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Morphology of the egg and first instar larva of *Coptocephala rubicunda* (LAICHARTING, 1781) and notes on its biology (*Coleoptera*: *Chrysomelidae*)

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ABSTRACT. The egg, larval case, and first instar larva of *Coptocephala rubicunda* (LAICHARTING, 1781) are described and illustrated for the first time. The adults were bred on the flowers of *Pimpinella saxifraga* L., and the larvae on decayed leaves of this plant. A comparative morphology of frons, labrum and pronotum of the first instar larva of *C. rubicunda* and *C. unifasciata* are described.

Key words: entomology, morphology, biology, egg, first instar larva, *Coleoptera*, *Chrysomelidae*, *Clythrinae*, *Coptocephala rubicunda*, *Apiaceae*.

INTRODUCTION

The genus *Coptocephala* CHEVROLAT, 1837, includes 14 European species, two of which - *C. rubicunda*, *C. unifasciata* - occur in Poland (WARCHAŁOWSKI 1991 b). So far, only the morphology of the first instar larva of *C. unifasciata* has been described. The description specifies its morphological features that allow for distinguishing it from the larva of an East-Asian species, *C. orientalis* (MEDVEDEV and ZAICEV 1978). Information concerning preimaginal stages of *C. scopolina* is scarce and limited only to the descriptions of larval excrement case and most of it dates back to the last century (SCHOLTZ 1848, LETZNER 1855). Besides, some fragmentary data on biology of the adults and larvae of the genus *Coptocephala* were provided by MEDVEDEV (1962) and ERBER (1969).

C. rubicunda (LAICHARTING, 1781) is distributed in Central and the Southern Europe. In Poland it is known from southern parts of the country. It inhabits the

places with xerothermic plants, which grow on dry and sunny slopes, often on cattle pasturelands (KUNTZE and NOSKIEWICZ 1938, BURAKOWSKI et al. 1990, WARCHAŁOWSKI 1991a). This paper contains the description of the egg and first instar larva of *C. rubicunda* with notes on biology of adults and larvae, observed in natural conditions and in laboratory. On the basis of my own observations and literature data (MEDVEDEV and ZAICEV 1978) the morphology of frons, labrum and pronotum in larvae of *C. rubicunda* and *C. unifasciata* was compared. The structure of these parts of the body seems to be the only good taxonomic feature for the genus *Coptocephala*.

MATERIAL AND METHODS

Observations of *C. rubicunda* were conducted from July to the end of August 1997-98 in the following villages: Ciechanki Krzesimowskie, Biała Góra, Machnów, Tarnogóra n. Izbica (SE Poland, the Wyżyna Lubelska Upland and Roztocze). Couples (male and female) of collected insects were kept in tall (20 cm), transparent plastic containers covered with gauze and lined with damp tissue paper. Breeding was conducted in the temperature of 21° C. The obtained eggs, and subsequently the first instar larvae were transferred to vesseles with soil collected in the field from under the host plant. The larvae were fed with decayed parts of *Pimpinella saxifraga* L. The eggs and larvae were preserved in etanol (90%). For microscopic slides they were cleared in chloralphenol. The sclerotized parts of these preparations were kept in 5% KOH solution at room temperature for several hours. Next they were embedded in Berlese liquid. Drawings were made with the use a microscope with camera lucida. The number of specimens examined: 10 eggs, 10 larval cases, 10 first instar larvae.

RESULTS

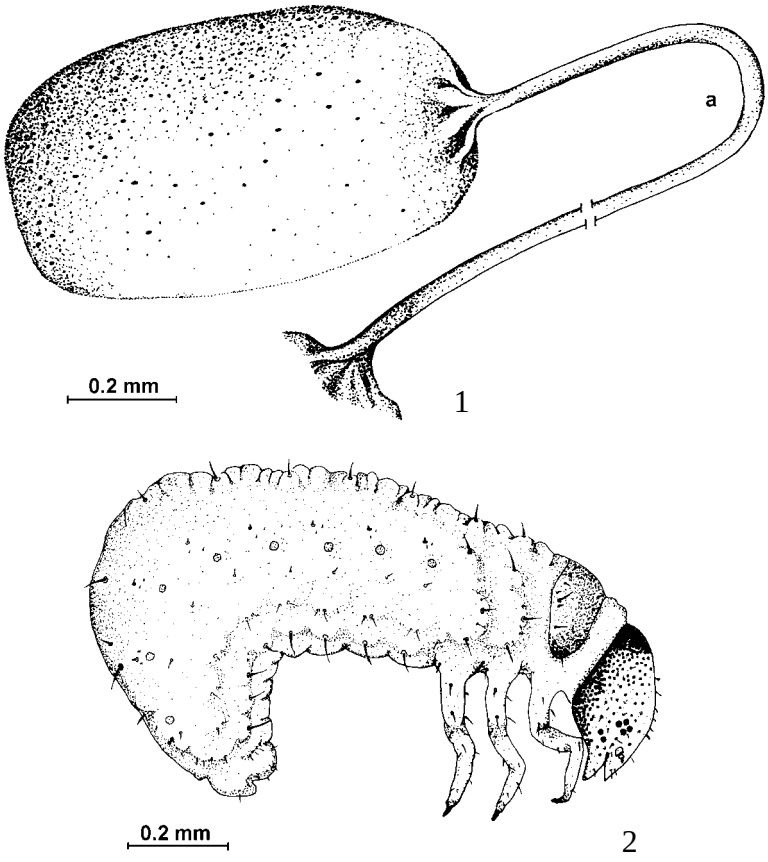
MORPHOLOGY

Egg (Fig. 1). Length without case: 0.82-0.87 mm (mean: 0.84), width: 0.40-0.47 mm (mean 0.44), length of tail: 1.95-2.40 mm, (mean: 2.15); colour: light yelow; shape: elongate oval. The surface of chorion is covered with two kinds of points: small, densely distributed and deeper, scarcely punctured. Brown cylindrical excrement case built of diamond-shaped, spirally arranged scales, thickness of the case: 0.3 mm. At its anterior pole the case has an opercle, of c. 0.55 mm diameter.

Larva (Fig. 2). Length (with bent abdomen): 1.04-1.16 mm; J-shaped body with the abdomen segment bent underneath; colour: head, pronotum, limbs - hockfeet - brown, rest of body: milk white.

Head (Fig. 3) covered with regularly distributed pentagonal or hexagonal points. Six dark brown stemmata in two grups present on each side, 4 of them

located behind the antennae and two - under the antennae. Antennual segment II with domed sensory papilla, one long seta and a few tiny ones on top (Fig. 5). Frons with 14 setae in 3 rows, the front row consists of 8 setae, the mid one - of 4 and the back row has 2 setae. Labrum (Fig. 8) trapeziform, distinctly indented at its front edge, with gently rounded projection in the middle of the indentation. Chaetotaxy with 20 setae (4 short setae, situated at the front edge). Mandibles (Fig. 9) symmetrical, with 4 teeth, chaetotaxy: 1 longer and 1-2 shorter setae. Labium (Fig. 6) consist of prementum and postmentum, which are separated from each other, and mentum fused with postmentum. There are three pairs of setae on the postmentum: one is asymmetrical, placed slightly below the mid length, two further pairs located at the top. Prementum: trapesiform, with a pair of tiny



1-2. *Coptocephala rubicunda*: 1 - egg, lateral aspect (a. tail), 2 - first instar larva, lateral aspect

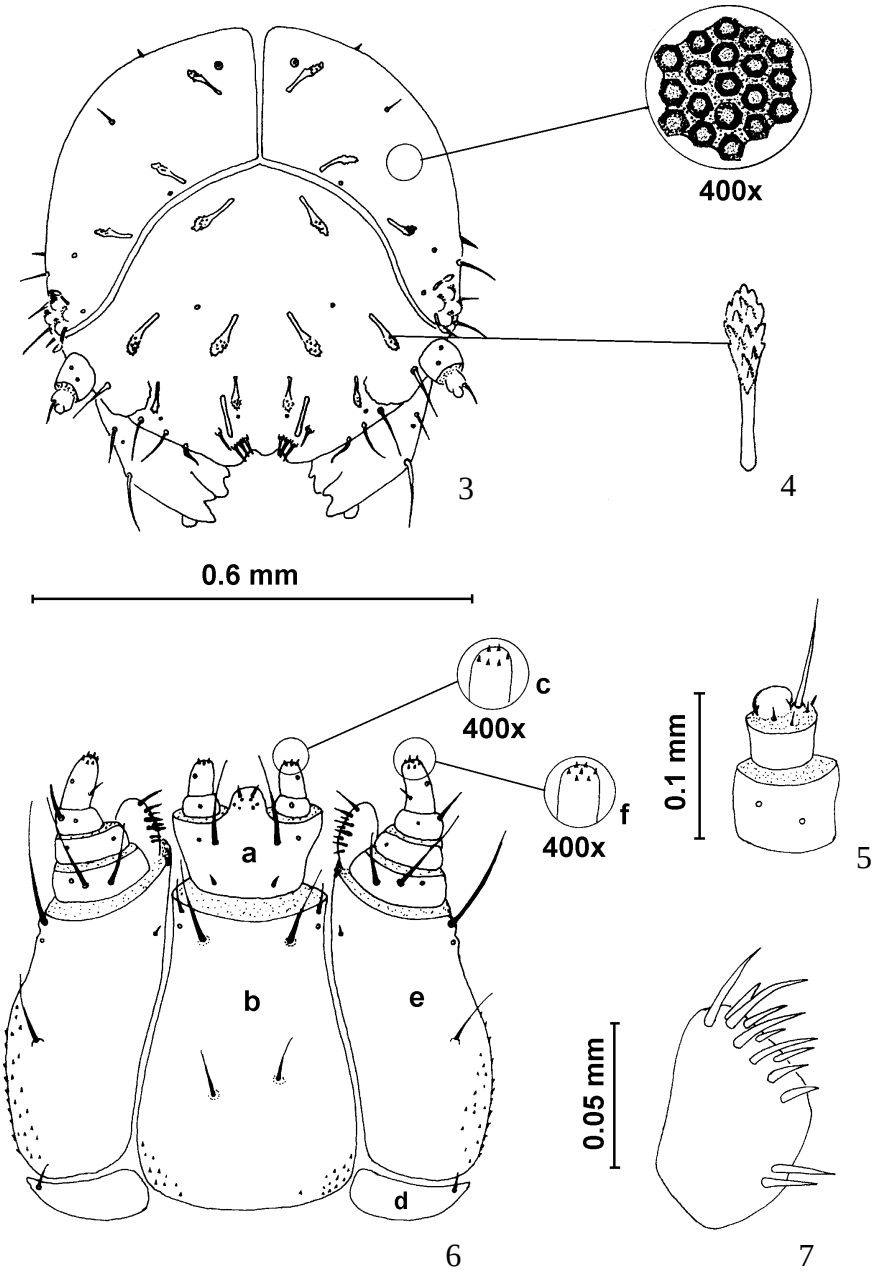
bristles, at the narrower base and with two long setae with papillae at the sides. The papillae are situated closer to the top. Labial palp: two-segmented with one sensilia on each segment, the second segment elongated, with 6 tiny, spike-like sensillae arranged as in Fig. 6 c. Maxilla (Fig. 6) consists of triangular cardo and stipes, which is twice as long as broad. Cardo with one seta in the external angle, stipes with two long setae at the outer margin, a short one at the inner margin, and numerous tiny spikes coming up to half its length. Maxillary palp 4-segmented: the first segment with 2 setae; third with one setae at the outer margin; fourth segment elongated, with one seta half way throught its length and with 7 tiny, spike-like sensiliae on top distributed as in Fig. 6 f. Galea (Fig. 7) with 10 long, spike-like setae, situated at the outer margin in two slightly disturbed rows, and with two setae nearer the base.

Thorax; pronotum well-sclerotized, brown, with straight setae of different length and sensillae distributed as in Fig. 10. Meso- and metathorax slightly sclerotized, soft, white. Legs: long, slim, all pairs alike, setae straight, distributed as in Fig. 11, tarsungulus single, straight and elongated. Abdomen: white, soft, elongated and bent under the body with long and short setae, arranged in more or less regular rows.

BIOLOGY

The adults of *C. rubicunda* feed on the flowers of *Apiaceae* (= *Umbeliferae*) (ERBER 1969, BURAKOWSKI et al. 1990). The most frequently observed feeding grounds for this species were *Pimpinella saxifraga* L., *Seseli annum* L. and sporadically, *Selinum carvifolia* L. The insects gnawed out the nectary circles and less willingly the flower bottoms. In natural conditions the species has not been reported to feed on flowers of *Daucus carota* L., like the two remaining species of the genus *Coptocephala* recorded from Poland (BURAKOWSKI et al. 1990, WARCHAŁOWSKI 1991a). Feeding the adults of *C. rubicunda* in culture with flowers of this plant also gave negative results.

The female laid eggs in loose deposits of 5-10 eggs each, or individually. In the laboratory the female fixed each egg separately with the use of a tail growing out of the posterior pole, onto various parts of the host plant or onto the walls of containers. Eggs were found in the field, and they were laid on grass blades. Immediately after she had laid an egg, the female covered it with excrement secretion. She began covering the egg with excrement in the place from which the tail grew out. Holding the egg in her hind legs and turning it gradually, the female covered the egg with overlapping diamond-shaped scales. The process of covering each egg with faeces was as follows: the female, touching the scale, that had already been put on with the end of her abdomen, dropped a little secretion on the hind angle of the scale, then she moved her abdomen up somewhat, to lower it again closer to the surface of the egg in a moment. As a result of this, the hind angle of the created scale gently rose over the surface, while the front one, placed slightly lower, was hidden under another plate. The whole case formed a dense



3-7. *Coptocephala rubicunda*; first instar larva: 3 - head, frontal aspect, 4 - frontal seta, 5 - antennae, 6 - labium and maxilla (a. prementum, b. postmentum, c. second segment of labial palp, chaetotaxy, d. cardo, e. stipes, f. fourth segment of maxillary palp, chaetotaxy), 7 - galea

structure, as the surface of the egg was accurately covered with the secretion. It is a kind of protection for the egg and the future larva. Between the surface of the egg chorion and the inner wall of the excrement case there is some free space. It enables the future larva to move quite freely. It can easily slip its body in or out, or even make a full turn inside the case. Even though the insects were constantly supplied with food, on an average 20% eggs laid by one female lacked cases. These eggs were more exposed to desiccation, as their very thin and delicate chorions did not protect them sufficiently from losing their moisture. Laying eggs in laboratory conditions lasted until the end of September. One female laid on an average 10 eggs per day. The first instar larvae were obtained both from the eggs which were protected by an envelope and from those without it. The larva, which lived in a case, did not leave it, but only its thorax, head and legs protruded. While moving, the larva usually kept its thorax raised above the surface at an angle of about 50^0. Sometimes it made characteristic, backward and forward movements with its abdomen. After hatching, the larvae were quite mobile but they did not feed. It was only after they had been kept at the temperature of 3^0C for about one month, that some of them started feeding on decayed leaves, stems and roots of *Pimpinella saxifraga* L. The insects most frequently fed on leaves and stems, gnawing out the external layer of tissue and sporadically, the layer, just below the root epiderm. Some of them fed on the larval cases of other larvae. It was observed that the larva enlarged its case. It used is mandibles to attach new portions of the excrement secretion to the edge of the entrance hole of the already existing case, thus elongating it. Then it thickened the walls, beginning to put the secretion on from the inside of the case. To make the case wider, the larva burst it and then it sealed up the cleft that had been formed at the bottom. The part built by the larva was clearly different from the maternal one because it was darker (brownish-black) and had no scale-like structure.

COMPARATIVE ANALYSIS OF THE MORPHOLOGY OF *COPTOCEPHALA RUBICUNDA* AND *C. UNIFASCIATA* OF THE LARVAL MORPHOLOGY

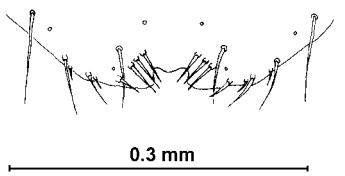
The comparative analysis of the morphology of *Coptocephala rubicunda* and *C. unifasciata* was carried out on the basis of three structural elements: frons, labrum and pronotum. These parts in *C. unifasciata* were described and illustrated by MEDVEDEV and ZAICEV (1978). The features that differentiate the particular structural elements are:

- the shape of 8 pairs of frontal setae in the front row; *C. rubicunda* - 2 pairs of papillate, notched setae, one pair of setae that are widened and flattened at the end, one pair of simple setae; *C. unifasciata* - all setae are simple.
- the distribution of 8 central setae on the labrum: four setae in each of the 2 groups; *C. rubicunda* - 3 setae close to one another in each group; the fourth one - at the front edge; *C. unifasciata* - all 4 setae situated close to one another.

- number and shape of setae on the pronotum: *C. rubicunda* - seven simple setae on both the front and hind edge of pronotum; *C. unifasciata* - 6 clubbed setae and one simple setae on the front edge of pronotum, 10 simple setae on the hind edge of pronotum.

DISCUSSION AND CONCLUSIONS

The studies conducted so far have not presented the course of the full development cycle of *C. rubicunda*. The second inster larva has not been obtained. The cause of high mortality of the first instar larvae still remains a controversial issue. It might have been caused by inadequate thermal, moisture or trophic conditions. The larvae were kept at a temperature of 3^0C for about one month and then they started feeding. Based on this it can be supposed that the first instar larva is a wintering form. It was observed that the larvae fed on decayed leaves and stems of *Pimpinella saxifraga* L. This diet seems to be insufficient becouse the larvae did not survire. On the basis of literature data (JOLIVET 1952, MEDVEDEV 1962) it can be claimed that *C. rubicunda*, like most species of the subfamily *Clythrinae* require a certain species of ants to develop. However, the observations conducted so far do not confirm or deny this hypothesis. To solve this problem, as well as to define the thermal requirments of preimaginal stages, it is necessary to carry out further studies.



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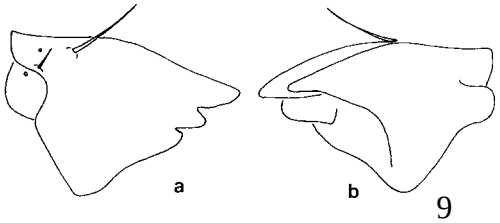

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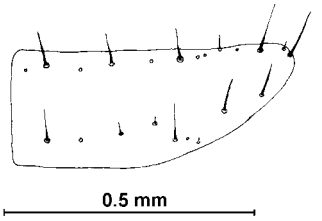

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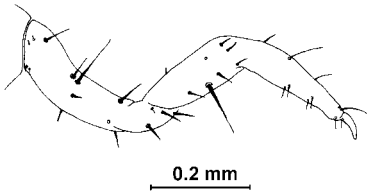

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8-11. *Coptocephala rubicunda*; first instar larva: 8 - labrum, dorsal, 9 - mandibles (a - dorsal, b - ventral), 10 - pronotum, 11 - fore leg, lateral

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