



On the distinction between *Modisimus* and *Hedypsilus* (Araneae, Pholcidae), with notes on behavior and natural history

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Evidence is presented that the genera *Hedypsilus* Simon, 1893 and *Modisimus* Simon, 1893 are subjective synonyms. Precedence is given to *Modisimus* over *Hedypsilus*. The type species of both genera (*M. glaucus* Simon, 1893 and *H. culicinus* Simon, 1893) are redescribed. *Hedypsilus lawrencei* Lessert, 1938 is synonymized with *Hedypsilus culicinus* Simon, 1893. It appears to be a pantropical, synanthropic species. Preliminary notes on its natural history are presented. Two closely related new species are described, *Modisimus simoni* sp. n. (Venezuela) and *Modisimus david* sp. n. (Central America). *Modisimus globosus* Schmidt, 1956 (Colombia?) is redescribed and illustrated for the first time. Notes on the usefulness of the curvature of eye rows and of leg formulae for the systematics of pholcids are given. © 1997 The Norwegian Academy of Science and Letters. All rights reserved

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Introduction

Simon's (1893b) classification of Pholcidae (and later classifications that were largely based upon it, e.g. Petrunkevitch, 1939; Mello-Leitão, 1946) has been seriously questioned several times (e.g. Timm, 1976; Deeleman-Reinhold, 1986; Huber, 1995). Almost none of his 'groupes' are presently considered to be monophyletic. While Simon paid much attention to eye patterns and carapace shape, most recent authors agree that pholcid systematics should be founded largely on genitalia (e.g. Gertsch, 1973; Timm, 1976; Brignoli, 1981; Deeleman-Reinhold, 1986; Huber, 1995).

The genera *Modisimus* Simon, 1893 and *Hedypsilus* Simon, 1893, both originally monotypic, were primarily distinguished by their eye pattern: in *Modisimus* the posterior eye row was recurved, in *Hedypsilus* procurved. However, many subsequently described *Modisimus* species have a procurved posterior eye row (see Gertsch, 1971). In the present paper it is argued that *Modisimus* and *Hedypsilus* cannot be maintained as separate genera.

Material and methods

This study is based on material deposited in: American Museum of Natural History, New York (AMNH); Musée royal de l'Afrique Centrale, Tervuren (MRAC); Forschungsinstitut Senckenberg, Frankfurt (SMF); Muséum National d'Histoire Naturelle, Paris (MNHN), and the author's collection. Line drawings were made using a compound microscope with camera lucida.

Family PHOLCIDAE

Genus *Modisimus* Simon, 1893

Modisimus glaucus Simon, 1893 (Fig. 1)

Modisimus glaucus Simon, 1893a: 322; Simon, 1893b: 484-485, figs 480-482, 485; Bryant, 1948: 369-370, figs 38, 41, 56.

Material examined. Female holotype from Santo Domingo, Dominican Republic (MNHN, 6840).

Other material. Bryant (1948) redescribed the species with material from Puerto Plata, Dominican Republic. She had not examined Simon's types, and moreover, notes that his figure of the male pedipalp is mistaken. It remains to be established whether her acceptable figures really represent this species.

Note. The male(s) from Simon's material could not be found in the MNHN and is/are obviously lost. A second vial with Simon's label "19836 *Mod. glaucus* 95 ins. Margarita (D1m)" and another label by P. Brignoli "*Modisimus glaucus* Simon 1893 1♀-Lectotypus P. Brignoli vid. 1971" contains a female from a different genus (without eye turret) that apparently got into the vial erroneously.

Redescription. Female: Prosoma ochre yellow, only eye turret darker. Opisthosoma ochre, with darker spots dorsally. Six eyes on a prominent eye turret (Fig. 1 A,B), Epigynum a simple plate when viewed ventrally (Fig. 1 C). All legs missing. Measurements (mm): total length: 1.9; carapace length: 0.6; carapace width: 0.6; opisth. length: 0.9.

Modisimus culicinus (Simon, 1893) comb. n. (Figs 2-4)

Hedypsilus culicinus Simon, 1893a: 322; Simon, 1893b: 484-486, figs 483, 484, 486; Gertsch & Peck, 1992: 1191-1192, figs 20-26.

Hedypsilus lawrencei Lessert, 1938: 434-436, figs 15-17. syn. n.

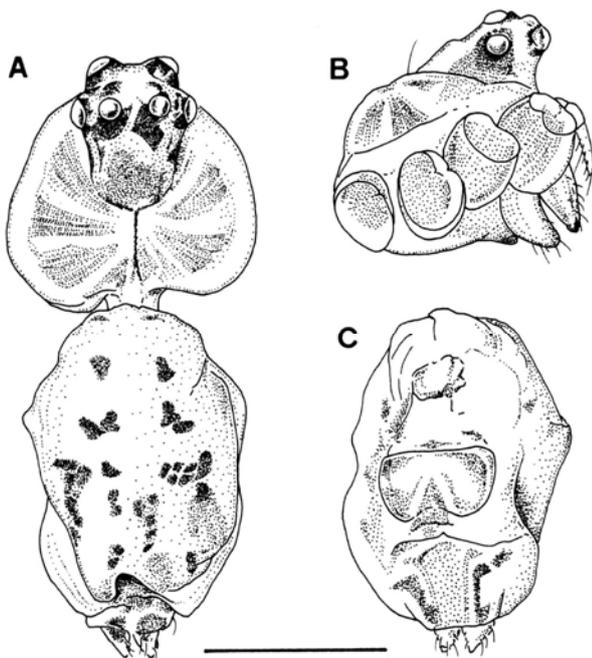


Fig. 1. *Modisimus glaucus*.—A. Female, dorsal view.—B. Female prosoma, lateral view.—C. Opisthosoma, ventral view, with epigynum. Scale line: 0.5 mm.

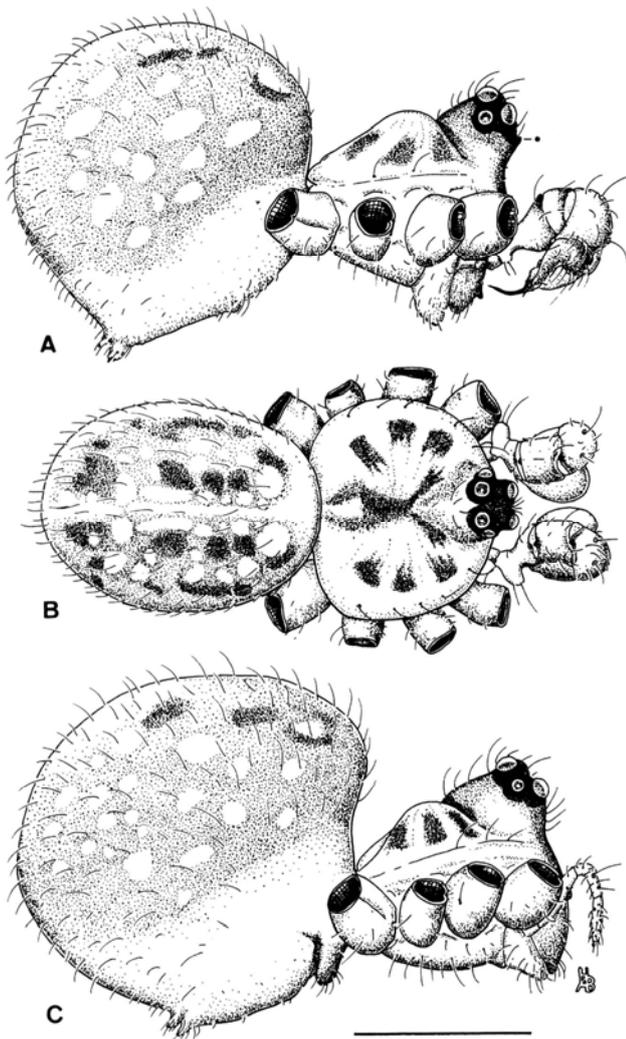


Fig. 2. *Modisimus culicinus*.—A. Male, lateral view. Asterisk marks cuticular lobe.—B. Male, dorsal view.—C. Female, lateral view. Scale line: 0.5 mm.

Material examined. *Hedypsilus culicinus*: lectotype: 1 male from 'Orinoco', Venezuela (MNHN, 9629) designated herein following the suggestion on labels by Saaristo, 1991 (unpublished); *Hedypsilus lawrencei*: male lectotype (designated herein) and 4 female paralectotypes from Kananga, Zaire (MRAC, 5202, 5203, 12943-12945); Males and females, collected in Costa Rica, deposited in AMNH (2 males and 2 females); more males and females in the author's collection.

Note. Gertsch & Peck (1992) claim to have designated a lectotype, but they did not label the chosen male and did not realize that the two males in Simon's vial were not conspecific. Their designation is considered invalid.

Diagnosis. Males are easily recognized by the cuticular lobe on the frontal side of the eye-turret (Fig. 2 A; see Huber, in press). This 'nasute projection' does not occur in the males of 'some' species, as indicated by Gertsch & Peck (1992). Other distinguishing characters are the forms of the male pedipalps (femur-apophysis, bulbal apophysis, procurus), the male chelicerae and the female epigynum (see Figs 3, 4).

Redescription. Male: Measurements in Table I (in order to save the lectotype which is in bad condition and moreover has no legs 3 and 4, the measurements were taken from specimens collected by the author; tibia 1 and carapace width in the lectotype are 1.86 and 0.59 mm respectively, which is slightly below the respective ranges in Table I).

Colours in living specimens: carapace pale ochre with distinctive pattern of dark spots (Fig. 2). Dark stripe on clypeus from eyes to chelicerae. Sternum whitish without spots. Opisthosoma dorsally grayish with white and dark spots, ventrally lighter without spots. Legs ochre-yellow with dark rings on femora (distally) and tibiae (proximally and distally). Alcohol-preserved animals (including the lectotype) are paler with the spots on the opisthosoma less distinctive or even invisible. The pattern of dark spots on the carapace remains visible.

Six eyes on turret that has a frontal cuticular lobe. Pedipalp with simple genital bulb (Fig. 3). Chelicerae with a pair of frontal apophyses (Fig. 4A).

Female: Measurements in Table I. Colours and spots essentially the same as in the male. Eye turret of slightly different shape (Fig. 2C), without cuticular lobe. Chelicerae without frontal apophyses, epigynum see Fig. 4B.

Records. Lectotype from Venezuela ('Orinoco'), no date (E. Simon). Lectotype and paralectotypes of *Hedypsilus lawrencei* de Lessert, 1938 from 'Luluabourg' (Kananga), Zaire, Africa, no date (R. P. Cambier).

Males and females from an office in the Escuela de Biología, Universidad de Costa Rica (elev. 1150 m), Province San José, Costa Rica, February to May 1995 (B. A. Huber). 1 male and 3 females from a house in Fortuna (elev. 250 m), Province Alajuela, Costa Rica, October 4, 1995 (B. A. Huber). Three males and 5 females from a house in Escuintla, Guatemala, September 19, 1996 (B. A. Huber). Gertsch & Peck, 1992 list a number of additional records, including the USA (Cambridge, Massachusetts; Southern Florida), southern Mexico, the Galápagos Islands, Hawaiian Islands and Marshall Islands. The spider has also been found on the Seychelles (M. I. Saaristo pers. comm.).

Distribution. The records suggest the *M. culicinus* may be pantropical. Since it was found in large numbers (about 70 individuals) in the Biology School building, it may be a mainly synanthropic species that often went unnoticed due to its small size (for similar cases see *Psilochorus simoni* (Berland, 1911) in Europe, Huber, 1994; and the cosmopolitan *Micropholcus fauroti* (Simon, 1887), Deeleman-Reinhold & Prinsen, 1987). Most records are from within human buildings, only Gertsch & Peck (1992) give 'arid-zone thorn scrub' as a natural habitat in the Galápagos Islands.

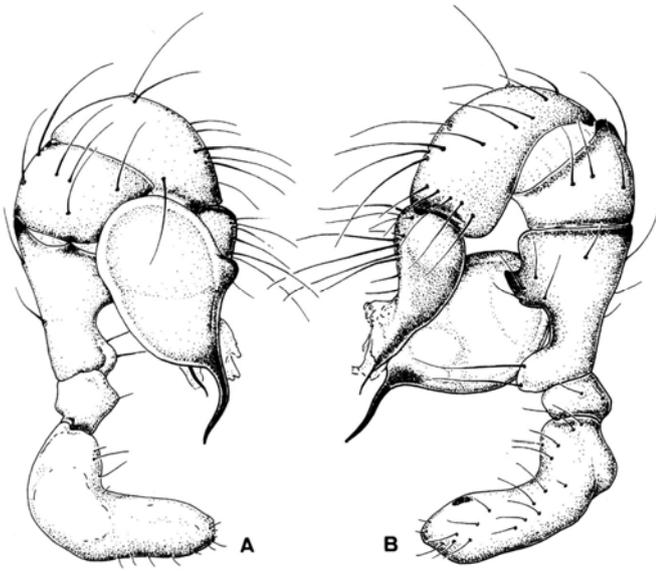


Fig. 3. *Modisimus culicinus*, male pedipalp.—A. Prolateral view.—B. Retrolateral view. Scale line: 0.2 mm.

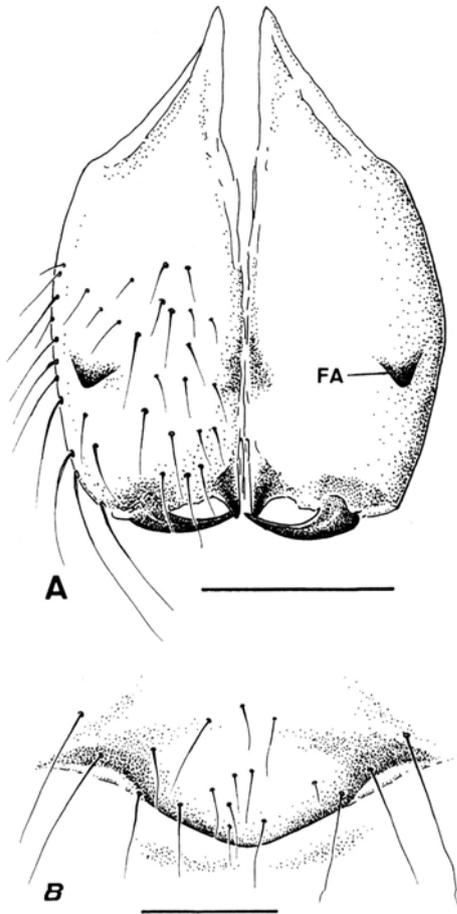


Fig. 4. *Modisimus culicinus*.—A. Male chelicerae, frontal view; FA: frontal apophysis.—B. Female epigynum, ventral view. Scale lines: 0.1 mm.

Modisimus simoni sp. n. (Figs 5-7)

Holotype. 1 male, together with the lectotype of *Modisimus culicinus* (Simon) in vial no. 9629, MNHN.

Type locality. 'Orinoco', Venezuela.

Etymology. Named for Eugène Simon.

Diagnosis. Short legged *Modisimus*, without cuticular lobe on eye-turret, with a pair of cheliceral apophyses. Distinguished also by the form of the pedipalps (bulb, femur-apophysis, procurus with spine—Fig. 6).

Note. This species is very similar to *M. chiapa* Gertsch, 1977 which has shorter legs (fem I: 1.3 mm, tib I: 1.0 mm, vs 1.6 mm and 1.5 mm in *M. simoni*). From the existing descriptions it cannot be distinguished from *M. tzotzile* Brignoli, 1973. However, *M. chiapa* was described from a single male, *M. tzotzile* from a single female, both from Chiapas, Mexico. Leg length in *M. tzotzile* is approximately what would be expected for the female *M. chiapa* (assuming that leg length dimorphism is within the range of other species of the genus). The descriptions allow no certain conclusions, so they may well represent the same species.

Description. Male: Measurements in Table I. Holotype almost absolutely colourless. Six eyes on a turret (Fig. 5). Pedipalps see Fig. 6. Chelicerae with a pair of simple frontal apophyses (Fig. 7). Female unknown.

Record. Known only from the holotype, from Venezuela, 'Orinoco' (E. Simon).

Modisimus david sp. n. (Figs 8-10)

Holotype. Male, deposited in AMNH.

Type locality. City of David, Chiriquí Province, Panama. Under stones at a 2 m stripe of open grassland on the side of a footpath.

Paratypes. 1 male and 1 female from the same locality as holotype, deposited in AMNH.

Other material. Several males and females from same locality as holotype, in the author's collection. Males and females from San Juan del Sur, Nicaragua (B. A. Huber), 1 male and 1 female deposited in AMNH.

Etymology. Specific name from type locality, city of David, Panama.

Diagnosis. Short legged *Modisimus* without frontal apophyses on the male chelicerae, with large dark smudges on the opisthosoma. Further distinguished by the form of the male pedipalps (femur apophysis, bulb, procurus—Fig. 9).

Description. Male: Measurements in Table I. Carapace pale ochre with a pair of spots posteriorly and another pair at the posterior basis of the eye turret (Fig. 8). Sternum whitish, without spots. Clypeus pale ochre, without dark stripe. Opisthosoma greenish-gray, with some large dark dorsal smudges, ventrally lighter, without spots. Legs ochre-yellow without dark rings but with darker trochanters. All colors are from living animals. In alcohol-preserved animals the trochanters are no longer dark, otherwise there are no obvious differences. Six eyes on a turret. Pedipalps with simple genital bulb (Fig. 9). Chelicerae without frontal apophyses or modified hairs (Fig. 10A).

Female: Measurements in Table I. Colors and spots, eye turret and chelicerae essentially the same as in the male. Epigynum see Fig. 10B.

Records. Type specimens from the city of David, Chiriquí province, Panama. 12 females, 4 males, 5 juveniles, 22 April 1995 (B. A. Huber), under stones at a 2 m stripe of open grassland on the side of a footpath.

Other material from San Juan del Sur, Nicaragua. 5 females, 4 males, 9 juveniles, 21 July 1995 (B. A. Huber), under stones of a dry brook-bed south of the village.

Table I. Measurements of carapace, opisthosoma and legs (mm). For *M. culicinus* (Simon) arithmetic means and ranges are given for N=5, illustrating considerable intraspecific variation. In *M. david* sp. n. only the type is measured thoroughly whereas means and ranges (N=7) are given only for tibiae 1. In the type of *M. simoni* sp. n. tarsi 1 and 4 are missing

	<i>Modisimus culicinus</i>				<i>M. simoni</i> male	<i>M. david</i>		<i>M. globosus</i> male
	male		female			male	female	
	Y	range	Y	range				
Total length	1.32	1.22-1.41	1.39	1.18-1.53	1.30	1.07	1.31	1.33
Ceph. length	0.57	0.53-0.63	0.54	0.47-0.59	0.49	0.45	0.44	0.54
Ceph. width	0.65	0.63-0.69	0.60	0.53-0.66	0.57	0.51	0.51	0.60
Opisth. length	0.77	0.69-0.83	0.86	0.78-1.09	0.76	0.61	0.86	0.82
Leg 1 total	7.67	6.28-8.02	5.68	5.42-6.27	-	4.51	3.24	14.63
fem	2.12	1.91-2.25	1.56	1.50-1.73	1.59	1.26	0.89	3.80
pat	0.22	0.21-0.23	0.20	0.18-0.21	0.17	0.18	0.16	0.20
tib	2.10	1.91-2.20	1.53	1.47-1.70	1.46	1.27	0.89	3.70
met	2.64	2.43-2.72	1.87	1.78-2.07	≥1.84	1.43	0.98	5.92
tar	0.59	0.54-0.62	0.52	0.49-0.56	-	0.37	0.32	1.01
Leg 2 total	5.90	5.43-6.33	4.48	4.31-4.91	4.32	3.55	2.60	8.86
fem	1.73	1.55-1.83	1.28	1.24-1.42	1.21	1.02	0.72	2.53
pat	0.21	0.21-0.23	0.20	0.19-0.21	0.16	0.18	0.16	0.20
tib	1.57	1.45-1.65	1.14	1.09-1.26	1.08	0.90	0.64	2.23
met	1.96	1.86-2.13	1.46	1.40-1.60	1.49	1.15	0.80	3.29
tar	0.43	0.36-0.49	0.40	0.39-0.42	0.38	0.30	0.28	0.61
Leg 3 total	4.72	4.29-4.93	3.50	3.34-3.82	3.47	2.88	2.16	5.33
fem	1.37	1.27-1.42	1.00	0.96-1.11	1.02	0.81	0.60	1.92
pat	0.20	0.18-0.21	0.18	0.18-0.19	0.16	0.17	0.14	0.20
tib	1.16	1.03-1.21	0.83	0.78-0.91	0.83	0.71	0.51	1.52
met	1.64	1.47-1.73	1.18	1.14-1.29	1.11	0.94	0.69	2.28
tar	0.35	0.34-0.36	0.31	0.28-0.32	0.35	0.25	0.22	0.41
Leg 4 total	6.96	6.37-7.30	5.20	4.93-5.73	-	4.30	3.18	7.79
fem	2.09	1.91-2.20	1.56	1.50-1.73	1.59	1.27	0.93	2.43
pat	0.21	0.20-0.21	0.20	0.18-0.21	0.16	0.17	0.15	0.20
tib	1.79	1.65-1.86	1.32	1.24-1.45	1.37	1.14	0.84	1.87
met	2.43	2.20-2.56	1.72	1.65-1.91	≥1.75	1.39	0.98	2.78
tar	0.44	0.41-0.47	0.40	0.36-0.43	-	0.33	0.28	0.51
					Tibia 1 (N=7)			
					Y = 1.30		Y = 0.91	
					1.20-1.39		0.88-0.97	

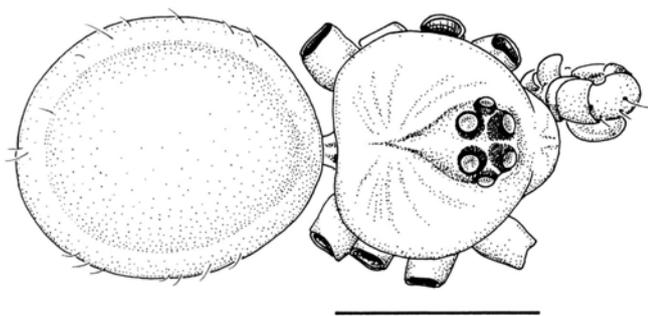


Fig. 5. *Modisimus simoni*. Male, dorsal view. Scale line: 0.5 mm.

Modisimus globosus Schmidt, 1956 (Fig. 11)

Modisimus globosus Schmidt, 1956: 24-25.

Material examined. Male holotype (SMF, 37453)

Remark. Although this spider is quite different from the other species described in this paper, it is redescribed here as the original description provides no illustration and gives no characters to distinguish it from *M. david* sp. n. and *M. simoni* sp. n.

Diagnosis. Separated from other spiders in this paper by the frontal armature on the male chelicerae (Fig. 11C) and much longer legs (Table I).

Redescription. Male: Measurements in Table I. Carapace pale yellow (in original description: pale brownish), with

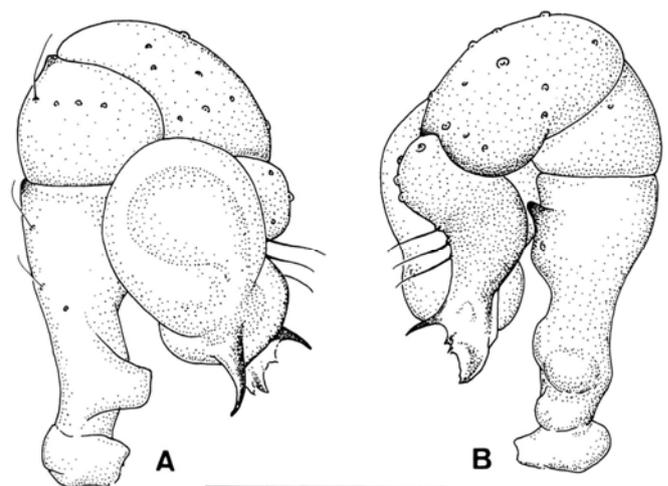


Fig. 6. *Modisimus simoni*, male pedipalp.—A. Prolateral view.—B. Retrolateral view. Scale line: 0.2 mm.

darker muscles shining through, and pigments in the eye turret. Otherwise no dark markings. Opisthosoma ochre without dark patterns (orig. descr.: pale-greenish, without points), globose. Legs pale yellow (orig. descr.: femur apically darkened, tibia basally and apically darkened). Chelicerae with very distinctive frontal apophyses, provided with cones (modified hairs, Fig. 11C). Both

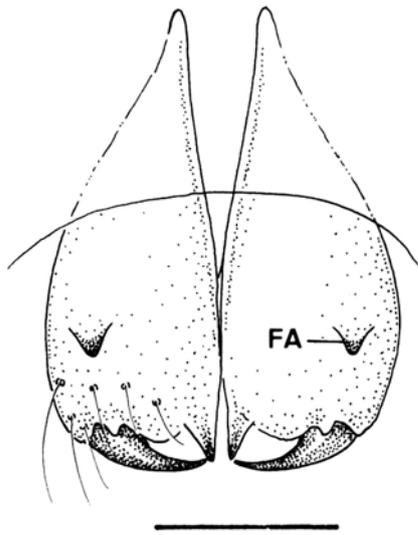


Fig. 7. *Modisimus simoni*. Male chelicerae; FA: frontal apophyses. Scale line: 0.1 mm.

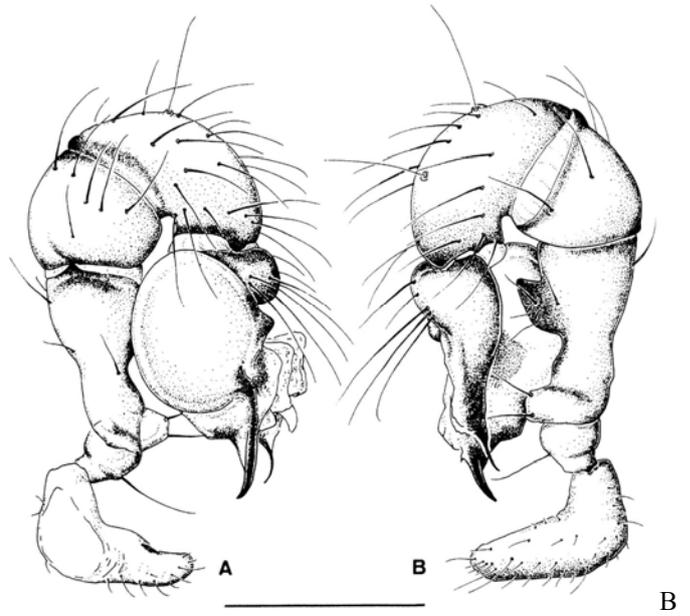


Fig. 9. *Modisimus david*, male pedipalp.—A. Prolateral view.—B. Retro-lateral view. Scale line: 0.2 mm.

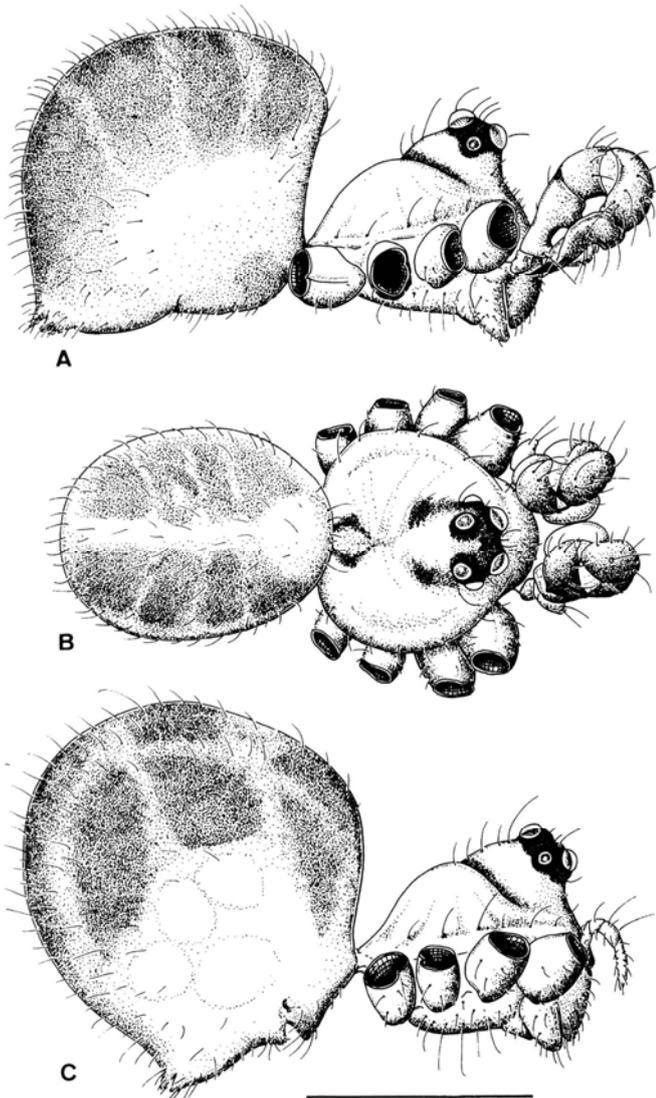


Fig. 8. *Modisimus david*.—A. Male, lateral view.—B. Male, dorsal view.—C. Female, lateral view. Scale line: 0.5 mm.

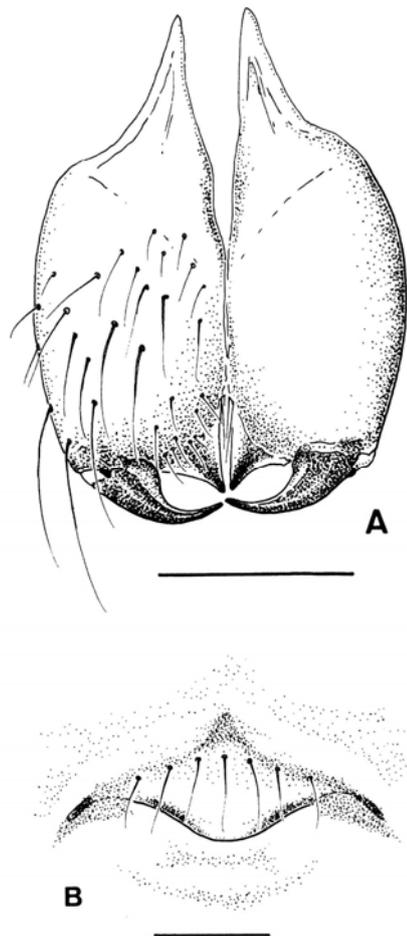


Fig. 10. *Modisimus david*.—A. Male chelicerae, frontal view.—B. Female epigynum, ventral view. Scale line: 0.1 mm.

pedipalps are missing, the original description only states that the procurus is distally pointed clawlike. Female unknown.

Record. The holotype was found in Hamburg, Germany, in a shipment of bananas from Colombia (G. Schmidt, no date). No other records.

Justification of the synonymy of *Modisimus* Simon, 1893 and *Hedysilus* Simon, 1893

For reasons detailed below, *Modisimus* and *Hedysilus* are regarded as subjective synonyms. As both names were introduced simultaneously by the same author, in the same work, precedence is given (herewith!) to the more frequently used name *Modisimus* (Article 50f, IRZN). The putative synapomorphy that links the type species of the two genera is the elevated eye turret. A different relationship has been proposed by Mello-Leitão (1946) who linked *Hedysilus* to *Systemita* Simon, 1893. He did not mention any synapomorphy and probably never saw Simon's type of *Systemita* which is a long-bodied pholcid with two eye triads on separate elevations far apart, with strong club-shaped hairs on the chelicerae and completely different forms of the genitalia (Huber, in prep. a). Gertsch & Peck (1992) have synonymized *Modisimops* Mello-Leitão, 1946 with *Hedysilus*. Apart from the fact that the type species of *Modisimops* (*Modisimus dilutus* Gertsch, 1941) does not fit their own diagnosis of *Hedysilus*, the separation between *Modisimus* and *Modisimops* has been convincingly discarded by Brignoli (1973). The following paragraphs deal with characters that have been used to distinguish *Modisimus* from *Hedysilus*.

A comparison of the curvature of the posterior eye row seen from above in the 33 species of *Modisimus* in which this character is given in literature revealed the following:

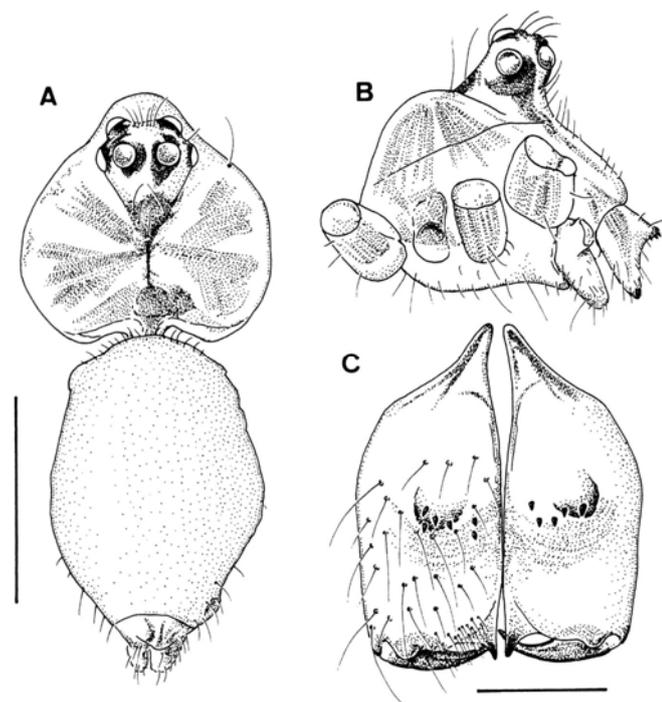


Fig. 11. *Modisimus globosus*.—A. Cephalothorax, lateral view.—B. Cephalothorax, dorsal view. Scale line: 0.5 mm.—C. Male chelicerae, frontal view. Scale line: 0.1 mm.

in 8 species the row is recurved, in 10 species it is straight, in 15 species it is procurved. In addition, I know of no paper dealing with pholcids in which 'view from above' is defined. This can be essential, however, as the hypothetical case in Fig. 12 demonstrates. Depending on the reference plane, three curvatures can be deduced: when looking at the prosoma lying in the dissecting dish, the row appears straight (A), taking the carapace-margin as a reference plane, the row appears recurved (B), looking at the eye turret 'from above' results in the row appearing procurved (C). It becomes evident that the curvature of eye rows is not a useful character in these spiders, at least without detailed information on the reference plane, not given in any description in the literature. This problem is nicely illustrated in the recent description of *M. solus* by Gertsch & Peck (1992) in which the posterior eye row is clearly recurved in the figure, yet 'procurved' in the text.

The argument could still be made that procurved eye rows described for certain *Modisimus* species result from the orientation used by the author, and that, given another orientation, they would be recurved. This argument is invalid since some species (e.g. *M. elevatus* Bryant, 1940; *M. propinquus* Cambridge, 1896; *M. inornatus* Cambridge, 1895; *M. maculatipes* Cambridge, 1895) have procurved posterior eye rows in all three positions given in Fig. 12, as can be seen from illustrations in side view.

Simon (1893b) gives a second difference, which concerns the male chelicerae. According to him, they are equipped with modified hairs in *Modisimus* but with horns (= frontal apophyses) in *Hedysilus*. In fact, most *Modisimus* described since then have modified hairs on the male chelicerae, but some have these hairs on blunt projections (e.g. *M. cornutus* Kraus, 1955; *M. elongatus* Bryant, 1940), others have horns that are equipped with modified hairs (e.g. *M. sexoculatus* Petrunkevitch, 1929) and some even have only horns (e.g. *M. signatus* (Banks, 1914), see Petrunkevitch, 1929; *M. montanus* Petrunkevitch, 1929). Additionally, modified hairs on the male chelicerae have evolved convergently in distantly related genera (e.g. *Hoplopholcus*, see e.g. Brignoli, 1971; *Metagonia*, see Gertsch, 1986; American '*Micromerys*', Huber, in prep.

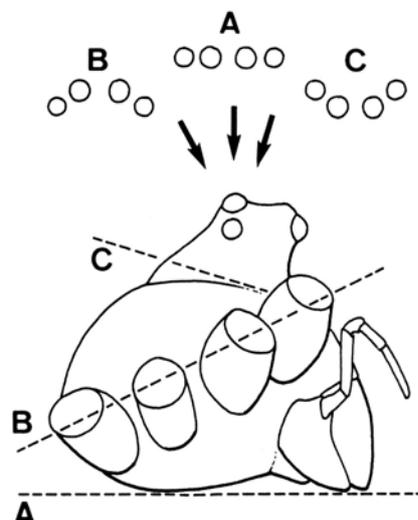


Fig. 12. Depending on how 'looking at the eyes from above' is defined, all possible eye row curvatures are possible in this hypothetical case.

b). Also the genus *Metagonia* comprises both species with modified hairs and with horns (Gertsch, 1977, 1986). Finally, *M. david* sp. n. has neither horns nor modified hairs.

This leaves one final difference given by Simon (1893b), the setiform projection on the male clypeus in *Hedypsilus*. However, such a projection does not exist in the original material and is probably an optical illusion: the inner margins of the chelicerae often seem as if they were the outer margins of a projection (see Fig. 7, in which this illusion is much weaker than in nature). The same may be true for the 'setiform projection' of *Modisimus femoratus* Bryant, 1948.

Gertsch & Peck (1992) state that in *Hedypsilus* females the ratio femur I/carapace length is 1.7, whereas in *Modisimus* females it is 'typically' about 6. However, they describe in the same paper a *Modisimus* (*M. solus*) with a ratio of 2.8, and transfer *M. dilutus* Gertsch, which has a ratio of 4.6, to *Hedypsilus*. When all published ratios of female *Modisimus* and *Hedypsilus* are plotted in a graph with ascending values (Fig. 13) there is no obvious discontinuity which could justify a separation into two genera.

A final point that became obvious during leg measurements concerns the 'leg formula', i.e. the sequence of legs according to their length. Unfortunately, only in eight species of *Modisimus* are measurements of all legs published; in all but one the formula is 1243. In the three short-legged species described in this paper, the leg formula is, in contrast, 1423. However, as the difference between legs 2 and 4 is in most cases very small and no variabilities are given in published accounts, this character cannot be adequately assessed. Moreover, too little is known on the relationship of relative leg length with overall size, habitat, prey capture, loss of legs in early instars, etc. Indirect evidence for such a correlation comes from the genera *Anopsicus* and *Pholcophora* whose representatives live in similar habitats near the ground, do not oscillate when disturbed, and also have the legs 4 longer than the legs 2 (Gertsch, 1982).

In conclusion, there is no evidence at present to separate *Hedypsilus* from *Modisimus*, and the former is regarded a synonym of the latter.

Natural history

Modisimus culicinus

The spiders were found in virtually all sheltered places in a room in the Biology department, University of Costa Rica, under sheets of paper and all sorts of objects, in piles of books, behind pictures on the wall, etc. They often lived near spiderlings of the pholcid *Physocyclus globosus* (Taczanowski, 1873). Their webs consisted of a few irregular threads in which they hung upside down or which they only touched with some legs while sitting on a firm surface. When disturbed they were never observed oscillating their bodies like many other pholcids but swiftly ran away on the substrate.

Capture of small *Drosophila* flies (the smallest flies were still larger than the spiders) was observed in captivity. The flies seemed not to get seriously entangled in the spider's silk but when they walked into a thread, the spiders swiftly attacked them by wrapping them and applying short bites between bursts of wrapping while the fly continued walking. Finally the spiders hung them up to feed on them.

Three complete copulations were observed under the dissecting microscope (three more were interrupted by freeze-fixation for another study). In two cases the females had been collected as adults, but had laid no eggs for one month. The third female had moulted to adult in captivity and was a virgin. Visible courtship occurred in all cases, and consisted of tapping movements of the male's anterior legs while he approached the female. Copulation consisted of a single simultaneous insertion of both pedipalps, and lasted for 27, 31 and 33 min respectively. The pedipalps were moved rhythmically during copulation, either synchronously or (most of the time) in alternation. The movement was an outward thrust of the pedipalp that occurred every 4-7 s throughout copulation. There is evidence for gustatorial courtship during copulation: the female mouth is in contact with the male cuticular lobe, at which a large clypeal gland opens (Huber, in press). In addition, the males lightly tapped the threads with the anterior legs, once every few minutes. During the last 30-50 s of each copulation the male bent his opisthosoma ventrally and repeatedly tapped the female's spinnerets with his; a thick, apparently viscid thread became visible between male and female spinnerets. In all three cases the male withdrew his pedipalps and dashed away without any obvious movement of the female.

As in other pholcids, females carried the egg-sac with their chelicerae. An average of 9.0 spiderlings emerged from each egg-sac ($N = 23$; range: 2-17). Two females produced three egg-sacs each, from which 8, 14, 13 and 9, 8, 5 spiderlings emerged, respectively. Average time between oviposition and emergence of spiderlings was 16.7 days ($N = 18$; range: 13-23). Average time between emergence of spiderlings and production of a new egg-sac was 16.2 days ($N = 11$; range: 8-24). In several cases (18) egg-sacs 'disappeared', i.e. were probably eaten by the females. This may be a result of the conditions in captivity rather than sperm depletion, since in the case of one female two egg-sacs 'disappeared', after each of which an egg-sac was produced from which spiderlings (6 and 10) emerged. However, two females produced three infertile egg-sacs

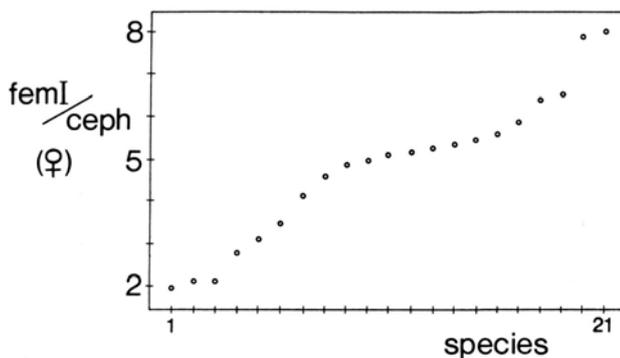


Fig. 13. The ratio femur I/carapace length in females of 21 species of *Modisimus* and *Hedypsilus*. There is no clear separation between short-legged *Hedypsilus* and long-legged *Modisimus*, as suggested by Gertsch & Peck (1992).

each before they died, which seems to argue against bad conditions.

Modisimus david sp. n.

In Panama the spider was found in close vicinity with *Anopsicus zeteki* (Gertsch, 1939) (this pholcid has so far only been recorded for the Canal Zone, Panama-Nentwig, 1993). Also in Nicaragua the spider lived close to an unidentified *Anopsicus* species, together with amblypygids, solenopids and scorpions. Prey capture, courtship and webs are very similar to *M. culicinus* (see above); this species was also never seen oscillating when disturbed. From 6 egg-sacs an average of 10.2 spiderlings emerged (range: 8-13). Average time between oviposition and emergence of spiderlings was 15.3 days ($N = 4$, range: 15-16). Time between emergence of spiderlings and production of a new egg-sac was 21 and 24 days. Also in this species, two egg-sacs 'disappeared' after 11 and 17 days, respectively. In one of these cases, the female later produced another egg-sac from which 8 spiderlings emerged.

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