

2. **X. montana** Casey.

Summer host: *Formica subpolita* (Wirtner).

Winter hosts: *Camponotus levigatus* (Schwarz, Fenyès); *C. herculeanus* var. *modoc* (Fenyès).

3. **X. caseyi** Wasmann.

Summer host: *Formica subpolita* (Wirtner).

4. **X. sharpi** Wasmann.

Winter host: *Camponotus auricomus* (Wasmann).

5. **X. angusta** Fall.

Winter host: *Camponotus fallax* subsp. *discolor* var. *clarithorax* (Fenyès).

AN ANT-NEST COCCINELLID (BRACHYACANTHA QUADRIPUNCTATA MELS.).¹

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Early in May, 1910, while I was collecting on the rocky southern slope of Great Blue Hill near Boston, Mass., my curiosity was aroused by some snow-white insects, resembling gigantic Coccids, in several nests of *Lasius umbratus* var. *aphidicola*. From hasty examination I conclude that these insects, which were moving about slowly or resting among the root-Coccids and root-Aphids so abundant during the spring months in the *aphidicola* nests, must be predaceous Coccinellid larvæ. Unfortunately, the vial in which they were collected dropped from my pocket and was lost before I could examine them at my leisure.

May 6, 1911, on returning to the same locality, I succeeded in finding ten of the larvæ in two nests of the same ant. Each of these nests also contained a large number of root-Coccids. Larvæ, ants and Coccids were taken home and placed in an artificial nest. The larvæ, when first found, were covered with dense tufts of delicate white wax, but these broke off in transit through rubbing against particles of earth, so that the specimens were almost denuded when they were installed in the nest. New tufts of wax, however, at once began to be secreted, and by May 15 the larvæ had the appearance

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 43.

shown in the accompanying figure. During this time they crawled about the nest without being molested or even noticed, and the number of Coccids in the nest suffered no diminution. By May 17 they had ceased to move and were huddled together preparatory to pupation. Whether they fasted for lack of their proper food, which probably consists of Coccid eggs, or because they had already attained their full growth when I confined them in the nest, I am unable to say, but the latter is the more probable explanation.

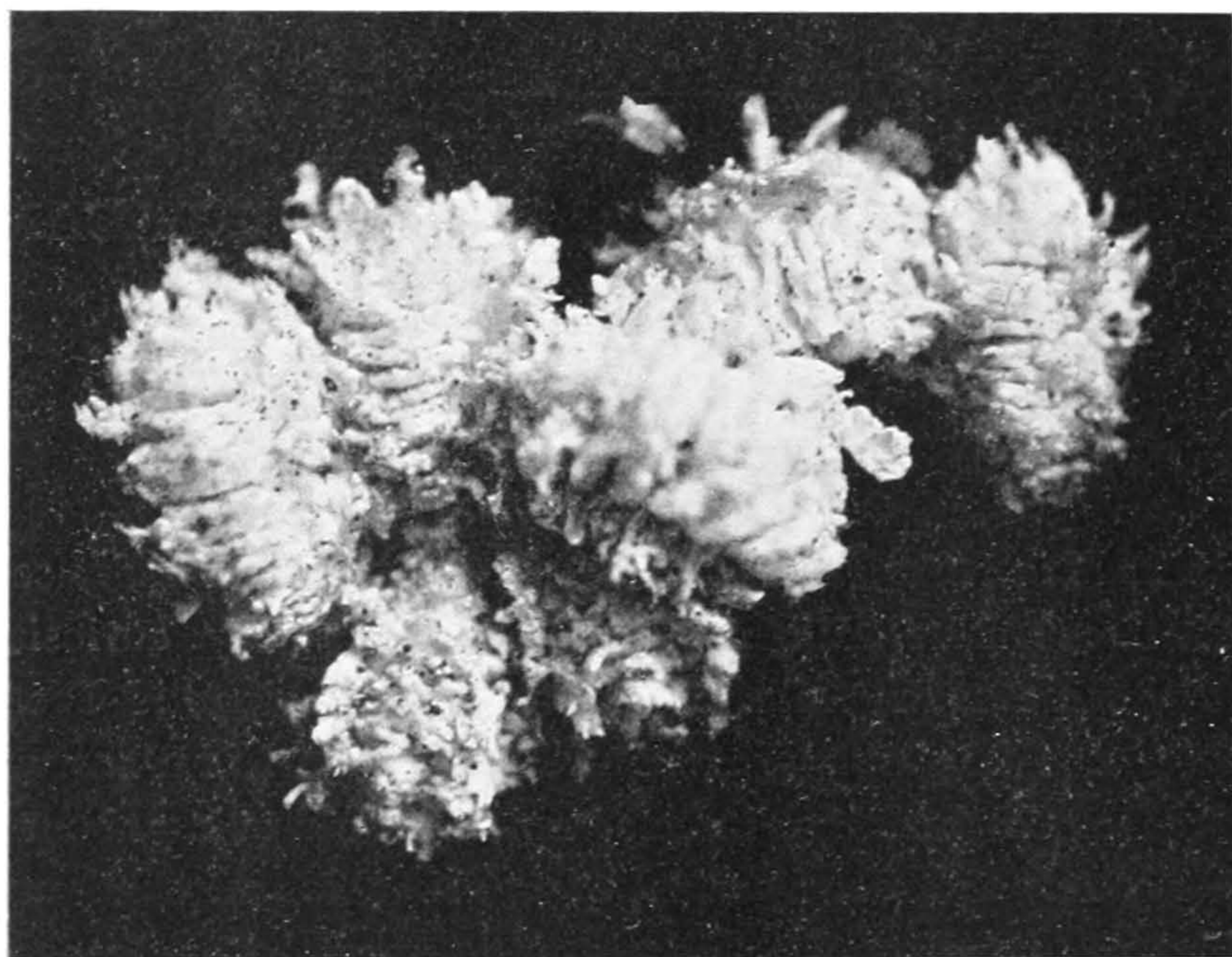


FIG. 1. Seven larvæ of *Brachyacantha 4-punctata* Mels. $\times 2\frac{1}{2}$.

The adult larva, covered with the waxy tufts, measured about 10 mm.; but after these had been dissolved away in chloroform, its body was only 6–7 mm. long, and was of a whitish or pinkish yellow color. It differed conspicuously from our common Coccinellid larvæ, not only in this lack of pigmentation, but also in having very much shorter and feebler legs, a much smaller head, a more obese and elliptical abdomen and in lacking the eyes and the rows of robust spiny processes along the sides and in the mid-dorsal region of the thorax and abdomen. The intersegmental constrictions were pronounced and each segment had a deeply impressed transverse line in the middle of its dorsal surface. The body was covered with delicate flexuous hairs, which varied in length but were conspicuously

long on the head and on the projecting lateral border of each segment. These hairs probably help to support or bind together the waxy secretion.

By May 22 some at least of the larvæ had pupated. This could not be determined by superficial examination, because the larval cuticle was not shed but merely separated from the underlying hypodermis, and the pupa was formed within the larval cuticle, which was not even ruptured in the middorsal line. It rested on the soil and retained intact its tufted covering of white wax.

June 15, on returning from a vacation, I found that the ants and Coccids had died some time during my absence and that a beautiful Coccinellid beetle, spotted with yellow and with iridescent blue-green eyes, had emerged from one of the pupæ and was running rapidly about the nest. Four more of these beetles hatched June 16, 17, 20 and 22. The pupal period therefore extends over a month and is probably not much shorter than larval life, unless the young larvæ hatch in the fall of the year.

Although it was evident that the beetle was a *Brachyacantha*, I had difficulty in deciding on its specific identity. I therefore sent it to our acknowledged authority on the Coccinellidæ, Mr. Charles Leng, who kindly wrote me as follows: "The Coccinellid beetle is *Brachyacantha 4-punctata* Mels. Melsheimer described the female under this name and later in the same paper described the male as *basalis*. The male which you send has two spots at the base of the elytra, the female only one; she lacks the humeral spot. Crotch regarded the insect as a variety of *ursina* but Mulsant, Gorham and Casey dissent from this view, and the differences in abdominal structure support their opinion. It will be treated as a distinct species in my forthcoming paper."

Turning to the literature, I find that the larva of this or of a very closely related *Brachyacantha* was long ago seen in ant nests by Dr. John B. Smith.² He says: "It would be supposed that the ants would be very careful to keep out all enemies of these their domestic animals (aphids), but there is one species that gets in and remains in undisturbed. It is the larva of a common "lady bird," *Brachyacantha ursina*. Unlike the larvæ of Coccinellids that prey

² Ants' Nests and their Inhabitants. Amer. Natur., XX, 1886, pp. 679-687.

on arboreal species, this is not brightly colored but sordid whitish-yellow. It is of the usual form of these larvæ, but secretes a waxy substance that exudes in long strings and gives the insect the appearance of being covered with cotton or hoar frost. This secretion seems to be much more palatable to the ants than that of the *Pemphigus*, and they unconcernedly see the Coccinellid feasting upon the former apparently concluding that the flavor is improved by passing through the latter." The meaning of the last sentence is not clear, unless Smith actually believed that the ants feed on the waxy secretion of the *Pemphigus* and *Brachyacantha* larvæ!

Schwarz³ says that the larva of *Brachyacantha ursina* "is abundant near Washington, D. C., in the colonies of *Lasius claviger* preying upon the *Pemphigus* domesticated by the ants. Whether or not this is the normal habit of the larva must be left to future observations." Whether the larva mentioned by these two authors is that of the true *B. ursina* or of *B. 4-punctata* which, as Leng says, was supposed by Crotch and others to be merely a variety of *ursina*, I am, of course, unable to decide.

Mann⁴ has very recently described and figured what is unquestionably the larva of a Coccinellid closely related to *Brachyacantha* from a nest of *Formica camponoticeps* at Wawaiwai, Washington. This larva measured 6-7 mm. in length and, as the figure shows, differs from my larvæ of *B. 4-punctata* only in having the head proportionally larger, the body somewhat more cylindrical and in being "covered densely with a white powder," instead of with long, dense tufts of wax. This last difference, however, may be unessential since rubbed *Brachyacantha* larvæ have the appearance of being merely powdered with the waxy secretion.

The only Coccinellid larvæ which I find recorded as living in ant-nests in the old world are *Scymnus formicarius* Muls., cited by Wasmann⁵ as having been found in the imaginal stage with *Formica rufa* in eastern Siberia, and *Hyperaspis reppensis* which was observed

³ Myrmecophilous Coleoptera found in Temperate North America. Proc. Ent. Soc. Wash., I, No. 4, 1890, pp. 237-247.

⁴ On Some Northwestern Ants and their Guests. Psyche, XVIII, No. 3, 1911, pp. 102-109, 3 figs.

⁵ Kritisches Verzeichniss der myrmekophilen und termitophilen Arthropoden. Berlin, 1894, p. 161.

by Silvestri⁶ in the nests of *Tapinoma erraticum nigerrimum* near Naples. The larva of the *Hyperaspis* feeds on the myrmecophilous *Tettigometra impressifrons* and *costulata* which live in the nests of this ant. It remains in the pupal stage from 20–30 days, during which time it is attached, together with its last larval cuticle, to the lower surface of the stones covering the nests or to leaves or sticks that may happen to be in the superficial chambers. The adult beetle appears in June. It clings to the stones during the warm hours of the day, with its feet and antennæ withdrawn under the thoracic and elytral borders, but when disturbed it runs about briskly. When it meets an ant it stops suddenly and attaches itself to the stone. The ants may endeavor to seize it by the sides of its body but seem never to be successful in holding it in their jaws. The larvæ are treated with indifference. According to Silvestri, *H. reppensis* is to be regarded as a synœkete having no direct relations with its host, but preying on the truly myrmecophilous *Tettigometræ*. Evidently the relations of *Brachyacantha 4-punctata* to its host, *Lasius aphidicola*, and to the root-Coccids and root-Aphids so assiduously cherished by this ant, are precisely similar.⁷

The close resemblance of the *Brachyacantha* larvæ to certain Coccids, a resemblance which must be extreme during the younger stages, would seem, at first sight, to be due to mimicry and to be interpretable as a protection from the mandibles of the ants. It is probable that this protection actually obtains, but when we stop to consider that some Coccinellids, which never live in ant-nests, but feed on the eggs of Coccids that live exposed on leaves and branches, nevertheless have larvæ very similar to those of *Brachyacantha*, we must decline to see in the waxy tufts of the latter any special adaptation developed for the purpose of enabling them to live in the nests

⁶ Contribuzioni alla Conoscenza dei Mirmecofili. I. Osservazioni su alcuni Mirmecofili dei dintorni di Portici. Ann Mus. Zool. R. Univ. Napoli, N.S., I, No. 13, 1903, 5 pp.

⁷ Since the foregoing remarks were written I have found that Donisthorpe (Fourmis et leur hôtes. 1er Congr. Internat. d'Entomologie, Bruxelles, 1910, pp. 199–208, Pl. XI) has found *Coccinella distincta* in the mounds of *Formica rufa* or in their vicinity in England. The beetle preys on the aphids in the ant-nests. "When it is attacked by the ants it withdraws its legs and antennæ and feigns death; at such times the mandibles of the ants cannot grasp its smooth elytra."

of *Lasius aphidicola*. The figures published by Howard,⁸ Sanders⁹ and Forbes¹⁰ of the larva of *Hyperaspis signata*, which feeds on the eggs of the cottony maple scale (*Pulvinaria innumcrabilis*), show that it is covered with tufts of delicate white wax and closely resembles the *Brachyacantha* larva. The larva of *H. binotata*, which preys on the same scale, has, judging from Sanders' figure, much shorter tufts of wax than *H. signata*. Howard says of the latter: "The striking likeness of the larvæ of the *Hyperaspis* to a mealy bug will at once be noticed. Were it feeding upon mealy bugs instead of upon Pulviniarias (and it frequently does feed upon mealy bugs) it would at once be evident that we have here a clear case of what Professor Poulton calls 'aggressive mimicry.'" It is clear, however, that even the theory of aggressive mimicry is inapplicable to this particular case, since the Coccids are neither able to see nor to escape from the enemies of their eggs. Is it not simpler to assume that these Coccinellid larvæ secrete an abundance of wax simply because they feed on organisms which, as shown by their secretions in turn, contain large quantities of substances that are readily convertible into wax?

Still another Coccinellid larva closely resembling *Brachyacantha* is that of the Australian *Cryptolamus montrouzieri*, which in its native country feeds on waxy Coccids of the genera *Dactylopius* and *Eriococcus* and when introduced into Hawaii proved to be very useful in destroying the *Pulvinaria psidii* of the coffee plantations. Lounsbury's figures of this Coccinellid, reproduced by Marchal¹¹ indicate that its pupa is formed within the larval skin exactly as in *Brachyacantha*.

⁸ Beneficial Work of *Hyperaspis signata* (Abstract), Proc. Twelfth Ann. Meet. Assoc. Econ. Ent., Bull., No. 26, N.S., U. S. Dept. Agric., 1900, pp. 17, 18. 1 fig.

⁹ The Cottony Maple Scale, Circ. No. 64, U. S. Dept. Agric., 1905, 7 pp., 4 figs.

¹⁰ Twenty-fourth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. Bloomington, 1908, 168 pp., 11 pls., 8 text figs.

¹¹ Utilisation des Insectes Auxiliaires Entomophages dans la Lutte contre les Insectes nuisibles à l'Agriculture. Ann. de l'Inst. Nat. Agron. (2), VI, 1907, pp. 1-74, 26 figs.