

Larvae of the Carabidae Genus *Dicheirotichus* Jacq. (Coleoptera, Carabidae) from the Fauna of Russia and Adjacent Countries: I. Larvae of the Subgenus *Dicheirotichus* Jacq.

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Received October 12, 1996

Abstract—III-instar larvae of *Dicheirotichus ustulatus* Dej., II- and III-instar larvae of *D. abdominalis* Motsch. and *D. desertus* Motsch. are reported for the first time. All larval instars of *D. gustavi* Crotch are redescribed. Diagnosis of the subgenus *Dicheirotichus* Jacq. and a key to species based on larval characters are given.

INTRODUCTION

A small, primarily Palaearctic, genus *Dicheirotichus* Jacq. is represented in the world fauna by slightly more than 40 species (Kryzhanovskii, 1983). Poor armament of the inner saccus of endophallus combined with the uniform aedeagus structure and, at the same time, significant morphological variability make complicated taxonomic analysis of these species. The composition of the genus cannot be considered fixed till now. Until recently, most authors accepted *Dicheirotichus* Jacq. and *Trichocellus* Ganglb. as independent genera and divided the latter into three subgenera: *Trichocellus* (s. str.), *Cardiostenus* Tschitsch., and *Oreoxenus* Tschitsch., on the basis of their distinctions in pronotal shape and pubescence of male tarsi (Tschitscherin, 1899, 1900; Jacobson, 1905–1916; Csiki, 1946; Lindroth, 1968; Habu, 1973; Noonan, 1976; Kryzhanovskii, 1983). However, the last prominent monograph concerned with the carabid fauna of Russia and neighboring countries (Kryzhanovskii *et al.*, 1995) accepts *Dicheirotichus* Jacq. as a unified genus, which is in agreement with Ganglbauer's understanding of *Trichocellus* Ganglb. as a subgenus of the genus *Dicheirotichus* Jacq. (1892). Because of weak distinction in male genital structure, separation of 4 subgenera, *Dicheirotichus* (s. str.), *Trichocellus* Ganglb., *Cardiostenus* Reitt., and *Oreoxenus* Tschitsch., is based mainly on the elytral pubescence and the number and position of discal elytral pores (Kataev in Kryzhanovskii *et al.*, 1995).

An analysis of characters of preimaginal stages can be helpful in solving controversial questions concern-

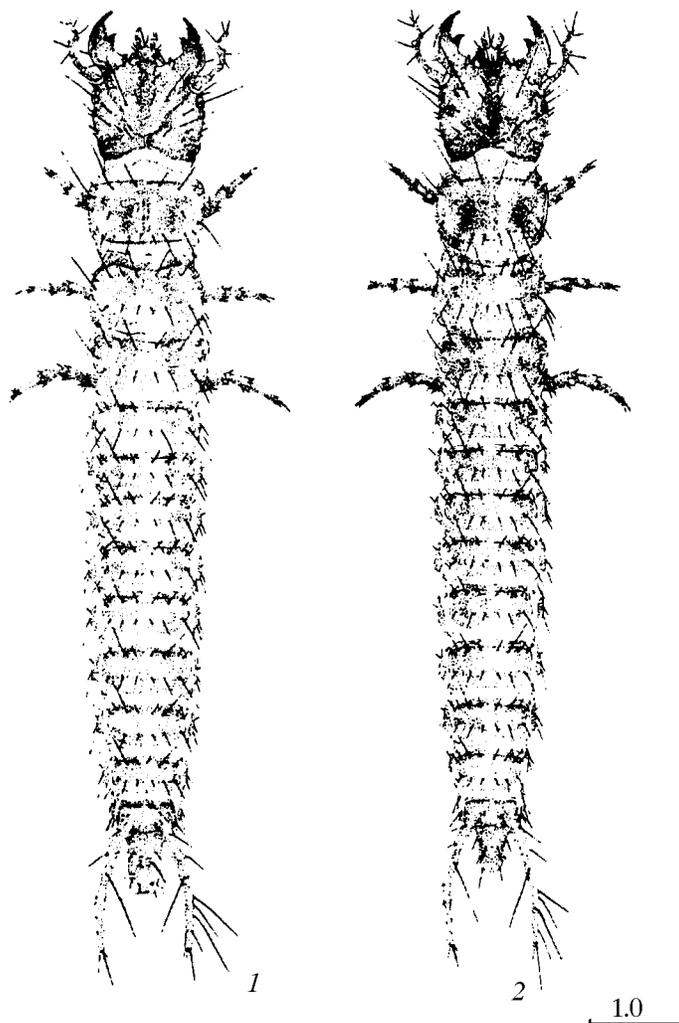
ing the genus composition and relations between its subgenera. This approach has been successful in clarifying a number of uncertainties in the taxonomy of the genus *Carabus* L. (Makarov, 1989). However, little has been known on larvae of the genus *Dicheirotichus* Jacq. Larvae have been described only for *D. gustavi* Crotch (Shiødte, 1867; Hurka, 1975; Luff, 1993) of 6 Russian species of the nominotypical subgenus; and only for 3 species (Kemner, 1913; Larsson, 1941; Hurka, 1975; Luff, 1993) of more than 20 species of *Trichocellus* Ganglb. Moreover, many of these descriptions are relatively incomplete, which complicates their comparison.

The present paper analyzes larvae of the genus *Dicheirotichus* from the fauna of Russia and offers a plausible variant of its phylogeny, based on larval characters.

The first communication provides the first descriptions of larvae of preimaginal stages for the species *D. ustulatus* Dej., *D. desertus* Motsch., and *D. abdominalis* Motsch. from the subgenus *Dicheirotichus*; re-descriptions of all-instar larvae for *D. gustavi* Crotch.; and more refined differential diagnosis of the subgenus together with a key to larvae of all the species.

MATERIALS AND METHODS

The present investigation was made using materials from collections of the Faculty of Zoology and Ecology, Moscow Pedagogical State University, Moscow (MPSU) and the Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZIN).



Figs. 1, 2. Subgenus *Dicheirot richus* s. str., general view and scheme of pigmentation of III-instar larvae. (1) *D. desertus* Motsch., (2) *D. gustavi* Crotch.

The material studied included: *D. gustavi* Crotch, 6 I-instar larvae, 2 II-instar larvae, and 1 III-instar larva; *D. desertus* Motsch., 2 II- and 4-III instar larvae; *D. abdominalis* Motsch., 2 II- and 4 III-instar larvae; and *D. ustulatus* Dej., 3 III-instar larvae.

D. gustavi larvae were identified according to keys by Arndt (1991, 1991a), Luff (1993), and Makarov (1994); larvae of *D. abdominalis* Motsch., *D. desertus* Motsch., and *D. ustulatus* Dej. were recognized provisionally on the basis of imaginal distribution.

To study the larval morphology, 12 total preparations in For-Berleze's solution were made. Examinations were conducted using an MBI-2 microscope with an AU-12 binocular attachment at magnifications of $\times 55.5$, $\times 120$, $\times 150$, and $\times 600$; and also with an MBS-1

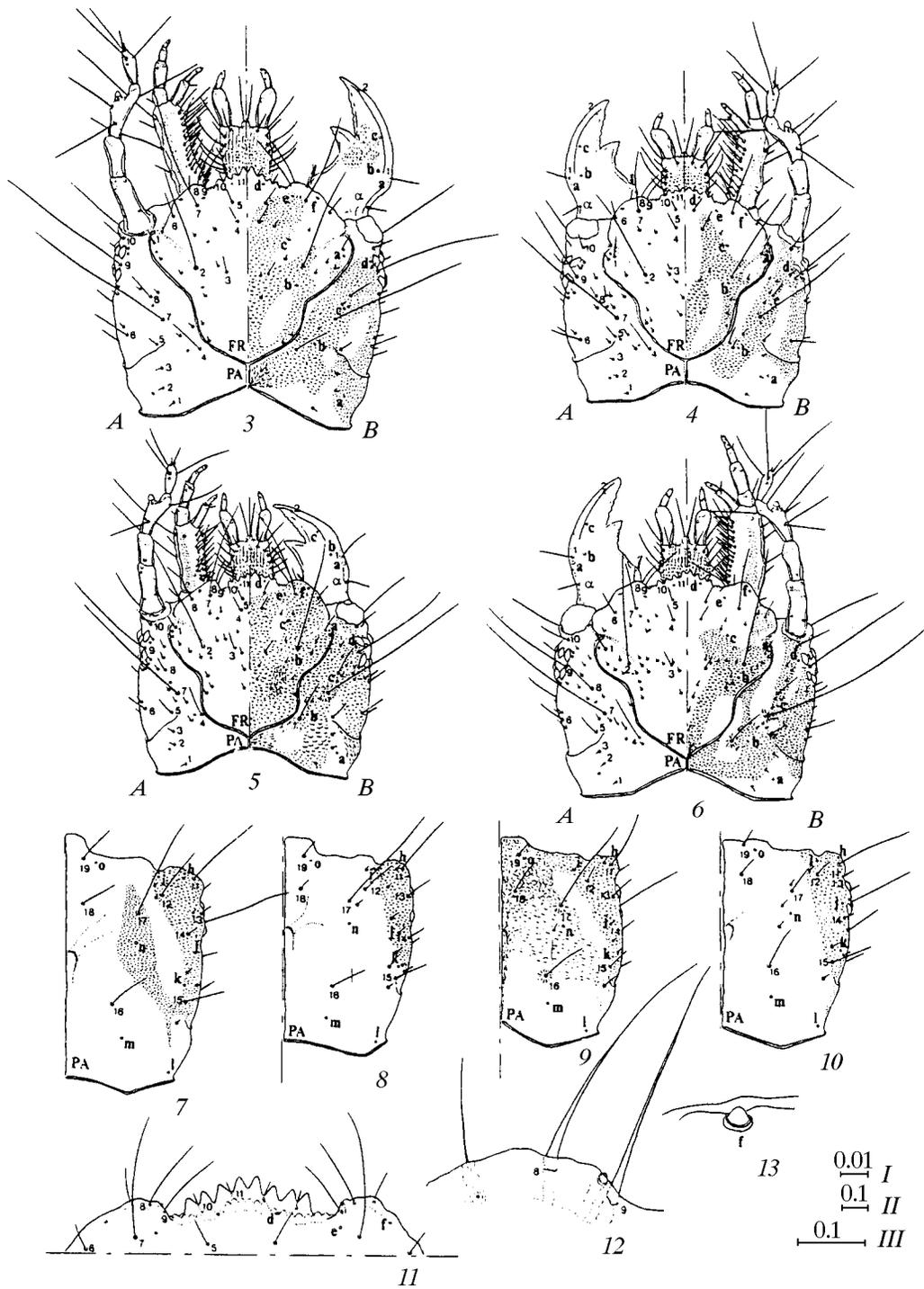
binocular microscope at magnifications of $\times 16$ and $\times 32$. The morphometric parameters were measured with the help of a standard ocular-micrometer. The results of morphometry are listed in the table. The standard deviations are given following the " \pm " sign.

The designation of primary chaetae and sensilla is given according to Bousquet and Goulet (1984); numeration of secondary chaetae on mandibles and urogomphus, to Bousquet (1985); sensillar classification, to Snodgrass (1935).

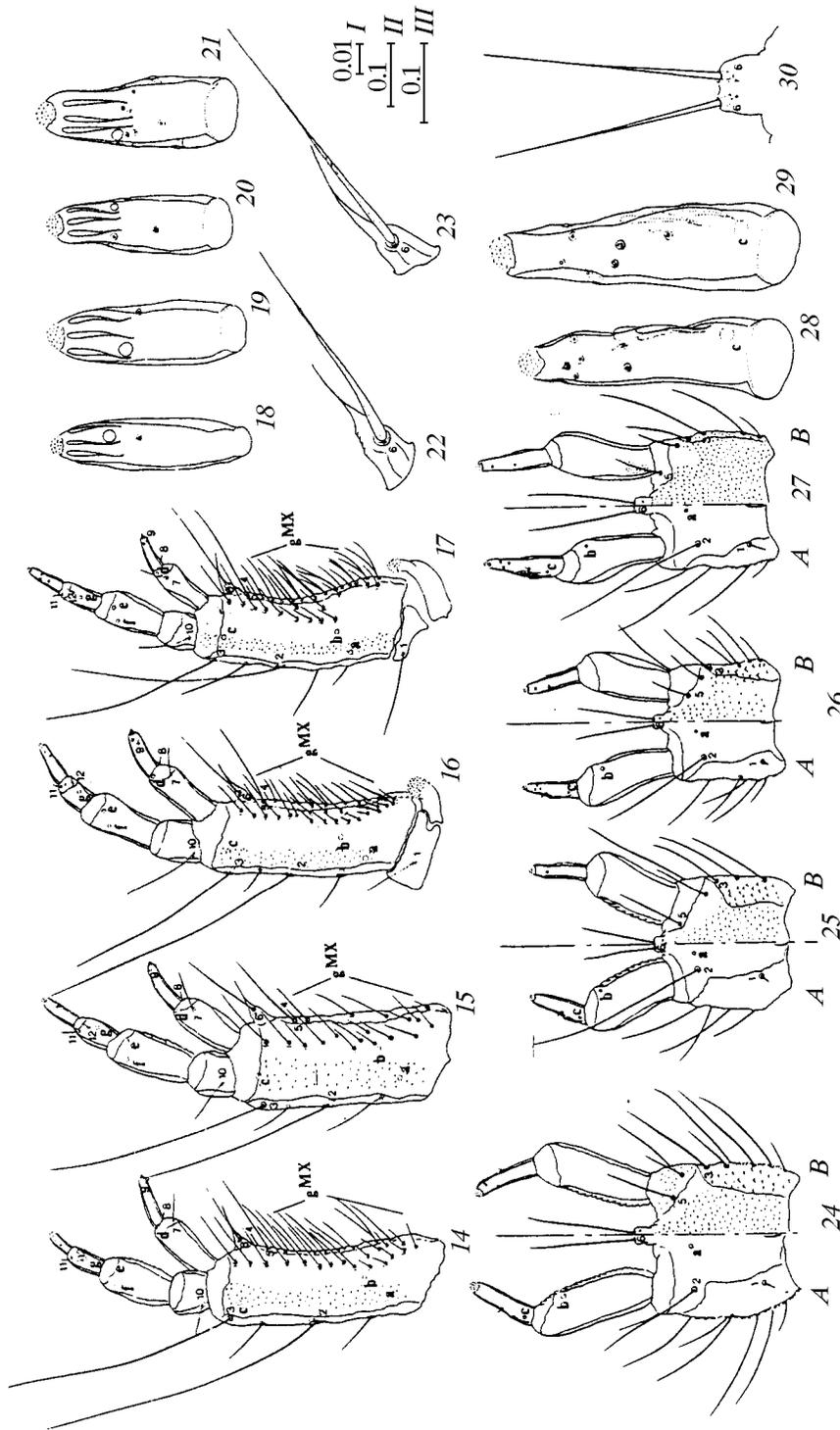
Genus *DICHEIROTRICHUS* Jacquelin du Val, 1857

Subgenus *Dicheirot richus* Jacquelin du Val, 1857

Comparison of larvae of *D. abdominalis* Motsch., *D. desertus* Motsch., and *D. ustulatus* Dej. with the



Figs. 3-13. Subgenus *Dicheirotichus* s. str., III-instar larvae. (3-6) Head capsule in dorsal view (A—without microsculpture, B— with microsculpture), (7-10) head capsule in ventral view, (11) nasale, (12) left plate of paraclypeus, (13) chaeta FR_r . FR—frontal sclerite, PA—parietal sclerite. (3, 7, 13) *D. gustavi* Crotch; (4, 8) *D. ustulatus* Dej.; (5, 9, 11) *D. desertus* Motsch.; (6, 10, 12) *D. abdominalis* Motsch. Scales: I—12-13, II—3-10, III—11.



Figs. 14-30. Subgenus *Dicheirotrichus* s. str., III-instar larvae. (14-17) Left maxilla, (18-21) fourth segment of maxillary palpi (in ventral view), (22, 23) labium, (24-27) labium (A—in ventral view, B—in dorsal view), (28, 29) second segment of labial palpi (in dorsal view); (30) ligula. (14, 18, 22, 24) *D. gustavi* Crotch.; (15, 19, 25, 28) *D. ustulatus* Dej.; (16, 20, 26) *D. desertus* Motsch.; (17, 21, 23, 27, 29, 30) *D. abdominalis* Motsch. Scales: I—18-23, 28-30; II—14, 17, III—15, 16 24-27.

larva of *D. gustavi* Crotch. and also a critical analysis of the descriptions of the latter have clarified the differential diagnosis of the subgenus. III-instar larvae being available for all the species, the differential diagnosis of the subgenus is based on characters of preimaginal larvae.

Differential diagnosis. Head capsule somewhat transverse (1.15-1.29 times wider than long), distinctly rounded laterally, with well developed microsculpture. Nasale weakly protruding, dentate, with two rows of denticles: upper row with 8 massive denticles, of which 2 central noticeably protruding for-

wards; lower row with 20–22 fine denticles (Fig. 11). Base of frontal sclerite somewhat constricted. Epicranial suture distinct, occipital sulcus long, extending to chaetae PA_5 and PA_{15} . Each paraclypeal facet with one long additional chaeta; one basiconical sensillum inserted between chaetae FR_3 and FR_6 on anterior margins of paraclypeus (Fig. 12). Mandibles massive, retinaculum situated near the middle and oriented anterodorsally at an angle of 35° , cutting edges of mandibles and those of retinaculum dentate (Figs. 3–6). Antennae distinctly longer than mandibles, with first and second segments bearing no additional chaetae; ventral surface at base of second segment with basiconical sensillum, first and third antennomeres of the same length. Lacinia slender, with drawn-out apex, laterally with chaeta MX_6 (Figs. 22, 23). Right maxilla with significantly greater number of chaetae in gMX than left one. Submentum subsquare (length/width ratio 0.75–1), ligula not pointed apically, chaetae LA_6 arranged strictly apically, chaeta LA_4 absent (Fig. 30). Abdominal tergites sclerotized, with well visible sutures, distinct carina separating pretergite and tergite, and well developed dentate microsculpture (Fig. 48). Hypopleurite with 7 chaetae. Urogomphus no less than 2.5 times longer than pygidium, with microsculpture along entire length: pretergite with distinct isodiametric reticulum, base of urogomphus intensively pectinate as far as the level of UR_β and uniformly finely-dentate more distally (Figs. 53–55).

Pores: PA_b lateral to chaeta PA_4 ; PA_c between chaetae PA_7 and PA_8 , PR_k lateral to PR_{12} , PR_1 apical to chaeta PR_{13} , ME_f lateral to chaeta ME_{13} , TE_b basad from TE_9 , TE_c lateral to TE_{10} . Chaeta TE_{11} short, no longer than secondary chaetae. Chaeta MN_a distinct, single. Chaeta UR_α represented by single chaeta or by a group of fine chaetae. gMX group with 23–45 chaetae on right maxilla and 19–40 on left one. Pore FR_f basiconical (Fig. 13). Femur with 4–6 thick secondary chaetae; trochanter without any. Secondary chaetae on thoracic and abdominal tergites rather abundant, fine.

Dicheirotrichus abdominalis Motschulsky, 1845.

Material. Khakassia, Abakan, alkali soil, I.V. Stebaev—2 L_2 , 3 L_3 (MPSU); Transbaikalia, 27 km SW of Kharanor, soda alkali soil, June 17, 1965, V.G. Morokovich—1 L_3 (MPSU).

Microsculpture. The best developed on head capsule, abdominal tergites, urogompha, and pygidial ter-

gite. Isodiametric reticulum only in area of sigillae on thoracic tergites, absent on abdominal sternites.

Head with rather coarse isodiametric reticulum from base of frontal sclerite to chaetae FR_2 – FR_1 and more delicate and thinner one near pore FR_c and chaeta FR_6 . Frontal base delicately-rugose at the boundary with epicranial suture. Parietal sclerite with isodiametric reticulum at epicranial suture and pore PA_b , and in the zone between chaetae PA_5 – PA_8 – PA_{10} and PA_{12} – PA_{15} (Figs. 6B; 10).

Abdominal tergites with continuous fine-dentate microsculpture. Pygidial tergite with delicate punctation.

Head. Brown-purple, 1.28 times wider than long. Abundant fine secondary chaetae inserted along frontal sutures, near chaetae FR_2 , FR_3 , PA_4 , PA_6 , PA_7 , PA_8 and pore FR_c , and along margin of eye field. Chaeta PA_7 1.15–1.18 times longer than chaeta PA_8 and 1.3–1.32 times longer than FR_2 (Fig. 6, c). Pore PA_j lies between chaetae PA_{13} and PA_{14} (Fig. 10).

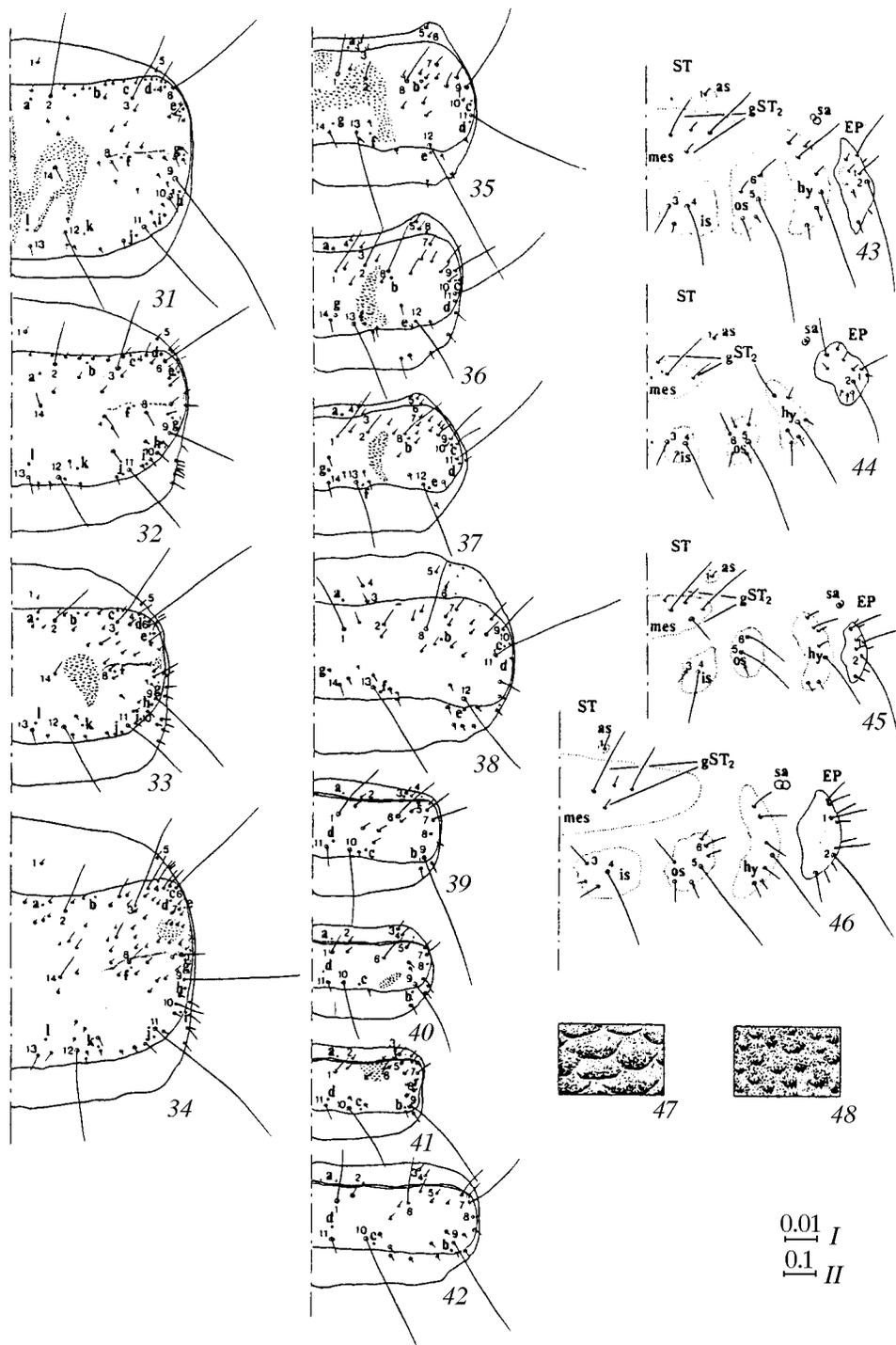
Labium transverse (length/width ratio 0.85), with uniformly finely dentate dorsal surface. Dorsolateral submental surface with 6 long chaetae. Second segment of labial palpi 1.25–1.27 times shorter than the first (Figs. 27, 29, 30).

Second antennomere 1.25–1.3 times longer than the fourth.

Maxillae slender, stipes 2.72–2.8 times longer than wide, having along outer margin a narrow band of finely dentate microsculpture bearing 5 chaetae. gMX chaetae arranged into two relatively regular rows: the outer significantly longer than the inner. Asymmetry of chaeta number in gMX on right and left maxillae considerable: 43–45 on right and 38–40 on left. First and fourth segments of maxillary palpi of the same length, 1.09–1.13 times shorter than the third and 1.63–1.69 times shorter than the second. Second galeal segment 1.4–1.5 times shorter than the first (Figs. 17, 21, 23).

Thoracic segments. Tergites yellow-brown, with abundant fine secondary chaetae along lateral margin and in dorsal third.

Prothorax transverse, 2.1–2.12 times wider than long. Chaeta PR_{11} 1.5 times longer than chaetae PR_6 and PR_9 and 2–2.2 times longer than PR_3 and PR_{12} . Chaetae PR_8 , PR_{10} , PR_{13} , and PR_{14} of about the same length and 7.5 times shorter than chaeta PR_{11} . Pore PR_f basad from chaeta PR_8 (Fig. 34).



Figs. 31–48. Subgenus *Dicheitrichus* s. str., III-instar larvae. (31–34) Prothorax, (35–38) mesothorax, (39–42) fourth abdominal tergite, (43–46) abdominal sternites, (47, 48) microsculpture of abdominal tergites. (31, 35, 39, 43) *D. gustavi* Crotch, (32, 36, 40, 44) *D. ustulatus* Dej., (33, 37, 41, 45) *D. desertus* Motsch., (34, 38, 42, 46) *D. abdominalis* Motsch. Scales: I—31–46, II—47, 48.

Basic morphometric indexes for larvae of 4 species of the subgenus *Dicheirotrichus* Jacq.

	<i>D. gustavi</i> Crotch			<i>D. ustulatus</i> Dej.	<i>D. desertus</i> Motsch.		<i>D. abdominalis</i> Motsch.	
	L_1	L_2	L_3	L_3	L_2	L_3	L_2	L_3
Total larva length	5.68±0.609	8.08±0.148	10.1±0.001	9.01±0.388	8.96±0.011	10.2±0.079	7.04±0.042	7.53±0.035
Head capsule length	0.69±0.021	0.84±0.005	0.92±0.002	0.79±0.021	0.70±0.007	0.84±0.011	0.64±0.007	0.73±0.007
Head capsule width	0.86±0.028	0.98±0.002	1.11±0.005	0.93±0.005	0.88±0.015	1.05±0.021	0.90±0.001	0.95±0.003
Prothorax length	0.38±0.005	0.46±0.003	0.63±0.003	0.49±0.109	0.48±0.003	0.56±0.009	0.47±0.009	0.65±0.005
Prothorax width	0.87±0.003	0.98±0.003	1.28±0.003	1.14±0.178	1.10±0.005	1.22±0.007	1.15±0.007	1.15±0.009
Mesothorax length	0.23±0.001	0.28±0.001	0.33±0.001	0.28±0.041	0.31±0.007	0.33±0.007	0.28±0.001	0.28±0.003
Mesothorax width	0.75±0.007	0.92±0.005	1.15±0.003	1.05±0.227	1.03±0.001	1.19±0.005	1.19±0.001	1.20±0.003
Urogomphus length	1.06±0.093	1.28±0.001	1.42±0.007	0.99±0.073	1.11±0.006	1.26±0.003	0.99±0.001	1.31±0.009
Pygidium length	0.33±0.015	0.38±0.003	0.41±0.003	0.41±0.001	0.40±0.001	0.47±0.005	0.37±0.004	0.42±0.007

Meso- and metathorax distinctly transverse, 4.1–4.2 times wider than long. Chaeta ME_{11} 1.62–1.72 times longer than ME_{12} and ME_{13} and 2.47–2.85 times longer than ME_1 , ME_8 , and ME_9 . Chaeta ME_{14} of the same length as ME_2 . Pore ME_b lateral to and somewhat lower than chaeta ME_8 at an angle of 45° , pore ME_d lateral to chaeta ME_{11} , pore ME_e basad from chaeta ME_{12} , pore ME_g anteromedially to chaeta ME_{14} at an angle of 45° (Fig. 38).

Legs slender, TA : TI : FE : TR length ratio 1.0 : 1.0 : 1.80 : 1.51. Ventral side of femur with 5 thick secondary chaetae; coxa with secondary chaetae: 6 apicad from CO_{12} ; 1, from CO_9 ; 2, from CO_s ; and 1, from CO_6 .

Abdominal segments. Tergites yellow-brown, with abundant fine secondary chaetae along lateral margin. Chaeta TE_{10} 1.12–1.13 times longer than chaeta TE_9 and 2.64–3 times longer than TE_1 , TE_6 , and TE_7 . Chaeta TE_{11} short, 3.4–3.5 times shorter than TE_6 . Pore TE_d apicad from chaeta TE_{11} (Fig. 42).

Abdominal sternites beige, with a larger set of chaeta. Mesosternite with 2 pairs of long chaetae and 2 pairs of short chaeta in between (gST_2); inner post-sternite with 4, outer one with 7 chaetae. Epipleurite with 5 chaetae near EP_2 , 3 basad 2 apicad, and 4 chaetae apicad from EP_1 (Fig. 46).

Cerci yellow-brown, 3–3.1 times longer than pygidium. Chaeta UR_4 the longest. Chaeta UR_α formed

by 7–9 fine chaetae. Chaetae UR_β and UR_2 of the same length; chaetae UR_γ and UR_ϵ 1.3–1.4 times shorter than UR_5 , chaeta UR_δ short, 4–4.3 times shorter than UR_γ and UR_ϵ (Fig. 52).

Pygidium slender, 2–2.1 times longer than wide. Chaetae PY_2 and PY_3 each having 1 fine secondary chaeta apicad; 3 short and 1 long chaetae apicad from PY_7 (Fig. 59).

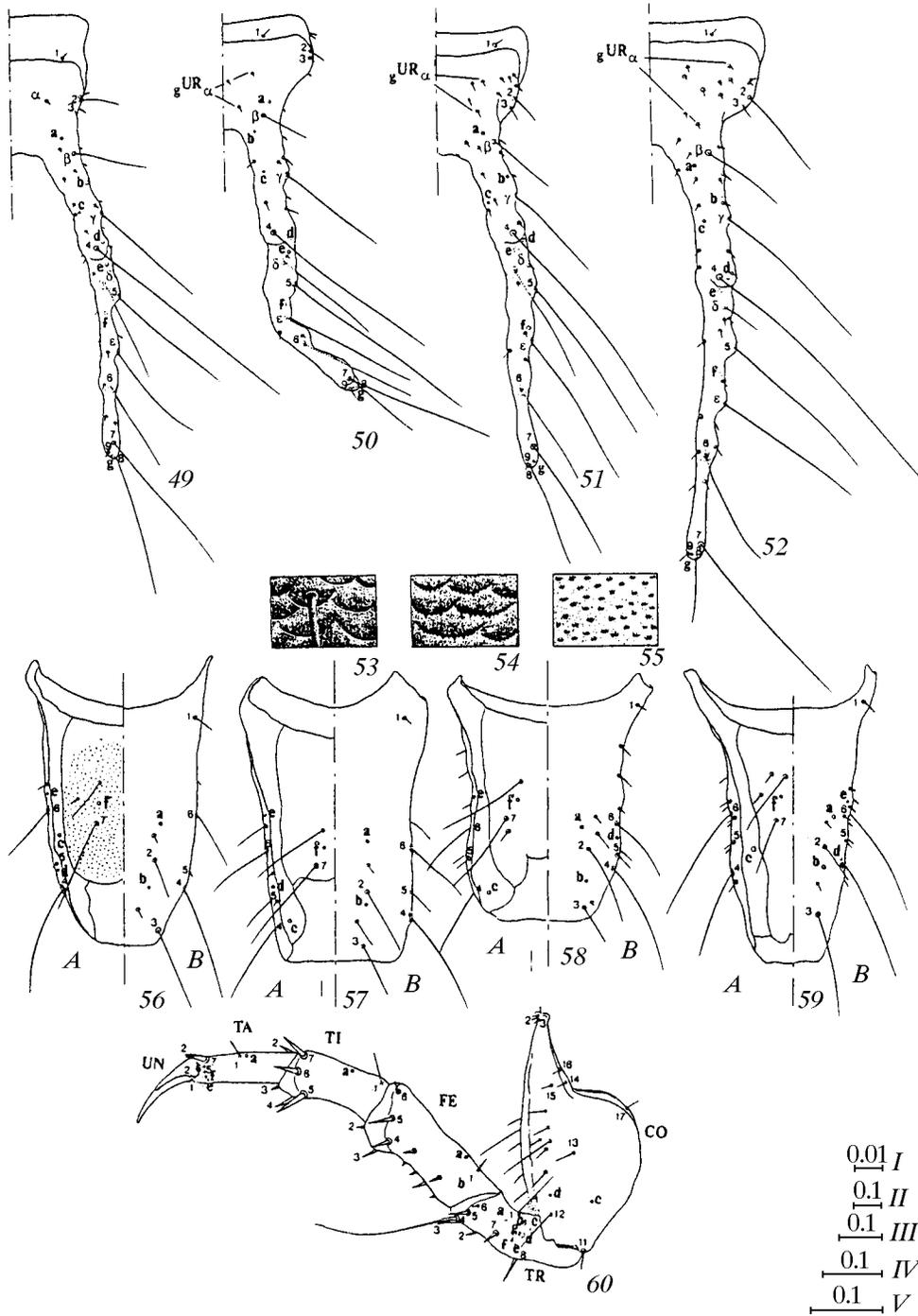
Instar differences. II-instar larvae differ in number of chaetae on outer surface of stipes and in gMX , submentum proportions, length ratio of leg segments, and smaller size (see the table).

Outer margin of stipes with 4 chaetae. Number of chaetae in gMX much less: 22–26 on right mandible, 18–20 on left one. Submentum square (length/width ratio: 1). Length ratio of TA : TI : FE : TR : 1.07 : 1.15 : 1.69 : 1.

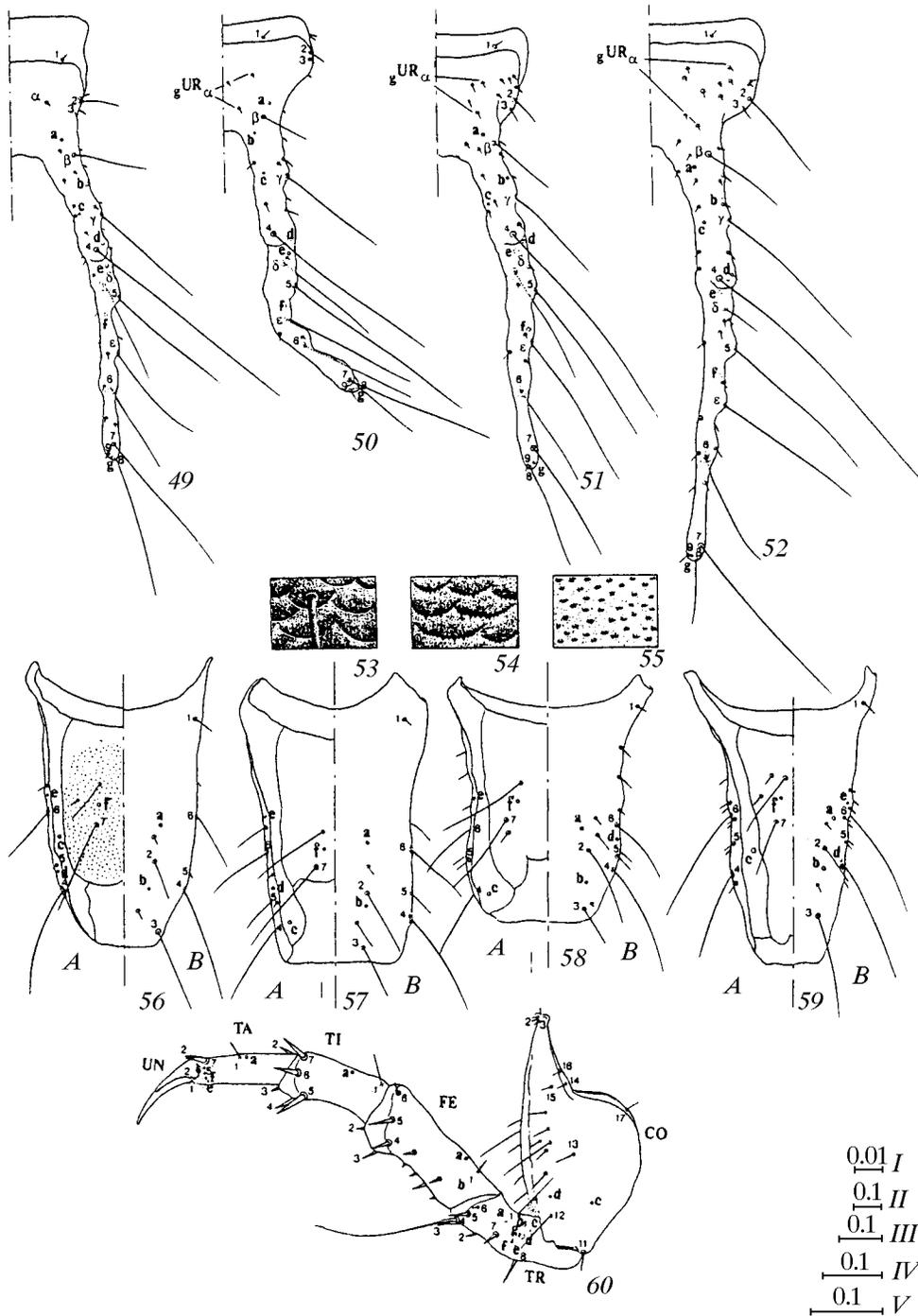
Dicheirotrichus desertus Motschulsky, 1850
(= *gotwaldi* Jedlička, 1966).

Scheme of pigmentation of III-instar larva shown in Fig. 1.

Material. Turgai Region, ? Kolodin, September 5, 1928, E.P. Luppova—1 L_3 (ZIN); Orenburg Region, Bolotovsk, alkali soil, May 19, 1968, L.V. Lapshin—2 L_3 (MPSU); Kalmykiya, settl. Tugtun, bank of Sarpa Lake, under plant detrite, May 9, 1973, S.V. Utyanskaya—1 L_3 (MPSU); Kalmykiya, Chernozemel'skii



Figs. 49–60. Subgenus *Dicheirotrichus* s. str., III-instar larvae. (49–52) Urogompha, (53–55) microsculpture of urogompha, (56–59) pygidium (A—in ventral view, B—in dorsal view), (60) leg. UN—ungues, TA—tarsus, TI—tibia, FE—femur, TR—trochanter, CO—coxa. (49, 56) *D. gustavi* Crotch, (50, 57) *D. ustulatus* Dej., (51, 58, 60) *D. desertus* Motsch., (52, 59) *D. abdominalis* Motsch. Scales: I—53–55; II—49; III—50–52, 60; IV—56, 59; V—57, 58.



Figs. 61–78. *Dicheirotichus gustavi* Crotch, I-instar larva. (61) Head capsule in dorsal view (A—without, B—with microsculpture), (62) head capsule in ventral view, (63, 64) nasale, (65) labium (A—in ventral view, B—in dorsal view), (66) left antenna, (67) right maxilla, (68) prothorax, (69) mesothorax, (70) fourth abdominal tergite, (71, 72) microsculpture of abdominal tergites, (73) abdominal sternites, (74) urogompha, (75, 76) microsculpture of urogompha, (77) pygidium (A—in ventral view, B—in dorsal view), (78) leg. FR—frontal sclerite, PA—parietal sclerite, UN—ungues, TA—tarsus, TI—tibia, FE—femur, TR—trochanter, CO—coxa. Scales: I—71, 72, 75, 76; II—61, 62, 74; III—66, 68, 70, 78; IV—73, 77; V—63–65, 67.

District, NW of Leninskii, alkali soil, April 18, 1982, S.V. Utyanskaya—2 L₂ (MPSU).

Microsculpture. The best developed on head capsule, abdominal tergites, eurugompha, and pygidial tergite. Thoracic tergites with isodiametric reticulum only at sigillae; abdominal sternites without microsculpture.

Head microsculpture developed to the greatest extent in comparison with other species of the subgenus. Frontal sclerite, except for nasale area, with continuous microsculpture: base with coarse reticulate microsculpture extending to the level of chaetae *FR*₃–*FR*₂ and turning into delicate and thin isodiametric striation closer to anterior margin. Dorsal surface of parietal sclerite between chaetae *PA*₄ and *PA*_{1–3} with coarse reticular sculpture farther turning into delicate isodiametric reticulum. Occiput, at each side of epicranial suture, and area of chaeta *PA*₇ delicately rugose. Ventral surface of parietal sclerite with isodiametric reticulum developed as far as the level of chaetae *PA*₁₂–*PA*₁₅; anterior part with delicate and dense reticular striation extending to the level of chaetae *PA*₁₃–*PA*₁₇ and sparse transverse striation basally to the level of chaeta *PA*₁₆ (Figs. 5B, 9).

Abdominal tergites with continuous finely dentate microsculpture. Pygidial tergite with fine punctation.

Head. Black-brown, 1.25–1.26 times wider than long. Scattered fine secondary chaetae arranged along frontal sutures, in area of chaetae *FR*₃, *PA*₇, *PA*₈, and *PA*₁₅, at pore *FR*_c, and also along margin of eye field. Chaeta *PA*₇ 1.1–1.15 times longer than *FR*₂ and 1.2–1.22 times longer than *PA*₉ (Fig. 5A). Pore *PA*_j close to chaeta *PA*₁₄ and lying somewhat apicad (Fig. 9).

Labium transverse (length/width ratio 0.75–0.8), with dentate heterogenic dorsal surface: denticles thinner and denser at the center and thicker and sparser laterally. Dorsolateral surface of submentum with 7 long chaetae. Second labial segment 1.4–1.5 times shorter than the first (Figs. 26, 28).

Second and fourth antennomeres of the same length.

Maxillae slender, stipes 2.9 times longer than wide, with a narrow bend of finely dentate microsculpture running along outer margin and bearing 4 chaetae. Chaetae in *gMX* arranged into two irregular rows. Asymmetry of chaeta number on right and left mandibles significant: 31–33 chaeta in right *gMX* and 27–29 in left one. First and fourth segments of maxillary palpi of the same length, 1.57–1.69 times shorter than

the second. Second segment of galea 1.35–1.38 times shorter than the first (Figs. 16, 20).

Thoracic segments. Tergites brown. Abundant fine secondary chaetae along lateral margin, lower than chaeta *PR*₃ and in area of chaeta *PR*₈.

Prothorax transverse, 2.14–2.15 times wider than long. Chaetae *PR*₆ and *PR*₉ of the same length, 1.25 times longer than *PR*₁₁ and *PR*₁₂ and 1.6–1.66 times, than *PR*₂ and *PR*₃. Chaetae *PR*₄, *PR*₈, *PR*₁₀, *PR*₁₃, and *PR*₁₄ of about the same length and 6.5–8.3 times shorter than *PR*₆ and *PR*₉. Pore *PR*_f close but somewhat lateral to chaeta *PR*₈ (Fig. 33).

Meso- and metathorax distinctly transverse, 3.55–3.58 times wider than long. Chaeta *ME*₁₁ 1.6 times longer than *ME*₁₂ and *ME*₁₃, twice as long as *ME*₉, and 2.5 times longer than *ME*₁ and *ME*₈. Chaeta *ME*₁₄ 2 times shorter than *ME*₂. Pore *ME*_b laterally to and somewhat lower than chaeta *ME*₈, pore *ME*_d basad from chaeta *ME*₁₁, pore *ME*_c lateral to *ME*₁₂, pore *ME*_g apicad from *ME*₁₄ (Fig. 37).

Legs slender, TA : TI : FE : TR length ratio 1.0 : 1.11 : 1.61 : 1.52. Ventral side of femur with 6 thick secondary chaetae, coxa with a group of 4 short and 1 long secondary chaetae distally to *CO*₁₂ (Fig. 60).

Abdominal segments. Abdominal tergites yellow-brown, with scattered fine secondary chaetae in area of chaetae *TE*₆, *TE*₇, and *TE*₉. Chaeta *TE*₉ 1.3–1.33 times longer than chaeta *TE*₁₀ and 2–2.5 times longer than *TE*₁, *TE*₆, and *TE*₇. Chaeta *TE*₁₁ short, 3.3–3.33 times shorter than *TE*₆. Pore *TE*_d laterally to and lower than chaeta *TE*₁₁ (Fig. 41).

Abdominal sternites beige, with a larger set of chaetae. Mesosternite bearing 2 pairs of long chaetae with 2 pairs of short chaetae in between and 1 pair of fine chaetae at the center (*gST*₂); inner poststernite with 3, outer one with 6 chaetae. Epipleurite with 6 fine secondary chaetae at *EP*₂ and 6 fine and 1 massive secondary chaetae at area of *EP*₁ (Fig. 45).

Cerci yellow-brown, 2.65–2.68 times longer than pygidium. Chaeta *UR*₄ the longest. Chaeta *UR*_α consisting of 5 fine chaetae. Chaetae *UR*_β and *UR*₂ of the same length. Chaetae *UR*_γ, *UR*_δ, and *UR*_ε 1.25 times shorter than chaeta *UR*₅ (Fig. 51).

Pygidium slender, 2.2 times longer than wide. Chaetae *PY*₂ and *PY*₆ each having 1 fine secondary chaeta apicad. Chaeta *PY*₇ with 1 short and 1 long secondary chaetae apicad.

Instar differences. II-instar larvae differ in number of chaetae in *gMX* and on abdominal sternites, shape of submentum, and smaller size (see the table).

The number of chaetae in *gMX* somewhat lower: 29–31 chaetae in right *gMX* and 27–29 in left one. Submentum is essentially square (length/width ratio: 0.93–0.95). Inner poststernite with 2, outer one with 3 chaetae. Epipleurite with 4 fine secondary chaetae at EP_2 and with 3 of these at EP_1 .

Dicheirotrichus gustavi Crotch, 1871
(= *pubescence* Paykull, 1790).

Scheme of pigmentation of I-instar larva shown in Fig. 2.

Material. Kandalaksha Reserve, littoral zone, August 21, 1977—6 L_1 , 1 L_2 , 1 L_3 (MPSU); White Sea, gulf of Kandalaksha, Kindo Peninsula, under alga drifts, July 28, 1988, A.O. Ben'kovskii—1 L_2 (MPSU).

Microsculpture. The best developed on head capsule, abdominal tergites, urogompha, and pygidium. Thoracic tergites with isodiametric reticulum only along anterior margin and in area of sigillae, abdominal sternites without any.

Head with distinct reticular sculpture nearly over whole frontal sclerite, except for areas of nasale and chaetae FR_1 , FR_6 , FR_7 , and FR_{8-9} and also small area at frons base. Parietal sclerite with the same sculpture on dorsolateral surface. Occipital area with distinct transverse striation on each side of epicranial suture (Figs. 3B, 7).

Abdominal pretergites with distinct isodiametric microsculpture up to transverse carina, finely dentate on the rest of surface (Figs. 47, 48).

Pygidial sternite with finely punctate microsculpture.

Head. Yellow-brown, 1.2–1.22 times wider than long. Scattered fine secondary chaetae at sinuses of frontal sutures and along margin of eye field. Chaeta PA_7 1.1–1.12 times longer than chaetae PA_9 , and 1.6 times longer than FR_2 (Fig. 3A). Pore PA_j laterally to chaeta PA_{14} (Fig. 7).

Labium square (length/width ratio 1), with dentate heterogenic dorsal surface: denticles thinner and denser at the center and thicker and sparser laterally. Dorsolateral surface of submentum with 8 long chae-

tae. Second segment of labial palpi 1.8–1.87 times shorter than the first (Fig. 24).

Second and fourth antennomeres of the same length.

Maxillae slender, stipes 3.2–3.22 times longer than wide, with finely dentate microsculpture on dorsal surface and 4 chaetae along outer margin. Chaetae in *gMX* forming two more or less distinct rows. Asymmetry of chaeta number in *gMX* on right and left mandibles insignificant: 30–32 chaetae in right *gMX*, 28–30 in left one. First and third segments of maxillary palpi of the same length, 1.4 times longer than the fourth and 1.9 times shorter than the second. Second segment of galea 1.3–1.33 times shorter than the first (Figs. 14, 18, 22).

Thoracic segments. Thoracic tergites black-brown, with scattered fine secondary chaetae borne, as a rule, along lateral margin.

Prothorax transverse, 2–2.1 times wider than long. Chaeta PR_9 1.9 times longer than PR_6 and PR_{11} and 2.7 times longer than PR_3 and PR_{12} . Chaetae PR_8 , PR_{13} , and PR_{14} of about the same length and 7 times shorter than chaeta PR_9 . Pore PR_f lies laterally to chaeta PR_8 (Fig. 31).

Meso- and metathorax distinctly transverse, 3.42–3.45 times wider than long. Chaeta ME_{12} 1.25–1.27 times longer than chaeta ME_{11} and 1.7–1.75 times longer than ME_{13} . Chaeta ME_{14} as long as ME_2 . Pore ME_b lies laterally to chaeta ME_8 , pore ME_d basad from chaeta ME_{11} , pore ME_e basad from chaeta ME_{12} , pore ME_g laterally to and somewhat above chaeta ME_{14} (Fig. 35).

Legs slender, TA : TI : FE : TR length ratio: 1.0 : 1.17 : 1.65 : 1.30. Ventral surface of femur with 6 thick secondary chaetae; coxa with 3 secondary chaetae distally to chaeta CO_{12} and 1 one distally to CO_{13} . Chaeta CO_{13} long, 1.6 times longer than CO_{12} .

Abdominal segments. Abdominal tergites black-brown. Secondary chaetae very fine and sparse. Chaeta TE_9 1.65–1.67 times longer than chaeta TE_{10} and 3.4–3.8 times longer than TE_1 , TE_6 , and TE_7 . Chaeta TE_{11} fine, twice as short as TE_6 . Pore TE_d lies laterally to and above chaeta TE_{11} (Fig. 39).

Abdominal sternites light-gray, with a larger set of chaetae. Mesosternite bearing 2 pairs of long chaetae with 2 pairs of short chaetae in between (gST_2); inner poststernite with 3, outer one with 5 chaetae. Epipleu-

rite with 3 chaetae basad from chaeta EP_2 and 4 chaetae apicad from chaeta EP_1 (Fig. 43).

Cerci yellow-brown, 3.4–3.45 times longer than pygidium, with chaetom significantly more complex because of the development of massive chaetae and a row of fine secondary chaetae. Chaeta UR_4 the most massive. Chaeta UR_α single, very fine. Chaeta UP_β slightly longer than chaeta UR_2 , chaetae UR_7 , UR_β , and UR_ϵ of about the same length and 1.2–1.25 times shorter than UR_5 (Fig. 49).

Pygidium massive, 1.55–1.58 times longer than wide, with several fine secondary chaetae apicad from PY_2 , PY_3 , and PY_7 (Fig. 56).

Instar differences. I-instar larvae differ in microsculpture of head capsule, presence of oviform denticles, homogenic dentate dorsal surface of submentum, hypopleurite without chaetae, absence of secondary chaetae (Figs. 61–78), and smaller size (see the table).

Head capsule 1.21–1.24 times wider than long, with well developed microsculpture. Frontal sclerite with thick, rather rough reticular microsculpture in the central area and delicate isodiametric striation laterally. Dorsolateral surface of parietal sclerite with distinct isodiametric sculpture as far as the level of PA_{12} – PA_{15} . Occipital area with distinct finely dentate microsculpture at each side of epicranial suture as far as the level PA_3 , PA_5 , and PA_7 (Figs. 61B, 62). 6–7 oviform denticles, of which 2 upper ones somewhat isolated and slightly more massive than the rest, form a row along frontal sutures at each side (Fig. 61A). Maxillae less slender, stipes only 2.4–2.5 times longer than wide. Characteristic feature: a large number of chaetae in gMX and their symmetry on right and left mandibles, 33–35 (Fig. 67). Submentum somewhat transverse (length/width ratio 0.86), with uniformly finely dentate dorsal surface (Fig. 65). Legs slender, TA : TI : FE : TR length ratio 1.35 : 1.0 : 1.37 : 1.27. Ventral surface of femur without additional chaetae (Fig. 78).

II- and III-instar larvae differ only in size (see the table).

Dicheirotichus ustulatus Dejean, 1829

Material. Kalmykia, Chernozemelskii district, NW of Leninskii, alkali soil, April 18, 1982, S.V. Utyanskaya—2 L_3 (MPSU); Kalmykia, Chernozemelskii district, NW of Leninskii, rush association, July 21, 1987, S.V. Utyanskaya—2 L_3 (MPSU).

Microsculpture. The best developed on head capsule, urogompha, and pygidium. Thoracic and abdominal tergites with delicate isodiametric reticulum along anterior margin and in area of sigillae; abdominal sternites without microsculpture.

Head with distinct isodiametric reticulum on frontal sclerite along frontal sutures as far as sinuses of frontal sutures, from base of sclerite to the level of chaeta FR_3 , along midline, and along the area between chaetae FR_2 and FR_5 . Parietal sclerite with isodiametric microsculpture along the line connecting chaetae PA_4 – PA_7 – PA_{10} and along lateral margin from the level of chaetae PA_6 – PA_9 to the level of PA_{12} – PA_{14} (Figs. 4B, 8).

Pygidial tergite and sternite with finely punctate microsculpture.

Head. Light-brown, 1.15–1.2 times wider than long, with fine secondary chaetae along frontal sutures, at chaetae FR_3 , PA_8 , PA_{12} , PA_{14} , PA_{15} , and PA_{17} , and also along margin of eye field. Chaeta PA_7 1.45–1.48 times longer than chaeta FR_2 and 1.6–1.66 times longer than PA_9 (Fig. 4A). Pore PA_j anteromedially to chaeta PA_{14} (Fig. 8).

Labium transverse (length/width ratio 0.82–0.88), with dentate heterogenic dorsal surface: denticles thinner and denser in the central area and larger and sparser laterally. Dorsolateral surface of submentum with 5 long chaetae. Second segment of labial palpi 1.55–1.57 times shorter than the first (Fig. 25).

Second and fourth antennomeres of the same length.

Maxillae stumpy, stipes 2.1–2.16 times longer than wide, with finely dentate sculpture on dorsal surface and with 4 chaetae along outer margin. Chaetae in gMX forming two irregular rows. The number of chaetae in gMX on right and left maxillae significantly assymmetric: 21–25 chaetae in right gMX and 18–21 in left one. Third and fourth segment of maxillary palpi of the same length, first one 1.8–1.9 times shorter than the second. Second segment of galea 1.3–1.33 times shorter than the first (Figs. 15, 19).

Thoracic segments. Thoracic tergites brown-purple, with rather abundant fine secondary chaetae along lateral margin.

Prothorax transverse, 2.2–2.4 times wider than long. Chaeta PR_6 1.26 times longer than chaetae PR_9 and PR_{11} and 1.5–1.52 times longer than PR_3 and PR_{12} . Chaetae PR_8 , PR_{10} , PR_{13} , and PR_{14} of about the same

length and 7.5 times shorter than PR_6 . Pore PR_f lies anteromedially to chaeta PR_8 (Fig. 32).

Meso- and metathorax distinctly transverse, 3.54–3.92 times wider than long. Chaeta ME_{11} 1.33–1.36 times longer than chaetae ME_{12} and ME_{13} , 1.55–1.6 times longer than ME_{13} . Chaeta ME_{14} twice shorter than ME_2 . Pore ME_b lies basad from chaeta ME_8 , pore ME_d basad from chaeta ME_{11} , pore ME_e medially to and somewhat lower than chaeta ME_{12} , pore ME_g lateral to and slightly above chaeta ME_{14} (Fig. 36).

Legs slender, TA : TI : FE : TR length ratio 1.0 : 1.0 : 1.40 : 1.25. Ventral side of femur with 4 thick secondary chaetae, coxa without additional chaetae.

Abdominal segments. Abdominal tergites brown-purple, with scattered fine secondary chaetae in area of chaeta TE_9 . The latter 1.2 times longer than chaeta TE_{10} and 3–3.75 times longer than chaetae TE_1 , TE_6 , and TE_7 . Chaeta TE_{11} fine, 2.5 times shorter than TE_6 . Pore TE_d lies anteromedially to chaeta TE_{11} (Fig. 40).

Abdominal sternites light-brown, with a larger set of chaetae. Mesosternite with 2 pairs of long chaetae and 1 pair of short ones (gST_2); inner poststernite with 3, outer one with 6 chaetae. Epipleurite with 3 fine chaetae basad from chaeta EP_2 and with 4 fine and 1 massive chaetae apicad from EP_1 (Fig. 44).

Cerci brown-purple, 2.45–2.47 times longer than pygidium. Chaeta UR_4 the longest. Chaeta UR_α formed by 3 fine chaetae. Chaeta UR_β twice as long as chaeta UR_2 ; chaetae UR_γ , UR_β , and UR_ϵ of about the same length and 1.42–1.66 times shorter than UR_5 (Fig. 50).

Pygidium stumpy, 1.6 times longer than wide. Chaetae PY_2 and PY_7 each with 1 fine secondary chaeta closer to apex. Chaeta PY_7 with 1 long secondary chaeta closer to apex (Fig. 57).

*Key to Larvae of Preimaginal Stages in the Subgenus
Dicheirotrichus Jacq.*

1(2). Larvae sharply bicolored: head and urogompha yellow-brown, tergites varying from black to black-brown. Urogompha long, nearly 3.5 times longer than pygidium. Chaeta UR_α fine, single. First segment of maxillary palpi twice shorter than the second. The number of gMX chaetae on maxillae nearly identical: 30–32 chaetae on right maxilla and 29–31, on left one. Pore PA_j lying apicad from PA_{14} 3.

2(1) Larvae unicolored except for somewhat darker head. Urogompha shorter, no more than 3.2 times longer than pygidium. UR_α formed by group of fine chaetae. First segment of maxillary palpi only 1.7 times shorter than the second. Asymmetry of chaeta number in gMX on right and left mandibles significant. Pore PA_j lying apicad from chaeta PA_{14} 3.

3(4). Second antennal segment markedly longer than the fourth. First segment of galea more than 1.5 times longer than the second. Stipes with 5 chaetae along outer margin. gMX with 43–45 chaetae on right maxilla and 38–40, on left one. First segment of labial palpi less than 1.5 times longer than the second. Urogompha relatively long, 3–3.1 times longer than pygidium. Group UR_α consisting of 7–9 fine chaetae. Tarsus and tibia combined only slightly longer than femur. Pore PR_f lying basad from chaeta PR_8 , pore ME_d laterally to chaeta ME_{11} . Width of head capsule 0.9 mm in L_2 , 0.95 mm in L_3 *D. abdominalis* Motsch.

4(3). Second and fourth antennomeres of the same length. First segment of galea less than 1.5 times longer than the second. Stipes with 4 chaetae along outer margin. gMX with no more than 35 chaetae. First segment of labial palpi more than 1.5 times longer than the second. Urogompha relatively short, no more than 2.8 times longer than pygidium. Group UR_α includes no more than 5 chaetae. Tarsus and tibia combined significantly longer than femur. Pore PR_f lying medially or laterally to chaeta PR_8 , pore ME_d basad from chaeta ME_{11} 5.

5(6). Stipes slender, nearly 3 times longer than wide. gMX with 31–33 chaetae on right maxilla and 27–29, on left one. Dorsolateral surface of submentum with 7 long chaetae. Urogompha more than 2.5 times longer than pygidium. UR_α consisting of 5 fine chaetae. Mesosternite with 10 chaetae. Ventral surface of femur with 6 thick secondary chaetae. Pore PR_f lying laterally to chaetae PR_8 , pore ME_b laterally to chaeta ME_8 . Width of head capsule 0.88 mm in L_2 , 1.05 mm in L_3 .

6(5). Stipes stumpy, less than 2.5 times longer than wide. gMX with 21–25 chaetae on right maxilla and 18–21 on left one. Dorsolateral surface of

submentum with 5 long chaetae. Urogompha less than 2.5 times longer than pygidium. UR_{α} formed by 3 fine chaetae. Mesosternite with 6 chaetae. Ventral surface of femur with 4 thick secondary chaetae. Pore PR_f lying anteromedially to chaetae PR_8 , pore ME_b basad from chaeta ME_8 . Width of head capsule 0.93–0.94 mm in L_3 .

CONCLUSION

In summary, some details of morphology of *Dicheirotrichus* larvae, unknown previously for the tribe Stenolophina, should be mentioned. The asymmetry of chaeta number in gMX is of prime interest. All the known species exhibit the reliably larger (except *D. gustavi* Crotch) number of chaetae in gMX on the right maxilla. At present it is difficult to explain this phenomenon because no information of this kind is available for Carabidae larvae in the publications known to me. Moreover, according to my observations, larvae of the genus *Stenolophus* Steph. are characterized by identical number of chaetae in gMX on both maxillae.

To estimate relations between species of this subgenus, 52 qualitative characters (the extent of development of microsculpture, chaetotaxy, etc.) have been analyzed. The extent of similarity was determined using the Jacquard coefficient. The results of a cluster analysis performed by the pair-unweighted-average method have shown that the general level of similarity is rather high (the coefficient of similarity > 0.6). The highest similarity is observed in larvae of *D. gustavi* Crotch and *D. desertus* Motsch. (0.87), with the *D. usutulatus* Dej. larva being very closely related to them (0.82). The *D. abdominalis* Motsch. larva is the most isolated in having the largest number of unique morphologic characters (for example: second antennomere is markedly longer than the fourth, group UR_{α} is formed by 7–9 fine chaetae, pore PR_f is lying basad from chaeta PR_8 , pore ME_d , laterally to chaeta ME_{11} , etc.). It should be noted that these results are preliminary and will be refined in the next communication by comparison with other genera of the subtribe.

ACKNOWLEDGMENTS

The author expresses deep gratitude to an assistant professor of the Faculty of Zoology and Ecology,

Moscow Pedagogical State University, K.V. Makarov, for the valuable constructive remarks on of the structure of this paper.

The present work was financially supported by the Russian Foundation for Basic Research, project no. 93-04-20191.

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