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Barbara Knoflach [a] & Antonius Van Harten [b]
[a] Institute of Ecology , University of Innsbruck , Innsbruck, Austria
[b] UAE Insect Project , Sharjah, United Arab Emirates
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The one-palped spider genera *Tidarren* and *Echinotheridion* in the Old World (Araneae, Theridiidae), with comparative remarks on *Tidarren* from America

BARBARA KNOFLACH[1] & ANTONIUS VAN HARTEN[2]

[1]*Institute of Ecology, University of Innsbruck, Innsbruck, Austria, and* [2]*UAE Insect Project, Sharjah, United Arab Emirates*

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Abstract

The one-palped spider genera *Tidarren* and *Echinotheridion* are more or less confined to the tropics and subtropics of the southern hemisphere, with occurrence in South America, continental Africa, Madagascar, Cape Verde Islands, Canary Islands, and Yemen. This comparative description of the taxonomy and biology of the one-palped spiders in the Old World comprises altogether 22 species, of which 17 are new to science. Four new species of *Tidarren* are described from Yemen (*T. dentigerum* n. sp. ♂♀, *T. gracile* n. sp. ♂♀, *T. konrad* n. sp. ♀, and *T. sheba* n. sp. ♂♀), eight from mainland Africa (*T. aethiops* n. sp. ♀, *T. afrum* n. sp. ♀, *T. circe* n. sp. ♀, *T. griswoldi* n. sp. ♀, *T. lanceolatum* n. sp. ♀, *T. perplexum* n. sp. ♀, *T. ubickorum* n. sp. ♀, and *T. usambara* n. sp. ♀), and five from Madagascar (*T. apartiolum* n. sp. ♀, *T. dasyglossa* n. sp. ♀, *T. ephemerum* n. sp. ♂, *T. horaki* n. sp. ♀, and *T. obtusum* n. sp. ♂♀). Three new synonyms are established. *Tidarren chevalieri* nov. syn. is a junior synonym of *T. cuneolatum*. *Theridion guineense* Simon, 1907 nov. syn. and *Theridion turrigerum* Simon, 1899 nov. syn. are synonymized with *Tidarren scenicum* (Thorell, 1899) nov. comb. (transferred from *Theridion*). The following further species are reconsidered: *Tidarren argo* Knoflach and van Harten, 2001 from Yemen, with a first record also from Chad; *T. cuneolatum* (Tullgren, 1910) from mainland Africa, Yemen, and the Canary Islands; and *T. levii* Schmidt, 1957 and *T. scenicum* from mainland Africa. In addition, the three American species *T. haemorrhoidale* (Bertkau, 1880), *T. mixtum* (O. P.-Cambridge, 1896), and *T. sisyphoides* (Walckenaer, 1842) are included for comparison. Thus all hitherto known *Tidarren* species of the world are covered. A key for the Yemeni species is provided (males and females) as well as a tentative key for the African species (females only; Madagascar included) and the American species. For *T. dentigerum* and *T. gracile* from Yemen we give a first description of the copulatory behaviour. The genus *Echinotheridion*, though represented by eight New World species, is known from only one species in the Old World, *E. gibberosum* (Kulczynski, 1899) from the Canary Islands and Madeira. Comparative notes on this endemic offshoot are given.

Keywords: *Africa, copulatory behaviour, distribution,* Echinotheridion, *Madagascar, taxonomy,* Tidarren, *Yemen*

Correspondence: Barbara Knoflach, Institute of Ecology, University of Innsbruck, Technikerstrasse 25, A-6020 Innsbruck, Austria. Email: barbara.knoflach@uibk.ac.at

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Introduction

The spider genera *Tidarren* Chamberlin and Ivie, 1934 and *Echinotheridion* Levi, 1963 represent prominent taxa owing to numerous morphological and ethological characteristics (Chamberlin and Ivie 1934; Bonnet 1935; Branch 1942; Knoflach and van Harten 2000, 2001; Knoflach 2002a, 2002b, 2004; Knoflach and Benjamin 2003; Levi 1957, 1963, 1980). They have a single male palp (Figures 4, 6, 8, 10, 75–80, 118, 132, 190, 293) and show striking sexual size dimorphism (Figures 1, 62–69, 103, 104, 116–119, 132–135, 286–289, 305–307). The minute males obligatorily self-amputate one of their palps after their penultimate moult (Figures 2–6). During copulation males die a sudden sexual death. Therefore, it seems unsurprising that sexual cannibalism is a regular phenomenon in these taxa (Knoflach and van Harten 2000). Moreover, in some species the males are emasculated by their mates during copulation (Figures 67–69, 307), the single male palp being amputated and acting independently of the male's body (Knoflach and van Harten 2001; Knoflach 2002a, 2002b). These outstanding biological traits raise questions on their

Figure 1. *Tidarren sisyphoides* (Walckenaer) from Mexico. (a) Female left, male right; (b) dead male after copulation with right palp still inflated. Note size dimorphism of male compared with female tibia IV.

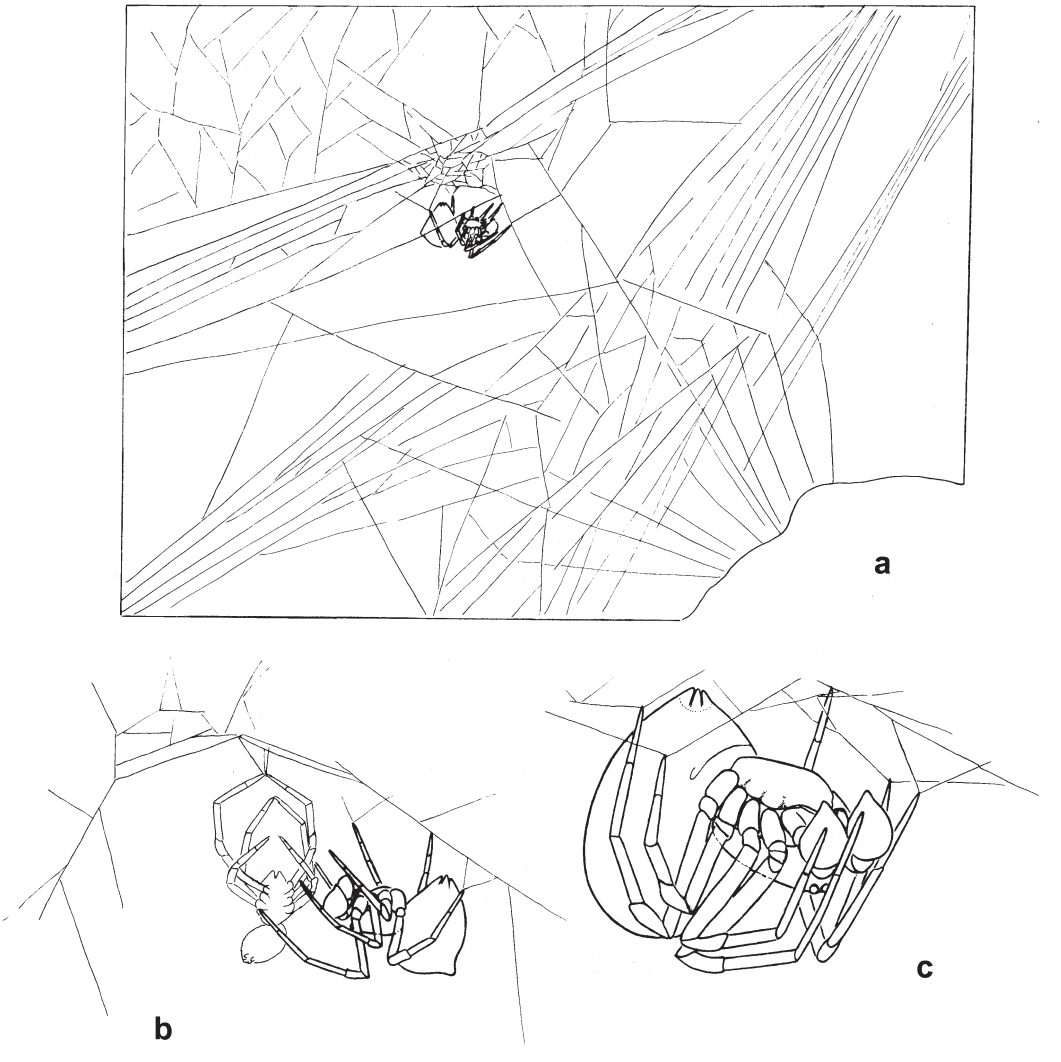


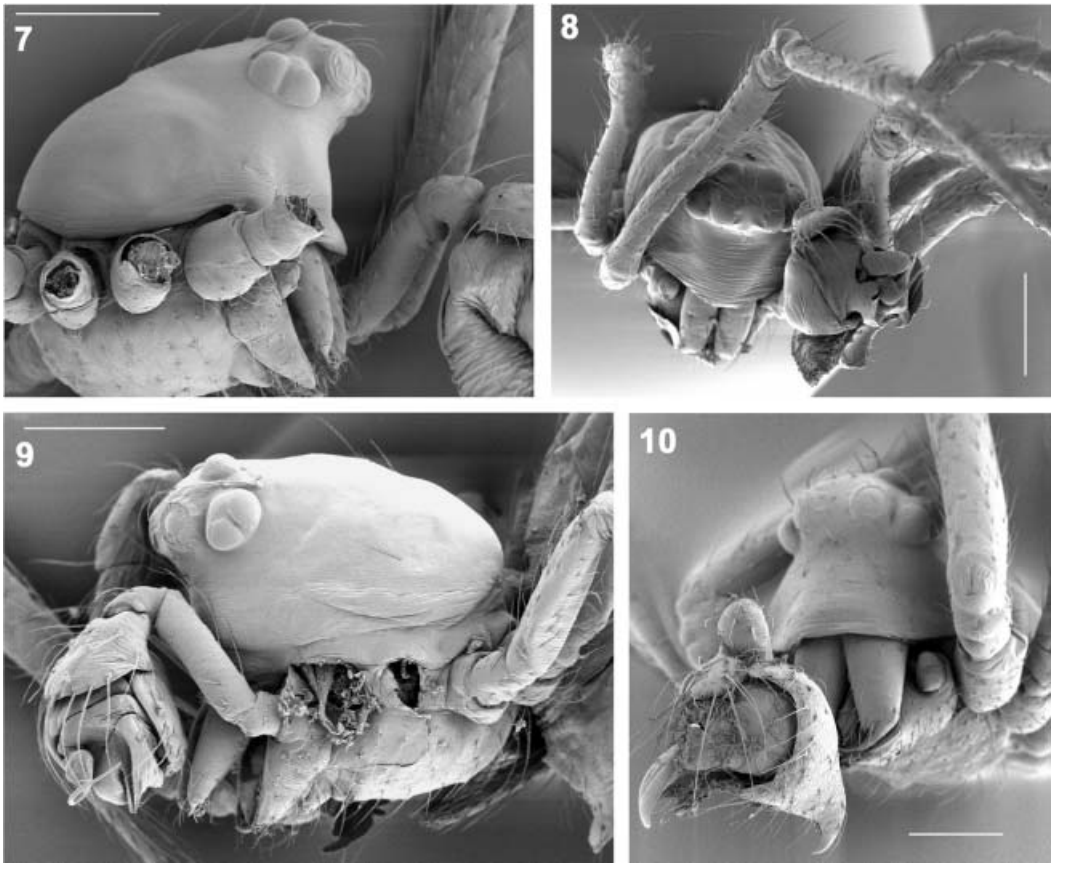
Figure 2. Male of *Tidarren cuneolatum* (Tullgren), just moulted into subadult stage. (a) Moulting and amputation site below hub, the usual resting place of the spider; (b) male (left) removing his exuvia from the moulting site; (c) two-palped male before amputation.

origin and evolution (e.g. Eberhard 1985; Ramos et al. 2004, 2005). Nevertheless, the present taxonomic situation appears to conceal even more problems, which are fundamental for further research in evolutionary biology and phylogenetic analysis. This study provides a synoptic basis for the taxonomy, biology, and distribution of the one-palped spiders in the Old World, but probably still covers only a fraction of the species occurring in this region, especially in Africa.

Currently 16 species of one-palped spiders are known worldwide from the tropics and subtropics of Africa and the Americas (seven species of *Tidarren*, nine species of *Echinotheridion*). Eleven of these occur in South and Central America (Platnick 2006). From Africa three representatives of *Tidarren* have so far been recorded: *T. cuneolatum* (Tullgren, 1910) from mainland Africa, the Canary Islands, and Yemen (Knoflach and van

Figures 3–6. Subadult males. (3, 4) *Echinotheridion gibberosum* (Kulczynski) from Tenerife. (3) Ecdysis just completed, male suspended on moulting thread, both palps present. (4) Palp amputation accomplished; arrow points to detached palp. (5, 6) *Tidarren sisyphoides* (Walckenaer) from Mexico. (5) Early phase of amputation, circling. (6) Amputated palp already sucked out.

Harten 2000); *T. levii* Schmidt, 1957 from an import from Congo, and *T. chevalieri* from the Cape Verde Islands (Berland 1936; Schmidt and Krause 1994; Schmidt et al. 1994), the last being considered here as a new synonym of *T. cuneolatum*. Another species has recently been described from Yemen, *T. argo* Knoflach and van Harten, 2001. In the course of our investigation of the theridiid fauna of Yemen, the genus *Tidarren* was found to be



Figures 7–10. Male prosoma, in lateral (7, 9) and frontal view (8, 10). (7, 8) *Tidarren argo* Knoflach and van Harten from Yemen. (9) *T. cuneolatum* (Tullgren) from Yemen. (10) *Echinotheridion gibberosum* (Kulczynski) from Tenerife. Note high and steep clypeus and site of palp amputation with trochanter still present. Scale bars: 0.2 mm.

represented by a number of unknown species. Further private and museum collections from continental Africa and Madagascar revealed a surprising diversification of this genus. As a result, a total of 17 species of *Tidarren* can be described as new to science, four from Yemen and 13 from Africa. According to the regular occurrence of this genus in Africa it is assumed that older descriptions, especially in the large collective genus *Theridion*, could involve also *Tidarren*. This is shown for *Tidarren scenicum* (Thorell, 1899) nov. comb., being transferred from *Theridion*. Owing to their small size, males are under-represented in museum collections, hence many species comprise females only. Also in the closely related genus *Echinotheridion* seven out of nine species have been described from one sex only (Platnick 2006) and thus are still poorly known. Eight of these species occur in South America. The only Old World representative, *E. gibberosum* (Kulczynski, 1899), which is endemic to the Canary Islands and Madeira, appears to be best established. Descriptions and diagnoses of both genera were based upon material from the Americas (Chamberlin and Ivie 1934; Levi 1957, 1963; Levi and Levi 1962), whereas our knowledge of the fauna of the Old World has to be regarded as incomplete. It is the aim of this study to address this deficiency.

Material and methods

Specimens were examined with a Wild M8 stereo microscope. For drawings of genitalia a Wild M20 compound microscope was used. Epigynes were immersed in Hoyers compound fluid. For measurements, palps and legs were separated from the body of the spider, prepared as permanent mounts and measured through a compound optical microscope. For species available only from one or a few museum specimens, leg measurements were taken from the whole animal through a stereo microscope. The latter method is indicated in the text to give an impression of accuracy of measurements. Number, position, and pattern of trichobothria have not been analysed in such cases.

SEM micrographs were made with a Zeiss DSM 950 by K. Pfaller (Institute of Anatomy, Histology and Embryology; Department of Histology and Molecular Cell Biology, University of Innsbruck). For Figures 11–17, 47–51, 95, 96 the Auto-Montage system was used for assembling several images at different focal planes and producing one digital photo. Habitus photographs were done with an analogue Nikon camera. Photographs and figures are by B.K., unless indicated otherwise. Owing to their complexity, male and female genital organs are drawn in different perspectives. For space-saving reasons the orientation of the female epigynum in lateral view need not be in straight antero-aboral line, but may be rotated. Thus, direction of epigynal protuberance is discernible only on the habitus photos.

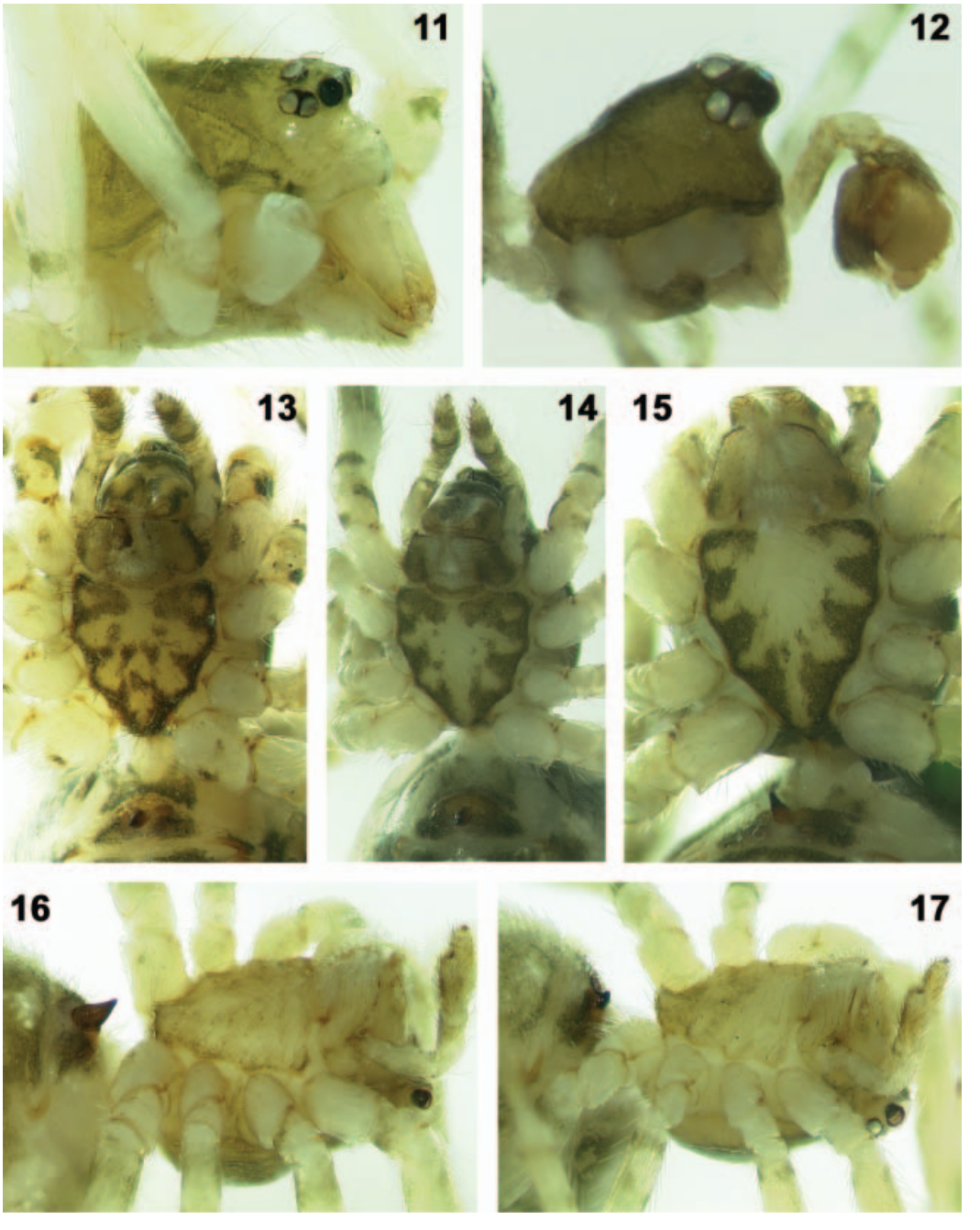
Spiders of all stages were kept alive separately in plastic boxes ($7 \times 4 \times 2.5$ cm) at room temperature in Innsbruck and reared to adulthood. Copulations were observed with a stereo microscope with horizontal objective body (Nikon SMZ-2B), magnification up to $\times 50$.

The following abbreviations are used: male palp—bH, basal haematodocha; C, conductor; dH, distal haematodocha; E, embolus; f, fundus of sperm duct; S, subtegulum; T, tegulum; MA, median apophysis; mH, median haematodocha. Epigynum/vulva—CO, copulatory orifice; CD, copulatory duct; FD, fertilization duct; R, receptaculum seminis. AMNH, American Museum of Natural History, New York; CAS, California Academy of Sciences, San Francisco; CTh, Thaler and Knoflach collection, Innsbruck; MHNG, Muséum d'Histoire Naturelle, Genève; MNHN, Muséum National d'Histoire Naturelle, Paris; MRAC, Musée Royal de l'Afrique Central, Tervuren; NHMB, Naturhistorisches Museum Basel; NHRS, Naturhistoriska Riksmuseet, Stockholm; NMBS, Naturhistorisches Museum Bern; NMW, Naturhistorisches Museum Wien; SMF, Senckenberg Museum, Frankfurt am Main.

Details of the generic diagnosis of *Echinotheridion* are based upon the only Old World representative *E. gibberosum*. The type species has not been examined. A key is provided for the Yemeni *Tidarren* species. The key for the African species has to remain provisional owing to the scarcity of material. Altogether, 25 species of *Tidarren*, grouped by geographic region, and one species of *Echinotheridion* are treated herein.

Tidarren Chamberlin and Ivie, 1934

Yemen:
T. argo Knoflach and van Harten, 2001 ♂♀
T. cuneolatum Tullgren, 1910 ♂♀
T. dentigerum n. sp. ♂♀
T. gracile n. sp. ♂♀
T. konrad n. sp. ♀
T. sheba n. sp. ♂♀



Figures 11–17. Prosoma, lateral (11, 12), ventral (13–15), and ventro-lateral view (16, 17) of *Tidarren* females (11, 13–17) and male (12). (11–15) *T. cuneolatum* (Tullgren) from Yemen (11, 12), Cape Verde Islands (13), and Tanzania (14, 15). (16) *T. konrad* n. sp. from Yemen. (17) *T. dentigerum* n. sp. from Yemen. Eye region in female recessed, clypeus low and concave (11). Note posterior sternal tubercle in 16, 17.

Mainland Africa:
T. aethiops n. sp. ♀
T. afrum n. sp. ♀
T. circe n. sp. ♀
T. griswoldi n. sp. ♀
T. lanceolatum n. sp. ♀
T. levii Schmidt, 1957
T. perplexum n. sp. ♀
T. scenicum (Thorell, 1899)
T. ubickorum n. sp. ♀
T. usambara n. sp. ♀

Madagascar:
T. apartiolum n. sp. ♀
T. dasyglossa n. sp. ♀
T. ephemerum n. sp. ♂
T. horaki n. sp. ♀
T. obtusum n. sp. ♂♀

South and Central America:
T. haemorrhoidale (Bertkau, 1880) ♂♀
T. mixtum (O. P.-Cambridge, 1896) ♀
T. sisyphoides (Walckenaer, 1842) ♂♀

Echinotheridion Levi, 1963

Canary Islands and Madeira:
E. gibberosum (Kulczynski, 1899) ♂♀

Generic diagnoses

Tidarren Chamberlin and Ivie, 1934

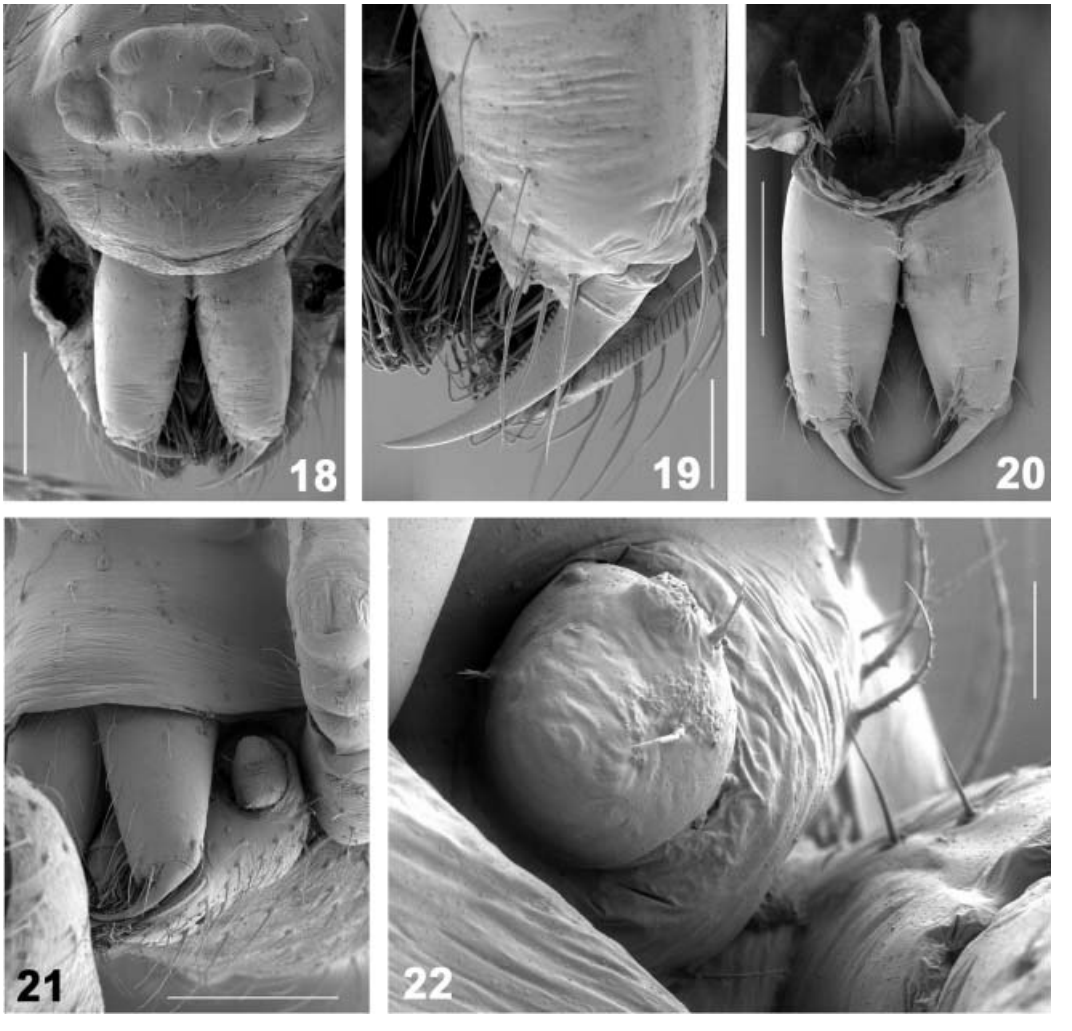
Type species: *T. sisyphoides* (Walckenaer, 1842).

Etymology

Tidarren is a hybrid Gosiute and Greek name, meaning small male; from Gosiute *Tidutsi*=short, small and Greek *arrhenos*=male, gender neuter, see Ubick et al. (2005).

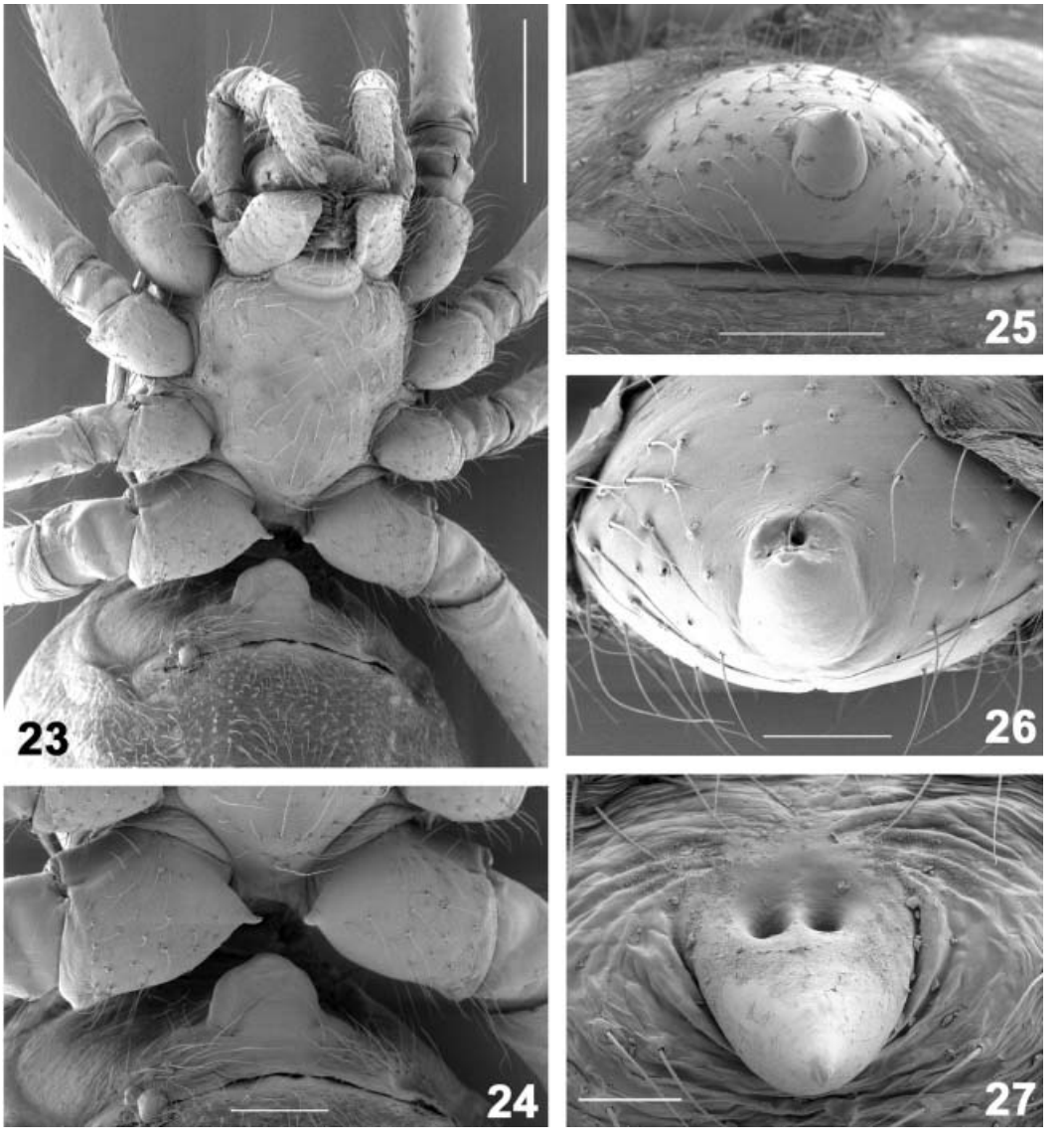
Description

Sexual size dimorphism pronounced (Figures 1, 62–69, 103, 104, 116–119, 132–135, 286–289). Females are medium-sized Theridiidae, mostly about 3 mm long, males are dwarfs with a total body length of approximately 1 mm. Adult males possess only one palp (Figures 4, 6, 8, 10, 75–80, 118, 132, 190, 293). Female palpal claw with particularly large dentition, which dominates the claw shaft and gives the claw a fan-shaped appearance (Figure 31 and as in Figures 28–30), semipalmate according to Agnarsson (2004). Such shape appears to be uncommon among Theridiidae, only *Achaearanea* is suggested to share this feature (Agnarsson 2004). Carapace 1.1–1.3 times longer than wide, without modifications. Clypeus in male high, with eye region protruding (Figures 7–9, 12), in



Figures 18–22. *Tidarren argo* Knoflach and van Harten from Yemen (18–20, 22) and *Echinotheridion gibberosum* (Kulczynski) from Tenerife (21). (18) Female prosoma in frontal view. (19) Ditto, detail of left chelicera. (20) Male chelicerae separated from carapace, aboral view. Note frontal basal apodemes. (21) Male prosoma in frontal view showing amputation site of male palp. (22) Detail of remaining segments (coxa and trochanter) of amputated male palp. Scale bars: 0.2 mm (18, 20, 21); 0.05 mm (19); 0.02 mm (22).

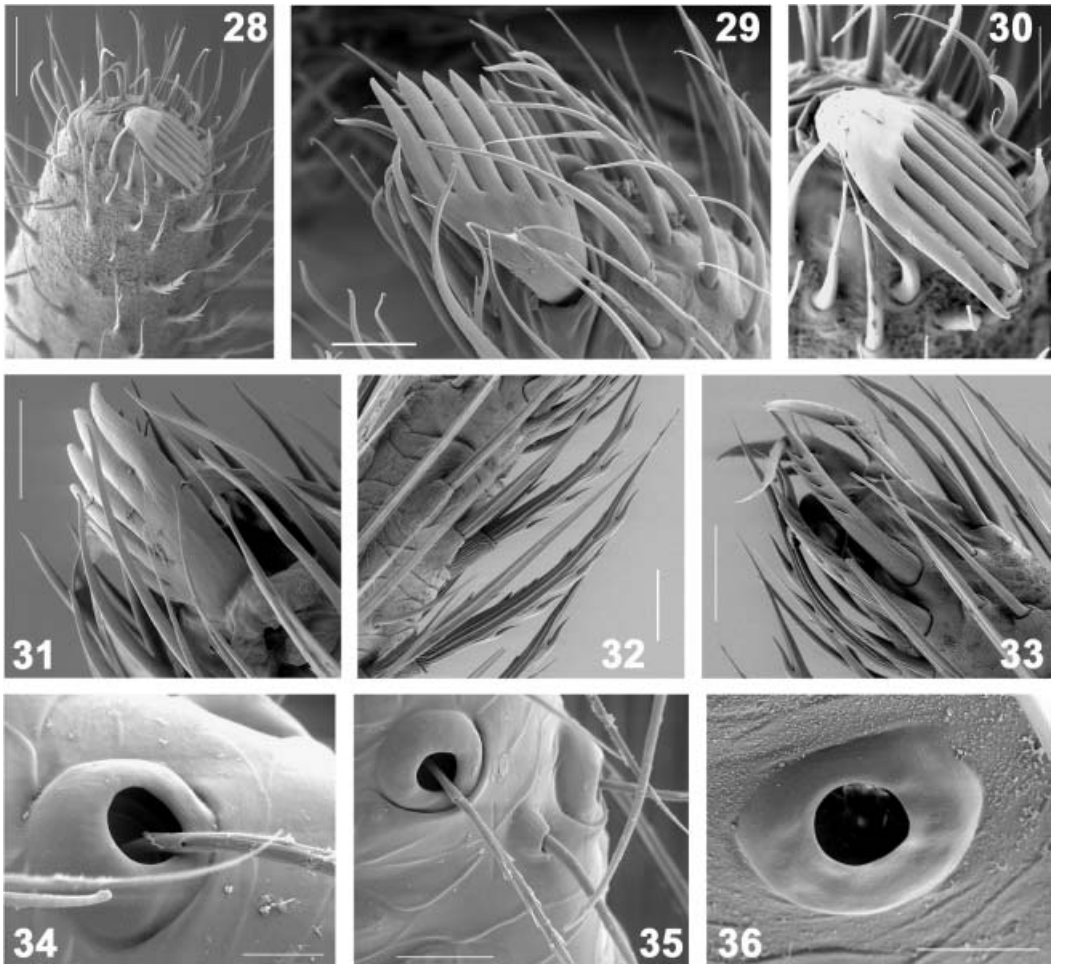
female concave, with eye region recessed (Figures 11, 18). Eyes about equal in size (Figures 7–9, 11, 12, 18). Male stridulatory organ on posterior border of prosoma present, but inconspicuous. Chelicerae in female about as long as height of prosoma (Figures 11, 18), in male half as long (Figures 7–9, 12). Promargin of fang furrow of chelicerae with one or two minute denticles (Figures 19, 20). Chelicerae with basal apodeme typical of Theridiidae, hidden beneath clypeus (Figure 20). Sternum sometimes with characteristic pattern (see Figures 13–15). Leg formula 1423. Coxae IV without spurs (Figures 13–17). Number of dorsal setae on tibiae I–IV 2/2/1/2. Metatarsi I–III with one trichobothrium. Middle tarsal claw almost as long as lateral ones and strongly curved towards ventral side of tarsus (Figure 33). Abdomen higher than long, in many species with dorsal tubercle, sometimes with white lines on sides and a white aboral stripe from apex to spinnerets



Figures 23–27. (23, 24) *Echinotheridion gibberosum* (Kulczynski) from Tenerife. (25, 26) *Tidarren argo* Knoflach and van Harten from Yemen. (27) *T. cuneolatum* (Tullgren) from Yemen. (23) Female, ventral view. (24) Ditto, details of coxal spurs on legs IV and epigynum. (25–27) Epigynum, oblique aboral (25) and ventral view (26, 27). Scale bars: 0.5 mm (23); 0.2 mm (24, 25); 0.1 mm (26); 0.05 mm (27).

(Figure 141b). Male epigaster not protruding (Figures 76–80, 190, 191, 260), with one to three pairs of epiandrous gland spigots (Figure 37). Colulus absent (Figures 38, 39), a synapomorphy for Theridiinae (Agnarsson 2004). Posterior lateral spinnerets with two conspicuous aggregate gland spigots (as in Figures 39, 40), which are typically compressed in most Theridiidae (Agnarsson 2004).

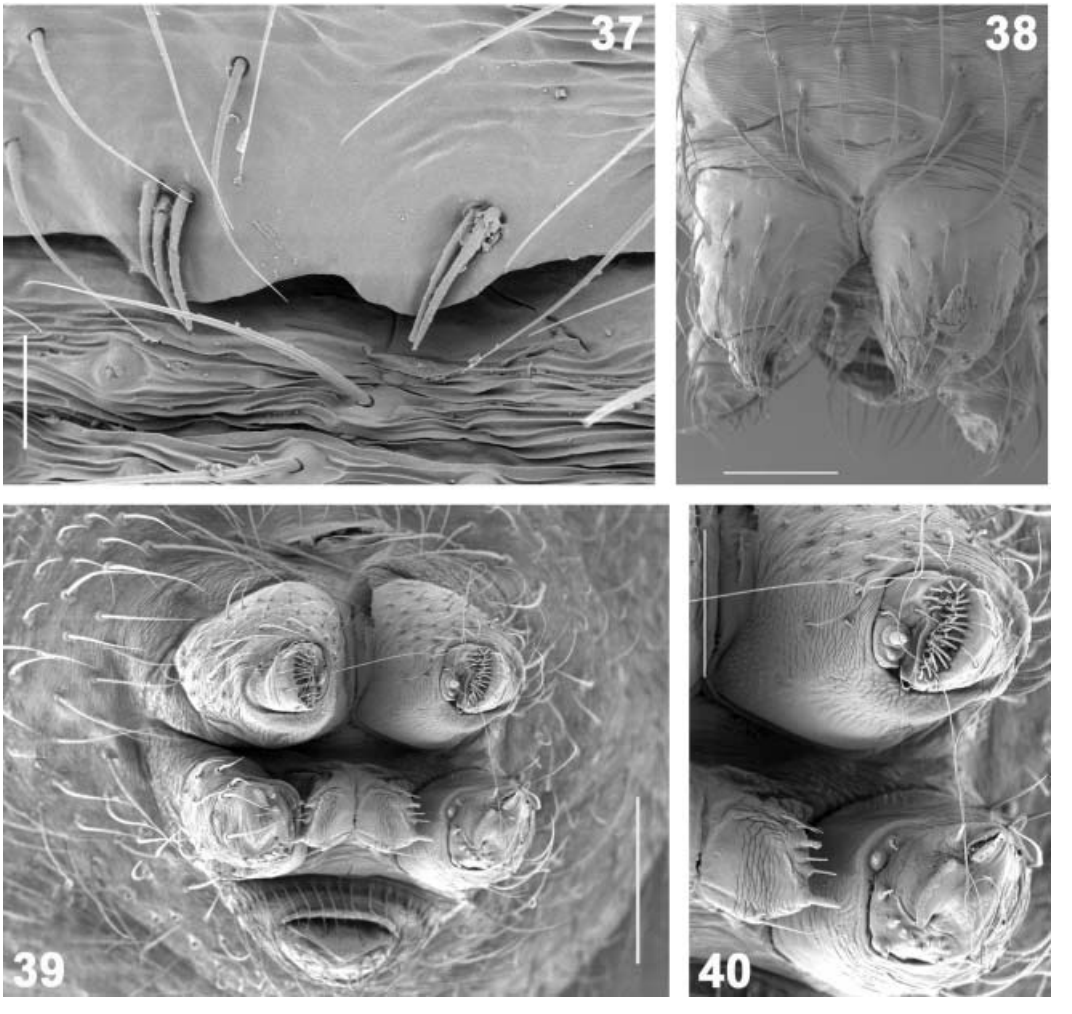
Epigynum/vulva. Epigynum strongly protruding and usually heavily sclerotized (Figures 16, 17, 25–27, 64, 65, 73, 81–84, 95, 141a, 142, 172–178, 181–188, 284,



Figures 28–36. (28–30, 36) *Echinotheridion gibberosum* (Kulczynski) from Tenerife. (31–33) *Tidarren argo* Knoflach and van Harten from Yemen. (34, 35) *T. cuneolatum* (Tullgren) from Yemen. (28–31) Female palpal claw with characteristic large dentition. (32) Serrated setae of tarsal comb of female leg IV. (33) Female tarsal claw. (34, 35) Trichobothria on male tibiae IV and III. Pore on base of hair shaft represents the moulting pore (F. G. Barth, in litt.). (36) Tarsal organ on female palp. Scale bars: 0.05 mm (28); 0.02 mm (29–33); 0.005 mm (34); 0.01 mm (35, 36).

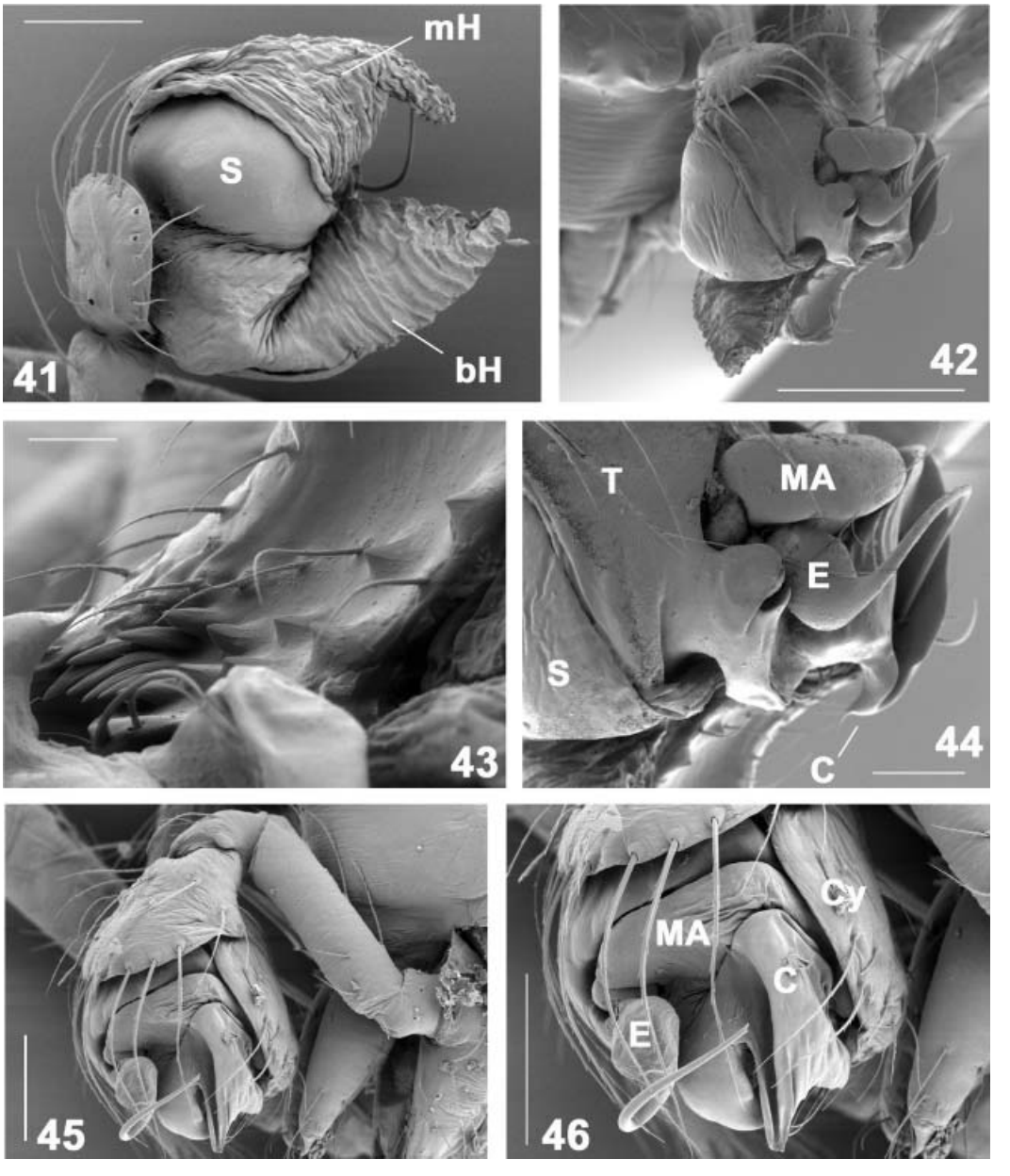
286). In most species copulatory orifices situated at anterior border of epigynal protuberance (e.g. Figures 26, 27, 61, 95, 99, 129, 137), rarely at centre (Figures 157–160). Copulatory ducts separate (e.g. Figures 27, 95, 99, 129, 205, 227, 231, 268, 269, 273–275, 280, 284) or fused at entrance (e.g. Figures 26, 61, 147–149, 197), rather short, mostly about 0.1 mm long. Receptacula oval. Entrances of copulatory and fertilization ducts close together. Fertilization ducts originate with a branched funnel within receptacula (Figures 96, 114, 115, 129–131, 139, 166, 167, 203, 225, 229, 232).

Male palp. The male palp is held inverted, a feature very uncommon among theridiids (Knoflach and Pfaller 2004). Thus, the topography of the palpal sclerites becomes reversed, cymbium on ventral side, bulbus dorsal (Figures 8, 9, 12, 45, 46). Width of palp about 0.2–0.3 mm. Tibia asymmetrically enlarged on dorsal side where it flanks palpal



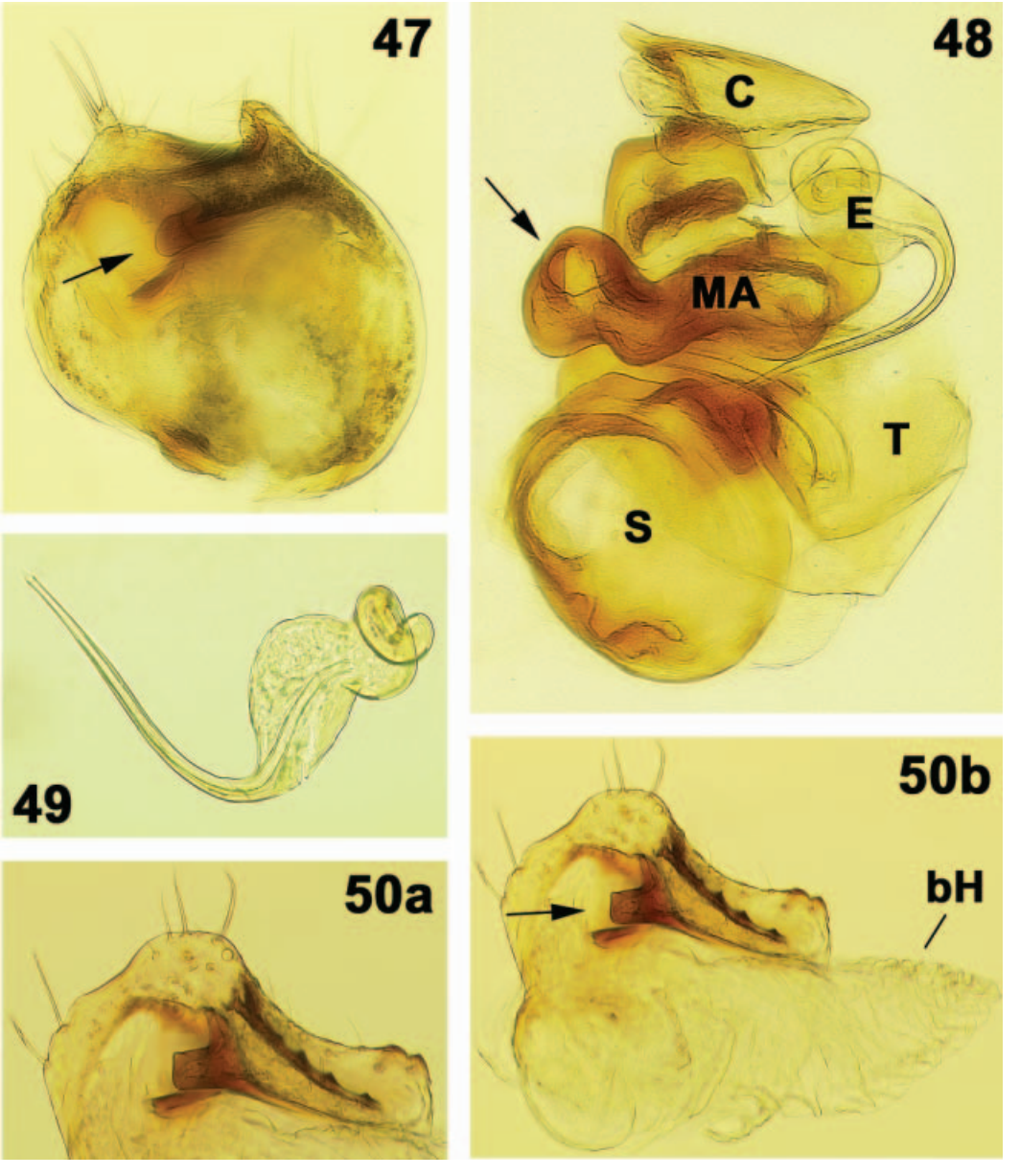
Figures 37–40. (37) *Tidarren sisyphoides* (Walckenaer) from Mexico. (38) *T. argo* Knoflach and van Harten from Yemen. (39, 40) *Echinotheridion gibberosum* (Kulczynski) from Tenerife. (37) Male epigaster with five epiandrous gland spigots. (38) Male spinnerets, colulus absent. (39, 40). Female spinnerets. Note absence of colulus and colular setae, a synapomorphy of Theridiinae according to Agnarsson (2004), and presence of large, compressed spigots of glandulae aggregatae on posterior lateral spinnerets, typical of Theridiidae. Scale bars: 0.02 mm (37); 0.05 mm (38); 0.2 mm (39); 0.1 mm (40).

organ; its long bristles reach distal part of bulbus (e.g. Figures 41, 42, 45, 46, 55, 89–91, 124, 127, 143–146, 240, 248, 263, 265); one prolateral trichobothrium present. Cymbium noticeably modified, bilobed, with numerous teeth, ridges or warts on distal part (Figures 43, 47, 50, 52–55, 85–88, 92, 105–110, 143–146, 154–156, 239, 240, 247–250, 261–264, 276–279). Base of cymbium hairless, bristles present only in distal half. Internal locking mechanism between bulbus and cymbium accomplished by a cymbial hook, which fits into a cavity on inner end of median apophysis (arrow, Figure 48). This cymbial hook is associated with a groove below it, where the median apophysis is adjusted. It is a blunt process in a distal-central position, facing retrolaterally (arrow, Figures 47, 50b), lying on the inner side of the cymbium and covered by the palpal organ. Subtegulum situated prolatero-ventrally, sometimes hidden by tegulum and cymbium. Tegulum well



Figures 41–46. Male palp. (41–44) *Tidarren argo* Knoflach and van Harten from Yemen. (45, 46) *T. cuneolatum* (Tullgren) from Yemen. (41) Palp expanded, basal and median haematodochae serve as holdfast structures. (42, 44) Palp with sclerites at rest in frontal-dorsal view. (43) Detail of distal part of cymbium. (45, 46) Palp in retrolateral view, showing inverted position, cymbium ventral, bulbus dorsal. Scale bars: 0.2 mm (42, 45); 0.1 mm (41, 46); 0.02 mm (43); 0.05 mm (44).

developed, with conductor as solid prolateral outgrowth, and median apophysis (*sensu* Levi 1957; Agnarsson 2004) as movable retrolateral sclerite (labelled tegular apophysis TA in Knoflach and van Harten 2000). Distal rim of tegulum usually with one to two small projections or corresponding incisions on prolateral side (tegular process TP in Knoflach



Figures 47–50. Left male palp. (47–49) *Tidarren cuneolatum* (Tullgren) from Yemen. (50a, b) *T. argo* Knoflach and van Harten from Yemen. (47, 50a, b) Cymbium separated from bulbus, viewed from inside (dorsal view). Arrows point to cymbial hook. (48) Palpal organ with sclerites loosened. (49) Embolus, showing two basal lobes. Auto-Montage digital photos.

and van Harten 2000). The conductor turns from prolateral side of tegulum to the retrolateral side of the palp, where its main part with a distinct furrow guides the embolus. Embolar base twisted into two distinct basal lobes (Figures 49, 55, 90, 91, 105, 106, 127, 144–146, 240, 248, 263, 265), which fit in prolateral, incised tegular rim. Distal part of embolus directed counterclockwise in right palp, 0.1–0.3 mm long, longer than female

copulatory ducts. Remarkably, the fundus of the sperm duct is unusually voluminous (f in Figures 85, 86, 105, 124, 145, 247, 266, 279). From there the sperm duct abruptly narrows within the tegulum, runs along the periphery of the tegulum and enters the embolar base without passing the median apophysis. Wall of sperm duct rather thin. Unlike most other Theridiidae the distal haematodocha is reduced to a tiny rudiment (dH in Figures 127, 144–146, 266, 276; arrow in Figures 89, 124, 263). As a result of this reduction, the sclerites do not rotate much against each other during insertion, whereas a functional distal haematodocha would force sclerites and embolus in a certain direction. Therefore it is assumed that males are able to insert their single palp either ipsilaterally or contralaterally and thereby may favour a certain, e.g. the virgin, side of the female vulva (Knoflach and van Harten 2000). In this one-palp system either receptacle may be inseminated, irrespective of male "handedness". In *T. argo* the basal and median haematodochae assume a most unusual form when inflated (Figures 41, 72). These horn-shaped membranes serve as holdfast structures during genital contact (Figures 67–69; Knoflach and van Harten 2001).

Shape of epigynal protuberance, cymbium, distal tegular rim, and conductor are diagnostic features. Unusually among Theridiidae, the cymbium shows marked species-specific features, such as shape, protuberances, ridges, and denticles. It provides the main functional contact, as it is placed over the epigynal protuberance during insertion (Knoflach and van Harten 2000).

Recently, the spermatozoa of *T. argo* have also been investigated (Michalik et al. 2005). They differ from those hitherto found in other spiders and appear to be highly specific, with a strongly elongated nucleus, a conspicuous implantation fossa, base of axoneme close to acrosomal complex, axoneme extending deeply into postcentriolar elongation, and proximal centriole unusually far away from the distal one. A thin secretion sheath encloses the encapsulated cleistospermium. Interestingly, mature spermatozoa are embedded in a copious secretion instead of being close-packed (Michalik et al. 2005).

Behaviour

Palp amputation. In contrast to all other known spiders, adult males of *Tidarren* and *Echinotheridion* have only one palp, as a result of self-amputation (Branch 1942; Knoflach and van Harten 2000, 2001). Juveniles and newly moulted subadults still have both palps (Figures 2, 3, 5). The semi-emasculation is accomplished a few hours after the penultimate moult, when the male raises one palp and turns around in circles until the palp becomes caught in the threads at the moulting site. By further circling the palp becomes constricted and finally breaks off (Figure 4), regularly at the trochanter and femur joint (Figures 10, 21, 22). The amputation takes about 4–13 min in *T. cuneolatum* (see Knoflach and van Harten 2000), 2–6 min in *T. argo* (see Knoflach and van Harten 2001), 2–3 min in *T. sisyphoides* (see Branch 1942; Knoflach and Benjamin 2003), and involves 8–15 rotations of the male. Subsequently, the male feeds on its own detached palp (Knoflach and van Harten 2000; see also Figure 6, palp already sucked out). The last moult therefore involves only one-palped males. Among several hundreds of males there was no adult male with two palps.

Copulatory behaviour. Tidarren species show numerous outstanding behavioural traits during copulation (Knoflach and van Harten 2000, 2001; Knoflach 2002a, 2002b, 2004; Knoflach and Benjamin 2003). Males generally die from a sudden sexual death during insertion. They become exhausted with copulation, probably because a considerable part of the haemolymph is shifted from the male's body into the palpal organ (Figures 67, 68, 104, 117, 118, 132, 133,

287, 289). Moreover, the prosoma of the male becomes shrivelled (Figure 70), supposedly owing to irreversible contraction of the prosoma muscles. As a consequence, copulation comprises a single insertion only. In most species hitherto observed copulation is associated with sexual cannibalism of the male, either post-copulation or concurrent with sperm transfer. In *T. cuneolatum* the male is devoured after a few minutes of insertion (Knoflach and van Harten 2000), in *T. dentigerum* from Yemen likewise after some minutes (Figure 119, see species description). *Tidarren argo* synchronizes sperm transfer and sexual cannibalism by emasculation, by tearing off the single male palp, which is accomplished within half a minute by the female immediately after successful genital contact (Figures 67–69; Knoflach and van Harten 2001; Knoflach 2002a, 2002b). The separated gonopod remains fastened to the epigynum for several hours and presumably continues with sperm transfer independently of the male's body, while the female feeds on the palpless, emasculated male (Figures 68, 69). By this means genital contact is prolonged considerably. Furthermore, this procedure provides a temporary mating plug and thus may lengthen the interval between copulations of a female. Another new species from Yemen described herein shows an intermediate behaviour. In *T. gracile* n. sp. females start to consume their mates during copulation, without amputating the male gonopod (Figures 133, 134). After a period of such consummatory sexual act the male is removed from the epigynum and finally completely sucked out (Figures 123, 135). The American *T. sisyphoides* is an exception as regards mate consumption. Although copulation is also accompanied by the male's death, the female removes the dead male from the epigynum and casts him away without consuming him (Knoflach and Benjamin 2003; see also Figures 1b, 288).

Sex roles are evidently reversed in *Tidarren*. Males are monogynous, while females practise polyandry, which implicates higher potential reproductive success in females. This reversal is also indicated by the unusually active role of females during courtship. In many species, females actively court their mates throughout courtship.

In species with considerable size dimorphism, problems may arise concerning orientation of the partners in order to assume the appropriate copulatory posture. In *Tidarren*, this is solved by construction of a mating thread, where the male plucks rhythmically until the female approaches. Copulation then takes place on the mating thread. Obviously, it helps the male to locate the female genital organ. The female even cooperates by assuming a special posture, her legs III flexed and forming a circle, the tarsi close together on the mating thread (Figures 63, 65, 103). When the male approaches along the mating thread he is guided by her legs to the epigynum (Knoflach and van Harten 2000; Knoflach 2004). Only in *T. sisyphoides* does no web-spinning take place. Here the male climbs directly on to the female venter (Knoflach and Benjamin 2003; see also Figures 286, 287).

Inbreeding tolerance

In *Tidarren argo* females were observed to copulate with their offspring, apparently tolerating a certain amount of inbreeding in captivity.

Natural history

Egg-sac. Usually grey to brownish, with parchment-like envelope. Species produce different numbers of eggs according to differences in body size. The greatest fecundity is given in the large *Tidarren sisyphoides*, with 350–477 eggs per cocoon (Guarisco 2000), far away from *T. cuneolatum* with about 70 on average (Knoflach and van Harten 2000).

Smaller species such as *T. argo* produce ca 40 eggs per sac (Knoflach and van Harten 2001) and *T. gracile* ca 20 (see below).

Web. The web consists of a retreat and a scaffold of threads extending to the side of a wall, not or rarely reaching the ground. Web dimensions depend on the space available, in the field large female webs may measure up to half a metre in height. The retreat is a densely spun hub into which mineral particles, exuviae, plant and prey remnants are incorporated. The webs of *Tidarren haemorrhoidale* and *T. sisyphoides* do not contain gum-footed lines or other viscid elements (Benjamin and Zschokke 2003).

Enemies. In Kansas *Tidarren sisyphoides* was severely preyed upon by the pirate spider *Mimetus puritanus* Chamberlin, 1923 (Mimetidae; Guarisco 2000). Other predators were the araneophagic theridiids *Argyrodes trigonum* (Hentz, 1850) and *A. cancellatus* (Hentz, 1850), which also invaded the webs of *T. sisyphoides* (see Guarisco 2000). The mantispid *Mantispa viridis* Walker, 1853 was encountered from egg-sacs of *T. sisyphoides* in Kansas (see Guarisco 2000). In Florida the eulophid hymenopteran *Comastichus zopheros* LaSalle, 1994 parasitized an egg-sac of *T. sisyphoides* (see Guarisco 2001). One juvenile female of the Yemeni *T. argo* was infested by a Mermithidae (Nematoda). One female of *T. cuneolatum* from South Africa had been parasitized by an acrocerid (Diptera), the primary larva being visible through the book lung cover. Another female from Tanzania had an ectoparasitic hymenopteran larva on the abdomen.

Distribution (Figure 51)

South and Central America, Africa, Yemen, Madagascar, Cape Verde, and Canary Islands. There are no records from northern Africa. Obviously, the genus is not present in SE Asia (Song et al. 1999). Most species are known from a few localities only. Two species are

Figure 51. World distribution of the one-palped spider genera *Echinotheridion* (open circles) and *Tidarren* (closed circles and stripes). Occurrence in America based mainly upon Levi (1957, 1963, 1967).

expansive and behave hemisynanthropically (*T. cuneolatum* in Africa and *T. sisyphoides* from southern USA to South America). For further details see discussion and species description.

Echinotheridion Levi, 1963

Type species: *E. cartum* Levi, 1963.

In the Old World, the genus *Echinotheridion* is represented by only one species, *E. gibberosum*. As the type species from South America is not taken into consideration herein, a comparative analysis is not justified. For details of generic diagnosis see Levi (1963). *Echinotheridion* shares numerous features with *Tidarren*, sexual size dimorphism, general appearance and habits, web structure, palp amputation, copulatory behaviour, see also species description. In the following only differentiating characters are given.

The most striking and eponymous (*Echinotheridion*="spiny *Theridion*") character of this genus is shown by the females, which have coxal spurs. Posteriorly on the base of each coxa IV a conspicuous spur faces towards the other and towards the epigynal protuberance (Figures 23, 24). It still is uncertain whether these spurs serve as additional holdfast structures or rather facilitate the female to terminate genital contact more easily (Figure 310). At least they are not essential for genitalia coupling. During insertion, contact between male palp and coxal spurs sometimes occurs and sometimes not.

Males have no coxal spurs. The male palp of *Echinotheridion*, especially of the three South American species known from the male, is apparently even more elaborate than that of *Tidarren* (figures given by Levi 1980; Buckup and Marques 1989; Ramirez and Gonzalez 1999). Cymbium and palpal organ exhibit numerous huge projections. These are comparatively less pronounced in *E. gibberosum* (Figures 295–298). Unlike in *Tidarren*, the embolus lacks distinct lobes at its base. The distal and presumably also the median haematodochae are vestigial, which is assumed to have similar effects on palpal application as in *Tidarren*. Basal haematodocha not modified (Figure 307–309). It appears that the epigynal protuberance is less prominent and less pointed (Figures 299, 303; see also figures given by Levi 1963; Marques and Buckup 1989; Ramirez and Gonzalez 1999). Unlike *Tidarren* species, in *E. gibberosum* the copulatory ducts are long, coiled, and heavily sclerotized.

Behaviour

Palp amputation. Loss of one palp is achieved by self-amputation also in *E. gibberosum* males. The process closely resembles that in *Tidarren*. Two to three hours after the penultimate moult two males circled around their own appendage 16–17 times, thereby twisting off the palp within 6–11 min (Knoflach 2002a, 2002b; Knoflach and Pfaller 2004).

Copulatory behaviour. Echinotheridion gibberosum follows the overall copulatory pattern of *Tidarren* (Knoflach 2002a, 2002b, 2004): copulation is induced via a mating thread, accompanied by the male's exhaustion and concludes with sexual cannibalism (Figures 305–307). As in *T. argo* the male is emasculated before being consumed. The female detaches the palp by continuous circling, but later than in *T. argo*, at least after some minutes of cataleptic insertion, during which the male appears to die of fatigue. Also here the palp remains on the female for many hours. However, the main holdfast structures for genital coupling are sclerites and not palpal membranes (Figures 307–310): the cymbium locks behind the epigynal protuberance in a fold of the integument, whereas the conductor adjoins the anterior side of the epigynum. Emasculation obviously also occurs in the South American *E. cartum*, as a female was collected with attached male palp (Ramirez and

Gonzalez 1999). The protruding cymbium was found to even pierce the female's cuticle, thereby leaving copulatory scars.

Natural history

Web. Similar to that of *Tidarren*.

Enemies. In some retreats of *Echinotheridion gibberosum* from Tenerife the characteristic cocoons of the genus *Ero* (Mimetidae) were present, which may indicate possible predation by this araneophagic spider.

Distribution (Figure 51)

Echinotheridion gibberosum is apparently endemic to the Canary Islands and Madeira. The other eight species are restricted to South America: *E. andresito* Ramirez and Gonzalez, 1999 known from Brazil and Argentina; *E. cartum* Levi, 1963 from Brazil, Paraguay, and Argentina; *E. elicolum* Levi, 1963 from Venezuela; *E. levii* Ramirez and Gonzalez, 1999, *E. lirum* Marques and Buckup, 1989, *E. urarum* Marques and Buckup, 1989, and *E. utibile* (Keyserling, 1884) from Brazil, and *E. otlum* Levi, 1963 from Ecuador (Platnick 2006).

Discussion

The one-palped spiders constitute a well-defined and conspicuous taxonomic group within Theridiidae, although discovered rather recently by Chamberlin and Ivie (1934) and Levi (1963). However, the generic separation of *Tidarren* and *Echinotheridion* has been discussed controversially (Wunderlich 1987, 1992; Schmidt 1990), since the proposed synonymy with *Tidarren* by Wunderlich (1987) has been withdrawn again (Schmidt 1990; Wunderlich 1992). Both genera appear to share a number of synapomorphic characters, such as palp amputation, overall copulatory behaviour accompanied by sexual cannibalism, sexual size dimorphism, and morphology of the male palp, e.g. the modified cymbium, the large development of the tegulum, and the enormous fundus of the sperm duct. Generic differentiation is based mainly on the female coxal spurs present in *Echinotheridion* (Figures 23, 24) and on details of the male palp and epigynum. For a better understanding of these relationships a more profound knowledge of the species of *Echinotheridion* is required. Seven out of the nine species are known from one sex only. In recent taxonomic works the generic rank of *Echinotheridion* has not been doubted any more (Marques and Buckup 1989; Ramirez and Gonzalez 1999).

In the comprehensive phylogenetic analysis of Theridiidae by Agnarsson (2004) *Tidarren* is placed in the derived subfamily Theridiinae owing to reduction of trichobothria on the male palpal tibia and absence of a colulus. For *Echinotheridion* a similar assignment was suggested. Interestingly, some of the copulatory features of the one-palped spiders are widespread in basal theridiids and apparently have been retained here, as copulation takes place via a mating thread and sperm induction is independent of copulation (Knoflach 2004). Close affinities evidently exist with *Achaearanea* in general morphology and habits, for its morphological and genetic conformity and close phylogenetic relationship see Agnarsson (2004) and Arnedo et al. (2004). Surprisingly, sister relationship of *Echinotheridion* and *Tidarren* is rejected in a recent phylogenetic study based on molecular and morphological data (Agnarsson forthcoming).

According to their world distribution the subtropical to tropical spider genera *Tidarren* and *Echinotheridion* pose a classical biogeographical problem owing to their disjunct distribution in South America and Africa. Their occurrence in the Old World includes continental Africa, Madagascar, Cape Verde Islands, Canary Islands, and Yemen (Figure 51). There are no records from Asia and Australia. No fossil records exist for one-palped spiders (J. Wunderlich, personal communication). Anyway, their phylogenetic placement among Theridiinae (Agnarsson 2004) suggests that this lineage is too recent for a Gondwanan fragmentation. Oldest fossil Theridiinae trace back to the Dominican amber, being only 10–30 million years old (Wunderlich 1988, 2004). Thus, one-palped spiders must have spread rather late, probably by ''oceanic dispersal'' (de Queiroz 2005), resulting in the current cross-continental ''amphi-Atlantic'' distribution.

As a result of the present study, the genus *Tidarren* is known from 21 species in the Old World. Hot spots of species diversity are in particular in Africa and Yemen, whereas *Echinotheridion* seems to be largely vicariant in South America. Another remarkable gross vicariance pattern is evident when comparing the world distribution of the speciose genus *Achaearanea*. This genus shows its highest diversity in the tropics of America (about 40% of species) and SE Asia (about 30% of species; see Platnick 2006), whereas only two species (out of more than 140) are known from mainland Africa. There, it appears to be replaced by *Tidarren*, at least at large scale. This may be supported also by the personal collections of A.v.H. in mainland Yemen, where six *Tidarren* species were found, but no *Achaearanea*, while in the Socotra archipelago only *Achaearanea* turned up.

At present, lack of knowledge and sampling does not allow assessment of the distribution pattern at species level. Almost 40% of the Old World species are recorded from single localities, with allopatric occurrence being predominant. In only a few localities, e.g. in Yemen, two or three species occurred sympatrically. *Tidarren cuneolatum* shows the most widespread distribution area, as this species behaves hemisynanthropically. According to preliminary evidence the Malagasy representatives appear to be distinct from the continental African species. These regions have no species in common. The American species of *Tidarren* differ from the Old World representatives in genital morphology, the copulatory orifices being widely separated in the *T. sisyphoides* group and the conductor of the male palp forming a small, hyaline appendage. Moreover, sexual size dimorphism is much more pronounced in the American species, presumably owing to female giantism coupled with a decrease of male size (Hormiga et al. 2000). Hence these species separate unequivocally in a distinct group, which evidently mirrors biogeographical splitting.

The spider genera with a single male palp exhibit interesting morphological and behavioural traits, which still deserve further research in evolutionary biology, but they also hide numerous problems concerning biogeography, taxonomy, and phylogenetics. The present study should draw attention to these outstanding, though long-neglected spiders.

Key to the *Tidarren* species of Yemen

Females

1. Abdomen rounded (Figures 62–67, 73, 142) 2
– Abdomen with dorsal tubercle (Figures 81–84, 104, 116–123, 134, 135, 141a) . 3

2. Epigynal protuberance broad, strongly protruding (Figures 25, 26, 56–61, 73), pointing anteriorly; common copulatory orifice at anterior border of epigynal protuberance (Figures 26, 57, 59, 61) . *T. argo* Knoflach and van Harten, 2001

– Epigynal protuberance inconspicuous, weakly protruding (Figures 142, 147–153), pointing posteriorly; common copulatory orifice at centre of protuberance (Figures 147, 149) . . . . . *T. sheba* n. sp.

3. Sternum with small tubercle between coxae IV (Figures 16, 17) 4
– Sternum without posterior tubercle 5

4. Epigynal protuberance short, stout, curved in side view (Figures 17, 111–115, 120), about half as long as receptacula, directed ventrally . . . . *T. dentigerum* n. sp.
– Epigynal protuberance long and strongly protruding, pointed, cone-shaped (Figures 16, 136–140, 141a), as long as receptacula, directed anteriorly . . . . . *T. konrad* n. sp.

5. Epigynal protuberance long (Figures 27, 95, 97–102), longer than or equal to receptacula, evenly narrowing, clearly delimited from surrounding epigastric region in aboral view; large species, carapace width 1.0–1.3 mm . . . . . *T. cuneolatum* Tullgren, 1910
– Epigynal protuberance short (Figures 128–131), shorter than receptacula, abruptly narrowing, not clearly delimited from surrounding epigastric region in aboral view; small species, carapace width 0.6–0.8 mm . . . . *T. gracile* n. sp.

Males

1. Abdomen rounded (Figures 62–65, 75–77) 2
– Abdomen with dorsal tubercle (Figures 78–80, 116, 132) 3

2. Cymbium distally broad, with teeth; embolus short (Figures 50, 52–55, 154); haematodochae modified (Figures 41, 72) *T. argo* Knoflach and van Harten, 2001
– Cymbium tapering, without teeth, but with ridges, embolus rather long (Figures 143–146, 155); haematodochae normal (as in Figure 94b) *T. sheba* n. sp.

3. Cymbium with large finger-like process and conspicuous teeth and ridges (Figures 79, 105–110) . . . . . *T. dentigerum* n. sp.
– Cymbium inconspicuous, without teeth, but with some ridges (Figures 85–88, 92, 124–126, 156) 4

4. Cymbium distally with two distinct hairy lobes (Figure 92); distal tibial rim facing bulbus about as wide as palpal organ (Figures 89–91); base of tibia comparatively broad; basal segments of palp and cymbium dark brown; prolateral part of conductor conspicuous (Figures 85–88). . . . . *T. cuneolatum* Tullgren, 1910
– Distal lobes of cymbium less distinct (Figure 156); distal tibial rim facing bulbus about 0.6 the width of palpal organ (Figure 127); base of tibia slender; basal segments of palp and cymbium pale yellow; prolateral part of conductor less prominent (Figures 124, 125) . . . . . *T. gracile* n. sp.

Provisional key to the *Tidarren* species of Africa mainland and Madagascar (females only)

1. Abdomen rounded or abdominal tubercle inconspicuous (Figures 62–67, 73, 181, 182, 184, 185, 188) 2
– Abdomen with distinct dorsal tubercle (Figures 172–180, 183, 186, 187, 192) . 6

2. Epigynal protuberance tongue-like, hairy, rounded, occupying main part of epigastric region (Figures 188, 234–237), more than twice as long as receptacula; copulatory orifice situated level with anterior end of receptacula . . . . . *T. dasyglossa* n. sp. (Madagascar)
– Otherwise 3

3. Entire epigastric region strongly projecting and sclerotized (Figures 184, 185, 243–246); epigynal protuberance as in Figures 243–246 . . . . . *T. horaki* n. sp. (Madagascar)
– Entire epigastric region not strongly projecting (e.g. Figures 181–183, 186) . . 4

4. Epigynal protuberance very slender (Figures 181, 182, 222–225); abdomen rounded . . . . . *T. ubickorum* n. sp. (South Africa)
– Epigynal protuberance comparatively broad (Figures 25, 56–61, 208–211) . . 5

5. Copulatory ducts fused at entrance, long, running anteriorly; common copulatory orifice far behind receptacula (in ventral view, Figures 57, 59, 61); epigynal protuberance as in Figures 56–61; abdomen usually rounded; comparatively large species, carapace width 0.8–0.9 mm . . . . . *T. argo* Knoflach and van Harten, 2001 (Chad, Yemen)
– Copulatory ducts separate, short, running posteriorly; copulatory orifice level with posterior half of receptacula (in ventral view, Figure 209); epigynal protuberance see Figures 208–211; abdomen with indistinct tubercle; comparatively small species, carapace width 0.5–0.6 mm . . . . . *T. levii* Schmidt, 1957 (Democratic Republic of Congo)

6. Sternum with small tubercle between coxae IV, epigynal protuberance as in Figures 174, 196–199 . . . . . *T. circe* n. sp. (Namibia)
– Sternum without posterior tubercle 7

7. Epigynal protuberance broadly rounded, scarcely tapering, short and therefore rather inconspicuous (Figures 157–163, 172, 178, 180, 186, 216–221, 251–258) 8
– Epigynal protuberance distinctly tapering and pointed, long, or otherwise . 10

8. Large species, carapace width 1.4–1.6 mm, tibia I 2.1–2.3 mm; abdomen ending in high dorsal tubercle (Figures 178–180); epigynum see Figures 216–221 . . . . . *T. scenicum* (Thorell, 1899) (widespread in Africa)
– Comparatively small species, carapace width 0.9–1.1 mm, tibia I 1.0–1.5 mm; abdominal tubercle lower (Figures 172, 186, 192) 9

9. Copulatory orifice at centre of epigynal protuberance, which therefore is laterally incised (Figures 157–163); in aboral view protuberance gradually fuses with surrounding integument, more sclerotized than adjacent integument . . . . . *T. aethiops* n. sp. (Democratic Republic of Congo)
– Copulatory orifice at anterior border of epigynal protuberance, which is evenly rounded laterally (Figures 251–258); in aboral view protuberance is clearly delimited from the surrounding integument, less sclerotized than adjacent integument . . . . . *T. obtusum* n. sp. (Madagascar)

10. Epigynal protuberance long and distinctly protruding (Figures 81–84, 95, 97–102, 175, 176, 183, 200–207, 226–229) 11

– Epigynal protuberance comparatively short and less protruding (Figures 164–171, 173, 177, 187, 212–215, 230–233) 14

11. Epigynal protuberance noticeably protruding, 0.3 mm long, about twice as long as receptacula (Figures 204–207) *T. lanceolatum* n. sp. (Democratic Republic of Congo)
– Epigynal protuberance less protruding, about 0.15 mm long, as long as receptacula 12

12. Epigynal protuberance curved posteriorly, forming a hooknose (Figures 183, 226–229) . . . . . *T. usambara* n. sp. (Tanzania)
– Epigynal protuberance straight (Figures 81–84, 95, 97–102, 175, 200–203) . 13

13. Copulatory ducts separate, running posteriorly and laterally (Figures 27, 95, 97–102), epigynal protuberance relatively slender . . . . . *T. cuneolatum* Tullgren, 1910 (widespread in Africa)
– Copulatory ducts fused at entrance, running anteriorly and laterally (Figures 200–203), protuberance comparatively broad at base . *T. griswoldi* n. sp. (Cameroon)

14. Copulatory orifices in ventral view close to anterior end of receptacula, epigynal protuberance nose-like, with posterior hump (Figures 187, 230–233), a little shorter than receptacula; receptacula seminis rather long, 0.2 mm long . . . . . *T. apartiolum* n. sp. (Madagascar)
– Copulatory orifices in ventral view close to posterior end or at posterior half of receptacula; epigynal protuberance otherwise and without posterior hump (Figures 164–167, 212–215) 15

15. Copulatory orifices in ventral view at posterior half of receptacula; copulatory ducts run laterally, rather short; epigynal protuberance triangular (Figures 212–215), about 0.7 the length of receptacula; receptacula seminis 0.12 mm long. . . . . *T. perplexum* n. sp. (Cameroon, Democratic Republic of Congo)
– Copulatory orifices in ventral view behind posterior end of receptacula; copulatory ducts run anteriorly in parallel; epigynal protuberance with rounded tip (Figures 164–167), less than half the length of receptacula; receptacula seminis fairly large, 0.2 mm long . . . . . *T. afrum* n. sp. (Cameroon, Uganda)

Provisional key to the *Tidarren* species of America

1. Females 2
– Males 4

2. Abdomen rounded or abdominal tubercle inconspicuous (Figures 1a, 260a, 286–289) 3
– Abdomen with distinct dorsal tubercle; epigynum as in Figures 272–275; copulatory orifices at central anterior border of epigynal protuberance; copulatory ducts relatively long, forming a wide coil . . . . . *T. mixtum* (O. P.-Cambridge, 1896) (male unknown)

3. Epigynal protuberance rather small, triangular (Figures 267–271); copulatory orifices at anterior sides of epigynal protuberance; copulatory ducts forming a small coil . . . . . *T. haemorrhoidale* (Bertkau, 1880)

– Epigynal protuberance strongly developed, broad at base, ending in slender tip, heavily sclerotized (Figures 280–284); copulatory orifices widely separated, at anterior border of epigynal protuberance; copulatory ducts very short . . . . . *T. sisyphoides* (Walckenaer, 1842)

4. Cymbium protruding considerably beyond bulbus, distal process facing away from bulbus (Figures 276–279); ground colour reddish brown; legs uniformly reddish brown; total body length 1.4–1.6 mm . . . *T. sisyphoides* (Walckenaer, 1842)
– Cymbium scarcely protruding beyond bulbus, without distal process (Figures 261–264); ground colour pale yellow; legs pale yellow with dark annulations and spots; total body length 1.1–1.4 mm. . . . . *T. haemorrhoidale* (Bertkau, 1880)

Descriptions

Tidarren argo Knoflach and van Harten, 2001

(Figures 7, 8, 18–20, 22, 25, 26, 31–33, 38, 41–44, 50, 52–76, 259c; Tables I, II)

Theridion cuneolatum (Tullgren): Denis 1955, p 2, Figures 2–4, ♀ Tibesti, misidentified.

Type material

Yemen: Khamis Bani Sa'd, 15°11′N, 43°25′E, 550 m, route Sana'a–Al Hudaydah, 27 July 1999, leg. A. van Harten, reared to adulthood in captivity, see Knoflach and van Harten (2001).

Other material examined

Yemen: ♂♀ ex ovo breeding, Khamis Bani Sa'd. 1♂, 2♀ (♂ adult on 9 April 2000, ♀ on 13 April and 29 April 2000), NMBS, ibidem, 28 March 2000, leg. A. van Harten. 1♀, NMBS, Sana'a, 15°21′N, 44°13′E, 2300 m, 30 October 1999, in garden, leg. A. van Harten. 3♀, CTh, near Hammam 'Ali, 14°41′N, 44°08′E, 1600 m, 18 April 2001; 2♀, NMW, 26 June 2001, below tree trunk, leg. A. van Harten. 1♂, 1♀, CTh, ar-Rujum, 15°26′N, 43°40′E, 1900 m, 9 April 2001, ♀ under stone, ♂ beaten from vegetation, leg. A. van Harten. 1♂, NMW, near Hajjah, 15°42′N, 43°35′E, 25 June 2002, leg. A. van Harten. **Chad**: 1♀, 1sad♀ (MNHN AR 2368), Tibesti, source de Yerra, S of Koussi, 19°49′N, 18°30′E, 1000 m, 1 December 1949, leg. P. de Miré, det. Denis (1955, sub *Theridion cuneolatum*).

Description

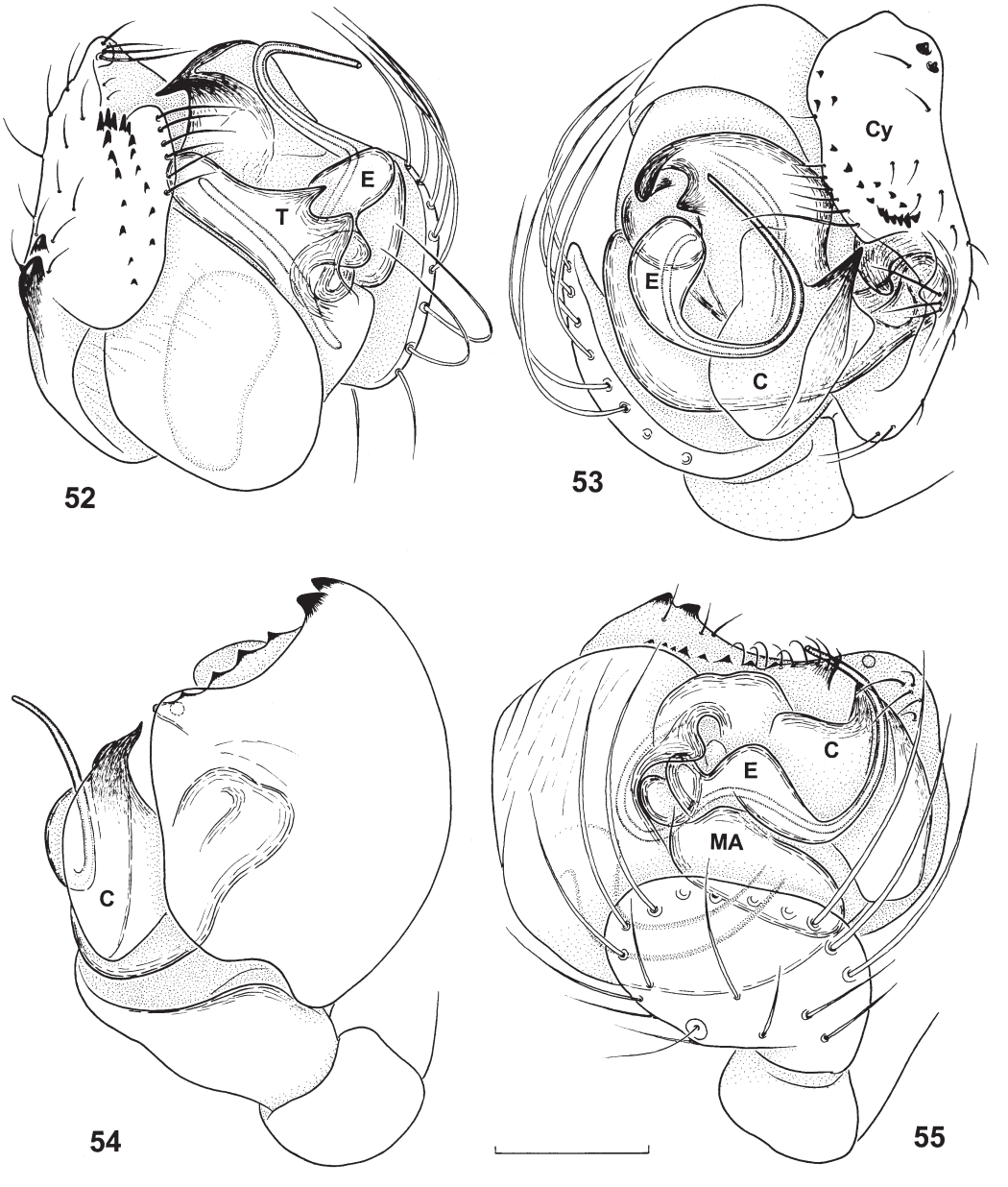
Denis (1955, sub *Theridion cuneolatum*), ♀; Knoflach and van Harten (2001), ♂♀.

Etymology

The specific name refers to the copulatory behaviour of this species, sharing some analogies with the cephalopod *Argonauta argo* L., 1758 (Knoflach and van Harten 2001).

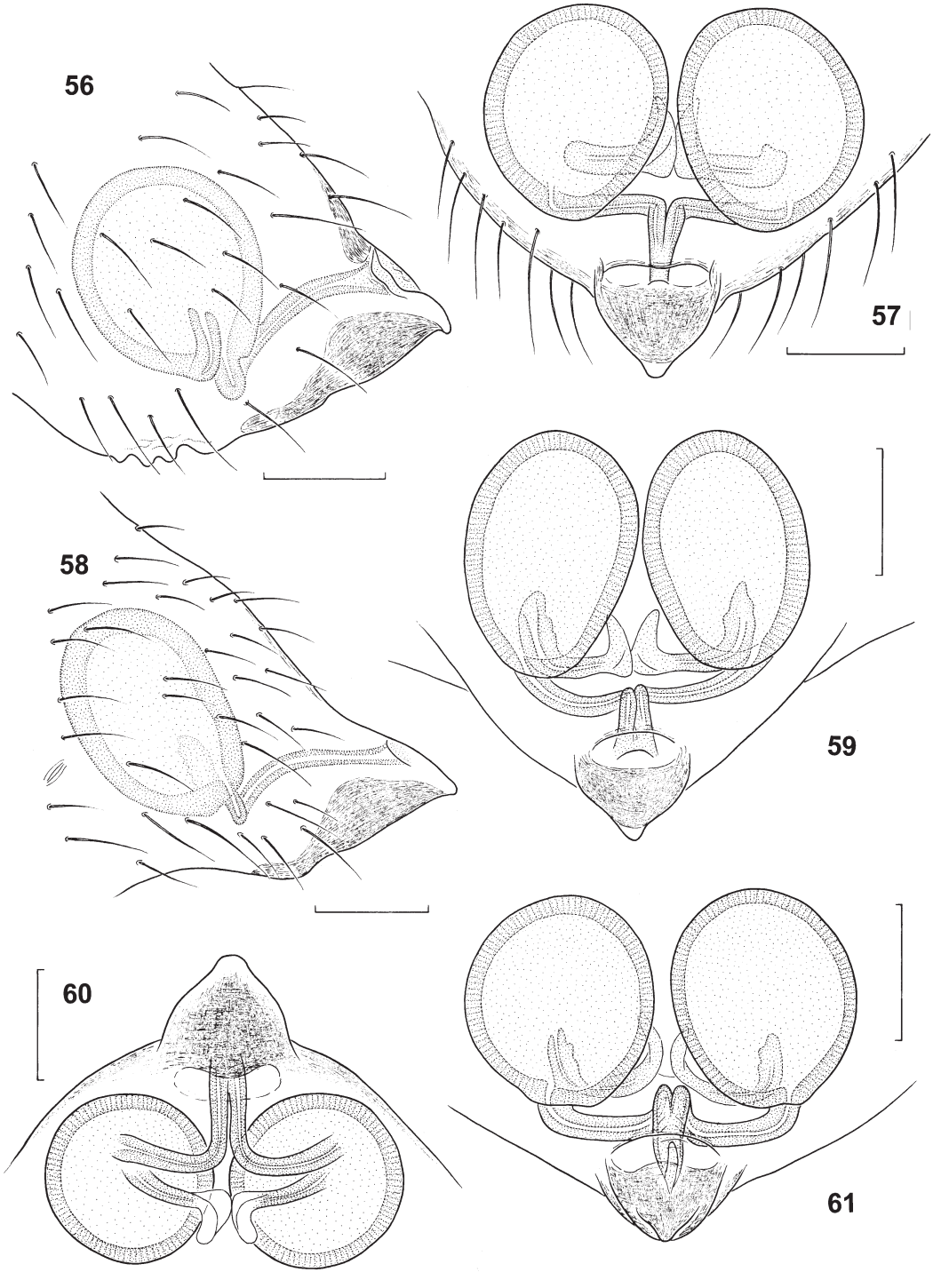
Diagnosis

Tidarren argo is distinguished from most of its Yemeni congeners by having the abdomen rounded (Figures 62–69, 73, 75, 76). Epigynal protuberance broad and strongly protruding

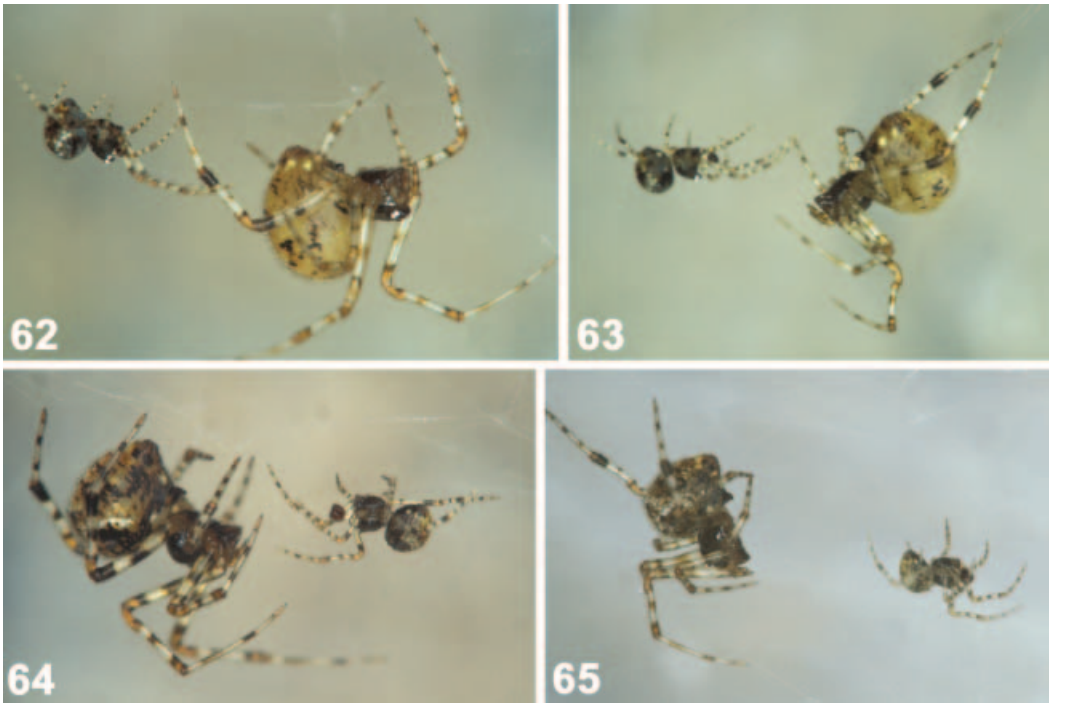


Figures 52–55. *Tidarren argo* Knoflach and van Harten from Yemen. Male palp, anterior (52), retrolateral-dorsal (53), retrolateral (54), dorsal view (55). Scale bar: 0.1 mm.

(Figures 56–61, 73), copulatory orifices fused to tiny atrium and copulatory ducts long. The male palp differs by the broad cymbium (Figures 50, 52–55), with distal teeth, by the shape of conductor and distal rim of tegulum and in particular by the system of haematodochae when expanded (Figures 41, 67–69, 72). Ethological traits distinct from other species: copulation with palp amputation performed by the female (emasculation) when contact of genitalia is achieved (Figures 66–69).



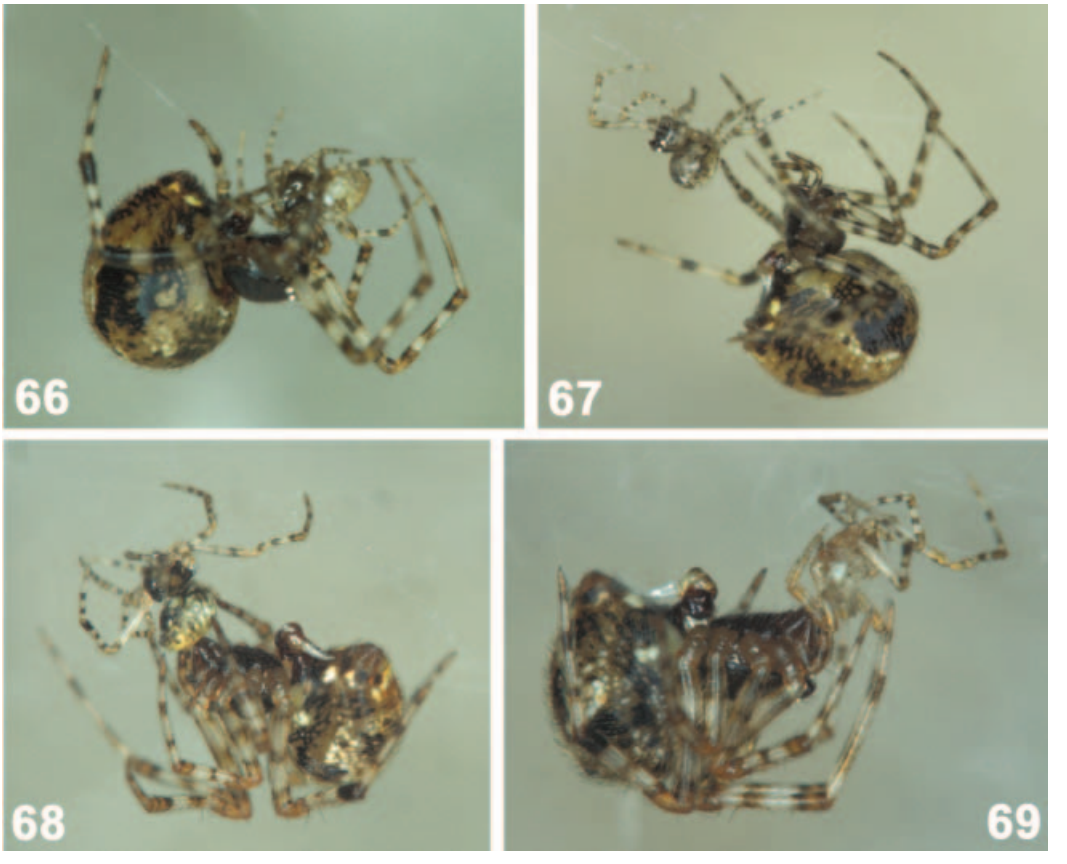
Figures 56–61. *Tidarren argo* Knoflach and van Harten from Yemen, Hammam 'Ali (56, 57, 60), Khamis Bani Sa'd (61), and from Tibesti (58, 59). Female epigynum/vulva in lateral (56, 58), ventral (57, 59, 61), and aboral view (60). Scale bar: 0.1 mm.



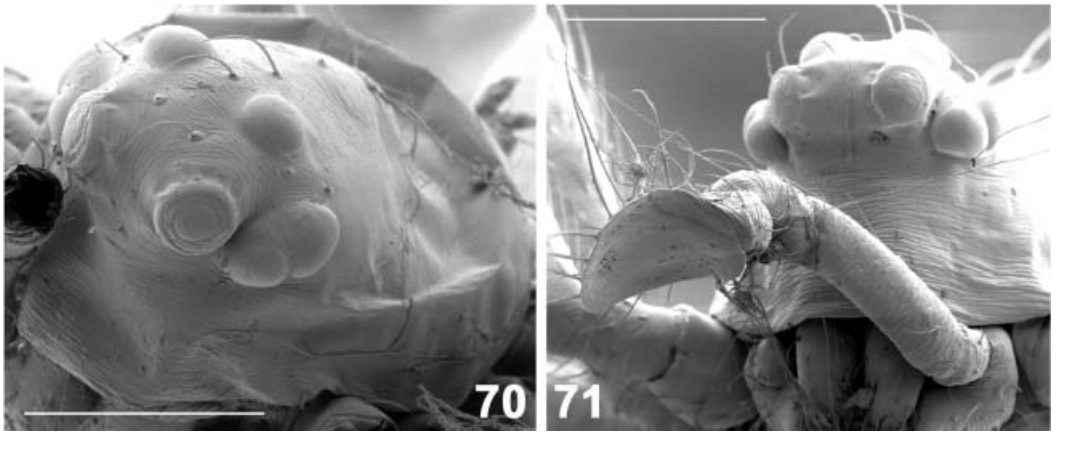
Figures 62–65. *Tidarren argo* Knoflach and van Harten from Yemen, copulatory behaviour. (62) Direct courtship, male palpating hind leg of female. (64) Courtship, male circuiting female. (63, 65) Female in copulatory posture with legs III close together on mating thread, thereby guiding male to epiygnum. (63) Male approach along mating thread. (65) Male leaving female after unsuccessful insertion attempt and returning to starting position on mating thread.

Measurements (mm)

[♂/♀, *n*=12/11, minimum–maximum (mean).] Total length 0.97–1.15 (1.07)/2.35–2.82 (2.61), carapace length 0.45–0.53 (0.48)/0.88–1.05 (0.97), width 0.39–0.47 (0.43)/0.80–0.94 (0.88), length femur I 0.57–0.66 (0.62)/1.33–1.62 (1.47), tibia I 0.35–0.43 (0.39)/0.78–0.98 (0.88). Abdomen 0.69–0.79 (0.76)/1.36–2.84 (2.00) high, 0.57–0.73 (0.64)/1.12–2.52 (1.72) long and 0.55–0.67 (0.60)/1.04–2.08 (1.55) wide (*n*=8/8). Ventral side (distance petiolus to spinnerets) 0.44–0.53 (0.48)/0.84–1.32 (1.13) long. Clypeus 0.16–0.22 (0.19)/0.18–0.29 (0.24) high (*n*=8/8). Chelicerae 0.12–0.20 (0.17)/0.30–0.46 (0.37) long (*n*=8/8). Sternum about as long as wide, 0.28–0.32 (0.30)/0.48–0.65 (0.60) long and 0.28–0.32 (0.30)/0.48–0.63 (0.57) wide (*n*=8/8). Labium 0.11–0.14 (0.12)/0.20–0.28 (0.25) wide and 0.05–0.06 (0.05)/0.12–0.16 (0.14) long (*n*=5/8). Gnathocoxae 0.16–0.18 (0.16)/0.32–0.42 (0.36) long and 0.05–0.07 (0.06)/0.14–0.20 (0.17) wide (*n*=5/8). Femur of male palp ca 0.2 long. Leg formula 1423, see Tables I, II. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 2/1, of legs I–IV 2/2, 2/1, 2/2, 2/3 in female and IV 2/1, 2/1, 2/2, 2/2 in male (2♂, 2♀ examined). Metatarsi I–III with one trichobothrium, position on I 0.26–0.29 (0.24–0.27), on II 0.33–0.35 (0.30–0.31), on III 0.38 (0.34–0.38). Tarsal claws of legs with three to four side teeth (Figure 33). Claw of female palp consisting of seven to eight teeth (Figure 31). Tarsal organ on female palp at 0.85–0.88, on female (male) legs I–IV 0.39–0.45 (0.31–0.37), 0.31–0.39 (0.25–0.29), 0.26–0.30 (0.23–0.25), 0.26–0.30 (0.27) [*n*=2].



Figures 66–69. *Tidarren argo* Knoflach and van Harten from Yemen, copulatory behaviour. (66) First seconds of insertion. (67–69) Emasculation completed. Male palp twisted off by female and attached to epigynum, acting independently of male. (68, 69) Female occupied with mate consumption.



Figures 70, 71. *Tidarren argo* Knoflach and van Harten from Yemen. Male after copulation with shrivelled prosoma (70) and palp separated between tibia and tarsus (71). Scale bars: 0.2 mm.

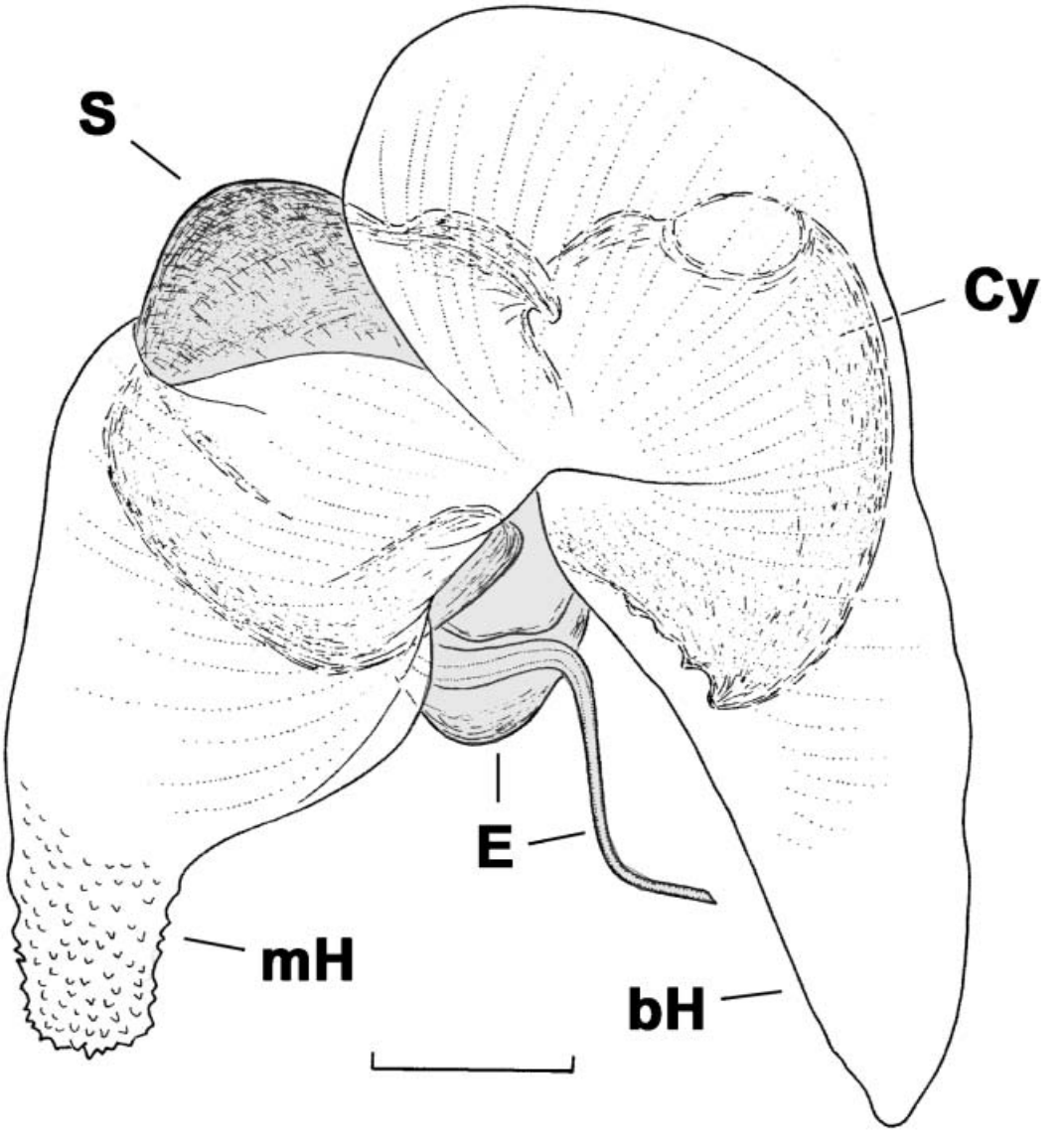
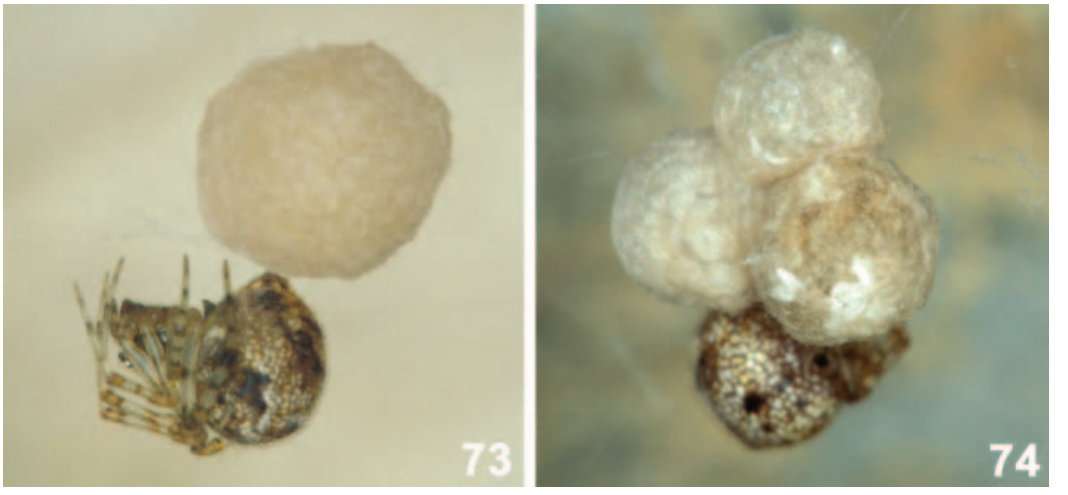


Figure 72. *Tidarren argo* Knoflach and van Harten from Yemen. Male palp with expanded horn-shaped haematodochae which keep palp fastened to epigynum. Basal haematodocha (posterior horn) pressed against the female's venter, median one (anterior horn) towards her epigaster.

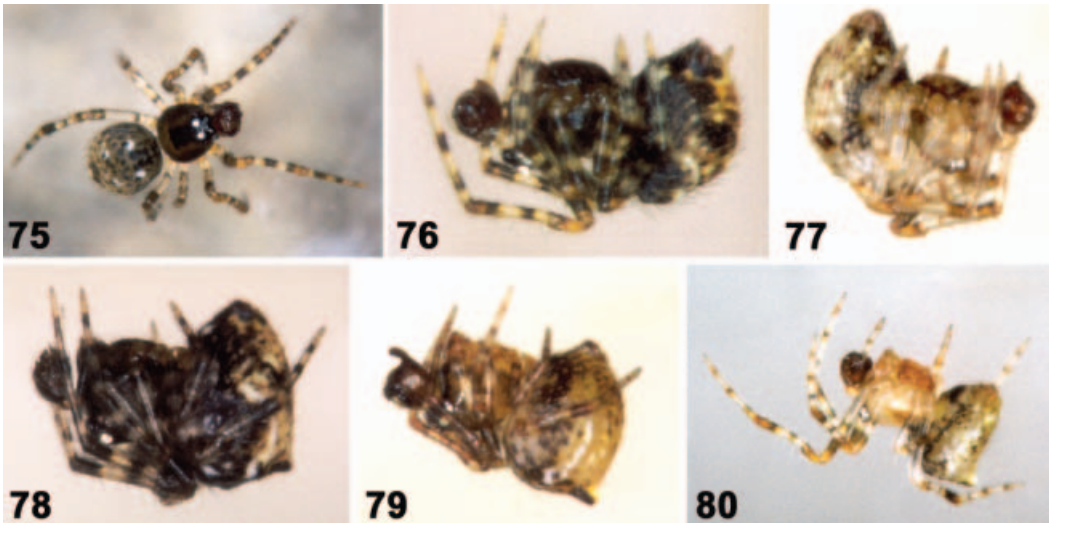
Somatic features, colouration (Figures 62–69, 73–76)

Sternum without posterior knob. Abdomen rounded, without tubercle, higher than long. Carapace uniformly dark brown in female. In male carapace brown to dark brown with darkened margins and darkened median band from eye region to centre. Chelicerae light brown, slightly suffused with grey. Sternum, gnathocoxae, and labium dark brown. Legs and female palp pale yellow to yellow brown with dark patches and annnulations. Basal segments of male palp pale yellow, cymbium yellow brown. Abdomen yellow to light



Figures 73, 74. *Tidarren argo* Knoflach and van Harten from Yemen. (73) Female guarding egg-sac. (74) Further egg-sacs are attached at intervals of about 2 weeks and guarded. Upper one already hatched, right with first instars emerged from the eggs, left with eggs just deposited.

brown, speckled, dorsally and laterally with numerous dark spots of various extent and white guanin patches. Anterior half dark with some white patches, posterior half light with a few dark markings. A small dark patch in apical region. Aboral region with indistinct white median stripe from apex to spinnerets and dark transverse arches. Epigaster dark brown in both sexes, book lung covers pale yellow. Venter with two white paramedian patches between epigastric furrow and spinnerets. Further white patches encircle spinnerets. Spinnerets brown to dark brown.



Figures 75–80. Male habitus. (75, 76) *Tidarren argo* Knoflach and van Harten. (77) *T. sheba* n. sp. (78) *T. cuneolatum* (Tullgren). (79) *T. dentigerum* n. sp. (80) *T. gracile* n. sp. All specimens from Yemen.

Table I. Leg measurements (mm) of *Tidarren argo* Knoflach and van Harten, female (n=2), minimum–maximum.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.22–0.30	0.14–0.19	0.14–0.19	–/–	0.26–0.33	0.76–1.00
I	1.23–1.74	0.39–0.50	0.73–1.00	1.02–1.40	0.55–0.67	3.92–5.34
II	0.84–1.19	0.34–0.47	0.46–0.70	0.67–0.92	0.44–0.53	2.76–3.81
III	0.62–0.92	0.28–0.37	0.35–0.50	0.46–0.65	0.40–0.46	2.10–2.89
IV	1.01–1.59	0.37–0.50	0.62–0.87	0.79–1.14	0.51–0.60	3.30–4.69

Male palp (Figures 41–44, 50, 52–55, 72)

Tibia not as wide as bulbus, tapering distinctly at base. Cymbium about as long as wide (ca 0.3 mm), distally not tapering, but broad (Figures 50, 52–55), with several teeth and hairs at end (Figures 43, 52–55), hairless at base. Cymbium slightly longer than bulbus. Distal rim of tegulum with two small, triangular projections near embolar base, a rounded and a pointed one (Figure 52). Retrolateral membranous part of conductor 0.16 mm long, its tip pointed and sclerotized, with furrow guiding the embolus (Figures 52–54); prolateral part rounded, inconspicuous. Embolar base suboval and rather slender. Distal part of embolus ca 0.2 mm long. The male palp of *T. argo* differs from its congeners when inflated by a special haematodochal system. Basal and median haematodochae form large horns (Figures 41, 72), which anchor the separated palp to the epigynum after emasculation, see also copulatory behaviour (Figures 67–69).

Epigynum (Figures 25, 26, 56–61)

Epigynal protuberance pointed, broadly protruding, ca 0.1 mm long, directed anteriorly towards posterior end of sternum (Figure 73); surrounded by strongly projecting epigynal region, which covers almost entire epigastric region (Figures 25, 26). In side view, tip of protuberance slightly recurved, posterior part of protuberance sclerotized, anterior part light (Figures 56, 58). Copulatory ducts 0.16–0.18 mm long, fused near entrance. After a short anterior course they diverge laterally and enter receptacula posteriorly. Common copulatory orifice situated in front of anterior border of epigynal protuberance (Figures 26, 57, 59, 61); in ventral view far behind receptacula. Receptacula seminis 0.16–0.19 mm long and 0.13–0.15 mm wide. Epigynal protuberance shorter than receptacula (Figures 57, 59, 61).

Taxonomic remark

The specimen from Tibesti differs slightly by having its epigynal protuberance a little more slender (Figure 58 versus Figure 56) and the receptacula longer than wide (Figure 59 versus Figures 57, 61). Moreover, there is a tiny, inconspicuous abdominal tubercle. It is not yet possible to judge this variation precisely. Dimensions are similar to the Yemeni specimens

Table II. Leg measurements (mm) of *Tidarren argo* Knoflach and van Harten, male (n=2), minimum–maximum.

	Fe	Pa	Ti	Mt	Ta	Total
I	0.66–0.67	0.21–0.22	0.41–0.46	0.42–0.48	0.32–0.34	2.03–2.14
II	0.46–0.50	0.19–0.21	0.27–0.30	0.28–0.32	0.30–0.31	1.48–1.62
III	0.38–0.46	0.16–0.17	0.20–0.21	0.20–0.23	0.27–0.28	1.20–1.34
IV	0.52–0.57	0.19–0.21	0.32–0.35	0.32–0.33	0.31–0.31	1.65–1.77

(carapace length 1.00, width 0.96, femur I 1.66, sternum 0.64 long and 0.60 wide, clypeus 0.26 mm high), only tibia I is a little longer (1.17 mm). Denis (1955) identified the female from Tibesti as *T. cuneolatum* with some doubt.

Copulatory behaviour (Figures 62–72)

Courtship. During courtship females continuously vibrate their bodies and move their legs II. The male carefully walks around the female and from time to time palpates the female's legs or body (Figure 62). After ca 10 min of such mutual courtship, he installs a mating thread from the female's vicinity to a distance of 3–4 cm away. At the opposite end, the male then plucks intensively. This vibratory signal induces the female to approach him along the thread and to adopt the copulatory posture (Figures 63–65).

Copulation. The ensuing copulation proceeds in a fairly unusual manner (Knoflach and van Harten 2001). At the immediate beginning of insertion the male palp becomes torn off by the female. She turns quickly around the only contact zone between the pair, the palp–epigynum connection, until the single palp of the male breaks off (Figures 66–69). The point of detachment is between the tibia and tarsus (Figures 67, 71). This emasculation is accomplished within half a minute and after 3–14 rotations of the female. The amputated gonopod remains attached to her epigynum for several hours (4–5 h on average, up to 10 h), presumably allowing sperm transfer and, moreover, acting as a mating plug. At the same time the palpless male is sucked out by the female (Figures 68, 69). Special haematodochal structures provide a tight holdfast (Knoflach and van Harten 2001). With the abrupt increase of hydraulic pressure at the beginning of insertion the basal and median haematodochae inflate and form a large posterior and anterior horn (Figures 41, 67, 68, 72). These are pressed against the female's epigaster and venter (Figures 67–69). Obviously, there is no loss of haemolymph, and the volume of the haematodochal horns does not decrease noticeably in the detached palp. The female removes the gonopod usually after consuming the male, by either pushing it away with her hind legs or, indirectly, by circling again, so that the projecting palp becomes fixed to the threads of the web and finally is torn off. Thereafter it is sucked out at the haematodochal horns.

Natural history

From the fifth day after copulation onwards the female proceeds with the production of egg-sacs, altogether five to six at intervals of 1–2 weeks (Knoflach and van Harten 2001). Three females were observed to build their first cocoon even on the fourth day after copulation. The brownish, round egg-sacs are attached together and guarded by the female (Figures 73, 74). Each egg-sac contains about 40 hatchlings. Hatchlings appear about 2 weeks after egg-laying. Observations on development indicate rapid post-embryonic development. Males become adult after three moults within about 18 days after hatching, females after 36 days. The subadult males matured after 7–9 days. Adult females live for 3–5 months (Knoflach and van Harten 2001). The species apparently tolerates a certain amount of inbreeding. On a few occasions females were observed to copulate with their offspring.

Parasites. One juvenile female collected on 27 July 1999 in Khamis Bani Sa'd was infested by a mermithid (Nematoda), which emerged from the spider on 6 August.

Distribution, habitat (Figure 259c)

Tidarren argo is known from several localities in Yemen and from a single record from Tibesti. In the type locality it was collected from old stumps of banana up to 60 cm, in banana plantations in a valley bed with a permanent river at 500 m a.s.l. surrounded by rocky mountains 1000 m high. In Sana'a *T. argo* occurred in a garden, where *T. cuneolatum* also lives in large numbers. At Hammam 'Ali it was found under an old tree trunk, at ar-Rujum under a rock, in both cases in agricultural areas. The specimens from Tibesti came from a small grotto at 1000 m altitude, ''petite grotte sous la grande cascade de la source de Yerra'' (Denis 1955).

Tidarren cuneolatum (Tullgren, 1910)

(Figures 2, 9, 11–15, 27, 34, 35, 45–49, 78, 81–104, 121, 259c; Tables III–V)

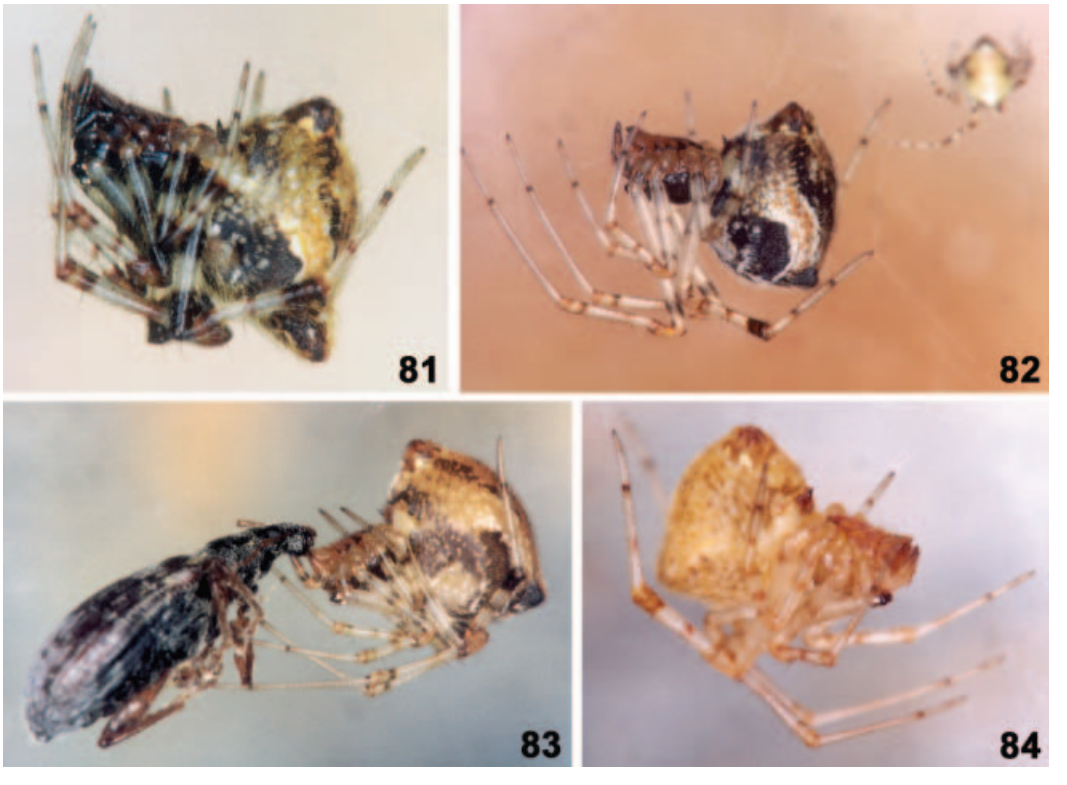
Theridion cuneolatum Tullgren 1910, p 132, Plate 2, Figure 48; n. sp., ♀, type locality Kibonoto, Kenya, leg. Sjöstedt.

Theridium scenicum Thorell: Simon 1907, p 40, misidentification.

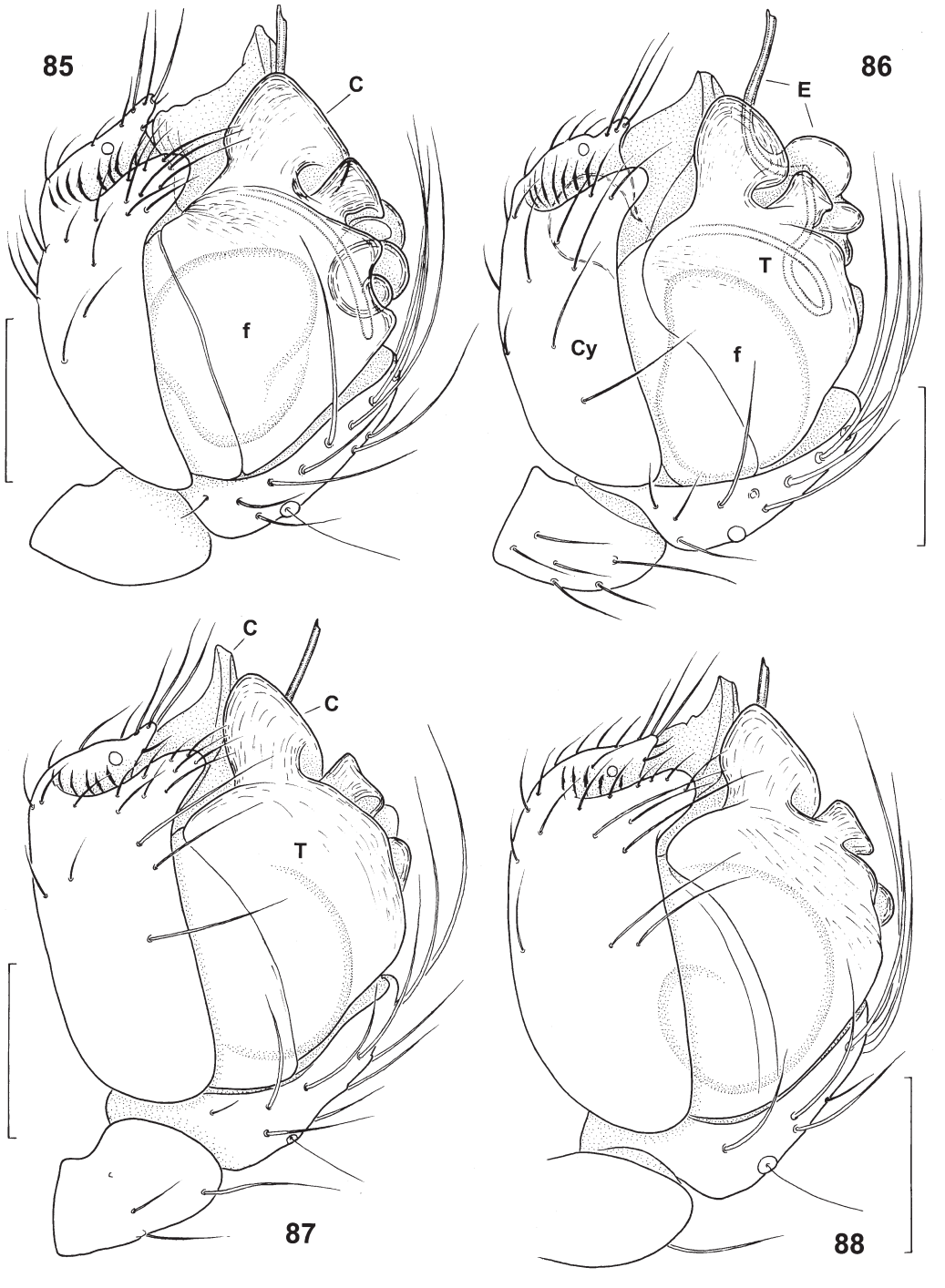
Theridion chevalieri Berland 1936, p 82, Figures 28, 29; n. sp., ♀, type locality Santo Antao, Cape Verde Islands, leg. Chevalier. Nov. syn.

Tidarren chevalieri: Schmidt et al. 1994, p 93, Figures 5, 6, ♂.

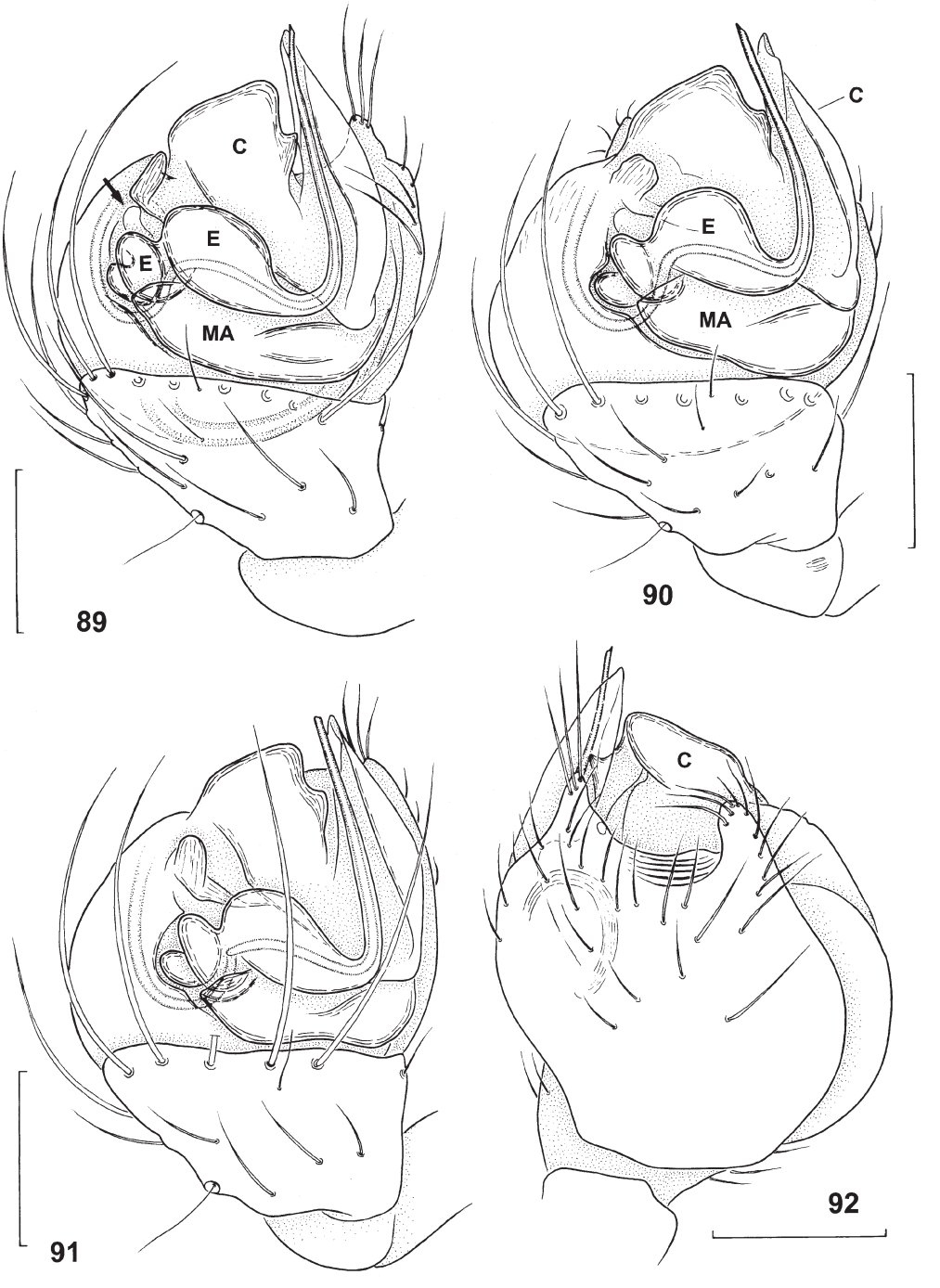
Tidarren chevalieri: Wunderlich 1987, p 208.



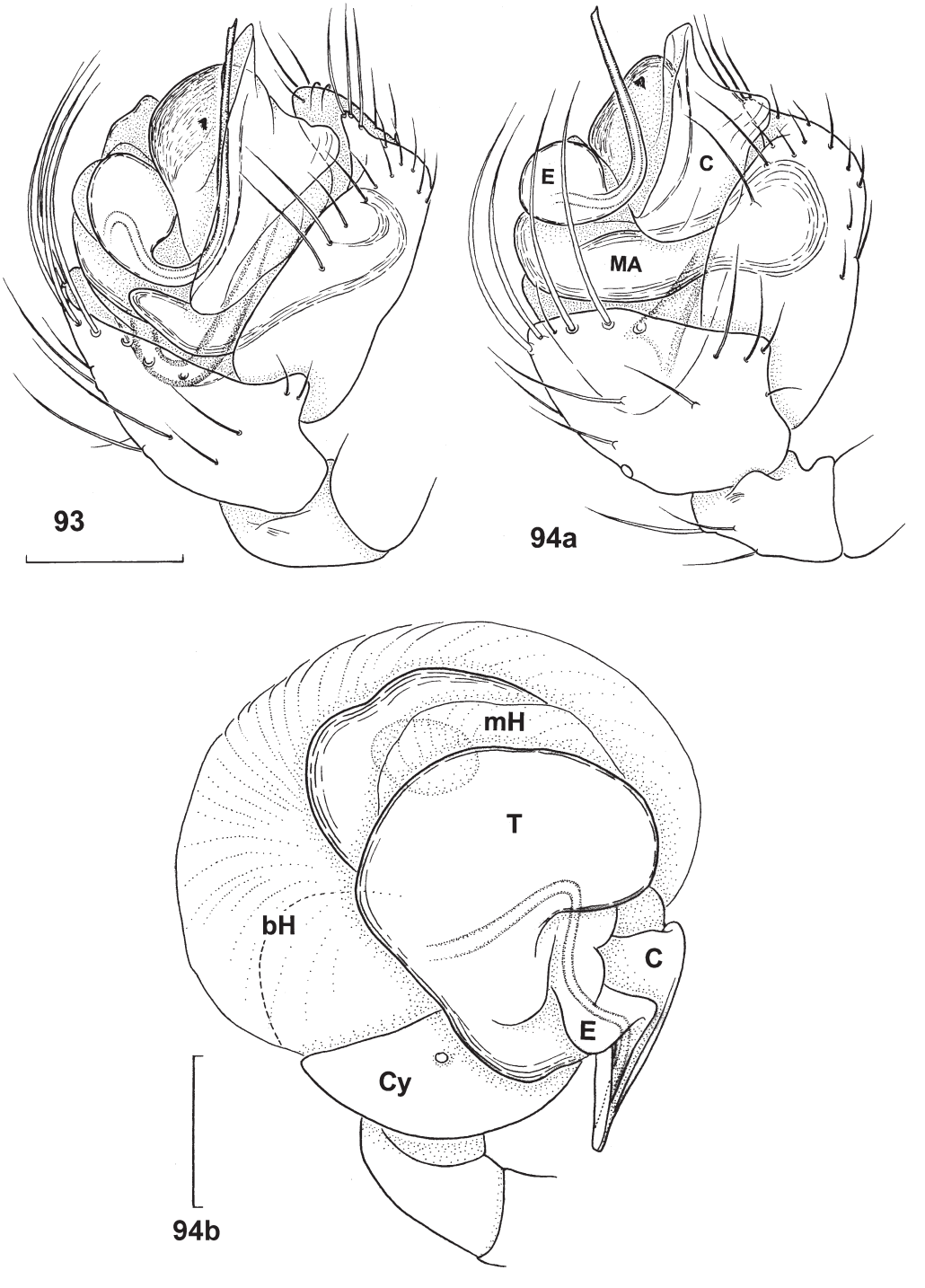
Figures 81–84. *Tidarren cuneolatum* (Tullgren). Female from Yemen, Ta'izz (81), Sana'a (82, 83), and Gran Canaria (84). (82) Male out of focus in foreground to right of female. (83) Female sucking out a curculionid beetle.



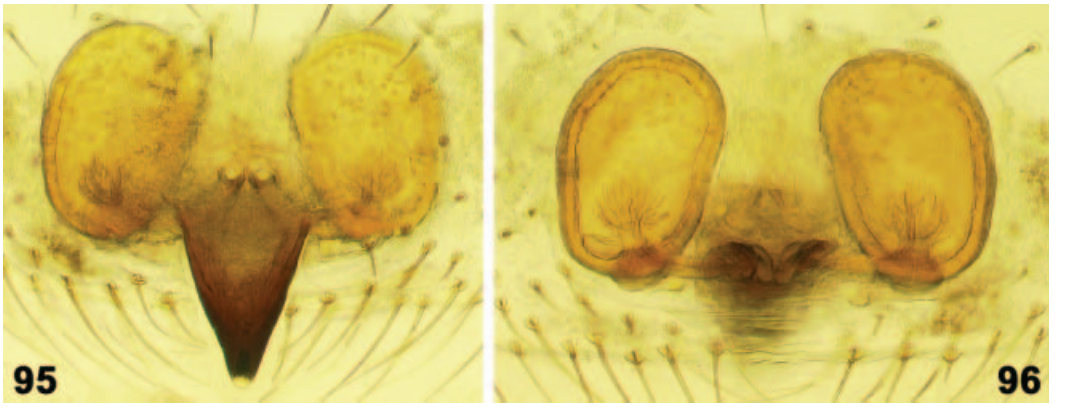
Figures 85–88. *Tidarren cuneolatum* (Tullgren). Right male palp, prolateral view. Specimens from Yemen, Ta'izz (85), Sana'a (86), Cape Verde Islands (87), and Gran Canaria (88). Scale bars: 0.1 mm.



Figures 89–92. *Tidarren cuneolatum* (Tullgren). Right male palp, dorsal (89–91) and ventral view (92). Specimens from Yemen, Ta'izz (89, 92), Cape Verde Islands (90), and Gran Canaria (91). Arrow points to distal haematodocha. Scale bars: 0.1 mm.



Figures 93, 94. *Tidarren cuneolatum* (Tullgren). (93, 94a) Right male palp, retrolateral view. Specimens from Yemen, Ta'izz (93) and Cape Verde Islands (94a). (94b) Male palp, expanded. Haematodochae unmodified. Specimen from Yemen. Scale bars: 0.1 mm.



Figures 95, 96. *Tidarren cuneolatum* (Tullgren) from Yemen. Female epigynum/vulva ventral (95) and dorsal view (96). Auto-Montage digital photos.

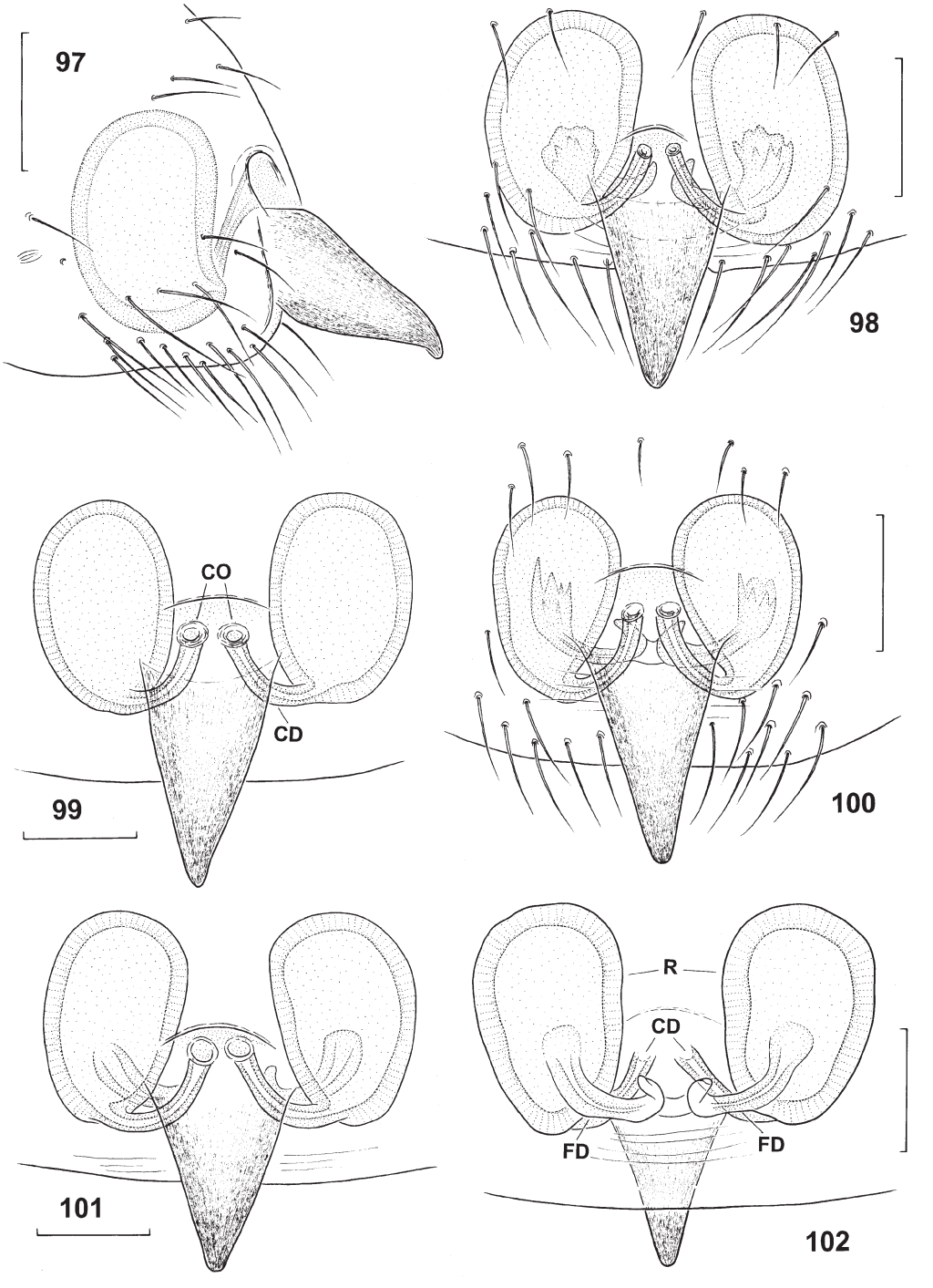
Theridion hagemanni Schmidt 1956, p 146, Figures 4–6; n. sp., ♂♀, type region Canary Islands, import (=*T. chevalieri*, see Wunderlich 1992, p 410).
Tidarren hagemanni: Wunderlich 1987, p 208, Figure 546, ♀.
T. pseudogibberosum Schmidt 1973, p 368, Figure 5; n. sp., ♀, type locality Gran Canaria (=*T. chevalieri*, see Wunderlich 1992, p 410; removed from synonymy of *Echinotheridion gibberosum*, *contra* Wunderlich 1987).
T. cuneolatum: Knoflach and van Harten 2000, p 1639, Figures 1–22.

Type material and published records examined

Holotype of *T. cuneolatum*, 1♀, NHRS, Tanzania, Kilimandjaro, Kibonoto, cultivated area, August 1905–1906, leg. Y. Sjöstedt (Tullgren 1910). 1♀, AR 2555 MNHN, Tanzania (Afrique Orientale Anglaise), Serengeti, Mbuyuni (st. no. 63), 03°09′S, 39°53′E, 13–14 March 1912, ca 1550 m, leg. Alluaud and Jeannel (Berland 1920, p155). 1♀, MHNG, Democratic Republic of Congo, Medje, August 1909–1915, det. R. de Lessert (de Lessert 1929, p 122). Type series of *T. chevalieri*, 6♀, 4juv (AR 2379 MNHN), Cape Verde Islands, Santo Antao, Campo de Cao, ca 17°05′N, 25°10′W, leg. Chevalier, 4 September 1936 (Berland 1936). The type material of *Tidarren hagemani*, imported from the Canary Islands with bananas (Schmidt 1956), is perhaps partially lost, female holotype missing, male allotype without palp (SMF 14367/2). In a female syntype of *T. pseudogibberosum*, also imported from the Canary Islands with bananas (Schmidt 1973; SMF 14369/2), the epigynum is missing. Further five vials from Gran Canaria (Playa del Ingles, Maspalomas) contain *T. cuneolatum* females (sub *T. hagemanni*; Schmidt 1973; SMF 25214/1–25218/1; 25670/1); five vials with *T. cuneolatum* from the Cape Verde Islands Santiago (Taraffal, Cidade Velha) and Fogo (Sao Filipe) (sub *T. chevalieri*, see Schmidt et al. 1994; SMF 37476, 37478, 37353 female without epigynum, 37503, 38013 male without palp). Guinea-Bissau (Guinée portugaise): 1♀, MNHN AR 2370 (sub *Theridium scenicum* Thorell, see Simon 1907).

Other material examined

Yemen: 3♂, 7♀, Sana'a, 15°21′N, 44°13′E, 2300 m, September to October 1997; 3♀, 1sad♀, November to December 1997; 2♂, 1♀, 1sad♂, 1inad.♂, 30 January 1998; 1sad♂, 24



Figures 97–102. *Tidarren cuneolatum* (Tullgren). Female epigynum/vulva in lateral (97), ventral (98–101), and dorsal view (102). Specimens from Yemen, Sana'a (97, 98, 102), Kenya (99), Cape Verde Islands (100), and Gran Canaria (101). Scale bars: 0.1 mm.

Figures 103, 104. *Tidarren cuneolatum* (Tullgren) from Gran Canaria, copulatory behaviour. (103) Male approach along mating thread. Female with legs III close together on mating thread, thereby guiding male to epiygnum. (104) Copulation, male palp inserted, his hind legs extended straight up and backwards.

February 1998, beaten from *Tamarix*; 13♂, 7♀, 1sad♀, 1sad♂, 7inad♂, 1inad♀, 17 April 1998; 1♀, 26 April 1998; 1♂, 10 May 1998 (adult on 5 June 1998); 1♀, 3 June 1998 (adult on 12 July 1998); 1♂, 2♀, 1sad♀, 17–18 June 1998 (♂ adult on 1 July 1998); 3♀, 16 July 1998; 37♂, 7sad♂, 1♀, 28 July 1998; 14♀, 29 October 1998; 3♂, 5♀, 30 October 1998; 2♀, 19 November 1998; 1♂, 28 September 1999; 1♀, 22–26 April 2000; 1♀, 9 July 2001; all leg.

Table III. Leg measurements (mm) of *Tidarren cuneolatum* (Tullgren), females from Sana'a (n=2)/female from Cabo Verde.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.35/0.35/0.30	0.22/0.21/0.18	0.21/0.20/0.17	–	0.37/0.37/0.30	1.14/1.12/0.94
I	2.56/2.61/2.14	0.65/0.65/0.47	1.54/1.54/1.14	2.24/2.19/1.49	0.84/0.84/0.65	7.82/7.82/5.89
II	1.64/1.66/1.22	0.57/0.57/0.42	0.89/0.89/0.65	1.37/1.34/0.94	0.67/0.65/0.55	5.14/5.12/3.78
III	1.24/1.24/0.94	0.52/0.47/0.35	0.62/0.62/0.47	0.97/0.92/0.66	0.60/0.60/0.45	3.95/3.85/2.87
IV	2.09/2.16/1.54	0.65/0.67/0.47	1.19/1.22/0.87	1.59/1.56/1.12	0.75/0.72/0.57	6.26/6.33/4.57

Table IV. Leg measurements (mm) of *Tidarren cuneolatum* (Tullgren), males from Sana'a and Cabo Verde (n=3), minimum–maximum.

	Fe	Pa	Ti	Mt	Ta	Total
I	0.59–0.64	0.20	0.35–0.37	0.37–0.39	0.30–0.33	1.84–1.89
II	0.40–0.43	0.18–0.19	0.24	0.24–0.25	0.27–0.28	1.29–1.37
III	0.32–0.37	0.16	0.16–0.18	0.18–0.19	0.23–0.25	1.06–1.13
IV	0.48–0.50	0.18–0.19	0.26–0.28	0.26–0.27	0.26–0.27	1.46–1.48

A. van Harten. 1♂, 2♀, Ta'izz, 13°35′N, 44°02′E, 1400 m, 31 May 1998; 2♂, 12 July 1999; 1♂, 2♀, 9 August 1999; 1♀, adult 10 September 1999, leg. A. van Harten. 1♀, ar-Rujum, 15°26′N, 43°40′E, 1900 m, 18 April 2000 (adult in June 2000), leg. A. van Harten. 1♀, Sanhan, 15°15′N, 44°18′E, 2400 m, 25 April 2000, leg. A. van Harten. 1♂, Wadi Warazan, 13°25′N, 44°15′E, 1200 m, 9 August 1999, adult 27 August 1999, leg. A. van Harten. 1♀, Wadi Dahr, 15°24′N, 44°09′E, 2200 m, 5 March 2000, leg. A. van Harten. 1♀, 1sad♀, Shibam-at-Tawilah, 15°32′N, 43°49′E, 2900 m, 8 April 1998, leg. A. van Harten. 1♂, 1♀, near Kuhlan 'Affar, 15°44′N, 43°43′E, 2300 m, 10 July 2001, leg. A. van Harten (♂ adult on 18 July 2001, ♀ on 30 August 2001). 1♀, Hammam 'Ali, 14°41′N, 44°08′E, 1600 m, 11 August 1998, leg. A. van Harten. **Kenya**: 1♀, CTh, Njoro, Nakuru, Egerton-University, zoological laboratory, 0°22′S, 35°56′E, 19 September 1995, leg. L. Füreder. 3♀, 1juv,

Table V. Body dimensions of females of *Tidarren cuneolatum* (Tullgren) from different regions, minimum–maximum (mean); for carapace and leg measurements, minimum–maximum and (mean ± SE) are given.

	Tanzania (n=10)	Cape Verde Islands (n=10)	South Africa (n=10)	Kenya (n=5)
Total length	2.15–3.44 (2.68)	2.86–3.68 (3.19)	2.74–3.91 (3.24)	3.33–4.38 (3.7)
Carapace length	0.86–1.07	1.06–1.29	1.11–1.25	1.37–1.49 (1.42)
Carapace length	(0.99 ± 0.021)	(1.22 ± 0.025)	(1.15 ± 0.021)	(1.42 ± 0.032)
Carapace width	0.70–0.92	0.98–1.29	0.94–1.05	1.13–1.29
Carapace width	(0.84 ± 0.021)	(1.04 ± 0.020)	(1.00 ± 0.012)	(1.21 ± 0.039)
Length femur I	1.49–1.96	2.07–2.54	2.07–2.35	2.35–3.05
Length femur I	(1.80 ± 0.048)	(2.32 ± 0.042)	(2.19 ± 0.028)	(2.67)
Length tibia I	0.90–1.21	1.21–1.49	1.17–1.37	1.41–1.92
Length tibia I	(1.12 ± 0.033)	(1.36 ± 0.031)	(1.29 ± 0.021)	(1.63)
Clypeus height	0.18–0.25 (0.22)	0.25–0.31 (0.27)	0.23–0.27 (0.26)	0.25–0.29 (0.28)
Abdomen high	1.68–3.13 (2.29)	2.27–3.52 (2.85)	1.96–3.83 (2.97)	2.35–3.87 (3.18)
Abdomen long	1.29–2.19 (1.71)	1.76–2.82 (2.14)	1.64–2.62 (2.13)	1.96–2.90 (2.43)
Abdomen wide	1.21–1.96 (1.53)	1.49–2.35 (1.91)	1.33–2.23 (1.82)	1.64–2.66 (2.14)
Distance petiolus to spinnerets	0.98–1.45 (1.18)	1.25–1.68 (1.46)	1.21–1.64 (1.42)	1.37–1.80 (1.64)

CAS, Nyeri, Mt Kenya, 16 km S Nayuki, Bulguret trail, lower W-side, 0°02′S, 37°04′E, 1–2 October 1992, leg. V. and B. Roth. **Zambia**: 1♀, CAS, 6 km W Mumbwa, 15°02′S, 27°00′E, 30 March 1995, leg. W. J. Pulawski. **Tanganyika**: 1♀, CAS, Amani 850 m, 9 November 1957, leg. E. S. Ross and R. E. Leech. **Tanzania**: 2♂, 1♀, 3juv, CAS, Tanga, W Usambara Mtns, Mazumbai, forest, 4°49′S, 38°30′E, 1400–1800 m, 11–20 November 1995, sifting litter, leg. C. E. Griswold, N. Scharff, D. Ubick. 3♀, 1sad♀, CAS, Tanga, W Usambara Mtns, Mazumbai, forest, 4°49′S, 38°30′E, 1400–1800 m, 10–20 November 1995, leg. C. E. Griswold, N. Scharff, D. Ubick. 1♀, 1sad♀, CAS, Tanga, W Usambara Mtns, Mazumbai, station, 4°48.5′S, 38°30′E, 1500 m, 10–20 November 1995, around buildings, leg. C. E. Griswold, N. Scharff, D. Ubick. 1♀, 1sad♀, CAS, Tanga, E Usambara Mtns, Amani, forest, 5°5.7′S, 38°38′E, 950 m, 27 October to 9 November 1995, leg. C. E. Griswold, N. Scharff, D. Ubick. 17♀, 2sad♀, 9juv, CAS, Tanga, E Usambara Mtns, Amani, forest, 5°5.7′S, 38°38′E, 950 m, 27 October to 9 November 1995, leg. C. E. Griswold, N. Scharff, D. Ubick. 3♂, 5♀, 5sad♂ (1sad♂ shortly before maturation), 13juv, CAS, Tanga, E Usambara Mtns, Amani, around buildings, 5°5.7′S, 38°38′E, 950 m, 27 October to 9 November 1995, leg. C. E. Griswold, N. Scharff, D. Ubick. 1♀, CAS, Tanga, E Usambara Mtns, Amani, Mbomole Hill, 5°5.7′S, 38°37′E, 1000 m, 5–8 November 1995, sifting litter, leg. C. E. Griswold, N. Scharff, D. Ubick. **South Africa**: 11♀, 1sad♀, MNHN AR 2363, Pret., Bloemfontein, Hamman's Kraal, det. E. Simon. Mpumalanga, Badplaas, 8♀, in coll. Horak, 26 March 2001, bulky waste site close to thermal building, 25°57′S, 30°34′E, 26 March 2001, leg. O. P. Horak. 2♀, CAS, Mpumalanga, Badplaas, 25°57′03″S, 30°34′00″E, 1100 m, at night and in litter under riparian trees, 26–29 March 2001, leg. D. and S. Ubick. 30♀, 2sad♀ (one shortly before maturation) 2juv, CAS, Mpumalanga, Badplaas, Embuleni Nature Reserve, grassvelt savanna, in wooded areas, 25°57′12″S, 30°33′15″E, 1100 m, 28 March 2001, leg. D. and S. Ubick. 2♀, 1juv, CAS, Mpumalanga, Songimvelo Nature Reserve, Kromdraai, 26°02′33″S, 31°00′05″E, 800 m, secondary highveld forest, cabin area, 16–23 March 2001, leg. D. and S. Ubick. 1♀, CAS, Mpumalanga, Songimvelo Nature Reserve, Kromdraai, Komati River, 26°02′34″S, 31°00′33″E, 800 m, secondary highveld forest, 18–23 March 2001, leg. D. and S. Ubick. 1♀, 1juv, CAS, Mpumalanga, Badplaas, Embuleni Nature Reserve, grassvelt savana, in wooded areas, 25°57′12″S, 30°33′15″E, 1100 m, 28 March 2001, leg. C. E. Griswold. 1♂, 3♀, 1juv, 1♂ without palps, CAS, Gauteng, Tswaing Crater, 40 air km NNW Pretoria, mixed bushveld, 10 October 1999, leg D. Ubick and S. Prinsloo. 1♀, 1sad♀, CAS, Gauteng, Tswaing (Soutpan), 40 km N Pretoria, 25°25′18″S, 28°04′49″E, 1100 m, *Acacia* savanna, 31 March 2001, leg. D. and S. Ubick. 3♀, CAS, KwaZulu-Natal: Geluksberg, 26 km SE Bergville, 1200 m, non-native vegetation, 18–19 October 1999, leg. D. Ubick and S. Prinsloo. 1♀, Drakensberge, Royal Natal National Parc, Gorge Pad, 6 June 2005, leg. G. Alberti. **Namibia**: 6♀, 1sad♀, CAS, near Waterberg, 20°30′'S, 17°13′E, 9 April 1991, leg. V. D. and B. Roth. **Senegal**: 1♀, CAS, Dakar, km 15 R. Rufisque, 14°44′N, 17°17′W, 30 June 1981, W. Settle. 1♀, CAS, Dakar, 1336 Bourgiba, 20 July 1981, leg. W. Settle. 1♀, CAS, Dakar, Corniche, 8 June 1981, leg. W. Settle. **Ghana**: 1♀, CAS, Kumbungu, 9°35′N, 0°58′W, 20 December 1974, Martin Rice. **Nigeria**: 1♀, CAS, Kaduna junction, 12 March 1951, on leaves, leg. R. W. **Cape Verde Islands**: 8♂, 31♀, 3sad♂, Santiago, Sao Jorge dos Orgaos, 15°03′N, 23°37′W, 400 m, 15 December 1999 to 10 January 2000; 4♂, 6♀, 1juv, same locality, December 2001 to January 2002; 2♀, Santiago, Achada Fazenda, 15°07′N, 23°35′W, 20 m, 28 December 1999. 1♂, Santiago, Taraffal, 15°17′N, 23°46′W, 20 m, 31 December 1999, all leg. A. van Harten. **Spain, Canary Islands**: 1♀, Gran Canaria, Maspalomas, 27°45′N, 15°34′W, 3 April 1983, leg. E. Kreißl; 2♀, 2sad♀, Maspalomas, 7 April 1983, leg.

E. Kreißl. 7♂, 20♀, Playa del Ingles, 27°46′N, 15°35′W, on fences, February 2001, leg. B. Knoflach and K. Thaler. 7♂, same locality, ex ovo breeding, adult on 17 June 2001. 5♂, ex ovo breeding, adult on 5 September 2001.

Depository. Voucher specimens (males and females) are deposited in AMNH, CAS, CTh, MHNG, MNHN, MRAC, NHMB, NHRS, NMBS, NMW, and SMF.

Description

Tullgren (1910) ♀; Berland (1936, sub *Theridion chevalieri*) ♀; Schmidt (1956, sub *Theridion hagemanni*) ♂♀, Schmidt et al. (1994, sub *Tidarren chevalieri*), ♂; Wunderlich (1987, sub *Tidarren hagemanni*) ♀; Knoflach and van Harten (2000) ♂♀.

Etymology

The species name apparently reflects the epigynal shape; lat. *cuneolatus* is a diminutive of *cuneatus*, meaning attenuate.

Diagnosis and differentiation

Tidarren cuneolatum belongs to the species that have a dorsal tubercle on the abdomen (Figures 78, 81–84, 121). Among these it is the largest representative in Yemen with respect to females, mean carapace width of female 1.14 mm. Sternum without posterior knob. The epigynal protuberance is long, pointed, and strongly protruding (Figures 27, 95, 97–102), copulatory orifices separate, copulatory ducts short. The male palp shows a relatively inconspicuous cymbium (Figures 45–47, 85–93, 94), with two distal hairy lobes and ridges. It also differs from its congeners by the shape of the tibia. Distal rim of tibia about as wide as palpal organ, basal rim also rather broad. Prolateral part of conductor and distal tegular rim form two distinct processes (Figures 85–88). Basal segments of palp and cymbium dark or greyish.

Measurements (mm)

[♂/♀ from Yemen, $n=15$, minimum–maximum (mean).] Total length 0.94–1.11 (1.02)/2.58–3.52 (3.10), carapace length 0.47–0.50 (0.48)/1.13–1.46 (1.29 ± 0.027 SE), width 0.41–0.47 (0.44)/1.00–1.31 (1.14 ± 0.025 SE), length femur I 0.57–0.66 (0.60)/2.15–2.74 (2.44 ± 0.051 SE), tibia I 0.31–0.41 (0.36)/1.25–1.58 (1.43 ± 0.029 SE). Abdomen 0.70–0.98 (0.81)/2.54–3.60 (3.04) high, 0.62–0.74 (0.65)/1.92–2.74 (2.34) long and 0.55–0.68 (0.62)/1.72–2.35 (1.99) wide ($n=10/11$). Ventral side (distance petiolus to spinnerets) 0.41–0.51 (0.47)/1.33–1.76 (1.50) long ($n=10/11$). Clypeus 0.15–0.20 (0.17)/0.27–0.31 (0.29) high ($n=10/11$). Chelicerae 0.14–0.20 (0.16)/0.39–0.49 (0.46) long ($n=10/11$). Sternum about as long as wide, 0.29 (0.29)/0.74–0.90 (0.81) long and 0.29 (0.29)/0.60–0.72 (0.66) wide ($n=10/11$). Labium 0.12/0.24–0.31 (0.28) wide and 0.06/0.12–0.20 (0.16) long ($n=5/11$). Gnathocoxae 0.17/0.41–0.49 (0.44) long and 0.06/0.18–0.23 (0.21) wide ($n=5/11$). Femur of male palp 0.19–0.22 (0.21) long ($n=11$). Leg formula 1423, legs I–IV in two females from Sana'a 7.8, 5.1, 4.0, 6.3 long, in a female from Cabo Verde 5.9, 3.8, 2.9, 4.6 long; in male 1.8–1.9, 1.3–1.4, 1.1, 1.5 long ($n=3$), see also Tables III–V. Number of dorsal setae on tibiae I–IV 2/2/1/2 in both sexes. Trichobothria (Figures 34, 35)

in retrodorsal/prodorsal row on tibia of female palp 2/1 (n=3), of legs I–IV variable, 4/2, 3/2, 3/3, 4/3 and 3/2, 3/2, 3/3, 3/3 in two females from Sana'a, and 2/2, 2/1, 2/2, 3/3 in a female from Cabo Verde, in male 2/1, 2/1, 2/2 (or 1/2), 2/2 (9♂ examined, of which 6♂ with tibia III with 1/2 trichobothria). Metatarsi I–III with one trichobothrium, position in female (male) on I 0.27–0.34 (0.27–0.32), on II 0.31–0.35 (0.32–0.36), on III 0.36–0.42 (0.33–0.40) [n=3]. Female metatarsi I–IV 2.3–2.6, 1.7–2.1, 1.5–1.6, 2.0–2.2 times longer than tarsi, and 1.3–1.5, 1.5, 1.4–1.6, 1.3 times longer than tibiae I–IV (n=3). Metatarsi of male approximately as long as tibiae (I–IV 1.1, 1.0. 1.1, 1.0), metatarsi I 1.1–1.3 times longer than tarsi I, ratio of metatarsi II–IV to tarsi II–IV 0.9, 0.7–0.8, 1.0 (n=3). Tarsal claws of legs with three to four side teeth in female, claw of female palp consisting of seven to eight teeth. Tarsal organ on female palp at 0.80–0.86, on female (male) legs I–IV 0.51–0.59 (0.35–0.40), 0.40–0.50 (0.28–0.31), 0.30–0.44 (0.21–0.28), 0.28–0.40 (0.19–0.21) [n=3].

Variation. Females from Tanzania show smaller body dimensions than females from Yemen, Cape Verde Islands, and South Africa (see Table V).

Somatic features, colouration (Figures 11–15, 78, 81–84, 103, 104)

Sternum without posterior knob. Abdomen higher than long, with dorsal tubercle. Tubercle usually as in Figures 82–84, sometimes even more pronounced (Figure 81).

Females. Colouration variable; in most localities females with dark prosoma and dark abdominal pattern were predominant (Figures 81–83, 121), in South Africa (Badplaas) pale females (Figure 84, 103, 104) were more frequent. Common form (female): carapace uniformly dark brown. Chelicerae, labium, and gnathocoxae light brown. Sternum light brown with dark markings of various extent (Figures 13–15). Legs and female palp yellow brown with dark patches and annulations. Abdomen usually with large dark markings. Dorsum with irregular, longitudinal, whitish to brownish band, which is distinctly outlined by two paramedian white stripes and accompanied by a broad dark area at sides and at apex. From subapical region a clear white stripe branches laterally, interrupting dark lateral field. Anterior declivity of tubercle dark, posteriorly light. Aboral region yellowish to whitish with clear white median stripe from apex to spinnerets, two dark longitudinal bands and three dark transverse arches. Epigaster greyish or dark, book lung covers pale yellow. Venter whitish with two dark paramedian patches. Spinnerets brown. In pale form dark pigmentation is almost completely absent: carapace light brown, abdomen of yellowish ground colour.

Males. Males from Yemen have a uniformly dark carapace (about 50 specimens checked), whereas males from Cape Verde Islands, Canary Islands, and Tanzania usually have carapace yellow brown with dark median band from eye region to centre, with dark clypeus and dark margins. Chelicerae brown to dark brown, gnathocoxae and labium lighter, only males from Cabo Verde and Canary Islands light brown. Sternum with large dark pattern on light background. Legs pale yellow with dark patches and annulations. Male palp dark brown from femur to cymbium. Abdominal pattern in male less distinct. Anterior half dark from petiolus to tubercle, dark zone tapering at apex. Posterior half light, aboral region whitish with a few tiny dark flecks. Epigaster dark, book lung covers pale yellow. Venter dark with two paramedian spots between epigastric furrow and spinnerets. Spinnerets brown.

Male palp (Figures 85–94)

Distal rim of tibia almost as wide as bulbus, tapering gradually towards base. Cymbium slightly shorter than bulbus (ca 0.9 length of bulbus), bulbus ca 0.2 mm long. Palpal organ 0.20 mm wide. Cymbium bilobed, with parallel ridges in distal concavity (Figure 92). Tegulum with small, angular, plate-like process on prolateral side near embolar base (Figures 85–88). Prolateral part of conductor sclerotized and rounded, with a small tooth on inner side (Figures 93, 94a). Retrolateral part of conductor membranous, with guiding furrow, without sclerotized tip. Embolar base suboval, 0.07 long and 0.05 mm wide. Distal part of embolus ca 0.16 ($n=2$) and 0.19 ($n=1$) mm long, longer than female copulatory duct. Haematodochae not modified (Figure 94b).

Epigynum/vulva (Figures 27, 95–102)

Epigynal protuberance strongly protruding, long, slender, and pointed, on average 0.16 mm $\pm$ 0.003 SE long, range 0.14–0.21 mm ($n=51$); about 1.5 (2.1) times ventral (lateral) basal width. In side view, anterior contour procurved, posterior one recurved; tip of protuberance slightly curved posteriorly. Copulatory ducts separate (Figures 98–102), short, 0.08–0.10 mm long. They diverge posteriorly and enter receptacula posteriorly. Copulatory orifices well separated, situated in front of anterior border of epigynal protuberance (Figures 27, 95, 98–101), and in ventral view at posterior half of receptacula. Protuberance about as long as receptacula. Receptacula seminis 0.17–0.19 mm long and 0.11–0.13 wide.

Synonymy

Recently collected material from the Cape Verde Islands and the type series of *Tidarren chevalieri* correspond well with *T. cuneolatum*; genital structures, body dimensions, and somatic characters confirm this new synonymy. Wunderlich (1992) already indicated the resemblance to *T. cuneolatum*, but hesitated to synonymize them without knowledge of the male. Females from the type region, around Kilimandjaro in Tanzania, from other localities in mainland Africa, the Canary Islands, Yemen, and Cape Verde all have very similar epigynes (Figures 98–102) and palpal organs (Figures 85–93, 94). General appearance and measurements also agree. Copulations between females from the Cape Verde Islands and males from Yemen proceeded typically, see below.

Copulatory behaviour

Courtship and copulation proceed via a mating thread (Figure 103). Courtship lasts 3.5 min on average and involves active female courting (Knoflach and van Harten 2000). Her twanging with legs II and body oscillations induce the male to spin the mating thread. At the starting point of this thread he performs intensive plucking sequences, which stimulate the female to approach him along the mating thread and to assume the copulatory posture (Figure 103). Insertion lasts 4 min on average and is terminated by the female pulling off her mate. Males die during insertion. Sexual cannibalism takes place after copulation (Knoflach and van Harten 2000). This overall copulatory procedure has been observed many times in pairs from Yemen, but was the same in the few pairs from the Canary Islands (Figures 103, 104) and Cape Verde Islands. In one pair from the Cape Verde Islands courtship lasted 14 min, insertion 4.6 min, until the male was removed from

the epigynum and sucked out by the female. Four females from the Cape Verde Islands were allowed to copulate with males from Yemen, as follows. Courtship lasted 0.5–13.0 min (mean 7.4, $n=4$), insertions lasted 2.8, 4.8, and 5.9 min ($n=3$). Three copulations proceeded typically. However, one female did not remove the dead male from the epigynum for 3.5 h and then she removed him also from the web, without eating him. This exceptional female behaviour possibly may be explained by her well-nourished state.

Natural history

Egg-sac grey to light brown, with parchment-like envelope (Figure 121), containing 68 eggs on average (minimum–maximum 22–142, $n=12$; population from Yemen). One female was observed to build three egg-sacs, the first 6 days after copulation. Development of *T. cuneolatum* from the Cape Verde Islands corresponds fully to the development of the Yemeni specimens, as observed by Knoflach and van Harten (2000). Juveniles hatch from the egg-sac in an early phase, and palp amputation and maturity moult take place outside the cocoon. Unlike in the rearings from Yemen, two virgin females from Cape Verde built two to three egg-sacs 2–3 months after they had reached maturity, which they devoured again after a few days of guarding. Schmidt et al. (1994) assumed that males of "*T. chevalieri*" from Cape Verde would reach adulthood within the cocoon, which appears impossible according to our observations. We believe that the two one-palped males mentioned by these authors had stayed within a retreat and not hatched from an egg-sac, which is usually deposited in the retreat.

Parasites. One female from South Africa (Badplaas) had been infested by an acrocerid (Diptera), as the primary larva was visible through the book lung cover. One female from Tanzania had an ectoparasitic hymenopteran larva on the abdomen.

Prey. Prey remnants from 20 retreats of *T. cuneolatum* from Yemen, Sana'a, contained 58 ants (Myrmicinae), five bugs, four isopods, four flies, four springtails, three Hymenoptera (Terebrantes), three aphids, two beetles, one *Euryopis episinoides* female (Theridiidae), etc. On Gran Canaria *T. cuneolatum* was frequently observed to feed on Myrmicinae (personal observation) and also on the Cape Verde Islands ants were a main prey (Schmidt et al. 1994; sub *T. chevalieri*).

Habitat

In many localities *T. cuneolatum* behaves hemisynanthropically. Its preferred web sites are mainly stone walls and rock crevices, as well as house walls and window frames, and the stems of large, rough-barked trees. This may explain the synanthropic aspect of this species.

Distribution (Figure 259c)

Tidarren cuneolatum is widespread in continental Africa (South Africa to Kenya, Senegal, and Namibia) and mainland Yemen, and also occurs on the Cape Verde Islands. Berland (1920) reports this species also from Ethiopia. Apparently, it is not present in North Africa, the northernmost locality being Gran Canaria, where it obviously has been introduced. There is no record up to now from Madagascar.

Tidarren dentigerum n. sp.
(Figures 17, 79, 105–120; Tables VI, VII)

Type material

Yemen: 1♂ holotype, deposited in MHNG, Ta'izz, 9 August 1999 (adult on 10 September 1999 in captivity). 1♂ paratype MHNG, Ta'izz, 13°35′N, 44°02′E, 1400 m, April 1998, light trap. 3♀ (paratypes 2♀ CTH, 1♀ NHRS), Ta'izz, 12 July 1999, adult beginning of August 1999; 2♂, 10♀, 2juv (paratypes 2♂, 1♀ CTh, 2♀ MNHN, 3♀ NMW), Ta'izz, 9 August 1999 (♀♀ adult in captivity). 1♂ paratype NMW, Ta'izz, October 2001, in light-trap. 2♀ paratypes MHNG, Jemen, near Hammam 'Ali, 14°41′N, 44°08′E, 24 January 2001 (1♀ adult on 18 June 2001). 4♂, 2♀, near Hammam 'Ali, 26 June 2001 (1♂ paratype MNHN, 1♂ paratype SMF, 2♀ MRAC, 1♂ MRAC, 1♂ NHRS). 1♀ paratype MRAC, near Hammam 'Ali, 9 July 2002. All specimens leg. van Harten.

Other material examined

Yemen: 1♀ MHNG, ar-Rujum, 15°26′N, 43°40′E, 1900 m, 18 April 2000, leg. van Harten.

Etymology

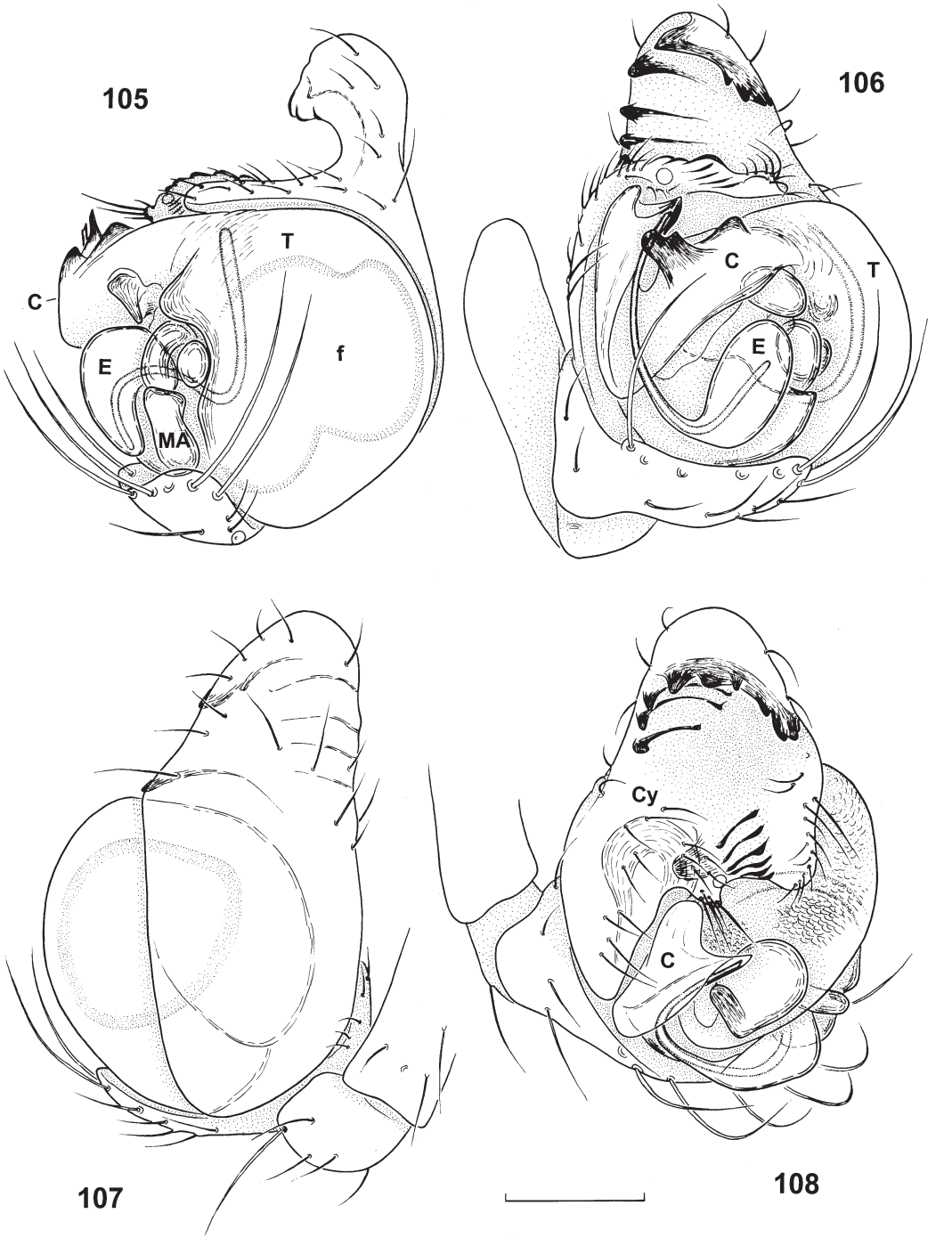
Latin adjective derived from *dens* tooth and *ger(um)* to carry something, referring to the male cymbium, which bears several conspicuous teeth. The suffix agrees in gender of the genus name.

Diagnosis

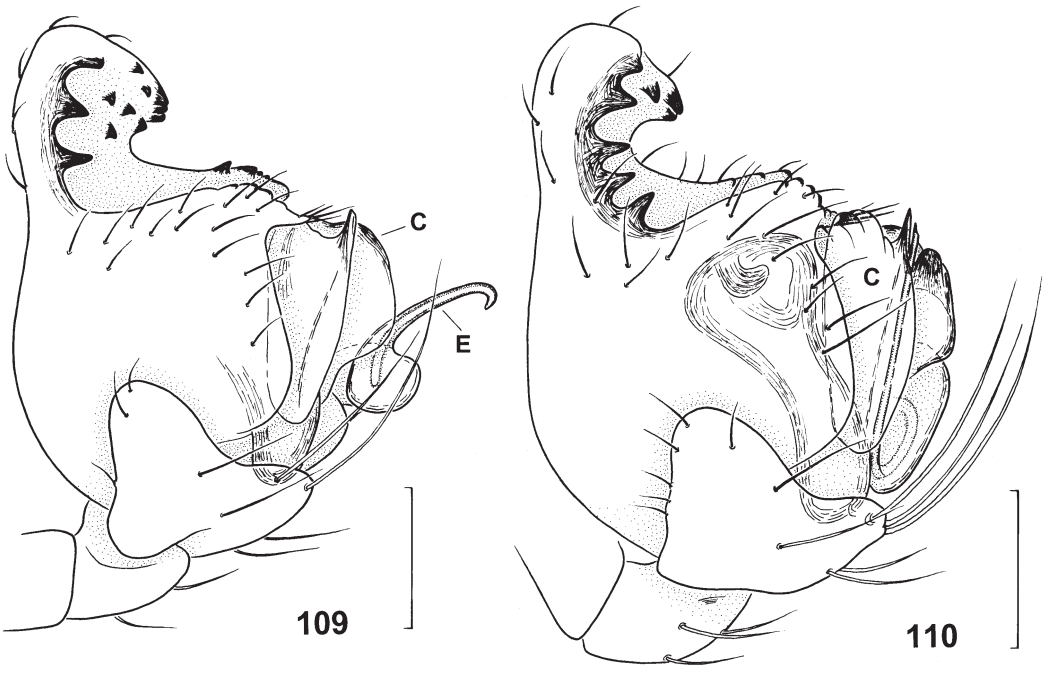
Abdomen with dorsal tubercle (Figures 79, 116–120). Female sternum with posterior knob (Figure 17), similar to that of *T. konrad*. Epigynal protuberance distinctly shaped, short, stout, and curved (Figures 17, 111–115). The male is characterized by the strongly dentated and ribbed cymbium with a striking finger-like projection (Figures 79, 105–110). Prolateral part of conductor with two sclerotized humps (Figure 106).

Measurements (mm)

[♂/♀, *n*=5/11, minimum–maximum (mean).] Total length 0.93–1.09 (1.04)/2.27–2.86 (2.56), carapace length 0.46–0.51 (0.49)/0.82–0.98 (0.91), width 0.41–0.46 (0.44)/0.74–0.88 (0.78), length femur I 0.50–0.54 (0.53)/1.23–1.53 (1.36), tibia I 0.31–0.35 (0.33)/0.70–0.84 (0.76). Abdomen 0.49–0.92 (0.70)/1.60–2.42 (1.98) high, 0.45–0.66 (0.58)/1.29–1.78 (1.51) long and 0.43–0.62 (0.55)/1.21–1.50 (1.36) wide. Ventral side (distance petiolus to spinnerets) 0.39–0.49 (0.43)/0.98–1.17 (1.03) long. Clypeus 0.18–0.23 (0.21)/0.20–0.23 (0.22) high. Chelicerae 0.11–0.20 (0.15)/0.29–0.38 (0.34) long. Sternum about as long as wide, 0.29 (0.29)/0.53–0.60 (0.56) long and 0.29–0.31 (0.30)/0.49–0.55 (0.51) wide. Labium 0.10–0.12 (0.11)/0.20–0.23 (0.21) wide and 0.05–0.07 (0.06)/0.10–0.13 (0.11) long. Gnathocoxae 0.12–0.18 (0.14)/0.29–0.33 (0.31) long and 0.06 (0.06)/0.12–0.14 (0.12) wide. Femur of male palp 0.22–0.25 (0.24) long. Leg formula 1423, see Tables VI, VII. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 2/1, of legs I–IV 2/1, 2/1, 2/2, 2/3 in female (1♀



Figures 105–108. *Tidarren dentigerum* n. sp. from Yemen, Ta'izz. Left male palp, prolateral-dorsal (105), dorsal (106), prolateral-ventral (107), and apical view (108). Scale bar: 0.1 mm.

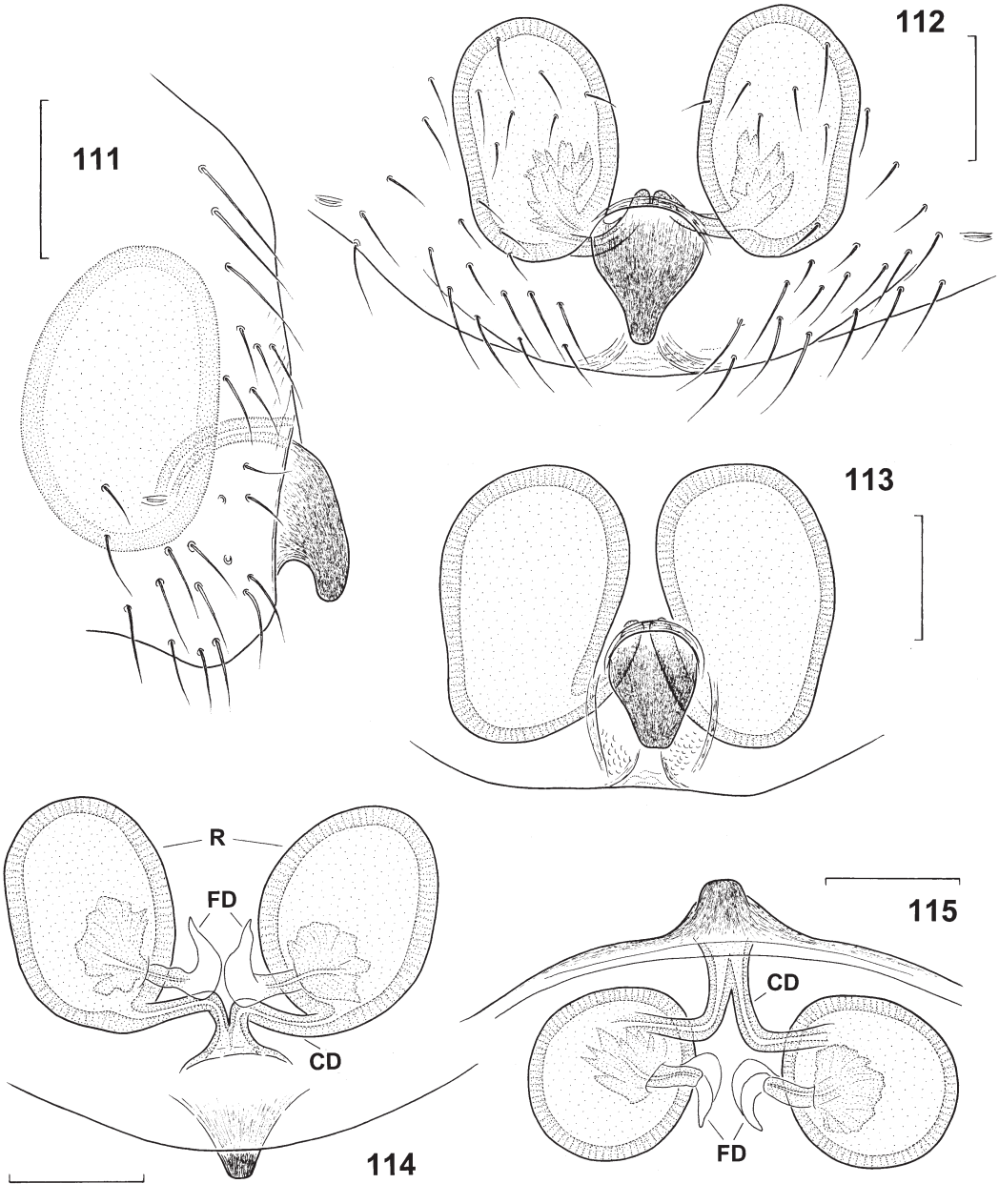


Figures 109, 110. *Tidarren dentigerum* n. sp., different specimens from Yemen, Ta'izz. Left male palp, retrolateral view. Scale bars: 0.1 mm.

examined) and 2/1, 2/1, 1/2, 2/2 in four males, 2/1, 2/1, 2/2, 2/2 in one male and 2/1, 2/0, 1/2, 2/2 in another male. Metatarsi I–III with one trichobothrium, position on I in female (male) 0.29 (0.31), on II 0.33 (0.46), on III 0.46 (0.40). Tarsal claws of legs with two to three side teeth, claw of female palp consisting of eight teeth. Tarsal organ on female palp at 0.85, on female (male) legs I–IV 0.43 (0.36), 0.41 (0.31), 0.22 (0.22), 0.41 (0.26).

Somatic features, colouration (Figures 17, 79, 116–120)

In female, sternum shows a distinct posterior tubercle between coxae IV, bearing long hairs (Figure 17); further tiny, marginal humps arise level with coxa. Male without sternal tubercle. Abdomen higher than long, with dorsal tubercle (Figures 79, 119, 120). Carapace uniformly dark brown in female. In male carapace yellow brown with dark longitudinal median band from eye region to centre, with dark to greyish clypeus and thin greyish margins. Chelicerae, labium, and gnathocoxae light brown to pale yellow. Chelicerae sometimes lightly suffused with grey. Sternum light brown with dark markings of various extent. Legs and female palp yellow brown to pale yellow with dark patches and annulations; in males dark markings less predominant. Basal segments of male palp pale yellow, cymbium yellow or reddish brown. Abdomen usually with large dark markings; abdominal pattern in male less distinct. Dorsum and sides dark brown from petiolus to tubercle; this dark anterior area may be interrupted by a longitudinal, lighter, whitish zone, ending subterminally. From subapical region a clear white stripe bends laterally and ventrally and forms borderline between anterior dark zone and an intermediate light zone. Apex dark anteriorly and light posteriorly. Aboral region with clear white median stripe from apex to spinnerets and dark longitudinal markings, sometimes rather large. Epigaster



Figures 111–115. *Tidarren dentigerum* n. sp. from Yemen, Ta'izz. Female epigynum/vulva in lateral (111), ventral (112, 113, different specimens), dorsal (114), and aboral view (115). Scale bars: 0.1 mm.

dark brown in both sexes, in females a small white membranous area behind epigynal protuberance; book lung covers pale yellow. Venter in female with dark and white marks, in male dark with two paramedian spots between epigastric furrow and spinnerets. Spinnerets brown. In two females the dark pattern was faded out, one female was very dark.

Figures 116–119. *Tidarren dentigerum* n. sp. from Yemen, Ta'izz, copulatory behaviour. (116) First minutes of copulation, left male palp inserted, his legs extended sideways. Haematodochae largely inflated, but unmodified. (117) Male death during copulation, his legs contracted. (118) Female removes dead male from epiygnum. (119) Mate consumption. Male palp remains inflated after copulation (118, 119).

Male palp (Figures 105–110)

Tibia not as wide as bulbus, tapering distinctly at base. Palpal organ 0.23–0.25 (0.24) mm wide (n=5). Cymbium modified, protruding far beyond bulbus, ending as conspicuous, finger-like projection (Figures 79, 105–110), which bears several large sclerotized teeth. Number of teeth apparently variable (Figures 109, 110). This finger-like process was observed to be in contact with the epigastric furrow of the female during insertion. Distal

Table VI. Leg measurements (mm) of *Tidarren dentigerum* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.25	0.15	0.15	–	0.26	0.82
I	1.55	0.42	0.88	1.20	0.54	4.59
II	1.02	0.39	0.55	0.78	0.44	3.18
III	0.78	0.32	0.39	0.55	0.40	2.44
IV	1.25	0.42	0.68	0.89	0.49	3.72

Table VII. Leg measurements (mm) of *Tidarren dentigerum* n. sp., male (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
I	0.50	0.18	0.31	0.32	0.27	1.56
II	0.35	0.17	0.20	0.20	0.25	1.16
III	0.28	0.14	0.15	0.15	0.19	0.91
IV	0.39	0.17	0.23	0.21	0.22	1.21

cymbial rim forms two small lobes facing palpal organ and shows ridges in between them. One of these lobes is close to conductor and bears strong hairs and tarsal organ. Tegulum very large. Subtegulum hidden between tegulum and cymbium. Distal rim of tegulum with short, rounded projection near embolar base. Retrolateral, membranous part of conductor 0.16 mm long, ending with pointed, sclerotized tip; prolateral, sclerotized part with a larger bilobed process and a small hump. Embolar base suboval, 0.10 long and 0.05 mm wide. Distal part of embolus 0.19 mm long. Haematodochae not modified (Figures 116–119).

Epigynum, vulva (Figures 17, 111–115)

Epigynal protuberance stout, short, about 0.1 mm long, strongly curved and therefore less protruding, heavily sclerotized, in side view hook-shaped (Figure 111). Epigynal region around protuberance also sclerotized (0.3 mm diameter), posterior margin of this sclerotization behind epigynal protuberance excavated in midline, joining a small membranous area. Epigynal protuberance not clearly delimited from dark epigastric region, directed ventrad and therefore facing a similar direction as sternal knob (Figure 17). Both protuberances may serve as forceps for the male palp during genital coupling. Their distance apart, ca 0.2 mm, corresponds roughly with palpal width. In aboral view the protuberance is not clearly delimited from the surrounding integument (Figure 115). Copulatory ducts short, 0.11–0.13 mm long, separate for most of their length, fused only at entrance. They bend laterally and enter receptacula at posterior inner side. Atrium with copulatory orifices situated in front of anterior border of epigynal protuberance (Figures 112–114), and in ventral view at posterior part of receptacula. Protuberance about half length of receptacula. Receptacula seminis 0.20–0.23 mm long and 0.13–0.14 mm wide.

Copulatory behaviour (Figures 116–119)

Tidarren dentigerum follows the courtship and copulatory pattern of *T. cuneolatum*. Sexual cannibalism occurs *post copulam*. Only one out of two copulations was observed completely. Courtship lasted 6 and 7 min (n=2). The female vibrated her body intensively and continuously and also plucked with her legs II. The male approached the female several times, palpated her, and installed a mating thread. At the starting point of this thread he performed a plucking sequence, which induced the female to assume the copulatory posture. Before successful insertion, the male made five attempts to insert his palp but did not achieve genital coupling. Insertion lasted 13 min (Figures 116, 117), then the female removed him from the epigynum (Figure 118) and started to suck him out (Figure 119). During copulation the male's legs became contracted, which obviously indicated his death (Figure 117 versus Figure 116). After 4.5 h the female had completed her meal.

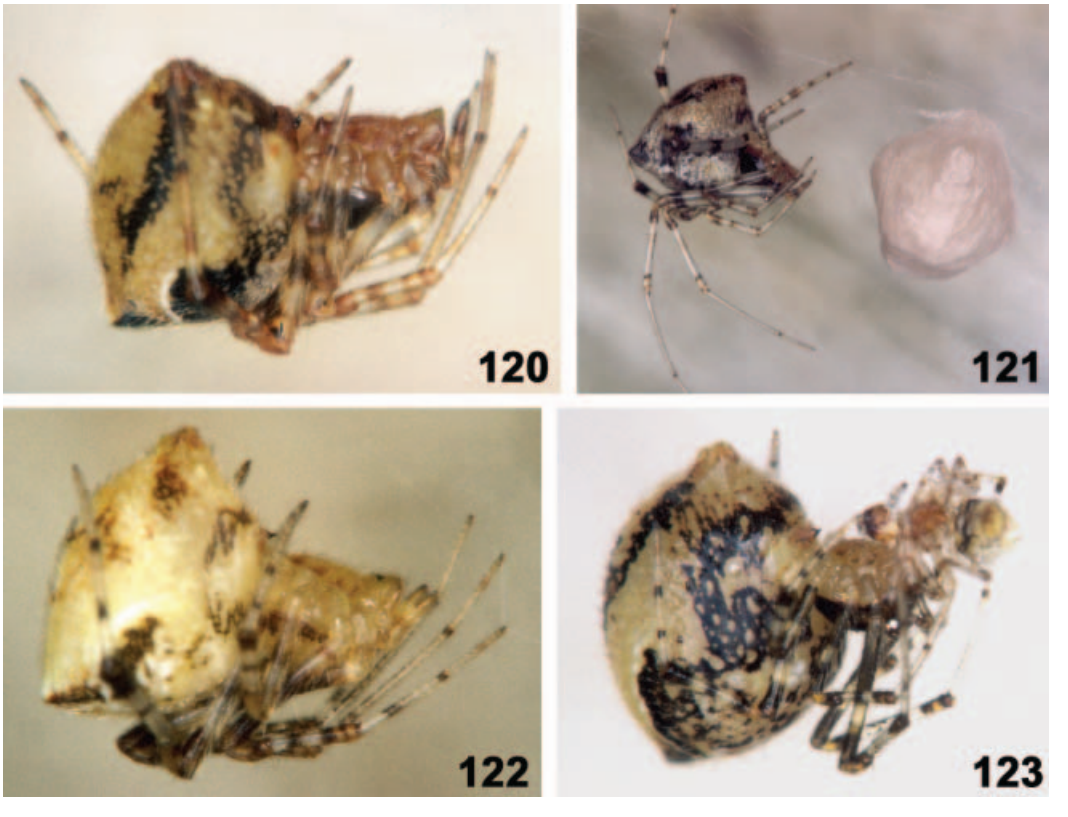
Distribution, habitat

Tidarren dentigerum has been collected from three localities in Yemen. At Ta'izz, *T. dentigerum* lived on small *Lantana camara* shrubs, up to 1 m high, at an agricultural research station. At Hammam 'Ali the species was found in mixed weeds at the margins of agricultural fields. *Tidarren dentigerum* seems to build its webs on the vegetation, whereas *T. cuneolatum* prefers brick walls, window frames, or large tree stems. At Ta'izz nearby buildings were closely inspected, but no webs were found.

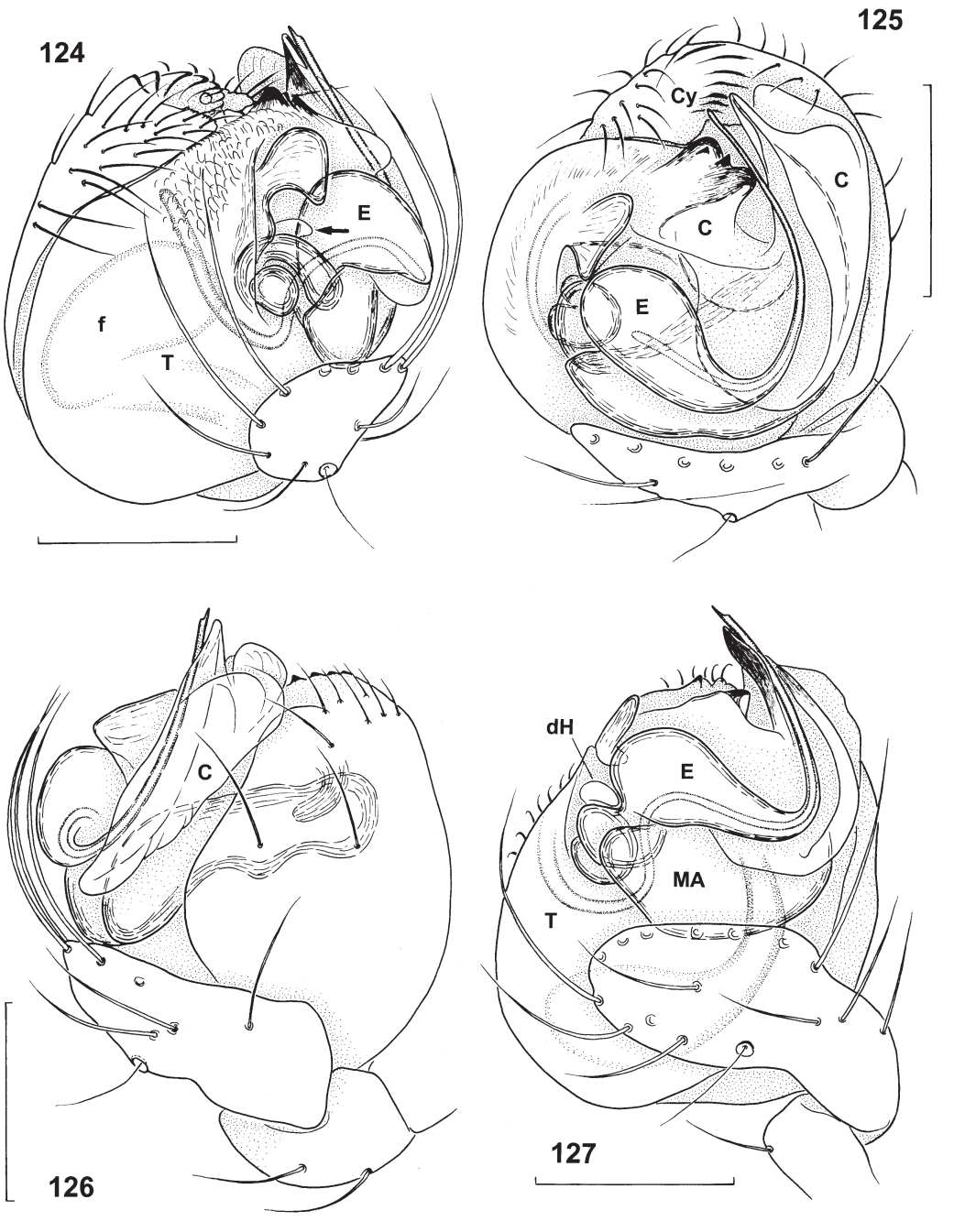
Tidarren gracile n. sp.
(Figures 80, 122–135, 156; Tables VIII, IX)

Type material

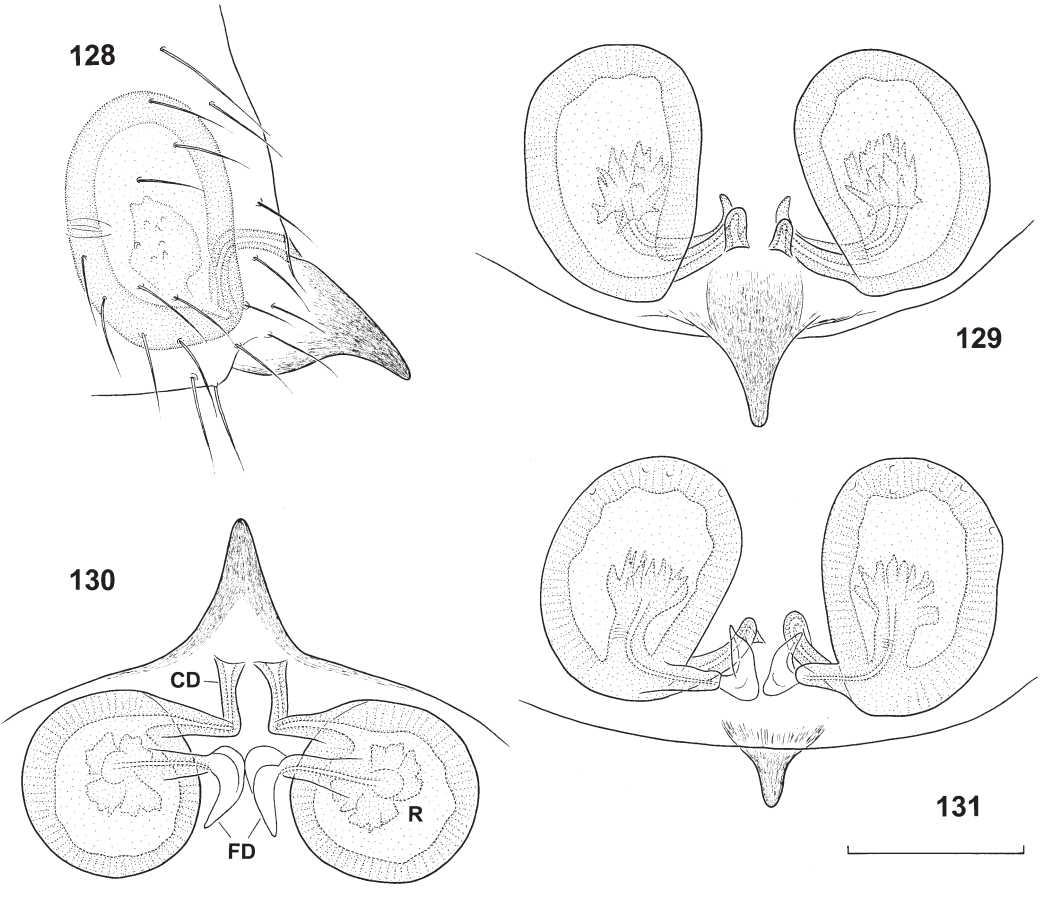
Yemen: 1♀ holotype deposited in MHNG, 8♂, 8♀ paratypes (partially reared ex ovo; deposited in CAS, CTh, MHNG, MNHN, NMW, NRS), Al-Kowd, Zinjibar, 13°05′N, 45°22′E, 20 m, 12 July 1999 and 16 January 2001, only a few kilometres from the Indian Ocean, leg. van Harten.



Figures 120–123. Female habitus. (120) *Tidarren dentigerum* n. sp. (121) *T. cuneolatum* (Tullgren) female guarding egg-sac. (122, 123) *T. gracile* n. sp. Female sucking out male (123). All specimens from Yemen.



Figures 124–127. *Tidarren gracile* n. sp. from Yemen, Al-Kowd. Right male palp, prolateral-dorsal (124), apical-dorsal (125), retrolateral (126), and dorsal view (127). Scale bars: 0.1 mm. Arrow points to vestigial distal haematodocha (124).



Figures 128–131. *Tidarren gracile* n. sp., from Yemen, Al-Kowd. Female epigynum/vulva in lateral (128), ventral (129), aboral (130), and dorsal view (131). Scale bar: 0.1 mm.

Material examined

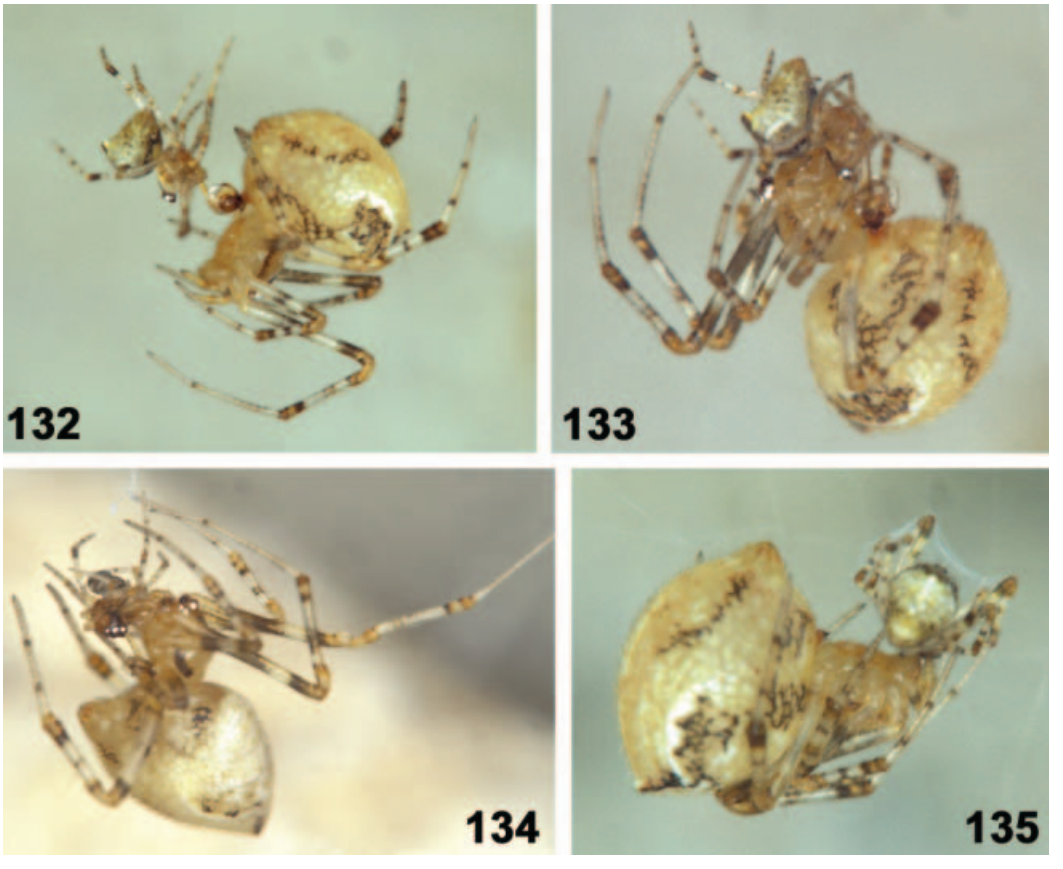
Only the types.

Etymology

Latin adjective *gracile* referring to the gracile appearance of this species. The suffix agrees in gender of the genus name.

Diagnosis

As in many *Tidarren* species from Yemen the abdomen ends in a dorsal tubercle (Figures 80, 122, 123, 132–135), and females lack a sternal knob. *Tidarren gracile* is the smallest representative in Yemen, female carapace width 0.6–0.8 mm. It differs by its pointed, hook-like and heavily sclerotized epigynal protuberance (Figures 128–131). Copulatory orifices separate, copulatory ducts short. The male is characterized by the



Figures 132–135. *Tidarren gracile* n. sp. from Yemen, Al-Kowd, copulatory behaviour of two pairs. (132) First minutes of copulation, right male palp inserted, his legs extended sideways. (133, 134) Female changes position and starts to suck out male, his palp still inserted. Sperm transfer and sexual cannibalism are synchronized. (135) Mate consumption after functional contact.

Table VIII. Leg measurements (mm) of *Tidarren gracile* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.22	0.14	0.13	–	0.26	0.76
I	1.72	0.40	0.98	1.28	0.60	4.98
II	1.10	0.35	0.55	0.75	0.48	3.22
III	0.80	0.30	0.40	0.56	0.42	2.49
IV	1.32	0.40	0.72	0.90	0.52	3.88

Table IX. Leg measurements (mm) of *Tidarren gracile* n. sp., male (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
I	0.52	0.16	0.30	0.30	0.28	1.56
II	0.36	0.16	0.20	0.20	0.26	1.18
III	0.28	0.12	0.14	0.15	0.22	0.92
IV	0.41	0.15	0.21	0.20	0.26	1.24

shape of the cymbium (Figures 124–127, 156), which is not projecting, and by the slender palpal tibia (Figure 127). Distal rim of tegulum with knob-like process (Figure 124), prolateral part of conductor with a few small humps and denticles (Figure 125). Basal segments of palp and cymbium pale yellow.

Measurements (mm)

[♂/♀, *n*=5/7, minimum–maximum (mean).] Total length 0.82–1.01 (0.92)/2.17–2.71 (2.38), carapace length 0.39–0.45 (0.42)/0.70–0.92 (0.81), width 0.35–0.39 (0.38)/0.58–0.82 (0.69), length femur I 0.47–0.55 (0.50)/1.21–1.78 (1.61), tibia I 0.29–0.35 (0.31)/0.68–1.01 (0.90). Abdomen 0.39–0.72 (0.60)/1.97–2.34 (2.13) high, 0.45–0.57 (0.51)/1.40–1.99 (1.59) long, and 0.39–0.49 (0.46)/1.27–1.68 (1.48) wide. Ventral side (distance petiolus to spinnerets) 0.27–0.41 (0.35)/0.72–1.07 (0.93) long. Clypeus 0.10–0.18 (0.15)/0.16–0.25 (0.20) high. Chelicerae 0.09–0.14 (0.12)/0.29–0.37 (0.33) long. Sternum about as long as wide, 0.24–0.27 (0.26)/0.45–0.58 (0.51) long and 0.25–0.27 (0.26)/0.45–0.55 (0.50) wide. Labium 0.08–0.10/0.18–0.23 wide and 0.05/0.09–0.12 long (3♂/6♀). Gnathocoxae 0.12/0.25–0.29 long and 0.05/0.10–0.12 wide (2♂/6♀). Femur of male palp 0.2 long. Leg formula 1423, see Tables VIII, IX. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 1/1, of legs I–IV 2/2, 2/1, 2/2, 3/3 in female and 2/1, 2/0, 2/2, 2/2 in male (1♂, 1♀ examined). Metatarsi I–III with one trichobothrium, position on I in female (male) 0.35 (0.28), on II 0.35 (0.35), on III 0.35 (0.37). Tarsal claws of legs with two to three side teeth, claw of female palp consisting of five to six teeth. Tarsal organ on female palp at 0.80, on female (male) legs I–IV 0.41 (0.28), 0.35 (0.23), 0.28 (0.23), 0.26 (0.24).

Somatic features, colouration (Figures 80, 122, 123, 132–135)

Sternum without posterior knob. Abdomen with dorsal tubercle (Figures 80, 122, 123), higher than long. Overall colouration in male and female similar; abdominal pattern in male less distinct. Carapace pale yellow brown with dark median band from eye region to centre; in females usually with broad dark margins, males not. Clypeus dark or greyish. Chelicerae light yellow brown, in females sometimes lightly suffused with grey. Gnathocoxae and labium pale yellow. Sternum usually uniformly pale yellow, sometimes with dark interrupted margins and some small dark spots. Legs pale yellow with dark patches and annulations; in females dark markings usually predominant. Female palp light yellow, with darkened distal part of tibia. Male palp pale yellow. Abdomen whitish to yellow brown with variable dark markings (Figures 122, 123, 132–135). Dorsum without longitudinal band, but showing two irregular paramedian dark bands at anterior sides, which meet at apex. Dark markings sometimes rather indistinct. Aboral area yellowish to whitish with white median stripe from apex to spinnerets and sometimes with two paramedian dark longitudinal markings. Epigaster yellow brown in female, greyish in male, book lung covers pale yellow. Venter in female with dark and white patches, in male dark with two paramedian spots between epigastric furrow and spinnerets. Spinnerets pale yellow to brown.

Male palp (Figures 124–127, 156)

Tibia rather slender, distal rim ca 0.6 width of palpal organ; at base strongly constricted in dorsal view, 0.4 width of distal rim (Figure 127). Palpal organ 0.20 mm wide. Cymbium

inconspicuous and comparatively small, about as long as wide, slightly shorter than bulbus, distally not tapering much, with apical ridges (Figures 124–126, 156). Tegulum very large. Subtegulum hidden between tegulum and cymbium. Distal rim of tegulum with distinct, asymmetric knob-like process near embolar base. Retrolateral, membranous part of conductor 0.15 mm long, its tip pointed and sclerotized, with furrow guiding embolus; prolateral part sclerotized, with a few humps and denticles. Embolar base suboval, 0.08 long and 0.05 mm wide. Distal part of embolus 0.17 mm long. Haematodochae not modified (Figure 132).

Epigynum, vulva (Figures 128–131)

Epigynum heavily sclerotized, clearly delimited from epigastric region. Epigynal protuberance distinct, pointed, hook-like (Figures 128, 129), about 0.1 mm long, directed forwards (Figures 123, 135). In side view, posterior contour curved, anterior one slightly arched. In aboral view protuberance gradually fuses with surrounding integument (Figure 130). Copulatory orifices well separated, situated in front of anterior border of epigynal protuberance (Figure 129), in ventral view at posterior end of receptacula. Copulatory ducts very short, 0.08 mm long, separate. They run laterally and enter receptacula at posterior inner side. Receptacula seminis 0.14 mm long and 0.10 wide. Epigynal protuberance shorter than receptacula (Figure 129).

Copulatory behaviour (Figures 123, 132–135)

Tidarren gracile differs from the hitherto studied one-palped spiders in copulatory behaviour. Females start to consume their mates during copulation, without amputating the male gonopod (Figures 133, 134). After 10–20 min of such consummatory sexual act the male is removed from the epigynum and finally completely sucked out (Figures 123, 135). Males die during copulation. Three copulations were observed. During courtship the female shook and vibrated her body intensively, but did not pluck at all. Courtship lasted 2.0 min, 5.0 min and 7.8 min ($n=3$). As typical of other *Tidarren* species, the male approached the female and installed the mating thread. At the starting point of this thread he performed a plucking sequence, which immediately induced the female to adopt the copulatory posture, perpendicular to the mating thread. Before insertion was successful, three, five and 15 insertion attempts were performed ($n=3$).

In one observation insertion lasted a very long time, 172.8 min. During the first 10 min of insertion the male pulsated his abdomen and along with this his prosoma became more and more shrivelled. Then he became motionless. After 10 min of insertion the female changed her inclined posture to a horizontal one so that the male's abdomen came to lie at her mouthparts (compare Figures 133 and 132). She then started to suck him out from the abdominal tubercle, while his palp remained inserted. In time with her sucking movements he was rhythmically see-sawed. In the 43rd minute of insertion the female tried to get rid of the male palp, but failed to loosen genital contact. She wrapped him with silk and continued consumption after changing her position. After 85 min of such synchronous sperm transfer and sexual cannibalism the male's abdomen was almost completely sucked out, its volume having become smaller than that of his prosoma (see Figure 134), whereas the volume of the palpal haematodochae did not decrease noticeably. Only after 150 min was haematodochal inflation observed to be smaller. During the last hour of insertion the female became more and more restless and sucked out the male from various parts of the

body, changing from one leg to another and finally to the male's prosoma. She tried to pull off the male palp another two times, but did not succeed. Finally, after 172.5 min the remnants of the male were rapidly dislodged. Afterwards the female sucked out the male palp, which was still partially filled with haemolymph.

In the other two observations genital contact was much shorter, 12.5 and 21 min. The females started sexual cannibalism after 6.5 and 8.2 min, respectively, while palpal insertion was maintained. After removal the females continued to consume their mates for 4.5 and 5.5 h.

Natural history

Egg-sac white to grey, number of eggs low (20; $n=1$). The sparse data on postembryonic development reveal fast growth. Males were found to be subadult 28 days and adult ca 35 days after egg-laying. Females show considerable longevity. One female was still alive 6 months after her maturation.

Distribution, habitat

Tidarren gracile is known only from the type locality in Yemen close to the Indian Ocean, from an agricultural area, where mainly fruit crops (mango, banana, guava), sorghum, cotton, sesame, and some vegetables are grown. *Tidarren gracile* was collected from a large shrub, which was densely covered with webs of a species of Pisauridae.

Tidarren konrad n. sp.
(Figures 16, 136–141; Table X)

Type material

Yemen: 1♀ holotype, deposited in MHNG, 1♀ paratype NMW, 1sad♀, Hammam 'Ali, 14°41′N, 44°08′E, 1600 m, 27 July 1998, leg. A. van Harten (1♀ matured on 10 August 1998). 1♀ paratype CTh, Madinat ash-Shirq, 14°38′N, 43°58′E, 1300, 7 August 2001, leg. A. van Harten (adult on 20 September 2001).

Material examined

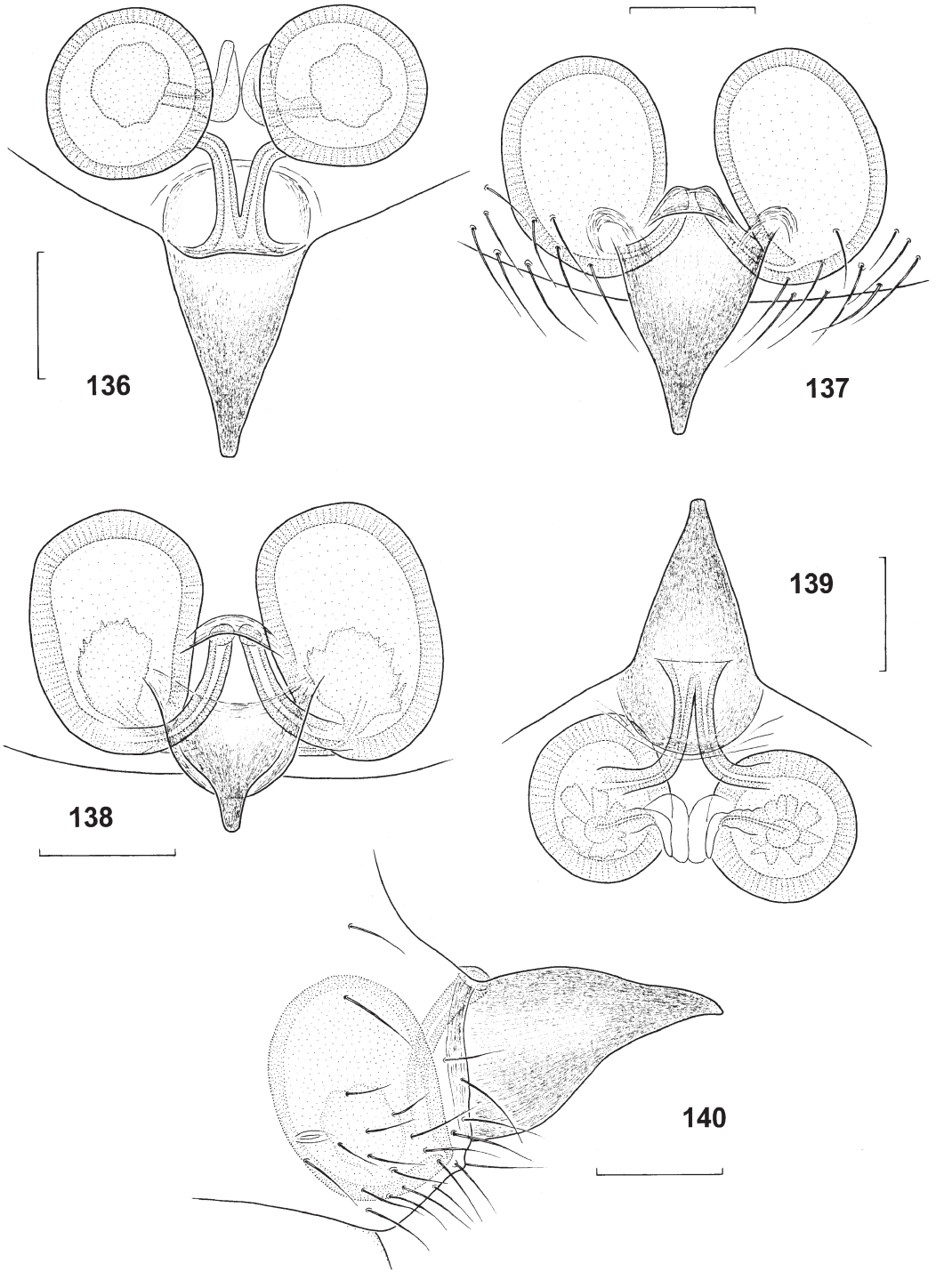
Only the types.

Etymology

Proper noun in apposition and hence invariable. This species is named in honour of Prof. Dr Konrad Thaler (19 December 1940 to 11 July 2005) with whom B.K. had the good fortune to share a most pleasant, fascinating, and interesting period of life.

Diagnosis

Like most species in Yemen the abdomen bears a dorsal tubercle (Figure 141a). As in *T. dentigerum*, females have a posterior sternal tubercle (Figure 16). *Tidarren konrad* differs by



Figures 136–140. *Tidarren konrad* n. sp., from Yemen, Hammam 'Ali. Female epigynum/vulva in frontal (136), ventral (137, 138), aboral (139), and lateral view (140). Scale bars: 0.1 mm.

Table X. Leg measurements (mm) of *Tidarren konrad* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.28	0.18	0.16	–	0.30	0.92
I	1.68	0.48	0.88	1.25	0.56	4.84
II	1.10	0.44	0.55	0.78	0.48	3.34
III	0.82	0.35	0.45	0.59	0.41	2.62
IV	1.38	0.50	0.72	0.95	0.46	4.01

its long and strongly projecting, pointed, anteriorly directed epigynal protuberance (Figures 16, 136–140, 141a). Male unknown.

Measurements (mm)

[♀, n=3, respectively.] Total length 2.47–2.69–3.25, carapace length 0.98–1.03–1.13, width 0.80–0.92–0.98, length femur I 1.46–1.68–1.76, tibia I 0.82–0.88–0.94. Abdomen 2.05–2.82 high, 1.33–2.03 long, and 1.37–1.92 wide (2♀). Ventral side (distance petiolus to spinnerets) 1.11–1.37 long. Clypeus 0.20–0.25 high. Chelicerae 0.33–0.37 long. Sternum 0.59–0.64 long and 0.57–0.64 wide (2♀). Labium 0.25 wide and 0.12 long (1♀). Gnathocoxae 0.31 long and 0.14 wide (1♀). Leg formula 1423, see Table X. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 2/1, of legs I–IV 3/2, 3/2, 2/2, 3/3 (1♀ examined). Metatarsi I–III with one trichobothrium, position on I 0.32, on II 0.34, on III lacking. Tarsal claws of legs with four side teeth, claw of female palp consisting of eight teeth. Tarsal organ on female palp at 0.82, on legs I–IV 0.48, 0.42, 0.34, 0.56.

Somatic features, colouration (Figures 16, 141)

Sternum with posterior tubercle between coxae IV (Figure 16, arrow). Abdomen higher than long, with small dorsal tubercle (Figure 141). Carapace uniformly brown to dark brown. Chelicerae, gnathocoxae, and labium light brown; sternum light brown with narrow dark margins or medium brown. Legs light yellow with extended dark patches and annulations. Pedipalps darker than legs. Posterior half of abdomen whitish to yellowish light brown, anterior half dark at sides. These different pigmentations join at tubercle. Dorsal band indistinct. In aboral whitish area a distinct white median stripe leads from tubercle straight to spinnerets (Figure 141b). Venter with dark and white patches. Spinnerets brown.

Epigynum, vulva (Figures 136–140)

Epigynal protuberance strongly protruding, ca 0.2 mm long, directed anteriorly towards posterior tubercle of sternum (Figures 16, 141a); more or less cone-shaped, in lateral view broad at base, but distinctly tapering at about half its length (Figure 140). Posterior contour curved, anterior one only slightly arched. In aboral view protuberance clearly delimited from surrounding integument (Figure 139). Copulatory ducts fused at entrance for very short distance, altogether ca 0.13–0.14 mm long. They diverge posteriorly and enter receptacula posteriorly. Common copulatory orifice at anterior border of epigynal protuberance (Figure 137), in ventral view at posterior part of receptacula. Protuberance about as long as receptacula (Figure 137). Receptacula seminis 0.19 mm long and 0.12 wide.

Distribution, habitat

Tidarren konrad has been collected from two localities in Yemen in a habitat similar to that of *T. dentigerum*.

Tidarren sheba n. sp.
(Figures 77, 142–153, 155; Tables XI, XII)

Type material

Yemen: 1♀ holotype, deposited in MHNG, Ar-Rujum, 15°26′N, 43°40′E, 1900 m, 29 January 2001, leg. van Harten (adult on 18 February 2001). 1♀ paratype, CTh, near Hammam 'Ali, 14°41′N, 44°08′E, 18 April 2001, leg. van Harten. 1♂ paratype, MHNG, Madinat ash-Shirq, 14°38′′N, 43°58′E, 1300 m, 15 August 2000, leg. van Harten. 2♂, 1♀ paratypes, 1♂ CTh, 1♂,1♀ NMW, Ta'izz, 9 August 1999, 13°35′N, 44°02′E, 1400 m, leg. A. van Harten (1♂ adult on 28 August 1999, ♀ on 11 September 1999).

Material examined

Only the types.

Etymology

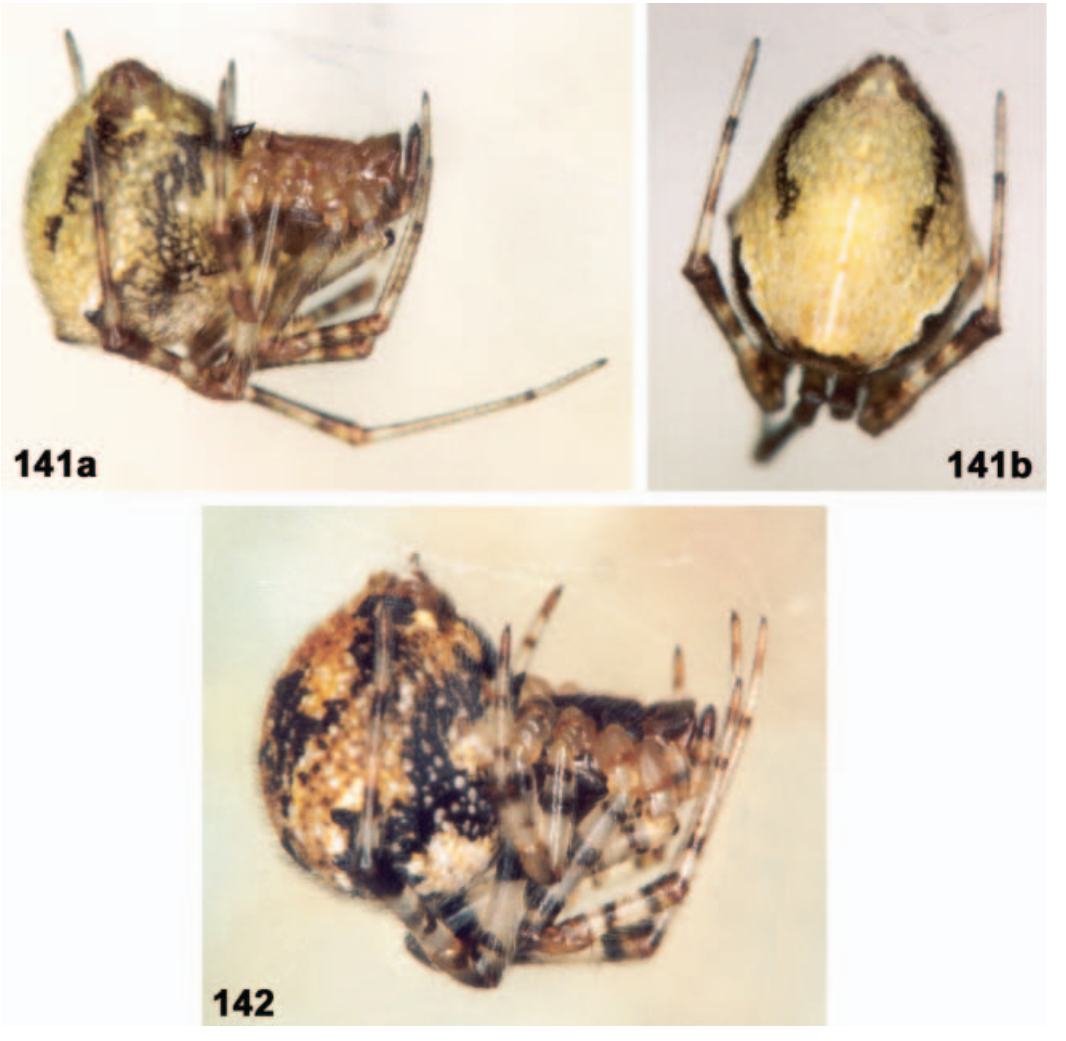
The species epithet is a noun in apposition, referring to its occurrence in Yemen, the ancient Sheba kingdom. The biblical Sheba (Arab: Saba') was the kingdom founded by the Sabaeans in the southwestern part of the Arabian Peninsula. Between the 10th and the 2nd century BC it was one of the most powerful and wealthy states of Arabia.

Diagnosis

Among the species from Yemen *T. sheba* shares with *T. argo* a rounded abdomen lacking a tubercle (Figures 77, 142). Female sternum also without knob. *Tidarren sheba* differs by the shape of the epigynal protuberance, which is inconspicuous, weakly sclerotized and scarcely projecting (Figures 142, 147–153). Copulatory ducts long, fused at entrance. Inner side of femur and tibia I of female speckled. The male is distinguished by the tapering cymbium (Figures 143–146, 155), which is not provided with teeth, but with ridges. Prolateral part of conductor with large spur-like process and several small denticles (Figures 144–146). Distal rim of tegulum forming two trianguloid processes (Figures 143, 145, 146). The embolus is rather long.

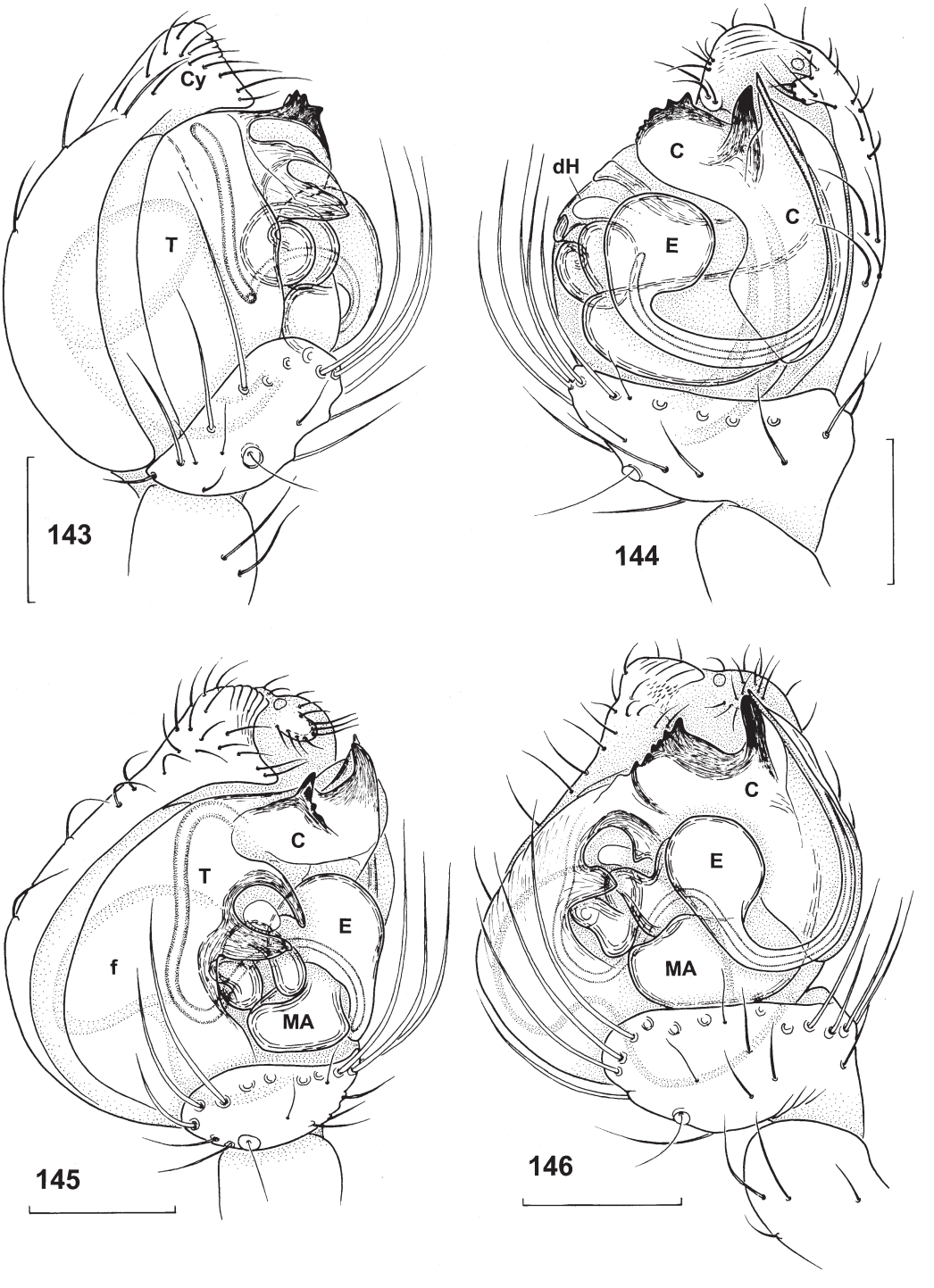
Measurements (mm)

[♂/♀, $n=3$, respectively.] Total length 1.03–1.11–1.23/3.56–3.18–3.29, carapace length 0.45–0.47–0.53/1.17–1.21–1.27, width 0.39–0.43–0.41/1.05–1.07–1.09, length femur I 0.62–0.66–0.69/1.97–2.2–2.05, tibia I 0.39–0.39–0.42/1.13–1.2–1.23. Femur of male palp 0.2 long. Abdomen 0.72–0.78–0.84/1.85–2.15–2.93 high, 0.66–0.66–0.68/1.81–2.01–2.93 long, and 0.62–0.55–0.59/1.60–1.76–2.54 wide (3♂/3♀, respectively). Ventral side (distance petiolus to spinnerets) 0.47–0.51–0.53/1.07–1.37 long. Clypeus 0.16–0.18–

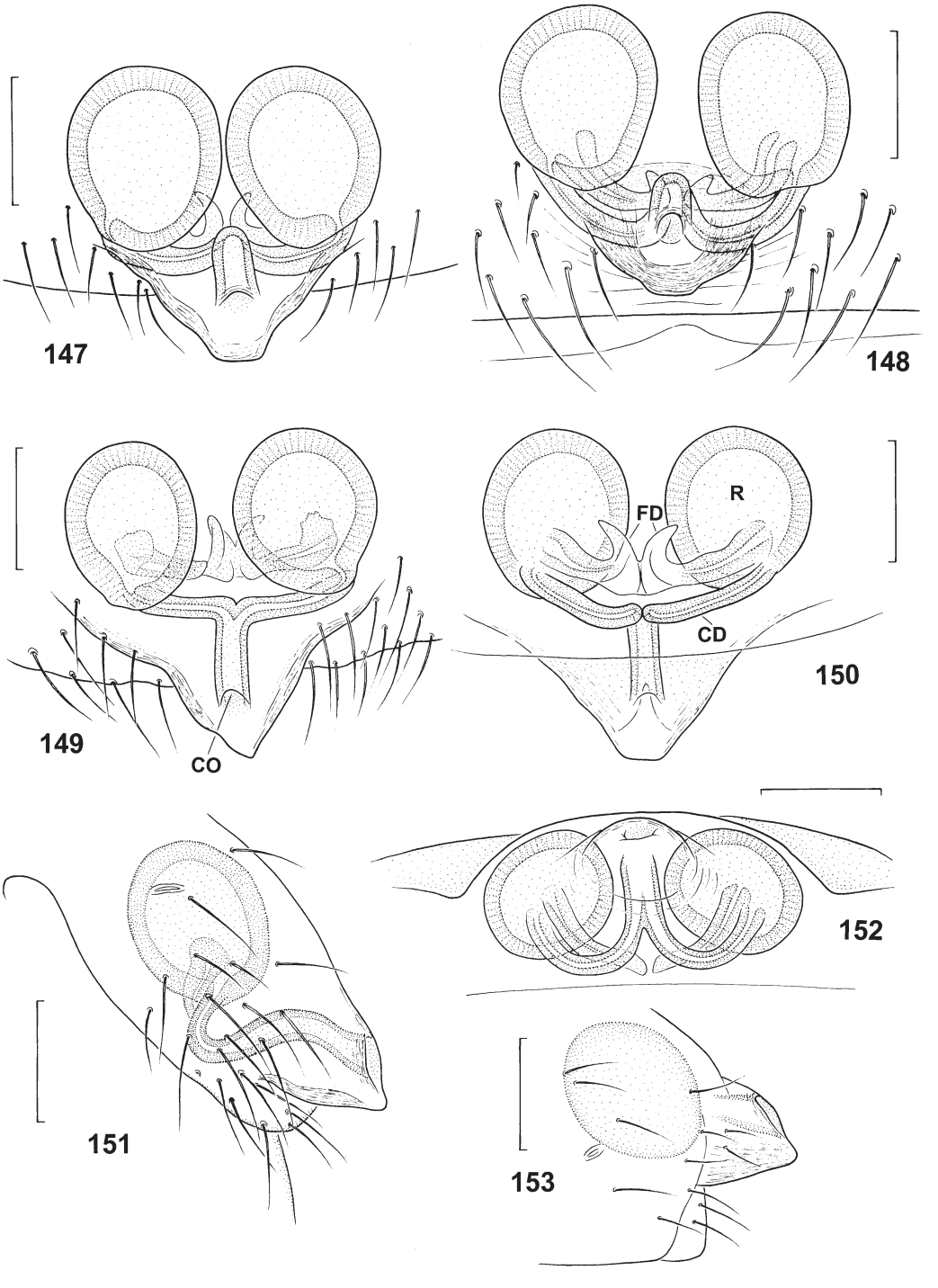


Figures 141, 142. Female habitus. (141) *T. konrad* n. sp., lateral (a) and aboral (b). (142) *T. sheba* n. sp. All specimens from Yemen.

0.20/0.21–0.29 high (3♂/2♀, respectively). Chelicerae 0.16–0.16–0.23/0.47–0.49 long. Sternum 0.25–0.27–0.31/0.74–0.78 long and 0.27–0.27–0.31/0.64–0.64 wide (3♂/2♀). Labium 0.12/0.27–0.29 wide and 0.04/0.14–0.16 long (1♂/2♀). Gnathocoxae 0.14/0.39–0.45 long and 0.08/0.16–0.16 wide (1♂/2♀). Leg formula 1423, see Tables XI, XII. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 2/1, of legs I–IV 4/2, 3/2, 3/3, 3/3 in female and 2/1, 2/1, 1/2, 2/2 in male (1♂, 1♀ examined). Metatarsi I–III with one trichobothrium, position on I in female (male) 0.35 (0.28), on II 0.35 (0.32), on III 0.37 (0.33). Tarsal claws of legs with three to four (three) side teeth in female (male), claw of female palp consisting of six teeth. Tarsal organ on female palp at 0.84, on female (male) legs I–IV 0.57 (0.40), 0.45 (0.30), 0.40 (0.26), 0.38 (0.24).



Figures 143–146. *Tidarren sheba* n. sp. from Yemen, Ta'izz. Right male palp, prolateral (143), dorsal-retrolateral (144), dorsal-prolateral (145), and dorsal view (146). Scale bars: 0.1 mm.



Figures 147–153. *Tidarren sheba* n. sp., from Yemen, Hammam 'Ali (147, 148, 150, 153) and Ta'izz (149, 151, 152). Female epigynum/vulva in ventral (147–149), dorsal (150), lateral (151, 153), and aboral view (152). Scale bars: 0.1 mm.

Figures 154–156. Male palp, ventral (154, 155) and apical view (156) showing cymbium. (154) *Tidarren argo* Knoflach and van Harten. (155) *T. sheba* n. sp. (156) *T. gracile* n. sp. All specimens from Yemen.

Somatic features, colouration (Figures 77, 142)

Sternum without tubercle. Abdomen rounded, without hump, about as high as long or only slightly higher. Colouration sexually dimorphic. Female carapace uniformly dark brown, in male pale yellow brown with dark margins and dark median area from eye region to centre. Chelicerae light brown, sometimes with dark longitudinal patches on inner margin. In female, sternum, gnathocoxae, and labium dark brown with a few small light spots. In male, sternum yellow brown, with dark margins and numerous dark spots; labium and gnathocoxae yellow brown. Legs light yellow brown with dark patches and annulations. In female, leg I with numerous small dark dots on inner side of femur and tibia. Female palp light yellow, with darkened tibia and tarsus. Male palp pale yellow. Abdomen whitish with dark markings of various extent. Dorsum lacks a longitudinal band, but shows two transverse, irregular dark bands, which may fuse at sides. Sides therefore dark in anterior half. Apical region with a small dark semilunar mark. White median stripe from apex to

Table XI. Leg measurements (mm) of *Tidarren sheba* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.33	0.22	0.20	–	0.37	1.11
I	2.22	0.68	1.22	1.86	0.71	6.70
II	1.38	0.56	0.72	1.08	0.56	4.30
III	1.02	0.46	0.52	0.75	0.52	3.29
IV	1.80	0.62	1.04	1.32	0.66	5.45

Table XII. Leg measurements (mm) of *Tidarren sheba* n. sp., male (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
I	0.69	0.22	0.42	0.46	0.35	2.13
II	0.47	0.19	0.27	0.28	0.30	1.51
III	0.35	0.16	0.20	0.21	0.27	1.18
IV	0.53	0.20	0.32	0.31	0.30	1.65

spinnerets very inconspicuous or lacking. Aboral area yellowish to whitish with two to three irregular transverse bands which may fuse at sides in female. Abdominal pattern less distinct in male. Epigaster dark brown in both sexes, book lung covers pale yellow. Venter in female with dark and white patches, in male dark with two paramedian spots between epigastric furrow and spinnerets. Spinnerets brown to dark brown.

Male palp (Figures 143–146, 155)

Tibia at distal rim almost as wide as bulbus (Figure 144), distinctly constricted at base. Palpal organ 0.24 mm wide. Cymbium rather inconspicuous and comparatively slender, about 1.2 times longer than wide (ca 0.3 mm long), distally tapering and projecting beyond bulbus, at end with some indistinct ridges and small scales. Distal rim of tegulum excavated and forming two trianguloid processes near embolar base; in the excavation between these processes lies the rudimentary distal haematodocha. Retrolateral, membranous part of conductor large, 0.2 mm long, and guides embolus. Prolateral, sclerotized part bears a large spur-like process and several small denticles. Embolar base circular, 0.06 mm in diameter. Distal part of embolus rather long, ca 0.3 mm.

Epigynum, vulva (Figures 147–153)

Epigynum embedded in dark epigastric region and therefore not clearly delimited. Epigynal protuberance inconspicuous, weakly sclerotized and scarcely projecting, less than 0.1 mm long; in ventral and lateral view it is a short, blunt, trianguloid process (Figures 147, 151, 153). In aboral view the protuberance gradually merges with the surrounding integument (Figure 152). Tip of protuberance asymmetric in one female (Figure 149). Copulatory ducts ca 0.19 mm long, fused for almost half their length. From this common part they diverge laterally and enter receptacula posteriorly. Copulatory orifice situated close to apex and below anterior border of epigynal protuberance (Figures 147, 150, 151, 153), in ventral view far behind receptacula. Protuberance about as long as receptacula or shorter (Figures 147–149). Receptacula seminis 0.14 mm long and 0.12 mm wide.

Distribution, habitat

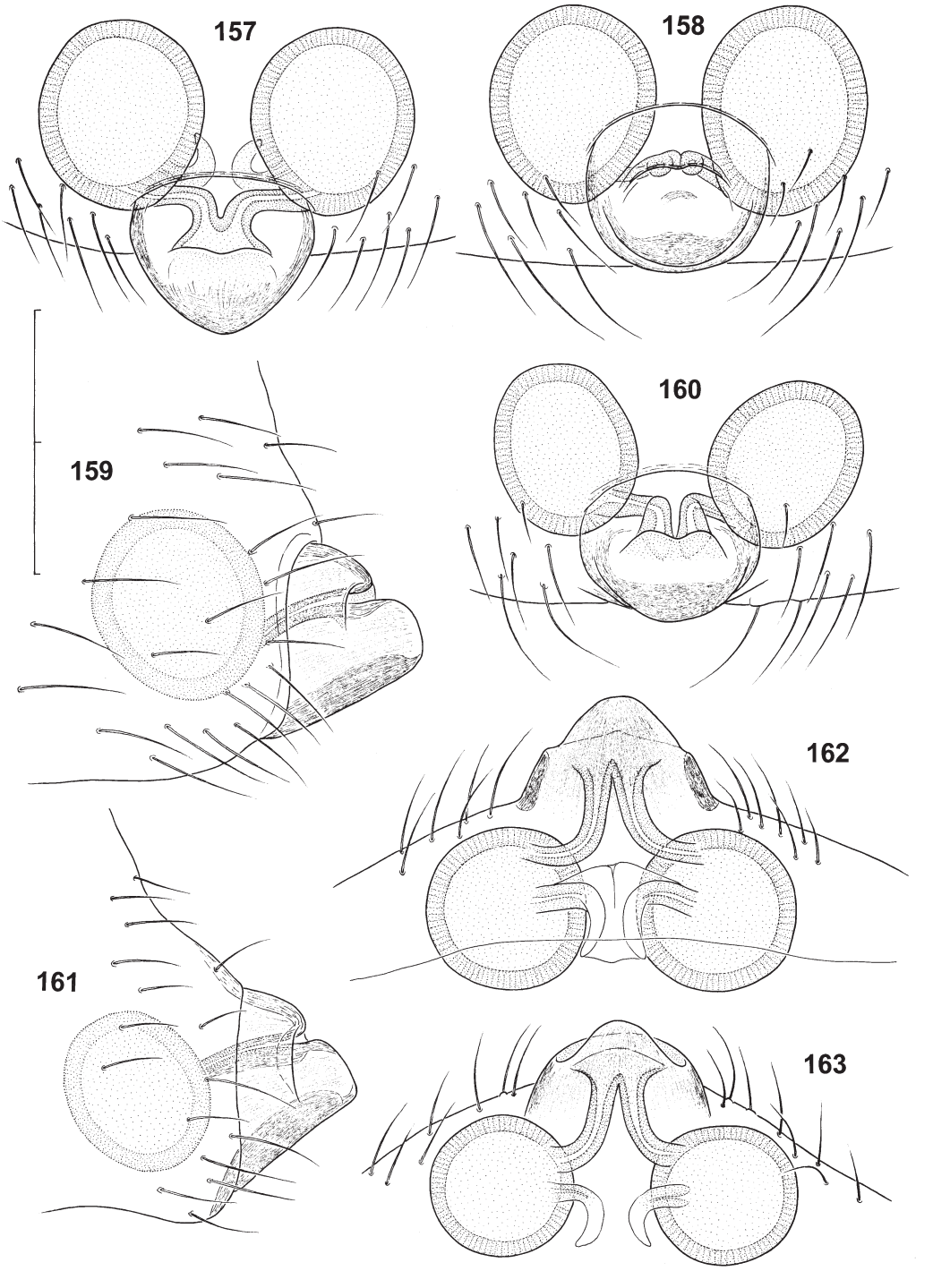
Tidarren sheba is known from three localities in Yemen. It occupies a habitat similar to that of *T. dentigerum*.

Tidarren species from mainland Africa

Tidarren aethiops n. sp.
(Figures 157–163, 172; Table XIII)

Type material

Democratic Republic of Congo: 1♀ holotype, 2♀ paratypes, MHNG, Poko, R. de Lessert (sub *Theridion* sp.). 2♀ paratypes, NMW, ''Belg. Kongo'' without exact locality (Inv. No. 709, sub *Theridion cuneolatum*, det. Reimoser 1938; together with 1♀ *Tidarren lanceolatum* n. sp. and 3♀ *Tidarren perplexum* n. sp.).



Figures 157–163. *Tidarren aethiops* n. sp., from Democratic Republic of Congo. (157–159, 162) from Poko. (160, 161, 163) Without exact locality. Female epigynum/vulva in frontal-ventral (157), ventral (158, 160), lateral (159, 161), and aboral view (162, 163). Scale bar: 0.2 mm.

Table XIII. Leg measurements (mm) of *Tidarren aethiops* n. sp., female from Poko (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.38	0.22	0.20	–	0.40	1.19
I	2.25	0.60	1.40	1.85	0.80	6.90
II	1.50	0.55	0.88	1.20	0.62	4.75
III	1.25	0.48	0.60	0.82	0.55	3.70
IV	1.88	0.62	1.05	1.32	0.68	5.55

Material examined

Only the types.

Etymology

The specific epithet is a noun in apposition and refers to the terra typica of the species (ancient Greek *aethiops* meaning burnt face).

Diagnosis

Tidarren aethiops is distinguished by its rounded and laterally incised epigynal protuberance (Figures 157–163). Position of copulatory orifices not at anterior border, but roughly at centre of epigynal protuberance. Male unknown.

Measurements (mm)

[♀, n=5, minimum–maximum (mean).] Total length 3.29–3.40 (3.33), carapace length 1.17–1.37 (1.23), width 0.94–1.10 (1.01), length femur I 1.92–2.15 (2.01), tibia I 1.13–1.37 (1.24). Abdomen 2.74–3.13 (2.96) high, 2.07–2.35 (2.19) long, and 1.96–2.11 (2.00) wide. Ventral side (distance petiolus to spinnerets) 1.49–2.07 (1.67) long. Clypeus 0.21–0.27 (0.26) high. Chelicerae 0.39–0.53 (0.48) long. Sternum 0.72–0.78 (0.74) long and 0.62–0.70 (0.66) wide. Labium 0.13 long and 0.26 wide. Gnathocoxae 0.41 long and 0.18 wide (mean). Leg formula 1423, see Table XIII. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 1/1, of legs I–IV 3/2, 3/2, 3/3, 3/3 (1♀ examined). Metatarsi I–III with one trichobothrium, position on I 0.34, on II 0.35, on III 0.39. Tarsal claws of legs with four side teeth, claw of female palp consisting of eight teeth. Tarsal organ on female palp at 0.82, on legs I–IV 0.50, 0.48, 0.37, 0.29.

Somatic features, colouration

Somatic features and colouration based on females from NMW (type specimens faded). Sternum without posterior tubercle. Abdomen higher than long, forming a dorsal hump (Figure 172). Carapace with broad dark brown central area, broad dark margins, and interposed light paramedian bands. Chelicerae, labium, and gnathocoxae light brown. Legs and pedipalps light yellow with indistinct dark patches and annulations. Sternum either uniformly light yellow or with a few thin peripheral markings. Abdomen brownish, with dark pigmentation and white guanin markings; broad dorsal median area outlined by a pair

of distinct white stripes, which branch laterally and end at tip of abdomen; lateral area behind stripes lighter than anterior area. From apex a distinct white median stripe leads straight to spinnerets, surrounded by a greyish zone and two dark longitudinal stripes. Epigynal protuberance flanked by dark epigastric region. Book lung covers light yellow. Venter dark, with a few white patches. Spinnerets light brown.

Epigynum, vulva (Figures 157–163)

Epigynal protuberance rounded, and incised in lateral view (Figures 159, 161), 0.10 mm long, 0.14 mm broad at widest part (Figures 157, 158, 160). Margins more sclerotized than whitish central area. In aboral view the protuberance fuses gradually with surrounding integument (Figures 162, 163). Lateral incision contains copulatory orifices, which are not situated at anterior border, but at anterior third of epigynal protuberance. In ventral view orifices close to posterior end of receptacula. Copulatory ducts separate for a major part (Figures 157, 162, 163), ca 0.1 mm long. They immediately diverge and enter receptacula posteriorly, at inner side. Receptacula seminis 0.14 mm long, 0.11–0.12 mm wide. Epigynal protuberance slightly shorter than receptaculum (Figures 157, 158, 160).

Distribution

Known from the Democratic Republic of Congo (Zaire).

Tidarren afrum n. sp.
(Figures 164–171, 173; Table XIV)

Type material

Cameroon: 1♀ holotype, 4♀ paratypes, CAS, Southwest Prov., Fako Div., Limbe Subdiv., 1.4 km NE of Etome, ca 400 m, 4°02′58″N, 9°07′31″E, 13–19 January 1992, leg. Larcher, Hormiga, Coddington, Griswold, and Wanzie.

Other material examined

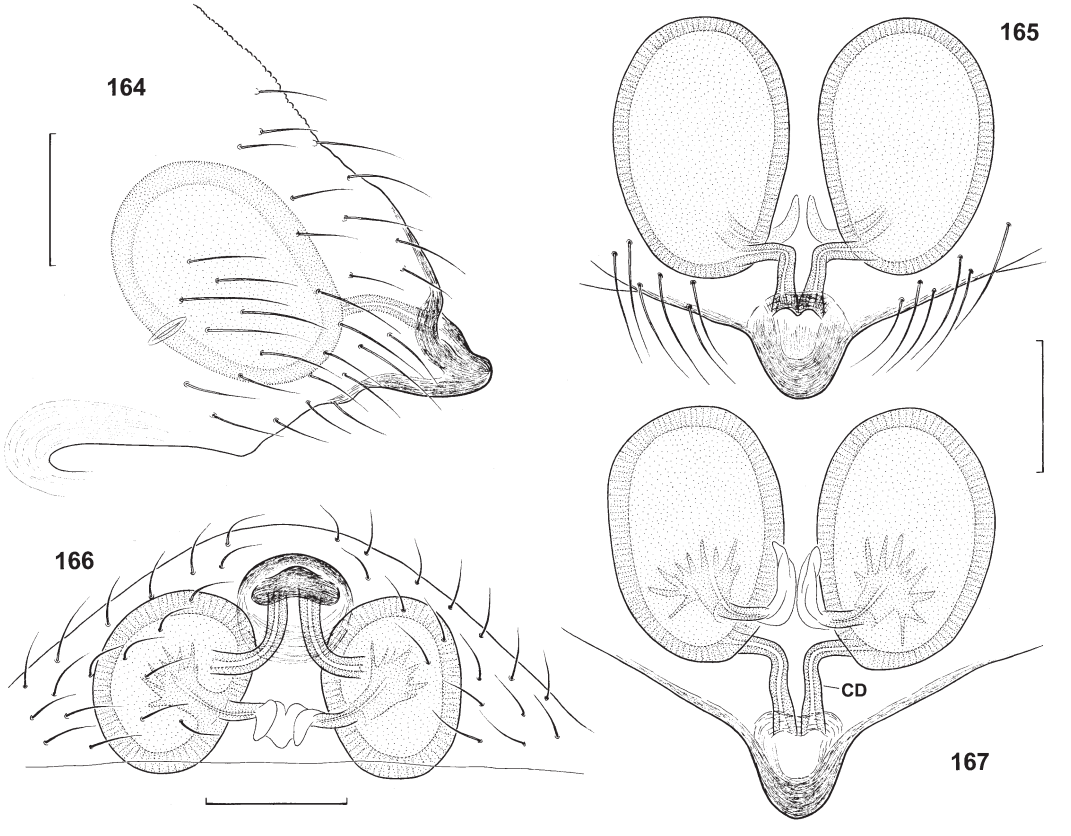
Uganda: 1♀, CAS, Rukungiri Dist., Kitahurira, Bwindi Impenetrable National Park, ca 0°58′S, 29°41′E, ca 1740 m, roadcuts in forest, 17–19 September 1996, leg. C. Griswold and G. Mayoba.

Etymology

The specific epithet is derived from the Latin adjective *afer*, *afra*, *afrum* meaning African. The suffix agrees with the gender of the genus name.

Diagnosis

Tidarren afrum differs by its epigynal shape (Figures 164–167), with tapered, but still rounded tip. Copulatory ducts run anteriorly in parallel before abruptly bending laterally towards receptacula. Receptacula seminis rather large. Male unknown.



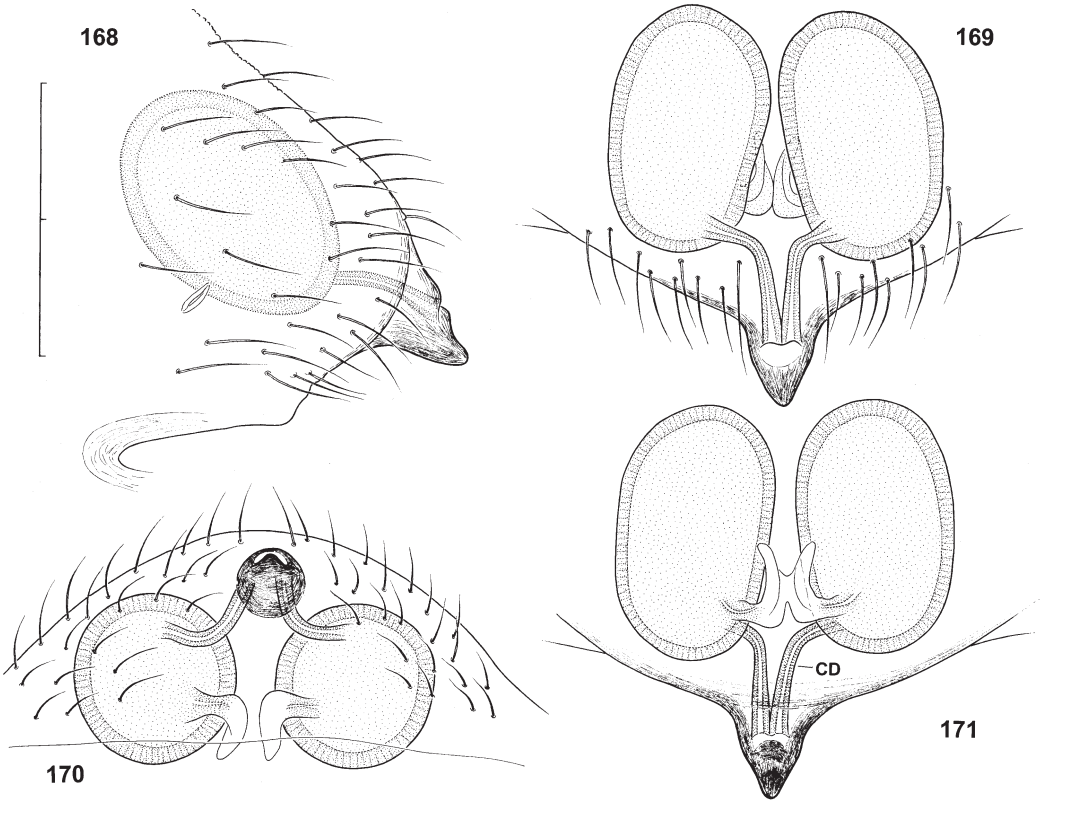
Figures 164–167. *Tidarren afrum* n. sp., from type region Cameroon. Female epigynum/vulva in lateral (164), ventral (165), aboral (166), and dorsal view (167). Scale bars: 0.1 mm.

Measurements (mm)

[♀, n=5, minimum–maximum (mean).] Total length 2.74–3.44 (3.14), carapace length 1.13–1.29 (1.21), width 0.98–1.10 (1.03), length femur I 2.07–2.31 (2.18), tibia I 1.25–1.45 (1.37). Abdomen 2.03–2.62 (2.45) high, 1.60–2.03 (1.89) long, and 1.49–1.88 (1.73) wide. Ventral side (distance petiolus to spinnerets) 1.37–1.56 (1.48) long. Clypeus 0.27–0.29 (0.29) high. Chelicerae 0.43–0.53 (0.48) long. Sternum 0.68–0.76 (0.71) long and 0.60–0.68 (0.64) wide. Labium 0.26 wide and 0.14 long. Gnathocoxae 0.44 long and 0.20 wide (mean). Leg formula 1423, see Table XIV.

Somatic features, colouration

Sternum without posterior small tubercle. Abdomen higher than long, ending in tubercle (Figure 173). Carapace uniformly dark brown. Chelicerae brownish, gnathocoxae and labium light yellow or brown. Sternum light yellow, with distinct dark wavy margins, sometimes also with a few dark spots in centre. Pedipalps and legs light yellow with large dark annulations and patches. Abdomen brownish, with dark pigmentation and white guanin markings; whitish dorsal median area outlined by a pair of distinct white stripes, which diverge laterally; lateral area behind stripes lighter than anterior area. Aboral side



Figures 168–171. *Tidarren afrum* n. sp., from Uganda. Female epigynum/vulva in lateral (168), ventral (169), aboral (170), and dorsal view (171). Scale bar: 0.2 mm.

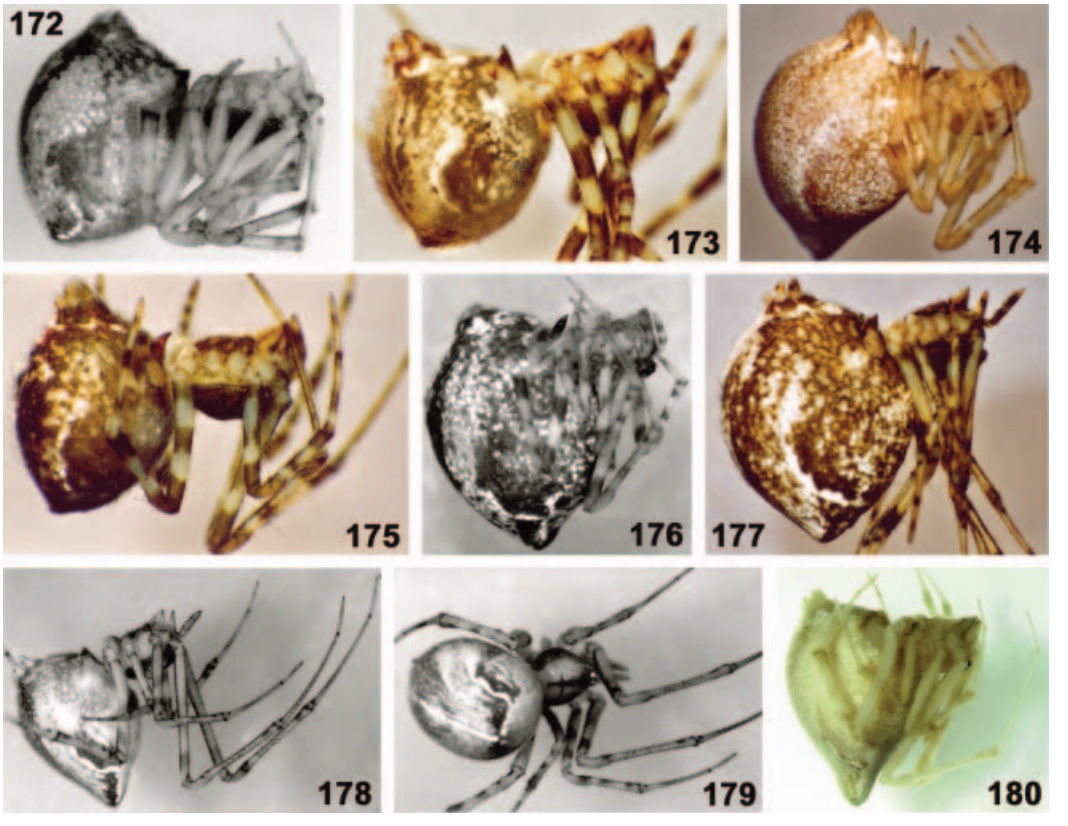
with white median stripe from apex to spinnerets and transverse, upwardly curved dark pigmentation of various extent, sometimes forming two to three stripes. Epigastric region dark, book lung covers light yellow. Venter dark with white patches. Spinnerets light brown to brown.

Epigynum, vulva (Figures 164–167)

Epigynal protuberance tapered, rounded, directed ventrally, ca 0.1 mm long (in lateral view, Figure 164), 0.08 mm broad at widest part (Figure 165), fused gradually with

Table XIV. Leg measurements (mm, by stereo microscope) of *Tidarren afrum* n. sp., female.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.3	0.2	0.2	–	0.3	1.0
I	2.1	0.5	1.4	1.7	0.8	6.6
II	1.4	0.5	0.8	1.1	0.6	4.5
III	1.0	0.4	0.5	0.8	0.5	3.3
IV	1.8	0.5	1.1	1.3	0.6	5.3

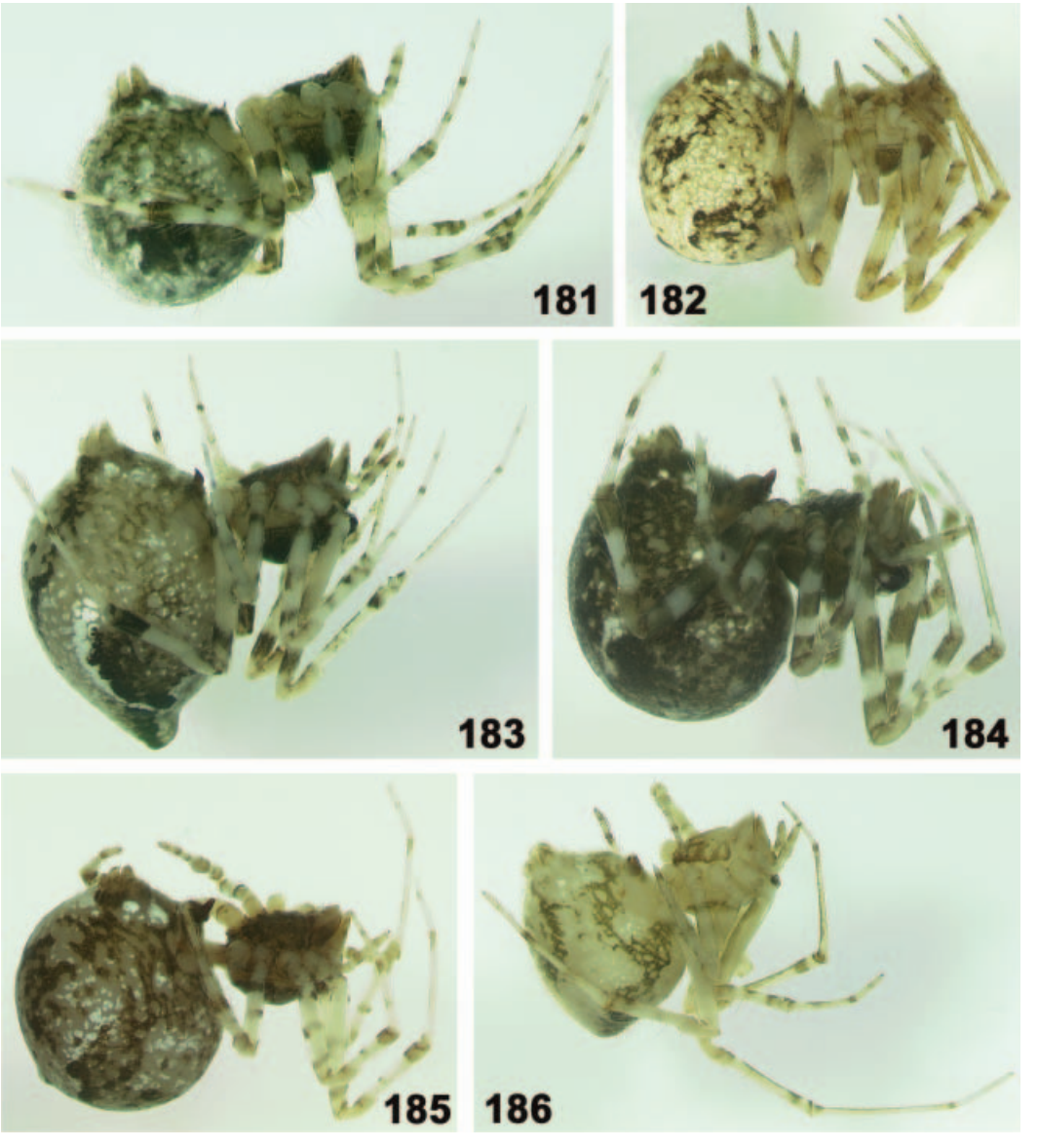


Figures 172–180. Female habitus. (172) *Tidarren aethiops* n. sp. from Democratic Republic of Congo. (173) *T. afrum* n. sp. from Cameroon. (174) *T. circe* n. sp. from Namibia. (175) *T. griswoldi* n. sp. from Cameroon. (176) *T. lanceolatum* n. sp. from Democratic Republic of Congo. (177) *T. perplexum* n. sp. from Cameroon. (178–180) *T. scenicum* (Thorell) from South Africa, Swaziland (178, 179) and from Cote d'Ivoire, Haute Cavally (180, type of *Theridion turrigerum* Simon). Photos from specimens preserved in alcohol.

surrounding integument. Copulatory orifices close together, situated at anterior border of epigynal protuberance, in ventral view behind receptacula. Copulatory ducts separate (Figures 165–167), ca 0.1 mm long. They run anteriorly in parallel and then abruptly bend laterally towards receptacula, entering them at posterior inner side. Receptacula seminis rather long, 0.2 mm long, 0.13 mm wide. Epigynal protuberance less than half length of receptacula (Figures 165, 167).

Variation

The single female from Uganda differs by having its epigynal protuberance more slender and pointed (Figures 168–171 versus Figures 164–167) and the copulatory orifices situated more distally at tip (Figures 169, 171 versus Figures 165, 167). It is not yet possible to judge precisely this variation. Overall general appearance as in the specimens from Cameroon, but dimensions are a little smaller (in mm: total length 2.50, carapace length 1.06, width 0.88, length femur I 1.84, tibia I 1.17, abdomen 2.07 high, 1.60 long, 1.37

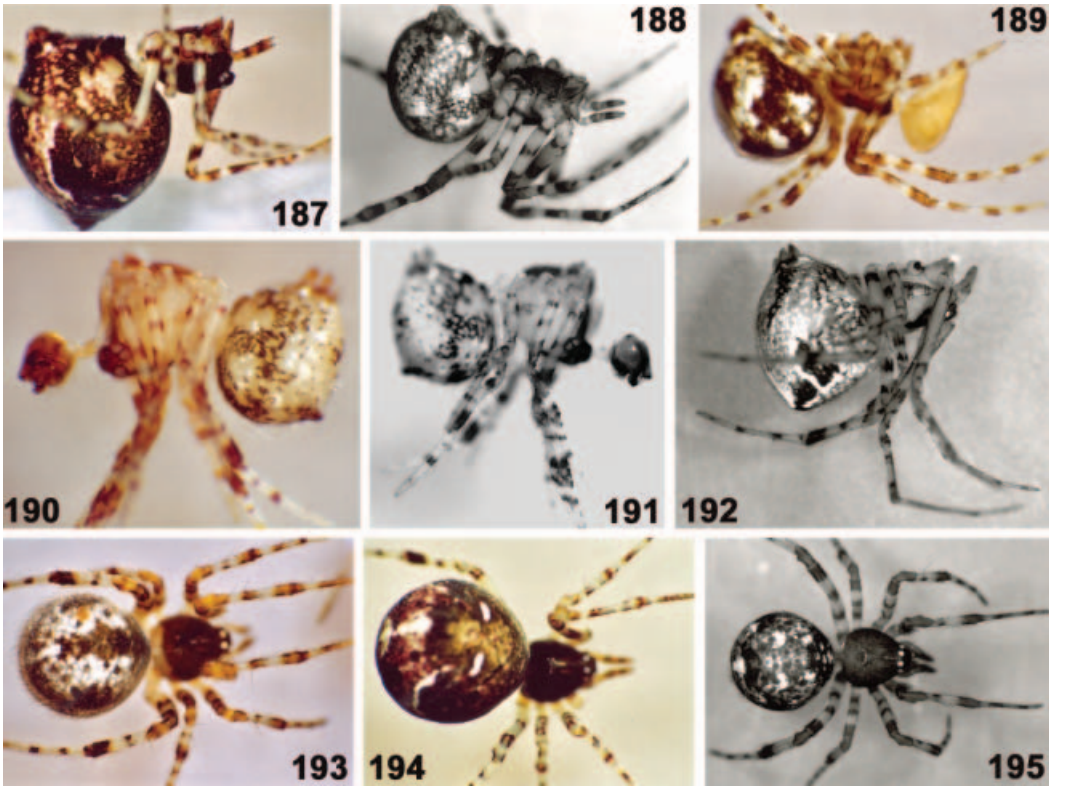


Figures 181–186. Female habitus. (181, 182) *Tidarren ubickorum* n. sp. from South Africa (181) and Zimbabwe (182). (183) *T. usambara* n. sp. from Tanzania. (184, 185) *T. horaki* n. sp. from Madagascar, Toamasina (184) and Antsiranana (185). (186) *T. obtusum* n. sp. from Madagascar. Auto-Montage digital photos from specimens preserved in alcohol.

wide, ventral side 1.3 long, clypeus 0.25 high, chelicerae 0.39 long, sternum 0.68 long, 0.59 wide, labium 0.26 wide, 0.14 long, gnathocoxae 0.39 long, 0.18 wide).

Distribution

Tidarren afrum is known from the type region, Cameroon. One female from Uganda, which apparently is very close, indicates a wider distribution.



Figures 187–195. Habitus of female (187, 188, 192–195), subadult male (189), and adult male (190, 191). (187, 194) *Tidarren apartiolum* n. sp. from Madagascar. (188, 189) *T. dasyglossa* n. sp. from Madagascar, Toamasina (188) and Betroka (189). (190–192) *T. obtusum* n. sp. from Madagascar, Ankarafantsika, Forêt de Tsimaloto (190, 191) and Perinet (192). (193) *T. ubickorum* n. sp. from South Africa. (195) *T. horaki* n. sp. from Madagascar, Toamasina. Photos from specimens preserved in alcohol.

Tidarren circe n. sp.
(Figures 174, 196–199; Table XV)

Type material

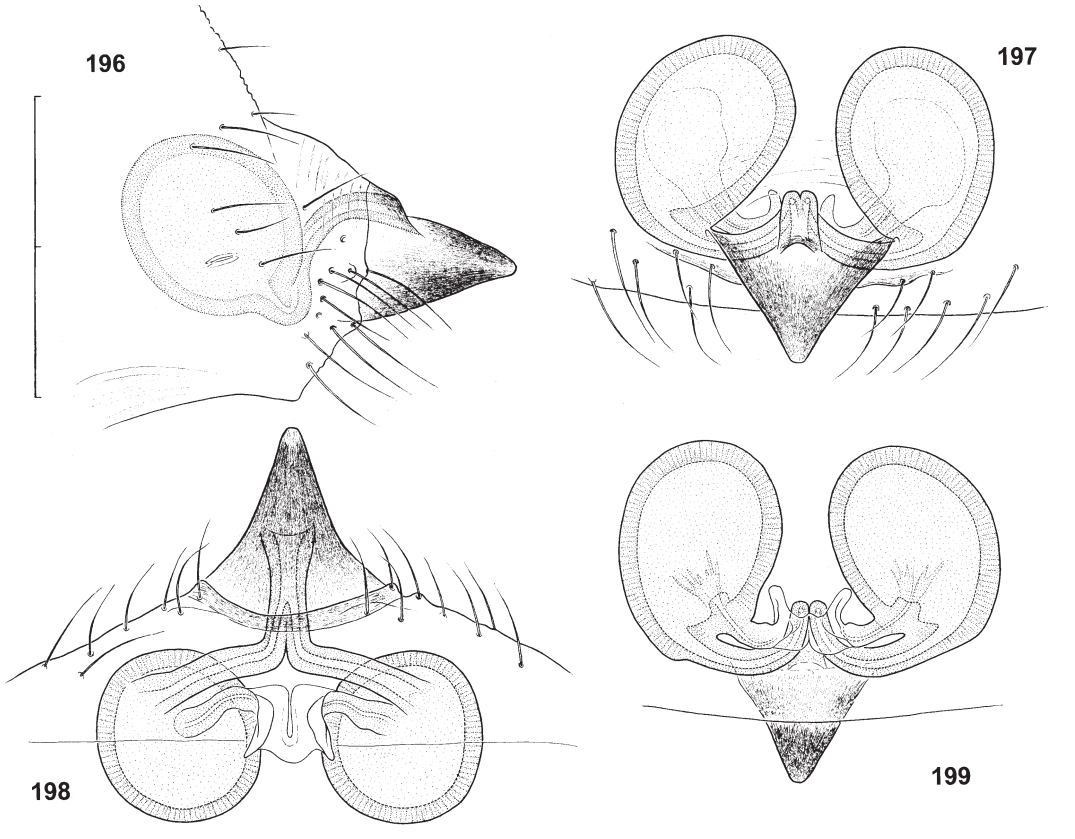
Namibia: 1♀ holotype, CAS, near Waterberg, 17°14′00″E, 20°30′59″S, 9 April 1991, leg. V. D. and B. Roth.

Material examined

Only the type.

Etymology

Specific epithet *circe*, mighty enchantress in Greek mythology, noun in apposition and hence invariable.



Figures 196–199. *Tidarren circe* n. sp., from Namibia. Female epigynum/vulva in lateral (196), ventral (197), aboral (198), and dorsal view (199). Scale bar: 0.2 mm.

Diagnosis and differentiation

Tidarren circe is the only species hitherto known from mainland Africa which has a small posterior tubercle on the sternum. Further distinguishing characters are provided by the epigynal protruberance, which is very distinctive, triangular, pointed, and directed anteriorly (Figures 174, 196–199). Copulatory ducts fused at entrance. *Tidarren circe* belongs to the smallest species in Africa, carapace width ca 0.6 mm. Male unknown.

Table XV. Leg measurements (mm, by stereo microscope) of *Tidarren circe* n. sp., female.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.20	0.12	0.10	–	0.20	0.60
I	1.27	0.29	0.68	0.98	0.43	3.65
II	0.76	0.25	0.39	0.59	0.33	2.32
III	0.57	0.25	0.25	0.39	0.31	1.78
IV	0.94	0.29	0.51	0.68	0.35	2.77

Measurements (mm)

Total length 2.74, carapace length 0.72, width 0.64, length femur I 1.31, tibia I 0.68. Abdomen 2.78 high, 1.56 long, and 1.50 wide. Ventral side (distance petiolus to spinnerets) 1.06 long. Clypeus 0.18 high, chelicerae 0.27 long. Sternum 0.47 long and 0.41 wide. Leg formula 1423, see Table XV.

Somatic features, colouration

Sternum with posterior small tubercle. Abdomen higher than long, forming a large dorsal hump (Figure 174). Carapace yellow brown with dark median area from centre to eye region and with faint greyish margins. Chelicerae, gnathocoxae, and pedipalps yellow brown. Sternum pale yellow with dark margins. Legs light yellow with slightly darkened patches and annulations. Abdomen whitish to yellowish brown, large white guanin areas predominate; on dorsum an irregular, white, broad band ends before tip of abdomen; on the sides a pair of distinct white stripes curve anteriorly; area behind these stripes whitish, lighter than anterior area. From apex a clear white median stripe leads straight to spinnerets. This stripe surrounded by large whitish aboral area. Venter whitish. Spinnerets light brown.

Epigynum, vulva (Figures 196–199)

Epigynal protuberance distinctly protruding (Figure 196), ca 0.1 mm long, directed anteriorly, almost touching posterior end of sternum (Figure 174); its shape triangular, evenly narrowing to pointed tip. In aboral view protuberance clearly delimited from surrounding integument (Figure 198). Copulatory ducts fused at entrance (Figure 197), ca 0.15–0.18 mm long. Common copulatory orifice situated below anterior border of epigynal protuberance, in ventral view level with posterior end of receptacula. Copulatory ducts run anteriorly for a short distance, then abruptly diverge posteriorly and laterally (Figures 197–199), and enter receptacula posteriorly. Receptacula seminis 0.14 mm long and 0.10 mm wide. Epigynal protuberance about 0.7 length of receptacula (Figure 197).

Distribution

Tidarren circe is known only from the type locality in Namibia. The single female was collected together with numerous females of *T. cuneolatum*.

Tidarren fornicatum (Simon, 1884) nov. comb.

Theridion fornicatum Simon 1884, p 22, n. sp., juvenile ♀, type region Sudan. Nov. comb.

Type material examined

Sudan (“Soudan égyptien”): juvenile ♀ (type), MNHN AR 2376, Khartoum.

Remarks

Since *Tidarren fornicatum* was described from a juvenile female, it is not possible to consider this species appropriately. Its general appearance, especially the large abdominal hump, agrees with the female of *T. scenicum*. However, *T. fornicatum* cannot be proposed as a

senior synonym of *T. scenicum* without knowledge of the genitalia. Adult specimens from the type region, Khartoum, would probably help to clarify this problem.

Tidarren griswoldi n. sp.
(Figures 175, 200–203; Table XVI)

Type material

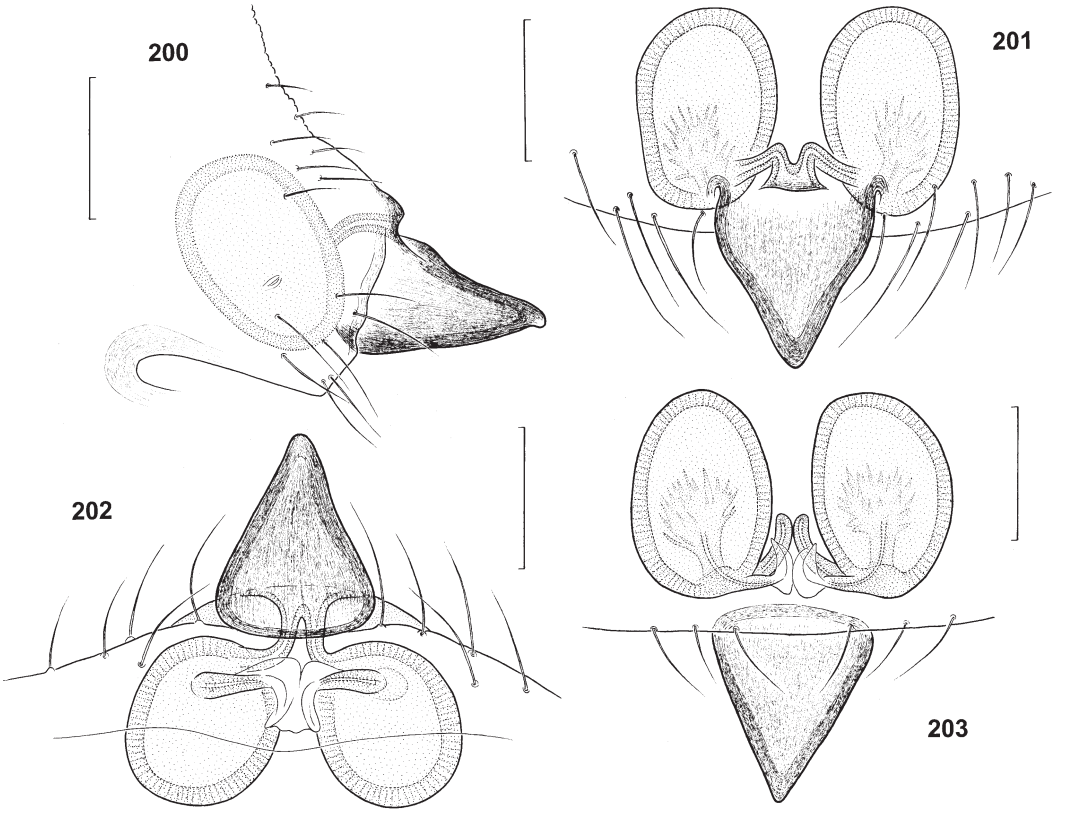
Cameroon: 1♀ holotype, 3♀ paratypes, CAS, Southwest Prov., Fako Div., Limbe Subdiv., 1.4 km NE of Etome, ca 400 m, 4°02′58.58″N, 9°07′31.43″E, 13–19 January 1992, leg. Larcher, Hormiga, Coddington, Griswold, and Wanzie.

Material examined

Only the types.

Etymology

The species is named in honour of Dr Charles Griswold (Californian Academy of Sciences, San Francisco), who collected numerous *Tidarren* specimens included in this study.



Figures 200–203. *Tidarren griswoldi* n. sp., from Cameroon. Female epigynum/vulva in lateral (200), ventral (201), aboral (202), and dorsal view (203). Scale bars: 0.1 mm.

Table XVI. Leg measurements (mm, by stereo microscope) of *Tidarren griswoldi* n. sp., female.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.20	0.12	0.10	–	0.27	0.68
I	1.37	0.37	0.82	1.17	0.55	4.27
II	0.90	0.33	0.49	0.74	0.45	2.91
III	0.64	0.25	0.37	0.49	0.41	2.17
IV	1.07	0.35	0.64	0.86	0.45	3.38

Diagnosis

Tidarren griswoldi has a pointed, triangular, anteriorly directed epigynal protuberance (Figures 200–203). Copulatory ducts are fused at entrance and short. Male unknown.

Measurements (mm)

[♀, n=4, minimum–maximum (mean).] Total length 2.11–2.35 (2.20), carapace length 0.82–0.88 (0.85), width 0.70–0.74 (0.72), length femur I 1.31–1.44 (1.37), tibia I 0.78–0.86 (0.81). Abdomen 1.56–2.15 (1.84) high, 1.25–1.56 (1.36) long, and 1.13–1.49 (1.30) wide. Ventral side (distance petiolus to spinnerets) 0.94–1.21 (1.02) long. Clypeus 0.18–0.20 (0.19) high. Chelicerae 0.27–0.35 (0.32) long. Sternum 0.51–0.55 (0.52) long and 0.47 wide. Labium 0.10 long and 0.19 wide. Gnathocoxae 0.28 long and 0.13 wide (mean). Leg formula 1423, see Table XVI.

Somatic features, colouration

Sternum without posterior small tubercle. Abdomen higher than long, ending in tubercle (Figure 175). Carapace uniformly dark brown. Chelicerae, gnathocoxae, and labium light brown or brown. Sternum dark, with light yellow central area surrounded by several light yellow spots. Pedipalps and legs light yellow with large dark annulations and patches. Abdomen brown to dark brown, dorsal and aboral white line pattern as in *T. afrum*. Sides with a few white guanin patches. Epigastric region dark, book lung covers light yellow. Venter dark with two small white spots near spinnerets. Spinnerets brown.

Epigynum, vulva (Figures 200–203)

Epigynal protuberance distinctly protruding (Figures 175, 200), ca 0.13–0.14 mm long, directed anteriorly; its shape triangular and pointed, in lateral view tip slightly bent (Figure 200). In aboral view protuberance clearly delimited from surrounding integument (Figure 202). Copulatory ducts fused at entrance (Figure 201), short, only 0.07 mm long. Copulatory orifices at anterior border of epigynal protuberance, in ventral and dorsal view close to posterior end of receptacula. Copulatory ducts run anteriorly for a short distance and abruptly diverge laterally. They enter receptacula posteriorly, at inner side. Receptacula seminis 0.15 mm long and 0.10 mm wide. Epigynal protuberance almost as long as receptacula (Figure 201).

Distribution

Known only from the type locality in Cameroon.

Tidarren lanceolatum n. sp.
(Figures 176, 204–207; Table XVII)

Type material

Democratic Republic of Congo: 1♀ holotype, NMW, without exact locality, "Belg. Kongo" (Inv. No. 709, sub *Theridion cuneolatum*, det. Reimoser 1938, together with 2♀ of *T. aethiops* n. sp. and 3♀ of *T. perplexum* n. sp.).

Material examined

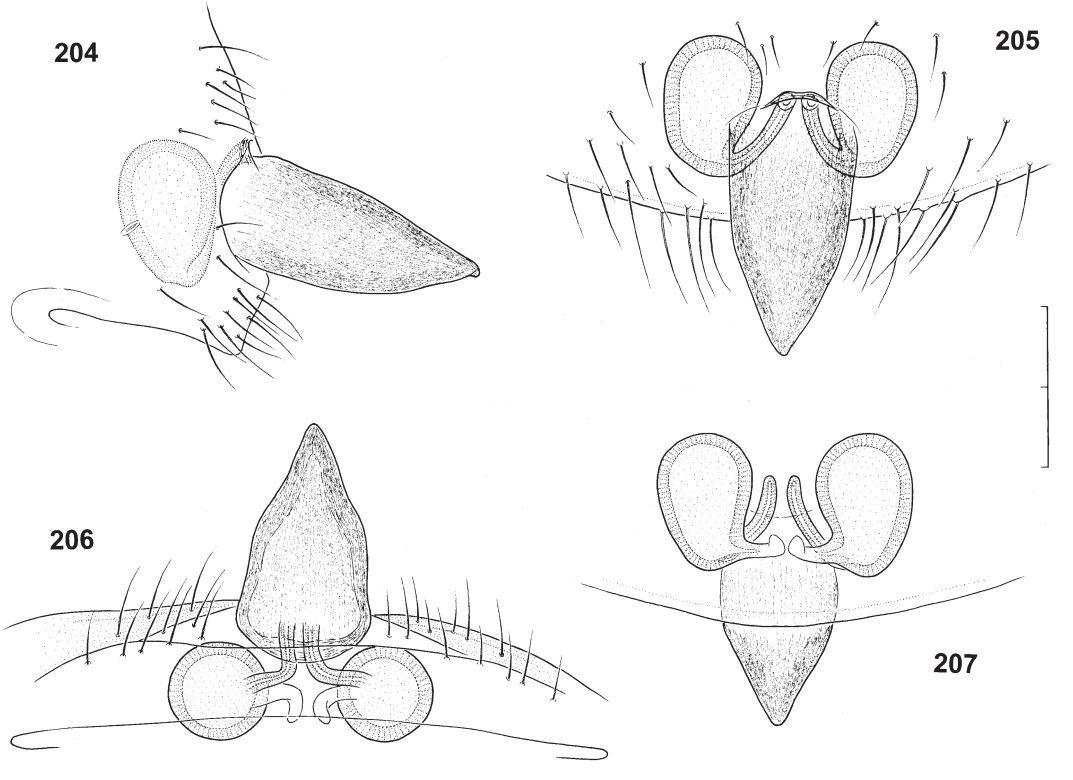
Only the type.

Etymology

The species name refers to the lance-like shape of the epigynum, from Latin adjective *lanceolatus*. The suffix agrees with the gender of the genus name.

Diagnosis

In *T. lanceolatum* the epigynum is extremely protruding (Figure 176, 204–207), very long related to body size. This species has the longest epigynal protuberance among the representatives from mainland Africa. Male unknown.



Figures 204–207. *Tidarren lanceolatum* n. sp., from Democratic Republic of Congo. Female epigynum/vulva in lateral (204), ventral (205), aboral (206), and dorsal view (207). Scale bar: 0.2 mm.

Table XVII. Leg measurements (mm, by stereo microscope) of *Tidarren lanceolatum* n. sp., female.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.25	0.14	0.14	–	0.27	0.80
I	1.89	0.45	1.09	1.60	0.62	5.66
II	1.29	0.39	0.68	0.94	0.55	3.84
III	0.86	0.35	0.43	0.60	0.47	2.71
IV	1.52	0.45	0.84	1.11	0.55	4.47

Measurements (mm)

Total length 3.01, carapace length 0.98, width 0.88, length femur I 1.89, tibia I 1.09. Abdomen 3.09 high, 2.23 long and 1.01 wide. Ventral side (distance petiolus to spinnerets) 1.45 long. Clypeus 0.25 high, chelicerae 0.39 long. Sternum 0.59 long, about as wide as long. Leg formula 1423, see Table XVII.

Somatic features, colouration

Sternum without posterior tubercle. Abdomen higher than long, forming a large dorsal hump (Figure 176). Carapace dark brown, central area slightly lighter with diffuse radial stripes. Chelicerae and gnathocoxae light brown. Sternum light brown with thin dark margins and small dark spots. Legs and pedipalps light yellow with dark patches and annulations. Abdomen whitish to greyish brown, with white guanin areas; on dorsum a pair of distinct white stripes outline an irregular, broad band, branching laterally and ending before tip of abdomen; area behind these stripes lighter than anterior area. From apex a clear white median stripe leads straight to spinnerets. Aboral area of abdomen whitish with two transverse, strongly upwardly bent dark stripes. Venter dark and white speckled. Spinnerets light brown.

Epigynum, vulva (Figures 204–207)

Epigynal protuberance straight, pointed, and extremely protruding (Figures 176, 204), directed anteriorly, 0.33 mm long, 0.16 mm broad at widest part, its shape reminiscent of tip of a lance. In aboral view protuberance clearly delimited from surrounding integument (Figure 206). Copulatory orifices at anterior border of epigynal protuberance, in ventral view at half length of receptacula. Copulatory ducts separate (Figures 205, 207), ca 0.1 mm long. They diverge posteriorly and enter receptacula posteriorly. Receptacula seminis 0.17 mm long and 0.12 mm wide. Epigynal protuberance about twice as long as receptacula (Figure 205).

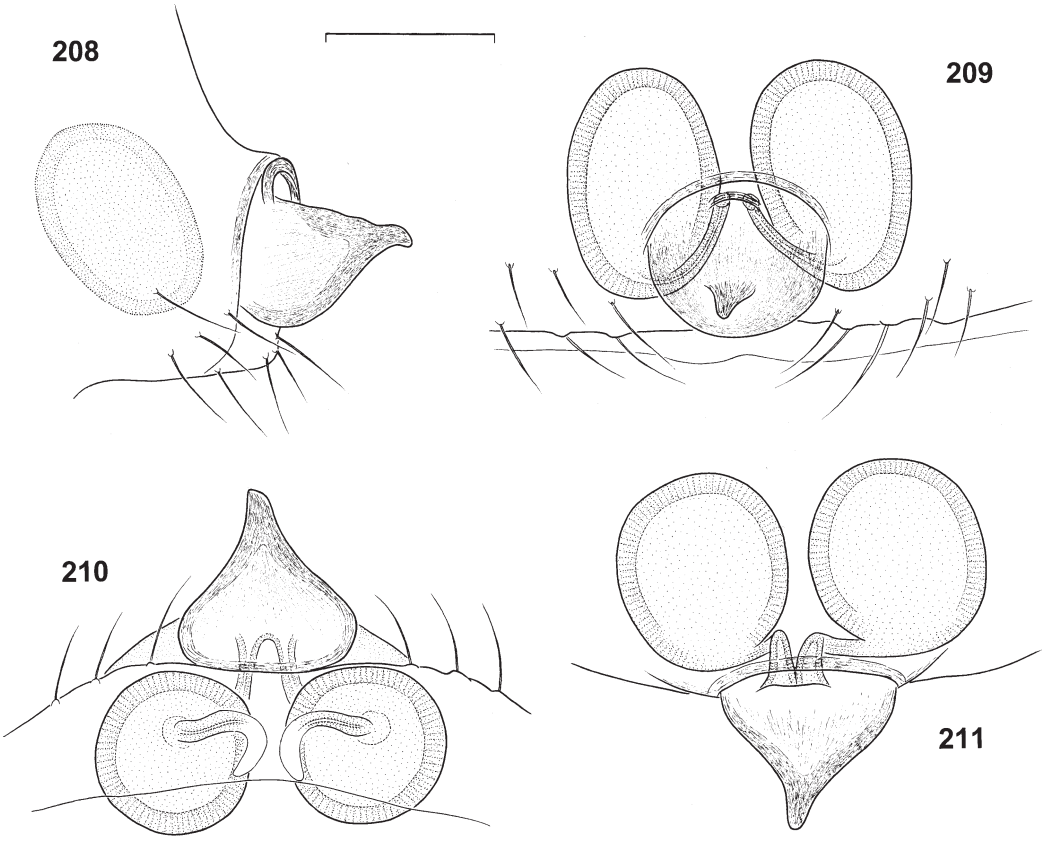
Distribution

Tidarren lanceolatum is known only from the type region, Democratic Republic of Congo, without exact locality.

Tidarren levii Schmidt, 1957

(Figures 208–211; Table XVIII)

Tidarren levii Schmidt 1957, p 283, Figures 4, 5; n. sp., ♀, type region Zaire (Democratic Republic of Congo), import.



Figures 208–211. *Tidarren levii* Schmidt, from an import from Democratic Republic of Congo. Female epigynum/vulva in lateral (208), ventral (209), aboral (210), and dorsal view (211). Scale bar: 0.1 mm.

Type material examined

Democratic Republic of Congo (Zaire): ♀ holotype, imported with bananas, SMF 14373, shrivelled and faded; microscopic slide of 14373.

Other material examined

Democratic Republic of Congo (Zaire): ♀ SMF 37459 and subadult ♂ SMF 37592 (shrivelled and faded), imported with bananas, without exact locality.

Table XVIII. Leg measurements (mm, by stereo microscope) of *Tidarren levii* Schmidt, female.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.21	0.12	0.12	–	0.21	0.66
I	–	–	–	–	–	–
II	0.72	0.23	0.41	0.55	0.38	2.29
III	0.55	0.20	0.27	0.35	0.33	1.70
IV	0.88	0.29	0.57	0.68	0.41	2.83

Description

Schmidt (1957). The following redescription is based mainly on non-type material, as this female is intact. The holotype female is shrivelled and faded; the epiygnum, which is preserved as a microscopic slide, is partially destroyed, epigynal protuberance and copulatory ducts are broken off and missing, only receptacles and fertilization ducts present. General appearance and dimensions are similar in the two females.

Diagnosis

Tidarren levii is a small-sized species with abdominal tubercle being very indistinct. Its epigynal protuberance is broad and pointed, clearly delimited from surrounding integument (Figures 208–211) and well sclerotized. Copulatory ducts diverge posteriorly. Male unknown.

Measurements (mm)

Holotype ♀ shrivelled, carapace length 0.74, width 0.55, length femur I 1.21, tibia I 0.78. Abdomen 1.60 high, 1.37 long, and 1.31 wide. Clypeus 0.16 high, chelicerae 0.23 long. Sternum shrivelled.

Dimensions (in mm) of non-type ♀ SMF 37459 (legs I missing): total length 1.72, carapace length 0.72, width 0.60. Abdomen 1.27 high, 1.09 long, and 1.19 wide. Ventral side (distance petiolus to spinnerets) 0.58 long. Clypeus 0.16 high, chelicerae 0.25 long. Sternum 0.47 long, 0.39 wide. Labium 0.08 long and 0.16 wide. Gnathocoxae 0.23 long and 0.10 wide. Legs, see Table XVIII.

Somatic features, colouration

Sternum without posterior tubercle. Abdomen higher than long, more or less rounded, tubercle very indistinct. Carapace uniformly dark brown. Chelicerae light brown, suffused with grey. Labium and gnathocoxae light brown. Sternum dark grey with several light spots. Legs and pedipalps pale yellow with dark patches and annulations. Coxae uniformly pale yellow. Abdomen dark, with interrupted white line pattern. White dots on dorsum are probably remnants of former outlines of a dorsal band. Sides with white arched stripe, aboral region with white stripe from apex to spinnerets. Venter dark with two pairs of paramedian white spots. Spinnerets brown.

Epigynum, vulva (Figures 208–211)

Epigynal protuberance broad and pointed, 0.1 mm long, 0.1 mm broad at widest part, evenly sclerotized. In side view, tip of protuberance slightly recurved (Figure 208), anterior contour straight, posterior one arched. In aboral view protuberance clearly delimited from surrounding integument (Figure 210). Copulatory orifices close to anterior border of epigynal protuberance, in ventral view level with posterior half of receptacula. Copulatory ducts separate (Figures 209, 211), less than 0.1 mm long. They diverge posteriorly and enter receptacula posteriorly. Receptacula seminis 0.14 mm long and ca 0.1 mm wide (in holotype ♀ 0.15 long and 0.1 wide). Epigynal protuberance about 0.7 length of receptacula (Figure 209).

Distribution

Known only from an import from tropical Africa (Democratic Republic of Congo) without exact locality (Schmidt 1957).

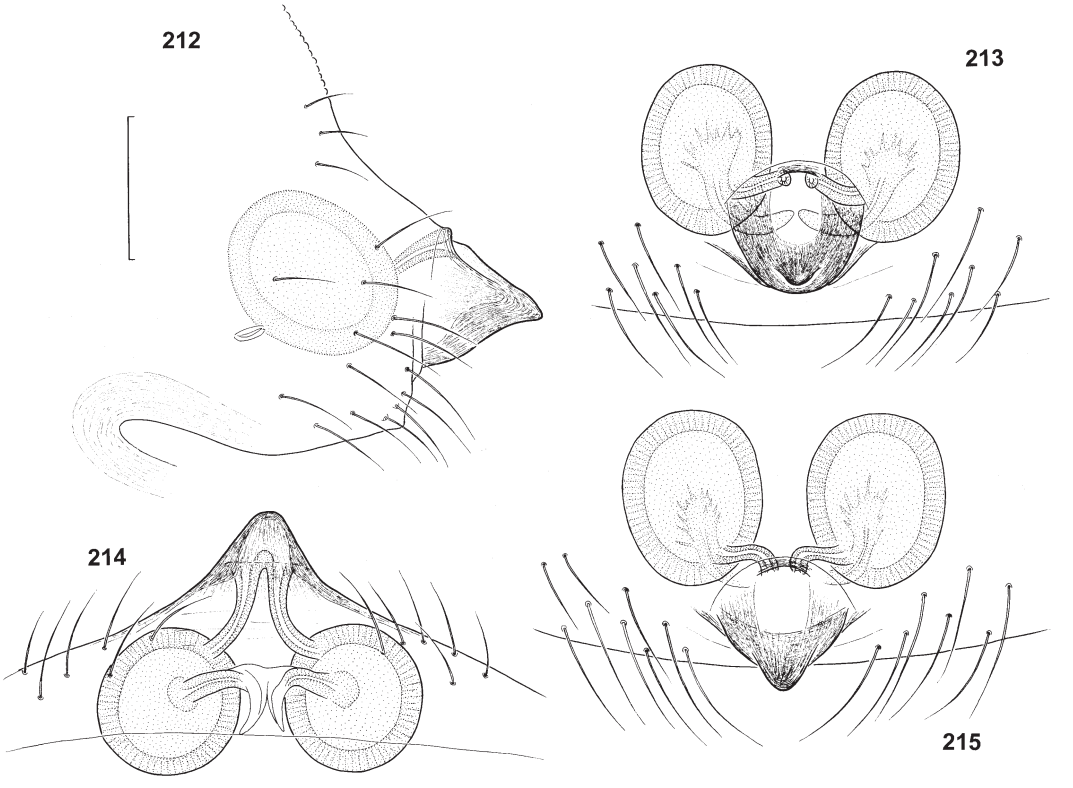
Tidarren perplexum n. sp.
(Figures 177, 212–215; Tables XIX, XX)

Type material

Cameroon: 1♀ holotype, 1♀ paratype, CAS (gift from USNM 1992), Southwest Prov., Fako Div., Mt Cameroon, near Mann's Spring, 2050 m, 4°08′30″N, 9°07′01″E, 21–25 January 1992, leg. Coddington, Griswold, Larcher, and Hormiga.

Other material examined

Democratic Republic of Congo: 3♀, NMW, without exact locality, "Belg. Kongo" (Inv. No. 709, sub *Theridion cuneolatum*, det. Reimoser 1938, together with 2♀ of *T. aethiops* n. sp. and 1♀ of *T. lanceolatum* n. sp.).



Figures 212–215. *Tidarren perplexum* n. sp., from Cameroon. Female epigynum/vulva in lateral (212), ventral (213), aboral (214), and ventral-frontal view (215). Scale bar: 0.1 mm.

Table XIX. Leg measurements (mm, by stereo microscope) of *Tidarren perplexum* n. sp., female paratype/holotype.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.27/0.31	0.16/0.18	0.18/0.18	–	0.27/0.29	0.88/0.96
I	1.56/1.85	0.43/0.47	0.98/1.07	1.19/1.39	0.64/0.68	4.80/5.46
II	1.07/1.25	0.39/0.41	0.57/0.60	0.80/0.90	0.55/0.55	3.38/3.71
III	0.78/0.98	0.31/0.35	0.45/0.47	0.59/0.64	0.47/0.47	2.60/2.91
IV	1.29/1.52	0.39/0.47	0.74/0.82	0.92/0.94	0.59/0.60	3.92/4.35

Etymology

The specific epithet is derived from the Latin adjective *perplexus* meaning obscure. The name refers to the taxonomic situation among the inscrutable number of African *Tidarren* species. The suffix agrees with the gender of the genus name.

Diagnosis

According to genital characters *T. perplexum* closely resembles *T. levii* (Figures 212–215 versus Figures 208–211), but is differentiated by its ca 1.5 times larger size and by the presence of a distinct abdominal tubercle (Figure 177). In contrast to *T. levii* the protuberance is not delimited from the surrounding integument in aboral view (Figure 214) and is less sclerotized. Male unknown.

Measurements (mm)

[♀ holotype.] Total length 2.78, carapace length 1.09, width 0.95, length femur I 1.85, tibia I 1.07. Abdomen 2.35 high, 1.68 long, and 1.53 wide. Ventral side (distance petiolus to spinnerets) 1.57 long. Clypeus 0.29 high, chelicerae 0.39 long. Sternum 0.70 long, 0.60 wide. Gnathocoxae 0.39 long, 0.16 wide. Labium 0.14 long, 0.25 wide. Leg formula 1423.

Dimensions of three females from Democratic Republic of Congo: total length 2.50/2.86/2.86, carapace length 0.94/1.07/1.15, width 0.74/0.84/0.90, length femur I 1.76/2.05/–, tibia I 1.07/1.27/–. Abdomen 2.27/2.46/2.54 high, 1.60/1.57/1.88 long, and 1.49/1.49/1.60 wide. Ventral side (distance petiolus to spinnerets) 1.17/1.17/1.29 long. Clypeus 0.21/0.15/0.25 high, chelicerae 0.33/0.39/0.35 long. Sternum 0.59/0.68/0.68 long, 0.51/0.59/0.59 wide. Gnathocoxae 0.31–0.37 long, 0.14–0.18 wide. Labium 0.10–0.14 long, 0.20–0.25 wide. Leg formula 1423, see Tables XIX, XX.

Table XX. Leg measurements (mm, by stereo microscope) of *Tidarren perplexum* n. sp., two females from Democratic Republic of Congo.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.27/0.29	0.12/0.20	0.14/0.20	–	0.29/0.29	0.82/0.98
I	1.76/2.05	0.41/0.51	1.07/1.27	1.35/1.68	–/0.66	–/6.17
II	1.05/1.31	0.35/0.43	0.64/0.72	0.78/1.05	0.49/0.59	3.32/4.10
III	0.78/0.92	0.29/0.33	0.43/0.51	0.57/0.68	0.41/0.52	2.48/2.96
IV	1.37/1.66	0.41/0.49	0.78/0.96	1.01/1.17	0.53/0.62	4.10/4.90

Somatic features, colouration

Sternum without posterior tubercle. Abdomen higher than long, ending in distinct tubercle (Figure 177). Carapace dark brown. Chelicerae light brown with dark patches. Labium and gnathocoxae uniformly pale yellow or with dark patches. Sternum light yellow with dark margins and reticulate pattern or dark with several light spots. Legs and pedipalps pale yellow with dark patches and annulations. Coxae uniformly pale yellow. Abdomen whitish to greyish brown, with pattern as in *T. lanceolatum*. Venter dark and white speckled. Spinnerets brown. The females from the Democratic Republic of Congo show similar colour and pattern. In one of them the carapace is not uniformly dark brown, but has two light paramedian longitudinal bands.

Epigynum, vulva (Figures 212–215)

Epigynal protuberance triangular, short, and pointed (Figures 177, 212), 0.08 mm long, 0.09 mm broad at widest part (Figure 213). Anterior median part of protuberance less sclerotized. In side view, tip of protuberance slightly recurved, anterior contour straight, posterior one only slightly arched. In aboral view protuberance not delimited from surrounding integument (Figure 214), its sclerotization diffusing gradually. Copulatory orifices close to anterior border of epigynal protuberance, in ventral and dorsal view level with posterior half of receptacula; in aboral view close to end of protuberance. Copulatory ducts separate (Figure 213, 215), ca 0.07 mm long. They diverge laterally and enter receptacula at posterior inner side. Receptacula seminis 0.12 mm long and ca 0.1 mm wide. Epigynal protuberance about 0.7 length of receptacula (Figure 213).

The genital organ of the females from the Democratic Republic of Congo differs slightly in the shape of the epigynal protuberance. In side view, the protuberance is slightly more slender, the posterior contour less arched, and its tip is scarcely sclerotized. The copulatory orifices appear to be wider than in the types. Aboral view, position of copulatory orifices, course of the ducts, and overall dimensions are similar: epigynal protuberance 0.08 mm long and 0.07 mm broad at widest part. Copulatory ducts separate, 0.08 mm long. Receptacula seminis 0.12 mm long and 0.10 mm wide. Epigynal protuberance about 0.6 length of receptacula.

Geographic variation

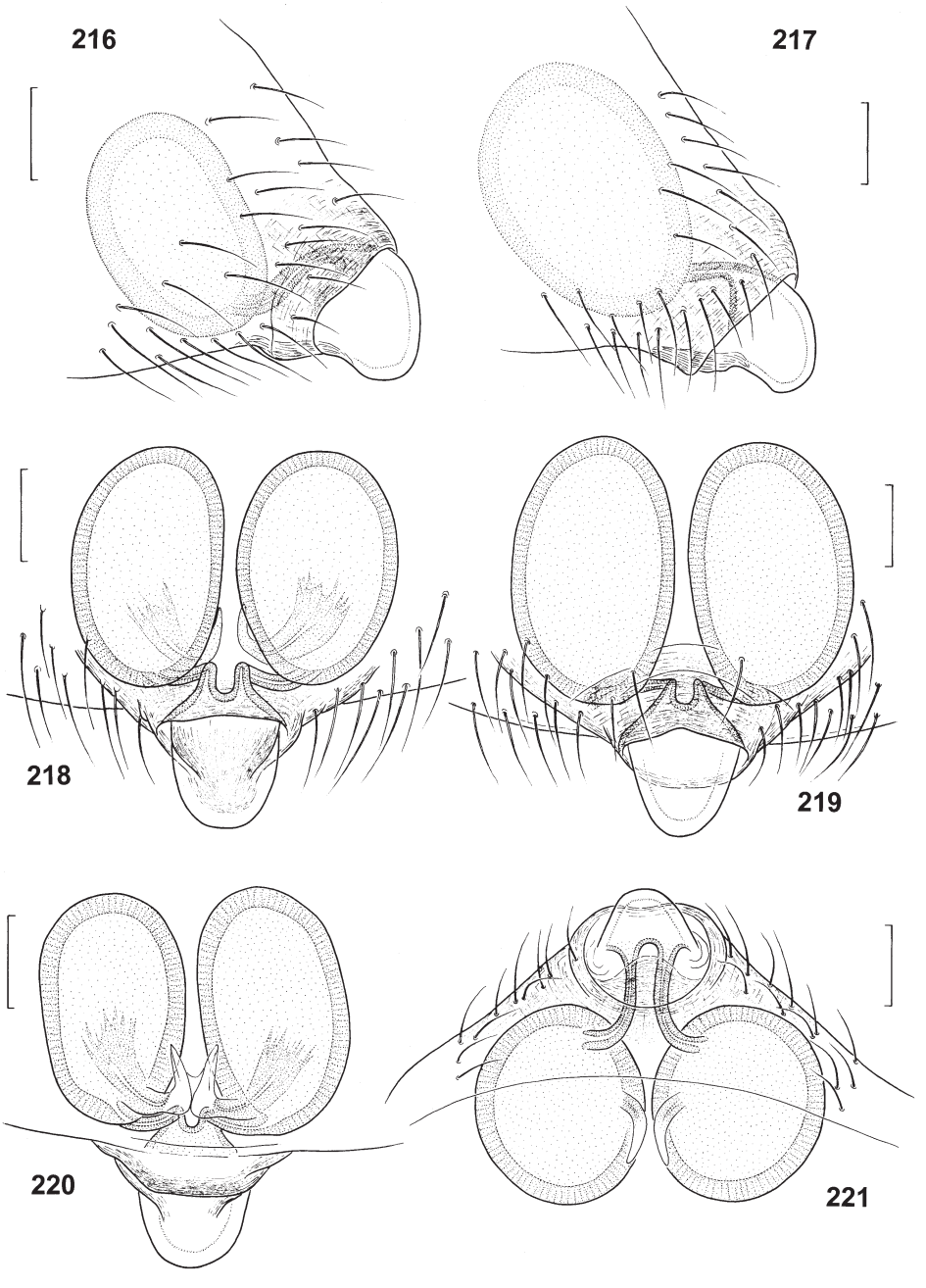
The specimens from the Democratic Republic of Congo agree with the type females in general appearance, colour, pattern, and dimensions. Slight differences were found in the shape of the epigynal protuberance, see above. Without knowledge of males it is not yet possible to judge this minute variation.

Distribution

Known from the type locality in Cameroon and from the Democratic Republic of Congo without exact locality.

Tidarren scenicum (Thorell, 1899) nov. comb.
(Figures 178–180, 216–221, 259c; Table XXI)

Theridium scenicum Thorell 1899, p 24; n. sp., ♀, type locality Cameroon.
Theridion turrigerum Simon 1899, p 417; n. sp., ♀, type locality Cavally, Cote d'Ivoire. Nov. syn.
Theridion guineense Simon 1907, p 40; n. sp., ♀, type locality Guinea-Bissau. Nov. syn.



Figures 216–221. *Tidarren scenicum* (Thorell), from South Africa, Swaziland (216, 218, 220) and Guinea-Bissau (217, 219, 221; type of *Theridion guineense* Simon). Female epigynum/vulva in lateral (216, 217), ventral (218, 219), dorsal (220), and aboral view (221). Scale bars: 0.1 mm.

Table XXI. Leg measurements (mm, by stereo microscope) of *Tidarren scenicum* (Thorell), female from Guinea-Bissau/Cote d'Ivoire/South Africa, respectively).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.49/–/0.44	0.29/–/0.25	0.29/–/0.23	–	0.49/–/0.43	1.56/–/1.37
I	3.60/3.72/3.72	0.82/0.94/0.82	2.07/2.23/2.27	2.74/3.01/2.93	0.94/1.02/0.94	10.17/10.92/10.68
II	2.07/2.35/2.23	0.66/0.82/0.67	1.25/1.29/1.17	1.68/1.92/1.68	0.78/0.78/0.78	6.46/7.20/6.53
III	1.56/1.76/1.45	0.55/0.67/0.59	0.82/0.94/0.82	1.21/1.33/1.29	0.70/0.70/0.67	4.85/5.40/4.81
IV	2.86/3.01/2.90	0.78/0.90/0.78	1.49/1.76/1.60	2.00/2.23/2.15	0.82/0.94/0.88	7.94/8.84/8.31

Type material examined

Cameroon: 1♀, RMS No. 384 (type of *T. scenicum*), leg. Sjöstedt, 1891 (Thorell 1899). **Cote d'Ivoire**: 1♀, MNHN AR 2606 (type of *Theridion turrigerum*), at upper river Cavally ''Haut Cavally'' at frontier post Zo, leg. Ch. van Cassel, September 1899 (''Soudan français, au poste du Zo'' according to Simon 1899; Mali according to Platnick 2006). **Guinea-Bissau** (''Guinée portugaise''): 1♀, MNHN AR 2369 (type of *Theridion guineense*), Bolama, 11°35′N, 15°28′W (Simon 1907).

Other material examined

South Africa: 1♀, NMBS, Swaziland, Mlilwane, Mlilwane Game Reserve, 20 km S Mbabane, 31 March 2001, 26°22′50″S 31°03′40″E, near house, leg. P. Horak. 1♀ shrivelled, CTh, Drakensberge, Royal Natal National Park, Gorge Pad, 6 June 2005, leg. G. Alberti.

Diagnosis and differentiation

Tidarren scenicum is the largest species in the Old World, carapace 1.4–1.6 mm wide. The abdomen ends in a high tubercle (Figures 178–180). Epigynal protuberance small and rounded, barely sclerotized, receptacula rather large (Figures 216–221). Male unknown.

Measurements (mm)

[Female from Guinea-Bissau (type of *T. guineense*)/Cote d'Ivoire (type of *T. turrigerum*)/ South Africa, respectively.] Total length 5.79/5.36/4.73, carapace length 1.76/1.88/1.72, width 1.45/1.60/1.49, length femur I 3.60/3.72/3.72, tibia I 2.15/2.23/2.27. Abdomen 4.70/5.67/4.81 high, 3.52/3.80/3.21 long, and 3.13/3.21/2.78 wide. Ventral side (distance petiolus to spinnerets) 2.74/2.78/2.50 long. Clypeus 0.43–0.45 high, chelicerae 0.57–0.66 long. Sternum 0.98–1.13 long and 0.86–0.88 wide. Gnathocoxae 0.53–0.55 long and 0.21–0.25 wide, labium 0.18–0.20 long and 0.37–0.39 wide. Leg formula 1423, see Table XXI.

Somatic features, colouration (Figures 178–180)

[Based on females from Cote d'Ivoire, Guinea-Bissau, and South Africa.] Sternum without posterior tubercle. Abdomen higher than long, forming a large dorsal hump (Figures 178, 180), so that the species name *T. turrigerum* chosen by Simon (1899) would be apposite. Carapace light yellow with broad dark margins and dark brown median band (Figure 179), which branches laterally at centre of carapace. Chelicerae light brown, labium and

gnathocoxae light yellow. Sternum light yellow with dark patches at margins and some median spots. Legs and pedipalps light yellow with dark patches and annulations, especially femur, tibia, and metatarsus I covered with numerous fine dots. Abdomen brownish, with white guanin markings and some dark pigmentation; broad and light dorsal median area outlined by distinct white stripes, which branch laterally and end shortly before tip of abdomen; surrounding lateral area darker. Aboral field whitish, partially overlain by dark pigmentation, with distinct white median stripe from apex to spinnerets. Epigastric region light, book lung covers light yellow. Venter uniformly light brown or with a few white patches. Spinnerets light brown. The type of *T. guineense* is largely light yellow and perhaps partially faded (Figure 180), though Simon (1907) mentioned the light yellow colouration.

Epigynum, vulva (Figures 216–221)

Epigynal protuberance rounded, short in comparison with body size (Figures 178, 180, 216, 217), ca 0.11–0.12 mm long, directed posteriorly; protuberance whitish, scarcely sclerotized, in contrast to surrounding sclerotized integument. In aboral view protuberance clearly delimited from surrounding integument (Figure 221). Copulatory ducts fused to tiny atrium at entrance (Figures 218, 219), short, 0.14 mm long. Copulatory orifice at anterior border of epigynal protuberance, in ventral view behind posterior end of receptacula. Copulatory ducts run foward for a short distance and abruptly diverge laterally. They enter receptacula posteriorly, at inner side (Figure 220). Receptacula seminis large, 0.27–0.32 mm long and 0.16–0.21 mm wide. Epigynal protuberance less than half length of receptacula (Figures 218, 219).

Distribution (Figure 259c)

Tidarren scenicum, although known from five females only, appears to be widespread in Africa.

Synonymy

Both *Tidarren turrigerum* Simon, 1899 and *T. guineense* Simon, 1907 correspond well with the type of *T. scenicum* Thorell, 1899 in body dimensions, shape of abdomen and of epigynum, and are therefore considered as synonyms. *Tidarren fornicatum* was described from a juvenile female from Sudan (sub *Theridion fornicatum*; Simon 1884). General appearance, especially the large abdominal hump, agrees with the female of *T. scenicum*. Nevertheless, this species should not be proposed as a senior synonym without knowledge of the genitalia. Otherwise, *T. fornicatum* would have priority. Further material from the type region would probably clarify this problem.

Theridion turrigerum Simon and *T. scenicum* Thorell are clearly synonyms, but were both described in 1899. The exact date of publication should decide on the priority. Thorell's paper was almost certainly printed in 1899. It is the first part of *Bihang till Kongliga Svenska Vetenskaps-Akademiens Handlingar*, Volume 25, Section IV, Zoology. This volume contains six independently paginated papers, each with a separate title page, papers 1–3 having the printing year 1899 and papers 4–6 1900 (T. Kronestedt, in litt.). The ''communicatum'' date of the reprint, 8 February 1899, has nothing to do with the printing date but indicates that the paper was presented to the academy early in 1899 and thus was almost certainly printed in the same year (T. Kronestedt, in litt.). The footnote on the reprint of Simon's

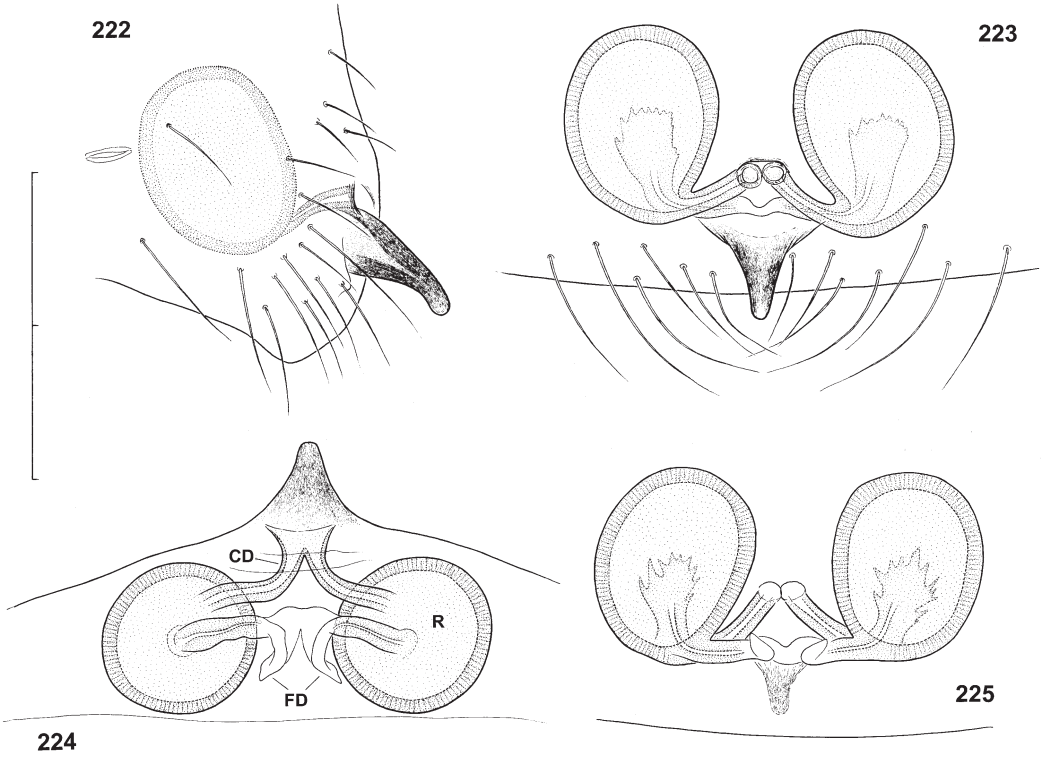
work, ''Imprimerie nationale—Janvier 1900'' indicates that the actual date of publication was later. For this reason, *T. scenicum* has to be considered the valid name. Localization of the type locality of *T. turrigerum* appears to be arguable. According to Simon (1899) it was collected from ''Soudan français'', which would be partially consistent with Mali (Platnick 2006). Yet, when trying to locate the ''frontier post'' Zo at the river Cavally, it appears more likely to match Cote d'Ivoire.

Simon (1907) indicated a close relationship between *T. turrigerum* and *T. scenicum*, but his *T. scenicum* now turns out to be a female of *T. cuneolatum* (from Guinea-Bissau, MNHN AR 2370), see above. Therefore, it is not surprising that he distinguished *T. turrigerum* by its larger size, although being as large as the proper *T. scenicum*, and by the obtuse epigynal shape.

Tidarren ubickorum n. sp.
(Figures 181, 182, 193, 222–225; Table XXII)

Type material

South Africa: 1♀ holotype, 2♀ paratypes, CAS, Mpumalanga, Songimvelo Nature Reserve, Diepgezet, 25°59′03″S, 31°04′33″E, 1050 m, grassland–highveld forest transition, 17 March 2001, leg. D. and S. Ubick.



Figures 222–225. *Tidarren ubickorum* n. sp., from South Africa. Female epigynum/vulva in lateral (222), ventral (223), aboral (224), and dorsal view (225). Scale bar: 0.2 mm.

Table XXII. Leg measurements (mm, by stereo microscope) of *Tidarren ubickorum* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.23	0.11	0.16	–	0.23	0.74
I	1.22	0.37	0.74	0.96	0.53	3.82
II	0.86	0.31	0.47	0.60	0.41	2.65
III	0.62	0.29	0.31	0.45	0.37	2.05
IV	1.03	0.37	0.58	0.68	0.43	3.10

Other material examined

Zimbabwe: 1♀, CTh, Harare, 17°49′04″S, 31°02′41″E, suburban garden, July 2004, leg. M. Cummings.

Etymology

The species epithet is dedicated to the collectors Drs Darell and Suzanne Ubick (Californian Academy of Sciences, San Francisco).

Diagnosis

Tidarren ubickorum is the only species from mainland Africa hitherto known, which has a rounded abdomen (Figures 181, 182, 193). Its epigynal protuberance is slender in side view and rather small (Figures 222–225). Copulatory orifices separate, copulatory ducts short. Male unknown.

Measurements (mm)

[3♀, respectively.] Total length 2.34/2.46/3.06, carapace length 0.86/0.88/1.05, width 0.74/0.74/0.96, length femur I 1.12/1.27/1.64, tibia I 0.74/0.70/0.96. Abdomen higher than long, 1.80/2.38/2.38 high, 1.35/1.70/1.89 long, and 1.33/1.60/1.99 wide. Ventral side (distance petiolus to spinnerets) 0.72/0.78/0.88 long. Clypeus 0.18–0.20 high, chelicerae 0.39 long. Labium 0.20–0.21 wide, 0.10–0.12 long, gnathocoxae 0.21–0.25 long, 0.10–0.12 wide. Sternum about as long as wide, 0.45–0.58. Leg formula 1423, see Table XXII.

Somatic features, colouration (Figures 181, 182, 193)

Abdomen without tubercle. Sternum without posterior tubercle, projecting between coxae IV and separating coxae IV by one diameter. Carapace uniformly dark brown, in one female with yellow posterior and lateral parts. Sternum dark brown with irregular light median area or stripe. Chelicerae light brown with dark longitudinal patches at margins. Legs and palps light yellow with dark patches and annulations. Abdomen dorsally with irregular, dark median band, which ends at the highest point (Figure 193). This band is surrounded by a zone of white guanin inclusions, in which dark spots are also embedded. Each side is flanked by a large dark patch within a light intermediate area. Aboral part of abdomen with clear white stripe from highest point to spinnerets, on a background of irregular dark pigmentation. Spinnerets brown, surrounded by a dark ring. Book lung covers yellow, epigaster dark brown, venter with white mark between epigastric furrow and spinnerets. Abdominal markings in one female faint.

Epigynum, vulva (Figures 222–225)

Epigynal protuberance in side view slender and finger-like (Figures 181, 222), 0.09 mm long, rather small and tapered. In aboral view protuberance not clearly delimited, gradually merging with surrounding integument (Figure 224). Copulatory orifices close together, apparently separate (Figure 223, 225), situated anterior to epigynal protuberance, in ventral view close to posterior end of receptacula. Copulatory ducts separate, short, 0.07 mm, diverging laterally and entering receptacula posteriorly. Receptacula seminis 0.13 mm long and 0.10 mm wide. Epigynal protuberance about half as long as receptacula (in ventral view, Figure 223).

Geographic variation

Body dimensions of the female from Zimbabwe are slightly larger than those from South Africa (in mm: total length 3.21, carapace length 1.09, width 0.98), and legs are considerably longer (in mm: length femur I 2.01, tibia I 1.19).

Distribution

Known from the type locality Mpumalanga in South Africa and from a suburban garden in Zimbabwe.

Tidarren usambara n. sp.
(Figures 183, 226–229; Table XXIII)

Type material

Tanzania: 1♀ holotype, 1♀ paratype, CAS, Tanga, W Usambara Mtns, Mazumbai, forest, 4°49′S, 38°30′E, 1400–1800 m, 10–20 November 1995, leg. C. E. Griswold, N. Scharff, and D. Ubick.

Material examined

Only the types.

Etymology

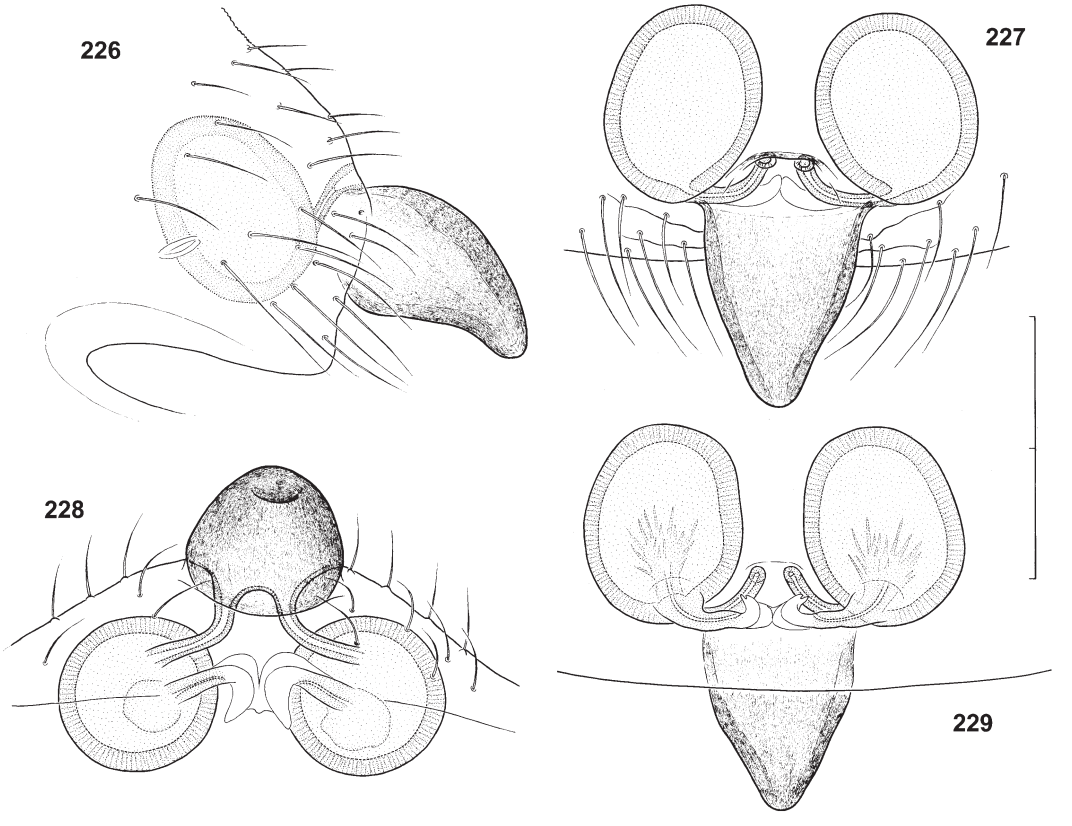
Noun in apposition referring to the type locality.

Diagnosis

The species is characterized by the aquiline shape of the epigynal protuberance in lateral view (Figures 183, 226–229). Copulatory ducts short. Abdomen with large dorsal hump (Figure 183). Male unknown.

Measurements (mm)

[2♀.] Total length 2.54/2.93, carapace length 0.98/1.01, width 0.86/0.84, length femur I 1.76/1.72, tibia I 1.01/1.01. Abdomen higher than long, 2.38/2.99 high, 1.58/1.81 long,



Figures 226–229. *Tidarren usambara* n. sp., from Tanzania. Female epigynum/vulva in lateral (226), ventral (227), aboral (228), and dorsal view (229). Scale bar: 0.2 mm.

and 1.52/1.68 wide. Ventral side (distance petiolus to spinnerets) 0.98/0.94 long. Clypeus 0.20 high, chelicerae 0.41 long. Labium 0.23 wide, 0.10 long, gnathocoxae 0.31 long, 0.14 wide. Sternum 0.59 long and 0.53 wide. Leg formula 1423, see Table XXIII. Metatarsi I–III with one trichobothrium, position on I 0.24, on II 0.32, on III 0.41.

Somatic features, colouration

Abdomen higher than long, forming a large dorsal hump (Figure 183). Sternum without posterior knob. Carapace dark brown except for posterior-median, light, triangular area. Sternum, gnathocoxae, and labium reddish brown. Chelicerae brown, with dark

Table XXIII. Leg measurements (mm, by stereo microscope) of *Tidarren usambara* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.27	0.16	0.14	–	0.29	0.86
I	1.76	0.45	1.01	1.46	0.64	5.33
II	1.17	0.41	0.59	0.88	0.53	3.57
III	0.88	0.37	0.45	0.60	0.47	2.77
IV	1.42	0.45	0.78	1.03	0.57	4.25

longitudinal stripes at margins. Legs and palps light yellow with dark patches and annulations. Dorsum of abdomen with clear, white outlined, serrated, longitudinal band which ends at tip of abdomen; from longitudinal band one or two pairs of white stripes curve downwards along sides; upper lateral area between these stripes dark. Aboral area of abdomen with distinct white median stripe from apex to spinnerets, surrounded by a large whitish zone and some dark lateral pigmentation downwards to spinnerets. Venter with whitish marking. Spinnerets brown.

Epigynum, vulva (Figures 226–229)

Epigynal protuberance aquiline and rounded in side view (Figures 183, 226), 0.15 mm long, triangular in ventral view, its outlines slightly curved. In aboral view protuberance clearly delimited from surrounding integument (Figure 228). Copulatory orifices well separated, situated anterior to epigynal protuberance, in ventral view close to posterior end of receptacula. Copulatory ducts separate and short (Figures 227, 229), ca 0.09 mm long, diverging posteriorly and laterally and entering receptacula posteriorly. Receptacula seminis 0.15 mm long and 0.12 mm wide. Epigynal protuberance as long as receptacula (Figure 227).

Distribution

Known only from the type locality Usambara Mtns at Mazumbai. The species was collected together with *Tidarren cuneolatum*.

***Tidarren* species from Madagascar**

Tidarren apartiolum n. sp.
(Figures 187, 194, 230–233; Table XXIV)

Type material

Madagascar: 1♀ holotype, CAS, Mahajanga Prov., Parc National d'Ankarafantsika, Ampijoroa Station Forestière, 40 km 306° NW Andranofasika, 16°19′15″S, 46°48′38″E, 130 m, 26 March to 1 April 2001, tropical dry forest, EF28 beaten from low vegetation, leg. Fisher, Griswold et al., BLF3524.

Material examined

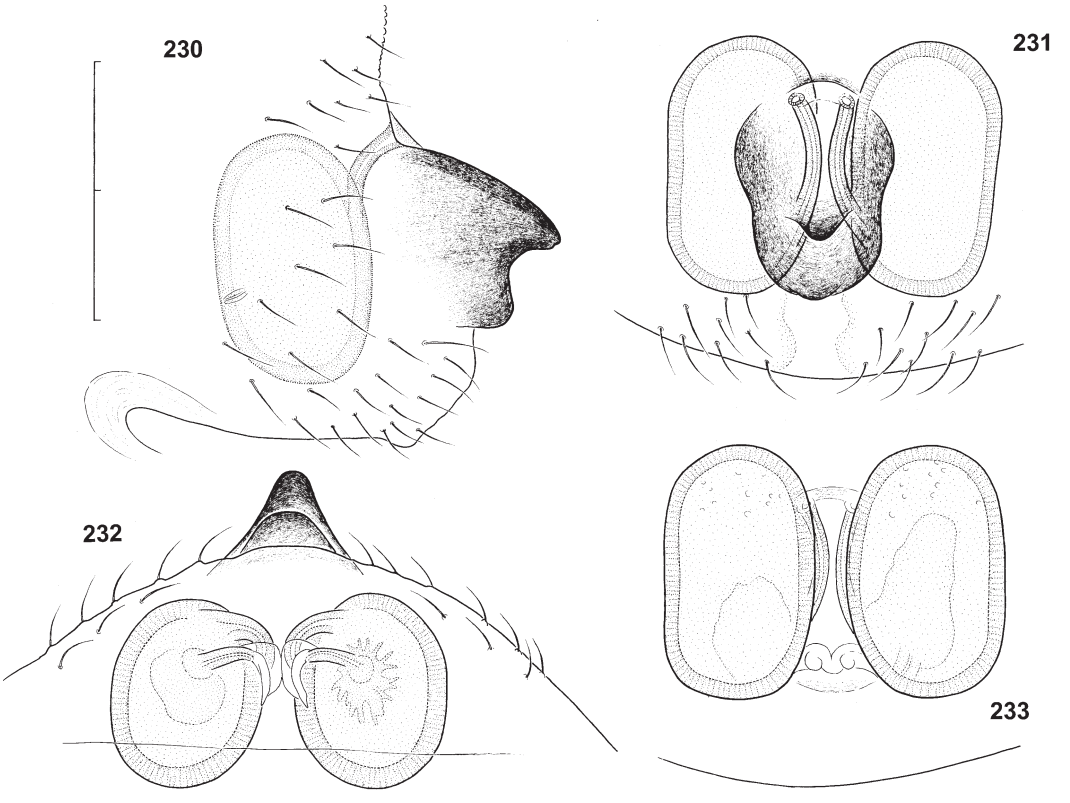
Only the type.

Etymology

The specific epithet is a diminutive and indicates that the species is apart from the others, and also refers to the APART-grant from the Austrian Academy of Sciences (Austrian Programme for Advanced Research and Technology), by which B.K. was supported.

Diagnosis

Smallest species in Madagascar. Epigynal protuberance nose-like, with posterior hump (Figures 187, 230–233). Copulatory orifices separate. Copulatory ducts run posteriorly. Receptacula rather large. Male unknown.



Figures 230–233. *Tidarren apartiolum* n. sp., from Madagascar. Female epigynum/vulva in lateral (230), ventral (231), aboral (232), and dorsal view (233). Scale bar: 0.2 mm.

Measurements (mm)

Total length 2.3, carapace length 0.74, width 0.66, length femur I 1.19, tibia I 0.68. Abdomen higher than long, 2.05 high, 1.56 long, and 1.44 wide. Ventral side (distance petiolus to spinnerets) 1.15 long. Clypeus 0.20 high, chelicerae 0.33 long. Sternum 0.47 long and 0.43 wide. Labium 0.10 long, 0.17 wide. Gnathocoxae 0.23 long, 0.08 wide. Leg formula 1423, see Table XXIV.

Somatic features, colouration (Figures 187, 194)

Sternum without posterior tubercle. Abdomen higher than long, ending in tubercle (Figure 187). Carapace dark brown. Chelicerae brown, with dark longitudinal stripes at

Table XXIV. Leg measurements (mm, by stereo microscope) of *Tidarren apartiolum* n. sp., female.

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.20	0.10	0.12	–	0.21	0.62
I	1.19	0.33	0.68	0.94	0.49	3.63
II	0.76	0.25	0.37	0.51	0.37	2.26
III	0.53	0.23	0.31	0.41	0.37	1.85
IV	0.92	0.33	0.53	0.66	0.41	2.85

margins. Sternum, gnathocoxae, and labium dark brown. Legs and palps light yellow with dark patches and annulations. Abdomen dark, except for some white stripes and light brown patches; without dorsal longitudinal median band or longitudinal white outlines (Figure 194); instead, two short white transverse bars. At sides a distinct white stripe arches downwards; anterior lateral area darker than posterior one. Aboral area of abdomen with white median stripe from apex to spinnerets, surrounded and partially overlain by dark and reddish brown pigmentation. Venter and epigaster dark, book lung covers light. Two lateral white spots next to anterior spinnerets. Spinnerets brown.

Epigynum, vulva (Figures 230–233)

Epigynal protuberance in side view ca 0.1 mm long, nose-like (Figures 187, 230), with posterior hump, in ventral view 0.16 mm long, outlines curved (Figure 231); in aboral view triangular (Figure 232). Copulatory orifices at anterior border of epigynal protuberance (Figure 231), in ventral view close to anterior end of receptacula. Copulatory ducts separate, ca 0.12 mm long (Figure 231), run posteriorly and enter receptacula at posterior inner side. Receptacula seminis comparatively large, 0.20 mm long and 0.12 mm wide (Figure 233). Epigynal protuberance a little shorter than receptacula (Figure 231).

Distribution

Known only from the type locality in Madagascar.

Tidarren dasyglossa n. sp.
(Figures 188, 189, 234–238; Table XXV)

Type material

Madagascar: 1♀ holotype, deposited in NMBS, Toamasina, St. Marie, Ch Vavate Plantage, from plants, 19 September 1999, 17°06′21″S 49°49′50″E, leg. P. Horak. 1♀ paratype, CAS, Fianarantsoa Prov.: Parc Nationale Ranomafana, Talatakely, 21°14.9′S, 47°25.6′E, 19–30 June 1998, leg. C. E. Griswold and D. H. Kavanaugh.

Other material examined

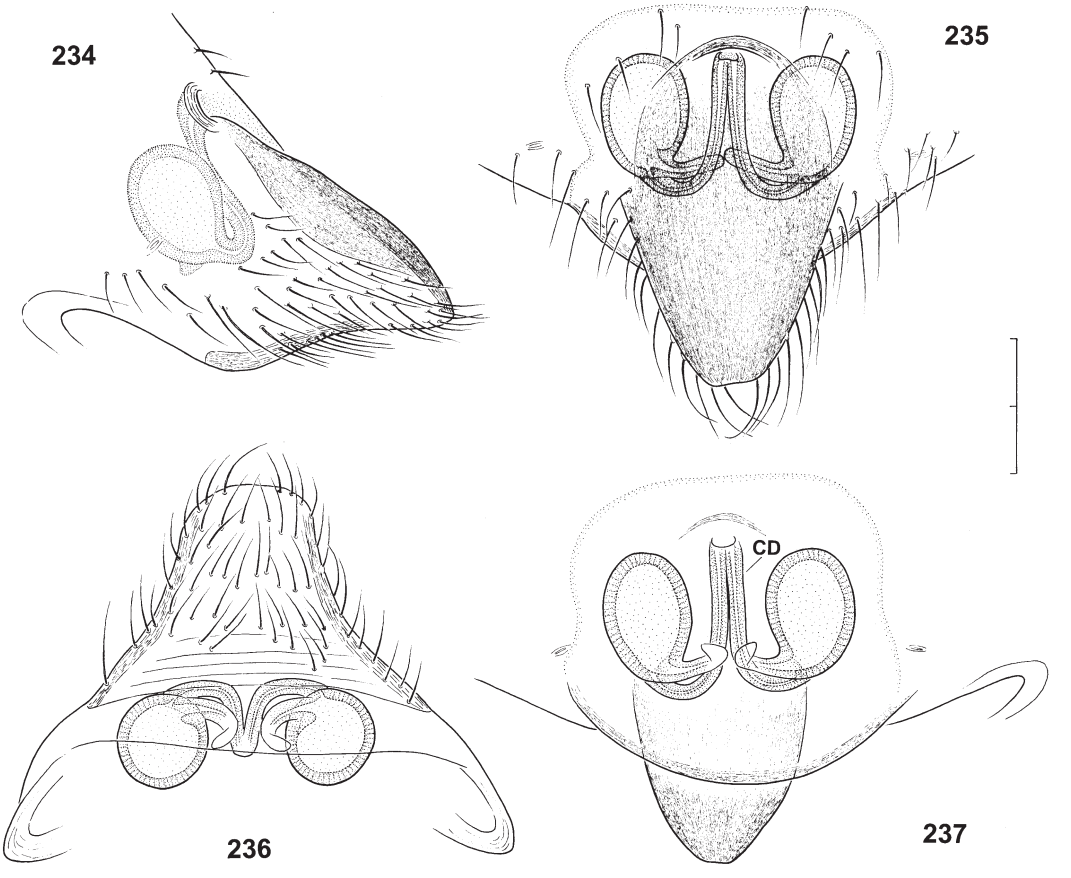
Madagascar: one subadult ♂, CAS, 20 km S of Betroka, 750 m, 10 December 1959, leg. E. S. Ross.

Etymology

The species name is derived from ancient Greek *dasys*, meaning hairy or villous, and from *glossa*, meaning tongue; compound adjective and noun in apposition, hence invariable. It refers to the tongue-shaped epigynum, which bears numerous hairs on its posterior side.

Diagnosis

Tidarren dasyglossa is the only species hitherto known from Madagascar with a small tubercle on posterior end of sternum. As in *T. horaki* the abdomen is rounded. The species has a characteristic tongue-shaped, hairy epigynal protuberance, which occupies most of



Figures 234–237. *Tidarren dasyglossa* n. sp., from Madagascar, Toamasina. Female epigynum/vulva in lateral (234), ventral (235), aboral (236), and dorsal view (237). Scale bar: 0.2 mm.

the epigastric region (Figures 188, 234–237). Copulatory ducts are fused at entrance and run posteriorly in parallel. Adult male unknown. It is expected to have a large palp.

Measurements (mm)

[2♀.] Total length 3.05/3.36, carapace length 1.17/1.17, width 1.05/1.03, length femur I 2.11/2.03, tibia I 1.33/1.25. Abdomen higher than long, 2.35/2.66 high, 2.03 long, and 1.64/1.88 wide. Ventral side (distance petiolus to spinnerets) 1.45 mm long. Clypeus 0.27 high, chelicerae 0.44 long. Sternum 0.78/0.72 long and 0.64/0.60 wide. Labium 0.14 long, 0.29 wide. Gnathocoxae 0.39 long, 0.17 wide. Leg formula 1423, see Table XXV.

Somatic features, colouration (Figures 188, 189)

Sternum with posterior tubercle. Abdomen higher than long, rounded (Figure 188) or bearing an indistinct tubercle. Carapace dark brown. Chelicerae brown, with dark longitudinal stripes at margins. Gnathocoxae and labium dark brown with margins lighter. Sternum uniformly dark. Legs and palps light yellow with dark patches and annulations. Coxae light yellow, distally with large dark patches. Abdomen with white and dark patches

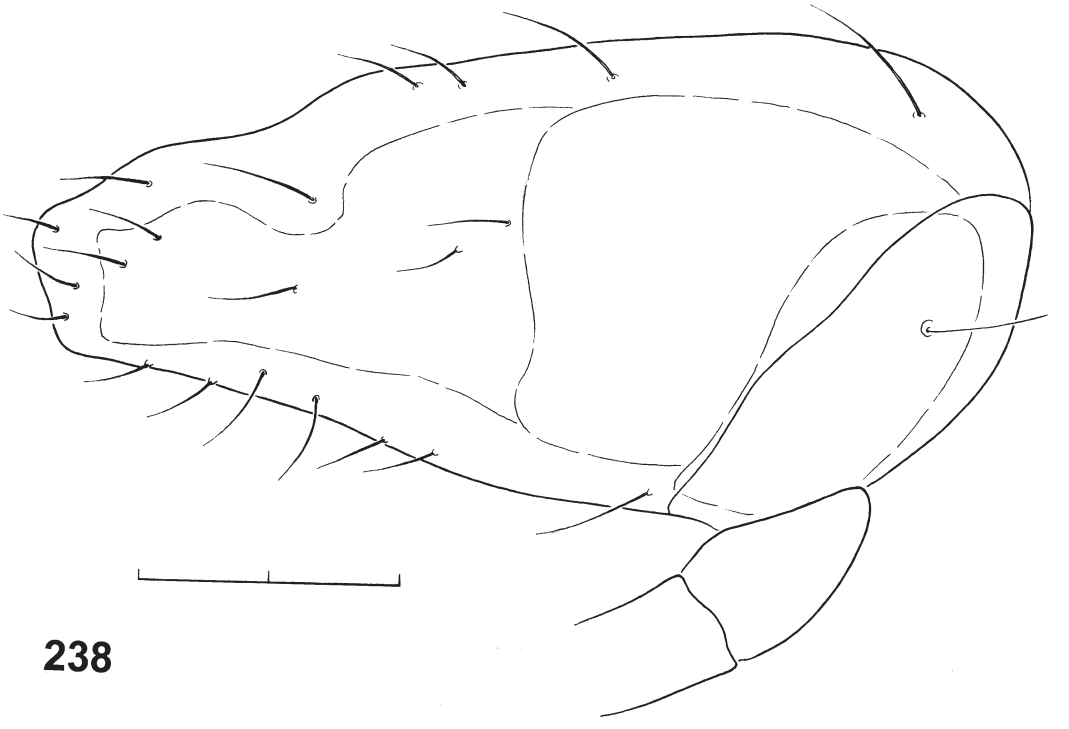


Figure 238. *Tidarren dasyglossa* n. sp., from Madagascar, Betroka. Palp of subadult male. Scale bar: 0.2 mm.

of various extent, in one female rather light. Dorsum with dark irregular median longitudinal band, not distinctly outlined by white stripes. In one female four white paramedian spots. Sides and aboral area whitish with numerous dark spots. White median stripe from apex of tubercle to spinnerets partially overlain by dark pigmentation. Epigaster dominated by sclerotized epigynal protuberance, book lung covers light. Venter dark, with white patches. Spinnerets brown to dark brown.

Epigynum, vulva (Figures 234–237)

Epigynal protuberance strongly developed (Figures 188, 234) occupying main part of epigastric region. It is tongue-shaped, in side view ca 0.4 mm long, in ventral view ca 0.5 mm, with evenly tapering outlines; distal end broad; posterior, aboral side hairy (Figure 236), anterior side heavily sclerotized (Figure 235). Copulatory orifice at anterior border of epigynal protuberance, in ventral view level with anterior end of receptacula. Copulatory ducts with common orifice (Figure 235), ca 0.3 mm long, run posteriorly and

Table XXV. Leg measurements (mm, by stereo microscope) of *Tidarren dasyglossa* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.39	0.20	0.20	–	0.39	1.18
I	2.05	0.57	1.31	1.76	0.64	6.32
II	1.33	0.53	0.74	1.07	0.57	4.23
III	0.96	0.39	0.47	0.66	0.45	2.93
IV	1.76	0.55	1.07	1.37	0.59	5.33

enter receptacula posteriorly. Receptacula seminis 0.19 mm long and 0.13 mm wide. Epigynal protuberance more than twice as long as receptacula (Figure 235).

Distribution

Tidarren dasyglossa is known from three localities in Madagascar.

Matching of sexes

One subadult male is assigned to *T. dasyglossa* owing to its well-developed palp (ca 0.6 mm long, see Figure 189, 238), which corresponds to the large female genital organ. The male has an indistinct posterior tubercle on the sternum and on the abdomen (Figure 189). Sternum dark, coxae with dark distal rims, abdomen dorsal with four white spots. Body dimensions (in mm): total length 1.29, carapace length 0.53, width 0.49, length femur 0.72, tibia I 0.47. Clypeus 0.21 mm high, chelicerae 0.27 mm long. The adult male is expected to have a large and elongate palp.

Tidarren ephemerum n. sp.
(Figures 239–242; Table XXVI)

Type material

Madagascar: 1♂ holotype, CAS, Antsiranana Prov., Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, 13°25′10″S, 48°19′52″E, 30 m, 19–24 March 2001, rainforest, EC30 beating low vegetation, leg. Fisher, Griswold et al., BLF3426.

Material examined

Only the type.

Etymology

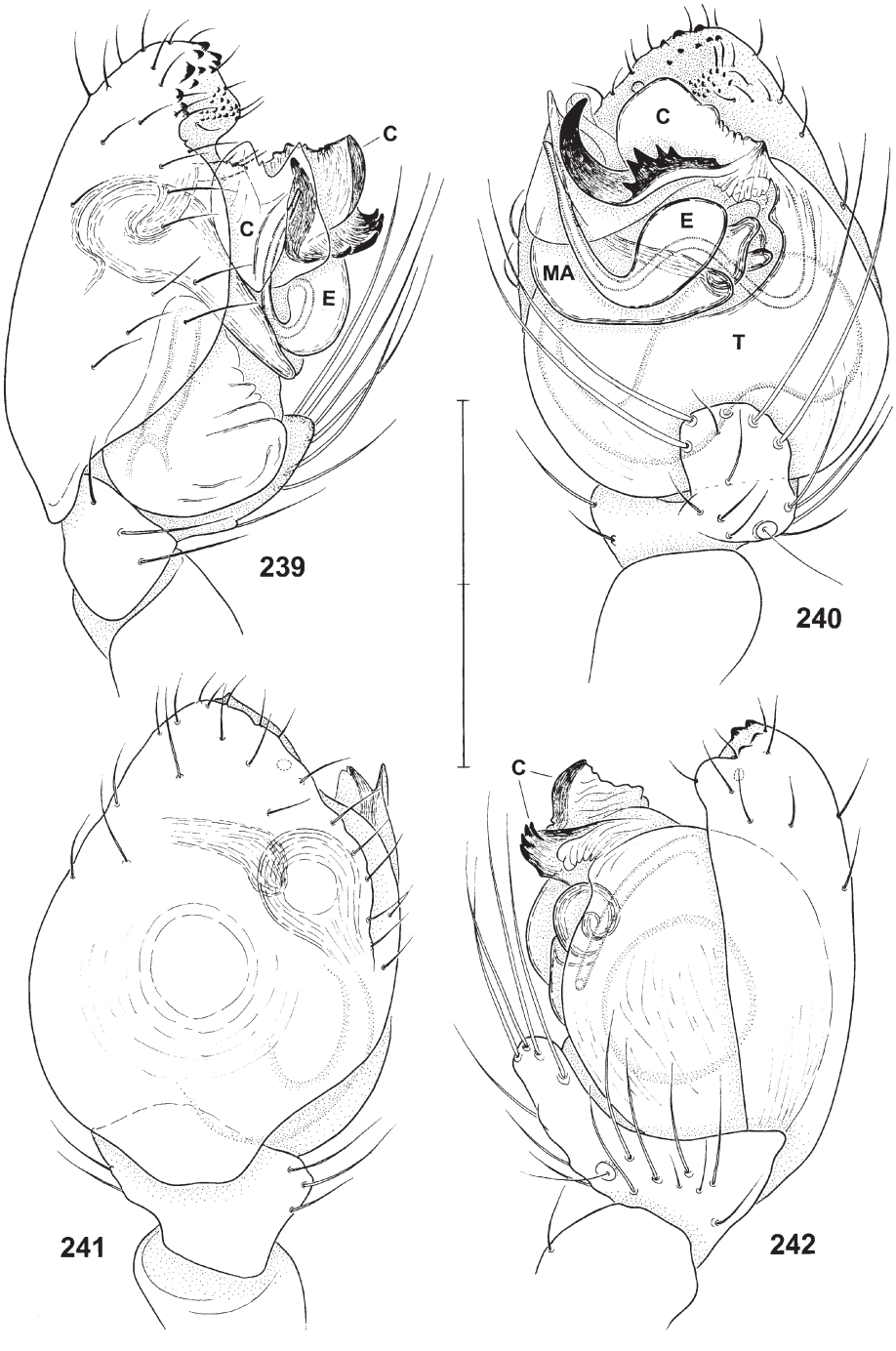
The species name refers to the ephemeral presence of males in all *Tidarren* species, since they die with copulation, and also to the possible ephemeral state of this species, as the male may turn out to belong to either *T. apartiolum* n. sp. or *T. horaki* n. sp.

Diagnosis

The male is distinguished by the slender, tapering cymbium, which lacks distal lobes (Figure 239–242), but bears apical teeth. Prolateral part of conductor with large sickle-shaped process and several conspicuous teeth arranged like a crown (Figure 240). Distal rim of tegulum without process. Female unknown. It cannot be excluded that *T. ephemerum* is the male of either *T. apartiolum* or *T. horaki*.

Measurements (mm)

Total length 1.00, carapace length 0.47, width 0.39, length femur I 0.50, tibia I 0.28. Abdomen 0.79 high, 0.56 long, and 0.54 wide. Ventral side (distance petiolus to spinnerets) 0.43 long. Clypeus 0.19 high. Chelicerae 0.20 long. Sternum 0.25 long and



Figures 239–242. *Tidarren ephemerum* n. sp. from Madagascar. Left male palp, retrolateral (239), dorsal (240), ventral (241), and prolateral view (242). Scale bar: 0.2 mm.

Table XXVI. Leg measurements (mm) of *Tidarren ephemerum* n. sp., taken from entire male by compound optical microscope.

	Fe	Pa	Ti	Mt	Ta	Total
I	0.50	0.17	0.28	0.30	0.28	1.51
II	0.33	0.15	0.21	0.20	0.21	1.09
III	0.30	0.11	0.17	0.14	0.23	0.94
IV	0.44	0.14	0.24	0.21	0.24	1.26

0.27 wide. Femur of male palp ca 0.2 long. Leg formula 1423, see Table XXVI. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia 2/1, 2/1, 1/2, 2/2. Metatarsi I–III with one trichobothrium, position on I 0.23, on II 0.30.

Somatic features, colouration

Sternum without tubercle. Abdomen higher than long, ending in tubercle. Carapace pale yellow with dark median band from clypeus to eye region and to centre. Chelicerae light yellow with greyish inner margin. Gnathocoxae and labium pale yellow. Sternum pale yellow, with broad dark wavy margins and some small dark spots. Legs pale yellow with dark patches and annulations, coxae pale yellow. Palp pale yellow. Abdomen whitish to yellow brown with dark markings on anterior half. Aboral area whitish with indistinct white median stripe. Epigaster greyish, book lung covers pale yellow. Venter dark with two paramedian spots between epigastric furrow and spinnerets. Spinnerets pale yellow at base, distally brown.

Male palp (Figures 239–242)

Tibia at widest part ca 0.6 width of palpal organ. Distal projection of tibia lobe-like and slender, ca 0.3 width of palpal organ (Figure 240). Palpal organ 0.20 mm wide. Cymbium inconspicuous and less modified than in the other species, apparently without distal lobes, but tapering (Figure 241), with several apical teeth; about 1.3 times longer than wide, projecting slightly beyond bulbus. Distal rim of tegulum without process. Retrolateral, membranous part of conductor 0.08 mm long, its tip pointed and hyaline, with furrow guiding embolus; prolateral, sclerotized part with large sickle-shaped process and several conspicuous teeth arranged like a crown (dorsal view, Figure 240) or like a claw (side view, Figure 239). Embolar base suboval, 0.06 long and 0.04 mm wide, with two small basal lobes. Distal part of embolus 0.11 mm long.

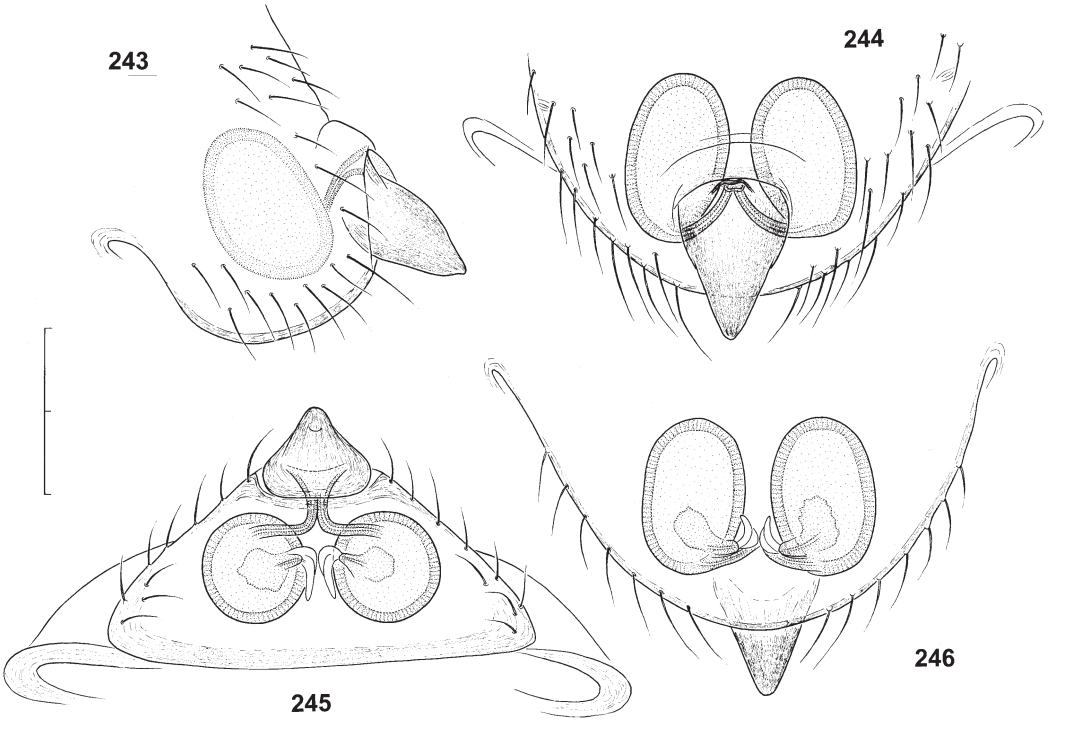
Distribution

Known only from the type locality in Madagascar.

Tidarren horaki n. sp.
(Figures 184, 185, 195, 243–246; Table XXVII)

Type material

Madagascar: 1♀ holotype, 3♀ paratypes, NMBS, Toamasina, St. Marie, Ch Vavate Plantage, from plants, 19 September 1999, 17°06′21″S, 49°49′50″E, leg. P. Otto. 1♀



Figures 243–246. *Tidarren horaki* n. sp., from Madagascar, Toamasina. Female epigynum/vulva in lateral (243), ventral (244), aboral (245), and dorsal view (246). Scale bar: 0.2 mm.

paratype, CTh, Ile St. Marie, La Crigue, 11 October 2000, leg. E. Heiss. 1♀ paratype, CAS, Prov. Antsiranana, Tamatave, ca 18°03′17″S, 49°21′43″E, 4 August 1992, leg. V. and B. Roth.

Material examined

Only the types.

Etymology

This species is dedicated to our enthusiastic fellow arachnologist Dr Peter Horak (Graz).

Table XXVII. Leg measurements (mm) of *Tidarren horaki* n. sp., female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.22	0.14	0.13	–	0.26	0.75
I	1.18	0.38	0.70	0.98	0.56	3.79
II	0.83	0.35	0.45	0.62	0.46	2.70
III	0.63	0.29	0.37	0.46	0.39	2.13
IV	1.05	0.39	0.59	0.75	0.49	3.27

Diagnosis

In *T. horaki* the abdomen is rounded or has an inconspicuous dorsal tubercle (Figures 184, 185). Apart from the epigynal protuberance, the entire epigastric region is strongly projecting, rounded and sclerotized (Figures 184, 185, 243–246). Male unknown.

Measurements (mm)

[♀, $n=5$, minimum–maximum (mean).] Total length 2.35–2.90 (2.66), carapace length 0.88–1.05 (0.95), width 0.74–0.92 (0.82), length femur I 1.17–1.40 (1.29), tibia I 0.66–0.86 (0.75). Abdomen 1.64–2.15 (1.95) high, 1.41–1.88 (1.65) long, and 1.21–1.72 (1.53) wide. Ventral side (distance petiolus to spinnerets) 1.10–1.17 long. Clypeus 0.21 high. Chelicerae 0.41 long. Sternum 0.55–0.59 (0.57) long and 0.33–0.35 (0.34) wide. Labium on average 0.12 long, 0.22 wide. Gnathocoxae 0.34 long, 0.14 wide. Leg formula 1423, see Table XXVII. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 1/1, of legs I–IV 2/1, 2/1, 2/2, 2/2 (1♀ examined). Metatarsi I–III with one trichobothrium, position on I 0.21, on II 0.29, on III 0.36. Tarsal claws of legs with three to four side teeth, claw of female palp consisting of seven teeth. Tarsal organ on female palp at 0.80, on legs I–IV 0.21, 0.33, 0.28, 0.29.

Somatic features, colouration (Figures 184, 185, 195)

Sternum without posterior tubercle. Abdomen higher than long, more or less rounded, tubercle inconspicuous (Figures 184, 185). Carapace uniformly dark brown. Chelicerae light brown, suffused with greyish longitudinal stripes at margins. Gnathocoxae and labium dark brown, lighter at margins. Sternum uniformly dark. Legs and palps light yellow with large dark patches and annulations. Coxae light yellow, distally with large dark patches or at least darkened. Abdomen dark in most specimens, with several white spots (Figure 195). In one well-nourished female with numerous white and dark spots on light brown background. Dorsum without longitudinal band, but with four white paramedian patches; from posterior one an indistinct white line turns laterally. Aboral area dark (in one female dark and white speckled), with interrupted white median stripe from apex of tubercle to spinnerets. Epigastric region strongly protruding. Epigaster dark to greyish, book lung covers light. Venter dark, with two white paramedian spots. Spinnerets dark brown.

Epigynum, vulva (Figures 243–246)

Entire epigastric region swollen, rounded and strongly projecting together with epigynal protuberance, ca 0.3 mm beyond venter (Figures 184, 185, 243–246), epigynum itself 0.12–0.14 mm long in side view. Protuberance triangular, directed anteriorly, in ventral view ca 0.2 mm long, with gradually tapering outlines; posterior, aboral side clearly delimited from surrounding integument, but surrounding aboral region also sclerotized (Figure 245). Copulatory orifice at anterior border of epigynal protuberance, in ventral view closer to posterior end of receptacula. Copulatory ducts separate, though with common orifice (Figures 244, 245), ca 0.1 mm long; they immediately diverge posteriorly and laterally and enter receptacula at posterior inner side. Receptacula seminis 0.19 mm long and 0.12 mm wide. Epigynal protuberance about as long as receptacula (in ventral view, Figure 244).

Distribution

Tidarren horaki was collected from three localities in Madagascar.

Tidarren obtusum n. sp.
(Figures 186, 190–192, 247–258, 259c; Tables XXVIII, XXIX)

Type material

Madagascar: 1♀ holotype, 3♀ paratypes, CAS, Mahajanga Prov., Réserve d'Ankoririka, 10.6 km 13° NE de Tsaramandroso, 16°16′02″S, 46°02′55″E, 210 m, 9–14 April 2001, tropical dry forest, general coll. night, leg. J. J. Rafanomezantsoa et al., JJR0148. 1♂ paratype, CAS CASENT 9002892, Mahajanga Prov., Parc National d'Ankarafantsika, Forêt de Tsimaloto, 18.3 km 46° NE de Tsaramandroso, 16°13′41″S, 46°08′37″E, 135 m, 2–8 April 2001, tropical dry forest, EF28 beaten from low vegetation, leg. J. J. Rafanomezantsoa et al., JJR0147. 1♀ paratype, CTh, Perinet, 18°56′S, 48°25′E, 10 November 1995, near water, leg. T. Kopf.

Other material examined

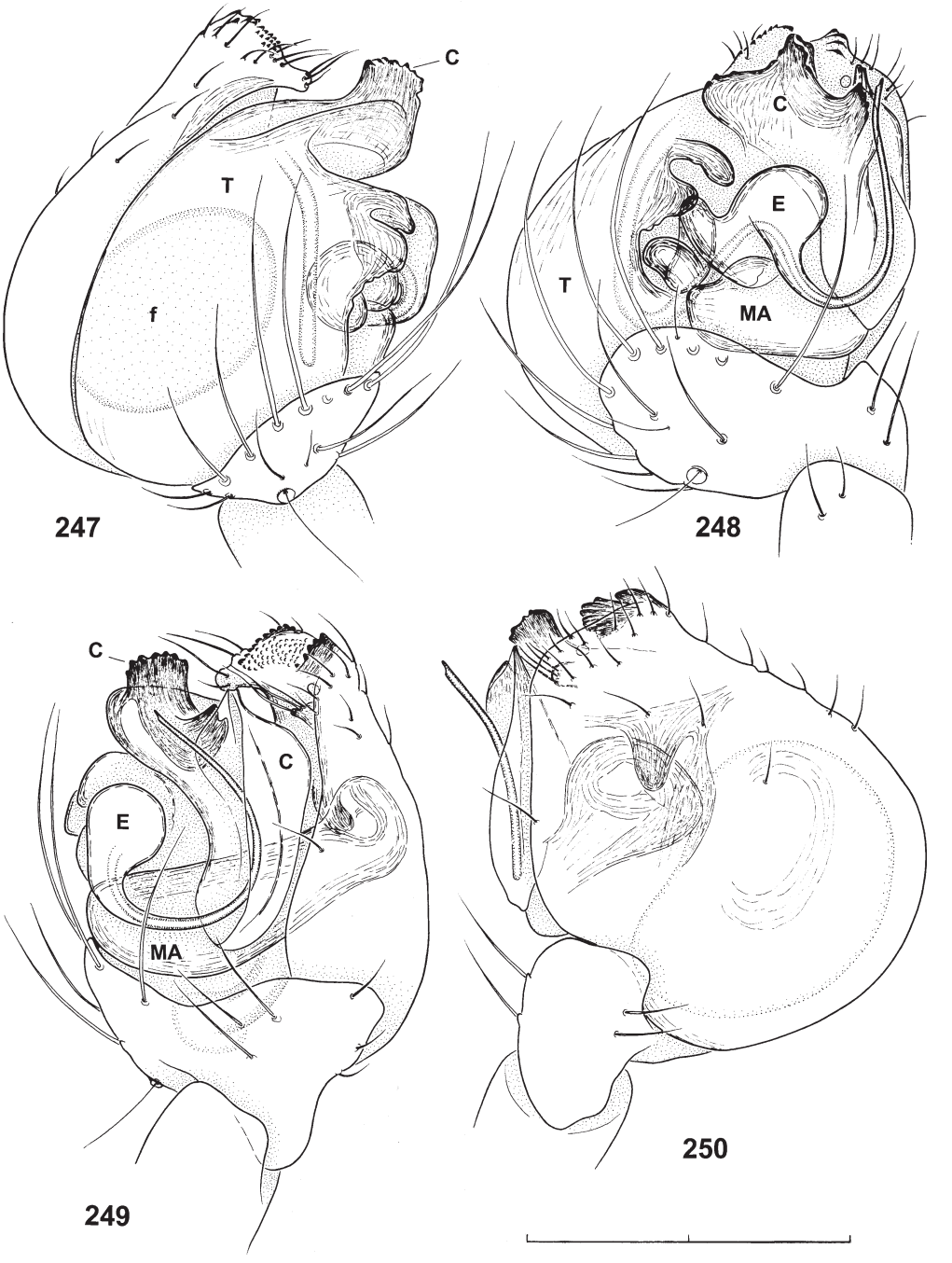
Madagascar: 2♀, CAS, Mahajanga Prov., Parc National d'Ankarafantsika, Forêt de Tsimaloto, 18.3 km 46° NE de Tsaramandroso, 16°13′41″S, 46°08′37″E, 135 m, 2–8 April 2001, tropical dry forest, general coll. night, leg. J. J. Rafanomezantsoa et al., JJR0145. 1♀, CAS, Mahajanga Prov., Parc National d'Ankarafantsika, Ampijoroa Station Forestière, 40 km 306° NW Andranofasika, 16°19′15″S, 46°48′38″E, 130 m, 26 March to 1 April 2001, tropical dry forest, EF28 beaten from low vegetation, leg. Fisher, Griswold et al., BLF3524. 1♀, CAS, Mahajanga Prov., Parc National d'Ankarafantsika, Ampijoroa Station Forestière, 40 km 306° NW Andranofasika, 16°19′15″S, 46°48′38″E, 130 m, 26 March to 1 April 2001, tropical dry forest, general collect. night, leg. J. J. Rafanomezantsoa et al., JJR0142. 1juv♀, CAS, Antsiranana Prov., Foret d'Orangea, 3.6 km 128° SE Remena, 12°15′32″S, 49°22′29″E, 90 m, 22–28 February 2001, littoral rainforest, EG28 beaten from low vegetation, leg. Fisher, Griswold et al., BLF3202.

Etymology

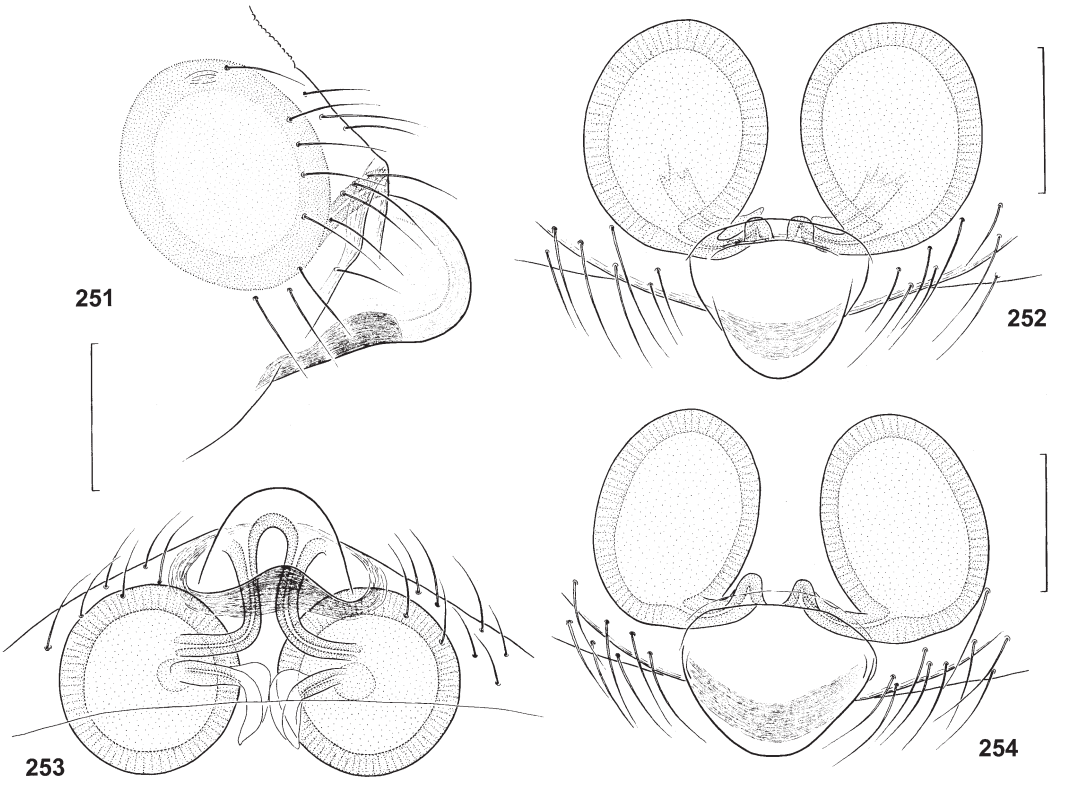
The specific epithet refers to the obtuse epigynal protuberance, from the Latin adjective *obtusus*. The suffix agrees with the gender of the genus name.

Diagnosis

Among the species from Madagascar *T. obtusum* shows the least projecting epigynum, its protuberance being a rounded, scarcely sclerotized knob (Figures 186, 251–258). In contrast to *T. aethiops* from mainland Africa the protuberance is not laterally incised (Figures 251, 255), the copulatory orifices being situated at its anterior border. The male is characterized by the sclerotized prolateral part of the conductor, which is strongly protruding (Figures 190, 191, 247, 249). Cymbium distally tapering, with apical warts (Figures 247–250). Distal rim of tegulum with two sclerotized, rounded processes (Figure 247).



Figures 247–250. *Tidarren obtusum* n. sp. from Madagascar, Ankarafantsika, Forêt de Tsimaloto. Right male palp, prolateral (247), dorsal (248), retrolateral (249), and retrolateral-ventral view (250). Scale bar: 0.2 mm.



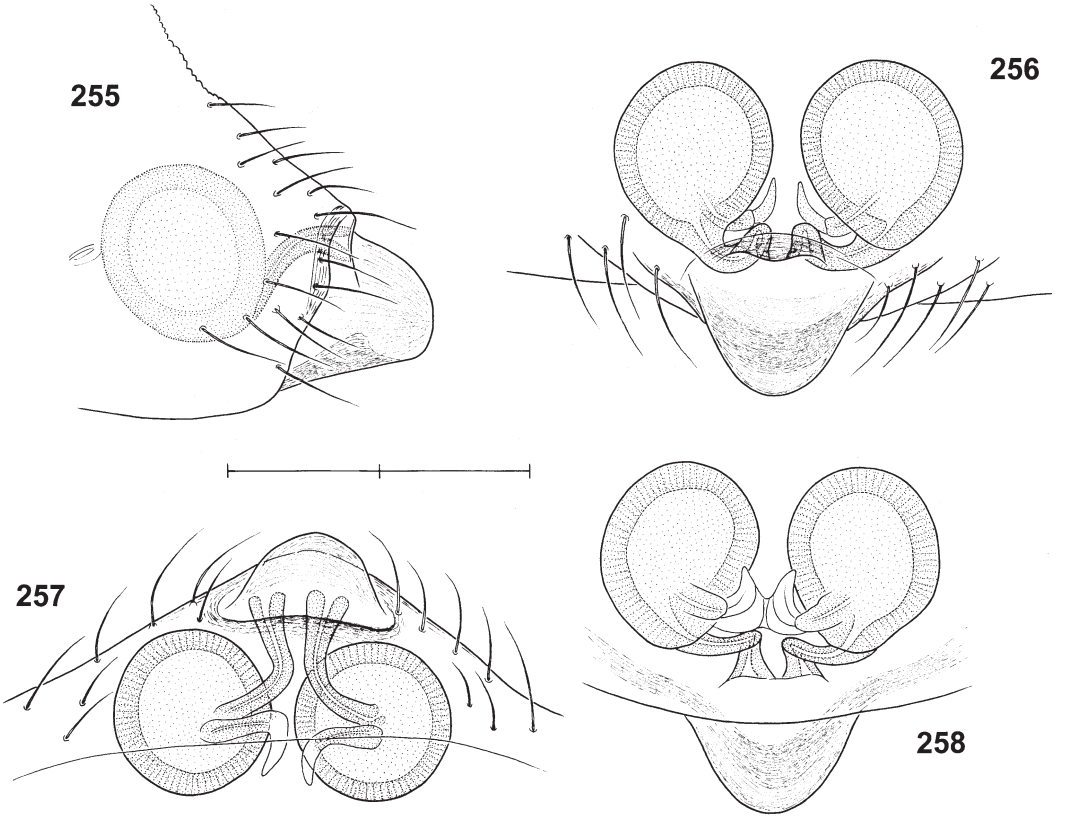
Figures 251–254. *Tidarren obtusum* n. sp., from Madagascar, Ankarafantsika, Ampijoroa station (251–253) and Forêt de Tsimaloto (254). Female epigynum/vulva in lateral (251), ventral (252, 254), and aboral view (253). Scale bars: 0.1 mm.

Measurements (mm)

[♂ *n*=1/♀ *n*=8, minimum–maximum (mean).] Total length 1.17/2.82–3.56 (3.13), carapace length 0.52/1.07–1.29 (1.17), width 0.43/0.88–1.07 (0.98), length femur I 0.57/1.76–2.51 (2.15), tibia I 0.35/1.01–1.48 (1.24). Abdomen 0.74/2.15–3.09 (2.7) high, 0.62/1.68–2.27 (2.0) long, and 0.49/1.41–1.92 (1.7) wide. Ventral side (distance petiolus to spinnerets) 0.51/1.21–1.64 (1.39) long. Clypeus in male 0.23 high, in females on average 0.27. Chelicerae 0.20/0.46 long. Sternum 0.32/0.64–0.74 (0.70) long and 0.30/0.57–0.68 (0.62) wide. Labium 0.05/on average 0.16 long, 0.10/0.27 wide. Gnathocoxae 0.15/0.41 long, 0.06/0.16 wide. Femur of male palp 0.31 long. Leg formula 1423, see Tables XXVIII, XXIX. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 2/1, of female legs I–IV 3/?, 3/?, 3/2, 3/3 (1♀ examined), of male legs I–IV 2/1, 2/1, 1/2, 2/2. Metatarsi I–III with one trichobothrium, position on I 0.30 (0.23), on II 0.30 (0.30), on III 0.35 (0.34) in female (male). Tarsal claws of legs with three side teeth in female, with only one side tooth in male, claw of female palp consisting of seven teeth. Tarsal organ on female palp at 0.76, on female legs I–IV 0.42, 0.35, –, 0.33, on male legs I–IV 0.23, 0.28, 0.28, 0.26.

Somatic features, colouration (Figures 186, 190–192)

Sternum without posterior tubercle. Abdomen higher than long, ending in tubercle.



Figures 255–258. *Tidarren obtusum* n. sp., from Madagascar, Perinet. Female epigynum/vulva in lateral (255), ventral (256), aboral (257), and dorsal view (258). Scale bar: 0.2 mm.

Table XXVIII. Leg measurements (mm) of *Tidarren obtusum* n. sp., female (taken by stereo microscope (n=1)/ light microscope (n=1)).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.33/0.32	0.20/0.19	0.20/0.19	–	0.37/0.36	1.10/1.06
I	2.50/2.24	0.62/0.57	1.48/1.29	2.03/1.81	0.82/0.71	7.45/6.62
II	1.56/1.44	0.53/0.50	0.86/0.76	1.29/1.14	0.62/0.57	4.86/4.41
III	1.15/1.04	0.43/0.40	0.62/0.57	0.92/0.77	0.59/–	3.71/–
IV	1.99/2.04	0.60/0.55	1.13/0.99	1.56/1.34	0.70/0.60	5.99/5.51

Table XXIX. Leg measurements (mm) of *Tidarren obtusum* n. sp., taken from entire male by compound optical microscope.

	Fe	Pa	Ti	Mt	Ta	Total
I	0.57	0.19	0.35	0.37	0.30	1.77
II	0.40	0.18	0.23	0.23	0.27	1.30
III	0.32	0.16	0.18	0.17	0.23	1.05
IV	0.47	0.18	0.29	0.27	0.27	1.47

Female (Figures 186, 192). Carapace yellow with dark median area from eye region to centre, sometimes also with dark margins. Chelicerae yellow, rarely suffused with greyish longitudinal stripes at margins. Gnathocoxae and labium pale yellow. Sternum with variable pattern, from pale yellow with indistinct greyish margins and undulations to distinct pattern, covering posterior half of sternum, or sternum even mainly dark with several light spots. Legs and palps light yellow with dark patches and annulations of various extent. Coxae light yellow. Abdomen whitish to yellowish, with white line pattern and some dark pigmentation. Dorsum with broad whitish longitudinal band, ending on tubercle and surrounded by dark pigmentation. One short anterior and one longer posterior white line curve downwards laterally. Aboral area yellowish, with clear white median stripe from apex to spinnerets and one or two interrupted dark transverse bands. Epigastric region yellowish, epigynal area sometimes darkened, book lung covers pale yellow. Venter yellowish, sometimes with a few dark and white spots. Spinnerets light brown.

Male (Figures 190, 191). Carapace yellow with dark median area from clypeus to centre. Chelicerae light brown, mainly suffused with grey. Gnathocoxae and labium brown. Sternum dark brown. Legs pale yellow with dark patches and annulations. Coxae distally slightly darkened. Basal segments of male palp pale yellow with brown patches, cymbium brown. Abdomen yellowish to whitish, with dark pigmentation and white spots. Anterior half dark, posterior half light. Epigaster dark, book lung covers yellow. Venter dark, with two small white paramedian spots. Spinnerets brown.

Male palp (Figures 247–250)

Tibia distally ca 0.7 width of palpal organ; its base ca 0.4 width of distal rim (Figure 248). Cymbium tapering, with two small distal lobes, and intermediate part with several rows of apical warts. Cymbium scarcely projecting beyond bulbus. Bulbus ca 0.2 mm long and 0.25 mm wide. Distal rim of tegulum with two sclerotized, rounded projections. Retrolateral, membranous part of conductor 0.16 mm long, its tip pointed, with furrow guiding embolus. Prolateral part with conspicuous, large, sclerotized process (Figures 247, 249, visible also in Figures 190, 191) and a smaller inner one close to tip of membranous part; their distal surfaces bear some warts. Embolar base circular, 0.05 mm in diameter, with two small basal lobes. Distal part of embolus 0.2 mm long.

Epigynum, vulva (Figures 251–258)

Epigynal protuberance short and rounded (Figures 186, 251, 255), 0.08–0.09 mm long in side view; protuberance itself scarcely sclerotized, thus appearing whitish in contrast to darker surrounding integument (Figure 253); posterior, aboral side delimited from surrounding integument (Figures 253, 257). Copulatory orifice at anterior border of epigynal protuberance, in ventral and dorsal view level with posterior end of receptacula. Copulatory ducts with separate orifices (Figures 252–254, 256–258), ca 0.1 mm long; they diverge anteriorly and then laterally and enter receptacula at posterior inner side. Receptacula seminis 0.13–0.16 mm long and 0.10–0.12 mm wide. Epigynal protuberance about 0.7 length of receptacula (in ventral view, Figures 252, 256).

Matching of sexes

It cannot be definitely assured that the male is conspecific with the females, as different species may occur together in the same region. However, the single male was collected from

exactly the same locality as two females. Also the yellowish colouration of the carapace agrees with that of the females.

Distribution (Figure 259c)

Tidarren obtusum occurs in several places on Madagascar.

Tidarren sp.
(Figure 259a, b)

Material examined

Madagascar: 1♂ (palp expanded), CAS CASENT 9008029, Antsiranana Prov., Nosy Be, Réserve Naturelle Intégrale de Lokobe, 6.3 km 112° ESE Hellville, 13°25′10″S, 48°19′52″E, 30 m, 19–24 March 2001, rainforest, EC30 beating low vegetation, leg. Fisher, Griswold et al., BLF3426.

This male specimen eluded a clear assignment to other Madagasy species, as its male palp is expanded and its details are hard to compare (Figure 259a, b). However, it does not agree with *T. ephemerum*. Shape of conductor also differs from *T. obtusum*. Probably, it represents the male of another species.

Comparative material from South and Central America

Tidarren haemorrhoidale (Bertkau, 1880)
(Figures 260–265, 267–271; Tables XXX, XXXI)

Theridium haemorrhoidale Bertkau 1880, p 78; n. sp., ♀, type locality: Rio (Brazil).
Tidarren mixtum: Kraus 1955, p 19, only Figures 45–48, ♀ (not Figures 43, 44 = *T. mixtum*).
Tidarren haemorrhoidale: Levi 1969, p 71.
Synonyms: see Platnick (2006).

Material examined

Costa Rica: 2♀, 1juv, NMW Inv. No. 720, San José, La Caja, 9°58′N, 84°07′W, leg. E. Schmidt, 1930, det. Reimoser (sub *Theridion fordulum*). **Venezuela**: 2♀, MNHN 11236 AR 10708, Carabobo, La Cumbre, leg. Simon, 1888, det. Levi, 1960 (sub *Tidarren fordum*). 6♀ 2sad♀, MNHN 11664, without AR number, La Guaira, leg. E. Simon, det. Levi, 1960 (sub *T. fordum*). 1♀, MNHN 11299 AR 10774, Aragua, Tovar, leg. Simon, 1888, det. Levi, 1960 (sub *T. fordum*). 8♀ 5juv, MNHN AR 2411, Caracas, in vial of "*Theridium taeniatum*" together with several *Achaearanea* females, which at least partially appear to represent *Achaearanea taeniata* (Keyserling, 1884). **French Guiana**: 1♀, MNHN AR 10710, Gomdouville, leg. R. Benoit, 1914 (sub *T. fordum*). 2♀, 1juv (together with one theridiid female), MNHN 10709, St. Jean de Maroni, leg. R. Benoit, 1914 (sub *T. fordum*). 1♀, MNHN 23784 AR 10711, Cayenne, leg. R. Benoit, 1914, det. Levi, 1960 (sub *T. fordum*). 1♀, MNHN AR 10703, Farinda N. Niag (sub *T. fordum*). **Brazil**: 1♀, MNHN 19240, without AR number, Bahia, Salvador, 12°59′S, 38°31′W, leg. Goeldi. 1♀, MNHN AR 2300, Bahia, in vial of *Nesticodes rufipes* (Lucas, 1846) sub *Theridium albonotatum* Taczanowski, 1872, which is a synonym of *N. rufipes*. **Paraguay**: 1♀, MNHN 9054 AR

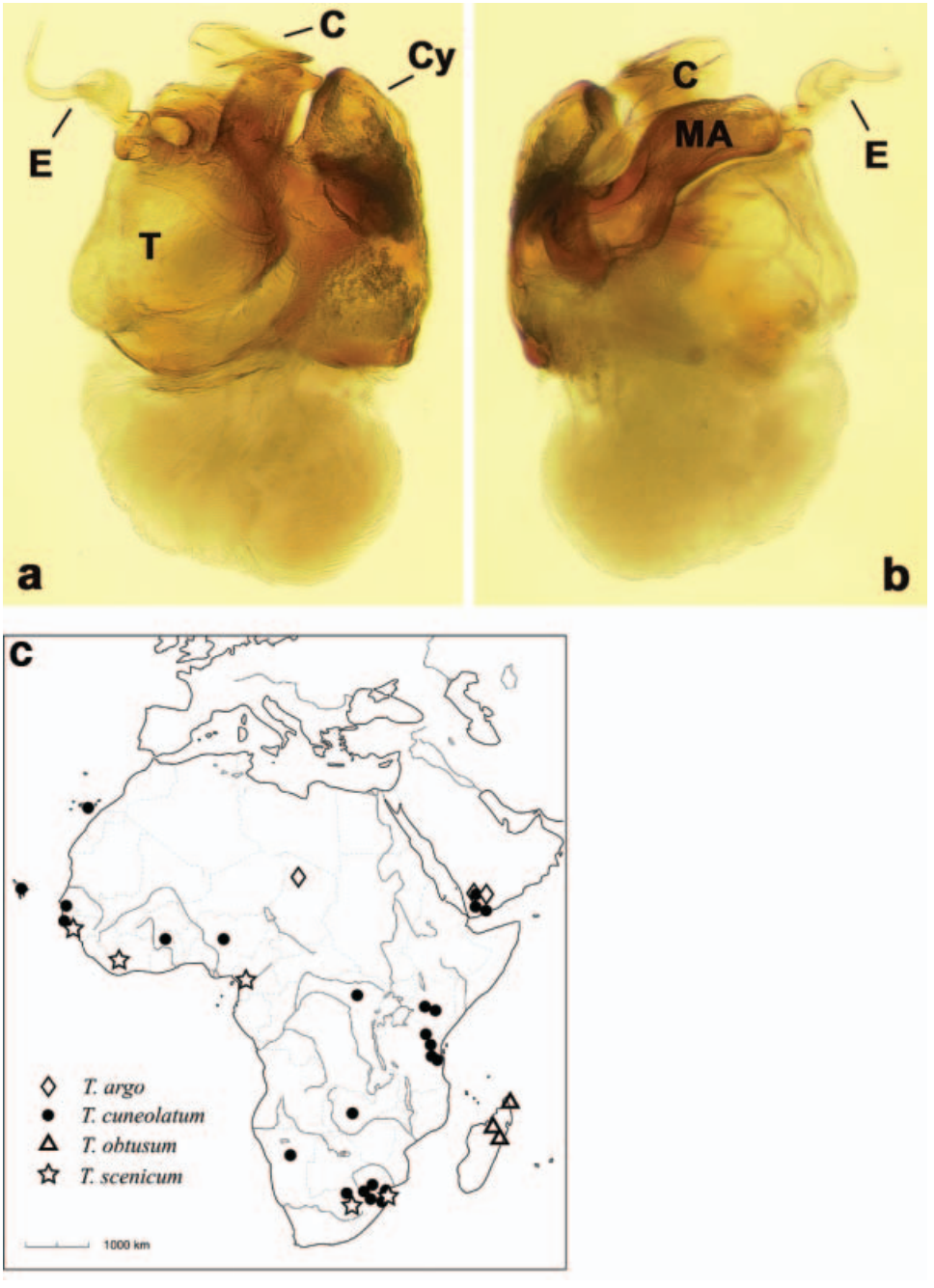


Figure 259. (a, b) *Tidarren* sp. from Madagascar, Nosy Be. Left male palp, expanded, prolateral (a) and retrolateral (b). (c) Distribution of four *Tidarren* species, *T. argo* Knoflach and van Harten, *T. cuneolatum* (Tullgren), *T. obtusum* n. sp., and *T. scenicum* (Thorell).

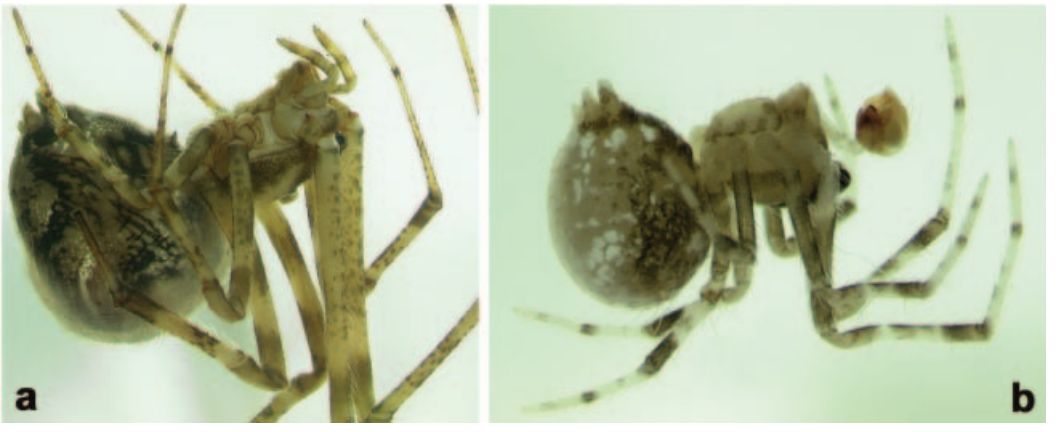


Figure 260. *Tidarren haemorrhoidale* (Bertkau) from Mexico. Habitus of female (a) and male (b). Auto-Montage digital photos from specimens preserved in alcohol.

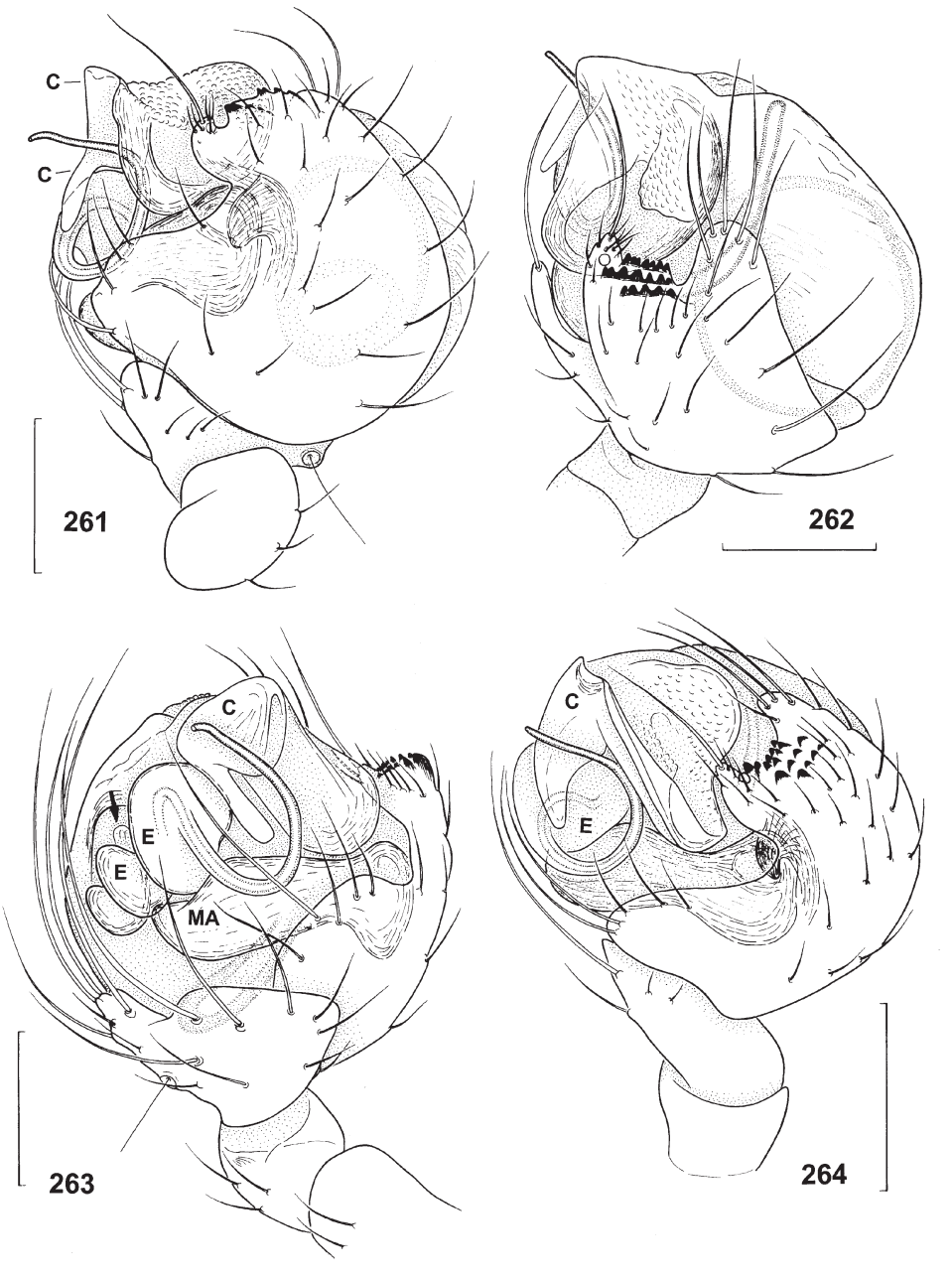
10773, Germain (locality unclear, two labels, on one Germ, on the other Germain), det. Levi, 1960 (sub *T. fordum*). **Peru**: 5♀, 3juv, MNHN 4066, without AR number, Loreto, Pebas, 3°20′S, 71°49′W. 2♀, MNHN AR 2304, same locality, det. E. Simon (sub *Theridium giganteum* Keyserling, 1884). **Mexico**: Chiapas state, Tapachula, Rosario Itzapa, ♂♀, 6–12 October 2001, leg. S. P. Benjamin and J. A. Garcia-Ballinas. Descendants of these from five egg-sacs were reared to adulthood in captivity in Basel by S. P. Benjamin. Voucher specimens are deposited in AMNH, CAS, CTh, MHNG, MNHN, MRAC, NHMB, NHRS, NMBS, NMW, SMF.

Description

Chamberlin and Ivie (1934, sub *Tidarren minor*, ♀), Levi (1957, sub *T. fordum*, ♂♀). Identification according to Levi (1957, 1969).

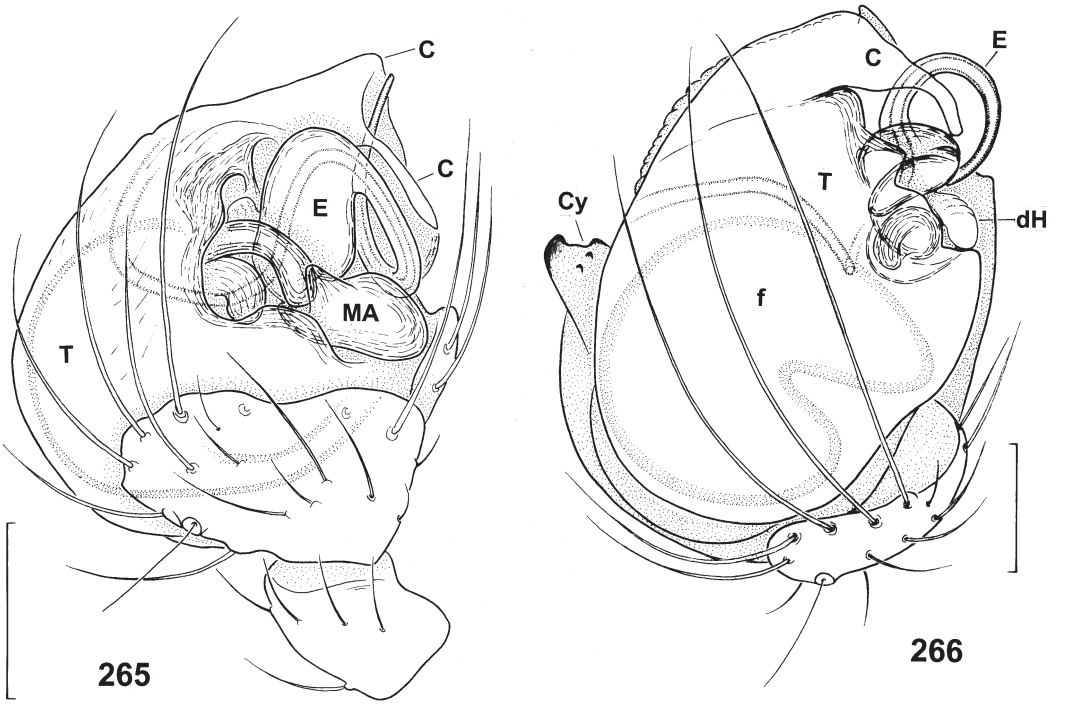
Measurements (mm)

[♂/♀, n=6/7, minimum–maximum (mean).] Total length 1.07–1.44 (1.32)/3.01–5.31 (4.38), carapace length 0.45–0.57 (0.53)/1.10–2.35 (1.77), width 0.45–0.50 (0.48)/0.96–2.03 (1.48), length femur I 0.74–0.86 (0.82)/1.72–4.70 (3.57), tibia I 0.49–0.55 (0.53)/1.02–3.09 (2.32). Abdomen 0.74–1.13 (1.01)/2.46–4.58 (3.4) high, 0.59–0.88 (0.79)/1.96–3.40 (2.70) long, and 0.59–0.83 (0.73)/1.72–2.93 (2.35) wide. Ventral side (distance petiolus to spinnerets) 0.45–0.64 (0.59)/1.25–2.54 (2.05) long. Clypeus in male 0.14–0.30 (0.17) high, in females 0.23–0.49 (0.35). Chelicerae 0.15–0.25 (0.21)/0.39–0.78 (0.63) long. Sternum 0.33–0.35 (0.35)/0.64–1.37 (1.00) long and 0.31–0.35 (0.33)/0.58–1.09 (0.85) wide. Labium on average 0.07/0.21 long, 0.13/0.27–0.55 (0.39) wide. Gnathocoxae 0.15–0.20 (0.17)/0.39–0.70 (0.57) long, 0.06–0.08 (0.07)/0.19–0.35 (0.28) wide. Femur of male palp 0.21 long (mean). Leg formula 1423, see Tables XXX, XXXI. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 2/2, of legs I–IV 3/3, 3/3, 3/3, 4/4 in female and 2/1, 2/1, 2/2, 2/2 in male (1♂, 1♀ examined). Metatarsi I–III with one trichobothrium, position on I in female (male) 0.28 (0.33), on II 0.31 (0.39), on III 0.44 (0.46). Tarsal claws of legs with four to five (one to



Figures 261–264. *Tidarren haemorrhoidale* (Bertkau) from Mexico. Right male palp, ventral (261), apical (262), retrolateral (263), and retrolateral-apical view (264). Arrow points to vestigial distal haematodocha (263). Scale bars: 0.1 mm.

two) side teeth in female (male), claw of female palp consisting of seven teeth. Tarsal organ on female palp at 0.80, on female (male) legs I–IV 0.51 (0.36), 0.26 (0.31), 0.34 (0.27), 0.33 (0.29).

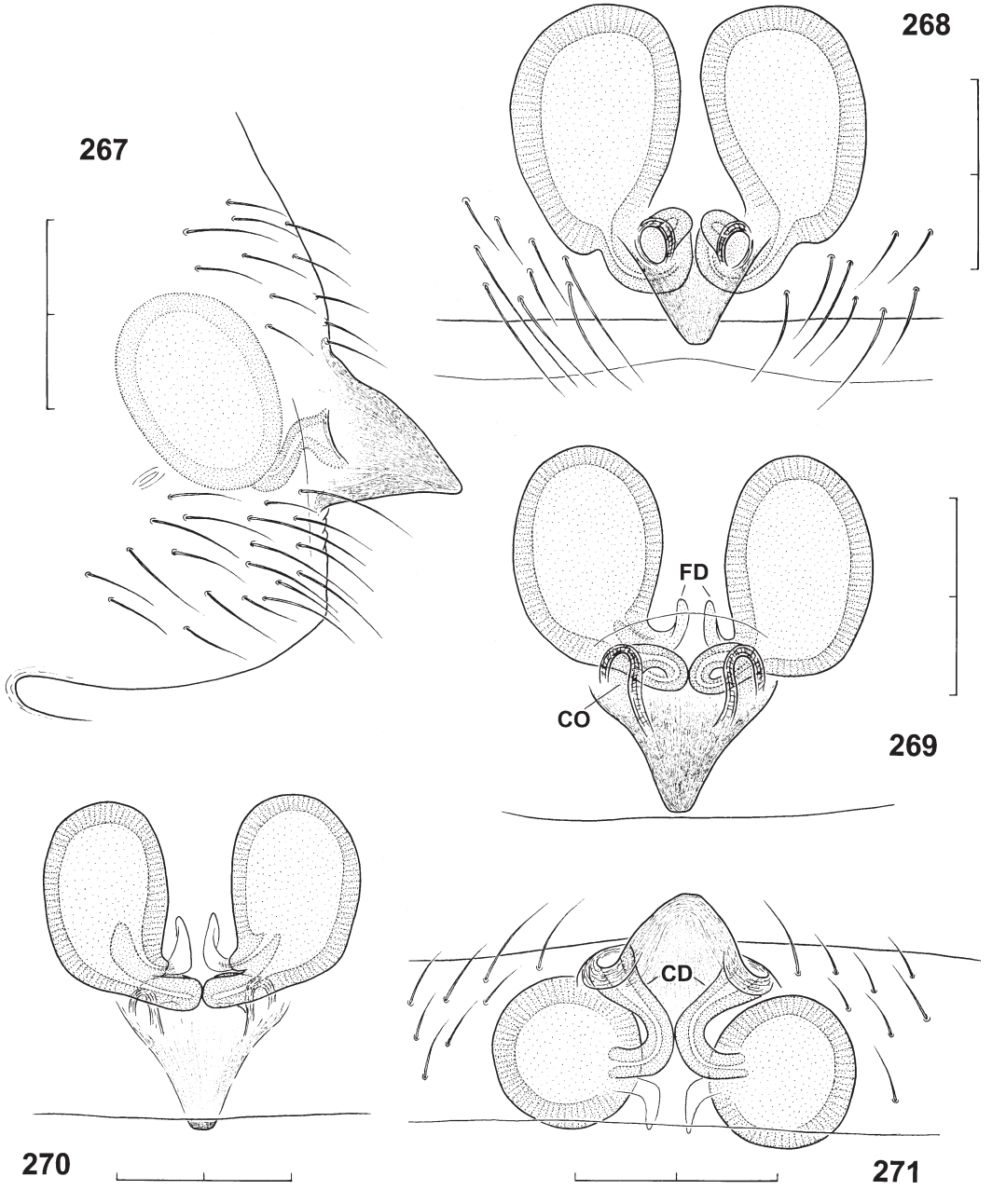


Figures 265, 266. Right male palp, dorsal view. (265) *Tidarren haemorrhoidale* (Bertkau) from Mexico. (266) *T. sisyphoides* (Walckenaer) from Costa Rica. Scale bars: 0.1 mm.

Somatic features, colouration (Figure 260)

Sternum without posterior tubercle. Abdomen higher than long, rounded, without tubercle.

Female (Figure 260a). Carapace yellow with broad dark margins and with dark median band from eye region to centre, tapering posteriorly and sometimes extending laterally. Clypeus greyish. Chelicerae, gnathocoxae, and labium light brown or yellow. Sternum light brown to yellow, with thin dark margin and frequently with distinct dark stripes opposite each coxa; sometimes with numerous fine dots instead. Legs and palps light brown to yellow with dark patches and annulations of various extent. Numerous fine dots present especially on femora I–II and tibia I–II. Coxae light yellow, only in few specimens coxae I and IV with a greyish spot. Abdomen whitish to light brown, with white line pattern and variable dark pigmentation. On dorsum two dark, rounded median patches just before apex, outlined by clear white lines; from these two white stripes curve to each side. Further white and dark dots on anterior part of dorsum. Sides sometimes with large areas of dark pigmentation. In some specimens this abdominal pattern is very indistinct or even almost absent. Aboral area whitish to brownish with clear white median stripe from apex to spinnerets and with two or three dark transverse, upwardly curved bands. Epigastric region greyish, region in front of epigynal protruberance yellowish, so that receptacula are visible through integument. Book lung covers yellow. Venter with dark and white patches. Spinnerets light brown.



Figures 267–271. *Tidarren haemorrhoidale* (Bertkau) from Brazil, Bahia (267, 269, 270) and Peru, Loreto (268). Female epigynum/vulva in lateral (267), ventral (268, 269), dorsal (270), and aboral view (271). Scale bars: 0.2 mm.

Male (Figure 260b). Carapace pale yellow with dark median area from eye region to centre, gradually tapering, and sometimes also with dark margins. Clypeus greyish. Chelicerae yellow, often suffused with grey. Gnathocoxae and labium yellow. Sternum yellow with dark undulated margins as in female. Legs pale yellow with dark patches and annulations of

Table XXX. Leg measurements (mm) of *Tidarren haemorrhoidale* (Bertkau), female (taken by light microscope (n=1)/stereo microscope (n=1)).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.49/0.51	0.26/0.31	0.30/0.32	–	0.51/0.60	1.56/1.75
I	4.10/4.70	0.84/0.98	2.53/3.09	3.25/4.30	1.09/1.29	11.82/14.36
II	2.46/2.93	0.67/0.86	1.42/1.72	1.99/2.58	0.83/0.94	7.37/9.04
III	1.66/1.96	0.55/0.70	0.91/1.06	1.20/1.60	0.66/0.76	4.98/6.08
IV	3.06/3.52	0.81/0.96	1.74/2.07	2.01/2.82	0.72/0.98	8.33/10.35

various extent. Coxae uniformly pale yellow. Male palp uniformly pale yellow. Abdomen yellowish to whitish. Dark pigmentation, if present at all, on anterior half of dorsum and sides. Posterior half light. Epigaster greyish or dark, book lung covers yellow. Venter dark, with two small white paramedian spots. Further white spots surround spinnerets. Spinnerets light brown suffused with grey.

Male palp (Figures 261–265)

Tibia ca 0.7 width of palpal organ at widest part; its base ca 0.4 width of distal rim (Figure 265). Cymbium with retrolateral incision and two distal lobes, which bear long hairs (Figures 262, 264). Intermediate part with three to four ridges with teeth. Cymbium not projecting beyond bulbus. Bulbus ca 0.2 mm long and 0.25 mm wide. Distal rim of tegulum sclerotized and bulging, but without processes (Figure 265). Retrolateral part of conductor membranous, with hyaline, slender appendix (Figures 263, 265). Prolateral part more sclerotized, its surface sculptured with numerous tiny scales. Embolar base suboval, 0.1 mm long and 0.05 mm wide, coiled into two small basal lobes (Figures 263, 265). Distal part of embolus 0.2 mm long. Haematodochae not modified.

Epigynum, vulva (Figures 267–271)

"Epigyne als kleines, spitz dreieckiges Hornzäpfchen vorragend" (Bertkau 1880). Epigynal protuberance triangular, short and pointed, directed ventrad. However, its length is remarkably variable (Levi 1957). Posterior, aboral side gradually merges with surrounding integument (Figure 271). Copulatory orifices widely separated, situated at sides of epigynal protuberance (Figures 268, 269), in ventral view level with posterior end of receptacula. Copulatory ducts short, 0.17–0.18 mm long; they turn to midline and enter receptacula at posterior inner side after a short coil. Receptacula seminis 0.18–0.26 mm long and 0.14–0.17 wide (n=3).

Table XXXI. Leg measurements (mm) of *Tidarren haemorrhoidale* (Bertkau), male (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
I	0.80	0.26	0.53	0.55	0.40	2.54
II	0.56	0.22	0.33	0.35	0.32	1.77
III	0.39	0.17	0.21	0.24	0.26	1.27
IV	0.59	0.22	0.35	0.36	0.32	1.83

Variation

Levi (1957, 1969) referred to the considerable variation of females in size, epigynal shape, and internal genitalia, with all intergradations and without clear pattern. Only a better knowledge of males from various regions will help to judge this variation. Among the present material the offspring of five females from Mexico were reared to adulthood (by S. P. Benjamin). One of these females was rather large in size and differed in epigynal shape and size of receptacula from the other four. Female descendants resembled their respective mothers. However, male descendants did not show obvious differences in their palpal organs. They were only slightly smaller as compared with the male offspring of the larger female, but still with overlap (compare with measurements of six males above). Body dimensions of male descendants of a small-sized female [in mm, $n=5$, minimum–maximum (mean)]: total length 1.01–1.07 (1.06), carapace length 0.43–0.51 (0.47), width 0.41–0.43 (0.42), length femur I 0.59–0.68 (0.64), tibia I 0.37–0.43 (0.40); clypeus 0.12–0.14 (0.13) high.

Natural history

Web. According to Benjamin and Zschokke (2003), the web of *T. haemorrhoidale* contains neither gum-footed lines nor other viscid elements.

Prey. Surprisingly, aphids were the most dominant prey of *T. haemorrhoidale* in a cotton agroecosystem in Texas (Nyffeler et al. 1988).

Distribution

Tidarren haemorrhoidale is widespread and occurs from southern USA to Argentina (Levi 1957).

Tidarren mixtum (O. P.-Cambridge, 1896)

(Figures 272–275)

Theridion mixtum O. P.-Cambridge 1896, p 206, Plate 24, Figure 11; n. sp., ♀, type locality Chiajan (Chiacam), Guatemala.

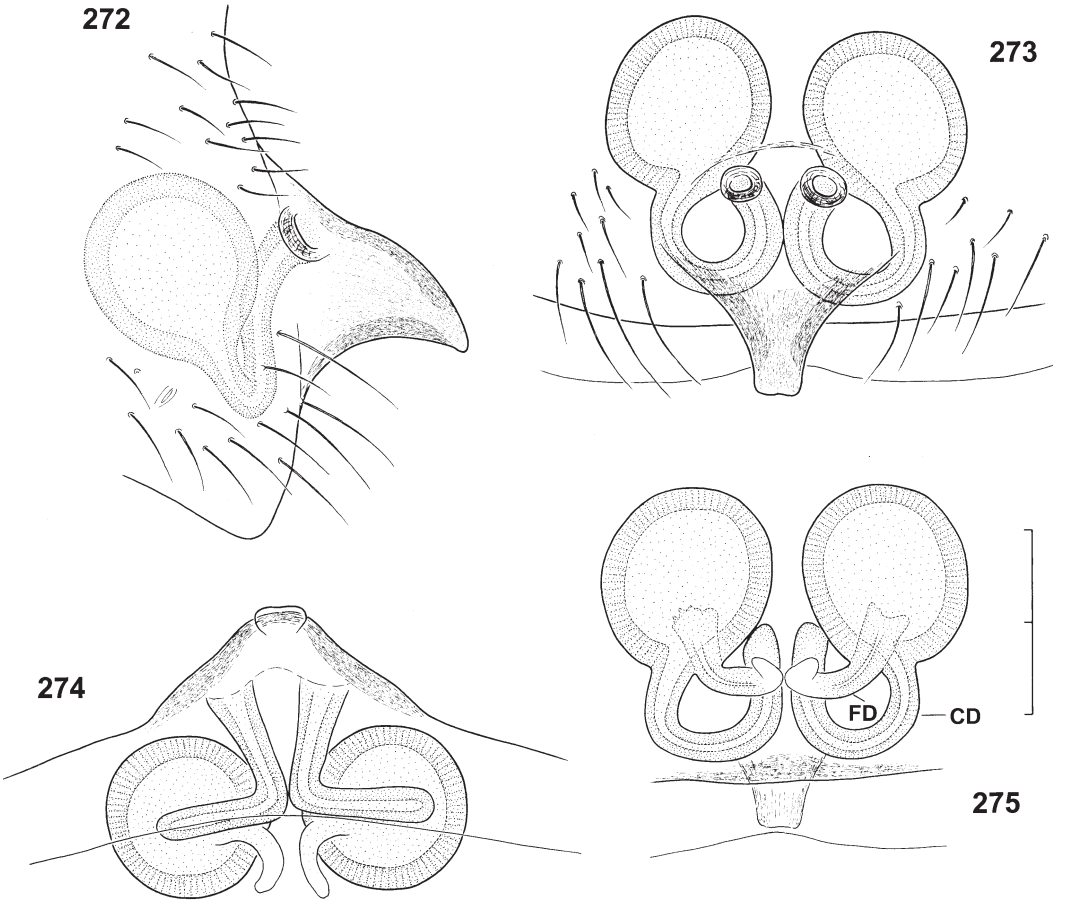
Tidarren mixtum: Kraus 1955, p 19, only Figures 43, 44, ♀ (not Figures 45–48 = *T. haemorrhoidale*).

Material examined

Costa Rica: 1♀, NMW Inv. No. 736 San José, La Caja, 9°58′N, 84°07′W, leg. E. Schmidt 1931, det. Reimoser, 1938 (sub *Theridion mixtum*). 1♀, AMNH, San Jose, leg. Enrique Schmidt, det. Levi, 1954 (see Levi 1957).

Description

Chamberlin and Ivie (1934) and Levi (1957). Identification according to Levi (1957). *Tidarren mixtum* is known only from the female (contrary to Roewer 1942 and Platnick 2006).



Figures 272–275. *Tidarren mixtum* (O. P.-Cambridge), from Costa Rica. Female epigynum/vulva in lateral (272), ventral (273), aboral (274), and dorsal view (275). Scale bar: 0.2 mm.

Measurements (mm)

[♀, *n*=2.] Total length 4.8–5.8, carapace length 1.9–2.0, width 1.7–1.8, length femur I 3.0, tibia I 1.9. Abdomen 3.0–4.5 high, 3.0–3.5 long, and 2.7–3.1 wide. Distance petiolus to spinnerets 2.0–2.4 long. Clypeus 0.4–0.5 high. Chelicerae 0.41 long. Sternum 1.1–1.2 long and 1.0 wide. Labium 0.25 long, 0.4 wide. Gnathocoxae 0.5–0.6 long, 0.3 wide. Leg formula 1423.

Somatic features, colouration

Sternum without posterior tubercle. Abdomen higher than long, forming a distinct dorsal tubercle. Colour pattern faded in both females. Femora I–II and tibiae I–II dotted.

Epigynum, vulva (Figures 272–275)

Epigynal protuberance triangular, pointed and curved posteriorly in lateral view (Figure 272), truncate in ventral view and broader than in *T. haemorrhoidale*. Aboral side

gradually merging with surrounding integument (Figure 274). Copulatory orifices separate (Figure 273), situated near midline and at anterior border of epigynal protuberance (in *T. haemorrhoidale* at sides), in ventral view level with posterior end of receptacula. Copulatory ducts comparatively longer, 0.26–0.29 mm long; they turn posteriorly to midline and after a wide coil enter receptacula at posterior inner side (Figures 273, 275). Epigynal protuberance 0.19 mm long in side view, 0.25 mm wide in ventral view, about as long as receptacula. Receptacula seminis 0.19 mm long and 0.18 mm wide. The epigynum of one female from El Salvador illustrated by Kraus (1955, Figures 43, 44) fully agrees with the present ones.

Distribution

Tidarren mixtum appears to be less widespread than *T. haemorrhoidale* and occurs from Mexico to Costa Rica (Levi 1957).

Tidarren sisyphoides (Walckenaer, 1842)

(Figures 1, 5, 6, 37, 266, 276–289; Tables XXXII, XXXIII)

Theridion sisyphoides Walckenaer 1842, p 321; n. sp., ♀.
Theridium fordum (Keyserling 1884), p 23, Plate 1, Figure 9, ♀.
Further synonyms: see Platnick (2006).

Material examined

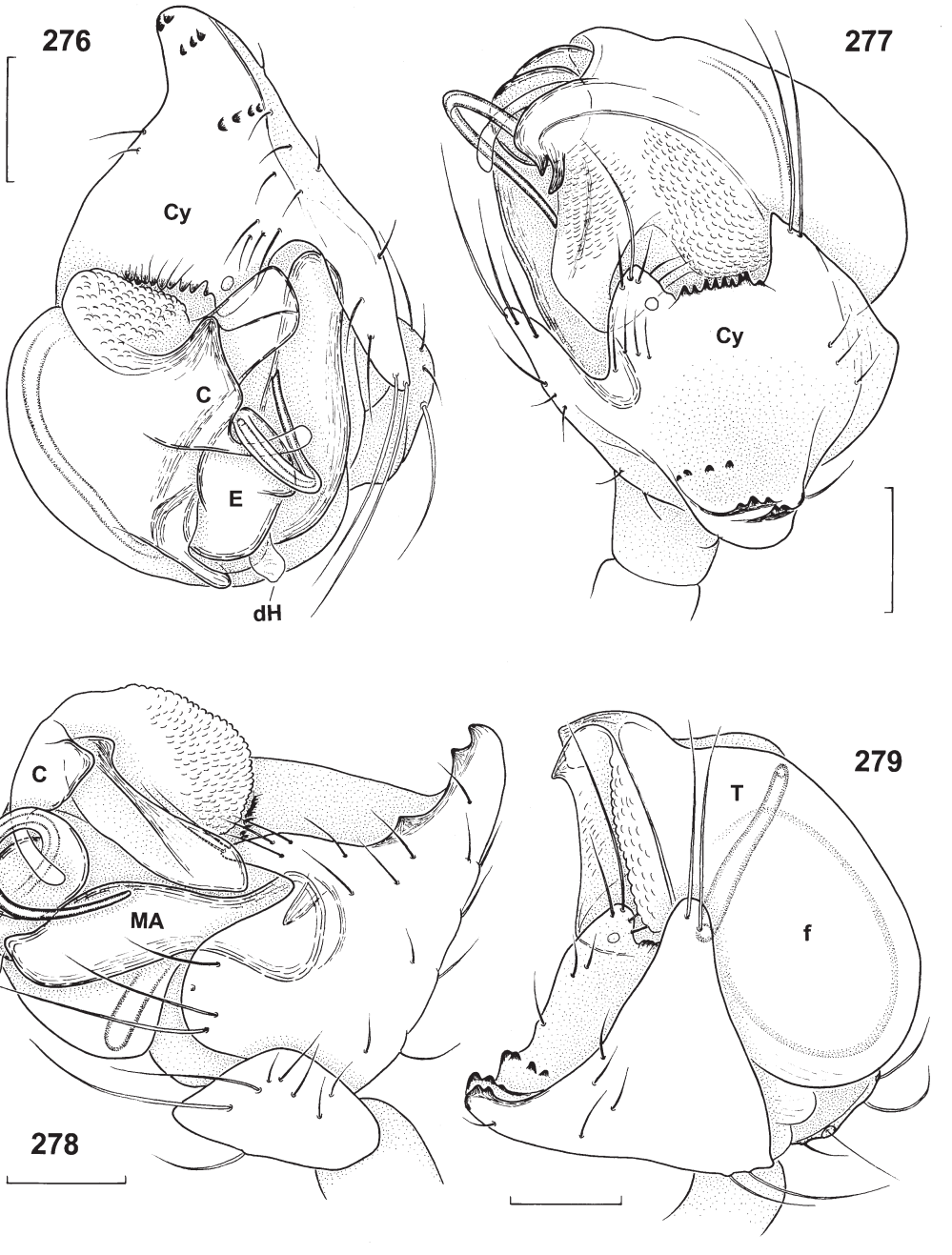
El Salvador: 1♀ CTh, Tazamal near Santa Ana, 17 August 1977, leg. Kübelböck. **Costa Rica**: 1♀, MNHN AR 2909, without exact locality, leg. Banks (sub *Theridium fordum* Keyserling). **Mexico**: ♂♀, Chiapas state, Tapachula, Rosario Itzapa, 6–12 October 2001, leg. S. P. Benjamin and J. A. Garcia-Ballinas. Descendants from one egg-sac were reared to adulthood in captivity in Innsbruck. Depository: see Knoflach and Benjamin (2003).

Description

Chamberlin and Ivie (1934, sub *Tidarren fordum*), Levi (1957), Gruia (1977, ♂), and Agnarsson (2004).

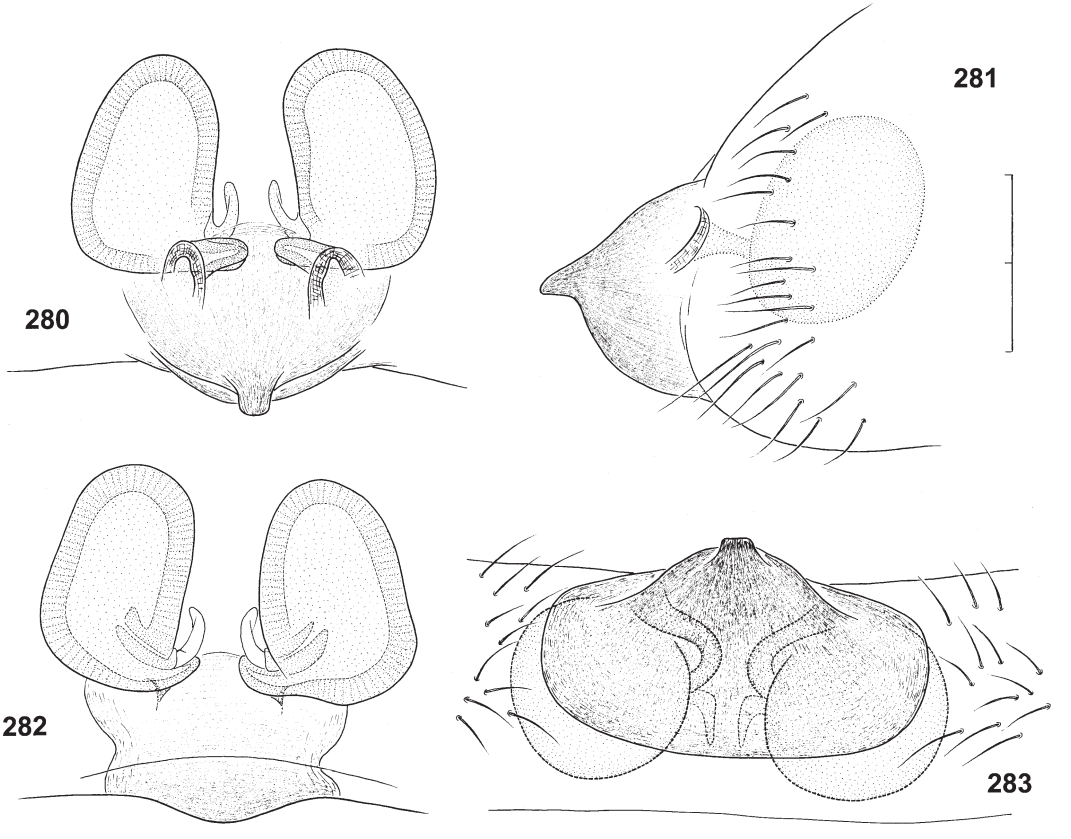
Measurements (mm)

[♂/♀, n=6/6, minimum–maximum (mean).] Total length 1.40–1.56 (1.49)/6.02–6.90 (6.54), carapace length 0.59–0.64 (0.62)/2.46–2.86 (2.71), width 0.57–0.60 (0.59)/2.23–2.46 (2.28), length femur I 0.82–0.92 (0.89)/4.28–5.23 (4.99), tibia I 0.59–0.60 (0.60)/2.77–3.33 (3.22). Abdomen 0.92–1.19 (1.07)/4.28–5.39 (4.82) high, 0.78–0.92 (0.85)/3.80–4.28 (4.10) long, and 0.70–0.90 (0.80)/3.17–3.80 (3.55) wide. Ventral side (distance petiolus to spinnerets) 0.53–0.60 (0.57)/2.62–3.65 (2.99) long. Clypeus in male 0.20–0.23 (0.21) high, in female 0.53–0.62 (0.57). Chelicerae 0.25–0.31 (0.29)/0.82–0.98 (0.89) long. Sternum 0.39–0.43 (0.41)/1.37–1.66 (1.57) long and 0.39–0.41 (0.39)/1.13–1.29 (1.24) wide. Labium on average 0.07/0.33 long, 0.15/0.57 wide. Gnathocoxae 0.20–0.21 (0.20)/0.78–0.88 (0.83) long, 0.09–0.10 (0.09)/0.37–0.45 (0.41) wide. Femur of male palp 0.23–0.27 (0.25) long. Leg formula 1423, see Tables XXXII, XXXIII. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female

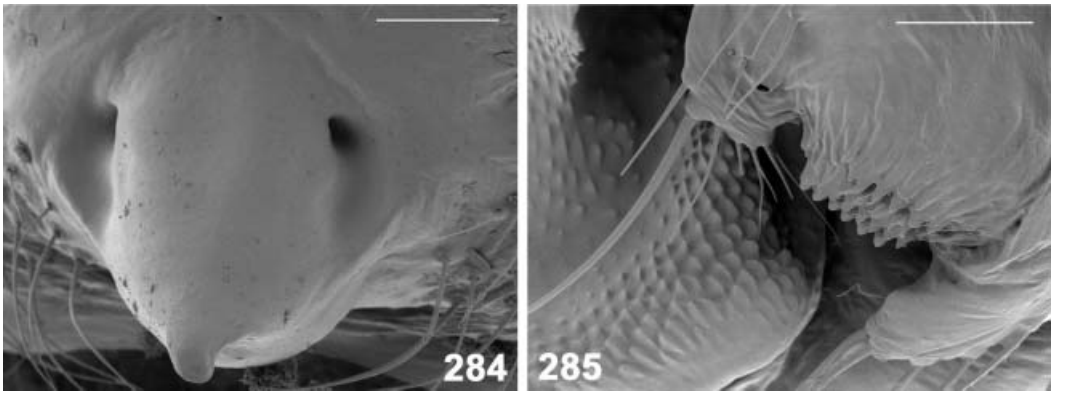


Figures 276–279. *Tidarren sisyphoides* (Walckenaer) from Costa Rica. Right male palp, apical (276–277), retrolateral (278), and prolateral-apical view (279). Scale bars: 0.1 mm.

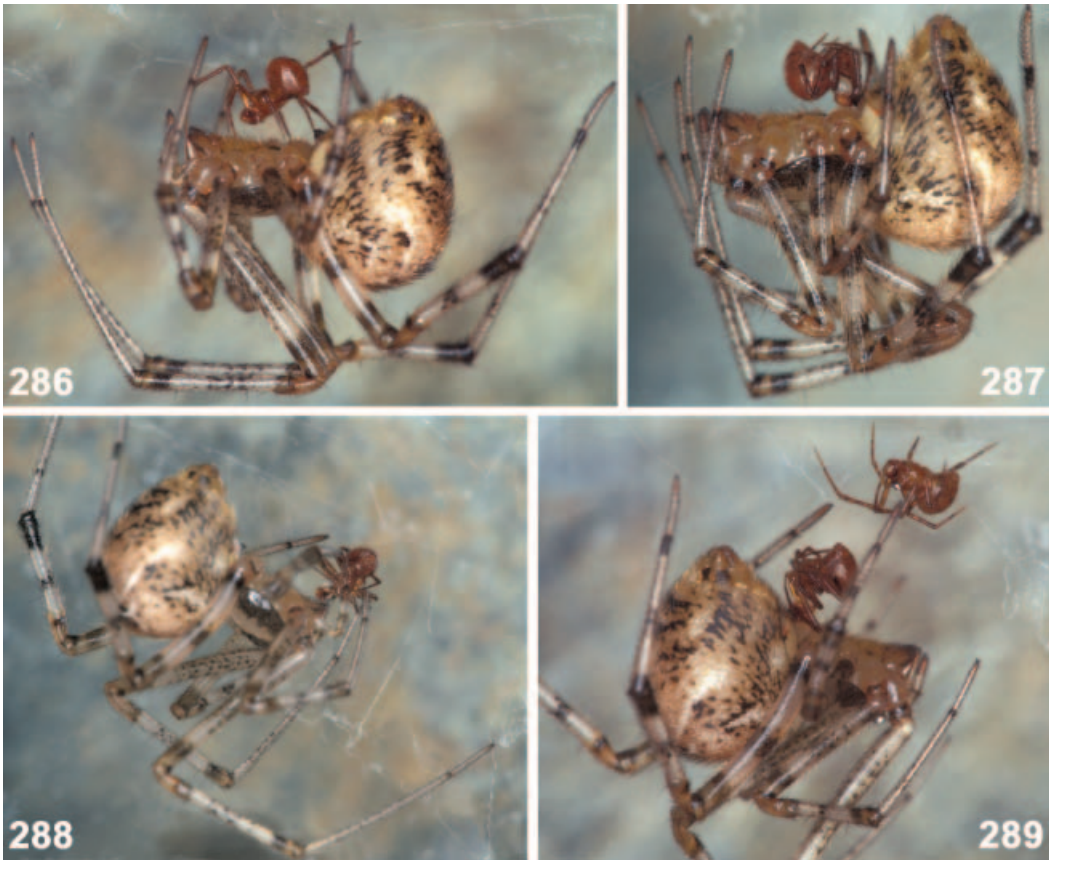
palp 2/2, of legs I–IV 5/2, 5/2, 4/3, 5/5 in female and 2/1, 2/1, 1/2, 2/2 in male (1♂, 1♀ examined). Metatarsi I–III with one trichobothrium, position on I in female (male) 0.31 (0.24), on II 0.33 (0.26), on III 0.37 (0.36). Tarsal claws of legs with five to six (one to two) side teeth in female (male), claw of female palp consisting of seven teeth. Tarsal organ



Figures 280–283. *Tidarren sisyphoides* (Walckenaer) from USA, Georgia. Female epigynum/vulva in ventral (280), lateral (281), dorsal (282), and aboral view (283). Scale bar: 0.2 mm.



Figures 284, 285. *Tidarren sisyphoides* (Walckenaer) from Mexico. (284) Female epigynum, ventral view. (285) Detail of male palp, distal part of cymbium and conductor. Scale bars: 0.1 (284); 0.05 mm (285).



Figures 286–289. *Tidarren sisyphoides* (Walckenaer) from Mexico, copulatory behaviour. (286) Male palpating female sternum. (287, 289) Copulation, contracted legs of male indicate his death. (289) Another male waiting for a chance. (288) Female removes dead male and casts him away. Sexual cannibalism absent.

on female palp at 0.81, on female (male) legs I–IV 0.54 (0.36), 0.45 (0.38), 0.41 (0.32), 0.48 (0.29).

Somatic features, colouration (Figures 1, 286–289)

Sternum without posterior tubercle. Female sternum with three pairs of tiny lateral tubercles level with coxa I–III. Abdomen higher than long, rounded, without tubercle. In

Table XXXII. Leg measurements (mm) of *Tidarren sisyphoides* (Walckenaer), female (taken by stereo microscope (n=1)/light microscope (n=1)).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.63/0.69	0.35/0.35	0.39/0.40	–	0.76/0.77	2.13/2.21
I	4.36/4.87	1.19/1.17	2.77/3.08	4.20/4.60	1.35/1.42	13.87/15.13
II	2.93/3.20	0.95/0.99	1.74/1.86	2.62/2.87	1.07/1.09	9.31/10.02
III	2.06/2.38	0.79/0.84	1.19/1.29	1.86/1.96	0.87/0.93	6.78/7.41
IV	3.73/4.07	1.15/1.17	2.14/2.38	3.13/3.30	1.19/1.14	11.33/12.07

Table XXXIII. Leg measurements (mm) of *Tidarren sisyphoides* (Walckenaer), male (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
I	0.97	0.29	0.65	0.75	0.46	3.12
II	0.69	0.26	0.41	0.45	0.39	2.20
III	0.50	0.22	0.28	0.34	0.31	1.64
IV	0.77	0.25	0.46	0.51	0.37	2.37

one female indistinct abdominal tubercle present. Overall colouration light brown in female, reddish in male.

Female (Figures 1a, 286–289). Carapace light brown with broad dark margins and dark median band from eye region to centre, tapering posteriorly and extending laterally at centre. Clypeus greyish. Chelicerae, gnathocoxae, and labium light brown. Sternum light brown, with dark stripes opposite each coxa from margin to centre. Posterior half darker than anterior. Palps uniformly light brown, sometimes tibiae and tarsi distally darkened. Legs light brown with dark patches and annulations. Numerous fine dots on femora, tibiae and metatarsi. Coxae light brown. Abdomen light brown, with dark and some white patches. Dorsum with irregular small dark patches of various extent, sometimes outlined by white lines, which branch laterally. Apex marked by a dark patch, from where a white stripe leads down to spinnerets. Aboral region and sides light brown, with several dark spots. Epigastric region light brown, book lung covers light brown. Venter anteriorly dark, posteriorly light owing to two large white paramedian patches. Spinnerets brown.

Male (Figures 1b, 286–289). Carapace light yellow to reddish brown with dark margins and dark median area from eye region to centre, tapering posteriorly. Clypeus light greyish. Chelicerae, gnathocoxae, and labium uniformly light brown. Sternum light brown, with fine dark margins. Legs uniformly yellow to reddish brown, sometimes suffused with grey. Male palp yellow brown from coxa to tibia. Distal parts of cymbium reddish brown. Abdomen uniformly reddish brown, with indistinct greyish longitudinal band, ending in apical region. Spinnerets brown.

Male palp (Figures 266, 276–279, 285)

Very conspicuous and three-dimensional, as cymbium and bulbus face in various directions. Most noticeable part formed by highly modified cymbium (Figures 276–279). Tibia ca 0.5–0.6 width of palpal organ. Cymbium with two distal lobes, which bear long hairs and face bulbus (Figure 285). Distal rim between two lobes with several teeth. Another large sclerotized apical projection bearing three rows of teeth faces in opposite direction. Cymbium projecting well beyond bulbus. Bulbus wider than long (0.41 wide and 0.34 mm long, n=1). Distal rim of tegulum sclerotized and bulging, but without distinct processes (Figure 266). Retrolateral-dorsal part of conductor membranous, with hyaline, slender appendix (Figures 276, 278). Prolateral-ventral part larger, more sclerotized, its surface covered with numerous tiny scales. Embolar base suboval, with two small basal lobes (partially visible in Figure 266). Distal part of embolus 0.24 mm long. Haematodochae not modified (Figures 1b, 287).

Epigynum, vulva (Figures 280–284)

Epigynal protuberance broad at base, but ending in small pointed tip in side view (Figures 281, 284). Sclerotized aboral side forms a transverse suboval plate, clearly delimited from surrounding integument (Figure 283). Copulatory orifices separate (Figures 280, 284), situated paramedially at anterior border of epigynal protuberance, in ventral and dorsal view at level of posterior end of receptacula. Copulatory ducts short (Figures 280, 282), ca 0.15 mm long, turn to midline, then immediately enter receptacula at posterior inner side. Epigynal protuberance 0.2 mm long in side view, 0.3 mm wide in ventral view, almost as long as receptacula. Receptacula seminis 0.25 mm long and 0.16 mm wide.

Copulatory behaviour (Figures 1b, 286–289)

Tidarren sisyphoides differs from the other congeners in some respects (Knoflach and Benjamin 2003). Courtship proceeds without construction of a mating thread and females remain motionless. The male mounts the female venter from behind and sometimes also moves forward to the female's sternum (Figure 286), palpating her body and legs throughout. In response to these movements, the female lowers her body. Interestingly, each insertion succeeds at once on the first attempt. At the beginning of copulation the male's legs are stretched out straight. After about 3 min his legs become contracted (Figures 287, 289), evidently indicating the male's death. He then remains passively coupled to the female for the next 2.4 h, while she is cataleptic. There is no obvious movement by either partner. Finally, the female removes the dead male from the epigynum (Figure 288) and casts him away without cannibalizing him. The moment of removal is determined by the female. She may pull off the male after 14 min or after more than 6 h. His palp remains inflated after removal (Figure 1b).

Natural history (Figures 5, 6)

Tidarren sisyphoides occurs around buildings, below overhanging rock cliffs, trunks of trees, and under bridges (Chamberlin and Ivie 1934; Guarisco 2000). The web has an average diameter of about 60×30 cm, and the retreat consists of dried leaves, debris, and prey remains and forms an inverted basket. Gum-footed lines or viscid elements are absent (Benjamin and Zschokke 2003). Nevertheless, this species is able to catch large prey, such as harvestmen, crickets, katydids (Guarisco 2000), and in captivity they were fed with crickets and tenebrionid larvae. The egg-sacs are brown, parchment-like. Fecundity is considerable in this species, 350 and 477 eggs were found per sac (Guarisco 2000). Post-embryonic development lasts longer compared with the other *Tidarren* species, related to its larger size. Males moult three to four times (incomplete stages within cocoon not taken into account) and mature ca 55 days after hatching from the cocoon; females need five to six moults and ca 100 days to reach maturity (Gonzalez 1982). The subadult stage of males reared from a Mexican egg-sac lasted 11.6 days on average (± 0.54 SE, range 10–18, $n=18$). *Tidarren sisyphoides* was the first species in which the process of palp amputation was described (Branch 1942, sub *T. fordum*; see also Figures 5, 6). One amputation occurred ca 2 h after the moult and took only 3 min (Knoflach and Benjamin 2003). Males cohabit in female webs, up to a dozen males have been found in a single web (Chamberlin and Ivie 1934).

Enemies. In Kansas *T. sisyphoides* was observed to suffer severe predation by *Mimetus puritanus* Chamberlin, 1923 (Mimetidae; Guarisco 2000). Also the araneophagic theridiids *Argyrodes trigonum* (Hentz, 1850) and *A. cancellatus* (Hentz, 1850) invaded the webs of *T. sisyphoides*. The mantispid *Mantispa viridis* Walker, 1853 was encountered from egg-sacs of *T. sisyphoides* in Kansas (Guarisco 2000). In Florida an egg-sac was infested by the eulophid hymenopteran *Comastichus zopheros* LaSalle, 1994 (see Guarisco 2001).

Distribution

Tidarren sisyphoides occurs from southern USA to South America, its northernmost locality in Kentucky (Levi 1957), southernmost in Argentina (Catamarca; see Gonzalez 1982). However, numerous records exist from Georgia and Florida to California and Mexico, but only a few from South America. The species is also known from the West Indies (Cuba, Haiti, and Puerto Rico; Levi 1957).

The genus *Echinotheridion* in the Old World

Echinotheridion gibberosum (Kulczynski, 1899)

(Figures 3, 4, 10, 21, 23, 24, 28–30, 36, 39, 40, 290–310; Tables XXXIV, XXXV)

Theridion gibberosum Kulczynski 1899, p 364, Plate 6 Figure 27, Plate 7 Figures 37–40; n. sp., ♀, type locality Madeira.
Achaearanea gibberosa: Denis 1962, p 62.
Echinotheridion gibberosum: Schmidt 1973, p 369.
Tidarren pseudogibberosum: Schmidt 1981, p 96, Figure 5, ♂ from Gomera (misidentified).
Tidarren gibberosum: Wunderlich 1987, p 207, Figures 544, 545, ♀.
Echinotheridion gibberosum: Knoflach 2002a, p 140, Figures 1–10, ♂♀.

Material examined

Spain: ♂♂♀♀, Canary Islands, Tenerife, above Orotava/Aguamansa, 28°46′N, 17°45′W, pine and laurel forest, 1000–1100 m, 17 February 2000 (males adult in March 2000); ♂♀, mts. Anaga, near Las Mercedes, Cruz de Carmen, 28°32′N, 16°12′W, 20 February 2000, leg. Knoflach and Thaler (males adult in March 2000). Gomera, Montes del Cedro, 700–1000 m, laurisilva, ♂♀, 4 March 2004, leg. Steinberger. Ibidem, 1♂ without palp, SMF 29627, sub *Tidarren pseudogibberosum* (see Schmidt 1981). Ibidem, 1♀, SMF 29411, leg. Schmidt 1976, det. 1977. 2♀, SMF 29401, Gomera, Arure, June 1976, leg. Schmidt (Schmidt, 1981). 1♂, SMF 34010, La Palma, leg. Wunderlich, det. 1985.

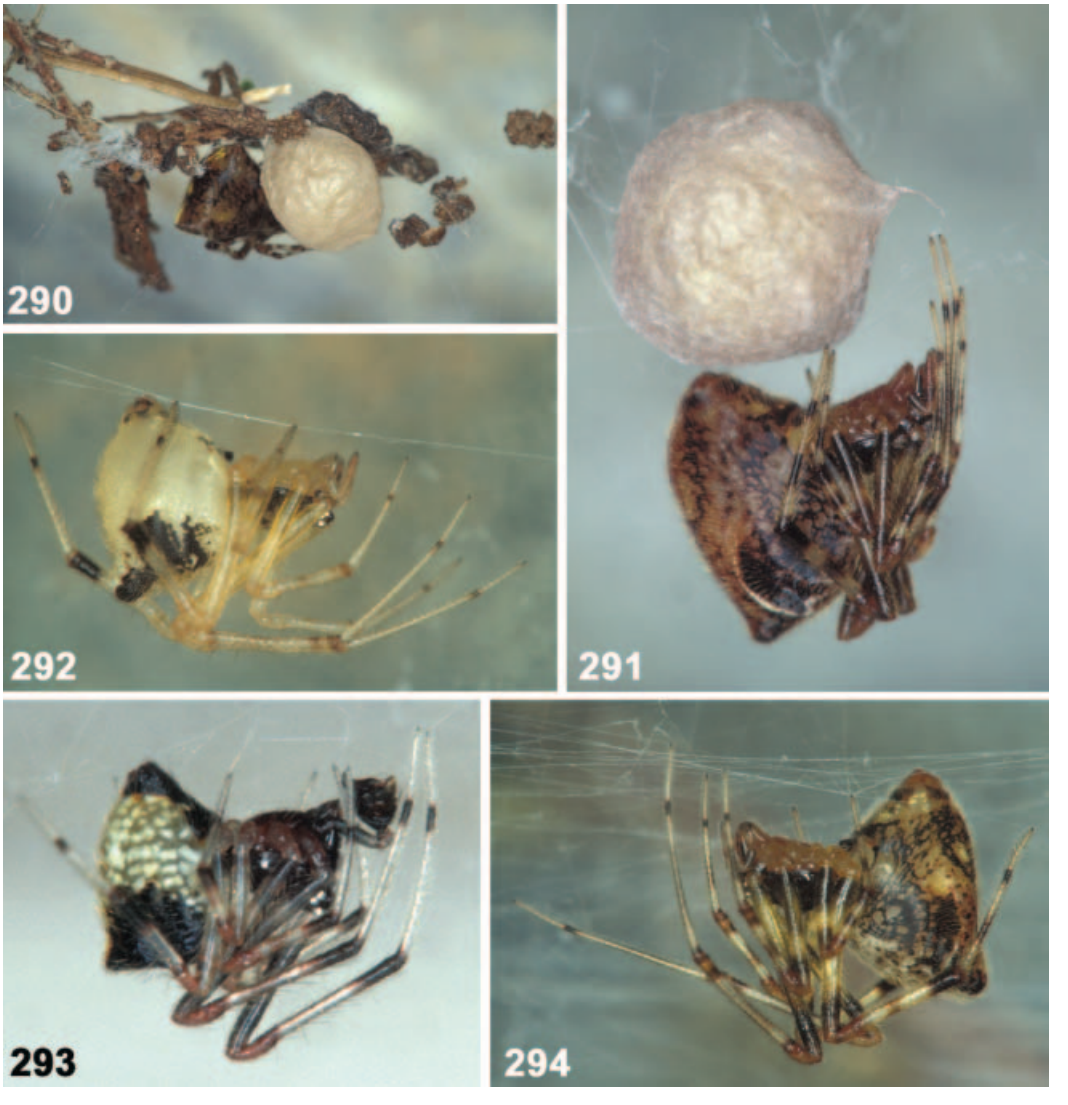
Voucher specimens deposited in AMNH, CAS, CTh, MHNG, MNHN, MRAC, NHMB, NHRS, NMBS, NMW, SMF.

Description

Kulczynski (1899, ♀), Knoflach (2002, ♂♀).

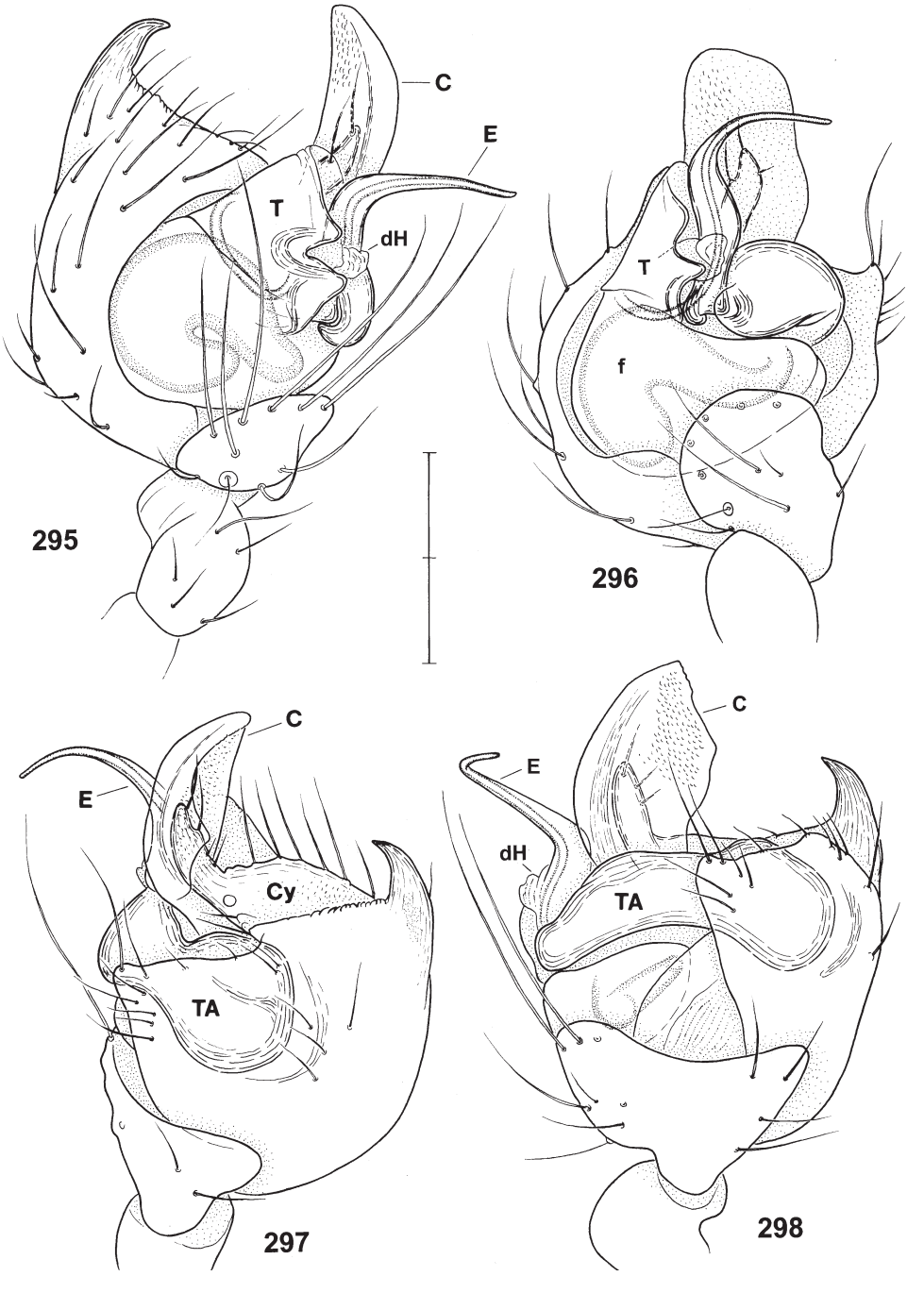
Measurements (mm)

Dimensions of male/female [minimum–maximum (mean), $n=10$.] Body length 1.45–1.88 (1.67)/3.29–3.72 (3.53), prosoma length 0.59–0.72 (0.66)/1.35–1.56 (1.42), prosoma



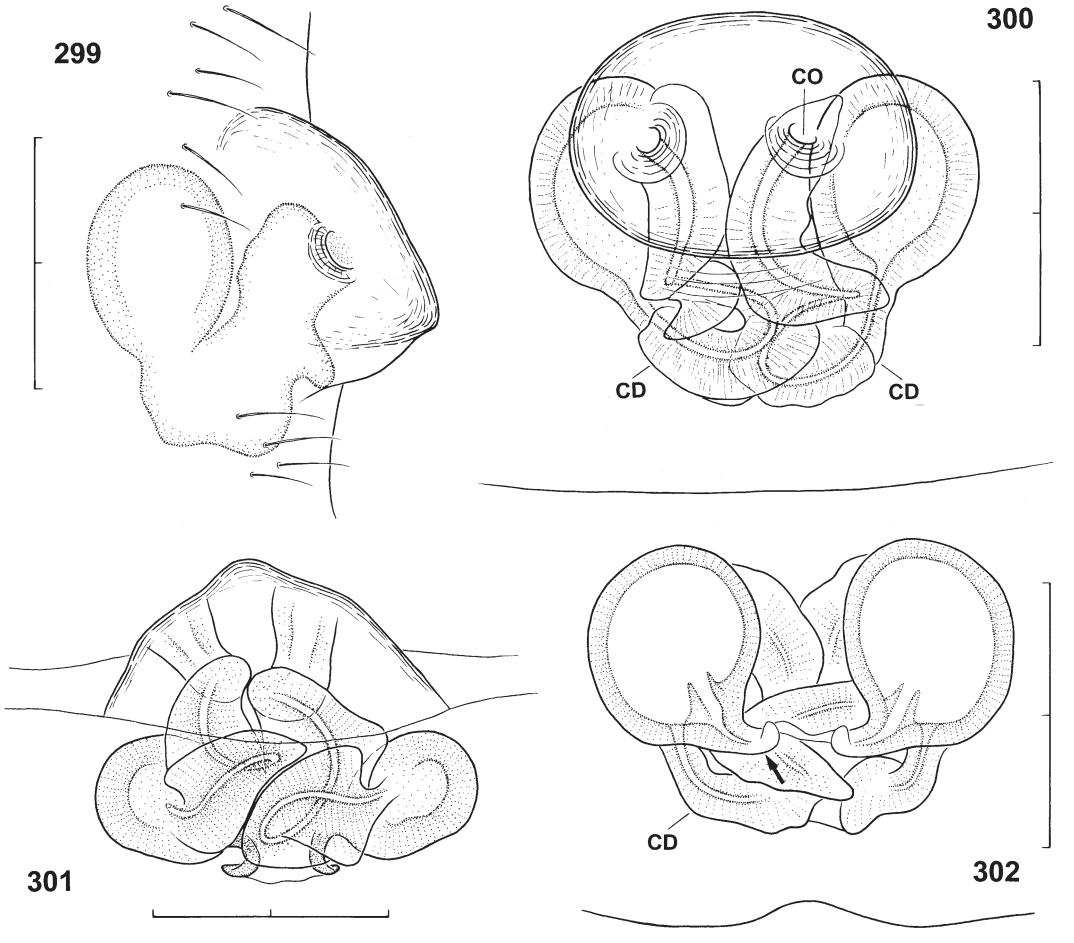
Figures 290–294. *Echinotheridion gibberosum* (Kulczynski) from Tenerife. (290, 291) Female guarding egg-sac. Habitus of male (293) and female (291, 292, 294) showing colour variation.

width 0.55–0.64 (0.59)/1.01–1.25 (1.11), length femur I 1.15–1.44 (1.25)/2.70–3.36 (2.95), tibia I 0.78–1.00 (0.84)/1.76–2.19 (1.92). Abdomen 0.92–1.56 (1.14)/2.54–4.15 (3.09) high, 0.86–1.13 (0.97)/1.88–2.93 (2.25) long, and 0.66–1.05 (0.80)/1.56–2.54 (1.89) wide. Ventral side (distance petiolus to spinnerets) 0.59–0.92 (0.73)/1.56–2.15 (1.73) long. Clypeus in male 0.21–0.29 (0.25) high, in female 0.27–0.37 (0.28). Chelicerae 0.22–0.29 (0.27)/0.49–0.59 (0.53) long. Sternum 0.39–0.47 (0.42)/0.78–0.88 (0.81) long and 0.39–0.43 (0.40)/0.66–0.72 (0.69) wide. Labium on average 0.07/0.16 long, 0.18/0.30 wide. Gnathocoxae 0.21–0.25 (0.23)/0.45–0.49 (0.47) long, 0.09–0.12 (0.10)/0.18–0.23 (0.20) wide. Femur of male palp 0.31–0.39 (0.34) long. Leg formula 1423, see Tables XXXIV, XXXV. Number of dorsal setae on tibiae I–IV 2/2/1/2. Trichobothria in retrodorsal/prodorsal row on tibia of female palp 1/1, of legs I–IV 3/2, 3/2, 3/3, 3/4 in

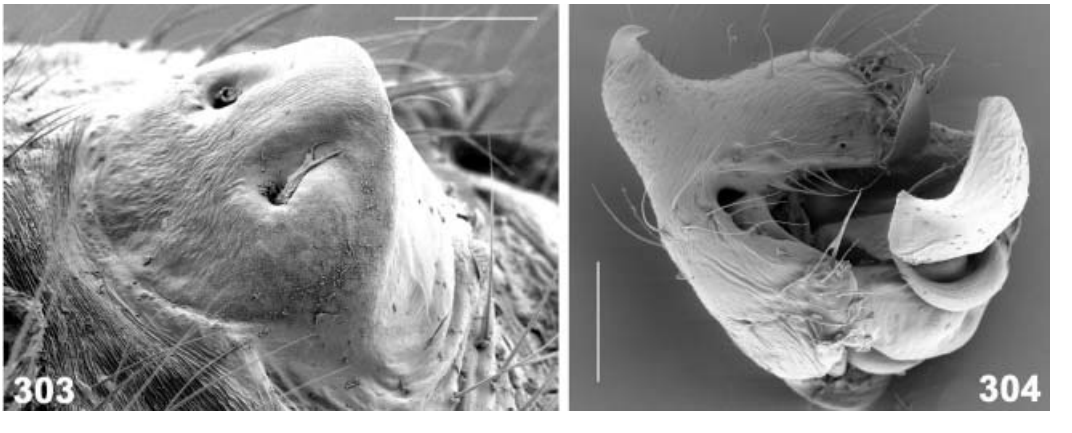


Figures 295–298. *Echinotheridion gibberosum* (Kulczynski) from Tenerife. Right male palp, prolateral (295), dorsal (296), retrolateral-apical (297), and retrolateral view (298). Scale bar: 0.2 mm.

female and 2/1, 2/1, 1/2, 2/2 in male (1♂, 1♀ examined). Metatarsi I–III with one trichobothrium, position on I in female (male) 0.36 (0.27), on II 0.38 (0.30), on III 0.39 (0.29). Tarsal claws of legs with four (three) side teeth in female (male), claw of female palp



Figures 299–302. *Echinotheridion gibberosum* (Kulczynski) from Tenerife. Female epigynum/vulva in lateral (299), ventral (300), aboral (301), and dorsal view (302). Arrow points to fertilization duct. Scale bars: 0.2 mm.



Figures 303, 304. *Echinotheridion gibberosum* (Kulczynski) from Tenerife. (303) Female epigynum in lateral-ventral view. (304) Male palp, apical view. Scale bars: 0.1 mm.

Figures 305–308. *Echinotheridion gibberosum* (Kulczynski) from Tenerife, copulatory behaviour in different pairs. (305, 306) Insertion, advanced phase, male's legs already contracted. (307) Emasculation accomplished by female. Male palp fastened to epigynum while female feeds on his body. (308) Functional contact of male palp after emasculation. Haematodochae unmodified. Palpal sclerites serve as holdfast structures. Scale bar: 0.2 mm.

consisting of seven to eight teeth (Figures 28–30). Tarsal organ on female palp at 0.76 (Figure 36), on female (male) legs I–IV 0.41 (0.38), 0.38 (0.30), 0.35 (0.27), 0.36 (0.28).

Somatic features, colouration (Figures 291–294, 305–307)

Females with a spur on posterior base of coxae IV (Figures 23, 24). Sternum in female with small posterior tubercle, in male absent. Abdomen higher than long, cone-shaped, ending in tubercle.

Female (Figures 291, 292, 294, 305–307). Overall colouration highly variable (see also Knoflach and Pfaller 2004). Most common variant shows extended dark pigmentation (Figures 291, 294), some females yellowish with only a few dark pigmented areas (Figure 292), some predominantly reddish and with red instead of dark brown pigments. In common variant carapace either uniformly dark brown or light brown with broad dark margins and dark median band from eye region to centre. In lighter variants carapace uniformly yellow to reddish brown. Chelicerae dark or light brown. Gnathocoxae and labium light brown. Sternum usually reddish with light anterior median area and six light peripheral patches, opposite coxae I–III, sometimes light brown with a few reddish patches.

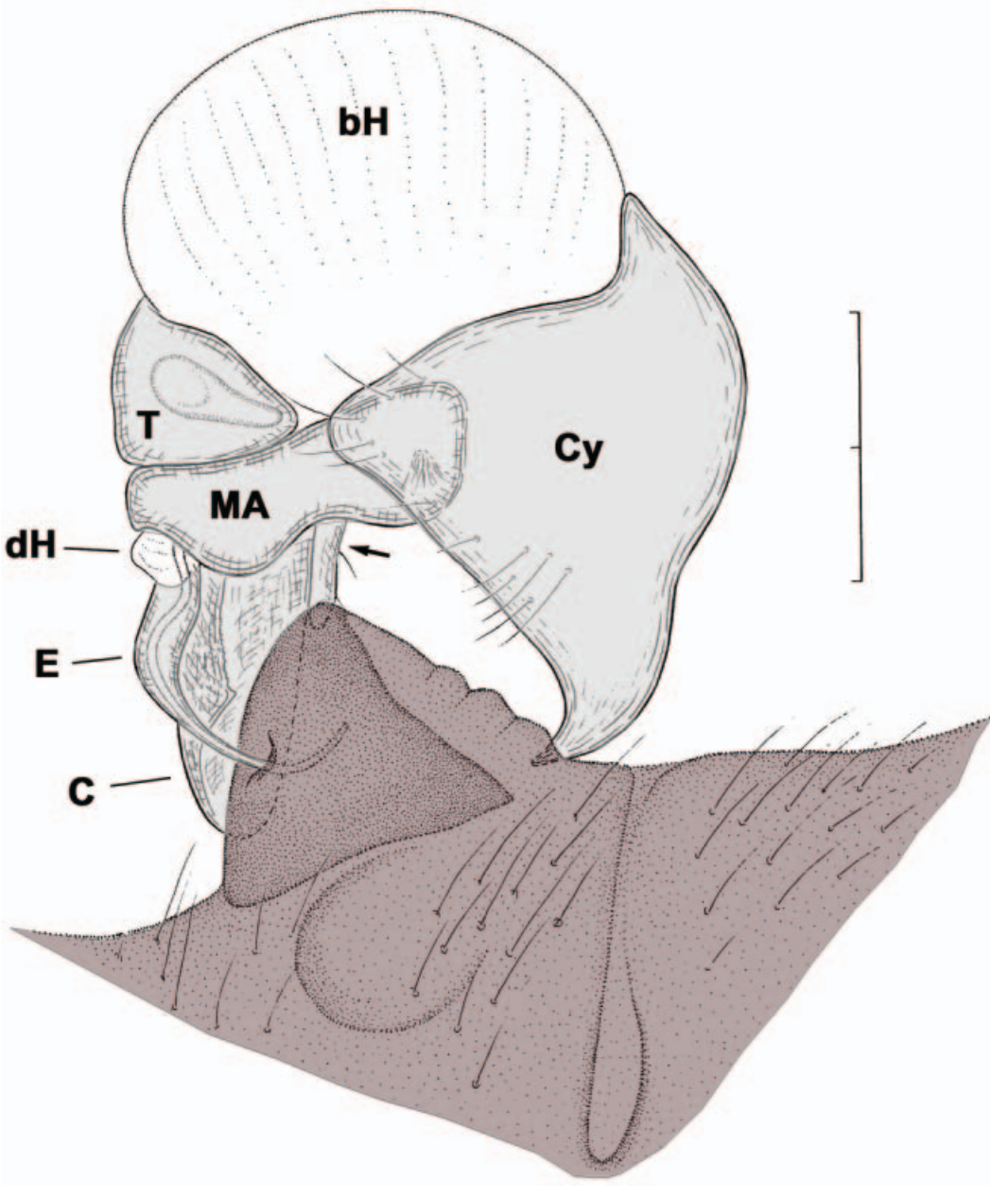


Figure 309. *Echinotheridion gibberosum* (Kulczynski) from Tenerife. Functional contact of left male palp after emasculation. Sclerites keep palp fastened to epigynum. Cymbium locks behind, conductor in front of epigynal protruberance. Haematodochae not modified. Female parts dark, sclerites of male palp greyish. Scale bar: 0.2 mm.

Palps and legs yellowish (sometimes reddish) with dark patches and annulations of various extent. Coxae yellow. Abdomen with whitish dorsal median band and posterior white lines, which branch laterally. Aboral area with distinct white stripe from apex to spinnerets. Epigastric region and venter of variable colouration according to degree of overall

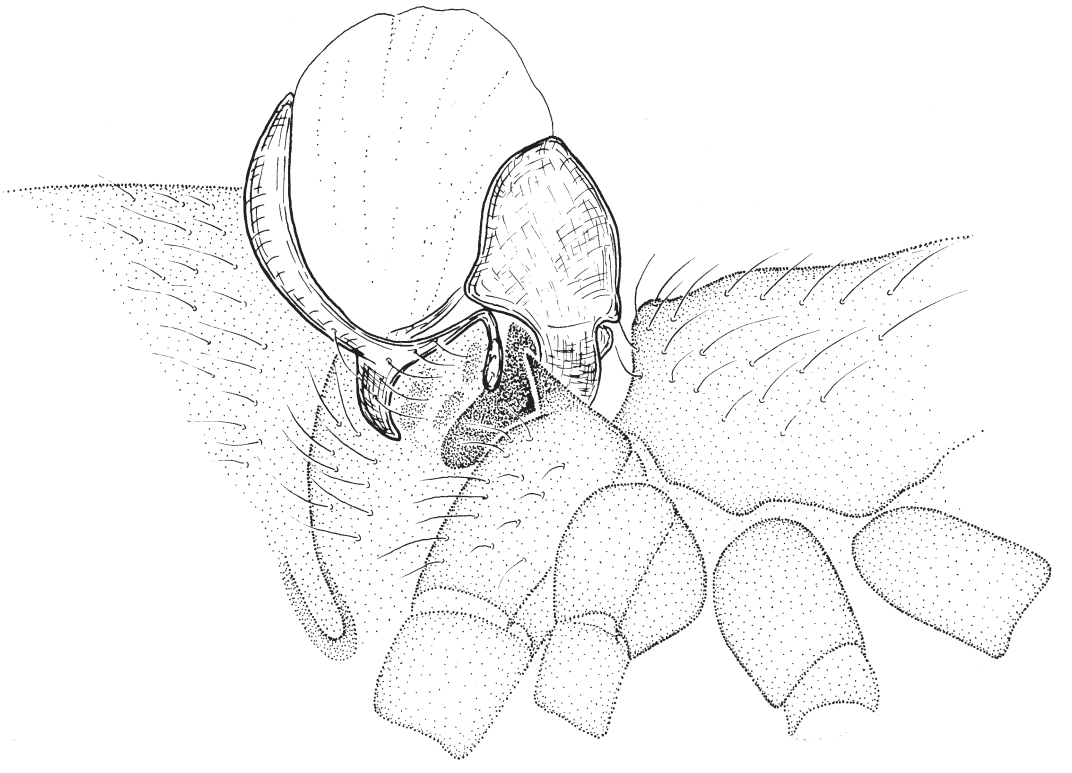


Figure 310. *Echinotheridion gibberosum* (Kulczynski) from Tenerife. Functional contact of male palp after emasculation. Palp comes to rest close to female coxal spurs, but without direct contact.

pigmentation, book lung covers light brown. Epigynal protuberance heavily sclerotized in contrast to surrounding integument.

Male (Figure 293, 305). Carapace, chelicerae, gnathocoxae, labium, and sternum uniformly dark or reddish brown. Legs light to reddish brown, with some dark patches and annulations, sometimes largely suffused with grey. Distal parts of male palp dark to reddish brown. Abdomen usually dark or reddish brown, with a few white patches on dorsum, aboral area whitish with white stripe from apex to spinnerets. Epigaster dark to reddish brown, book lung covers yellow. Venter dark to reddish brown with two small white paramedian patches. Spinnerets dark to reddish brown.

Table XXXIV. Leg measurements (mm) of *Echinotheridion gibberosum* (Kulczynski), female (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.35	0.20	0.20	–	0.44	1.18
I	2.91	0.62	1.89	2.36	0.84	8.62
II	1.79	0.55	1.04	1.39	0.65	5.42
III	1.39	0.47	0.72	0.99	0.57	4.15
IV	2.48	0.65	1.42	1.74	0.70	6.98

Table XXXV. Leg measurements (mm) of *Echinotheridion gibberosum* (Kulczynski), male (n=1).

	Fe	Pa	Ti	Mt	Ta	Total
I	1.15	0.31	0.77	0.89	0.46	3.57
II	0.69	0.25	0.42	0.49	0.37	2.22
III	0.52	0.21	0.27	0.35	0.32	1.66
IV	0.83	0.29	0.45	0.53	0.37	2.46

Male palp (Figures 10, 295–298, 304, 308, 309)

Tibia ca 0.5 width of palpal organ at widest part (dorsal view); its base ca 0.3 width of distal rim (Figure 296). Male palp pincer-shaped, owing to strongly protruding cymbium and conductor (Figures 10, 295, 308, 309). Cymbium ends in a hook-like, apical process and a hairy, narrow lobe, bearing tarsal organ and adjoining broad furrow of conductor (Figure 297, 309 arrow). Its apical margin is strongly incised (Figure 297). On retrolateral side another, less distinct, hairy projection (Figures 297, 298). Bulbus ca 0.4 mm long (including conductor) and 0.33 mm wide. Subtegulum and tegulum appear to be partially fused, though hard to recognize, connecting median haematodocha presumably reduced or at least inconspicuous. Distal rim of tegulum sclerotized and incised, with two small rounded, but indistinct projections (Figures 295, 296). Conductor strongly developed, curved, forming a lamella with broad, shallow furrow, its inside curved surface covered with tiny scales (Figures 295–298). Base of embolus slender and apparently lacking the two basal lobes present in all *Tidarren* species (Figure 296), gradually passing into distal part. Distal part of embolus about 0.15–0.16 mm long. Haematodochae not modified, basal one largely expanded, distal and presumably also median one vestigial (Figures 308–310).

Epigynum, vulva (Figures 24, 299–303, 308, 309)

Epigynum a broadly rounded, heavily sclerotized protuberance (Figures 24, 299, 303), ca 0.1 mm long in side view, 0.25 mm wide in ventral view, longer than receptacula. Anterior declivity sclerotized, forming a transverse suboval plate, clearly delimited from surrounding integument (Figures 299, 300) and from posterior membranous, whitish declivity. Copulatory orifices well separated (Figures 300, 303), situated at midline of anterior declivity, in ventral view at level of anterior end of receptacula. Copulatory ducts strongly sclerotized throughout, rather long (ca 0.4 mm), coiled and folded, with narrow lumen, but with gibbous walls, so diameter not evenly wide (Figures 300–302); coils visible through transparent integument of posterior declivity. Copulatory ducts turn posteriorly and enter receptacula at posterior side. Receptacula seminis 0.15 mm long and 0.13 mm wide.

Copulatory behaviour (Figures 305–310)

Echinotheridion gibberosum shows a similar bizarre mode of copulation as *Tidarren argo*. Copulation involves single usage of the male palp and regularly ends in exhaustion of the male, in emasculation and subsequent sexual cannibalism (Knoflach 2002a). Copulation proceeds via a mating thread. Unlike *T. argo*, emasculation does not take place immediately after application of the male palp. At first, there is a normal insertion for about 4 min on average, during which both partners are completely motionless (Figures 305, 306). The male seems to be dead, the female is cataleptic. When she awakes from her cataleptic state, she entangles the male and starts to turn around in circles. Emasculation takes more than

3 min, and the female has to try several times until she succeeds in breaking off the palp. The breaking point of the palp is usually between the tibia and tarsus, as in *T. argo*. Holdfast structures of the palp are sclerites, there is no haematodochal modification. These palpal sclerites clasp the epigynum like forceps, the hook-like apex of the cymbium locks on the membranous folds of the posterior declivity of the epigynum, and the conductor locks in front of the epigynal protruberance (Figures 307–309). The male palp remains fastened to the epigynum for 5 h on average (up to 11 h) while the female is occupied with mate consumption (Figure 307). The function of the coxal spurs on legs IV (Figures 23, 24) of the female remains uncertain, as they seem to not be necessary for genital coupling (Figure 310). Remarkably, the first observation on the copulatory behaviour of *E. gibberosum* was mistaken as a heterospecific copulation between two genera (Schmidt 1980).

Natural history (Figures 3, 4, 290, 291)

In Tenerife, the webs of *Echinotheridion gibberosum* were found at a height of about 1–2 m on tree trunks and between large branches. The spiders are concealed in their large retreats, which consist mainly of debris. The egg-sac has a parchment-like light brown envelope (Figures 290, 291). In some of the retreats cocoons of the pirate spider *Ero* (Mimetidae) were also found, which may indicate possible predation by this araneophagic spider. For palp amputation (Figures 3, 4) see generic diagnosis and Knoflach (2002a).

Distribution

Echinotheridion gibberosum is known only from laurel forests or mixed pine and laurel forests in Madeira and Canary Islands and appears to be the only representative of the genus in the Old World.

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Addendum

Tidarren argo Knoflach and van Harten, a cryptic comb-footed spider with bizarre copulatory behaviour has recently aroused philatelic interest as an endemic Yemeni spider.