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Description of *Haliphus* larvae from Lebanon (Coleoptera: Haliplidae)

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Abstract

The third instar larvae of *Haliphus kulleri* VONDEL and *H. maculatus* MOTSCHULSKY (Coleoptera: Haliplidae) are described from Lebanon. The first and second instar larvae of *Haliphus kulleri* or *maculatus* are described although the two species could not be separated. *Haliphus maculatus* is reported from Lebanon for the first time. Chaetotaxy of legs is discussed.

Key words: Coleoptera, Haliplidae, larva, Lebanon.

Introduction

In 2002 and 2003 A. van Nieuwenhuijzen and R.I. Storey examined the water insect fauna of the Aammiq wetlands in the Bekaa Valley in Lebanon. During that research adults of four species of Haliplidae were collected: *Haliphus lineatocollis* (MARSHAM, 1802), *H. kulleri* VONDEL, 1988, *H. maculatus* MOTSCHULSKY, 1860 and *Peltodytes caesus* (DUFTSCHMID, 1805) (van Nieuwenhuijzen, personal communication). Together with these adults a number of larvae was collected. I had the opportunity to examine some of these larvae.

Material and methods

Two 1st instar larvae, about 15 2nd instar larvae and about 30 3rd instar larvae from Lebanon, (Aammiq Marsh, the Bekaa, 2.V–27.VII.2002, leg. R. Storey) were examined.

Methods used are according to VONDEL (1997). The leg chaetotaxy is examined according to NILSSON (1988). Legs were embedded in Euparal and observed at a magnification of up to 400x in a light microscope provided with a phase-contrast system and a photo-tube.

The larvae of *Haliphus lineatocollis* and *Peltodytes caesus* are well known (VONDEL 1997) and clearly differing from the larvae treated here, which leads to the conclusion that these larvae almost certainly belong to *H. kulleri* and/or *H. maculatus*. In the third instar material it is possible to recognize two different size groups. As the adults of *H. maculatus* are clearly larger than those of *H. kulleri*, it is most likely that in the larvae this is also the case. In this paper the larger specimens are therefore described as *H. maculatus* and the smaller ones as *H. kulleri*. So far I failed to recognize two different groups in the first and second stage material. I am not yet able to assign them to one of the two species and so I will describe them here as *Haliphus kulleri/maculatus*.

Faunistics

Only three species of Haliplidae were recorded from Lebanon so far (VONDEL 2005): *Haliplus kulleri*, *H. lineatocollis* and *Peltodytes caesus*. Therefore, *Haliplus maculatus* is here recorded from Lebanon for the first time.

Descriptions of third instar larvae

Haliplus kulleri VONDEL, 1988 (Figs. 1–11)

MATERIAL EXAMINED: 12 3rd instar larvae (in authors collection).

DESCRIPTION: Total length 7.7–9.3 mm. Shape elongate and subcylindrical (Fig. 1). Surface on dorsal and ventral side covered with small tubercles (microtracheal gills), dorsally yellowish brown, at most vaguely maculated, ventrally yellow to yellowish brown. Measurements are given in Table 1.

Head: Oval to rectangular. Mandible with long narrow apex, sucking channel running to the apex and ending ventrally in an oval opening, one spine on outer margin (Fig. 5). Eyes consisting of six ocelli grouped together. Antenna with segments 1 and 2 of same length and segment 3 about $5-6 \times$ as long as segment 2, on its apex two narrow parallel segments, of which one has a bristle (Fig. 4).

Thorax: Thoracic segments laterally with backward directed extensions, dorsally with four weak extensions on hind margin. Dorsal surface densely covered with tubercles, tubercles on extensions darkened (Fig. 2).

Legs: Protibia simple, distally not dilated, the location of sensillae on anterior and posterior side of legs is shown in Figs. 6–11.

Abdomen: Abdominal segments 1–9 with lateral extensions, segments 1–7 dorsally with four extensions (Fig. 2) and segments 8 and 9 with two extensions on hind margin (Fig. 3). Dorsal surface partly covered with tubercles, tubercles on extensions darkened. Abdominal segment 10 usually with approximately 95 % fused urogomphi (Fig. 1). Abdominal segments ventrally with small tubercles.

DIFFERENTIAL CHARACTERS: The differences between *H. kulleri* and *H. maculatus* are listed in Table 2.

Haliplus maculatus MOTSCHULSKY, 1860 (Figs. 12–22)

MATERIAL EXAMINED: 10 3rd instar larvae (in authors collection).

DESCRIPTION: Total length 11–12 mm. Shape elongate and subcylindrical (Fig. 12). Surface on dorsal and ventral side covered with small tubercles (microtracheal gills), dorsally yellow to yellowish brown, at most vaguely maculated, ventrally yellow to yellowish brown. Measurements are given in Table 1.

Head: Approximately rectangular. Mandible with broad base and nipple-like apex, 1 spine on outer margin (often broken off), sucking channel running to the apex and ending ventrally in an oval opening (Fig. 16). Eyes consisting of six ocelli grouped together. Antenna with segments 1 and 2 of same length, segment 3 about $5 \times$ as long as segment 2, on its apex two narrow parallel segments, one of these with a bristle (Fig. 15).

Table 1: Measurements of the 3rd instar larvae of *Haliphus kulleri* and *H. maculatus* (in mm).

	<i>H. kulleri</i> (n = 12)	<i>H. maculatus</i> (n = 10)
Total length	7.70–9.30	11.00–12.00
Length from mandible to apex of abdominal segment 9	5.90–6.50	7.60–8.80
Length of abdominal segment 10	1.80–2.80	3.20–3.70
Length of head including mandibles	0.43–0.50	0.50–0.55
Width of head including eyes	0.63–0.70	0.70–0.75
Antenna		
Length of segment 2	0.02	0.03
Length of segment 3	0.11	0.15
Ratio segments 2–3	5.5:1	5:1
Mandible		
Length from apex to hind lobe	0.22	0.25
Pronotum		
Length	0.68–0.75	0.80–0.85
Width	1.28–1.50	1.65–1.80
Mesonotum		
Length	0.43–0.50	0.52–0.55
Width	1.20–1.45	1.50–1.70
Metanotum		
Length	0.39–0.45	0.47–0.50
Width	1.20–1.45	1.50–1.60

Thorax: Thoracic segments laterally with a long backward directed extension, dorsally, on hind margin, with two strong narrow inner extensions and two small outer extensions, consisting of a few dark tubercles. Dorsal surface partly covered with tubercles, tubercles on extensions darkened (Fig. 13).

Legs: Protibia simple, distally not dilated, the location of sensillae on anterior and posterior sides of legs is shown in Figs. 17–22.

Abdomen: Abdominal segments 1–9 with long lateral extensions and dorsally, on hind margin, with two strong narrow inner extensions and two small outer extensions, consisting of a few dark tubercles. Outer extensions absent on abdominal segments 8 and 9. Dorsal surface partly covered with tubercles, tubercles on extensions darkened. Abdominal segment 10 with completely fused urogomphi. Abdominal segments ventrally with small tubercles.

DIFFERENTIAL CHARACTERS: The differences between *H. maculatus* and *H. kulleri* are listed in Table 2.

Table 2: Significant differences between 3rd instar larvae of *Haliphus kulleri* and *H. maculatus*.

Character	<i>H. kulleri</i>	<i>H. maculatus</i>
Total length	7.7–9.3 mm	11.0–12.0 mm
Width of pronotum	1.3–1.5 mm	1.65–1.80 mm
Dorsal extensions on hind margin of thorax and abdominal segments 1–7	Inner and outer extensions nearly equal in length	Inner extensions clearly longer than outer ones
Urogomphi	About 95 % fused	Completely fused
Secondary setae on profemur	8	15–16
Secondary setae of mesofemur	10	13–14
Secondary setae on metafemur	7	15–17

Description of first and second instar larvae

Haliphus kulleri/maculatus first instar (Figs. 23–29)

MATERIAL EXAMINED: 2 1st instar larvae (in authors collection).

DESCRIPTION: Total length 1.6–1.9 mm. Shape wedge like, with wide head and body tapering backwards (Fig. 23). Surface on dorsal and ventral side smooth without clearly visible structure, dorsally and ventrally yellowish white. Measurements are given in Table 3.

Head: Oval to rectangular. Mandible with long narrow apex, sucking channel running to the apex, one spine on outer margin (not visible in second specimen). Eyes consisting of six ocelli grouped together. Antenna with segments 1 and 2 of same length and segment 3 about 6 × as long as segment 2, on its apex two narrow parallel segments, of which one has a bristle (Fig. 23).

Thorax: Prothoracic segment laterally with long forked unsegmented extensions (tracheal gills) and a smaller one anteriorly, dorsally in anterior part with two long unsegmented extensions and posteriorly with two long and two short extensions. Meso- and metathoracic segments laterally with long forked extensions, dorsally with two long and two very short extensions. All extensions distally with a long seta (often broken off) (Fig. 23).

Legs: Protibia simple, distally not dilated, the location of sensillae on anterior and posterior side of legs is shown in Figs. 24–29. Details of coxae and trochanters are however not clearly visible because of a great number of diatoms covering the body.

Abdomen: Abdominal segments 1–9 with long lateral extensions, segments 1–7 dorsally with two long and two very short extensions (Fig. 23) and segments 8 and 9 with two long extensions on hind margin (Fig. 23). Dorsal surface without clearly visible structure. Abdominal segment 10 with approximately 50 % fused urogomphi (Fig. 23). Abdominal segments ventrally without clearly visible structure.

Haliphus kulleri/maculatus second instar (Figs. 30–36)

MATERIAL EXAMINED: 8 2nd instar larvae (in authors collection).

DESCRIPTION: Total length 3.1–3.9 mm. Shape elongate and subcylindrical, tapering behind the middle (Fig. 30). Surface on dorsal and ventral side generally smooth without clearly visible structure, dorsally yellowish brown, ventrally yellow to yellowish brown. Measurements are given in Table 3.

Head: Circular to rectangular. Mandible with long narrow apex, sucking channel running to the apex and ending ventrally in an oval opening, one spine on outer margin. Eyes consisting of six ocelli grouped together. Antenna with segments 1 and 2 of same length and segment 3 about 4 × as long as segment 2, on its apex two narrow parallel segments, of which one has a bristle.

Thorax: Thoracic segments laterally with backward directed extensions, which are anteriorly provided with tubercles (tracheal gills). Prothorax dorsally with two strong and two small extensions on hind margin, provided with tubercles and in anterior part with two small extensions. Dorsal surface in anterior part with some small tubercles. Meso- and metathorax dorsally with two strong and two small extensions on hind margin and in anterior part with two tubercles. Legs: Protibia simple, distally not dilated, the location of sensillae on anterior and posterior side of legs is shown in Figs. 31–36.

Abdomen: Abdominal segments 1–9 laterally with backward directed extensions, which are anteriorly provided with tubercles (tracheal gills). Segments 1–7 dorsally with two strong and

two small extensions on hind margin and two tubercles in anterior part (Fig. 30) and segments 8 and 9 with two extensions on hind margin (Fig. 30). Abdominal segment 10 usually with approximately 90 % fused urogomphi, provided with long tubercles (Fig. 30).

Table 3: Measurements of the 1st and 2nd instar larvae of *Haliphus kulleri/maculatus* (in mm).

	1 st instar (n = 2)	2 nd instar (n = 8)
Total length	1.50–1.70	3.10–3.90
Length from mandible to apex of abdominal segment 9	1.0–1.15	2.10–2.80
Length of abdominal segment 10	0.50–0.55	1.00–1.10
Length of head including mandibles	0.22–0.24	0.32–0.36
Width of head including eyes	0.29–0.30	0.40–0.44
Antenna		
Length of segment 2	0.018	0.03
Length of segment 3	0.11	0.12
Ratio segments 2–3	6:1	4:1
Mandible		
Length from apex to hind lobe	0.11	0.16
Pronotum		
Length	0.14–0.17	0.24–0.32
Width	0.26–0.32	0.46–0.56
Mesonotum		
Length	0.09–0.10	0.20–0.21
Width	0.22–0.28	0.40–0.56
Metanotum		
Length	0.09–0.10	0.20–0.21
Width	0.20–0.26	0.40–0.56

Leg chaetotaxy

The two available first instar larvae were examined. Both are, one more than the other, covered with diatoms, which makes it difficult to recognize some details of the body, coxae and trochanters. The chaetotaxy of the femur, tibia and tarsus is illustrated in Figs. 24–29. NILSSON (1988) figured the primary sensillae (or setae) of *Haliphus lineolatus* MANNERHEIM. Although there are some differences between *H. lineolatus* and *H. kulleri/maculatus* I used Nilssons numbering as far as possible. Figs. 31–36 show the leg chaetotaxy of one of the 2nd instar larvae, but in other specimens there seem to be some differences in the number of sensillae especially of the tarsus. If this is a differential character for *H. kulleri* and *H. maculatus* is not clear to me now, but can probably be solved after further research. Figs. 6–11 and Figs. 17–22 show the leg chaetotaxy of 3rd instar larvae of *H. kulleri* and *H. maculatus* respectively. There is a number of differences in the two 3rd instar larvae as illustrated, but if these are all constant is not sure, because sometimes setae are broken off or are hardly visible in the microscopic slide.

The main difference is that *H. maculatus* has more secondary setae on the femur than *H. kulleri*: 15–16, 13–14, 15–17 on the pro-, meso- and metafemur respectively in *H. maculatus*, while these numbers are 8, 10, 7 in *H. kulleri*. More specifically on the dorsal side of the femur (series D) these numbers are 5–6, 4–5, 5–7 in *H. maculatus* and 3, 0, 3 in *H. kulleri*.

Only very few 1st instar larvae of Haliplidae were described so far and more research on leg chaetotaxy is needed before further conclusions are possible.

In Table 4 the primary and supposed secondary sensillae are listed for three larval instars.

Table 4: Position of sensillae (setae) on legs of larvae (instar I, II and III) of *Haliphus kulleri/maculatus*. Numbering corresponds to homologous adephagan setae (BOUSQUET & GOULET 1984, NILSSON 1988); numbering with an asterisk refers to additional setae; positions as in WOLFE & ROUGHLEY (1985): A = anterior, D = dorsal, Di = distal, P = posterior, Pr = proximal, V = ventral. Indication for separate legs: x = foreleg, y = midleg, z = hindleg. Setae in series are only specified when already present in 2nd instar.

Sensillae	Position	present or number in series in 1 st instar <i>kulleri/maculatus</i>	present or number in series in 2 nd instar <i>kulleri/maculatus</i>	present or number in series in 3 rd instar <i>kulleri</i>	present or number in series in 3 rd instar <i>maculatus</i>
CO1	DPr	???	y	yz	x
CO2	APr	???	xy		yz
CO3	APr	???	xyz	xy	z
CO4	APr	???		xy	xyz
CO5	A	???	xyz	xy	xz
CO6	A	???			
CO7	A	???	z	xyz	xyz
CO8	ADi	???		x	xz
CO9	ADi	???	xyz	xyz	xyz
CO10	ADi	???	xyz	yz	xyz
CO11	PDi	???	y	xyz	xyz
CO12	PDi	???	yz	xyz	xy
CO13	P	???	xy	xz	xyz
CO14	PPr	???	x	xz	xz
CO15	PPr	???	x	xz	
CO16	DPr	???		y	xy
CO17	VPr	???		z	
CO18	APr	???			yz
CO19*	PPr				y
CO20*	P				y
CO21*	V				y
CO22*	A				y
CO23*	PPr		x	x	
CO24*	PPr			x	
CO25*	V				y
TR1	D	???	xyz	xyz	xyz
TR2	A	???	xy	xyz	xyz
TR3	ADi	x??	xyz	xyz	xyz
TR4	VDi	???	xyz	x	
TR5	PDi	x??	xyz	yz	xyz
TR6	PDi	???	y	xz	
TR7	V	???	yz	xyz	xyz
TR8*	P	???		y	
TR9*	VPr				y
TR10*	PPr				
FE1	DPr		z	xz	xz
FE2	ADi	xyz	xyz	xyz	xyz
FE3	ADi	xyz	xyz	xyz	xyz
FE4	PDi	xyz	xyz	xyz	xyz
FE5	PDi	xyz	xyz	xy	xyz
FE6	PDi		x	z	xy
FE series D	D			x:3, y:0, z:3	x:5-6, y:3-4, z:5-7
FE series A	A			x:0, y:3, z:2	x:3, y:2, z:4
FE series P	P			x:2, y:3, z:0	x:4, y:2, z:2
FE series AV	AV			x:1, y:3, z:2	x:1, y:3, z:3
FE series PV	PV			x:2, y:1, z:0	x:2, y:2, z:1
FE7*	A		xyz	xyz	yz
FE10*	V		yz	xy	xyz
FE12*	D		z	xz	xyz
FE15*	P		x	xz	z
TI1	DPr	xyz	x	y	x
TI2	DDi	xy	yz	xyz	xyz
TI3	APr	xyz	xyz	xyz	xz
TI4	APr	xyz	xyz	xyz	xy
TI5	PDi	xyz	xyz	xyz	xyz
TI6	PDi	xyz	xyz	xyz	xyz
TI7	PDi	xyz	yz	xyz	xyz
TI8*	PDi			z	
TI9*	A				y
TI10*	A				x
TA1	D	xyz	xyz	yz	xyz

TA2	DDi	xyz	xyz	xyz	xyz
TA3	ADi	xyz	xyz	xyz	yz
TA4	ADi	xyz	xyz	xyz	yz
TA5	PDi	xyz	xyz	xyz	xyz
TA6	PDi	xyz	xyz	xyz	xyz
TA7	DDi	xyz	xyz	xyz	xyz
TA8	ADi	xyz	xyz	xyz	xyz
TA9*	PDi		xyz	xyz	yz
TA10*	PDi		z	y	
TA11*	ADi		y		
TA12*	P		z		
PT1	VPr	xyz	xyz	xyz	xyz
PT2	VPr	xyz	xyz	xyz	xyz

Discussion

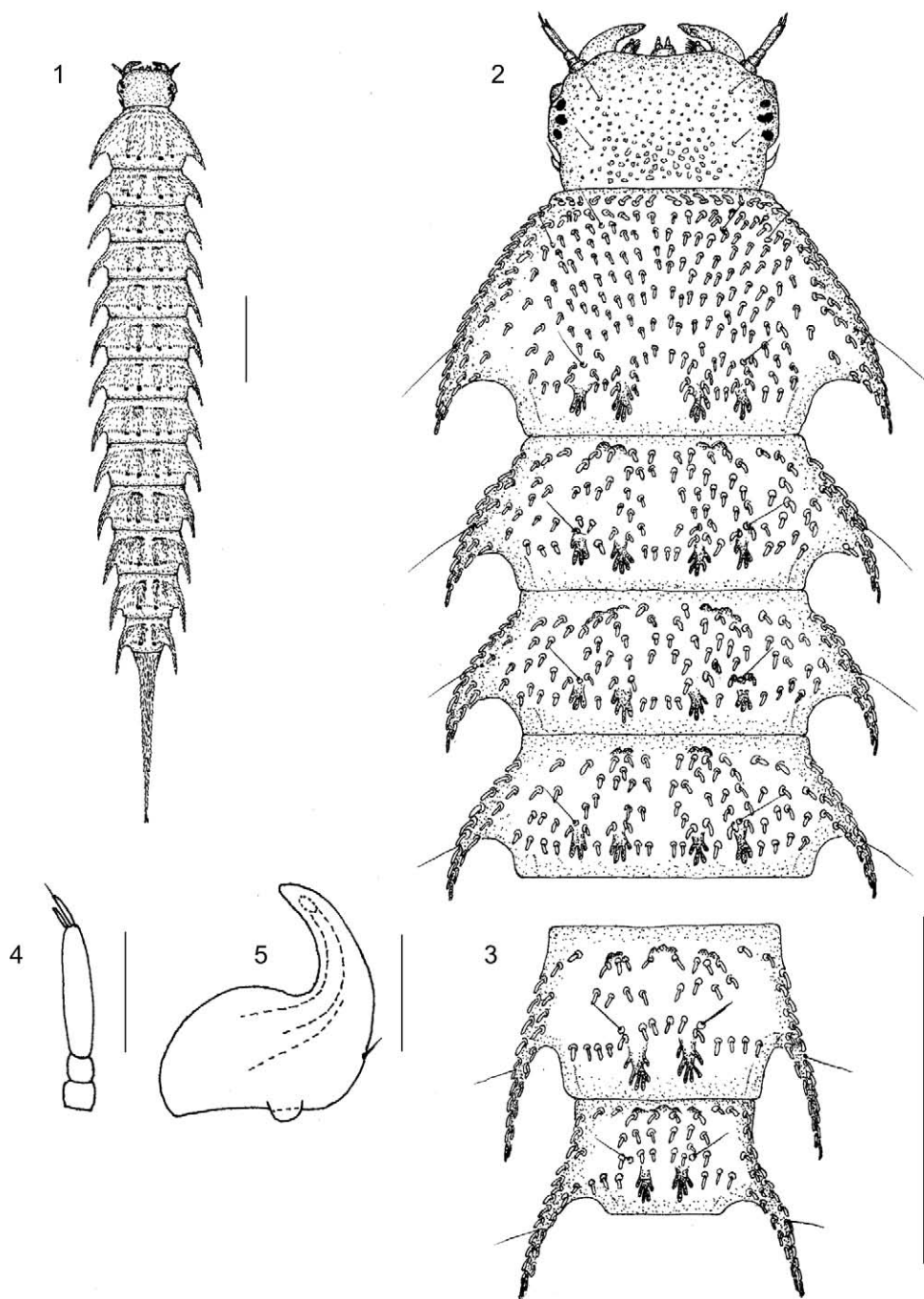
The two species treated above belong to the subgenus *Liaphlus* GUIGNOT, 1928. Larvae of *Liaphlus* species can be distinguished from the other subgenera of *Haliphus* by the forelegs not having special adaptations for feeding on filamentous algae in combination with the well developed lateral and dorsal extensions on the thoracic and abdominal segments. This is also the case in the two species described above.

The third instar larvae of *H. kulleri* and *H. maculatus* can be distinguished from other known West Palaearctic *Haliphus* species by the key of VONDEL (1997), adapted as below:

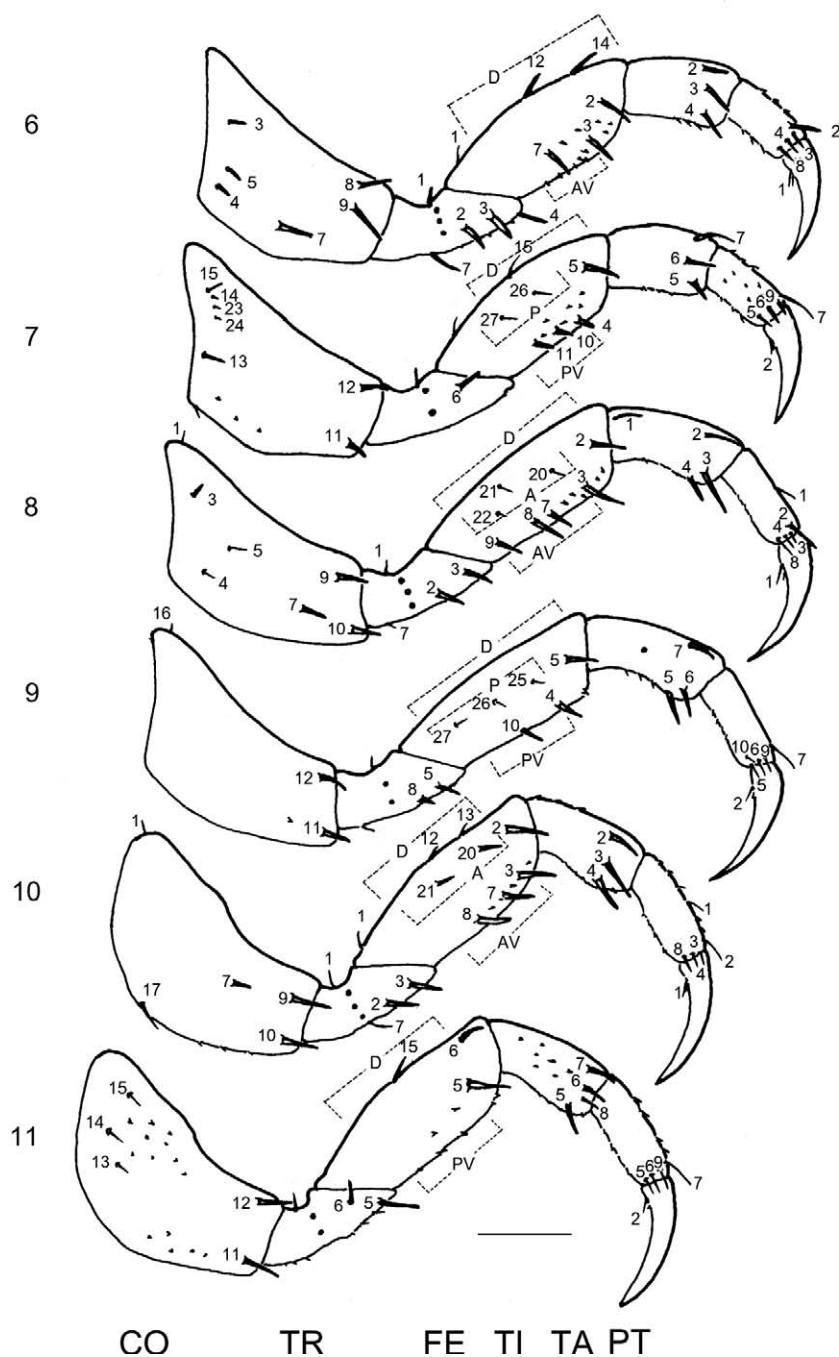
17. Thoracic segments with six posterior processes, lateral ones longer than inner ones 18
 - Thoracic segments with four posterior processes, all equal or subequal in length 21
18. Dorsal processes of thoracic and abdominal segments in lateral view projecting backward, semierect *mucronatus*
 - Dorsal processes of thoracic and abdominal segments oppressed against the body, in lateral view not projecting 19
19. Dorsal posterior processes very small, usually with two tubercles *variegatus*
 - Dorsal processes, at least the middle ones, well developed with 3–7 tubercles 20
20. Inner and outer dorsal processes on thorax and first seven abdominal segments about equal in length. Metafemur dorsally with three setae *kulleri*
 - Inner dorsal processes on thorax and first seven abdominal segments clearly longer than outer ones. Metafemur dorsally with more than five setae *maculatus*
21. Dorsal processes on thoracic and abdominal segments long and thin, in lateral view much longer than width at base. Mandibles broadly pointed *fulvus*
 - Dorsal processes on thoracic and abdominal segments short and triangular, in lateral view hardly longer than width at base. Mandibles with a slender and sharp point *flavicollis*

Acknowledgements

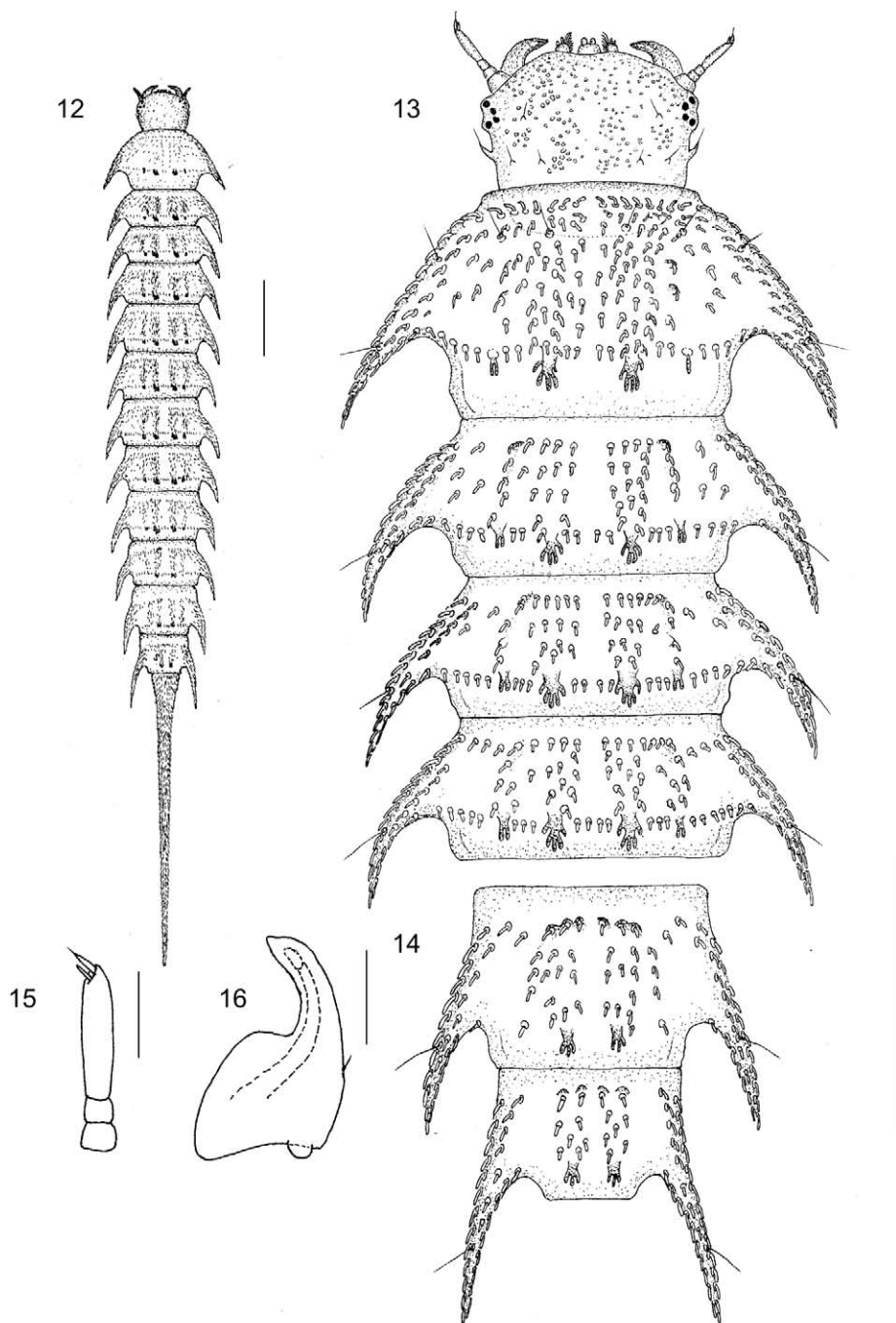
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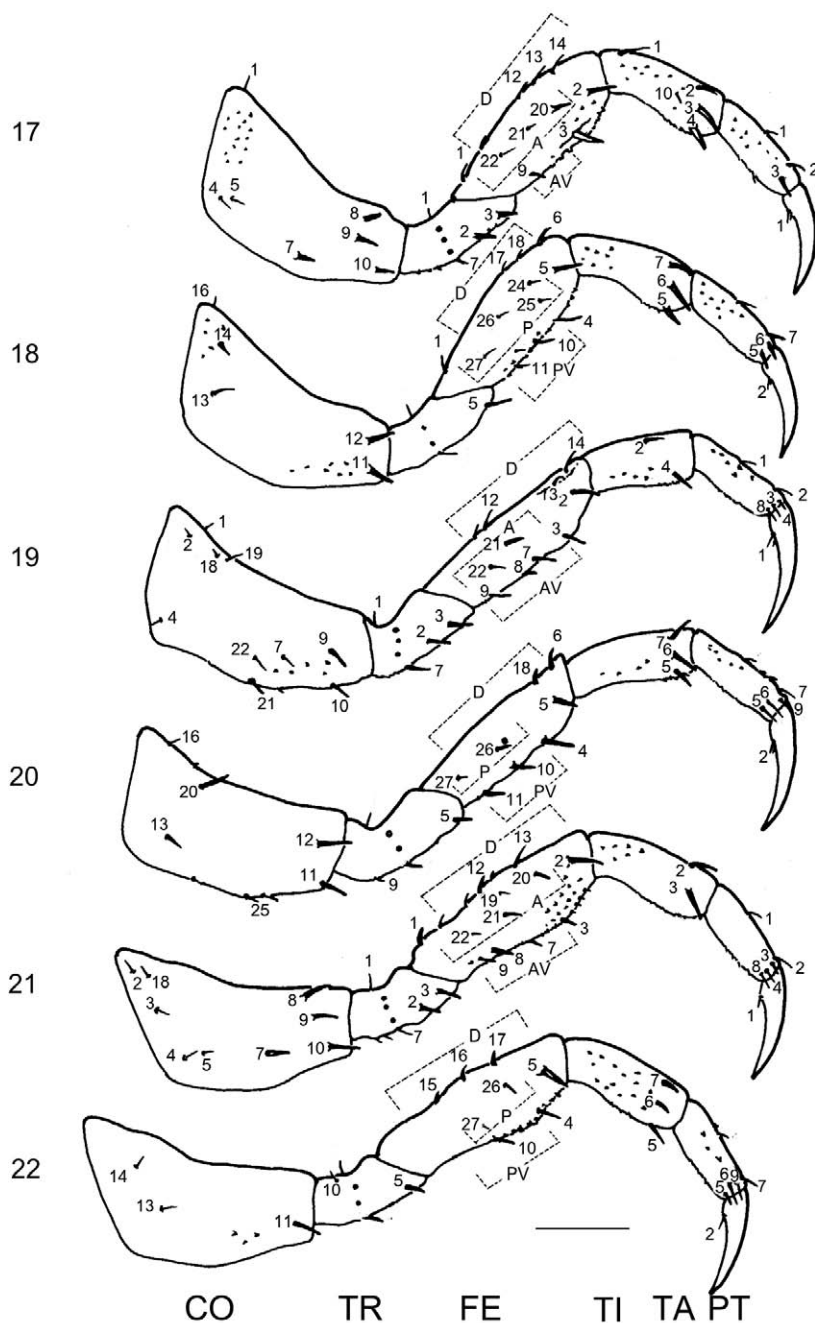
Figs. 1–5: 3rd instar larva of *Haliphus kulleri*: 1) habitus, dorsal view; 2) dorsal view of head, thoracic segments and abdominal segment 1; 3) dorsal view of abdominal segments 9 and 10; 4) antenna; 5) mandible. Scale for Figs. 1–3: 1 mm; 4–5: 0.1 mm.



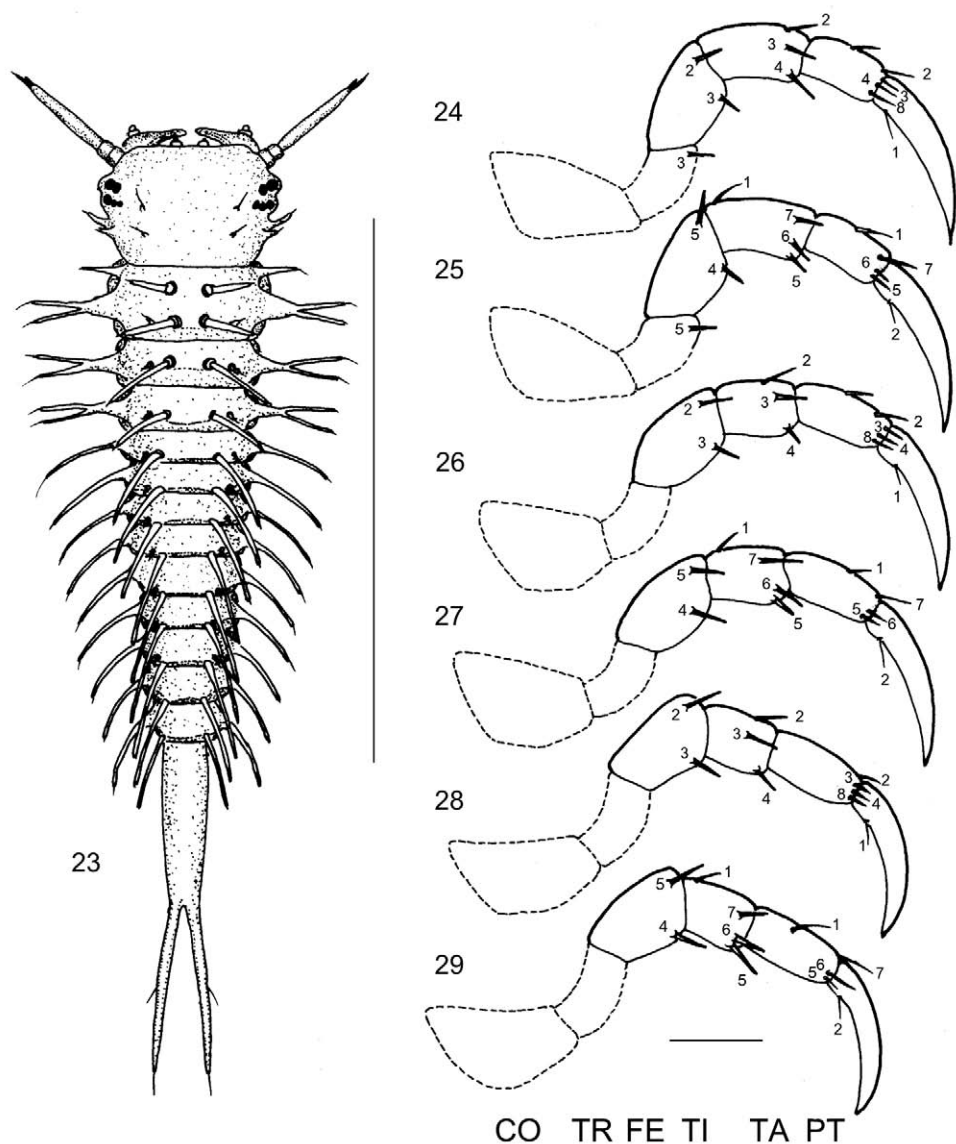
Figs. 6–11: 3rd instar larva of *Haliphus kulleri*: 6) foreleg, anterior view; 7) foreleg, posterior view; 8) midleg, anterior view; 9) midleg, posterior view; 10) hindleg, anterior view; 11) hindleg, posterior view. CO = coxa; TR = trochanter; FE = femur; TI = tibia; TA = tarsus; PT = pretarsus (claw). Small numbers and capital letters refer to Table 4. Scale for all Figs.: 0.1 mm.



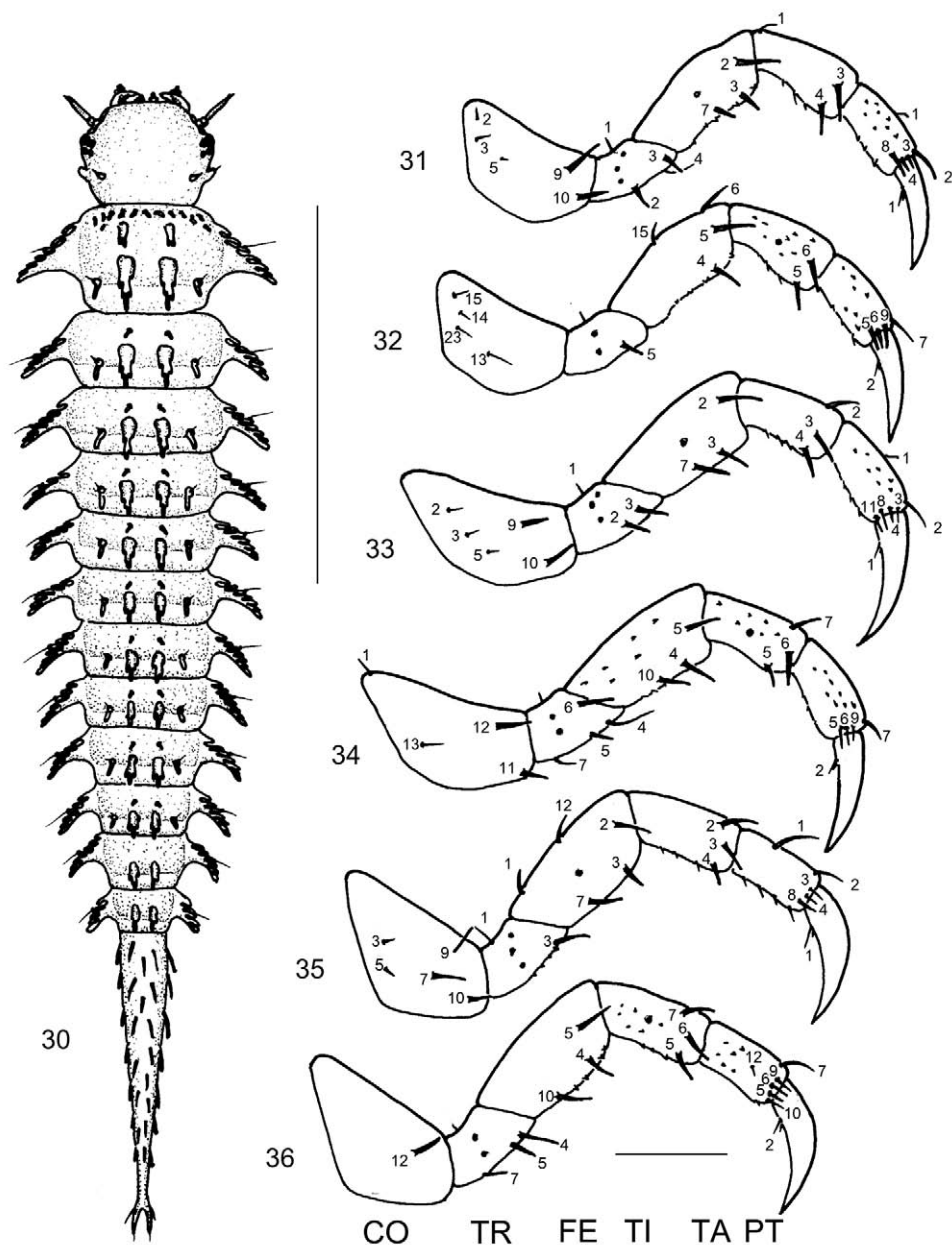
Figs. 12–16: 3rd instar larva of *Haliplus maculatus*: 12) habitus, dorsal view; 13) dorsal view of head, thoracic segments and abdominal segment 1; 14) dorsal view of abdominal segments 9 and 10; 15) antenna; 16) mandible. Scale for Figs. 12–14: 1 mm; 15–16: 0.1 mm.



Figs. 17–22: 3rd instar larva of *Haliphus maculatus*: 17) foreleg, anterior view; 18) foreleg, posterior view; 19) midleg, anterior view; 20) midleg, posterior view; 21) hindleg, anterior view; 22) hindleg, posterior view. CO = coxa; TR = trochanter; FE = femur; TI = tibia; TA = tarsus; PT = pretarsus (claw). Small numbers and capital letters refer to Table 4. Scale for all Figs.: 0.1 mm



Figs. 23–29: 1st instar larva of *Haliphus kulleri* or *maculatus*: 23) habitus, dorsal view; 24) foreleg, anterior view; 25) foreleg, posterior view; 26) midleg, anterior view; 27) midleg, posterior view; 28) hindleg, anterior view; 29) hindleg, posterior view. CO = coxa; TR = trochanter; FE = femur; TI = tibia; TA = tarsus; PT = pretarsus (claw). Small numbers and capital letters refer to Table 4. Scale for Fig. 23: 1 mm; 24–29: 0.1 mm.



Figs. 30–36: 2nd instar larva of *Haliplus kulleri* or *maculatus*: 30) habitus, dorsal view; 31) foreleg, anterior view; 32) foreleg, posterior view; 33) midleg, anterior view; 34) midleg, posterior view; 35) hindleg, anterior view; 36) hindleg, posterior view. CO = coxa; TR = trochanter; FE = femur; TI = tibia; TA = tarsus; PT = pretarsus (claw). Small numbers and capital letters refer to Table 4. Scale for Fig. 30: 1 mm; 31–36: 0.1 mm.

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