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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN.

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to

JUNE, 1890.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS,
ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

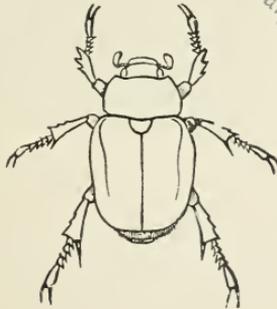
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SPECIAL NOTES.

Insect Pests in East India.—We have just received through the kindness of Mr. E. C. Cotes, of the Indian Museum, Calcutta, a very interesting paper, entitled "Notes on Indian Insect Pests," which forms No. 1 of Vol. I of the "Indian Museum Notes," published by the trustees of the museum and by the authority of the revenue and agricultural department of the Government of India. This publication is to take the place of "Notes on Economic Entomology," of which two numbers have appeared. The present number is divided into three parts; the first part contains "Notes on Rhynchota," by Mr. E. T. Atkinson, and includes short articles upon the Rice Sapper (*Leptocorisa acuta*), an insect which considerably injures the autumn rice by settling upon it when it is milky and sucking out the juice, leaving the husk dry; as many as 6 to 10 of the insects have been seen upon a single ear; the Chora-poka (probably *Carbula biguttata*), an insect which appears in vast numbers when the sesamum crop is gathered and stacked on the threshing floor and eats out the kernel of the seed, leaving only the husk; the Green Bug (*Nezara viridula*), which occurs upon potato balms; also several species of *Capsidæ*, *Jassidæ*, *Aphidæ*, and *Coccidæ*. A new species of *Cerataphis* and a new species of *Pemphigus* are mentioned as feeding upon Cinchona. The second part is by Mr. L. de Nicéville, and treats of a Butterfly injurious to Rice and the Ceylon cardamom pest. The butterfly is *Saustus gremius*, and the larvæ feed upon the leaves of rice. The cardamom pest is *Lamphides elpis*, the larva of which bores circular holes into the capsules and destroys the contents. The damage done by this latter pest is sometimes as great as 80 to 90 per cent. to young plantations. Between from 5 to 10 per cent. of the fruit capsules are perforated.

In the third part Mr. E. C. Cotes gives us further notes on the Wheat and Rice Weevil, on the Sugar-cane Borer-moth (*Chilo saccharalis*), the Sorghum borer (species not determined), a caterpillar injurious to tea, cut-worms, a moth injuring a cultivated timber tree known as *Cedrela toona*, Clothes moths, *Hispa anescens* injuring rice, a

The statements of these farmers, confirmed by my own observations, show that the eggs are deposited, in great part, in a sandy-clay knoll thinly clothed with grass and of but few acres area, from which the locusts migrate to all parts of the valley.

No effort has been made here to control the locusts except an ineffectual attempt to use a large flock of turkies for this purpose, but it would seem, in view of the limited area in which eggs are placed, to be a comparatively easy matter to keep them in subjection by the use of the measures already given.

The Locust Mite, Dipterous larvæ, and Hair-worms were found to infest the locust here in somewhat less numbers than at Franklin.

THE IMPORTED AUSTRALIAN LADY-BIRD.

Vedolia cardinalis.

By D. W. COQUILLET, *Los Angeles, Cal.*

In his annual report for the year 1888, published in the report of this Department for that year, Professor Riley has given an account of "The Importation of Parasites and Predaceous Insects from Australia," containing an account of the importation by the Department of certain kinds of insects which naturally prey upon the Fluted or Cottony-cushion Scale (*Icerya purchasi*, Maskell). At the time of writing the above report only a few specimens of the black and red Lady-bird had been received, so that very little could be said in regard to its habits and early stages. As I have now carefully worked them out, I give herewith a brief account of them, in accordance with directions from the Division of Entomology.

EARLY STAGES.

EGG.—Elongate-ovate, or rarely elongate ellipsoidal, its width never more than one-half its length; very rough, or scabrous; deep orange-red; length, one-half millimeter.

LARVA (*first stage*).—Dark orange-red; first segment with two small black warts placed subdorsally, and with two long whitish bristles on each side; segments two to eleven each, with three dark-brown warts each side—those on segments two and three situated in the subdorsal, supra-stigmatal, and stigmatal regions, while those on the remaining segments are situated in the dorsal, supra-stigmatal, and stigmatal regions; each of those in the stigmatal region bears two long whitish bristles, while each of the others bears a single shorter whitish bristle, those on the eleventh segment the longest; head about five-sixths as wide as the first segment and slightly darker, its sides blackish; six thoracic legs orange-red, the tibiæ darker; last segment furnished with a retractile proleg.

Second stage.—Same as in the first, with these exceptions: Head about three-fifths as wide as the first segment; this segment bears two additional bristles near each corner, and two others in front of the middle; second and third segments each with an additional but much smaller wart in front of those in the stigmatal region, each bearing a single short bristle; bristles, except those in the stigmatal region, black, the warts in this region reddish, and larger than the others.

Third stage.—Same as in the second, except that the head is proportionately narrower, being only about one-half as wide as the first segment.

Fourth stage.—Same as in the third, except that the warts in the sub-dorsal and supra-stigmatal region on either side of the third, and usually of the second segment, are connected by a black spot, and the body finally becomes covered over with a light gray powder; length when fully grown, about 6 millimeters (Fig. 9).

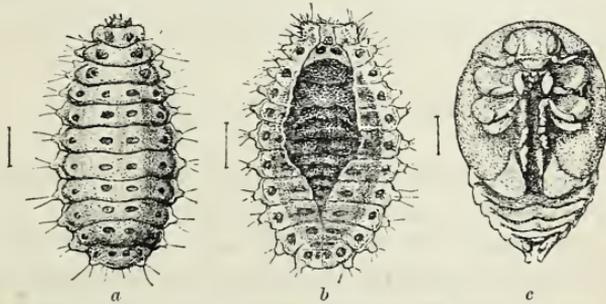


FIG. 9.—*Vedolia cardinalis*: a, Full-grown larva; b, pupa, dorsal view, enclosed in last larval skin; c, pupa, naked, ventral view—all enlarged. (Original.)

PUPA.—Partially inclosed in the old larval skin, which is of a whitish color, marked with black dots, which indicate the position of the warts on the larva as described above; this skin is rent from near the front edge of the first segment to the middle of the eighth; the exposed part is mottled light and brownish red, the first segment marked with two dorsal black dots, or the entire dorsum of this segment, and also that of the second and third segments, black; abdomen with a polished-black interrupted dorsal line; length, 4 millimeters (Fig. 9).

The following table exhibits the length of time passed by these Lady-birds in their different stages:

Egg laid.	Egg hatched.	First molt.	Second molt.	Third molt.	Pupated.	Beetle issued.
Apr. 20	Apr. 26	May 3	May 5	(?)	May 14	May 21
Apr. 23	Apr. 29	May 3	May 7	May 15	May 19	May 26
	Apr. 27	May 3	May 5	May 11	May 19	May 26
	May 6	May 11	May 14	May 19	May 29	June 5
		May 11	May 13	May 17	May 23	May 31
			May 9	May 12	May 20	May 26
			May 17	May 22	May 31	June 5
				May 10	May 17	May 25
				May 11	May 19	May 27
				May 12	May 19	May 26
					Apr. 25	May 4
					Dec. 5	Dec. 18

Averages: *Egg*, six days. *Larva*, nearly twenty-two days (*i. e.*, first stage, five and a half days; second stage, two and three-fifths days; third stage, five and one-sixth days; fourth stage, seven and five-ninths days). *Pupa*, seven and three-fourths days. Egg to beetle, a little over thirty-five days.

Three of the beetles which issued from the pupa May 4 were kept in a breeding cage in a sunny window of my office and supplied with an abundance of food; one of them died on the 20th of May, another on the 26th, and the third died on the 5th of June. It is probable, therefore, that in the open air in summer the beetles live about four weeks after issuing from the pupa, so that their existence from the time the egg is laid until the adult which originated from it dies a natural death covers a period of about two months. During the colder portion of the year, however, this period is doubtless extended considerably beyond this limit, as will be seen by reference to the above table; for instance, the larva that pupated December 5 was changed to a beetle thirteen days later, whereas the one that pupated May 31 produced the beetle five days later.

HABITS AND NATURAL HISTORY.

The eggs are usually thrust beneath the *Iceryas*, but are sometimes attached to the cottony egg-masses; they are placed on one of their sides, sometimes singly but usually in pairs or in groups of three or more. In hatching, the egg-shell is rent nearly the entire length along its upper side, and after the young larva has issued the shell becomes of a whitish color, and retains nearly its original form. The recently-laid egg is more slender and of a deeper red color than the egg of the *Icerya*.

The young larvæ usually burrow into the egg-masses from below and feed upon the eggs; later they attack the *Iceryas* of all sizes, usually making the attack on the under side of the abdomen. The young larva is easily distinguished from the young *Iceryas* by lacking the long black antennæ so conspicuous in the latter. When about to cast its skin the larva attaches the posterior end of its body to some object, and at the proper moment breaks away the whole anterior end of the old skin and crawls out of the opening thus made.

When about to pupate the larva attaches the posterior end of its body to the bark or leaf of the tree and suspends itself head downward. It remains in this position about three days, when the skin along its back splits open, exposing a portion of the pupa to view. When the beetle is fully formed the old pupa-skin partially breaks away, showing the beetle to be of a pale reddish color. It remains in this situation about two days longer, when the beetle issues clad in its normal colors of black and red, as shown in the figure (Fig. 10). Coition occurs shortly afterward. In fact I have frequently seen the males standing by and wait-

ing for the females to issue, even going so far as to tear away the old pupa-skin and uniting with the female while she is still soft and helpless. Egg laying begins the next day, and is continued during nearly the entire life of the beetle. One that I kept in a breeding-cage and supplied with an abundance of food, deposited 42 eggs in eight days. The total number deposited by one female will probably average from 150 to 200 eggs.

The adult beetles as well as the larvæ also feed upon the *Iceryas*, but with this difference, that the attack is usually made from above instead of from below.

I have never seen these Lady-birds in any of their stages feeding upon any other insect than the *Icerya*. On one occasion I confined six Lady-bird larvæ in a breeding-cage containing black scales (*Lecanium oleæ* Bernard), some of which were quite soft, but after the lapse of seven days none of these scales had been attacked, whereas three of the Lady-bird larvæ had been devoured by their comrades. At the same date I placed an equal number of these larvæ in another cage containing specimens of an undetermined species of *Lecanium* found on a peach-tree, several of the scales being still soft, but at the end of seven days none of them had been attacked, while four of the Lady-bird larvæ had fallen a prey to their rapacious brothers. I also tested these larvæ with a species of plant-louse found on orange-trees, but they did not attack them. It seems very evident, therefore, that the *Iceryas* are the natural food of these Lady-birds, and they feed upon these in all their stages, even attacking the winged males.

I have never seen any of our native insects attacking these Lady-birds, although Col. J. R. Dobbins informs me that on one occasion he saw a lace-winged fly larva (*Chrysopa* sp.?) in such a position that he thought it might have been engaged in feeding upon a Lady-bird larva. The ants do not molest them.

IMPORTATION AND SPREAD.

The first consignment of these Lady-birds reached me on the 30th of November, and numbered twenty-eight specimens; the second consignment of forty-four specimens arrived December 29; and the third consignment of fifty-seven specimens reached me January 24, making one hundred and twenty-nine specimens in all. These, as received, were placed under a tent on an *Icerya*-infested orange-tree, kindly placed at my disposal by Mr. J. W. Wolfskill, of this city. Here they were allowed to breed unmolested, and early in April it was found that nearly all of the *Iceryas* on the inclosed tree had been destroyed by these voracious Lady-birds. Accordingly, on the 12th of April, one side of the tent was removed, and the Lady-birds were permitted to spread to

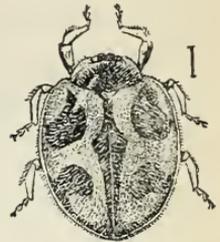


FIG. 10.—*Vedolia cardinalis*, adult; enlarged.
(After Riley).

the adjoining trees. At this date I began sending out colonies to various parts of the State, and in this work have been greatly aided by Mr. Wolfskill and his foreman, Mr. Alexander Craw, both of whom were well acquainted with the condition of the orchards in this part of the State. By the 12th of June we had thus sent out 10,555 of these Lady-birds, distributing them to two hundred and eight different orchardists; and in nearly every instance the colonizing of these Lady-birds on *Icerya*-infested trees in the open air proved successful. The orange and other trees—about seventy-five in number—and also the shrubs and plants growing in Mr. Wolfskill's yard, have been practically cleared of *Iceryas* by these Lady-birds, and the latter have of their own accord spread to the adjoining trees to a distance of fully three-fourths of a mile from the original tree.

Besides the three consignments of these Lady-birds referred to above I also received two later consignments. The first of these reached me February 21, and numbered thirty-five specimens; these I colonized on an *Icerya*-infested orange-tree in the large orange grove belonging to Colonel J. R. Dobbins, of San Gabriel. The last consignment of three hundred and fifty specimens arrived March 20; one-third of these I left with Colonel Dobbins, while the remainder I colonized on orange-trees in the extensive grove owned by Messrs. A. B. and A. Scott Chapman, in the San Gabriel Valley. All of these colonies have thrived exceedingly well. During a recent visit to each of these groves I found the Lady-birds on trees fully one-eighth of a mile from those on which the original colonies were placed, having thus distributed themselves of their own accord. The trees I colonized them on in the grove of Colonel Dobbins were quite large and were very thickly infested with the *Iceryas*, but at the time of my recent visit scarcely a living *Icerya* could be found on these and on several of the adjacent trees, while the dead and dry bodies of the *Iceryas* still clinging to the trees by their beaks, indicated how thickly the trees had been infested with these pests, and how thoroughly the industrious Lady-birds had done their work.

EXTRACTS FROM CORRESPONDENCE.

Enemies of *Diabrotica*.

With this I mail you a spider which I found with a *Diabrotica soror* in his jaws. Will you please send me the name of this spider, as also of the family to which it belongs? If new, would it not be well to describe it, or to have Dr. Marx do so if he will?

It may interest you to know that I have bred a *Tachina* fly from *D. soror*, but its wings never expanded, so it is not fit for study. I have just captured a large number of these beetles, and will try to breed perfect specimens of this fly.—[D. W. Coquillett, Los Angeles, Cal., June 19, 1889.]

REPLY.—The spider which you found eating *Diabrotica* is *Nyxistius gulosus* Keyserling. It belongs to the family Thomisidæ. Your note concerning the breeding of the Tachinid from the *Diabrotica* is very interesting.—[July 3, 1889.]