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BALAUSTIUM XEROTHERMICUM SP. NOV. FROM POLAND WITH REMARKS ON ALL WORLD SPECIES OF THE GENUS (ACARI: ACTINEDIDA: ERYTHRAEIDAE)

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Abstract.— Male, female and nymph of *Balaustium xerothermicum* **sp. nov.** are described. Key to the Polish species and data on distribution and ecological requirements are given.

Key words.— Acari, Parasitengona, Erythraeidae, *Balaustium*, new species, taxonomy, key.

INTRODUCTION

There have been 18 species described within *Balaustium* von Heyden, 1826 hitherto, the generic affiliation of which is doubtless: 10 from Palaearctic, 4 from Nearctic, 3 from Ethiopian, and 1 from Neotropical regions. The systematic position of other species seems problematic. There are several clues which suggest that *Erythraeus antarcticus* Trägårdh, 1907 which has been described from Falkland Islands (Port Darwin) and *Erythraeus medioareolatus* Kramer, 1898 from Tierra del Fuego (Argentina) belong to the genus *Abrolophus* Berlese, 1891 (see Southcott 1961). Some of the Ethiopian species described by Meyer and Ryke (1959) from South Africa show characters intermediate between *Balaustium* and *Abrolophus* (e. g. *B. medicagoense* – fading crista metopica, characteristic denticle on palpal claw present but urnulae absent and *B. vignae* – palpal claw denticle present but urnulae absent). I herein accept the Southcott (1961) criterion of affiliation to the genus *Balaustium* which is the presence of a pair of urnulae. Therefore I do not discuss in this paper the four species listed above. Their systematic status can be established only after the examination of the type material. In the course of systematic study of Polish Erythraeidae, 60 individuals, exclusively xerothermic, have been recognized as new species of the genus *Balaustium*.

MATERIAL AND METHODS

Several collection methods were applied for specimens: sifting the substrate (litter, turf etc.) with entomological sieve of 6 mm mesh and then collecting mites directly on a white sheet without prior extraction with Tullgren apparatus (Berlese funnels), sifting substrate and then extracting with Tullgren apparatus, extracting with Tullgren apparatus without prior sifting, collecting with entomological sweeping net, direct collecting in the field.

Material was cleared in cold KOH (<10%) and mounted in Faure's medium (see Gabryś 1994).

The terminology follows Southcott (1961), Welbourn and Young (1987) and Gabryś (1992a, b, 1999). All drawings were made by camera lucida, all measurements are in micrometers (μm) unless stated otherwise.

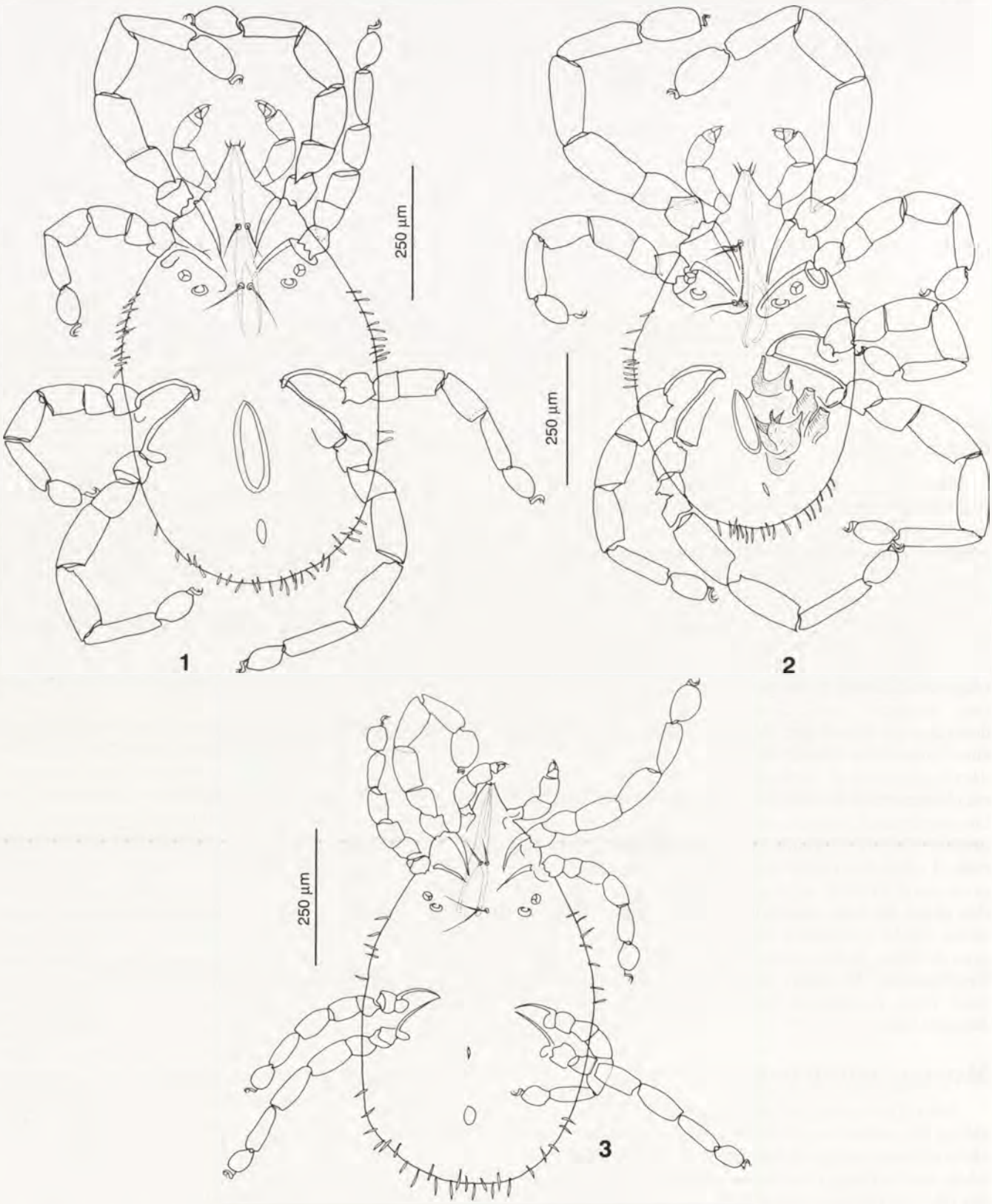
TAXONOMY

Balaustium xerothermicum sp. nov.
(Figs 1–27, 31, Table 1)

Etymology. The species epithet is derived from ecological preferences of newly described taxon.

Diagnosis. Female (Figs 1, 19, 20). Relatively small, one pair of typical urnulae located posterad and mesad of the eyes (Fig. 5); palps narrow and fine, palpal claw denticle weaker than in the "murorum" group, a cluster of specialized setae on palpgenu (semipectinalae) absent (Figs 24–27); the rod of crista metopica almost always present, sensillary areas absent, always 4 nonsensillary setae AL, posterior AL always shorter than the anterior ones (Figs 5, 8, 9); sensillary setae PSens always longer than ASens, setae of both types setulose in the distal part (Figs 5–7); dorsal setae short (the longest never exceed 36 μm), stem divided into two branches running very close to each other, one straight, the second slightly curved what makes it look a bit shorter; both branches setulose but setulae on the straight one shorter; from the side view both branches seem to form one, hairy stem (Figs 10, 11); ventral setae soft, similar in length, mid-ventral smooth (Figs 12, 13); on coxae III, an unusually long, bare and apically pointed flagellate seta (80–100 μm!) (Fig. 4).

Male (Figs 2, 21–23). General appearance similar to female; differences basically refer to the genital region: there is a strongly sclerotized internal genital sclerite, gen-



Figures 1–3. *Balaustium xerothermicum* sp. nov. General view in transparency: (1) female, (2) male, (3) nymph.

ital opening longer, labialae shorter, more numerous and setulose, anus slightly shorter (Figs 21–23).

Nymph (Fig. 3). General appearance similar to adults; differences are rather quantitative: smaller body size, scarcer body and leg setation, somewhat stronger sclerotized region of crista metopica (particularly the rod). Genital opening rudimentary, still closed.

Larva. Not known.

For differential diagnosis see "Remarks on taxonomy".

Species markedly xerothermic.

Description (based on holotype, supplemented by data of paratypes, all metric data in Table 1). Body oval, covered with dense setae both on the dorsal and ventral sides; colour in life red; legs relatively short, I and IV pair more or less of body length, epimera well pronounced (Figs 1–3).

Gnathosoma. Chelicerae typical, dagger like, contracted into the body; rostrum typical with several setae of various length located apically (ventral ones more numerous); palps narrow and slender with diverse setae, palptarsus cylindrical, slightly narrowing and rounded apically and with numerous solenidia; palptibial claw with a denticle; the arch on the ventral side between the top of the claw and the denticle shallow; palpgenu and other palpal segments without specialized setae of the "semipectinalae" type (Figs 24–27).

Dorsal side of idiosoma. Divided into aspidosoma and opisthosoma by an indistinct furrow, covered with short, relatively uniform, setulose setae which have ciliate fringes on lateral sides of two branches of the stem (see diagnosis) (Figs 10, 11). The region of crista metopica marked by weakly sclerotized scutum; crista metopica present only in a form of a rudimentary rod between bases of ASens and PSens (Fig. 5); ASens and PSens scarcely setulose in distal part, ASens always shorter than PSens (Figs 6, 7); the nonsensillary setae AL distinct from other dorsal setae and arranged into two pairs: first one (Fig. 9) always long and slender, located anterad of ASens, the second one (Fig. 8) short, stout, its stem divided into two branches running closely and paralelly, located posterad of ASens, all AL slightly setulose at sides. Urnulae well shaped, placed closely to the eyes – slightly posterad and mesad, more or less at the PSens base level; one pair of sessile eyes (Fig. 5).

Ventral side of idiosoma. Covered with dense, fine, smooth or slightly setulose, straight setae of relatively uniform length (Figs 12, 13). Genital opening elongate, centro- and epivalves covered with setae similar to ventral setae in shape but shorter; anus oval, surrounded by distinct sclerite with 10 setae slightly shorter than ventral and genital ones but similar in shape (Figs 19, 20).

Legs. Typical, pair I the longest, IV a little shorter, II and III the shortest, more or less

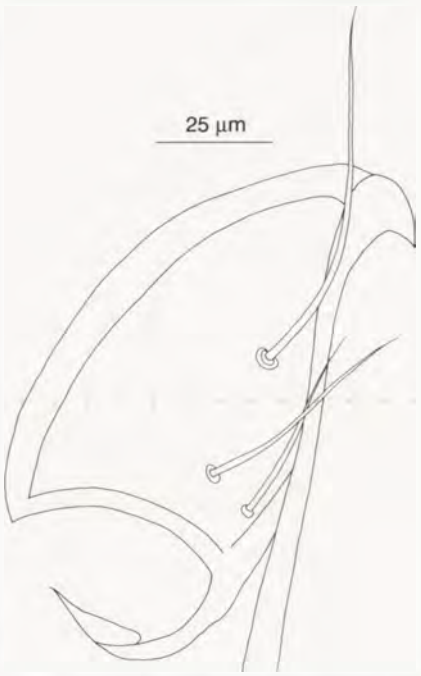


Figure 4. *Balaustium xerothermicum* sp. nov. Coxalae III.

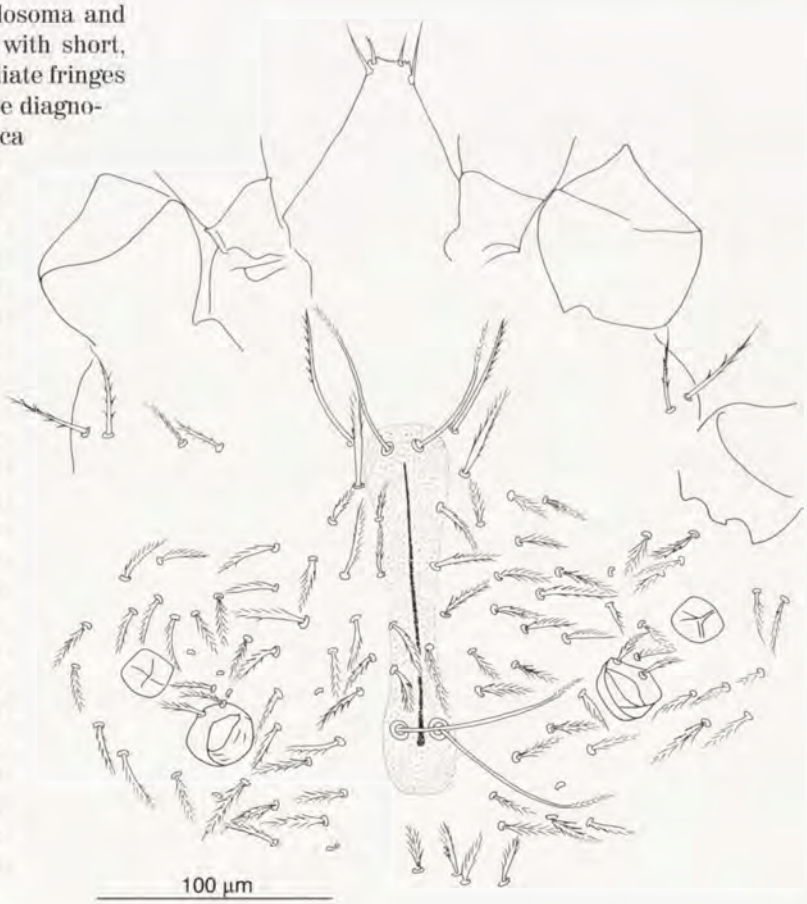
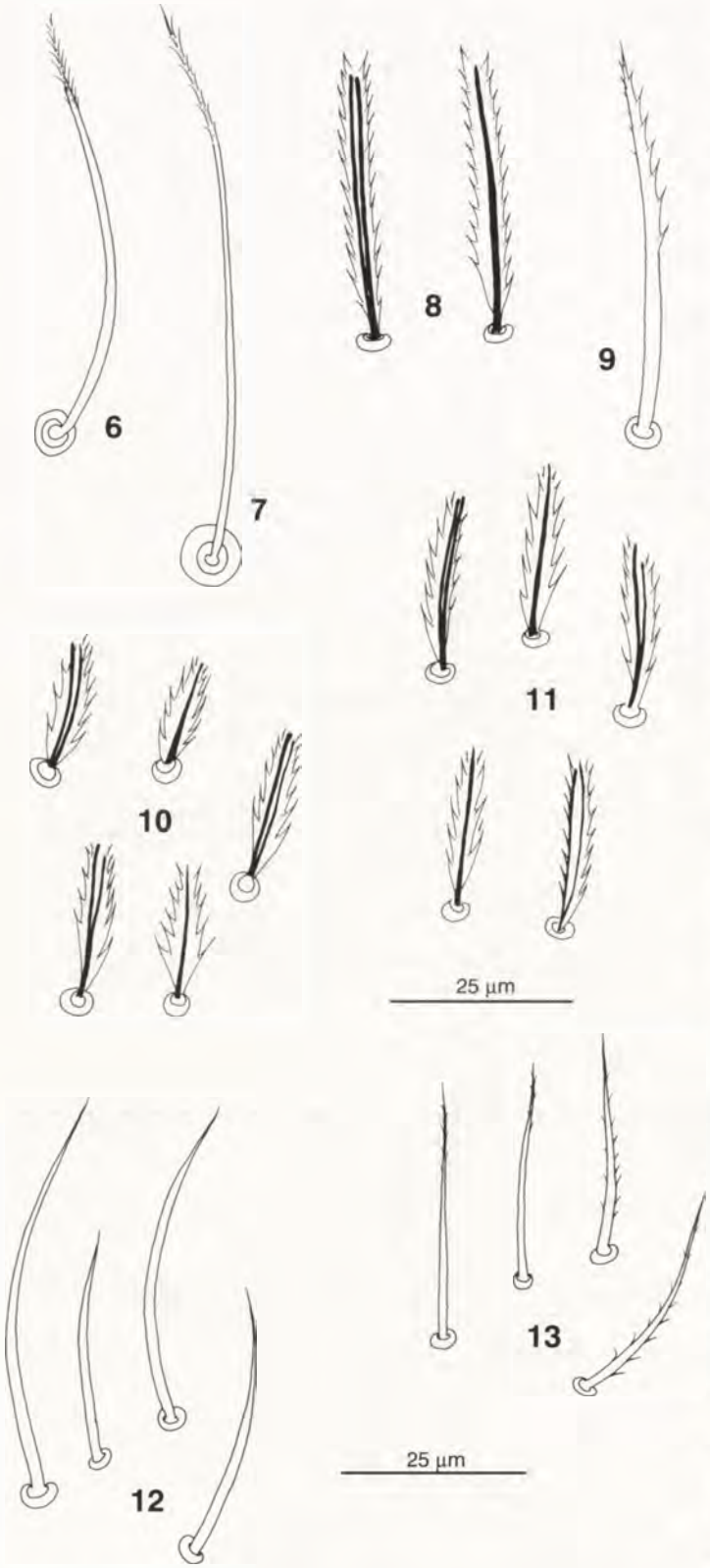


Figure 5. *Balaustium xerothermicum* sp. nov. Region of crista metopica.



Figures 6–13. *Balaustium xerothermicum* sp. nov. (6) ASens seta; (7) PSens seta; (8) AL II seta (from both sides); (9) AL I seta; (10) mid-dorsal setae (from different sides); (11) post-dorsal setae (from different sides); (12) mid-ventral setae; (13) post-ventral setae.

equal; length of the legs and, consequently, all segments (including tarsus) variable (Table 1). Coxae I–IV with flagellate setae similar to ventral ones but always longer – medial coxala III is particularly characteristic (see diagnosis) (Fig. 4). All legs covered with simple scobalae and tactalae, ventral side of tarsi I–IV with characteristic "brush", all tarsi with two claws on a stalk. Specialized setae are: solenidia, particularly numerous on tarsi; vestigialae singly in distal dorsal parts of Ti I (11 µm), Ge I (8 µm) and Ge II (8 µm). Famulus absent (Figs 14–18).

Male and nymph. See the diagnosis.

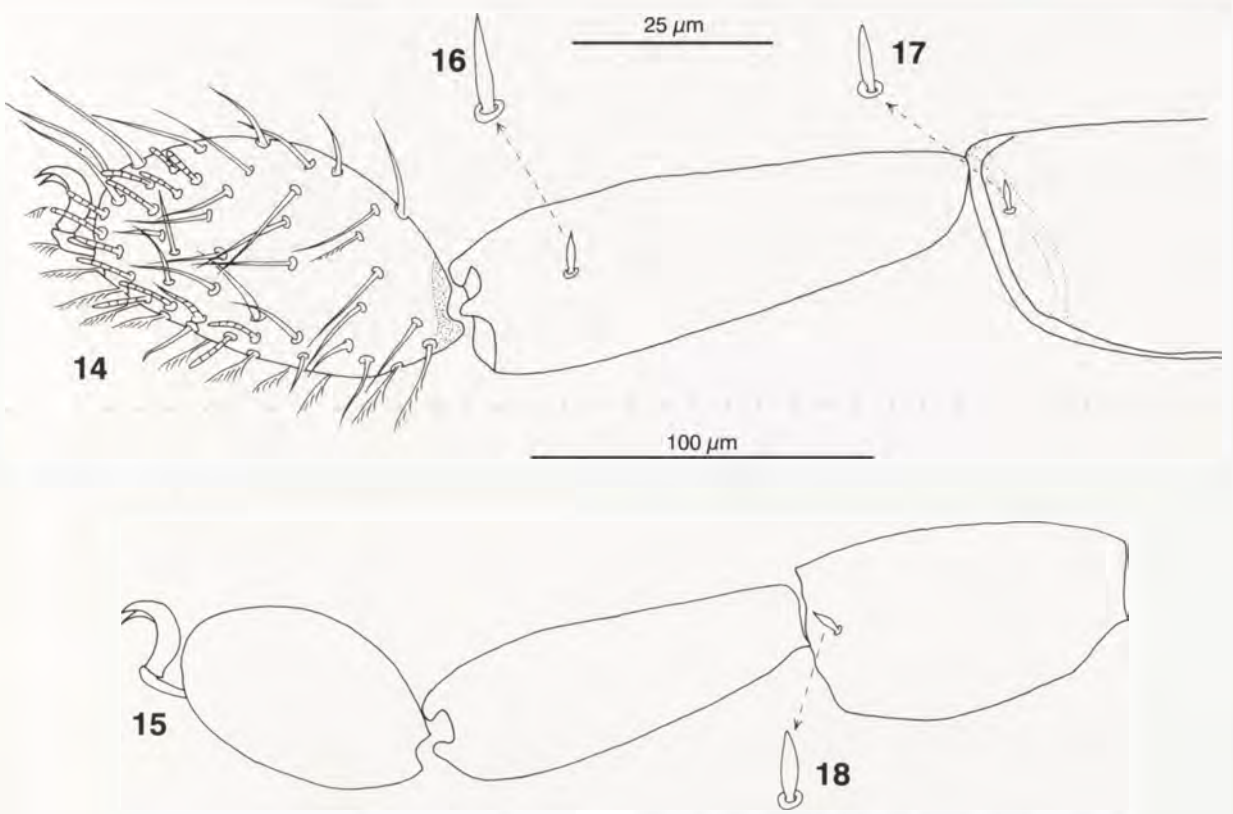
Type material. Holotype – PL/BK/7/6 ♀ collected directly, 11 June 1985, Sutno on Bug River at Siemiatycze (Podlaskie Province), xerothermic meadow, leg. G. Gabryś, deposited in Museum of Natural History, Wrocław University (MU 814).

Fifty nine paratypes distributed as follows: 1 ♀ (KI/4/2) and 1 nymph (ZA/38/5) in Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany; 2♂♂ (KI/2/8, ZA/37/3), 4♀♀ (BK/9/2, BK/9/3, KI/2/5, KI/4/4) and 2 nymphs (ZA/17/8, ZA/17/9) in Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville, Florida, USA; 5♂♂, 26♀♀ and 18 nymphs in author's collection. For paratypes' distribution see "Localities in Poland" and Fig. 31.

Localities in Poland (see Fig. 31). Abbreviations used: AK – A. Kaźmierski; BOR – L. Borowiec; DAM – Dept. of Animal Morphology, Adam Mickiewicz University, Poznań; GAB – G. Gabryś; N – nymph; NP – National Park; NR – Nature Reserve; RAF – J. Rafalski; WN – W. Niedbała.

Species extremely xerothermic, found at 10 localities all over Poland from May to August; all postlarval life stages have been present in samples (7♂♂, 32♀♀, 21 N). The ecological preferences are confirmed in detailed description of the localities. Numbers correspond to those in Fig. 31.

1 – Radolin at Trzcianka, xerothermic slope, 4 June 1975 leg. DAM (2♀♀); 2 – NR Zbocza Płutowskie at Chełmno, S slope of xerothermic ravine, very dry, 25 June 1968 leg. RAF (1♀); 3 – Sutno at Siemiatycze, xerothermic meadow, 9–11 June 1985 leg. GAB (4♂♂, 16♀♀); 4a – Skowronno, at road side, 3 Aug. 1993, leg. BOR (1♂, 3♀♀); 4b – Pińczów, xerothermic meadow (sward), 5 June 1984 leg. BOR (1♂, 9♀♀); 5 – NR Milechowy at Chęciny, small patches of xerothermic meadow (sward) (*Thalictro-Salvietum* among others) between rocks at a top of a ravine slope, 20 May 1982 leg. AK and WN (1N); 6 – Sandomierz-Kamień Plebański, dry slopes of Cambrian shale, scarce bushes: *Rosa*, *Crataegus*, *Prunus spinosa*, scarce grass, dry leaves, moss, very dry, 1 Aug. 1968 leg. RAF (1); 7 – Wieprzecka Góra at Zamość, dry meadow with *Geranium sanguineum*, *Echium vulgare*, *Vincet-*



Figures 14–18. *Balaustium xerothermicum* sp. nov. (14) Leg I (tarsus, tibia and part of genu) posteriorly; (15) leg II (tarsus, tibia and genu) posteriorly; 16–18. Vestigial setae: (16) Ti I, (17) Ge I, (18) Ge II.

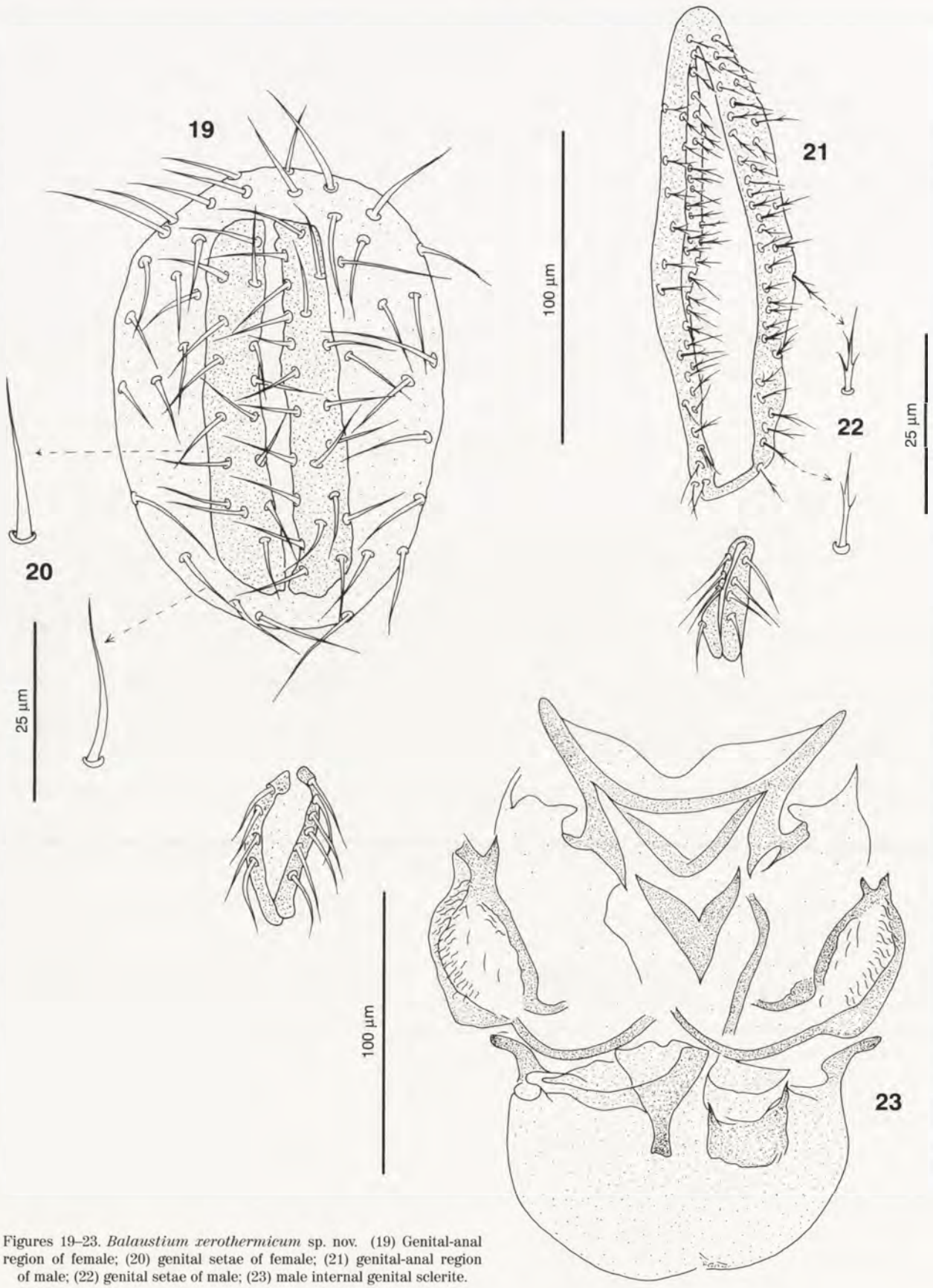
oxicum officinale and *Salvia pratensis*, moss, 11 June 1987 leg. GAB (8 NN); 8 – Zwierzyniec, at the border of the Roztoczański NP, dry cavity beneath sand dune at the edge of pine forest, 22 May 1986 leg. GAB (1 N); 9 – Józefów, quarries, xerothermic vegetation of a different type, 12 June 1987 leg. GAB (1♂, 9 NN); 10 – Siedliska at Lubycza Królewska, psammophilous meadow (sward) with *Hieracium pilosella*, 8 June 1987 leg. GAB (2NN).

Remarks on taxonomy

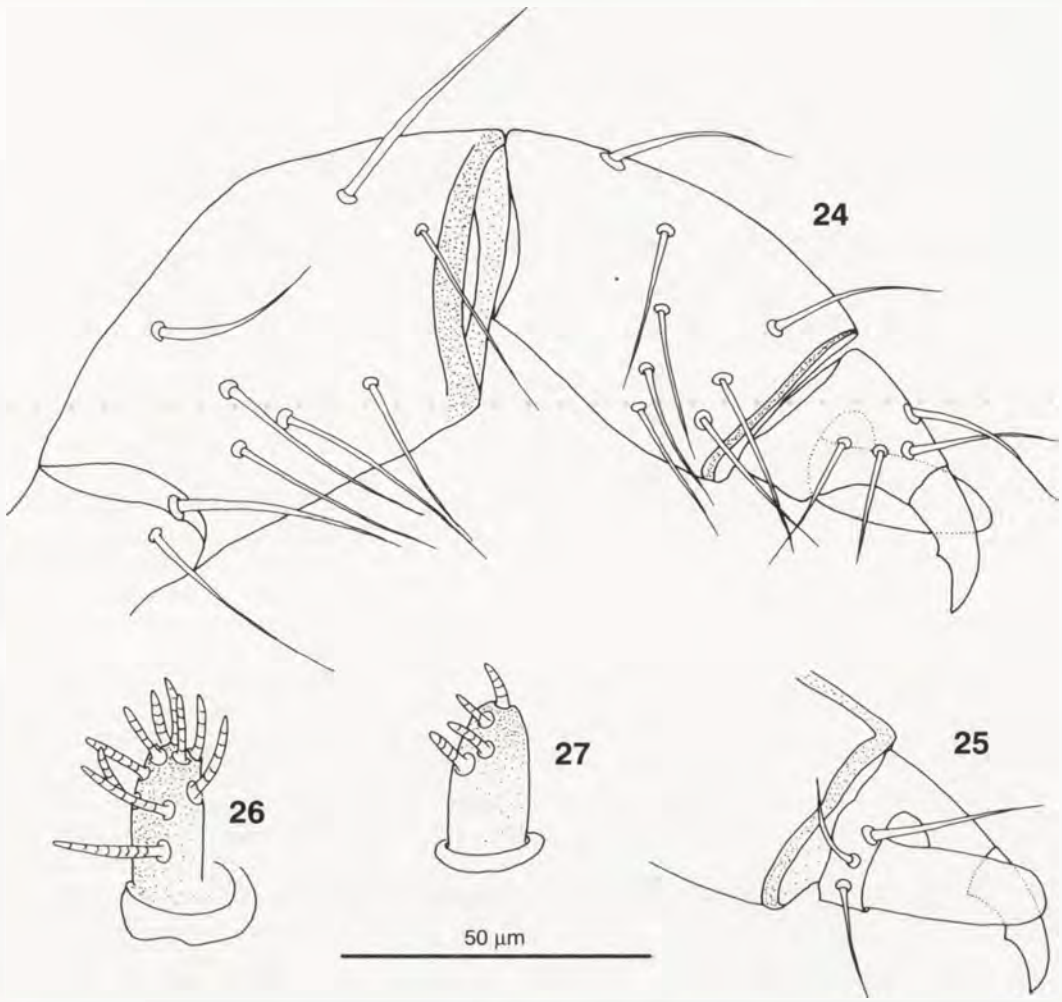
All Ethiopian species, i. e. *B. cristatum* Meyer and Ryke, 1959, *B. graminum* Meyer and Ryke, 1959 from South Africa and *B. southcotti* Feider and Chioreanu, 1977 from St. Helen Island differ from *B. xerothermicum* sp. nov. in presence of distinct crista metopica with two sensillary areas, structure of idiosomal setae and absence of a denticle on ventral side of palpal claw. Moreover: *B. cristatum* (nymph) has clearly shorter PSens (41) and shorter (49) and narrower (18!) Ta I. *B. graminum* (nymph) has longer (89) Ta I and *B. southcotti* (adult) is slightly bigger (820–1305 long, 605–734 wide), has longer dorsal setae (32–47), longer Ta IV (101), longer Ti IV (188–261) and smooth ASens and PSens.

Neotropical *B. obtusum* (Trägårdh, 1931) from Juan Fernández Islands (Más a Tierra) differs from *B. xerothermicum* sp. nov. in more spherical body shape (1080 long and 720 wide), stronger palps, structure of idiosomal setae which are simple, setiform and slightly bent, and in longer legs (I – 1356, II – 810, III – 846, IV – 1116, without coxae).

In Nearctic, there are 4 species known: *B. aonidiphagus* (Ebeling, 1934) from California (USA), *B. dowelli* Smiley, 1964 (fully described in 1966) from Arkansas (USA), *B. putmani* Smiley, 1968 from Ontario (Canada) and *B. kendalli* Welbourn, 1991 from Maine. *B. aonidiphagus* differs from *B. xerothermicum* sp. nov. in larger body size (1750–2000 long), clearly longer palps (350) and absence of denticle on palpal claw. *B. dowelli* differs from *B. xerothermicum* sp. nov. in the length ratio of nonsensillary setae AL to PSens; its AL are almost equal to PSens (in *B. xerothermicun* AL are always distinctly shorter), considerably longer Ta I (191) and Ti I (300) and structure of ASens and PSens which are hairy all over. *B. putmani* (in which two sexes are also known) differs from *B. xerothermicum* sp. nov. in having strongly elongate, cylindrical palptarsi, ASens equal to PSens, and both ASens and PSens setulose all over (*B. xerothermicum* sp. nov. has ASens visibly shorter than PSens, and both types of sensillary setae setulose only in distal part), greater and unstable number of AL (♀– 9, ♂– 5), longer Ta I (186), and leg IV shorter than leg I by 1/3 (in *B. xerothermicum* sp. nov. the leg IV is shorter by 1/10 at most); the body length of the holotype (♀– 1600) exceeds considerably that of the largest specimen from Poland (985). *B. kendalli* differs from *B. xerothermicum* sp. nov. in posterior dorsal setae (PDS) length and structure: they



Figures 19–23. *Balaustium xerothermicum* sp. nov. (19) Genital-anal region of female; (20) genital setae of female; (21) genital-anal region of male; (22) genital setae of male; (23) male internal genital sclerite.



Figures 24–27. *Balaustium xerothermicum* sp. nov., adult. (24) Left palp medially; (25) left palptarsus and palptibia laterally; (26) left palptarsus with solenidia laterally; (27) left palptarsus with solenidia medially.

are slightly longer (37–44) and have setulae only in their basal parts. Moreover *B. kendalli* has more AL setae (9–10), bigger eye (28), much longer legs (I – 1262, II – 888, III – 986, IV –1224, all without coxae) and is considerably bigger (1125 – 1197 long by 810 – 887 wide).

The Palaearctic species can be divided into two groups: "*murorum*" and "*araneoides*". The first group includes: *B. afghanicum* Cooreman, 1960, *B. bulgariense* Oudemans, 1913, *B. florale* Grandjean, 1947 (postlarval form interpreted in 1959), *B. madeirense* Willmann, 1939, *B. murorum* (Hermann, 1804), *B. neomurorum* Schweizer, 1951, *B. submurorum* Schweizer and Bader, 1963 and *B. unidentatum* (Trägårdh, 1904); the second one includes: *B. araneipes* Cooreman, 1956 and *B. araneoides* (Berlese, 1910).

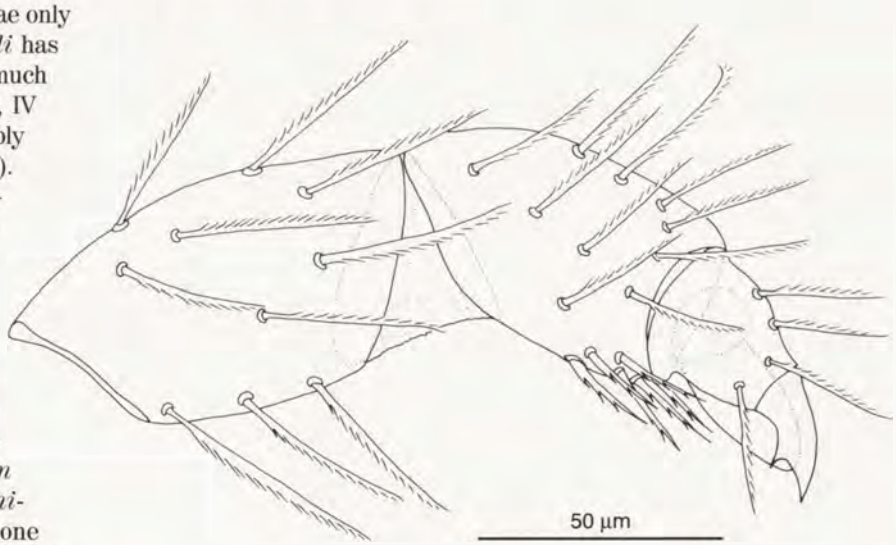
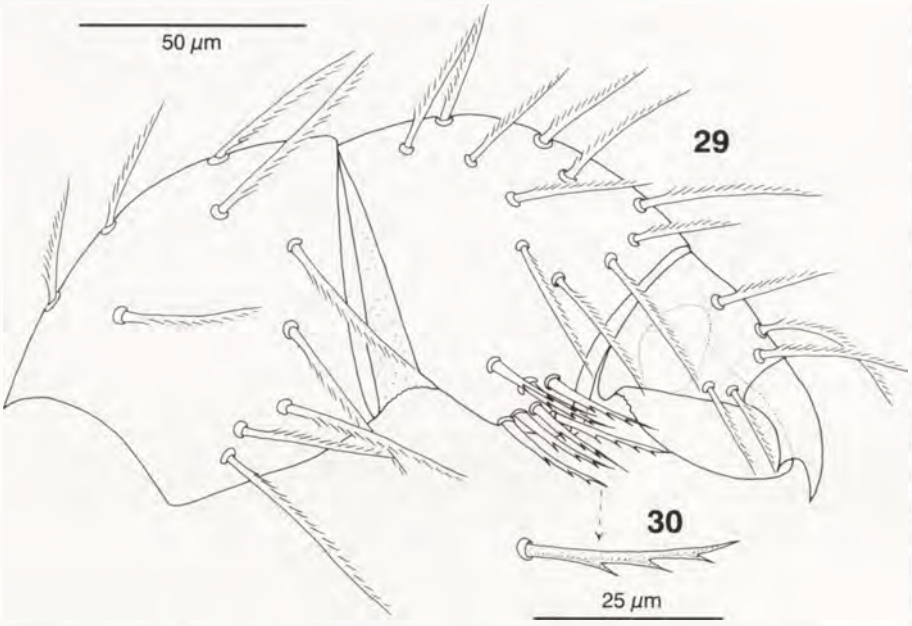


Figure 28. *Balaustium unidentatum* (Trägårdh, 1904), adult – left palp medially.



Figures 29–30. *Balaustium murorum* (Hermann, 1804), adult. (29) Left palp medially; (30) specialized seta "semipectinala".

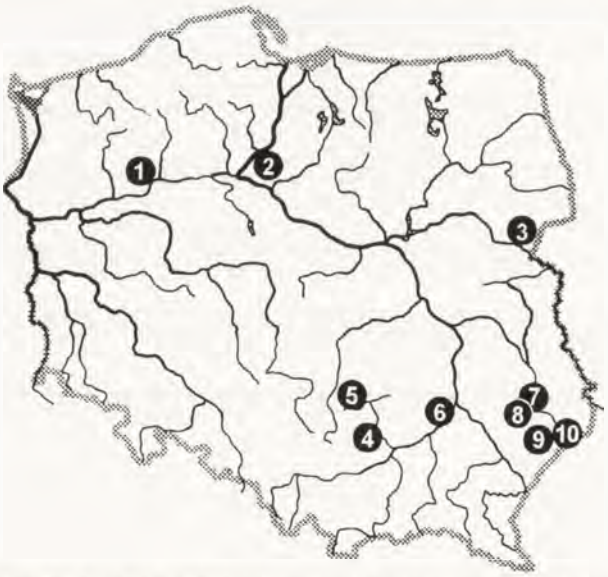


Figure 31. Localities of *Balaustium xerothermicum* sp. nov. in Poland; numbers correspond to those in the text.

All species of the "*murorum*" group have opisthosomal setae (MDo, PDo) considerably longer, reaching 48–60 on distal end of opisthosoma (analogous setae in *B. xerothermicum* sp. nov. never exceed 36); *B. afghanicum* is bigger (1600), has longer AL (100), ASens (90), ISD (220), palps (264 – excluding PaTr) and legs (I – 1250, II – 850, III – 900, IV – 1150); *B. madeirense* has different shape of anterior part of aspidosoma, eyes situated behind bases of PSens (i. e. distance OPS is negative), AL are about twice longer than ASens and visibly longer than PSens; *B. neomurorum* has very characteristic tubular urnulae which visibly protrude from idiosoma in the not mounted specimens, longer ISD (180–192), considerably longer legs (I – 1287, II – 945, III – 1017, IV – 1237 including coxae), longer Ta I (162 long, 72 wide), Ti I (270), Ta IV (118 long, 63 wide) and Ti IV (270); *B. submurorum* has longer ASens (72) and PSens (96), strongly shaped denticle on palpal claw and characteristic ring shaped urnulae. *B. murorum* and *B. unidentatum* have stouter palps, more strongly framed denticle on palptibial claw, different dorsal and ventral setae (both longer, and ventral more setulose), shorter and stouter coxalae III – they are thicker, setulose and do not exceed 80 (in *B. xerothermicum* sp. nov. they are smooth, flagellate and always over 80), generally greater body size reaching 1600; the most characteristic feature is the cluster of strong, serrate setae ("semipectinalae") on medial ventral side of palpgenu (generally 6–8 in adults and 3–4 in nymphs)(Figs 28–30). It seems that the last feature is characteristic of all species of the "*murorum*" group but it requires re-examination of types. The authors probably did not pay sufficient attention to it and did not put it in the descriptions. Both *B. florale* and *B. bulgariense* (from postlarval instars known only as nymphs) have such kind of setae.

Moreover, it seems that *B. murorum* is a parthenogenetic species. The best interpretation of the latter one was given by Oudemans (1916) and Schweizer (1951).

Species of the "*araneoides*" group differ in length of the legs. *B. araneoides* (sensu Berlese, 1910) from Sicily has leg I 2200 while its body is 850 (i. e. the ratio Leg I : LB = 2.3:1). *B. araneipes* Cooreman, 1956 (= *B. araneoides* sensu Halbert, 1920 non Berlese, 1910) from Ireland (Halbert) and Algeria (Cooreman) differs from *B. xerothermicum* sp. nov. in longer legs (I – 1460–1560, II – 900, III – 860, IV – 1100, without coxae), ratio leg I (without coxa) : body length 1.45:1 (Ireland) and 1.56:1 (Algeria), stout palps with wide femur and arched genu and PSens setulose from the base and ASens setulose in 2/3 distally.

KEY TO THE POLISH SPECIES OF POSTLARVAL *BALAUSTIUM*

1(2). Dorsal setae very short (max. 36) (Figs 10–11), palpgenu without specialized stout setae (semipectinalae) (Figs 24, 25), mid-ventral setae needle-like, elongate, slender and almost bare (Figs 12, 13) ..... ***Balaustium xerothermicum*** sp. nov.

2(1). Dorsal setae much longer (up to 60), palpgenu with 5–7 (adults) or 3–5 (nymphs) specialized stout setae (semipectinalae) (Figs 28–30), mid-ventral setae similar to dorsal but narrower and strongly setulose 3

3(4). Palps strong, palpgenu thick, as long as wide, "swollen", twice as wide as palptibia base (Figs 29, 30) ..... ***Balaustium murorum*** (Hermann, 1804)

4(3). Palps slender, palpgenu distinctly longer than wide, 1/3 wider than palptibia base (Fig. 28) ..... ***Balaustium unidentatum*** (Trägårdh, 1904)

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Character	H♀BK 7/6	P♀BK 7/7	P♀KI 2/5	P♂BK 9/5	P♂ZA 37/3	PN KI 13/1	PN ZA 38/7
1	2	3	4	5	6	7	8
LB	878	755	985	693	863	492	776
WB	524	462	508	447	524	242	404
ASRo	161	160	187	133	168	–	–
PSG	257	188	288	197	229	–	–
GAn	60	48	59	30	22	–	–
GOp	198	140	208	110	168	–	–
AnOp	89	44	110	38	100	–	–
MDS	20–34	20–30	20–36	18–30	22–30	20–30	18–30
PDS	20–32	18–30	20–34	20–30	20–34	24–30	22–34
MVS	20–50	25–35	25–50	22–30	26–32	20–30	20–35
PVS	24–35	22–30	25–40	22–30	26–32	20–28	20–30
AL(n)	4	4	4	4	4	4	4
AL(a/p)	60/40	50/40	61/48	50/34	61/42	41/28	36/32
ASE=ASens	63	56	65	52	53	45	41
PSE=PSens	83	81	90	80	76	64	61
SL	180	188	198	146	180	–	–
SW	38	26	36	30	28	–	–
ISD	123	135	150	97	126	69	93
SBa	16	16	12	12	15	12	10
SBp	18	18	16	16	16	13	15
OCM	121	99	122	94	99	64	109
OAS	87	91	107	79	100	49	67
OPS	36	44	43	16	26	20	26
Ur	26	24	26	22	24	14	22
OUr	44	36	42	34	34	24	28
O	20	19	22	18	16	13	18
O-O	241	198	244	188	198	128	218
Ur-Ur	175	156	193	142	155	91	174
ExG(L)	139	135	140	158	178	–	–
ExGLa(L)	20–26	19–21	20–24	11–14	16–19	–	–
An(L)	49	45	51	40	40	28	30
AnLa(n)	10	7	7	7	8	6	6
prCxIII L	80	80	100	80	92	60	67
Palps							
PaFe(W)	52	50	55	47	50	40	42
PaGe(W)	40	36	45	40	42	34	34
PaTi(W)	27	24	30	26	28	24	22
PaTa(L)	26	26	26	20	24	18	22
PaTa(W)	12	11	12	10	10	10	10
PaTr(L)	36	35	36	32	34	16	20
PaFe(L)	73	75	77	60	72	41	48
PaGe(L)	51	51	65	47	52	36	42

1	2	3	4	5	6	7	8
PaTi(L)	24	23	24	19	20	14	16
PaTiCl(L)	22	22	24	20	22	18	18
PaL(sum)	206	206	226	178	200	125	144
Legs							
I Cx	170	162	181	130	166	67	114
Tr	73	55	71	59	63	35	51
Bf	75	71	79	79	90	43	45
Tf	118	110	130	135	126	67	75
Ge	154	134	154	146	150	87	83
Ti	158	138	154	158	174	87	95
Ta	110	102	110	107	110	67	75
Ta(H)	61	59	67	60	52	47	47
LI(sum)	858	772	879	814	879	453	538
II Cx	138	130	126	107	138	91	87
Tr	55	51	43	44	51	35	28
Bf	55	47	59	63	63	28	35
Tf	71	71	79	71	87	40	39
Ge	99	87	91	87	99	47	51
Ti	115	107	110	110	122	55	67
Ta	75	75	73	71	79	45	51
Ta(H)	43	40	51	43	47	35	35
LII(sum)	608	568	581	553	639	341	358
III Cx	114	118	107	110	126	71	67
Tr	51	55	51	51	47	35	32
Bf	59	55	55	55	59	35	35
Tf	79	87	75	79	102	43	45
Ge	102	99	102	99	106	67	59
Ti	114	110	118	114	122	67	75
Ta	75	75	79	69	79	47	52
Ta(H)	39	37	47	40	43	32	35
LIII(sum)	594	599	587	577	641	365	365
IV Cx	150	158	158	146	166	94	110
Tr	67	59	63	51	59	27	39
Bf	71	63	79	75	79	39	47
Tf	122	114	122	118	130	47	71
Ge	138	130	134	138	146	83	83
Ti	150	139	146	142	150	84	88
Ta	83	79	79	67	83	47	55
Ta(H)	41	39	47	39	43	28	32
LIV(sum)	781	742	781	737	813	421	493
IP	2841	2681	2828	2681	2972	1580	1754

Table 1. Metric data of *Balaustium xerothermicum* sp. nov. for holotype (H)(BK/7/6) and 6 paratypes (P) – 2♀♀, 2♂♂, 2 nymphs (N).