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Description of a new *Gibbaranea* (Araneae: Araneidae) from the Western Mediterranean

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Abstract. A new humped orb-weaver, *Gibbaranea bruuni* Lissner **spec. nov.**, is described from specimens collected in Majorca, Spain. The new species is most closely related to two other western Palaearctic species, *Gibbaranea gibbosa* (Walckenaer, 1802) and *Gibbaranea occidentalis* Wunderlich, 1989. *Araneus dromedarius cuculliger* Simon, 1909 (= *Gibbaranea bituberculata cuculliger*) is synonymized with *Gibbaranea bituberculata* (Walckenaer, 1802), **syn. nov.**

Keywords: Algeria, Araneinae, humped orb-weaver, Iberian Peninsula, Majorca, new synonymy, Portugal, Spain, taxonomy, Tunisia

Zusammenfassung. Beschreibung einer neuen *Gibbaranea*-Art aus der westlichen Mittelmeerregion (Araneae: Araneidae). Eine neue Höcker-Radnetzspinne, *Gibbaranea bruuni* Lissner **spec. nov.**, wird nach Exemplaren beschrieben, die auf Mallorca (Spanien) gesammelt wurden. Die neue Art ist nahe verwandt mit zwei anderen Arten der Westpaläarktis, *Gibbaranea gibbosa* (Walckenaer, 1802) und *Gibbaranea occidentalis* Wunderlich, 1989. *Araneus dromedarius cuculliger* Simon, 1909 (= *Gibbaranea bituberculata cuculliger*) wird mit *Gibbaranea bituberculata* (Walckenaer, 1802) synonymisiert (**syn. nov.**).

Gibbaranea Archer, 1951 is a small genus with ten species (World Spider Catalog 2016). The combined distribution of the species spans the Palaearctic ecozone from the Azores to Japan, extending well into the boreal zones. One species, *G. nanguosa* Yin & Gong, 1996, may extend into the Indomalayan ecozone at Hunan, China (Yin & Gong 1996). Three additional subspecies have been described from Europe and North Africa during 1870-1936 (World Spider Catalog 2016), however these subspecies are only known from the original collectors. In at least one of these subspecies the description was based on a specimen with aberrant colour markings as shown in this study.

Gibbaranea was separated from *Araneus* Clerck, 1757 by Archer (1951) as a fairly homogenous group of araneid spiders. Previous to that, the majority of the *Gibbaranea* species were grouped within the genus *Araneus* Clerck, 1757 for comfort of identification, as for example in the classic works on the European species (Locket & Millidge 1953, Simon 1929, Wiehle 1931). Simon (1929) operated with a group "No 14" consisting of *Gibbaranea* species, having *G. gibbosa* as the type species. Later Levi (1971, 1973, 1974a, 1974b, 1975, 1977a, 1977b) and Grasshoff (1968, 1976, 1983) reorganized the nomenclature and taxonomy of *Araneus*, based on the structure of the copulatory organs for the North American and Central European species, which is accepted by the rest of the world's authors. An excellent diagnosis of *Gibbaranea* was provided by Helsdingen (2010). All four members of this genus in Europe (Tenerife and the Azores excluded) are widely distributed, and therefore it was a surprise to discover a new species in Majorca. Further specimens of this new species have subsequently been identified among older material from Algeria, Tunisia, Portugal and mainland Spain extending the known distribution to northern Africa and the Iberian Peninsula. The aim of this paper is to describe this new species and briefly discuss its ecology and relationships.

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Abbreviations

TL = total length;
PL = prosoma length;
PW = prosoma width;
OL = opisthosoma length;
CJL = coll. Jørgen Lissner;
CRB = coll. Robert Bosmans.

Material and methods

Spiders were collected by shaking vegetation or beating bushes. Illustrations were created from photos of selected features using a Leica Wild M10 stereomicroscope fitted with Leica DFC425 digital camera connected to a computer with Leica Application Suite software v. 4.3.0, Zerene Stacker software v. 1.04 and the vector graphics editor Inkscape v. 0.48.

Results

***Gibbaranea bruuni* Lissner spec. nov.** Figs 1-8

The species described here is assigned to *Gibbaranea*, based on the presence of the following characters: one pair of laterodorsal tubercles anteriorly on abdomen; a narrow, pale longitudinal dorsal band in front of tubercles; median eyes of the two rows placed in a quadrangle; posterior median eyes larger than anterior medians; all femora of males with blackish apical half in front legs, only apical third in hind legs, blackish area shorter in females; males with a distinct posterior-apical

Fig. 1: *Gibbaranea bruuni* Lissner spec. nov., male

Fig. 2: *Gibbaranea bruuni* Lissner spec. nov., female

tooth on coxa I and femora I with two rows of ventral spines; leg II of male most heavily spined of all legs; tibia II shorter and slightly thicker than tibia I and with two rows of long and thick ventral to prolateral spines in the apical two-thirds; maxillae with a basal external tooth; male palpal femur with a swelling ventrally and prolaterally; cymbium not spinose, narrow and with straight edges in dorsal view; median apophysis in the male palp in transverse position possessing a narrow spur at proximal end, dilated and blunt at tip; epigyne with short scapus and of similar build as in congeners.

Etymology. The species is named in honour of the outstanding arachnologist, friend and mentor of the first author, Lars Bruun.

Type material. Holotype ♂: SPAIN: Majorca: Gorg Blau, beaten from bushes in open coniferous forest adjoining the reservoir (N39°48'3.5", E2°48'44.5"), 615 m, 29.X.2014 (specimen matured in captivity), leg. Lissner (CJL-10073). Paratypes: subadult ♂, same as holotype, 29.X.2014, 8♂♂ 2♀♀, 7.X.2015 (all matured in captivity), leg. Lissner (CJL-11026). Holotype and paratypes are deposited at the Zoological Museum of Copenhagen.

Other material examined. SPAIN: Majorca: Puig Randa, mixed forest, beaten from branches (N39°31'27.8", E2°55'5"), 380 m, 1♂, 27.X.2014 and 1♂ 5♀♀, 8.IV.2016 (most specimens matured in captivity), leg. Lissner (CJL-10074). Majorca: Cuber, track along reservoir towards Coll de l'Ofre (N39°46'11", E2°46' 5"), 815 m, 1♂, 4.IV.2014 (matured in captivity), leg. Lissner (CJL-1151). Majorca: Gorg Blau, 3♂♂ 1♀, beaten from bushes in open coniferous forest adjoining the reservoir (N39°48'3.5", E2°48'44.5"), 615 m, 7.IV.2016 (specimen matured in captivity). Cadiz: Tarifa, (N36°0'53" W5°35'18"), 60m, 2♀♀, IV.1992, leg. P. Poot (CRB). PORTUGAL: Beja: Villa Nova de Milfontes, Rio Mira, on bushes bordering salt marsh (N37°35'54"W8°49'5"), 5m, 2 ♀♀, 16.IV.2013, leg. Bosmans (CRB). ALGERIA: El Tarf: El Kala, Lake Tonga, beating branches in *Quercus suber* forest (N36°52'35" E8°29'28"), 5 m, 1♂, 23.XI.1989, leg. Bosmans (CRB). Tipaza: Zeralda, beating branches of *Pistacia lentisca* in coastal dunes (N36°42'53"E2°50'36"), 10 m, 4♀♀, 25.IV.1987, leg. Bosmans (CRB). TUNISIA: Jendouba: Ras Rajel, beating branches in *Quercus suber* forest (N36°59'9" E 8°51'40"), 200 m, 1♂, 8.V.2006, leg. Bosmans (CRB). *Gibbaranea gibbosa*: SPAIN: Majorca: Gorg Blau, 1♂, beaten from bushes in open coniferous forest adjoining the reservoir (N39°48'3.5", E2°48'44.5"), 615 m, 29.X.2014 (specimen matured in captivity), leg. Lissner (CJL-10072). ALGERIA: Blida: Meurdja, beating in *Cedrus* forest (N36°29'59" E3°8'54"), 1050 m, 1♀, 20.IV.1988, leg. Bosmans (CRB); Bouira, Massif du Djurdjura, Tala Rana, beating in *Cedrus* forest (N36°25'46" E4°13'57"), 1400m, 2♂♂ 1♀, 1.VI.1988, leg. Bosmans (CRB); Tissemsilt, Massif de l'Ouarsenis, beating in *Cedrus* forest (N35°52'15", E1°56'41"), 1550 m, 1♂, 19.IV.1988, 1♀, 13.V.1988, 1♀, 1.VI.1988, leg. Bosmans (CRB). *Gibbaranea occidentalis*: PORTUGAL: Azores: Terceira, Terra Brava (N38°44'7", W27°12'7"), 650 m, 6♂♂ 5♀♀, 4 juv., VI.2012, leg. Paulo Borges (CJL-11309-11311).

Diagnosis

The species is separated from congeners by the genitalia being distinctive in both sexes. Males are most easily separated by the shape of the median apophysis. The epigynes of *G. bruuni* and *G. occidentalis* are quite similar, but the females of the two species do not overlap in size or in distribution, the much larger *G. occidentalis* being endemic to the Azores.

Description

Male

Measurements (n=14, average value with range in parenthesis)**.** TL: 3.4 (2.6-4.2), PL: 1.8 (1.4-2.0), PW: 1.4 (1.1-1.6).

Colour. A well-camouflaged species, habitus of live specimen as in Fig. 1. Carapace dark brown, rather densely covered with light brown and whitish hairs, particularly in cephalic region (Fig. 1). Chelicerae yellow with grey reticulations on anterior surface. Sternum with dark reticulations. Abdomen with dark brown folium and dark spots in anterior part (Figs 1, 4b). Areas to the sides of the folium also brownish, only the median line reaching the fore margin of the abdomen is cream or whitish (white in alcohol conserved specimens). Area between epigastric furrow and spinnerets black. With dense co-

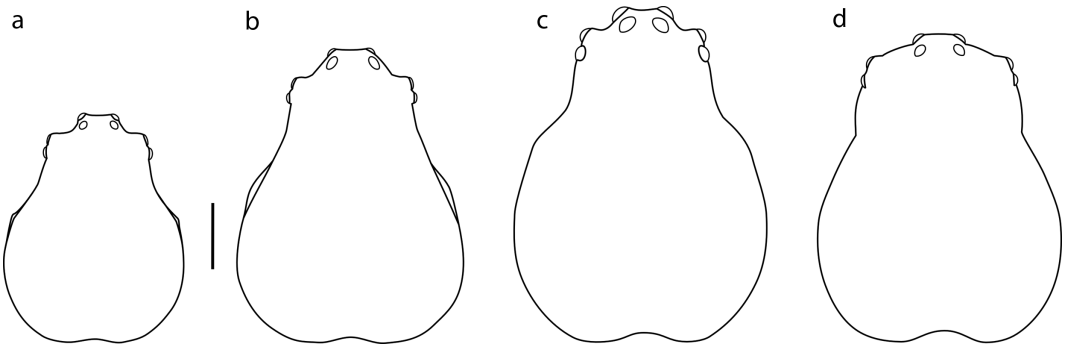

Fig. 3: Outline of prosomas of *Gibbaranea* species: **a.** *G. bruuni* Lissner spec. nov. male from Majorca; **b.** *G. gibbosa* (Walckenaer, 1802), male from Majorca; **c.** *G. occidentalis* Wunderlich, 1989, male from the Azores; **d.** *G. bruuni* Lissner spec. nov., female from Majorca. Only lenses of eyes drawn, sockets omitted.
Scale bar 0.5 mm

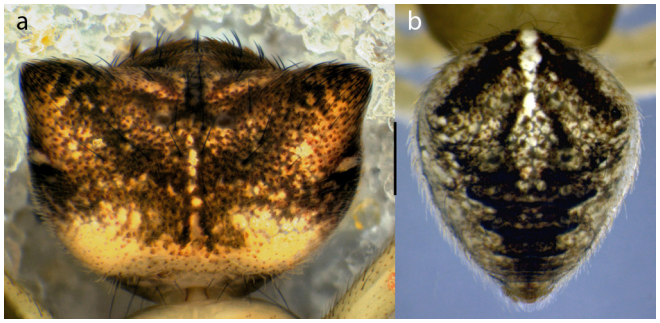

Fig. 4: *Gibbaranea bruuni* Lissner spec. nov., alcohol conserved specimens: **a.** female abdomen in anterior view; **b.** male abdomen in dorsal view. Scale bar 0.5 mm

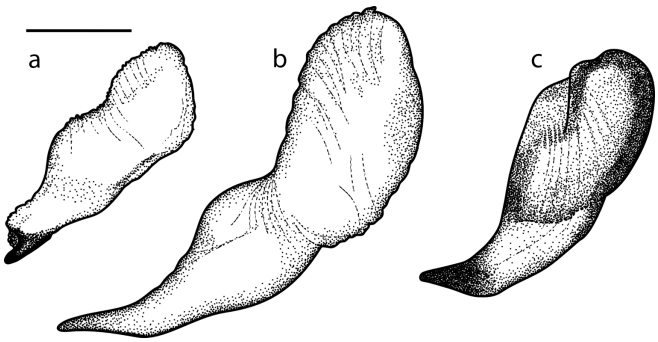

Fig. 5: Median palpal apophysis: **a.** of *Gibbaranea bruuni* spec. nov.; **b.** *G. gibbosa*; **c.** *G. occidentalis*. Scale bar 0.1 mm

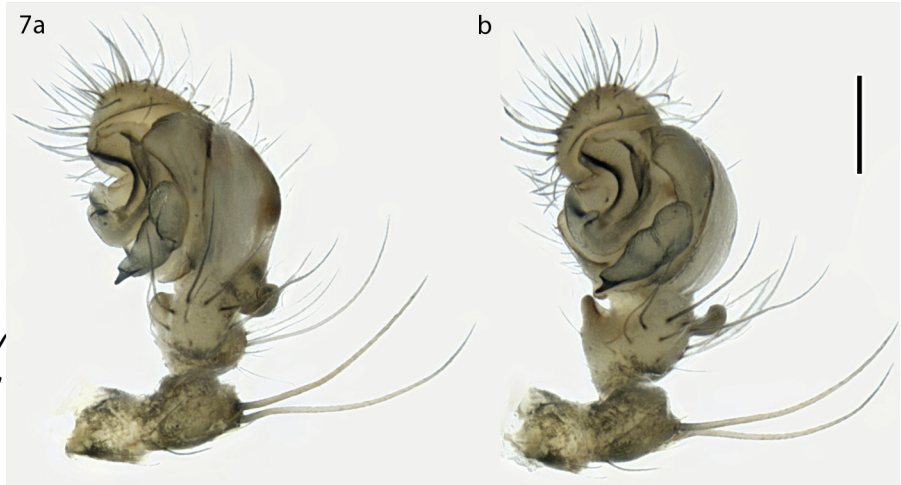

Fig. 6: Palp of *G. bruuni* Lissner spec. nov. in ventral view. Scale bar 0.2 mm **Fig. 7:** *Gibbaranea bruuni* Lissner spec. nov., male palp: **a.** retrolateral view; **b.** ventral view. Scale bar 0.2 mm

verage of hairs of same colour as carapace. Trochanters and basal half of femora pale, remaining leg parts annulated with dark brown as in Fig. 1. The many strong spines vary in colour, some whitish with brown bases, some entirely dark, and some dark with pale median part.

Eyes. Median eyes projecting and forming a quadrangle as seen in frontal view (Figs 3a, 3d). All eyes ringed with black, posterior medians with much wider encircling, thus appearing larger than anterior medians (Fig. 3a). Measurements of eyes relate here only to the diameter of lenses or distances between them: anterior median eyes separated by 0.18 (2.4 times the diameter of an anterior median eye), posterior medians separated by 0.16, anterior medians separated by 0.13 from posterior medians. Sockets of anterior and posterior lateral eyes are contiguous, lenses separated by 0.065. Lens diameter of an anterior median eye 0.075, posterior median eye 0.091, anterior lateral eye 0.066 and posterior lateral eye 0.073.

Prosoma. Clypeus as high as the width of an anterior median eye. The lateral edges of carapace rather sharply bent at about midway between the eyes and rear edge (Fig. 3a). Maxillae with a basal external rounded tooth projecting retrolaterally. Cheliceral promargin with four large teeth, three form a group positioned opposite mid position of fang, and a fourth projecting ca. 45° forward, situated near basal position of fang. Cheliceral retromargin with three smaller teeth.

Legs. Coxa I with distinct posterior-apical tooth or hook. All legs with strong spines, tibia II most heavily spined of all segments. Leg formula I-II-IV-III.

Abdomen. Abdominal humps weakly developed (Fig. 4b).

Male palp. Patella of male palp with two strong dorsal spines (Fig. 5c). Paracymbium with distinct hook, gradually bent (Figs 6, 7b). Median apophysis of the male palp transverse with blackish endal spur abruptly narrowed near tip and with a blunt ectal end (Figs 5a, 7b). Conductor spoon-like, narrowed and smoothly bent near tip (Fig.7a). Terminal apophysis barely with dark sclerotization.

Female

Measurements (n=11, average value with range in parenthesis)**.** TL: 4.1 (3.6-4.8), PL: 2.1 (1.9-2.3), PW: 1.8 (1.5-1.9).

Colour (Fig. 2)**.** In drab colours as male and with similar co-

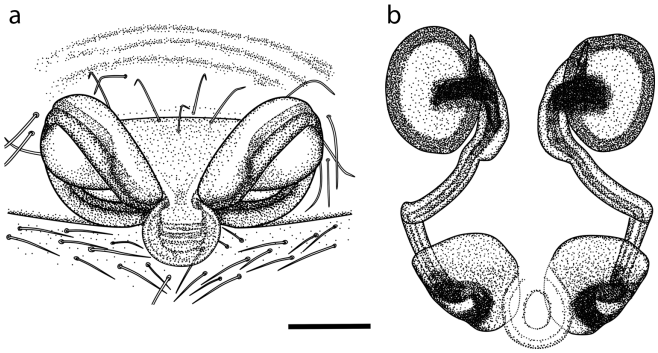

Fig. 8: *Gibbaranea bruuni* Lissner spec. nov., epigyne: **a.** ventral view; **b.** vulva in dorsal/posterior view. Scale bar 0.1 mm

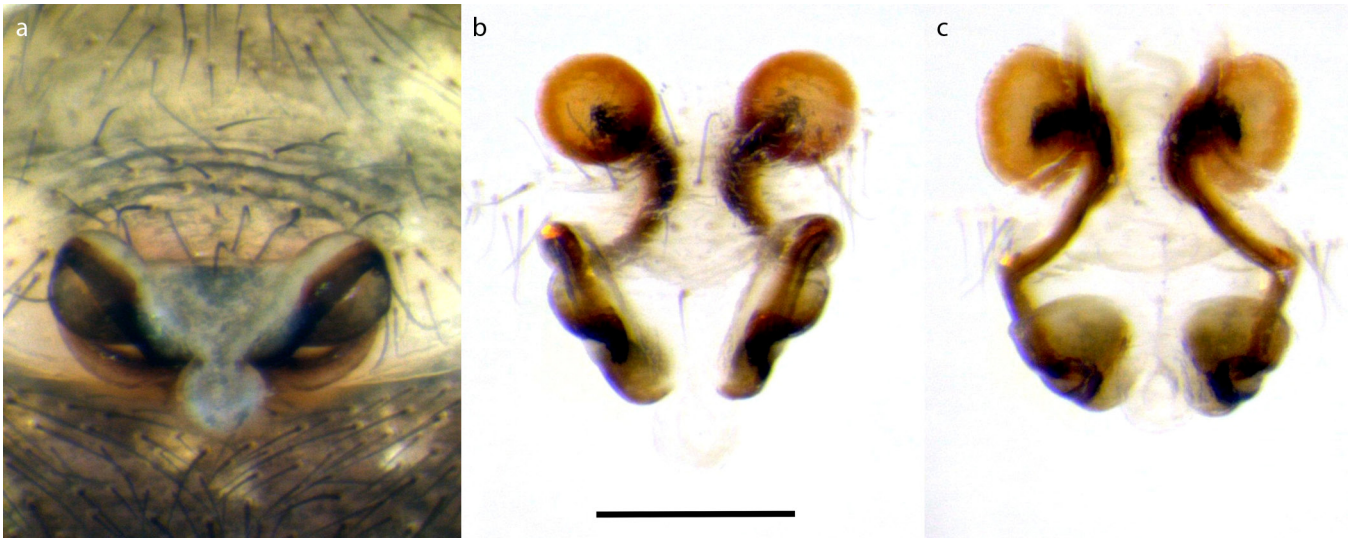

Fig. 9: *Gibbaranea bruuni* Lissner spec. nov.: **a.** epigyne in ventral view; **b.** detached epigyne in ventral-slightly anterior view showing underlying vulva; **c.** vulva in dorsal-posterior view for maximum visibility of structures. Scale bar 0.2 mm

lour of pubescence. Dark annulations of femora I and II less prominent, only apical quarter of segments are dark brown. Chelicerae and sternum coloured as in male. Abdomen with folium. One female out of eleven collected in Majorca has different abdominal markings, possessing a dark triangle spanning the width of the dorsum in area of humps. Females from Tunisia and Portugal have prosoma grey brown, cephalic part with triangular whitish spot, abdomen at level of humps with triangular grey to nearly black spot with median white stripe in anterior part, posterior part white with minute brown speckles contrasting abruptly with grey brown venter.

Eyes. Quadrangle of median eyes situated on a less projecting prominence compared to the male. Eyes of the same size as in male, but spaced more apart due to a wider head in the female. Measurements: anterior median eyes separated by 0.23 (3.1 times the diameter of an anterior median eye), posterior medians separated by 0.22, anterior medians separated by 0.15 from posterior medians. Sockets of anterior and posterior lateral eyes contiguous, lenses separated by 0.075. Lens diameter of an anterior median eye 0.075, posterior median eye 0.091, anterior lateral eye 0.075 and posterior lateral eye 0.077.

Prosoma. Clypeus 1½ times higher as the width of an anterior median eye. Lateral edges of carapace smoothly narrowed with protruding sides of head convex (Fig. 3d). Cheliceral promargin with four large, equally spaced teeth, retromargin with three smaller teeth as in male.

Legs. As in male but with tooth on coxa I lacking and spination of tibia II not much different from that of other tibiae.

Abdomen. Humps of female much more pronounced than in male (compare Figs 2, 4a, with figs 1, 4b).

Epigyne/vulva. with central structure looping around lateral bulb-like structures all the way to the posterior margin of the epigyne, almost to join opposite loop (Figs 8a, 9a, 9b). Scape circular in ventral view. Ducts of vulva form mirrored "S" (Figs 8b, 9c). Spermathecae circular, separated by slightly less their diameter (Figs 9b, 9c).

Fig. 10: *Gibbaranea occidentalis* Wunderlich, 1989, female from Azores. The carapace has a conspicuously dark triangular marking. Abdominal humps vary in size but are generally rather small in this species (photo courtesy of Paulo A. V. Borges)

Discussion

This is the smallest member of the genus with measured males and females not exceeding 4.2 and 4.8 mm respectively. The species does not overlap in size with any congeners, except males of *G. occidentalis* (TL: 3.2-5.5 according to data in Wunderlich 1989). Measurement data is based mainly on Majorcan specimens, and the size-ranges presented here may not extrapolate to all populations throughout the distributional range of the species. The species resembles *G. gibbosa* with which it may co-occur, but possesses no green markings. The green colours of *G. gibbosa* may be striking in live specimens, but fades in alcohol with time. Southern European specimens of *G. gibbosa* are generally much less greenish than Northern European ones. Accordingly, the Majorcan specimen of *G. gibbosa* has only a green median spot at the anterior border of the abdomen. In *G. bruuni* there is a fairly thin midline in this place, white or cream in all live specimens inspected. A complete lack of green colours may be distinctive for *G. bruuni* and allow separation from *G. gibbosa* in the field. The shape of the male prosoma as seen in dorsal view also differs between the two species. The lateral margin is rather abruptly narrowed in *G. bruuni*,

while tapering smoothly in *G. gibbosa*, and the head is not approximately parallel-sided as in *G. occidentalis*. Abdominal humps as in congeners, largest in females, but with base of humps in non-gravid females less clearly delineated from the abdomen compared to *G. gibbosa* and humps are not directed upwards, but to the side as in *G. bituberculata*. Size and direction of the humps may be different in gravid females. The palp is highly distinctive, particularly the wedge-shaped median apophysis terminating in a blackish spur and with edges undulating (Fig. 5a). The ectal end is blunt in all three species: *G. bruuni*, *G. gibbosa* and *G. occidentalis* (Fig. 5). Paracymbium with distinct hook as in *G. gibbosa*, but more gradually bent. The marginal sclerotized coil of the epigyne is parallel-sided and not widened anteriorly as in *G. gibbosa* (compare Fig. 8a with Fig. 168g in Almquist 2005). The scapus of *G. bruuni* is roughly as long as wide in ventral view, not longer than wide as in *G. occidentalis*, and the spermathecae are situated further apart (compare Figs 8a, 8b with Figs 6, 9 in Wunderlich (1989). Otherwise the epigynes appear very similar in ventral view, that of *G. occidentalis* only slightly larger than that of *G. bruuni* even though the overall size of females differs considerably between these species.

The new species is assumed to be closest to *G. gibbosa* and *G. occidentalis*, based on a similar build of the male palp and epigyne as illustrated by Roberts (1995) and Wunderlich (1989). *G. bruuni* seems to possess relatively little variability in colouration compared to the huge variability in *G. occidentalis*, the markings of the latter species also highly variable among specimens captured at the same locality (Figs 10-11).

Habitat and phenology. In Majorca specimens were beaten from bushes and lower branches of conifers in fairly shaded areas at 380-815 m a.s.l. At Cuber and Gorg Blau it is particularly common in dense stands of thorny, unpalatable shrubs in grazed, open forest. At Gorg Blau it co-occurred with *G. gibbosa*, at Puig Randa with *G. bituberculata*. Subadults were collected in late October and performed their final moult in captivity from late November – early January (males generally earlier than females). In the field males have been encountered in October, April and May and females in April. Subadults of both sexes collected in April matured later in April or in May. In Algeria, one adult male was captured in October, in Tunisia one adult male in May. Adult females were captured in April in Algeria and Portugal. In North Africa, *Gibbaranea bruuni* was only captured at low altitude, from sea level to 200 m, while *G. gibbosa* was only found in forests above 1000 m.
Distribution. Algeria, Portugal, Spain (Majorca, Cadiz), Tunisia.

New synonymy
Gibbaranea bituberculata (Walckenaer, 1802)
Araneus dromedarius cuculliger Simon, 1909 **syn. nov.**

Type material
Holotype ♀ MOROCCO: Essaouira (Mogador), MNHNP Coll. Simon 6366; examined.

Comments
Simon (1909) described *Araneus dromedarius cuculliger* Simon, 1909 from Morocco. In the World Spider Catalog (2016) it is mentioned as *Gibbaranea bituberculata cuculliger*. The holotype was examined in order to test its validity and there appears to be no difference between the epigynes of the nominal species and the subspecies. It is just a colour variation and *G. bituberculata cuculliger* is declared here a junior synonym of the nominal species.

Fig. 11: *Gibbaranea occidentalis* Wunderlich, 1989 (Azores), examples of variation in abdominal colour markings (alcohol conserved specimens): **a.** female; **b.**, **d.** subadult females; **c.** male. Scale bar 1 mm

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