The Canadian Entomologist.

VOL. XLIX.

LONDON, MARCH, 1917

No. 3

POPULAR AND PRACTICAL ENTOMOLOGY.

PRECIPITATION IN RELATION TO INSECT PREVALENCE AND DISTRIBUTION.

BY NORMAN CRIDDLE, DOMINION ENTOMOLOGICAL LABORATORY,
TREESBANK, MANITOBA.

In this paper an attempt is made to draw attention to a few instances of how humidity, chiefly in the form of rain or snow, has been and is instrumental in either aiding or curtailing the spread of insects over the country, particularly in the Prairie Provinces.

There are very few insects, if any, that can live through all their stages without the aid of moisture. Most of them, indeed, are very much dependent upon it, especially in their larval stages. Numerous examples could be given, and a suitable one is provided in the various races of Tiger Beetles (*Cicindela*). We find these beetles from haunts in close proximity to water, to habitations on plains of drifting sand, apparently far removed from it; yet an examination a few inches below the surface, in the latter place, will show that the sand, if not equally moist, is at least sufficiently so for the wants of the beetle larvæ, which are easily able to burrow down to it. There are occasions, however, when the insects' prairie haunts become very dry; at such times there is reason to believe that some of the larvæ perish while the remainder retire to the bottom of their burrows and remain inactive until such time as rain once more moistens the soil.

While most insects require water in some form or other, there are certain kinds which seem to thrive best when it is least prevalent, and are only found in the dryest situation. In this class we have most of our locust pests, and the celebrated Rocky Mountain Locust (*Melanoplus spretis*) supplies a good example. This locust, as is well known, has caused enormous losses in years gone by and has invaded our territory on more than one occasion. There is somewhat of a mystery surrounding this insect at the present time

which may, indeed, never be solved. We know that its breeding grounds once extended over a very wide area, much of this having been classed as permanent by Riley and others who investigated the plague at that time. At present, however, the insect seems to have vanished completely. Indeed, there are some who would place it with the Passenger Pigeon as an object of the past. It seems almost incomprehensible, however, that such can be the case. More probably the real permanent breeding grounds are more restricted than was supposed, and the locust will yet be located either by the discovery of its real haunts or by a new invasion following favourable weather conditions for breeding purposes. This, however, is beside the question. What I wanted to point out was that the Rocky Mountain Locust always invaded Western Canada during a dry season, arriving in swarms from elsewhere in July or August. As this was the time of oviposition, eggs were soon deposited in vast numbers, and, as a result, crops naturally suffered much more the following year than they did on the insects' first appearance. While the locusts were able to breed for a season or so in the invaded territory they seldom remained long. Frequently an excess of moisture to what they had been accustomed to produced sickness from which many died, while others taking advantage of sunny days and favourable breezes drifted to parts unknown.

In other words, dry weather had enabled them to overstep their usual breeding grounds, only, however, to be driven out or killed by a return to normal climatical conditions. The same dryness which induced an invasion of Rocky Mountain locusts was also instrumental in increasing the indigenous species of *Orthoptera*, so that such kinds as the Lesser Migratory Locust (*M. atlanis*) became almost as destructive as its close relative mentioned above, while many other species were sufficiently numerous to aid materially in the work of destruction. We have another example of an insect's control by conditions of humidity alone in the Western Wheat-stem Sawfly (*Cephus sp.*). In this instance a lack of precipitation causes a dearth of the flowering stems of grasses in which the larval life is passed, resulting in a decrease of the species in proportion to prevalence of suitable grass stems for breeding purposes. This, of course, relates to natural conditions before

the husbandman made his appearance. The sowing of cereals has altered matters so that when the grasses fail to produce stems the saw-flies were able to continue their increase by attacking wheat and rye, with the result that they are now a serious pest.

Yet another insect which is checked by lack of moisture is the Hessian Fly. Dry seasons are generally recognized as anti-fly years and in Manitoba the partial second brood is frequently destroyed outright by a premature ripening of the grain, due to dry, hot weather conditions in late July. A knowledge of this fact is often of the greatest importance in forecasting as to the probabilities of a Hessian-Fly outbreak. It also comforts us in the thought that weather conditions will seldom remain favourable to the insect for any length of time, though we have the unpleasant knowledge that good crop years are frequently best adapted to Hessian-Fly increase. Moisture is probably still more important over northern latitudes in the form of snow when it provides a thick covering to the objects beneath, protecting them from both frost and sun. It is really astonishing how a blanket of snow will afford protection even to the tender plants. For instance, potatoes have more than once survived the winter, even in our invigorating Manitoba climate where the temperature, at times, attains a minimum of fifty below zero. Yet expose these same potatoes directly to four or five degrees of frost and they will present a sorry spectacle next morning.

Snow is unquestionably a very important factor in preserving insect life in winter time, and there is no doubt that it is largely responsible for the preservation of many forms which would perish without its covering. Perhaps there is no better example of its preserving influence than was shown by the Colorado Potato Beetle. This beetle invaded Manitoba a number of years ago, but did not become a serious pest until comparatively recent times. It had, however, gradually extended its range northward. In 1913 its ravages were severely felt in Southern Manitoba as far north as latitude 50° and to a lesser degree for some distance farther north. In the winter following, that is 1914-15, there was a great scarcity of snow in portions of the province so that some places used wheels throughout the winter. The result of this lack of snow was that the frost penetrated considerably deeper into the ground than

usual. While an occasional thaw came in direct contact with the surface, thus providing a thawing and freezing condition known to be detrimental to insect life, there is no doubt that several species suffered in consequence, but the Colorado Potato Beetle, as a rule, burrows sufficiently deeply to escape the thawing effect, hence frost alone was to be reckoned with.

The result of this lack of snow was very marked the following May. Beetles which had gone into winter quarters in a healthy condition were found huddled together in a state of death, not a single living example being located in the more exposed situations, though later in the season odd individuals turned up on potato plants forming the nucleus for future generations. The country was by no means all affected in the same way; some parts had a light covering, others a foot or more. Consequently the amount of snow necessary for protection could be ascertained with reasonable accuracy. As was mentioned above, complete lack of snow, or less than three inches, did not afford sufficient covering for the beetles, the few survivors having probably sought shelter beneath some straw or brush pile. Where there was a depth of snow amounting to from four to six inches the survivors were considerably increased. At eight inches about half the beetles survived, while a foot or more of snow apparently produced complete immunity from frost.

In the vicinity of the Entomological Laboratory at Treesbank very few beetles escaped, which proved a great boon to potato growers. The effect of this winter killing is still very marked (1916), less than one per cent. of the plants being infected. Near Winnipeg, on the other hand, where the snow fall was ample no mortality was noticeable among the beetles, and they have continued to be a serious pest there.

From the above account it is evident that snow plays an important part in the preservation of animal life, it also saves many a garden plant from destruction. Under normal conditions it will continue to afford protection to the Colorado Potato Beetle, but we can at least see that there will be years of severe check, like the winter of 1914-15. While there is every reason to believe that those portions of the country where snowfall is light will never prove a prolific breeding ground for that insect.