

Fossil and extant species of the genus *Leptopholcus* in the Dominican Republic, with the first cases of egg-parasitism in pholcid spiders (Araneae: Pholcidae)

BERNHARD A. HUBER¹ & JÖRG WUNDERLICH²

¹Alexander Koenig Zoological Research Museum, Bonn, Germany, and ²Hirschberg, Germany

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Abstract

Representatives of the pholcid spider genus *Leptopholcus* are extremely rare on the American mainland, but fairly common on the major Caribbean islands. Previously, four extant Caribbean species were known, each one endemic to one of the Greater Antilles. Here we describe the first fossil representative of the genus, *Leptopholcus kiskeya* Huber and Wunderlich n. sp., originating from Dominican amber about 20 million years old. Two new extant species from the Dominican Republic are also described, *L. toma* Huber n. sp. and *L. baoruco* Huber n. sp., and new records are given for the widely distributed *L. hispaniola* Huber, 2000. Egg-parasitism by a wasp of the genus *Baeus* Haliday (Scelionidae, Baeini) is documented for *L. baoruco* and *L. hispaniola*. These are the first records of egg-parasitism in Pholcidae, and the first Neotropical *Baeus* species to parasitize spiders other than Araneidae and Theridiidae.

Keywords: *Baeus*, Dominican amber, egg-parasitism, fossil, genitalia, *Leptopholcus*, Miocene, Pholcidae, Scelionidae

Introduction

The genus *Leptopholcus* has an interesting geographic distribution: it is widely distributed in the Old World tropics, but in the New World it is largely restricted to the Greater Antilles. Only recently, *Leptopholcus* was also recorded from the New World mainland (Huber et al. 2005), but in contrast to the Greater Antilles, where *Leptopholcus* is widely distributed in humid forests and has been frequently collected on each island, the three South American species are rare relicts in low precipitation areas. Since the usual habitat of *Leptopholcus* (underside of large live leaves) is in South and Central America occupied by representatives of the pholcid genus *Metagonia*, it has been suggested that this peculiar biogeography is the result of competitive exclusion (Huber et al. 2005). In agreement with this idea, *Metagonia* is largely absent from the Greater Antilles, where it is represented by a single troglomorphic species known from a Cuban cave (Pérez González and Huber 1999).

Correspondence: Bernhard A. Huber, Alexander Koenig Zoological Research Museum, Adenauerallee 160, 53113 Bonn, Germany. Email: b.huber.zfmk@uni-bonn.de
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The distribution of *Leptopholcus* thus suggests that New World representatives are old relicts, derived from spiders present in the area before the break up of Pangaea in the Mesozoic. It was thus reasonable to expect that *Leptopholcus* was present on Hispaniola at the time of origin of Dominican amber, about 20–40 million years ago (Poinar 1992). This expectation was also based on the fact that pholcids are well represented in Dominican amber (Wunderlich 1988). Actually, more fossil than extant pholcid species are currently known from Hispaniola (Penney and Pérez-Gelabert 2002). Recently, one of us (J.W.) discovered an adult male specimen of *Leptopholcus* in Dominican amber. In the present paper we describe this new species and compare it with the previously described *L. hispaniola* as well as with two newly described species. This is the first in a series of papers on newly collected material that will elevate the number of known extant Hispaniolan pholcids from eight to about 25 species.

Egg-parasitism by wasps and flies is a common phenomenon in spiders (e.g. Austin 1985; Disney 1994; Foelix 1996), but no case has previously been known for pholcid spiders, who carry their egg sacs with their chelicerae until the spiderlings hatch. Here we describe the first such case, involving scelionid wasps of the genus *Baeus* and at least two Dominican *Leptopholcus* species.

Materials and methods

The amber piece containing the fossil species described herein will be deposited in the Senckenberg Museum Frankfurt (SMF). The mine where it was found is unknown. All other specimens treated were collected by the first author during an expedition to the Dominican Republic in November and December 2005. The material is currently at the Alexander Koenig Zoological Research Museum, Bonn (ZFMK), but will later be partly transferred to the Museo Nacional de Historia Natural, Santo Domingo. Style of descriptions is as in Huber (2000). Measurements are in mm unless indicated otherwise. Drawings were done with a camera lucida, either on a Leitz Dialux 20 compound microscope or a Wild dissecting microscope. Photographs were made with a Nikon Coolpix 995 digital camera (2048 × 1536 pixels) mounted on a Nikon SMZ-U dissecting microscope. For SEM photographs, specimens were cleaned ultrasonically, dried in hexamethyldisilazane (HMDS) (Brown 1993), and photographed with a Hitachi S-2460 scanning electron microscope.

Taxonomy

Genus *Leptopholcus* Simon, 1893

Leptopholcus Simon 1893, p 474; Brignoli 1980, p 651–654; Huber 1997, p 357–358; Huber 2000, p 76; Deeleman-Reinhold and van Harten 2001, p 201–202; Huber et al. 2005, p 99–100.

***Leptopholcus baoruco* Huber, new species**

(Figures 1a, b, 2a, b, g–i, 3, 4, 9a)

Type

Male holotype from near Polo (18°06.8'N, 71°16.2'W), Sierra de Baoruco, Barahona Prov., Dominican Republic; forest with plantations, 850 m a.s.l., underside of leaves, mostly banana, 17 November 2005 (B. A. Huber), in ZFMK.

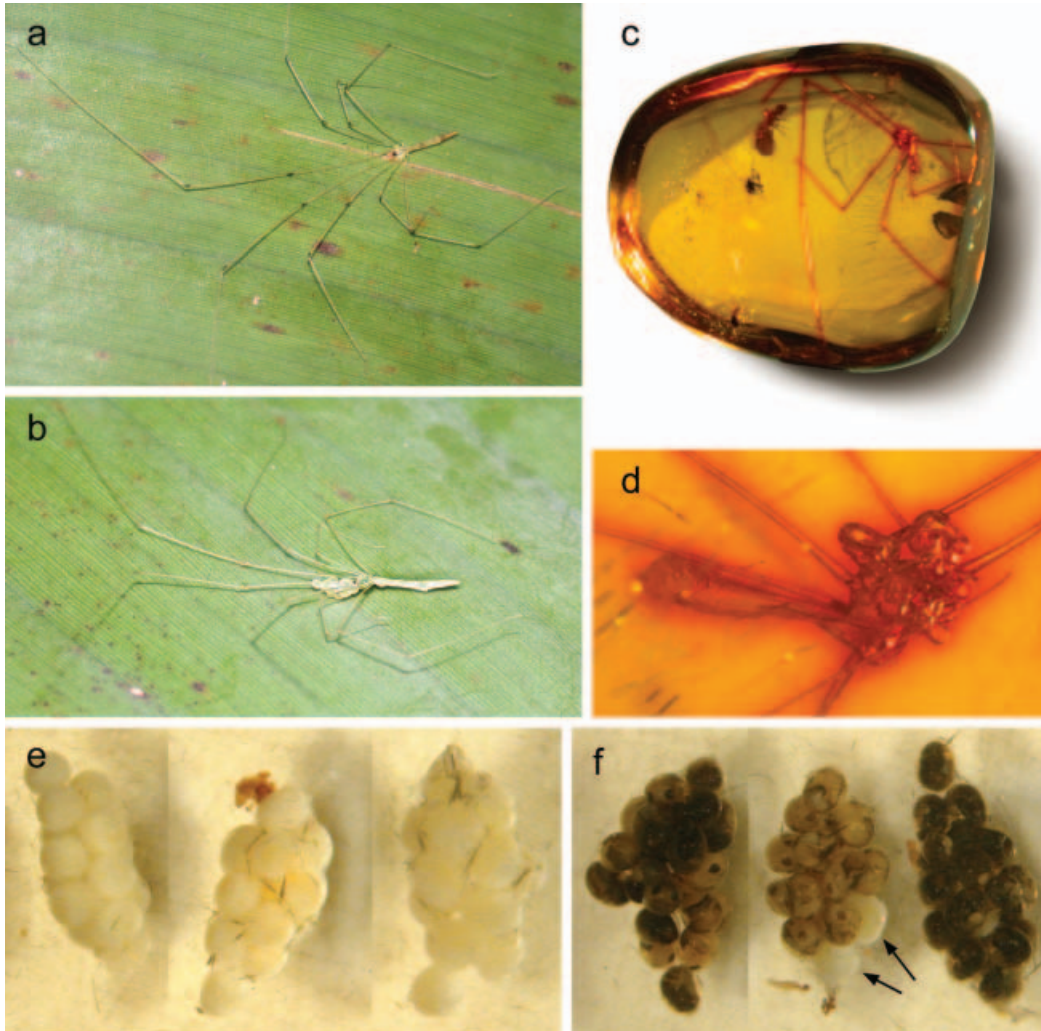


Figure 1. (a, b) *Leptopholcus baoruco*, male (a) and female with egg sac (b) on banana leaves, in the typical position flat against the leaf; (c) the piece of amber containing the holotype of *L. kiskeya* and four unidentified insects; the length of the piece is 23 mm; (d) ventral view of *L. kiskeya*; (e) unparasitized egg sacs of *L. baoruco*; (f) parasitized egg sacs of *L. baoruco* (arrows point to two unparasitized eggs).

Etymology

The species name is a noun in apposition, derived from the type locality.

Diagnosis

Distinguished from known Caribbean congeners by the shapes of the apophyses on the male genital bulb, especially the unique appendix (Figures 3a, 4b, c, 9a), by the shape of the procurus (Figure 3b), and by the internal sclerotized structures in the female genitalia (Figures 2i, 3d); from *L. hispaniola* also by the much longer male palpal trochanter apophysis (Figure 3b) and longer abdominal projection beyond the spinnerets (Figure 2b); from *L. toma* also by the dark ocular area (Figure 2a).

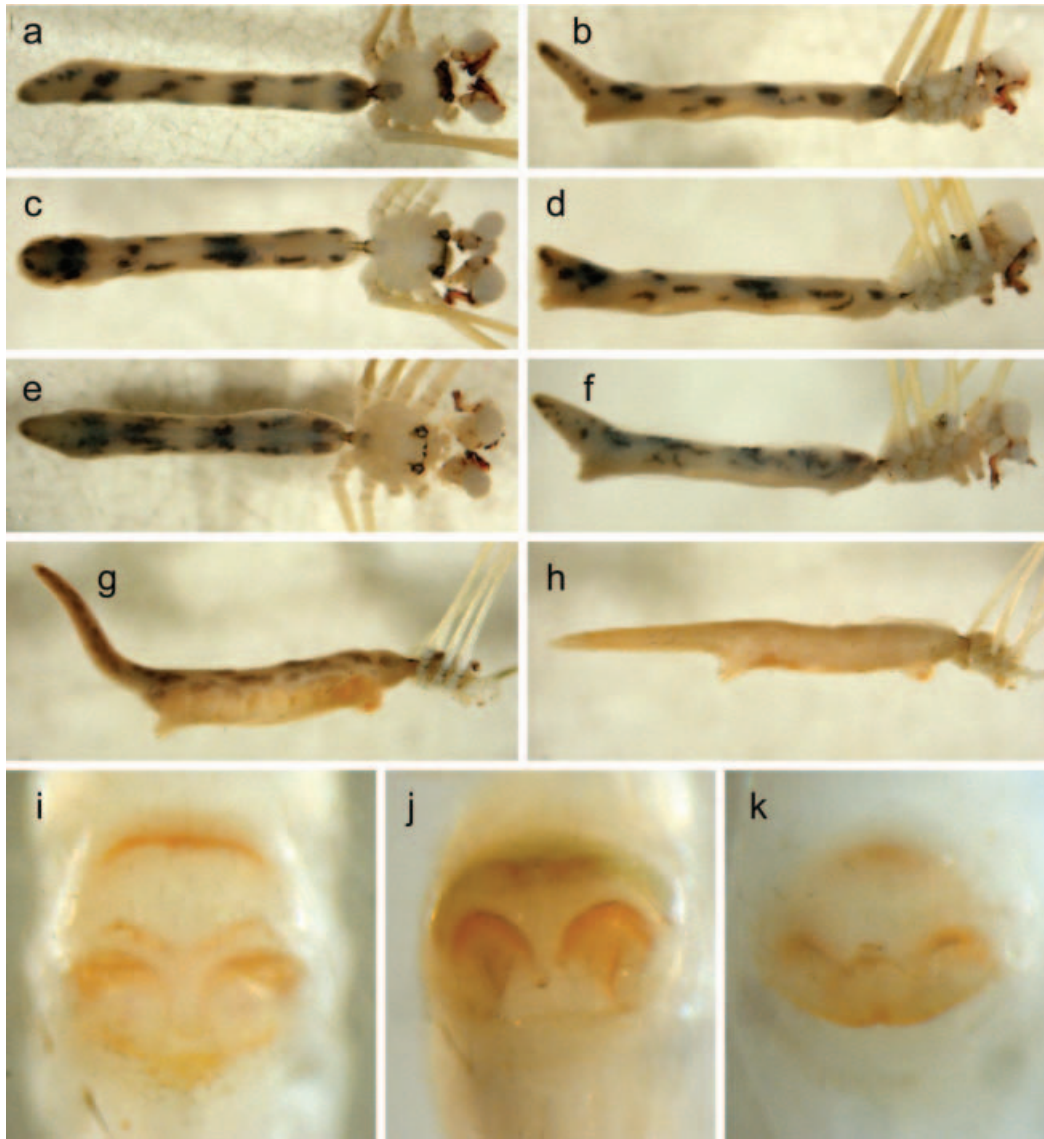


Figure 2. (a–f) Males in dorsal and lateral views: *Leptopholcus baoruco* (a, b); *L. hispaniola* (c, d); *L. toma* (e, f); (g, h) *L. baoruco* females, lateral views; (i–k) untreated female genitalia in ventral views: *L. baoruco* (i); *L. hispaniola* (j); *L. toma* (k).

Male (holotype)

Total length 5.4, carapace width 1.0. Leg 1: 37.0 (8.8+0.4+8.9+17.3+1.6), tibia 2: 5.8, tibia 3: 3.6, tibia 4: 5.7. Tibia 1 L/d: 112. Habitus as in Figures 2a, b; prosoma very pale ochre-grey, only ocular area dark, almost black; sternum whitish, legs pale ochre, patellae and tibia–metatarsus joints dark (almost black), abdomen ochre-grey with black spots dorsally (Figure 2a). Ocular area slightly elevated, with lateral triads on distinct low humps; distance PME–PME 285 μ m; diameter PME 100 μ m; distance PME–ALE 20 μ m; distance AME–AME 85 μ m, diameter AME 20 μ m. Thoracic furrow absent. Sternum about as wide

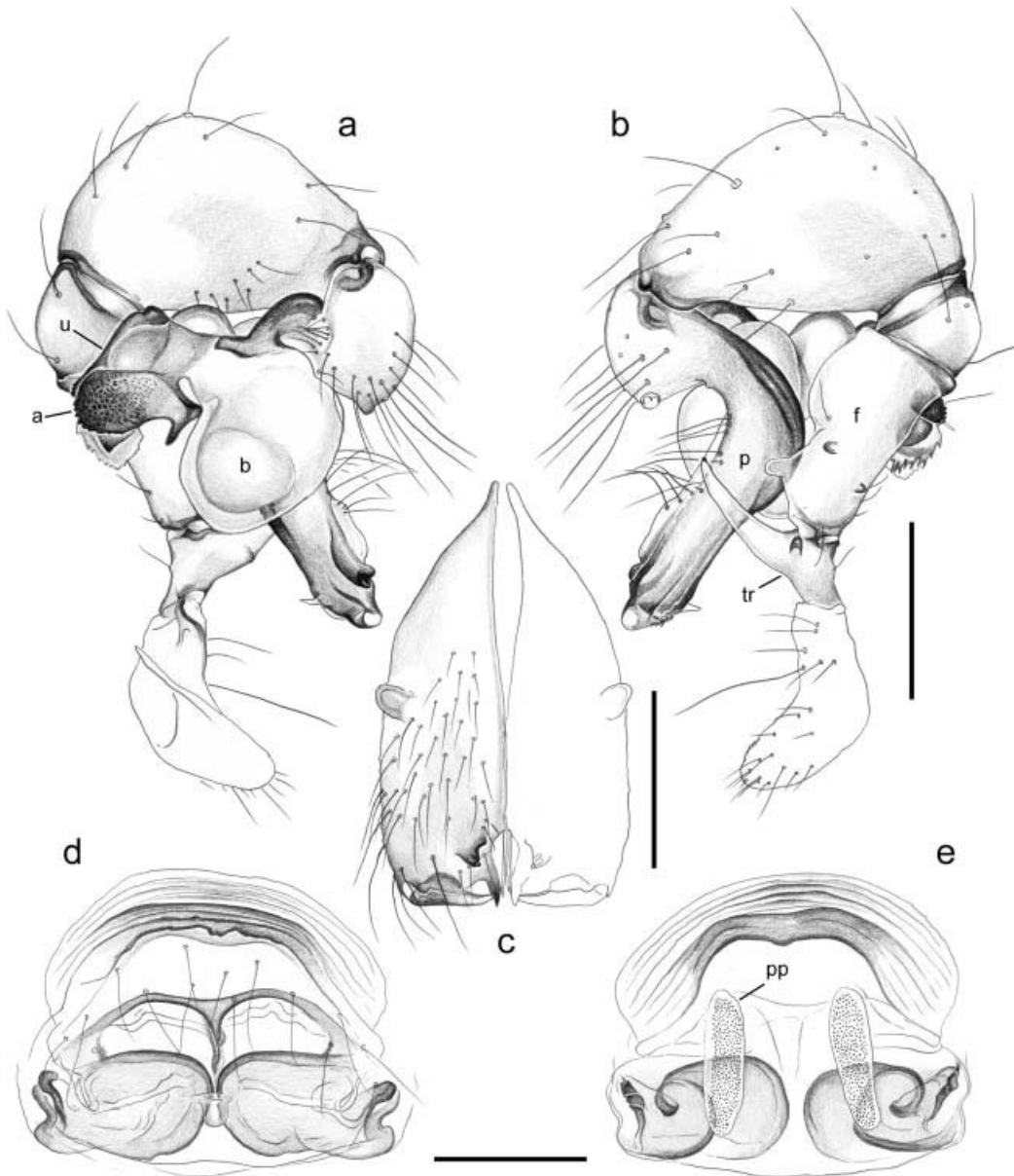


Figure 3. *Leptopholcus baoruco*. (a, b) Male palp in prolateral and retrolateral views; (c) male chelicerae, frontal view; (d, e) cleared epigynum in ventral and dorsal views. a, appendix; b, bulb; f, femur; p, procrurus; pp, pore plate; tr, trochanter; u, uncus. Scale bars: 0.3 mm (a, b); 0.2 mm (c–e).

as long (0.6). Chelicerae with proximo-lateral projections and two modified hairs on distal apophyses (Figures 3c, 4d). Palps as in Figure 3a, b; coxa unmodified, trochanter with short retrolateral and long ventral apophyses, the latter with distal modified hair (Figure 4h); femur with two small apophyses retrolaterally and one larger projection ventrally; procrurus strongly bent dorsally, distal part longer than in other species, with distinctive distal structures (Figure 4e); genital bulb with distinctive uncus and appendix and slightly

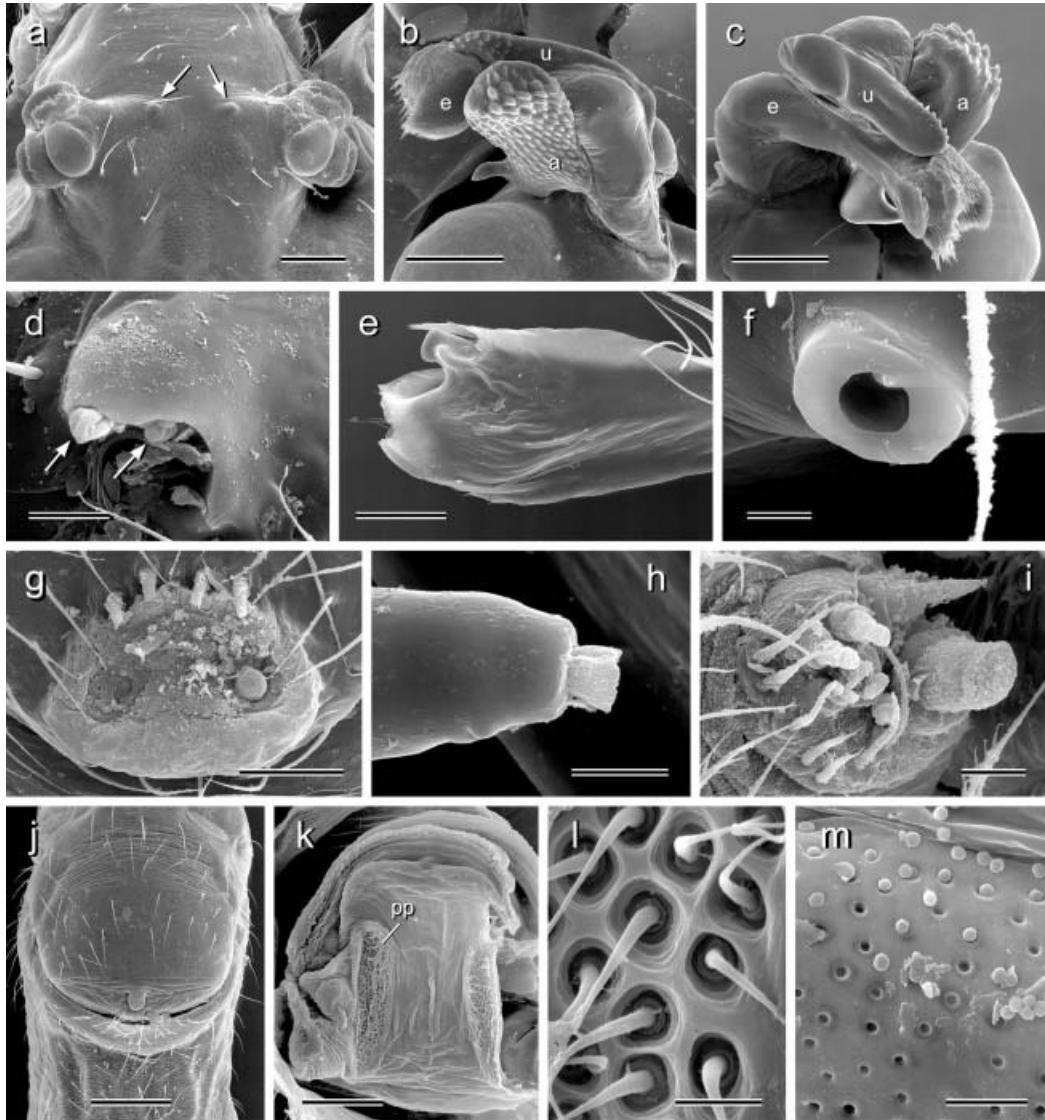


Figure 4. *Leptopholcus baoruco*, SEM images. (a) Female ocular area (arrows point to AME); (b, c) male bulbal projections; (d) male distal cheliceral apophysis (arrows point to modified hairs); (e) tip of procurus, retrolateral view; (f) male palpal tarsal organ; (g) male gonopore; (h) tip of male palpal trochanter apophysis with modified hair at tip; (i) female ALS; (j) epigynum, ventral view; (k) female internal genitalia, dorsal view of cleared genitalia; (l) pore plate, dorsal view; (m) pore plate, ventral view. a, appendix; e, embolus; pp, pore plate; u, uncus. Scale bars: 100 μm (a–c, k); 10 μm (d, f, h, i, m); 70 μm (e); 40 μm (g); 200 μm (j); 6 μm (l).

sclerotized embolus (Figures 3a, 4b, c, 9a); palpal tarsal organ capsulate (Figure 4f). Retrolateral trichobothrium of tibia 1 at 6%; prolateral trichobothrium absent on tibia 1, present on other tibiae; legs without spines and curved hairs, few vertical hairs; serrated hairs on tarsi 4 as in *L. toma* (cf. Figure 8g); pseudosegments on tarsi very indistinct, only a few visible distally. Gonopore with four epiandrous spigots (Figure 4g). Spinnerets as in female (see below).

Variation

The pattern on the abdomen is fairly constant but variably distinct. Tibia 1 in two other males: 8.4, 8.7.

Female

In general similar to male, but abdomen tip mostly longer, in some cases much longer (Figure 2g, h), and ocular area not darker. Pattern on abdomen usually less distinct, in some cases even missing. All specimens with small but distinct AME lenses (Figure 4a). Usually with pair of small grey marks behind ocular area. ALS with one widened, one pointed, and five cylindrically shaped spigots (Figure 4i), PMS with two small pointed spigots, PLS without spigots. Epigynum with median rounded projection (Figures 3d, 4j), with distinctive internal sclerotized structures, very elongated pore plates (Figures 3e, 4k). Tibia 1 in 18 females: 5.8–6.8 (mean: 6.4). Serrated hairs on tarsi 4 as in male.

Distribution

Known only from type locality (Figure 10).

Material examined

Dominican Republic: Barahona Prov.: near Polo: type above, together with 5♂, 20♀, same collection data (ZFMK).

***Leptopholcus hispaniola* Huber, 2000**

(Figures 2c, d, j, 5, 6, 9b)

L. hispaniola Huber 2000, p 77–79, Figures 300, 301 (female not conspecific, see below).

Type

Male holotype from Parque Nacional Bermudez Cienaga, La Vega Prov., Dominican Republic; tropical evergreen forest at 1100 m a.s.l., 19 July to 2 August 1995 (S. and J. Peck), in AMNH.

Diagnosis

Distinguished from known Caribbean congeners by the shapes of the apophyses on the male genital bulb (Figures 5a, 6a–c, 9b), by the shape of the procurus (Figure 5b), by the short male palpal trochanter apophysis (Figure 5b), and by the internal sclerotized structures in the female genitalia (Figures 2j, 5c, d). From *L. toma* and *L. baoruco* also distinguished by the shorter abdomen tip (Figure 2d).

Male (type locality)

For a detailed description of the male holotype see Huber (2000). All males from the type locality have distinct black spots in the area of the AME, lenses are either absent or not visible in the dissecting microscope; other eyes as usual: distance PME–PME 300 µm;

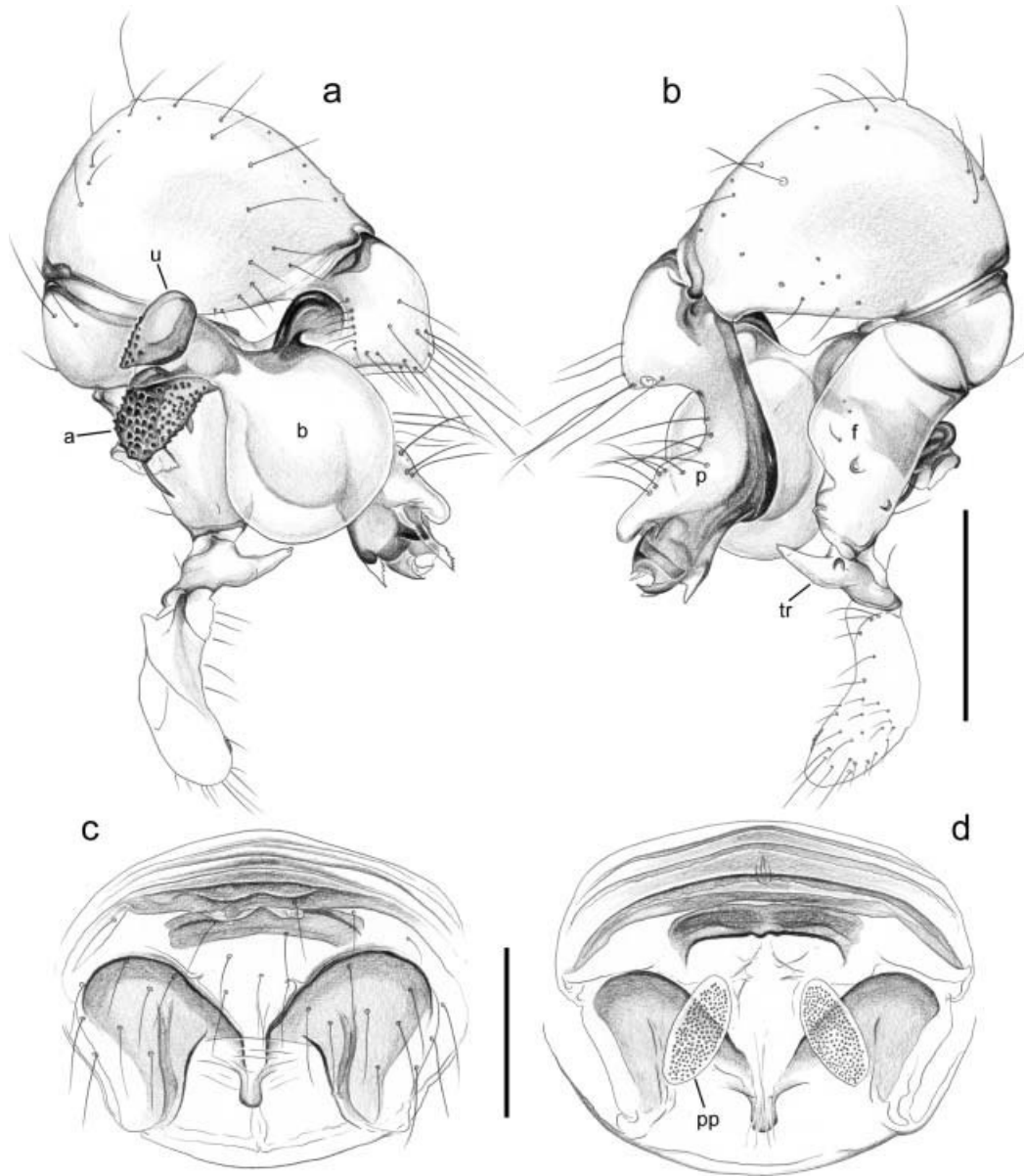


Figure 5. *Leptopholcus hispaniola*. (a, b) Male palp in prolateral and retrolateral views; (c, d) cleared epigynum in ventral and dorsal views. a, appendix; b, bulb; f, femur; p, procurrus; pp, pore plate; tr, trochanter; u, uncus. Scale bars: 0.3 mm (a, b), 0.2 mm (c, d).

diameter PME 80 μm ; distance PME–ALE 20 μm . Habitus as in Figure 2c, d; prosoma very pale ochre-grey, with darker band between eye triads extending over dorsal half of clypeus; sternum whitish, legs pale ochre, patellae and tibia–metatarsus joints dark (almost black), abdomen ochre-grey with black spots dorsally (Figure 2c). Chelicerae not visibly different from those of *L. baoruco* (cf. Figure 3c), with indistinguishable distal apophyses

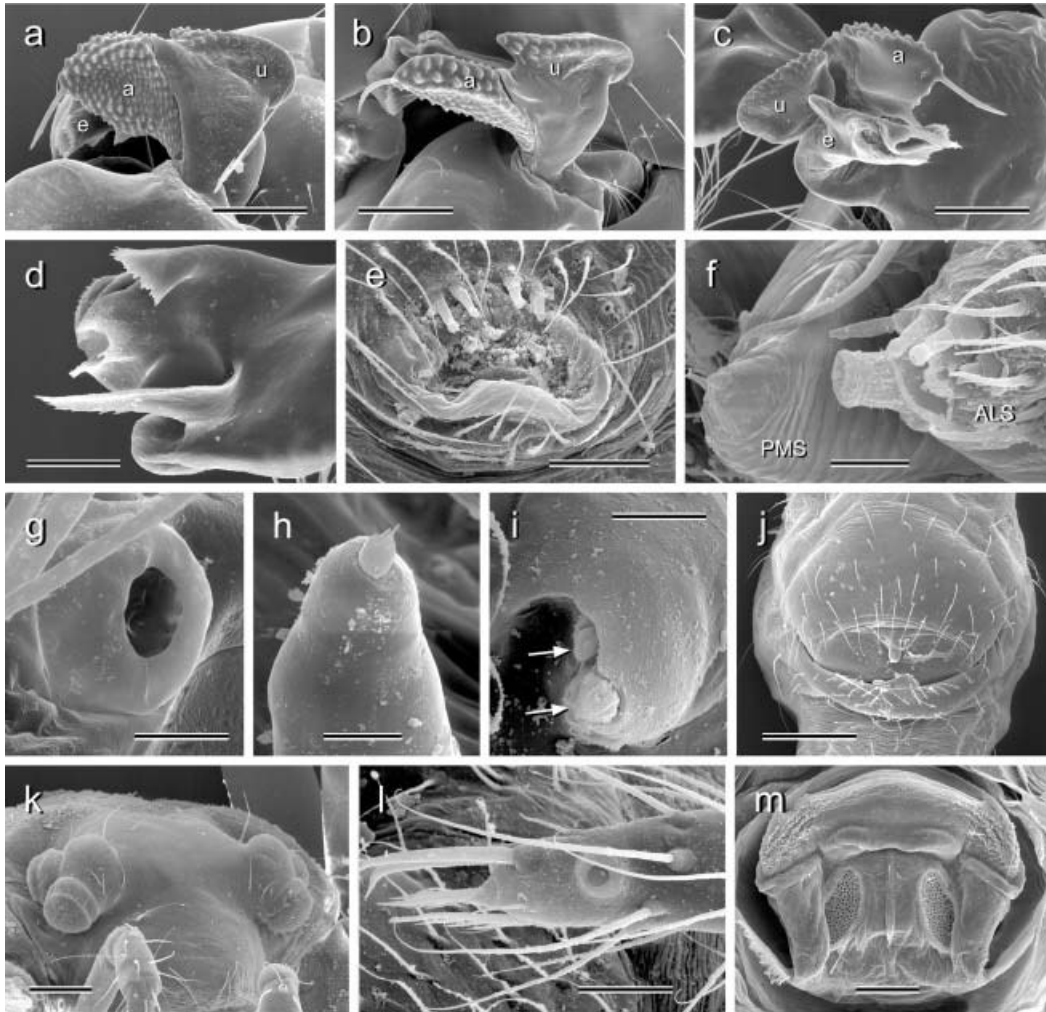


Figure 6. *Leptopholcus hispaniola*, SEM images. (a–c) Male bulbal projections; (d) tip of procurus, prolateral view; (e) male gonopore; (f) male ALS and PMS; (g) male palpal tarsal organ; (h) tip of male palpal trochanter apophysis with modified hair at tip; (i) male distal cheliceral apophysis (arrows point to modified hairs); (j) epigynum, ventral view; (k) ocular area of a female with distinct AME pigment but without AME lenses; (l) tip of female pedipalp; (m) female internal genitalia, dorsal view of cleared genitalia. a, appendix; e, embolus; u, uncus. Scale bars: 100 μm (a–c, k, m); 60 μm (d); 40 μm (e); 10 μm (f–i); 200 μm (j); 30 μm (l).

(Figure 6i). Palps as in Figure 5a, b; coxa unmodified, trochanter with small retrolateral and relatively short ventral apophyses, the latter with distal modified hair (Figure 6h); femur with three small apophyses retrolaterally; procurus strongly bent dorsally, with distinctive distal structures (Figure 6d); genital bulb with distinctive uncus and appendix and slightly sclerotized embolus (Figures 5a, 6a–c, 9b); palpal tarsal organ capsulate (Figure 6g). Prolateral trichobothrium absent on tibia 1, present on other tibiae. Gonopore with four epiandrous spigots (Figure 6e). Spinnerets as in *L. baoruco* (see above, and Figure 6f). Serrated hairs on tarsi 4 as in *L. toma* (cf. Figure 8g).

Variation

All males (and females) from the Cordillera Central (La Cienaga; near Jima) have distinct AME spots (sometimes apparently even lenses), while males (and females) from all other localities lack these spots as well as any trace of AME lenses. The genitalia (male and female) in all these specimens are indistinguishable. Tibia 1 in 36 males: 6.3–8.3 (mean: 7.2).

Female

The single female specimen available at the time of the original description was from Haiti, Damiens (Huber 2000). The newly collected material clearly shows that this female specimen is not conspecific with the type specimen of *L. hispaniola*, but probably represents an undescribed species. Females of *L. hispaniola* have relatively short abdominal tips (similar to males), and the distinctive internal sclerotized structures in the genitalia differ markedly from those of the Haitian specimen (compare Figure 5d with Figure 308 in Huber 2000). Tibia 1 in 56 females: 4.7–6.6 (mean: 5.4). Epigynum as in Figures 5c, 6j; internal genitalia with oval pore plates (Figures 5d, 6m). Palpal tarsus with short distal cone-shaped claw, pair of strong hairs, and capsulate tarsal organ (Figure 6l). Figure 6k shows a female from La Cienaga with distinct AME pigment but without any trace of AME lenses. Serrated hairs on tarsi 4 as in male.

Distribution

Known from several localities in central, northern, and eastern Dominican Republic (Figure 10)

Material examined (all collected by the first author)

Dominican Republic: La Vega Prov.: near La Cienaga, path to Los Tablones (19°03.5'N, 70°53.0'W), ~1200 m a.s.l., 3♂, 3♀ (8 November 2005); near La Cienaga, path along river (~19°03'N, 70°53'W), ~1100 m a.s.l., underside of leaves, 2♂, 5♀ (9 November 2005). Monseñor Nouel Prov.: forest at brook through plantation near Jima (19°01.4'N, 70°28.8'W), ~700 m a.s.l., underside of leaves, 4♂, 8♀ (8 November 2005). Samaná Prov.: forests near Saltos de Limón (~19°16.6'N, 69°26.5'W), ~120 m a.s.l., underside of leaves, 4♂, 13♀ (11 November 2005). Puerto Plata Prov.: N of La Cumbre (19°34.3'N, 70°38.0'W), forest near plantations, 600 m a.s.l., underside of leaves, 2♂, 10♀ (13 November 2005). Espaillat Prov.: near Jamao al Norte (19°38.6'N, 70°26.9'W), forest along river, 40 m a.s.l., underside of leaves, 5♂, 2♀ (13 November 2005). Monte Plata Prov.: near Monte Plata (18°48.7'N, 69°47.1'W), forest along river, 60 m a.s.l., underside of leaves, 2♂, 2♀ (21 November 2005); near Yamasá (18°45.9'N, 70°01.2'W), forest along river, 70 m a.s.l., underside of leaves, 10♂, 6♀ (20 November 2005). Hato Mayor Prov.: N of Manchado (18°50.2'N, 69°18.5'W), forest near river, 150 m a.s.l., underside of leaves, 2♂, 10♀ (21 November 2005). El Seibo Prov.: near Miches (18°56.8'N, 69°05.2'W), forest with plantations, ~300 m a.s.l., underside of leaves, 2♂, 3♀ (22 November 2005). La Romana Prov.: near Batey El Gato (18°27.7'N, 69°04.7'W), near entrance to cave, 80 m a.s.l., underside of leaves, 1♂, 1♀ (24 November 2005). Distrito Nacional: Santo Domingo, Jardín Botánico (18°29.7'N, 69°57.2'W), forest along brook, 50 m a.s.l., underside of leaves, 3♂, 1♀ (27 November 2005).

Assigned tentatively: Puerto Plata Prov.: S of Puerto Plata, forest along path towards Isabel Torres National Park (19°46.4'N, 70°42.3'W), ~400 m a.s.l., underside of leaves,

1♀ (14 November 2005). Duarte Prov.: Reserva Científica Loma Quita Espuela, ~300 m a.s.l. (19°41'N, 70°08'W), one juvenile (10 November 2005).

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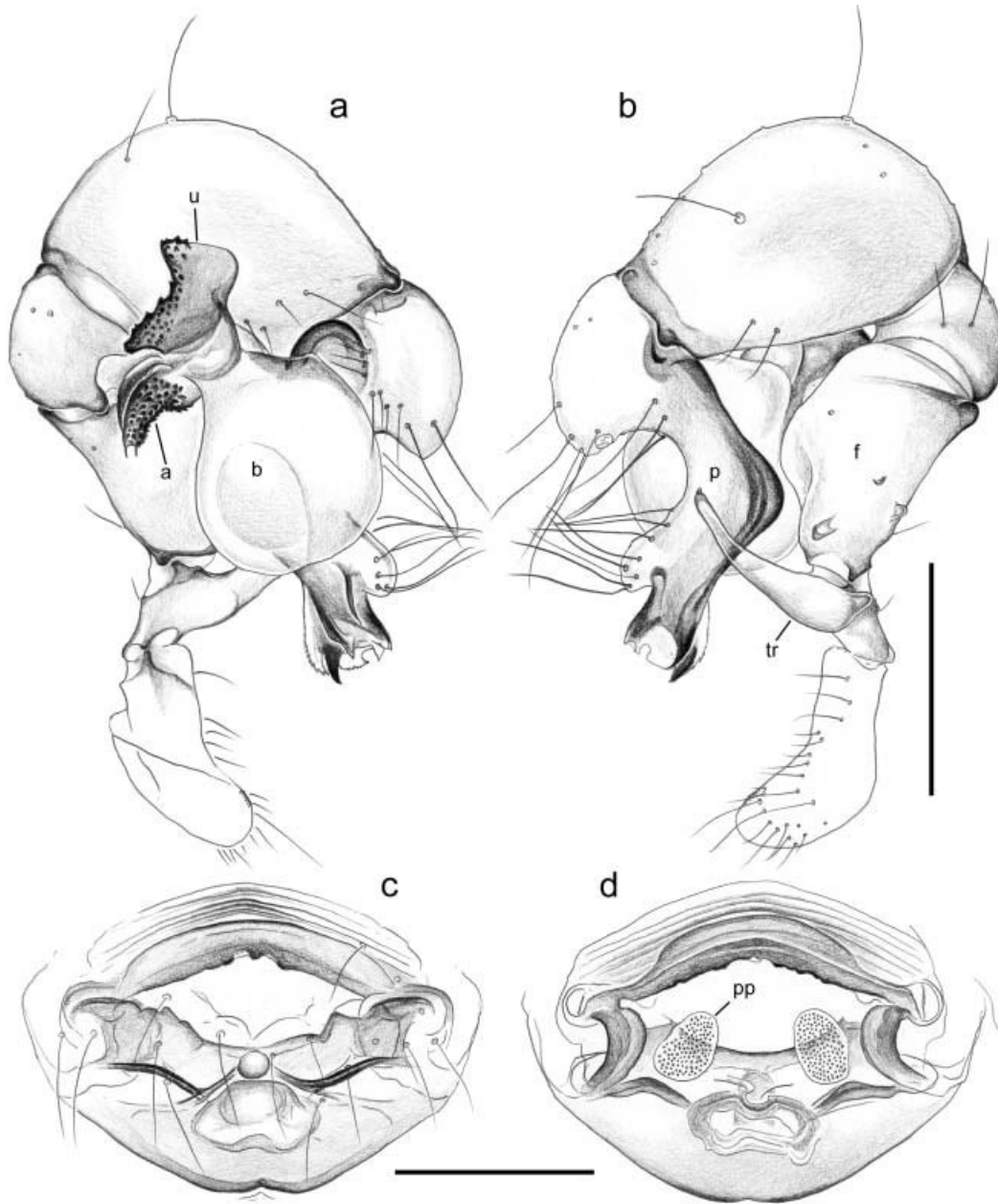


Figure 7. *Leptopholcus toma*. (a, b) Male palp in prolateral and retrolateral views; (c, d) cleared epigynum in ventral and dorsal views. a, appendix; b, bulb; f, femur; p, procurrus; pp, pore plate; tr, trochanter; u, unguis. Scale bars: 0.3 mm (a, b), 0.2 mm (c, d).

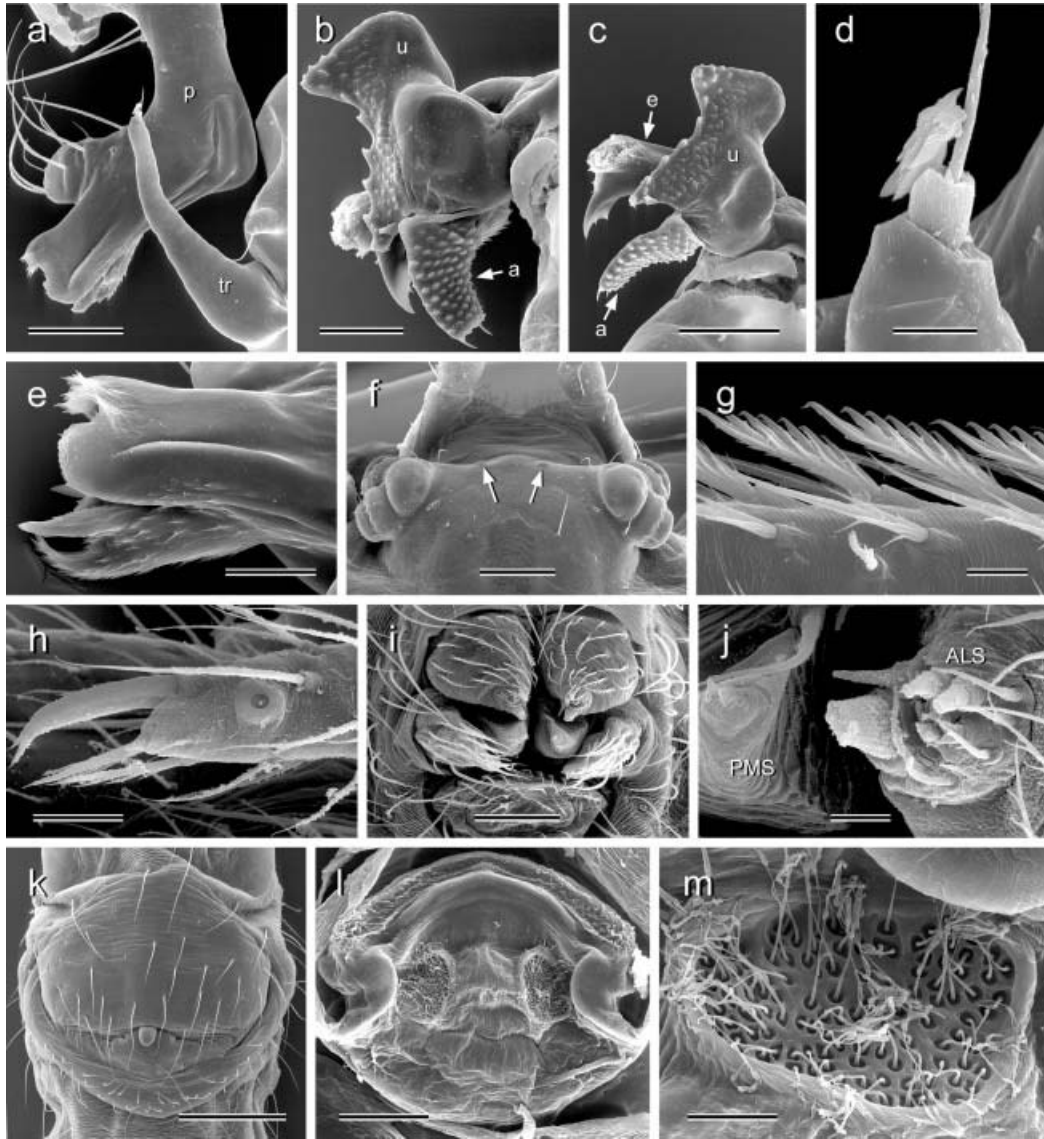


Figure 8. *Leptopholcus toma*, SEM images. (a) Left procurus and palpal trochanter, retrolateral view; (b, c) male bulbal projections; (d) tip of male palpal trochanter apophysis with modified hair; (e) tip of procurus, retrolateral view; (f) female ocular area (arrows point to AME lenses); (g) female tarsus 4 with row of serrated hairs; (h) tip of female pedipalp; (i) female spinnerets and anal cone; (j) female ALS and PMS; (k) epigynum, ventral view; (l) female internal genitalia, dorsal view of cleared genitalia; (m) pore plate, dorsal view. a, appendix; e, embolus; p, procurus; tr, trochanter; u, uncus. Scale bars: 100 μm (a, c, f, l); 70 μm (b, i); 10 μm (d, g, j); 50 μm (e); 30 μm (h); 200 μm (k); 20 μm (m).

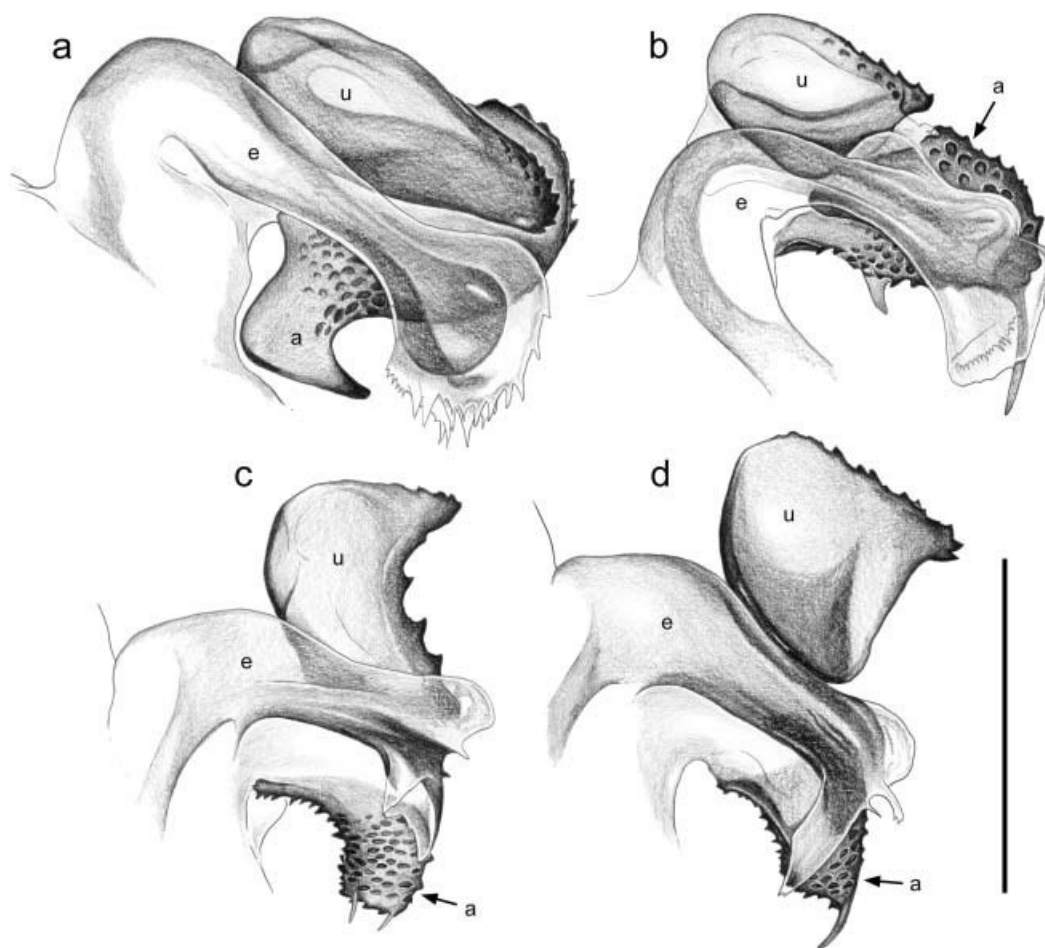


Figure 9. Distinctive bulbal projections (left bulbs in retrolateral views). (a) *Leptopholcus baoruco*; (b) *L. hispaniola*; (c) *L. toma* from type locality; (d) *L. toma* from near Cabral. a, appendix; e, embolus; u, uncus. Scale bar: 0.2 mm.

***Leptopholcus toma* Huber, new species**
(Figures 2e, f, k, 7, 8, 9c, d)

Type

Male holotype from forest near La Toma (18°27.5'N, 70°07.2'W), San Cristóbal Prov., Dominican Republic; 70 m a.s.l., underside of leaves, 7 November 2005 (B. A. Huber), in ZFMK.

Etymology

The species name is a noun in apposition, derived from the type locality.

Diagnosis

Distinguished from known Caribbean congeners by the shapes of the apophyses on the male genital bulb (Figures 7a, 8b, c, 9c), by the shape of the procurus (Figures 7b, 8a), and

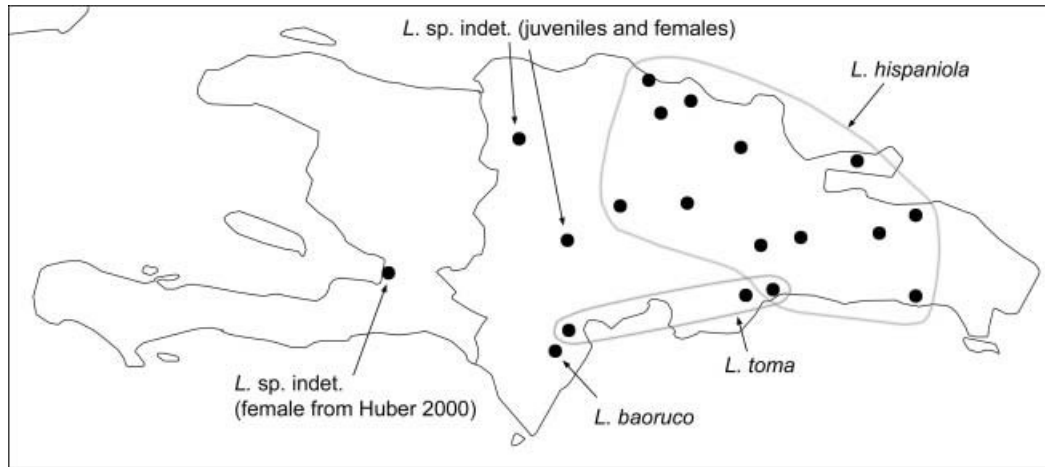


Figure 10. Known distribution of *Leptopholcus* in Hispaniola. Unidentified females and juveniles were collected at two localities in the Dominican Republic: near El Pino ($19^{\circ}24.7'N$, $71^{\circ}29.9'W$), E of San Juan de la Maguana ($18^{\circ}47.6'N$, $71^{\circ}12.2'W$). All other localities are detailed in the text.

by the internal sclerotized structures in the female genitalia (Figures 2k, 7c, d). From *L. hispaniola* also by the much longer male palpal trochanter apophysis (Figure 7b) and longer abdominal projection beyond the spinnerets (Figure 2f); from *L. baoruco* also by the light ocular area (Figure 2e).

Male (holotype)

Total length 3.9, carapace width 0.83. Leg 1: 28.8 (7.2+0.35+7.1+12.6+1.5), tibia 2: 4.4, tibia 3: 2.7, tibia 4: 4.0. Tibia 1 L/d: 107. Habitus as in Figure 2e, f; prosoma very pale ochre-grey, with slightly darker band frontally between eye triads, sternum whitish, legs pale ochre, patellae and tibia–metatarsus joints dark (almost black), abdomen ochre-grey with black spots dorsally (Figure 2e). Ocular area slightly elevated, with lateral triads on distinct but low humps; distance PME–PME 275 μm ; diameter PME 70 μm ; distance PME–ALE 20 μm ; distance AME–AME 55 μm , diameter AME 20 μm . Thoracic furrow absent. Sternum about as wide as long (0.5). Chelicerae with proximo-lateral projections and two modified hairs on distal apophyses as in other species above. Palps as in Figure 7a, b; coxa unmodified, trochanter with short retrolateral and long ventral apophyses, the latter with distal modified hair (Figure 8d); femur with three small apophyses retrolaterally; procurus strongly bent dorsally, with distinctive distal structures (Figure 8e); genital bulb with distinctive uncus and appendix and slightly sclerotized embolus (Figures 7a, 8b, c, 9c). Retrolateral trichobothrium of tibia 1 not seen; prolateral trichobothrium apparently absent on tibia 1, present on other tibiae; legs without spines and curved hairs, few vertical hairs; tarsus 4 with single row of serrated hairs ventrally (cf. female below); pseudosegments on tarsi very indistinct (<10 visible distally).

Variation

The other male from the type locality is slightly paler, with less distinct spots on the abdomen. The male from near Cabral has very similar palps, including the shape of the

procursus, but the bulbal apophyses (especially the unculus) differ quite clearly (Figure 9d). This male is therefore assigned tentatively. Tibia 1 in other male from type locality: 6.1; male from near Cabral: 6.5.

Female

In general similar to male, but abdomen tip longer. AME pigment always present, but lenses indistinct (Figure 8f), in the dissecting microscope sometimes not visible. Epigynum with median rounded projection (Figures 7c, 8k), with distinctive internal sclerotized structures and roundish pore plates (Figures 7d, 8l, m). Palpal tarsus with short distal cone-shaped claw, pair of strong hairs, and capsulate tarsal organ (Figure 8h). Tibia 1 in three females from type locality: 4.6–4.7; female from near Cabral: 4.6; females from Santo Domingo: 3.9, 4.3. Tarsus 4 with single row of serrated hairs ventrally (Figure 8g). Spinnerets as in Figure 8i, ALS with one widened, one pointed, and five cylindrically shaped spigots (Figure 8j), PMS with two small pointed spigots, PLS without spigots.

Distribution

Known from three localities in southern Dominican Republic (Figure 10). Note that the specimens from two of these localities are assigned tentatively (see below).

Material examined

Dominican Republic: San Cristóbal Prov.: forest near La Toma: type above, together with 1♂, 4♀, same collection data (ZFMK).

Assigned tentatively: Distrito Nacional: Santo Domingo, Jardín Botánico (18°29.7'N, 69°57.2'W), forest along brook, 50 m a.s.l., underside of leaves, 2♀, 27 November 2005 (B. A. Huber) (ZFMK). Barahona Prov.: near Cabral (18°14.6'N, 71°11.8'W), degraded forest, 40 m a.s.l., underside of palm leaves, 1♂, 1♀, 17 November 2005 (B. A. Huber) (ZFMK).

***Leptopholcus kiskeya* Huber and Wunderlich, new species** (Figures 1c, d, 11)

Type

Male holotype in Dominican amber, “F1554/DB/AR/CJW”, no further data, in SMF.

Etymology

Kiskeya (or Quisqueya) was the name of Hispaniola used by the Tainos, an Arawak-speaking people originally occupying the island. It is here used as a noun in apposition.

Diagnosis

Distinguished from extant Caribbean *Leptopholcus* species by the long and slender procursus that is widened distally on the ventral side (Figure 11c; not widened on the dorsal side like *L. hispaniola* and *L. toma*), and by the shapes of unculus and appendix; from *L. hispaniola* also by the longer trochanter apophysis and the presence of distinct AME

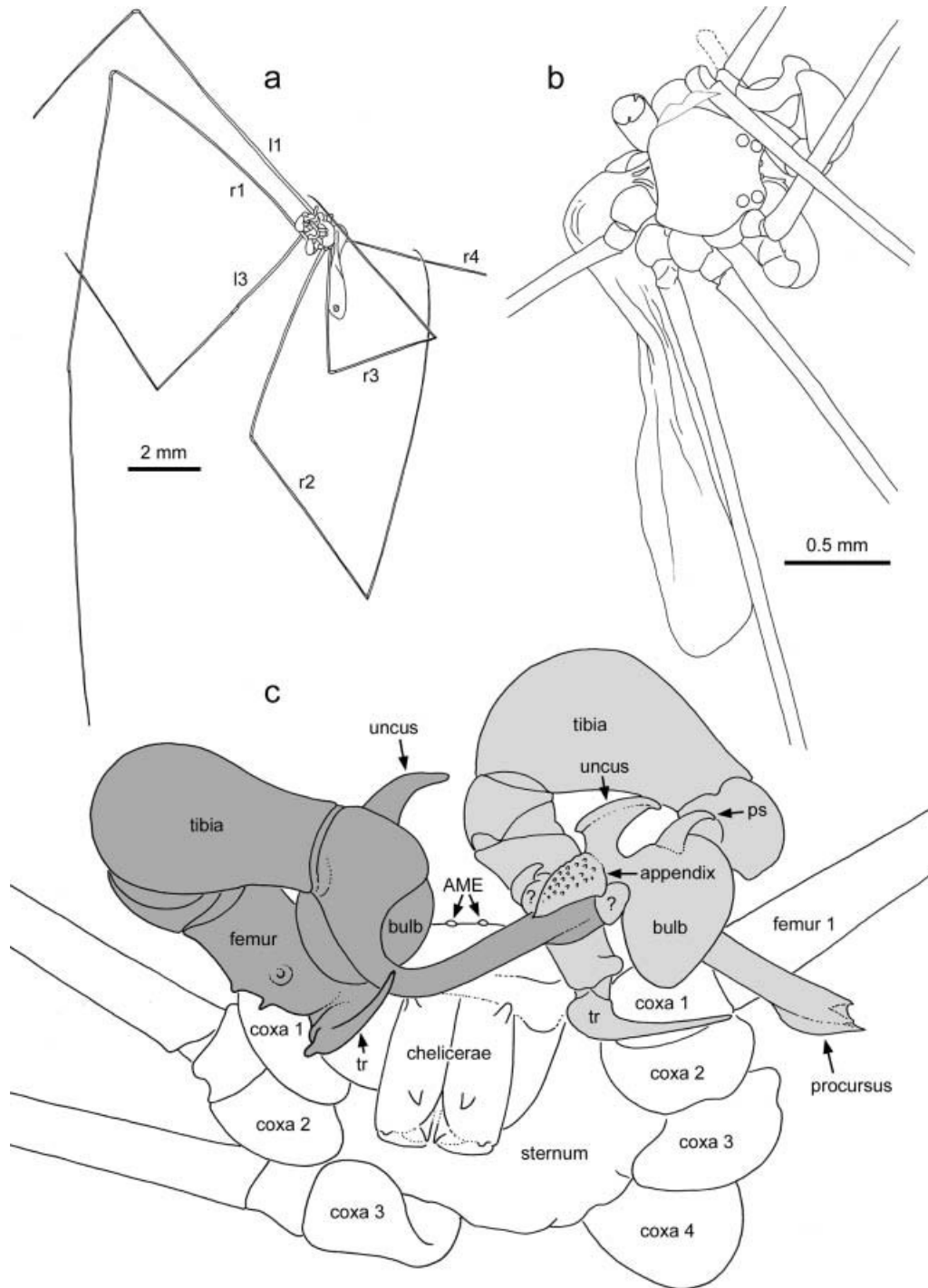


Figure 11. *Leptopholcus kiskeya*, holotype. (a) Entire specimen in ventral view; (b) body without legs, dorsal view; (c) prosoma with chelicerae and palps (grey), frontal to ventral view. l1, 3, left legs 1 and 3; ps, proximal bulbal sclerite; r1–4, right legs 1–4; tr, trochanter.

lenses; from *L. baoruco* and *L. toma* apparently also by the abdomen tip that barely projects beyond the spinnerets.

Male (holotype)

Total length ~3.4, carapace width 0.65. Leg 1: 7.0+0.3+7.8, metatarsus broken; leg 2: 20.0 (5.1+0.3+5.0+8.7+0.9); leg 3: 10.9 (3.2+0.3+2.8+3.9+0.7); leg 4: only broken right femur. Entire animal pale reddish to ochre-yellow. Carapace slightly deformed, without thoracic groove. Eight eyes, lateral triads only slightly elevated, distance PME–PME ~240 µm; diameter PME ~80 µm, AME with distinct lenses, diameter ~20 µm. Chelicerae with two pairs of frontal apophyses, presence of modified hairs on distal apophyses could not be verified. Palps as in Figure 11c; trochanter with small retrolateral and long ventral apophyses, femur with three distinctive apophyses, procurus long and slender, strongly curved, distally widened on the ventral side, genital bulb egg-shaped, with curved uncus and triangular appendix. Tarsal organ not seen. Legs densely covered with regular mechanoreceptive hairs, apparently without spines and curved hairs, vertical hairs not seen; pseudosegments barely visible.

Female

Unknown

Distribution

Dominican Republic; mine not identified.

Material examined

Only type above.

Other inclusions

The amber piece contains four additional specimens: one ‘acalyptrate’ fly and one ceratopogonid (Diptera, kindly identified by B. Sinclair), one Hymenoptera, and one unidentified neopterous insect.

Table I. Details on the five parasitized egg sacs studied: total number of eggs per egg sac, numbers of spider embryos, and numbers and sexes of *Baeus* wasps.

Host	Eggs	Spider embryos	Wasps (♂-♀-unidentified)
<i>Leptopholcus baoruco</i>	22	1	21 (1-20-0)
	17	0	17 (17-0-0)
	23	0	23 (3-9-11)
	18	2	16 (sex unidentified)
<i>Leptopholcus hispaniola</i>	15	0	15 (2-13-0)

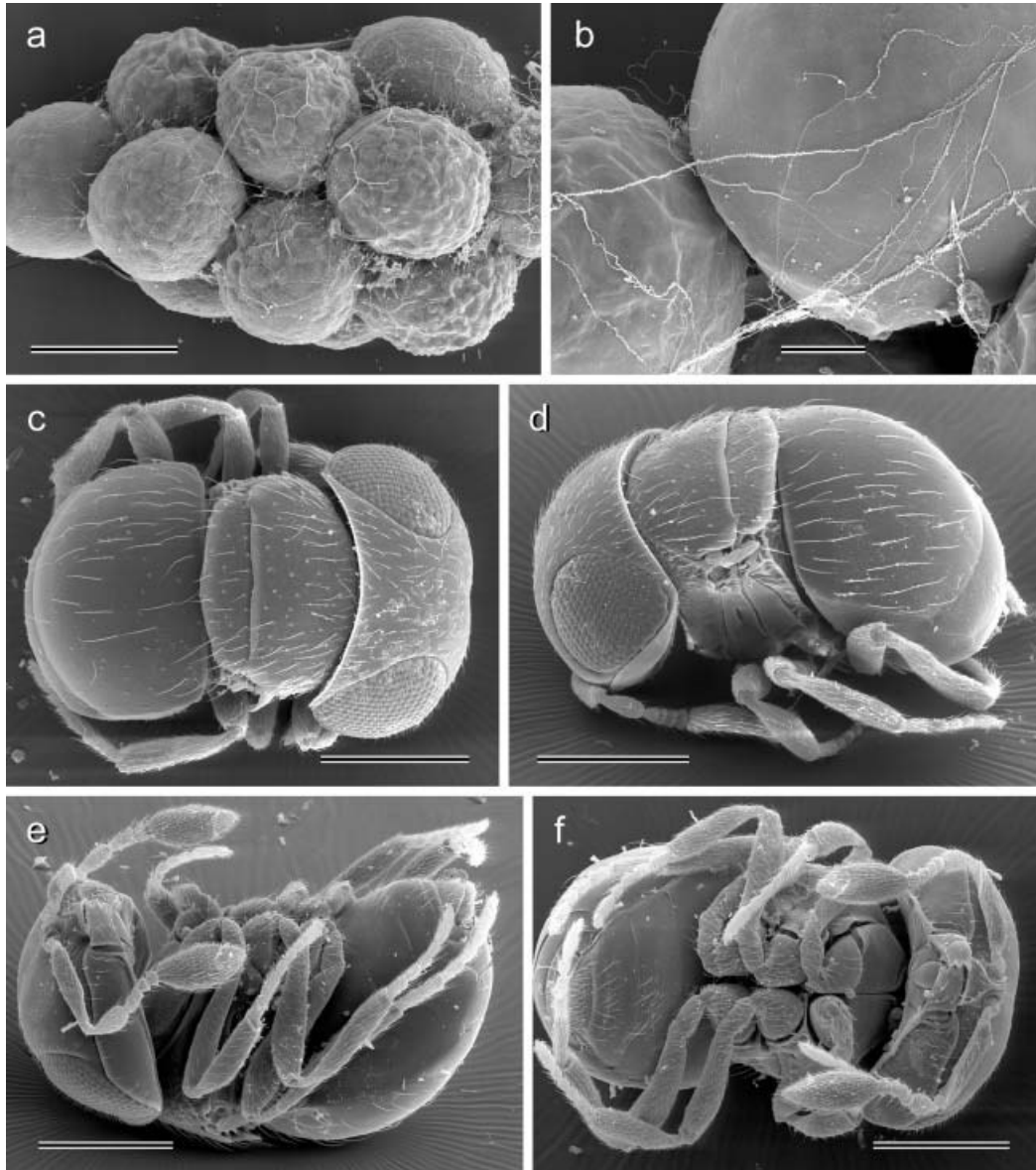


Figure 12. (a) Egg sac of *Leptopholcus hispaniola* and (b) detail of egg sac of *L. baoruco*, showing that eggs are not protected by silk but only held together by a few lines; (c–f) *Baeus* sp. females, dorsal, dorsolateral, ventrolateral, and ventral views. Scale bars: 400 μm (a); 100 μm (b); 200 μm (c–f).

Egg-parasitism

In *L. baoruco*, at least four of the nine egg sacs collected in the field were parasitized by a wasp of the genus *Baeus* Haliday (Baeini, Scelionidae). In two of them, all eggs had a developing wasp inside, which is easily visible through the egg shell (Figure 1f). In the other two egg sacs (one of them is the median one in Figure 1f), two and one eggs, respectively, remained unparasitized (Table I). In *L. hispaniola*, one of six egg sacs was parasitized (originating from La Cienaga). In most egg sacs, there was a strong bias towards females

(Table I). In one egg sac, however, all 17 eggs contained male wasps (the sexes are easily identified by their sexual dimorphisms: females are wingless and have strongly expanded antennal clubs; Loiácono and Margaría 2004). The SEM images in Figure 12c–f show two females that were still inside the eggs of a *L. baoruco* female but apparently close to eclosion.

According to Austin et al. (2005), all Baeini are endoparasitoids of spider eggs. The genus is cosmopolitan, with most species (but *all* Neotropical species) parasitizing representatives of just two spider families: Araneidae and Theridiidae (Austin 1985). Of the six currently known Neotropical *Baeus* species, only one is known from the Caribbean Islands: *B. latrodecti* Dozier from Haiti (Loiácono and Margaría 2004). This species was studied by Pierce (1939; sub *B. californicus*), who found that 98.6% of eggs in affected egg sacs were parasitized. The respective number in the present sample is 96.8% (Table I).

Spider egg sacs probably protect the eggs and spiderlings from a variety of adversities, like unfavourable microclimate, micro-organisms, flooding, parasitoids, and predators (Austin 1985). Spiders and specialized parasitoids are thought to evolve in an arms race, and the squat rounded wingless body of the tiny *Baeus* females has been considered an adaptation to burrowing through the thick-walled egg sacs of Araneidae and Theridiidae (Austin 1985). It is thus remarkable that, in the present case, the spider host has an egg sac that is not protected by any silk cover (as in all pholcids; Figure 12a, b). Pholcid females carry their egg sacs with their chelicerae until the spiderlings hatch, and this behaviour may have favoured the evolution of morphologically unprotected egg sacs. The present species of *Baeus* is the first known parasitoid who has obviously managed to bypass the female protecting behaviour and to exploit the otherwise easily accessible eggs.

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