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JOHN R. WATSON

State Entomologist of Florida, Formerly Associate Professor of Biology, University of New Mexico

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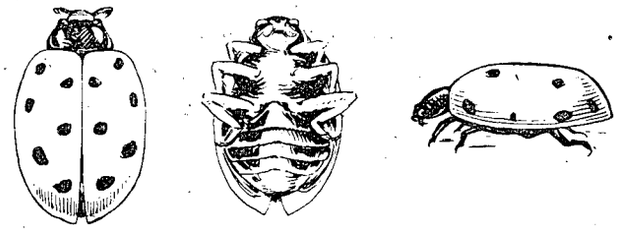
In the First Report of the Natural Resources Survey of New Mexico (p. 72) the writer noted the finding of large hibernating colonies of the ladybeetle, Hypodamia convergens on both Mt. Taylor and the Sandia Mountains. It has seemed to him that this is a discovery of sufficient importance to the rapidly developing melon industry of the state to deserve that a more detailed account be given of it, and that the attention of the ranchers of the state be called to the use to which these colonies are being put in California.

It has long been recognized that the melon aphis or plant-louse (Aphis gossypii) is nearly everywhere in

the United States the worst insect enemy of plants of the gourd family, including watermelons, cantaloupes, squashes, egg-plant, and pumpkins, as well as a serious enemy of the cotton plant, the raising of which is said to be a rapidly developing and very promising industry of the lower Pecos Valley.

The individual aphids are so small (less than 1/12 inch) and so exclusively do they stick to the under



Lady-Beetle, Hypodamia Convergens
(9 Times Natural Size.)

sides of the leaves, with the light green color of which they harmonize so perfectly, that they are very inconspicuous. Hence their attacks are extremely insidious and the rancher is frequently caught napping, the aphid infestation sweeping through his fields like a fire, leaving in its wake a sere brown waste; and the grower meets financial disaster where he had dreamed of a golden harvest.

This destruction of an entire field in three or four days is rendered possible by the enormous powers of

reproduction of the insects. Until late in the season reproduction is entirely viviparous and parthenogenic; i. e., the young are born alive and not from fertilized eggs. Indeed, during the growing season no males are produced. Practically this means that every individual that reaches maturity is a producer of young. A single aphid has been observed to give birth to eight young in twenty-four hours and these in turn are able to begin to reproduce when five or six days old. With a generation each week and eight young per day for the fortnight or two of her adult life anyone mathematically inclined may figure out for himself the number of possible young at the end of three or four months. Their viviparous habit means that no time is lost in the egg stage and that the young begin feeding at once. Although each individual is small ,it is capable of withdrawing from the plant a by no means insignificant amount of sap, as the aphids are greedy feeders; so greedy indeed that much of this sap, after undergoing elaboration in the intestines, is secreted from the anus as a sweet liquid; the so-called honey-dew. This is a favorite food of ants, which are in constant attendance upon aphids and often protect them from some at least of their enemies.

In the fall true females and males are produced and the fertilized females lay eggs. These last over win-

ter to hatch out in the spring, thus preserving the species through the unfavorable season.

I have dwelt upon the life-history of the melon aphis in order that it may be understood how they are able to appear so suddenly in such numbers as to cause the grower to believe in spontaneous generation. He has failed to observe the few individuals to be found in early spring, which, however, are sufficient after a few generations to cause serious damage.

Usually no such rapid reproduction as is theoretically possible takes place, as they are delicate, defenseless creatures and have many enemies. Damp or cold weather will often cause the death of the vast majority of them; but such weather is rare in New Mexico and doubtless this is one reason why aphids are so troublesome throughout the semi-arid southwest.

Among the most persistent enemies of aphids everywhere are lady-beetles, lady-bugs or lady-birds, as they are variously called. Most of them prefer aphids to almost any other food. And none are more fond of them than Hypodamia convergens, which is by far the most abundant species in New Mexico. The author estimated that in the Rio Grande Valley this species constitutes over ninety per cent of all the lady-beetles present.

The insect is a brownish-red, oval beetle, about ¼ inch long, usually with black dots on the wing covers.

On the black pro-thorax there are two whitish lines which converge forward and give to the insect its specific name.

It lays its eggs in a colony of aphids, upon which the young also feed.

HIBERNATION.

It spends the winter in the adult stage. As it is in this connection that our opportunity lies, I shall treat this part of the life-history of the lady-beetle somewhat fully.

Over the mesas and in the valleys their favorite place of hibernation is among the dead leaves in the yucca rosettes. This plant, Yucca glauca, commonly called also amole, soap-weed, bear-grass ,and Spanish bayonet or dagger, is very abundant in the more sandy soils. As the old leaves die they turn brown and form underdeath the living leaves a mat often several inches deep. The dead bases of the leaves cling to the thick stem for a long time, forming a particularly warm and dry domicile for a hibernating insect, and thus is utilized by a great many varieties, among which *Hypodamia convergens* is conspicuous. Under each rosette can usually be found from one to a dozen beetles. Very rarely has the writer met with a hibernating individual in any other situation. Over 90% of these he has found hibernating have been taken from these rosettes. At

these lower altitudes there is apparently no tendency towards gregariousness. Higher up, at the base of the mountains in the cedar and piñon associations, they are found also under the rosettes of the Yucca; but here there is apparently a gregarious tendency, as from fifty to a hundred or more beetles are often found under a single rosette, while neighboring ones are deserted. But it is on the very highest peaks only that one encounters the great colonies composed of tens and hundreds of thousands of beetles. Here indeed they occur in huge masses most conveniently measured in terms of quarts and gallons.

Colonies of these same beetles occur in California on the high peaks of the Sierras. There seems to be some slight differences in their location and origin in the two regions. E. K. Carnes in the Monthly Bulletin of the State Commission of Horticulture (Vol. I, No. 3, Feb., 1912) states that there they occur "usually in close proximity to running water". In New Mexico they are very far from running water. The writer has found them only on the topmost peaks of the mountains where some pile of rock forms the highest point in the vicinity. On Mount Taylor, as stated in the report above cited, the colony was on the very apex of the south peak. In the Sandia Mountains the colonies were found on several of the lesser peaks at the south end of the range east of Bear Cañon and on North Mountain. The tops of these ranges are very dry and it would be necessary to descend a thousand feet or more before meeting with running water.

This progressive tendency of the beetles to collect in large masses as the altitude becomes greater is a very interesting phenomenon. As to its cause the writer can do no more than to guess that it may be a reaction to a lower temperature. The mortality seems to be high in these colonies, as abundant elatra of the previous winter's colony were observed in all cases. Equally strange is the tendency to congregate on the very apex of the peaks and in the same place year after year. The colonies of the succeeding years are not, of course, composed of the same beetles, as these never live throughout two winters. It would be interesting to determine if the individuals are negatively geotropic and might as a consequence of their reaction to gravity work their way up the mountain side.

Carnes seems to imply that the California colonies are composed of individuals which gather from the plains and valleys to hibernate in the mountains in masses, as he says that in November they "have begun to arrive in the mountains". The writer has observed nothing in New Mexico that would lead to this conclusion for that part of the country. On the contrary, the numbers under the yucca rosettes would indicate that at least no very large proportion leave the mesa

and valleys. It is the most common lady-beetle in the mountains, although perhaps not quite so numerically preponderant there as on the mesas and in the valleys, and there is no reason to suppose that the mountains themselves are unable to supply the individuals necessary for the colonies as far as New Mexico is concerned.

UTILIZATION OF THESE COLONIES IN CALIFORNIA.

While viewing the ravages of the aphids in the melon fields, the idea occurred to Supt. Carnes to collect these colonies and distribute the beetles over the aphid infested melon fields. The experiment was tried and appears to have achieved great success.

The method there pursued is to go into the mountains in November and locate the colonies. Their surroundings are carefully mapped and blazes on trees made to facilitate their re-location. In January and February the collecting parties go into the mountains with sacks, sieves with which to separate the beetles from the trash which is invariably present in the colonies, pack-animals, etc. The colonies are carried to stations, where they are sorted, placed in boxes and kept in cold storage until needed. These boxes have wire netting only on two sides to insure good ventilation and are kept at a temperature of a little less than

40 degrees Fahr. Two men collect from fifty to one hundred pounds of beetles per day. A pound will contain about 23,000 beetles, sufficient for 7 acres of melons.

As soon as the grower in the Imperial Valley or elsewhere notices the first aphids of the season he at once writes or telegraphs to the insectary and a box of beetles is expressed to him, 30,000 for each ten acres. The express company carries these beetles free of charge. In this manner tons of beetles are distributed each season, to the immense advantage of the melon industry.

Aphids are small and the beetles hungry and 30,000 of them will destroy an immense number of the pests. If the aphids are scarce the beetles will hunt only the more diligently. Their eggs are laid among the aphids and if the latter are scarce the eggs will be scattered more widely over the field, which is an additional advantage to the grower. The beetles thus catch the aphids at the very inception of the infestation; a thing that it is impossible for the grower to do.

It might be said that the lady-beetles will in time find the aphids of their own accord; and so perhaps they will. But the discovery will in most cases come too late. The aphids will then be beyond control. The melon fields are far from the mountain tops and the farmer suffers, not because of a scarcity of the beetles

in the state as a whole, but because of their faulty distribution, from his point of view. Every business man appreciates the necessity of having an agent—*on the spot*. The grower has disturbed nature's balance by growing one species of plant only over a large extent of territory, and he must do his best to compensate for the disturbance and thus restore the balance, or he will suffer.

NEW MEXICO'S OPPORTUNITY.

We have now come to the point of this whole matter. The conditions here are the same as in California. We have the melons and intend to have more at once. And, alas, we have the aphids and will have more whether we intend to or not if we plant more melons. And fortunately we have the colonies of lady-beetles. It only remains to use them.

Although the writer has not seen as many or as large colonies as are obtained in California, it is because he has never searched for them in their haunts in November, the month during which the scouting is done in California. All of the writer's colonies have been seen in August and September, a season during which the California colonies are also few and small. There can be no reasonable doubt that a November survey will displose colonies as large and numerous as those in California. We have the mountains and the

lady-beetles. As stated above over 90% of our lady-beetles are of this species.

Furthermore, the task will be much easier here than in California. The mountains are more accessible, in that they are nearer the railroads and the melon fields; one starts from a higher altitude and therefore does not have so far to climb; but chiefly because the mantle of snow that causes the task of collecting the California beetles very laborious, slow and even dangerous ,is not nearly so deep here.

We have spoken of the use of the beetles only in connection with the melon industry. But they can be used with equal success in combating aphids on any crop liable to their attacks; such as apples, beets, including sugar-beets, cabbages, cucumbers, lettuce, garden truck of practically all kinds, peppers, and roses.

As stated above, the writer has found the colonies in two of our mountain ranges, the San Mateo and the Sandia. Undoubtedly a thorough search of the others such as the Organ, Magdalena, Manzano, Black Range, Jemez, and Santa Fé, would result in the finding of large colonies.

At least this preliminary work of locating the colonies should be done this year.

Let us apply our conservation ideals to this natural resource; the best kind of conservation, that which uses a resource that would otherwise go to waste.