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Linyphiidae (Araneae) inhabiting hollow oaks in Mediterranean forests: new descriptions and temporal distribution of remarkable species

José A. Barrientos, Jesús Hernández-Corral & Estefanía Micó

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Abstract. Hollows in mature trees provide a variety of habitats for high species richness and diversity of different arthropod groups. The scarcity of samplings carried out in tree hollows, especially on spiders and on mature oaks, predict the existence of taxonomic novelties in these rich microenvironments. A total of 18 Linyphiidae species, including one species new to science, were sampled with 49 tree hollow emergence traps set in deciduous *Quercus* forests in the Western Iberian Peninsula. Both sexes of *Scotinotylus vettonicus* Barrientos & Hernández-Corral **sp. nov.** and the female of the endemic Iberian *Pelecopsis monsantensis* Bosmans & Crespo, 2010 are described and both sexes of these two species and of *Centromerus succinus* (Simon, 1884) are illustrated. In addition, the spatial and temporal distribution of *P. monsantensis*, *C. succinus*, *Midia midas* (Simon, 1884) and *Lepthyphantes minutus* (Blackwall, 1833) is figured. Furthermore, the checklist of Linyphiidae species recorded in Salamanca province (Spain) is updated to a total of 40 species, representing 13% of all the linyphiids occurring in the Iberian Peninsula.

Keywords: emergence trap, endemism, new species, *Quercus pyrenaica,* taxonomy, Spain, spiders, tree hollows

Zusammenfassung. Linyphiidae (Araneae) in Baumhöhlen in mediterranen Eichenwäldern: Neubeschreibungen und Phänologie bemerkenswerter Arten. Höhlen in alten Bäumen bieten Habitate für eine hohe Artenvielfalt und für verschiedene taxonomische Gruppen. Dass nur selten in Baumhöhlen gesammelt wird, insbesondere Spinnen in alten Eichen, lässt taxonomische Neuheiten in diesem Mikrohabitat erwarten. Insgesamt wurde mit 49 Baumhöhlen-Emergenzfallen in Eichenwälder im Westen der Iberischen Halbinsel 18 Linyphiidenarten gefangen, eine davon neu für die Wissenschaft. Beide Geschlechter von *Scotinotylus vettonicus* Barrientos & Hernández-Corral **sp. nov.** und das Weibchen des iberischen Endemiten *Pelecopsis monsantensis* Bosmans & Crespo, 2010 werden beschrieben und beide Geschlechter dieser beiden Arten und von *Centromerus succinus* (Simon, 1884) werden abgebildet. Die Verbreitung und die Phänologie von *P. monsantensis*, *C. succinus*, *Midia midas* (Simon, 1884) und *Lepthyphantes minutus* (Blackwall, 1833) werden dargestellt. Darüber hinaus wird die Checkliste der Linyphiidae der Provinz Salamanca (Spanien) aktualisiert und umfasst nun 40 Arten, was 13 % der Linyphiidenarten der Iberischen Halbinsel ausmacht.

Resumen. Linyphiidae (Araneae) en oquedades de roble en un bosque Mediterráneo: nuevas descripciones y distribución temporal de especies notables. Las oquedades en árboles maduros proporcionan una variedad de hábitats para una alta riqueza de especies y diversidad de diferentes grupos de artrópodos. La escasez de muestreos llevados a cabo en oquedades, especialmente sobre arañas y en robles maduros, hace prever la existencia de novedades taxonómicas en estos ricos microambientes. Un total de 18 especies de Linyphiidae, incluida una especie nueva para la ciencia, fueron colectadas utilizando 49 trampas de emergencia en oquedades de bosques caducifolios de *Quercus* en el Oeste de la Península Ibérica. Se describen ambos sexos de *Scotinotylus vettonicus* Barrientos & Hernández-Corral **sp. nov.** y la hembra del endemismo ibérico *Pelecopsis monsantensis* Bosmans & Crespo, 2010, y se ilustran ambos sexos de estas dos especies y de *Centromerus succinus* (Simon, 1884). Además, se representa la distribución espacial y temporal de *P. monsantensis, C. succinus*, *Midia midas* (Simon, 1884) y *Lepthyphantes minutus* (Blackwall, 1833). Además, se actualiza la lista de especies de Linyphiidae presentes en la provincia de Salamanca (España) a un total de 40 especies, lo que representa el 13% de todos los linífidos citados en la Peninsula Ibérica.

Tree hollows have been considered a key habitat for saproxylic fauna in European forests (Micó et al. 2011, 2013) and Araneae form an important part of the tree hollow communities (Martínez de Murguía et al. 2007, Machač et al. 2018). The family Linyphiidae represents the second of the most globally diverse spider families (World Spider Catalog 2020). In Europe, countries such as France, Italy, Austria, Germany and Switzerland have the highest linyphiid diversity (Nentwig et al. 2020). 302 linyphiid spider species have been cited from the Iberian Peninsula (Branco et al. 2019), a number substantially lower than those of neighbouring countries despite having a much larger area than most of them, which could indicate that linyphiids are probably insufficiently sampled in Spain.

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Several known species of linyphiids are strictly bound to the bark of trees (Szinetár & Horváth 2005) and have been recorded by different researchers from European forests (Szinetár & Horváth 2005, Blick 2011, Machač & Tuf 2016). However, our current knowledge on spiders living on tree trunks is still limited to the bark and very little is known about the spiders inhabiting tree hollows as a consequence of the lack of sampling in this particular microhabitat. Thus, it remains unknown how many more species are specialised in living both on tree bark and in tree hollows. In addition, according to Szinetár & Horváth (2005), *Quercus robur* L. was the only species of Central European *Quercus* for which data on its araneofauna is available. Any information on spiders inhabiting other *Quercus* species is missing.

Linyphiidae has been recognised as the richest Araneae family of tree hollows. Linyphiidae are known to disperse by ballooning due to their small size and low weight, which allows them to become rapidly distributed over available habitats to avoid competition (Tolbert 1977). Both immature and adult male and female linyphiids can travel in this way (Vugts & Van Wingerden 1976), therefore the availability of mature trees can affect the temporal and spatial dynamics of linyphiids depending on tree bark and/or tree hollows (Lindenmayer et al. 2012, Machač & Tuf 2016).

The general aim of the present study is to provide extensive research on the Linyphiidae fauna from tree hollows of mature *Q. pyrenaica* Willd. in western Spain using tree hollow emergence traps. We also aim to analyse the temporal distribution of some remarkable species, differentiating between sexes and immature activity periods. In addition, we update the checklist of linyphiid spiders for Salamanca province, Western Spain.

Due to the novelty of the study of spiders in the cavities of *Q. pyrenaica* and to the scarcity of whole year sampling studies, a considerable increase of the knowledge of the biology, phenology and distribution of Linyphiidae is expected.

Material and methods

Sampling was conducted in the El Rebollar Natural Area (Agallas, La Genestosa, Dehesa de Perosín, Villarrubias) (henceforth El Rebollar) and Sierra de las Quilamas Natural Area (La Bastida, El Cabaco) (henceforth Sierra de las Quilamas) in Western Spain (Tab. 1). These are mature ecosystems of extensive *Quercus pyrenaica* forest. The average altitude is close to 1000 m (Tab. 1). The climate is continental Mediterranean with an Atlantic influence. The average annual rainfall is approximately 563 mm, with summer aridity being the most important climatological factor.

Fig. 1: Tree hollow emergence trap (ET) (Photo J. Ordoñez)

Sampling was conducted using tree hollow emergence traps (Fig. 1), all of which were placed in the cavities of living *Quercus pyrenaica* trees. A total of 48 emergence traps was set over two consecutive periods of one year each: 27 traps were set in Sierra de las Quilamas from April 2012 to April 2013, and 21 traps were set in El Rebollar and Sierra de las Quilamas from April 2014 to April 2015. Samples were collected monthly. In the analysis of phenology of the species discussed, the specimens were assigned to the month in which the trap was working for a higher number of days.

Tab. 1: Coordinates and altitude of the sampled localities in Salamanca province, Spain

Natural Area	Locality	Latitude	Longitude	m a.s.l.
El Rebollar	Agallas	40.39397°N	6.43205°W	1085
El Rebollar	La Genestosa	40.34981°N	6.77932°W	891
El Rebollar	Dehesa de Perosín	40.28122°N	6.67871°W	883
El Rebollar	Villarrubias	40.32508°N	6.62715°W	879
Sierra de las Quilamas	La Bastida	40.59428°N	6.05315°W	1192
Sierra de las Quilamas	El Cabaco	40.56547°N	6.13390°W	972

Species identification. All collected specimens were labelled and transferred to 70% ethanol. Spiders were identified using classic literature (Simon 1914-1937, Locket & Millidge 1951, 1953, Locket et al. 1974, Roberts 1985, 1987, 1995, Nentwig et al. 2020). For preparing the drawings, an ocular reticulum has been used. The shading of figures indicates their texture and degree of pigmentation. The nomenclature follows the World Spider Catalog (2020). All measurements are provided in millimetres.

Abbreviations. Eyes. ALE: anterior lateral eyes; AME: anterior median eyes; PLE: posterior lateral eyes; PME: posterior median eyes. **Male genitalia.** arp: anterior radical process; cy: cymbium; dp: distal part of paracymbium; e: embolus; em: embolic membrane; bh: basal haematodocha; ibe: internal branch of embolus; mp: median part of paracymbium; p: paracymbium; pp: proximal part of paracymbium; prp: posterior radical process; r: radix; rta: retrolateral tibial apophysis; sd: sperm duct; st: subtegulum; t: tegulum; ti: tibia. **Female genitalia.** pi: epigyne pit; lw: lateral edge of the epigyne pit; s: scape; sp: spermathecae.

Repositories. CEUA: Colección Entomológica de la Universidad de Alicante (CIBIO, University of Alicante), MNCM: Museo Nacional de Ciencias Naturales de Madrid.

Leg. GMR: A. García, E. Micó & A. Ramírez; GR: L. González & P. Ramilo.

Results and discussion

A total of 245 specimens (44% males, 37% females, 19% immatures) was collected. All adults and only few immatures were identified to species level, resulting in a total of 15 genera and 18 species identified belonging to the family Linyphiidae (Tab. 2). The number of specimens, registered in each sampling site, of the species *C. succinus*, *L. minutus*, *M. midas*, *P. monsantensis* and *S. vettonicus* **sp. nov.** are provided (Tab. 3). The sex ratio in case of all species with high number of sampled specimens (i.e. *Lepthyphantes minutus, Pelecopsis monsantensis, Scotinotylus vettonicus*) was very close to 1:1.

From the 309 species of Linyphiidae known from the Iberian Peninsula, 40 have been registered in the province of Salamanca (western Spain) (Tab. 4), and most of these references originate from a few works conducted in mountainous areas with an altitude higher than 770 m.

Although the number of species recorded in Salamanca province represents 13% of all linyphiid spiders of the Iberian Peninsula, we expect that it is a low number for such a heterogeneous and extensive province – especially because hollow-dwelling spiders are rarely studied and their diversity is often underestimated (Blick 2011).

Tab. 2: Species list of Linyphiidae spiders and their number of specimens collected with tree hollow emergence traps on *Quercus pyrenaica* trees. M = male, F = female, I = immature

Species	M	F	I	Total
Bolyphantes nigropictus Simon, 1884	.	1	2	3
Centromerus dilutus (O. Pickard-Cambridge, 1875)	2	.	.	2
Centromerus succinus (Simon, 1884)	6	3	.	9
Diplocephalus protuberans (O. Pickard-Cambridge, 1875)	.	2	.	2
Hypomma cornutum (Blackwall, 1833)	.	1	.	1
Lepthyphantes minutus (Blackwall, 1833)	16	14	9	39
Lepthyphantes sp. indeterminate	.	.	5	5
Micrargus herbigradus (Blackwall, 1854)	1	2	.	3
Midia midas (Simon, 1884)	.	4	.	4
Palliduphantes stygius (Simon, 1884)	1	.	.	1
Pelecopsis monsantensis Bosmans & Crespo, 2010	49	50	9	108
Pelecopsis susannae (Simon, 1915)	8	3	.	11
Pocadicnemis pumila (Blackwall, 1841)	4	.	.	4
Scotinotylus vettonicus **sp. nov.**	8	6	.	14
Tenuiphantes tenuis (Blackwall, 1852)	2	3	1	6
Trichoncus trifidus Denis, 1965	3	.	.	3
Typhochrestus bogarti Bosmans, 1990	2	1	.	3
Walckenaeria corniculans (O. Pickard-Cambridge, 1875)	2	.	.	2
Walckenaeria dalmasi (Simon, 1915)	4	1	.	5
Linyphiidae indeterminate	.	.	20	20

Tab. 3: Number of specimens of the five discussed Linyphiidae species in each of the six collecting sites. A = Agallas, B = Dehesa de Perosín, C = El Cabaco, D = La Genestosa, E = La Bastida, F = Villarrubias

Species	A	B	C	D	E	F
Centromerus succinus	3	.	.	.	6	.
Lepthyphantes minutus	2	1	1	10	25	.
Midia midas	.	.	1	.	3	.
Pelecopsis monsantensis	.	.	.	.	107	1
Scotinotylus vettonicus **sp. nov.**	.	.	.	4	9	1

Tab. 4: Checklist of Linyphiidae recorded in Salamanca province, Spain
[1]: endemic taxa to the Iberian Peninsula
*: also present in southern France (Danflous pers. comm.)
**: *Silometopus ambiguus* was recorded from Salamanca, Avila and Tarragona. However, following Blick (2014), those records should be checked since *S. ambiguus* could be confused with *S. curtus* (Simon, 1881).
[CL]: first species record for Castilla y León autonomous region (western Iberian Peninsula) (Jerardino et al. 1988, 1991, Majadas & Urones 2002, Urones et al. 1990, 1995, Branco et al. 2019)

Species
Agyneta rurestris (C. L. Koch, 1836)
Bolyphantes nigropictus Simon, 1884
Centromerus capucinus (Simon, 1884)
Centromerus dilutus[CL] (O. Pickard-Cambridge, 1875)
Centromerus incilium (L. Koch, 1881)
Centromerus levitarsis (Simon, 1884)
Centromerus succinus[CL] (Simon, 1884)
Diplocephalus protuberans[CL] (O. Pickard-Cambridge, 1875)
Erigone dentipalpis (Wider, 1834)
Frontinellina frutetorum (C. L. Koch, 1834)
Hypomma cornutum[CL] (Blackwall, 1833)
Lepthyphantes minutus (Blackwall, 1833)
Lepthyphantes notabilis Kulczyński, 1887
Linyphia triangularis (Clerck, 1757)
Micrargus herbigradus[CL] (Blackwall, 1854)
Microctenonyx subitaneus (O. Pickard-Cambridge, 1875)
Microlinyphia impigra (O. Pickard-Cambridge, 1871)
Microlinyphia pusilla (Sundevall, 1830)
Midia midas[CL] (Simon, 1884)
Palliduphantes stygius (Simon, 1884)
Parapelecopsis nemoralis (Blackwall, 1841)
Pelecopsis eminula (Simon, 1884)
Pelecopsis monsantensis[1, CL] Bosmans & Crespo, 2010
Pelecopsis susannae (Simon, 1915)
Pocadicnemis pumila (Blackwall, 1841)
Prinerigone vagans (Audouin, 1826)
Scotinotylus vettonicus[1 *] **sp. nov.**
Silometopus ambiguus[**] (O. Pickard-Cambridge, 1906)
Silometopus reussi (Thorell, 1871)
Sintula furcifer (Simon, 1911)
Tapinocyba mitis (O. Pickard-Cambridge, 1882)
Tenuiphantes mengei (Kulczyński, 1887)
Tenuiphantes tenuis (Blackwall, 1852)
Tenuiphantes zimmermanni (Bertkau, 1890)
Trichoncus trifidus[1, CL] Denis, 1965
Typhochrestus bogarti Bosmans, 1990
Walckenaeria acuminata Blackwall, 1833
Walckenaeria corniculans (O. Pickard-Cambridge, 1875)
Walckenaeria dalmasi (Simon, 1915)
Walckenaeria stylifrons (O. Pickard-Cambridge, 1875)

A new species for science, along with several interesting species of linyphiids, appeared in our oak hollow samplings. *Scotinotylus vettonicus* **sp. nov.** seems to be abundant (14 individuals) in this microhabitat type. Moreover, *Pelecopsis monsantensis,* until now known only from a single male and two females (which have not been formally described so far, see Crespo et al. 2018), was common in our survey (108 individuals). The female of this species is described for the first time in the present study. Four individuals of *Midia midas* were also collected, being an exceptionally rarely recorded spider species linked to the tree hollows and with only two records in Spain until now (Castro 2009, Crespo et al. 2018). In addition, the captures of *Centromerus succinus* and *Lepthyphantes minutus* are of interest due to their rarity in Spain. *Hypomma cornutum* (Blackwall, 1833) is the third record for Spain, having been previously cited in Navarra and Girona according to Bellvert (2016).

***Scotinotylus vettonicus* Barrientos & Hernández-Corral sp. nov.** (Figs 2a-g, 3a-b, 4) (Tabs 3, 5, 6)

Type material examined. All types are from La Bastida (40.59428°N 6.05315°W, 1192 m a.s.l.), La Genestosa (40.34981°N 6.77932°W, 891 m a.s.l.) and Villarrubias (40.32508°N 6.62715°W, 879 m a.s.l.) (Salamanca, SPAIN): ♂ holotype (CEUA 106295), La Bastida, 22. Nov. 2012, GMR leg. ♀ paratype 1 (CEUA 106296), La Bastida, 10. Jan. 2013, GMR leg. ♂ paratype 2 (MNCN 20.02/19334), La Genestosa, 9. Jan. 2015, GR leg. ♀ paratype 3 (MNCN 20.02/19335), La Genestosa, 9. Jan. 2015, GR leg. ♂ paratype 4 (CEUA 106331, coll. Barrientos), La Bastida, 10. Jan. 2013, GMR leg. ♀ paratype 5 (CEUA 106330, coll. J.A. Barrientos), La Bastida, 19. Feb. 2013, GMR leg. ♂ paratype 6 (CEUA 106297), Villarrubias, 9. Sep. 2014, GR leg. ♀ paratype 7 (CEUA 106298), La Bastida, 27. Apr. 2012, GR leg.

Other material. All material is from La Bastida (40.59428°N 6.05315°W, 1192 m a.s.l.) and La Genestosa (40.34981°N 6.77932°W, 891 m a.s.l.) (Salamanca, SPAIN): ♂ (CEUA 106299), La Bastida, 22. Nov. 2012, GMR leg. ♂ (CEUA 106300), La Bastida, 19. Feb. 2013, GMR leg. ♂ (CEUA 106301), La Bastida, 10. Jan. 2013, GMR leg. ♂ (CEUA 106302), La Bastida, 22. Nov. 2012, GMR leg. ♀ (CEUA 106303), La Genestosa, 9. Mar. 2015, GR leg. ♀ (CEUA 106304), La Genestosa, 9. Mar. 2015, GR leg.

Etymology. Adjective, referring to the "vettones", ancient pre-Roman inhabitants of the central-western area, between the Duero and Tajo rivers of the Iberian Peninsula, where the species was collected.

Diagnosis. The cephalic region of the male prosoma develops a small protuberance accentuated by the lateral glandular pits. The bulb of the male has a grooved paracymbium on its middle and distal part (Fig. 3a), curved and narrowed progressively towards to its tip. The embolus is subcircular with a short branch in its basal part. On this branch there is a transparent and slightly pleated embolic lamina. The female epigyne has a broad pit with clear and sharp edges, especially in its posterior and lateral part. The sagittal scape is narrow.

The structure of the female genitalia in *S. vettonicus* **sp. nov.** clearly resembles those described by Millidge (1981) for *S. majesticus* (Chamberlin & Ivie, 1947) and *S. patellatus* (Emerton, 1917). Especially, the presence of a thin long and rigid scape, dividing the pit, is clearly pronounced in other species of the *S. sacer* group (Millidge 1981). It is also present in *S. kimjoopili* Eskov & Marusik, 1994, a species from North Siberia. The new species resembles more its relatives from North Asia than from Europe.

Male description (holotype)

Measurements. Length/width of carapace: 0.86/0.64. Length/width of opisthosoma: 0.56/0.89. Leg formula: 4, 1, 2, 3.

Prosoma (Fig. 2a-b). Carapace with arched and blunt protrusion in the cephalic region lateral and fusiform glandular pits. The pits anteriorly with rounded and dark glandular orifice. ALE and PLE juxtaposed and finely areolate. AME smaller than ALE and PLE, rounded and close to each other. PME posteriorly to the other pairs, separated from each other. Width of the clypeus equal to distance between AME and PME. Viewed from the front the eye arrangement in two rows: "6-2". Fovea hardly visible. Carapace yellowish-brown, with darker stripes posterior to fovea.

Chelicerae with elongated basal segment (0.27 mm long; 2.5 times its width), fang long and curved. Promargin of cheliceral furrow with a series of four acute denticles, decreasing in size towards the apical part, preceded by a smaller denticle. No denticles on the retromargin. Basal segment striated laterally in its distal part, with pointed basal extension (hidden beneath clypeus). Colouration of chelicerae darker than of carapace. Legs long, thin, pale yellow, clearly lighter than carapace. Leg measurements in Tab. 5. Tibiae and patellae III and IV with one dorsal spine. Spination formula of Tibia I-IV: 1-1-1-1 (all in normal size and proximal position except on tibia IV where it is more centred), position of TmI: 0.51, TmIV absent. Opisthosoma ovoid, with patchy greyish colour and without a defined pigmentary pattern, covered with short, transparent, scattered hairs.

Male palp (Fig. 2e-g). Patella and tibia of similar length, cylindrical and narrower in their basal area. Tibia (ti) with rounded laminar rim in dorsodistal part, covering base of cymbium. Retrolateral apophysis (rta) small and flat with a sclerotised edge. Cymbium (cy) small, concave, with small protruding tip; indentation anchoring the paracymbium in basal part of retrolateral margin, covered with scattered hairs. Proximal part of paracymbium (pp) flattened and partially hidden, middle part (mp) ribbed, distal parts (dp) curved, tapering, hook-like (Fig. 2e). Sperm duct (sd) visible, basal hematodocha (bh) hidden by subtegulum (st). Tegulum (t) sclerotised, semicircular, with a rounded projection on its prolateral end; anteriorly, turned inwards and joined to embolic division, whose reduced basal part or radix (r) with two small apophyses (anterior – arp, posterior – prp) (Fig. 2f). Embolus at the base wide and flattened, beginning between the two apophyses just like the sclerotised base of embolic membrane (em) linked to anterior apophysis (arp). Embolic membrane transparent and laminar, slightly pleated at its end. Embolus (e) turned (180º), tapering; in its first quarter bifurcate, with short and sclerotised branch (ibe), supporting embolic membrane (Fig. 2f-g). Fig. 3 provides an interpretation of the elements that make up the bulb.

Female description (paratype 5)

Measurements. Length/width of carapace: 0.84/0.62. Length/width of opisthosoma: 1.21/0.59. Leg measurements in Tab. 6. All tibiae and patellae III and IV with 1 dorsal spine. Spination formula of Tibia I-IV: 1-1-1-1 (like the male), position of TmI: 0.62, TmIV absent. Leg formula: 4, 1, 2, 3.

Prosoma. Carapace yellowish-brown, lighter in thoracic region. Anterior eyes distant from front edge of carapace. Eyes in two transversal rows, AME slightly smaller than the other eyes; thin black rings around ALE and PLE. Chelicerae with long basal segment (0.32 mm, length > width: 1.8), fang thin and curved; cheliceral dentition on promargin similar to male, retromargin with series of five small denticles. Opisthosoma ovoid and elongated, coated (especially on the dorsal side) with thin translucent and whitish hairs. Tegument yellowish to greyish, without traces of any pigmentary pattern.

Epigyne (Fig. 2c). With wide pit (pi), open towards ventral side, its edges (lw) clearly delimited by integumentary sclerotising, especially at its posterior and lateral borders. Pit is longer than wide, narrowed by a notch on each side. Epigyne anteriorly less sclerotised, scape (s) present, directed backwards, not reaching posterior edge of pit; spermathecae (sp)

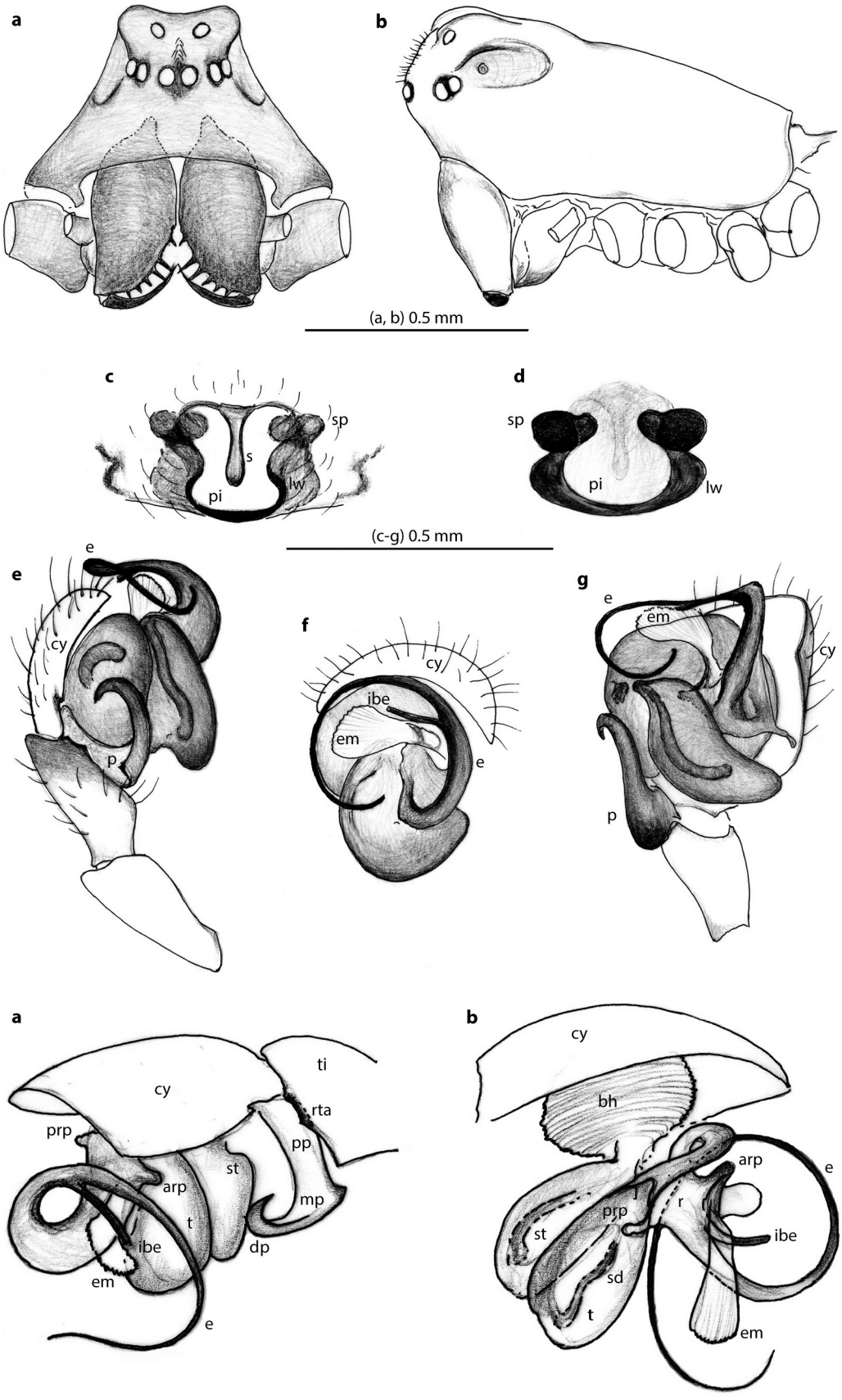

Fig. 2: *Scotinotylus vettonicus* Barrientos & Hernández-Corral **sp. nov. a.** male prosoma anterior view; **b.** male prosoma lateral view; **c.** epigyne; **d.** vulva; **e.** male pedipalp retrolateral view; **f.** male pedipalp antero-frontal view; **g.** male pedipalp ventral view

Fig. 3: *Scotinotylus vettonicus* Barrientos & Hernández-Corral **sp. nov.** Schema of expanded pedipalp with interpretation of its parts (without scales). **a.** retrolateral view; **b.** prolateral view

Tab. 5: Leg measurements of the male (holotype) of *Scotinotylus vettonicus* sp. nov.

Leg	coxa	trochanter	femur	patella	tibia	metatarsus	tarsus	Total
I	0.19	0.08	0.70	0.15	0.56	0.47	0.39	2.54
II	0.18	0.08	0.64	0.15	0.54	0.43	0.37	2.39
III	0.16	0.07	0.50	0.14	0.43	0.41	0.37	2.08
IV	0.19	0.08	0.66	0.15	0.62	0.45	0.73	2.88

Tab. 6: Leg measurements of the female of *Scotinotylus vettonicus* sp. nov.

Leg	coxa	trochanter	femur	patella	tibia	metatarsus	tarsus	Total
I	0.20	0.12	0.78	0.19	0.66	0.47	0.35	2.77
II	0.19	0.10	0.66	0.17	0.58	0.43	0.35	2.48
III	0.17	0.09	0.60	0.16	0.43	0.39	0.35	2.19
IV	0.20	0.10	0.78	0.17	0.70	0.58	0.35	2.88

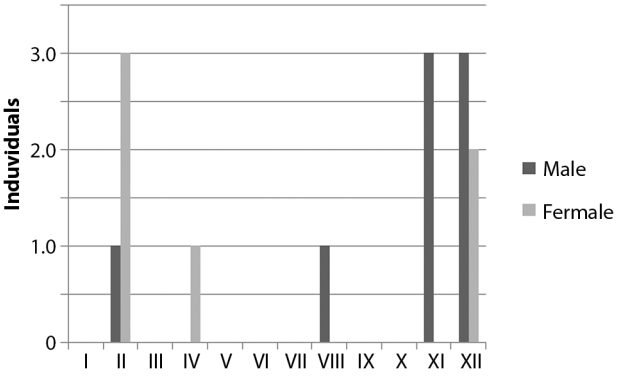

Fig. 4: Phenology of *Scotinotylus vettonicus* **sp. nov.**

rounded. Scape narrow at its base, broader and rounded at its end; its tegument fine and translucent, reinforced at the edges. Posterior half of the pit clearly rounded.

Vulva (Fig. 2d). Copulatory and fertilization ducts hardly visible. Copulatory openings at lateral edges (lw) of the epigyne pit, in anterior part, and linked in an immediate way, with corresponding spermathecae (sp); elliptical, without other associated structures.

Distribution. The type localities only: SPAIN, La Bastida (Sierra de las Quilamas), La Genestosa and Villarrubias (El Rebollar), Castilla y León Community, Salamanca province (Tabs 1, 3). However, it is also known from southern France (Danflous in litt.).

Phenology (Fig. 4). It is a winter active species, with its main reproductive period between November and February.

Remarks. The genus *Scotinotylus* was described by Simon (1884). Later a study of Nearctic forms was published by Millidge (1981). Nowadays, the genus has a Holarctic distribution, with the majority of the 46 species currently known occurring in Canada and the USA (World Spider Catalog 2020). However, Eskov (1989) and Eskov & Marusik (1994) described new species from Siberia and new data from the North of Asia. In Europe, only six species have been mentioned (Nentwig et al. 2020). Millidge (1981) redefined the genus *Scotinotylus* based on the characters of the type species, *Scotinotylus antennatus* (O. Pickard-Cambridge, 1875), especially the male and female genitalia. The males of *Scotinotylus vettonicus* have a simple and curved paracymbium with a grooved appearance. This character is, undoubtedly, a consequence of the reduction that this structure undergoes in comparison with the relative complexity shown in many other Linyphiidae. In this sense, the new species, accords with the definition of this genus by Millidge (1981) and has a certain resemblance to *S. antennatus*. The embolic division of *S. vettonicus* consists of a spiral embolus, which is a character shared with other linyphiid genera (*Araeoncus* Simon,1884, *Hypomma* Dahl, 1886, *Trichoncus* Simon, 1884, *Typhochrestus* Simon, 1884, etc.). However, in the case of *S. vettonicus* a developed tibial apophyses is missing. *Scotinotylus vettonicus* also has a reduced laminar process, like other species of the genus [*S. evansi* (O. Pickard-Cambridge, 1894), *S. protervus* (L. Koch, 1879) and *S. kenus* (Chamberlin, 1949)], and a membranous pleated expansion, next to the small suprategular apophysis, is shared with other *Scotinotylus* species.

Other remarkable species

Pelecopsis monsantensis Bosmans & Crespo, 2010 (Figs 5a-d, 6a-f, 7, 11, Tabs 3, 7)

Material. 49 ♂♂, 50 ♀♀, 9 jj (see Tab. 3).

Description of female (Fig. 5a-d, Tab. 7) (somatometric data refer to a female of intermediate characters).

Measurements. Length/width of carapace: 0.97/0.86. Length/width of opisthosoma: 2.03/1.63. Leg formula: 4,1,2,3. Spination formula of Tibia I-IV: 1-1-1-1 (very small), position of TmI: 0.61, TmIV absent.

Prosoma. As in other *Pelecopsis*, carapace with intense brown colouration and reddish tones (Fig. 5a-b). Very characteristic radial lines starting at fovea, formed by a series of darker contour points, at the end of the cephalic region. The cephalic portion clearly prominent. Eyes (typically for this group) finely areolate with darker macules, clearly separated; all eyes similar in size. Basal segment of chelicerae (0.29 mm long by 0.17 mm wide) of similar colour to carapace, tridentate promargin, fang short and curved.

Opisthosoma. Ovoid, covered (especially on the dorsal side) with thin and short scattered hairs. Tegument greyish without traces of pigmentary pattern, paler on ventral side. In its middorsal part, four thick sigilla form a square (Fig. 5a).

Epigyne (Fig. 5c). Female plate in middle part of epigaster, with a black pigmented sclerotized area, posteriorly a pair of slight depressions of rounded contour, yellowish-white colour prior to entrance of ducts. Broad and short septum, anterior edge of pits continues backwards, widens between them to partially close behind (in an inverted "T") the two depressions.

Vulva (Fig. 5d). Pair of spermathecae clearly differentiated, rounded, tiny, ducts convoluted ("knot"-like). Each of ducts starts from the pit of corresponding depression of epigyne. Backwards a transverse trabecula at edge, linked with counterpart in middle part.

Male of *Pelecopsis monsantensis* (Fig. 6a-f). Drawings are provided of its habitus in different views (Fig. 6a-c), the pedipalp in retrolateral and prolateral position, and the tibial apophysis (Fig. 6d-f).

Distribution and phenology (Figs 7, 11, Tab. 3). The ♂ holotype studied by Bosmans et al. (2010) was collected in November (Portugal, Lisboa, Parque de Monsanto). In Spain it was recorded in Lleida (Crespo et al. 2018). Data from our study are from La Bastida (Sierra de las Quilamas) (107speci-

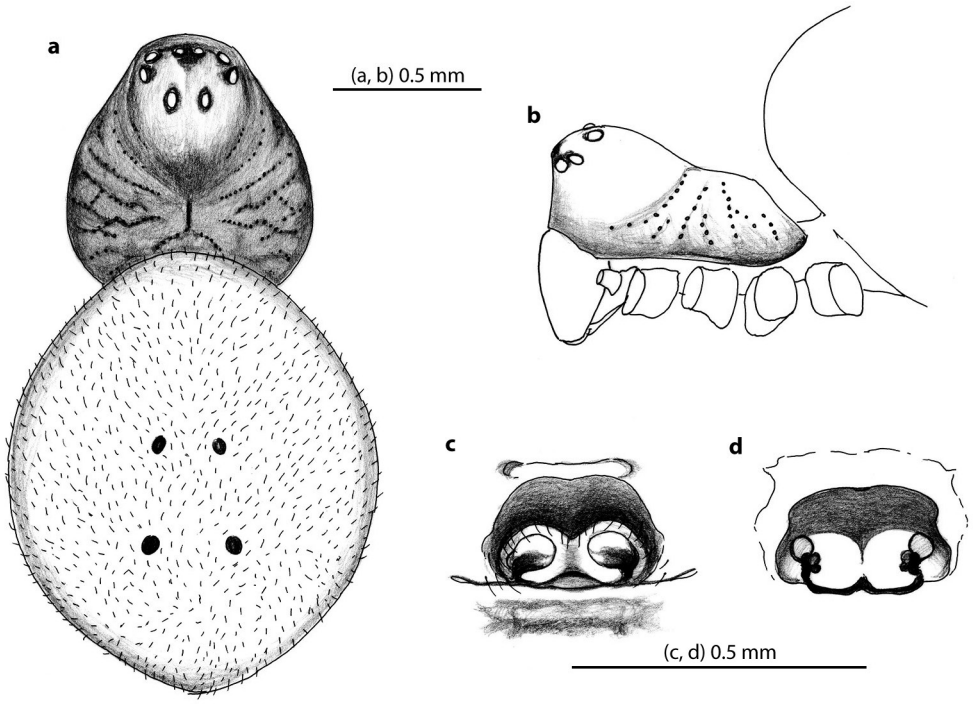

Fig. 5: Female of *Pelecopsis monsantensis*. **a.** dorsal view; **b.** lateral view of the prosoma; **c.** epigyne; **d.** vulva

Tab. 7: Leg measurements of the female of *Pelecopsis monsantensis*

Leg	coxa	trochanter	femur	patella	tibia	metatarsus	tarsus	Total
I	0.23	0.13	0.58	0.25	0.62	0.56	0.37	2.74
II	0.23	0.13	0.58	0.25	0.60	0.53	0.35	2.67
III	0.21	0.13	0.58	0.17	0.47	0.53	0.29	2.38
IV	0.27	0.15	0.86	0.21	0.86	0.68	0.33	3.36

mens) and Villarrubias (El Rebollar) (1 specimen), both in the province of Salamanca (Tab. 3, Fig. 11). The highest number of males was captured in November and December (12 in each month). Females were most active in November, December and March (Fig. 7) and we did not observe them in late spring and summer. The adults of *P. monsantensis* are winter active.

Remarks. The genus *Pelecopsis* Simon, 1864 currently comprises 87 species (World Spider Catalog 2020), and is primarily a Palaearctic-Afrotropical genus, since only five Nearctic species are known. However, a high diversity of species exists in the western Mediterranean area, perhaps because the majority of studies concentrated on this region – including the description of 17 species from the Maghreb (Morocco, Algeria, Tunisia), two from the Canary Islands and 12 from the Iberian Peninsula: *P. bicornuta* Hillyard, 1980, *P. bucephala* (O. Pickard-Cambridge, 1875), *P. coccinea* (O. Pickard-Cambridge, 1875), *P. denisi* Brignoli, 1983, *P. eminula* (Simon, 1884), *P. inedita* (O. Pickard-Cambridge, 1875), *P. mengei* (Simon, 1884), *P. modica* Hillyard, 1980, *P. monsantensis* Bosmans & Crespo, 2010, *P. parallela* (Wider, 1834), *P. pooti* Bosmans & Jocqué, 1993 and *P. susannae* (Simon, 1915). The Iberian fauna of this genus can be identified using the works of Bosmans & Abrous (1992), Bosmans & Jocqué (1993) and Bosmans et al. (2010).

In spite of the diversity of this genus, its taxonomy and biology is not studied sufficiently, since very little data is available for several species, while much of it is fragmentary. The male of *P. denisi* and the female of *P. eminula* are still unknown. We describe here the female of *P. monsantensis* for the first time. Similarly, some species are reported from one or two sites only, although they are locally abundant with an important aerial dispersal capacity. In oak tree hollows, *Pelecopsis* constitute 48.5% of the Linyphiidae collected, most of them belonging to *P. monsantensis*. There are probably more species of this genus associated with tree hollows.

Females of *P. monsantensis* are similar to *P. mengei* by having a couple of well-defined depressions in the posterior part of their epigyne, anterior to the entrance of the ducts. The middle part of the epigyne is formed as a broad and short septum, it widens (in an inverted "T") and partially closes behind the two depressions. *Pelecopsis monsantensis* differs from *P. mengei* in the structure of the internal ducts and spermathecae. In *P. mengei*, they are thick and parallel, while the spermathecae of *P. monsantensis* are tiny and their narrow ducts form a compact loop. The vulva mostly resembles *P. modica* and *P. susannae*.

Centromerus succinus (Simon, 1884) (Figs 8a-d, 9, 11, Tab. 3)
We have identified as *C. succinus* 6 ♂♂and 3 ♀♀. These new records are from La Bastida (Sierra de las Quilamas) (6 specimens) and Agallas (El Rebollar) (3 specimens), both in the province of Salamanca, Spain (Tab. 3, Fig. 11). Its morphological features coincide with those described by Bosmans (1986), see Fig. 8a-d.

Centromerus succinus is a widespread species throughout the western Mediterranean: France (Simon 1914-1937), Algeria (Bosmans 1986), Italy/Sardinia (Bosmans & Colombo 2015). It seems to inhabit concealed places. In the Iberian Peninsula, it had been noted at several localities in Portugal (Cardoso

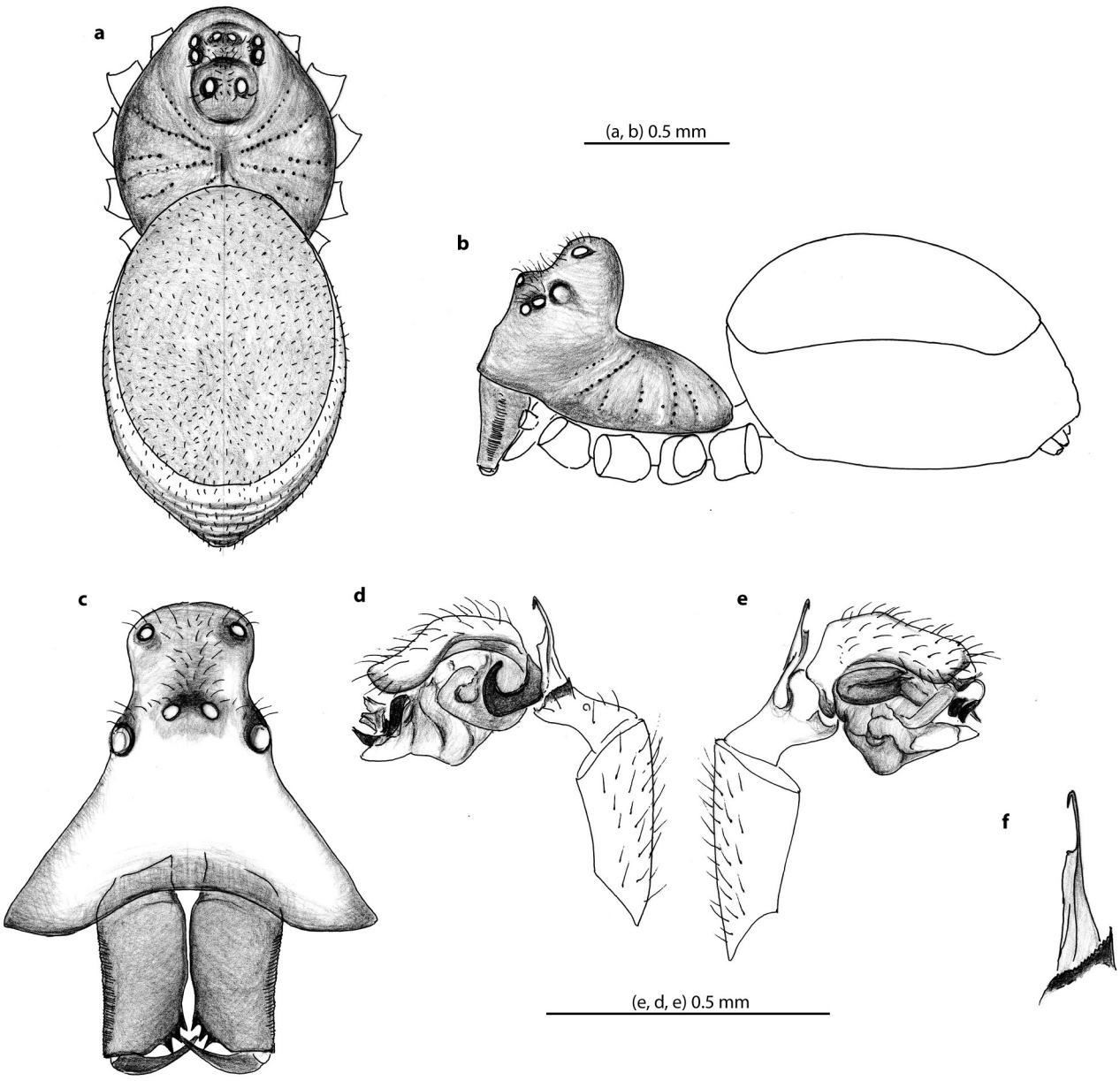

Fig. 6: Male of *Pelecopsis monsantensis*. **a.** habitus dorsal view; **b.** habitus lateral view; **c.** prosoma frontal view; **d.** pedipalp retrolateral view; **e.** pedipalp prolateral view; **f.** apophysis of palpal tibia retrolateral view (without scale)

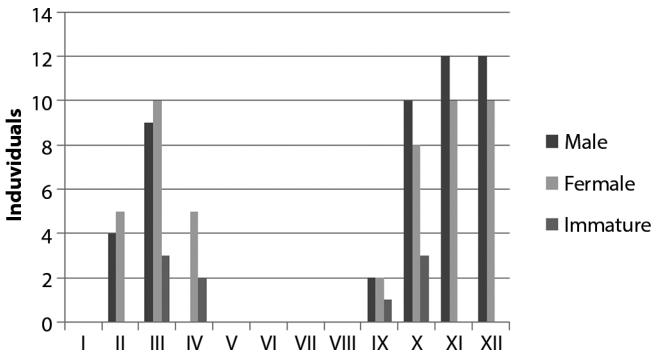

Fig. 7: Phenology of *Pelecopsis monsantensis*

2004, Bosmans et al. 2010). There is also a record from Tablas de Daimiel National Park (Morano 2017) (Fig. 11).
This species seems to prefer wooded areas with an abundance of tree hollows and humid soils. It was reported from *Cedrus* and *Q. ilex* forests, and in hollows of *Q. pyrenaica*; from a mixed forest of *Cedrus* sp., *Abies* sp. and *Quercus* sp.; in litter of *Quercus ilex* and *Cedrus* sp. (Simon 1929, Bosmans 1986, Cardoso 2004, Bosmans & Colombo 2015).
Phenology (Fig. 9). According to literature, the ♂♂activity is in May and the ♀♀ are most active between between March and May (Nentwig et al. 2020). Our data show that the species is also winter active: ♂♂were collected in February, November and December, ♀♀ in November and December.

Midia midas (Simon, 1884) (Fig. 11, Tab. 3)
Phenology. In agreement with Nentwig et al. (2020), females were collected from May to August and males from May to July.
Remarks. We have identified 4 ♀♀ of *M. midas*, 3 from La Bastida and 1 from El Cabaco (Sierra de las Quilamas) (Tab. 3). It is a monotypic genus (Saaristo & Wunderlich 1995). It is widespread in Europe (Nentwig et al. 2020), and it has been mentioned twice in the Iberian Peninsula, in Navarra, Spain (Castro 2009) and in León, Spain (Crespo et al. 2018). We report the presence of this species in the Central Sys-

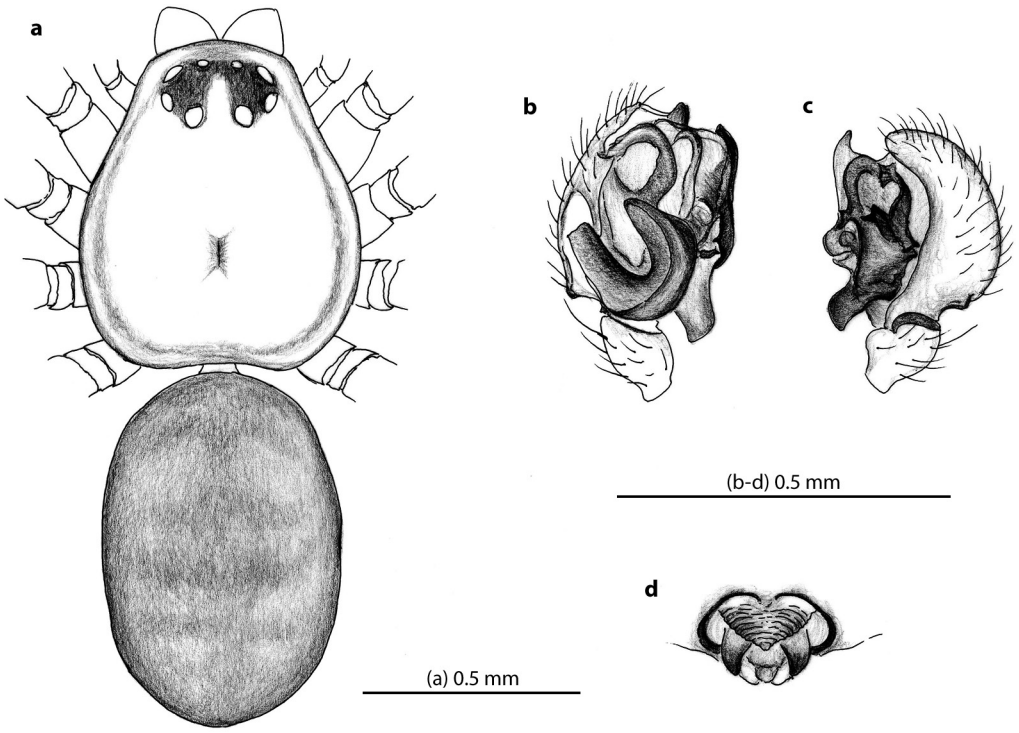

Fig. 8: *Centromerus succinus*. **a.** dorsal view of female; **b.** male pedipalp, retrolateral view; **c.** ditto, prolateral view; **d.** epigyne

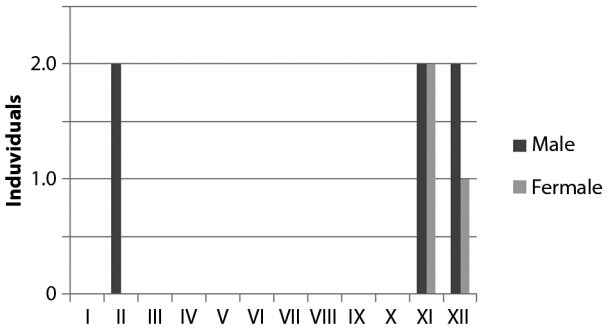

Fig. 9: Phenology of *Centromerus succinus*

tem mountain range at two localities (La Bastida and El Cabaco, Sierra de las Quilamas, both in Salamanca province, Spain), which are distant from previously noted Iberian localities (Fig. 11). This species, rarely recorded in ten countries in Europe (Nentwig et al. 2020), is associated with hollows in ancient trees, at ground level and in cavities resulted from pollarding the trees (Růžička et al. 1991, Saaristo & Wunderlich 1995, Svatoň & Mihál 2000, Kubcová & Schlaghamerský 2002, Russell-Smith et al. 2013, Machač et al. 2018).

Lepthyphantes minutus (Blackwall, 1833) (Figs 10, 11, Tab. 3)
Phenology (Fig. 10). The maximum number of captured adults of both sexes coincides with the month of November, while the maximum number of captured immatures occurred in June and July (Fig. 10). The species seems to be present throughout the year, with a maximum of the adults between August and November in Central Europe (Blick pers. comm.).
Remarks. *Lepthyphantes minutus* was the second most abundant species in our samples (39 individuals, 15.9% of captured specimens). The species has an affinity to coniferous forests (Nentwig et al. 2020) but it could by also observed in many other forest types (Hänggi et al. 1995, Harvey et al. 2002). Our captures demonstrate that this species is also abundant in oak (*Q. pyrenaica*) forests, where it colonises the hollows of oak trunks. This is congruent with the observations of Urones et al. (1990) and Cardoso et al. (2008a, 2008b), who reported this species in forests of *Quercus ilex* L. and *Quercus robur* L., respectively. Although data are very scarce, *L. minutus* in the Iberian Peninsula seems to be primarily linked to *Quercus* species in mountain forests, but it was also found in pine forests (Cardoso 2004). This species is widespread throughout the temperate and cold zones of Europe. Our data add new records for Salamanca province [La Bastida and the El Cabaco (Sierra de las Quilamas); Agallas, La Genestosa and Dehesa el Perosín (El Rebollar)] to the previously known localities from San Juan de la Peña, Huesca (Ribera & Hormiga 1985), Salamanca (Jerardino et al. 1988), Martinamor, Salamanca (Urones et al. 1990), Bragança, Portugal (Cardoso 2004), Mata da Albergaria, Braga, and Vale da Rasca, Setubal, Portugal (Cardoso et al. 2008a, 2008b), and Mata Nacional do Choupal, Coimbra, Portugal (Bosmans et al. 2010) (Fig. 11). Moreover, there are other scattered localities which suggest the widespread presence of this species throughout the western Iberian Peninsula.

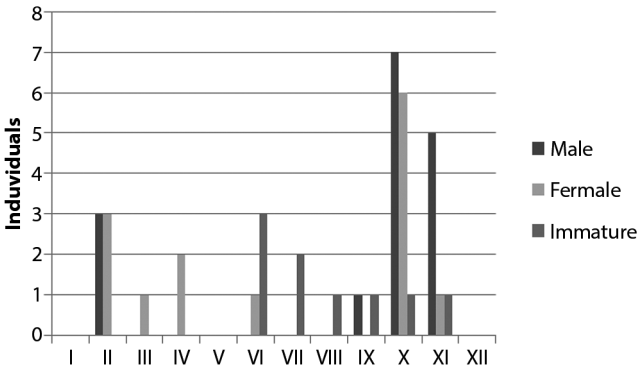

Fig. 10: Phenology of *Lepthyphantes minutus*

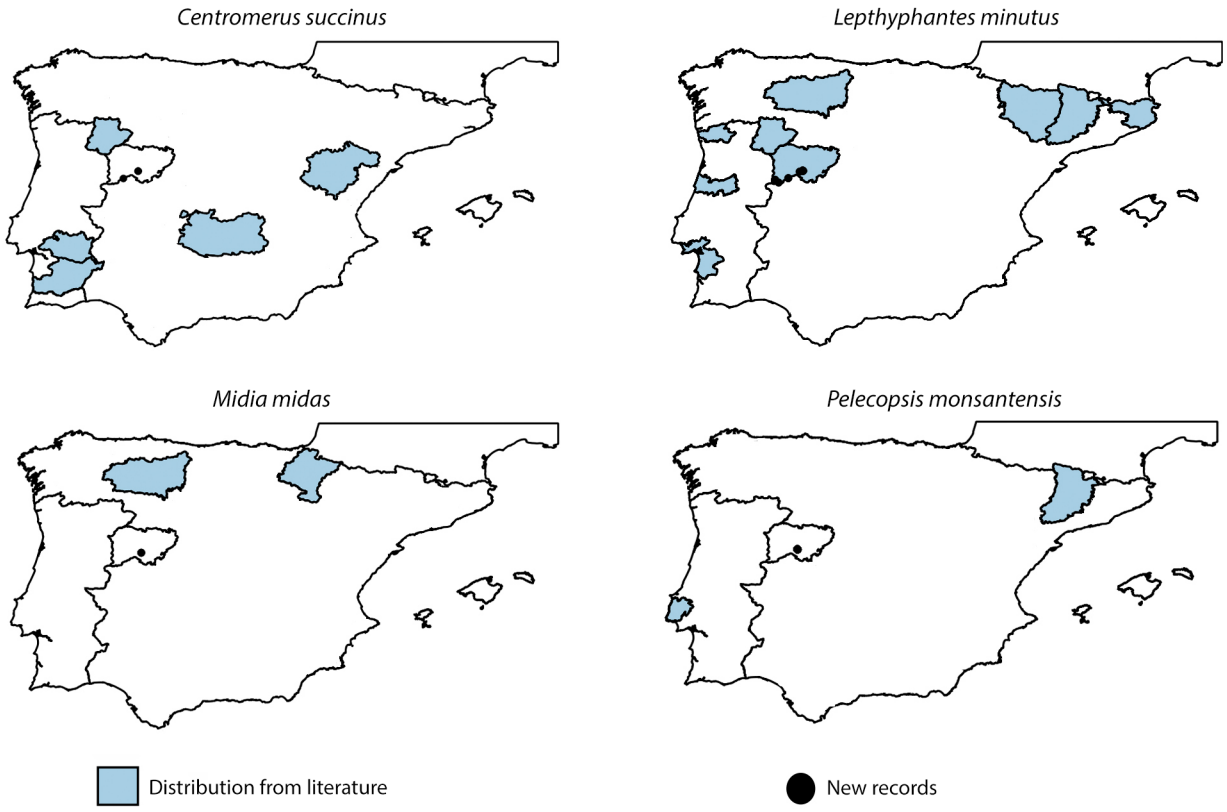

Fig. 11: Known distribution in the Iberian Peninsula of the four discussed Linyphiidae species: *Centromerus succinus, Lepthyphantes minutus, Midia midas* and *Pelecopsis monsantensis*

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