee

Xestocephalus fulvocapitatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 25

Van Duzee in his description records this species for Lancaster. "In company with the preceding (pulicarius) of which it may prove a variety."

Genus PARABOLOCRATUS Fieb.

Parabolocratus viridis Uhler

Glossocratus viridis Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 462
Parabolocratus viridis Uhler, Stand. Nat. Hist. 1884. 2: 247; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 198

Common over wide extent of United States. Recorded for vicinity of Buffalo and Jamaica [Van Duzee].

Genus SPANGBERGIELLA

Spangbergiella vulnerata Uhler

Glossocratus vulneratus Uhler. U. S. Geol. & Geog. Sur. Bul. 3, p. 464

Spangbergiella vulneratus Sign. Am. Soc. Ent. Fr. ser. 5, 9:274

Two specimens of this rare form have been noted in the National Museum labelled "N.Y." It is a southern species and while we might expect it to be found on Staten Island or Long Island it seems hardly probable that it will be found to occur further north.

Genus PARAMESUS Fieb.

Paramesus vitellinus Fitch

Acocephalus vitellinus Fitch. Homop. N. Y. State Cab. 1851. p. 57. reprinted in Lintner. 9th Rep't. 1893. p. 397; Van Duzee. Can. Ent. 1889. 91:9

Selenocephalus vitellinus Ashm. Smith, Ins. N. J. 1890. p. 445; Van Duzee. Psyche. 1890. 5:390

Parabolocratus vitellinus Southwick. Science. 1892. 19:318

Paramesus vitellinus Van Duzee. Am. Ent. Soc. Trans. 21:290

To the original description we may add that the species is to be distinguished from its allies by the bright fulvous color with yellowish transparent round spots and the short rather thick and scarcely notched median process of the last ventral segment in the female. It is a handsome species but usually rare. It was probably secured by Dr Fitch in the vicinity of Salem and Van Duzee has recorded it for Buffalo and reports it for Lake Placid.

Genus PLATYMETOPIUS Burm.

Platymetopius acutus Say.

Jassus acutus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6:306; reprinted in Compl. Wr. 1869. 2:382; Fitch, Homop. N. Y. State Cab. 1851. p. 62 (mention); reprinted in Lintner. 9th Rep't. 1893. p. 402

Platymetopius acutus Uhler. U. S. Geol. & Geog. Sur. Bul. 1877. 3:473; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Say's description of this species is quite accurate and fortunately no synonyms have been created.

It is an abundant species from Maine to the Rocky mountains and in New York has been recorded for Buffalo and collected the past summer at Karner [Felt], Salem, Eagle Bridge, Cold Spring Harbor and Jamaica by myself, Lake Placid, Phoenicia and Kingston by Van Duzee.

Platymetopius cuprescens n. sp.

Form of acutus, face entirely yellow, color more coppery, elytral spots less numerous or indistinct. Length of female, 5 mm.

Vertex long, acute, about twice as long as width between eyes, front long narrowed at apex, clypeus widening gradually from basal fourth. Pronotum about two thirds as long as vertex, hind border slightly emarginate, elytra flaring at tips, with a few hyaline spots near apex and in costal border.

Color. Vertex brownish with dark elytral area, a narrow wedge-shaped apical line and two narrow spots on the disk of vertex. Face entirely yellow, eyes brownish, pronotum coppery brown, a faint median line and lateral border yellowish. Scutellum brown with yellowish discal spots and two short parallel lines on apical portion. Elytra coppery with rather faint dark ramose lines and minute dots and reflexed veinlets fuscous, yellowish hyaline spots on base of apical cells, apex of anteapical cells. Costal space subhyaline, beneath yellowish with fuscous markings on abdominal segments and dots on tibiae.

Genitalia. Last ventral segment of female elongate, narrowed and rounded at apex with another prominent carina on posterior half, pygofers reaching nearly to tip of ovipositor.

A single specimen collected by Mr E. P. Van Duzee at Phoenicia N. Y. It resembles acutus in size and shape, the hyaline spots much less pronounced, lacks the brown borders of face and has a distinctly carinate female ventral segment. From latus Baker which it resembles in genital segment, it differs in being darker, more coppery, elytra more hyaline on costa, the profile of head not so curved.

Platymetopius frontalis Van Duzee

Platymetopius frontalis Van Duzee. Can. Ent. 1890. 22:112; Southwick, Science. 1892. 19:318; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 198

Platymetopius albopunctatus Fitch. Ms Ashm.; Smith. Cat. Ins. N. J. 1890. p. 445

Specimens have been noted in the collections for Poughkeepsie, Karner, New York city, Mosholu and Cold Spring Harbor. It was recorded for Buffalo by Mr Van Duzee who says: "With acutus, but much less abundant. June to Sep. most frequently on oak bushes." He reports it in 1904 from Phoenicia, Kingston and Staten Island.

Apparently much more abundant in recent years. Plentiful in 1904 on oaks. Probably a grass feeder but collecting on oaks at maturity.

It is readily separated from a c u t u s by the smaller size, darker color, and strong contrast of bright yellow front against the dark border of face. I collected it last summer at nearly every point where collections were made—Hamburg, Eagle Bridge, Nassau, Salem, Cold Spring Harbor, Jamaica and Staten Island and at all places it seemed more plentiful than a c u t u s. It must have been very rare to have escaped Dr Fitch's attention during his work a half century ago.

Platymetopius obscurus Osborn

Ohio Nat. 5: 274

Taken at Cold Spring Harbor August 1904.

Platymetopius angustatus n. sp.

Slender; light olivaceous green, length of female 4 mm.

Vertex acutely pointed nearly twice as long as width between eyes. Front very narrow, tapering to clypeus, long, slender, twice as long as wide, apex rounded, lorae, elongate nearly reaching margin of genae, pronotum strongly arched in front a little more than half as long as vertex, posterior margin slightly sinuate. Scutellum large, median impression deep, strongly curved, elytra truncate at apex, costal cells hyaline.

Color. Light greenish olivaceous somewhat tinged with cupreus; vertex with dusky lines somewhat diverging toward apex and front light yellowish green, more greenish at apex where there are three angular lines extending to border of the front; ocelli yellow, eyes black, pronotum greenish mottled with dusky, elytra greenish coppery with round hyaline spots in anteapical and apical cells; dorsum of abdomen black, margins yellow; costal cells hyaline, margined with black, beneath yellowish green, legs pale, base of spines and the tarsal claws dusky.

Genitalia. Last ventral segment of female rounded behind, pygofers reaching tip of ovipositor. What appears to be the male of this species collected at the same time and from the same trees differs from the above described in that the vertex is shorter, less acute, about 1½ times as long as width between the eyes, the angular lines on front somewhat less conspicuous. The color more inclined to yellowish. The pronotum, scutellum and elytra somewhat more coppery, the genitalia having the valve large, convex, posterior border angulate, plates triangular, short, about ½ length of pygofers. Length 3.75 mm. Described from one female and five male specimens beaten from pinetrees, Oyster Bay, Aug. 18, 1904.

Platymetopius fulvus n. sp.

Black, fulvous with scattered white spots on elytra. Length of female 5 mm, male 4.5 mm.

Vertex acute but not very long about $1\frac{1}{4}$ times as long as width between eyes and about equal to pronotum. Frontal sutures sinuous, clypeus about $1\frac{2}{3}$ times as long as wide. Pronotum slightly concave on hind border; scutellum with broad median impression.

Color. Vertex, pronotum, angles of scutellum and elytra bright fulvous with divergent lines on vertex. Five parallel lines on pronotum and numerous dots on elytra whitish. Central portion of scutellum yellow; costal cells hyaline or faintly whitish, beneath lighter, yellowish or pallid.

Genitalia. Last ventral segment of female elongate, posterior border rounded with small black spots close to hind border. Pygofer extending almost to tip of ovipositor, brown. Male valve triangular, hind border with distinct sharp angle.

Described from a number of specimens, 10 females and six males beaten from pine and huckleberry, Oyster Bay, Aug. 18, 1904. As all are adults it is impossible to determine the food plant with certainty though it seems likely that it is the huckleberry and that the individuals taken from pines were resting accidentally on the trees.

Deltocephalus sayi (Fitch)

Amblycephalus sayi Fitch. Homop. N. Y. State Cab. 1851. p. 61; reprinted in Lintner. 9th Rep't. 1893. p. 401

Jassus sayi Walker. Homop. 1852. 4: 1158

Deltocephalus sayi Uhler. U. S. Geol. & Geog. Sur. Bul. 4. 1878. p. 511; Southwick, Science. 1892. 19: 288; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Deltocephalus sayi Fitch. Van Duzee, Buf. Soc. Nat. Hist. Bul. 4, p. 198

Reported for Buffalo, Poughkeepsie, Otto, Karner, Lake Placid, Phoenicia and Kingston. I collected it in numbers at Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Staten Island.

Fitch's types are in fair preservation and represent the small and rather dark form of the species.

Deltocephalus sylvestris O. & B.

Deltocephalus sylvestris Osborn & Ball. Ia. Acad. Sci. Proc. 4: 213

Collected at Lake Placid by Mr Van Duzee.

Deltocephalus minki Fieb.

Deltocephalus minki Fieb Verh. Zool. Bot. Ges. in Wien. 1869 19: 217

Reported for Lake Placid [Van Duzee].

Hitherto recorded for Canada and Mr Van Duzee has specimens collected at Lake Placid in the Adirondacks determined by Mr Ball. I collected it at Salem, Eagle Bridge and Cold Spring Harbor.

Deltocephalus apicatus Osborn

Deltocephalus apicatus Osborn. Can. Ent.

This species was found in considerable numbers within a patch of grass (Panicum lanuginosum Ell.) a few rods square at Hamburg N. Y., Aug. 7. I also collected it at Salem at Fitch Point close to Fitch's home place and Mr Van Duzee reports it for Lake Placid.

Deltocephalus flavicosta Stal.

Deltocephalus flavicostatus Van Duzee. Can. Ent. 24: 116
Deltocephalus flavicosta Baker. Psyche 8: 117

This was found in considerable abundance at points where I collected and specially at Cold Spring Harbor, Salem, Eagle Bridge, Nassau and Jamaica.

The dark color with the bright yellow costal line is very distinctive for this species.

Deltocephalus areolatus Ball

Can. Ent. 31: 188

A specimen of this species has been sent to me in a collection of Jassids from Mr J. R. de la Torre Bueno collected in vicinity of New York city and I have one from Mr Van Duzee labelled Woodbine N. J.

Deltocephalus debilis Uhler

Deltocephalus debilis Uhler. U. S. Geol. & Geog. Sur. Bul. 1867. 2: 360; Van Duzee, Can. Ent. 1889. 21:11
Deltocephalus debilis Van Duzee. Buf. Soc. Nat. Hist. Bul. 4: 198

Reported for Lancaster, Buffalo and Colden, also Lake Placid [Van Duzee].

This is a low ground species and by no means uniform in its occurrence or distribution.

Deltocephalus compactus O. & B.

Deltocephalus compactus Osborn and Ball. Ia. Acad. Sci. Proc. 4: 217

Lake Placid, Phoenicia and Staten Island, collected by Mr Van Duzee. I took it at Cold Spring Harbor.

This is a very small species related to the southern weedi. It has now been recognized from the state of Washington to New York. The short, compact form, rather blunt head and mottled elytra are most apparent characters though in the latter point it resembles inimicus.

Deltocephalus obtectus O. & B.

Deltocephalus obtectus Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7: 78

Taken at Eagle Bridge, Hamburg and Salem.

This is the first time the species has been recorded from New York. It is however fairly common in certain grasses and on some hillside pastures was abundant enough to be considered an economic factor.

Deltocephalus configuratus Uhler

Deltocephalus configuratus Uhler. U. S. Geol. & Geog. Sur. Bull. 1871. 4: 511

Deltocephalus configuratus Van Duzee. Buf. Soc. Nat. Hist. Bul. 4: 198

Reported for Buffalo and the Adirondacks.

Van Duzee speaks of this as "a common meadow insect from May to August" but except at Hamburg, I found it rare or absent during this summer's trip.

Deltocephalus melsheimeri Fitch

Amblycephalus melsheimeri Fitch. Homop. N. Y. State Cab. p. 61

The Fitch type of this species in the New York State collection is a female in fair state of preservation. It measures 2.5 mm in length, is narrow, the head distinctly pointed, elytra transparent. The female ventral segment margin straight with no teeth or sinuation and very narrowly bordered with black. While much faded it furnishes structural characters of value. The specimens in the National Museum for this species consist of three examples, the first, bearing the original Fitch label "Amblycephalus melshemerii N.Y." is considerably broken with elytra and

end of abdomen present, the latter showing the female genitalia. Elytra are shorter than abdomen, rounded at apex, female segment truncate narrowly black on margin, (indistinct), size agreeing with other specimens. The second specimen bears the original label "var. A." and with added labels "Fitch's type," "Fitch's collection" is all gone but the abdomen. This shows the female ventral segment which is truncate, faintly sinuate with narrow black margin on middle. Fragments of elytra adhering to pin are shorter than abdomen. The third specimen is whole, in fair condition evidently remounted on paper point from the pinned specimen, labelled "Fitch type" "Fitch's collection." This measures nearly 3 mm to end of abdomen. The head is narrow, pointed as in the Albany specimen, elytral tip reaching end of abdomen, female ventral segment truncate with narrow black border. The whole form narrow. It appears to agree so far as parts are present to compare with the Albany specimen. The elytra are all hyaline slightly infuscated in the cells, specially bordering the veins.

I secured specimens at Eagle Bridge, Salem and other points that agree distinctly with these types. It appears from this comparison that the original melshemerii of Fitch is not the insect that has been placed under this name by Van Duzee and others although the description, except for length, would apply equally as well to both forms.

Deltocephalus affinis Gillette & Baker

Deltocephalus melsheimeri Van Duzee. Am. Ent. Soc. Trans. 21: 292

Deltocephalus affinis Gillette & Baker. Hemip. Colorado, p. 84

This species answers the brief description of melsheimeri perfectly except in the length. The type specimen of melsheimeri in the New York State collection is not only smaller than the average of this form but has a much narrower body and more pointed head as shown in the discussion of that species.

This is widely distributed in the State and during recent years has undoubtedly been a much more abundant species than melsheimeri. It is described fully under the name of melsheimeri in the review of Deltocephalus by Osborn and Ball.

Deltocephalus nigrifrons Forbes

Collected at Hamburg, Aug. 8, 1904, in abundance; also "rare at Lancaster, June to August 1887" [Van Duzee, Buf. Hemip. p. 194].

I have retained the name and limits adopted in the review of the genus Deltocephalus by Osborn and Ball, notwithstanding the difficulty that is felt in adopting this as final.

This has been recorded several times as occurring in immense numbers in oats, lawn grass, etc. but it seems as a rule most abundant in annual grasses like foxtail and panic grasses.

Deltocephalus inimicus Say

Jassus inimicus Say. Am. Acad. Nat. Sci. Phila. Jour. 1831. 6:305; reprinted in Compl. Wr. 1869. 2:382
Amblycephalus inimicus Fitch. Homop. N. Y. State Cab. 1851. p. 61; reprinted in Lintner, 9th Rep't. 1893. p. 401
Tettigonia inimica Walker. Homop. 1852. 4:1158
Deltocephalus inimicus Van Duzee. Can. Ent. 1889. 21:11; Southwick, Science. 1892.. 19: 288; Van Duzee, in Lintner 9th Rept. 1893. p. 410
Jassus 6-punctatus Prov. Nat. Can. 1872. 4:378
Deltocephalus inimicus Van Duzee. Buf. Soc. Nat. Hist. Bul. 4:199

Reported for Buffalo, Otto, Lake Placid, Phoenicia, Kingston and Karner. I collected it in numbers at Hamburg, Nassau, Salem, Cold Spring Harbor, Jamaica and Staten Island.

Taken everywhere that collections are made in grass land, at least where blue grass occurs. In many localities it becomes at times a serious pest in grass land and it has also been recorded as a pest in wheat fields.

Genus SCAPHOIDEUS

Scaphoideus consors Uhler

Scaphoideus consors Uhler. Md. Acad. Sci. Trans. 1. 1889. p. 56

Separated from scalaris by broader vertex. Uhler referred this species to New York, Maryland and Texas. It has been seldom noticed probably because of its limitation in food plant.

Scaphoideus sanctus Say ??

I mention under this name a specimen from Cold Spring Harbor sent me by Mr H. G. Barber which differs so much in size and genitalia that it can not be safely referred to either sanctus Say or fasciatus Osborn but still the elytral picture and general facies relates it closely to these species.

While additional specimens will in all probability show it to be distinct it seems undesirable to describe as new with but one sex and but one specimen of that in hand. As stated in my paper on "The Genus Scaphoideus" the real sanctus of Say is in some doubt."

Scaphoideus scalaris Van Duzee

Scaphoideus scalaris Van Duzee. Ent. Am. 6: 51

Reported for Phoenicia by Mr Van Duzee.

Scaphoideus luteolus Van Duzee

Scaphoideus luteolus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 210

This species was described from specimens taken near New York city and Anglesea N. J. It is closely related to immistus and either has been confused with that species or has been so rare as to escape notice.

Scaphoideus lobatus Van Duzee

Scaphoideus lobatus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 199

Described from specimen collected at Lancaster, Sep. 8 and has since been collected at Hamburg, Ithaca, Mosholu, Jamaica, Cold Spring Harbor and Poughkeepsie. A well marked species but so far noticed in very small numbers.

Scaphoideus auronitens Prov.

Scaphoideus auronitens Provancher. Pet. Faune Ent. Can. 1889. 3: 277; Van Duzee. Cat.; Am. Ent. Soc. Trans. 21: 301; Osborn & Ball, Ia. Acad. Sci. Proc. 4: 232 (record)
Scaphoideus auronitens Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 199; Osborn, Cin. Soc. Nat. Hist. 19: 194

Recorded for New York by Van Duzee and Osborn, definite records based on specimens in collection at Albany, Lancaster and Albion. I took it at Hamburg and Jamaica. Van Duzee reports it for Phoenicia also and Mr H. G. Barber has sent me a specimen labeled Cold Spring Harbor.

At Hamburg it occurred in numbers on Geranium robertsonium and it seems quite probable that this is its food plant. Larvae occurring on same plants and without much doubt the immature form of this species.

Larva. Head sharply pointed, body fusiform. Length 4.5 mm. Two triangular black spots near apex of vertex. Transverse quadrate spot on vertex, one anterior median, two lateral quadrate spots on pronotum, two on mesothorax, and two small narrow points on metathorax, orange red. Head and prothorax, front of head and metathorax, wing pads white. Abdomen fuscous, white points in series on segments 1–6. 4 and 5 with larger white patch in one specimen (more mature). Seventh segment ivory white above. Below whitish, eyes marked with black dots. Anterior margin of vertex and upper part of front bearing three black lines.

Scaphoideus jucundus Uhler

Scaphoideus jucundus Uhler. Md. Acad. Sci. Trans. 1. 1889. p. 34; Van Duzee, Can. Ent. 1889. 21: 11 (mention); Van Duzee, Am. Ent. Soc. Trans. 21: 300; Osborn, Cin. Soc. Nat. Hist. Jour. 19: 795

A specimen of this handsome species collected at Karner, Aug. 31, 1904 [N.Y. State coll.] Van Duzee mentions it as occurring in the vicinity of Buffalo.

Scaphoideus ochraceus Osb.

Scaphoideus ochraceus Osborn. The Genus Scaphoideus. Cin. Soc. Nat. Sci. Jour. 19: 202.

Reported for Gowanda by Mr E. P. VanDuzee.

Scaphoideus intricatus Uhl.

Scaphoideus intricatus Uhler. Trans. Md. Acad. Sci. 1: 34.

Collected at Albion by Mr E. P. VanDuzee.

Scaphoideus carinatus Osborn

Scaphoideus carinatus Osborn. Cin. Soc. Nat. Hist. Jour. 19: 201

This is a large and well marked species but evidently very rare as it has so far been noted for but three localities. Our New York record is based on a single specimen collected by Mr Van Duzee at Hamburg and one for Cold Spring Harbor [Barber] but it has been taken in New Hampshire and New Jersey and should occur in eastern New York.

Scaphoideus productus Osborn

Cin. Soc. Nat. Hist. Jour. 19: 200

A specimen of this species known hitherto only from Iowa, Kansas and Kentucky has been sent to me by Mr H. G. Barber, collected at "Cold Spring Harbor, July 25, 1900."

Scaphoideus immistus Say

Jassus immistus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 306
Scaphoideus immistus Uhler. Md. Acad. Sci. Trans. 1. 1889. p. 33.
Scaphoideus immistus Southwick. Science, 1892. 19: 288
Scaphoideus immistus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5. 1894. p. 190
Scaphoideus immistus Osborn. Cin. Soc. Nat. Sci. Jour. 19: 204

Collected at Hamburg, Eagle Bridge, Salem, Karner, Cold Spring Harbor and Jamaica. "Found most frequently on witch hazel and other bushes" Van Duzee, July to September. Reported also for Lake Placid, Phoenicia, Kingston and Jamaica by Mr Van Duzee.

This species presents great variability, and many of the variations seem to defy limitation, passing by such insensible grades as to make precise definition impossible.

Scaphoideus opalinus n. sp.

Belongs to immistus group and is possibly a rather extreme variety of that species although it has a broader, more robust appearance and the white is brighter, more milky, translucent. Gray; vertex, scutellum, two broad sutural spots of elytra and three roundish translucent spots bordering claval suture, opalescent white.

Length of female to tip of elytra 5. mm. Length of male to tip of elytra 4.75 mm.

Vertex subangulate about one and one half times as long at middle as next eye. Front narrowed below antennae, clypeus expanding from middle. Lores large, their borders almost touching margin of cheek. Pronotum broad, posterior border concave. Claval veins not very strongly recurved. Reflexed veins two or three, from anterior half of outer ante-apical cell.

Color. Grayish tinted with fulvous. Vertex ivory white crossed by a rather obscure brownish band. Prothorax with ivory white band between hind border of eyes. Scutellum polished ivory white, except outer angles which are black. Sutural border of clavus with broad circular milky or milky opalescent spots separated by a black bar on the slightly recurved claval vein and with a black spot anteriorly and posteriorly, the latter at the end of the clavus. The remainder of the elytra with fuscous, fulvous and milky white patches of general pattern of immistus.

Genitalia. Last ventral segment of female long, posterior borders, rounded, polished, black on apical portion. Male; valve short, rounded; plates short reaching a little more than half the length of pygofer, obliquely truncate, minutely ciliate.

This species was beaten from red cedar at Cold Spring Harbor and appears in some minute particulars to differ so distinctly from the varieties of immistus that it seems best to give it separate description. While there is little difference in genitalia or general color pattern, there is quite a marked difference in the width of the claval spots, angle of the claval vein, and shape of body as a whole. The two circular opalescent spots formed by the semicircles on each clavous present a quite distinctive picture.

Athysanus obsoletus Kirsch

Athysanus obsoletus Kirsch. Die Athysanus Arten v. Wiesb. 1858. p. 7

Athysanus obsoletus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Reported for Buffalo and Lancaster.

Athysanus venosus n. sp.

Robust, broad, elytra with very conspicuous pallid veins, apical cells nearly obsolete. Length of female to tip of ovipositor, 5 mm.

Vertex elongate, one and one third times as long at middle as at eye with a rather evident elevation paralleling the occiputal margin from front border of eye, vertex rounding uniformly on to front, front broad, full, tapering evenly to the apex which is slightly broader near base, clypeus slightly rounded. Pronotum short, about three times as wide as its length at middle, almost lunate in form, the scutellar margin distinctly concave, elytra short reaching base of sixth dorsal segment, subhyaline, veins very conspicuous, a second cross vein between inner fork of the ulna and the radial, five apical cells, four lying next the subtruncate apical margin much reduced, wings about three fourths length of elytra.

Color. Light brown faintly lined on vertex and mottled on pronotum and scutellum with gray, ocelli red, frontal arcs almost obsolete, the sutural lines of face a little more intense, claval suture brown, elytral veins whitish, a series of points at base of apical spines. The apical portions of tarsi, the tarsal claws, the hind border of the last ventral segment and margin of ovipositor blackish.

Genitalia. Last ventral segment of female twice as long as preceding one, slightly produced into a tooth at the lateral posterior angle and roundingly produced at the middle, pygofers tumid, very scantily ciliate, reaching to tip of ovipositor.

A single specimen of female collected by Mr E. P. Van Duzee at Lake Placid, Adirondacks. This species may be associated with the extrusus group, being very similar to extrusus in general shape, the vertex somewhat more produced and differing decidedly in the color and markings.

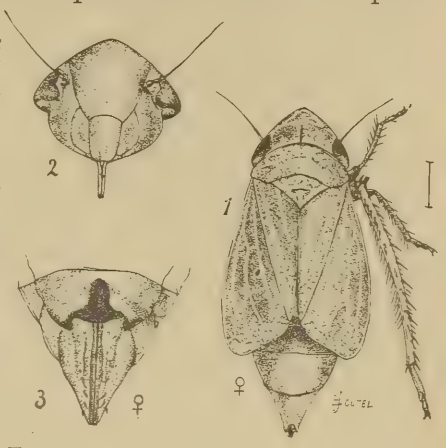


FIG. 22 Athysanus venosus Osb. 1=female dorsal view; 2=face; 3=female genitalia (Drawn by L. H. Joutel)

Athysanus extrusus Van Duzee

Athysanus extrusus Van Duzee. Can. Ent. 1893. 25:283
Athysanus extrusus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Reported for Mosholu [American Museum], Adirondacks, Portage Falls [Van Duzee].

Athysanus striola Fall.

Cicada striola Fall. Acta Holm. 1806. 27:31
Athysanus striola Van Duzee. Can. Ent. 1889. 21:11; Cat., p. 303 (Limnotettix)
Athysanus striola Osborn & Ball. Dav. Acad. Nat. Sci. 1898. Proc. 7:91, pl. 5, fig. 4
Limnotettix striola Van Duzee. Buf. Soc. Nat. Sci. Bul. b. 300

Collected at Buffalo and Phoenicia by Van Duzee. A specimen from Karner, Aug. 31, 1904 and I took one at Hamburg, Aug. 8, 1904. Widely distributed in Europe and North America.

Athysanus osborni Van Duzee

Deltocephalus osborni Van Duzee. Am. Ent. Soc. Trans. 1882. 19:309; Buf. Soc. Nat. Sci. Bul. 5, p. 198
Athysanus osborni Osborn & Ball. Ohio Nat. 2:249

Described from Lancaster N. Y. but apparently quite rare.

Athysanus simplarius O. & B.

Deltocephalus simplex Van Duzee. Am. Ent. Soc. Trans. 19: 305; Am. Ent. Soc. Trans. 21: 293
Athysanus simplarius Osborn & Ball. Ohio Nat. 2: 249

The record by Mr Van Duzee is the only one for the State.

Athysanus anthracinus Van Duzee

Athysanus anthracinus Van Duzee. Can. Ent. 1894. 26: 136

This species was described as from Iowa, Kansas and Colorado, Osborn and Ball record in addition District of Columbia, Mr Van Duzee reports it as collected at Lake Placid and I have specimens from Mr H. G. Barber collected at Woods Hole Mass. so it may be added to the New York fauna.

Athysanus plutonius Uhler

Jassus plutonius Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 47
Athysanus plutonius Prov. Pet. Faune Ent. Can. 1889. 3: 282
Athysanus plutonius Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Reported for Hamburg, Buffalo and Lake Placid [Van Duzee, Buf. Hemip. p. 199], Mosholu [Bueno]. A small black or nearly black species usually quite rare. I collected it at Jamaica.

Athysanus striatulus Fallen

Cicada striatula Hem. Suec. 1826. 2: 45
Athysanus instabilis Van Duzee. Can. Ent. 1893. 25: 284
Athysanus striatulus Osborn & Ball. Ohio Nat. 2: 242

"Size and form of preceding species, but darker and lacking tawny tinge, legs dark, femora twice annulate with pale. Length ♀ 4.5 mm, ♂ 4 mm; width, 1 mm."

Closely related to vaccinii and occurring in similar range in this country but also found in Europe. Recorded for New York by Osborn and Ball. One specimen long winged, Cold Spring Harbor.

Athysanus vaccinii Van Duzee

Athysanus striatulus Fall. (?) (or vaccinii nov.) Van Duzee. Am. Ent. 1890. 6: 134
Athysanus striatulus Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 1898. 7: 91, pl. 5, fig. 3.
Athysanus vaccinii Osborn & Ball. Ohio Nat. 2: 242

"Form and size of striatulus, but lighter colored. Smaller and narrower than symphoricarpae, which it approaches in color. Olive testaceous, darker below; the tips of the anterior and middle femora and all of the tibiae, orange. Length ♀ 4.5 mm, ♂ 4 mm; width 1 mm."

A rather common species and records for Karner and Poughkeepsie are based on New York State collection; Lake Placid, specimens from Van Duzee.

Athysanus curtisii Fitch

Athysanus curtisii Fitch. Homop. N. Y. State Cab. 1851. p. 61 reprinted in Lintner. 9th Rep't. 1893. p. 401
Tettigonia curtisii Walker. Homop. 1852. 4: 1159
Deltocephalus curtisii Prov. Pet. Faune Ent. Can. 1889. 3: 278
Athysanus curtisii Van Duzee. Psyche. 1890. 5: 290
Jassus nervatus Prov. Nat. Can. 1872. 4: 378
Athysanus curtisii Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 199

Records from Buffalo, Otto, New York city, Ithaca, Karner, Nassau, Clinton Heights, Warwick, Lake Placid, Kingston, Phoenicia, Staten Island.

I took it at Hamburg, Nassau, Eagle Bridge, Salem, Cold Spring Harbor and Jamaica.

A very common species specially in or near woodland where it thrives on grasses. The Fitch types are in fair condition and leave no question as to the species.

Genus DRIATURA Osborn & Ball

Driatura gammaroidea Van Duzee

Athysanus gammaroidea Van Duzee. Buf. Soc. Nat. Sci. Bul 1894. 5: 209
Driatura gammaroidea Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 7:89.

Taken at Cold Spring Harbor, Hamburg [O.], Jamaica and Mosholu [Bueno].

Originally described from Kansas. This species has not till recently been recognized from this State.

It is a small blackish insect with wide vertex, short elytra and extended ovipositor.

GENUS ATHYSANELLA Bak.

Athysanella acuticauda Baker

Psyche, 8: 187.

Reported for Lake Placid by Mr Van Duzee.

GENUS GONIOGNATHUS

Goniagnathus palmeri Van Duzee

Goniagnathus palmeri Van Duzee. Can. Ent. 1891. 23: 171

Specimens from Forest Park, L. I. collected by Mr J. R. de la Torre Bueno.

Described from North Carolina, distribution South. I have specimens from Greensburg Pa. collected by Rev. Modesto Wirtner.

Genus EUTETTIX Van Duzee

Eutettix seminuda Say

Jassus seminudus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 307, reprinted in Compl. Wr. 1869. 2: 383
Bythoscopus seminudus Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398

Thamnotettix seminudus Uhler. Stand. Nat. Hist. 1884. 2:246
Athysanus seminudus Van Duzee. Psyche. 1890. 5:389
Eutettix seminudus Van Duzee. Psyche. 1892. 6:307
Eutettix seminudus Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 191

I have seen specimens in collections for Hamburg, Ithaca, Albany, Nassau and New York city. It has been reported for eastern New York, Lancaster, Buffalo [Van Duzee, Buf. Hemip. p. 199] and I took it at Eagle Bridge, Salem, Cold Spring Harbor and Staten Island.

Eutettix cincta Osborn & Ball

Eutettix cincta Osborn & Ball. Dav. Acad. Nat. Sci. Proc. 1898. 7:97
Eutettix jucundus Van Duzee. Psyche. 1890. 6:307

A specimen of this species collected at Jamaica, Long Island by Mr Van Duzee. It has hitherto been recorded for Iowa, Texas and Washington D. C.

Eutettix lurida Van Duzee

Thamnotettix lurida Van Duzee. Can. Ent. 22:250
Eutettix lurida Van Duzee. Psyche, 6:307

Two specimens from Karner in the New York State collection. The species is probably rare or restricted to some particular food plant of restricted distribution.

Eutettix brunneus n. sp.

Approaching lurida in general pattern but with elytra more hyaline, head and pronotum darker and sutural spot less evident. Length female 6 mm, male 5 mm.

Vertex rounded in front, scarcely longer at middle, transverse furrows very indistinct, front narrowing rapidly to clypeus, clypeus long widening to tip, apex subtruncate, lores large, wider than

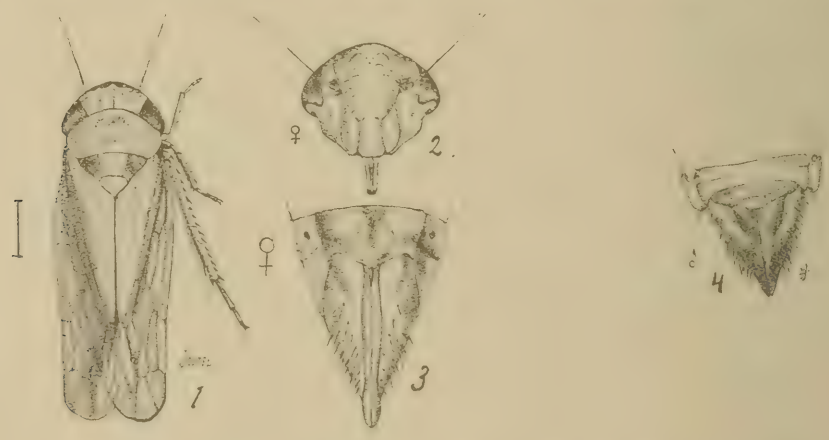


FIG. 23 Eutettix brunneus Osb. 1=female dorsal view; 2=face; 3=female genitalia; 4=male genitalia (Drawn by Joutel)

clypeus, pronotum about two and one half times as wide as length at middle, posterior border slightly concave. Elytra long, rather narrow distinctly flaring toward apex.

Color. Brown, vertex with lighter patches on occiput and interior margin. Front with about seven faint arcs, obsolete towards the center, sutural margins reddish, elytra subhyaline, tinged with yellowish brown infuscated toward the apex. A faint grayish spot on the sutual margins of posterior half of clavus. Legs with fine blackish lines, black dots at bases of spines.

Genitalia. Last ventral segment of female moderately long, simple, posterior border very faintly toothed at lateral angles and at middle. Dentated lateral margin and bidentated middle toothed. Male, valve short, broad, rounded behind, plates narrowing evenly to an acute apex, the margin rather densely ciliate.

Two specimens male and female from Mr E. P. Van Duzee, the former labeled Gowanda, Aug. 18, 1898, also one specimen, female apparently of the same species but with abdomen lost, labeled Karner, N. Y. from Dr E P. Felt.

Eutettix strobi Fitch

Bythoscopus strobi Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; N. Y. State Agric. Soc. Trans. 1857. 17: 739

Phlepsius strobi Van Duzee. Ent. Soc. Trans. 21: 249

Collected in eastern New York, [Fitch] Buffalo, [Van Duzee].

This species has suffered many generic changes due to its possessing in some degree characters relating it to many groups. While it shows some faint ramose lines on elytra, the character of the vertex and its general facies seem to place it more properly with the species included under Eutettix.

In Fitch's type the head is subangular, longer on middle than next the eye, narrower than pronotum, the transverse depression on vertex scarcely visible, no trace of irrorations on the elytra, the last ventral segment simple, very slightly convex, about twice as long as preceding.

Eutettix southwicki Van Duzee

Eutettix southwicki Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 209

Original description was from two male specimens taken near New York city by Mr Southwick.

A type specimen is in the Iowa State College and another in the Cornell University collection.

Eutettix johnsoni Van Duzee

Eutettix johnsoni Van Duzee. Can. Ent. 1894. 26: 137

This is a rather rare species originally described from the vicinity of New York and Philadelphia. I have seen specimens from Mosholu [Bueno]—June 28, 1902, and took it at Staten Island and Jamaica the past summer. It is fully described by Mr Van Duzee.

GENUS PHLEPSIUS Fieb.

Phlepsius humidus Van Duzee

Phlepsius humidus Van Duzee. Am. Ent. Soc. Trans 19:76; Southwick, Science. 1892. 19:288
Paraphlepsius ramosus Baker. Can. Ent.

The type of the species is from Buffalo and it has been collected also near New York city and at Phoenicia. It is a broad species, the margin of the head acute so that it bears some resemblance to the Acocephalids but in all other characters it is closely associated with the Phlepsids.

It is found in low ground and may be swept from rank growth along streams. According to Mr Van Duzee its host plants are Sagittaria and Polygonum.

Phlepsius nebulosus Van Duzee

Phlepsius nebulosus Van Duzee. Am. Ent. Soc. Trans. 1892 19:78

One specimen of female of this large and interesting species has been received from Harry G. Barber collected at "Cold Spring Harbor, L. I." Van Duzee gave its distribution as Dakota, Iowa (?), Mississippi and Florida. I have a specimen from Nebraska and males from Angelsea N. J., and Durham N. H. so it appears to be quite widely distributed.

Phlepsius apertus Van Duzee

Phlepsius apertus Van Duzee. Am. Ent. Soc. Trans. 1892. 19:76

Originally described from Canada. This species has been taken at Keene Valley, July 1898, [Felt] and Lake Placid [Van Duzee].

Phlepsius fuscipennis Van Duzee

Phlepsius fuscipennis Van Duzee. Am. Ent. Soc. Trans. 1892. 19:70, pl. 1, fig. 2; Southwick, Science. 1892. 19:287

Van Duzee cites "New York" as habitat for the species. I have seen specimens from Albany in the New York State Museum from Mr Bueno. Mr Southwick has also reported it.

Phlepsius fulvidorsum Fitch.

Jassus fulvidorsum Fitch. Homop. N. Y. State Cab. 1851. p.62. reprinted in Lintner. 9th Rep't. 1893. p. 402
Phlepsius fulvidorsum Van Duzee. Psyche. 1890. 5:390; Am. Ent. Soc. Trans. 1892. 19:74, pl. 1, fig. 10; Southwick, Science, 1892. 19:287; Van Duzee, in Lintner. 9th Rep't 1893. p. 410; Van Duzee, Buf. Hemip. p. 199

While the types of this species are too much changed for satisfactory comparison there is no doubt as to the correctness of Mr Van Duzee's reference and his full redescription furnishes a good basis for the identification of the species. The pronounced fulvous color of head, pronotum, and scutellum mark it off at once from other species.

Aside from Fitch's original locality, probably Salem, it has been recorded from Buffalo and vicinity, Colden, Lake Placid and Lancaster by Mr Van Duzee. His record that it occurs "always on hemlock, spruce or pines" seems to be supported by later collections.

Phlepsius incisus Van Duzee

Phlepsius incisus Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 73; Buf. Soc. Nat. Hist. Bul. p. 199

Specimens noted for Gowanda in addition to Buffalo and Lancaster. Previously recorded by Mr Van Duzee, also collected by him at Lake Placid in 1904.

Phlepsius irroratus Say

Jassus irroratus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 308; reprinted in Compl. Wr. 1869. 2: 1384; Fitch, Homop. N. Y. State Cab. 1851. p. 62; reprinted in Lintner. 9th Rep't. 1893. p. 402; N. Y. Agri. Soc. Trans. 856. 16: 449; Lintner. 1st Rep't. 1882, 133, (notice)

Allygus irroratus Uhler. Stand. Nat. Hist. 1884. 2: 245, fig 310

Phlepsius. irroratus Van Duzee. Am. Ent. 1890. 6: 93; Psyche. 1890. 9: 389; Am. Ent. Soc. Trans. 1892. 19: 71, pl. 1, fig. 6, 7, 21; Van Duzee, in Lintner. 9th Rep't. 1893. p. 410

Buffalo [Van Duzee], New York city [Bueno], Salem, Nassau, Cold Spring Harbor, Staten Island, Jamaica.

Abundant everywhere that collections have been made. Occurs on a wide range of plants and in a wide range of conditions.

Phlepsius majestus Osborn & Ball

A specimen of this interesting species has been received from Mr J. R. De La Torre Bueno, collected at Mosholu N. Y. Heretofore the species has been recognized from New Jersey, Iowa, and Ohio. It is very rare in collections due probably to the fact that it is extremely active and difficult to capture, often escaping from the net into which it may have been swept. It occurs on wet land being swept from the low vegetation but the particular food plant if it has a single host has not been determined. It is the largest and one of the most handsome species of the genus.

Phlepsius decorus Osborn & Ball

Phlepsius decorus Osborn & Ball. Ia. Acad. Sci. Proc. 1894. 4: 230

Evidently a rare specimen in the State as it has been collected only at Hamburg by Mr Van Duzee. It has been taken at Brockville Ont. by Mr Metcalfe, Aug. 23, 1903.

It occurs in moist locations and probably feeds on some of the coarse grasses but the particular species has not been determined.

Phlepsius excultus Uhler

Jassus excultus Uhler. U. S. Geol. & Geog. Sur. Bul. 3. 1877. p. 467
Phlepsius excultus Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 80, pl. 1, fig. 17

This species is included in the New York list on the authority of Mr Uhler. It has not come to light in any recent collections in the State that I have seen.

Thamnotettix kennicotii Uhl.

Thamnotettix kennicottii Uhl. Am. Ent. Soc. Proc. 1863. 2: 161
Thamnotettix kennicottii Uhler. Stand. Nat. Hist. 1884. 2: 246; Osborn, Ia. Acad. Su. Proc. 1, 1892. pt 2, p. 12; Van Duzee, Psyche. 1892. 6: 306

Reported for Buffalo Plains and Hamburg "on oak and hickory bushes" [Van Duzee, Buf. Hem: p. 200], also for 1904 from Lake Placid.

Thamnotettix belli (Uhl.)

Jassus belli Uhler. U. S. Geol. & Geog. Sur. Bul. 1877. 3: 471
Thamnotettix belli Van Duzee. Psyche, 6: 306

A single specimen in the New York State collection at Albany is referred here, though the genitalia do not agree well with Uhler's description.

Thamnotettix eburata Van Duzee

Thamnotettix eburata Van Duzee. Can. Ent. 1889. 21: 10 Am. Ent. Soc. Trans. 21: 301

Evidently rare and having its distribution northward.

Thamnotettix clitellarius (Say)

Jassus clitellarius Say. Acad. Nat. Sci. Phila. Jour. 1831. 6: 309; reprinted in Compl. Wr. 1869. 2: 384; Walker Homop. 1852. 4: 1164 (mention); Harris, Hitchcock Geol. of Mass. 1835. ed 2, p. 580; Smith, Cat. Ins. N. J. 1890. p. 446
Thamnotettix clitellarius Van Duzee. Psyche. 1893. 6: 306 (notice); in Lintner. 9th Rep't. 1893. p. 410

This has been very generally recognized over the country owing to its conspicuous appearance as well as its common occurrence on a variety of plants. New York collections have been noted for Albany, Highland, Clinton Heights, Poughkeepsie, Lake Placid, Phoenicia, Mosholu, Forest Park. I collected at it Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Staten Island the past summer.

Thamnotettix exquisitos n. sp.

Resembles clitellarius but is larger, the vertex distinctly angular, the sutural spot long and narrow, the frontal spots larger, closer together. A black spot at the base of antennae, the color

blackish, the female genital segment with broad triangular excavation within which the ligulate process shorter, not longer than segment. Length ♀ 6mm, ♂ 5.5mm.

Head broad, vertex about one and one half times as long at middle as at eye; subangulate, front narrowing evenly to clypeus, clypeus rounding at apex. Lores elongate, cheek rather broadly rounded at the sides, pronotum rather strongly arcuate in front, truncate behind.

Color. A deep fuscous black, vertex except at base, posterior part of pronotum, elongate spot on elytra, bright lemon yellow; costal half of elytra light yellowish, transparent, terminating abruptly and squarely near the apex; face and beneath light yellow; two conspicuous oval black spots just below the vertex almost meeting at the apex of the vertex. Small spot at base of antennae black.

Genitalia. Last ventral segment of female broad, with deep triangular excavation including a short ligulate process not reaching the hind border of the segment. Pygofers with rather coarse bristles, ovipositor reaching tip of pygofer and of the same color. Male valve small, plates elongate, triangular, acuminate, reaching beyond pygofer, the border ciliate.

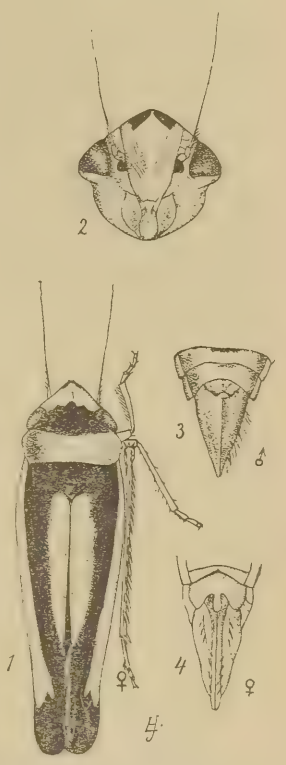


FIG. 24 Thamnotettix exquisitos Osb. 1=Female dorsal view; 2=face; 3=male genitalia; 4=female genitalia (Drawn by L. H. Joutel)

A number of specimens were collected in a deep wood in a boggy swamp in Hamburg N. Y. by Mr E. P. Van Duzee and myself. They occurred on underbrush but the particular food plant, if they are confined to a single species was not determined. The species has such a striking resemblence superficially to clitellarius that it is perhaps not strange that its distinctness has been overlooked. Moreover, it is very rare in collections and perhaps its occurrence in deep wood is responsible for this.

Three specimens of this species were observed also in Cornell University collection associated with clitellarius and a single specimen has stood for some years in the O. S. U. collection having been collected at Ithaca N. Y., by Mr J. S. Hine, This specimen bearing the determination of clitellarius by Mr Van Duzee.

The species may be at once separated by the genital character and furthermore by constant difference in shape of vertex, position of spots under vertex, shape of sutural spot and transparent costal area and blacker color.

The known distribution so far has been limited to the two points mentioned—Hamburg and Ithaca N.Y.

Thamnotettix fitchi Van Duzee

Thamnotettix fitchi Van Duzee. Am. Ent. 1890. 6:133
Cicadula 4-punctata Fitch, M. Insect Life. 1894. 6:267
Thamnotettix fitchi Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 200

Recorded for Buffalo [Van Duzee, Buf. Hemip. p. 200], Lancaster, Hamburg, Colden, New York. Specimens are in collections for Albion, Phoenicia and Staten Island. I collected it at Cold Spring Harbor. This is fully characterized by Mr Van Duzee in the original description. It is sometimes quite common but I have never known it swarm in such abundance as some of the species.

Thamnotettix decipiens Prov.

Thamnotettix decipiens Prov. Pet. Faune Ent. Can. 1890 3: 285.

Collected by Mr Van Duzee at Lake Placid.

Thamnotettix inornata Van Duzee

Thamnotettix inornata Van Duzee. Am. Ent. Soc. Trans. 1892. 19: 303
Thamnotettix inornata Buf. Soc. Nat. Sci. Bul. 5, p. 300

Aside from the type locality, Lancaster, Mr Van Duzee has taken this at Lake Placid and I took it at Salem.

Thamnotettix placidus n. sp.

Somewhat similar to inornata but distinctly more yellowish and with different genitalia. Length of female 5 mm.

Vertex rounded in front about one fourth longer at middle than at eye, front with lateral margins evenly curved, clypeus widening slightly toward tip, scarcely truncate, lores barely reaching margin of cheek, pronotum broadly rounded in front emarginate behind, elytra hyaline.

Color a rather deep straw yellow, a little more intense on the vertex and face and tip of pygofers, tip of ovipositors tinged with fulvus, margins of the abdominal segments tinged with fulvus, margins of the abdominal segments, sometimes most of the tergum blackish, tip of beak and a series of median and ventral spots black.

Last ventral segment of female emarginate, median border faintly striated, pygofers elongate reaching almost to tip of ovipositor with stiff setae, those toward tip stronger and tinged with fulvus.

Six specimens collected at Lake Placid by Mr E. P. Van Duzee. It differs from fitchii in the absence of any spots on the margin of the vertex and in the presence of black spots underneath and in the general color which, while hard to describe, is very evident in associated specimens. The shape of the genital segment is also different.

Thamnotettix infuscata Gill. & Bak.

Thamnotettix infuscata Gill & Bak. Hemip. Colo. p. 98.
Thamnotettix punctiscuta Gill & Bak. Hemip. Colo. p. 99.

Resembles Athysanus obsoletus in general shape but with a more produced vertex and very long elytra and wings, these extending considerably beyond end of abdomen. Length of female 5.5 mm.

Vertex produced, angulate in front, one and one half to one and three fourths times as long at middle as at eyes, margin rounded over to front. Front broad, nearly as wide at antennae as its length, broader at apex than at base of clypeus, clypeus narrowing slightly at apex, apex broadly rounded, lores ovoidal, not reaching border of genae, pronotum semicircular in front, slightly concave behind, elytra with conspicuous nervures, one cross vein between the fork of the radial and ulnar veins, apical cells well developed, very narrow appendix.

Color. Greenish olivaceous to brownish. The vertex, anterior border of pronotum, scutellum, and costal border of elytra mostly greenish yellow, posterior portion of pronotum and elytra except costal margin a rather translucent greenish gray, the elytra in some specimens deeply infuscated. Front yellowish gray with faint arcs, the sutural lines infuscated, those between the apical portion of the lores and clypeus sometimes broadening slightly to a fairly distinct spot, thorax and end of abdomen below mostly black, yellow margins, the legs greenish with fuscous points and tarsal claws, all the colors more intense in the male.

Genitalia. Last ventral segment of female moderately long, polished, truncate at apex, slightly, produced at lateral angles and faintly notched at middle, pygofers extending almost to tip of ovipositor, scantily clothed with short setae. Male, last ventral segment with yellowish border, the valve short, obtuse, angulate behind, blackish, the plates angulate narrowing gradually to an obtusely rounded tip.

Three specimens of this species collected by Mr E. P. Van Duzee at Lake Placid in the Adirondacks. I have also a specimen from Sault Ste. Marie collected by Mr H. M. Parish.

While very distant from the locality where this species was originally described the fact of its occurrence in the mountain region and the intermediate locality of Sault Ste. Marie indicates that it has a rather wide distribution in boreal regions. It was thought to be undescribed but there seems little doubt that it belongs to this species.

Thamnotettix melanogaster Prov.

Tassus melanogaster Prov. Nat. Can. 1872. 4:378
Thamnotettix melanogaster Prov. Pet. Faune Ent. Can. 1890. 3:284
Thamnotettix melanogaster Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 200

Occurs in low damp places on coarse grass or sedges. Hamburg.

Thamnotettix cyperaceus Osb.

Thamnotettix cyperaceus Osb. Ia. Acad. Sci. Proc. 5: 246

Collected at Hamburg by Mr Van Duzee, Aug. 8, 1904, the first instance of its occurrence east of its original locality in Iowa.

Genus CHLOROTETTIX Van Duzee

Chlorotettix unicolor Fitch

Bythoscopus unicolor Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; Walker, Homop. 1852. 4: 1161
Athysanus unicolor Southwick. Science. 1892. 19: 288
Chlorotettix unicolor Van Duzee. Psyche. 1892. 6: 306, 308. Lintner. 9th Rep't. 1893. p. 410
Chlorotettix unicolor Van Duzee. Buf. Hemip. p. 200

Specimens from Albany, Saranac Inn, Lake Placid, Keene Valley, Essex county, Phoenica, Cold Spring Harbor, Oyster Bay, Eagle Bridge, Salem, Jamaica, Staten Island; Mosholu [American Museum]. Probably described from specimen collected at Salem. Buffalo, June to August [Van Duzee, Buf. Hemip. p. 200.]

Chlorotettix tergata Fitch

Bythoscopus tergatus Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398; Walker, Homop. 1852. 4: 1161, (mention)
Athysanus tergatus Southwick. Science. 1892. 19: 288
Chlorotettix tergatus Van Duzee. Psyche. 1892. 6: 306, 309; Lintner. 9th Rep't. 1893. p. 410

Described from specimens probably collected at Salem and since recorded for Buffalo [Van Duzee, Buf. Hemip. p. 200] and New York city. I took it at Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica, Staten Island and have seen specimens in collections from Nassau, Karner, and Mosholu. It is a widely distributed species easily known by the smoky color with evenly rounded vertex.

Chlorotettix viridia Van Duzee

Chlorotettix viridia Van Duzee. Psyche. 1892. 6: 309; Weed, Can. Ent. 1892. 24: 278.
Athysanus viridius Southwick. Science. 1892. 19: 288

Mr Van Duzee reports it for Lake Placid, Jamaica and Staten Island and I collected two specimens at Jamaica, Aug 20 and Mr H. G. Barber sends me a specimen from Cold Spring Harbor.

Chlorotettix galbanata Van Duzee

Chlorotettix galbanata Van Duzee. Psyche. 1892. 6: 310
Athysanus galbanatus Southwick. Science. 1892. 19: 288

Occurs in southern part of the State, in vicinity of New York city. It is more abundant to south and west, I secured specimens at Salem and Nassau, and Mr Van Duzee reports collecting it at Jamaica and Staten Island.

Chlorotettix balli Osborn

Chlorotettix balli Osborn. Ia. Acad. Sci. Proc. 5:247

One specimen collected at Jamaica, Aug. 20. This species was described from Iowa and this is the first record east of the Alleghanies.

Chlorotettix lusoria Osborn & Ball

Thamnotettix lusoria Osborn & Ball. Ia. Acad. Sci. Proc. 1896. 4:226

This species resembles tergatus in color but is at once separated from that species by the more pointed head.

It appears to be rare in New York, only three instances of its occurrence, Lake Placid, Phoenicia, [Van Duzee] and Poughkeepsie, having come to my notice. Specimens in the Van Duzee collection and the State Museum.

Jassus olitorius Say

Jassus olitorius Say. Acad. Nat. Sci. Phila. Jour. 1831. 6:310
Coelidia olitaria Fitch. Homop. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398
Jassus (*sens. strict.*) olitorius Van Duzee. Psyche. 1890. 5:389; reprinted in Lintner. 9th Rep't. 1893. p. 410
Jassus subbifasciatus Say. Acad. Nat. Sci. Phila. Jour. 1831. 6:310
Coelidia subbifasciata Fitch. Homop. N. Y. State Cab. 1851. p. 58; reprinted in Lintner. 9th Rep't. 1893. p. 398
Jassus subfasciatus Southwick. Science. 1892. 19:288
Jassus olitorius Say. Van Duzee. Buf. Soc. Nat. Sci. Bul. 5:200

Reported for Karner, Staten Island, Aug. 15; Mosholu, Sep. 14, 1902 [Bueno]; Buffalo and Phoenica [Van Duzee]. Fitch records it for beech and raspberry. This is an abundant species found on various bushes and shrubs. I took it at Hamburg, Salem, Cold Spring Harbor and Jamaica.

Paracoelidia tuberculata Baker

Paracoelidia tuberculata Baker. Can. Ent. 1898. 30:292

I took a number of specimens by beating small pinetrees on the "barrens" near Oyster Bay.

The species is readily recognized by the prominence of the clypeus. Pine is evidently the host plant as I have never met it on other vegetation and Baker in his description states that the specimens from Baltimore [Uhler's] were taken on pine.

Cicadula 6-notata Fall.[1]

Cicada 6--notata Fallen. Acta Holm. 1806. 27:34
Cicadula 6-notata Southwick. Science. 1892. 19:288

This species common to Europe and North America has been noted for New York city, Karner, Poughkeepsie, Big Moose, Keene

[1] For full bibliography and synonomy consult Van Duzee's Catalogue, Jassoidea, North America, Am. Ent. Soc. Trans. 16: 307

Valley [N.Y. State col.] Lake Placid, Phoenicia, Kingston [Van Duzee] and I collected it at Hamburg, Eagle Bridge, Salem, Cold Spring Harbor, Jamaica and Nassau.

It is unquestionably a species of economic importance as it often swarms in grass land. It seems to favor the annual grasses rather than the perennials.

Cicadula slossoni Van Duzee

Cicadula slossoni Van Duzee, Can. Ent. 1893. 25: 281; Buf. Soc. Nat. Sci. Bul. 5, p. 200

Evidently a rare species as Van Duzee says "a single example of this pretty little species was taken by me at Lancaster, July 12, 1889." He reports taking it in August 1904 at Lake Placid and Phoenicia.

Cicadula variata Fall.

Cicada variata Fall. Acta Holm. 1806. 27: 34
Jassus variatus H. Sch. Nom. Ent. 1835. p. 70
Limotettix variata Sahlbg. Cicad. 1871. p. 250
Cicadula variata Fieb. Revue d. Ent. 1885. 4: 51; Van Duzee, Psyche. 1892. 6: 305
Cicadula variata Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 200

Reported for Lancaster. June to September [Van Duzee].

While by no means so abundant as 6-notata this species has a wide distribution and may doubtless be found in all parts of the State. I took it at Nassau in August and Mr Van Duzee at Lake Placid during the same month, also at Phoenicia.

Cicadula punctifrons var. americana Van Duzee

Cicadula punctifrons var. americana Van Duzee. Can. Ent. 1891. 23: 169; Buf. Soc. Nat. Sci. Bul. 5, p. 201

Recorded for Buffalo [Van Duzee], and specimens from "Keene Valley", "Essex Co.," are in the N.Y. State collection.

It occurs in abundance on low scrubby willows, usually most common on sandy margins of streams.

Cicadula punctifrons Fall.

Cicada punctifrons Fall. Hemip. Suec. Cicad. 1826. p. 42
Thamnotettix punctifrons Boh. K. Vet.—Akad. Handl. 1847
Jassus punctifrons Flor. Rhyng. Livl. 1861. p. 328
Cicadula punctifrons Fieb. Revue d. Ent. 1885. 4: 50. (For full synonomy *see* Van Duzee Catalogue.)

Represented for Ithaca [Cornell Coll.], Lancaster [Van Duzee, Buf. Hemip. p. 201]; one example [Van Duzee]

Apparently much less common than the variety listed below.

Cicadula lepida Van Duzee

Can. Ent. 1894. 26: 139

Described in part from a specimen collected in New York city.

Cicadula macgillivrayi Baker

Collected at Hamburg N. Y. by Mr E.P. Van Duzee.

Gnathodus punctatus Thunb.

Cicada punctata Thunb. Act. Ups. 1782. 6:21
Jassus punctatus Walk. Homop. 3:877
Gnathodus punctatus Fieb. Verh. Zool. Bot. Ges. in Wien. 16:505
Typhlocyba punctata, Prov. Pet. Faune Ent Can. 1890. 3:301
Typhlocyba vernalis Fitch, M. (*vide* Van Duzee)
Gnathodus punctatus Van Duzee, Am. Ent. Soc. Trans. 21:307

This abundant species has been taken at a number of points in the State; Ithaca [Cornell Univ.], Albany and Poughkeepsie [N.Y. State coll.]. I collected it at Hamburg and Jamaica in August and Mr Van Duzee reports it from Lake Placid, Phoenicia and Kingston.

Gnathodus impictus Van Duzee

Can. Ent. 1892. 24:113; Am. Ent. Soc. Trans. 21:307

Credited to New York in Van Duzee's Catalogue.

Gnathodus viridis n. sp.

Green, broader than punctatus; head less produced, not spotted. Length ♀ 4 mm.

Head slightly narrower than pronotum, slightly subangulate, rounded in front, scarcely longer at middle than at eye. Front broad, short; clypeus long slightly tumid. Pronotum wide, much rounded in front, hind border concave, elytra nearly hyaline.

Color green, elytra greenish, hyaline becoming transparent toward apex. Eyes, antennae, apex of beak, and tarsal claws touched with fuscous.

Female segment rather long, simple, truncate; pygofers with few bristles, ovipositor passing pygofer.

One specimen from Mr E. P. Van Duzee collected at Lake Placid, N.Y. "Summit." The clear green color and shape of pronotum are quite characteristic in this species.

Family TYPHLOCYBIDAE

Genus ALEBRA

Alebra albostriella Fallen

Cicada albostriella Fallen. Hemip. Suec. Cicad. 1829. p. 54
Typhlocyba albostriella Flor. Rhynch. Livl. 1861. p. 373, 382
Alebra albostriella Fieber. Kat. d. eur. Cicad. 1872. p.14
Typhlocyba aurata pallida, and binotata Walsh. Bost. Soc. Nat. Hist. Proc. 1864. p. 315
Alebra aurea, pallida, and binotata Woodworth. Psyche. 1889. 5:213
Erythroneura mali Provancher. Pet. Faune Ent. Can. 1890. 3:298
Alebra aurea Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, p. 201

Taken at Hamburg by Mr Van Duzee, who also reports taking the variety fulveola at Phoenicia, Kingston and Jamaica in August 1904.

Alebra fumida Gillette

Alebra fumida Gillette. U. S. Nat. Mus. Proc. 20: 714

Described from specimens taken at Ithaca.

Genus DICRANEURA

Dicraneura cruentata Gillette

Dicraneura cruentata Gillette. U. S. Nat. Mus. Proc. 20: 717

Recorded for Ithaca by Gillette.

Dicraneura communis Gillette

Dicraneura communis Gillette. U. S. Nat. Mus. Proc. 20: 718

Credited to Ithaca in Gillette's paper on the group, also collected at Lake Placid and Phoenicia by Mr Van Duzee.

Dicraneura Fieberi Löw.

Dicraneura fieberi Melichar. Cicadinen von Mittel-europa. 1896. p. 325

Recorded for Ithaca, July 25 and Aug. 28.

Dicraneura flavipennis Fabr.

Collected at Hamburg N. Y. by Mr E. P. Van Duzee.

Genus EMPOASCA

Empoasca obtusa Walsh

Reported for Phoenicia and Kingston by Mr E. P. Van Duzee.

Empoasca smaragdula Fallen

Cicada smaragdula Fallen. Hemip. Suec. Cicad. 1829. p.53
Typhlocyba smaragdula Flor. Rhynch. Livl. 1861. 2: 393.
Kybos smaragdulus Fieber. Verh. Zool. Bot. Ges. in Wien. 1866. 16: 508
Empoasca smaragdula Gillette & Baker. Colo. Agric. Exp. Sta. Bul. 31. 1895. p. 110

A common species throughout the State. I secured specimens at Hamburg and Salem.

Empoasca trifasciata Gillette

Empoasca trifasciata Gillette. U. S. Nat. Mus. Proc. 20: 726

Gowanda collected by Mr E. P. Van Duzee.

Empoasca atrolabes Gill.

U. S. Nat. Mus. Proc. 20:736

Mr Van Duzee reports collecting this species at Lake Placid.

Empoasca mali Le Baron

Tettigonia mali Le Baron. Prairie Farmer. 1853. 13:330
Empoasca mali Osborn. Ia. Acad. Sci. Proc. 1892. 2:12
Typhlocyba photophila Berg. Hemip. Argent. 1879. p. 273
Empoa albopicta Forbes. Ill. State Ent. Rep't 13. 1883. p. 181, pl. 14
Empoa scaalbopicta Woodworth. Psyche. 1889. 5:213; Van Duzee, Buf. Soc. Nat. Sci. Bul. 5, p. 201

A very abundant and destructive species over a large part of the United States. Recorded for vicinity of Buffalo.

Empoasca flavescens Fabricius

Cicada flavescens Fabricius. Ent. Syst., IV., Hafn., 1794
Chlorita flavescens Fieber. Kat. d eur. Cicad. 1872. p. 14
Empoasca flavescens Gillette. U. S. Nat. Mus. Proc. 20:745

Recorded for Ithaca and Mr Van Duzee reports it for Lake Placid.

Empoasca flavescens var. **birdii** Goding

Empoasca birdii Goding. Ent. News. 1. 1890. p. 123

Reported for Albany [N. Y. State coll.], also recorded for Ithaca [Gillette].

Empoasca alboneura Gill

U. S. Nat. Mus. Proc. 20:743

Reported for Jamaica by Mr E. P. Van Duzee.

Empoasca viridescens Walsh

Empoasca viridescens Walsh. Bost. Soc. Nat. Hist. Proc. 1864. 9:316
Empoasca consobrina Walsh. Bost. Soc. Nat. Hist. Proc. 1864. 9:316.
Empoasca viridescens Gillette. U. S. Nat. Mus. Proc. 15:747

Gillette records it for Ithaca. Van Duzee reports it for Phoenicia and Staten Island.

Genus EUPTERYX

Eupteryx vanduzei Gillette

Eupteryx vanduzei Gillette. U. S. Nat. Mus. Proc. 20:748

Described from specimens collected by Mr E. P. Van Duzee at Hamburg, who also collected it at Lake Placid.

Eupteryx nigra n. sp.

Above black except anterior portion of vertex and costal margin of elytra; below greenish white except pygofers which are smoky black. Length ♀ 3.75 mm.

Vertex produced, broadly subangulate, about half as long as pronotum; front moderately narrow, full, tapering to base of

clypeus; clypeus with sides nearly parallel narrowing at apex, about one and one third times as long as broad. Pronotum very convex in front, hind border truncate, costal apical cell very deep, extending half way across the elytron, central apical cell pedunculate, first sector evident on discal portion of elytron.

Color. Front part of vertex, all of face, thorax, legs and venter including last ventral segment of female greenish white. Costal border of elytra milky white, toward apex tinged with greenish. Posterior two thirds of vertex suffused with smoky brown, pronotum dead black, scutellum and all of elytra, except costal border, dark smoky brown or blackish, in one specimen showing faint lighter areas in apical portions of clavus and in apical cells.

Genitalia. Last ventral segment of ♀ broad, long, with hind borders evenly rounded, slightly tinged with yellowish; pygofers smoky black like the terga of abdominal segments, with a few marginal whitish cilia.

A specimen from Jamaica collected Aug. 20, 1904. I have also one specimen collected at Columbus O. Sep. 15, 1903.

Eupteryx flavoscuta Gillette

Eupteryx flavoscuta Gillette. U. S. Nat. Mus. Proc. 20: 749

Collected at Hamburg with the preceding, and also at Lake Placid and Phoenicia.

Genus TYPHLOCYBA

Typhlocyba coccinea Fitch

Empoa coccinea Fitch. Homop. N. Y. State Cab. 1851. p. 63; reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba coccinea Woodworth. Psyche. 1889. 5: 213

Dr Fitch described this as taken from pines.

Typhlocyba tricincta Fitch

Erythroneura tricincta Fitch. Homop. N. Y. State Cab 1851. 9: 63; N. Y. State Agric. Soc. Trans. 1856. 16: 392, 436. reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba tricincta Woodworth. Psyche. 1889. 5: 213

A common species occurring on a variety of plants. Fitch credited it to currant and raspberry, others have taken it on grape, elm etc.

Typhlocyba trifasciata Say

Tettigonia trifasciata Say. Acad. Nat. Sci. Phil. Jour. 1825; 4: 343
Typhlocyba trifasciata Woodworth. Psyche. 1889. 5: 213

Common everywhere on grape.

Typhlocyba tenerrima H. S.

Gillette. Nat. Mus. Proc. 20: 770

One specimen of this species has been sent to me by Mr E. P. Van Duzee who collected it at Lake Placid in the Adirondacks.

Typhlocyba obliqua Say

Tettigonia obliqua Say. Acad. Nat. Sci. Phila. Jour. 1825 4: 342
Erythroneura obliqua Fitch. Homop. N. Y. State Cab. 1851. p. 63; N. Y. State Agric. Soc. Trans. 1856. 16: 435; reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba obliqua Woodworth. Psyche. 1889. 5: 213

Another widely distributed species occurring on grape or other plants.

Typhlocyba comes Say

Tettigonia comes Say. Acad. Nat. Sci. Phila. Jour. 1825. 4: 343; reprinted in Compl. Wr. 1891. 2: 259.
Typhlocyba comes Woodworth. Psyche. 1889. 5: 213.
Erythroneura vitifex Fitch. N. Y. State Agric. Soc. Trans. 1856. 16: 392.
Typhlocyba vitifex Woodworth. Psyche. 1889, 5: 213.

Everywhere common on grape and occurring also in a large number of varieties the following being well marked and noted for New York, basilaris, vitis, and the typical form vitifex of Fitch, ziczac Walsh, rubra Gill, and 8-natata Walsh.

Typhlocyba vulnerata Fitch

Erythroneura vulnerata Fitch. Homop. N. Y. State Cab. 1851. p. 62; N. Y. State Agric. Soc. Trans. 1856. 16: 393; reprinted in Lintner. 9th Rep't. 1893. p. 402
Typhlocyba vulnerata Woodworth. Psyche. 1889. 5: 213

Abundant on grape vines and occurring everywhere that its food plant is found.

Typhlocyba querci Fitch

Empoa querci Fitch. Homop. N. Y. State Cab. 1851. p. 63; reprinted in Lintner. 9th Rep't. 1893. p. 403
Typhlocyba querci Woodworth. Psyche. 1889. 5: 214.

Fitch says, "On oaks, sometimes excessively numerous." An interesting variety with long dusky spots in outer ends of discal cells was sent to me by Mr Van Duzee, collected at Lake Placid.

The variety bifasciata Gill is reported by Mr Van Duzee for Lake Placid, Phoenicia and Kingston.

Typhlocyba ulmi Linnaeus

Cicada ulmi Linnaeus. Fauna Suecica. 1761. p. 900.
Anomia ulmi Fieber. Kat. d eur. Cicad. 1872. p. 15
Typhlocyba ulmi Puton. Cat. Hemip. Palae. 1886. p. 88

Gillette says, "I received a good many males and females of this species from Dr Lintner labelled, 'Albany, N.Y., 1886.'"

Typhlocyba rosae Linnaeus

Cicada rosae Linnaeus
Typhlocyba rosae Tollin. Ent. Zeit. v. Stett. 1851. p. 67
Tettigonia rosae (Harris) Harris. Ins. Inj. to Veg. ed. 2. 1852. p. 192
Typhlocyba rosae Woodworth. Psyche. 1889. 5: 214

Abundant everywhere on roses and other plants.

Typhlocyba illinoiensis Gillette

Collected at Hamburg N. Y. by Mr E. P. Van Duzee.

LIST OF HEMIPTERA TAKEN IN THE ADIRONDACK MOUNTAINS

BY E. P. VAN DUZEE

During the past summer I had occasion to spend a few days collecting Hemiptera about Lake Placid in the Adirondacks and at the suggestion of Dr E. P. Felt I have gotten together some brief notes on these, incorporating with them a few observations I made in one day's collecting on the grounds of the Lake Placid Club, Sep. 22, 1902, and adding the Hemiptera recorded from Axton by Professor MacGillivray.[1] My collecting at Lake Placid the present season [1904] was included between Aug. 10 and 15 and embraced the following localities: one hour's work near the railway station at Saranac Lake Junction between 7 a.m. and 8 a.m. while waiting for a train; one day's work along the borders of a swampy woods immediately before the Isham House; one day on and about Cobble hill, a rocky and partially wooded elevation of about 600 feet behind the Forest View House; one day and a half in the deep rich woods and along the road between Isham's and Wilmington Notch extending as far east as the bridge over the Ausable river; a little work in and between showers in the woods about "Balance rock;" and one half hour spent on the bald summit of Mt Whiteface with a few things taken along the trail on its slopes. The weather was generally cold and rainy and much of my work was done in a chilling mist driven by a cold north wind. With warm sunny weather the results of the six days spent there would certainly have been very different. As it was I took some interesting forms among which were four that Professor Osborn considers new, the descriptions of which he will publish shortly, and three or four others that may prove to be still undescribed.

A comparison of this list with the *List of the Hemiptera of the Muskoka Lake District of Canada* published by me in the *Canadian Entomologist* for 1889 will show that the faunas of these regions are very similar and differ from that of western New York mostly by the presence of such species as Oncometopia costalis, Philaenus lineatus, and Homoemus aeneifrons, species characteristic of a region of rocks and sand.

[1]Ent. News. 14: 263. 1903.

There is still much work to be done before we can form any very accurate estimate of the insect fauna of our own State. Certain portions have been fairly well worked and a few faunal papers have been published giving the results of such work. Of the hemipterous fauna even less is known than of some of the other insect orders. Four papers on the New York hemipterous fauna have appeared: Fitch's *Catalogue of the Homopterous Insects in the New York State Cabinet of Natural History*, published in 1851; my own *List of the Hemiptera of Buffalo and Vicinity*, published in the bulletin of the Buffalo Society of Natural Sciences, 1894, v.5; Dr Southwick's *Notes on Local* [New York city] *Jassidae, Bythoscopidae, Cercopidae, Membracidae, and Fulgoridae* published in volume 19 of *Science;* and lastly the few hemiptera included in the list of insects taken in the Adirondack mountains by Prof. A. D. MacGillivray and C. O. Houghton, in volumes 13 and 14 of *Entomological News*. Dr Fitch's paper is one of the most valuable contributions to our knowledge of the North American Homoptera and is indispensable to the student on account of the many new species described. My own paper lists 381 species and does not include the Psyllidae, Aphididae or Coccidae.

A few lists of Hemiptera from regions adjacent to New York State have been published and will be useful by way of comparison with our own fauna. Among these may be mentioned the following:

Harris. List of Insects. Hitchcock's Report on the Geology, Mineralogy, Botany and Zoology of Massachusetts, 1835. ed. 3.

Rathvon. List of Insects. Mombert's History of Lancaster Co., Pa. 1869.

Provancher. Petite Faune Entomologique du Canada. 1886–90. v. 3, Les Hemipteres.

Van Duzee. List of Hemiptera from the Muskoka Lake District, Canada. Can. Ent. 1889, v. 21.

Smith. Catalogue of the Insects found in New Jersey. 1900. ed. 2.

Harrington. Fauna Ottawaensis, Hemiptera. Ottawa Nat. 1892. v. 6; 1894. v. 8.

Slosson. Lists of Insects Taken in the Alpine Region of Mt Washington. Ent. News. 1894. v. 5; sup. in subsequent volumes.

Osborn. List of the Hemiptera of Ohio.

Published quite recently. I have not yet seen this paper but understand that it is a preliminary list merely.[1]

[1] Since this paper was prepared a *Preliminary List of the Hemiptera of Western Pennsylvania* by P. M. Wirtner has appeared in v. 3, no. 1, of the *Annals of the Carnegie Museum*. This list enumerates 416 species and is well up to date in its nomenclature. It is the best local list of the North American Hemiptera that has yet appeared so far as I am aware.

Of the papers here enumerated that by MacGillivray and Houghton is the only one treating of the hemipterous fauna of the Adirondack region, and the few species there listed have been included in the present list. Further collecting in this wild and mountainous portion of our State will certainly add many species to the present very imperfect enumeration of its interesting hemipterous fauna, especially among those forms that are characteristic of the Canadian region. This list is published with a full appreciation of its fragmentary character but with the belief that it will make a useful addition to our knowledge of the hemipterous fauna of New York State.

PENTATOMIDAE

Homoemus aeneifrons Say. This insect proved to be very generally distributed and common in the Adirondacks where there were low marshy spots with carices intermixed with the swamp grasses. I took the young with the adults on a species of Scirpus on the summit of Cobble Hill. On Sep. 22, 1902, I found them equally abundant but then all seemed to have reached maturity.

Sehirus cinctus P. B. I took this species occasionally wherever I collected about Lake Placid but in one field immediately behind the Isham House I found them in unnumbered thousands. The weather was cold and when the sun would shine these insects, at that time [Aug. 12] mostly in the larval state, would gather in dense masses as large over and as thick as one's hand, on the sides of logs and stones or wherever the bare ground would draw the heat of the sun. A week later these larvae were rapidly reaching the adult state. I found the food plant of this species was a low hirsute labiate plant called "horse nettle" by the farmers about there.

Euschistus fissilis Uhler. Recorded from Axton by Professor MacGillivray.

Euschistus tristigmus Say. Also taken by Professor MacGillivray at Axton. I saw numbers of the young of this and other pentatomids while collecting in August but the season was not far enough advanced for me to obtain the adults.

Coenus delius Say. Taken at Axton by Professor MacGillivray.

Neottiglossa undata Say. I captured this species along the road toward Wilmington Notch. In determining the material taken by Professor MacGillivray I inadvertently wrote Mormidea undata and the species was so entered in his list.

Cosmopepla carnifex Fabr. Taken at Axton by Professor MacGillivray.

Podisus sereiventris Uhler. One fine large specimen of this species was taken on the grounds of the Lake Placid Club on Aug. 15. It was also taken by Professor MacGillivray at Axton.

Podisus maculiventris Say. This species and the next were among the material taken at Axton by Professor MacGillivray.

Podisus modestus Dallas. With the preceding.

Acanthosoma lateralis Say. I took a few examples of this species in beating trees. Professor MacGillivray seems to have found it more abundant at Axton.

Acanthosoma cruciata Say. Taken by Professor MacGillivray at Axton.

COREIDAE

Protenor belfragei Haglund. Taken in numbers on a tall coarse grass by the Wilmington road near the Ausable river.

Corizus novaeboracensis Sign. Not uncommon in the fields about the Lake Placid Club grounds, Aug. 12 and Sep. 22.

Corizus nigristernum Sign. Common everywhere.

LYGAEIDAE

Nysius angustatus Uhler. Common August 1904 and September 1902.

Nysius sp. One example taken near the Ausable river of a species I have not yet been able to determine.

Ischnorhynchus resedae Panzer (**didymus** Zett.) Taken at Saranac Lake and elsewhere.

Phlegyas abbreviatus Uhler. Taken at Axton by Professor MacGillivray. This species is certainly quite distinct from annulicrus Stal which is a more western form occurring from Kansas through the Rocky mountain region.

Cymus angustatus Stal. Common.

Cymus claviculus Fallen. I took this species on the bald summit of Mt Whiteface and found it abundant on the lower levels, August and September.

Ligyrocoris sylvestris Linn. Taken on the summit of Mt Whiteface and abundantly everywhere in the fields about Lake Placid.

Ligyrocoris contracta Say. Less abundant than sylvestris. This insect is hardly distinguishable from that determined by me as Ligyrocoris balteatus Stal in Dr Skinner's list of insects taken at Beulah N. M. If that determination was correct Stal's species may have to fall as a synonym. The species I identify as Say's constricta is a Pamera (according to Heidemann) proportionately longer and more slender than Perigenes fallax Heid. I have taken it about Buffalo and at Phoenicia in the Catskills.

TINGIDAE

Corythuca juglandis Fitch. Taken occasionally.

Physatochila plexa Say. Taken by Professor MacGillivray at Axton.

ARADIDAE

Aradus 4-lineatus Say. One young example of the species that passes for 4-lineatus was taken on Cobble Hill.

Aradus niger Stal. I captured an immature example of this species in the dense woods near the Ausable river. I have already recorded the occurrence of this species about Buffalo [Ent. News, 13: 23] and Mr Heidemann records its capture at Washington D. C. and Kirbyville Tex. Stal described it from South Carolina.

Aradus abbas Bergr. Taken at Axton by Professor MacGillivray.

HYDROMETRIDAE

Rhagovelia obesa Uhler. Taken in numbers from the surface of the Ausable river beneath the Wilmington road bridge.

Microvelia americana Uhler. From the pond in the golf links of the Lake Placid Club. Also taken from a small ditch of running water near the Ausable river.

GERRIDAE

Hygrotrechus remigis Say. Lower slopes of Mt Whiteface. Also recorded from Axton by Professor MacGillivray.

REDUVIDAE

Coriscus ferus Linn. Common.

Coriscus rufusculus Reut. Taken at nearly all stations.

Coriscus inscriptus Kirby. This species was amongst the material taken by Professor MacGillivray at Axton.

Coriscus vicarius Reut. Numerous brachypterous examples and one fully winged one were taken by me from the rank vegetation growing in the low swampy woods along the road from Isham's to the Ausable river. I also took it in a tamarack swamp near Lake Placid in September 1902.

Coriscus subcoleoptratus Kirby. Recorded from Axton by Professor MacGillivray.

Sinea diadema Fabr. Not uncommon.

SALDIDAE

Salda pallipes Fabr. Common.

Salda deplanata Uhler. Taken at Axton by Professor MacGillivray.

ANTHOCORIDAE

Anthocoris musculus Say. Common.

Anthocoris sp. Two examples taken on the golf links of the Lake Placid Club.

Piezostethus galactinus Fieb. Lake Placid, Sep. 22, 1902.

Triphleps insidiosus Say. Taken on the summit of Mt Whiteface.

CAPSIDAE

Trigonotylus ruficornis Fallen. Common.

Leptopterna dolobrata Linn. Another common species.

Miris affinis Reut. Abundant here as elsewhere.

Miris rubellus Uhler. Taken about the Lake Placid Club grounds as well as on my former visit in September 1902. This species seems to grade into the darker specimens of affinis.

Collaria meilleuri Prov. Common, August and September.

Lopidea media Say. Occasional.

Diommatus congrex Uhler. I have taken this on willows both here and at Buffalo.

Cyrtorrhinus marginatus Uhler. One example taken near the Ausable river.

Phytocoris eximus Reut. Taken on the summit of Mt Whiteface and common elsewhere.

Phytocoris breviusculus Reut. From the Lake Placid Club grounds.

Compsocerocoris annulicornis Reut. Taken on Cobble Hill.

Neurocolpus nubilus Say. Not uncommon.

Calocoris rapidus Say. Taken on the summit of Mt Whiteface and elsewhere.

Calocoris tinctus Uhl.? From Cobble Hill and vicinity.

Melinna modesta Uhler. Swept from bushes in low woods near the Ausable river.

Lygus pratensis Linn. Common everywhere.

Lygus pabulinus Linn. Generally distributed in wooded areas.

Lygus invitus Say. Common.

Lygus invitus Say var. Summit of Mt Whiteface and in wooded places about Lake Placid. This is a rather larger form than invitus, and stouter built and more deeply colored.

Lygus sp. nov. Taken on the golf links.

Lygus hirticulus Uhl. M. S. Several taken in the dense woods along the valley of the Ausable river.

N. gen. et sp. near **Neaborus.** Three examples from near the Ausable river.

Poeciloscytus unifasciatus Fabr. Taken in the heavy woods along the Wilmington road.

Poecilocapsus lineatus Fabr. Occasional.

Systratiotus venaticus Reut. Not uncommon. A variety with the cuneus black occurred in the low lands near the Ausable river.

Camptobrochis grandis Uhler. Common. August to September.

Camptobrochis nebulosus Uhler. Generally distributed and moderately abundant.

Labops hesperius Uhler. Taken at Axton by Professor MacGillivray.

Monolocoris filicis Linn. Common on ferns in woodlands here as elsewhere.

Hyaliodes vitripennis Say. Beaten from bushes near Saranac Lake Aug. 10.

Sthenarops malina Uhler. Taken on the rank vegetation near the Ausable river.

Pilophorus clavipes Uhler. M. S. Swept from low huckleberry bushes on the summit of Mt Whiteface and of common occurrence elsewhere on pine trees.

Stiphrosoma stygica Say. Common.

Stiphrosoma croseipes Uhl. One example from near the Ausable river.

Halticus apterus Linn. From woodlands near the Ausable river.

Mecomma gilvipes Stal. Taken in numbers in the open swampy woods on the bottom lands along the Ausable river.

Dicyphus famelicus Uhler. Reported from Axton by Professor MacGillivray.

Dicyphus agilis Uhler. From the summit of Mt Whiteface and not uncommon elsewhere.

Diaphnidia pellucida Uhler. Common on trees.

Rhinocapsus vanduzei Uhler. Beaten from red raspberry bushes among the rank vegetation in open swampy woods near the Ausable river. About Buffalo and wherever else I have taken this pretty species it has always been in just such humid and shady situations. At Buffalo it is most abundant about the first week in July.

Orthotylus chlorionis Say. Common.

Dichrooscytus elegans Uhler. Taken on cedar bushes here as elsewhere.

Plagiognathus obscurus Uhler. Taken on the summit of Mt Whiteface and abundant at lower levels.

Plagiognathus politus Uhler. Common.

Plagiognathus fraternus Uhler. Captured near Isham's.

Chlamydatus pulicarius Fallen. Common. In using this name in place of Agalliastes I follow Hüeber's *Catalogue* as the most convenient accessible authority.

Psallus n. sp. Captured on the golf links.

NOTONECTIDAE

Notonecta undulata Say. Dredged from the pond in the golf links.

Buenoa platycnemis Fieb. One example taken with the preceding species.

CORIXIDAE

Corixa sp. One small Corixa was taken in the pond with the foregoing species.

HOMOPTERA

MEMBRACIDAE

Campylenchia curvata Fabr. Rich woods near the Ausable river.

Ceresa turbida Godg. Varying in color from green to almost uniformly black. It was common on willows and alders. Professor Osborn has informed me that he has redescribed this species as Ceresa melanogaster in Bul. Nat. Hist. Lab. Iowa State Univ., Jan. 1893. 2:290.

Ceresa diceros Say. On elder bushes, occasional.

Stictocephala lutea Walk. Taken at Axton by Professor MacGillivray.

Carynota marmorata Say. One example taken near the banks of the Ausable river.

Telamona reclivata Fitch. Cobble Hill. One example beaten from a Cottonwood tree.

Telamona sp. One individual taken in the woods near the Ausable river.

FULGORIDAE

Scolops sulcipes Say. Taken on the summit of Mt Whiteface and elsewhere.

Cixius coloepium Fitch. Taken on the summit of Mt Whiteface and common everywhere on huckleberries, August and September.

Cixius stigmatus Say. Taken with the preceding in numbers.

Megamelus notulus Germ. Sep. 22, 1902, on the grounds of the Lake Placid Club.

Pissonotus dorsalis VanD. Swept from weeds.

Stenocranus dorsalis Fitch. Swept in numbers from a swampy spot Sep. 22, 1902.

Laccocera vittipennis VanD. Taken by me on Cobble Hill and at Axton by Professor MacGillivray.

Liburnia pellucida Fabr. One male taken on the slopes of Mt Whiteface.

Liburnia puella VanD. Taken with the preceding.

Liburnia laminalis VanD. A female taken on the summit of Mt Whiteface has the venter black.

Liburnia lutulenta VanD. Very abundant everywhere. I took one macropterous male with the abdomen mostly black.

Liburnia campestris VanD. I captured a single example of this tiny species near Isham's. It however is doubtless abundant in the Adirondacks.

Lamenia vulgaris Fitch. Not common.

Bruchomorpha oculata Newmn. Generally distributed throughout the district collected over, and taken on Sep. 22, 1902.

Peltonotus histrionicus Stal. Cobble Hill, one example. Also taken on the club grounds on Sep. 22, 1902.

CERCOPIDAE

Lepyronia 4-angularis Say. Common.

Aphrophora 4-notata Say. Occasional.

Philaenus lineatus Linn. Summit of Mt Whiteface. Also taken in abundance everywhere I have collected in the Adirondacks.

Clastoptera obtusa Say. Common.

Clastoptera proteus Fitch. Swept from a Cornus bush by the Wilmington road on the banks of the Ausable river.

TETTIGONIDAE

Oncometopia costalis Fabr. Common everywhere with its young.

Tettigonia gothica Sign. Another common species. This is the insect listed as Tettigonia hieroglyphica by Harrington from Ottawa, by Provancher from Quebec, and by myself from Muskoka and Buffalo N.Y.

Diedrocephala coccinea Forst. Rich woods near the Ausable river, and on the club grounds, Sep. 22, 1902.

Draeculacephala mollipes Say. Common. Prof. E. D. Ball has established the genus Draeculacephala for those species of the old genus Diedrocephala that have the head more pointed.

Draeculacephala novaeboracensis Fitch. Abundant in places.

Helochara communis Fitch. I noted the occurrence of this common insect during my collecting about Lake Placid.

Eucanthus acuminatus Fabr. (**orbitalis** Fitch). A few examples were taken in open woods on the slopes of Mt Whiteface and on Cobble Hill.

Gypona quebecensis Prov. Taken in the woods near Isham's.

BYTHOSCOPIDAE

Bythoscopus cognatus VanD. A few taken on Cobble Hill.

Bythoscopus minor Fitch. One example from the low woods along the Ausable river.

Bythoscopus pruni Prov. Abundant everywhere in the Adirondacks on birch and alder.

Pediopsis viridis Fitch. Common on willows.

Pediopsis trimaculata Fitch. Taken at Axton by Professor MacGillivray. This is the trimaculata of my catalogue not my insignis which Osborn and Ball now place as Fitch's trimaculata.

Pediopsis canadensis VanD. Two examples were beaten from alder bushes on the Lake Placid Club grounds.

Pediopsis basalis VanD. One dark specimen taken on Cobble Hill.

Idiocerus pallidus Fitch. Common.

Idiocerus suturalis Fitch. Abundant everywhere on poplars.

Idiocerus suturalis var. **lunaris** Ball. This variety or race occurred here as elsewhere with the typical suturalis. Whatever its relationship may be with that species it certainly should have a name by which it may be distinguished therefrom.

Idiocerus alternatus Fitch. Not common.

Idiocerus lachrymalis Fitch. Taken on the summit of Mt Whiteface and at other places on Populus grandidentata. The males of this species are much smaller than the females and somewhat resemble alternatus.

Idiocerus provancheri VanD. One example beaten from a thorn bush.

Agallia novella Say. Occasional.

Agallia 4-punctata Prov. Taken on the summit of Mt Whiteface and elsewhere.

Agallia sanguinolenta Prov. Common.

JASSIDAE

Xestocephalus pulicarius VanD. Taken at Lake Placid, Sep. 22, 1902.

Paramesus vitellinus Fitch. One example from Cobble Hill.

Platymetopius acutus Say. Common.

Deltocephalus configuratus Uhler. Not uncommon. One darkly colored female was taken on the summit of Mt Whiteface.

Deltocephalus minki Fieber. Taken Sep. 22, 1902, near Lake Placid. On Aug. 25 of this year [1904] I swept numbers of them from grass on the hillsides at Phoenicia in the Catskills.

Deltocephalus sylvestris O. & B. Taken in open woods near the Ausable river and on Cobble Hill.

Deltocephalus melscheimeri Fh. Several taken on Cobble Hill and elsewhere. This is the smallest species of Deltocephalus known to me.

Deltocephalus debilis Uhler. Common in all gradations from the pale yellowish forms to those with black elytra.

Deltocephalus sayi Fitch. Summit of Mt Whiteface and elsewhere.

Deltocephalus compactus O. & B. Taken September 22, 1902.

Deltocephalus sp. One example from Cobble Hill.

Deltocephalus apicatus O. & B. One dark example with the elytral nervures distinctly pale was taken on the summit of Mt Whiteface.

Deltocephalus inimicus Say. Abundant everywhere.

Athysanus venosus Osb. One large pale female was taken on the summit of Mt Whiteface.

Athysanus extrusus VanD. Taken at Axton by Professor MacGillivray.

Athysanus vaccini VanD. From the slopes of Mt Whiteface and on Cobble Hill.

Athysanus plutonius Uhler. Occasional. One example from Cobble Hill being very pale. I also took this species at Lake Placid on Sep. 22, 1902.

Athysanus anthracinus VanD. Taken at Axton by Professor MacGillivray.

Athysanus curtisii Fitch. Not uncommon. August and September.

Athysanus sp. One pair swept from rank grasses in an opening in the forest on the slopes of Mt Whiteface.

Athysanella acuticauda Baker. Professor MacGillivray took this species at Axton and I swept several from grass on Cobble Hill and in that vicinity.

Phlepsius fulvidorsum Fitch. Taken occasionally on deciduous trees and balsams about Lake Placid.

Phlepsius apertus VanD. One male and two females taken in rich woods near the Ausable river.

Phlepsius incisus VanD. Three examples taken with the preceding species and at Saranac Lake. I was surprised not to find the common and universally distributed Phlepsius irroratus in my material when I reached home. It is doubtless common about Lake Placid.

Scaphoideus immistus Say. Occasional.

Thamnotettix clitellaria Say. Not uncommon.

Thamnotettix kennicotti Uhler. One example taken on Cobble Hill.

Thamnotettix decipiens Prov. Swept in large numbers from a tall swamp grass at Lake Placid on Sep. 22, 1902. I also took it in a swampy spot near the Ausable river in August 1904.

Thamnotettix inornata VanD. A few examples swept from tall grasses near the Ausable river.

Thamnotettix placidus Osb. Taken in numbers with the preceding.

Thamnotettix infuscata G. & B. Taken at various localities about Lake Placid, specially in wooded areas near the Ausable river.

Chlorotettix unicolor Fitch. Common, August and September.

Chlorotettix tergatus Fitch. With the preceding.

Chlorotettix viridia VanD. Taken at Lake Placid.

Chlorotettix lusoria O. & B. One example taken near the Ausable river. Also taken Sep. 22, 1902.

Cicadula 6-notata Fallen. Summit of Mt Whiteface and more abundantly on the lower levels about Lake Placid.

Cicadula slossoni VanD. Common in grass on the Lake Placid Club grounds. The males are considerably smaller and darker in color than the females.

Cicadula variata Fall. One pale example.

Gnathodus punctatus Thungb. Common.

Gnathodus viridis Osb. One example taken on the summit of Mt Whiteface.

TYPHLOCYBIDAE

Dicraneura communis Gillette. Several examples were taken on the summit of Mt Whiteface. I have also taken this species at Phoenicia, Ulster co., and at Lancaster, Erie Co., N.Y.

Empoasca atrolabis Gillette. Not uncommon on bushes in open woods.

Empoasca flavescens Fabr. One example from near the Ausable river.

Eupteryx vanduzei Gillette. One example taken in the rich swampy woods near Isham's. This specimen has the costa conspicuously pale yellow bordered within by a black vitta.

Eupteryx flavoscuta Gillette. A very dark specimen is among the material taken on the summit of Mt Whiteface. Others were taken on Cobble Hill and in that vicinity. It lives on ferns and is widely distributed.

Typhlocyba rosea Linn. From the golf links of the Lake Placid Club.

Typhlocyba tenerrima H. S. One example from near the Ausable river.

Typhlocyba querci Fitch. Summit and slopes of Mt Whiteface. I also took this species at Kingston and Phoenicia in the Catskills.

Typhlocyba sp. Beaten from a thorn bush in an opening in the woods near "Balance rock."

PSYLLIDAE

Trioza tripunctata Fitch. Taken at Axton by Professor MacGillivray.

Psylla sp. Six species of this genus and three of Livia were taken by me about Lake Placid. So little has been done with our North American species in this family that it is quite useless to attempt the determination of our material at present. Probably no family of our Hemiptera is so much in need of careful and conscientious study by a competent student as this.

LIST OF LEPIDOPTERA TAKEN AT KEENE VALLEY N.Y.

BY G. F. COMSTOCK

With additions from State Museum records

The following list of species has been kindly placed at our disposal for publication by Mr G. F. Comstock. His list of captures have been supplemented by records taken from the New York State collection, the added species being indicated by a star. He has been kindly assisted in many identifications by Messrs G. Franck, W. D. Kearfott, and W. Beutenmuller.

Papilionidae

Papilio glaucus *Linn.*
P. polyxenes *Fabr.*

Pieridae

Pieris napi *Linn.*
P. rapae *Linn.*
Eurymus philodice *Godt.*
E. interior *Scudd.*

Nymphalidae

Argynnis cybele *Fabr.*
A. aphrodite *Fabr.*
A. atlantis *Edw.*
Brenthis myrina *Cram.*
B. bellona *Fabr.*
Euphydryas phaeton *Dru.*
Phyciodes tharos *Dru.*
P. batesii *Reakirt*
Polygonia comma *Harr.*
P. faunus *Edw.*
P. gracilis *G. & R.*
P. progne *Cram.*
Eugonia j-album *Boisd. & Lec.*
Euvanessa antiopa *Linn.*
Aglais milberti *Godt.*
Vanessa atalanta *Linn.*
V. huntera *Fabr.*
V. cardui *Linn.*
Basilarchia arthemis *Dru.*
B. archippus *Cram.*

Agapetidae

Cercyonis alope *Fabr.* c. nephele *Kirby*
Enodia portlandia *Fabr.*
Cissia eurytus *Fabr.*

Lymnadidae

Anosia plexippus *Linn.*

Lycaenidae

Feniseca tarquinius *Fabr.*
Chrysophanus thoe *Boisd.*
Epidemia epixanthe *Boisd. & Lec.*
Heodes hypophleas *Boisd.*
Cyaniris ladon *Cram.*
Everes comyntas *Godt.*

Hesperidae

Amblyscirtes vialis *Edw.*
A. samoset *Scudd.*
Pamphila palaemon *Pallas*
Atrytone hobomok *Harr.*
Erynnis sassacus *Harr.*
Anthomaster leonardus *Harr.*
Thymelicus otho *S. & A.* a. egeremet *Scudd.*
T. mystic *Scudd.*
T. cernes *Boisd. & Lec.*
Polites peckius *Kirby*
Thorybes pylades *Scudd.*
Thanaos icelus *Lint.*
T. lucilius *Lint.*

Sphingidae

Hemaris diffinis *Boisd.*
H. thysbe *Fabr.*
*Deilephila gallii *Rott.*
D. lineata *Fabr.*
Pholus pandorus *Hübn.*
Ampelophaga choerilus *Cram.*
Sphinx kalmiae *S. & A.*
S. drupiferarum *S. & A.*
S. chersis *Hübn.*
Ceratomia undulosa *Walk.*
Marumba modesta *Harr.*
Smerinthus jamaicensis *Dru.*
S. cerysii *Kirby*
*Paonias excaecatus *S. & A.*
*Cressonia juglandis *S. & A.*

Saturniidae

Tropaea luna *Linn.*
Telea polyphemus *Cram.*
Automeris io *Fabr.*

Syntomidae

*Scepsis fulvicollis *Hübn.*
Lycomorpha pholus *Dru.*
Ctenucha virginica *Charp.*

Lithosiidae

Lexis bicolor *Grt.*
*Hypoprepia miniata *Kirby*

Arctiidae

Eubaphe immaculata *Reak.*
E. aurantiaca *Hübn.*
Haploa lecontei *Boisd.*
H. confusa *Lyman*
Isia isabella *S. & A.*
Phragmatobia fuliginosa *Linn.*
*Diacrisia virginica *Fabr.*
Apantesis virgo *Linn.*
A. intermedia *Stretch*
A. parthenice *Kirby*
*A. arge *Dru.*
Arctia caia *Linn.* a. americana *Harr.*
Halisidota tessellaris *S. & A.*

Noctuidae

Raphia frater *Grote*
Apatela americana *Harr.*
A. dactylina *Grote*
A. morula *Grote*
*A. interrupta *Guen.*
A. hamamelis *Guen.*
A. fragilis *Guen.*
A. impressa *Walk.*
Arsilonche albovenosa *Goeze*
*Microcoelia dipteroides *Guen.*
Chytonix palliatricula *Guen.*
Baileya ophthalmica *Guen.*
Platysenta videns *Guen.*
Balsa malana *Fitch*
Caradrina miranda *Grote*
Perigea vecors *Guen.*
Oligia exesa *Guen.*
Hadena binotata *Walk.*
H. genetrix *Grote*
H. mactata *Guen.*
H. stipata *Morr.*
H. apamiformis *Guen.*
H. lateritia *Hübn.*
*H. dubitans *Walk.*
H. devastatrix *Brace*
H. arctica *Boisd.*
H. lignicolor *Guen.*
Dryobota illocata *Walk.*
*Hyppa xylinoides *Guen.*
Euplexia lucipara *Linn.*
*Actinotia ramosula *Guen.*
Pyrophila pyramidoides *Guen.*
Rhynchagrotis gilvipennis *Grote*
R. anchocelioides *Guen.* a. brunneipennis *Grote*
R. alternata *Grote*
Adelphagrotis prasina *Fabr.*
Eueretagrotis sigmoides *Guen.*
E. perattenta *Grote*
Semiophora elimata *Guen.* b. janualis *Grote*
*Agrotis ypsilon *Rott.*
*A. geniculata *G. & R.*
*A. astricta *Morr.*
*Peridroma margaritosa *Haw.* a. saucia *Hübn.*
Noctua smithii *Snell.*
N. normaniana *Grote*

N. bicarnea *Guen.*
N. c-nigrum *Linn.*
N. jucunda *Walk.*
N. phyllophora *Grote*
*N. plecta *Linn.*
N. collaris *Grt. & Rob.*
N. haruspica *Grote*
N. clandestina *Harr.*
Feltia subgothica *Haw.*
F. jaculifera *Guen.*
a. herilis *Grote*
*Paragrotis scandens *Riley*
P. insulsa *Walk.*
*P. tessellata *Harr.*
P. redimicula *Morr.*
Mamestra nimbosa *Guen.*
M. imbrifera *Guen.*
M. purpurissata *Grote*
M. lustralis *Grote*
*M. meditata *Grote*
M. detracta *Walk.*
M. grandis *Boisd.*
M. latex *Guen.*
*M. adjuncta *Boisd.*
M. goodelli *Grote*
M. renigera *Steph.*
*M. olivacea *Morr.*
M. lorea *Guen.*
Nephelodes minians *Guen.*
*Heliophila unipuncta *Haw.*
H. pseudargyria *Guen.*
H. luteopallens *Smith*
H. albilinea *Hübn.*
H. insueta *Guen.*
H. commoides *Guen.*
Orthodes crenulata *Butl.*
O. vecors *Guen.*
Graphiphora peredia *Grote*
*Tricholita signata *Walk.*
Lithomoia germana *Morr.*
Litholomia napae *Morr.*
Calocampa curvimacula *Morr.*
*Cucullia convexipennis *Grt.& Rob.*
*C. asteroides *Guen.*
*C. intermedia *Speyer*
Gortyna americana *Speyer*
Papaipema harrisii *Grote*
Brotolomia iris *Guen.*
Trigonophora periculosa *Guen.*
Eucirroedia pampina *Guen.*
Scoliopteryx libatrix *Linn.*
Cosmia paleacea *Esper.*
Orthosia bicolorago *Guen.*
O. helva *Grote*
Ipimorpha pleonectusa *Grote*
Rhodophora florida *Guen.*
Euthisanotia grata *Fabr.*
Calpe canadensis *Beth.*
Panchrysia purpurigera *Walk.*
Plusia aerea *Hübn.*
P. aeroides *Grote*
P. balluca *Geyer*
*Euchalcia contexta *Grote*
Autographa bimaculata *Steph.*
*A. precationis *Guen.*
A. octoscripta *Grote*
A. rectangula *Kirby*
*A. u-aureum *Guen.*
A. ampla *Walk.*
A. falcigera *Kirby* a. simplex *Guen*
Ambrostola urentis *Guen.*
Eustrotia synochitis *Grt. & Rob.*
E. musta *Grt. & Rob.*
E. muscoscula *Guen.*
E. carneola *Guen.*
Eumestleta flammicincta *Walk.*
Chamyris cerintha *Treits.*
*Metathorasa monitifera *Guen.*
*Euherrichia mollissima *Guen.*
Drasteria erechtea *Cram.*
Euclidia cuspidea *Hübn.*
Catocala relicta *Walk.*
C. concumbens *Walk.*
C. unijuga *Walk.*
C. coccinata *Grote* a. sinuosa *Grote*
C. cerogama *Guen.*
Panapoda rufimargo *Hübn.*
Parallelia bistriaris *Hübn.*
*Epizeuxis americalis *Guen.*
E. aemula *Hübn.*
E. lubricalis *Geyer*
Zanclognatha laevigata *Grote*
Z. marcidilinea *Grote*
Chytolita petrealis *Grote*
Renia discoloralis *Guen.*
R. fraternalis *Smith*
R. flavipunctalis *Geyer*
Heterogramma pyramusalis *Walk.*
Palthis angulalis *Hübn.*
Bomolocha scutellaris *Grote*
B. deceptalis *Walk.*

Notodontidae

Melalopha albosigma *Fitch*
Notodonta basitriens *Walk.*
Pheosia dimidiata *Herr.-Schaef.*
Nadata gibbosa *S. & A.*
Symmerista albifrons *S. & A.*
Heterocampa manteo *Double*
H. biundata *Walk.*
H. guttivitta *Walk.*
Schizura unicornis *S. & A.*
Gluphisia septentrionalis *Walk.*
*Ellida caniplaga *Walk.*

Thyatiridae

*Habrosyne scripta *Gosse.*
H. rectangulata *Ottolengui*
Pseudothyatira cymatophoroides *Guen*
*P. expultrix *Grote*

Liparidae

*Notolophus antiqua *Linn.*
Hemerocampa leucostigma *S. & A.*
Olene plagiata *Walk.*

Lasiocampidae

Malacosoma americana *Fabr.*

Platypterygidae

Eudeilinea herminiata *Guen.*
Oreta rosea *Walk.*
Drepana arcuata *Walk.*

Geometridae

Eudule mendica *Walk.*
Carsia paludata *Thunb.*
Nannia morensata *Hulst.*
*Tephroclystis luteata *Pack.*
T. interruptofasciata *Pack.*
T. absinthiata *Clerck*
Eucymatoge intestinata *Guen.*
Venusia cambrica *Curtis*
Euchoeca albovittata *Guen.*
E. lucata *Guen.*
Hydria undulata *Linn.*
Eustroma diversilineata *Hübn.*
*E. testata *Linn.*
*E. populata *Linn.*
E. destinata *Möschl.*
E. prunata *Linn.*
Rheumaptera hastata *Linn.*
Mesoleuca ruficilliata *Guen.*
M. gratulata *Walk.*
M. lacustrata *Guen.*
M. truncata *Hufn.*
Hydriomena latirupta *Walk.*
H. custodiata *Guen.*
H. unangulata *Haw.*
Coenocalpe magnoliata *Guen.*
Marmopteryx marmorata *Pack.*
*Gypsochroa designata *Hufn.*
G. sitellata *Guen.*
Petrophora ferrugata *Clerck*
P. fluctuata *Linn.*
Synelys alabastaria *Hübn.*
S. ennucleata *Guen.*
Cinglis purata *Guen.*
Leptomeris quinquelinearia *Pack.*
Eois inductata *Guen.*
Annemoria bistriaria *Pack.*
Nemoria pistaceata *Guen.*
Eufidonia notataria *Walk.*
Orthofidonia vestaliata *Guen.*
Physostegania pustularia *Guen.*
Sciagraphia flavivenata *Hulst.*
S. granitata *Guen.*
*S. mellistrigata *Grote*
Philobia notata *Linn.*
P. enotata *Guen.*
*Cymatophora ribearia *Fitch*
C. subcessaria *Walk.*
Apaecasia defluata *Walk.*
Caripeta divisata *Walk.*
Nepytia semiclusaria *Walk.*
Selidosema humarium *Guen.*
Cleora indicataria *Walk.*
C. pampinaria *Guen.*
C. larvaria *Guen.*
Melanolophia canadaria *Guen.*
Glena cognataria *Hübn.*
Ectropis crepuscularia *D. & S.*
Lycia cognataria *Guen.*
Lychnosea intermicata *Walk.*
Therina fervidaria *Hübn.*
Metrocampa praegrandaria *Guen.*
Eugonobapta nivosaria *Guen.*
Ennomos subsignarius *Hübn.*
*E. magnarius *Guen.*
Xanthotype crocataria *Fabr.*
Plagodis serinaria *Herr.-Schaef.*
Hyperitis amicaria *Herr.-Schaef.*
Ania limbata *Haw.*
Gonodontis hypochraria *Herr.-Schaef.*
Euchlaena obtusaria *Hübn.*
*E. johnsonaria *Fitch*
E. astylusaria *Walk.*
E. pectinaria *D. & S.*
Metanema inatomaria *Guen.*
M. determinata *Walk.*
M. textrinaria *Grt. & Rob.*
Azelina ancetaria *Hübn.*
Caberodes confusaria *Hübn.*
C. majoraria *Guen.*
Tetracis crocallata *Guen.*
Sabulodes transversata *Dru*

Epiplemidae

Callizzia amorata *Pack.*

Nolidae

Nola ovilla *Grote*

Sesiidae

Sesia pictipes *Grt. & Rob.*

Pyralidae

Pantographa limata *Grt. & Rob.*
Evergestis straminalis *Hübn.*
*Nomophila noctuella *D. & S.*
*Phlyctaenia terrealis *Treit.*
P. tertialis *Guen.*
Pyrausta pertextalis *Lede.*
P. aeglealis *Walk.*
P. thestealis *Walk.*
*P. theseusalis *Walk.*
P. orphisalis *Walk.*
P. unifascialis *Pack.*
P. phoenicealis *Hübn.*
Pyralis cuprina *Zell.*
Galasa rubidana *Walk.*
Crambus agitatellus *Clem.*
C. hortuellus *Hübn.*
C. mutabilis *Clem.*
Benta asperatella *Clem.*
Mineola tricolorella *Grote*
Tlascala finitella *Walk.*
Salebria basilaris *Zell.*

Pterophoridae

Pterophorus homodactylus *Walk.*
P. paleaceus *Zell.*

Tortricidae

Olethreutes dimidiana *Sodof.*
*O. hemidesma *Zell.*
O. campestrana *Zell.*
*O. dealbana *Walk.*
Eucosma juncticiliana *Walsingham*
*E. dorsisignatana *Clem.*
Thiodia signatana *Clem.*
Proteoteras aesculanum *Riley*, a moffatiana *Fern.*
Sparganothis xanthoides *Walk.*
*Archips cerasivorana *Fitch*
*A. obsoletana *Walk.*
A. fervidana *Clem.*
A. virescana *Clem.*
A. persicana *Fitch*
A. melaleucana *Walk.*
Tortrix conflictana *Walk.*
T. argentana *Clerck*
Amorbia humerosana *Clem.*

Xylorictidae

Stenoma schlaegeri *Zell.*

Oecophoridae

Machimia tentoriferella *Clem.*
Depressaria pulvipennella *Clem.*

EXPLANATION OF PLATES[1]

Plate 1

1 Wing of Mansonia titillans Walk. x21
2 Wing of Mucidus alternans Westw. x21
3 Portion of wing of Mansonia titillans Walk. x110
4 Portion of wing of Mucidus alternans Westw. x110

Plate 2

1 Wing of Aedeomyia squammipenna Arrib. x21
2 Wing of Eretmapodites quinquevittatus Theo. x21
3 Portion of wing of Aedeomyia squammipenna Arrib. x110
4 Portion of wing of Eretmapodites quinquevittatus Theo. x110

Plate 3

1 Wing of Theobaldia incidens Thom. x21
2 Wing of Sabethes remipes Wied. x21
3 Portion of wing of Theobaldia incidens Thom. x55
4 Portion of wing of Sabethes remipes Wied. x110

Plate 4

1 Male genitalia of Cellia albipes Theo. x110
2 Male genitalia of Cycloleppteron grabhamii Theo. x110

Plate 5

1 Male genitalia of Pyretophorus costalis Loew x110
2 Male genitalia of Janthinosoma lutzii Theo. x110

Plate 6

1 Male genitalia of Grabhamia discolor Coq. x110
2 Male genitalia of Desvoidea panalectros Theo. x110

Plate 7

1 Male genitalia of Mucidus alternans Westw. x80
2 Male genitalia of Culicada subcantans, n.sp. x65

[1]Reproduces from photomicrographs by the author and J. R. Gillett.

Plate 8

1 Male genitalia of Culicada cantans Meig. x65
2 Male genitalia of Culicada fitchii Felt x65

Plate 9

1 Male genitalia of Culicada abfitchii Felt x80
2 Male genitalia of Culicada confirmatus Theo. x110

Plate 10

1 Male genitalia of Culicada curriei Coq. x110
2 Male genitalia of Culicada pullatus Coq. x110

Plate 11

1 Male genitalia of Culicada abserratus Felt & Young x80
2 Male genitalia of Culicada dupreei Coq. x110

Plate 12

1 Male genitalia of Theobaldia incidens Thom. x110
2 Male genitalia of Theobaldia annulata Meig. x110

Plate 13

1 Male genitalia in part of Theobaldia spathipalpis Rond. x80
2 Male genitalia in part of Culex diversus Theo. x80

Plate 14

1 Male genitalia of Culex viridiventer Giles x110
2 Male genitalia in part of Culex pulcriventer Giles x110

Plate 15

1 Male genitalia of Melanoconion atrata Theo. x110
2 Male genitalia of Taeniorhynchus perturbans Walk. x110

Plate 16

1 Male genitalia of Taeniorhynchus brevicellulus Theo. x80
2 Male genitalia of Taeniorhynchus aurites Theo. x80

Plate 17

1 Male genitalia of *Stegomyia fasciata* Fabr. x110
2 Male genitalia of *Pneumaculex signifer* Coq. x110

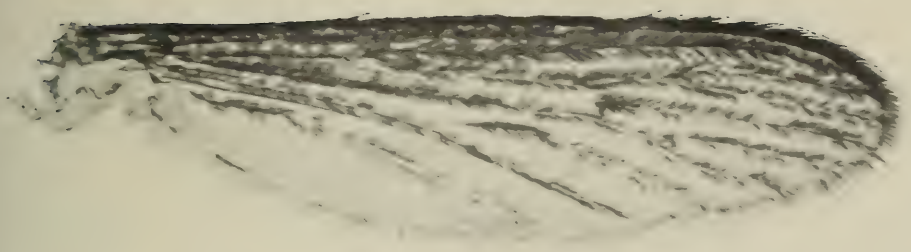
Plate 18

1 Male genitalia of *Protoculex serratus* Theo. x110
2 Male genitalia of *Aedes fuscus* O.S. x110

Plate 19

1 Male genitalia of *Megarhinus portoricensis* Von Roder x80
2 Male genitalia of *Corethrella brakeleyi* Coq. x240

Plate 1



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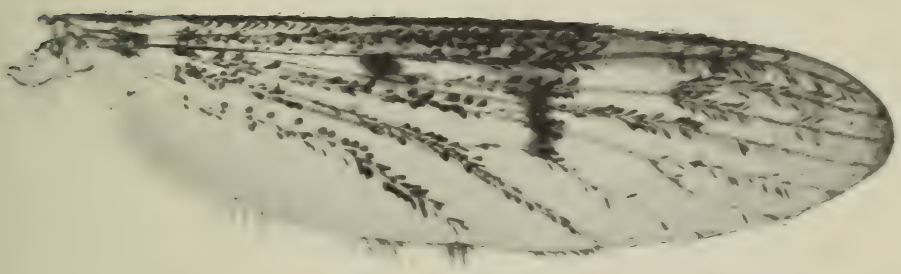

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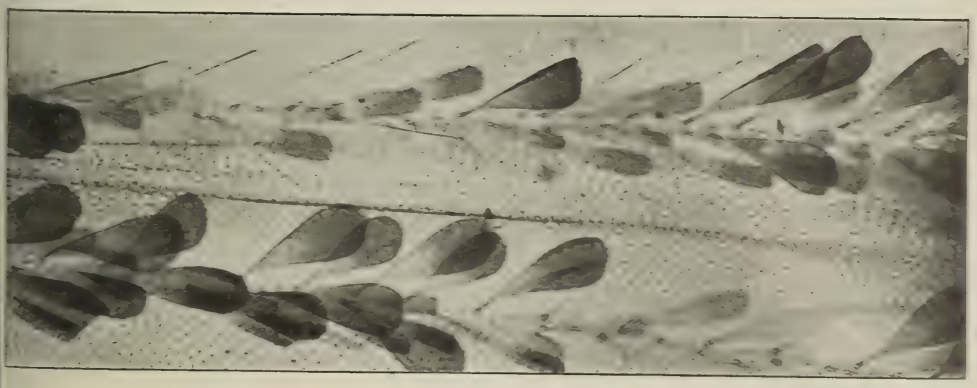
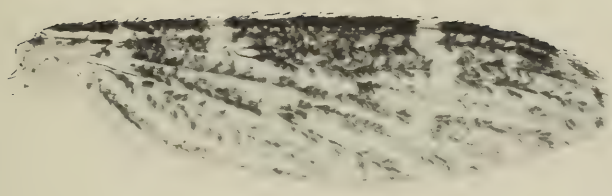


4

1, 3 Mansonia titillans. 2, 4 Mucidus alternans

Plate 2



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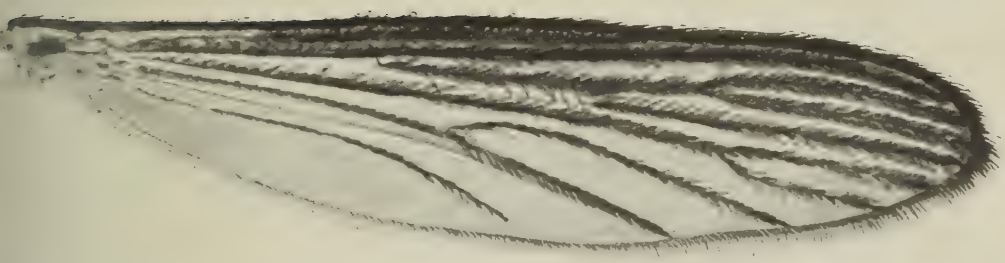


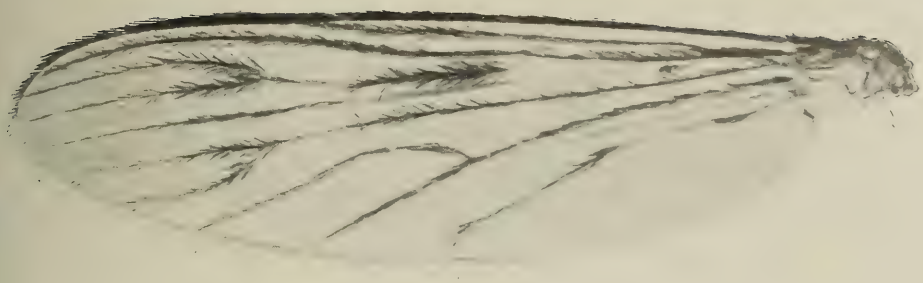
2

3

4

1, 3 Aedeomyia squammipenna. 2, 4 Eretmapodites quinquevittatus

Plate 3



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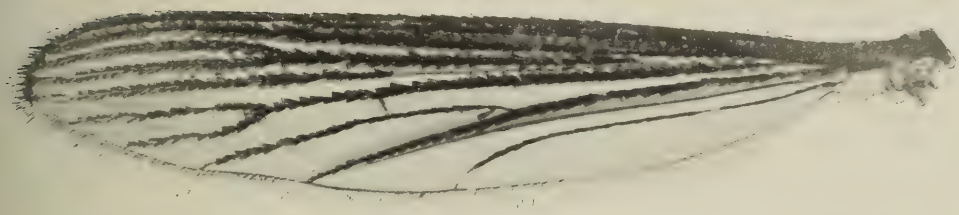

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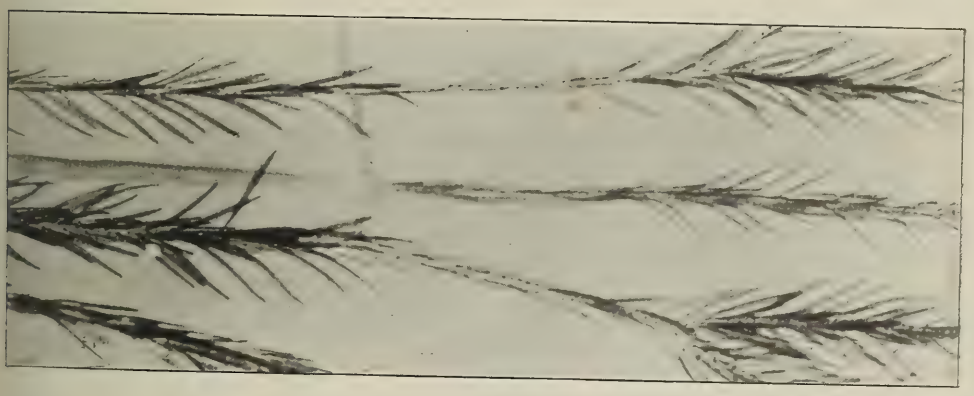

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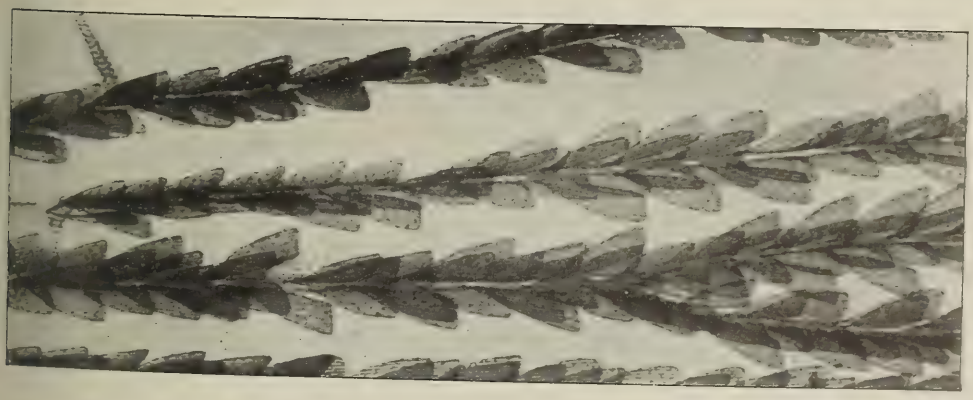
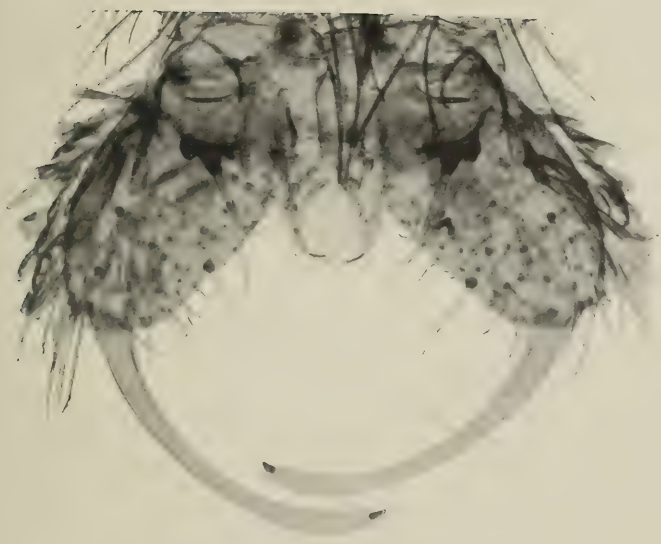


4

1, 3 Theobaldia incidens. 2, 4 Sabethes remipes

Plate 4

1



2

1 Cellia albipes. 2 Cycloleppteron grabhamii

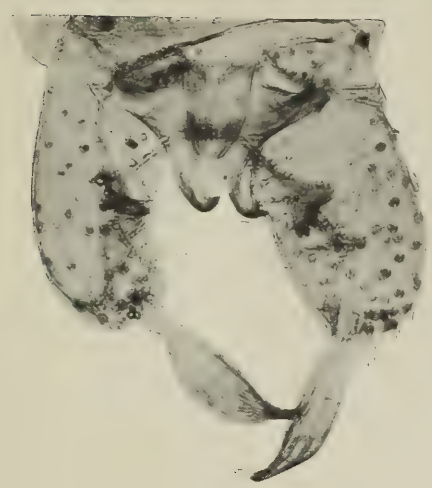
Plate 5

1

2

1 Pyretophorus costalis. 2 Janthinosoma lutzii

Plate 6



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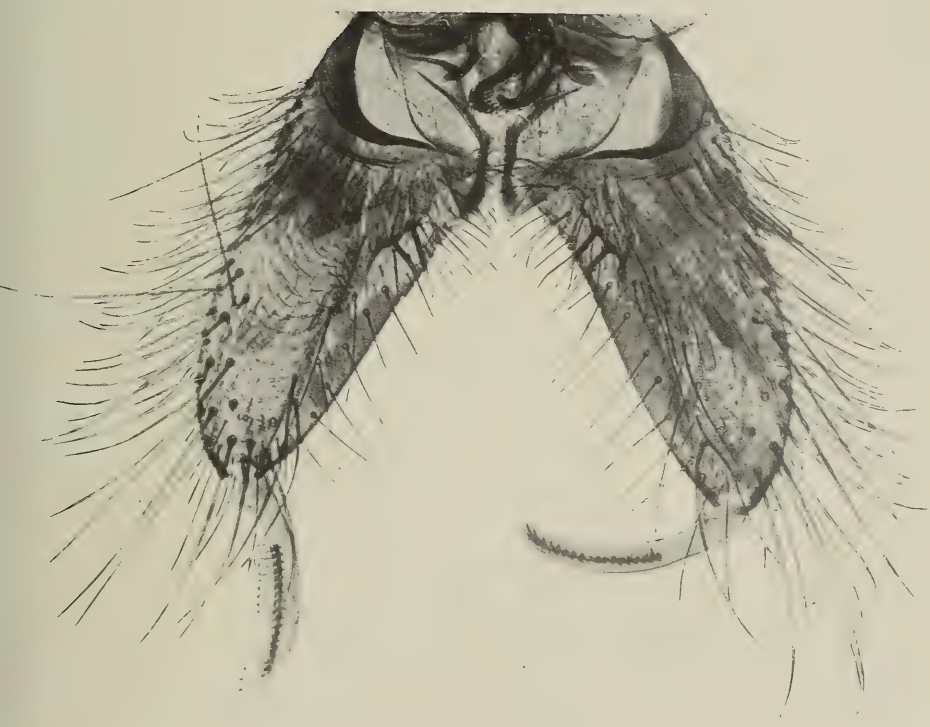


2

1 Grabhamia discolor. Desvoidea panalectros

Plate 7

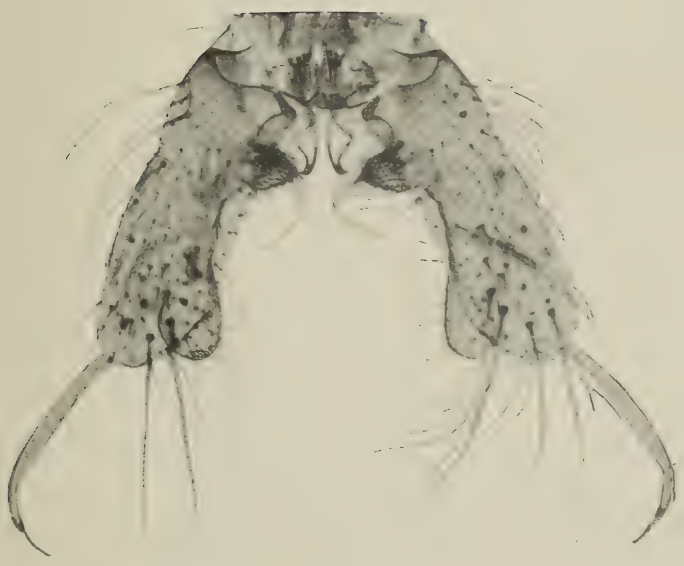
1

2

1 Mucidus alternans Culicada subcantans

Plate 8

1



2

1 Culicada cantans. 2 C. fitchii

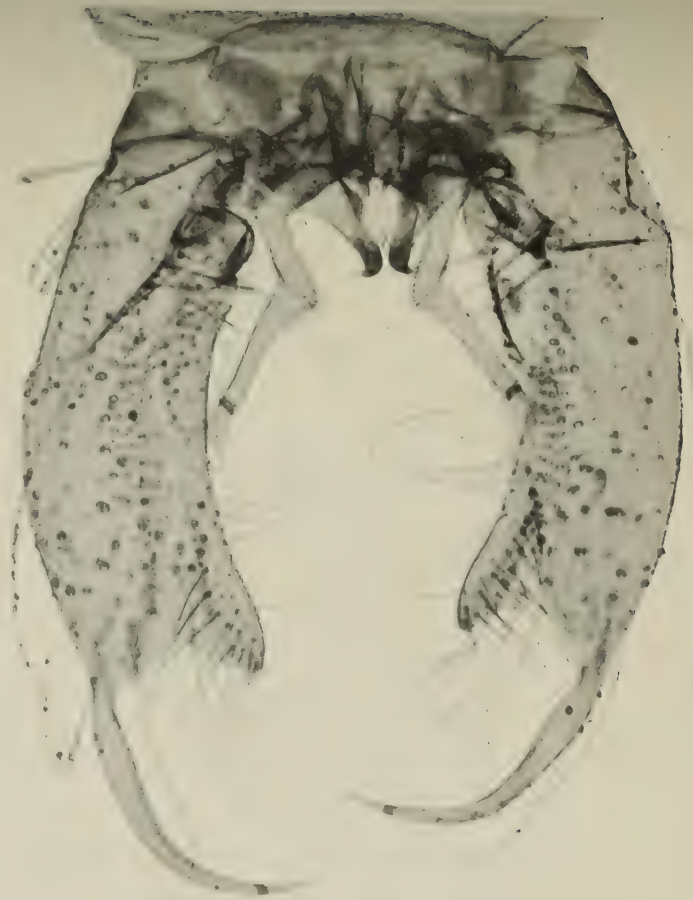
Plate 9

1

2

1 Culicada abfitchii. 2 C. confirmatus

1



2

1 Culicada currei. 2 C. pullatus

Plate 11

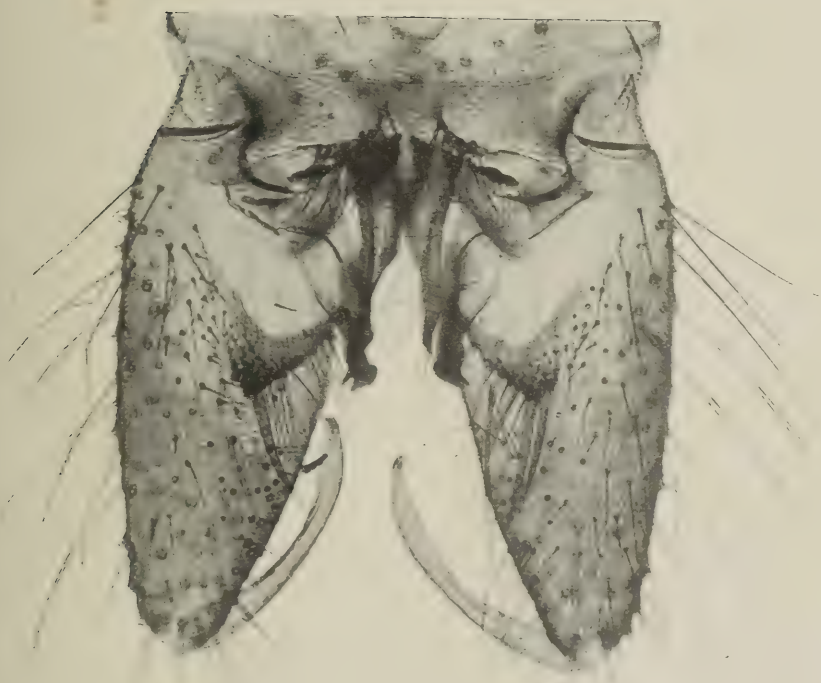
1

2

1 Culicada abserratus. 2 C. dupreei

Plate 12

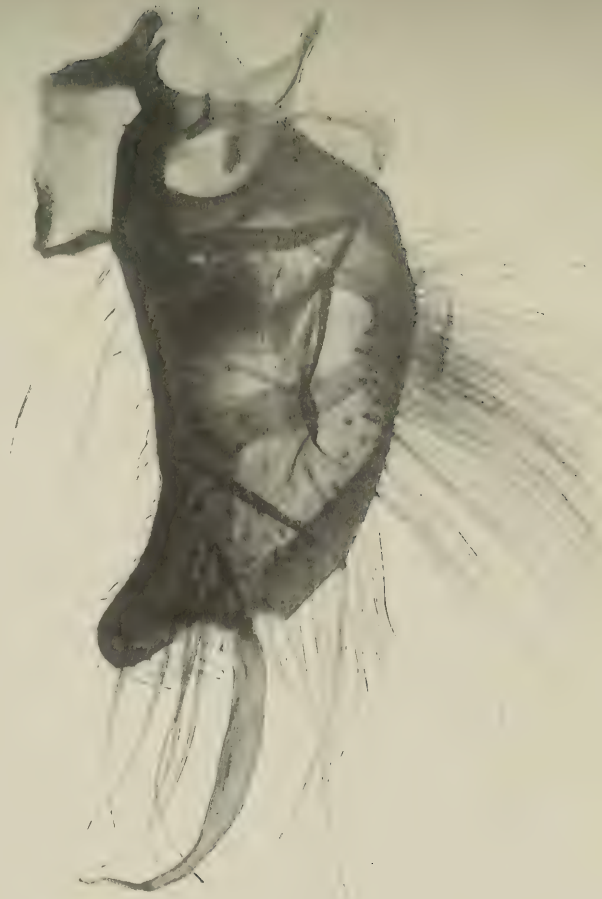
1



2

1 Theobaldia incidens. 2 T. annulata

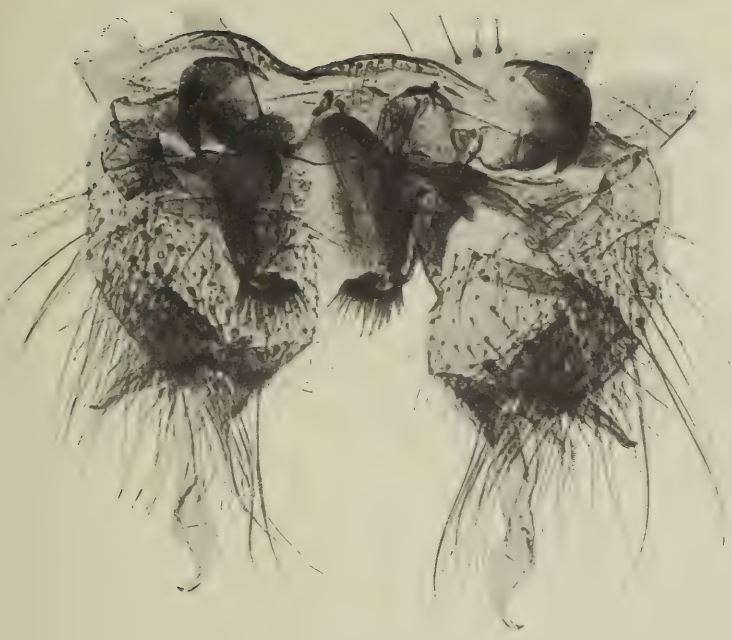
1



2

1 Theobaldia spathipalpis. 2 Culex diversus

Plate 14



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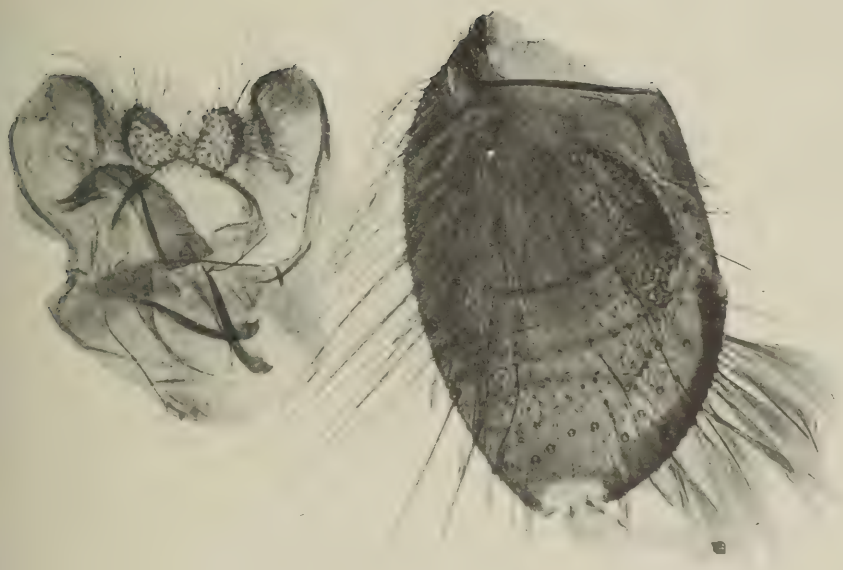
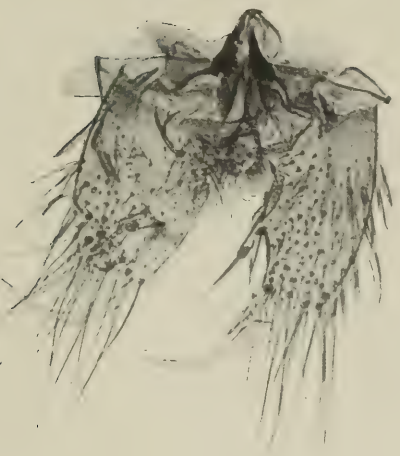


2

1 Culex viridiventer. 2 C. pulcriventer

Plate 15

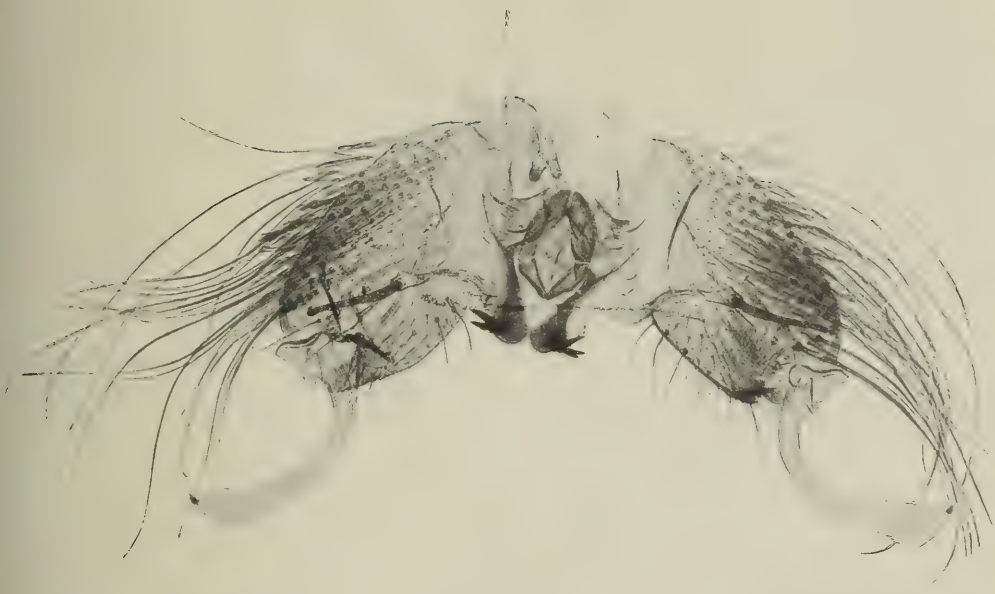


1

2

1 Melanoconion atrata. 2 Taeniorhynchus perturbans

Plate 16



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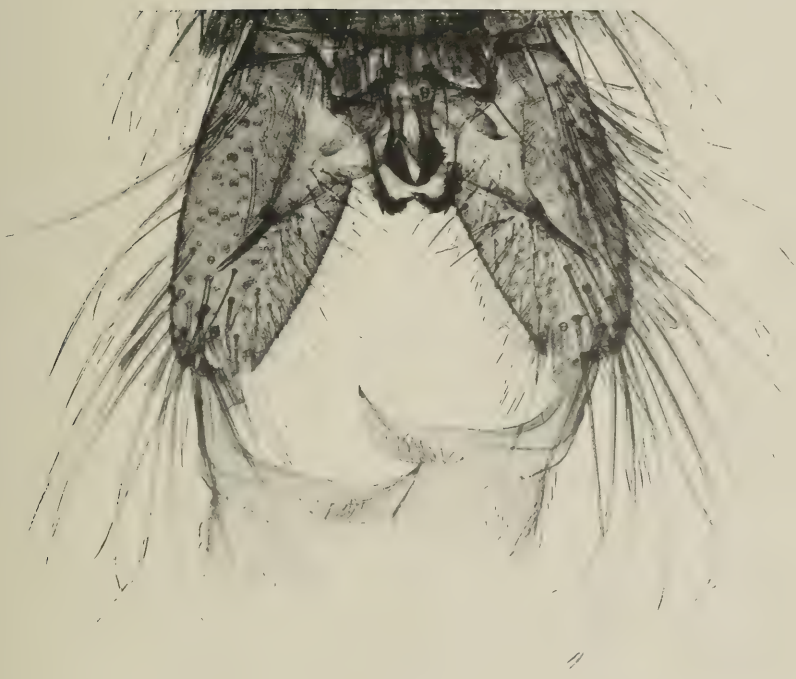


2

1 Taeniorhynchus brevicellulus. 2 T. aurites

Plate 17

1

2

1 Stegomyia fasciata. 2 Pneumaculex signifer

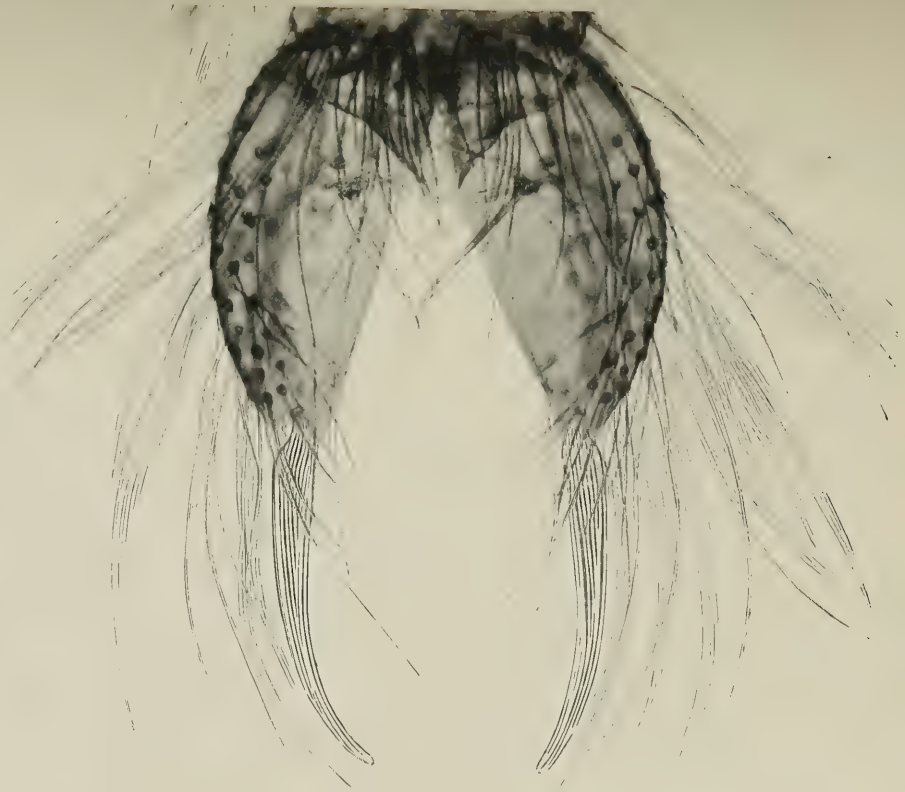
Plate 18

1

2

1 Protoculex serratus. 2 Aedes fuscus

1



2

1 Megarhinus portoricensis 2 Corethrella brakeleyi

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New York State Museum

PUBLICATIONS

Postage or express to places outside of New York State must be paid in addition to the price given. On 10 or more copies of any one publication 20% discount will be given, the buyer to pay transportation. Editions printed are only large enough to meet special claims and probable sales. When the sale copies are exhausted, the price for the few reserve copies is advanced to that charged by secondhand booksellers, in order to limit their distribution to cases of special need. Such prices are inclosed in [ ]. All publications are in paper covers, unless binding is specified.

Museum annual reports 1847–date. *All in print to 1892, 50c a volume, 75c in cloth; 1892–date, 75c, cloth.*

These reports are made up of the reports of the director, geologist, paleontologist, botanist and entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, O; 2, 14–16, Q.

The annual reports of the early natural history survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50		

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904.

Paleontologist's annual reports 1899–1903.

See fourth note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with geologist's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	9	$.25	15 (En 9)	$.15
2	.30	10	.35	16 (" 10)	.25
5	.25	11	.25	17 (" 14)	.30
6	.15	12	.25	18 (" 17)	.20
7	.20	13	.10	19 (" 21)	.15
8	.25	14 (En 5)	.20	20 (" 24)	.40

Reports 2, 8–12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–date of which they form a part; the first botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–96 and 1898 (Botany 3) are out of print. Report for 1897 may be had for 40c; 1899 for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins [*see* Bo. 5–8[.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), 56th (1902), 57th (1903) and 58th (1904) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

Museum bulletins 1887–date. O. *To advance subscribers, $2 a year or 50c a year for those of any one division:* (1) *geology, economic geology, mineralogy,* (2) *general zoology, archeology and miscellaneous,* (3) *paleontology,* (4) *botany,* (5) *entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*
G 1	48, v.1	Pa 2, 3	54, v.3	En 11	54 v.3	Ar 3	52, v.1
2	51, v.1	4	" v.4	12, 13	" v.4	4	54, v.1
3	52, v.1	5, 6	55, v.1	14	55, v.1	5	" v.3
4	54, v.4	7–9	56, v.2	15–18	56, v.3	6	55, v.1
5	56, v.1	10	57, v.1	19	57, v.1, pt 2	7	56, v.4
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Ig 5, 6	48, v.1	4	54, v.1	21	" v.1 "	9	" v.2
7	50, v.1	5–7	" v.3	22	" v.1 "	Ms 1, 2	56, v.4
8	53, v.1	8	55, v.1	Bo 3	52, v.1		
9	54, v.2	9	56, v.3	4	53, v.1	*Memoir*	
10	" v.3	10	57, v.1	5	55, v.1	2	49, v.3
11	56, v.1	En 3	48, v.1	6	56, v.4	3, 4	53, v.2
M 2	" v.1	4–6	52, v.1	7	57, v.2	5, 6	57, v.3
3	57, v.1	7–9	53, v.1	Ar 1	50, v.1	7	" v.4
Pa 1	54, v.1	10	54, v.2	2	51, v.1		

The figures in parenthesis in the following list indicate the bulletin's number as a New York State Museum bulletin.

Geology. G1 (14) Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. *10c.*

G2 (19) Merrill, F: J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 119pl. map. Nov. 1898. [*50c*]

G3 (21) Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. *5c.*

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——The Water Biscuit of Squaw Island, Canandaigua Lake, N. Y.
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3 Clarke, J: M. The Oriskany Fauna of Becraft Mountain, Columbia Co. N. Y. 128p. 9pl. Oct. 1900. *80c.*

4 Peck, C: H. N. Y. Edible Fungi, 1895–99. 106p. 25pl. Nov. 1900. *75c.*
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5 Clarke, J: M. & Ruedemann, Rudolf. Guelph Formation and Fauna of New York State. 196p. 21pl. July 1903. *$1.50, cloth.*

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