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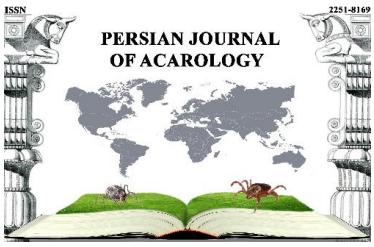

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Monograph

Leptus Latreille (Trombidiformes: Erythraeidae) of the world: revised classification and keys

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ABSTRACT
The genus *Leptus* (larvae) is revised based on type specimens and other specimens from species and locations worldwide. A total of 220 species were identified and divided into 8 morpho-groups, and 40 subgroups of species; the following synonymies were also made: *Leptus* (*Leptus*) *eslamizadehi* as a junior synonym of *L.* (*L.*) *trimaculatus*, *L.* (*L.*) *ilzae* as a junior synonym of *L.* (*L.*) *kyushuensis*, *L.* (*L.*) *laplandicus* as a junior synonym of *L.* (*L.*) *clethrionomydis*, *L.* (*L.*) *alopecurus* as a junior synonym of *L.* (*L.*) *alvimordax*, *L.* (*L.*) *annikae* as a junior synonym of *L.* (*L.*) *cercopius*, *L.* (*L.*) *welbourni* as a junior synonym of *L.* (*L.*) *ghiradellae*, *L.* (*L.*) *laviniacus* as a junior synonym of *L.* (*L.*) *agenori*, *L.* (*L.*) *machilidis* as a junior synonym of *L.* (*L.*) *albertensis*, *L.* (*L.*) *gyas* as a junior synonym of *L.* (*L.*) *meloidarum*, *L.* (*L.*) *coloanensis* as a junior synonym of *L.* (*L.*) *astrubali*, and *L.* (*L.*) *sidorchukae* as a junior synonym of *L.* (*L.*) *maldonadoicus*. In addition, tibial and tarsal chaetotactic maps are shown, leg chaetotaxy is discussed, and keys to species groups, subgroups, and species are included. We amended and provided new morphological data for 109 species.

KEY WORDS: Acari; chaetotactic formula; larva; morphology; taxonomy.

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INTRODUCTION

The genus *Leptus* was defined by Latreille (1796) as a member of Hexapodes of the class Acéphales of insects, with *Acarus phalangii* de Geer, 1778 as its type species. Billberg (1820) placed *Leptus* in the family Leptidae (Leptides in original paper) of the order Arachnoida of Insecta. However, since Erythraeidae Robineau-Desvoidy, 1828 was better known, along with the vast usage by students of acarology, and also based on a request by Southcott from International Comission on Zoological Nomenclature, Erythareidae was preserved in preference to Leptidae Billberg, 1820 (Leptides) and only subfamily Leptinae Billberg, 1820 is now valid (Southcott 1961). *Leptus* is the largest genus within erythraeid mites with about 240 species described from the larval stage (Mąkol and Wohltmann 2012, 2013). It is a cosmopolitan genus of the family Erythraeidae with its larvae being frequently found as ectoparasites upon Arthropoda, especially main orders of insects including Orthoptera, Coleoptera, Hymenoptera, Diptera, and Lepidoptera (e.g. Southcott 1961; Felska *et al*. 2018).

Southcott (1946–1999) and Haitlinger (1987–present) described many species of *Leptus* from different continents and different hosts. Southcott did excellent works and wrote some revisions (1991, 1992, 1993, 1999) with keys to species of Europe and North America (1992), Australia (1991), Australia and New Guinea (1993, 1999), Asia and New Guinea (1994). Haitlinger wrote some keys to species of the genus e.g. to European and North African species in 1990, and to species of Neotropical region in 2016. Southcott discussed the history of the genus in his revisions (1991, 1992, 1993, 1999) especially on *Leptus ignotus* in 1992.

The genus *Leptus* has two subgenera, namely *Leptus* (*Leptus*) and *Leptus* (*Amaroptus*) Haitlinger, 2000. To date, species of *Leptus* (*Leptus*) were divided into four groups based on various characters including:

1. Fain *et al*. (1987) divided the genus into four groups based on the number of solenidia on tibia and genu of leg I: **I.** *schedingi* species group: with five solenidia on Ge I and one solenidion on Ti I including only one species, *L. schedingi*; **II.** *stieglmayri* species group: with 2–5 solenidia on Ge I

and 3, 5 or 7 solenidia on Ti I including three species, *L. stieglmayri* (Oudemans, 1905), *L. southcotti* Beron, 1975 and *L. echinopus* Beron, 1975; **III.** *sieversi* species group: with one solenidion on Ge I & II and Ti I & II including only one species, *L. sieversi*; **IV**. *ignotus* species group: with one solenidion on Ge I, without solenidion on Ge II, and Ti I & II with one solenidion including remaining species of *Leptus*.

2. Fain (1991) and Southcott (1992) divided the genus into four groups based on the number of setae on palpfemur [2 or 1] and palpgenu [2 or 1]: **I.** with two setae on each palpal femur and genu; **II**. with two setae on the palpal femur and one seta on palpal genu; **III**. with one seta on the palpal femur and two setae on palpal genu; **IV.** with one seta on each palpal femur and genu. This grouping was mainly accepted and used by other researchers.

In recent years, some species have been redescribed (e.g. Mąkol *et al*. 2012; Haitlinger 2013; Haitlinger and Šundić 2016) based on type or new specimens or reared and described based on larval and post-larval specimens and in some cases, neotypes have been designated (e.g. Łaydanowicz and Mąkol 2010; Mąkol *et al*. 2011). Many species of *Leptus* are described based on a single or few specimens which are not representative of intraspecific variations, e.g. 34 species were described from Afrotropical region but only one species (*Leptus* (*L*.) *chingombensis* Bernard, Felska & Mąkol, 2019) is described based on 34 specimens [See Bernard *et al*. (2019) for more information].

In this paper, we follow mainly the last presented and mostly followed grouping and put all species morphologically in 8 groups, and 40 subgroups, make 11 synonymies, present tibial and tarsal chaetotactic maps and discuss leg chaetotaxy, present keys to species groups, subgroups, and species, and correct some morphological data of 107 species based on the examination of type materials and two species from received data (see Table 1).

MATERIAL AND METHODS

We studied about 800 specimens of 15 *Leptus* species (two species described as *L*. (*L*.) *darvishi* Saboori *et al*., 2018 and *L*. (*L*.) *tridentatus* Saboori *et al*., 2018, others undescribed now) collected from different parts of Iran during recent years, as well as 107 type species (see Table 1) in Jalal Afshar Zoological Museum (JAZM), Museum of Natural History, Wrocław University (MNHWU), Poland, South Australian Museum (SAM), and the Australian National Insect Collection (ANIC), CSIRO, Canberra ACT, Australia. Photographs were taken with a digital camera attached to a BX 51 phase contrast Olympus microscope in Iran and different microscopes outside of Iran. Figures and measurements (given in micrometers) were made using a BX 51 phase contrast Olympus microscope equipped with a drawing tube in Iran and by different cameras coupled with microscopes outside of Iran. The terminology and abbreviations are adapted from Southcott (1992), Wohltmann *et al.* (2007) and Saboori *et al*. (2009). We used Mąkol and Wohltmann (2012, 2013) for species distributions and papers published after 2013.

RESULTS

Diagnosis (based on Łaydanowicz and Makol (2010) with some modofications)

Scutum triangular in outline, widest at its anterior part, with two pairs of trichobothria and two pairs of non-sensillary setae. One pair of sensilla in anterior half, the other one close to the posterior margin of scutum, both covered with setules. The first pair of non-sensillary setae located close to the level of anterior sensilla, the next one close to the posterior margin of scutum. First segment of chelicera bulbus proximally and narrowed distally. One pair of circular eyes, placed laterally to scutum, at the level of posterior sensilla or posterolaterally to scutum. Leg segmentation formula: 7-7-7. Coxal setation formula: 1-1-1. All tarsi terminated with double claws and empodium. Anterior claw and empodium falciform, posterior claw feather-like.

Morphology

Gnathosoma

There is always a palpal supracoxal seta on each side of gnathosoma. Chelicerae may be punctated (in most cases) or striated which is an important character to separate species. Shape, length, and width (combined) of chelicerae are also good characters and can separate species. Chelicerae may suddenly narrow (e.g. in *L.* (*L.*) *darvishi* Saboori, Hakimitabar & Khademi, 2018; *L.* (*L.*) *halli*) or narrow gradually (e.g. in *Leptus* (*L.*) *faini* Southcott, 1993). Number of hypostomal setae vary from 2 to 4. Hypostomal setae may be barbed or nude. When posterior hypostomal seta is long and stout, anterior hypostomal seta is minute (spine-like) (e.g. in *L.* (*L.*) *tridentatus* Saboori, Hakimitabar & Khademi, 2018) or absent (e.g. in *L.* (*L.*) *sayi* Southcott, 1992). Galeala or adoral seta (*cs*) may be present (in most cases) or absent and barbed or nude.

Number, length, and shape of setae on palpal femur and genu are important characters to separate species. They are always barbed. The number of these setae is used for grouping species. There are always three setae on palpal tibia which may be barbed (in most cases) or nude (one of them). The number of setae on palpal tarsus is 8 including a basal solenidion and a terminal eupathidium. Six normal setae may be barbed or nude and can be used for separation of the species. Length of gnathosoma varies among species.

Scutum

Shape and dimensions of scutum are important characters to separate species. Position of anterior sensillary setae (ASens) with respect to AL and PL bases is a useful character for determining the species subgroup: i.e: ASens bases anterior to or level with AL bases, ASens bases between AL and PL bases or ASens bases level with or posterior to PL bases. Anterior border of scutum may be convex, straight or concave. The rate of concavity (ASBM) completely affect the shape of scutum and differs among species (See southcott (1992), Fig. 1). The shape of anterolateral and posterolateral angles (pointed or blunted) and AL, PL (pointed, clavate), ASens and PSens (completely barbed or 2/3, half, 1/3 barbed), and length and width of scutum (longer than wide or wider than long) are useful diagnostic characters for differentiating the species. When measurements of scutum are similar among species, geometric morphometric assessment of scutum may be a great help to separate species because shape of scuta are significantly different whereas their measurements severly overlap.

Dorsal idiosomal setae

Shape, length, and number of dorsal idiosomal setae are different among species. Shape may be clavate (in most cases, e.g. in *L. millipedius*), foliate (e.g. in *L. foliatus* Southcott, 1999), spindle-shaped (e.g. in *L. barmeedius* Southcott, 1999), catkin-like (e.g. in *L. scutellatus* Southcott, 1999), expanded in the middle part (e.g. in *L. clethrionomydis* Haitlinger, 1987), paddle-shaped (e.g. in *L. batjallus* Southcott, 1999), and wedge-shaped (e.g. in *L. baudini* Southcott, 1999). Length of median dorsal setae (MDS) and posterior dorsal setae (PDS) are different among species. The number of dorsal idiosomal setae has an intraspecific variability which should be considered for comparison.

Ventral idiosomal setae

There is one pair of intercoxal setae I (*1a*), one pair of intercoxal setae II (*2a*) and no setae between coxae I & II in many species of *Leptus*. There are a few species with more than two intercoxal setae II and some setae between coxae I & II (e.g. *akkus* species subgroup). There are three different numbers of setae between coxae II & III: 1. two setae, 2. four setae, 3. more than four setae which have a variation among species e.g. ~30–44 in *L. tridentatus* Saboori *et al*., 2018. There are different numbers of setae behind coxae III which have a variation among species (e.g. ~46–56 in *L. tridentatus* Saboori *et al*., 2018) in which setae are similar to dorsal ones but shorter in many species.

Leg chaetotaxy

All species of *Leptus* have fnCx 1-1-1, fnTr 1-1-1, fnTFe 5-5-5, fn Ge 8-8-8. The formula for basifemora is 2-2-1 in most cases, in other cases 3-3-2, 3-2-2, 2-2-2.

Tibial normal setae

The formula 14-15-15 is constant for all species of *Leptus*. There are 9–10 normal setae before the first solenidion (φ_1). There are always 4 normal setae on the base of Ti I & II, and 3 on the base of Ti III (Figs. 1–3).

Tarsal normal setae

The formula for Ti I-III of many species of *Leptus* is 27–28, 25–26, 25–26, respectively (See Table 1). In most cases, the formula is 28-26-26. There are 14–15 (14 in most cases) normal setae on Ta I proximal to solenidion (except in *L.* (*L.*) *halli* Southcott, 1993 which is 16) and 6 setae at the end of the tarsus (Fig. 4). Also, there are always 5 normal setae on the base of Ta I-III (Figs. 4–6). There are 12–14 (12 in most cases) normal setae on Ta II proximally to solenidion.

Solenidia

Solenidia present on different leg segments namely BFe, TFe, Ge, Ti, and Ta. Solenidia present on BFe III only in *Leptus* (*L.*) *candangus* Šundić, Haitlinger & Pompermaier, 2017. There are different numbers of solenidia on TFe I-III, e.g. one solenidion of each segment of TFe-III in *Leptus* (*L.*) *delijanensis* Khademi, Saboori & Hakimitabar, 2015, and 12–15 on TFe III in *L.* (*L.*) *candangus*. Number of solenidia in most cases on Ge I is 1, on Ge II-III is 0 but sometimes it will increase to 2 on Ge I e.g. in *torresianus* species subgroup, 3–5 on Ge I and 3 on Ge II e.g. in *L.* (*L.*) *trimaculatus* (Rossi, 1794), 11–13 on Ge III in *L.* (*L.*) *candangus*. The common formula of solenidia on Ti I-III is 2-2-1 whereas 3 solenidia on Ti I can be seen e.g. in *indianensis* species subgroup, 1 on Ti II e.g. in *asahinai* species subgroup, 2 on Ti III in e.g. in *L.* (*L.*) *francesi*, 7–9 in *L.* (*L.*) *candangus*. The formula of SoTa I-III is 1-1-0.

If one solenidion is present on TFe I-III or 1–2 solenidia are present on Ge I-III, they are placed on mid-dorsal of the segments. Solenidia on Ti I are distal. One solenidion on Ti II is proximal and the other one is distal. Solenidia on Ta I & II are placed about the mid-dorsal of the segment except in *L.* (*L.*) *halli* which is placed in 2/3 of the length, distally.

When the number of solenidia on a segment exceeds 2, there is usually an abnormality in the number of solenidia e.g. 3–5 (4–5 L/3R) solenidia on Ge I in *L.* (*L.*) *echinopus* and 4(R)/5(L) solenidia on TFe I in *L.* (*L.*) *comosus*.

Length of solenidia especially on Ta I is an important character to separate species. There is always one solenidion on the base of palpal tarsus.

Microsetae

Number and placement of microsetae are constant. Only one microseta is placed on the distal end of each Ge I-II and Ti I. Some species of *Leptus* have large microsetae, about half length of the solenidia on the segment. They can be distinguished from the short solenidion by their acute end and being suddenly narrowed at distal end whereas solenion gradually narrows and has no acute end (Fig. 14).

Eupathidia

Eupathidia (specialized sensory setae) are placed at distal end of tarsi. They have small babrbs in most cases. The formula of eupathidia on Ta I-III is 2-2-1. One of the eupathidia on Ta I-II is subterminal and the ohter one is tectal (dorsal), and eupathidium on Ta III is subterminal. There is always one terminal eupathidium on palpal tarsus.

Famulus

Famulus is always present on Ta I, in many cases on Ta II but in most cases is difficult to see. In many species, famulus is placed very close to solenidion.

Taxonomy

We considered 8 groups of species of *Leptus* based on the number of setae on the palpal femur, palpal genu, and between coxae II & III. Fain (1991) and Southcott (1992) considered the number of setae on palpfemur [2 or 1] and palpgenu [2 or 1] and we considered the number of intercoxalae between coxae II and III [2, 4 or > 4] too. These characters can easily separate species groups of *Leptus*.

Key to subgenera of *Leptus* of the world (larva)

1. Scutum with three pairs of normal setae ……..……. *Leptus* (*Amaroptus*)
– Scutum with two pairs of normal setae ……. *Leptus* (*Leptus*)

Subgenus *Leptus* (*Amaroptus*)

Only one species is known from this sugenus i.e. *L.* (*Amaroptus*) *vuki* Haitlinger, 2000.

Subgenus *Leptus* (*Leptus*)

Leptus (*Leptus*) *debeauforti* Oudemans, 1905 was not considered because of insufficient data.

Note

The keys are made for identification purposes and do not necessarily reflect phylogenetic relationships.

Key to species groups of *Leptus* (*Leptus*) of the world (larva)

1. Palpal femur with two setae ……..……..…… 2
– Palpal femur with one seta ……..……..4
2. Palpal genu with two setae ……..…….. *lomani* species group
– Palpal genu with one seta ……..……... 3
3. More than four setae between coxae II-III ……..…… *monolithosicus* species group
– Four setae between coxae II-III ……..……. *trimaculatus* species group
4. Palpal genu with two setae …….. 5
– Palpal genu with one seta ……..……... 6
5. More than four setae between coxae II-III ……..…… *sudanensis* species group
– Four setae between coxae II-III ……..……. *anomalus* species group
6. Two setae between coxae II-III ……. *oudemansi* species group
– More than two setae between coxae II-III ……..…… 7
7. More than four setae between coxae II-III …… *slivovi* species group
– Four setae between coxae II-III ……..……. *phalangii* species group

***lomani* species group**

Palpal femur with two setae, palpal genu with two setae, more than four setae between coxae II & III.

Species included: *Leptus* (*Leptus*) *lomani* (Oudemans, 1902), *L.* (*L.*) *maldonadoicus* Haitlinger, 2000 including *L.* (*L.*) *sidorchukae* Costa *et al*., 2019 **syn. nov.**

Key to species of *lomani* species group

1. ASens anterior to AL ……..…… *L.* (*L.*) *lomani* Chile
– ASens between AL and PL ……..…… *L.* (*L.*) *maldonadoicus* Peru, Brazil

Remarks

Costa *et al*. (2019) separated *L.* (*L.*) *sidorchukae* from *L.* (*L.*) *maldonadoicus* by the presence of nine setae between coxae II and III (six in *L.* (*L.*) *maldonadoicus*), lacking a solenidion on genu III (present in *L.* (*L.*) *maldonadoicus*), and fn Ti 15-15-15 (12-12-14 in *L.* (*L.*) *maldonadoicus*). Our re-examination of *L.* (*L.*) *maldonadoicus* shows that there is an abnormality on number of solenidion Ge III (0R/1L), fn is Ti 14-15-15 (See Table 1). Also, six or nine setae between coxae II and III, and 15 setae on Ti I can be considered as an intraspecific variations. For this reason, we considered *L.* (*L.*) *sidorchukae* as a junior sunonym of *L.* (*L.*) *maldonadoicus*.

***monolithosicus* species group**
Palpal femur with two setae, palpal genu with one seta, more than four setae between coxae II & III.

Species included: *L.* (*L.*) *monolithosicus* Haitlinger, 2003.

***trimaculatus* species group**
Palpal femur with two setae, palpal genu with one seta, four setae between coxae II & III.

Species included: *Leptus* (*Leptus*) *trimaculatus* (Rossi, 1794) including *L.* (*L.*) *eslamizadehi* Saboori, 2002 **syn. nov.**, *L.* (*L.*) *southcotti* Beron, 1975.

Key to species of *trimaculatus* species group

1. Genu I with 3–5 solenida, femur I 113–128 ……...…. *L.* (*L.*) *trimaculatus* Austria, Belgium, Bulgaria, Croatia?, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Iran, Italy, Japan?, Latvia, Luxembourg, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Ukraine.
– Genu I with 2 solenida, femur I 153–155 ……..…….…. *L.* (*L.*) *southcotti* Australia

Remarks

Saboori (2002) described *L.* (*L.*) *eslamizadehi* from Iran. During our revision of the Iranian *Leptus* deposited in JAZM, we found that there is only one seta on BFe III; Saboori (2002) considered one of idiosomal setae as seta of BFe III (legs are were placed under idiosoma). He compared *L.* (*L.*) *eslamizadehi* with *L.* (*L.*) *echinopus* Beron, 1975 and *L.* (*L.*) *southcotti* Beron, 1975, not with *L.* (*L.*) *trimaculatus* redescribed by Wendt *et al*. (1992) because *L.* (*L.*) *echinopus* was considered as a junior synonym of *L.* (*L.*) *trimaculatus* by Haitlinger (2008). When we compared *L.* (*L.*) *eslamizadehi* with *L.* (*L.*) *trimaculatus*, they were very similar regarding their metric and meristic data, shape of scutum, etc. which can be considered as intraspecific variations. Specimens of *Leptus* (*L.*) *trimaculatus* from Germany and Iran have punctation and faint striations on chelicerae (Figs. 7, 8). It is likely that the character state is present also in specimens from other countries. For these reasons, we considered *L.* (*L.*) *eslamizadehi* as a junior synonym of *L.* (*L.*) *trimaculatus*.

***sudanensis* species group**
Palpal femur with one seta, palpal genu with two setae, more than four setae between coxae II & III.

Species included: *Leptus* (*L.*) *sudanensis* (Oudemans, 1911), *L.* (*L.*) *dubius* Paoli, 1937, *L.* (*L.*) *pyrenaeus* André, 1953, *L.* (*L.*) *josifovi* Beron, 1975, *L.* (*L.*) *polythrix* Fain & Elsen, 1987, *L.* (*L.*) *akkus* Haitlinger, 1990, *L.* (*L.*) *guus* Haitlinger, 1990, *L.* (*L.*) *mogadoranus* Haitlinger, 1990, *L.* (*L.*) *ogazulacus* Haitlinger, 1990, *L.* (*L.*) *pasopaicus* Haitlinger, 1990, *L.* (*L.*) *comosus* Southcott, 1991, *L.* (*L.*) *bertoldi* Haitlinger, 1993, *L.* (*L.*) *heleus* Southcott, 1993, *L.* (*L.*) *horiacus* Haitlinger, 1994, *L.* (*L.*) *tammuzi* Haitlinger, 1994, *L.* (*L.*) *auliacus* Haitlinger, 1998, *L.* (*L.*) *batoricus* Haitlinger, 1998, *L.* (*L.*) *hammameticus* Haitlinger, 1998, *L.* (*L.*) *korematus* Southcott, 1999, *L.* (*L.*) *rosellae* Haitlinger, 1999, *L.* (*L.*) *esmailii* Saboori & Ostovan, 2000, *L.* (*L.*) *bogoriacus* Haitlinger, 2001, *L.* (*L.*) *kamalii* Karimi Iravanlou & Saboori, 2001, *L.* (*L.*) *olamukijacus* Haitlinger, 2001, *L.* (*L.*) *hospeticus* Haitlinger, 2002, *L.* (*L.*) *andae* Haitlinger, 2003, *L.* (*L.*) *pelebinus* Haitlinger, 2007, *L.* (*L.*) *pozzoicus* Haitlinger, 2007, *L.* (*L.*) *canaricus* Haitlinger, 2009, *L.* (*L.*) *edwini* Haitlinger, 2009 (shape of dorsal setae), *L.* (*L.*) *korneli* Haitlinger, 2009, *L.* (*L.*) *maxorata* Haitlinger, 2009, *L.* (*L.*) *salicus* Haitlinger, 2009 , *L.* (*L.*) *tenerificus* Haitlinger, 2009, *L.* (*L.*) *delijanensis* Khademi, Saboori & Hakimitabar, 2015, *Leptus* (*L.*) *darvishi* Saboori, Hakimitabar & Khademi, 2018.

We divided this species group into 9 subgroups.

Key to subgroups of *sudanensis* species group

1. TFe I with 1 ≥ solenidion ……. *comosus* species subgroup
– TFe I without solenidion ……..…….. 2
2. Ge I with two solenidia ……. *hospeticus* species subgroup
- Ge I with one solenidion ……...…….. 3
3. fn BFe 3-3-2 …… *tridentatus* species subgroup
– fn BFe 2-2-2 or 2-2-1 ……..... 4
4. fn BFe 2-2-2 ……...…… *polythrix* species subgroup
– fn BFe 2-2-1 …… 5
5. With more than two setae between coxae II (more than one pair of intercoxal setae II) ……..……
……..…… *akkus* species subgroup
– With two setae between coxae II (one pair of intercoxal setae II) ……..……. 6
6. ASens bases level with PL bases ……. *sudanensis* species subgroup
– ASens bases anterior to PL bases …… 7
7. ASens bases anterior to or level with AL bases ……..…… *dubius* species subgroup
– ASens bases between AL and PL bases ……..…… 8
8. fD > 135 ……..…… *bogoriacus* species subgroup
– fD < 125 ……..…… *pasopaicus* species subgroup

***comosus* species subgroup**
TFe I with solenidion.

Species included: *L.* (*L.*) *comosus* Southcott, 1991, *L.* (*L.*) *delijanensis* Khademi, Saboori & Hakimitabar, 2015.

Key to species of *comosus* species subgroup

1. TFe I with more than one solenidion ……...…….. *L.* (*L.*) *comosus* Australia
– TFe I with one solenidion ……. *L.* (*L.*) *delijanensis* Iran

Remarks

Some corrections and additions to the original descriptions of studied species are made (Table

1).

***hospeticus* species subgroup**
TFe I without solenidion, Ge I with two solenidia.

Species included: *L.* (*L.*) *hospeticus* Haitlinger, 2002.

***tridentatus* species subgroup**
TFe I without solenidion, Ge I with 1 solenidion, fn BFe 3-3-2.

Species included: *L.* (*L.*) *tridentatus* Saboori, Hakimitabar & Khademi, 2018.

***polythrix* species subgroup**
TFe I without solenidion, Ge I with 1 solenidion, fn BFe 2-2-2.

Species included: *L.* (*L.*) *polythrix* Fain & Elsen, 1987.

***akkus* species subgroup**
TFe I without solenidion, Ge I with one solenidion, fn BFe 2-2-1, with setae between coxae I-II, with more than two setae between coxae II (more than one pair of intercoxal setae II).

Species included: *L.* (*L.*) *akkus* Haitlinger, 1990, *L.* (*L.*) *guus* Haitlinger, 1990, *L.* (*L.*) *rosellae* Haitlinger, 1999, *L.* (*L.*) *olamukijacus* Haitlinger, 2001, *L.* (*L.*) *pelebinus* Haitlinger, 2007, *L.* (*L.*) *pozzoicus* Haitlinger, 2007, *L.* (*L.*) *darvishi* Saboori, Hakimitabar & Khademi, 2018.

Key to species of *akkus* species subgroup

1. Ti III < 260 2
– Ti III > 310 5
2. Number of setae between coxae II-III > 35 3
– Number of setae between coxae II-III < 30 4
3. Ti III > 230, AW > 90 ..... *L.* (*L.*) *pozzoicus* Italy (Sardinia)
– Ti III < 200, AW < 80 ..... *L.* (*L.*) *olamukijacus* Kenya
4. Scutum wider than long, AW 100–113, PW 108–123 ..... *L.* (*L.*) *darvishi* Iran
– Scutum longer than wide, AW 90–96, PW 104–106 ..... *L.* (*L.*) *rosellae* Turkey
5. AW < 115 6
– AW > 120 ..... *L.* (*L.*) *guus* Turkmenistan
6. PSens > 90, Ti I < 250 ..... *L.* (*L.*) *pelebinus* Benin
– PSens < 80, Ti I > 300 ..... *L.* (*L.*) *akkus* Spain

Remarks

Leptus (*L.*) *akkus* and *L.* (*L.*) *guus* should be redescribed, they have been described briefly and new drawings and meristic data are needed.

***sudanensis* species subgroup**
TFe I without solenidion, Ge I with one solenidion, fn BFe 2-2-1, without setae between coxae I-II, with two setae between coxae II (one pair of intercoxal setae II), ASens bases level with PL bases.

Species included: *Leptus* (*L.*) *sudanensis* (Oudemans, 1911), *L.* (*L.*) *heleus* Southcott, 1993, *L.* (*L.*) *korematus* Southcott, 1999.

Key to species of *sudanensis* species subgroup

1. With two hypostomalae (pHy) 2
– With four hypostomalae (aHy & pHy) ..... *L.* (*L.*) *korematus* Australia
2. Leg III > 650 ..... *L.* (*L.*) *sudanensis* Sudan
– Leg III < 500 ..... *L.* (*L.*) *heleus* Australia

***dubius* species subgroup**
TFe I without solenidion, Ge I with one solenidion, fn BFe 2-2-1, without setae between coxae I-II, with two setae between coxae II, ASens bases anterior to or levelwith AL bases.

Species included: *L.* (*L.*) *dubius* Paoli, 1937, *L.* (*L.*) *pyrenaeus* André, 1953, *L.* (*L.*) *josifovi* Beron, 1975, *L.* (*L.*) *mogadoranus* Haitlinger, 1990, *L.* (*L.*) *ogazulacus* Haitlinger, 1990, *L.* (*L.*) *hammameticus* Haitlinger, 1998, *L.* (*L.*) *tenerificus* Haitlinger, 2009.

Key to species of *dubius* species subgroup

1. Scutum with a heart-like shape ..... *L.* (*L.*) *josifovi* Bosnia and Hercegovina, Bulgaria, Croatia, Greece, Italy (Sardinia), France (Corsica), Portugal, Switzerland
– Scutum with different shape 2
2. L < 60, W < 85 ..... *L.* (*L.*) *pyrenaeus* France
– L > 70, W > 90 3
3. AW < 85, PW < 95 4
– AW > 90, PW > 100 5
4. AL < 50, PL < 45 ..... *L.* (*L.*) *dubius* Italy
– AL > 60, PL > 50 ..... *L.* (*L.*) *ogazulacus* Mozambique
5. Anterior margin of scutum straight ..... *L.* (*L.*) *mogadoranus* Morocco
– Anterior margin of scutum deeply concave 6
6. Ti III < 280, Ti I < 240 ..... *L.* (*L.*) *tenerificus* Spain (Canary Islands)
– Ti III > 290, Ti I > 250 ..... *L.* (*L.*) *hammameticus* Italy, Tunisia

Remarks
Leptus (*L.*) *mogadoranus* and *L.* (*L.*) *ogazulacus* should be redescribed because they they have been described briefly and new drawings and meristic data are needed.

***bogoriacus* species subgroup**
TFe I without solenidion, Ge I with one solenidion, fn BFe 2-2-1, without setae between coxae I-II, with two setae between coxae II, ASens bases between AL and PL bases, fD > 135.

Species included: *L.* (*L.*) *bogoriacus* Haitlinger, 2001, *L.* (*L.*) *andae* Haitlinger, 2003, *L.* (*L.*) *canaricus* Haitlinger, 2009, *L.* (*L.*) *edwini* Haitlinger, 2009, *L.* (*L.*) *maxorata* Haitlinger, 2009.

Key to species of *bogoriacus* species subgroup

1. Anterior margin of scutum straight ..... *L. bogoriacus* Kenya
– Anterior margin of scutum concave 2
2. Proximal half of dorsal setae without setules ..... *L. edwini* Spain (Canary Islands)

– Proximal half of dorsal setae with setules 3
3. Ti III > 190, Ge III > 110 ..... *L. canaricus* Spain (Canary Islands)
– Ti III < 180, Ge III < 105 4
4. AW 78–80, PW 90–92 ..... *L. andae* Rwanda
– AW 88–100, PW 96–106 ..... *L. maxorata* Canary Islands

***pasopaicus* species subgroup**
TFe I without solenidion, Ge I with one solenidion, fn BFe 2-2-1, without setae between coxae I-II, with two setae between coxae II, ASens bases between AL and PL bases, fD < 125, other characters variable.

Species included: *L.* (*L.*) *pasopaicus* Haitlinger, 1990, *L.* (*L.*) *horiacus* Haitlinger, 1994, *L.* (*L.*) *tammuzi* Haitlinger, 1994, *L.* (*L.*) *auliacus* Haitlinger, 1998, *L.* (*L.*) *batoricus* Haitlinger, 1998, *L.* (*L.*) *esmailii* Saboori & Ostovan, 2000, *L.* (*L.*) *kamalii* Karimi Iravanlou & Saboori, 2001, *L.* (*L.*) *korneli* Haitlinger, 2009, *L.* (*L.*) *salicus* Haitlinger, 2009.

Key to species of *pasopaicus* species subgroup

1. W < 98 2
– W > 102 5
2. L < 85 3
– L ≥ 90 4
3. ASBa 20–25, anterior margin of scutum concave ..... *L.* (*L.*) *horiacus* Syria
– ASBa 16, anterior margin of scutum straight ..... *L.* (*L.*) *pasopaicus* Namibia
4. Ti III < 140 ..... *L.* (*L.*) *korneli* Cape Verde
– Ti III > 190 ..... *L.* (*L.*) *salicus* Cape Verde
5. Ti III < 155 ..... *L.* (*L.*) *batoricus* Mongolia
– Ti III > 165 6
6. AW > 115, PW > 125 ..... *L.* (*L.*) *auliacus* Kazakhstan
– AW < 110, PW < 120 7
7. Ti III 170–204 ..... *L.* (*L.*) *tammuzi* Israel, Syria, Saudi Arabia
– Ti III > 215 8
8. fD > 90, *1b* > 70 ..... *L.* (*L.*) *kamalii* Iran
– fD < 70, *1b* < 60 ..... *L.* (*L.*) *esmailii* Iran

Remarks
Leptus (*L.*) *pasopaicus* should be redescribed because it they has been described briefly and new drawings and meristic data are needed.

***anomalus* species group**
Palpal femur with one seta, palpal genu with two setae, four setae between coxae II & III.

Species included: *L.* (*L.*) *anomalus* Southcott, 1946, *L.* (*L.*) *benzaliensis* Fain & Elsen, 1972, *L.* (*L.*) *glossinarum* Fain & Elsen, 1972, *L.* (*L.*) *aureliani* Fain & Elsen, 1987, *L.* (*L.*) *puylaerti* Fain & Elsen, 1987, *L.* (*L.*) *oxyae* Vishnupriya & Mohanasundaram, 1988, *L.* (*L.*) *gauphalus* Haitlinger, 1990, *L.* (*L.*) *charon* Southcott, 1991, *L.* (*L.*) *fortei* Southcott, 1991, *L.* (*L.*) *waldockae* Fain, 1991, *L.* (*L.*) *faini* Southcott, 1993, *L.* (*L.*) *halli* Southcott, 1993, *L.* (*L.*) *truncatus* Southcott, 1993, *L.* (*L.*) *utheri* Southcott, 1993, *L.* (*L.*) *mirenae* Haitlinger, 1994, *L.* (*L.*) *fathipeuri* Haitlinger & Saboori, 1996, *L.* (*L.*) *barmeedius* Southcott, 1999, *L.* (*L.*) *batjallus* Southcott, 1999, *L.* (*L.*) *carduus* Southcott, 1999, *L.* (*L.*) *hitchcocki* Southcott, 1999, *L.* (*L.*) *minno* Southcott, 1999, *L.* (*L.*) *pistoris* Southcott, 1999, *L.*

(*L.*) *smithi* Southcott, 1999, *L.* (*L.*) *hringuri* Haitlinger, 2000, *L.* (*L.*) *assagasicus* Haitlinger, 2001, *L.* (*L.*) *cabareticus* Haitlinger, 2004, *L.* (*L.*) *iguacuicus* Haitlinger, 2004, *L.* (*L.*) *dinekaicus* Haitlinger, 2006, *L.* (*L.*) *elminus* Haitlinger, 2007, *L.* (*L.*) *pakistanensis* Kamran, Afzal, Bashir, Raza & Khan, 2009, *L.* (*L.*) *sulawesicus* Haitlinger, 2011.

Leptus (*L.*) *similis* Fain & Elsen, 1987 should be checked for the number of intercoxalae II-III. We provisionally placed it in this group however due to insufficient data, it was not included in any subgroups or keys.

Key to subgroups of *anomalus* species group

1. Sensillary setae significantly setulose throughout their length ..... *iguacuicus* species subgroup
– Sensillary setae setulose in 1/3 or 2/3 distal half 2
2. Large microseta on Ge I-II & Ti I ..... *benzaliensis* species subgroup
– Microseta on Ge I-II & Ti I normal 3
3. ASens bases posterior to PL bases ..... *barmeedius* species subgroup
– ASens bases anterior to PL bases 4
4. ASens bases anterior to or level with AL bases ..... *anomalus* species subgroup
– ASens bases between AL and PL bases ..... *glossinarum* species subgroup

***iguacuicus* species subgroup**
Sensillary setae significantly setulose throughout the length.

Species included: *L.* (*L.*) *iguacuicus* Haitlinger, 2004, *L.* (*L.*) *pakistanensis* Kamran, Afzal, Bashir, Raza & Khan, 2009, *L.* (*L.*) *sulawesicus* Haitlinger, 2011.

Key to species of *iguacuicus* species subgroup

1. L < 70 ..... *L.* (*L.*) *pakistanensis* Pakistan
– L > 80 2
2. Ti III > 190, Ti I > 160 ..... *L.* (*L.*) *sulawesicus* Indonesia (Sulawesi)
– Ti III < 170, Ti I < 140 ..... *L.* (*L.*) *iguacuicus* Brazil

Remarks

We received the following corrected leg setal formula of *Leptus* (*L.*) *pakistanensis* as follows: 1 seta on BFe III, 5 setae on TFe II, 8 setae on each Ge I-III, 1κ on each Ge I-II and Ti I and Ti II without microseta, Ge I with 1 solenidion. Other characters especially for leg segments are in doubt and type specimens should be checked. There are many typographical errors in the original description and figures especially for legs are not standard nor clearly visible. For this reason, it should be redescribed. We checked *L.* (*L.*) *sulawesicus* and there are 4 setae between coxae II-III, not 6 as in the original description (See Fig. 13).

***benzaliensis* species subgroup**
Sensillary setae setulose in about distal half, large microseta on Ge I-II & Ti I.

Species included: *L.* (*L.*) *benzaliensis* Fain & Elsen, 1972.

***barmeedius* species subgroup**
Sensillary setae setulose in about distal half, microseta on Ge I-II & Ti I normal, ASens bases posterior to PL bases.

Species included: *L.* (*L.*) *barmeedius* Southcott, 1999.

***anomalus* species subgroup**
Sensillary setae setulose in about distal half, microseta on Ge I-II & Ti I normal, ASens bases anterior to or level with AL bases.

Species included: *L.* (*L.*) *anomalus* Southcott, 1946, *L.* (*L.*) *puylaerti* Fain & Elsen, 1987, *L.* (*L.*) *gauphalus* Haitlinger, 1990, *L.* (*L.*) *waldockae* Fain, 1991, *L.* (*L.*) *utheri* Southcott, 1993, *L.* (*L.*) *halli* Southcott, 1993, *L.* (*L.*) *mirenae* Haitlinger, 1994, *L.* (*L.*) *batjallus* Southcott, 1999, *L.* (*L.*) *carduus* Southcott, 1999, *L.* (*L.*) *hitchcocki* Southcott, 1999, *L.* (*L.*) *pistoris* Southcott, 1999, *L.* (*L.*) *smithi* Southcott, 1999, *L.* (*L.*) *hringuri* Haitlinger, 2000.

Key to species of *anomalus* species subgroup

1. Ti III > 180 2
– Ti III < 170 5
2. W < 100 ..... *L.* (*L.*) *batjallus* Australia
– W > 120 5
3. L > 115, PW > 130 ..... *L.* (*L.*) *hringuri* Peru
– L < 100, PW < 120 4
4. Microsetae on Ge I-II and Ti I large (more than half length of solenidia), ISD 46 ..... *L.* (*L.*) *mirenae* Spain
– Microsetae on Ge I-II and Ti I normal (less than ⅓ length of solenidia), ISD 60–66 ..... *L.* (*L.*) *gauphalus* Australia
5. Ti III < 95 6
– Ti III > 105 7
6. L > 90, W > 90 ..... *L.* (*L.*) *puylaerti* Malawi
– L < 80, W < 80 ..... *L.* (*L.*) *smithi* Australia
7. With four hypostomalae 8
– With two hypostomalae 11
8. Intercoxalae expanded, bushy ..... *L.* (*L.*) *anomalus* Switzerland
– Intercoxalae otherwise 9
9. aHy barbed ..... *L.* (*L.*) *waldockae* Australia
– aHy nude 10
10. AW > 70, Tibia I > 100 ..... *L.* (*L.*) *carduus* Australia
– AW < 70, Tibia I < 100 ..... *L.* (*L.*) *hitchcocki* Australia
11. Coxala I round-ended ..... *L.* (*L.*) *utheri* Australia
– Coxala I pointed 12
12. TiIII/AW > 2 ..... *L.* (*L.*) *pistoris* Australia
– TiIII/AW < 1.8 ..... *L.* (*L.*) *halli* Australia

Remarks

Leptus (*L.*) *puylaerti*, *L.* (*L.*) *gauphalus*, *L.* (*L.*) *waldockae* should be redescribed because they have been described briefly and new drawings and meristic data are needed. *Leptus* (*L.*) *mirenae* has large microsetae on Ge I & II, and Ti I about half length of solenidia (Fig. 14). These large microsetae are also seen in some other species of *Leptus*. Anterolateral angles of scutum a little more pointed, anterolateral and posterolateral borders straight in comparison with Fig. 1 (page 165) of the original description (Fig. 15). Southcott (1999) wrote in the diagnosis of *L.* (*L.*) *carduus* "ASens bases level with AL scutalae bases" (p. 260) whereas he wrote in the description "ASens bases slightly posterior

to AL scutalae bases" (p. 262) and showed it in the Fig. 91 (p. 261). We studied this species and confirm ASens bases are in level with AL scutalae bases (Fig. 16).

***glossinarum* species subgroup**
Sensillary setae setulose in about distal half, microseta on Ge I-II & Ti I normal, ASens bases between AL and PL bases.

Species included: *L.* (*L.*) *glossinarum* Fain & Elsen, 1972, *L.* (*L.*) *aureliani* Fain & Elsen, 1987, *L.* (*L.*) *charon* Southcott, 1991, *L.* (*L.*) *fortei* Southcott, 1991, *L.* (*L.*) *faini* Southcott, 1993, *L.* (*L.*) *truncatus* Southcott, 1993, *L.* (*L.*) *fathipeuri* Haitlinger & Saboori, 1996, *L.* (*L.*) *augusti* Haitlinger, 1999, *L.* (*L.*) *minno* Southcott, 1999, *L.* (*L.*) *assagasicus* Haitlinger, 2001, *L.* (*L.*) *cabareticus* Haitlinger, 2004, *L.* (*L.*) *dinekaicus* Haitlinger, 2006, *L.* (*L.*) *elminus* Haitlinger, 2007.

Key to species of *glossinarum* species subgroup

1. Leg III < 400 ..... *L.* (*L.*) *aureliani* Rwanda
– Leg III > 450 2
2. L > W 3
– L < W 8
3. L > 100 4
– L < 100 5
4. AP 16, Ti I 200–206 ..... *L.* (*L.*) *augusti* Laos
– AP 22, Ti I 188 ..... *L.* (*L.*) *glossinarum* Congo
5. Ti III > 150 ..... *L.* (*L.*) *elminus* Ghana
– Ti III < 135 6
6. fV < 20 ..... *L.* (*L.*) *cabareticus* Dominican Republic, Guadelupe
– fV > 25 7
7. fD > 80 ..... *L.* (*L.*) *dinekaicus* Ethiopia
– fD < 65 ..... *L.* (*L.*) *assagasicus* South Africa
8. Ti III > 225 ..... *L.* (*L.*) *faini* Australia
– Ti III < 210 9
9. fD > 100 ..... *L.* (*L.*) *truncatus* Australia
– fD < 70 10
10. Ti III/AW > 2.5 ..... *L.* (*L.*) *fathipeuri* Iran
– Ti III/AW < 2.3 11
11. Ti III/AW < 1.75 ..... *L.* (*L.*) *fortei* Australia
– Ti III/AW > 1.75 12
12. Ti III 136–160 ..... *L.* (*L.*) *minno* Australia
– Ti III 187–207 ..... *L.* (*L.*) *charon* Australia

Remarks

Leptus (*L.*) *glossinarum* and *L.* (*L.*) *aureliani* should be redescribed because they have been described briefly and new drawings and meristic data are needed.

***oudemansi* species group**
Palpal femur with one seta, palpal genu with one seta, two setae between coxae II & III.

Species included: *L.* (*L.*) *oudemansi* (Karppinen, 1958).

***slivovi* species group**
Palpal femur with one seta, palpal genu with one seta, more than four setae between coxae II & III.

Species included: *L.* (*L.*) *slivovi* Beron, 1975, *L.* (*L.*) *soddagus* Haitlinger, 1990, *L.* (*L.*) *ursyni* Haitlinger, 1991, *L.* (*L.*) *charanyca* Fain, 1991, *L.* (*L.*) *chiusicus* Haitlinger, 2014.

Key to species of *slivovi* species group

1. W > 145, more than two setae between coxae I, and between coxae II ……..... *L.* (*L.*) *ursyni* Chile
– W < 125, with two setae between coxae I, and between coxae II 2
2. Ti I > 220 ..... *L.* (*L.*) *soddagus* Tanzania
– Ti I < 205 3
3. fV < 30, sensilla barbed only in distal half ..... *L.* (*L.*) *chiusicus* Italy
– fV > 50, sensilla barbed through the length 4
4. With large microseta on Ti I, scutum with pointed angles ..... *L.* (*L.*) *slivovi* Bulgaria, Italy, Liechtenstein, Norway, Poland
– Microseta on Ti I with normal size, scutum with rounded angles ……..... *L.* (*L.*) *charanyca* Belgium

Remarks

Leptus (*L.*) *slivovi* from Bulgaria (Berson 1975) seems different from *L.* (*L.*) *slivovi* reported from Norway by Southcott (1992) as: *L.* (*L.*) *slivovi* from Bulgaria has a large microseta on Ti I (See Beron 1975; Fig. 8c, p. 55) vs. normal microseta on Ti I from Norway (See Southcott 1992; Fig. 7, p. 23), Ti I/AW (2.44 vs. 1.91–2.12), Ti III/AW (2.78 vs. 2.40–2.53), AL/AAS (2.27 vs. 1.73–1.85). Examination of specimens from both countries is needed for making a correct decision.

***phalangii* species group**
Palpal femur with one seta, palpal genu with one seta, four setae between coxae II & III.

Species included: *L.* (*L.*) *phalangii* (de Geer, 1778), *L.* (*L.*) *molochinus* (C. L. Koch, 1837), *L.* (*L.*) *stieglmayri* (Oudemans, 1905), *L.* (*L.*) *siemsseni* (Oudemans, 1910), *L.* (*L.*) *gagrellae* (Oudemans, 1910) , *L.* (*L.*) *gagzoi* (Oudemans, 1910), *L.* (*L.*) *schedingi* (Oudemans, 1911), *L.* (*L.*) *sieversi* (Oudemans, 1911), *L.* (*L.*) *terebrans* Vitzthum, 1926, *L.* (*L.*) *bathypogonus* Womersley, 1934, *L.* (*L.*) *chelonethus* Womersley, 1934, *L.* (*L.*) *atticolus* Lawrence, 1940, *L.* (*L.*) *madagascariensis* André, 1941, *L.* (*L.*) *killingtoni* Turk, 1945, *L.* (*L.*) *kyushuensis* Ishii, 1953 including *L.* (*L.*) *ilzae* Haitlinger, 1999 **syn. nov.**, *L.* (*L.*) *phyllotretae* Feider, 1956, *L.* (*L.*) *asahinai* Kawashima, 1958, *L.* (*L.*) *gifuensis* Kawashima, 1958, *L.* (*L.*) *hidakai* Kawashima, 1958, *L.* (*L.*) *japonicus* Kawashima, 1958, *L.* (*L.*) *kuroshimaensis* Kato & Kitahara, 1958, *L.* (*L.*) *saigusai* Kawashima, 1958, *L.* (*L.*) *galerucae* Feider, 1967, *L.* (*L.*) *carpenteri* Fain & Elsen, 1972, *L.* (*L.*) *maringensis* Fain & Elsen, 1972, *L.* (*L.*) *meloidarum* Beron, 1975, *L.* (*L.*) *orthopterarum* Beron, 1975, *L.* (*L.*) *calidus* Shiba, 1976, *L.* (*L.*) *cameronensis* Shiba, 1976, *L.* (*L.*) *hozumii* Shiba, 1976, *L.* (*L.*) *draco* Southcott, 1984, *L.* (*L.*) *aldonae* Haitlinger, 1987, *L.* (*L.*) *cavernicola* Fain & Elsen, 1987, *L.* (*L.*) *clethrionomydis* Haitlinger, 1987 including *L.* (*L.*) *laplandicus* Southcott, 1992 **syn. nov.**, *L.* (*L.*) *indianensis* Fain, Gummer & Whitaker, 1987, *L.* (*L.*) *jocquei* Fain & Elsen, 1987, *L.* (*L.*) *leleupi* Fain & Elsen, 1987, *L.* (*L.*) *lovaniensis* Fain & Elsen, 1987,*L.* (*L.*) *maranaensis* Haitlinger, 1987, *L.* (*L.*) *mariae* Haitlinger, 1987, *L.* (*L.*) *nearcticus* Fain, Gummer & Whitaker, 1987, *L.* (*L.*) *stolae* Haitlinger, 1987, *L.* (*L.*) *oxyae* Vishnupriya & Mohanasundaram, 1988, *L.* (*L.*) *tetrigius* Southcott, 1988, *L.* (*L.*) *torresianus* Southcott, 1988, *L.* (*L.*) *ariel* Southcott, 1989, *L.* (*L.*) *clarki* Southcott, 1989, *L.* (*L.*) *boggohoranus* Haitlinger, 1990, *L.* (*L.*) *managarus* Haitlinger, 1990, *L.* (*L.*) *alberti* Haitlinger, 1991, *L.* (*L.*) *alvimordax* Southcott, 1991 including *L.* (*L.*) *alopecurus* Southcott, 1991 **syn. nov.**, *L.* (*L.*) *cooremani* Fain, 1991, *L.* (*L.*) *cyryli* Haitlinger, 1991, *L.* (*L.*) *francesi* Southcott, 1991, *L.* (*L.*) *nikanori* Haitlinger,

2000, *L.* (*L.*) *olafi* Haitlinger, 1991, *L.* (*L.*) *stefani* Haitlinger, 1991, *L.* (*L.*) *swani* Southcott, 1991, *L.* (*L.*) *treati* Welbourn, 1991, *L.* (*L.*) *albertensis* Southcott, 1992 including *L.* (*L.*) *machilidis* Southcott, 1992 **syn. nov.**, *L.* (*L.*) *bakeri* Southcott, 1992, *L.* (*L.*) *californicus* Southcott, 1992, *L.* (*L.*) *calix* Southcott, 1992, *L.* (*L.*) *cercopius* Southcott, 1992 including *L.* (*L.*) *annikae* Haitlinger, 2000 **syn. nov.**, *L.* (*L.*) *coreophilus* Southcott, 1992, *L.* (*L.*) *danelli* (Southcott, 1992), *L.* (*L.*) *droozi* Southcott, 1992, *L.* (*L.*) *ghiradellae* Southcott, 1992 including *L.* (*L.*) *welbourni* Southcott, 1992 **syn. nov.**, *L.* (*L.*) *kalaallus* Southcott, 1992, *L.* (*L.*) *millipedius* Southcott, 1992, *L.* (*L.*) *miromiri* Haitlinger, 1992, *L.* (*L.*) *ruginus* Southcott, 1992, *L.* (*L.*) *sayi* Southcott, 1992, *L.* (*L.*) *agrotis* Southcott, 1993, *L.* (*L.*) *belicolus* Southcott, 1993, *L.* (*L.*) *cerambycius* Southcott, 1993, *L.* (*L.*) *georgeae* Southcott, 1993, *L.* (*L.*) *jenseni* Southcott, 1993, *L.* (*L.*) *monteithi* Southcott, 1993, *L.* (*L.*) *orthrius* Southcott, 1993, *L.* (*L.*) *spinalatus* Southcott, 1993, *L.* (*L.*) *tarranus* Southcott, 1993, *L.* (*L.*) *titinius* Southcott, 1993, *L.* (*L.*) *phuketicus* Southcott, 1994, *L.* (*L.*) *brachypodos* Zheng, 1996, *L.* (*L.*) *dolichopodos* Zheng, 1996, *L.* (*L.*) *hupingshanicus* Zheng, 1996, *L.* (*L.*) *rwandae* Fain & Jocqué, 1996, *L.* (*L.*) *shimenensis* Zheng, 1996, *L.* (*L.*) *sulciscutus* Zheng, 1996, *L.* (*L.*) *zhutingensis* Zheng, 1996, *L.* (*L.*) *gyas* Fain & Amico, 1997, *L.* (*L.*) *admeti* Haitlinger, 1998, *L.* (*L.*) *addari* Haitlinger, 1999, *L.* (*L.*) *agenori* Haitlinger, 1999, *L.* (*L.*) *alkmenae* Haitlinger, 1998, *L.* (*L.*) *agenori* Haitlinger, 1999 including *L.* (*L.*) *laviniacus* Haitlinger, 2002 **syn. nov.**, *L.* (*L.*) *astrubali* Haitlinger, 1999, *L.* (*L.*) *bankensis* Southcott, 1999, *L.* (*L.*) *baudini* Southcott, 1999, *L.* (*L.*) *calcar* Southcott, 1999, *L.* (*L.*) *cheesmanae* Southcott, 1999, *L.* (*L.*) *clavatus* Southcott, 1999, *L.* (*L.*) *clelandi* Southcott, 1999, *L.* (*L.*) *cultellus* Southcott, 1999, *L.* (*L.*) *elderi* Southcott, 1999, *L.* (*L.*) *fisheri* Southcott, 1999, *L.* (*L.*) *flindersi* Southcott, 1999, *L.* (*L.*) *foliatus* Southcott, 1999, *L.* (*L.*) *grossi* Southcott, 1999, *L.* (*L.*) *holgeri* Haitlinger, 1999, *L.* (*L.*) *lighti* Southcott, 1999, *L.* (*L.*) *lorarius* Southcott, 1999, *L.* (*L.*) *norrisi* Southcott, 1999, *L.* (*L.*) *pincheni* Southcott, 1999, *L.* (*L.*) *puniceus* Southcott, 1999, *L.* (*L.*) *scutellatus* Southcott, 1999, *L.* (*L.*) *tindalei* Southcott, 1999, *L.* (*L.*) *triacanthus* Southcott, 1999, *L.* (*L.*) *urodaci* Southcott, 1999, *L.* (*L.*) *zhangi* Saboori & Atamehr, 1999, *L.* (*L.*) *filipinae* Haitlinger, 2000, *L.* (*L.*) *onnae* Haitlinger, 2000, *L.* (*L.*) *simonettae* Haitlinger, 2000, *L.* (*L.*) *masaimaraicus* Haitlinger, 2001, *L.* (*L.*) *coloanensis* Haitlinger, 2006, *L.* (*L.*) *gennadicus* Hatlinger, 2003, *L.* (*L.*) *guilinicus* Haitlinger, 2006, *L.* (*L.*) *singhi* Saboori & Arbabi, 2003, *L.* (*L.*) *zhejiangensis* Zheng, 2003, *L.* (*L.*) *adaminae* Haitlinger, 2004, *L.* (*L.*) *fozicus* Haitlinger, 2004, *L.* (*L.*) *balicus* Haitlinger, 2006, *L.* (*L.*) *dalicus* Haitlinger, 2006, *L.* (*L.*) *tiranicus* Haitlinger, 2006, *L.* (*L.*) *ubudicus* Haitlinger, 2006, *L.* (*L.*) *abrofaicus* Haitlinger, 2007, *L.* (*L.*) *kattikus* Haitlinger, 2009, *L.* (*L.*) *multisolenidiae* Mayoral & Barranco, 2011, *L.* (*L.*) *biljanae* Šundić & Haitlinger, 2015, *L.* (*L.*) *brasilicus* Haitlinger, Šundić & Pompermaier, 2017, *L.* (*L.*) *planaltensis* Haitlinger, Šundić & Pompermaier, 2017, *L.* (*L.*) *candangus* Šundić, Haitlinger & Pompermaier, 2017, *L.* (*L.*) *chingombensis* Bernard, Felska & Mąkol, 2019, *L.* (*L.*) *haitlingeri* Jacinavicius, BassiniSilva & Welbourn, 2019.

Leptus (*L.*) *bicristatus*, *L.* (*L.*) *maringensis* and *L.* (*L.*) *similis* should be checked for the number of intercoxalae II-III. We provisionally placed them in this group, however due to insufficient data, they were not included in any subgroups or keys. *Leptus* (*L.*) *oxyae* was not included in any subgroups or keys because of inadequate data. Our efforts to borrow its type specimen or its photographs have been unsuccessful.

Key to subgroups of *phalangii* species group

1. BFe III with solenidion ..... *candangus* species subgroup
– BFe III without solenidion 2
2. TFe I with ≥ 1 solenidion ..... *schedingi* species subgroup
– TFe I without solenidion 3
3. Ge I with 2 solenidia ……..... *torresianus* species subgroup
– Ge I with 1 solenidion 4
4. Ti I with 3 solenidia ..... *indianensis* species subgroup

– Ti I with 2 solenidia 5
5. Ti III with 2 solenidia ..... *hozumii* species subgroup
– Ti III with 1 solenidion 6
6. Ge II with 1 solenidion ..... *kuroshimaensis* species subgroup
– Ge II without solenidion 7
7. Solenida on Ti II absent ..... *phyllotretae* species subgroup
– Solenidia on Ti II present 8
8. Ti II with 1 solenidion ..... *asahinai* species subgroup
– Ti II with 2 solenidia 9
9. BFe III with 2 setae ..... *guilinicus* species subgroup
– BFe III with 1 seta 10
10. Sensillary setae significantly setulose throughout the length ..... *killingtoni* species subgroup
– Sensillary setae setulose about distal half 11
11. ASens bases posterior to PL bases ..... *chelonethus* species subgroup
– ASens bases anterior to PL bases 12
12. ASens bases level with or anterior to AL bases ..... *gagzoi* species subgroup
– ASens bases between AL and PL bases 13
13. Large microsetae on Ge I-II & Ti I ..... *aldonae* species subgroup
– Microsetae on Ge I-II & Ti I normal 14
14. Chelicerae striated ..... *treati* species subgroup
– Chelicerae punctate 15
15. fD > 125 ..... *millipedius* species subgroup
– fD < 125 16
16. 100 < fD < 125 ..... *meloidarum* species subgroup
– fD < 100 17
17. Scutum distinctly longer than wide (> 15 μm) ..... *gagrellae* species subgroup
– Scutum otherwise 18
18. Scutum distinctly wider than long (≥ 14 μm) ..... *gifuensis* species subgroup
– Scutum length and width semi-equal (< 14 μm longer or wider) 19
19. Ti I < 125 ..... *molochinus* species subgroup
– Ti I > 125 20
20. Ti III > 340 & Ti I > 280 ..... *boggohoranus* species subgroup
– Ti III < 340 or Ti I < 280 ..... *phalangii* species subgroup

***candangus* species subgroup**
BFe III with solenidion.

Species included: *L.* (*L.*) *candangus* Šundić, Haitlinger & Pompermaier, 2017.

***schedingi* species subgroup**
BFe III without solenidion, TFe I with ≥ 1 solenidion.

Species included: *L.* (*L.*) *schedingi* (Oudemans, 1911), *L.* (*L.*) *spinalatus* Southcott, 1993.

Key to species of *schedingi* species subgroup

1. TFe I with more than 1 solenidion ..... *L.* (*L.*) *schedingi* Chile
– TFe I with 1 solenidion ..... *L.* (*L.*) *spinalatus* Australia

***torresianus* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 2 solenidia.

Species included: *L.* (*L.*) *torresianus* Southcott, 1988, *L.* (*L.*) *francesi* Southcott, 1991, *L.* (*L.*) *multisolenidiae* Mayoral & Barranco, 2011.

Key to species of *torresianus* species subgroup

1. Ge III with 7–9 solenidia, Ge II with 2 solenidia ..... *L.* (*L.*) *multisolenidiae* French Guiana
– Ge II & III without solenidion 2
2. Ti III with 2 solenidia, Ti II with 3 solenidia ..... *L.* (*L.*) *francesi* Australia
– Ti III with 1 solenidion, Ti II with 2 solenidia ..... *L.* (*L.*) *torresianus* Australia

***indianensis* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 3 solenidia.

Species included: *L.* (*L.*) *indianensis* Fain, Gummer & Whitaker, 1987, *L.* (*L.*) *triacanthus* Southcott, 1999.

Key to species of *indianensis* species subgroup

1. W > 100, L > 90, PW > 90 ..... *L.* (*L.*) *indianensis* USA
– W < 80, L < 80, PW < 70 ..... *L.* (*L.*) *triacanthus* Papua New Guinea

***hozumii* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 2 solenidia.

Species included: *L.* (*L.*) *hozumii* Shiba, 1976, *L.* (*L.*) *stefani* Haitlinger, 1991, *L.* (*L.*) *filipinae* Haitlinger, 2000.

Key to species of *hozumii* species subgroup

1. W > 150, L > 150 ..... *L.* (*L.*) *stefani* Colombia
– W < 100, L < 120 2
2. Ti I < 120, PL 59, ISD 50 ..... *L.* (*L.*) *hozumii* Malaysia (Malay Peninsula)
– Ti I > 160, PL 72-80, ISD 60-64 ..... *L.* (*L.*) *filipinae* Belize, Costa Rica, Mexico

***kuroshimaensis* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II with 1 solenidion.

Species included: *L.* (*L.*) *kuroshimaensis* Kato & Kitahara, 1958, *L.* (*L.*) *mariani* Haitlinger, 1991, *L.* (*L.*) *tetrigius* Southcott, 1988, *L.* (*L.*) *jenseni* Southcott, 1993, *L.* (*L.*) *dalicus* Haitlinger, 2006.

Key to species of *kuroshimaensis* species subgroup

1. W < 100 2
– W > 110 4
2. L > W, Ge III with one solenidion ..... *L.* (*L.*) *dalicus* Ethiopia

– L < W, Ge III without solenidion 3
3. aHy minute (3–4 μm) and spine-like ..... *L.* (*L.*) *kuroshimaensis* Japan
– aHy small (11–18 μm) ..... *L.* (*L.*) *mariani* Brazil
4. PSens < 70, ASens > 50, Ge III with one solenidion ..... *L.* (*L.*) *tetrigius* Sri Lanka
– PSens > 80, ASens < 45, Ge III without solenidion ..... *L.* (*L.*) *jenseni* Australia

***asahinai* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 1 solenidion.

Species included: *L.* (*L.*) *asahinai* Kawashima, 1958, *L.* (*L.*) *phuketicus* Southcott, 1994.

Key to species of *asahinai* species subgroup

1. Ti III > 250 ..... *L.* (*L.*) *asahinai* Japan
– Ti III < 220 ..... *L.* (*L.*) *phuketicus* Thailand

***guilinicus* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 1 solenidion, TFe III with 2 setae.

Species included: *L.* (*L.*) *guilinicus* Haitlinger, 2006.

***killingtoni* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae significantly setulose throughout the length.

Species included: *L.* (*L.*) *killingtoni* Turk, 1945, *L.* (*L.*) *cavernicola* Fain & Elsen, 1987, *L.* (*L.*) *albertensis* Southcott, 1992 including *L.* (*L.*) *machilidis* Southcott, 1992 **syn. nov.**, *L.* (*L.*) *droozi* Southcott, 1992, *L.* (*L.*) *brachypodos* Zheng, 1996, *L.* (*L.*) *dolichopodos* Zheng, 1996, *L.* (*L.*) *shimenensis* Zheng, 1996, *L.* (*L.*) *sulciscutus* Zheng, 1996, *L.* (*L.*) *grossi* Southcott, 1999, *L.* (*L.*) *scutellatus* Southcott, 1999, *L.* (*L.*) *singhi* Saboori & Arbabi, 2003, *L.* (*L.*) *ubudicus* Haitlinger, 2006.

Key to species of *killingtoni* species subgroup

1. Ti III > 220 2
– Ti III < 190 6
2. Ti III > 280 3
– Ti III < 260 4
3. Ti I > 230 ..... *L.* (*L.*) *dolichopodos* China
– Ti I < 200 ..... *L.* (*L.*) *droozi* USA
4. fD > 90 ..... *L.* (*L.*) *albertensis* Canada
– fD < 70 5
5. Scutum with convex anterior border, anterolateral angles rounded ..... *L.* (*L.*) *sulciscutus* China
– Scutum with concave anterior border, anterolateral angles pointed ..... *L.* (*L.*) *shimenensis* China
6. fD > 120, fV > 40 7
– fD < 70, fV < 30 8
7. Dorsal idiosomal setae narrow, elongate ..... *L.* (*L.*) *grossi* Australia

– Dorsal idiosomal setae slightly clavate, blunt-ended, with many fine, regular, pointed setules .... *L.* (*L.*) *killingtoni* Portugal (Azores Islands), Spain, United Kingdom
8. Chelicerae striated ..... *L.* (*L.*) *scutellatus* Papua New Guinea
– Chelicerae punctate 9
9. PW > 95, AW > 80 ..... *L.* (*L.*) *brachypodos* China
– PW < 85, AW < 70 10
10. Ti III/AW < 2.50 11
– Ti III/AW > 2.80 ..... *L.* (*L.*) *singhi* India
11. Ti III 142, Ti I 102–108 ..... *L.* (*L.*) *cavernicola* Rwanda
– Ti III 92, Ti I 70 ..... *L.* (*L.*) *ubudicus* Indonesia (Lesser Sunda Islands)

Remarks

Leptus (*L.*) *machilidis* is considered as a junior synonym of *L.* (*L.*) *albertensis* because their metric and meristic data, shape of scutum, etc. are the same or very close which can be considered as ranges of a species whereas they were collected from two different continents. Although they seem to be on the path of separation into two distinct species; their separation is yet to be completed. A molecular study can help separate species identity because the limited knowledge of intraspecifc variation, hinders the recognition of species borders and affects the views on the actual distribution of species. In the step 16 of Southcott's key (1992) to species, *L.* (*L.*) *machilidis* was considered "*Scutal sensillary setae with weak setules, in distal half only*" whereas in the description, he pointed out that "*Sensillary setae with fine setules, faint proximally, more prominent in distal half*". We checked it and confirm that sensillary setae are significantly setulose throughout the length. Zheng (1996b) described *Leptus* (*L.*) *sulciscutus* with 1 solenidion on Ti II (Fig. 37, p. 240) whereas it was written two solenidia on Ti II with their length. We considered it has two solenidia on Ti II.

***chelonethus* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases posterior to PL bases.

Species included: *L.* (*L.*) *chelonethus* Womersley, 1934.

***gagzoi* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases level with or anterior to AL bases.

Species included: *L.* (*L.*) *gagzoi* (Oudemans, 1910), *Leptus* (*L.*) *sieversi* (Oudemans, 1911), *L.* (*L.*) *terebrans* Vitzthum, 1926, *L.* (*L.*) *bathypogonus* Womersley, 1934, *L.* (*L.*) *madagascariensis* André, 1941, *L.* (*L.*) *kyushuensis* Ishii, 1953, *L.* (*L.*) *hidakai* Kawashima, 1958, *L.* (*L.*) *saigusai* Kawashima, 1958, *L.* (*L.*) *carpenteri* Fain & Elsen, 1972, *L.* (*L.*) *maringensis* Fain & Elsen, 1972, *L.* (*L.*) *calidus* Shiba, 1976, *L.* (*L.*) *cameronensis* Shiba, 1976, *L.* (*L.*) *draco* Southcott, 1984, *L.* (*L.*) *jocquei* Fain & Elsen, 1987, *L.* (*L.*) *leleupi* Fain & Elsen, 1987, *L.* (*L.*) *stolae* Haitlinger, 1987, *L.* (*L.*) *managarus* Haitlinger, 1990, *L.* (*L.*) *cyryli* Haitlinger, 1991, *L.* (*L.*) *calix* Southcott, 1992, *L.* (*L.*) *ruginus* Southcott, 1992, *L.* (*L.*) *agrotis* Southcott, 1993, *L.* (*L.*) *belicolus* Southcott, 1993, *L.* (*L.*) *cerambycius* Southcott, 1993, *L.* (*L.*) *georgeae* Southcott, 1993, *L.* (*L.*) *tarranus* Southcott, 1993, *L.* (*L.*) *alkmenae* Haitlinger, 1998, *L.* (*L.*) *zhutingensis* Zheng, 1996, *L.* (*L.*) *agenori* Haitlinger, 1999, *L.* (*L.*) *bankensis* Southcott, 1999, *L.* (*L.*) *cheesmanae* Southcott, 1999, *L.* (*L.*) *cultellus* Southcott, 1999, *L.* (*L.*) *flindersi* Southcott, 1999, *L.* (*L.*) *foliatus* Southcott, 1999, *L.* (*L.*) *lighti* Southcott, 1999, *L.* (*L.*) *norrisi*

Southcott, 1999, *L.* (*L.*) *pincheni* Southcott, 1999, *L.* (*L.*) *puniceus* Southcott, 1999, *L.* (*L.*) *zhangi* Saboori & Atamehr, 1999, *L.* (*L.*) *zhejiangensis* Zheng, 2003, *L.* (*L.*) *balicus* Haitlinger, 2006, *L.* (*L.*) *tiranicus* Haitlinger, 2006, *L.* (*L.*) *kattikus* Haitlinger, 2009, *L.* (*L.*) *planaltensis* Haitlinger, Šundić & Pompermaier, 2017.

Key to species of *gagzoi* species subgroup
(excluding *L. madagascariensis* because of insufficient data)

1. Dorsal idiosomal setae foliate ..... *L.* (*L.*) *foliatus* Australia
– Dorsal idiosomal setae typical, not foliate 2
2. Scutum striated 3
– Scutum punctate 4
3. L > 85, W > 90 ..... *L.* (*L.*) *cameronensis* Malaysia (Malay Peninsula)
– L < 75, W < 70 ..... *L.* (*L.*) *cultellus* Australia
4. Posterior part of bulbus of basal segment of chelicerae with narrow transverse striations .... *L.* (*L.*) *flindersi* Australia
– Bulbus of basal segment of chelicerae punctate 5
5. fD > 75 6
– fD < 70 11
6. Ti III > 280, Ti I > 230 7
– Ti III < 250, Ti I < 210 8
7. W > 160, L > 130 ..... *L.* (*L.*) *tarranus* Australia
– W < 140, L < 120 ..... *L.* (*L.*) *calix* USA
8. fD > 100, W > 115 ..... *L.* (*L.*) *agrotis* Australia
– fD < 95, W < 105 9
9. Ti III/AW < 2.3, trochanteral setae pointed ..... *L.* (*L.*) *bathypogonus* Australia
– Ti III/AW > 2.3, trochanteral setae blunt-ended ..... *L.* (*L.*) *belicolus* Australia
10. Ti III 105–120, L 64–66, W 80–82 ..... *L.* (*L.*) *georgeae* Australia
– Ti III 153–186, L 80–107, 91–102 ..... *L.* (*L.*) *bathypogonus* Australia
11. W > 190 ..... *L.* (*L.*) *stolae* Brazil
– W < 170 12
12. Leg I > 730 13
– Leg I < 700 31
13. W ≥ 118 14
– W ≤ 112 21
14. Ti I > 275 ..... *L.* (*L.*) *kattikus* Nepal, Vietnam
– Ti I < 260 15
15. PW 128–139, ISD > 90 ..... *L.* (*L.*) *jocquei* Malawi
– PW ≤ 122, ISD < 80 16
16. Ti I > 230 17
– Ti I < 220 18
17. With 4 hypostomal setae ..... *L.* (*L.*) *cheesmanae* Australia, Papua New Guinea
– With 2 hypostomal setae ..... *L.* (*L.*) *kyushuensis* Japan
18. Ta I < 130, Ti I > 215 ..... *L.* (*L.*) *cyryli* Brazil
– Ta I > 150, Ti I ≤ 210 19
19. With 4 hypostomal setae ..... *L.* (*L.*) *lighti* Australia
– With 2 hypostomal setae 20
20. L > 125, Leg I > 850 ..... *L.* (*L.*) *alkmenae* India
– L < 110, Leg I < 760 ..... *L.* (*L.*) *zhutingensis* China
21. L > 125 ..... *L.* (*L.*) *carpenter* Congo

– L < 115 22
22. Leg I > 1100 23
– Leg I < 1000 24
23. Ti I > 370 ..... *L.* (*L.*) *calidus* Malaysia (Malay Peninsula)
– Ti I < 320 ..... *L.* (*L.*) *draco* Papua New Guinea
24. With 4 hypostomal setae 25
– With 2 hypostomal setae 26
25. AL 88–91, PL 80–82 ..... *L.* (*L.*) *zhangi* Iran
– AL 55–58, PL 50–60 ..... *L.* (*L.*) *cerambycius* Australia
26. L = W, leg I 780 ..... *L.* (*L.*) *gagzoi* Panama, Trinidad and Tobago
– L < W, leg I > 790 27
27. *1b* > 130, *2b* > 45 ..... *L.* (*L.*) *zhejiangensis* China
– *1b* < 110, *2b* < 35 28
28. Ti I > 230 ..... *L.* (*L.*) *hidakai* Japan, Singapore
– Ti I < 210 29
29. PL < 65, ASens < 35 ..... *L.* (*L.*) *tiranicus* Venezuela
– PL > 75, ASens > 45 30
30. *1b* > 100, leg I 872 ..... *L.* (*L.*) *managarus* Indonesia (Java)
– *1b* < 85, leg I 792 ..... *L.* (*L.*) *saigusai* Japan
31. Leg I > 590 32
– Leg I < 540 37
32. GL < 165 33
– GL > 170 34
33. fD 62 ..... *L.* (*L.*) *bankensis* Australia
– fD 41 ..... *L.* (*L.*) *ruginus* USA
34. With 4 hypostomal setae 35
– With 2 hypostomal setae 39
35. Basal segment of chelicerae suddenly narrowed at the middle 36
– Basal segment of chelicerae graduately narrowed ..... *L.* (*L.*) *balicus* Indonesia (Lesser Sunda Islands)
36. Dorsal idiosomal setae clavate ..... *L.* (*L.*) *pincheni* Australia
– Dorsal idiosomal setae slender, not clavate 37
37. fV < 25 38
– fV 34 ..... *L.* (*L.*) *leleupi* Tanzania
38. AL 53–62 ..... *L. (L.) planaltensis* Brazil
– AL 70–74 ..... *L.* (*L.*) *agenori* Malaysia, Thailand
39. GL > 170 ..... *L.* (*L.*) *terebrans* Indonesia (Sumatra)
– GL < 140 40
40. Leg I > 500 ..... *L.* (*L.*) *norrisi* Australia
– Leg I < 450 41
41. Leg II < 350 ..... *L.* (*L.*) *sieversi* Venezuela
– Leg II > 400 ..... *L.* (*L.*) *puniceus* Australia

Remarks

Leptus (*L.*) *ilzae* is considered as a junior synonym of *L.* (*L.*) *kyushuensis* because their metric and meristic data, shape of scutum, etc. are the same or very close which can be considered as ranges of a species. ASens bases are level with AL bases in the holotype of *Leptus* (*L.*) *ruginus* (Southcott 1992, p. 78, paragraph 2 lines 7–8, and p. 79, Fig. 37) whereas in paratypes deposited in SAM, ASens bases are a little behind AL bases (Fig. 19). The holotype should be checked for making a correct decision. For this reason, we placed this species in this subgroup provisionally. Southcott (1993)

considered ASens bases slightly behind AL bases in *Leptus* (*L.*) *georgeae* (p. 1510) whereas in Fig. 23 (p. 1511) ASens bases showed in line with AL bases. Our re-examination of the holotype and paratype confirm "ASens bases are in level with AL bases (Fig. 20). *Leptus* (*L.*) *laviniacus* is considered as a junior synonym of *L.* (*L.*) *agenori* because their metric and meristic data, shape of scutum, etc. are the same or very close which can be considered as ranges of two populations of a species. There are abnormalities in the number of normal setae on Ti I-III and Ta I-III in the *L.* (*L.*) *flindersi* as follows: Ti I with 13 (Left side)/14 (Right side) normal setae, Ti II with 13 normal setae, Ti III with 13L/15R, Ta I with 26L/25R, Ta II with 22L/23 R and Ta III with 23 normal setae. For this reason, its tibial and tarsal setal formula is different from other species of *Leptus*. All type specimens should be studied to determine the real formula. Southcott (1999) wrote ASens bases level with AL scutalae bases in *Leptus* (*L.*) *lighti* but in Fig. 48 (p. 192) ASens bases are behind AL scutalae bases. We checked the holotype and confirm that ASens bases are slightly anterior to AL scutalae bases (Fig. 21). Some metric data missing in the original description of *Leptus* (*L.*) *zhangi* are as follows: LX 35, ASBM 25, ASBa 38, AAS 37, PDS 35–50, *2a* 59, aHy 32, pHy 54. *Leptus* (*L.*) *tiranicus* has fn Ta 30-26-26. Paratypes of the species should be checked for variation in the number of normal setae on Ta I. Mąkol *et al*. (2012) redescribed *Leptus* (*L.*) *kattikus* and reported that some characters of the type are incongruent with the data provided in the original description.

***phyllotretae* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II absent.

Species included: *L.* (*L.*) *phyllotretae* Feider, 1956.

Remarks

Leptus (*L.*) *phyllotretae* should be redescribed because it has been described briefly and new drawings and meristic data are needed.

***aldonae* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present, large microseta on Ge I-II & Ti I.

Species included: *L.* (*L.*) *aldonae* Haitlinger, 1987, *L.* (*L.*) *cooremani* Fain, 1991.

Key to species of *aldonae* species subgroup

1. Ti III 370, Ti I > 309, L 140 ..... *L.* (*L.*) *cooremani* Australia
– Ti III 108, Ti I 90–94, L 34–84 ..... *L.* (*L.*) *aldonae* Madagascar

Remarks

Leptus (*L.*) *aldonae* should be redescribed because it has been described briefly and new drawings and meristic data are needed. For corrected data see Table 1.

***treati* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present,

microseta on Ge I-II & Ti I normal, chelicerae striated.

Species included: *L.* (*L.*) *treati* Welbourn, 1991, *L.* (*L.*) *calcar* Southcott, 1999.

Key to species of *treati* species subgroup

1. fV 31, fD 66-80, PL 65–78 ..... *L.* (*L.*) *treati* USA
– fV 19, fD 49, PL 45–57 ..... *L.* (*L.*) *calcar* Australia, Papua New Guinea

Remarks

We studied a specimen of *L.* (*L.*) *treati* deposited in SAM (Table 1).

***millipedius* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present, microseta on Ge I-II & Ti I normal, chelicerae punctate, fD > 125.

Species included: *L.* (*L.*) *millipedius* Southcott, 1992, *L.* (*L.*) *bakeri* Southcott, 1992, *L.* (*L.*) *titinius* Southcott, 1993.

Key to species of *millipedius* species subgroup

1. Ti III < 170, Ti I < 150 ..... *L.* (*L.*) *millipedius* Portugal (Madeira), Spain (Canary Islands)
– Ti III > 210, Ti I > 170 2
2. fV 72, PDS 57–66 ..... *L.* (*L.*) *bakeri* USA
– fV 26, PDS 22–23 ..... *L.* (*L.*) *titinius* Australia

***meloidarum* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present, microseta on Ge I-II & Ti I normal, chelicerae punctate, 100 < fD < 125.

Species included: *L.* (*L.*) *meloidarum* Beron, 1975 including *L.* (*L.*) *gyas* Fain & Amico, 1997 **syn. nov.**, *L.* (*L.*) *mariae* Haitlinger, 1987, *L.* (*L.*) *clarki* Southcott, 1989, *L.* (*L.*) *baudini* Southcott, 1999.

Key to species of *meloidarum* species subgroup

1. Ti III/AW > 2.10 2
– Ti III/AW < 1.80 3
2. Ti III/AW > 2.50 ..... *L.* (*L.*) *clarki* Australia
– Ti III/AW < 2.40 ..... *L.* (*L.*) *mariae* Austria, Belgium, Bulgaria, Czech Republic [N], Estonia, Hungary, Italy, Latvia, Luxembourg, Macedonia, Norway, Poland, Romania, Slovenia, Spain, Sweden, Switzerland, The Netherlands
3. L > 100 ..... *L.* (*L.*) *meloidarum* Bulgaria, Italy, Kyrgyzstan
– L < 80 ..... *L.* (*L.*) *baudini* Australia

Remarks

Fain and Amico (1997) described *L.* (*L.*) *gyas* and compared it with *L.* (*L.*) *clarki* whereas all metric and meristic data of *L.* (*L.*) *meloidarum* and *L.* (*L.*) *gyas* are the same or very close together

and can be considered as range of metric and meristic data of one species, e.g. fD = 109 in *L.* (*L.*) *meloidarum* (vs. 108 in *L.* (*L.*) *gyas*), fV = 48 in *L.* (*L.*) *meloidarum* (vs. 49 in *L.* (*L.*) *gyas*).

***gagrellae* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present, Microseta on Ge I-II & Ti I normal, chelicerae punctate, fD < 100, scutum distinctly longer than wide (> 15 μm).

Species included: *Leptus* (*L.*) *gagrellae* (Oudemans, 1910).

***gifuensis* species subgroup**
BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present, microseta on Ge I-II & Ti I normal, chelicerae punctate, fD < 100, scutum distinctly wider than long (≥ 14 μm).

Species included: *L.* (*L.*) *gifuensis* Kawashima, 1958, *L.* (*L.*) *alberti* Haitlinger, 1991, *L.* (*L.*) *cercopius* Southcott, 1992, *L.* (*L.*) *rwandae* Fain & Jocqué, 1996, *L.* (*L.*) *admeti* Haitlinger, 1998, *L.* (*L.*) *clelandi* Southcott, 1999, *L.* (*L.*) *fisheri* Southcott, 1999, *L.* (*L.*) *tindalei* Southcott, 1999, *L.* (*L.*) *brasilicus* Haitlinger, Šundić & Pompermaier, 2017, *L.* (*L.*) *haitlingeri* Jacinavicius, BassiniSilva & Welbourn, 2019.

Key to species of *gifuensis* species subgroup

1. fD > 100 2
– fD < 60 3
2. Ti III > 180, Ti I > 150 ..... *L.* (*L.*) *tindalei* Australia
– Ti III < 150, Ti I < 120 ..... *L.* (*L.*) *clelandi* Australia
3. L < 65 ..... *L.* (*L.*) *gifuensis* Japan
– L > 70 4
4. With four hypostomal setae 5
– With two hypostomal setae 9
5. Ti III/AW < 2.30 6
– Ti III/AW > 2.40 8
6. Anterior border of scutum concave ..... *L.* (*L.*) *brasilicus* Brazil
– Anterior border of scutum nearly staight 7
7. Ti III 195, Ti I 170 ..... *L.* (*L.*) *fisheri* Australia
– Ti III 117–119, Ti I 105–108 ..... *L.* (*L.*) *rwandae* Rwanda
8. SoTa I ~30, aHy small (14 long) ..... *L.* (*L.*) *cercopius* USA
– SoTa I 62–66, aHy minute (3-4 long) ..... *L.* (*L.*) *haitlingeri* Brazil
9. AL 44, PL 60 ..... *L.* (*L.*) *alberti* Brazil
– AL > 70, PL > 80 ..... *L.* (*L.*) *admeti* Indonesia (Sumatra)

Remarks

Haitlinger (2000) described *L.* (*L.*) *annikae* and compared it with *L.* (*L.*) *mariani* and *L.* (*L.*) *gagzoi* whereas all metric and meristic data of *L.* (*L.*) *cercopius* and *L.* (*L.*) *annikae* are the same or

very close and can be considered as ranges of metric and meristic data of a species, e.g. fD = 58 in *L.* (*L.*) *cercopius* (vs. ~50 in *L.* (*L.*) *annikae*), fV = 18 in *L.* (*L.*) *cercopius* (vs. 22 in *L.* (*L.*) *annikae*), L 102 in *L.* (*L.*) *cercopius* (vs. 96 in *L.* (*L.*) *annikae*), W 120 in *L.* (*L.*) *cercopius* (vs. 116 in *L.* (*L.*) *annikae*), etc. For this reasons, we considered *L.* (*L.*) *annikae* as a junior synonym of *L.* (*L.*) *cercopius*. *Leptus* (*L.*) *gifuensis* Kawashima, 1958, *L.* (*L.*) *alberti*, *L.* (*L.*) *rwandae* and *L.* (*L.*) *admeti* should be redescribed because they have been described briefly and new drawings and meristic data are needed.

***molochinus* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, solenidia on Ti II present, microseta on Ge I-II & Ti I normal, chelicerae punctate, fD < 100, scutum length and width semi-equal (< 14 μm longer or wider), Ti I < 125.

Species included: *L.* (*L.*) *molochinus* (C. L. Koch, 1837), *L.* (*L.*) *maranaensis* Haitlinger, 1987, *L.* (*L.*) *olafi* Haitlinger, 1991, *L.* (*L.*) *danelli* (Southcott, 1992), *L.* (*L.*) *miromiri* Haitlinger, 1992, *L.* (*L.*) *monteithi* Southcott, 1993, *L.* (*L.*) *astrubali* Haitlinger, 1999 including *L.* (*L.*) *coloanensis* Haitlinger, 2006 **syn. nov.**, *L.* (*L.*) *onnae* Haitlinger, 2000, *L.* (*L.*) *simonettae* Haitlinger, 2000, *L.* (*L.*) *adaminae* Haitlinger, 2004.

Key to species of *molochinus* species subgroup

1. Ti III 190–212, Ti I 146–172 ..... *L.* (*L.*) *maranaensis* Madagascar
– Ti III < 170, Ti I < 130 2
2. fD ≥ 85 ..... *L.* (*L.*) *monteithi* Tasmania
– fD < 75 3
3. fD < 45 4
– fD ≥ 50 5
4. Ti III > 130, Ti I > 95, AL > 45 ..... *L.* (*L.*) *simonettae* Guatemala, Honduras, Brazil
– Ti III < 105, Ti I < 85, AL < 40 ..... *L.* (*L.*) *astrubali* India, Myanmar, Nepal, Thailand
5. Anterior border of scutum straight..... 6
– Anterior border of scutum concave 7
6. AL 46–54, *1a* 32–40 ..... *L.* (*L.*) *olafi* Colombia, Panama, Venezuela
– AL 34–40, *1a* 26–30 ..... *L.* (*L.*) *miromiri* Estonia, Poland
7. With four hypostomal setae 8
– With two hypostomal setae 9
8. ISD 58–68, TiIII/AW 1.23–1.72 ..... *L.* (*L.*) *molochinus* Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Great Britain, Greenland, Hungary, Iceland, Luxembourg, Macedonia, Mongolia, Norway, Poland, San Marino, Spain, Sweden, Switzerland, The Netherlands
– ISD 48–88, TiIII/AW 1.68–1.94 ..... *L.* (*L.*) *danelli* USA
9. L > W, Ti III/AW 1.93 ..... *L.* (*L.*) *onnae* Brazil, Mexico
– L < W, Ti III/AW 1.44–1.75 ..... *L.* (*L.*) *adaminae* Brazil

Remarks

Leptus (*L.*) *molochinus* has a scutum with pointed anterolateral angles (Fig. 22). We considered *Leptus* (*L.*) *maranaensis* has two solenidia on Ti II as we saw in *L.* (*L.*) *aldonae*. *Leptus* (*L.*) *olafi* has entire palpal tibial calw (it was shown bifid in Haitlinger 2006c). We studied type specimens of *L.* (*L.*) *danelli* deposited in SAM and ANIC. It seems they are two different species because the scutum is completely different. In some type specimens, scutum has pointed anterolateral angles and is a little

longer that wide and posterlateral borders are convex (Fig. 23), whereas in some of the other type specimens scutum has acute anterolateral angles and is distinctly longer that wide and posterolateral borders are concave (Fig. 24), similar to Fig. 14, page 40 in Southcott (1992). In both figures, Asens bases are level with AL bases whereas in Southcott (1992, Fig. 14, pp. 37 & 40), Asens bases are between AL and PL bases. A comprehensive study of all type specimens is needed simultaneously. Haitlinger (2006d) described *L.* (*L.*) *coloanensis* and separated it from *L.* (*L.*) *astrubali* in shorter ISD (34 vs 44), AM (20 vs. 26–32), GL (122 vs. 136–140), PsFd (28 vs. 38–42), TaI (74 vs. 84–86) and TiI (68 vs. 80–84). *Leptus* (*L.*) *coloanensis* is described based on single specimen and the latter based on two specimens. Differences considered by Haitlinger (2000) are very similar to each other especially considering that a low number of specimens was collected. We considered these differences as intraspecific variations.

***boggohoranus* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, Solenidia on Ti II present, Microseta on Ge I-II & Ti I normal, Chelicerae punctate, fD < 100, Scutum length and width semi-equal (< 14 μm longer or wider), Ti III > 340 & Ti I > 280.

Species included: *L.* (*L.*) *boggohoranus* Haitlinger, 1990, *L.* (*L.*) *lorarius* Southcott, 1999.

Key to species of *boggohoranus* species subgroup

1. Ti III 344–410, Ti I 284–319 ..... *L. boggohoranus* New Guinea
– Ti III 503–513, Ti I 387–405 ..... *L. lorarius* Papua New Guinea

Remarks

Leptus (*L.*) *boggohoranus* should be redescribed because it has been described briefly and new drawings and meristic data are needed.

***phalangii* species subgroup**

BFe III without solenidion, TFe I without solenidion, Ge I with 1 solenidion, Ti I with 2 solenidia, Ti III with 1 solenidion, Ge II without solenidion, Ti II with 2 solenidia, TFe III with 1 seta, sensillary setae setulose in about distal half, ASens bases between AL and PL bases, Solenidia on Ti II present, Microseta on Ge I-II & Ti I normal, Chelicerae punctate, fD < 100, Scutum length and width semi-equal (< 14 μm longer or wider), Ti III < 340 or Ti I < 280.

Species included: *L.* (*L.*) *phalangii* (de Geer, 1778), *L.* (*L.*) *siemsseni* (Oudemans, 1910), *L.* (*L.*) *atticolus* Lawrence, 1940, *L.* (*L.*) *japonicus* Kawashima, 1958, *L.* (*L.*) *galerucae* Feider, 1967, *L.* (*L.*) *orthopterarum* Beron, 1975, *L.* (*L.*) *clethrionomydis* Haitlinger, 1987, *L.* (*L.*) *nearcticus* Fain, Gummer & Whitaker, 1987, *L.* (*L.*) *ariel* Southcott, 1989, *L.* (*L.*) *alvimordax* Southcott, 1991, *L.* (*L.*) *swani* Southcott, 1991, *L.* (*L.*) *californicus* Southcott, 1992, *L.* (*L.*) *coreophilus* Southcott, 1992, *L.* (*L.*) *ghiradellae* Southcott, 1992, *L.* (*L.*) *kalaallus* Southcott, 1992, *L.* (*L.*) *sayi* Southcott, 1992, *L.* (*L.*) *orthrius* Southcott, 1993, *L.* (*L.*) *hupingshanicus* Zheng, 1996, *L.* (*L.*) *addari* Haitlinger, 1999, *L.* (*L.*) *elderi* Southcott, 1999, *L.* (*L.*) *holgeri* Haitlinger, 1999, *L.* (*L.*) *urodaci* Southcott, 1999, *L.* (*L.*) *nikanori* Haitlinger, 2000, *L.* (*L.*) *masaimaraicus* Haitlinger, 2001, *L.* (*L.*) *fozicus* Haitlinger, 2004, *L.* (*L.*) *gennadicus* Hatlinger, 2003, *L.* (*L.*) *abrofaicus* Haitlinger, 2007, *L.* (*L.*) *biljanae* Šundić & Haitlinger, 2015, *L.* (*L.*) *chingombensis* Bernard, Felska & Mąkol, 2019.

Key to species of *phalangii* species subgroup

1. Ti III/AW < 2 2
– Ti III/AW > 2 8
2. Ti III > 200 ..... *L.* (*L.*) *siemsseni* China
– Ti III < 200 3
3. DS 27–32 ..... *L.* (*L.*) *galerucae* Romania
– DS > 35 4
4. fD > 100 ..... *L.* (*L.*) *biljanae* Montenegro
– fD < 70 5
5. GL > 200 ..... *L.* (*L.*) *masaimaraicus* Kenya
– GL < 190 6
6. PL > 65, AL > 60 ..... *L.* (*L.*) *gennadicus* Greece
– PL < 60, AL < 55 7
7. PDS > 45, 20 setae behind coxae III ..... *L.* (*L.*) *ariel* Guatemala, Peru
– PDS < 40, 10 setae behind coxae III ..... *L.* (*L.*) *abrofaicus* Ghana
8. Ti III > 200 9
– Ti III < 195 22
9. Ti III ≥ 250 10
– Ti III ≤ 235 17
10. fD > 70 11
– fD < 60 12
11. AL/PL 0.84 ..... *L.* (*L.*) *sayi* USA
– AL/PL 0.9–1.1 ..... *L.* (*L.*) *chingombensis* Zambia
12. fV = 30 ..... *L.* (*L.*) *japonicus* Japan
– fV < 25 13
13. With four hypostomalae 14
– With two hypostomalae 15
14. Anterior border of scutum almost straight ..... *L.* (*L.*) *coreophilus* USA
– Anterior border of scutum deeply concave ..... *L.* (*L.*) *nikanori* Brazil
15. *1b* > 90 16
– *1b* < 90 ..... *L.* (*L.*) *ghiradellae* USA
16. Ti III < 310 ..... *L.* (*L.*) *alvimordax* Australia
– Ti III > 340 ..... *L.* (*L.*) *hupingshanicus* China
17. L < 90 ..... *L.* (*L.*) *urodaci* Australia
– L > 95 18
18. fD > 95 19
– fD < 60 20
19. W > 115, PW 103–113 ..... *L.* (*L.*) *phalangii* Austria, Belgium, Bulgaria, Denmark, France, Germany, Great Britain, Italy, The Netherlands, Hungary, Iceland, Ireland, Norway, Poland, Russia, Slovakia, Slovenia, Sweden
– W < 110, PW 87–96 ..... *L.* (*L.*) *nearcticus* USA
20. AL < PL ..... *L.* (*L.*) *holgeri* Laos
– AL > PL 21
21. AL > 60, leg I > 800 ..... *L.* (*L.*) *swani* Australia
– AL < 50, leg I < 750 ..... *L.* (*L.*) *californicus* USA
22. fD ≥ 56 23
– fD ≤ 51 25
23. Scutum with rounded angles ..... *L.* (*L.*) *clethrionomydis* Hungary, Poland
– Scutum with pointed angles 24

24. L > 95, W > 95 ..... *L.* (*L.*) *kalaallus* Denmark (Greenland)
– L < 80, W ≤ 90 ..... *L.* (*L.*) *orthrius* Australia
25. Ti III/AW < 2.96 26
– Ti III/AW > 3..... *L.* (*L.*) *addari* Thailand
26. With two hypostomalae, GL 150 ..... *L.* (*L.*) *elderi* Australia
– With four hypostomalae, GL 190–200..... *L.* (*L.*) *fozicus* Brazil

Remarks

Leptus (*L.*) *phalangii* has scutum with pointed anterolateral angles (Fig. 25). *Leptus* (*L.*) *atticolus* is provisionally placed in this subgroup. Due to insufficient data, it is not known whether it belongs to *boggohoranus* species subgroup or *phalangii* species subgroup. *Leptus* (*L.*) *japonicus*, *L.* (*L.*) *galerucae*, *L.* (*L.*) *orthopterarum*, *L.* (*L.*) *nearcticus aldonae* should be redescribed because they have been described briefly and new drawings and meristic data are needed. *Leptus* (*L.*) *alopecurus* is considered as a junior synonym of *L.* (*L.*) *alvimordax* because their metric and meristic data, shape of scutum, etc. are the same or very close which can be considered as ranges of two populations of a species. They were collected from Queensland and Southcott (1992) separated them from each other only by the length of dorsal setae (DS 45–50 in *L.* (*L.*) *alopecurus* vs. 50–61 in *L.* (*L.*) *alvimordax* and PDS 53–61 vs. 40–50). We considered these differences as intraspecific variations. Mayoral and Barranco (2011a, b) reported *L.* (*L.*) *nikanori* from Costa Rica and French Guiana and they presented metric data for 27 larvae from Costa Rica and 14 larvae from French Guiana (Mayoral and Barranco 2011a). Our investigation showed that the metric data probably belongs to more than one species. The senior author (2019) confirmed that metric data at least belonged to two species (personal communication). For this reason, we ignored those metric data in our key. *Leptus* (*L.*) *welbourni* is considered as a junior synonym of *L.* (*L.*) *ghiradellae* because their metric and meristic data, shape of scutum, etc. are the same or very close which can be considered as ranges of two populations of a species. They were collected from Tyringham, Massachusetts and Southcott (1992) separated from each other only by AW/AL (1.39–1.53 in *L.* (*L.*) *ghiradellae* vs. 1.58–1.62 in *L.* (*L.*) *welbourni*) and L/W (1.02–1.11 vs. 1.17–1.22) for larva and PDS (46–55 vs. 20–46) for protonymph. We considered these differences as intraspecific variations. *Leptus* (*L.*) *laplandicus* is considered as a junior synonym of *L.* (*L.*) *clethrionomydis* because their metric and meristic data, shape of scutum, etc. are the same or very close which can be considered as ranges of two populations of a species.

DISCUSSION

There are some main issues in *Leptus* classification, namely: 1. Insufficient data: some species have been described many years ago and their descriptions are incomplete and in some cases, their type specimens are lost; 2. Single specimen: many species of *Leptus* were described based on single specimen and variation of characters are not known especially when the species does not exhibit a distinct discriminatory character; 3. Mistakes in the descriptions: in the drawings and in identifying special setae e.g. solenidia. Abnormalities in the number of setae are common in terrestrial Parasitengona (Southcott 1997; Mąkol and Łaydanowicz 2006) and for this reason, the number of setae on both sides of the legs should be counted. The senior author observed abnormalities in the number of setae when he reared *Allothrombium triticium* Zhang in the laboratory. When we rear a species in the laboratory, we don't know the optimum condition for the species and sometimes it presents abnormalities or a range for meristic characters. Roland and Gabryś (2011) suggested unsuitable conditions may be responsible for some abnormalities (anomalies and malformations). Anomalies and malformations also occur in larvae captured in the field – to distinguish anomalies from intraspecific variations, in many cases, requires a better knowledge of the latter.

Southcott did not use the number of normal setae for separating species. Southcott considered number of normal setae on TFe-Ta in general as less valuable for taxonomic decisions. Metric data

are in particular convincing when being available for several specimens of a species sampled at different locations – in the majority of cases this condition is not met. Also, the metric characters considered by him especially ASBa, ASBM, LX, Ti III/AW, etc. which were not considered completely by subsequent authors, have important taxonomic values. We suggest to use the characters considered by him in the table of metric data as well as shape of scutum and chelicerae, number and shape (barbed, nude, or spine-like) of hypostomalae and galealae, number of barbed and nude setae on palpal tarsus, position and length of solenidia (as considered by Southcott), and other characters which are presented in the morphology section of this manuscript as diagnostic and discriminatory ones.

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Table 1. Corrections and additions to published descriptions of *Leptus* spp.

No.	Species	Original description	Source of correction	Correction/addition
1	*L.* (*L.*) *kattikus*	Haitlinger, 2009	Holotype	BFe III with 2 setae; 2 barbed hypostomalae; fn Ti 14-15-15; fn Ta 28-25L/26R-26
2	*L.* (*L.*) *horiacus*	Haitlinger, 1994	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
3	*L.* (*L.*) *tammuzi*	Haitlinger, 1994	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
4	*L.* (*L.*) *abrofaicus*	Haitlinger, 2007	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae; 2 solenidia on Ti II; Ge II with 1κ; fn Ti 14-15-15; fn Ta 28-26-~25 (not clearly seen) and fn ζ 2-2-1
5	*L.* (*L.*) *holgeri*	Haitlinger, 1999	Holotype	fn Ta 28-26-26 and fn ζ 2-2-1
6	*L.* (*L.*) *addari*	Haitlinger, 1999	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
7	*L.* (*L.*) *maldonadoicus*	Haitlinger, 2000	Holotype & paratype	fn BFe I-III: 3-3-2; fn Ti I-III 14-15-15, No setae on Ta I-III not visiable, Palptibia with 3n, Palpfemur with 2n, Ge II 1σ (-/1σ L.), Ge III 1σ (0σ R/1σ L.)
8	*L.* (*L.*) *annikae*	Haitlinger, 2000	Holotype	BFe III with 1n, Ta III with 26n; 8 setae on palpal tarsus including a solenidion and an eupathidium
9	*L.* (*L.*) *hringuri*	Haitlinger, 2000	Holotype	5 setae on each TFe I-III, 1σ, 1κ, 8n on Ge I, 1κ, 8n on Ge II, 8n on Ge III, 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III and 3 setae on palpal tibia
10	*L.* (*L.*) *filipinae*	Haitlinger, 2000	Holotype	4 hypostomalae; fn Ti 14-15-15; fn Ta 28-26-26; fn ζ 2-2-1 and one solenidion on Ti III
11	*L.* (*L.*) *nikanori*	Haitlinger, 2000	Holotype	4 hypostomalae; Ti II & III each with 15n; fn Ta I-III: 28-26-26; 8 setae on palpal tarsus including a solenoidion and an eupathidium, Ta I and Ta II each with 2ζ and Ta III with 1ζ, Ge II with 1κ
12	*L.* (*L.*) *simonettae*	Haitlinger, 2000	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
13	*L.* (*L.*) *onnae*	Haitlinger, 2000	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ta 28-26-26 and fn ζ 2-2-1
14	*L.* (*L.*) *olamukijacus*	Haitlinger, 2001	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 stout and barbed hypostomalae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
15	*L.* (*L.*) *masaimaraicus*	Haitlinger, 2001	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1

Table 1. Continued.

No.	Species	Original description	Source of correction	Correction/addition
16	*L.* (*L.*) *hospeticus*	Haitlinger, 2002	Holotype	14n on Ti I; 15n on each Ti II & III; 28n on Ta I and 26n on each Ta II & III
17	*L.* (*L.*) *cabareticus*	Haitlinger, 2004	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn TFe 5-5-5; fn Ti 14-15-15; fn Ta 28-26-25 and fn ζ 2-2-1(L)/2(R)
18	*L.* (*L.*) *iguacuicus*	Haitlinger, 2004	Holotype	2 long barbed pHy and 2 small nude aHy (Fig. 12) and 2 galealae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 1ε, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
19	*L.* (*L.*) *adaminae*	Haitlinger, 2004	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
20	*L.* (*L.*) *fozicus*	Haitlinger, 2004	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium, 4 hypostomalae; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
21	*L.* (*L.*) *tiranicus*	Haitlinger, 2006	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 30-26-26; fn ζ 2-2-1 Paratypes of the species should be checked for variation in the number of normal setae on Ta I
22	*L.* (*L.*) *olafi*	Haitlinger, 1991	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium, palpal tarsal calw entire (it was shown bifid in Haitlinger 2006c); fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
23	*L.* (*L.*) *maxorata*	Haitlinger, 2009	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 23, 25, 27n on Ta II (abnormality on Ta II) and 1ζ, 25n on Ta III and 1κ on Ge II
24	*L.* (*L.*) *edwini*	Haitlinger, 2009	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
25	*L.* (*L.*) *tenerificus*	Haitlinger, 2009	Holotype	4 hypostomalae; Anterior border of scutum deeply concave but differs from the Figures 22 and 24 in the original description (See Fig. 11); 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
26	*L.* (*L.*) *canaricus*	Haitlinger, 2009	Holotype	4 hypostomalae ; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
27	*L.* (*L.*) *hammameticus*	Haitlinger, 1998	Holotype	2 long and stout pHy and 2 minute aHy (Fig. 10); 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III

Table 1. Continued.

No.	Species	Original description	Source of correction	Correction/addition
28	*L.* (*L.*) *auliacus*	Haitlinger, 1998	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
29	*L.* (*L.*) *dinekaicus*	Haitlinger, 2006	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-25 and fn ζ 2-2-1
30	*L.* (*L.*) *dalicus*	Haitlinger, 2006	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae; fn Ti 14-15-15; fn Ta 28-26-26; one eupathidium on Ta III; 5 setae on TFe III
31	*L.* (*L.*) *fathipeuri*	Haitlinger & Saboori, 1996	Holotype	1σ, 1κ, 8n on Ge I; 1κ, 8n on Ge II; 8n on Ge III; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III; 4 hypostomalae and scutum with slightly concave anterior border and straight anterolateral and posterolateral borders (Fig. 18)
32	*L.* (*L.*) *aldonae*	Haitlinger, 1987	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; Ge I with 1 solenidion; Ti I & III each with 2 solenidia; Ge I-II and Ti I each with a large microseta; fn Cx 1-1-1; fn BFe 2-2-1; fn TFe 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 28-26-26; fn ζ 2-2-1
33	*L.* (*L.*) *rosellae*	Haitlinger, 1999	Holotype and Paratype	palpal tarus with 8 setae including a solenidion and an eupathidium; 4 hypostomalae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III;
34	*L.* (*L.*) *monolithosicus*	Haitlinger, 2003	Holotype	Ti II & Ti III with 15n; fn Ta I-III: 28-26-26,
35	*L.* (*L.*) *andae*	Haitlinger, 2003	Holotype	4 hypostomalae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
36	*L.* (*L.*) *gennadicus*	Hatlinger, 2003	Holotype	has 8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-25; fκ (1-1), (1-0), (0-0) and fn ζ 2-2-1
37	*L.* (*L.*) *guilinicus*	Haitlinger, 2006	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26; fn ζ 2-2-1
38	*L.* (*L.*) *ubudicus*	Haitlinger, 2006	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 1 eupayhidium on Ta III, one microseta on Ge II; fn Ti 14-15-15 and fn Ta 28-26-26
39	*L.* (*L.*) *balicus*	Haitlinger, 2006	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
40	*L.* (*L.*) *pelebinus*	Haitlinger, 2007	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 1ε, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
41	*L.* (*L.*) *elminus*	Haitlinger, 2007	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 1σ, 1κ, 8n on Ge I; fn Ti 14-15-15; fn Ta 28-26-25 and fn ζ 2-2-1

Table 1. Continued.

No.	Species	Original description	Source of correction	Correction/addition
42	*L.* (*L.*) *pozzoicus*	Haitlinger, 2007	Holotype	4 hypostomalae, 2 long and stout barbed pHy and 2 minute aHy (Fig. 9); 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 1ε, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
43	*L.* (*L.*) *salicus*	Haitlinger, 2009	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
44	*L.* (*L.*) *korneli*	Haitlinger, 2009	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
45	*L.* (*L.*) *sulawesicus*	Haitlinger, 2011	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 setae between coxae II-III, not 6 as in the original description (See Fig. 13); 1σ, 1κ, 8n on Ge I; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II; 1ζ, 26n on Ta III
46	*L.* (*L.*) *mirenae*	Haitlinger, 1994	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae on gnathosoma; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 26/27n on Ta I; 1ω, 2ζ, 24n on Ta II; 1ζ, 26n on Ta III; large microsetae on Ge I & II and Ti I about half length of solenidia
47	*L.* (*L.*) *chiusicus*	Haitlinger, 2014	Holotype	fn Ti 14-15-15and fn Ta 28 (27)-26-26
48	*L.* (*L.*) *molochinus*	C L. Koch, 1837	Larva obtained from female neotype by experimental rearing.	8 setae on palpal tarsus including a solenidion and an eupathidium; scutum with pointed anterolateral angles (Fig. 22); fn Ti 14-15-15 and fn Ta 28-26-26
49	*L.* (*L.*) *danelli*	Southcott, 1992	Paratype (ANIC 52-003835, J12439)	Ti I with 14n & Ti II with 15n; fn Ta I-III 28-26-26
50	*L.* (*L.*) *clarki*	Southcott, 1989	Partatypes (J12435, J12436, J12437, J12438)	8 setae on palpal tarsus including a solenidion and an eupathidium, 2 barbed pHy, 2 minute aHy and 2 barbed galealae; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
51	*L.* (*L.*) *francesi*	Southcott, 1991	Holotype (J13292)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2 nude pHy and no aHy seen; fn Ti 14-15-15; fn Ta 28-26-26 and 4 solenidia on Ti I
52	*L.* (*L.*) *chelonethus*	Womersley, 1934	Holotype (J3879)	8 setae on palpal tarsus including a solenidion and an eupathidium; TFe III with 5n; Ge II with 8n; Ti II & III each with 15n; Ta II with 25n; Ta III with 26n and fn ζ 2-2-1
53	*L.* (*L.*) *bathypogonus*	Womersley, 1934	Lectotype (J3880)	8 setae on palpal tarsus including a solenidion and an eupathidium; barbed pHy; small nude aHy and galealae; BFe II with 2n; TFe III with 5n; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1

Table 1. Continued.

No.	Species	Original description	Source of correction	Correction/addition
54	*L.* (*L.*) *swani*	Southcott, 1991	Holotype (J3884)	4 barbed hypostomalae and fn Ti 14-15-15 and fn Ta 28-26-26
55	*L.* (*L.*) *alvimordax*	Southcott, 1991	Holotype (J13293)	fn Ti 14-15-15 and fn Ta 28-26-26
56	*L.* (*L.*) *ruginus*	Southcott, 1992	Paratype (ANIC 52-003836, J12441)	fn Ta 28-26-26
57	*L.* (*L.*) *calix*	Southcott, 1992	Holotype (ACA2424)	nude pHy, minute aHy; fn Ti 14-15-15 and fn Ta 28-26-26
58	*L.* (*L.*) *welbourni*	Southcott, 1992	Paratype (J12440)	8 setae on palpal tarsus including a solenidion and an eupathidium; Ge III with 8n; Ti II & III each with 15n' Ta I with 28n and Ta III with 26n
59	*L.* (*L.*) *triacanthus*	Southcott, 1999	Holotype (J13358)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2 pHy and no aHy; fn TFe is 5-5-5; fn Ge 8-8-8, Ti 14-15-15 and fn Ta 28-26-26
60	*L.* (*L.*) *cheesmanae*	Southcott, 1999	Holotype (J13330)	8 setae on palpal tarsus including a solenidion and an eupathidium; TFe I & TFe II each 5n; Ge I-III each 8n; fn Ti I-III 14-15-15; Ta I & Ta II with 28n & 26n, respectively
61	*L.* (*L.*) *puniceus*	Southcott, 1999	Holotype (J13353)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15 and fn Ta I-III 28-26-26
62	*L.* (*L.*) *baudini*	Southcott, 1999	Holotype (J13325)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti I-III 14-15-15 and fn Ta I-III 28-26-26
63	*L.* (*L.*) *flindersi*	Southcott, 1999	Holotype (J13334)	TFe III with 5n, Ti I with 13 (L.eft side)/14 (Right side) normal setae, Ti II with 13 normal setae, Ti III with 13L./15R, Ta I with 26L./25R, Ta II with 22L./23 R and Ta III with 23 normal setae
64	*L.* (*L.*) *scutellatus*	Southcott, 1999	Holotype (J13356)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15 and fn Ta 28-26-26
65	*L.* (*L.*) *grossi*	Southcott, 1999	Holotype (J13341)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn TFe 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1 and faint striation and sparsely punctuation on scutum
66	*L.* (*L.*) *clelandi*	Southcott, 1999	Holotype (J 13339)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn TFe 5-5-5; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
67	*L.* (*L.*) *clavatus*	Southcott, 1999	Holotype (J 13337)	Ti II with 15n; fn Ta I-III: 28-26-26, Ta I and Ta II each with 2ζ
68	*L.* (*L.*) *elderi*	Southcott, 1999	Holotype (J13338)	8 setae on palpal tarsus including a solenidion and an eupathidium, 5n on TFe III; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
69	*L.* (*L.*) *foliatus*	Southcott, 1999	Holotype (J13333)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; Ta I-III are damaged
70	*L.* (*L.*) *urodaci*	Southcott, 1999	Holotype (J13360)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15 and fn Ta 28-26-broken
71	*L.* (*L.*) *lighti*	Southcott, 1999	Holotype (J13348)	14n on Ti I; 28n on Ta I; 26n on Ta III and fn ζ 2-2-1

Table 1. Continued.

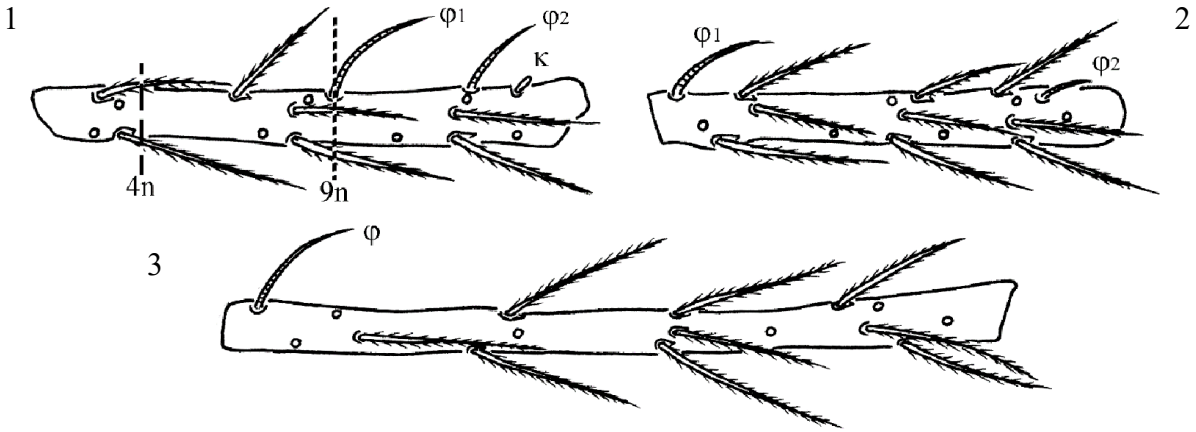
No.	Species	Original description	Source of correction	Correction/addition
72	*L.* (*L.*) *calcar*	Southcott, 1999	Holotype (J13327)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
73	*L.* (*L.*) *tindalei*	Southcott, 1999	Holotype & Paratypes (J13357) 5 specimens in one microscope slide	barbed pHy, minute aHy and nude galealae; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 27–28, 25–26, 25–26 and fn ζ 2-2-1
74	*L.* (*L.*) *pincheni*	Southcott, 1999	Holotype (J13352)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ta 28-26-26 and fn ζ 2-2-1
75	*L.* (*L.*) *cultellus*	Southcott, 1999	Holotype (J13331)	8 setae on palpal tarsus including a solenidion and an eupathidium; Ti III with 15n; fn Ta 28-26-26; Ta I and Ta II each with 2ζ
76	*L.* (*L.*) *bankensis*	Southcott, 1999	Holotype (J13322)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
77	*L.* (*L.*) *spinalatus*	Southcott, 1993	Holotype (J6952)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2 barbed pHy and no aHy and galealae; fn TFe 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
78	*L.* (*L.*) *tarranus*	Southcott, 1993	Holotype (J6953); Paratypes (J6950, J6951)	8 setae on palpal tarsus including a solenidion and an eupathidium, anterolateral angles pointed, 5 setae on TFe II; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
79	*L.* (*L.*) *agrotis*	Southcott, 1993	Holotype (J13332)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
80	*L.* (*L.*) *cerambycius*	Southcott, 1993	Holotype (J13336)	8 setae on palpal tarsus including a solenidion and an eupathidium; barbed pHy, nude aHy; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
81	*L.* (*L.*) *orthrius*	Southcott, 1993	Holotype (J13351)	fn TFe 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
82	*L.* (*L.*) *georgeae*	Southcott, 1993	Holotype (A) & Paratype (B) (J13295)	5n on TFe II; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
83	*L.* (*L.*) *monteithi*	Southcott, 1993	Holotype (J13350)	8 setae on palpal tarsus including a solenidion and an eupathidium; barbed pHy, nude aHy and galealae; 8n on Ge I; fn Ti 14-15-15; fn Ta 26L./27R-26-26 and fn ζ 2-2-1
84	*L.* (*L.*) *belicolus*	Southcott, 1993	Holotype (J13326)	nude pHy, minute aHy; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
85	*L.* (*L.*) *treati*	Welbourn, 1991	Paratype	2 nude pHy, 2 minute aHy and 2 nude galealae and fn Ta 28-26-26
86	*L.* (*L.*) *anomalus*	Southcott, 1946	Holotype (J13294)	5n on TFe I; 8n on Ge I; fn Ti 14-15-15 and fn Ta 28-26-26

Table 1. Continued.

No.	Species	Original description	Source of correction	Correction/addition
87	*L.* (*L.*) *charon*	Southcott, 1991	Holotype (J13329)	fn TFe is 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15 and fn Ta 27-25-25
88	*L.* (*L.*) *fortei*	Southcott, 1991	Holotype (J3898)	fn Ta is 28-26-26
89	*L.* (*L.*) *faini*	Southcott, 1993	Holotype (J13335)	8 setae on palpal tarsus including a solenidion and an eupathidium; nude haypostomalae and 2 nude galealae; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
90	*L.* (*L.*) *torresianus*	Southcott, 1988	Holotype (J2830); Paratypes (J2831–J2832)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2 barbed pHy and no aHy; fn TFe 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15 and fn Ta 28-26-26
91	*L.* (*L.*) *halli*	Southcott, 1993	Holotype (J13343)	8 setae on palpal tarsus including a solenidion and an eupathidium; fn TFe 5-5-5; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
92	*L.* (*L.*) *truncatus*	Southcott, 1993	Holotype (J13359)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2 barbed pHy and 2 nude aHy and galealae not seen; 8n setae on each Ge I-III; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I, 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
93	*L.* (*L.*) *barmeedius*	Southcott, 1999	Holotype (J13323)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
94	*L.* (*L.*) *batjallus*	Southcott, 1999	Holotype (J13324)	fn ζ 2-2-1
95	*L.* (*L.*) *smithi*	Southcott, 1999	Holotype (J6890); Paratypes (J6918-J6949)	2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 2ζ, 25n on Ta II and 1ζ, 25n on Ta III
96	*L.* (*L.*) *pistoris*	Southcott, 1999	Holotype (J13354)	8 setae on palpal tarsus including a solenidion and an eupathidium; 2 long, stout and babed hypostomalae (Fig. 17) and 2 nude galealae and fn ζ 2-2-1
97	*L.* (*L.*) *carduus*	Southcott, 1999	Holotype (J13328)	fn Ti I-III 14-15-15; fn Ta I-III: 28-26-26 and fn ζ 2-2-1
98	*L.* (*L.*) *hitchcocki*	Southcott, 1999	Holotype (J13345)	and 8 setae on palpal tarsus including a solenidion and an eupathidium; 2 nude pHy, 2 barbed aHy and 2 nude galealae and fn ζ 2-2-1
99	*L.* (*L.*) *minno*	Southcott, 1999	Holotype (J13349)	8 setae on palpal tarsus including a solenidion and an eupathidium; 4 hypostomalae; fn Ti 14-15-15; fn Ta 27-25-25 and fn ζ 2-2-1
100	*L.* (*L.*) *korematus*	Southcott, 1999	Holotype (J13347)	4 long hypostomalae; 5 setae on TFe III and fn ζ 2-2-1
101	*L.* (*L.*) *heleus*	Southcott, 1993	Holotype (J13344)	fn Ti 14-15-15 and fn Ta 28-26-26

Table 1. Continued.

No.	Species	Original description	Source of correction	Correction/addition
102	*L.* (*L.*) *comosus*	Southcott, 1991	Holotype (J3886); Paratypes (J3887–J3897, 11 paratypes)	1 minute anterior hypostomala; TFe I with 5 (l) or 4 (r) solenidia; TFe II with 4 (l) or 5 (r) solenidia; TFe III with 8 (l) or 6 (r) solenidia Ge II with 4 (l) or 5 (r) solenidia; Ge III with 7 solenidia; Ti I with 2φ, 1κ, 14n; Ti II with 2φ, 15n; Ti III with 1φ, 15n; Ta I with 1ω, 1ε, 2ζ, 28n; Ta II with 1ω, 2ζ, 25n (l) or 26n (r) and Ta III with 1ζ, 26n
103	*L.* (*L.*) *singhi*	Saboori & Arbabi, 2003	Holotype (ARS-20021102-1)	fn Ta 28-26-26
104	*L.* (*L.*) *esmailii*	Saboori & Ostovan, 2000	Paratypes (ARS-19970623-1b-1c)	8 setae on palpal tarsus including a solenidion and an eupathidium; nude pHy and galealae and minute aHy; Ti I with 2φ, 1κ, 14n; 2φ; Ti II with 15n; Ti III with 1φ, 15n; Ta I with 1ω, 1ε, 2ζ, 28n; Ta II with 1ω, 1ε, 2ζ, 25n, 27n (abnormality); Ta III with 1ζ, 25n, 27n (abnormality); fn Cx is 1-1-1; fn BFe 2-2-1; fn TFe 5-5-5 and fn Ge 8-8-8
105	*L.* (*L.*) *slamizadehi*	Saboori, 2002	Holotype (ARS-20011205-1)	BFe III with only 1 n
106	*L.* (*L.*) *zhangi*	Saboori & Atamehr, 1999	Holotype (ARS-1997070722-1a)	barbed pHy, nude aHy and galealae; fn Cx 1-1-1; fn Tr 1-1-1; fn BFe 2-2-1, TFe 5-5-5; fn Ge 8-8-8; fn Ti 14-15-15; fn Ta 28-26-26 and fn ζ 2-2-1
107	*L.* (*L.*) *kamalii*	Karimi Iravanlou & Saboori, 2001	Holotype	8 setae on palpal tarsus including a solenidion and an eupathidium; 2φ, 1κ, 14n on Ti I; 2φ, 15n on Ti II; 1φ, 15n on Ti III; 1ω, 1ε, 2ζ, 28n on Ta I; 1ω, 1ε, 2ζ, 26n on Ta II and 1ζ, 26n on Ta III
108	*L.* (*L.*) *pakistanensis*	Kamran *et al*., 2009	Holotype (data asked by the senior author and was sent by Muhammad Kamran)	1 seta on BFe III; 5 setae on TFe II; 8 setae on each Ge I-III; 1κ on each Ge I-II; Ti I and Ti II without microseta; Ge I with 1 solenidion; many typographical errors in the original description and figures especially for legs is not standard and cannot be seen clearly
109	*L.* (*L.*) *planaltensis*	Haitlinger *et al*., 2017	Paratype (data asked by the senior author and was sent by Miloje Šundić)	Ge II with one solenidion (Fig. 26)



Figures 1–3. Typical Ti I-III of a *Leptus* species (*Leptus* (*L.*) *tridentatus*) – Numbers under dashed lines show number of normal setae in proximal part of the segment before the lines (after Saboori *et al*. 2018).

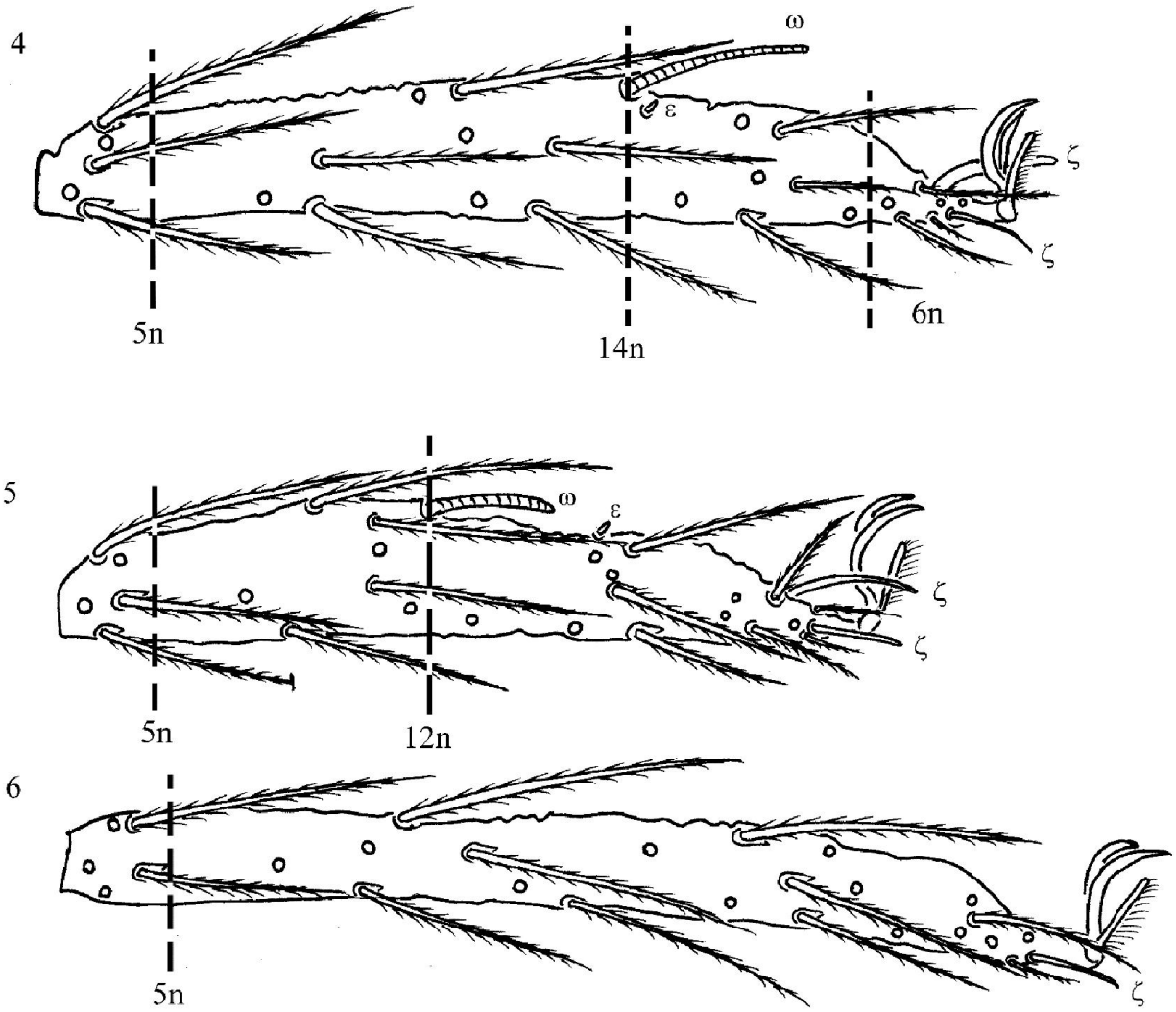


Figure 4–6. Typical Ta I-III of a *Leptus* species (*Leptus* (*L.*) *tridentatus*) – 4. Ta I; 5. Ta II; 6. Ta III. Numbers under dashed lines show number of normal setae in proximal part of the segment before the lines and the number 6 after the third dashed line on Ta I shows number of normal setae between dashed line and end of tarsus (after Saboori *et al*. 2018).

Figure 7. Cheliceral bases of *Leptus* (*L.*) *trimaculatus* from Germany. Photography by Andreas Wohltmann (400×).

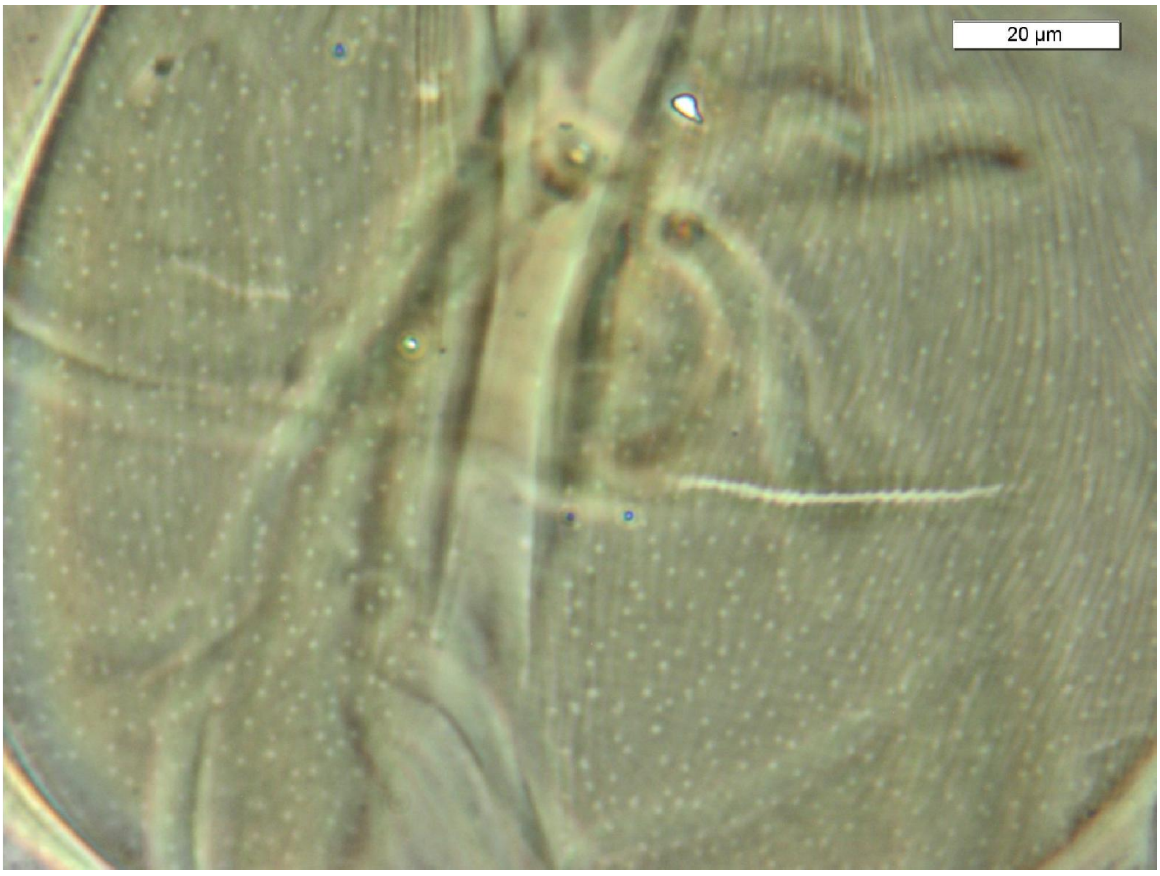


Figure 8. Cheliceral bases of *Leptus* (*L.*) *trimaculatus* from Iran.

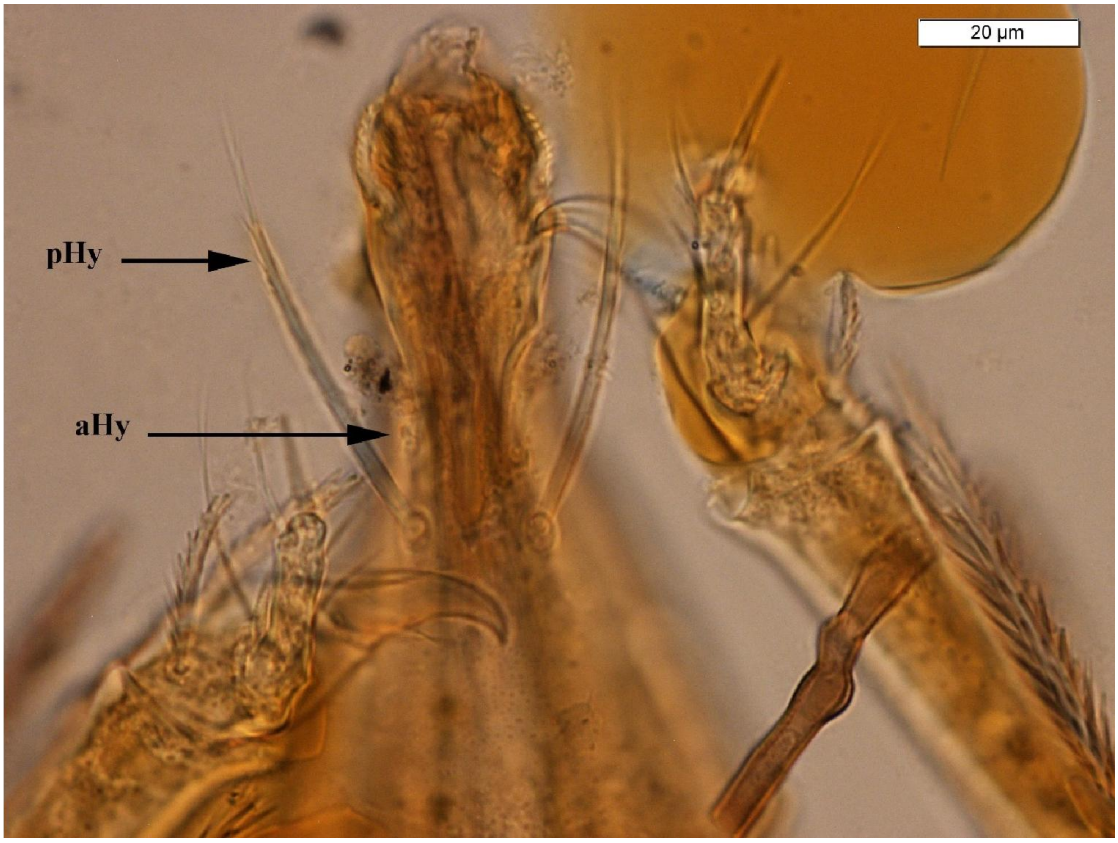


Figure 9. Anterior and posterior hypostomalae in *Leptus* (*L.*) *pozzoicus*.

Figure 10. Anterior and posterior hypostomalae in *Leptus* (*L.*) *hammameticus*.

Figure 11. Scutum in *Leptus* (*L.*) *tenerificus*.

Figure 12. Anterior and posterior hypostomalae in *Leptus* (*L.*) *iguacuicus*.

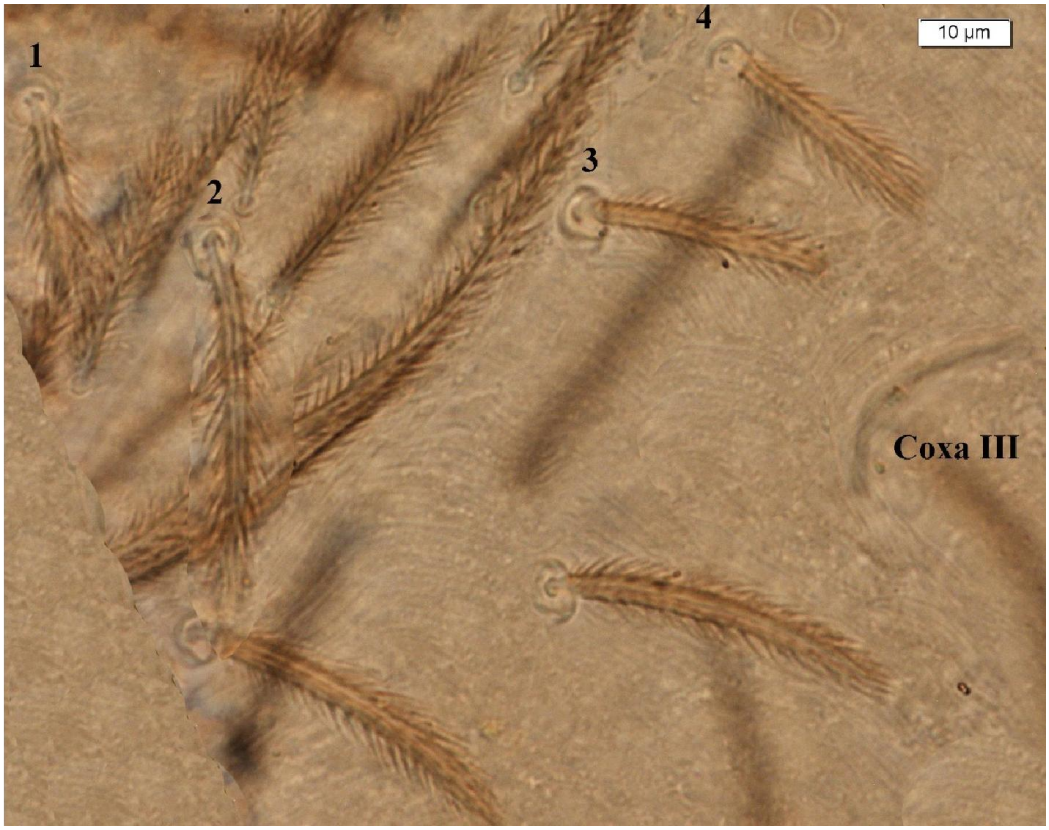


Figure 13. Setae between coxae II-III in *Leptus* (*L.*) *sulawesicus* (numbers show setae).

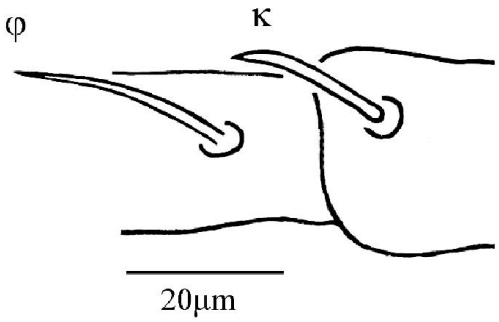


Figure 14. Microseta on Ge II and solenidion on Ti II of *Leptus* (*L.*) *mirenae*.

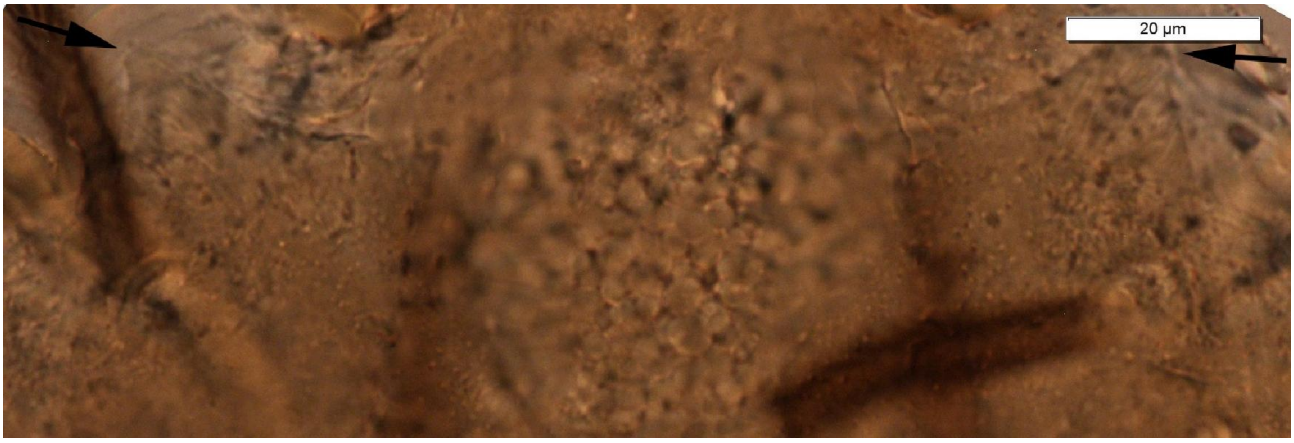


Figure 15. Anterolateral angles of scutum of *Leptus* (*L.*) *mirenae* (see arrows).

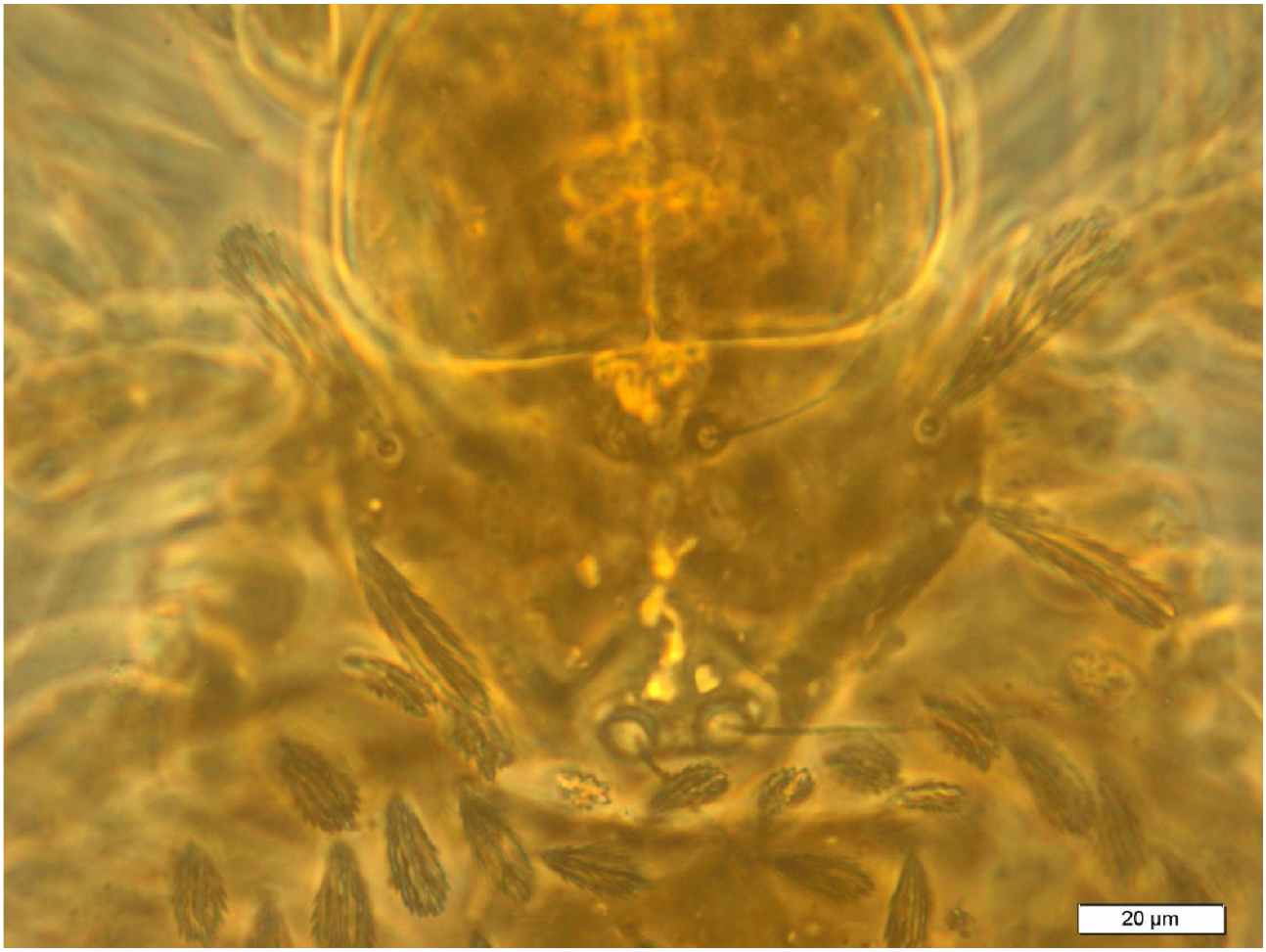


Figure 16. Scutum of *Leptus carduus*.

Figure 17. Hypostomalae of *Leptus* (*L.*) *pistoris* (distal end of setae not shown).

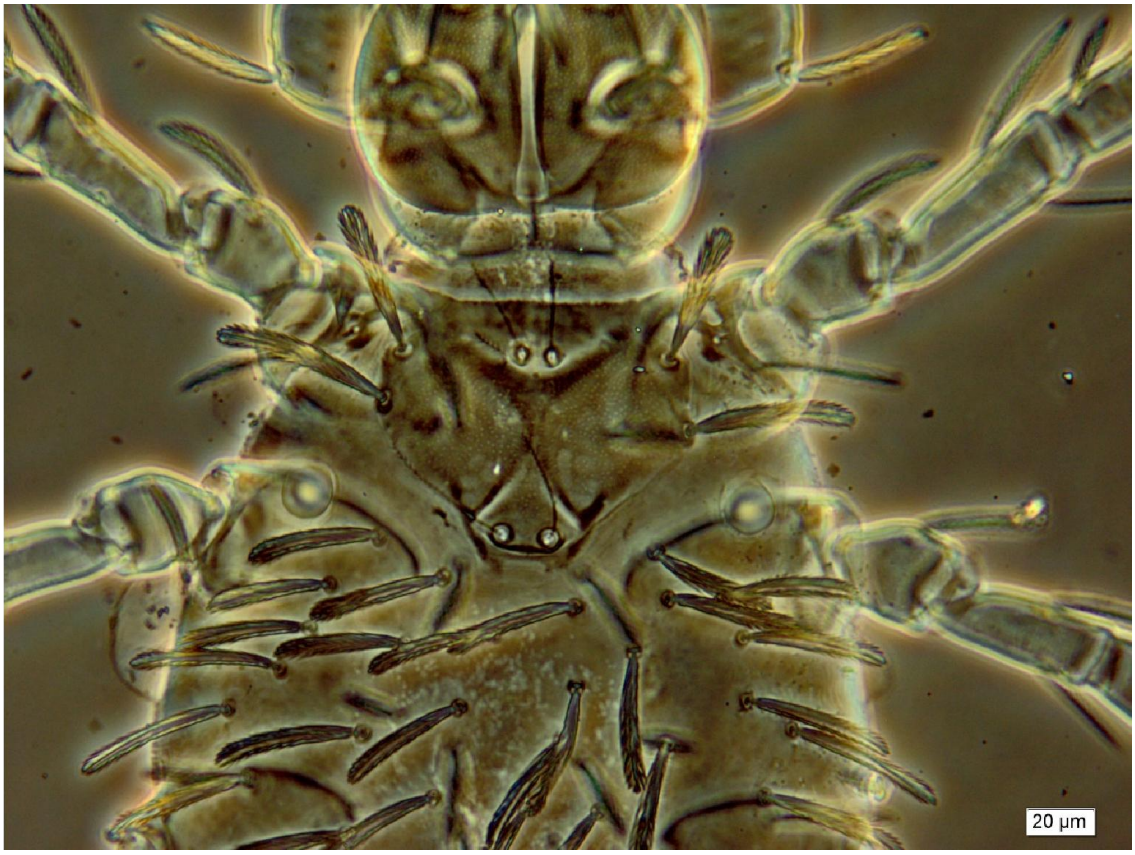


Figure 18. Propodosoma and scutum of *Leptus* (*L.*) *fathipeuri*.

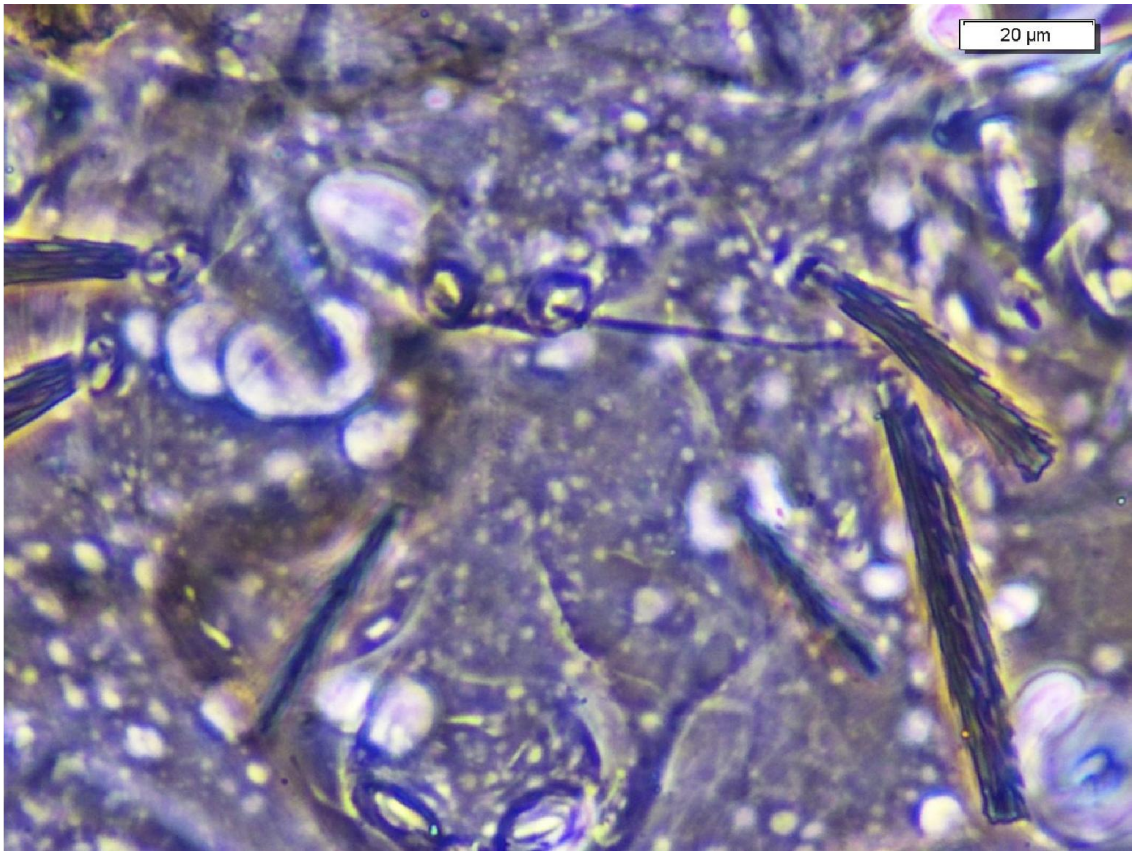


Figure 19. Scutum of *Leptus* (*L.*) *ruginus*.

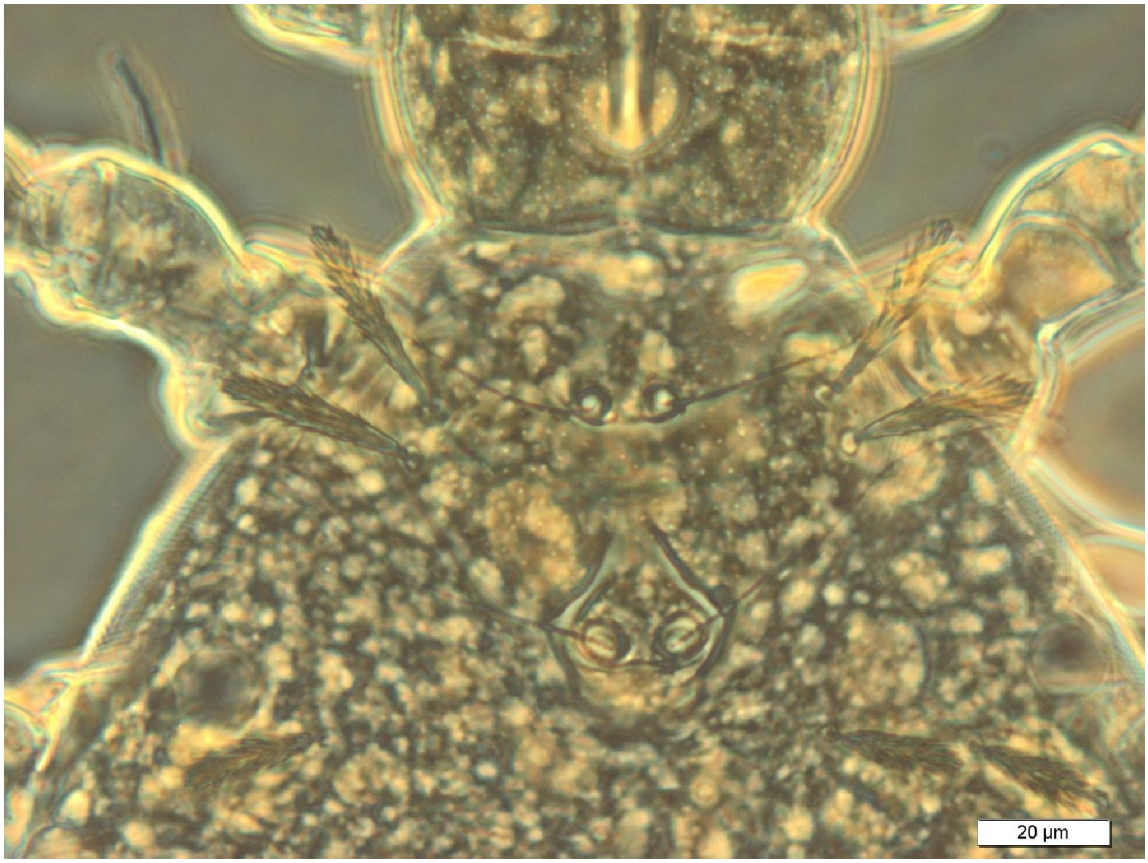


Figure 20. Scutum of *Leptus* (*L.*) *georgeae* (holotype).

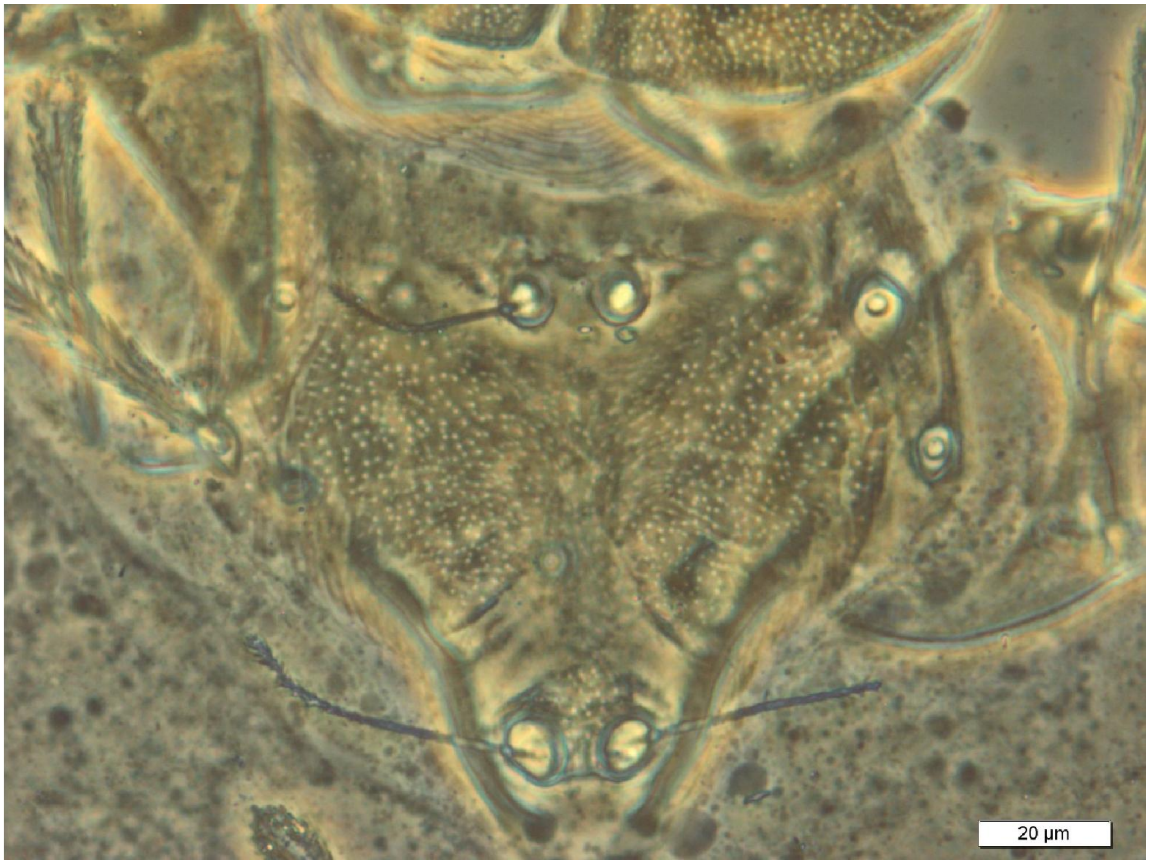


Figure 21. Scutum of *Leptus* (*L.*) *lighti* (holotype).

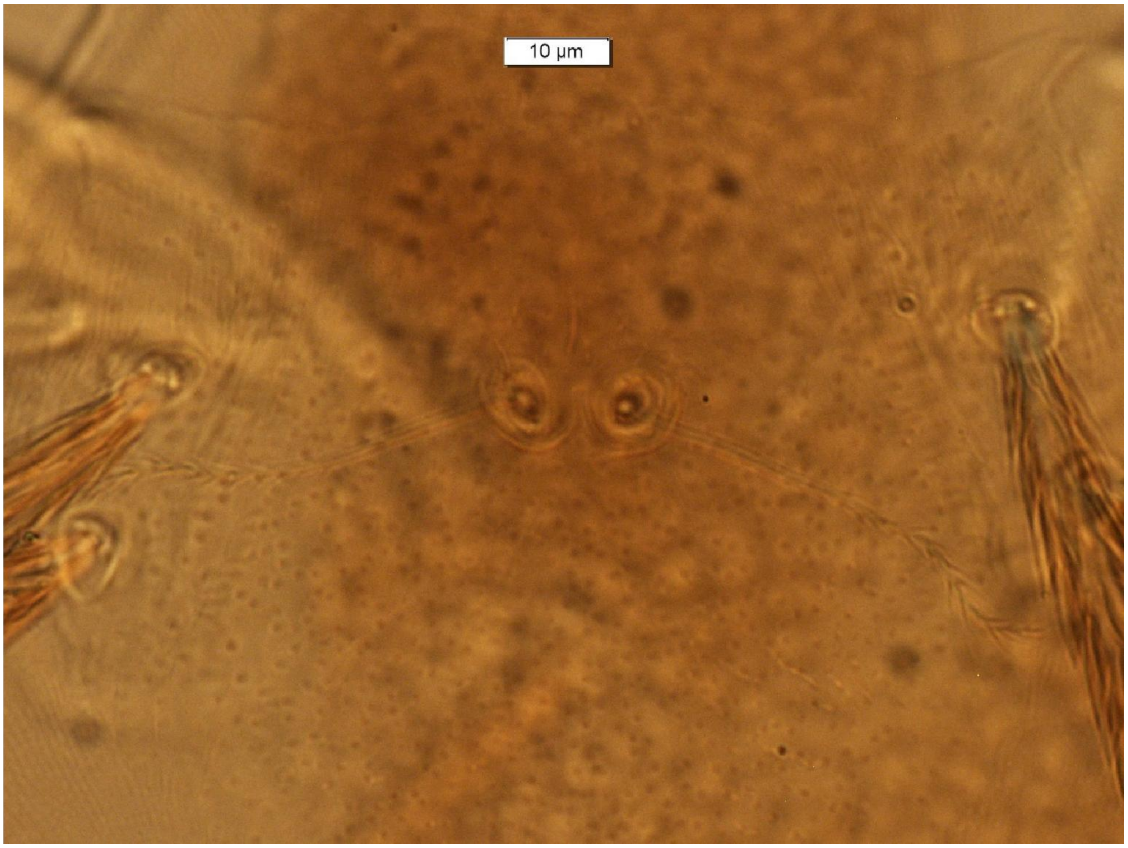


Figure 22. Anterolateral angles of scutum of *Leptus* (*L.*) *molochinus*.

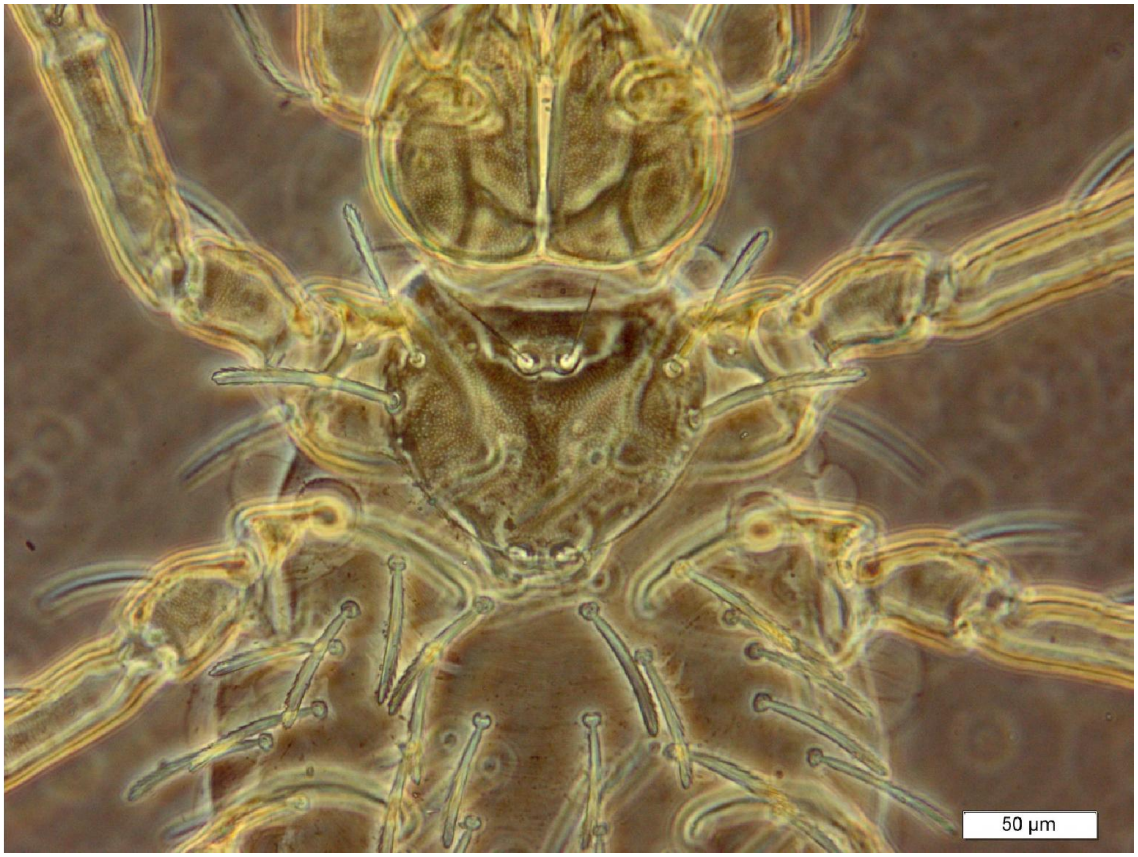


Figure 23. Scutum of one paratype of *Leptus* (*L.*) *danelli*.

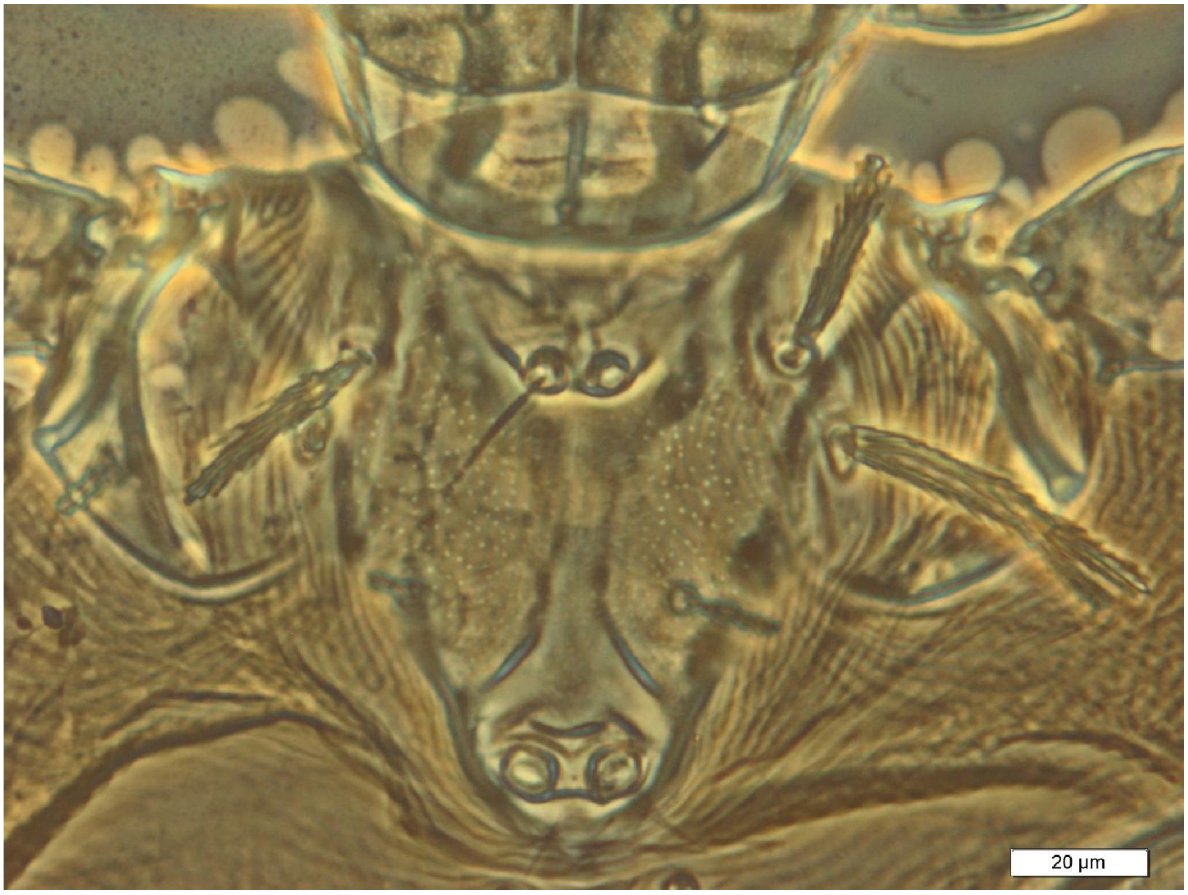


Figure 24. Scutum of another paratype of *Leptus* (*L.*) *danelli*.

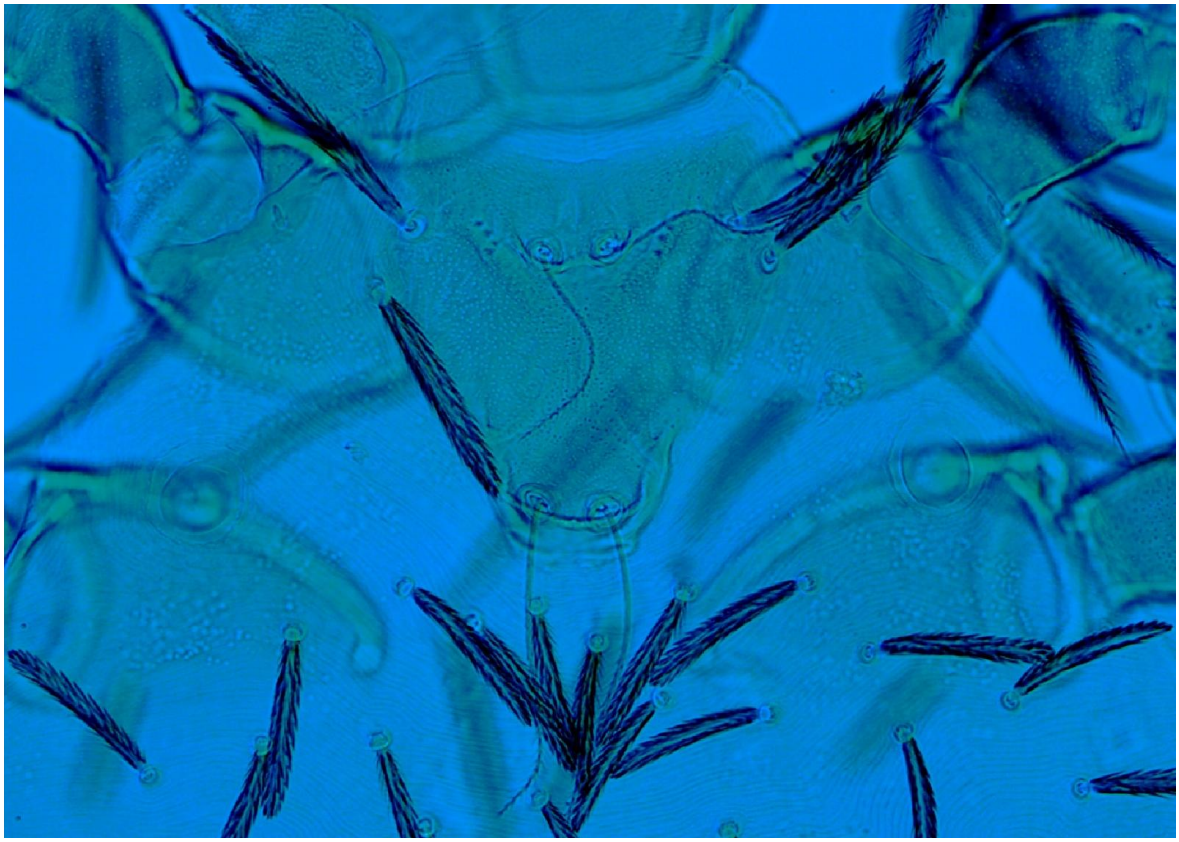


Figure 25. Scutum of *Leptus* (*L.*) *phalangii*.

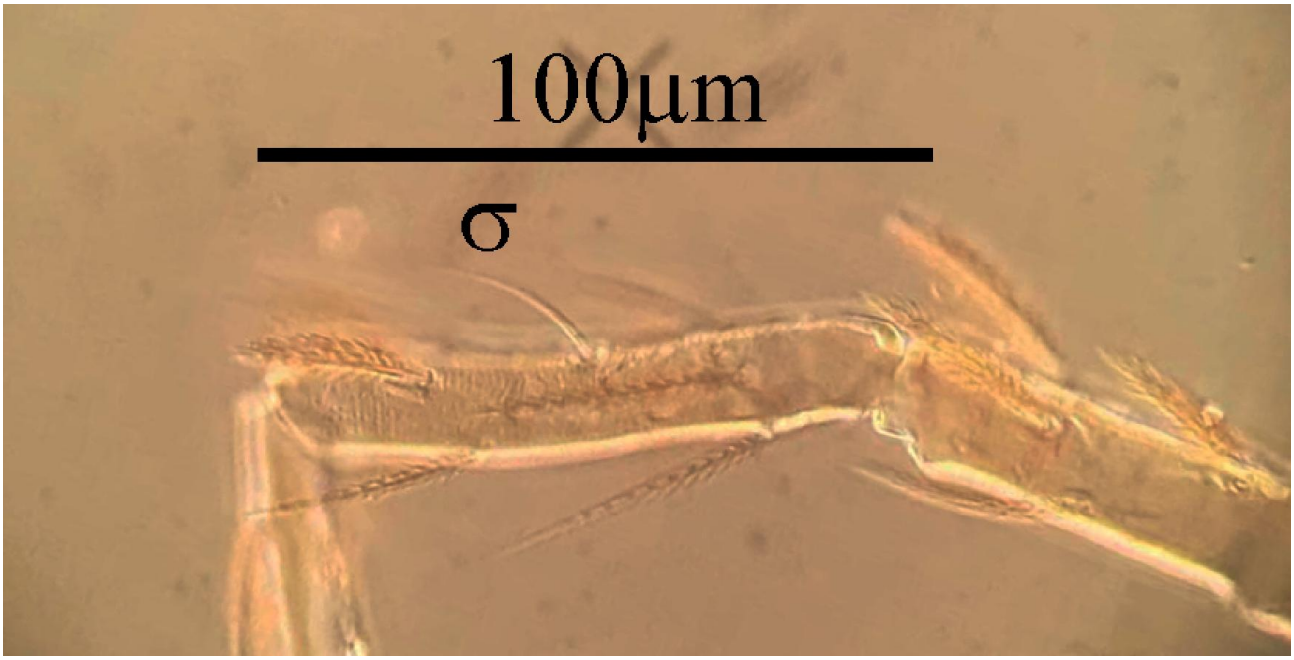


Figure 26. Ge II of *Leptus* (*L.*) *planaltensis*.

جنس *Leptus* (Trombidiformes: Erythraeidae) جهان: رده‌بندی بازبینی شده و کلیدها

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چکیده

جنس *Leptus* (لاروها) بر اساس نمونه‌های تایپ و دیگر نمونه‌های گونه‌ها از مناطق مختلف جهان بازبینی شد. در مجموع ۲۲۰ گونه شناسایی و در ۸ گروه گونه‌ای ریختی، و ٤٠ زیرگروه گونه‌ای ریختی قرار داده شدند؛ همچنین مترادف‌های زیر ایجاد شد: *Leptus* (*Leptus*) *eslamizadehi* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *trimaculatus*، *L.* (*L.*) *ilzae* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *kyushuensis*، *L.* (*L.*) *laplandicus* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *clethrionomydis*، *L.* (*L.*) *alopecurus* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *alvimordax*، *L.* (*L.*) *annikae* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *cercopius*، *L.* (*L.*) *welbourni* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *ghiradellae*، *L.* (*L.*) *laviniacus* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *agenori*، *L.* (*L.*) *machilidis* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *albertensis*، *L.* (*L.*) *gyas* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *meloidarum*، *L.* (*L.*) *coloanensis* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *astrubali*، و *L.* (*L.*) *sidorchukae* به عنوان مترادف کم‌سابقهٔ *L.* (*L.*) *maldonadoicus*. افزون بر این نقشهٔ کتوتاکسی موهای ساق و پنجهٔ پاها نشان داده شده، کتوتاکسی پاها مورد بحث قرار گرفته و کلید گروه‌ها و زیر گروه‌های گونه‌ای و گونه‌ها آورده شده است. اطلاعات ریخت‌شناسی ۱۰۹ گونه اصلاح شده است.

واژگان کلیدی: زیردهٔ کنه‌ها؛ فرمول کتوتاکسی؛ لارو؛ ریخت‌شناسی؛ آرایه‌شناسی.

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