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MORPHOLOGICAL CHARACTERS OF LARVAL INSTARS OF *PHALERA* (LEPIDOPTERA, NOTODONTIDAE) WITH KEYS AND DESCRIPTIONS TO THE UKRAINIAN SPECIES

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Morphological characteristics of the genus *Phalera* (Lepidoptera, Notodontidae) at the larval stage with keys and descriptions to the Ukrainian species. Dolinskaya, I. V. — The morphological characters of each larval instar of the two Ukrainian notodontid moth species belonging to the genus *Phalera* Hübner, 1819 were examined using a scanning electron microscope : the shape, colour and pattern of the head and body; the microsculpture of the head; and the form and diversity of the setae, stemmata and mouthparts. A comparative morphological analysis of these structures is provided. The morphological characteristics and their transformations during larval development are discussed. Identification keys to the two species of the genus *Phalera* occurring in Ukraine are presented. Through this analysis, we identified the diagnostic and taxonomic characteristics of the genus *Phalera* and the studied species. We also identified features common to some taxa within the family.

Key words: prominent moths, Ukraine, morphology, caterpillars 1–5 instars, descriptions, keys, digital camera, scanning electron microscopy.

Introduction

The circum-temperate genus *Phalera* comprises 60 species, most of which are found in China (Schintlmeister, 2013); two species have been recorded in Ukraine (Dolinskaya, 2012). The morphological characteristics of the genus are based on a comparative morphological analysis of the two studied species: the Trans-Palaearctic tem-

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perate species *Phalera bucephala* (Linnaeus, 1758), and the South European–Western Asian species *P. bucephaloides* (Ochsenheimer, 1810).

The immature stages (eggs and pupae) of *Phalera* species have been studied extensively (Döring, 1955; Dolinskaya, 1986, 1987, 2016, 2019; Patočka, 1990; Nakamura, 2007), but the caterpillars remained understudied. Dolinskaya & Pljushch (2003) and Dolinskaya (2008, 2011, 2013) described some morphological characters of larvae of *Phalera*. The mouthparts of adult *Phalera assimilis* (Bremer & Grey, 1853) caterpillars from China were examined using SEM (Liu & Jiang, 2023). Colour images of *Phalera assimilis*, *P. flavescens* (Bremer & Grey, 1853), *P. takasagoensis* Matsumura, 1919, and *P. grotei* Moore, 1860, with brief descriptions of the mature larvae from the Eastern Palearctic, are presented in the atlas of Japanese Lepidoptera (Nakatomi, 1987).

Good colour images of *P. bucephala*, *P. bucephaloides* caterpillars are available on European websites devoted to the Lepidoptera (Mazzei et al., 2025; Wagner, 2025; Lepiforum, 2025) and others.

Based on the above stated, the aim of this work is to describe in comparative-morphological aspect larvae of all instars of 2 species of Ukrainian Notodontidae of the genus *Phalera* and to show the change of morphological characters of caterpillars in the process of their growth. Diagnostic and taxonomic characters are highlighted and keys for the identification of the studied species are compiled.

Material and Methods

This research is based on the material collected by the author in Ukraine and Russia (Primorskii krai, Far East). Eggs were obtained from females captured at light. Larvae were reared through to pupation. The development period of larvae of each instar, and the change in colour and pattern as they developed were recorded. Larvae of every instar were placed into the cold water which was then boiled. After that larvae were fixed in 75% alcohol. The exuviae of the cephalic capsule, as well as fresh material preserved in alcohol, were studied. The microsculpture of the head, stigmata, mouthparts of larvae of all instars, were examined with a scanning electron microscope JSM–35C. Terminology for larval morphology, chaetotaxy of the head and body follows Hinton (1946), Gerasimov (1952), Stehr (1987) and Miller (1991). Colour photos of *Phalera bucephala* and *P. bucephaloides* were provided by Paolo Mazzei, Wolfgang Wagner, Lisa Eppler and Oleksiy Prokhorov. The taxonomic arrangement of the species from genus *Phalera* follows Schintlmeister (2008, 2013).

Results

Morphological characteristics of the genus *Phalera* on the larval stage

L1. Larva length 0.18–0.35 cm, width 0.02–0.03 cm, cephalic capsule width 0.03–0.05 cm.

Head. Colouration and Pattern. Colouration of head black, shiny. Coronal suture one third longer than frons. Microsculpture of head_smooth (Fig. 2, c). Setae. Only primary setae developed on head. Setae white, long, and pinnate (Fig. 2, d).

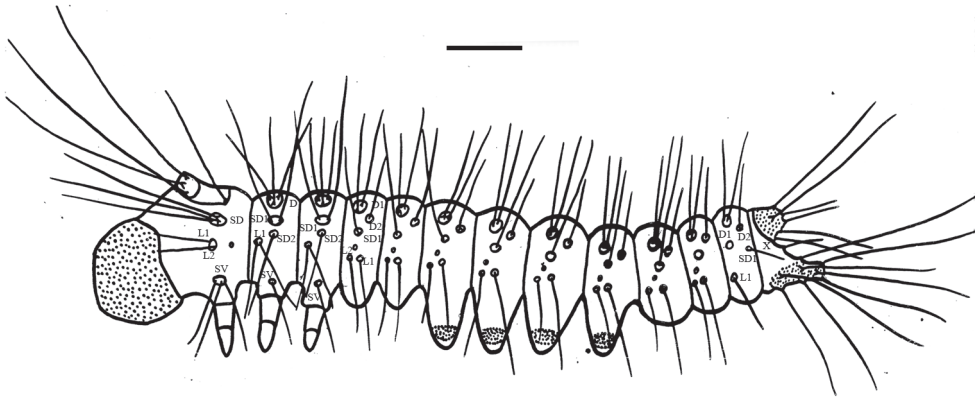


Fig. 1. *Phalera bucephala*. Larva. L1. Scale line 0.5 mm

They faintly marked and located on pinacula. Pinacula light, making them easier to navigate for identifying setae. Stemmata with typical arrangement, light. Sculpture weakly expressed (Fig. 2, c, e). Anteclypeus short and wide, 4× as wide as long, with weakly pronounced grooves (Fig. 2, a). Labrum. Outer margin with oval notch reaching 1/5–1/6 of length of lip and with small gap at base of notch. Outer margin of lip more strongly sclerotized in area of notch. Setae strong, clearly defined. Setae M1 and M2 located at same level. Distance between setae M1–M1 approximately 1.0–1.5 × greater than between M1–M2. Distance between setae M1–M2 1.0–1.3 × less than between M2–M3. Distance between setae L1–L2 1.7–1.8 × less than between L2–L3. Setae M1, M2, and M3 located above notch (Fig. 2, a). Mandible. Mandibular margin with 6 broad, serrated teeth. Mandibular carina slightly marked (Fig. 2, a, b). Labial palpus smooth (Fig. 2, f). Spinneret narrow and elongated, same length or slightly longer than first segment of labial palpus (Fig. 2, f). Hypopharynx with highly protruding posterior margin, smooth in distal part and with small setae in proximal part. Transverse fold pronounced (Fig. 2, f).

Thorax and Abdomen. General view. Body narrows in region of A9–A10. Anal prolegs transformed into small tubes. Prothoracic, anal shields, pinacula, setae, thoracic legs, lateral shields of abdominal prolegs and anal prolegs black. Setae long (Fig. 1). Colouration and Pattern. On main light grey or light brown background clearly defined lemon or yellow transverse bands and yellow or dark brown longitudinal bands. In mature caterpillars, broad dark brown dorsal area sometimes pronounced (Figs 9, a–b; 10, a). Cuticle shiny. Setae located on papillae, pinacula or warts. They located mainly in area of wide transverse yellow bands. Setae long, pinnate, moderately strong, brown and white, clearly distinguished. Longest and strongest setae on prothoracic and anal shields, as well as on anal prolegs. Few secondary setae (Fig. 1). Pinacula brown, clearly distinguished. Largest pinacula of setae D1 and D2, and SD1 and SD2 on T1. Prothoracic shield black, shiny, narrow and short. Anterior edge of shield raised and on it, on each side, one additional seta developed. XD1, XD2 and additional seta located on wart, on separate papillae. Setae long and strong, D1 and D2 less strong and short (Fig. 3, a). Anal shield black and shiny. Shield large, occupies entire surface of tergite, its posterior edge rounded, with 2 additional setae on shield (as in *Clostera* Samouelle and *Pygaera* Ochsenheimer). Setae

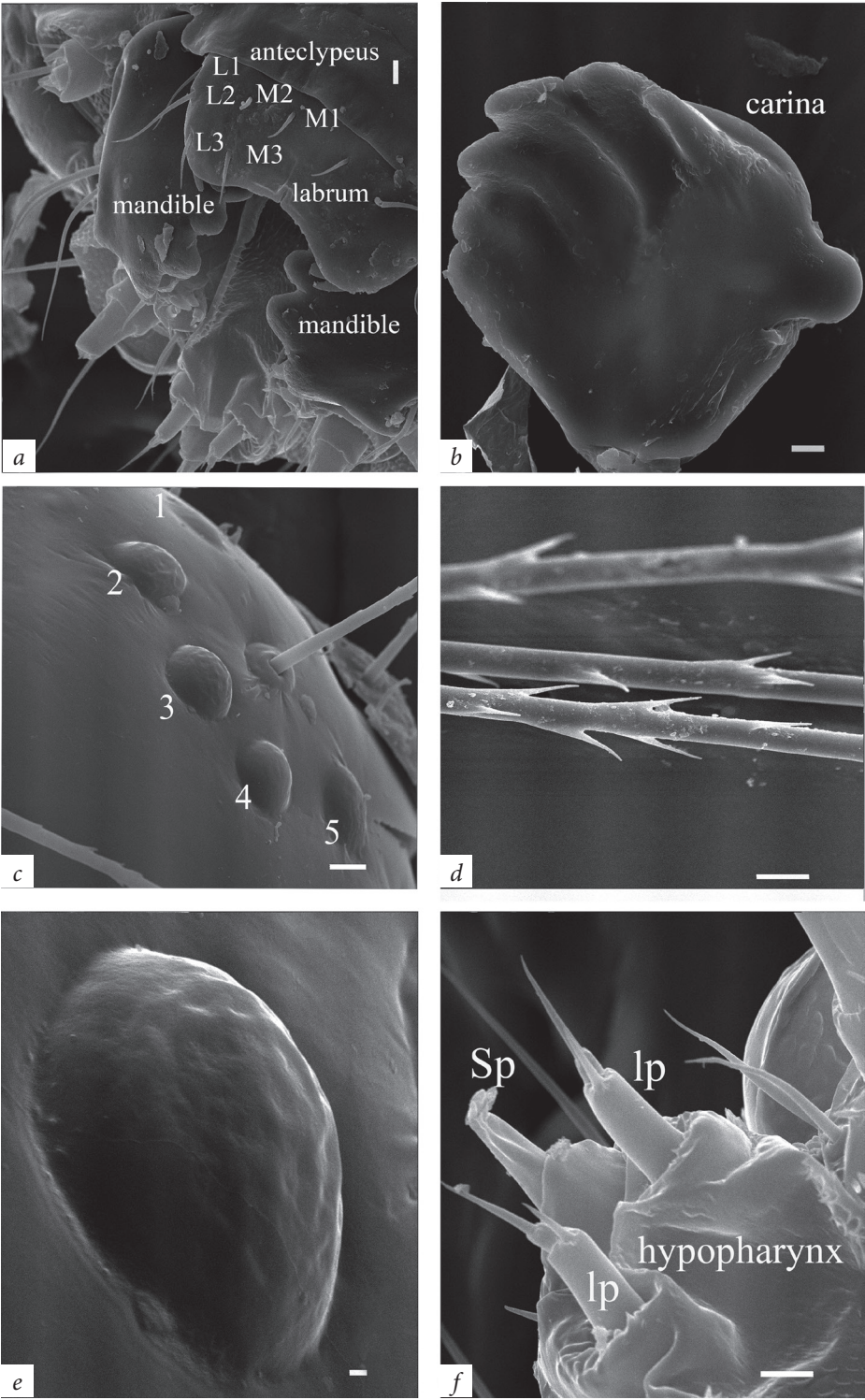


Fig. 2. *Phalera bucephala*. Larvae. L1: *a* — mouthparts, top view; *b* — right mandible, inside view; *c* — stemmatal area; *d* — setae of head; *e* — third stemma; *f* — spinneret and labium palpi, L1, outside view: sp — spinneret, lp — labium palpi. Scale line: *c* (100 μ), *a*, *b*, *d*, *f* (10 μ), *e* (1.0 μ)

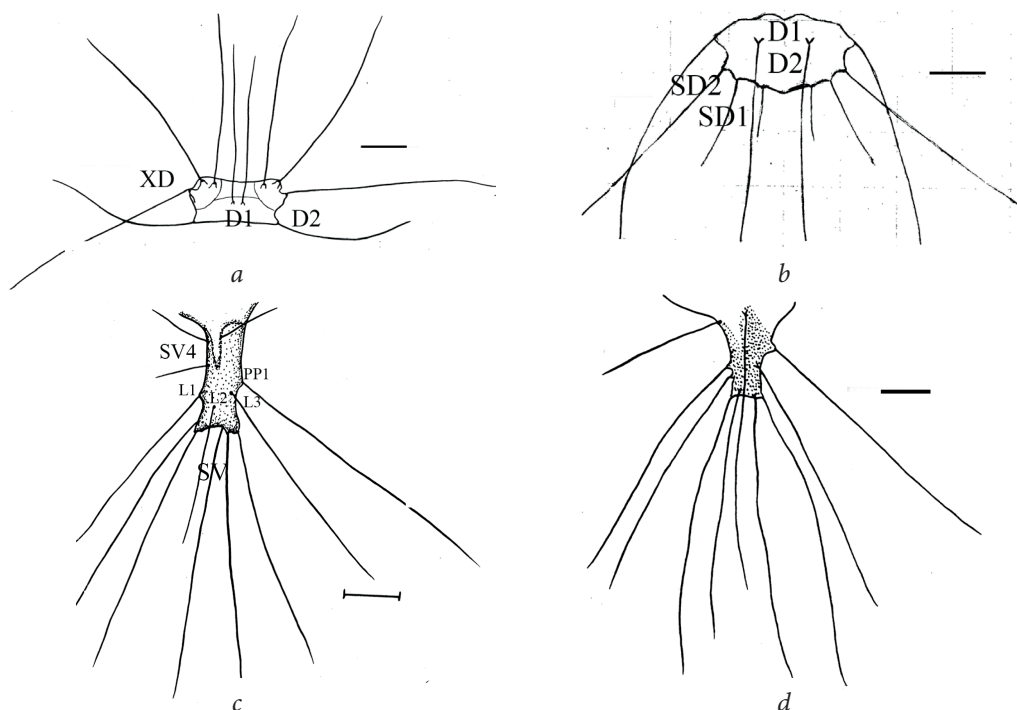


Fig. 3. *Phalera bucephala*. Larvae. L1: *a* — prothoracic shield; *b* — anal shield; *c*, *d* — anal proleg, outside view. Scale line: *a*, *b* — 0.25 mm, *c*, *d* — 0.15 mm

located on papillae; white and dark brown in apical part (Fig. 3, *b*). Chaetotaxy (Fig. 1). On T1, SD1 and SD2 setae located on common shield with additional setae. Setae L1 and L2 on common shield. In coxal part, on warts, number of setae varies from 2 to 4 (often 3), where SV1 and SV2 larger and clearly visible. On T2–T3, D1 and D2 setae located on common shield with additional seta. SD1 and SD2 setae located on different shields. In area of SD1 seta additional seta located. Only one seta developed from the subventral group SV. On A1–A9, setae D1 and D2 located on different pinacula, additional seta developed in area of seta D1. On ventral side, number and arrangement of setae varies somewhat. A1–A4, with 5 setae (3 on wart and 1–2 setae separately). On A2 — 7–8 setae (4–5 — on wart and 3 setae separately). On A7–A8 — 4 setae (2–3 — on wart and 1–2 setae separately). On A9 — 3 setae (2 — on wart and 1 seta — separately or all setae located on separate shields). Thoracic legs black. Abdominal prolegs of body colour. Lateral shields of abdominal prolegs clearly distinguished, in form of brown or black wide band. Setae light brown, located throughout shield. One whole row of setae located along lower edge of shield, with more than 14 of them. Setae with white rollers. Hooks on planta of abdominal prolegs arranged in single-tiered, normal, medial row, with very wide gap; in number 14–17. Anal prolegs black, transformed into small, narrow tubes, located parallel to body axis, with primary chaetotaxy. On outside, 9–10 long and strong black setae developed. (Fig. 3, *c*, *d*). Anal prolegs have developed elongated muscle drawn inward, end of which with several hooks. According to Porchinskij (1913), in L1 gland protrudes from the anal tubes (prolegs).

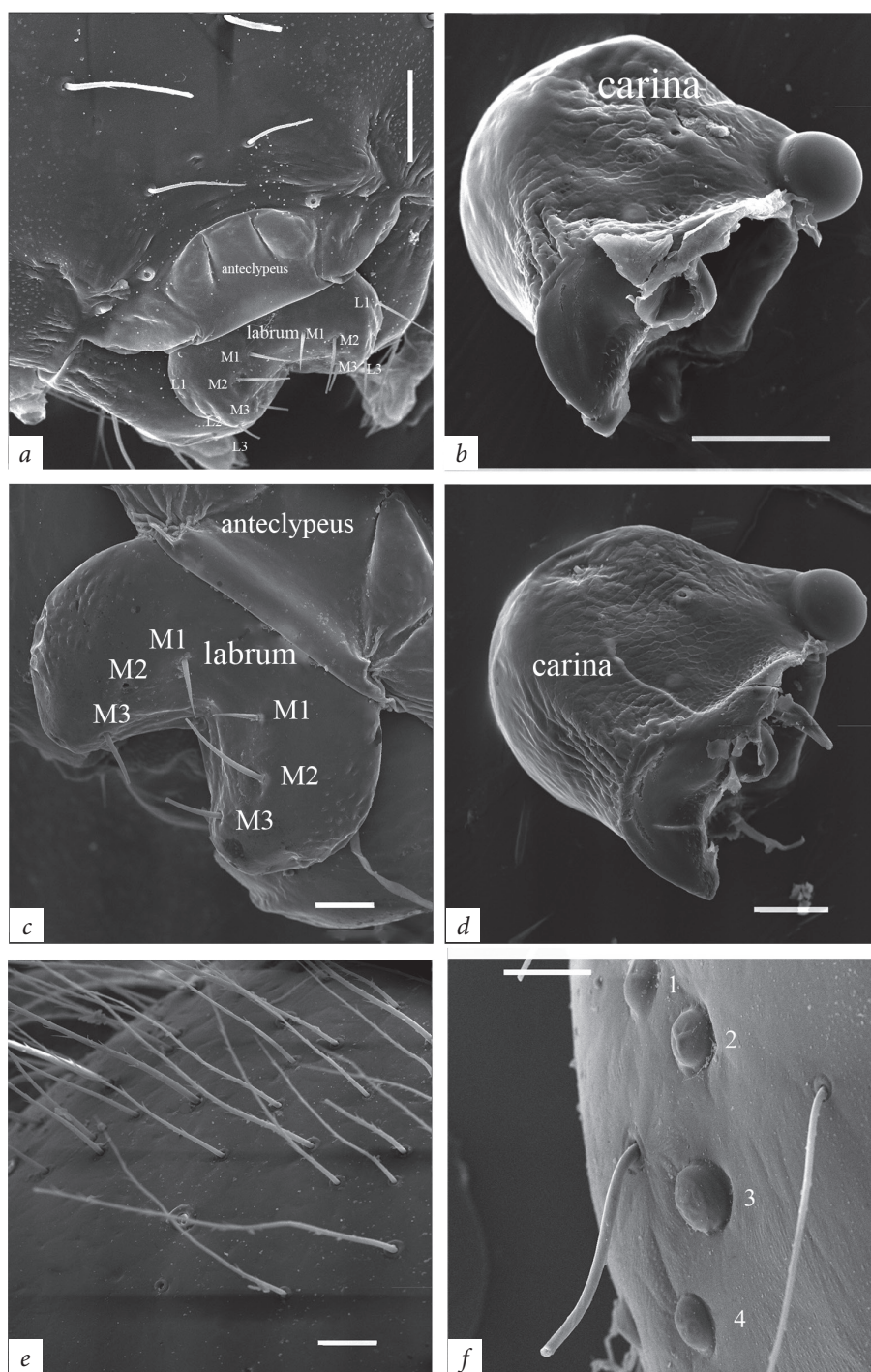


Fig. 4. *Phalera bucephala*. Larvae: *a* — lower half of head, frontal view, L2; *b* — left mandible, outside view, L2; *c* — anteclypeus and labrum, L4; *d* — left mandible, outside view, L4; *e* — microsculpture of head with secondary setae, L4; *f* — stemmatal area, L4. Scale line: *a–e* — 100 μ

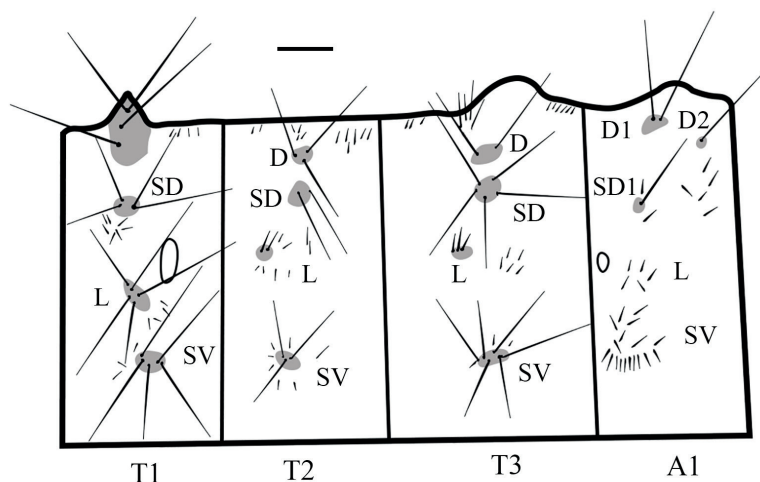


Fig. 5. *Phalera bucephala*. Chaetotaxy T1–T3, A1. L3. Scale line 0.5 mm

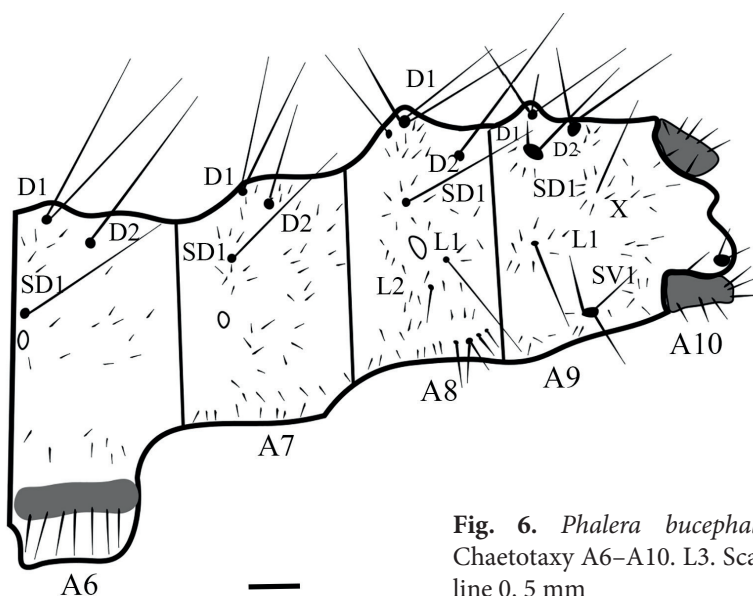


Fig. 6. *Phalera bucephala*. Chaetotaxy A6–A10. L3. Scale line 0.5 mm

L2. Larva length 0.43–0.8 cm, width 0.06–0.08 cm, cephalic capsule width 0.06–0.08 cm.

Head. Colouration and Pattern. Head black, plain or patterned with two dark submedial bands. Microsculpture of head similar to L1. Setae. Numerous, long, thin, pinnate, secondary setae developed. All setae located on pinacula. Chaetotaxy. P1 seta located closer to epicranial suture than P2. Lateral L1 seta, in most cases, located closer to P2 seta. Anterior A3 seta located at or above AF2 seta. A2 seta located above AF1 seta. A1 seta located below level of F1 seta. Anteclypeus. Central part of anteclypeus becomes sharply convex and large. Width of middle part exceeds length only by 1.4–1.6 ×. Two large lateral slits appear in middle part and swelling lateral to them (Fig. 4, a). Labrum. Outer edge of lip has acute-angled notch reaching 1/3 of lip length. Compared to L1, all setae shifted to lower edge of lip. Setae of group M located along acute-angled notch. Seta M2 located below seta M1. Distance between setae

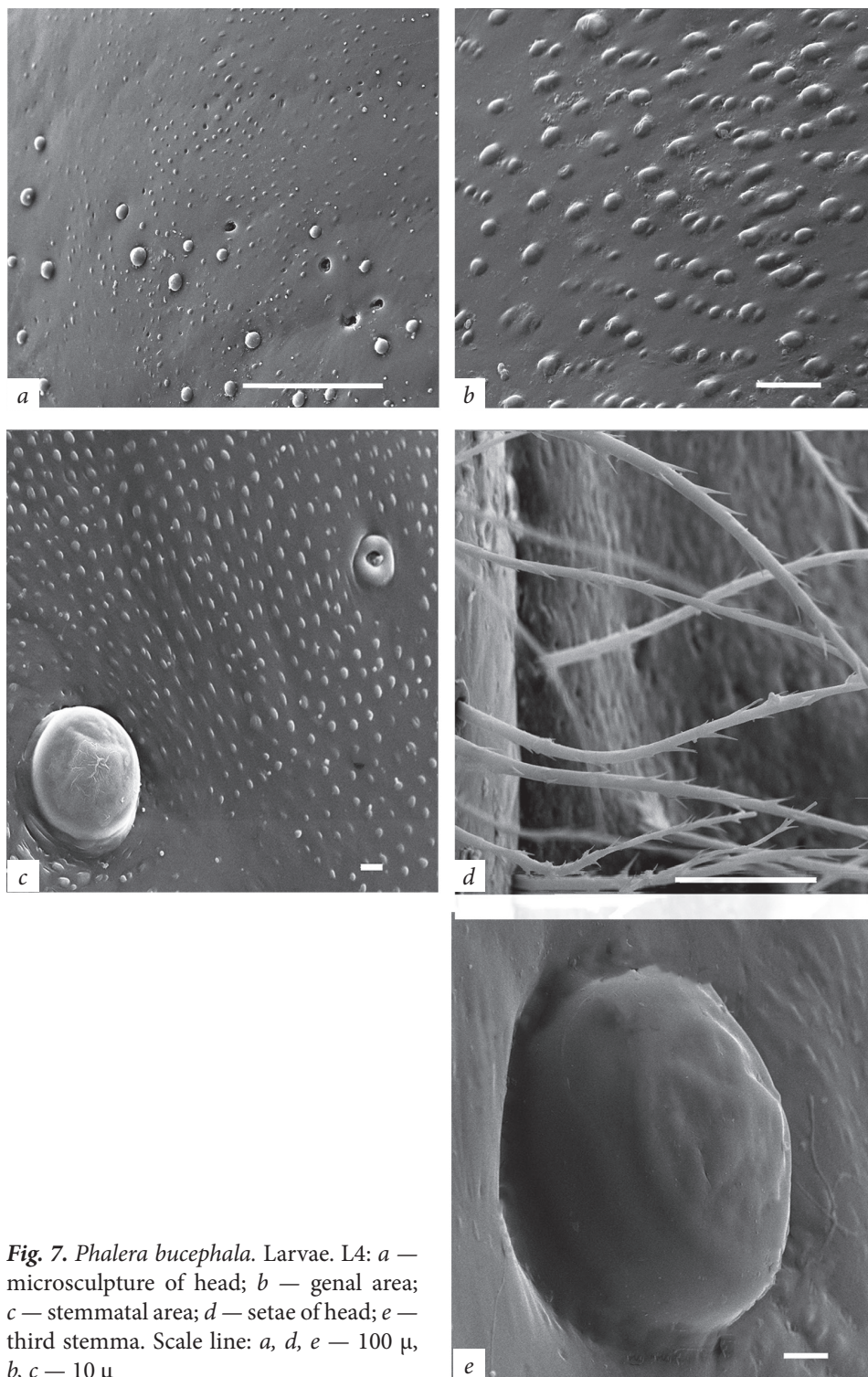


Fig. 7. *Phalera bucephala*. Larvae. L4: *a* — microsculpture of head; *b* — genal area; *c* — stemmatal area; *d* — setae of head; *e* — third stemma. Scale line: *a*, *d*, *e* — 100 μ , *b*, *c* — 10 μ

M1–M1 almost $1.5 \times$ greater than distance between M1–M2. Distance between setae M1–M2 same as that between M2–M3 or slightly shorter. Seta M1 located above notch. Setae M2 and M3 — at level of main part of notch. Distance between setae

L1–L2 and L2–L3 approximately same (Fig. 4, *a*). Mandible. Mandibular margin smooth. Retinaculum not pronounced or with hump. Carina well developed, it limits the mandible from dorsal, ventral sides and from cutting edge side (Fig. 4, *b*). Hypopharynx similar to L3–L5 (see Fig. 8, *c*).

Thorax and Abdomen. General view similar to L1. Colouration and Pattern basically same as in previous instar, only colouration becomes brighter in *P. bucephala* due to appearance of orange colouration (Fig. 9, *c*) or becomes lighter in *P. bucephaloides* due to appearance of orange transverse bands (Fig. 10, *b*). Pinacula dark, clearly defined, largest in area of D1 and SD1 setae. Warts yellow, clearly defined on brown background. Setae long, white, pinnate, hair-like, and clearly distinguished. Few secondary setae. Prothoracic shield black, shiny, same as L1. Anal shield black, shiny, same as L1, but with notch in middle of posterior margin. Like in L1, with 2 additional setae. Chaetotaxy. T1 with wart with 4 setae in area SD1–SD2. Setae L1–L2 on common shield. On T2–T3, D1–D2 setae on common shield with additional seta. Setae SD1–SD2 on common shield. Setae of group L on two shields located one below other, with several setae on each. Setae formula of subventral group on T1–T3 = 2–1–1. Setae area D1 on A1–A9 with 2 setae placed. Otherwise, with standard setae arrangement. Thoracic legs dark. Abdominal prolegs of body colour. Lateral shields of abdominal prolegs large, dark, with numerous setae located along lower edge. Hooks on planta of abdominal prolegs arranged in single-tiered, normal, medial row. Anal prolegs black, shiny, 1.5 to 2x thinner than abdominal ones, their location parallel to body axis. Number of setae same as in L1. Hooks on anal prolegs retracted into proleg; number of hooks = 4.

L3–L5. L3. Larva length 1.7–2.0 cm, width 0.15–0.17 cm, cephalic capsule width 0.21–0.22 cm. L4. Larva length 2.5–2.6 cm, width 0.34–0.35 cm, cephalic capsule width 0.33–0.35 cm. L5. Larva length 3.7–4.2 cm, width 0.4–0.6 cm, cephalic capsule width 0.42–0.57 cm.

Head. Colouration and Pattern. L3. *P. bucephala*. Head black. At L4–L5 head black with yellow “fork” along frontal sutures (Fig. 9, *d*). In L3–L5 *P. bucephaloides* most of head surface presented in form of brownish-black spots on yellow or orange-brown background (Fig. 10, *c–e*). Numerous, long, light, secondary setae developed on head. Microsculpture of head smooth or in form of weakly expressed granules (Fig. 7, *a*). In L4–L5, in stemmatal and especially genal areas, sculpture uniformly granulated (Fig. 7, *b, c*). It should be noted that in *Phalera* larvae numerous setae on the head are located in small depressions. Setae break off easily, as a result only small pits remain on head capsule (Fig. 4, *e*). This circumstance allowed some researchers (Gardner, 1943, and after him Miller, 1991) to come to the erroneous opinion that some *Phalera* larvae have a “punctured” head. Setae of head identical to that of preceding instar (Fig. 7, *d*). Stemmata. Location as in L1, sculpture weakly expressed (Fig. 7, *c, e*). Anteclypeus in general as in preceding instar, but swellings of anteclypeus becoming much pronounced. Lateral slits not parallel to each other, but at angle, resulting in lateral swellings of triangular shape. Width of middle part exceeds length by $1.4\text{--}1.6 \times$ (Fig. 4, *c*). Labrum. Outer lip cut reaches $1/2\text{--}1/3$ of lip length. Rest as in previous instar (Fig. 4, *c*). Mandible same as in preceding instar (Fig. 4, *d*). Labium palpi. In L3–L5, on inner side, large longitudinal

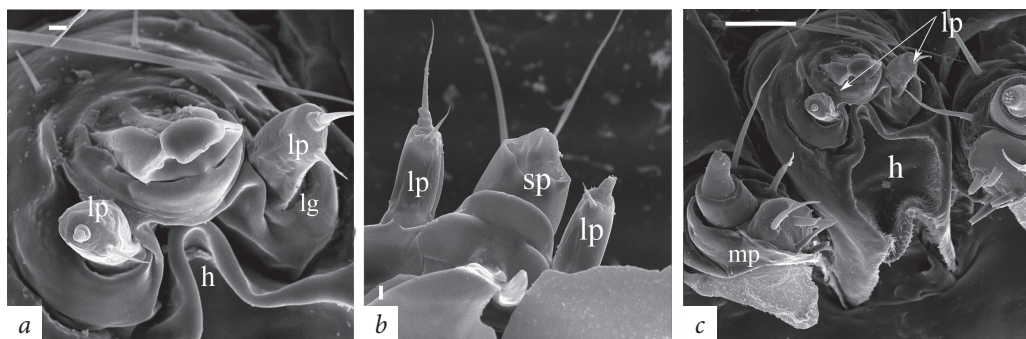


Fig. 8. *Phalera bucephala*. Larvae. L4: *a* — upper part of labium, top view, *lg* — longitudinal ridges; *b* — spinneret and labium palpi, outside view; *c* — labium and maxillary palpi, top view, *mp* — maxillary palpus, *lp* — labium palpi. Scale line: *c* — 100 μ , *a*, *b* — 10 μ

ridges developed (Fig. 8, *a*). Spinneret in L3–L5 short and wide, 1/3 shorter on outside than 1st segment of labial palpus (Fig. 8, *b*). Hypopharynx sharply defined, clearly distinguished by shape of posterior edge of distal region narrowed in middle part and protruding high upwards. Anterior edge of proximal region with very deep medial notch (Fig. 8, *a*, *c*).

Thorax and Abdomen. General view. Caterpillars without humps; with numerous, secondary setae located both on warts and everywhere throughout their bodies. Colouration and pattern generally as in preceding instars, with lemon or orange transverse and longitudinal bands located on black background. Transverse bands sometimes brightly expressed, orange-brown, with black shiny shields or light warts on them. Longitudinal lemon bands, much narrower than transverse. Basal and ventral bands broad, colourings as in longitudinal and transverse bands or slightly darker (Figs 9, *e–g*; 10, *d*, *f*; 11, *a*). Setae. Larvae densely covered with short and long, hair-like, pinnate and white setae. Pubescence more pronounced compared to previous instars. Pinacula small, brown, clearly visible on light background. Warts yellow, clearly visible on brown main background. Prothoracic shield broad, black, clearly sclerotized; inverted trapezoidal in shape, with anterior margin raised and longer than posterior, divided along longitudinal axis by pale notch. Shield with numerous, long, secondary setae. Anal shield sharply distinguished, black, shiny, oval-rounded with small notch along anterior margin (Fig. 11, *c*). Shield with numerous, long, secondary setae. Chaetotaxy (Figs 5, 6). Body of caterpillar covered with warts and numerous secondary setae. Primary setae longer, placed on distinct pinacula. Setae clearly visible only on transverse, lemon bands due to distinct dark shields. Warts large and sharply distinguished on thoracic segments. On T1–T3, setae SD1, SD2, L and SV located on large warts with additional setae. On abdominal segments, warts not pronounced; and numerous, small, weakly expressed secondary setae developed. On A1–A9, in area of D1 seta, wart with two or three setae developed, and D2 located on small pinaculum. Seta SD1 located on small pinaculum, and SD2 among numerous small setae. Setae of groups L and SV located among numerous small setae. Thoracic legs with dark shields. Abdominal prolegs normally developed. Lateral shields of abdominal prolegs broad, sickle-shaped, or transverse, black. Setae white, long, located over entire surface of shields, with about 20 of them. Hooks on planta of abdominal prolegs arranged in single-tiered, normal, medial row, in number 35–

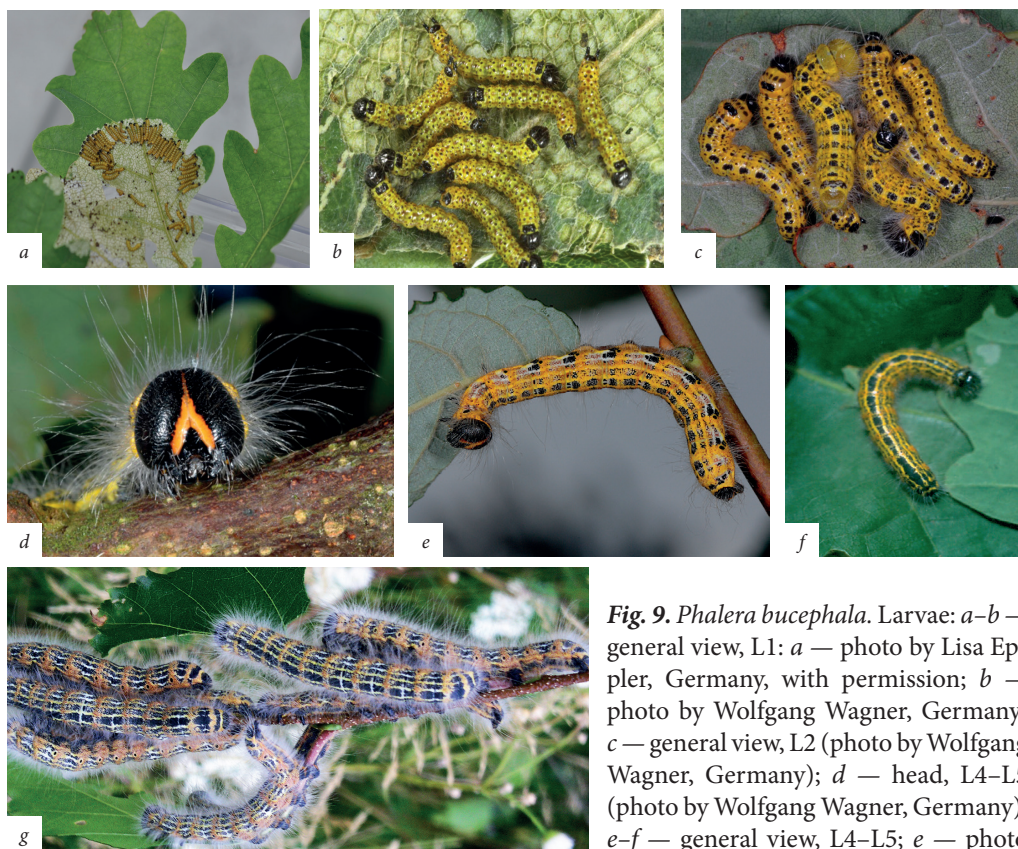


Fig. 9. *Phalera bucephala*. Larvae: *a-b* — general view, L1: *a* — photo by Lisa Epler, Germany, with permission; *b* — photo by Wolfgang Wagner, Germany; *c* — general view, L2 (photo by Wolfgang Wagner, Germany); *d* — head, L4-L5 (photo by Wolfgang Wagner, Germany); *e-f* — general view, L4-L5; *e* — photo

by Paolo Mazzei, Italy; *g* — group of caterpillars, L4-L5 (photo by Oleksiy Prokhorov, Ukraine), with permission; *b-d* — http://www.pyrgus.de/Phalera_bucephala_en.html, with permission. Accessed 04/26/2025; *e* — <https://www.leps.it/indexjs.htm?thlContNotod.htm>, with permission. Accessed 04/26/2025

40. Anal prolegs 1.5 to 2 × thinner than abdominal prolegs, their position is intermediate between parallel and perpendicular to body axis.

Ecology. Caterpillars of genus *Phalera* live in groups (Figs 9, *a-c*, *g*; 10, *a-b*). Larvae pupate in soil, in silk cocoon. Pupa overwinters.

Foodplants. Polyphagous caterpillars feed on many deciduous trees.

Distribution. Circum-temperate genus currently has about 60 described species. Largest number of species concentrated in Oriental region — about 33 species, in Palaearctic Region about 23 species, and 7 species recorded in Afrotropical Region. In Palaearctic, most species found in China (Schintlmeister, 2013). In Ukraine, 2 species recorded (Dolinskaya, 2012).

Keys to species

1. In L1, colouration light brown with yellow longitudinal and transverse bands (Fig. 9, *b*). In L2, head black (Fig. 9, *c*). In L3 head black. In L4-L5, head black with yellow 'fork' (Fig. 9, *d*). In L2-L5, anal shield monochromatic, without orange or lemon spots in area of D1 setae. In L4-L5, transverse bands on body of larvae orange-brown. Longitudinal bands lemon-yellow. Spots on body of caterpillar absent (Fig. 9, *e*, *g*) *P. bucephala*

- In L1, colouration light grey with lemon transverse bands (Fig. 10, *a*). In L2, head brownish-yellow with two broad submedial bands in form of small, dark spots (Fig. 10, *b*). In L3–L5, most of head surface presented as brownish-black spots on yellow or orange-brown background (Figs 10, *c–f*). In L2–L5 anal shield with distinct orange or lemon spots in area of D1 setae (Fig. 11, *c*). In L4–L5, transverse and longitudinal bands on body of larvae lemon-yellow. Entire body of larvae covered with numerous, pronounced, white, yellow or orange spots. Spots especially pronounced on dark background (Fig. 11, *b–c*) *P.bucephaloides*

Description of species

Phalera bucephala (Linnaeus, 1758)

L1. Head black, shiny. Body colour not monochromatic, with pronounced yellow longitudinal and transverse bands on light brown background (Fig. 9, *a, b*).

L2. Head black, shiny. Body colour becomes darker, orange. In dorsal area, sharply expressed, dark brown or black, in form of intermittent broad band. Yellow transverse bands become thinner. Ventral side light brown, ventral band thin, light yellow. Anal shield black, monochromatic (Fig. 9, *c*).

L3–L5. Head in L3 black, monochromatic. In L4–L5, pattern in form of yellow “fork” developed on head (Fig. 9, *d*). Main colour black. Transverse bands clearly defined, orange-brown. Longitudinal bands lemon (Fig. 9, *e–g*). Ventral side in tone of transverse bands with yellow rollers of setae. Anal shield black, monochromatic. Abdominal prolegs in tone of transverse bands. Stigmas in L3 brown in middle with black peritremes and brown border. In L4 black in middle with orange-yellow peritremes and orange border.

Ecology. In Ukraine, adult flight period occurs from April to early September. Species apparently has one extended generation. Winter diapause of pupae has been recorded from August to May–July. Pupa can overwinter twice (Zhiharyev, 1928). In literature, it is noted as a species capable of giving outbreaks of mass reproduction (Lozinskij, 1954).

Foodplants. *Quercus* L., *Fagus* L., *Ulmus* L., *Betula* L., *Alnus* L., *Corylus* L., *Carpinus* L., *Populus* L., *Salix* L., *Tilia* L., *Sorbus* L., *Malus* Mill., *Acer* L. (prefers *Quercus*).

Observations in nature and laboratory. After hatching, L1 caterpillars line up in dense, even row on upper side of leaves and skeletonize them. They continue to feed in groups until third instar. In nature, group of L4–L5 caterpillars was observed feeding on leaves (Fig. 9, *a–c, g*). Captured female laid 286 eggs in three clutches in 2 days in laboratory. Eggs laid in compact, single-layer groups of 2–50 eggs. Period of embryonic development of larvae lasted 10–12 days, and development of caterpillars (from the moment of hatching from egg to pupation) — 33–35 days. As can be seen, this period of development is very long — 43–47 days. The pre-pupae stage is 4 days.

Distribution. Trans-Palaearctic temperate species. From Europe to Korean Peninsula and north-eastern China (Schintlmeister, 2008). In Ukraine, it is a common species, found in all landscape zones (Dolinskaya, 2012).

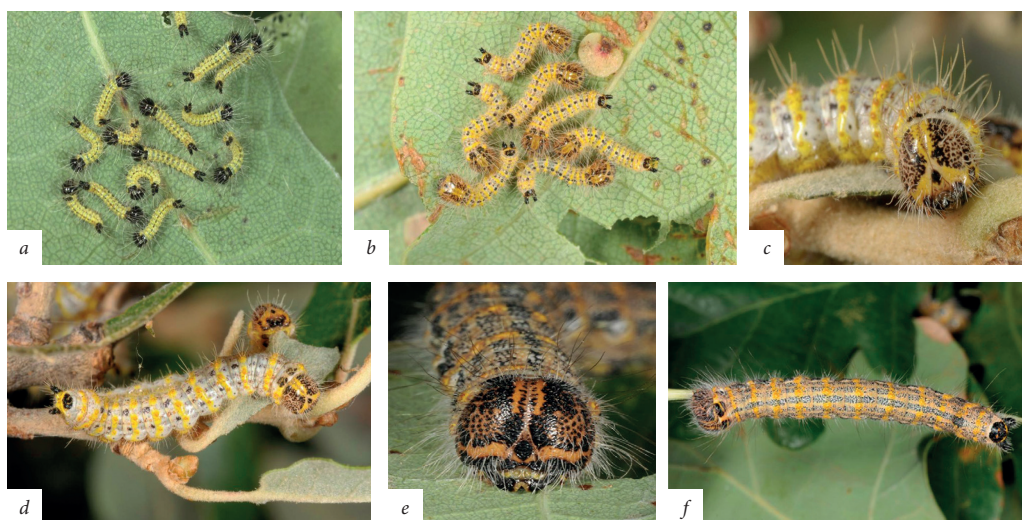


Fig. 10. *Phalera bucephaloides*. Larvae: *a-b, d, f* — general view (photo by Wolfgang Wagner, Germany); *a* — L1; *b* — L2; *d* — L3; *f* — L4–L5; *c* — head and anterior of the caterpillar's body, L3 (photo by Wolfgang Wagner, Germany); *e* — head and anterior of the caterpillar's body, L5 (photo by Paolo Mazzei, Italy); *a-d, f* — http://www.pyrgus.de/Phalera_bucephaloides_en.html, with permission. Accessed 04/26/2025; *e* — <https://www.leps.it/indexjs.htm?thlContNotod.htm>, with permission. Accessed 04/26/2025

Phalera bucephaloides (Ochsenheimer, 1810)

L1. Head black, shiny. Body colour not monochromatic; with clearly pronounced lemon transverse bands on light grey background (Fig. 10, *a*).

In **L2**, pattern appears on head, where two wide, brown submedial bands, in form of small spots, developed on brown-yellow background (Fig. 10, *b*). Colouration and pattern of body basically same as in previous instar, only basic colouration becomes lighter, as white longitudinal bands appear (Fig. 10, *b*). Prothoracic shield divided into two parts; its colouration represented by two black spots (Fig. 10, *b*). Anal shield black, shiny with faint orange or lemon spots in area of D1 setae (Fig. 10, *b*).

In **L3**, most of head surface presented in form of brownish-black spots. In area of epicranial and frontal sutures, with wide yellow colouration in form of triangle. Upper part of frons with large brownish-black spot (Fig. 10, *c, d*). Colour light, grey-white, with pronounced yellow, transverse bands and longitudinal bands that wide, brown, in grey-white spots. Dorsal band already distinguished, in form of separate black-grey-white spots. Basal band very wide, light brown with yellow spots, covers abdominal prolegs (Fig. 10, *d*). Prothoracic and anal shields as in previous instar (Fig. 10, *d*).

In **L4–L5** head becomes darker. Black spots cover most of head surface. In lateral area, spots less densely distributed. Brown-orange colour remains only in region of upper part of epicranial suture and wide band extending from genal to postgenal region (Fig. 10, *e*). Body colour becomes darker, where lemon transverse and black longitudinal bands located on dark grey or light brown background. Stigmatic band clearly distinguished with white border around stigmas. Entire body of caterpillar in numerous, brightly expressed small, white, yellow or orange spots (Figs 10, *f*, 11, *a-c*). Anal shield similar to previous instars, but it

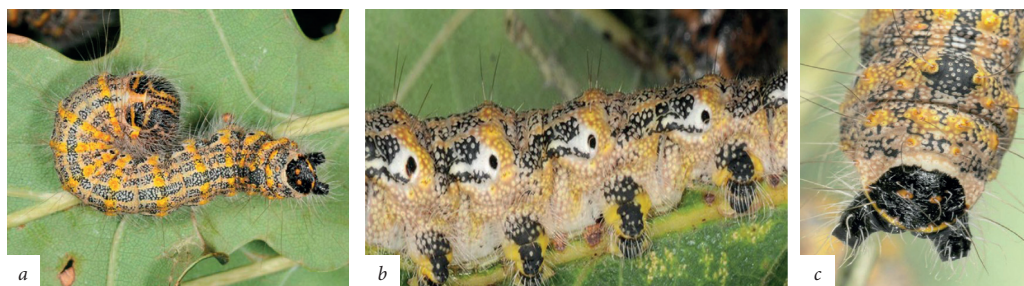


Fig. 11. *Phalera bucephaloides*. Larvae. L4–L5: a–c (photo by Wolfgang Wagner, Germany); a — general view; b — A3–A6; c — A8–A10. a–c — http://www.pyrgus.de/Phalera_bucephaloides_en.html, with permission. Accessed 04/26/2025

with distinct orange or lemon spots in area of D1 setae (Fig. 11, c). Lateral shields of abdominal prolegs sharply distinguished, dark, broad, elongated, with numerous, long, white setae (Fig. 11, b). Stigmata with white peritremes and white decoration, black inside (Fig. 11, b).

Ecology. I. I. Streltsov (1955) indicates that in Ukraine species develops in two generations. First generation appears in early July, whereas second from middle of first decade of August. According to Wolfgang Wagner (Wagner, 2025) this species occurs in Europe in single generation between May and August, probably with peak in late June and July. Larvae develop especially in late summer. Pupa hibernates.

Foodplants. *Quercus*.

Distribution. Southern Europe; Asia Minor to Israel, Jordan, northwestern Iraq (Schintlmeister, 2008). In Ukraine, this species is very rare and recorded only in the zone of broad-leaved forests and Transcarpathia (Dolinskaya, 2012).

Transformation of the main structures and features of larvae by the instars During the growth of larvae and their transition from one instar to another, many characters do not remain constant, but transformed. In the species under consideration, the transformation occurs as follows.

The head colouration and pattern. L1. The head is black, uniform. L2. The pattern appears on the head, where two submedial bands are developed. L3–L5. The submedial bands expand significantly and occupy most of the surface of the head. *P. bucephaloides*. L1–L3. The head is black, uniform. L4–L5. The yellow forked pattern has developed on the head. *P. bucephala*.

The form of the anteclypeus. L1. The anteclypeus is short and wide, with weakly transverse grooves. In L2–L5, the central part of the anteclypeus becomes sharply convex and large. Two large lateral slits appear in the middle part and a swelling lateral to them. As the result, it is divided into three parts.

The labrum. In L1, the outer margin with oval notch reaching 1/5–1/6 of length of the lip and with small gap at the base of the notch. The outer margin of the lip is more strongly and sclerotized in the area of the notch. The setae M1 and M2 are located at the same level and are significantly higher than the lip notch. In L2–L5, the outer edge of the labrum with acute-angled notch, reaching 1/2–1/3 of length of the lip. The seta M2 is located below seta M1 and they are shifted downwards and located along the notch.

The mandibles. In L1, the mandibular edge with 6 broad, serrated teeth. The mandibular carina is slightly marked. In L2–L5, the mandibular edge is smooth. The carina is well developed, it limits mandible from dorsal, ventral sides and from the cutting edge side.

The form of the hypopharynx. L1. The hypopharynx is with highly protruding posterior margin. L2–L5. The protruding posterior edge of the hypopharynx is sharply defined and strongly narrowed.

The anal shield. L1–L2. The shield is with 2 additional setae. L3–L5. The shield is with numerous, long, secondary setae.

Discussion

The genus *Phalera* is characterised by a number of unique characters: The smooth head microsculpture at L1–L5. The pinnate setae on the head and the body in L1–L5. The hypopharynx in L1–L5 is clearly distinguished by the shape of the posterior margin of the distal region, which is narrowed in the middle part and protrudes high upward. Also, *P. bucephaloides* is much lighter than *P. bucephala*.

The genus *Phalera* is also characterised by a number of characters shared with the certain taxa of Notodontidae. The mandibular carina is also clearly developed in the genera *Cnethodonta* Staudinger, *Nerice* Walker, *Dicranura* Reichenbach (Notodontinae) and *Micromelalopha* Nagano, *Clostera*, *Pygaera* (Pygaerinae). Numerous secondary setae on the head and body of caterpillars L1–L5 or L2–L5 also developed in the genera *Stauropus* Germar, *Harpyia* Ochsenheimer, *Dicranura* (Notodontinae), *Pygaera*, *Clostera* (Pygaerinae). The genus *Phalera* shares with the genera *Pygaera*, *Clostera* (Pygaerinae), and *Thaumatopoea* Hübner (Thaumatopoeinae) such a character as the presence of warts on the body of L3–L5. With 2 additional setae on anal shield in L1–L2 as in the genera *Clostera* and *Pygaera* (Pygaerinae). In the genus *Phalera* the anal prolegs transformed into small tubes. Modified anal prolegs are also typical for some genera of the subfamilies Notodontinae (*Stauropus*, *Cnethodonta*, *Cerura* Schrank, *Furcula* Lamarck), Phalerinae (*Uropyia* Staudinger) and Heterocampinae (*Hemifentonia* Kiriakoff, *Fentonia* Butler). The hooks on the planta of the abdominal prolegs are in the form of a medial row in L1–L5, which is also typical for the genera *Stauropus*, *Cnethodonta*, *Cerura* and *Harpyia* (Notodontinae). The caterpillars of the genus *Phalera* and the eastern-palaearctic species *Ptilodon hoegei* Graeser are located in group on underside of leaves.

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