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Description of the immature stages of *Dircaea quadriguttata* (PAYKULL, 1798) with notes on adult copulative organs (*Coleoptera: Melandryidae*)

Abstract: The previously unknown larva and pupa of *Dircaea quadriguttata* (PAYKULL) (*Coleoptera: Melandryidae: Serropalpini*) are described and illustrated in detail; the adult is redescribed, including illustrations of the male and female copulative organs and associated sclerites. This species is a primeval forest relict from Białowieża National Park, Poland. The larva and pupa develop subcortically in the sapwood of large, fallen birch (*Betula* sp.) logs.

Key words: *Coleoptera*, *Melandryidae*, *Dircaea*, larva, pupa, copulative organs, relict, Białowieża Primeval Forest

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INTRODUCTION

The genus *Dircaea* FABRICIUS, 1798 is included in the tribe *Serropalpini*, family *Melandryidae* (POLLOCK, 2002), and comprises nine species. The geographical distribution of the genus includes the Nearctic (two species), Palearctic (four species), Japan (two species), Australia (two species), and the Oriental (one species). It is possible that at least the Australian species will be transferred from *Dircaea* to a related genus within *Serropalpini* (POLLOCK, unpubl). In Europe there are two *Dircaea* species: *D. australis* FAIRMAIRE, 1856, in southwestern Europe: France, Germany, Switzerland, Austria, Hungary, Italy, Croatia, and *D. quadriguttata* (PAYKULL, 1798), in northeastern Europe. Specimens of *D. quadriguttata* are known from Småland Province in southern Sweden, Estonia, and Karelia (LUNDBERG 1995), Lithuania (Wilno, 1 specimen ex coll. P. Franck), two localities in northern Poland, southern Finland (HANSEN et al. 1960), and Siberia. Throughout its range, this species is apparently very

rare (NIKITSKY 1992). LENTZ (1879) recorded *D. quadriguttata* from Ostróda (Osterode) prov. Pojezierze Mazurskie in Poland; however, no additional specimens have been collected from that locality. TENENBAUM (1913) reported it from Podlesie, near Zamość, but we know of no voucher specimen that confirms this locality record. BURAKOWSKI et al. (1987) recorded *D. quadriguttata* from Białowieża Primeval Forest, but without detailed locality. *Dircaea quadriguttata* was described originally in the genus *Hypulus* by PAYKULL (1798). Since its original description, *D. quadriguttata* was redescribed in detail by SEIDLITZ (1898), and was illustrated and briefly described by KASZAB (1969).

MATERIAL EXAMINED

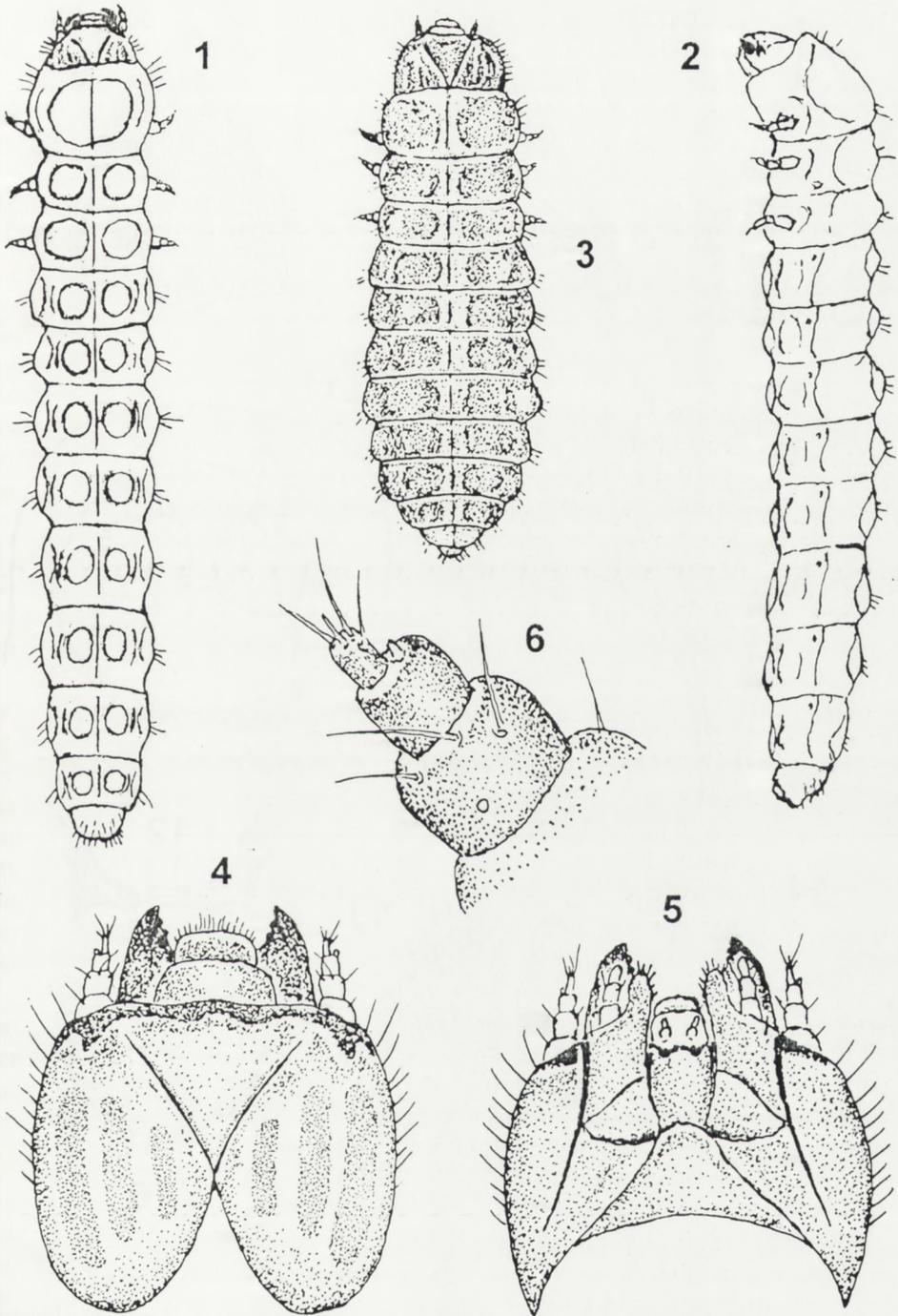
All material examined in this study is from a single locality: Poland, Białowieża National Park: compartment No. 192; 11.VI.1965, moist and sunny site, big fallen trunk of birch, beneath thick mature bark, in sapwood, 2 mature larvae and 5 pupae; larvae and one pupa preserved in ethanol, and on slides, four pupae taken for culture in the laboratory, four adults emerged on 22.VI.1965. All material was collected and reared by the first author, and is kept in the collection of the Museum and Institute of Zoology PAS, Warszawa.

RESULTS

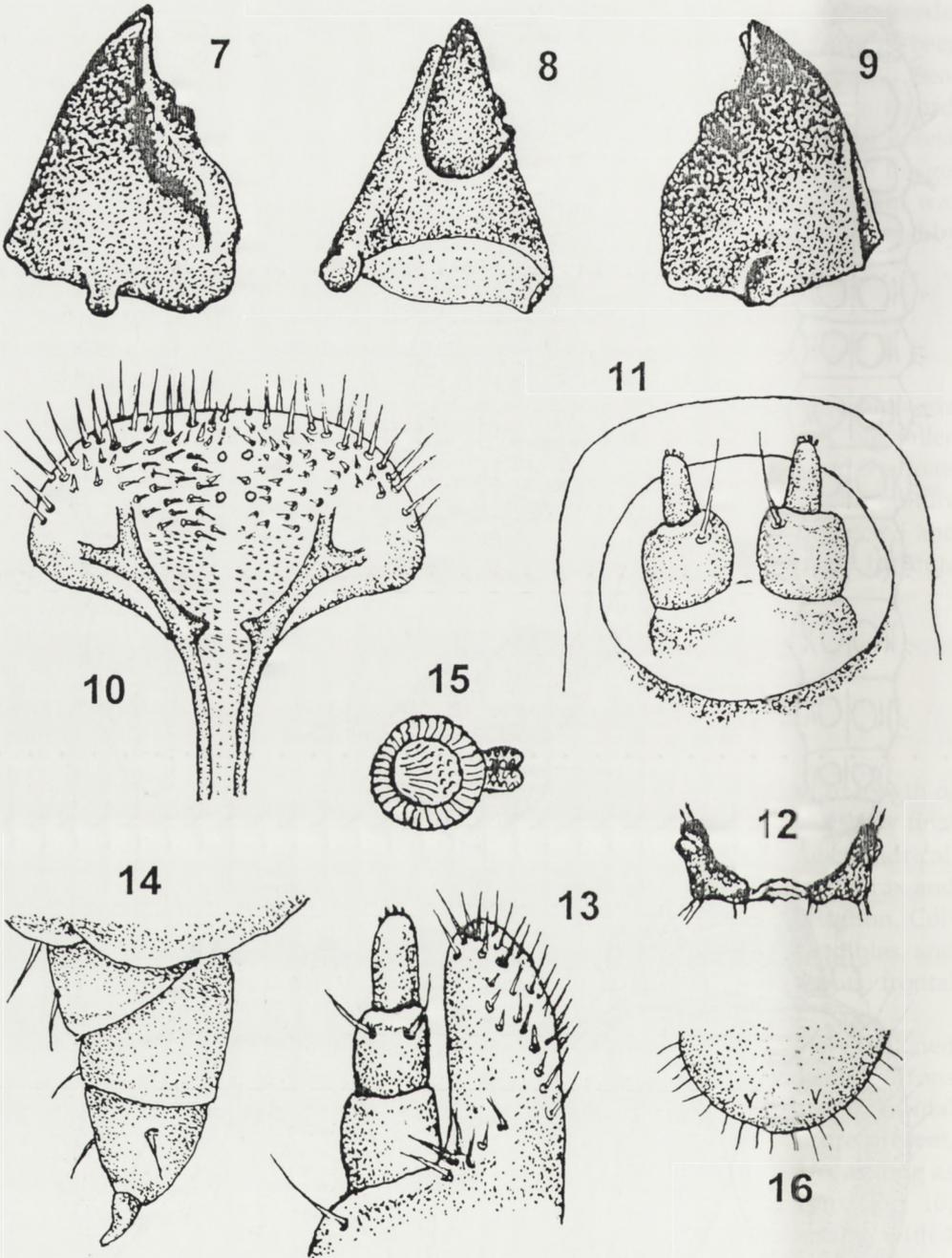
Descriptions of life history stages of *D. quadriguttata*

Mature larva (Figs 1–16). Fully-grown larva (Fig. 1 & 2) with maximum length of up to 11 mm; prepupa (Fig. 3) slightly shorter, about 2–3 mm shorter than early final instar larva; head width 1.5 mm, prothorax width 1.8 mm. Body subcylindrical, weakly constricted between segments, shiny, feebly sclerotized, surface of thorax and abdomen covered sparsely with microspicules visible under 80x magnification. Colour of body whitish, head yellowish with darkened regions, apices of mandibles, and hypopharyngeal sclerome black brown, parietal plates with six yellow spots; frontal suture, hypostoma and dorsal hind margin of head capsule reddish.

Head (Figs 4 & 5) globular, partially retracted into prothorax, moderately flattened dorsoventrally, with hind margin bilobed and somewhat thickened; frons subtriangular, emarginate along anterior margin, its basal angle about 60°, frontal arms V-shaped, incomplete, epicranial stem very short. Frontoclypeal suture present, clypeus and labrum transverse; labrum (Figs 4 & 10) free, semicircular, 0.6x as long as wide, with many prominent acute setae near anterior margin. Epipharynx (Fig. 10) membranous, with a pair of longitudinal rods approaching each other basally, with 4 sensillae in center of disk, anterolateral region with two clusters of microtrichia, densely and longitudinally distributed.



Figs 1-6. *Dircaea quadriguttata*, larva. 1-2. Mature, final instar: 1 - dorsal, 2 - lateral; 3 - Prepupal larval instar, dorsal. 4-5. Head: 4 - dorsal, 5 - ventral, 6 - antenna.



Figs 7-16. *Dircaea quadriguttata*, larva. 7-9. Right mandible: 7 - ventral, 8 - mesal, 9 - dorsal; 10 - Epipharynx; 11 - Prementum; 12 - Hypopharynx; 13 - Maxilla; 14 - Leg; 15 - Abdominal spinicle; 16 - 9th abdominal segment.

Antenna (Fig. 6) 3-segmented, short, fairly prominent, situated on large circular membrane; relative length of antennomeres as 1.4:1.0:0.7; sensory appendage on antennomere 2 very short, about 0.3 as long as antennomere 3; antennomere 1 transverse, with one pore and three setae, antennomere 3 dome-shaped, with 3 long setae and one styliform sensillum.

Mandibles (Figs 7–9) symmetrical, broadly triangular, thickened basally, with two obtuse apical teeth and smooth incisor edge, two small subapical obtuse teeth located on mesal surface of upper incisor lobe.

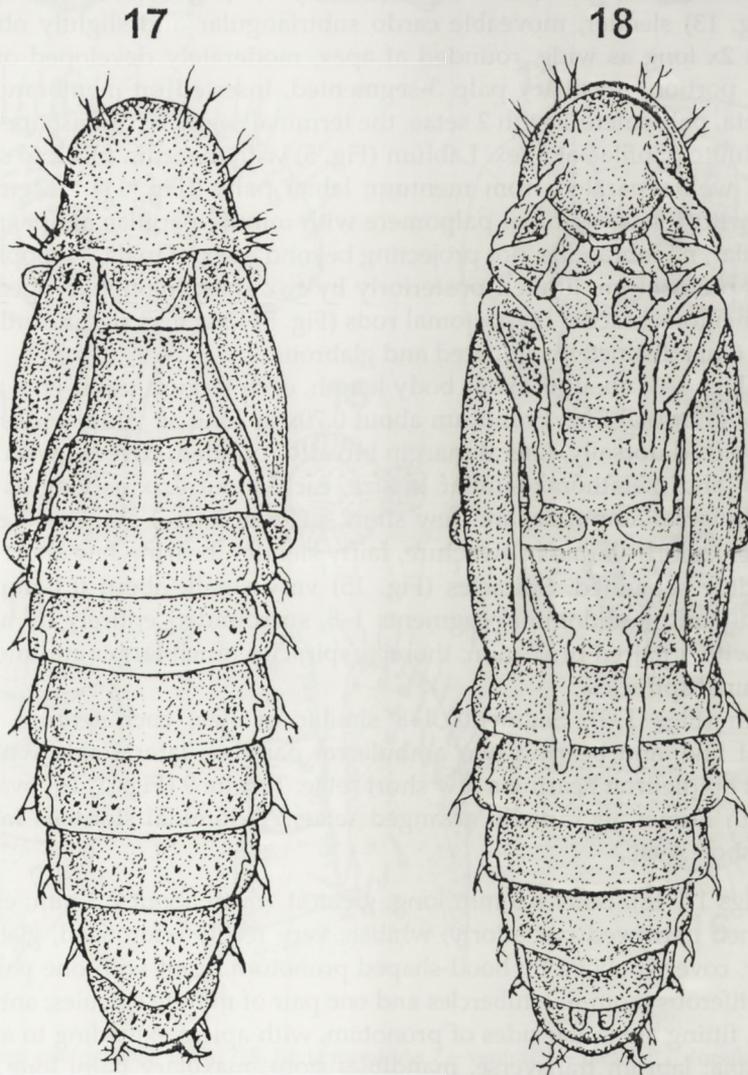
Occipital foramen-large, rim somewhat thickened. Center surface of epicranial halves almost smooth, glabrous. Ventral mouthparts (Fig. 5) about as long as wide. Maxilla (Fig. 13) slender, moveable cardo subtriangular and slightly obliquely oriented, mala 2x long as wide, rounded at apex, moderately developed outwardly at inner distal portion; maxillary palp 3-segmented, inserted on membranous palpifer bearing 1 seta, palpomere 1 with 2 setae, the terminal segment cone-shaped, bearing a group of minute papillae at apex. Labium (Fig. 5) with mentum fused to submentum, prementum well separated from mentum; labial palps (Fig. 11) 2-segmented, first palpomere with 1 seta, terminal palpomere with minute papillae at apex; ligula (Fig. 5) semicircular, membranous, not projecting beyond apex of mala. Hypopharynx (Fig. 12) beneath prementum, limited posteriorly by two dark hypopharyngeal scleromes with a ligamentous bracon. Hypostomal rods (Fig. 5) long and significantly diverging posteriorly. Gula distinct, invaginated and glabrous.

Thorax (Figs 1–3) about 0.25x as body length, each tergum transverse and divided by a pale longitudinal line. Pronotum about 0.70x as long as wide, widest at middle, lightly sclerotized dorsally, lateral margin broadly rounded, covered with many short setae. Meso- and metathorax similar in size, each about 0.5x as long as wide, with distinct ambulacral ampullae, and few short setae on lateral margins. Legs (Fig. 14) comparatively short, simple in structure, fairly slender, bearing few short setae, coxal cavities widely separated. Spiracles (Fig. 15) very small, about 0.1 mm in length, annular, situated on abdominal segments 1–8, surrounded entirely by a sclerotized peritreme, with a paired projection; thoracic spiracles much larger and more elliptical than abdominal spiracles.

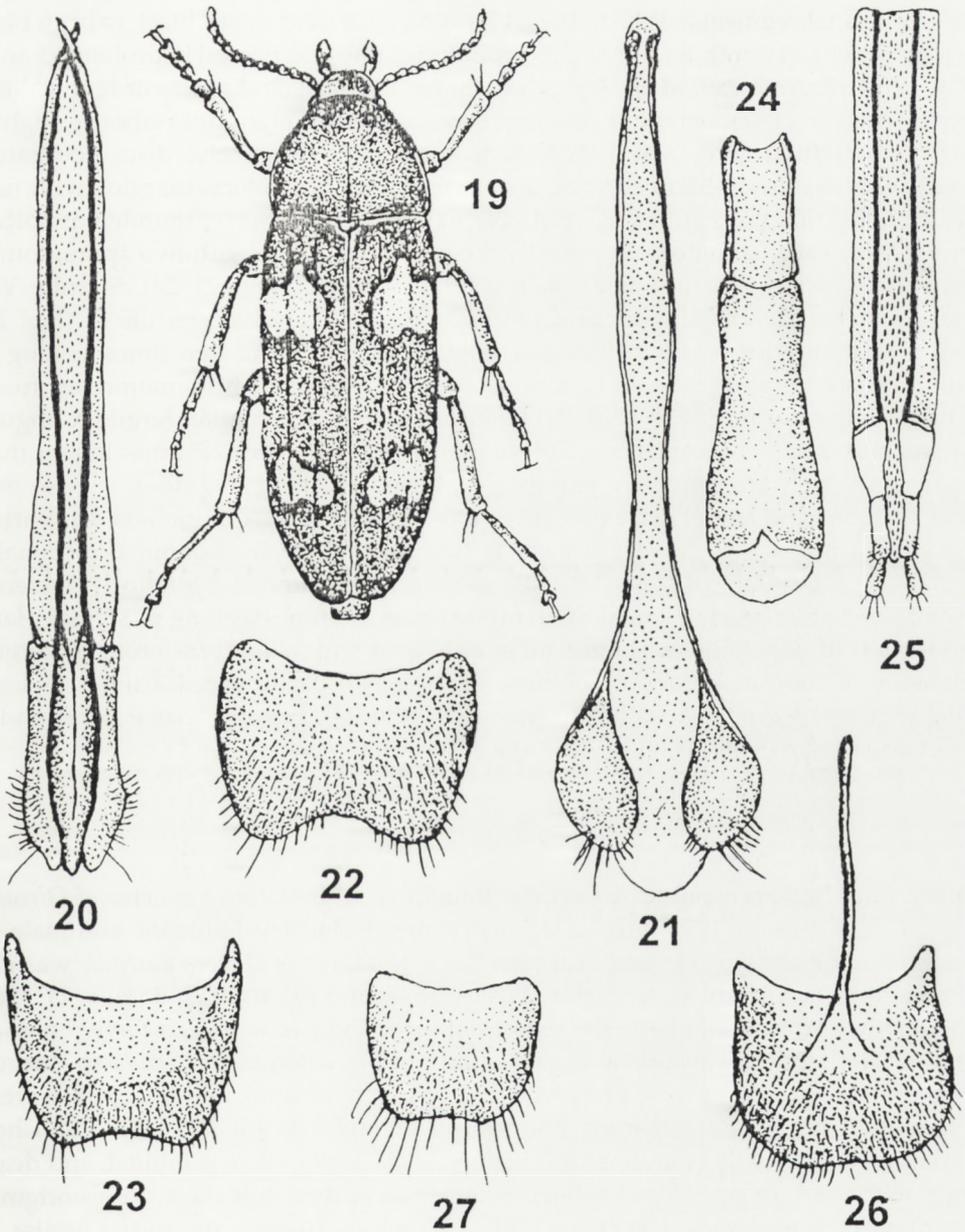
Abdomen (Figs 1–3). Segments 1–8 similar in size, each tergum divided by longitudinal line, and bearing two ambulacral papillae; lateral side with markedly protuberant epipleuron bearing a few short setae. Tergite 9 (Figs 1, 16) oval in outline, covered with numerous radially arranged setae. Abdominal sternites fairly smooth with a few short setae.

Pupa (Figs 17, 18). Body 8.5 mm long, greatest width about 2.3 mm; elongate-oval with abdomen narrowed posteriorly; whitish, very feebly sclerotized, glabrous. Head subglobular, covered above by hood-shaped pronotum, front with one pair of distinct modified setiferous mom-like tubercles and one pair of minute spicules; antennae short, moniliform, fitting along the sides of pronotum, with apices extending to anterior margin of protibia; labrum transverse, mandibles stout, maxillary palpi long, cylindrical, rounded apically. Pronotum almost trapezoidal, widest at base, anterior margin rounded, obtuse posterior angles projecting laterally, disc feebly convex, front region

with two pairs of setiferous thorn-like tubercles, lateral margin with five such tubercles. Nine abdominal segments visible; tergites 1–6 similar in shape, each with a row of eight minute spicules. Seventh tergite strongly produced posteriorly, with row of eight minute spicules and two caudal spines; eighth tergite strongly rounded, with four minute spicules. Ninth tergite very short, semicircular, with two upturned and widely separated urogomphi, bearing a few minute setae. Underside of body with only seven visible sternites, sternites 1–3 fused in single ventrite, sternites 4–6 semirectangular, sternite 7 semicircular, longer than remaining ones. Gonotheca originating from beneath sternum 8. Pleura each strongly protuberant, bearing a single setiferous thorn-like tubercle.



Figs 17 & 18. *Dircaea quadriguttata*, pupa: 17 – dorsal view, 18 – ventral view.



Figs 19–27. *Dircaea quadriguttata*, adult. 19 – dorsal view. 20–24. Male: 20 – aedeagus, 21 – IXth sternite, 22 – VIIIth sternite, 23 – VIIIth tergite, 24 – IXth tergite; 25–27. Female: 25 – ovipositor, 26 – VIIIth sternite, 27 – VIIIth tergite.

Adult (Figs 19–27). Body elliptical, moderately elongate and weakly convex, length of specimens reared from pupae in the laboratory, 6–10 mm; colour black to brownish-black, with four yellow spots, of which the anterior ones are narrowly prolonged anteriorly; head subspherical, maxillary palpi yellow, antennae and apices of femur dark-brown; antenna 11-segmented, extending beyond base of elytron. Prothorax slightly transverse, subtriangular and subcylindrical, rounded anteriorly, disc moderately convex with shallow median furrow, posterior margin and lateral margins with narrow bead. Elytra striato-punctate, gradually narrowed posteriorly, rounded at apices. Last ventrite of abdomen obtuse apically. Legs slender, tibiae with two spurs; fourth tarsomere on all legs emarginate. Male genital segments (Figs 21–24). Sternite VIII trapezoidal (Fig. 22), its anterior and posterior margins concave, sternite IX (Fig. 21) slender, each anterior part with elongate median process about four times as long as width of posterior part, covered by fine setae apically; sternite X membranous, fused with the ninth one. Tergite IX (Fig. 24) longitudinally quadrangular, tergite X linguiform, membranous. Aedeagus (Fig. 20) slender, with basal piece 2.7 times longer than parameres, which are narrowly elongate, flattened horizontally, stout at base and apical part, bearing lateral setae apically; penis straight and membranous, supported by chitinous rod, which project at base as two struts. Female abdominal terminalia (Figs 25–27). Sternite VIII (Fig. 26) subquadrangular, rounded posteriorly, covered with minute setae, bearing spiculum ventrale about 1.6 times as long as sternal plate. Ovipositor (Fig. 25) elongate, about 8 times as long as wide, slightly sclerotized; tergite IX consists of two membranous sclerites, bearing two baculi about 3 times as long as sternal plate IX; sternite IX with two triangular sclerites, bearing sparse pores and a few setae; each small stylus with a few apical sensorial setae.

DISCUSSION

Very little has been published on the immature stages of any species of *Dircaea*. BÖVING & CRAIGHEAD (1931) provided illustrations of the larval antenna and mala of *D. liturata* (LECONTE) (as *D. quadrimaculata* SAY). The larva of *Dircaea australis* was described and incompletely illustrated by PERRIS (1877) and PALM (1950). In June 11, 1965 in the Białowieża National Park, the senior author found two larvae and five pupae of *D. quadriguttata* in the subcortical region of an old big fallen birch (*Betula* sp.) trunk. The larvae and one pupa were preserved in 70 per cent ethanol, and four pupae were taken to the laboratory for rearing. Four adults emerged on June 22, 1965. Published information on the biology and natural history of *D. quadriguttata* is limited, and deals mainly with the host plants and collection localities of the adult stage. In his original description of the species, PAYKULL (1798: 251) wrote "*Habitat sub cortice betulae in Nylandia rarius*", indicating that the earliest known specimens were rare and were collected from under the bark of birch. SAHLBERG (1834) repeated this information, although it is not known whether this confirmation was based on any new observations. According to PALM (1950) *D. quadriguttata* is a primary relict of natural forests. This species lives only on birch trunk (PALM 1959) especially in areas that have been burned. Field-collected larvae were observed in the laboratory, and were seen to be

perfectly able to bore in sapwood, using their shovel-shaped mandibles and short legs during the process. The elongate, cylindrical body of the larva is adapted for tunneling in the wood; many other subcortical, wood-boring larvae share this body design (e.g. LAWRENCE 1991). In addition, the ambulacral ampullae and microspicules on upper and lower surfaces of body, by virtue of their divergence and upward direction, are likely useful in traveling in the sapwood.

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REFERENCES

- BÖVING A. G. & CRAIGHEAD F. C. 1931. An illustrated synopsis of the principal larval forms of the order Coleoptera. Ent. Amer. (N. S.) 11: 1-351.
- BURAKOWSKI B., MROCKOWSKI M. & STEFAŃSKA J. 1987. Melandryidae. In: Katalog fauny Polski, XXIII (14): 31-59.
- HANSEN V., KLEFBECK E., SJÖBERG O. *et al.* 1960. Catalogus Coleopterorum Fennoscandiae et Daniae, Helsingforsiae, 478 pp.
- KASZAB Z. 1969. Familie: Serropalpidae (Melandryidae). In: Die Käfer Mitteleuropas, Krefeld, Band 8: 196-218.
- LAWRENCE J. F. 1991. Order *Coleoptera* (general discussion, family key, many family treatments). In: F.W. STEHR (ed.). Immature Insects. Vol. 2. Kendall/Hunt Publishing Co., Dubuque. pp. 144-658.
- LENTZ F. L. 1879. Catalog der Preussischen Käfer neubearbeitet. Beitr. Naturk. Preuss. Königsberg, 4, 11 + 64 pp.
- LUNDBERG S. 1995. Catalogus Coleopterorum Sueciae. Stockholm, Naturhistoriska Riksmuseet, Entomologiska Foreningen, 217 pp.
- NIKITSKY N. B. 1992. [Fam. Melandryidae]. In: LER, P. A. (ed.), Opredelitel' Nasekomykh Dal'nego Vostoka SSSR v Shesti Tomakh, 3 (2): 435-474. Nauka, Sankt-Peterburg. (In Russian).
- PALM T. 1950. Våra *Dircaea*-arter med särlskild hansyn till *D. australis* Fairm. (Col., Serropalpidae). Opusc. Ent. Lund, 15: 11-16.
- PALM T. 1959. Die Holz- und Rinden-Käfer der süd- und mittelschwedischen Laubbäume. Opusc. Ent. Lund, Suppl. 26, 374 pp.
- PAYKULL G. 1798. Fauna Svecica, Upsaliae, Tomus I, 358 pp.
- PERRIS E. 1877. Larves de Coléoptères (Part.). Annales Soc. Linnéenne de Lyon. (1876): 1-430.
- POLLOCK, D.A. 2002. 100. Melandryidae Leach 1815, pp. 417-422. In: R.H. ARNETT, Jr., M. C. THOMAS, P. E. SKELLEY & J. H. FRANK (eds), American Beetles. Vol. 2. Polyphaga: Scarabaeoidea through Curculionoidea. CRC Press, Boca Raton, xiv +861 pp.
- SAHLBERG C. R. 1834. Insecta Fennica. I, dissertationibus Academicis A. 1817-1834 editio, Helsingforsiae, 517 pp.
- SEIDLITZ G. 1898. Melandryidae. In: Erichson's Naturgeschichte der Insecten Deutschlands, Band V, Teil 2, Lief; 2; 365-680.
- TENENBAUM S. 1913. Chrząszcze (Coleoptera) zebrane w Ordynacyi Zamojskiej w gub. Lubelskiej. Pam. Fizyogr., Warszawa, 21, III; 1-72.

[Tytuł: Opis młodszych postaci rozwojowych *Dircaea quadriguttata* (PAYKULL) z uwagami o narządach kopulacyjnych samców i samic (*Coleoptera: Melandryidae*)]

Praca zawiera szczegółowy opis larwy i poczwarki *Dircaea quadriguttata* (PAYKULL). Uzupełniono również znajomość morfologii postaci dojrzałych, ilustrując narządy kopulacyjne samca i samicy. Stanowisko *D. quadriguttata* zostało odkryte w Białowieżskim Parku Narodowym. Larwy i poczwarki zasiedlały warstwę podkorową grubego pnia powalonej brzozy.