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Description of *Leptus* (*Leptus*) *haitlingeri* n. sp. (Trombidiformes: Erythraeidae), parasitising horse flies (Diptera: Tabanidae), and a key to the larvae of *Leptus* spp. in Brazil

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Abstract The genus *Leptus* Latreille, 1796 (Trombidiformes: Erythraeidae) is represented by more than 250 species worldwide, and the larval stages of these mites are ectoparasites of many arthropod orders. In Brazil, there are 12 species of *Leptus*, some of which have been reported parasitising representatives of the orders Opiliones, Araneae, Coleoptera, Heteroptera, Hymenoptera and Diptera. This paper describes *Leptus* (*Leptus*) *haitlingeri* n. sp. collected from horse flies (Diptera: Tabanidae) in the state of Sao Paulo, Brazil. The new species is distinguished from *L.* (*L.*) *adaminae* Haitlinger, 2004 and *L.* (*L.*) *fozicus* Haitlinger, 2004 by the presence of 4 branched setae on palptarsus (*vs* 2 branched setae). A key to the larvae of *Leptus* spp. in Brazil is provided.

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Introduction

Most larvae in the family Erythraeidae Robineau-Desvoidy, 1828 are ectoparasites of arthropods and some could be potential vectors of pathogens or

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biological control agents of hosts (DiBlasi et al., 2011; González-Moraga et al., 2015; Welbourn, 1983). This family belongs to the order Trombidiformes Reuter, 1909 and comprises 66 genera, including *Leptus* Latreille, 1796 with approximately 275 species described worldwide (Mąkol & Wohltmann, 2012). In Brazil, larval stages of *Leptus* spp. have been recorded from species of the following arthropod orders: Opiliones; Araneae (Actinopodidae); Coleoptera (Chrysomelidae and Lycidae); Heteroptera (Lygaeidae, Pentatomidae and Reduviidae); Hymenoptera (Apidae); and Diptera (Sarcophagidae) (see Oudemans, 1905, Haitlinger, 1987, 1991; Coracini & Samuels, 2002; Teixeira, 2011; Pereira et al., 2012; Pinto et al., 2014; Martin & Correia-Oliveira, 2016; Salvatierra & Almeida, 2017).

Thirteen species of *Leptus* have been recorded from Brazil. One species, *Leptus* (*Leptus*) *calvescens* (Berlese, 1888), is only known from the free-living/predatory post-larval instar; the remaining 12 species are only known from the larval instar: *L.* (*L.*) *adaminae* Haitlinger, 2004; *L.* (*L.*) *alberti* Haitlinger, 1991; *L.* (*L.*) *brasilicus* Haitlinger, Šundić & Pompermaier, 2017; *L.* (*L.*) *candangus* Šundić, Haitlinger & Pompermaier, 2017; *L.* (*L.*) *cyryli* Haitlinger, 1991; *L.* (*L.*) *fozicus* Haitlinger, 2004; *L.* (*L.*) *iguacuicus* Haitlinger, 2004; *L.* (*L.*) *mariani* Haitlinger, 1991; *L.* (*L.*) *onnae* Haitlinger, 2000; *L.* (*L.*) *planaltensis* Haitlinger, Šundić & Pompermaier, 2017; *L.* (*L.*) *stieglmayri* Oudemans, 1905); and *L.* (*L.*) *stolae* Haitlinger, 1987 (Haitlinger, 1987, 1991, 2000a, 2004; Haitlinger & Šundić 2016; Haitlinger et al., 2017; Mąkol & Wohltmann 2012; Šundić et al., 2017).

Here we describe a new species of *Leptus* found on horse flies (Diptera: Tabanidae), collected in two municipalities in the State of São Paulo, Brazil and provide a key for identification of the larvae of *Leptus* spp. in Brazil.

Materials and methods

Parasitic larval erythraeids collected from horse flies (Diptera: Tabanidae), deposited in the Acari Collection of the Butantan Institute, São Paulo, Brazil (IBSP), were examined. The alcohol fixed specimens were slide-mounted in Hoyer's medium according to Walter & Krantz (2009). In addition, some old slide mounted specimens in the same collection, were remounted using the technique described by Jacinavicius et al. (2013).

The mites were examined using two microscopy techniques: phase contrast (PC) and differential interference contrast (DIC) microscopy. The specimens were illustrated and measured using a Leica DFC 500 digital camera coupled to a Leica DM4000B phase contrast microscope with a drawing tube and a Leica DFC310 FX digital camera coupled to a Leica DMi8 differential interference contrast inverted microscope. The images were edited by Inkscape V. 2 and Adobe Photoshop v.13.0. All measurements are given in micrometres as the range followed by the mean in parentheses.

The terminology and measurements generally follows Robaux (1974), Southcott (1992), Haitlinger (1999, 2013) and Haitlinger et al. (2017) with additional data from the leg solenidia. We also followed the terminology proposed by Grandjean (1935, 1947) for leg chaetotaxy, and we adopted the nomenclature proposed by Kethley (1990). For *L.* (*L.*) *nikanori* and *L.* (*L.*) *mariani* we used the comparative morphometric data by Mayoral & Barranco (2011) and Haitlinger & Šundić (2016), respectively.

Hosts collected between the years 1938 and 1940 are housed at the Entomological Collection of the Butantan Institute, São Paulo, Brazil (IBSP). These specimens were identified as belonging to *Fidena* and their taxonomic status was confirmed to the subgenus level *Fidena* (*Fidena*) spp. based on Coscarón & Papavero (2009).

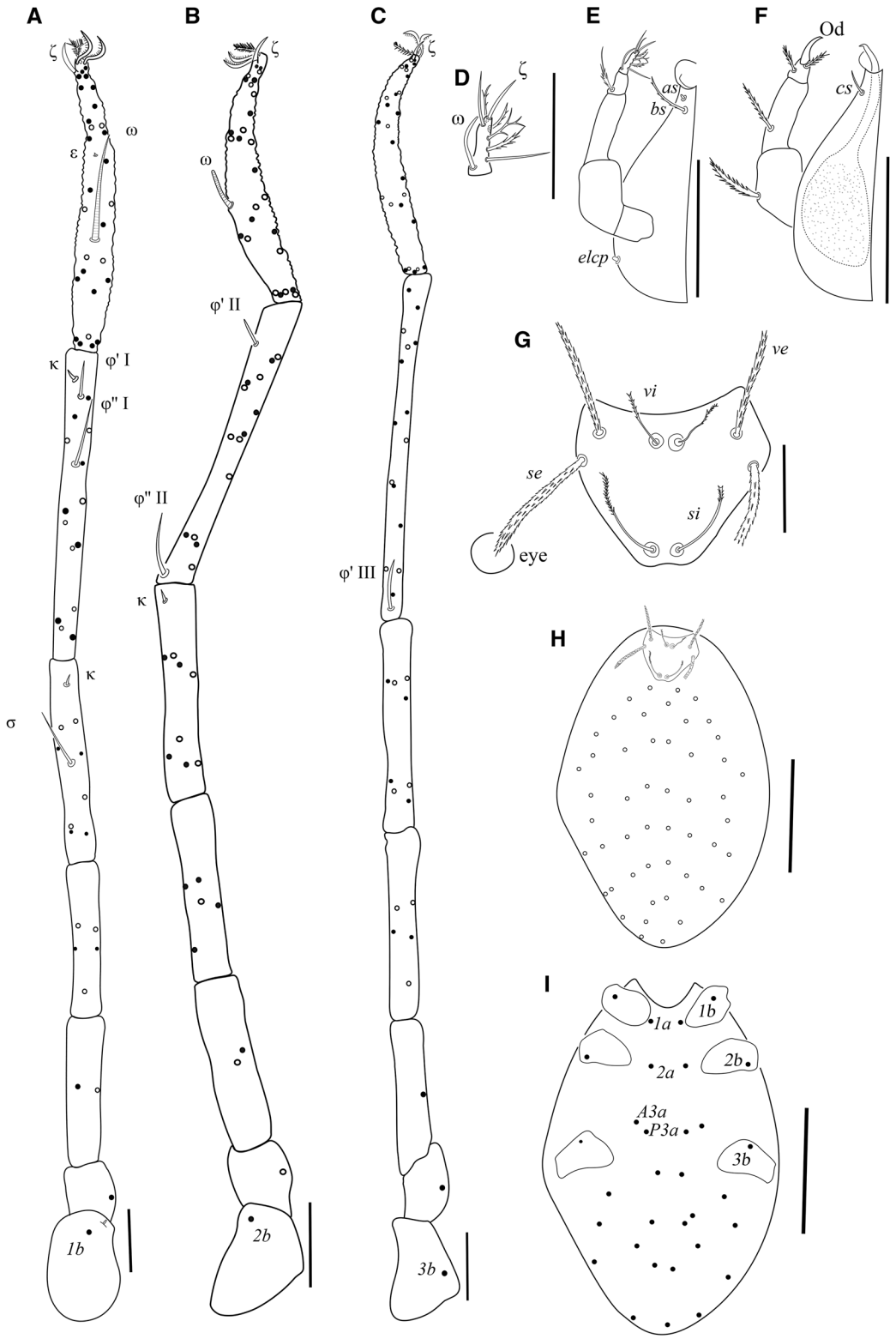
Family Erythraeidae Robineau-Desvoidy, 1828
Genus *Leptus* Latreille, 1796

***Leptus* (*Leptus*) *haitlingeri* Jacinavicius, Bassini-Silva & Welbourn n. sp.**

Type-host: *Fidena* (*Fidena*) sp. (Diptera: Tabanidae), horsefly.
Type-locality: Serra da Cantareira, São Paulo municipality, São Paulo State, Brazil.
Type-material: The holotype and 7 paratypes (all larval) from *Fidena* (*Fidena*) sp. (Diptera: Tabanidae) were deposited in the IBSP (reg. no. IBSP1830 - IBSP1835). Hosts were deposited in the Entomological Collection of Butantan Institute (reg. no. IBSP 3266, IBSP 3267, IBSP 3271, IBSP 3273, IBSP 3281 and IBSP 3291), 18.i.1940, coll. Fonseca.
Additional material examined: One larva of the same host species (host reg. no. IBSP 2725), same locality, 13.iii.1939, coll. Fonseca; mite deposited in the IBSP (reg. no. IBSP 1642); 3 larvae of the same host species (host reg. no. IBSP 2726 - IBSP 2728), same locality, 03.ii.1939, coll. Fonseca; all mite specimens deposited in the IBSP (reg. no. IBSP1643, IBSP1644 and IBSP1646); 1 larva of the same host species (host reg. no. IBSP 2729), same locality, 7.ii.1939, coll. Fonseca; mite deposited in the IBSP (reg. no. IBSP 1651); 12 larvae of the same host species (host reg. no. IBSP 3239, IBSP 3269, IBSP 3270, IBSP 3272, IBSP 3277, IBSP 3282, IBSP 3284–IBSP3286 and IBSP 3294), same locality, 20.i.1940, coll. Fonseca; all mite specimens deposited in the IBSP (reg. no. IBSP1837–IBSP 1846); 10 larvae of the same host species (host reg. no. IBSP 3268, IBSP 3274, IBSP 3276 and IBSP 329), same locality, 27.i.1940, coll. Fonseca; all mite specimens deposited in the IBSP (reg. no. IBSP1847–IBSP1849, IBSP1851, IBSP1852, IBSP1855 and IBSP1857); 1 larva of the same host species (host reg. no. IBSP 2630), Brazil, São Paulo state, Ribeirão Preto municipality, Fazenda Fortaleza, 18.vii.1938, coll. Fonseca; mite deposited in the IBSP (reg. no. IBSP 1688).
ZooBank registration: 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 the new species have been submitted to ZooBank. The Life Science Identifier (LSID) for *Leptus* (*Leptus*) *haitlingeri* n. sp. is urn:lsid:zoobank.org:act:BCA4682B-1993-4519-9C5E-BA2B99AC47D8.
Etymology: The name is given in honor of the Polish researcher Professor Ryszard Haitlinger, in recognition of his contributions to the knowledge of Brazilian Erythraeidae.

Description (Figs. 1–4)

Larva [Based on the holotype and 7 paratypes; Tables 1, 2, 3, and 4.] Gnathosoma: palp setal formula B/B/BBB/4B2Nζω (Figs. 1D–F); odontus entire, chelicera with expanded base and long narrow neck terminating in cheliceral blade with tricuspid cap; gnathobase punctate (Fig. 3D); nude galeal setae (*cs*); nude adoral setae (*as*), branched subcapitular setae (*bs*), longer than adoral setae; with supracoxal setae (*elcp*) (Figs. 1E, F). Idiosoma: eyes 2, prodorsal sclerite punctate, pentagonal shape with 2 pairs of flagelliform trichobothria (*si* and *vi*), 1 pair of *ve* (= AL) setae and 1 pair of *se* (= PL); $se \geq ve > si > vi$; distal quarter of *si* and *vi* with setules; anterior margin of prodorsal sclerite concave (Figs. 1G, 3A, B). Idiosoma with 68–76 setae, 50–58 scattered dorsal opisthosomal setae with small setules (Figs. 1H, 4A); ventral idiosoma with 16–18 setae with small setules on only one side (Figs. 1I, 4B), 1 pair of *1a* setae (Fig. 4D), 1 pair of *2a* setae (Fig. 4E) and 2 pairs of *3a* setae (Figs. 4G, H), anterior pair of 3a setae (*A3a*) shorter than posterior pair (*P3a*) (Fig. 1I, K). Legs: femur legs I-III each divided into basifemur and telofemur, each leg terminated with pair of falciform claws with onychotriches, and pulvilliform empodium; solenidia and eupathidia on legs without companion setae (z); coxal fields punctate. Leg I: coxal field with 1 branched seta *1b* (1B) (Fig. 4C) and a peg-like supracoxal seta; trochanter 1B; basifemur 2B; telofemur 5B; genu 8B, σ, with κ; tibia 14B, 2 φ, with κ; tarsus 27B, with ω, ε, terminating with subterminal eupathid (ζ), famulus (ε) distal to ω


A
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◀**Fig. 1** Morphological details of *Leptus* (*Leptus*) *haitlingeri* n. sp. Holotype. A, Leg I; B, Leg II; C, Leg III; D, Palp tarsus, ventral view; E, Gnathosoma, ventral view; F, Gnathosoma, dorsal view; G, Prodorsal sclerite; H, Idiosoma, dorsal view; I, Idiosoma, ventral view. Black spots: ventral setae of the idiosoma; white spots: dorsal setae of the idiosoma. *Abbreviations*: ζ, eupathidium on palp tarsus and on tarsus of legs I-III; ω, solenidion on palp tarsus and on tarsus of legs I-II; Od, odontus; *as*, anterior hypostomalae setae; *bs*, posterior hypostomalae setae; *cs*, galeal setae; *elcp*, supracoxal setae; *ve*, anterolateral setae; *se*, posterolateral setae; *vi*, anterior trichobothria; *si*, posterior trichobothria; σ, solenidia on the genu of legs I-III; κ, microsetae on genu of legs I-II and tibia of leg I; φ, solenidia on the tibia of legs I-III; ε, famulus on the tarsus of legs I; *1a*, anterior sternal setae; *2a*, medium sternal setae; *3a*, posterior sternal setae; *1b*, seta of the coxal field of leg I; *2b*, seta of the coxal field of leg II; *3b*, seta of the coxal field of leg III. *Scale-bars*: A–G, 50 μm; H, I, 100 μm

(Figs. 1A, 2A, 3C). Leg II: coxal field seta 2b (1B) (Fig. 4F); trochanter 1B; basifemur 2B; telofemur 5B; genu 8B, with κ; tibia 15B, 2 φ; tarsus 27B, with ω, with subterminal eupathids (ζ) near distal end of segment, (Figs. 1B, 2B). Leg III: coxal field seta *3b* (1B) (Fig. 4I), trochanter 1B; basifemur 1B; telofemur 5B; genu 8B; tibia 15B, φ; tarsus 26B, and subterminal eupathid (ζ) (Figs. 1C, 2C).

Post-larval instars unknown.

Differential diagnosis

Leptus (*Leptus*) *haitlingeri* n. sp. possesses four branched and two nude setae on palptarsus, two pairs of adoral setae (*as* and *cs*) and one pair of subcapitular setae (*bs*); the anterior pair (*as*) is shorter than the *cs*, the subcapitular setae (*bs*) are branched and longer. The new species is similar to the Neotropical species with a single seta on the palpfemur and the palpgenu, two pairs of 3a setae and one solenidion on genu of the leg I. These species include: *L.* (*L.*) *adaminae*; *L.* (*L.*) *alberti*; *L.* (*L.*) *annikae* Haitlinger, 2000; *L.* (*L.*) *ariel*; *L.* (*L.*) *cyryli*; *L.* (*L.*) *fozicus*; *L.* (*L.*) *mariani*; *L.* (*L.*) *nikanori* Haitlinger, 2000; *L.* (*L.*) *olafi* Haitlinger 1991; *L.* (*L.*) *onnae*; *L.* (*L.*) *simonettae* Haitlinger, 2000; *L.* (*L.*) *stolae*; and *L.* (*L.*) *tiranicus* Haitlinger, 2006 (see Haitlinger, 1987, 1991, 2000a, b, 2004, 2006; Southcott, 1989). However, the new species differs from *L.* (*L.*) *adaminae* in having *bs* branched (*vs* nude), palptarsus with 4B2NζωI (*vs* 2B4NζωI) and a palptibial formula BBB (*vs* NBB); from *L.* (*L.*) *annikae* in having a shorter *as*, *bs* branched (*vs* nude), and palptarsus with 4B2NζωI (*vs* 3B3NζωI); from *L.* (*L.*) *ariel* in having *bs* branched (*vs* nude) and a larger ω on the tarsus of leg I; from *L.* (*L.*) *cyryli* in having a shorter prodorsal sclerite (73–90 *vs* 100 μm), a concave anterior border (*vs* anterior border straight), a larger ωI (62–66 *vs* 52 μm), and a shorter φ′ II (10–12 *vs* 20 μm), φ″ II (30–33 *vs* 40 μm) and φ′ III (30–33 *vs* 42 μm); from *L.* (*L.*) *fozicus* in having palptarsus with 4B2NζωI (*vs* 2B4NζωI) and a palptibial formula BBB (*vs* NBB); from *L.* (*L.*) *mariani* in having palptarsus with 4B2NζωI (*vs* 6NζωI), a smaller prodorsal sclerite (length: 73–90 *vs* 98–102 μm; width: 106–119 *vs* 128–133 μm), AW (78–88 *vs* 92–94 μm), PW (94–108 *vs* 113–118 μm)] and a longer branched (*vs* nude) *bs* (41–54 *vs* 27–30 μm, cited incorrectly as *as*); from *L.* (*L.*) *nikanori* in having the palptarsus with 4B2NζωI (*vs* 1B5NζωI), unfortunately the original description did not describe the adoral or subcapitular setae; from *L.* (*L.*) *olafi* and *L.* (*L.*) *alberti* in having *bs* branched (*vs* nude), larger ω on the tarsus of leg I, palptarsus with 4B2NζωI (*vs* all setae nude); from *L.* (*L.*) *onnae* in having palptarsus with 4B2NζωI (*vs* 1B5NζωI), larger ω on the tarsus of leg I; from *L.* (*L.*) *simonettae* in having palptarsus with 4B2NζωI (*vs* 2B4NζωI), *bs* branched (*vs* nude); from *L.* (*L.*) *stolae* in having palptarsus with 4B2NζωI (*vs* 6NζωI); and from *L.* (*L.*) *tiranicus* in having palptarsus with 4B2NζωI (*vs* 1B5NζωI), *bs* branched (*vs* nude), incorrectly cited in original description as *as*.

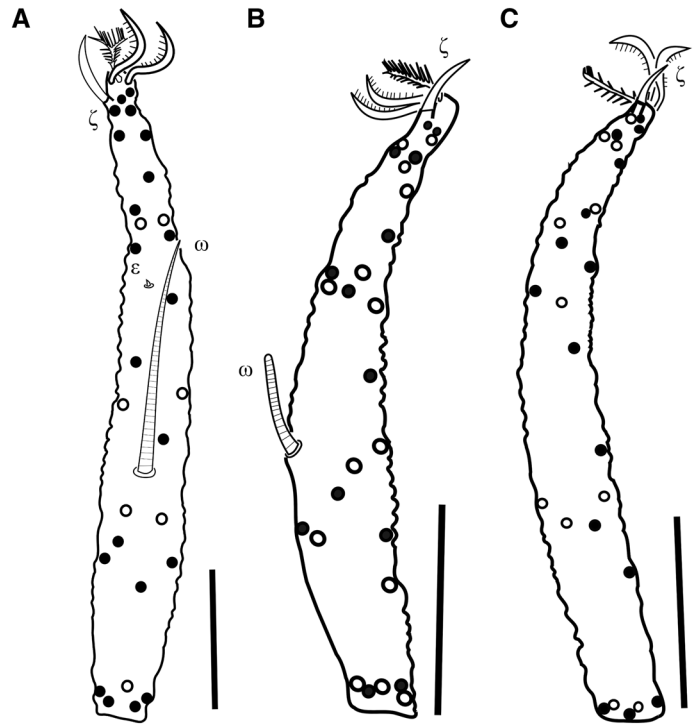

Fig. 2 Morphological details of *Leptus* (*Leptus*) *haitlingeri* n. sp. Holotype. A, Tarsus of leg I; B, Tarsus of leg II; C, Tarsus of leg III. Black spots: ventral setae of the idiosoma; white spots: dorsal setae of the idiosoma. *Abbreviations*: ζ, eupathidium on tarsus of legs I-III; ω, solenidion on tarsus of legs I-II; ε, famulus on the tarsus of leg I. *Scale-bars*: 50 μm

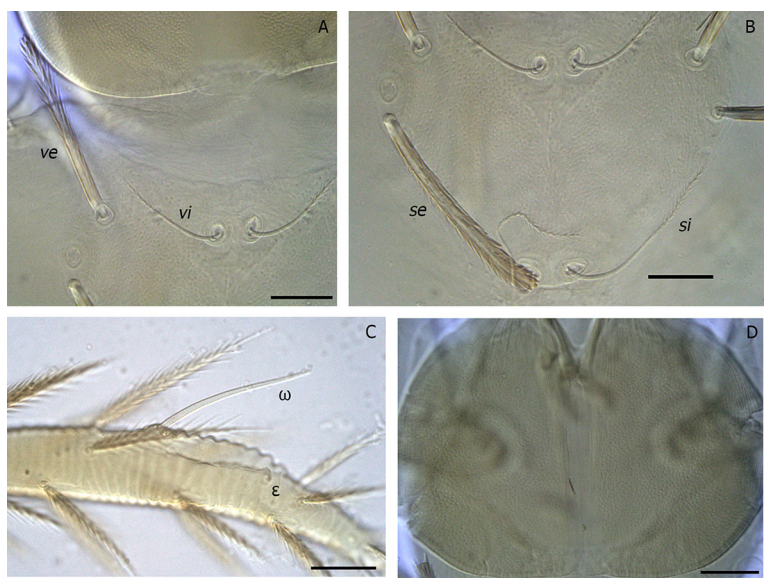

Fig. 3 Morphological details of *Leptus* (*Leptus*) *haitlingeri* n. sp. Paratype. A, Prodorsal esclerite, anterior view; B, Prodorsal esclerite, posterior view; C, Solenidion and famulus on tarsus of leg I; D, Details of the punctuation on the gnathobase. *Abbreviations*: ω, solenidion on tarsus of leg I; *ve*, anterolateral setae; *se*, posterolateral setae; *vi*, anterior trichobothria; *si*, posterior trichobothria; ε, famulus on the tarsus of leg I. *Scale-bars*: 20 μm

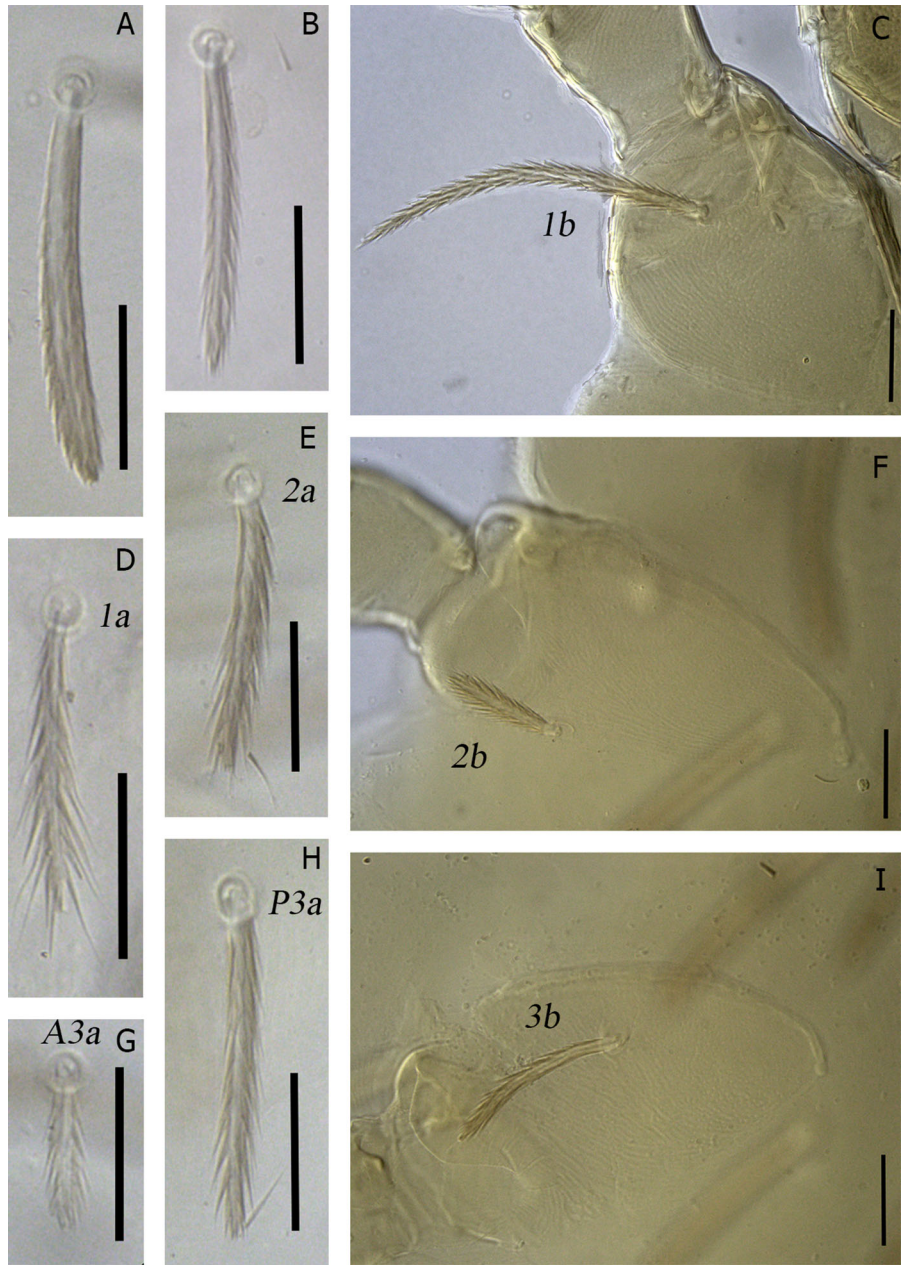

Fig. 4 Morphological details of the setae of *Leptus* (*Leptus*) *haitlingeri* n. sp. Paratype. A, Dorsal idiosomal seta; B, Ventral idiosomal seta; C, Seta of the coxal field of leg I; D, Seta between coxae I on ventral side of idiosoma; E, Seta in between coxae II on ventral side of idiosoma; F, Seta of the coxal field of leg II; G, Anterior setae in between coxae III on ventral side of idiosoma; H, Posterior setae in between coxae III on ventral side of idiosoma; I, Seta of the coxal field of leg III. *Abbreviations*: 1*a*, length of setae between coxae I on ventral side of idiosoma; 2*a*, length of setae in between coxae II on ventral side of idiosoma; A3a, length of anterior setae in between coxae III on ventral side of idiosoma; P3a, length of posterior setae in between coxae III on ventral side of idiosoma; 1*b*, length of the setae on coxa I; 2*b*, length of the setae on coxa II; 3*b*, length of the setae on coxa III. *Scale-bars*: 20 μm

Table 1 Standard measurements of *Leptus* (*Leptus*) *haitlingeri* n. sp.

	IL	IW	L	W	AW	PW	AA	SB	ISD	*ve*	*se*	AP	*vi*	*si*	DS	*1a*	*2a*	*A3a*	*P3a*	*1b*	*2b*	*3b*
Holotype	1,023	793	87	112	86	101	12	11	66	63	72	17	35	57	52–63	35	42	17	44	88	31	50
Paratype	554	388	73	107	78	99	13	15	60	63	68	20	29	52	48–63	33	38	18	42	72	28	43
Paratype	710	432	82	113	85	101	13	14	61	64	65	18	–	–	54–59	39	43	22	43	–	30	44
Paratype	449	347	90	109	82	96	11	13	63	62	66	20	37	54	43–60	36	42	17	41	79	32	48
Paratype	603	402	85	106	80	94	13	13	65	60	65	23	–	54	45–62	36	39	20	44	81	29	44
Paratype	401	284	76	119	88	108	13	14	65	65	72	22	–	–	49–59	39	44	20	45	75	27	44
Paratype	547	315	87	112	86	104	12	15	66	70	70	18	40	62	46–59	39	41	25	43	86	30	46
Paratype	490	250	80	111	83	101	12	14	62	62	70	18	–	–	45–60	40	42	26	43	87	31	41
Minimum	401	250	73	106	78	94	11	11	60	60	65	17	29	52	43	33	38	17	41	72	27	41
Maximum	1,023	793	90	119	88	108	13	15	66	70	72	23	40	62	63	40	44	26	45	88	32	50

Abbreviations: IL, length of idiosoma; IW, width of idiosoma; L, length of prodorsal sclerite (scutum); W, width of prodorsal sclerite; AW, distance between centers of bases of *ve* (AL) setae; PW, distance between centers of bases of *se* (PL) setae; AA, distance between centers of *vi* setae bases; SB, distance between centers of *si* bases; ISD, distance in between centers of *vi* and *si* setae (trichobothria); *ve*, length of *ve* (AL) setae; *se*, length of *se* (PL) setae; AP, distance between centers of bases of *ve* and *se* setae of same side; *vi*, length of *vi* (AM) setae; *si*, length of *si* (S) setae; DS, length of dorsal idiosomal setae; 1*a*, length of setae between coxae I on ventral side of idiosoma; 2*a*, length of setae in between coxae II on ventral side of idiosoma; A3a, length of anterior setae in between coxae III on ventral side of idiosoma; P3a, length of posterior setae in between coxae III on ventral side of idiosoma; 1*b*, length of the setae on coxa I; 2*b*, length of the setae on coxa II; 3*b*, length of the setae on coxa III

Table 2 Standard measurements of *Leptus* (*Leptus*) *haitlingeri* n. sp.

	GL	PsFd	PsGd	PaFe (L)	PaFe (W)	PaGe (L)	PaGe (W)	OD	*cs*	*Bs*	*as*	Pω	Cx I	Tr I	Bf I	Tf I	Ge I	Ti I	Ta I (L)	Ta I (W)
Holotype	219	76	43	56	40	63	24	29	18	43	4	21	86	55	105	83	136	170	162	27
Paratype	196	56	44	49	40	54	14	24	–	41	–	20	73	50	92	92	128	165	148	20
Paratype	198	49	–	45	34	42	19	25	–	–	–	–	79	49	100	94	135	185	161	21
Paratype	194	56	44	65	52	60	24	29	14	44	3	22	79	51	98	96	–	–	–	–
Paratype	195	58	–	57	38	46	16	31	16	41	4	22	78	49	106	91	132	184	152	29
Paratype	202	73	46	51	40	60	18	28	15	54	3	23	79	51	99	97	133	190	152	24
Paratype	189	60	49	57	31	63	22	30	15	50	4	20	81	58	90	98	139	191	154	29
Paratype	192	65	44	50	41	46	19	26	17	43	4	21	88	53	99	98	134	188	150	25
Maximum	219	76	49	65	52	63	24	31	18	54	4	23	88	58	106	98	139	191	162	29
Minimum	189	49	43	45	31	42	14	24	14	41	3	20	73	49	90	83	128	165	148	20
Maximum	219	76	49	65	52	63	24	31	18	54	4	23	88	58	106	98	139	191	162	29

Abbreviations: GL, length from posterior margin of gnathobase to the apex of the chelicerae; PsFd, length of dorsal setae on palpfemur; PsGd, length of dorsal setae on palpgenu; PaFe (L), length of palpfemur; PaFe (W), width of palpfemur; PaGe (L), length of palpgenu; PaGe (W), width of palpgenu; OD, length of odontus; *cs*, length of the galealae; *bs*, length of posterior subcapitular seta; *as,* length of anterior adoral seta; Pω, length of the solenidion on palptarsus; Cx I, length of coxa on leg I; Tr I, length of trochanter on leg I; Bf I, length of basifemur on leg I; Tf I, length of telofemur on leg I; Ge I, length of genu on leg I; Ti I, length of tibia on leg I; Ta I (L), length of tarsus on leg I; Ta I (W), width of tarsus on leg I

Table 3 Standard measurements of *Leptus* (*Leptus*) *haitlingeri* n. sp.

	Cx II	Tr II	Bf II	Tf II	Ge II	Ti II	Ta II (L)	Ta II (W)	Cx III	Tr III	Bf III	Tf III	Ge III	Ti III
Holotype	101	59	85	91	109	151	139	28	97	61	98	99	115	214
Paratype	82	53	86	88	117	149	–	–	95	59	85	115	113	–
Paratype	99	60	87	83	116	168	135	19	–	–	–	–	–	–
Paratype	96	52	–	–	–	–	–	–	90	50	91	103	124	191
Paratype	95	54	84	84	113	155	130	25	103	53	90	101	124	226
Paratype	99	45	87	85	113	148	136	21	98	51	100	115	127	236
Paratype	93	53	85	83	116	149	136	19	96	48	96	116	123	243
Paratype	94	55	84	84	111	150	134	20	101	51	98	110	120	230
Minimum	82	45	84	83	109	148	130	19	90	48	85	99	113	191
Maximum	101	60	87	91	117	168	139	28	103	61	100	116	127	243

Abbreviations: Cx II, length of coxa on leg II; Tr II, length of trochanter on leg II; Bf II, length of basifemur on leg II; Tf II, length of telofemur on leg II; Ge II, length of genu on leg II; Ti II, length of tibia on leg II; Ta II (L), length of tarsus on leg II; Ta II (W), width of tarsus on leg II; Cx III, length of coxa on leg III; Tr III, length of trochanter on leg III; Bf III, length of basifemur on leg III; Tf III, length of telofemur on leg III; Ge III, length of genu on leg III; Ti III, length of tibia on leg III

Table 4 Standard measurements of *Leptus* (*Leptus*) *haitlingeri* n. sp.

	Ta III (L)	Ta III (W)	Leg I	Leg II	Leg III	IP	σ	φ′ I	φ″ I	φ′-φ″ I	ω I	φ′ II	φ″ II	φ′-φ″ II	ω II	φ′ III
Holotype	145	24	797	735	829	2,361	33	32	37	34	62	10	31	118	19	31
Paratype	–	–	748	–	–	–	31	30	37	38	65	11	30	117	17	–
Paratype	–	–	803	748	–	–	31	30	36	37	65	10	31	117	22	–
Paratype	–	–	–	–	–	–	32	–	–	–	–	–	–	–	–	32
Paratype	148	20	792	715	845	2,352	32	31	38	34	66	10	32	120	22	30
Paratype	152	17	801	713	879	2,393	33	32	39	35	64	12	33	121	20	33
Paratype	168	23	811	715	890	2,416	31	31	37	36	66	11	33	118	21	31
Paratype	150	20	810	712	860	2,382	33	31	38	35	64	10	31	120	20	30
Minimum	145	17	748	712	829	2,352	31	30	36	34	62	10	30	117	17	30
Maximum	168	24	811	748	890	2,416	33	32	39	38	66	12	33	121	22	33

Abbreviations: Ta III (L), length of tarsus on leg III; Ta III (W), width of tarsus on leg III; Leg I, length of leg I; Leg II, length of leg II; Leg III, length of leg III; IP, sum of leg lengths (coxal field to tarsus); σ, length of the solenidion on genu of leg I; φ′ I, length of the anterior solenidion on tibia of leg I; φ″ I, length of the posterior solenidion on tibia of leg I; φ′-φ″ I, distance between solenidia on tibia of leg I; ω I, length of solenidion on tarsus of leg I; φ′ II, length of the anterior solenidion on tibia of leg II; φ″ II, length of the posterior solenidion on tibia of leg II; φ′-φ″ II, distance between solenidia on tibia of leg II; ω II, length of solenidion on tarsus of leg II; φ′ III, length of the solenidion on tibia of leg III

Key to the larvae of *Leptus* spp. in Brazil

1a Palpgenu with two setae ……..…. ……. *L.* (*L.*) *iguacuicus* Haitlinger, 2004
1b Palpgenu with one seta …… 2
2a Leg III with a single solenidion on the tibia; no solenidia on the genu, telofemur and basifemur of leg III ……... 3
2b Leg III with numerous solenidia on the tibia, genu, telofemur and basifemur ……..... *L.* (*L.*) *candangus* Šundić, Haitlinger & Pompermaier, 2017
3a Genu of leg I with one or no solenidion (σ) …….. 4
3b Genu of leg I with five σ …… ……..*L.* (*L.*) *stieglmayri* (Oudemans, 1905)
4a Genu of leg I with one solenidion (σ) ……..… 5
4b Genu of leg I without solenidia …… ……*L.* (*L.*) *planaltensis* Haitlinger, Šundić & Pompermaier, 2017
5a Genu of leg II without solenidia; palptarsus with at least one branched seta …… 6
5b Genu of leg II with one solenidion; palptarsus without branched setae ……... ……. *L.* (*L.*) *mariani* Haitlinger, 1991
6a Tibia of legs I-III each < 300 μm long ……..... 7
6b Tibia of legs I-III each > 300 μm long …….. ……. *L.* (*L.*) *stolae* Haitlinger, 1987
7a Tibia of leg III < 200 μm long; dorsal opisthosoma setae usually < 50 μm long …….…… 8
7b Tibia of leg III > 200 μm long; dorsal opisthosoma setae usually > 60 μm long …… …….. *L* (*L.*) *cyryli* Haitlinger, 1991
8a Palptarsus with at least 2 branched setae ……. 10
8b Palptarsus with 1 branched seta (fPTa = 1B5Nζω) …….. 9
9a Dorsal opisthosoma with at least 60 setae; dorsal opisthosomal setae filiform ……. ……. *L.* (*L.*) *onnae* Haitlinger, 2000
9b Dorsal opisthosoma with less than 50 setae; dorsal opisthosomal setae lanceolate ……. ……. *L.* (*L.*) *brasilicus* Haitlinger, Šundić & Pompermaier, 2017
10a Palptarsus with no more than 2 branched setae ……..…. 11
10b Palptarsus with 4 branched setae (fPTa= 4B2Nζω) ……..... ……. *L.* (*L.*) *haitlingeri* n. sp.
11a Tarsus of legs I and III each < 100 μm long; tibia of leg I each < 110 μm long; tibia of leg III each < 130 μm long …….. ……. *L.* (*L.*) *adaminae* Haitlinger, 2004
11b Tarsus of legs I-III each > 120 μm long; tibia of legs I and III each > 130 μm long; tibia of leg III each > 150 μm long ……. ……. *L.* (*L.*) *fozicus* Haitlinger, 2004

Leptus (*L.*) *alberti* Haitlinger, 1991 is omitted from the key due to an incomplete description.

Discussion

In the present study we are describing a new species, providing morphological images obtained in DIC observations. With this technique other characteristics can be observed, such as the ornamentation of the prodorsal sclerite, gnathobase and coxae field (in this case punctuated) and the shape of the dorsal and ventral setae of the idiosoma. These characteristics can be corroborating to identify the species, mainly species known only by the holotype, or when partially damaged.

Besides that, the problems with previously published keys to the species of *Leptus* of South America resulted from the low number of specimens examined and the high reliance on metrical data to separate species. Many species are known only from the holotype which makes species comparisons using metrical data of limited value. In this key we used mostly non-metric characters from published descriptions to differentiate Brazilian *Leptus* spp. It is our hope that future descriptions of South American species of *Leptus* will be complete and accurate.

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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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