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Two new species of *Leptus* Latreille, 1796 (Trombidiformes: Erythraeidae) from the Canary Islands, parasitising Curculionidae (Insecta: Coleoptera), with new metrical data for some *Leptus* spp.

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Abstract *Leptus* (*Leptus*) *grancanaricus* n. sp. and *L.* (*L.*) *machadoi* n. sp. are described from Gran Canaria and Fuerteventura (Canary Islands). They were collected from new hosts for the genus *Leptus*: *Herpisticus guanarteme* Machado and *Laparocerus maxorata* Machado (Coleoptera: Curculionidae). New metrical data for *Leptus* (*Leptus*) *andae*, *L.* (*L.*) *akkus*, *L.* (*L.*) *hammameticus*, *L.* (*L.*) *horiacus* and *L.* (*L.*) *tammuzi* based on examination on the type-material are provided.

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Introduction

To date, 19 terrestrial Parasitengona mites (excluding Leeuwenhoekiidae, Trombiculidae and Walchiidae) have been listed for the Canary Islands (Haitlinger, 2019). Of these, four species of *Leptus* Latreille, 1796 were found: *Leptus* (*Leptus*) *canaricus* Haitlinger, 2009, *L.* (*L.*) *edwini* Haitlinger, 2009 and *L.* (*L.*) *tenerificus* Haitlinger, 2009 on Tenerife and *L.* (*L.*) *maxorata* Haitlinger 2009 on Fuerteventura (Haitlinger, 2009). In this paper, we describe two new species of *Leptus*: *L.* (*Leptus*) *grancanaricus* n. sp. from Gran Canaria and *L.* (*L.*) *machadoi* n. sp. from Fuerteventura. This is the first record of erythraeid mites from Gran Canaria and the second record from Fuerteventura. All *Leptus* species were collected from curculionid beetles: *L.* (*L.*) *maxorata* from *Herpisticus calvus* Wollaston (Fuerteventura, endemic), *L.* (*L.*) *canaricus* from *Laparocerus crassifrons* Wollaston, *L.* (*L.*) *edwini* from *L. tessellatus* Boullé and *L.* (*L.*) *tenerificus* from *L. fernandezi* Roudier. They are all Tenerife endemics. *Herpisticus guanarteme* Machado, 2020 (Gran Canaria endemic, parasitised by *L.* (*L.*) *grancanaricus* n. sp.) and *L. maxorata* Machado (Fuerteventura endemic, parasitised by *L.* (*L.*) *machadoi* n. sp.) are new hosts for the complex of *Leptus* spp.

Supplementary data to the descriptions of *L.* (*L*) *akkus* Haitlinger, 1990, *L.* (*L.*) *andae* Haitlinger, 2003, *L.* (*L.*) *hammameticus* Haitlinger, 1998, *L.* (*L.*) *horiacus* Haitlinger, 1994 and *L.* (*L.*) *tammuzicus*

Haitlinger, 1994 based on examination of the type-material, are also provided (the types are in very poor condition and some metrical and meristic data could not be completed).

Materials and methods

One species of curculionid beetle was collected from Gran Canaria and one species of curculionid beetle was collected from Fuerteventura. From these, we obtained 32 larvae, 17 larvae of *Leptus* (*Leptus*) *grancanaricus* n. sp. from Gran Canaria and 15 larvae of *Leptus* (*Leptus*) *machadoi* n. sp. from Fuerteventura (all collected by AM). All specimens were preserved in ethanol (70%) and then mounted in Berlese's medium. Measurements (given in micrometres) were taken and figures were drawn using a NIKON Eclipse 59i microscope. Terminology and abbreviations follow Haitlinger (1999, 2013).

To comply with the regulations set out in Article 8.5 of the amended 2012 version of the *International Code of Zoological Nomenclature* (ICZN, 2012), details of all new taxa have been submitted to ZooBank. For each new taxon, the Life Science Identifier (LSID) is reported in the taxonomic summary.

Family Erythraeidae Robineau-Desvoidy, 1828
Genus *Leptus* Latreille, 1796

Leptus (*Leptus*) *grancanaricus* n. sp.

Type-host: Herpisticus guanarteme (Coleoptera: Curculionidae).
Type-locality: Tejada: Mirador de Timagada, altitude 1,258 m (27°58′39″N, 15°36′60″W), Gran Canaria, Canary Islands, Spain.
Type-material: The holotype and 16 paratypes, all from *H. guanarteme* (coll. 17.vii.2019). The holotype and 16 paratypes were deposited in Museum of Natural History, Wrocław University (MNHWU), Poland.
ZooBank registration: The Life Science Identifier (LSID) for *Leptus* (*Leptus*) *grancanaricus* n. sp. is urn:lsid:zoobank.org:act:6537C2C2-25F9-4092-9C48-441DC8130AF2.
Etymology: The species is named after the island where the holotype and paratypes were collected.

Description

Larva [Based on the holotype and 16 paratypes; measurements in Table 1; Figs. 1–12.] Dorsum of idiosoma with ∼210 setae with very short barbs (holotype), 210–240 (paratypes). Single eye present at the level of postero-lateral margins of scutum 16 (12–17) (Figs. 1, 2). Dorsal scutum punctate (in medial part of sclerite), with concave anterior border. Two cuticular lines present below anterior sensillae sockets cuticular line and below and laterally to posterior sensillae sockets. Posterior border with slight concavity. Scutalae AL longer than PL, all barbed. Anterior sensillae ASE and posterior sensillae PSE both with setules on distal half (Figs. 5–7). Ventral surface of idiosoma bearing setae *1a* and *2a, 1a* > *2a*, all barbed; 20 barbed setae between coxae II-III; 60 barbed setae (56–60) posterior to coxae III. Coxalae *1b, 2b, 3b* all barbed; coxalae *1b* distinctly longer than others. Peg-like supracoxal seta *elc I* (5 μm) present on dorsal rim of coxa I (Figs. 3, 4). Gnathosoma, with nude posterior hypostomalae (*bs*) and nude galealae (*cs*). Anterior hypostomalae (*as*) absent. Gnathobase punctate, with supracoxal setae (*elcp* ∼5 μm) with slight basal expansion, placed in dorso-lateral position, at gnathosoma base. Palpfemur with 1 barbed seta, palpgenu with 2 barbed setae. Palptibia with 3 barbed setae (Fig. 8). Palptarsus with 5 normal setae (all smooth), 1 solenidion (ω) located in the proximal part of the segment and 1 eupathidium (ζ) placed distally. (Fig. 9). Pedipalp formula: 0-B-BB-BBB-ωζNNNNN. Odontus simple. Legs setal formula. Leg I: Ta 1ω, 2ζ, 24 (20–24); Ti 2φ, 1κ, 14 (13–14); Ge 1σ, 1κ, 8; Tf 5; Bf 2; Tr 1; Cx 1 (Fig. 10). Leg II: Ta 1ω, 2ζ, 22 (19–22); Ti 2φ, 14 (13–15); Ge 1κ, 8; Tf 5; Bf 2; Tr 1; Cx 1 (Fig. 11). Leg III: Ta 1ζ, 23 (21–25); Ti 1φ, 15 (15–16); Ge 8; Tf 5; Bf 1; Tr 1; Cx 1 (Fig. 12). Solenidia and eupathidia on legs without companion setae (z); coxal fields punctate.

Postlarval instars unknown.

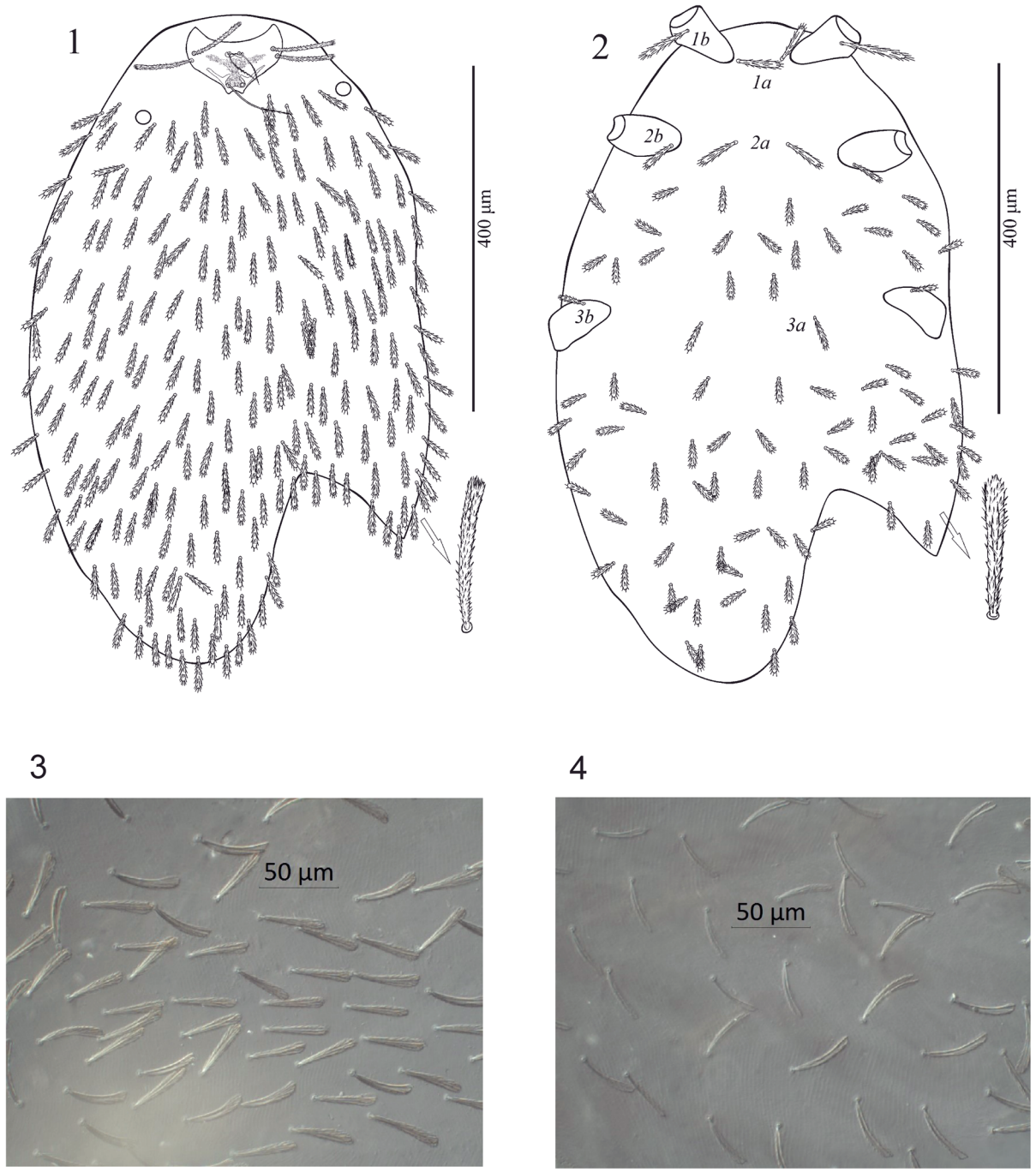
Differential diagnosis

Leptus (*Leptus*) *grancanaricus* n. sp. belongs to the species group of *Leptus* spp. bearing two setae on the palpgenu, two setae between coxae I-II, more than four setae between coxae II-III, Ta I > 160 μm and Ti III > 280 μm. This group includes *L.* (*L.*) *akkus* Haitlinger, 1990 from Spain, *L.* (*L.*) *bertoldi*

Table 1 Metrical data for *Leptus* (*Leptus*) *grancanaricus* n. sp.

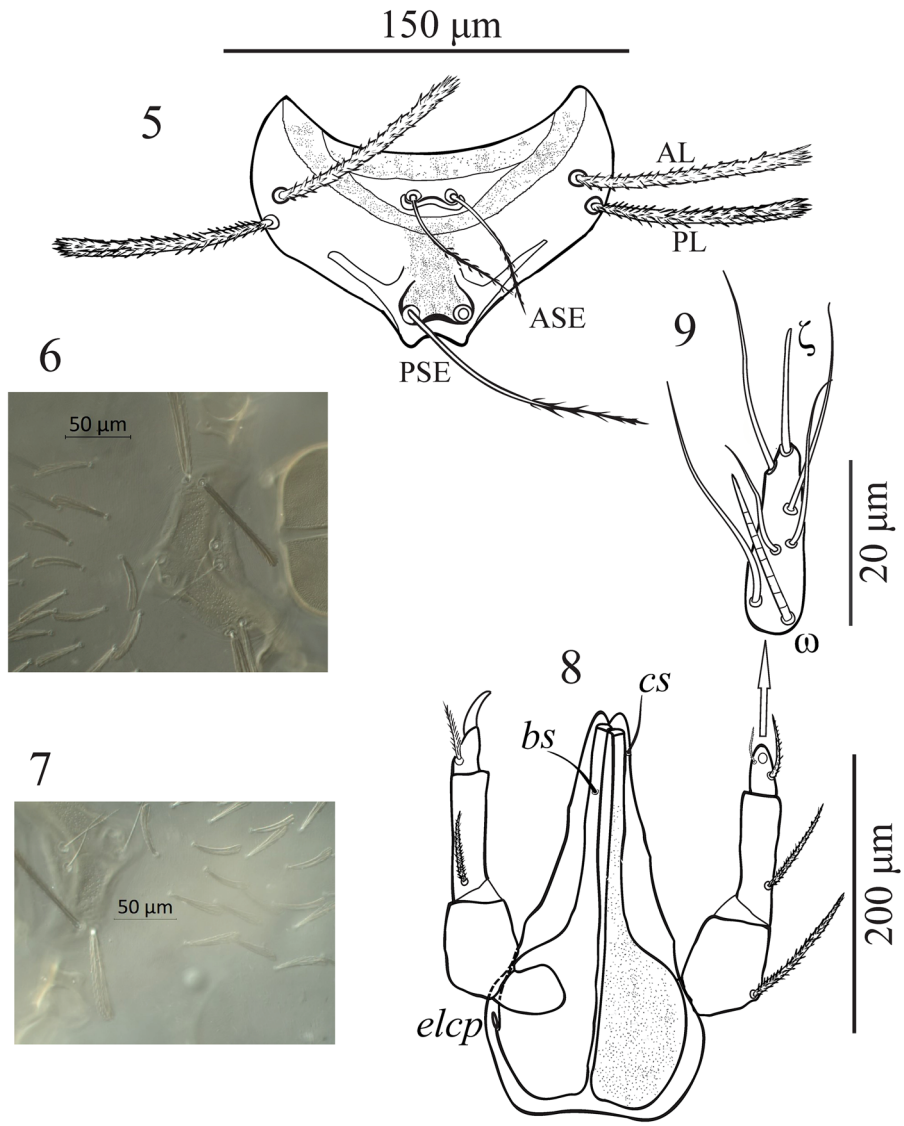
Character	Holotype	Paratypes (Range)	Character	Holotype	Paratypes (Range)
IL	746	439–953	ωI	30	21–32
IW	460	354–737	φIa	41	34–45
L	99	84–100	φIb	24	18–27
W	132	119–142	σI	41	25–41
AW	111	101–111	ωII	21	15–21
PW	115	105–117	ωI	30	21–32
ISD	40	35–42	φIIa	34	25–34
AP	11	8–13	φIIb	13	10–13
AA	15	13–17	TaI	170	168–183
SB	16	12–18	TiI	242	242–265
AL	82	76–91	GeI	166	157–173
PL	74	59–75	TfI	124	117–141
ASE	54	35–54	BfI	136	130–151
PSE	92	79–94	TrI	58	51–60
LX	44	20–46	CxI	85	70–85
ASBM	31	16–38	TaII	141	131–152
GL	288	258–288	TiII	197	192–207
DS	34–55	29–55	GeII	128	120–136
PsFd	94	80–94	TfII	94	89–104
PsGd	75	65–83	BfII	116	99–125
PsGv	52	52–67	TrII	50	49–56
PaFe(L)	76	67–78	CxII	81	65–85
PaFe(W)	35	28–40	TaIII	176	172–188
PaGe(L)	79	73–83	TiIII	294	285–317
PaGe(W)	18	17–21	GeIII	159	151–164
1a	54	46–58	TfIII	132	123–136
2a	47	40–49	BfIII	122	122–141
1b	73	68–83	TrIII	53	49–61
2b	35	28–36	CxIII	76	76–87
3b	35	31–38	LegI	981	949–1018
cs	37	27–43	LegII	807	786–834
bs	43	38–46	LegIII	1012	1,006–1,072
OD	33	26–33	IP	2,800	2,757–2,905

Haitlinger, 1993 from Ghana, *L.* (*L.*) *edwini* Haitlinger, 2009 from Canary Islands (Spain) and *L.* (*L.*) *hammameticus* Haitlinger, 1998 from Tunisia and Sicily (Haitlinger, 1990, 1993, 1998, 2009, 2012). It differs from *L.* (*L.*) *akkus* in the longer AL (76–91 *vs* 66–72 μm), GL (258–278 *vs* 222–228 μm), PSE (79–94 *vs* 68–74 μm), shorter Ta I (168–183 *vs* 200 μm), Ti I (242–265 *vs* 312 μm), Ta II (131–152 *vs* 160–166 μm), Ti II (192–207 *vs* 252–254 μm), Ta III (172–188 *vs* 206 μm) and Ti III (285–317 *vs* 362 μm); from *L.* (*L.*) *bertoldi* in the longer L (84–100 *vs* 66–70 μm), W (119–142 *vs* 100–104 μm), AW (101–111 *vs* 82–86 μm), PW (105–117 *vs* 94–98 μm), PaFe (L) (67–78 *vs* 50–56 μm), PaGe (L) (73–83 *vs* 60–61 μm), shorter Ti I (242–265 *vs* 332 μm), Ti II (192–207 *vs* 258–264 μm) and Ti III (285–317 *vs* 384 μm); from *L.* (*L.*) *edwini* in the longer AL (76–91 *vs* 60–68 μm), GL (258–278 *vs* 250–254 μm), PsFd (80–94 *vs* 64–74



Figs. 1–4 *Leptus* (*Leptus*) *grancanaricus* n. sp. 1, Idiosoma, dorsal view; 2, Dorsal opisthosomal setae; 3, Idiosoma, ventral view; 4, Ventral opisthosomal setae

µm), *1a* (46–58 *vs* 38–42 µm) and shorter ISD (35–42 *vs* 44–48 µm) and from *L.* (*L.*) *hammameticus* in the shorter PaGe (L) (73–83 *vs* 84–86 µm), Ge I (157–173 *vs* 180–192 µm), Ti II (192–207 *vs* 210–232 µm), Ge II (120–136 *vs* 140–148 µm), leg I (940–1,018 *vs* 1,032–1,110 µm), leg II (786–834 *vs* 868–918 µm), leg III (1,006–1,072 *vs* 1,089–1,150 µm), IP (2,757–2,905 *vs* 2,993–3,178 µm), fD (210–249

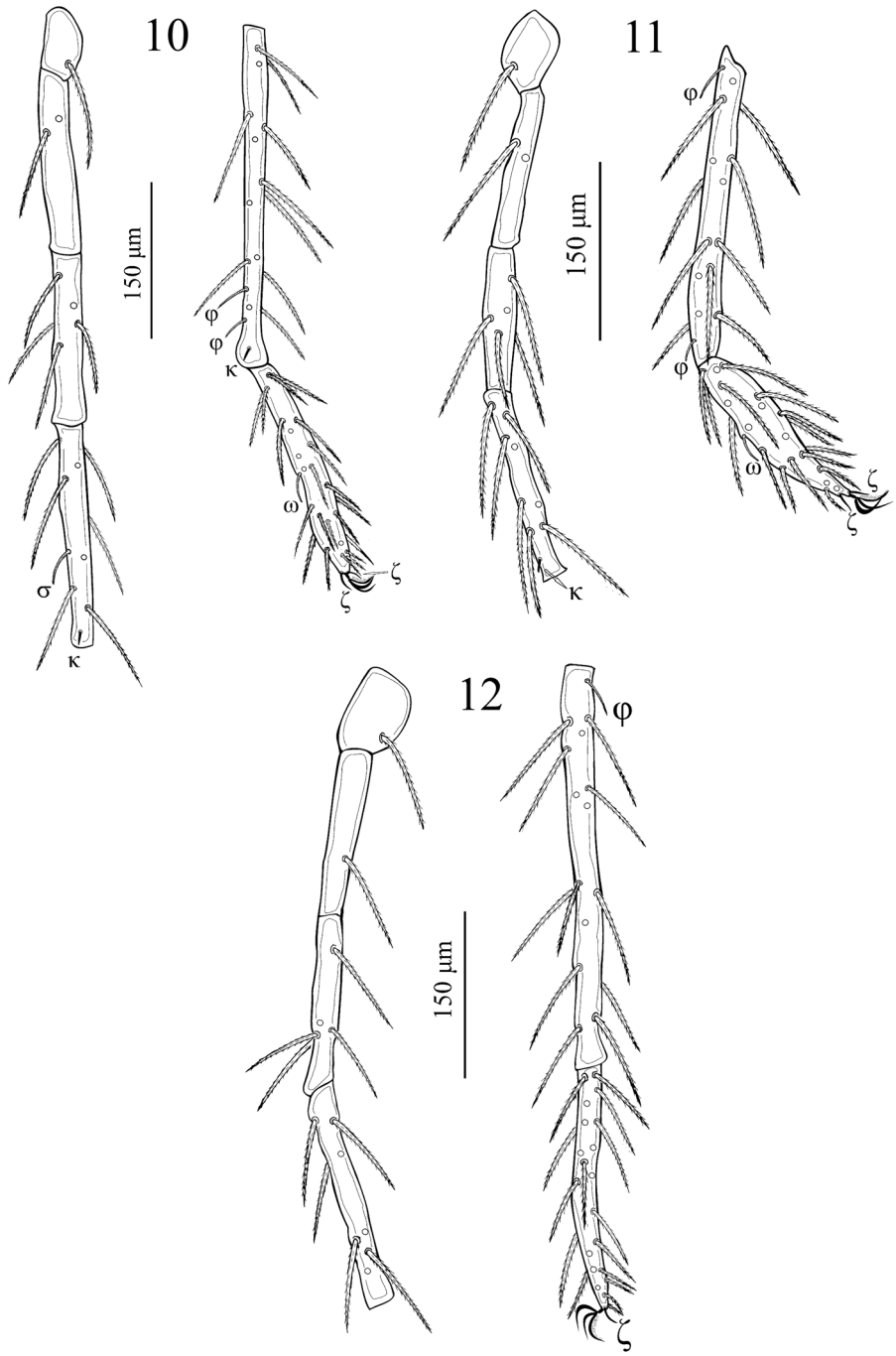


Figs. 5–9 *Leptus* (*Leptus*) *grancanaricus* n. sp. 5, Scutum; 6, Ornamentation of prodorsal sclerite; 7, AL, PL scutalae and ASE, PSE sensillae, 8, Gnathosoma; 9, Palptarsus

vs ~ 190) and fV (setae beyond coxae III) (50–60 *vs* 44).

Leptus (*Leptus*) *machadoi* n. sp.

Type-host: *Laparocerus maxorata* (Coleoptera: Curculionidae).
Type-locality: Jandia, Pico de la Zarza, 807 m (28°05′50″N, 14°01′12″W), Fuerteventura, Canary Islands, Spain.
Type-material: Holotype and 14 paratypes, all from *L. maxorata* (leg. A. Machado; coll. 5.iii.2011). Holotype and 14 paratypes were deposited in the Museum of Natural History, Wrocław University (MNHWU), Poland.
ZooBank registration: The Life Science Identifier (LSID) for *Leptus* (*Leptus*) *machadoi* n. sp. is urn:lsid:zoobank.org:act:7696BC00-612D-4EDA-A9FA-FDE94FE75AF5.

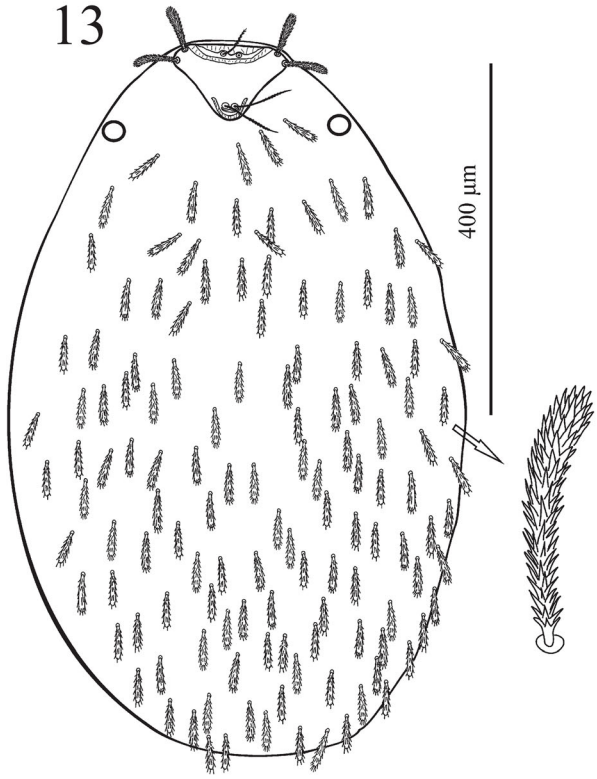


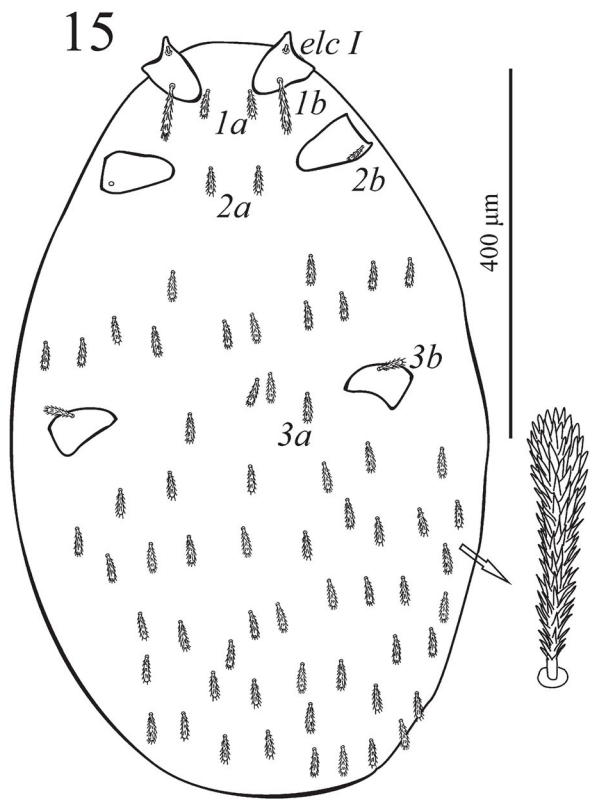
Figs. 10–12 *Leptus* (*Leptus*) *grancanaricus* n. sp. 10, Leg I; 11, Leg II; 12, Leg III

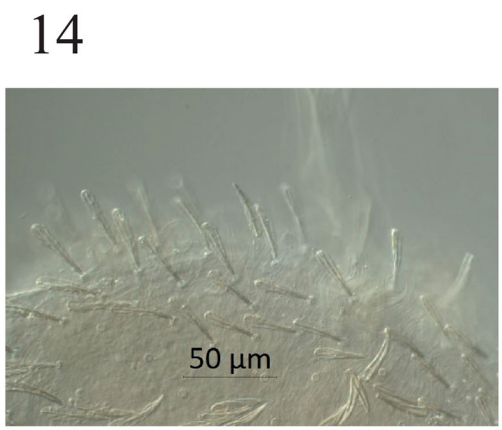
Etymology: The name is given in honor of the Spanish researcher Dr Antonio Machado, who donated mite larvae to all *Leptus* species described from the Canary Islands.

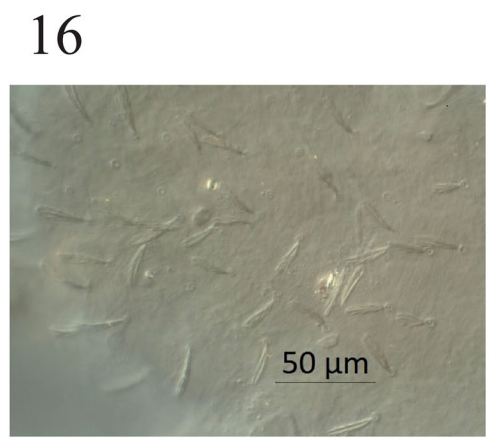
Description

Larva [Based on the holotype and 14 paratypes; measurements in Table 1; Figs. 13–24.] Dorsum of idiosoma with ∼130 barbed setae (110–130). One









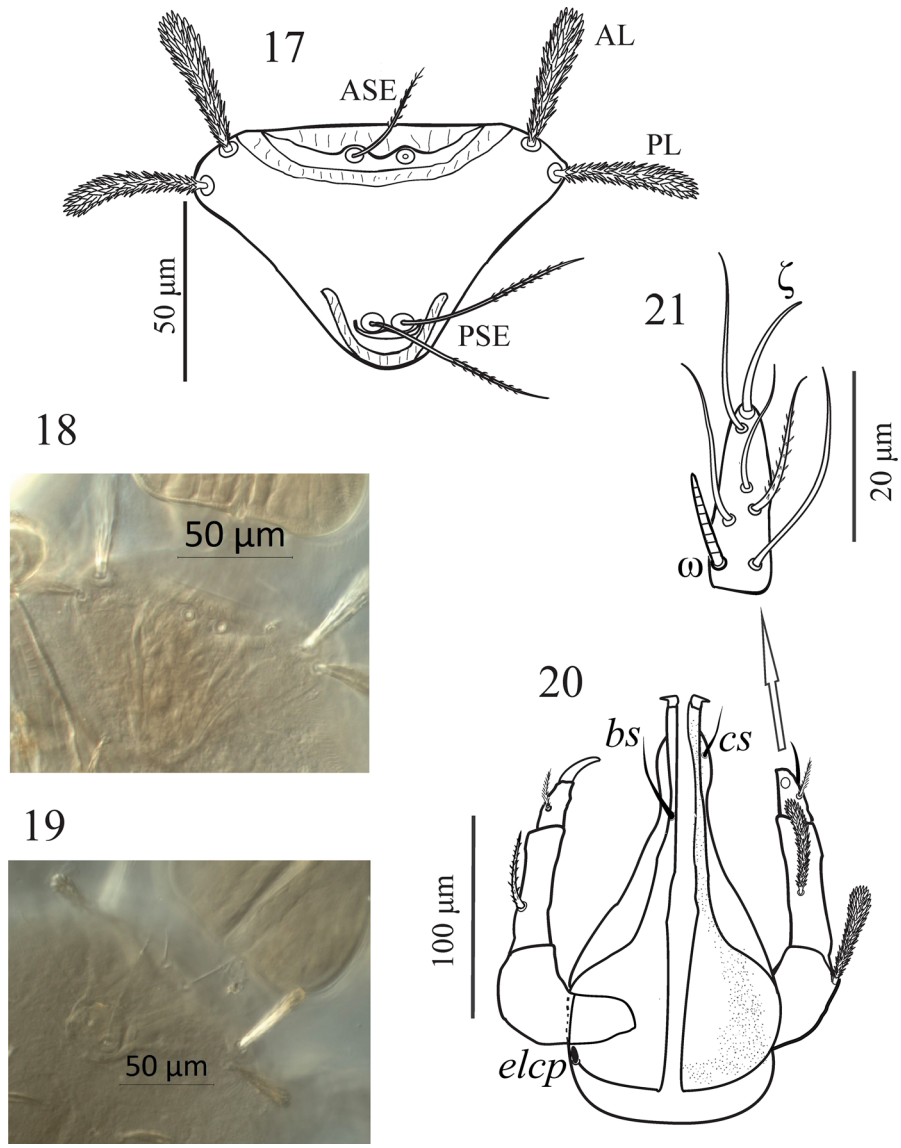
Figs. 13–16 *Leptus* (*Leptus*) *machadoi* n. sp. 13, Idiosoma, dorsal view; 14, Dorsal opisthosomal setae; 15, Idiosoma, ventral view; 16, Ventral opisthosomal setae

pair of eyes at level of postero-lateral margins of scutum 14 (13–16) (Figs. 13, 14). Dorsal scutum with straight anterior border (or slightly concave in some paratypes) (Table 2). Scutalae AL longer than PL, all barbed. Anterior sensillae ASE and posterior sensillae PSE with setules on distal half. Posterior sensillae sockets with cuticular lines posteriorly and laterally. Two wide cuticular lines present at anterior sensillae sockets (Figs. 17–19) (invisible in some paratypes). Ventral surface of idiosoma bearing setae *1a* and *2a,* all barbed; 14 barbed setae between coxae II-III; 44 (44–46) barbed setae posterior to coxae III. Coxalae

Table 2 Metrical data for *Leptus* (*Leptus*) *machadoi* n. sp.

Character	Holotype	Paratypes (Range)	Character	Holotype	Paratypes (Range)
IL	817	349–857	*bs*	36	27–38
IW	549	246–682	OD	22	20–24
L	71	71–85	ωI	24	19–26
W	117	101–120	φIa	33	25–33
AW	94	82–99	φIIa	27	20–27
PW	103	90–111	φIIb	10	10–12
ISD	47	41–51	TaI	119	112–131
AP	9	9–11	TiI	140	123–148
AA	14	11–16	GeI	107	84–110
SB	14	10–15	TfI	65	56–75
AL	44	38–49	BfI	75	60–83
PL	39	26–41	TrI	42	33–47
ASE	32	30–40	CxI	64	51–68
PSE	59	58–64	TaII	99	89–107
LX	15	12–22	TiII	112	98–114
ASBM	0	0–6	GeII	85	73–86
GL	215	191–219	TfII	57	50–65
DS	28–35	20–45	BfII	61	46–64
PsFd	54	53–62	TrII	39	34–46
PsGd	54	45–58	CxII	65	50–70
PdGv	34	30–43	TaIII	108	102–118
PaFe(L)	55	45–58	TiIII	150	135–160
PaFe(W)	36	27–39	GeIII	98	81–100
PaGe(L)	70	63–76	TfIII	69	55–72
PaGe(W)	19	18–21	BfIII	69	60–78
1a	28	22–30	TrIII	39	36–46
2a	27	18–28	CxIII	58	45–67
1b	50	45–57	LegI	612	563–646
2b	21	13–23	LegII	518	458–523
3b	30	21–31	LegIII	582	533–609
cs	28	19–28	IP	1,712	1,586–1,766

1b, *2b* and *3b* all barbed. Peg-like supracoxal seta *elc I* (5 μm) present on dorsal rim of coxa I (Figs. 15, 16). Gnathosoma with nude posterior hypostomalae (*bs*) and galealae (*cs*). Anterior hypostomalae (*as*) absent. Gnathobase punctate with supracoxal setae (elcp ~4 μm) with slight basal expansion, placed in dorso-lateral position, at gnathosoma base. Palpfemur with 1 barbed seta, palpgenu with 2 barbed setae. Palptibia with 3 setae, 1 of them nude (Fig. 20). Palp tarsus with five normal setae, of which 1 is covered with fine setules and 4 are nude, one solenidion (ω) located in proximal part of segment and 1 eupathidium (ζ), placed distally (Fig. 21). Pedipalp formula: 0-B-BB-BBN-ωζNNNNN. Leg setal formula. Leg I: Ta 1ω, 2ζ, 23 (19–23); Ti 2φ, 1κ, 12; Ge 1σ, 1κ, 8; Tf 5; Bf 2; Tr 1; Cx 1 (Fig. 22). Leg II: Ta 1ω, 2ζ, 19 (19–22); Ti 2φ, 12; Ge 1κ, 8; Tf 5; Bf 2; Tr 1; Cx 1 (Fig. 23). Leg III:

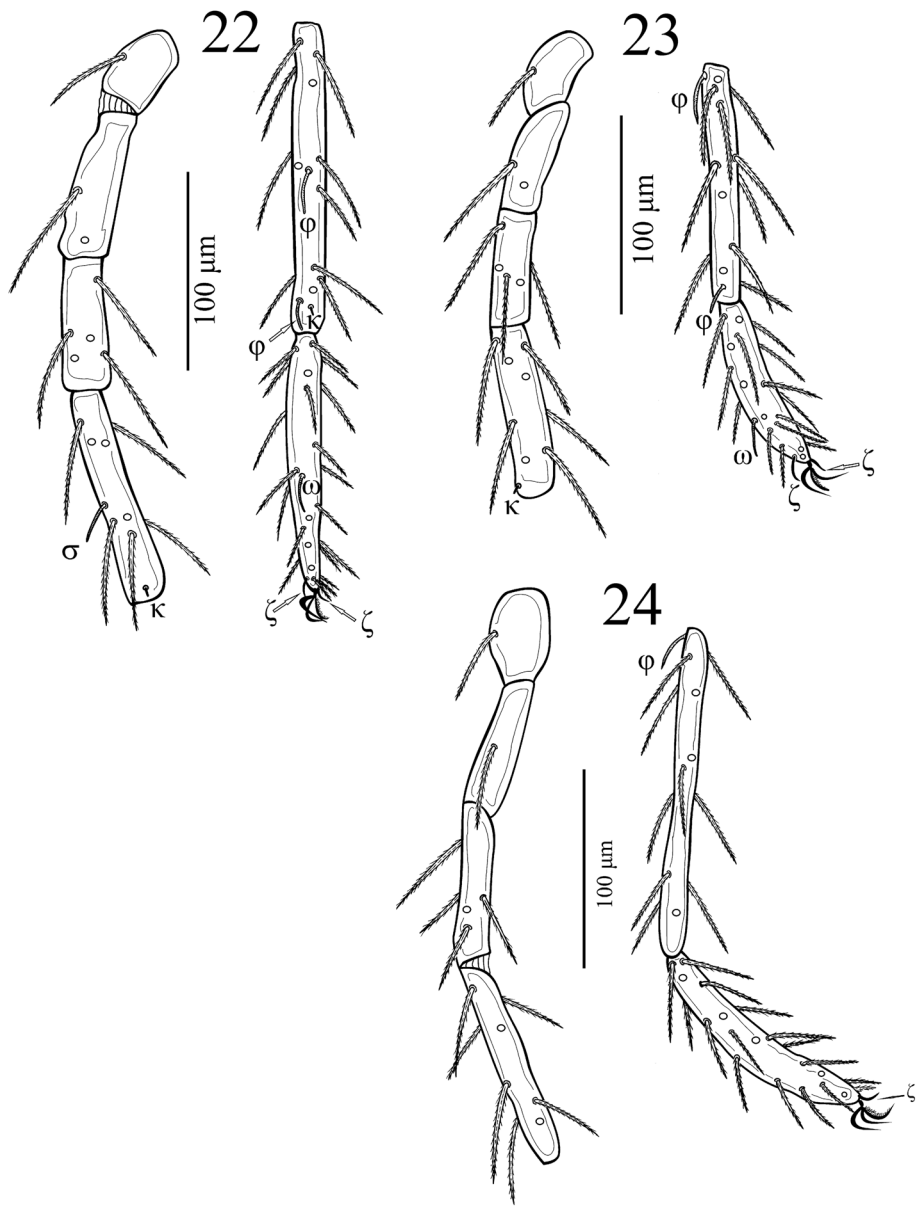


Figs. 17–21 *Leptus* (*Leptus*) *machadoi* n. sp. 17, Scutum; 18, Ornamentation of prodorsal sclerite; 19, AL, PL scutalae and ASE, PSE sensillae, 20, Gnathosoma; 21, Palptarsus

Ta 1ζ, 21 (18–22); Ti 1φ, 12 (12–14); Ge 8; Tf 5; Bf 1; Tr 1; Cx 1 (Fig. 24).
Postlarval instars unknown.

Differential diagnosis

Leptus (*Leptus*) *machadoi* n. sp. belongs to the species group of *Leptus* bearing two setae on the palpgenu, two setae between coxae I-II, more than four setae between coxae II-III, Ta I less than 140 µm and Ti III less than 190 µm. This group includes *L.* (*L.*) *andae* Haitlinger, 2003 from Rhodes (Greece), *L.* (*L.*) *dubius* Paoli, 1937 from Italy, *L.* (*L.*) *horiacus* Haitlinger, 1994 from Syria, *L.* (*L.*) *maxorata* Haitlinger, 2009 from Canary Islands (Spain), *L.* (*L.*) *mogadoranus* Haitlinger, 1990 from Morocco, *L.* (*L.*) *pasopaicus* Haitlinger, 1990 from Namibia, *L.* (*L.*) *polythrix* Fain & Elsen 1987 from Malawi, *L.* (*L.*) *pyrenaeus* André, 1953 from France, and *L.* (*L.*) *tammuzi* Haitlinger, 1994 from Israel, Saudi Arabia and Syria (Paoli, 1937;



Figs. 22–24 *Leptus* (*Leptus*) *machadoi* n. sp. 22, Leg I; 23, Leg II; 24, Leg III

André, 1953; Fain & Elsen, 1987; Haitlinger, 1990a, b, 1994, 2003, 2009). It differs from *L.* (*L.*) *andae* in the longer W (101–120 *vs* 92–100 µm), AW (82–99 *vs* 78–80 µm), *1a* (18 – 28 *vs* 36 µm), PaGe (L) (63–76 *vs* 58–60 µm), PaFe (L) (67–78 *vs* 56 µm), ANS (16–38 *vs* 8 µm) and fV (44–46 *vs* 27 µm); from *L.* (*L.*) *dubius* in fn intercoxalae (~ 14 *vs* 10), fD (110–130 *vs* 88 µm) and scutum without lines in median part *vs* scutum with lines in median part; from *L.* (*L.*) *horiacus* in the longer W (101–120 *vs* 90–96 µm), AW (82–99 *vs* 72–74 µm), PW (90–111 *vs* 78–84 µm), GL (191–219 *vs* 160–170 µm), PaGe (L) (63–76 *vs* 54–52 µm), Ti III (135–160 *vs* 184 µm) and fD (110–130 *vs* < 100 µm); from *L.* (*L.*) *maxorata* in the shorter AL (38–49 *vs* 50–54 µm), L (71–85 *vs* 84–98 µm), PsGv (30–43 *vs* 46–54 µm), ANS (0–6 *vs* 13–20 µm), ωI (19–26 *vs* 34–41 µm), leg III (533–609 *vs* 614–656 µm), IP (1,586–1,766 *vs* 1,768–1,854 µm) and fV (44–46 *vs* 58 µm); from *L.* (*L.*) *mogadoranus* in the shorter W (101–120 *vs* 134–146 µm), AW (82–99 *vs* 110–118

μm), PW (90–111 *vs* 122–130 μm), PL (25–41 *vs* 56 μm), *1a* (20–24 *vs* 32–38 μm), PsGd (45–58 *vs* 82 μm) and PsGv (30–43 *vs* 50 μm); from *L.* (*L.*) *pasopaicus* in the longer W (101–120 *vs* 94 μm), AW (82–99 *vs* 76 μm), PW (90–111 *vs* 84 μm), GL (191–219 *vs* 142 μm), ISD (41–51 *vs* 34 μm), shorter *1a* (20–24 *vs* 40 μm) and Ti III (135–160 *vs* 182 μm); from *L.* (*L.*) *polythrix* in the shorter AL (38–49 *vs* 51–64 μm), PL (26–41 *vs* 45–52 μm), longer PaGe (L) (63–76 *vs* 45 μm) and fD (110–130 *vs* ~200); from *L.* (*L.*) *pyrenaeus* in the longer AL (38–49 *vs* 25 μm), AL > PL *vs* AL = PL, AW (82–99 *vs* 64 μm), PW (90–111 *vs* 79 μm), fV (44–46 *vs* 54 μm) and scutum without a wide belt between AL *vs* scutum with a wide belt between AL and from *L.* (*L.*) *tammuzi* in the shorter L (71–85 *vs* 90–104 μm), PL (26–41 *vs* 42–52 μm), shorter Ta III (102–118 *vs* 126–140 μm), Ti III (135–160 *vs* 170–204 μm) and Ge III (81–100 *vs* 104–118 μm).

Leptus (*Leptus*) *akkus* Haitlinger, 1990

Corrections and additions to the original description
ASBM 7; LX 40 (33); *elcp* 5; *bs* nude 34 (31); *cs* 20; σI 38; φIb 13; φIIa 36; ωII 17 (paratype); palptibia 2B; 1N; palptarsus ωζBNNNN.

Leptus (*Leptus*) *andae* Haitlinger, 2003

Corrections and additions to the original description
PaFe (L) 56; PaFe (W) 39; *elcI* 4; ASBM 8; ωI 21; φIa 27; φIb 19; σI 23; ωII 18; φIIa 21; φIIb 12; OD 24.

Leptus (*Leptus*) *hammameticus* Haitlinger, 1998

Corrections and additions to the original description
ASBM 11; LX 45; *cs* 22; *elcp* 7; *elcI* 4; ωI 33; φIa 27; φIb 19; σ 31; ωII 19; φIIa 23; φIIb 11; OD 33; Leg I: Ta –; Ti 2φ, 1κ, 14; Ge 1σ, 1κ, 8; Tf 5; Bf 2; Tr 1; Cx 1. Leg II: Ta 1ω, 2ζ, 24; Ti 2φ, 14; Ge 1κ, 8; Tf 5; Bf 2; Tr 1; Cx 1. Leg III: Ta 1ζ, 26; Ti 1φ, 14; Ge 8; Tf 5; Bf 1; Tr 1; Cx 1.

Leptus (*Leptus*) *horiacus* Haitlinger, 1994

Corrections and additions to the original description
PaFe (L) 40 holotype (38–40 paratypes); PaFe (W) 32 (33–34); *bs* 25 (26); ωI 31; φIa 32 (both paratypes); ωII 18; φIIa 19 (24); φIIb 8, OD 22 (22–24).

Leptus (*Leptus*) *tammuzius* Haitlinger, 1994

Corrections and additions to the original description
PaFe (L) 48 holotype (51–56 paratypes); PaFe (W) 42 (38–43); *bs* 26 (24–29); ωI 22 (24–25), φIa 26; σI 27; φIb 22; ωII 16 paratype; OD 20 (22–25).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All applicable institutional, national and international guidelines for the care and use of animals were followed.

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