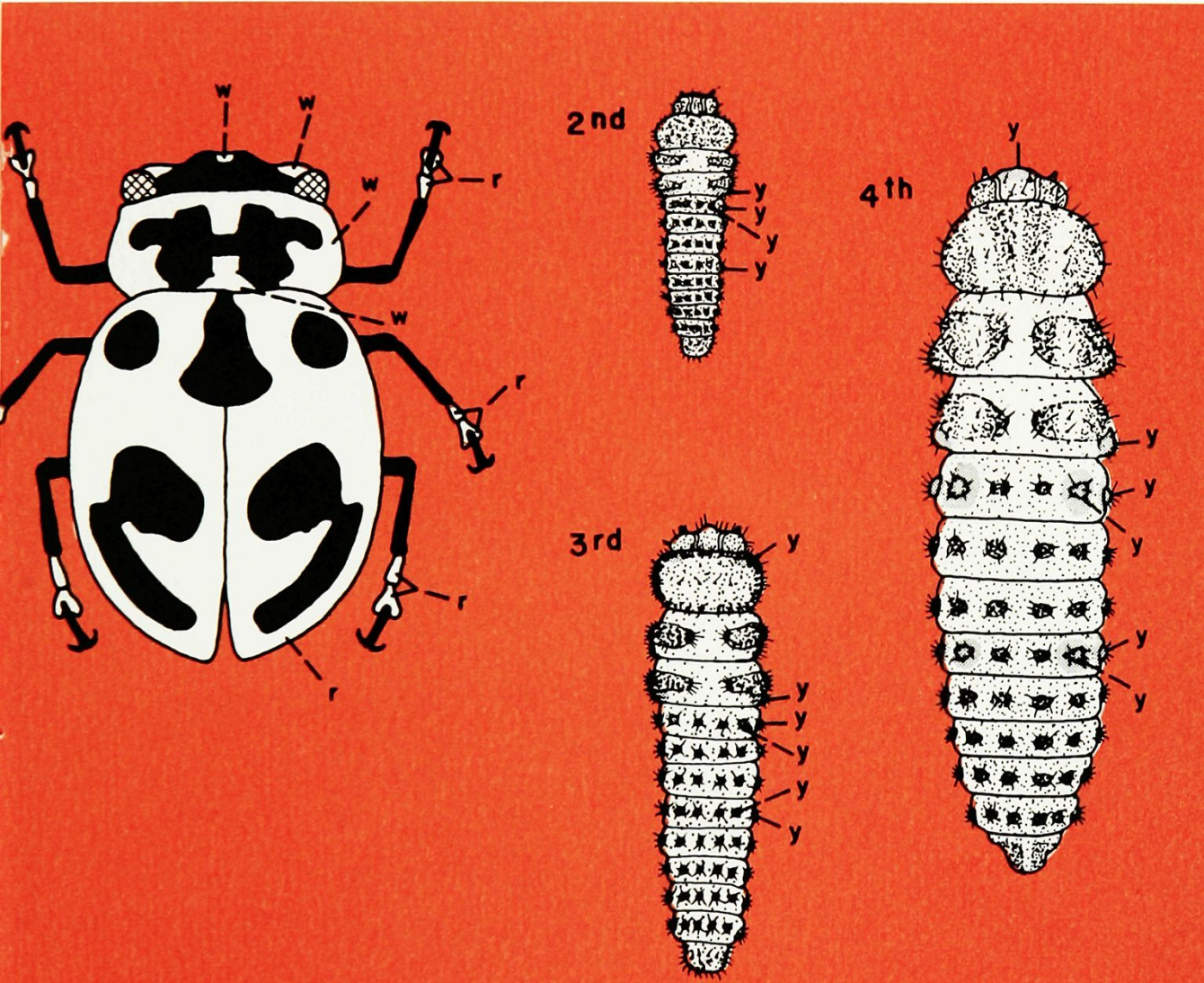


FIELD RECOGNITION OF THE LARVAE OF NATIVE COCCINELLIDAE, COMMON TO THE POTATO FIELDS OF AROOSTOOK COUNTY

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Abstract

The larvae of coccinellids commonly found in the potato fields of Aroostook County, Maine are figured with the adults of the species. The color pattern for each larval instar of the species concerned is described. A key, based on color pattern, is presented for field identification of the larvae. The key permits identification of the larvae without killing them.

Field Recognition of the Larvae of Native Coccinellidae, Common to the Potato Fields of Aroostook County

R. H. Storch¹

Introduction

The adult beetles of the family Coccinellidae are the well-known ladybird beetles or ladybugs. The larvae and adults of the subfamily Coccinellinae are considered beneficial because they feed on pest species, mainly aphids and scale insects. Aphids are among the most important pests of potatoes in Maine. They physically damage potato plants and are vectors of some potato diseases.

This study was undertaken to provide a means of recognizing the larvae of native coccinellids found in or around the potato fields of Aroostook County. Laboratory identification based on the presence or absence and size and shape of external and internal structures requires that the larvae be killed and preserved in special fluids for microscopic examination. For our purposes it is desirable to be able to identify the insect quickly and without killing it. Thus, the larval color pattern was chosen as a possible means of identification.

Gage (1920) studied the larvae of coccinellids found in Illinois. He used the color patterns and morphological characters to identify these species. In the descriptions of each species he noted the color patterns, but did not state the instar described (it is assumed that these descriptions are for the fourth instar). The larvae of the Palaearctic Coccinellini and Psylloborini were described by Strouhal (1926). He, also, constructed keys for identification of those species based on color patterns and morphological characters. However, in the descriptions of the species, he noted the changes in the color pattern between successive instars of the particular species. Descriptions of some coccinellid larvae of Colorado were made by Palmer (1914) which included changes in color patterns between successive instars of a species, but no key for identification was given. Read (1965) described the larvae of three common aphid-feeding coccinellids in New Zealand. He did not note differences in color pattern between successive instars of the species. Since his diagrams are of the fourth instar larvae, it is assumed the descriptions apply to that instar.

The species considered in this paper are *Adalia bipunctata* (Linnaeus) (the two-spotted lady beetle), *Coccinella transversoguttata*

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Falderman (the transverse lady beetle), *Coccinella trifasciata* Mulsant, *Hippodamia parenthesis* (Say), and *Hippodamia tredecimpunctata* (Say) (the thirteen-spotted lady beetle).

Materials and Methods

The larvae used to make the drawings were reared individually from eggs laid by easily identifiable adult females. For added recognition, drawings of the adult stage are also given.

The terminology followed is similar to Gage (1920). It is difficult to distinguish between a parascolus and struma in the second instar and third instar larvae. Therefore, these areas are simply referred to as setal areas. The dorsum of the mesothorax and that of the metathorax contains a pair of dorsal shields, *mesosh* and *metash*, respectively (see plates). There are also two pairs of setal areas on the pleura of the pterothorax. These are called the anterior pleural setal area (*apl*) and posterior pleural setal area (*ppl*). On the abdominal segments there are six pairs of setal areas; the dorsal setal area (*d*) adjacent to the dorsal midline, the dorsolateral setal area (*dl*) lateral to the dorsal group, and the lateral setal area (*l*) lateral to the dorsolateral group. The paralateral, ventrolateral, and ventrol setal areas are not colored in any of the species considered in this paper.

The second instar of *A. bipunctata* does not have any colored areas. Therefore, the drawing for this specimen is used to indicate the areas described in the text. The figures indicate all colored areas for a given instar of a particular species. The keys presented below contain only those colored areas necessary to distinguish the species.

To avoid confusion, all larvae illustrated are drawn without eyes and appendages other than the antennae. Legs are drawn on adults only for those species in which they are readily visible. Abbreviations for the figures are listed below.

Larval Color Patterns

It is realized that the color patterns of insects, especially immature forms are highly variable. However, the following identification aids have proven reliable for Aroostook County. There are no colored areas on the first instar larvae of any of the species considered in this paper.

Larvae of any instar of any species show some changes during a particular instar. After molting and before tanning of the cuticle the larvae are light brown. The red markings on those species which have them are visible at this time. Shortly after tanning, the larvae are black

except for the colored areas. In general, this is due to small hairs which are black and densely packed. As feeding proceeds, the membranes stretch. Thus, in the later stages of a particular instar the black base color changes to a gray or bluish black because the hairs are spread out and the lighter membranous areas become visible. The setal areas appear to be more sclerous and apparently stretch very little. Therefore, in the third and fourth instar larvae these areas, except for those which are colored, appear black and the membranous areas bluish black or gray. In most instances, the cuticle of the colored areas is transparent. The color is probably due to metabolic by-products deposited in the fat body or epidermis and is visible through the transparent areas.

Abbreviations

A	— adult
d	— dorsal setal area
dl	— dorsolateral setal area
l	— lateral setal area
mesosh	— mesothoracic shield
metash	— metathoracic shield
r	— red or red-orange
wh	— white or cream colored
y	— yellow or yellow-orange
2nd	— second instar larva
3rd	— third instar larva
4th	— fourth instar larva

Adalia bipunctata (Linnaeus) (Plate 1)

This species is more commonly found feeding on aphids which are on flowers and shrubs about buildings rather than feeding on aphids located in or about the potato fields. It is commonly found in April or May when the adults which hibernate in or about houses and out-buildings become active.

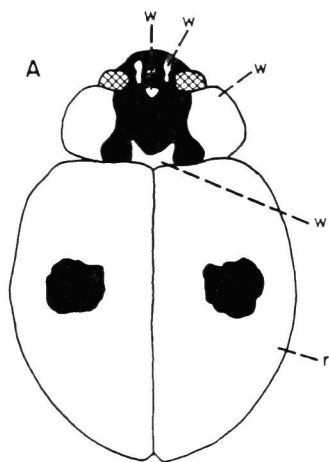
First instar larva—black to gray; no colored areas.

Second instar larva—black to gray; no colored areas.

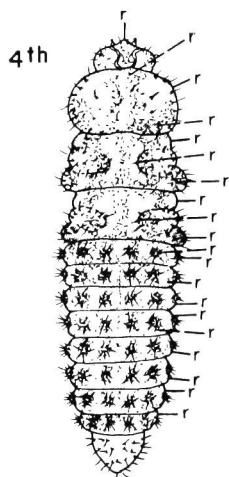
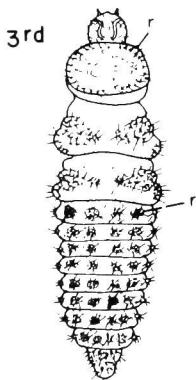
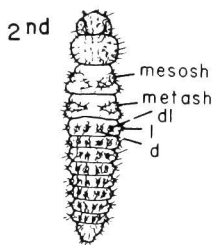
Third instar larva—black to gray; colored areas as follows: red to reddish orange on lateral apical margin of pronotum and dorso-lateral setal group of first abdominal segment.

Fourth instar larva—black to gray; red to reddish orange areas as follows: frons and clypeus; dorsal midline and spots on lateral apical and basal margins of prothorax; dorsum medial to shields and anterior pleural setal areas of mesothorax and metathorax; posterior pleural setal area of metathorax; dorsolateral and lateral setal areas of first abdominal segment; stripe on either side of dorsal midline on abdominal segments 1-3; stripe from dorsal setal area to dorsal midline at posterior margin on abdominal segments 4-8; dorsum just anterior to dorsolateral setal area on abdominal segments 2-8; dorsum encircling or nearly encircling lateral setal areas on abdominal segments 2-8.

Plate I



1mm



Coccinella transversoguttata Falderman (Plate 2)

This species is most abundant in July and August. A few specimens are found in June.

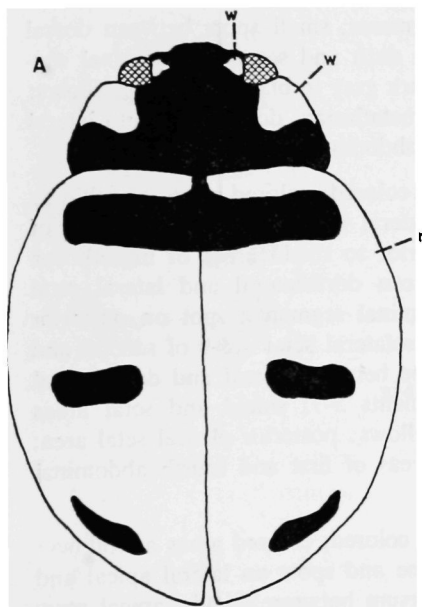
First instar larva—black to gray; no colored areas.

Second instar larva—black to gray; colored areas as follows: red to red-orange on posterior pleural setal area of metathorax; dorsolateral and lateral setal areas of first and fourth abdominal segments; thin stripe connecting dorsolateral and lateral setal areas of first abdominal segment.

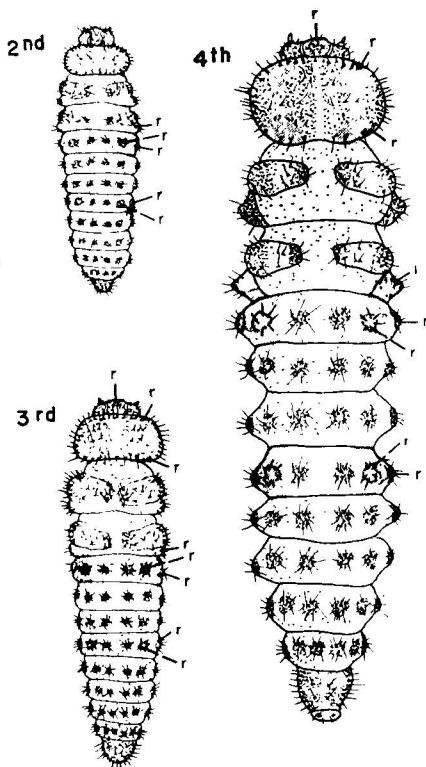
Third instar larva—black to gray; colored areas as follows: faint red on frons and clypeus; spots on lateral apical and basal margins of pronotum; red to red-orange on posterior pleural setal area of metathorax; dorsolateral and lateral setal areas of first and fourth abdominal segments; thin stripe connecting dorsolateral and lateral setal areas of first abdominal segment.

Fourth instar larva—black to gray; colored areas as follows: faint red on frons and clypeus; spots on lateral apical and basal margins of pronotum; red to red-orange on posterior pleural setal area of metathorax; dorsolateral and lateral setal areas of first and fourth abdominal segments with areas between them also colored; faint red on dorsolateral setal areas of fifth and sixth abdominal segments.

ite 2



1mm



Coccinella trifasciata Mulsant (Plate 3)

This species is commonly found in May and June. Very few specimens are collected in July and August.

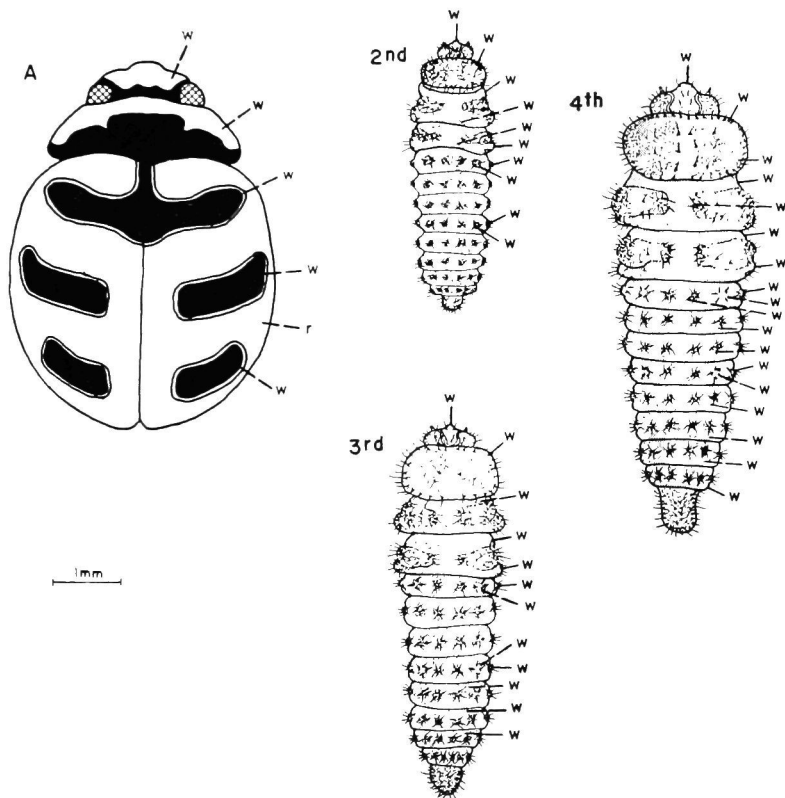
First instar larva—gray; no colored areas.

Second instar larva—gray to cream colored; colored areas as follows: white on frons and clypeus; dorsum anterior to shield and posterior mesal margin of mesothorax; posterior mesal margin of metathorax; dorsum between dorsolateral and lateral setal areas of first and fourth abdominal segments; small spots between dorsal and dorsolateral setal areas of sixth and seventh abdominal segments; shield and setal areas dark gray to black except as follows: posterior pleural setal area of metathorax; dorsolateral and lateral setal areas of first and fourth abdominal segments.

Third instar larva—gray to cream colored; colored areas as follows: white on frons and clypeus; lateral apical and basal margins of pronotum; apical margins anterior to shield areas of mesothorax and metathorax; dorsum between dorsolateral and lateral setal areas of first and fourth abdominal segments; spot on posterior margin between dorsal and dorsolateral setal areas of second and third abdominal segments; stripe between dorsal and dorsolateral setal areas on abdominal segments 5-7; shield and setal areas dark gray to black except as follows: posterior pleural setal area; dorsolateral and lateral setal areas of first and fourth abdominal segments.

Fourth instar larva—gray to cream colored; colored areas as follows: frons and clypeus; dorsal midline and spots on lateral apical and basal margins of pronotum; dorsum between shields, apical margins anterior to shields, and posterior to shields of mesothorax and metathorax; posterior pleural setal area of metathorax; spot between dorsal setal area and dorsum from edge of dorsal setal area to lateral setal area including dorsolateral and lateral setal areas of first abdominal segment; dorsum between dorsal setal areas and between dorsal and dorsolateral setal area of second and third abdominal segments; spot between dorsal setal areas and dorsum from edge of dorsal setal area to lateral setal area including dorsolateral and lateral setal areas of fourth abdominal segment; spot between dorsal setal areas and line between dorsal and dorsolateral setal areas of abdominal segments 5-7; posterior margin of eighth abdominal segment; all shield and setal areas except those noted above dark gray to black.

Plate 3



Hippodamia parenthesis (Say) (Plate 4)

This species is more abundant in June than July or August. It is commonly found in the margins of the fields.

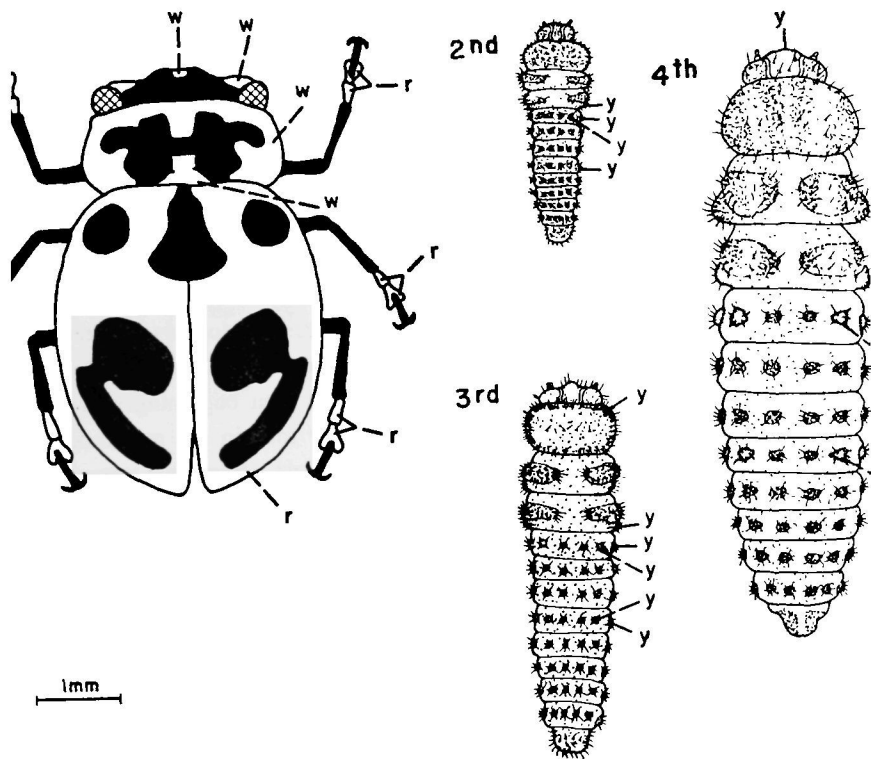
First instar larva—black to gray; no colored areas.

Second instar larva—black to gray; colored areas as follows: yellow to yellow-orange on posterior pleural setal area of metathorax; dorso-lateral and lateral setal area of first abdominal segment; dorso-lateral setal area of fourth abdominal segment.

Third instar larva—black to gray; colored areas as follows: yellow spot on lateral apical margin of pronotum; posterior pleural setal area of metathorax; yellow to yellow-orange on dorsolateral and lateral setal areas of first and fourth abdominal segments.

Fourth instar larva—black to gray; colored areas as follows: yellow on frons and clypeus; spot on lateral apical margin of pronotum; posterior pleural setal area of metathorax; faint stripe on dorsal midline of mesothorax and metathorax; yellow to yellow-orange on dorsolateral and lateral setal areas of first and fourth abdominal segments; faint spot between dorsolateral and lateral setal areas of abdominal segments 5-7.

e 4



Hippodamia tredecimpunctata (Say) (Plate 5)

These coccinellids are readily collected in July, August, and early September. They are very common in potato fields just prior to harvesting.

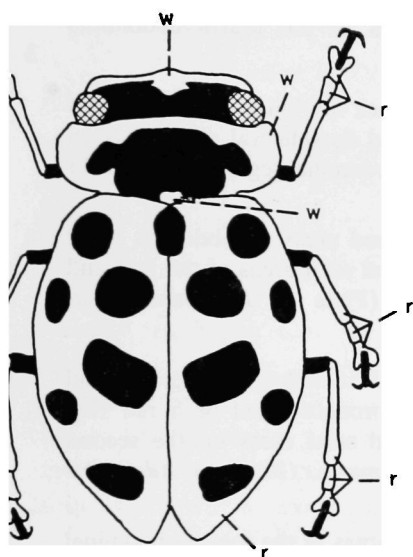
First instar larva—black to gray; no colored areas.

Second instar larva—black to gray; colored areas as follows: white on posterior pleural setal area of metathorax; dorsolateral and lateral setal areas of first abdominal segment; dorsal, dorsolateral, and lateral setal areas of fourth abdominal segment.

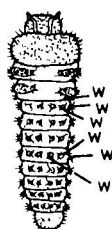
Third instar larva—black to gray; colored areas as follows: white on dorsal midline between shield areas of mesothorax; posterior pleural setal area and inverted Y-shaped area beginning between shield areas and continuing to posterior margin on metathorax; dorsolateral and lateral setal areas of first abdominal segment; dorsal, dorsolateral, and lateral setal areas of fourth abdominal segment.

Fourth instar larva—black to gray; colored areas as follows: white on dorsal midline between shield of mesothorax; posterior pleural setal area and inverted Y-shaped area beginning between the shield areas and continuing to posterior margin on metathorax; dorsolateral and lateral setal areas of first abdominal segment; dorsal, dorsolateral, and lateral setal areas of fourth abdominal segment.

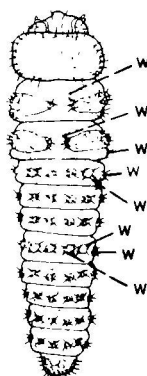
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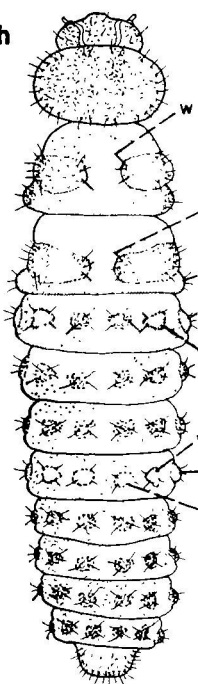
2nd



3rd



4th



KEY TO LARVAL IDENTIFICATION

1. (a) Larvae with white, yellow, or yellow-orange colored body markings
- (b) Larvae with red-orange or red body markings
2. (a) Larvae with dorsal, dorsolateral, lateral setal areas of the fourth abdominal segment white. (Plate 5) *Hippodamia tredecimpunctata*
- (b) Larvae with dorsal setal area of the fourth abdominal segment never white
3. (a) Very light except for a few black markings. Abdomen with white areas between dorsal and dorsolateral setal areas on at least the sixth and seventh abdominal segments. (Plate 3) *Coccinella trifasciata*
- (b) Black or blue black. No colored areas on abdomen other than the dorsolateral and lateral setal areas of the first and fourth abdominal segments. (Plate 4) *Hippodamia parenthesis*
4. (a) Dorsolateral setal area of the first abdominal segment and lateral apical margin of the pronotum red or a red ring around the base of the lateral setal areas on the second through eighth abdominal segments. (Plate 1) *Adalia bipunctata*
- (b) Dorsolateral and lateral setal areas of the fourth abdominal segment red or red-orange. (Plate 2) *Coccinella transversoguttata*

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