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**Descriptions of the unknown larvae of the genera *Hydaticus* LEACH
and *Graphoderus* DEJEAN (Coleoptera, Dytiscidae) with some data
on their biology**

[With 59 text-figures]

In my previous papers (GALEWSKI 1973 and in print) I discussed some diagnostic characters of the larvae of the genera *Graphoderus* DEJ. and *Hydaticus* LEACH, now I present detailed descriptions of the larvae of *Graphoderus bilineatus* (DEG.), *G. austriacus* (STURM), *Hydaticus stagnalis* (F.) and *H. grammicus* GERM., together with keys to all Central European species of the genera mentioned.

***Hydaticus stagnalis* (F.)**

Hydaticus stagnalis (F.) is a widely distributed species found in Europe except its southern parts, and in Siberia except extreme east (Maritime Territory), it has also been recorded from North America, but (see below) this record may correspond to a closely related, nevertheless distinct species. In Poland the species is common everywhere except in mountainous regions.

The larva attributed to *H. stagnalis* (F.) was described by WATTS (1970) from Canada, but as the identity of *H. stagnalis* (F.) in America has been questioned by some authors (WALLIS, 1939) — it seems to differ by a number of characters from the European form — one may be inclined to consider the American „*stagnalis*” a distinct species. Moreover, the description of the larva is so general and superficial that it may apply to larvae of various species and there is a total lack of figures which makes the description additionally unclear.

Description of the second stage larva

Body fairly broad, its length 13–18 mm. Dorsal side mostly unicolorous brownish or yellowish with some darker spots and marks.

Head (Fig. 2) roundish with strongly curved lateral margins rather feebly diverging anteriorly, and with well curved clypeal edge; head (without neck) almost as long (1.95–2.00 mm) as broad (at ocellar angles: 2.0–2.1 mm); neck relatively broad, slightly less than twice as broad as long. Mandibles fairly regularly curved, rather narrow in basal part, their length 1.30–1.35 mm. Maxillae narrow and slender, maxillar palpi and antennae thin; length of antennae 1.6–1.8 mm, length of maxillar palpi 1.15–1.20 mm. Margins of head with 8–11 tiny temporal spines.

Pronotum relatively broad, short, a little less than twice as broad as long; length of pronotum 1.70–1.75 mm, maximal width 2.90–3.00 mm. Lateral margins of pronotum strongly rounded and rather feebly diverging, the pronotum base not much shorter than anterior margin of pronotum (Fig. 5).

Meso- and metanotum fairly broad, their length 0.45–0.55 mm, width in the middle 2.60–2.65 mm (flattened under cover glass).

Two last abdominal segments (Fig. 8) about the same length (2.0 mm and 2.0–2.10 mm), the terminal segment bluntly terminated, its width at base equalling roughly half of its length (in dorsal view).

Cerci fairly long with apical setae about as long as last abdominal segment. Cercal lateral setae well developed.

Description of the third stage larva

Body length 18–25 mm. Dorsal side slightly darker than in the second stage, testaceous or brownish with some hardly visible colour pattern: head at most with some darker spots or marks, terga with a dark sutural line or band becoming blurred in posterior part of body, the anterior ones with inconspicuous darker patches or spots at sides. Body fairly broad, robust.

Head broad, feebly triangular with roundish sides (Fig. 10), its lateral margins strongly curved and feebly diverging; clypeal edge strongly regularly arched; head maximum width (2.90–3.00 mm) exceeding length without neck (2.70–2.75 mm); neck fairly broad, its width (1.50–1.55 mm) exceeding slightly half of that of head, mandibles robust, strongly curved, but relatively narrow in basal part. Maxillae (stipes) relatively slender, maxillar palpi relatively short (1.5–1.6 mm), together shorter than head (2.4–2.6 mm) (Fig. 10). Margins of head with 8–10 tiny temporal spines. Antennae fairly short, their length 2.3–2.5 mm.

Pronotum (Fig. 14) broad, almost twice as broad as long, with distinctly rounded sides; length of pronotum 2.90–3.00 mm; maximum width 5.6–5.7 mm (flattened under cover glass).

Meso- and metanotum relatively broad, their length in the middle 0.75–0.80 mm, width in the middle 4.8–5.0 mm (flattened as above).

Two last abdominal segments fairly sturdy, broad (Figs 19, 22); terminal abdominal segment with obtuse apex, its length (2.30–2.40 mm) equalling roughly that of the penultimate; base of penultimate 0.75 mm, that of terminal segment 1.5 mm.

Cerci (Fig. 19) fairly long together with apical setae roughly equalling terminal segment in length; length of cerci ca 2.00–2.10 mm, that of apical setae 0.30–0.50 mm.

Material, field and laboratory data.

Poland. Wawrzyszew – Chomiczówka (Warszawa), pools on a swampy meadow, mostly *Carex* L., grasses, mosses: May 25, 1956 – 1 second stage larva; June 7, 1952 – 4 third stage larvae; June 13, 1958 – 5 third stage larvae; June 17, 1958 – 10 third stage larvae; Sept. 20, 1956 – 2 third stage larvae, transferred onto damp sand Sept. 25, 1956 from aquaria, 2 imagines Oct. 16, 1956; June 20, 1956 – 3 third stage larvae, transferred onto damp sand same day, pupae – June 26 – 28, 1956, 1 imago – July 2, 1956. Warszawa-Radiowo, a pasture pool, mostly sedges, 1 ♀, May 24, 1956 several eggs laid in laboratory May 27, 28, 1956. Warszawa-Łomianki, a meadow ditch, *Carex* and grasses, May 26, 1956, 1 third stage larva. Warszawa-Miłosna, small holes and ground depressions filled with rain water, grasses, mosses, muddy clay bottom, pieces of bricks, June 19, 1958, 1 third stage larva, transferred onto damp sand same day, pupa – June 26, 1958. Sadowa distr. Nowy Dwór Maz., June 31, 1956, 1 ♀ from a drying-up hole with *Carex* L. and grasses; several eggs laid in aquarium Aug. 2, 1956 Warszawa-Zielonka, rainwater puddles in a birch grove (post-sphagnal peaty ground), without vegetation, Aug. 21, 1956, 2 third stage larvae. Białowieża distr. Bielsk Podl., puddles and pools on a swampy meadow along river Narewka, mostly *Carex* L.: May 15, 1953, 1 ♀, reared in laboratory, a dozen eggs laid 15 and 16 of May, 1953; Aug. 22, 1953, 1 ♀, several eggs laid Aug. 24–26, 1956; Sept. 1, 1956 1 first, 1 second and 8 third stage larvae; Aug. 18 and 19, 1959, 5 second and 3 third stage larvae; September 7 and 8, 1956 1 second and 16 third stage larvae, several larvae reared in aquaria and 1 transformed onto damp sand Sept. 10, 1956, pupa taken out Oct. 8, 1956; Sept. 18, 1956, 2 second and 18 third stage larvae; Sept. 20, 1956, 6 third stage larvae reared until Sept. 25, 1956, then transferred onto damp sand, pupa – Oct. 14, 1965. All leg. and cult. by K. GALEWSKI. Międzyrzecz distr. Mrągowo: June 9, 1956, small meadow pond with paludal and aquatic vegetation, 1 third stage larva; June, 1956 (no precise date), a fairly large field pond wholly overgrown with paludal and aquatic plants, 1 third stage larva; and Sept. 7, 1956 also 1 third stage larva; Aug. 5, 1960 a small field pond, flowing water, aquatic and paludal plants, 1 third stage larva; Aug. 6, 1959, a small pond on a fallowed field with water flowing through (fed from drainage ditches) various water and bog plants, 2 third stage larvae; Sept. 15, 1956, a field pond, stagnant water, tufts of *Carex* L., paludal and aquatic plants (a.o. *Lemna* L.), 1 third stage larva; all leg. Hydrobiological team of Warsaw University; same place, a fairly small ditch on a turfy meadow, Aug. 25, 1960, seasonally overflowed, paludal and aquatic plants and grasses at margins, some sites overshadowed with alders, 1 third stage larva, leg. E. GAJOWNIK.

German Federal Republik. Krefeld-Hülseberg, drainage ditch on a meadow, *Spartanium* L., *Callitriche* L., *Hottonia* L., June 29, 1964, 1 first, 1 second and 1 third stage larvae, leg. K. GALEWSKI.

Biology

Hydaticus stagnalis (F.) seems to be associated in its breeding period chiefly with shallow, ephemeral water bodies – shallow pools, puddles or swamps

with mostly grassy or sedgy vegetation. Such temporary waters are frequently encountered in paludal areas after rain periods in spring, summer or autumn but may also be formed of melt snow particularly after a snowy winter. The oviposition follows — in the absence of some thick-stemmed paludal plant such as *Typha* L., *Iris* L. or others — probably into *Carex* (similarly as in other *Hydaticus* species the beetles have a piercing ovipositor), grasses or *Juncus* stems, and the beetles perhaps also hide the eggs in leaf axils or beneath some sheathing leaves. The eggs-laying period is mostly late spring and early summer the first batches of eggs being laid sometime in May and June, the larvae appearing usually late in May and in June, and a second time in late summer — in July and August, producing larvae in August and early September. In deep ditches, pools or ponds there seems to be only one — longer — oviposition period as the larvae were taken there only in summer and early autumn the eggs being laid here somewhat later than in ephemeral pools.

The larvae are very voracious attacking not only various insect larvae (*Ephemeroptera*, *Diptera*, *Coleoptera*, etc.) of a suitable size (smaller, thin, difficult to catch larvae and worms e. g. larvae of *Chironomidae*, *Culicidae* or *Oligochaeta* are rather avoided) but also larvae of their own kind, which may be one good reason for keeping them alone in aquaria. The whole larval development lasts 3–4 weeks. The population takes place not far from water's margin under moss clumps or clumps of grasses or sedges in humid sites. Adults appear in summer and autumn. They are similarly as larvae very good swimmers and hunt similar food. They are also perfect flyers and when their breeding sites dry up in summer or in autumn the adults move readily to deeper water-bodies, but may return to their former habitats after rains and start oviposition anew. The hibernation is always on land away from water; the beetles disappear from their aquatic habitats on October and November and may be found in late autumn and winter under moss or in litter in woods, sometimes far from the nearest water-body. They reappear in water in early spring but do not start oviposition often until May after a sufficient growth of paludal and aquatic vegetation. They may sometimes be found in company of other *Hydaticus* species, particularly *Hydaticus seminiger* (DEG.), and the larvae may also be found together, but the latter species seems to prefer mostly deeper water-bodies with rich paludal and aquatic vegetation for reproduction.

Hydaticus grammicus (GERM.)

The species seems to have more southern distribution than the preceding one, ranging from South and Central Europe to Transcaucasia, Iran, Central Asia, and probably Japan (its presence in Japan requires yet confirmation see below); in South Europe the species is absent only in Iberian Peninsula but in Central Europe it is found sporadically (mostly in its southern area).

in Poland the species has been recorded from Niepołomicka Forest, Kujawy and surroundings of Warsaw but the records are unreliable and need verification; by contrast the species seems to be fairly common in Hungary at least in its southern parts according to collection made there.

Although I have failed to find the larvae in Poland I was lucky to come across them in Hungary in company of adults; they definitely differ from larvae of other European species.

A description of the third stage larva attributed to *H. grammicus* (GERM.) has been given from Japan by FUKUDA, KUROSA and HAYASHI (1959, p. 418); the Japanese authors also included a drawing of the larva and its labium — entirely unlike that of any *Hydaticus* larvae known so far and strikingly different from labium which I have observed in larvae taken in Hungary. The drawn labium has a strong lobular tridentate (!) (not bidentate as in other species) projection; the larva figured by Japanese authors has, moreover, more rounded head and is definitely smaller (14–17 mm vis. 18–20 mm in Hungarian specimens) and its two abdominal segments are of unequal length in contrast to my specimens. This all may suggest that the Japanese larvae may belong to another species.

Description of the third stage larva

It is definitely smaller than larvae of other European species; it differs, moreover, from *H. stagnalis* (F.) and *H. seminiger* (DEG.) by its smaller head, shorter terminal abdominal segment and cerci.

Body length 18–20 mm. Colouring of dorsal side pale yellowish or testaceous-yellowish with darker tiny spots at sides of head and terga; middle of terga with a more or less distinct pale line.

Head (Fig. 12) small (length without neck 2.60–2.65 mm, width at ocellar gles 2.70–2.75 mm) with lateral margins well diverging anteriorly and rather feebly curved: temporal angles inconspicuous. Head shape in general similar to that of *Hydaticus seminiger* (GYLL.). Neck fairly broad, its width 1.4 mm, length 0.7 mm; definitely broader and shorter than in the species mentioned. Lateral margins of head with 11–13 temporal spines and some setae. Clypeus margin strongly curved. Mandibles (Fig. 12) very peculiar, very narrow, slender, ungate, much narrower than in other *Hydaticus* species. Antennae long, relatively longer than in *H. seminiger* (GYLL.), their length (2.3–2.4 mm) exceeding that of lateral margin of head. Maxillae (stipes) slender, narrower than in the said species. Length of maxillar palpi 1.40–1.45 mm.

Pronotum (Fig. 16) broad, its shape recalling in general that of *H. stagnalis* (F.), with rounded sides, feebly converging anteriorly; length of pronotum 2.80–2.85 mm, its maximum width 5.3–5.4 mm.

Meso- and metanotum fairly broad, in general similar to those in *H. stagnalis* (F.).

Two last abdominal segments (Fig. 20) fairly short, shorter than in other species, of about similar length (2.20–2.25 and 2.30–2.40 mm); penultimate abdominal segment relatively broad (width at base 1.50–1.55 mm), the terminal one, however, rather slender (width at base 0.80–0.85 mm).

Cerci (Fig. 20) fairly short (1.6–1.7 mm) with short seate; length of cerci and that of apical setae combined a little smaller than length of terminal segment.

Material, field data

Two third stage larvae taken in south Hungary (between Tiszafüred and Hórtobagy near Debrecen) in a small road-side swamp (shallow probably rain-water swampy pools) overgrown mostly by sedges and grasses with sparse *Typha* L., on Aug. 12, 1959, leg. K. GALEWSKI. The larvae were taken together with adults in same sites.

Biology

Judging upon habitat in Hungary, the species may seek shallow, ephemeral water-bodies as breeding grounds. Unfortunately, scarce material does not allow to speculate much about the species ecological preferences and it is likewise impossible to say much about its breeding habits — oviposition, larval food, length of particular stages, phenology etc. The larvae may catch similar prey as the larvae of other *Hydaticus* species, e. g. various insect larvae (*Ephemeroptera*, *Diptera*) which occurred together in investigated pools and the life-cycle probably does not differ much from that of other European species.

To facilitate identification below I give a key to all four European species:

1. Dorsal side of body fairly dark with a pale mesonotum. Head very small (head length without neck 1.65–1.70 mm in the second stage and 2,30–2,50 mm in the third stage); lateral margins of head feebly curved (Figs. 3, 11) *H. transversalis* (PONTOP.).
- Dorsal side of body more or less unicolorous. Head larger (head length without neck 1, 95–2.00 mm in the second stage and 2,60–2.75 mm in the third stage); lateral margins of head more strongly curved (Figs. 1, 2, 9, 10, 12) 2.
2. Head fairly small (head length without neck 2.60–2.65 mm, maximum width 2.70–2.75 mm in the third stage); mandibles very narrow, slender (Fig. 12) *H. grammicus* (GERM.).
- Head fairly large (head length without neck 2.70–2.75 mm maximum width 2.90–3.00 mm, in the third stage). Mandibles much broader (Figs. 9, 10) 3.
3. Head more rounded with more curved sides (Figs. 2, 10). Pronotum broader (Figs. 5, 14). Two last abdominal segment broader robuster (Fig. 19). *H. stagnalis* (F.).
- Head more triangular with less curved sides (Figs. 1, 9). Pronotum narrower (Figs. 4, 15). Two last abdominal segments narrower (Fig. 18) *H. seminiger* (DEG.).

Graphoderus bilineatus DEJ.

The larva attributed to that species, described by MEINERT (1901) under the name *Acilius fasciatus* DEG. belongs quite probably to another species. The comparative length of the cerci (half of the length of terminal abdominal segment) indicated in the MEINERT description would suggest *G. zonatus* (HOPPE) rather than *G. bilineatus* (DEJ.) which has short cerci equalling about a quarter of the last abdominal segment in length — certainly not longer than in *G. cinereus* (L.). Unfortunately I possess but the third stage larvae.

Description of the third stage larva

Length of full grown larva 23–24 mm. Body relatively plump, stout, short recalling body of *Acilius canaliculatus* NIC. Colouring of dorsal side of body relatively pale, testaceous-golden, paler than usual colouring of *G. zonatus* (HOPPE) or *G. cinereus* (L.), with a slight rusty hue, two last abdominal segments slightly darkened — testaceous light brown; ventral side whitish.

Head (Fig. 29) relatively small, robust, feebly enlarged anteriorly, lateral margins feebly diverging anteriorly, with a relatively broad neck; length of head (including neck) 3.0 mm, width of head at ocular angles 2.05 mm; length of neck 0.6 mm, width of neck 1.2 mm. Appendages of head short, length of antennae 1.0 mm, length of maxillar palpi 0.5 mm, length of labial palpi 0.65 mm, length of mandibles 1.0 mm. Mandibles distinctly shorter than either in *G. zonatus* (HOPPE), or *G. cinereus* (L.), broad, sturdy, bearing 5–6 small teeth concealed between the inner and outer edge. Maxillae (stipes) very broad, provided with a row of very long setae. Maxillar palpi with two basal joints also relatively thick, apical joint, on the contrary, narrow, slender. Labial palpi likewise with thick, robust basal joint, the apical one relatively thin, slim. Labial process thick, robust with single apex, provided with stout long spines at sides.

Prosternum (Fig. 40) relatively broad and short; its length 1.50 mm, width 1.12 mm.

Pronotum (Fig. 36) not particularly differing from that of other species, its length 3.20 mm, width 4.20 mm.

Two last abdominal segments (Fig. 47) relatively short, robust, their lengths 3.0 mm and 3.60–3.65 mm. Both segments provided with relatively dense swimming hairs at edges; width at base 2.50 and 1.25 mm. Cerci short, their length about a quarter of that of the last abdominal segment, with short setae; length of cerci 1.0–1.05 mm.

Legs (Figs. 51–53), provided with relatively long and dense swimming hairs, feebly differentiated; length of front legs 5.4–5.5 mm, of middle legs 6.0–6.15 mm, and of hind legs 6.2–6.3 mm.

Material

Poland. Zaborów near Warszawa, distr. Nowy Dwór Maz., a fairly large fish pond in a State Agricultural Farm (PGR), at margin overgrown with paludal and aquatic plants: July 5, 1954 — 2 well grown third stage larvae; July 7, 1954 — 1 third well grown third stage larva.

Biology

Graphoderus bilineatus (DEG.) — a species distributed in Europe, except its southern part, and in western Siberia is found everywhere in Poland at lower elevations; so far the species was not taken in the mountainous regions.

It is certainly associated with stagnant, large, permanent water-bodies — larger ponds, ox-bow lakes, back waters and calmer lake shores profusely overgrown with vegetation. The habitat of larvae seem to corroborate the ecological preferences of the adults — the breeding grounds of the species seem to be in larger water-bodies, by contrast to the remaining species of the genus which are more at home in smaller, temporary waters (ditches, smaller ponds, bogs, pools or even puddles). Both the adults and larvae are excellent swimmers and floaters and can be found even in fairly deep water; the imagines are strongly enlarged posteriorly and relatively very flat, and a plump, swelled body with large tracheal stems of the larvae certainly, too, facilitates flotation. Owing most probably to a great degree of flotability, the cerci are more reduced than in other species and the larvae probably rarely visit the bottom and feed mostly on planktonic not benthic crustaceans. The short, serrated mandibles seem to be more primitive in comparison of those of other species but perhaps more suited for catching carapaced water-flies than some insect larvae or worms which are preyed upon by inhabitants of shallow pools or puddles.

Graphoderus austriacus STURM

A very short description of the first stage larva has been given by BERTRAND (1952). Larvae of the subsequent stages have not yet been described.

Description of the second stage larva

Distinctly smaller than larvae of the remaining European species. Length of body 8–16 mm. Body “plump”, short. Colouring of dorsal side variable — brown olive to pale yellowish olive, depends much on the environment conditions — in turfy, peaty waters the larvae are much darker than those in grassy meadows; head always fairly pale yellowish or testaceous, rarely pale brown with a distinct brown straight streak across the middle; anterior part of epi-

cranium very pale forming a pale arched band in front of a dark streak mentioned.

Head (Fig. 23) small, narrow (head length including neck 1.75–1.80 mm), its lateral margins feebly diverging, well curved at base; anterior margin of clypeus strongly curved; neck fairly broad, its width 0.70 mm, length 0.30 mm. Head appendages fairly long, mandibles regularly bent, their outer edge regularly arched; maxillae (stipes) fairly broad but maxillar and labial palpi with rather narrow, thin joints, the apical and basal one of similar breadth; length of maxillar palpi 0.45 mm; length of labial palpi 0.55–0.57 mm; length of antennae 0.65 mm; length of mandibles 0.65–0.75 mm; labial process thin and not excised at apex.

Pronotum (Fig. 30) small, its length 1.16 mm, maximum width 2.0 mm.

Two last abdominal segments (Fig. 41) rather short, fairly narrow, slender, length of terminal one (2.0–2.1 mm) exceeding by one and a half times that of penultimate (1.58–1.60 mm); basal width of penultima 0.7 mm, that of terminal segment 1.0 mm.

Cerci (Fig. 41) short (0.70–0.72 mm) rather thin, with fairly long setae. Legs differing little in length, with relatively sparse swimming hairs.

Description of the third stage larva

Smaller, shorter than larvae of the corresponding stage of other species; length 16–22 mm. Body “plump”, stout, even more than in the second stage. Colouring varying strongly — from dark brown olive to yellowish or even whitish yellow, partially darkened (dorsal side), specimens from peaty, muddy waters as a rule being much darker than those from clear-water grassy or sedgy pools; head slightly paler than rest of dorsal side, with a distinct dark cross-like pattern — a transverse dark streak across epicranium being combined with a longitudinal dark epicranial line — double in anterior part; pale areas inconspicuous or invisible, clypeus dark brown.

Head (Fig. 26) small, narrowly triangular, with lateral margins feebly diverging anteriorly and conspicuously curved at base; head (including neck) length 2.58–2.60 mm, width at ocellar angles 1.87–1.90 mm; neck relatively broad, its width 1.1–1.2 mm, length 0.43–0.45 mm. Appendages of head fairly long. Mandibles elongate, rather narrow with upper edge fairly regularly curved, distinctly serrated — the teeth fairly conspicuous, and numerous. Maxillae broad although narrower than in *G. bilineatus* DEG., maxillar and labial palpi with narrow joints of similar breadth; length of mandibles 1.0 mm, their width at base 0.4 mm; length of maxillar palpi 0.55–0.60 mm, length of labial palpi 0.70–0.72 mm. Labial process (0.27 mm) with apex not excised.

Pronotum (Fig. 33) relatively small, its length 2.75–2.80 mm, width 3.95–3.97 mm.

Prosternum (Fig. 37) fairly narrow, its length 1.52 mm, maximum width 0.85 mm.

Two last abdominal segments (fig. 45) fairly slender and short, their lengths 2.40–2.45 mm and 3.3–3.4 mm.

Cerci (Fig. 45) fairly long, about a third of length of terminal segment (1.20–1.25 mm), fairly slender. Cercal setae long.

Legs (Figs. 54–56) short, rather thin, feebly, differing in length, swimming hairs feebly developed; length of anterior legs 5.0 mm, middle legs 5.8 mm, and hind legs 6.0 mm respectively.

Material, field and laboratory data

Poland. Warszawa-Wawrzyszew (Chomiczówka), puddles and pools on a swampy meadow, *Carex*, grasses, mosses: June 17, 1958 ca 19 third stage larvae, transferred onto damp sand, 1 pupa June 26–28, 1958; June 20, 1958 several third stage larvae, transferred onto damp sand, 3 pupae 26–28 June, 1958, 2 imagines July 1–2, 1958; June 29, 1958, 1 third stage larva, transferred onto damp sand next day, pupa taken out July 9, 1958. Warszawa-Buraków, vicinity of Kampinoska Forest, Łuże, ditch on a *Carex* meadow, July 9, 1956, 1 female, eggs laid in laboratory July 10, 1956; 6 first stage larvae emerged 17 and 19 of July, 1956. Hutka near Jedlnice, July 17, 1958, 2 second stage larvae, leg T. BOJASIŃSKI. Zielonka near Warszawa, puddles and pools (rain-water) in a birch groove, 15 third stage larvae Aug. 11, 1955, several larvae reared until Aug. 14, 1955, then transferred onto damp sand, 4 imagines Aug. 22, 1955; Aug. 18, 1955, same locality and place, 2 second and 8 third stage larvae, 4 larvae, transferred onto damp sand same day, 4 imagines Aug. 29, 1955; same locality, road ditch in a birch grove: Aug. 5, 1954, 1 third stage larva reared until Aug. 10, 1954 then transferred onto damp sand, imago Aug. 19, 1954. Struga near Warszawa, shallow puddles on a meadow at margin of a birch grove, Aug. 18, 1956, sparsely *Carex* L., muddy bottom, withered *Carex* stems, 2 third stage larvae; all leg. and cult. K. GALEWSKI. Mikolajki 5, distr. Mrągowo, June 1956, a field pond, rich paludal and aquatic vegetation, leg. J. DOBRZAŃSKA and Z. FISCHER, 3 second stage larvae.

Hungary. Bócsa near Kecskemet, May 20, 1958, shallow saline pool on a pasture, sparse *Carex* L., bottom with detritus and rich algae flora, 4 second stage larvae; same locality and date, a narrow ditch on a meadow, *Carex* L. and grasses, sparsely *Hottonia* L., 1 second and 1 third stage larvae; Pécs, May 28, 1958, a narrow meadow ditch linked with a pond (stagnant water), *Carex* L., *Phragmites* L., *Lemna* L., grasses, 3 second and 15 third stage larvae. Between Tiszafüred and Hórtobágy near Debrecen, Aug. 12, 1969, shallow meadow pool, chiefly grasses, sparsely *Typha* L., mostly pluvial water, 3 second and 19 third stage larvae. All leg. K. GALEWSKI.

German Federal Republic, Holstein, Bültsee (an oligotrophic lake), sandy-muddy margins, *Carex* L., *Stratiotes* L., *Polygonum* L. (marginal swamps?), leg. W. SEEGER, 4 second stage larvae.

Biology

Small, shallow highly temporary water-bodies are the species usual breeding grounds and the larvae are more frequently than not, found there. I collected them in shallow rain-water puddles and pools with grassy and sedgy vegetation — on meadows and pastures on marshy areas, as well as in peaty postsphagnum birch groves; in Hungary the larvae were taken in saline shallow marshes with indicates that the species tolerates brackish water. The larvae are most probably laid in *Carex* or grasses stems or in stems of other paludal plants — if

there are any; the eggs may also be deposited under sheathing leaves or at leaf axils in absence of suitable sites for oviposition. The species most probably oviposit twice — in mid- or late spring and in the summer, the larvae appearing in late spring and early summer and subsequently in late summer and early autumn. The larvae feed most probably on *Crustacea* — *Ostracoda* may also be taken, but in their absence may also catch smaller insect larvae e. g. larvae of mosquitos as I was able to state in forest pools; these were almost entirely devoid of plankton but larvae of culicids were very abundant and were preyed upon by various Dytiscid larvae including those of *Graphoderus* DEJ. At any rate, the serrated mandibles seem to be an adaptation for capture of carapaced planctonic crustaceans — and the larvae of *Culicidae* may constitute a substitute in the absence of their usual food. The larvae are mediocre swimmers as compared with those of the other species and do not venture in deeper waters. They pupate in June or July and August and September and the adults appear a few weeks after disappearance of larvae. The adults are good flyers and leave dried-up puddles and pools in the summer for deeper waters but return in late summer and in the autumn to their habitats as soon as they fill with rain water; the hibernation is frequently under moss, *Sphagnum* tufts or litter on the bottom, or margin of dried up pools, but the beetles may probably also overwinter in the water — like other species. The adults appear in April or May from hibernation and the breeding starts shortly after.

Below I give a key to all four European species:

1. Head small, narrow, almost parallel-sided (Figs. 23, 26)
 *G. austriacus* (STURM).
- , Head larger, broader, distinctly triangular (Figs. 24—29)
 2.
2. Mandibles short (Fig. 29). Two basal joints of maxillar palpi and basal joint of labial palpi broad, "swollen", distinctly broader than apical joint (Fig. 29) *G. bilineatus* (GERM.).
- , Mandibles more elongate (Figs. 26—28). Basal joints of maxillar and labial palpi narrow, similar to the apical one (Figs. 26—28) 3.
3. Lateral margins of head regularly and distinctly curved (Figs. 25, 28). Mandibles longer in the third stage, either with a smooth inner edge or at most very finely denticulate at apex. Cerci in the third stage long, equalling in length about a third or more of the terminal abdominal segment (Fig. 46) *G. zonatus* (HOPPE).
- , Lateral margins of head feebly curved at least in the basal two thirds of head (Figs. 24, 27). Mandibles shorter, in the third stage distinctly serrated. Cerci in the third stage shorter, equalling at most about a quarter or one fifth of the terminal segment length (Fig. 44) *G. cinereus* (L.).

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STRESZCZENIE

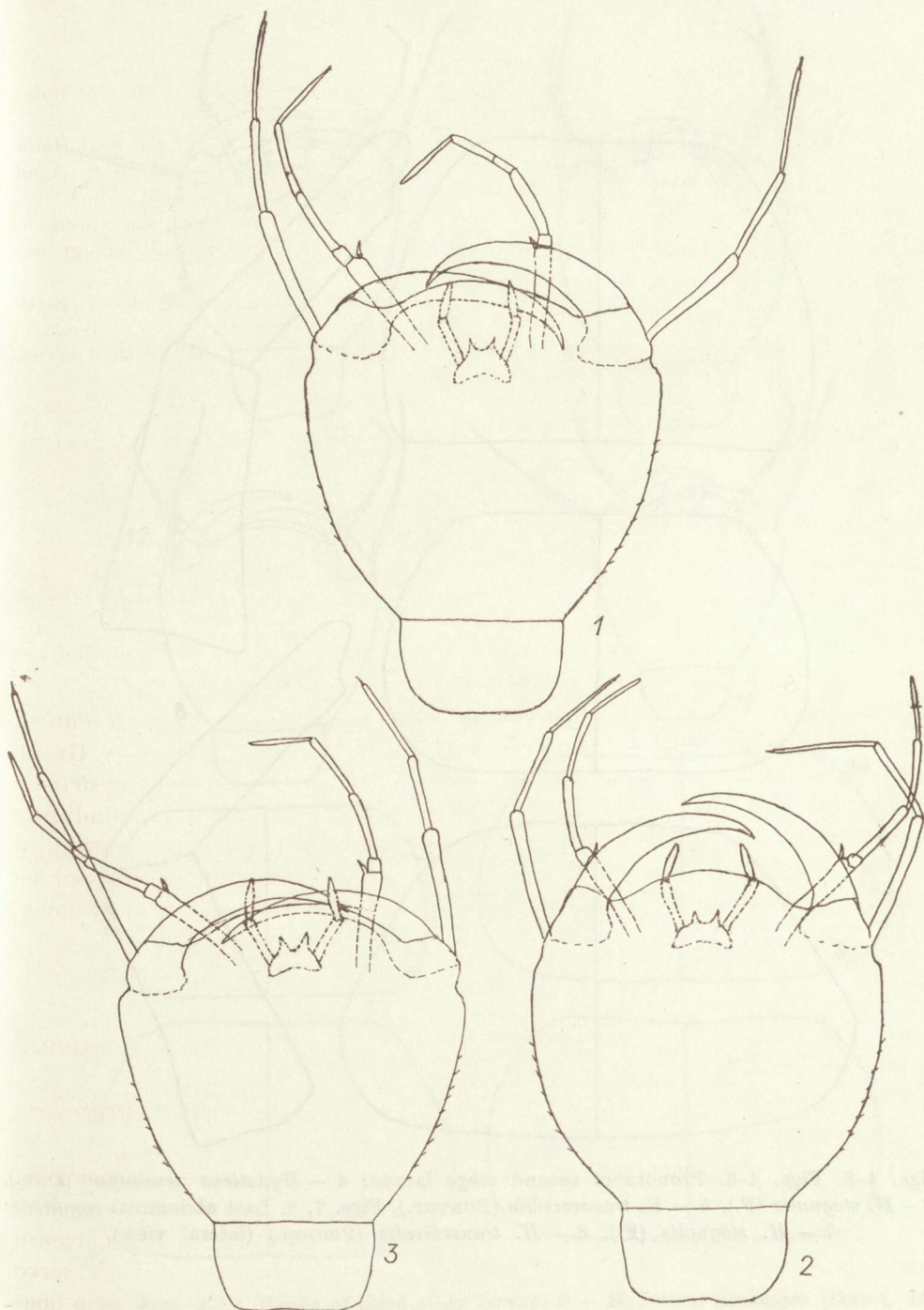
[Tytuł: Opisy nie znanych larw z rodzaju *Hydaticus* LEACH i *Graphoderus* DEJEAN (*Coleoptera*, *Dytiscidae*) wraz z danymi o ich biologii]

Praca zawiera opisy nie znanych dotychczas larw z rodzaju *Hydaticus* LEACH — *H. stagnalis* (F.) (larwy II i III stadium), *H. grammicus* GERM. (larwa III stadium), oraz rodzaju *Graphoderus* DEJ. — *Graphoderus austriacus* (STURM) (larwy II i III stadium) i *G. bilineatus* (DEG.) (larwa III stadium). Opisane larwy różnią się wyraźnie od siebie i od larw pozostałych gatunków europejskich. Autor podaje również klucze do oznaczania larw wszystkich europejskich gatunków wymienionych rodzajów oraz omawia ich cykl życiowy.

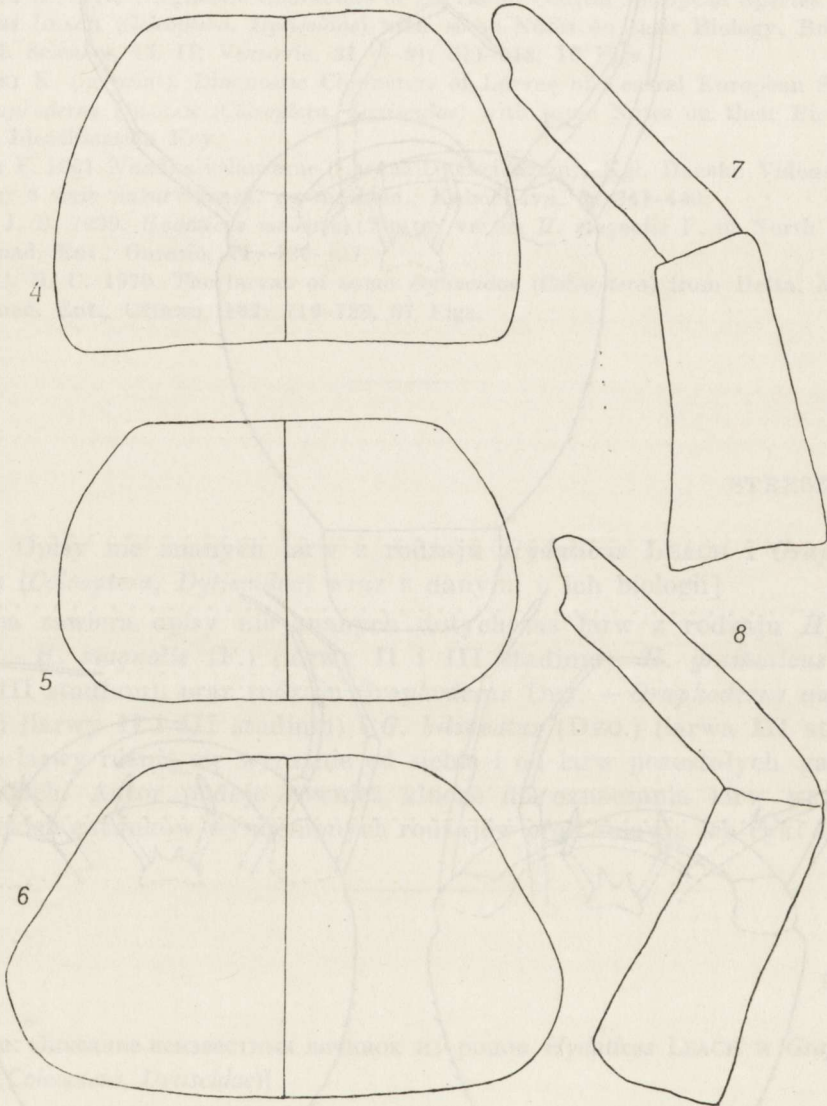
РЕЗЮМЕ

[Заглавие: Описание неизвестных личинок из родов *Hydaticus* LEACH и *Graphoderus* DEJEAN (*Coleoptera*, *Dytiscidae*)]

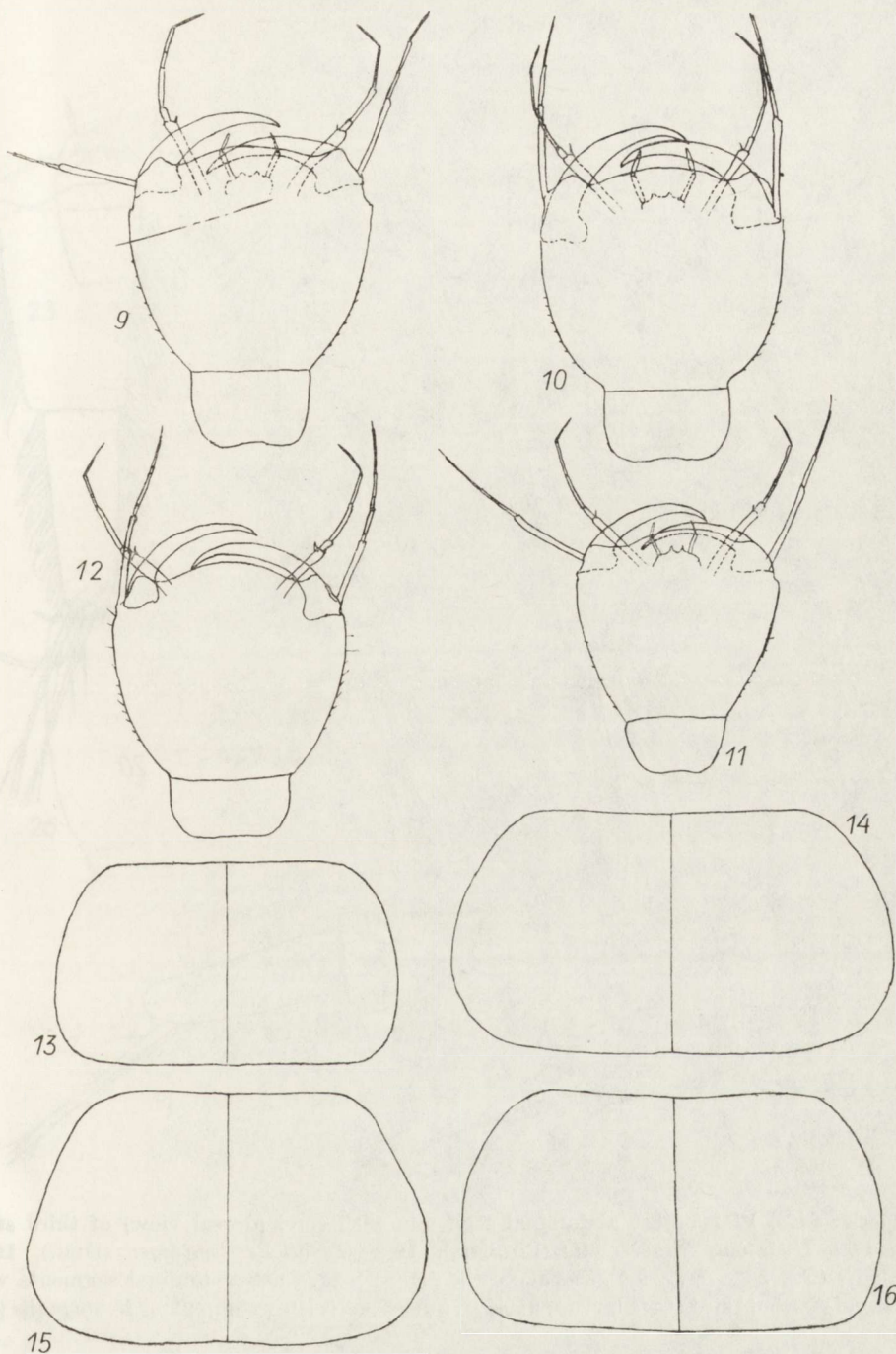
Работа содержит описание неизвестных до настоящего времени личинок из рода *Hydaticus* LEACH — *H. stagnalis* (F.) (личинки II и III стадии), *H. grammicus* GERM. (личинка III стадии) и рода *Graphoderus* DEJ. — *G. austriacus* (STURM) (личинки II и III стадии) и *G. bilineatus* (DEG.) (личинка III стадии). Описанные личинки четко отличаются друг от друга и от личинок остальных европейских видов. Автор приводит также определитель личинок всех европейских видов, принадлежащих к перечисленным родам, и рассматривает их жизненный цикл.



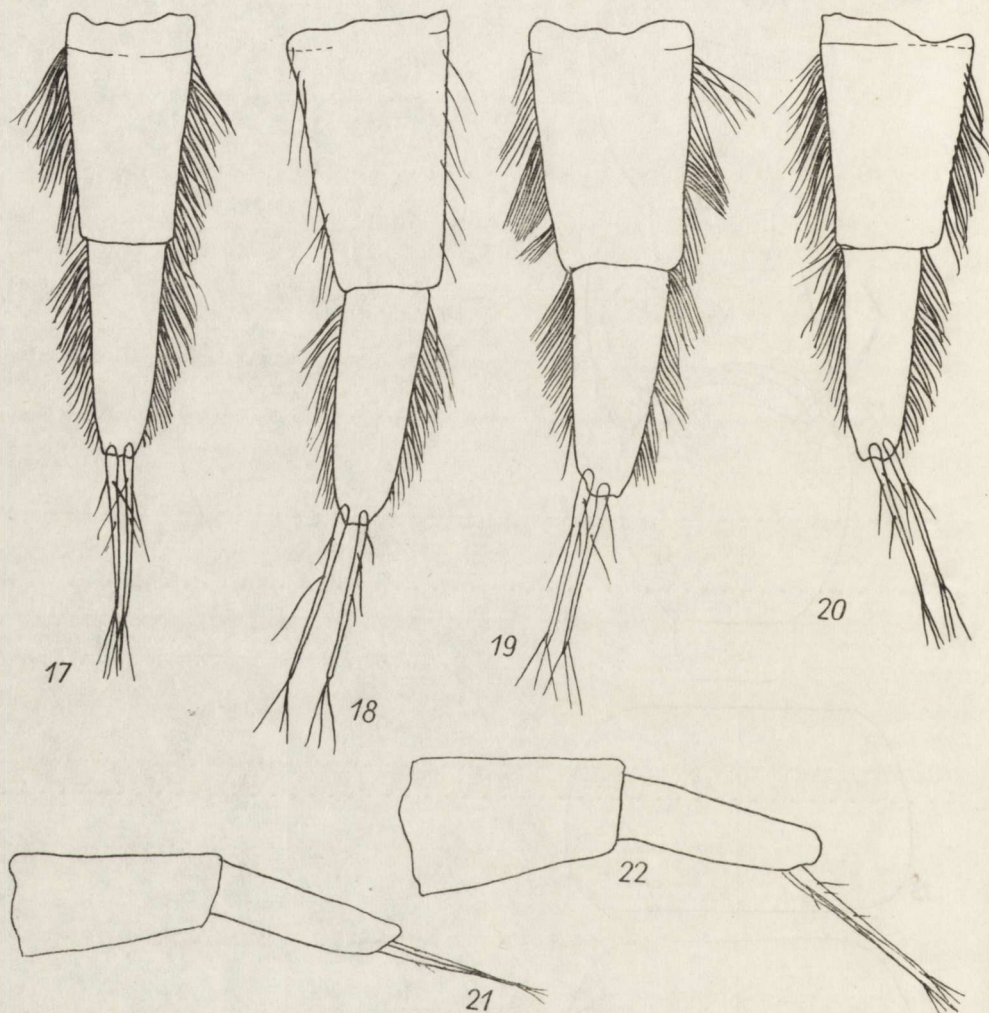
Figs. 1-3. Heads of second stage larvae; 1 - *H. seminiger* (DEG.), 2 - *H. stagnalis* (F.),
3 - *Hydracarus transversalis* (PONTOP.)



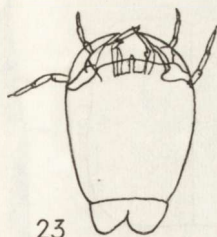
Figs. 4-8. Figs. 4-6. Pronota of second stage larvae; 4 - *Hydaticus seminiger* (DEG.),
 5 - *H. stagnalis* (F.), 6 - *H. transversalis* (PONTOP.), Figs. 7, 8. Last abdominal segments:
 7 - *H. stagnalis* (F.), 8 - *H. transversalis* (Pontop.) (lateral view).



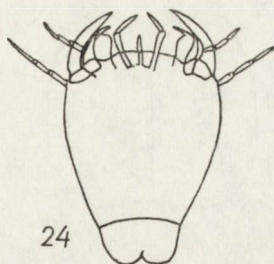
Figs. 9-16. Figs. 9-12. Heads of third stage larvae; 9 - *Hydracarus seminiger* (DEG.), 10 - *H. stagnalis* (F.), 11 - *H. transversalis* (PONTOP.), 12 - *H. grammicus* (GERM.). Figs. 13-16. Pronota of third stage larvae; 15 - *H. seminiger* (DEG.), 14 - *H. stagnalis* (F.), 13 - *H. transversalis* (PONTOP.), 16 - *H. grammicus* (GERM.).



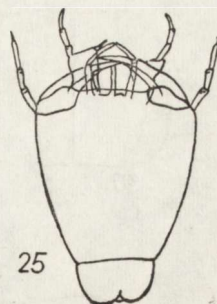
Figs. 17-22. Figs. 17-20. Last abdominal segments with cerci (dorsal view) of third stage larvae; 17 - *Hydaticus transversalis* (PONTOP.), 18 - *Hydaticus seminiger* (DEG.), 19 - *H. stagnalis* (F.), 20 - *H. grammicus* (GERM.). Figs. 21-22. Last abdominal segments with cerci (lateral view) of third stage larvae; 21 - *H. transversalis* (PONTOP.), 22 - *H. stagnalis* (F.).



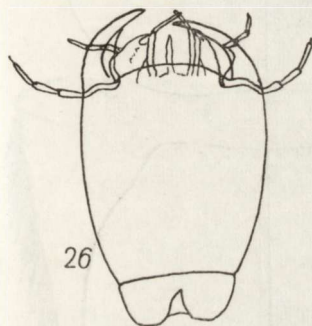
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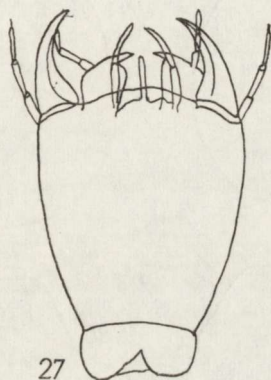
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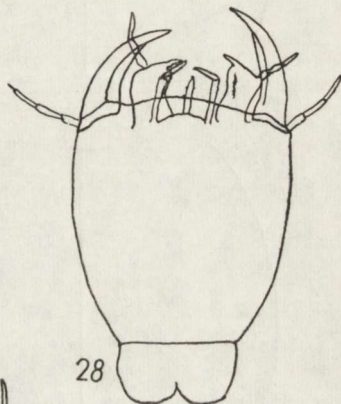
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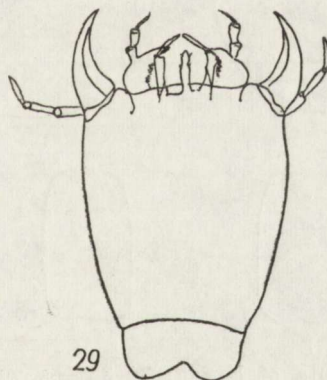
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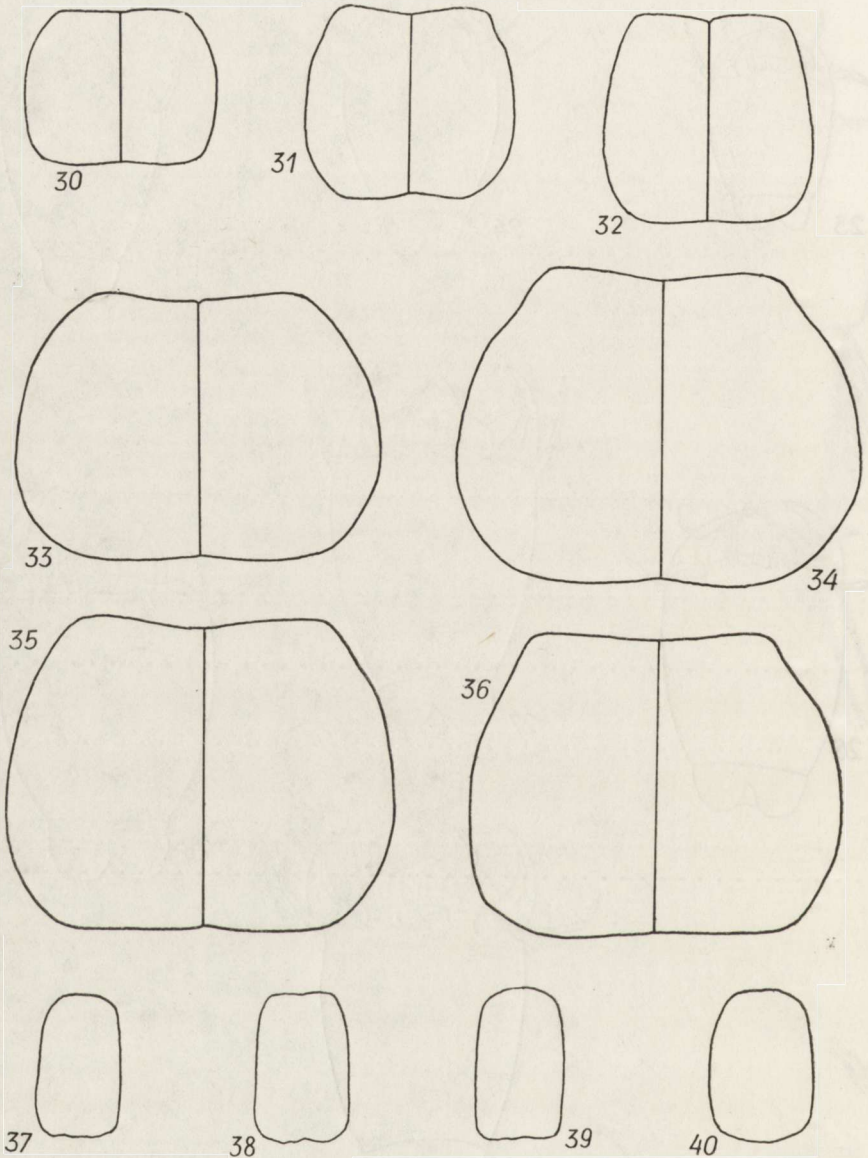


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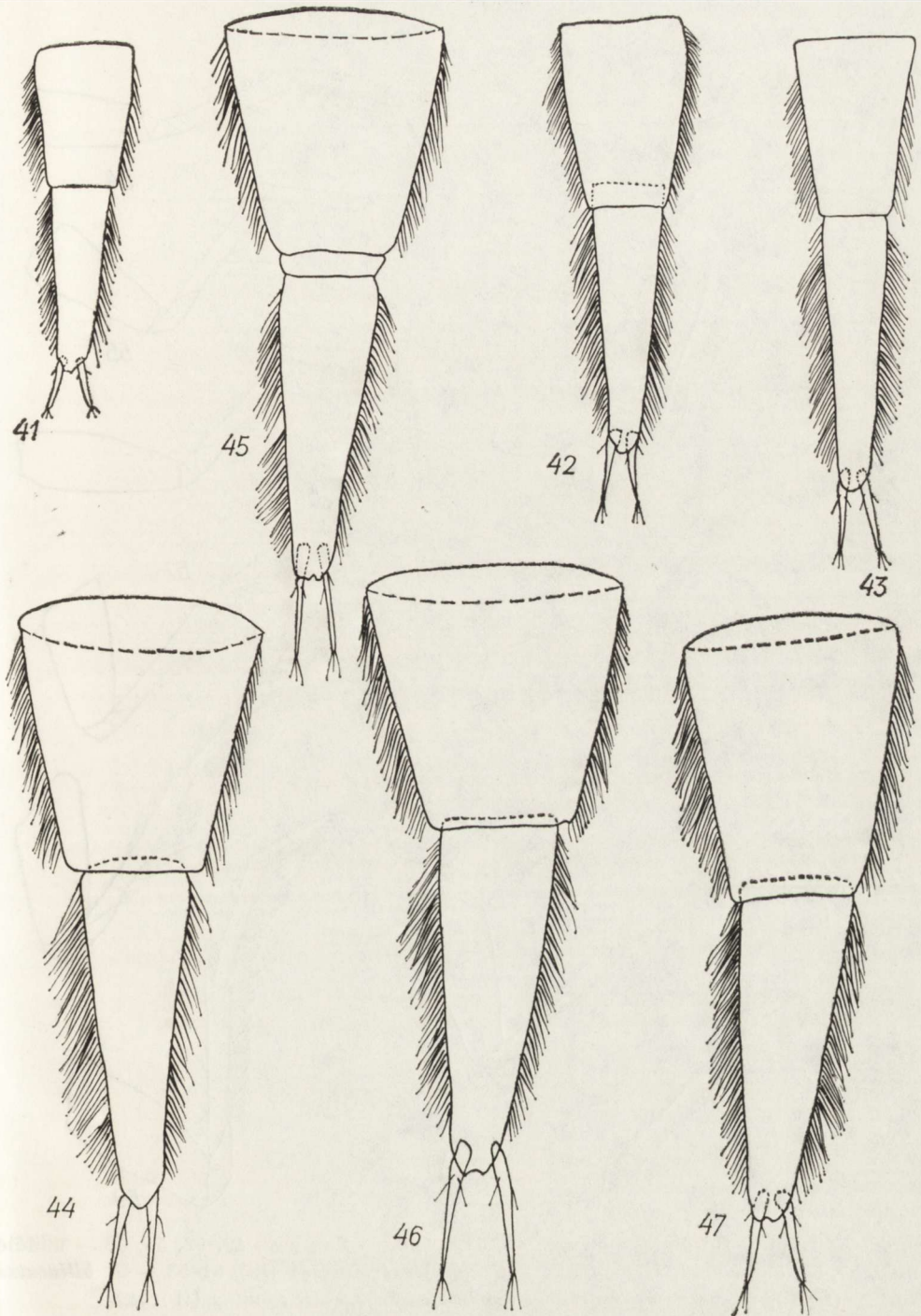


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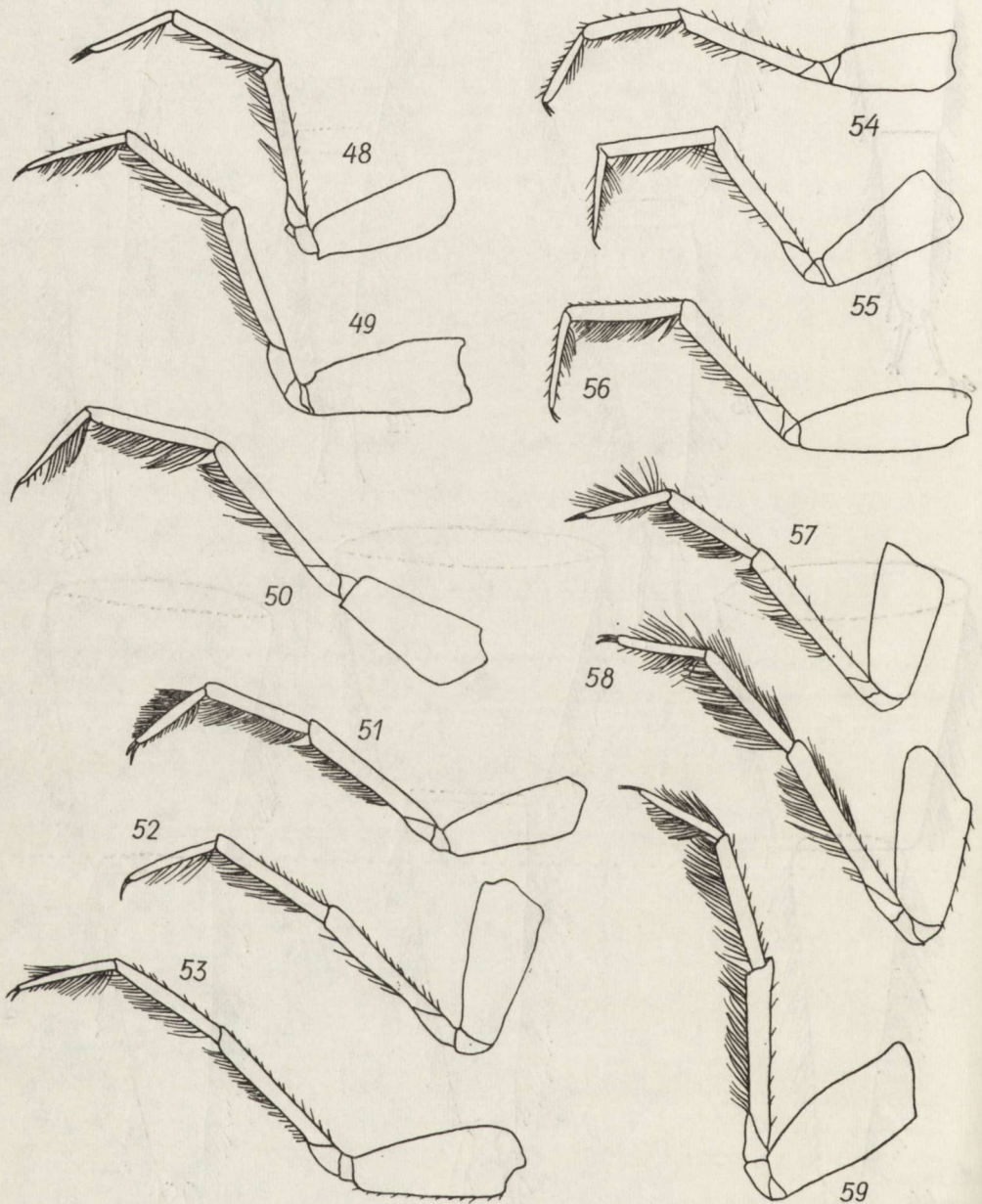
Figs. 23-29. Heads of larvae; 23-25 - second stage, 26-29 - third stage: 23, 26 - *Graphoderus austriacus* STURM, 24, 27 - *G. cinereus* (L.), 25, 28 - *G. zonatus* (HOPPE), 29 - *G. bilineatus* (DEG.).



Figs. 30-40. Figs. 30-36. Pronota of larvae; 30-32 - second, 33-36 - third stage: 30, 33 - *Graphoderus austriacus* (STURM), 31, 34 - *G. cinereus* (L.), 32, 35 - *G. zonatus* (HOPPE), 36 - *G. bilineatus* (DEG.) Figs. 37-40. Prosterona of third stage larvae; 37 - *Graphoderus austriacus* (STURM), 38 - *G. cinereus* (L.), 39 - *G. zonatus* (HOPPE), 40 - *G. bilineatus* (DEG.).



Figs. 41-47. Last abdominal segments with cerci; 41-43 - second stage, 44-47 - third stage larvae, 41, 45 - *Graphoderus austriacus* (STURM), 42, 44 - *G. cinereus* (L.), 43, 46 - *G. zonatus* (HOFFM.), 47 - *G. cylindricus* (DEG.).



Figs. 48-59. Legs of third stage larvae; 48, 51, 54, 55 - fore legs, 49, 52, 55, 58 - middle legs, 50, 53, 56, 59 - hind, legs. 48-50 - *Graphoderus cinereus* (L.), 51-53 - *G. bilineatus* (DEG.), 54-56 - *G. austriacus* (STURM), 57-59 - *G. zonatus* (HOPPE).

Redaktor pracy — prof. dr J. Nast

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