

Synonymy of the trapdoor spider genera *Cyrtauchenius* Thorell, 1869 and *Amblyocarenum* Simon, 1892 reconsidered (Araneae, Mygalomorphae, Cyrtaucheniidae)

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Summary

The genus *Amblyocarenum* Simon, 1892 is removed from synonymy with *Cyrtauchenius* Thorell, 1869. The separate identity of the genera *Cyrtauchenius* and *Amblyocarenum* is reconfirmed in comparative morphological studies of at least six newly collected species that, before the synonymizing of *Cyrtauchenius* and *Amblyocarenum* in 1985, would have been attributed to either of the two genera respectively. Comparison of this new collection with cyrtaucheniid species kept in the type collections of Mediterranean cyrtaucheniids in the MNHN, Paris, confirmed the separate identity of both *Cyrtauchenius* and *Amblyocarenum*. Further comparative studies of *Cyrtauchenius*, *Amblyocarenum* and three representative genera of non-Mediterranean cyrtaucheniids showed substantial morphological similarity between the genera *Cyrtauchenius*, *Acontius*, *Ancylotrypa* and *Bolostromus* and marked morphological differences between *Amblyocarenum* and all

examined cyrtaucheniid genera. From these observations a close relationship between *Cyrtauchenius* and the non-Mediterranean Cyrtaucheniidae is inferred, while *Amblyocarenum* is tentatively thought to have its closest relatives in the African Nemesiidae.

Introduction

Newly available samples containing at least six different species of cyrtaucheniid trapdoor spiders from the southwestern Mediterranean Basin (Fig. 1) were found to contain two morphologically distinct species groups. Comparison of these species groups with type material in the collection of the Muséum national d'Histoire naturelle in Paris (MNHN), the collection on which Mediterranean Cyrtaucheniidae were originally described (Lucas 1846; Simon 1892), revealed that they were morphologically conformable with the genera *Cyrtauchenius* Thorell, 1869 and *Amblyocarenum* Simon, 1892, respectively. This finding provoked renewed interest in the taxonomical status and the supposed synonymy of the genera *Cyrtauchenius* and *Amblyocarenum* (see Raven 1985: 129). Resolving the proposed synonymy of these two genera in a more definite statement is important in relation to on-going efforts to clarify the systematics of the mygalomorph spider family Cyrtaucheniidae (Bond *et al.* 2012). The classification of cyrtaucheniid taxa has long been regarded as problematic (Goloboff 1993; Bond & Opell 2002; Hedin & Bond 2006) and recent studies have led to the suggestion that the type genus of the family (*Cyrtauchenius*) ultimately might have to be allocated to the family Nemesiidae (Bond *et al.* 2012: 8). This suggestion is apparently based on the currently held premise that *Cyrtauchenius* and *Amblyocarenum* are synonyms (Platnick 2014). If, as we propose here, *Cyrtauchenius* and *Amblyocarenum* are not only discrete genera, but likely to be members of different mygalomorph families, *Cyrtauchenius* might prove to be an appropriate type genus for the Cyrtaucheniidae and future work on the classification of mygalomorph spider genera is relieved from a fundamental source of confusion.

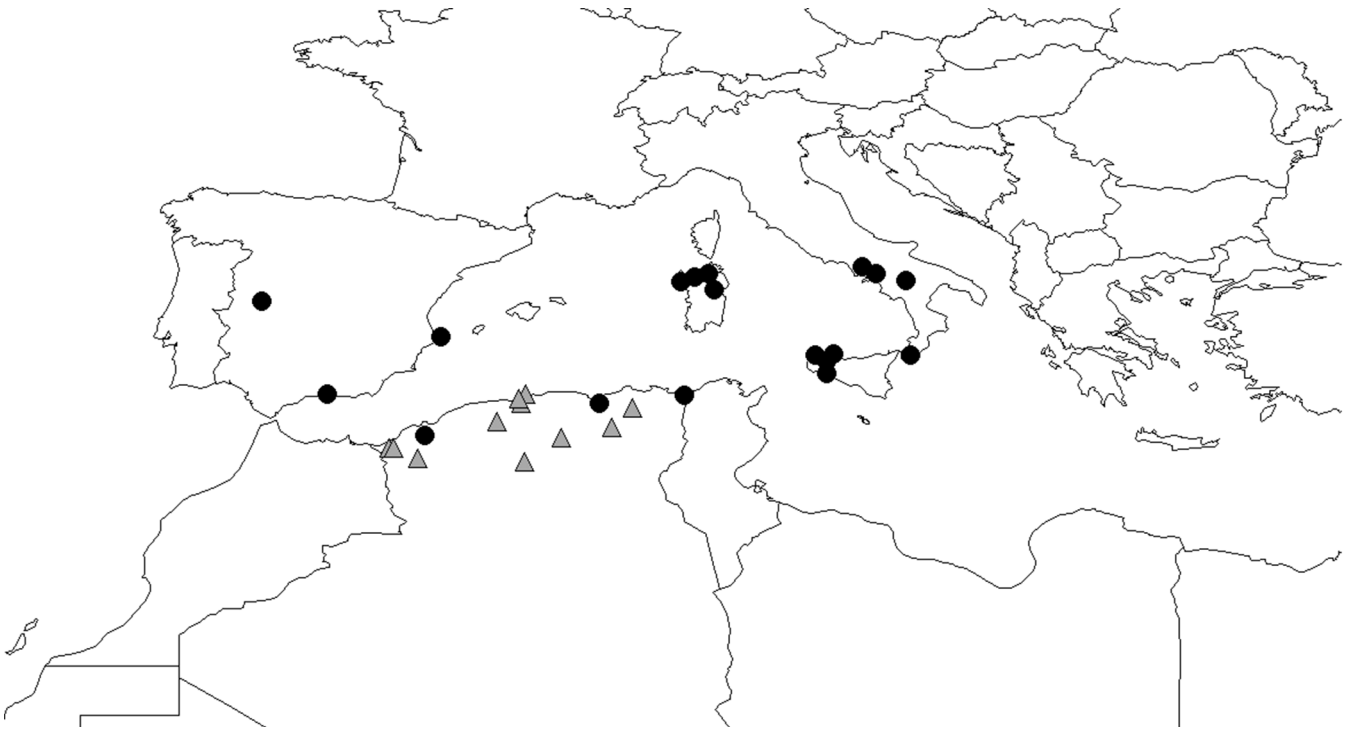


Fig. 1: Distribution of collection sites of specimens contained in a sample of 63 cyrtaucheniid trapdoor spiders from the western Mediterranean. Grey triangles indicate the known distribution of the genus *Cyrtauchenius*, black circles indicate the known distribution of the genus *Amblyocarenum*.

Material and Methods

We studied a sample of 31 specimens containing at least 18 species (14 males, 17 females) in three collections: the type collection in the MNHN, a reference collection of non-Mediterranean Cyrtaucheniidae, and a newly available collection of Mediterranean cyrtaucheniid trapdoor spiders (Table 1). Cyrtaucheniid trapdoor spiders, as understood here, differ from sympatric nemesiids and ctenizids by a set of combined macro-morphological characters of which the ten most conspicuous are listed in Table 2. A superficial examination of material in the type collection and the newly available sample confirmed previous definitions of the genera *Cyrtauchenius* (*Dolichoscaptus*) and *Amblyocarenum*, as given in Simon (1889, 1892). We selected seven of the most obvious alternative morphological character states to distinguish *Cyrtauchenius* from *Amblyocarenum* (see Table 3 and Figs. 6–19). In order to investigate the affinities of *Cyrtauchenius* and *Amblyocarenum* to non-Mediterranean Cyrtaucheniidae, some morphometric and qualitative descriptive characters were studied in these two genera and in the genera *Ancylotrypa*, *Acontius* (from sub-Saharan Africa), and *Bolostromus* (from Central America) (Table 1). Because superficial differences between *Cyrtauchenius* and *Amblyocarenum* showed up particularly well in the supposed functional morphology of different anatomical structures (palps and legs, mouthparts, spinning apparatus, sexual organs) we focussed our studies on these structures to investigate possible affinities between *Cyrtauchenius*, *Amblyocarenum* and three non-Mediterranean cyrtaucheniid genera: *Acontius*, *Ancylotrypa* and *Bolostromus*.

All specimens were studied using a Huvitz HSZ-600 stereomicroscope and a binocular Biolam-Runhardt transmitted light microscope both equipped with a Euromex

CMEX-5000 digital camera running an ImageFocus v 2.0 program for taking measurements and photographs. Measurements are accurate to 0.01 mm. All specimens were studied fully submerged in 70% ethanol, and fixed in position by supporting them with insect pins stuck in the polystyrene bottom of a small dish (diameter 530 mm, depth 330 mm) or mounted on glass slides for transmitted light microscopy. Measurements were taken by positioning body parts horizontally with respect to the microscope's objective and having both points of measurement simultaneously in sharp focus. Habitus photographs were taken using an Olympus E500 camera equipped with a 50 mm macro lens and ring flash. All measurements are given in millimetres. Geographic locations of collection sites (approximations for 19th century records) were plotted on a map using DIVA-GIS 5.2 freeware (Hijmans *et al.* 2005).

Abbreviations: TBL = total body length, CL = carapace length, AR = anterior eye row, PR = posterior eye row, PLEs = posterior lateral eyes, PSS = posterior sternal sigilla, MSS = median sternal sigilla, PaTi = palp tibia, Tib. III, Pat. III = tibia and patella of the third leg, L = length, W = width. KMMA = Koninklijk Museum voor Midden-Afrika, Tervuren. MNHN = Muséum national d'Histoire naturelle, Paris. MCSN = Museo civico di Scienze naturali, Bergamo. WSC = World Spider Catalog.

Results

Based on the general appearance of the spiders, two groups/genera were readily identifiable in the newly available sample of Mediterranean cyrtaucheniids (Table 1, New Coll.). One group consisted of relatively light coloured and elegantly built spiders, with longer cocoon-shaped abdomens (Figs. 2, 4). The other group consisted of darker

coloured, more compactly built spiders with short abdomens and less differentiated legs (Figs. 3, 5). On closer inspection, these two groups were further found to differ in a number of, alternatively varying, qualitative morphological characters (the most obvious are summarized in Table 3) to indicate the presence of two distinct genera in our sample. This hypothesis, of two distinct genera in our sample, was confirmed by finding the same sets of alternatively varying characters in all species attributed to either the genus *Cyrtauchenius* or the genus *Amblyocarenum* in the type collections in the MNHN. These characters, diagnostic at genus level, were found to be constant and uniform at the species level in all specimens studied (Table 4). The genus level diagnostic alternative character states (4 in both males and females, 2 in males only, 1 in females only) were found to differ as follows (see also Tables 3–4): Spigots: large with an inflated, bell-shaped base *versus* small with a narrow, tube-shape base (Figs. 6–7). PLEs: modified with a central division *versus* not modified and undivided (Figs. 8–9). PSS: large, faintly outlined and placed subcentrally and partly between MSS *versus* smaller, sharply outlined and placed sublaterally well behind MSS (Figs. 10–11). Tib. III & Pat. III: prolaterally armed with a group of 5–21

short spines *versus* a few 2–4 prolateral spines placed in line centrally on the segment (Figs. 12–13). Male palps: long with strongly elongated segments (femur, patella and tibia) *versus* short without any elongated segments (Figs. 14–15). Male embolus: flexible, smooth, and thread-like with a narrow tip *versus* stout, blunt tipped and ornamented with ribs and denticles (Figs. 16–17). Spermathecae: tiny, complexly shaped (lobed) and fragile *versus* robust, simple tubes (Figs. 18–19) (see also Table 4).

To study differences and similarities between *Cyrtauchenius*, *Amblyocarenum* and the three non-Mediterranean cyrtaucheniid genera (see above) we focussed on the supposedly functional morphology of the ambulatory system, the mouthparts, the spinning apparatus and the sexual organs. The morphology of palps and legs in trapdoor spiders is apparently related to differences in function between the anterior and posterior appendages. The anterior appendages, palps, and first two pairs of legs primarily function in support, manipulating, grabbing, and copulation, while legs III and IV function in propulsion, and grip on the substrate and burrow walls (personal observations). We found that (within the limits of the material available) the morphology of the legs and palps in *Cyrtauchenius* was highly similar

Collection	Coll. No.	Reg. No.	Species	Sex	Country
Type Coll.	AR11425	NHMP.001	<i>Amblyocarenum</i> sp.	♀	Algeria
Type Coll.	AR11425	NHMP.002	<i>A. walckenaeri</i>	♀	Algeria
Type Coll.	AR11425	NHMP.003	<i>A. walckenaeri</i>	♀	Algeria
Type Coll.	AR4290	NHMP-012	<i>Cyrtauchenius vitatus</i>	♀	Algeria
Type Coll.	AR7076	NHMP-010	<i>C. maculatus</i>	♀	Algeria
Type Coll.	AR4300	NHMP-008	<i>C. bicolor</i>	♀	Algeria
Type Coll.	ND6334	NHMP-006	<i>C. structor</i>	♀	Algeria
Type Coll.	NHMP-005	NHMP.005	<i>C. terricola</i>	♀	Algeria
Type Coll.	AR4293	NHMP-019	<i>Cyrtauchenius</i> sp.	♂	Algeria
Type Coll.	AR4296	NHMP-015	<i>C. gracilipes</i>	♂	Algeria
Type Coll.	AR7073	NHMP-014	<i>C. latastei</i>	♂	Algeria
Ref. Coll.	21/2/85-3	21/1/85-3	<i>Bolostromus panamana</i>	♀	Panama
Ref. Coll.	12/7/85-9	12/7/85-9	<i>Bolostromus panamana</i>	♂	Panama
Ref. Coll.	139247	KMMA-002	<i>Ancylotrypa decorata</i>	♂	Congo
Ref. Coll.	139327	KMMA-001	<i>Ancylotrypa angulata</i>	♀	Congo
Ref. Coll.	235869	KMMA-003	<i>Ancylotrypa</i> sp.	♂	Nigeria
Ref. Coll.	214451	KMMA-004	<i>Acontius</i> sp.	♂	Congo
Ref. Coll.	135.670	KMMA-005	<i>Acontius</i> sp.	♀	Congo
New Coll.	Bosm-001	Bosm-001	<i>A. walckenaeri</i>	♀	Algeria
New Coll.	Isaia-063	Isaia.063	<i>A. doleschalli</i>	♀	Sicily
New Coll.	Isaia-028	Isaia.028	<i>A. doleschalli</i>	♀	Sicily
New Coll.	Colo-013	Colo.013	<i>A. n. sp.</i>	♀	Sardinia
New Coll.	NHMB-101	NHMB.101	<i>A. n. sp.</i>	♀	Calabria
New Coll.	06/04/07-1	06/04/07-1	<i>A. similis</i>	♀	Spain
New Coll.	JvK12-1	JvK12.1	<i>A. similis</i>	♂	Spain
New Coll.	Bosm-002	Bosm.002	<i>A. walckenaeri</i>	♂	Algeria
New Coll.	Colo-001	Colo.001	<i>A. n. sp.</i>	♂	Sardinia
New Coll.	NHMB-216	NHMB.216	<i>A. doleschalli</i>	♂	Sicily
New Coll.	NHMB-006	NHMB.006	<i>A. n. sp.</i>	♂	Campania
New Coll.	Bosm-007	Bosm.007	<i>Cyrtauchenius</i> sp.	♂	Algeria
New Coll.	Bosm-006	Bosm.006	<i>Cyrtauchenius</i> sp.	♂	Algeria

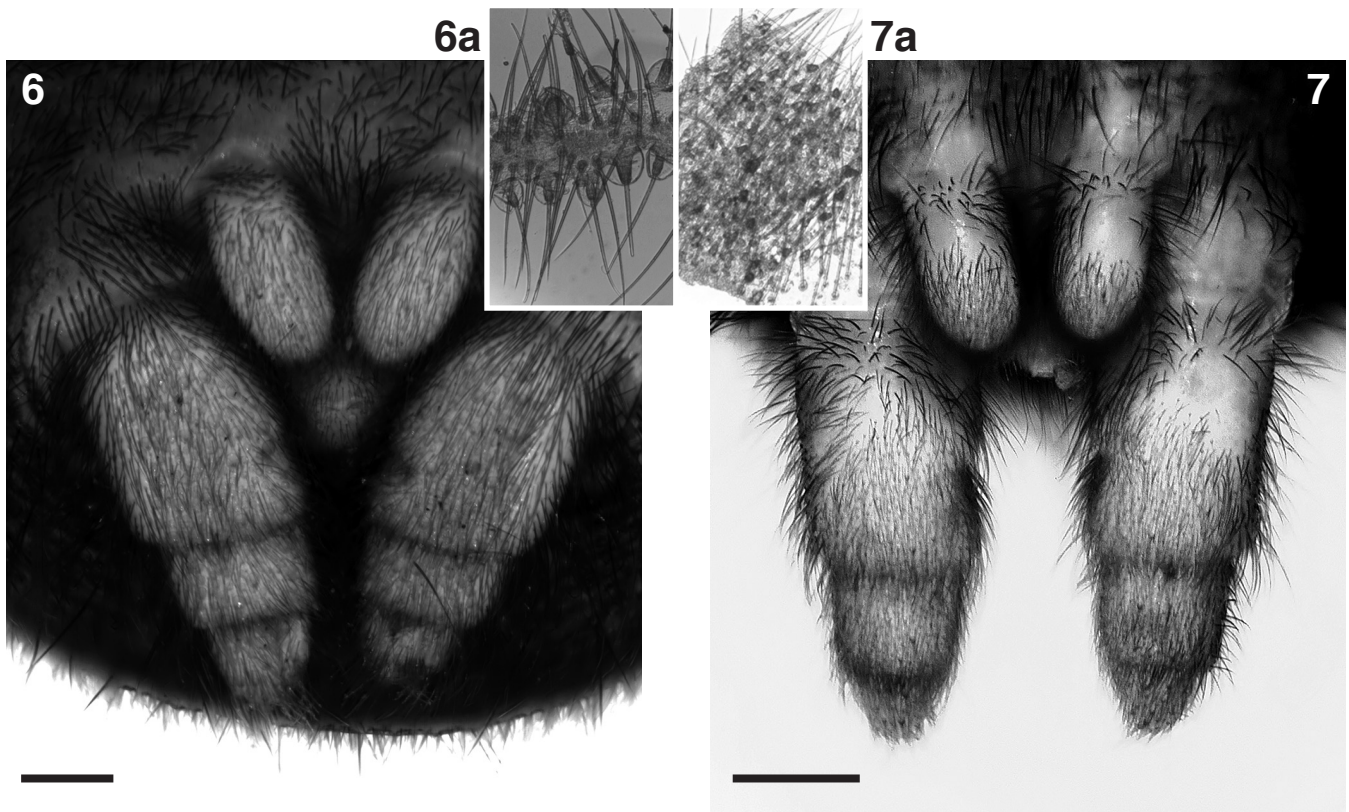
Table 1: List of specimens contained in the study sample. Collection: Type Coll. = species found in the collection of the MNHN, Ref. Coll. = non-Mediterranean cyrtaucheniid species used for reference partly in the collection of the KMMA-Tervuren, partly in private collections, New Coll. = recently found specimen partly in the collection of the MCSN-Bergamo, partly in private collections; Coll. No.: number found on tube label in museum collection; Reg. No.: number used in our database; Species: species names found on tube labels in museum collections and private collections; Sex: ♂ or ♀; Country: country where the specimens were originally collected.



Figs. 2–3: Dorsal aspect of male spiders. **2** *Cyrtachenius* sp. from Algeria (sample no. MHMP-019) TBL = 14.1; **3** *Amblyocarenum* sp. from Sardinia (sample no. Colo-001) TBL = 14.3.



Figs. 4–5: Dorsal aspect of female spiders. **4** *Cyrtachenius* sp. from Algeria (sample no. NHMP-005) TBL = 24.9; **5** *Amblyocarenum* sp. from Algeria (sample no. NHMP-001) TBL = 23.0.



Figs. 6–7: Spinnerets in ventral view. **6** *Cyrtauchenius*, note inflated bases of spigots (inset **6a**) and proximal segment of PLS slightly longer than median + distal segments; **7** *Amblyocarenum*, note dense setting of smaller spigots (inset **7a**) and proximal segment PLS twice as long as median + distal segments. Scale lines = 0.5 mm

to that in non-Mediterranean cyrtaucheniid genera and that, in contrast, *Amblyocarenum* differed from *Cyrtauchenius*, *Acontius*, *Bolostromus* and *Ancylotrypa* in all aspects studied (Table 5). With respect to the morphology of the mouthparts (labium, maxillae, fangs), spinning apparatus (spigot morphology), and sexual organs, we found a similar grouping of *Cyrtauchenius* with the non-Mediterranean cyrtaucheniiids versus *Amblyocarenum* (Table 6).

Based on our findings, it seems that *Amblyocarenum* might fall outside the Cyrtaucheniiidae altogether and, although we did not study the taxonomic position of *Amblyocarenum* in depth, a number of morphological characters found in this genus (morphology of the ambulatory system, mouthparts, spinning apparatus, sexual organs) show remarkable similarities to the African Nemesiidae.

Conclusions

Based on the results we conclude that *Amblyocarenum* Simon, 1892 should be removed from synonymy with *Cyrtauchenius* Thorell, 1869 and be recognized as a distinct trapdoor spider genus.

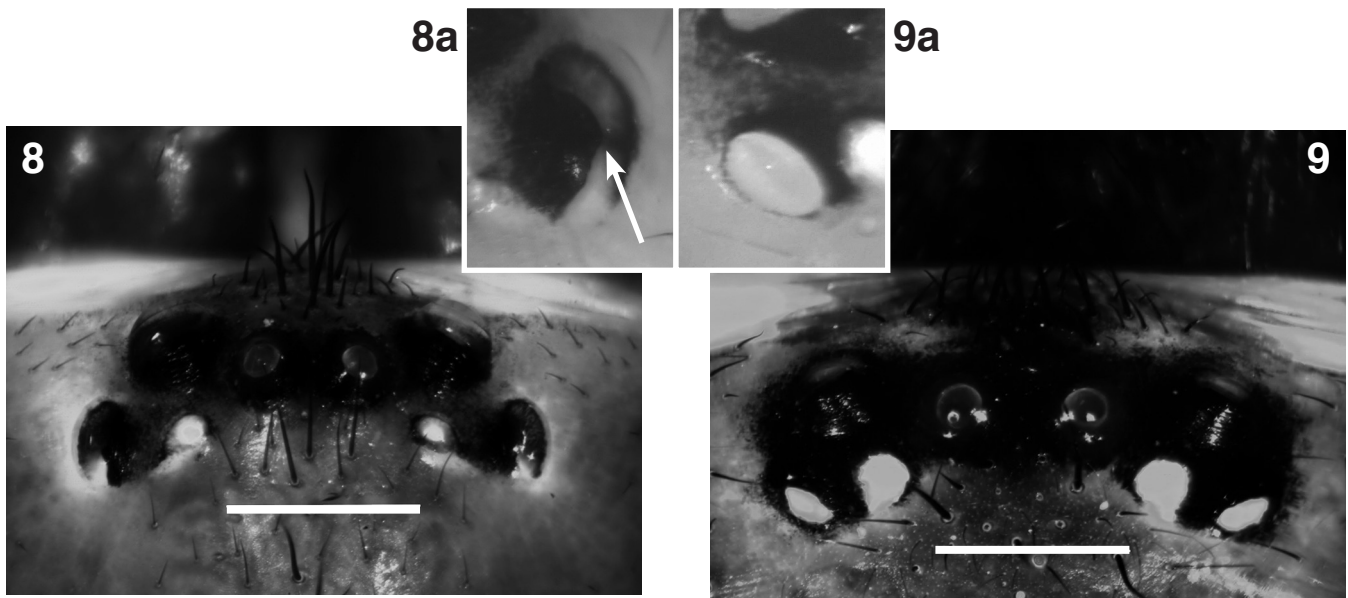
The strong morphological similarities between *Cyrtauchenius*, *Acontius*, *Ancylotrypa* and *Bolostromus* hint at a mutual relationship of these four genera within the family Cyrtaucheniiidae.

Amblyocarenum is tentatively thought to have its closest related genera within the African Nemesiidae.

The known distribution of *Cyrtauchenius* is restricted to northern Algeria (Fig. 1). The known distribution of *Amblyocarenum* partly overlaps with that of *Cyrtauchenius*, but is further extended into Spain, other Maghreb countries, Sicily, Sardinia, and southern Italy (Fig. 1).

Family	Character									
	1	2	3	4	5	6	7	8	9	10
Cyrtaucheniiidae	-	-	-	-	-	+/-	-	-	-	+
Nemesiidae	+	+	-	-	+	-	-	-	+	+
Ctenizidae	+	+	+	+	+	+	+	+	+/-	-

Table 2: The rows in this table give three unique combinations of ten macro-morphological characters that distinguish three Mediterranean trapdoor spider families: Cyrtaucheniiidae, Nemesiidae and Ctenizidae (+ indicates presence of character, - indicates absence of character). Characters: 1 = distinct ocular process, 2 = compact eye group, 3 = rastellar process, 4 = dense fields of short spines on the distal segments of the anterior appendages, 5 = short knob-shaped apical segments of PLS, 6 = centrally placed sternal sigilla, 7 = labial cuspules, 8 = row of teeth on both sides of the cheliceral furrow, 9 = clasper-hooks on prolateral tibia I in males, 10 = dense scopulae on distal segments of the anterior appendages of females.



Figs. 8–9: Eye formations. **8** *Cyrtauchenius*, note PR approx. 0. 25% longer than AR, inset **8a** shows centrally divided PLE; **9** *Amblyocarenum* sp., PR slightly longer than AR, inset **9a** shows undivided PLE. Scale lines = 1.0 mm.

Genus *Cyrtauchenius* Thorell, 1869

Cyrtocephalus Lucas, 1845 (type species *C. terricola*; *nomen nudum*; original designation; reported type location Djebel Mansourah, wilaya Constantine, NE Algeria).

Cyrtocephalus – Lucas 1846 (*C. terricola* n. sp.; description ♀; confusingly, and in conflict with his 1845 work, Lucas (1846) reported this species from Djebel Santa Cruz, wilaya Oran in NW Algeria).

Dolichoscaptus Simon, 1889 (regarding *Mygale gracilipes* (♂) and *Cyrtocephalus terricola* (♀), both Lucas, 1846, as conspecific type material; *M. gracilipes* reported from the region Oran, NW Algeria (Lucas 1846); pl. 1, fig. 2 in Lucas (1846) indicates *M. gracilipes* is indeed to be classified in the genus *Cyrtauchenius*).

Cyrtauchenius – Simon, 1892 (after recognition of Lucas’s original designation of *C. terricola* as type species for the genus; Thorell’s (1869) renaming of *Cyrtocephalus* on grounds of predisposition and *Dolichoscaptus* as a junior synonym of *Cyrtauchenius*).

Cyrtauchenius – Raven 1985 (correct redescription of the genus; erroneous conclusion to synonymize *Amblyocarenum* with *Cyrtauchenius* based on insufficient sampling and confusion in literature).

Diagnosis. North African cyrtaucheniid genus that differs from the only known sympatrically occurring “cyrtaucheniid” genus, *Amblyocarenum*, by having a more slender

general appearance (Figs. 2–5) and by the macro-morphological characters here described. Modified spigots with inflated dome-shaped bases in dense groups on all segments of the PLS and PMS (Fig. 6–6a). PLEs centrally sub-divided (Fig. 8–8a) in all females and most males observed (see Table 4). Eyes arranged in a strongly trapezoidal group (Fig. 8). PSS, large, vaguely outlined and placed sub-centrally partly between the more laterally placed MSS (Fig. 10). Short strong spines arranged in groups on the pro-lateral Pat. III and Tib. III (Fig. 12). Male palps elongated, particularly in the femur, patella and tibia (Fig. 14). Male palpal organ with embolus thin, flexible, curved and smoothly tapering to sharp tip, and diagonal oriented globular part (Fig. 16). Spermathecae small, delicate and complexly lobed with irregularly distributed ‘islands’ of glandular tissue (Fig. 18).

Description. Genus descriptions in literature (Simon 1892 and Raven 1985) are accurate; information given here is additional. Measurements: TBL in females 16.9–30.1 (n = 10), in males 11.4–14.1 (n = 8). Abdomen relatively long (Fig. 4) cocoon-shaped in females (mean TBL/CL = 3.1). Males (Fig. 2) have a somewhat shorter, more ovoid abdomen (mean TBL/CL = 2.4). CL females = 6.1–8.5 (n = 10). CL males = 4.0–6.2 (n = 10). PR is approximately 25% longer than AR both in females and males (female mean AR/PR = 0.75 (n = 10), male mean AR/PR = 0.77 (n = 10)). Maxillary cuspules are absent both in females and males. Spinnerets are well developed with the proximal segment of the PLS slightly longer than the median and distal segment together (Fig. 6).

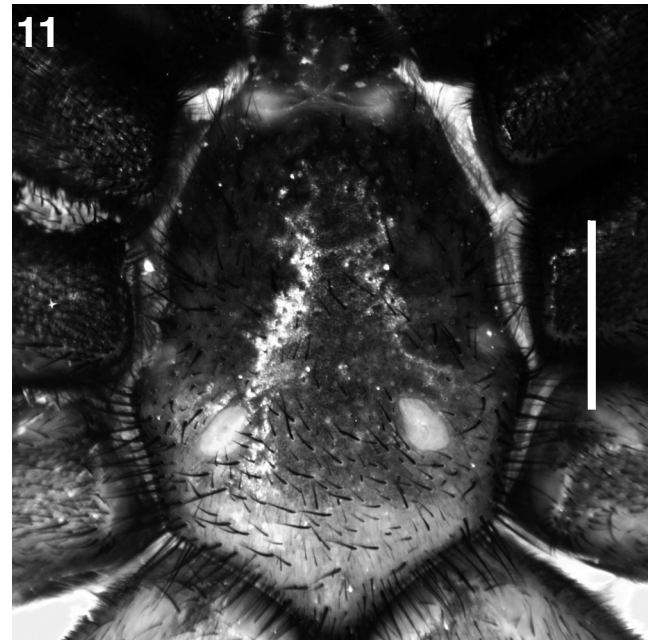
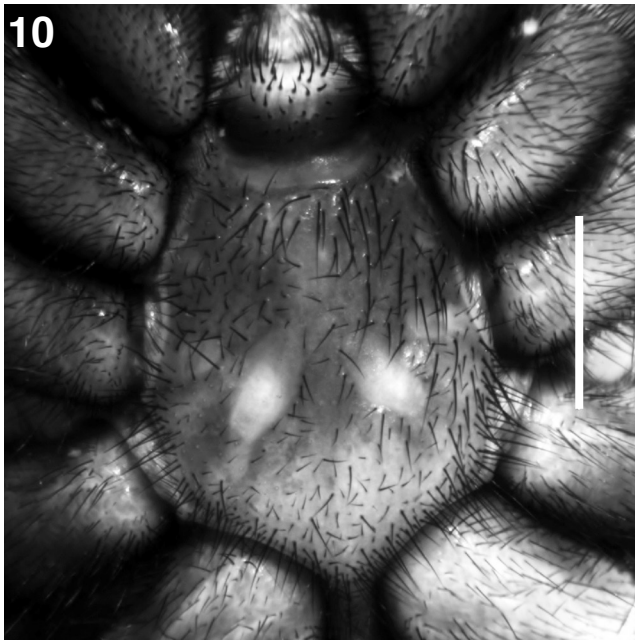
Genus *Amblyocarenum* Simon, 1892

Cyrtocephalus Lucas, 1845 (first reported as *C. mauretanicus*; *nomen nudum*; reported type location Djebel Santa-Cruz, wilaya Oran (Wahrān) Region NW Algeria).

Cyrtocephalus – Lucas 1846 (described and figured as *C. walckenaeri* n. sp. on the basis of a ♀ specimen confusingly, and in conflict with his 1845 work, Lucas (1846) reported this

Character	<i>Cyrtauchenius</i>	<i>Amblyocarenum</i>
Spigot base	inflated (Fig. 6a)	not inflated (Fig. 7a)
PLEs	subdivided (Fig. 8a)	undivided (Fig. 9a)
PSS	subcentral (Fig. 10)	sublateral (Fig. 11)
Pro-Patella III spines	in groups (Fig. 12)	in line (Fig. 13)
Male palp	elongated (Fig. 14)	not elongated (Fig. 15)
Embolus	slender/smooth (Fig. 16)	strong/ornamented (Fig. 17)
Spermathecae	small/complex (Fig. 18)	large/simple (Fig. 19)

Table 3: Summary of alternative character states for *Cyrtauchenius* and *Amblyocarenum*.



Figs. 10–11: Sternum shapes and sigilla patterns. **10** *Cyrtauchenius*, note relatively short sternum, PSS large, vaguely outlined and placed partly between MSS; **11** *Amblyocarenum* sp., note relatively long sternum, sharply outlined PSS placed behind MSS. Scale lines = 2.0 mm.

species from several locations: Mustapha-Supérieur and Camp de Kouba, both wilaya Alger NC Algeria, and from Koudiat-Ati and Mansourah, both wilaya Constantine in NE Algeria).

Cyrtauchenius Thorell, 1869 (replacement name based on predisposition; designation of *C. walckenaeri* as type species without examination of original type material; see below).

Cyrtauchenius – Ausserer 1871 (genus description and report of new species from southern Europe).

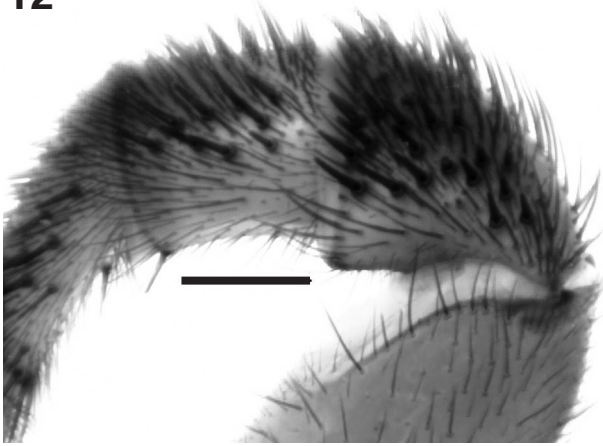
Cyrtauchenius – Simon 1889 (genus description).

Amblyocarenum Simon, 1892 (revision of Mediterranean *Cyrtauchenii*dae; designation of *A. walckenaeri* as type species).

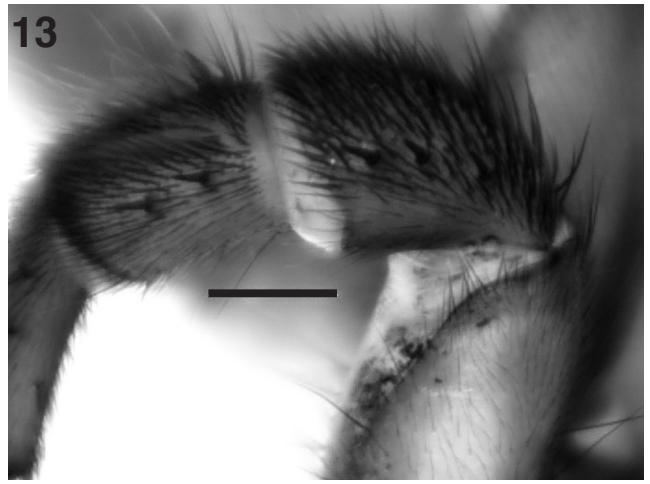
Status/Collection	Species Label	Sex	Character						
			1	2	3	4	5	6	7
New Coll.	<i>Amblyocarenum dolescalli</i>	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum dolescalli</i>	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum dolescalli</i>	♂	2	2	2	2	2	2	
New Coll.	<i>Amblyocarenum</i> n. sp. Calabria	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum</i> n. sp. Campania	♂	2	2	2	2	2	2	
New Coll.	<i>Amblyocarenum</i> n. sp. Sardinia	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum</i> n.sp.Sardinia	♂	2	2	2	2	2	2	
New Coll.	<i>Amblyocarenum similis</i>	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum similis</i>	♂	2	2	2	2	2	2	
Type Coll.	<i>Amblyocarenum walckenaeri</i>	♀	2	2	2	2			2
Type Coll.	<i>Amblyocarenum walckenaeri</i>	♀	2	2	2	2			2
Type Coll.	<i>Amblyocarenum walckenaeri</i>	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum walckenaeri</i>	♀	2	2	2	2			2
New Coll.	<i>Amblyocarenum walckenaeri</i>	♂	2	2	2	2	2	2	
Type Coll.	<i>Cyrtauchenius bicolor</i>	♀	1	1	1	1			1
Type Coll.	<i>Cyrtauchenius gracilipes</i>	♂	1	1	1	1	1	1	
Type Coll.	<i>Cyrtauchenius latastei</i>	♂	1	1	1	1	1	1	
Type Coll.	<i>Cyrtauchenius maculatus</i>	♀	1	1	1	1			1
Type Coll.	<i>Cyrtauchenius structor</i>	♀	1	1	1	1			1
Type Coll.	<i>Cyrtauchenius terricola</i>	♀	1	1	1	1			1
Type Coll.	<i>Cyrtauchenius vitatus</i>	♀	1	1	1	1			1
Type Coll.	<i>Cyrtauchenius</i> sp.	♂	1	1	1	1	1	1	
New Coll.	<i>Cyrtauchenius</i> sp.	♂	1	1	1	1	1	1	
New Coll.	<i>Cyrtauchenius</i> sp.	♂	1	1	1	1	1	1	

Table 4: *Cyrtauchenius* and *Amblyocarenum* characters as listed in Table 3 specified for individual specimen in their respective collections. Characters: 1 = spigot base (1 = inflated, 2 = not inflated); 2 = PLEs (1 = subdivided, 2 = undivided); 3 = PSS (1 = subcentral, 2 = sublateral); 4 = pro lateral Pat. III spines (1 = numerous in groups, 2 = few in line); 5 = male palp (1 = elongated, 2 = not elongated); 6 = embolus (1 = flexible and thread-like, 2 = stiff, finely ribbed and ornamented); 7 = receptacles (1 = minute and lobed, 2 = large single tubes).

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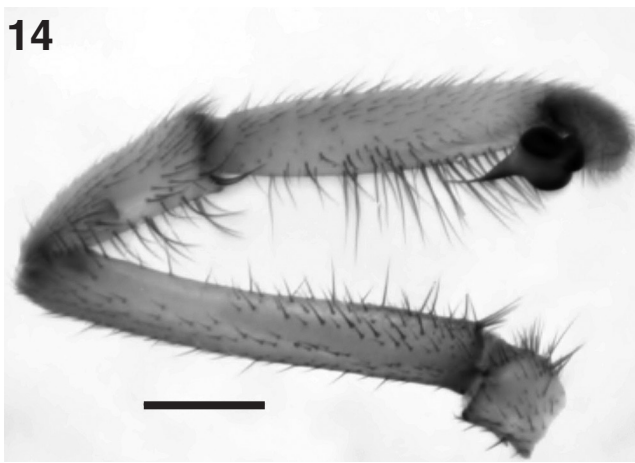


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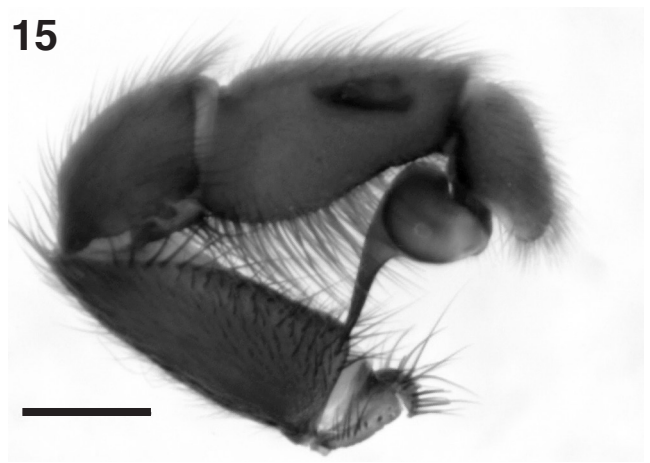


Figs. 12–13: Prolateral tibia III and patella III. **12** *Cyrtauchenius*, note groups of strong, short spines; **13** *Amblyocarenum*, note few strong, short spines in lines. Scale lines = 1.0 mm.

14



15



Figs. 14–15: Male palps, prolateral view. **14** *Cyrtauchenius*, note elongated femur, patella and tibia; **15** *Amblyocarenum*, note non-elongated segments. Scale lines = 1.0 mm.

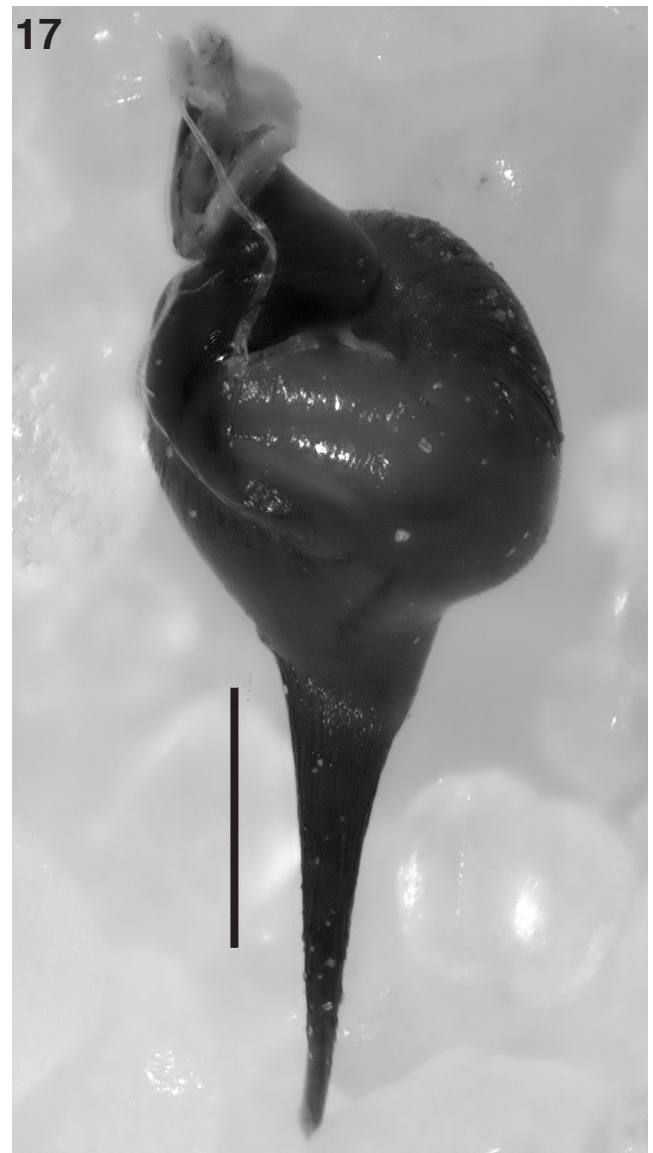
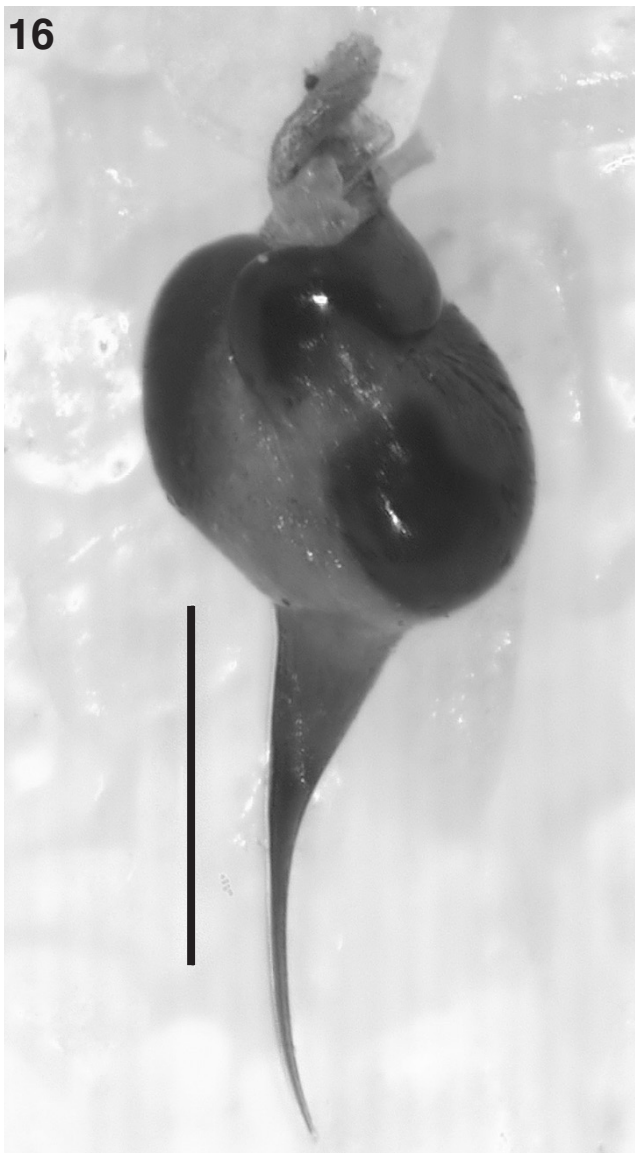
Diagnosis. Western Mediterranean genus that differs from the only known and partly sympatrically occurring cyrtaucheniid genus, *Cyrtauchenius*, by having a more robust and compact general appearance (Figs. 2–5) and by the macro-morphological characters here described. Fine spigots, without inflated bases and of different sizes are placed in compact groups on the ventral and distal parts of all segments of the PLS and on the PMS (Figs. 7–7a). Eyes are internally undivided and arranged in a slightly trapezoidal or rectangular group (Figs. 9–9a). PSS sharply outlined and placed sub-laterally caudally from MSS (Fig. 11). Few (2–4) short strong spines arranged in line on the pro-lateral Tib. III and Pat. III (Fig. 13). Male palps short

and compactly built (Fig. 15). Male palpal organ with embolus stout, stiff, blunt tipped and ornamented with ribs and tiny denticles and horizontal oriented globular part (Fig. 17). Spermathecae relatively large, robust, simple shape tubes evenly covered with fine glandular tissue (Fig. 19).

Description. Genus descriptions in literature (Ausserer 1871, Simon 1888, 1892) are accurate. Information given here is additional. Measures TBL in females 18.9–26.6 (n = 11), in males 11.4–21.2 (n = 23). The abdomen (Figs. 3, 5) is relatively short and ovoid in both sexes (mean TBL/CL = 2.9 in females, 2.4 in males). CL females = 6.0–9.8 (n = 11). CL males = 5.3–7.6 (n = 24). PR is approximately as long as AR both in females and males (female mean AR/

Genus	No. spp.	Character							
		1	2	3	4	5	6	7	8
<i>Amblyocarenum</i>	5	sh	≤ 2.0	≤ 1.97	≤ 0.32	≤ 0.27	≤ 3	≤ 4	-
<i>Cyrtauchenius</i>	5	el	≥ 2.5	> 1.97	≥ 0.35	≥ 0.27	≥ 5	≥ 7	+
<i>Acontius</i>	1	el	≥ 2.5	> 1.97	≥ 0.35	≥ 0.27	≥ 5	≥ 7	+/-
<i>Ancylotrypa</i>	3	el/dif	≥ 2.5	> 1.97	≥ 0.35	≥ 0.27	≥ 5	≥ 7	+/-
<i>Bolostromus</i>	1	el	≥ 2.5	> 1.97	≥ 0.35	≥ 0.27	≥ 5	≥ 7	+

Table 5: Morphometric and descriptive observations on the ambulatory system showing similarities and differences between *Cyrtauchenius* & *Amblyocarenum* and three non-Mediterranean cyrtaucheniid genera. No. spp. = number of species examined in each genus. Characters: 1 = male palp; sh = short (Fig. 3), el = elongated (fig. 2); dif = different; 2 = L/W ♂ PaTi; 3 = L/W ♀ PaTi; 4 = ♂ LPaTi/CL; 5 = ♀ LPaTi/CL; 6 = no. spines on prolateral Pat III in males; 7 = n. spines on prolateral Pat III in females; 8 = spine groups on tarsus IV. + = present, - = absent.



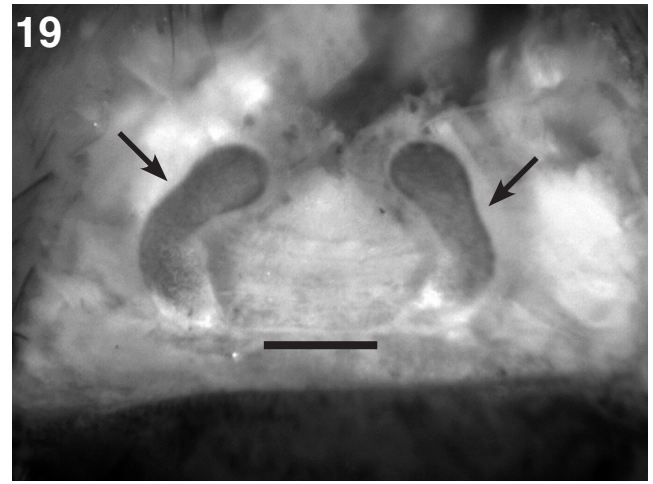
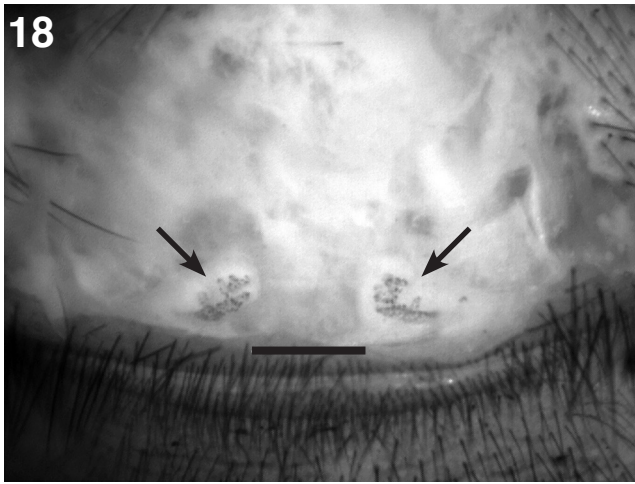
Figs. 16–17: Male papal organs (left) in ventral view. **16** *Cyrtauchenius*, note curved, smoothly tapering, sharp-tipped embolus and diagonal orientation of the globular part; **17** *Amblyocarenum*, note the stout, stiff, blunt-tipped embolus, ornamented with fine ribs and tiny denticles and the more horizontal-oriented globular part. Scale lines = 0.5 mm.

PR = 0.98 (n = 16), male mean AR/PR = 1.01 (n = 24)). The presence of a small group of cuspules on the proximal maxillae in most specimens, both females and males, is a further character to distinguish *Amblyocarenum* from *Cyrtauchenius*. Spinnerets are well developed with the proximal segment of the PLS more than twice as long as the median and distal segments together (Fig. 7).

Brief History of *Cyrtauchenius* Taxonomy

Problems with the classification of cyrtaucheniid trapdoor spiders arose from the very start of their discovery. Lucas (1845) published the first report on the existence of cyrtaucheniid trapdoor spiders, from a sample of specimens collected in Algeria. To distinguish these cyrtaucheniiids from earlier known ctenizids he erected the genus *Cyrtocephalus* (now *Cyrtauchenius* Thorell, 1869) and named two species without further description. *C. terricola* was denoted type species for the new genus and *C. mauretanicus* was regarded congeneric. However, Lucas (1845: 58) wrote

a very interesting footnote on *C. mauritanicus* (now *C. walckenaeri*), partly reproduced here: “C’est avec doute que je place cette espèce dans ce genre, elle pourrait bien servir de type à une autre nouvelle coupe générique ...”. In other words, Lucas was not sure if he had found one or two new cyrtaucheniid genera. This initial uncertainty about the identity of taxa still affects our modern understanding of cyrtaucheniid taxonomy. According to our present understanding, *C. terricola* and *C. walckenaeri* are both classified within the genus *Cyrtauchenius* and *C. terricola* is correctly indicated as type species for the genus in the WSC 14.5 (Platnick 2014). Six expert views, published over time, need to be considered in order to understand the present classification of the genus *Cyrtauchenius*. First, Lucas (1846) published detailed descriptions and accurate illustrations of both *C. terricola* and *C. walckenaeri* (in which *C. walckenaeri* was a replacement name for *C. mauritanicus* Lucas, 1845 used without further justification). Lucas (1846) did not reconfirm the type species status of *C. terricola* in his 1846 publication. Lucas’s original illustrations (1846, pl.



Figs. 18–19: Female spermathecae (arrow indications). **18** *Cyrtauchenius*, receptacles small, delicate, and complexly lobed with irregularly distributed islands of glandular tissue; **19** *Amblyocarenum*, receptacles relatively large, robust, and simple tubes, evenly covered with fine glandular tissue. Scale lines = 0.5 mm.

1, figs. 3–4) clearly show the difference in general appearance of *Cyrtauchenius* and *Amblyocarenum*, that is fully compatible with our findings discussed above, and also hint at the subdivision in the PLEs of the last genus (1846, pl. 1, fig. 4a). Second, Thorell (1869) replaced Lucas's genus *Cyrtocephalus* by *Cyrtauchenius* on grounds of predisposition. Thorell's name change is universally accepted and used in arachnological literature today (Platnick 2014). Thorell had apparently overlooked Lucas's (1845) appointment of *C. terricola* as type species for the genus and, confusingly, designated *C. walckenaeri* (Lucas, 1846) as type species for the genus *Cyrtauchenius*. Thorell apparently did so without examination of Lucas's original type material but, instead, studied a ctenizid (probably *Cyrtocarenum cunicularium*) from Corfu (Greece) as a 'model specimen' for the genus, thus indicating that his concept of *Cyrtauchenius* was not clear. Thorell's confusion, however, can be excused by the fact that Lucas himself was confused as well about cyrtaucheniid taxonomy, and had included a ctenizid (*Cyrtocarenum lapidarius* = *C. cunicularium* Decae, 1996) from Crete in his genus *Cyrtocephalus* (Lucas 1853). Third, Simon (1881), reporting on new collections of spiders from Algeria, described five new *Cyrtauchenius* species, thus significantly extending the known diversity of the genus. Fourth, Simon (1889) concluded that Lucas's decision to place *C. terricola* and *C. walckenaeri* in a single genus was untenable and that actually two different cyrtaucheniid genera existed in the western Mediterranean

Region. Erroneously following Thorell (1869), he regarded *C. walckenaeri* type species for the genus *Cyrtauchenius* and for all other species previously included in *Cyrtauchenius* he established the new genus *Dolichoscaptus* without appointing a type species for this genus (*C. terricola* is not listed in Simon 1889). He furthermore described six new species in *Dolichoscaptus*. Fifth, Simon (1892) rediscovered Lucas's (1845) original designation of *C. terricola* as type species for *Cyrtauchenius*. In consequence he correctly regarded his new genus *Dolichoscaptus* a junior synonym for *Cyrtauchenius* which in turn, obliged him to establish a new genus, *Amblyocarenum* Simon, 1892, to accommodate *C. walckenaeri*. Sixth, Raven (1985), in his landmark revision of mygalomorph taxonomy, apparently missed parts of the complex history outlined above. In his discussion of the taxonomical confusion surrounding the genera *Cyrtauchenius* and *Amblyocarenum* he concluded, "that Simon's concept of *Amblyocarenum* was based upon a misidentified type species." (Raven 1985: 129) On this argument, Raven re-synonymized *Amblyocarenum* with *Cyrtauchenius*, in effect restoring Lucas's unfortunate original decision to regard *C. terricola* and *C. walckenaeri* as con-generics. Based on newly collected material by one of the authors (RB) and a study of Simon's type collection in the MNHN we argue that Simon (1892) correctly erected *Amblyocarenum* (type species *A. walckenaeri*) as distinct from *Cyrtauchenius* (type species *C. terricola*).

Genus	No. spp.	Character							
		1	2	3	4	5	6	7	8
<i>Amblyocarenum</i>	5	≥ 1.9	≤ 0.52	tu	gr	kn	ser	stif	sin
<i>Cyrtauchenius</i>	5	< 1.9	≥ 0.59	inf	ab	ab	smo	flex	lob
<i>Acontius</i>	1	< 1.9	≥ 0.59	inf	gr	sp	smo	flex	lob
<i>Ancylotrypa</i>	3	< 1.9	≥ 0.59	inf/tu	gr	sp	smo	flex	lob
<i>Bolostromus</i>	1	< 1.9	≥ 0.59	inf	ln	sp	smo	flex	lob

Table 6: Morphometric and descriptive observations on the mouthparts (maxillae, labium, fangs), spigots, and sexual organs showing similarities and differences between *Cyrtauchenius*, *Amblyocarenum*, and three non-Mediterranean cyrtaucheniid genera. No. spp. = number of species examined in each genus. Characters: 1 = ratio ML/MW; 2 = ratio LL/LW; 3 = spigots, tu = with tubular base, inf = with inflated base; 4 = arrangements of maxillary cuspules, gr = in groups, ln = in line, ab = absent; 5 = type of maxillary cuspules, kn = knobby, sp = spiky, ab = absent; 6 = keel on fang, ser = serrated, smo = smooth; 7 = male embolus, stif = stiff, flex = flexible; 8 = female receptaculæ, sin = single tubes, lob = lobed tubes.

Discussion and Recommendations

Based on our conclusion the following taxonomical amendments to the WSC 14.5 are suggested:

- The genus *Amblyocarenum* Simon 1892 should be resurrected to contain: *A. walckenaeri* (Lucas, 1846) (type species by original designation), *A. doleschalli* (Ausserer, 1871) and *A. obscurus* (Ausserer, 1871).
- All twelve species formerly classified in the genus *Dolichoscapus* Simon, 1889, together with *C. longipalpus* Denis, 1945, should remain to be classified in the genus *Cyrtauchenius* Thorell, 1869.
- *C. talpa* Simon, 1891 should be regarded as a probably erroneous record (Raven 1985), best to be removed from the genus *Cyrtauchenius* and maybe tentatively allocated to a North American taxon.
- New sampling at the locations indicated below is necessary to resolve the conflicting information about the type location of *C. terricola* (Djebel Mansourah, NE Algeria in Lucas 1845 versus Djebel Santa Cruz, NW Algeria in Lucas 1846).
- The supposed occurrence of *Cyrtauchenius* in the eastern Mediterranean (Crete) appears to be based on misidentifications (Bosmans *et al.* 2013).

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