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 guage 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 voteries, 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 out 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