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Aquatic Insects of the Saranac Region.

By E. P. FELT, D. Sc., STATE ENTOMOLOGIST.

NEW YORK STATE MUSEUM.

UNIVERSITY OF THE STATE OF NEW YORK.

THE State of New York annually expends large sums of money in rearing young fish and planting them in various bodies of water, and yet we have no very definite knowledge of the food requirements of the different species. They are put in lake, pond or stream, and if in later years the fish planted is found abundantly we consider that body of water well adapted to that particular form, and if not, after repeated trials, we are obliged to admit that, for some reason or other, frequently unknown, certain varieties of fish will not thrive under those conditions.

An attempt was made in 1900 to study this problem from a scientific standpoint, and in the beginning the effort was very naturally confined to one group of animals, viz., insects. Two investigators, Dr. J. G. Needham and Cornelius Betten, were located, through the courtesy of the Fisheries, Game and Forest Commission, at the Adirondack Hatchery, Saranac Inn, Franklin county, with instructions "to collect and study the habits of aquatic insects, paying special attention to the conditions necessary to the existence of the various species, their relative value as food for fishes, the relations of the forms to each other and their life histories."

Such instructions were necessarily very broad, and the carrying of them out in detail must, in the nature of things, be a labor of years. The results obtained at Saranac Inn give us a much better idea of the aquatic insect fauna of that section, and form, together with work done in 1901, an excellent basis for learning the conditions which govern the existence of the various species in different bodies of water. The first thing to be ascertained in any such investigation is to find out what forms inhabit the water or waters where the studies are being made, and in this respect the work done by Dr. Needham and his assistant has proved most admirable, since they have succeeded in adding materially to our knowledge of the aquatic forms in the Saranac region.

Complexity of Animal Life. An investigation such as is described above cannot be limited to any one family, order, or even class of animals, but it must eventually

Explanation of Plate 1.

Simulium Society

FIG.

1. Two imagos of *Hydropsyche* sp.?, at rest, natural size.
2. Imago of *Hydropsyche* sp.?, lateral view, x 6.
3. Larva of *Hydropsyche* sp.?, lateral view, x $3\frac{1}{2}$.
4. Pupal case of *Hydropsyche* sp.?, x 2.
5. Imago of *Roederiodes juncta*, lateral view, x 10.
6. Larva of *Roederiodes juncta*, lateral view, x 5.
7. Pupa of *Roederiodes juncta*, lateral view, x 5.
8. Pupa of *Roederiodes juncta* in an habitual position in the abandoned pupal case of *Simulium venustum*.
9. Egg masses of *S. venustum*, and two females ovipositing.
10. Pupæ, empty pupa skins, and pupal cases of *S. venustum*.
11. Larva of *S. venustum*, x 5.
12. Male imago of *Leuctra tenella*, dorsal view, x 4.
13. Imago of *Baetis pygmaea*, lateral view, x 5.
14. Imago of *Baetis pygmaea*, dorsal view, x 5.
15. Imago of *Heptagenia pulchella*, x 2.
16. Nymph of *Heptagenia pulchella*, natural size.
17. Pupal cases of *Hydropsyche* sp.?, in situ. natural size.
18. Pupæ of *Simulium venustum*, in situ.
- 19, 20. Larva of *S. venustum* in situ.

Plate 1



L. H. Joutel, 1900

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SIMULIUM SOCIETY

[Reprint from N.Y. State Museum Bulletin, 47.]



be extended to include all living organisms, because it is not only necessary in such a study to ascertain what any one species of fish, for example, feeds upon, but we must also know what its competitors devour, and its relation to other fishes. The mere knowledge of the species of insects found in association with any one kind of fish, combined with some idea of their value as food, is only part of the question, because, as in the case of the fish, we must know what each insect feeds upon, and in turn its relations to other insects inhabiting the same surroundings. As these investigations are pushed farther and farther it may be found that all living organisms, including even the lowest of the plants and animals, have some bearing upon this question. The unraveling of the intricate relationships existing in any such group is a labor of years, and the study must be undertaken with the greatest care and discrimination; otherwise, many incorrect conclusions may be drawn.

Before this investigation is completed it will make demands not only upon the entomologist and the ichthyologist; but the botanist and the zoologist, using the latter term in a very general sense, will also be called upon to assist in solving some of these interesting and practical problems.

Intricacies of Insect Societies. This subject alone is one calling for considerable study as will at once be seen by an examination of Plate I, which was prepared and drawn under the direction of Dr. J. G. Needham. There we find depicted in a portion of a running stream a number of interesting and diverse insects, and when these are taken from their native habitat and carefully identified and reared to maturity, we find that the apparently large number of forms represented above this bit of rushing water is by no means excessive. Living side by side in the water, there may be found not only the small *Simulium* larvæ but the interesting nymphs of two species of Mayflies, the young of a predaceous caddis fly and the aquatic larva and pupa of a small fly. These insects obtain their living in some manner or other from the rushing water or the things borne along by it, and the biologist who attempts to solve the relationships existing between the forms, even in such a limited colony as this, will find therein material for many months of study, and when this investigation is pushed farther, to include not only a little colony in one limited portion of a stream, but all of the aquatic insects or all of the forms living in a brook or pond or lake, the amount of work necessary will be immensely increased.

Insects as Fish Food. Some fish are dependent for sustenance upon insects and other forms which spend a greater or less proportion of their lives under the water, and certain species obtain a considerable part of their nourishment from insects which live in the neighborhood of water and fall upon its surface only by accident.

The end of an investigation of this subject is very far in the distance and yet the value of such work can hardly be questioned by one who compares the money expended in the rearing of fish with the amount necessary for such study.

The early researches of Prof. S. A. Forbes, State Entomologist of Illinois, convinced him that insects comprise the most important portion of the food of adult fresh water fishes, they furnishing 40 per cent of all the food of the specimens which he examined. He found the principal insectivorous fishes to be the smaller species whose size and food structure when adult unfit them for the capture of Entomostraca and yet do not bring them within reach of fishes or mollusca. Some of these fishes have peculiar habits which render them specially dependent upon insect life. The little minnow, *Phenacobius*, which according to his studies depends for nearly all of its food upon insects (98 per cent), seeks for them in running water. Next come the pirate perch, *Aphredoderus* (91 per cent), then the darters (87 per cent), the croppies (73 per cent), halfgrown sheepshead (71 per cent), the shovel fish (59 per cent), the chub minnow (56 per cent), the black warrior sunfish (*Chaenobryttus*) and the brook silversides (each 54 per cent), and the rock bass and the Cyprinoid genus *Notropis* (each 52 per cent). He found insects wholly or nearly absent from the adult dietary of the burbot, the pike, the gar, the black bass, the wall-eyed pike, the great river catfish, from that of the hickory shad and the mud-eating minnows (the shiner, the fathead, etc.). He found, however, that the larger fishes all go through an insectivorous stage, whether their food when adult be almost wholly other fishes, as with the gar and the pike, or mollusks, as with the sheepshead. The mud-feeders, however, do not seem to pass through this stage, but adopt the limnophagous habit as soon as they cease to depend upon Entomostraca. Terrestrial insects dropping into the water accidentally or swept in by rains are also diligently sought after and largely depended upon by several species, such as the pirate perch, the brook minnow, the top minnows or killifishes (*Cyprinodonts*), the toothed herring and several *Cyprinoids* (*Semotilus*, *Pimephales* and *Notropis*).

He also found that among aquatic insects slender dipterous larvæ belonging mostly to *Chironomus*, *Corethea* and allied genera were of remarkable importance, making in fact nearly one-tenth of the food of all the fishes studied. They were most abundant in *Phenacobius* and *Etheostoma*, which genera have become especially adapted to search for these insect forms in shallow rocky streams. Next they were found most generally in the pirate perch, the brook silversides and the sticklebacks, in which they averaged 45 per cent of the stomach contents. They amounted to about one-third of the food of fishes as large and important as the red horse and the river carp and made nearly one-fourth of that of 51 buffalo fishes. They appear

further in considerable quantities in the food of a number of the minnow family (*Notropis*, *Pimephales*, etc.) which habitually frequent the swift water of stony streams.

Prof. Forbes' studies also convinced him that nearly one-fifth of the entire amount of food consumed by all the adult fishes examined by him consisted of aquatic Neuropteroid larvæ, the greater part of them being the young of May-flies, principally of the genus *Hexagenia*. These larvæ were eaten especially by the miller's thumb, the sheepshead, the white bass, the striped bass, the common perch, 13 species of darters, both of the black bass, 7 of the sunfishes, the rock bass and croppies, the pirate perch, the brook silversides, the sticklebacks, the mud minnow, the top minnow, the gizzard shad, the toothed herring, 12 species each of the true minnow family and of the suckers and buffalo fish family, 5 catfishes, the dogfish and the shovel fish — 70 species out of the 87 he studied.

Among these he found that Neuropteroid larvæ were the most important food of the white bass, the toothed herring and the shovel fish (51 per cent) and the croppies; while they made a fourth or more of the alimentary contents of the sheepshead (46 per cent), the darters, the pirate perch, the common sunfishes (*Lepomis* and *Chænobryttus*), the rock bass, the little pickerel and the common sucker (36 per cent). The important food relations of May-fly larvæ is noted in detail in a following paragraph and will not be treated of in this connection.

The following biological and other records as well as the illustrations of the forms mentioned are taken largely from a partial report on the work done at the Entomologic Field Station, Saranac Inn, Franklin county, in 1900, by Dr. James G. Needham of Lake Forest University, Illinois, and his assistant at that time, Cornelius Betten. This work has been published with many additional details in Bulletin 47, New York State Museum, to which the interested reader is referred for further information. This publication also contains a number of valuable tables for the identification of both adults and young of aquatic insects.

Stone Flies.

(*Plecoptera*)

The stone flies are inhabitants of rapid streams and their nymphs may be found in such localities clinging to the under side of stones. It is only necessary to lift a stone or a stick from the water and turn it over quickly in order to find these interesting forms. They cling close to such objects with their legs stretched to full extent and their claws gripping firmly. They are said to be a favorite food of brook

trout. The adults are known to English fishermen, in addition to the general common name given above, as the red fly (Old Joan) and the willow fly (Shamrock fly), according to Prof. Miall. They are also known as Duns in this country. These insects were not very common at Saranac Inn as most of the water in that region was not rapid enough for them.

Chloroperla bilineata Say. This species had begun to disappear by June 15th, though a few could be found about the hatchery windows each day. Many dead ones were also discovered entangled in spider webs, and adults were not observed flying except from the place of transformation to the window. Empty nymphal skins were very abundant, and hundreds were to be found sticking to the sides of the hatchery troughs, the greatest number near the inflow pipe.

Leuctra tenella Prov. This form, the adult of which is shown at plate 1, figure 12, was much less common than the preceding one, and adults were not observed in flight. A few were taken on the hatchery windows, some on aquatic vegetation close to the water and others under boards overhanging the water near the railway embankment where there is a little ripple. In this last mentioned place nymphs were found crawling over the surface of stones and boards among the brown and empty cases of *Simulium* pupæ.

May-flies.

(*Ephemeridæ*)

The May-flies, or Ephemeridæ, are very common insects along the banks of streams and beside bodies of water. They are known to fishermen as drakes, including the green and other varieties. Other fishermen's names common in England as listed by Prof. Miall are as follows: March Brown, Great Red Spinner, Yellow Dun, Iron Blue Dun, Jenny Spinner, Little May Yellow Dun, Sky Blue, Orange Dun, Dark Mackerel, Pale Evening Dun, Whirling Blue Dun, July Dun and August Dun. The May-flies are readily recognized by their delicate structure. The very slender body is tipped posteriorly by two or three long, many-jointed filaments. The wings are many veined, the hinder pair being either much smaller than the fore pair or entirely absent. A glance at plate 2 will enable anyone to recognize the May-flies, as all the species have a very characteristic appearance.

It is popularly supposed that these insects live but a few hours or a day, and this is undoubtedly true of some forms, but others have an adult existence extending over a longer period. The eggs are deposited by some species on the surface of the water and by others on stones beneath the water. A note regarding the prolificacy of one form, *Heptagenia pulchella* Walsh, may be of interest in this con-

nection. Dr. Needham, in dissecting a female sub-imago of this species, counted a portion of the eggs in her ovaries, and on this basis estimated their entire number at 1,340.

The young, or nymphs, as they are termed, live under water. They may be recognized by a study of the two forms represented at figures 1, 2, 5 and 6 on plate 2. It will be seen that they are slim, six-legged crawlers, bearing slender, barbed, anal filaments, and with a row of tracheal gills or breathing organs along the outer margin of the abdomen. Once seen they are easily identified. It has been truly observed of these creatures by Dr. Needham, that the struggle for existence falls upon them, and, consequently, there are several highly specialized groups, each nicely adapted to its peculiar habits. Some of these nymphs live in or among the water plants, while others burrow in the mud and obtain their food at or near the bottom of the water. All of them are delicate morsels for fish, and are fed upon to a considerable extent.

The studies of Prof. Forbes have shown that May-fly larvæ were eaten by 213 specimens representing 48 species, not counting the young. The larvæ of *Hexagenia*, one of the commonest of the "river flies" in Illinois, were by far the most important insects of this group, they alone amounting to about one-half of all the neuropteroid larvæ eaten. They made nearly one-half of the food of the shovel fish, more than one-tenth of that of the sunfishes, and were the principal food resource of half-grown sheepshead. They were rarely taken by the sucker family and comprised only five per cent of the food of the catfish group.

The abundance of these forms is well-known to almost anyone who is at all familiar with aquatic life. At times they occur in almost innumerable swarms. Such flights have been compared to snowstorms, and Mr. Cheney, our late State Fish Culturist, records an instance of having seen them cover the front of a large hotel, windows, doors and every inch of woodwork, as though the house had been plastered with them. This condition is not infrequent in Buffalo and vicinity. Only last spring the writer observed in the lower section of the city that buildings were nearly covered in the early evening by these insects, and they were so numerous as to be a source of positive annoyance to pedestrians. Five, six or even twenty might alight on a person at one time. Residents along the St. Lawrence river are familiar with the immense annual swarms of these insects. A further idea of their abundance in nature may be gained from the following observations by Dr. Needham at Saranac Inn. In a quantitative study of a plat of 15 square feet, embracing the margin and a portion of the bed of a small stream, he found 15 nymphs, or one to every square foot of surface.

Explanation of Plate 2.

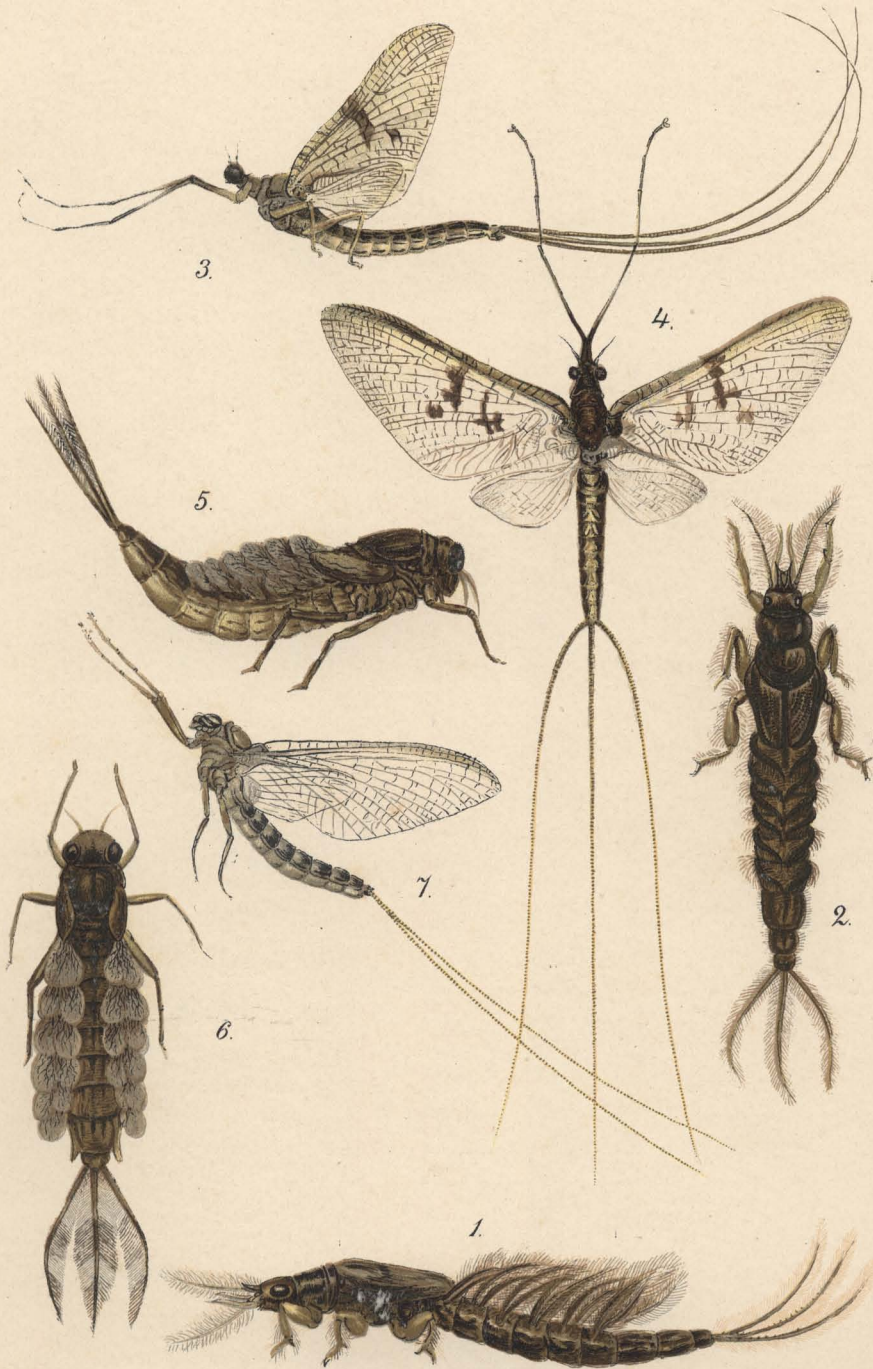
Ephemera varia Etn.

1. Lateral view of the nymph. Note the latero-dorsal breathing organs or gills on the abdominal segments.
2. Dorsal view of the nymph. This view shows how these organs may arch over the back.
3. Lateral view of the male imago.
4. Dorsal view of the male imago.

Siphonurus alternatus Say.

5. Lateral view of the nymph. This larva possesses a different type of abdominal breathing organs or gills.
6. Dorsal view of the nymph. This view shows the overlapping of the gills and also gives some hint of the number of tracheæ or air tubes, represented by black lines in each.
7. Lateral view of the male imago.

Plate 2



L. H. Joutel, 1900

James B. Lyon, State Printer

MAYFLIES

[Reprint from N.Y. State Museum Bulletin, 47.]



Dragon flies bear an evil reputation in the popular mind, and on account of that they have earned such designations as darning needles, devil's needles, snake doctors, etc., all indicating the popular estimate of these relatively harmless creatures.

The adult dragon flies have a very characteristic appearance, and the more powerful ones are seen in most localities near the water, and frequently at a considerable distance from it. They are characterized by their four large, nearly equal membranous, many-veined wings. The larger dragon flies, as is well known, are strong fliers. The body is cylindrical, the thorax very well developed, and the head conspicuous by its enormous eyes. There are two groups of these interesting insects—one comprising the larger forms, which may always be recognized when at rest by their wings being extended horizontally, and the other, a group of smaller dragon flies, now frequently called damsel flies, which are much more slender, delicate creatures than the above described. The latter are usually brilliantly colored, and they may be recognized when at rest by their wings being folded together and extending lengthwise over the body.

The young of dragon flies are aquatic and may be found in a great variety of situations, inhabiting as they do most of the less rapid fresh waters. The nymphs possess rudimentary wings and may be recognized by reference to the illustrations on plate 3. The head is enormous, and the most characteristic feature of all is the large mask or lower lip, which is capable of being extended forward to seize the unwary prey. A few of these nymphs are illustrated at figure 1 on plate 3, and their adults are shown in the same plate hovering over the water.

The nymphs of damsel flies may be distinguished from their more powerful relatives in much the same way as the adults, by their more slender frail structure, and also by the anal flaps protruding from the posterior extremity.

The eggs are deposited in various ways by different species. Some females course back and forth over the water, touching its surface here and there, and at each contact depositing a number of eggs; others alight on a floating piece of wood or other support and place their eggs within the plant tissues; and still others, particularly some of the damsel flies, are known to crawl beneath the surface of the water, in order to deposit their eggs in the stems of aquatic plants.

Saranac Inn, as was proven by the investigations of Dr. Needham, is the home of a great number of species of the larger dragon flies. His short stay of ten weeks sufficed for the collecting of 36 species of these insects, and in his quantitative studies along Little Clear Creek, he found that their nymphs were exceedingly abundant. For example, in one small fishpond, made by impounding the creek with its eastern side boarded up to a height of 15 or 20 inches above the

level of the water for a distance of perhaps 20 yards, he was able during the month of June to collect 170 cast skins from the boarded side. This number may possibly represent one-half of the nymphs which found sustenance in this limited area of water, figure 1. Still further evidence of the abundance of these insects was observed by the writer a little later in the season, when this portion of the stream was cleaned out and the mud and accumulated debris on the bottom were thrown upon the bank. Only a few minutes after this fluid or semi-fluid matter had been cast upon the land one could see here and there a movement, and out would wriggle a dragon fly nymph. These creatures were so abundant that it was very easy to collect a quart or more by picking them from the material shoveled out of the creek. Some quantitative studies made by Dr. Needham a little lower down on this same stream showed that in a space of only 15 square feet, extending from the bank out into the stream, there were 26 nymphs of these larger dragon flies.

These figures give some idea of the immense numbers of these forms which exist under favorable conditions, and as they are very voracious, they require a large amount of food. They prey not only upon themselves but upon other insects and to some extent upon smaller fishes and in turn fall victims to larger fish and other inhabitants of the stream that may be powerful enough to overcome them and keen enough to detect them. The studies of Prof. Forbes show that dragon fly nymphs comprise 25 per cent of the food of the grass pickerel, and in the croppie, the pirate perch and the common perch the proportion ranges from 10 to 13 per cent.

The following brief notes on various dragon flies, studied at Saranac Inn, were taken from Dr. Needham's report on the work done in 1900. See Bulletin 47 of the New York State Museum for tables for the separation of the species and other details.

Ophiogomphus aspersus Morse. This form, hitherto known as a very rare species, was common at Saranac Inn. Many imagos of both sexes were observed flying over Little Clear Creek in places where the shallow current rippled over sand. The males would fly back and forth a few times and then rest for a while on some prominent twig near shore, generally on the higher bank. They were not difficult to approach or to capture when at rest. Except when ovipositing, the female seemed to remain less of the time in the vicinity of the water, and then she makes a succession of sweeps back and forth near the head of some little ripple, striking the water, after a few short flights, again and again near the same place and leaving her eggs in it. The nymphs, plate 3, figure 5, were very common in the sandy bed of the creek, and their cast skins were abundant along the banks through the months of June and July, sticking to some support within a foot of the edge of the water.

Hagenius brevistylus Selys. This species was common along Little Clear Creek. The nymphs, plate 3, figure 7, were found in the midst of trash on the bed of the stream, and during the season of transformation exuviae dotted the banks rather conspicuously. Few adults were seen at large. These fly swiftly about the stream from one resting place to another. They are easy to approach and not very difficult to capture when resting on the bridges crossing the stream. The eggs are dropped by the female during flight. She descends and strikes the water repeatedly at points wide apart and from 10 to 20 eggs are liberated at each descent. Nymphs of various sizes are always found together, and as they are easily divided by size into three or more groups, this species may have a developmental period of four or more years duration.

Gomphus brevis Hagen. This species was common at Saranac Inn though but a single imago was captured, very few being seen. The nymphs, plate 3, figure 3, were very plentiful in Little Clear Creek. The season of transformation was apparently about ended on our arrival at Saranac Inn, June 12.

Gomphus descriptus var. *borealis* Ndm. This interesting variety was not uncommon at Saranac Inn. A few were observed on the Otisville road, and others were seen resting on the bare sand near the outlet of Little Clear Pond.

Gomphus exilis Selys. This species was abundant at Saranac Inn, flitting by every roadside through the month of June and well along into July. The nymphs were found in all waters, and about the first of July the exuviae freely sprinkled the banks. Few adults were observed in the immediate vicinity of the water, and these were mostly females ovipositing. They spun along over the water at a lively rate, unattended by the male, descending here and there to strike the surface and liberate eggs, making but one or two dips in a place, and flying some distance before descending again. The nymphs transformed at the very edge of the water, seldom crawling more than an inch or two above its surface. Moss-grown logs on the edges of Little Clear Pond were in many places covered several layers deep with the exuviae of this species.

Gomphus scudderi Selys. This handsome black species, plate 3, figure 10, was common at Saranac Inn and even more so, judging from the numbers of exuviae in evidence along the bank, at Axton, but few imagos were seen at large, though many were bred from nymphs, plate 3, figure 2, taken from Little Clear Creek beside the hatchery.

Gomphus spicatus Hagen. This species, next to *G. exilis*, was the commonest gomphine at Saranac Inn, where it frequented all sorts of waters. Adults were common during the latter part of June and the first two weeks of July along the wagon

Explanation of Plate 3.

Dragon Flies and their Nymphs.*

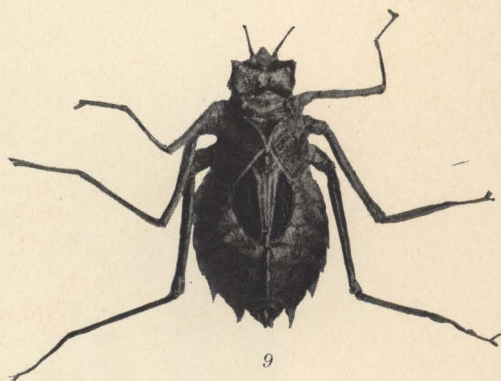
1. Nymph of *Dromogomphus spinosus* Selys
 2. Nymph of *Gomphus scudderi* Selys
 3. Nymph of *G. brevis* Selys
 4. Nymph of *G. spicatus* Selys
 5. Nymph of *Ophiogomphus aspersus* Morse
 6. Nymph of *Lanthus parvulus* Selys
 7. Nymph of *Hagenius brevistylus* Selys
 8. *Aeschna constricta* Say
 9. Nymph of *Didymops transversa* Say
 10. *Gomphus scudderi* Selys
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* All from photos by Dr J. G. Needham.

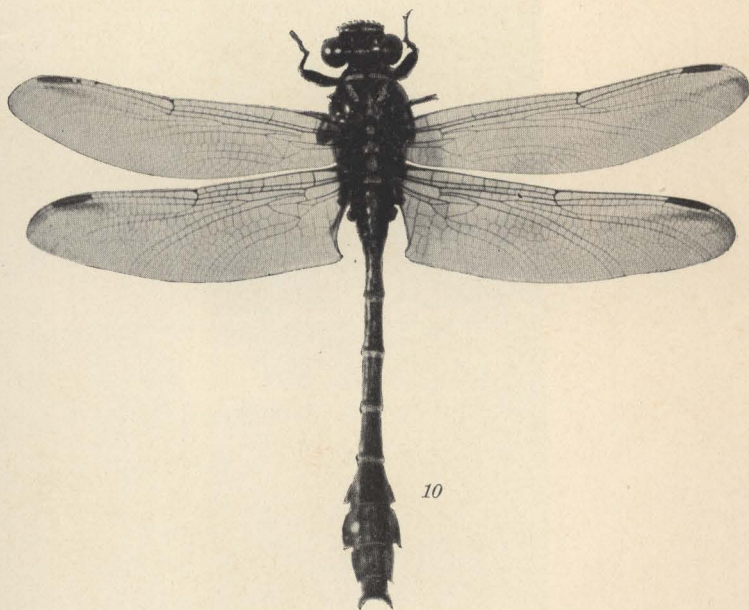
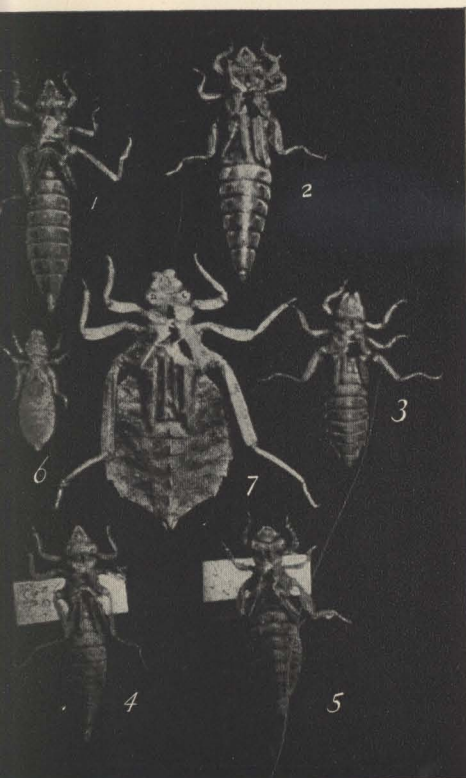
PLATE 3.



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9



10

DRAGON FLIES AND THEIR NYMPHS.



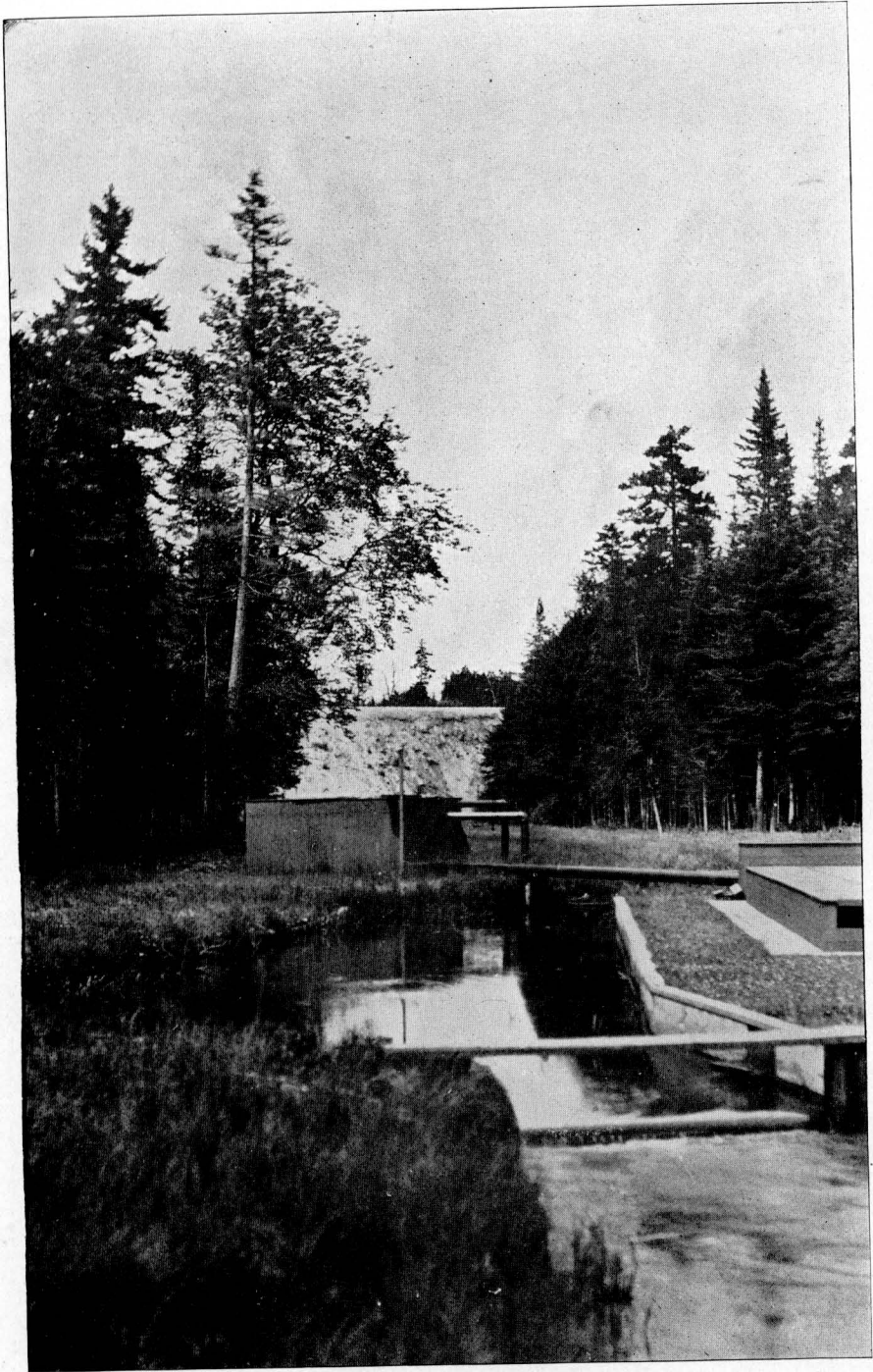


FIG. 1. A HOME OF DRAGON FLY NYMPHS
LITTLE CLEAR CREEK ON THE HATCHERY GROUNDS, SARANAC INN.
PHOTO BY J. G. NEEDHAM.



road and railroad between Little Clear and Big Clear Creeks. A goodly number of nymphs, plate 3, figure 4, was collected from Little Clear Creek on the hatchery grounds, Little Clear Pond near its outlet and from Bone Pond.

Dromogomphus spinosus Selys. This species was taken at Saranac Inn only during the week which included June 30th in Little Clear Pond near the outlet. The nymphs, plate 3, figure 1, were crawling onto stumps and logs from the rather deep water along the bank. A big pine stump that stood partly in the water halfway between the outlet and the cold water pipe seemed a favorite place for transformation. It was fairly dotted with exuviae.

Boyeria vinosa Say. This species was very common at Saranac Inn in Little Clear Creek and in the borders of the pond above. The nymphs were transforming commonly on the sides of the timbers along the edge of the water from the middle of June until the latter end of July.

Basiaeschna janata Say. This species was common about the hatchery grounds June 12th and had about disappeared by midsummer. Mostly immature nymphs were found at this time at Saranac Inn. Females were observed ovipositing several times, and in each instance the eggs were deposited in leaves of bur-reed, *Sparganium*, which, where it occurred in the deeper water of the creek, trailed its long leaves on the surface of the stream. The female flitted from plant to plant, making a few thrusts with her ovipositor into each at the water line and then settled and balanced herself carefully on a long floating leaf and began more extensive operations. Backing down into the water until her abdomen was almost wholly submerged, she began thrusting with her ovipositor, first to right, then to left, moving forward a little between the thrusts and leaving behind a double row of stitches as regular as the neatest double stitching done with a needle. Several such double rows of eggs were placed in the tissues of one leaf before it was left.

Epiaschna heros Fabr. is the largest of our dragon flies, and is widely distributed throughout the state. It not infrequently enters houses and apparently migrates in numbers.

Aeschna constricta Say, plate 3, figure 8, and *A. clepsydra* Say, were both common at Saranac Inn during the latter half of the summer.

Anax junius Drury. This well-known species, which is very common in most parts of the State, was rather rare at Saranac Inn. The nymph is probably better known than that of any other species, as it is sure to come into the net of the aquatic collector. It usually clings to water weeds nearer the surface than the bottom in an attitude of alertness, with head poised low and abdomen slightly elevated.

Cordulegaster maculatus Selys. This species was not uncommon at Saranac Inn.

It was to be seen during the greater part of the summer on sunshiny days coursing up and down Little Clear Creek on the hatchery grounds. It was observed nowhere else, and it has not been hitherto reported from New York State.

Didymops transversa Say. This form was not very common at Saranac Inn, but nymphs, plate 3, figure 9, were taken in the borders of Little Clear Pond and Creek, and exuvia were found along the eastern shore of Lake Clear, hung up in the bushes or attached to large logs several yards from the water's edge.

Epicordulia princeps Hagen. This species was seen but a few times at Saranac Inn, and no specimens were taken either as nymphs or imagos. It is not uncommon in other places in the State, and will probably be found quite generally distributed when proper search is made for it.

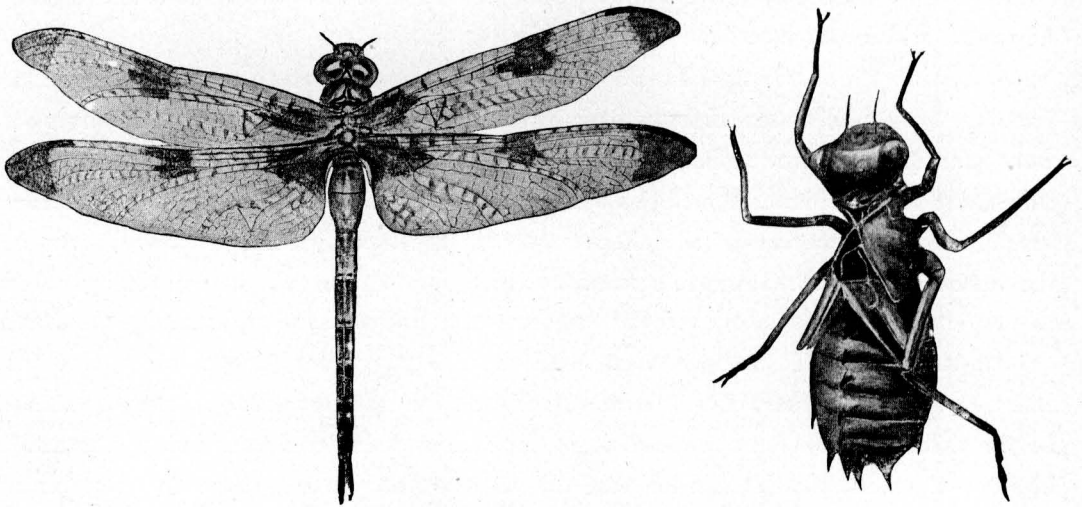


FIG. 2. EPICORDULIA PRINCEPS HAGEN, ADULT AND NYMPH.

DRAWING BY MRS. J. G. NEEDHAM.

Tetragoneura. Four species of this genus were all common at Saranac Inn, and Dr. Needham found eggs laid in strings, which probably belong to this genus. They were attached together in masses and hung on partly submerged twigs at the surface of the water, and were very common objects about the shores of Little Clear Pond. While their identity cannot be absolutely proven it is very probably as stated.

Tetragoneura spinigera Selys. This dragon fly was exceedingly abundant at Saranac Inn during the month of June, flying about the hatchery grounds in common with the other species, and occurring also about every little clearing in the forest.

Tetragoneura cynosura Say or dog-tail. This species, which has hitherto been recorded from but few localities within the State, is likely to be found in most

large ponds in central and western New York. The typical form was not common at Saranac Inn.

Tetragoneura semiaqua Burm. This form was found associated with the others at Saranac Inn.

Tetragoneura spinosa Hagen. This dragon fly was less abundant at Saranac Inn than other members of the genus listed as occurring there.

Helocordulia uhleri Selys. This species was not uncommon in Little Clear Creek on the hatchery grounds. Imagos were seen flying a few times about the banks of Little Clear Pond close in shore and well above the water. The nymphs live in the borders of the creek, mainly in the shallow places in red-rotten vegetable debris.

Somatochlora elongata Scudd. A few imagos of this species were seen flying with great swiftness about the borders of Bone Pond. A nymph was taken from Little Clear Pond and a cast skin was found later in the season on the north side of the outlet of Little Clear Pond on a bed of moss a few inches above the water line.

Somatochlora walshii Scudd. has been recorded from Keene valley and probably occurs in the Saranac region.

Cordulia shurtleffi Scudd. This species was common at Saranac Inn. A few imagos were observed flying about the hatchery grounds and the creek, but their favorite resort for foraging and support was the edge of a bog pond hidden in the deep woods. The nymphs were found in a shaded trashy place on the edge of Little Clear Pond and also in Bone Pond.

Dorocordulia libera Selys. This dainty and beautiful dragon fly was not uncommon at Saranac Inn. The imagos were taken about the borders of bog ponds. One nymph was found in the edge of Little Clear Pond at its outlet.

Leucorhinia glacialis Hagen. This beautiful species, previously only known from a few males, was common at Saranac Inn. Early in July it was easily found about the outlet of Little Clear Pond, and nymphs were obtained and the oviposition of females observed. Its various stages and the two sexes are illustrated on plate 4.

Sympetrum costiferum Hagen. One example of this species was unexpectedly obtained on August 8 in one of the breeding cages. No imagos were seen at large.

Sympetrum vicinum Hagen. The nymphs of this form were found on the north side of the outlet of Little Clear Pond, on a shelving bank behind hummocks of cat tails.

Sympetrum assimilatatum Uhler. This dragon fly was very common in Little Clear Creek, and during the latter part of July the nymphs could be seen in the morning climbing up the *Sparganium* stems and transforming.

Explanation of Plate 4.

Leucorhinia glacialis Hagen

FIG.

1. Two nymphs on the bottom of the pond.
2. The empty nymph skin, left clinging to a branch after transformation.
3. The female imago.
- 4, 5. Dorsal and lateral views of the male imago.

Plate 4



L. H. Joutel, 1900

James B. Lyon, State Printer

LEUCORHINIA GLACIALIS

[Reprint from N.Y. State Museum Bulletin, 47.]



Sympetrum rubicundulum Say. Occurs in the Saranac region. It is a common species.

Sympetrum obtrusum Hagen. Occurs in the Saranac region and is a common species.

Mesothemis simplicicollis Say. This widely distributed species is much more common southward and westward. A single specimen was seen at Saranac Inn.

Ladonia julia Uhler. This dragon fly was very common at Saranac Inn. It began to appear in numbers June 13, and the imagos were abundant along every roadside during the remainder of the month. Females were only a little less abundant than males. Nymphs were numerous in trashy places in the borders of Little Clear and Bone Ponds, and few were found in Little Clear Creek.

Libellula basalis Say. One imago and one nymph were taken at Saranac Inn.

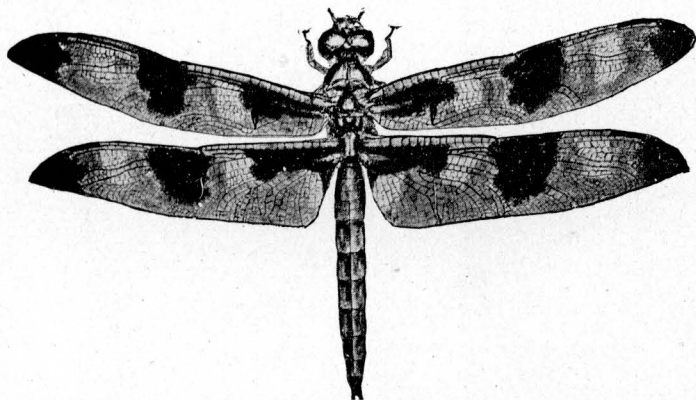


FIG. 3. LIBELLULA PULCHELLA DRURY.

Libellula quadrimaculata Linn. This form occurred sparingly at Saranac Inn. A few imagos were observed sitting on twigs which rose directly a few feet out of the water. They were shy and difficult to capture, and when disturbed would rarely return to the same vicinity.

Libellula pulchella Drury. This dragon fly was not common at Saranac Inn, and but few specimens were seen.

Fish Flies, Dobson and Others.

This group as now defined includes such well-known insects as ant lions, aphid lions, the dobson and other allied species, and while the appearance of these various forms differs in many respects, still they have certain affinities which have led to their being placed in a single order.

The aquatic members of this family comprise the alder or orl flies, fish flies, the dobson and the smaller forms to which Dr. Needham has given the common name of *Spongilla* or *Sponge flies*.

The family *Sialidæ* includes some of the more common aquatic species, such as the fish flies, and in particular the dobson, an insect whose larva is highly valued by fishermen as bait. Few insects of such inconspicuous coloration and secretive habits are so well known as these. The adults do not ordinarily wander far from their native streams or ponds, and they are generally found sitting closely on some support with wings folded like a roof over the back.

Sialis infumata Newm. This species is known as the smoky orl fly, and several adults were taken on both Little and Big Clear Creeks during the latter half of June. Larvæ were obtained in small numbers from Little Clear Creek on the hatchery grounds. They live in the borders of streams and ponds in trashy places filled with aquatic plants and clamber through the falling vegetation with great agility.

Transformation from the larvæ to the adult takes place in moist soil at some little distance from the edge of the water. An oval cell is formed in the soil from several inches to a foot or more beneath the surface, in which the larva curls itself up, and without making a cocoon becomes a pupa, the adult emerging two or three weeks later.

The genus *Chauliodes* includes eight North American species, but two of which had previously been recorded from this State. These and another were found by Dr. Needham at Saranac Inn. The adults are less retiring than those in other genera of the family, and some species at least are habitually abroad during the hours of sunshine, making short fluttering flights from stem to stem. The eggs are placed in somewhat regular rows on the surface of a leaf or other support, sometimes over the water, but oftener at a short distance from it. The larvæ live in wet places at the edge of the water or in the water close to the surface, and are perhaps oftenest found clinging to the under side of floating logs or crawling beneath loosened bark. The full-grown larva excavates a cell in a layer of moss or in rotten wood, just above the level of the water, in which it transforms to the adult without spinning a cocoon.

Chauliodes rastricornis Ramb. The adult of this species was not observed outside of the breeding cages, though larvæ and pupæ were obtained in several places about the shore of Little Clear Pond. The latter were so abundant that in one small bay 25 pupæ were obtained in a very little while. Eggs, which apparently belong to this species, were not uncommonly found attached to the flat surface of some board several feet above the surface of the water. They were more grayish in

color than those of *C. serricornis*, and were arranged in somewhat more regular V-shaped rows, never more than one layer in depth. The minute egg parasite, *Trichogramma minutum* Riley, destroyed a great many eggs of this species. In a number of clusters over 70 per cent were attacked.

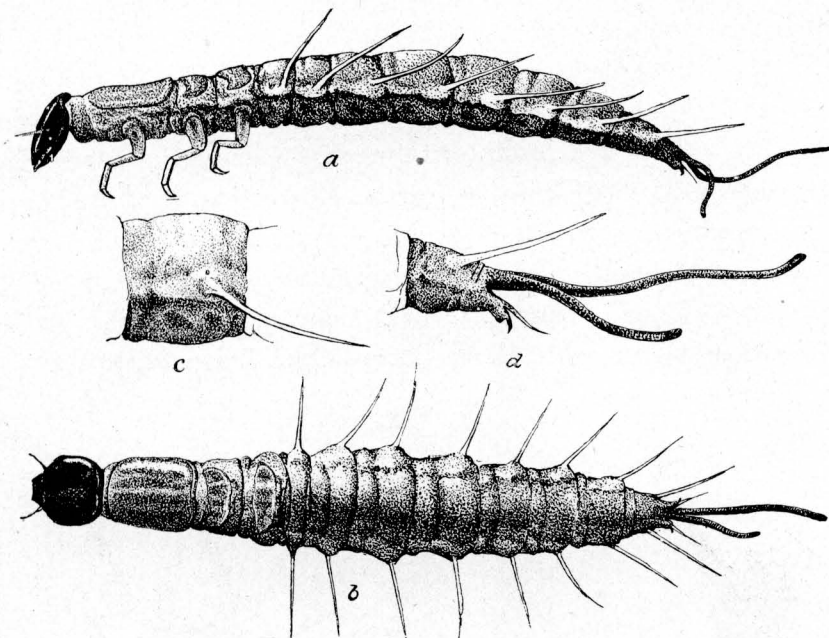


FIG. 4. LARVA OF CHAULIODES PECTINICORNIS.

a, side view; *b*, dorsal view; *c*, an abdominal segment enlarged; *d*, anal segment with appendages similarly enlarged.

AFTER LINTNER.

Chauliodes pectinicornis Linn. This species is known as the comb-horned fish fly, and a single female specimen was bred from a pupa found in an old pine stump in the edge of the water near the outlet of Little Clear Pond. This is the largest of the ashen gray species of *Chauliodes*.

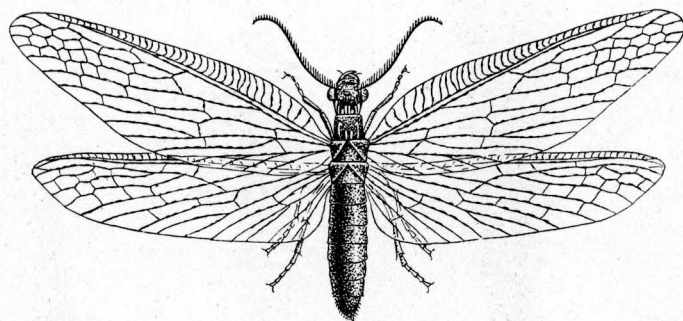


FIG. 5. THE COMB-HORNED FISH-FLY, CHAULIODES PECTINICORNIS, NATURAL SIZE.

AFTER LINTNER.

Chauliodes serricornis Say. This form, known as the saw-horned fish fly, was very common along Little Clear Creek between the hatchery and the railroad. Half

a dozen specimens could be picked any day in July from the sedges and flowering ferns in walking across this short open space. A large number of egg

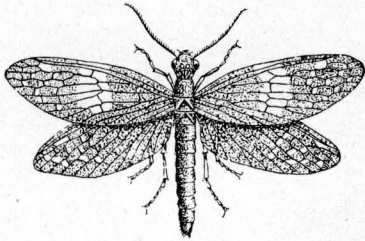


FIG. 6. THE SAW-HORNED FISH FLY, CHAULIODES SERRICORNIS, NATURAL SIZE.

AFTER LINTNER.

clusters were seen, all of them on the under side of the leaves of the flowering fern, *Osmunda regalis*. One cluster was found to contain 900 eggs, and, while others were larger, many of them were smaller. The period of incubation is about 17 days, and there appears to be a great uniformity in all eggs

of the same mass. Numerous clusters were picked with the eggs all hatching at once, heads protruding and jaws widely swung open, a most curious sight, a veritable *cheval de frise* of great rapacious mandibles.

Corydalus cornuta Linn. This is the giant member of the family, and is known commonly to entomologists as the horned Corydalus. The larva is the well-known

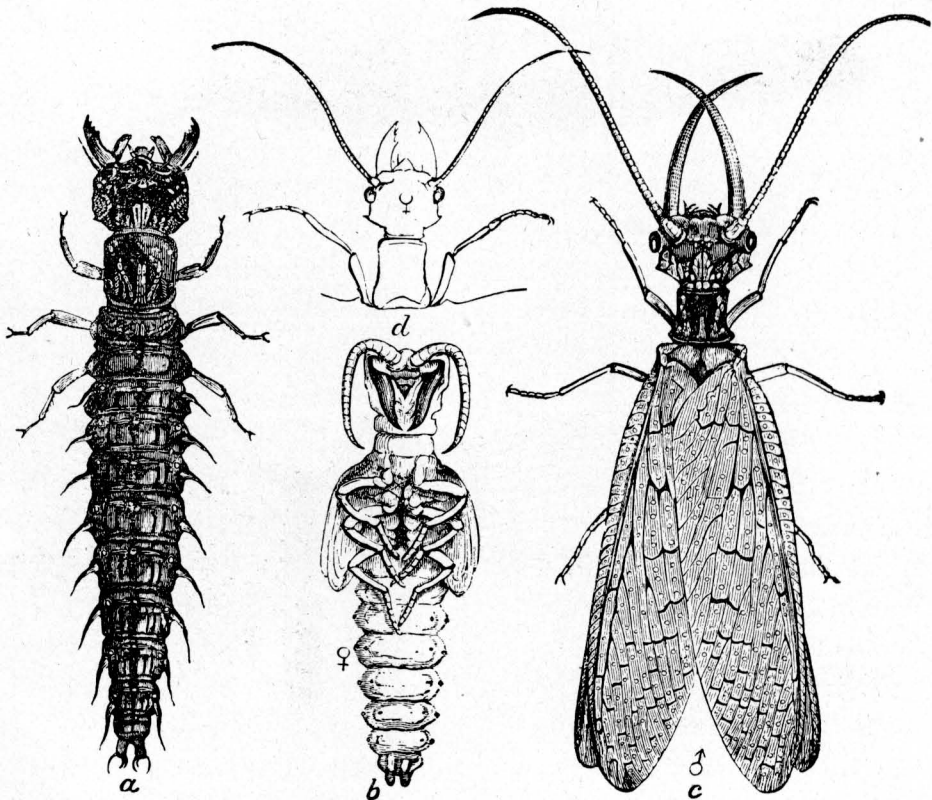


FIG. 7. HORNED CORYDALIS, CORYDALIS CORNUTA LINN.

a, the larva; *b*, the pupa; *c*, the male imago; *d*, head and thorax of the female.

AFTER RILEY.

dobson of the fishermen. This species is easily identified by the accompanying figures, and it is so well known that further notice is hardly necessary in this connection.

The family *Hemcrobidae* is familiar through one of its larger and a number of its medium sized species. The large *Polystachotes* is a very characteristic insect of the Adirondacks, and in certain sections, at least, it occurs in enormous numbers. It was abundant at the railway station at Saranac Inn, and Dr. Lintner found it in immense numbers at Keene valley. Nothing is known regarding its larval life, though probably it is terrestrial. Dr. Needham succeeded in obtaining eggs.

The medium sized species of this family are well known as lace-winged flies, and they, like the *Chrysopidae*, the more common lace-winged flies, known in the larval state as aphid lions, are terrestrial in habit. Two genera of the smallest forms were reared by Dr. Needham, the larvæ of both being aquatic and living at Saranac Inn in fresh water sponges.

Sisyra umbrata Ndm. Plate 5. A few of the larvæ of this species were found on fresh water sponges living in the hatchery and about the middle of June their cocoons began to appear on the sides of the supply trough in such numbers that it was evident that the larvæ were coming in from the supply pipes. This larva is peculiar in that it possesses paired, jointed appendages beneath the abdominal segments and on account of its long downward-curved, piercing mouth parts which are of a unique suctorial type. The cocoons spun in the hatchery were located just above the water on the smooth tarred vertical sides, some on the upper edges, some on the sides and edges of the hatching trough below, but mostly on the outside of the supply trough and in the angles which they make with the hatching troughs or in the thread grooves at the base of the faucets. The larva spins over itself a hemispheric cover of close woven silk attached by its edges to the supporting surface and a complete inner cocoon of considerably smaller size, likewise close woven. Adults were present in the hatchery in vast numbers, hundreds of them being easily collected from the ceiling in the best lighted portions of the room. A few were taken in trap lanterns placed near the outlet of Little Clear Pond. One or two specimens were caught while sweeping aquatic vegetation in Little Clear Creek.

Climacia dictyona Ndm. Plate 5. The cocoons of this species, like those of the preceding, were also very common in the hatchery troughs and they are easily recognized by the outer covering of coarse silk woven in hexagonal meshes like bobinet within which is the inner cocoon of closely woven finer threads. Adults reared from these beautiful cocoons proved to be this species. The first appeared on June 18 and throughout the remainder of the month they were fairly common. Then they

Explanation of Plate 5.

Ctimacia dictyona Needham.

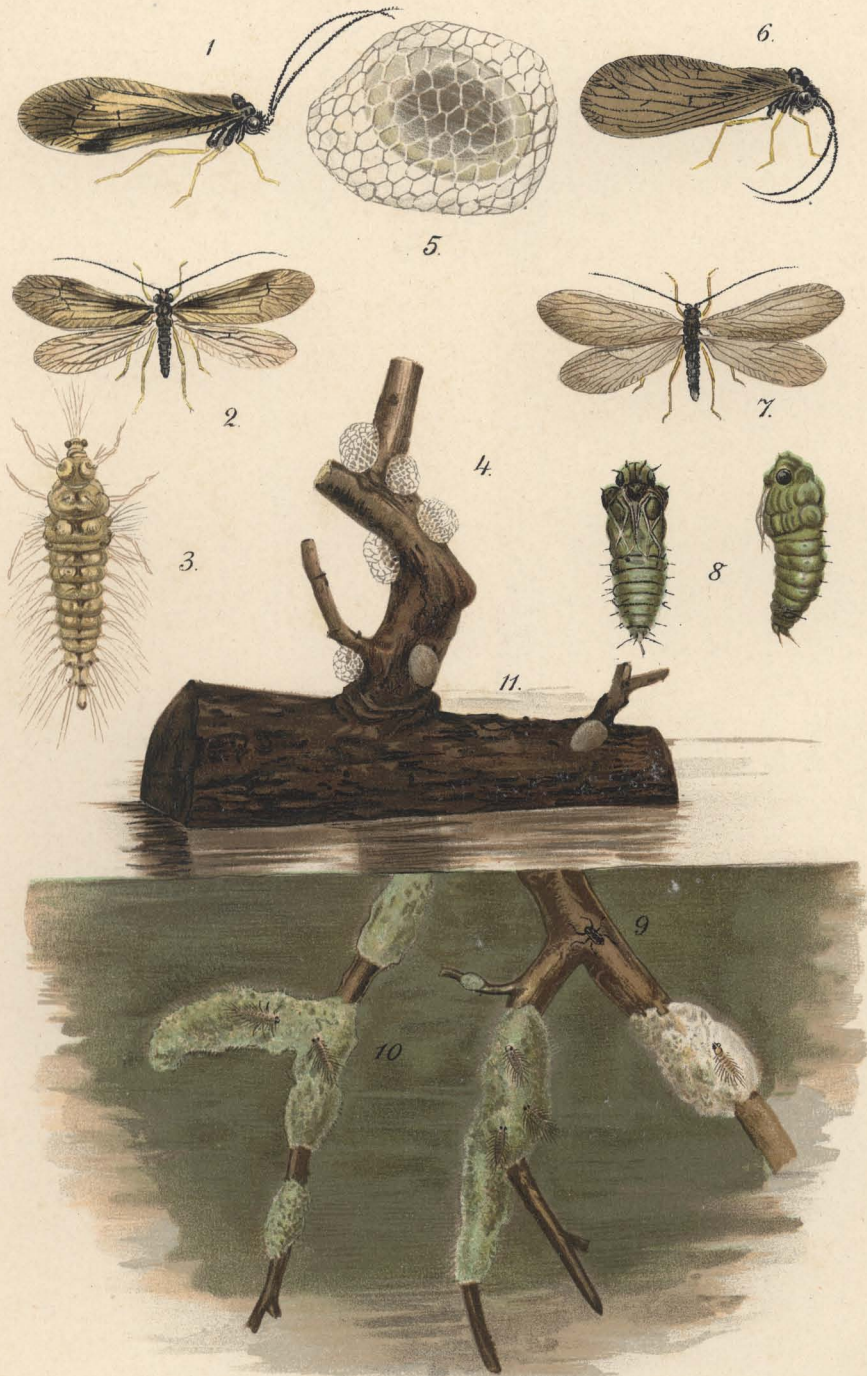
FIG.

1. Imago, lateral view, x 4.
2. Imago, dorsal view, x 3.
3. Larva, dorsal view, x 6.
4. Pupal cases, in situ, natural size.
5. One of the same, enlarged, showing the hexagonal meshes of the outer covering.

Sisyra umbrata Needham.

6. Imago, lateral view, x 4.
7. Imago, dorsal view, x 3.
8. Two newly formed pupæ, lateral and ventral views, x 6.
9. *Macronychus glabratus* Say (Coleoptera: Parnidæ); an associate of the sponge fly larvæ, on submerged timbers.
10. Fresh-water sponges (*Spongilla* ? *fragilis* Leidy) in situ, with the sponge fly larvæ crawling about over them.
11. Two pupal cases of *S. umbrata*, showing the closely woven outer covering, natural size.

Plate 5



L. H. Joutel, 1900

James B. Lyon, State Printer

SPONGILLA FLIES

[Reprint from N.Y. State Museum Bulletin, 47.]

disappeared for a time but were present in some numbers about the middle of August. They were taken a few times in trap lanterns and also in sweeping aquatic vegetation, but the hatchery ceiling was the best collecting ground. The larvæ and pupæ are very similar in form and habits to those of *Sisyra* described above.

Caddis Flies.

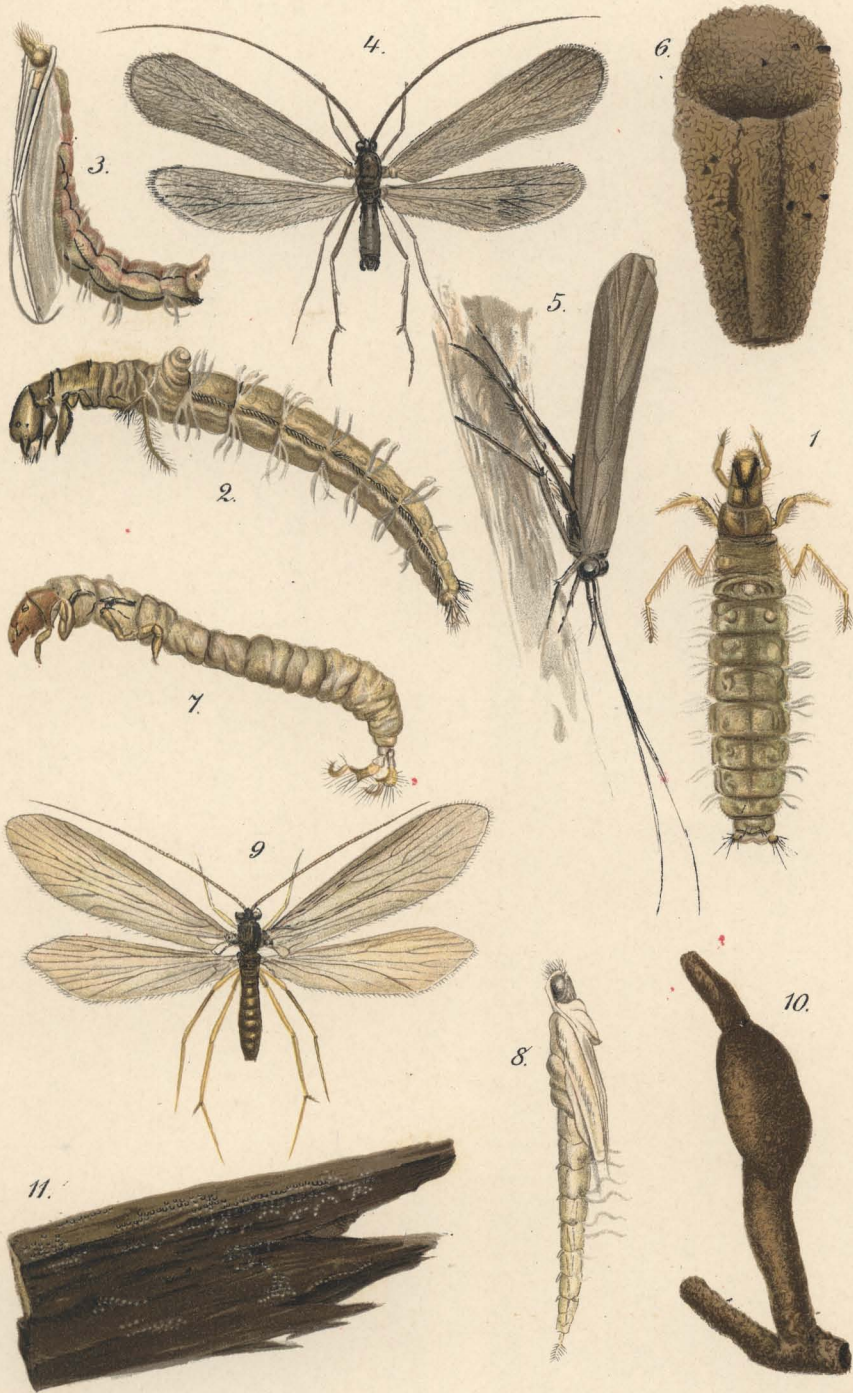
The caddis flies are known to lovers of nature as case worms, so frequently seen at the bottom of streams. Fishermen are also acquainted with these curious larvæ, and if one has never seen them, they are comparatively easy to find by examining closely the bottom of almost any body of water. One may see here and there a peculiar, usually somewhat cylindrical case, made of some of the materials found at hand. For example, these cases are not infrequently made of two sticks of wood, one longer than the other, the longer one usually projecting quite a little distance beyond the end of the case proper, and with the intervening space filled by smaller particles of vegetable debris and the interior lined with silk. This species is exceedingly common in many of the brooks of New York State. Other forms use, instead of vegetable matter, grains of sand, small shells or pebbles, and in some species there is no tube, but the larvæ lurk in rapidly rushing water under stones, and depend for sustenance upon the exceedingly interesting web or net which is stretched across a very small portion of the running stream. This little creature is predaceous, and catches its food in what is really a water net. The adult insects look very much like moths. They are soft creatures with four large wings, which are more or less densely closed with hairs or scale-like hairs. They are considered as being closely related to the moths and butterflies, and when one examines both the adults and the case worms themselves this relationship is quite evident. The English fishermen, according to Prof. Miall, know some of these insects under the following names: Blue Dun, Little Red Spinner, Sand Fly, Grannom, Turkey Brown, Dark Spinner, Silver Horns and Cinnamon Fly. They are also known as Duns. The inhabitants of these cases are interesting, and resemble caterpillars very much indeed, though, of course, they have become adapted to living under water. Two forms of these interesting larvæ are represented at figures 1, 2 and 8 on plate 6. These case worms are fed upon by fish to some extent. The studies of Prof. Forbes show that they occurred somewhat rarely in the stomach of the rock bass, forming, perhaps, 15 per cent of its food and but 12 per cent of the food in minnows of the *Hybopsis* group. Apart from these, they averaged from 1 to 6 per cent of the food in less than half of the species studied by Prof. Forbes. Mr.

Explanation of Plate 6.

Caddis Flies.

FIG.

1. Dorsal view of larva of *Molanna cinerea* Hagen, x 4.
2. Lateral view of larva of *M. cinerea*, x 5.
3. Lateral view of the pupa of *M. cinerea*, x $4\frac{1}{2}$.
4. Dorsal view of imago of *M. cinerea*, x 4.
5. The accustomed resting position of the imago of *M. cinerea*.
6. Ventral view of the flat larval case of *M. cinerea*, x 2.
7. Lateral view of larva of *Polycentropus lucidus* Hagen, showing the very long anal prolegs, and the absence of gill filaments, x 5.
8. Lateral view of pupa of *P. lucidus*, x 6.
9. Dorsal view of imago of *P. lucidus*, x $3\frac{1}{2}$.
10. Larval case of *P. lucidus*; tube composed of sand and silk; the enlargement near the end is two layered, and contains the pupa.
11. Eggs laid by *P. lucidus* female on a stick protruding from the water in a breeding cage.



L. H. Joutel, 1900

James B. Lyon, State Printer

CADDIS FLIES

[Reprint from N.Y. State Museum Bulletin, 47.]

Cheney, quoting Lanman, states that trout which feed extensively on caddis worms have red flesh and are of a golden hue, with an increased number of red spots. As many as 588 caddis-worm cases have been found in the stomach of one trout. These insects were very abundant at Saranac Inn, and the following notes are taken almost entirely from Mr. Betten's report on this interesting group. He reared several species from the egg, and found that hydras killed many of the young but were unable to use them as food because of their size. He observed several species feed on stone wort, *Nitella*, and river weed, *Potamogeton*, which flourished in Little Clear Creek.

A large number of adults were taken in trap lanterns, and though the laying of eggs was not observed, many clusters were found on the bark of submerged trees, which lead to the conclusion that in some cases the female goes under water to deposit the eggs. The circular cluster of eggs shown in figure 4 was found suspended on a submerged twig under a log floating in deep water. The number of eggs in this cluster was estimated at 450.

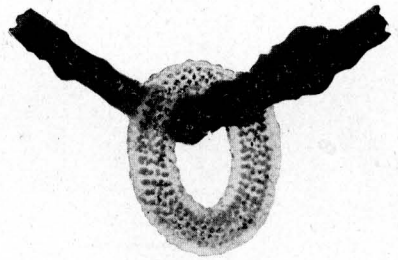


FIG. 8. EGGS OF AN UNKNOWN CADDIS FLY.
AFTER BETTEN.

Molanna cinerea Hagen. Larvæ and pupæ of this form were found in great abundance on sand bottoms with little or no vegetation. The adults, plate 6, figure 4, rest on vegetation or other support near the place of emergence. They are shown in the natural resting position on plate 6, figure 5, with antennæ laid flat on the support, the wings and the abdomen level, which causes them to be easily mistaken for small snags. They were abundant from the early part of June to the latter part of August. The case is a flat one covered with sand and very fine stones, plate 6, figure 6, and the larva is represented at figures 1 and 2, plate 6.

Polycentropus lucidus Hagen? Larvæ and pupæ were found in sand bottoms where there was little or no vegetation and adults were commonly seen resting on plants in the creek and on the side of the hatchery near the stream. This species was abundant throughout the period mentioned above. The case, plate 6, figure 10, is a very soft tubular one of fine sand. It is frequently branched and the caterpillar occupies the enlarged portion of the tube which is composed of two distinct layers. This retreat is much larger than the larva and is not portable. The caterpillar is represented at plate 6, figure 7, and attention is called to the large terminal hooks on the very long pro-legs. The eggs of this species are represented at figure 11, plate 6.

Hydropsyche species (near *phalerata* Hagen). Plate 1, figures 1, 2. The larvæ

and pupæ of this predaceous form were found in rapid currents in Little Clear Creek, and adults settled in great numbers on the hatchery windows. This insect was abundant throughout the period of work. No larval case was made, but strands of silk were stretched between stones lying in the rapids. The caterpillar is represented at plate 1, figure 3, and the pupal case at figure 4.

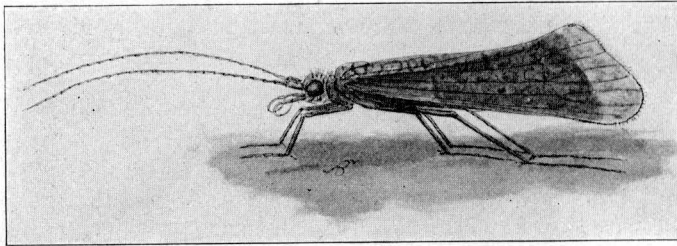


FIG. 9. HYDROPSYCHE SCALARIS HAGEN.

DRAWING BY MRS. J. H. COMSTOCK.

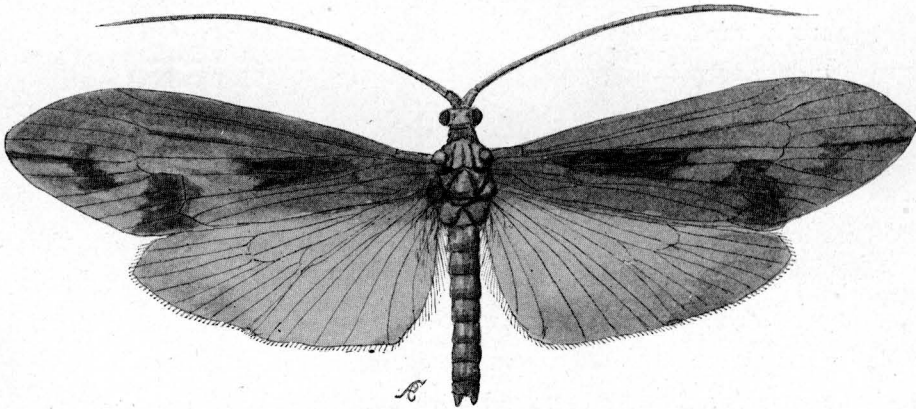


FIG. 10. HALESUS HOSTIS HAGEN.

DRAWING BY MRS. COMSTOCK.

1 *Halesus* species. Larvæ and pupæ were found in Little Clear Creek and along the shore of Little Clear Lake, especially on wood-strewn bottoms. The caterpillars were quite plentiful during the entire period of work, but pupæ were obtained during the latter part of the season, and a single specimen was bred August 31. The case consists of thin pieces of wood, placed at right angles to the length of the case, with their ends crossed. The coarseness of the material used varies, but it is uniform for each case. The eggs of this species are laid in a compact cluster with abundant gelatine. A cluster of about 300 was kept until the larvæ hatched, and their identity was shown by the characteristic cases made.

2 *Halesus* species. Larvæ and pupæ were found in Little Clear Creek. The pupæ are commonly fastened to submerged tree branches, and closely resemble

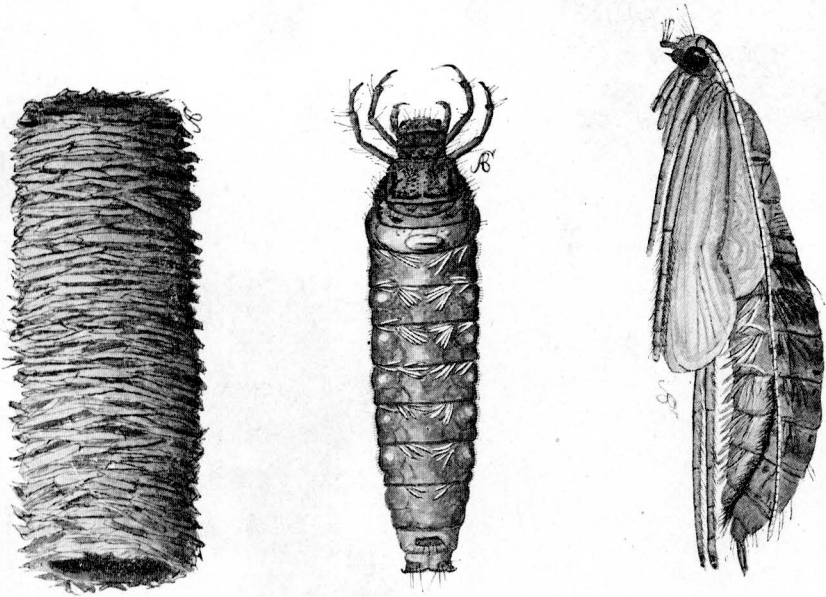


FIG. 11. CASE, LARVA AND PUPA OF 1 HALEBUS.
DRAWING BY MRS. COMSTOCK.

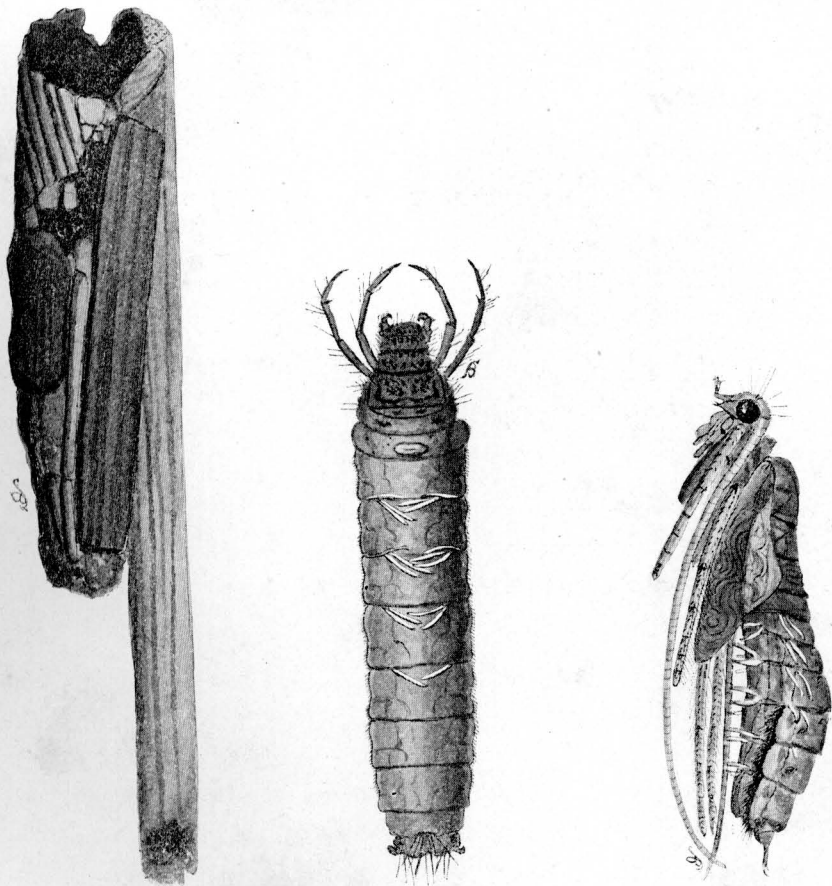


FIG. 12. CASE, LARVA AND PUPA OF 2 HALEBUS.
DRAWING BY MRS. COMSTOCK.

broken twigs. The former were common throughout the period of work, but the latter were not found till toward the end of August. The case consists of irregular pieces of wood placed longitudinally, with a slender stick extending beyond the posterior end.

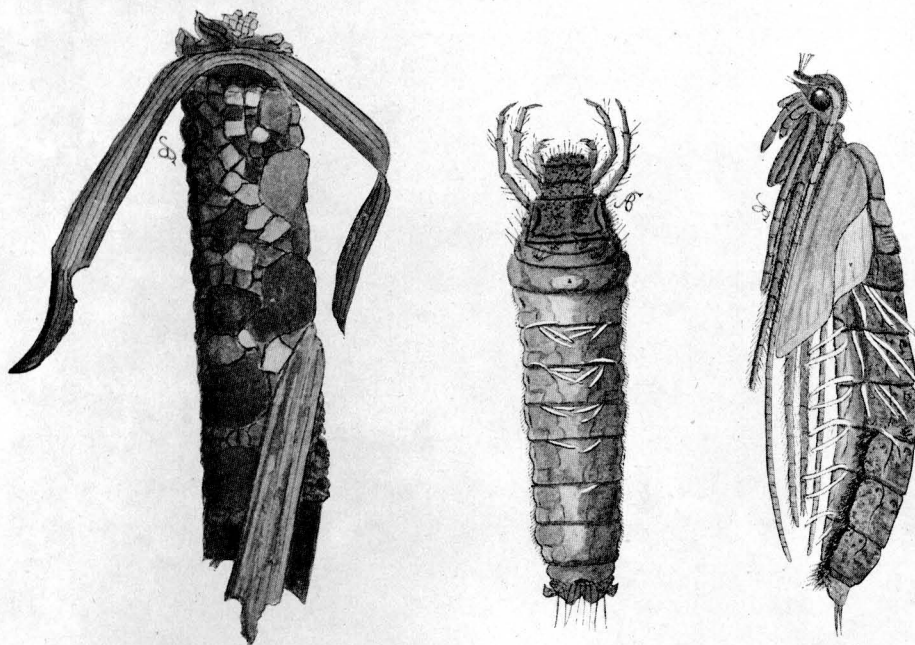


FIG. 13. CASE, LARVA AND PUPA OF *HALESUS*.

DRAWING BY MRS. COMSTOCK.

3 *Halesus* species. Larvæ were quite common throughout the period in Little Clear Creek, and pupæ were found only from August 16th to the 20th. The case is a cylindrical one of wood and sand or small stones, and it is often finely colored.

4 *Halesus* species. Only one specimen was found which for a time was confused with number 3 of this genus. The cases and larvæ of other species were found by Mr. Betten, but he was able to refer them to their families only, and no further mention of them will be made in this connection.

List of Adult Caddis Flies Found at Saranac Inn.

Phryganeidae.

- Phryganea cinerea Hag. August 5.
- Phryganea vestita Walk. July 25.
- Neuronia dossuaria Say. August 10.
- Neuronia postica Walk. July 16.

Limnophilidae.

- Limnophilus ornatus Banks. July 18.
 Goniotaulius dispectus Walk. ? August 8.
 Goniotaulius pudicus Hag. July 18.
 Halesus indistinctus Hag. August 14.
 Halesus hostis Hag. July 30.
 Stenophylax scabripennis Ramb. July 22.
 An undetermined Limnophilid. August 20.

Leptoceridae.

- Molanna cinerea Hag. (reared) (pl. 6, fig. 1-6) July 6 to August 20.
 Triaenodes ignita Walk. July 16, 18.
 Leptocerus *species?* August 4.
 Leptocerus *species?* (*near flaveolata*) June 29, July 7.
 Leptocerus resurgens Walk. July 2, August 8.
 Mystacides nigra Linn. August 1.

Hydropsychidae.

- Hydropsyche scalaris Hag. July 3, August 12.
 Hydropsyche *species?* *near phalerata* (reared) July 5, August 14.
 Polycentropus lucidus Hag? (reared) (pl. 6, fig. 7-11) July 7, August 19.

Rhyacophilidae.

- Chimarrha aterrima Walk. July 15, 19.
 Chimarrha *species?* July 18.

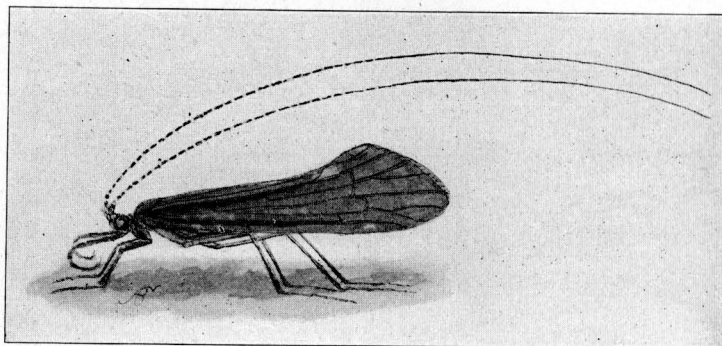


FIG. 14. LEPTOCERUS RESURGENS WALK.

DRAWING BY MRS. COMSTOCK.

Flies

The true flies, or Diptera as they are known to entomologists, comprise only those insects which have two membranous wings and a pair of what are believed to be modified wings, which are known as halteres or balancers. This order contains a very large number of insects, but for the present we are concerned only with those which are aquatic during a portion of their existence.

Crane flies, or *Tipulidæ*, were very abundant about Saranac Inn, and while no special attempt was made to identify the few specimens collected, the larvæ of the giant *Tipula abdominolis* Say was determined by Dr. Needham as it is the only common one which could produce the large adult which was caught so frequently about the hatchery during August.

Mosquitoes, or *Culicidæ*, were present at Saranac Inn in considerable numbers, but so much time was given to the other orders of insects that they received comparatively little attention, although a few species were bred.

The midges, or *Chironomidæ*, were also abundant at Saranac Inn, one of the most common forms being the harmless *Simulium venustum* Say. An undetermined *Simulium* was found by the writer August 24 in large numbers. It was very annoying about Axton to both man and beast. It was in all probability *Simulium invenustum* Walk.

Horse flies, or *Tabanidæ*, were also very numerous at Saranac Inn and their larvæ were found abundant in the semi-stagnant waters in which they live. No attempt was made to rear them.

Soldier flies, or *Stratiomyidæ*, were taken in small numbers. Two very interesting species were studied and the larvæ of the larger and handsomer one, *Stratiomyia badius* Walk., were obtained and described by Dr. Needham. This fine soldier fly was not uncommon on Golden Rod along the railroad track east of the Saranac Inn station during August. It was associated with the wasp mimicking Conopid, *Physocephala furcillata* Will. One of the smaller members of the family was found by Mr. D. W. Coquillett to represent a new genus and species, and it was described and named by him as *Zabrachia polita*.

Empididæ. A new genus and species belonging to this family was found in its immature stage in rapids associated with *Simulium venustum* Say and was reared. The larvæ and pupæ of this species, *Rocderiodes juncta* Coq., were discovered first, the former crawling among the pupal cases of *Simulium* and the latter usually resting within an abandoned *Simulium* pupal case. The flies were found clinging in companies to the under side of pieces of board which rested just above the level of

Explanation of Plate 7.

Sepedon fascipennis Loew.

FIG.

1. Larva, dorsal view, x 5.
2. Larva, lateral view, x 6.
3. Puparium, dorsal view, x 5.
4. Puparium, lateral view, x 5.
5. Open puparium, x 5.
6. A seed floating which the puparium simulates, x 5.
7. Imago, dorsal view, x 5.
8. Imago, lateral view, x 5.

Tetanocera pictipes Loew.

9. Larva, dorsal view, x 6.
10. Larva, lateral view, x 6.
11. Puparium, lateral view, x 6.
12. Puparium, dorsal view, x 5.
13. Imago, dorsal view, x 5.
14. Imago, lateral view, x 5.



L. H. Joutel, 1900

James B. Lyon, State Printer

SEPEDON AND TETANOCERA

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the water. A score might occur on a piece of board within an area of a few square inches and as they flew only when disturbed, most of them easily could be collected in a cyanid bottle. The various stages of this interesting form are represented in figures 5-8 on plate 1.

Sciomyzidae. Two interesting swale flies, *Sepedon fuscipennis* Loew. and *Tetanocera pictipes* Loew. were reared in large numbers. The former was quite common at Saranac Inn, in Little Clear Creek, in places where the creek flowed through beds of bur-reed, *Sparganium*, intermixed below the surface of the water with river weed, *Potamogeton* and Algæ. The adults sit on the foliage with wings laid back, and they fly rarely and rather poorly. The larvæ when undisturbed lie commonly at the surface of the water, amid a tangle of vegetation. The various stages are represented at figures 1-5, 7 and 8 on plate 7. The puparium of this fly is remarkable for its resemblance to a floating seed, which was not uncommon in the creek. Compare figures 4 and 6 on plate 8, and though the enlargement has destroyed much of the resemblance, there is still considerable in common between the two. A single parasite was bred, which has been described by Mr. Ashmead as *Atractodes sepedontis*. The adults of *Tetanocera pictipes* Loew. are found in the same bur-reed beds, but they habitually rest on the leaves near the surface of the water, and are, therefore, seldom seen. The larvæ, pupæ and imagos were common at Saranac Inn, associated in all stages with *Sepedon fuscipennis*. They are represented in figures 9-14 on plate 7.

The preceding account has been prepared for the purpose of emphasizing the value of our aquatic insects as food for fish and also to call attention to the important position this group occupies in nature. The numerous illustrations should render easy the identification of some of the more important forms. Considerable space has been given purposely to the habits of these insects because of the great value of such data to the student of nature. The study of the life history and the habits of any species is one of the most natural introductions to extended research. This broad and largely unoccupied field affords abundant opportunities to every lover of nature, and as the Saranac region is a well-known health and pleasure resort, it is expected that many students who spend a portion of their vacation in that section will doubtless be very ready to aid as far as opportunity permits in extending these investigations.