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SPRINGTAILS AS ECONOMIC INSECTS

HARLOW B. MILLS

Springtails, or Collembola, are minute soft bodied insects which, although the number of species is small, sometimes attract attention by the numbers in which, under favorable conditions, they appear. They have been somewhat overlooked by workers in the different phases of biology; no doubt a natural consequence of their small size (1-4 mm.), and inconspicuous, retiring habits. They generally live in organic debris, or wherever there is sufficient moisture to support their existence. But for a part of one family, in which there is a poorly developed tracheal system, the respiration in this order is cutaneous and the skin must be kept moist in order that the respiratory processes may function. The integument is so delicate that in low humidities the body dries out rapidly. The members of some genera bear an armor of scales, and within this protective covering they may venture into a more dry atmosphere than their scaleless relatives.

They are capable of withstanding relatively low temperatures without becoming dormant; occasionally emerging in hordes on the snow. One emergence of *Achorutes socialis* in Ontario was estimated by Macnamara to consist of between 9,000,000 and 10,000,000 individuals.

Their economic importance is only slowly being realized, and this paper is an attempt to present a survey of their activities under the very doubtfully distinctive name of "economic insects."

The damage which they do is quite small when compared to such orders as Coleoptera and Hemiptera but it is not inconsiderable. Their field of activities extends from germinating seeds to the terminal buds of trees, and from the destruction of tick eggs to the parasitism of poultry. The mouthparts in this order are both chewing and suctorial, but damage is without exception confined to species with chewing mandibles. The damage that each individual does is small, but their large numbers make the sum total of injury very severe at times.

For some time it was supposed that the damage inflicted on plants was secondary, the springtails following in the wake of

larger more apparent pests, but the fallacy of this theory has been demonstrated by several workers.

Springtails may be of detriment in various ways. The damage may be directly traced to feeding activities. Theobald (10) states that a species of *Isotoma* was found abundantly in old poultry nests, and was causing considerable distress in the flock. As far as is known this is the only record of Collembola attacking animals as a parasite.

The greatest harm that is done is in the direct attack on plant tissue. Several species do a great deal of damage of this type and one has become sufficiently infamous to be included in the list of common names of insects approved for general use by the American Association of Economic Entomologists. The host list for this species, *Bourletiella hortensis*, reads, as Macnamara (7) says "like the index to a seedman's catalogue." Its damage is chiefly inflicted on the first cotyledonary leaves of vegetables but it is not at all restricted to them. Two bulletins upon the control of cucurbit insects (8, 11) have been published which deal partially with the control of *B. hortensis* on squash and cantaloupes.

Smynthurus viridis is very much of a pest on lucerne in Southern Australia as Lea (6) has shown. *S. luteus* has been found to injure the leaves of apple trees and *Sira nigromaculata* has been found attacking the terminal buds of Scotch pine. Other species of other genera are guilty of depredations almost as bad. Theobald (10) has recorded damage to strawberry roots by *Templetonia nitida*, and only recently Spencer and Stracener (9) have found considerable damage done to sugar cane in Louisiana by *Lepidocyrtus violentus*, *Onychiurus armatus*, and *Isotoma minuta*.

The injury done by Collembola may also be of an indirect nature. Some of the scaled genera — *Seira* and *Lepidocyrtus* — are capable of withstanding a rather dry atmosphere and may infest houses. They probably do no real damage. Other species cause some inconvenience by getting into cistern and drinking water. The writer received one sample of cistern water from Northern Missouri that contained hundreds of dead bodies of *Folsomia fimetaria*. Other specimens of an unidentified species of *Lepidocyrtus* were taken from the surface of a pitcher of drinking water that was drawn from moist pipes in the cellar. Investigation showed the insects to be quite common on the pipes. *Achorutes socialis* has caused annoyance in maple sugar camps in New England by getting into the sap buckets.

Springtails have also been accused of carrying disease. Accord-

ing to Theobald (10) a species of *Smynturus* was recorded as eating wheat rust uredospores, but any good that might have come from the act was counteracted by the fact that the insect was also found to spread the disease. The same author states that *Smynturus luteus* plays a part in the spread of potato disease. Collinge (1) shows that some species carry fungus spores and may infest sterile ground with injurious fungus forms. Macnamara has photographed fungus spores from the intestine of *Achorutes socialis*.

There is no exception to the rule that an ill wind blows nobody good in the order Collembola, for some species seem to be of considerable value. It has been shown by Guthrie (5) that springtails may become so abundant in the soil as to keep it stirred up too much for germinating plants to take root. There is a possibility that this movement of the soil, if not extreme, might help to aerate and keep the soil loose. Collinge (1) says that *Achorutes viaticus* becomes at times abundant in sewage filters and cleans out the colloidal deposit, making it unnecessary to shut down the filter for that purpose.

A very striking example of a beneficial act on the part of Collembola is recorded by Cotton (4) whose experiments in raising fever ticks on grass plots were interfered with by hosts of "Thysanura and Collembola" which ate the tick eggs in the sod. In part he says that the affected experiments "indicate a considerable destruction of tick eggs deposited in grass lands under natural conditions, especially if they be laid during the cooler portions of the year, for at such times there are long periods during which the development of the embryo within the egg is slight and these low insects are quite active."

The following is a list containing a record of all species known to be of economic importance, together with their beneficial or detrimental acts, where these have been recorded. This list is not complete as to the damage done for often references to damages do not include the names of the species which are the causative agents.

Onychiurus ambulans. Attacks peas, cauliflower, celery, sea kale, bean seedlings, narcissus bulbs, and asparagus.

Onychiurus armatus. Attacks sugar cane roots.

Onychiurus burmeisteri.

Onychiurus fimetarius. Attacks carrots and potatoes.

Anurida granaria.

Achorutes armatus. Attacks mushrooms, bean seedlings, and narcissus bulbs.

Achorutes longispinus. Attacks bean seedlings.

- Achorutes manubrialis*.
Achorutes purpurascens. Attacks cabbage.
Achorutes rufescens. Attacks mushrooms.
Achorutes socialis. Contaminates maple sap.
Achorutes viaticus. Cleans sludge from sewage filters.
Isotoma minuta. Attacks sugar cane roots.
Isotoma tenella.
Isotomurus palustris.
Folsomia fimetaria. Contaminates water.
Templetonia nitida. Attacks strawberry roots.
Orchesella cincta. Attacks orchids.
Entomobrya multifasciata.
Entomobrya nivalis. Attacks hops and currants.
Scira buskii. Infests houses. Lives in meal. *Scira nigromaculata*. Infests houses. Lives in meal. Attacks growing Scotch pine buds.
Lepidocyrtus americanus. Infests houses.
Lepidocyrtus violentus. Attacks sugar cane roots.
Bourletiella hortensis. Attacks beans, beets, cabbage, cantaloupes, carrots, clover, corn, cucumbers, kale, lettuce, mangolds, onions, peas, sweet peas, potatoes, pumpkins, radishes, rye, spinach, squash, tobacco, tomatoes, turnips, violets, watermelons, wheat, and wild cucumbers.
Smynthurus fuscus.
Smynthurus luteus. Attacks currants, potatoes, and apple leaves. Carries a disease of potatoes.
Smynthurus viridis. Attacks lucerne, African dandelion, carnations, nettles, peas, beans, potatoes, oats, barley, and other grasses.

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