

ARGULIDAE FROM THE SHUBENACADIE RIVER, NOVA SCOTIA.

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A survey of the Shubenacadie river, which empties into the Basin of Minas, Nova Scotia, was recently made by Mr. A. H. Leim in connection with the Canadian shad fisheries. During this survey many specimens of both young and adult argulids were obtained at Shubenacadie with the tow-net in tidal water which seemed to be fresh rather than salt.

These specimens were sent to the present author for identification, and they proved to contain an abundance of both sexes of two species of *Argulus*, one of which had previously been found in many localities on the Atlantic coast farther south, while the other was new to science. The following record of these two species is herewith submitted.

ARGULUS ALOSÆ Gould.

Argulus alosæ Gould, Invertebrata of Massachusetts, 1841, p. 340, text figure: S. I. Smith, Report U. S. Com. Fish and Fisheries, 1872, p. 575 (281): R. Rathbun, Proc. U. S. National Museum, vol. 7, 1884, p. 485: J. F. Whiteaves, Cat. Marine Invertebrata of Eastern Canada, 1901, p. 216: C. B. Wilson, Proc. U. S. National Museum, vol. 25, 1902, p. 707, pl. 12; pl. 26, fig. 80.

Record of specimens. Ten specimens, including both sexes, were obtained August 1, 1919, at 8.45 p.m.: two males were obtained on the same date at 9.10 p.m.: a single male was obtained July 21, at 6.15 p.m.

Remarks. This species was doubtfully recorded by Mr. J. F. Whiteaves in the reference given above as attached to *Gasterosteus biculeatus* Shaw, and other small fishes taken off Pictou island in the Gulf of St. Lawrence. All the other recorded localities are much farther south. The present record substantiates that of Whiteaves and fully establishes the species in Canadian waters. Again it has hitherto been found only upon fish hosts in salt water; the present specimens were captured in a tow-net in fresh water. Their presence in the tow makes it certain that they infest fish in the immediate vicinity, and it may be that they will be found some day upon the shad whose name they bear.

ARGULUS PIPERATUS, new species.

Record of specimens. Twenty-two specimens, of which six were females and the rest males, were obtained August 1, 1919, at 8.45 p.m. in company

with the first lot of *Argulus alosæ*. Another lot of ten specimens, including both sexes, were caught in the second towing, August 1 at 9.15 p.m. Five males were obtained July 31 at 9.50 p.m., and two males on the same date at 10.10 p.m. The majority of all these specimens were of small size although sexually mature. But a few of them were large enough to be regarded as fully developed adults, and from these the following description has been taken.

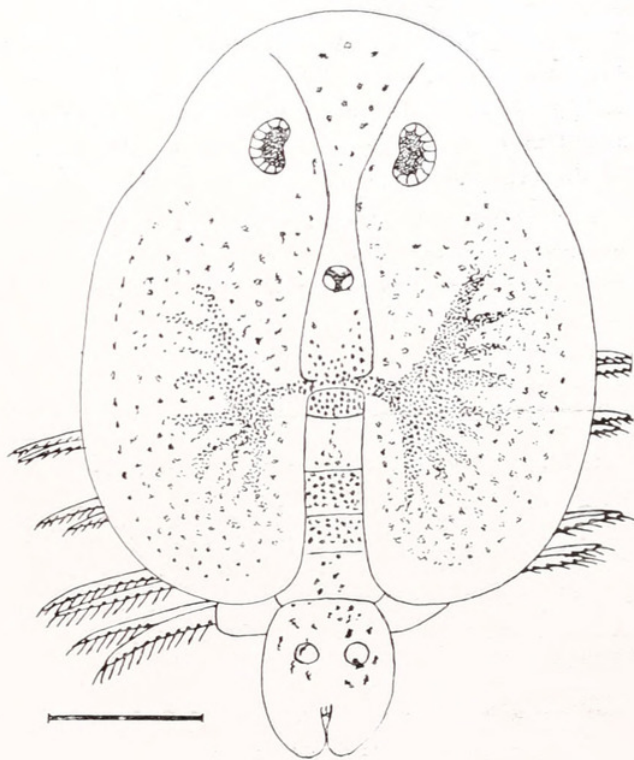


Fig. 1. Dorsal view of *Argulus piperatus*, female. The line represents a length of 1 mm.

Specific characters of female. General shape of the carapace elliptical, one-fourth longer than wide, with shallow lateral sinuses and broad, well rounded posterior lobes. Posterior sinus, one-third the length of the carapace, with parallel sides; posterior lobes just reaching the base of the abdomen. Eyes far forward and well separated.

Abdomen elliptical, one-fourth the length of the carapace, the longitudinal and transverse diameters in the proportion of 11 to 9; its posterior lobes well rounded and inclined inward so that their inner margins are in contact. Anal sinus 27.50% of the abdomen length; anal laminae basal, minute and unarmed; sperm receptacles small, circular and rather widely separated.

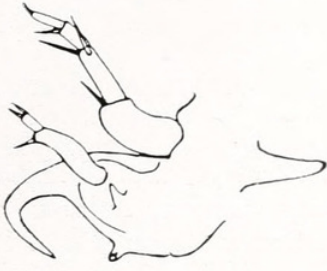


Fig. 2. *Argulus piperatus*: first and second antennae of male, much enlarged.

Lateral claw of basal joint of first antenna long and slender and curved into a half circle; anterior claw short and weak. Second joint slender, three times the length of the terminal joint, and armed at the distal anterior corner with a short spine; terminal joint tipped with two spines. Second antenna of the usual pattern, the basal joint one-half wider than the succeeding joints and tipped with a long spine; second joint with two spines, third and fourth joints with one spine each.

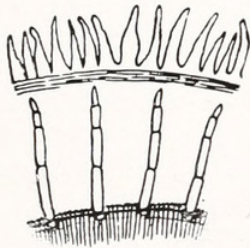


Fig. 3. *Argulus piperatus*: supporting rods in sucking disks; much enlarged.

Sucking disks of second maxillae far forward and well separated, each about 15% of the width of the carapace; the supporting rods slender and far apart, each made up of four cylindrical joints which diminish regularly in size from the base outwards, and which do not quite reach the margin. The latter has a fringe of flattened fleshy setae, attached side by side in a single row.

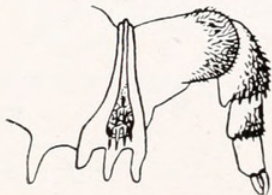


Fig. 4. *Argulus piperatus*: maxilliped of male; much enlarged.

The maxillipeds are rather short but stout; the triangular plate on their base is wide posteriorly and much narrowed anteriorly, but extends to the anterior margin of the appendage; the teeth are long and wide and bluntly rounded. Inside of the base of the appendage, on the ventral surface of the head, is an accessory tooth of the same pattern as those on the plate itself.

The rami of the swimming legs reach considerably beyond the margin of the carapace. The lobes on the basal joints of the fourth legs are small and not very prominent.

Color a light cartilage gray, the dorsal surface covered with small black dots, as though it had been sprinkled with pepper. These dots are not evenly distributed but are massed as shown in the figure.

Total length 5 mm. Carapace 4 mm. long, 3.25 mm. wide. Abdomen 1 mm. long, 0.90 mm. wide.

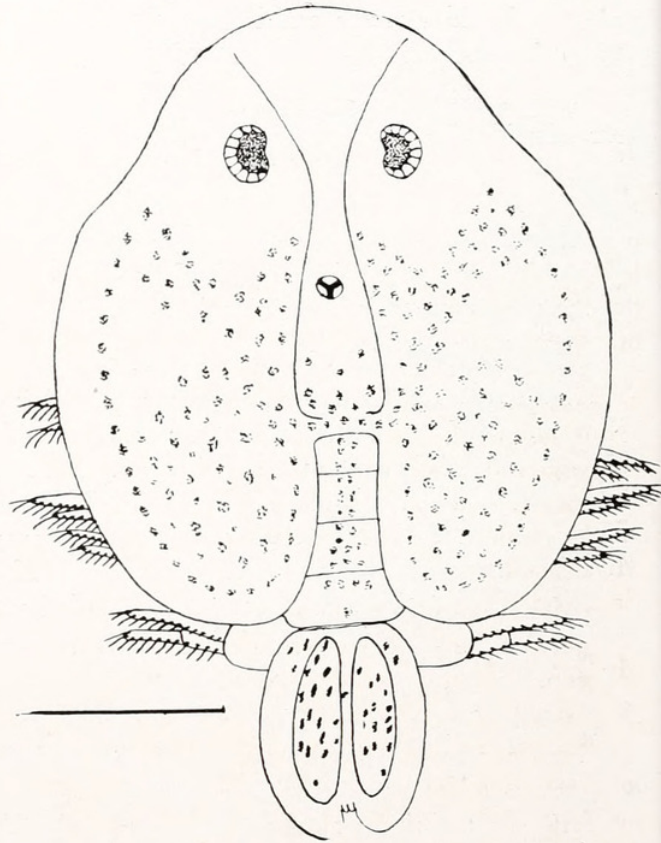


Fig. 5. Dorsal view of *Argulus piperatus*, male. The line represents a length of 1 mm.

Specific characters of male. Carapace relatively the same size and shape as in the female; abdomen longer, one-third the length of the carapace, the longitudinal and transverse diameters in the proportion of 15 to 11. Anal sinus not as deep, only 14% of the length of the abdomen and never closed by the approximation of the posterior lobes.

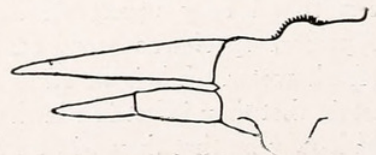


Fig. 6. *Argulus piperatus*: third legs of male, much enlarged.

Of the accessory sexual characters the peg on the anterior margin of the basal joint of the fourth legs is a broad cone, inclined strongly outwards and bluntly rounded at the tip, with a tiny spine on its

anterior margin. On the ventral surface of the basal joint of the third legs is a broad flap, projecting backwards, and on the anterior margin a rounded knob armed with minute setae.

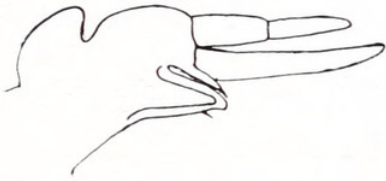


Fig. 7. *Argulus piperatus*; fourth legs of male; much enlarged.

Color the same as in the female except that the black spots on the dorsal surface are larger and more scattered.

Total length 4 mm. Carapace 3 mm. long, 2.65 mm. wide. Abdomen 1 mm. long, 0.80 mm. wide. (*piperatus*, sprinkled with pepper, alluding to the black spots).

The types of this species are deposited in the Museum of the Atlantic Biological Station, St. Andrews, N.B.

BIRDS IN RELATION TO INSECT CONTROL.

By NORMAN CRIDDLE, ENTOMOLOGICAL LABORATORY, TREESBANK, MAN.

The value of birds to mankind has unfortunately been brought down to the level from which we gauge most things nowadays, namely, dollars and cents. We might in the past, have classed them with art, poetry and music, but to-day the aesthetic side is lost in the mad rush for wealth and those of us who still value wild life for what it is, rather than for its economic significance, are obliged to weigh its qualities by the standard which modern thought demands.

The value of birds in relation to agriculture is a question that has frequently been discussed. The value of birds as destroyers of noxious insects is usually linked with the preceding problem though experts are not as unanimous in their conclusions regarding this part of the question, adverse contentions being especially strong among Italian entomologists who are apt to disclaim any assistance from birds to agriculture or kindred sciences. The Italians have their school of followers in North America but they are fewer. Since, however, they are men of ability it seems well to look rather more fully into the reasons for these differences of opinion.

Probably the first obstacle to unanimity lies in the fact that two sciences are involved namely ornithology and entomology whose votaries, on the whole, have but a superficial knowledge of each other's work. For instance, the ornithologist may be well aware that birds eat insects but he does not always know that the insects consumed may contain within them those that are useful. The entomologist on the other hand, knows little of the habits of birds and is, therefore, apt to view the question wholly as an insect one and to depend upon insects for insect control arguing that birds in eating a single noxious insect may destroy half a hundred useful ones, and so prevent the spread of allies that

would control a pest far more quickly than birds could, even supposing the latter were able to accomplish the task at all.

The first point to accept in this discussion is that insect extermination is cut of the question. The problem is not how to exterminate a pest but it is rather to secure the best means of keeping it within bounds.

I believe we shall eventually reach the conclusion that insect parasites are of most value in controlling serious outbreaks while birds reach their greatest usefulness by destroying the surplus under normal conditions and so prevent outbreaks. Neither of these differences in value are clearly defined, however, as a great many minor issues are involved in the whole question some of which I give below.

The rapid increase of an insect pest is due to several causes among which the absence of parasites is an important one. Under these circumstances the chances of birds destroying useful parasites in feeding upon the host at that time, is small, while by devouring the increasing pest they are playing an important part in keeping it within bounds. Occasionally, however, the pest increases beyond the rate at which birds can check it, this being due largely to meteorological conditions. At such times neither parasites nor birds are of much value and the pest spreads over wide areas as was exemplified in the grasshopper outbreak of the last two years in the Prairie Provinces. It is at this point that birds fall behind and parasites usually come to the fore and as these last have now unlimited food available they multiply with great rapidity. It matters little under these circumstances, whether birds devour parasites or not as the latter are too widely spread to be affected. Indeed the ultimate result is for the parasites to become over abundant in which case they are reduced to insignificance by starvation due



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