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Front cover: *Nigma puella* (Simon, 1870) © Arnaud Henrard

The bleeding heart spider, *Nigma puella* (Simon, 1870), belongs to the family Dictynidae. This small spider weaves cribellate webs on the leaves of shrubs and trees in various habitats. The female is easily recognizable by its striking red abdominal mark. Although *N. puella* is widely distributed in Europe, it was only recently observed in Belgium (Henrard et al., 2025, p. 103, this issue). Belgium now hosts three species of this genus: *Nigma puella, Nigma flavescens* (Walckenaer, 1830), and *Nigma walckenaeri* (Roewer, 1951).

Content

Research articles

Short notes

Erratum

Meeting reports

Anyphaena furva Miller, 1967 (Araneae, Anyphaenidae), a new addition to the Belgian spider fauna

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Abstract

Anyphaena furva Miller, 1967 is reported for the first time in Belgium, based on two adult males discovered at a chalk grassland in Nismes. The authors provide a summary on how to distinguish this species from other European *Anyphaena* species. Additionally, the ecology and European distribution of *Anyphaena furva* are briefly discussed.

Samenvatting

De Roetstruikspin, *Anyphaena furva* Miller, 1967, wordt voor het eerst gemeld in België op basis van twee mannelijke exemplaren gevonden op een kalkgrasland in Nismes. De auteurs geven een samenvatting over hoe deze soort te onderscheiden van andere Europese *Anyphaena* soorten. Daarnaast worden zowel de ecologie als de Europese verspreiding van *Anyphaena furva* kort besproken.

Résumé

Anyphaena furva Miller, 1967 est signalée pour la première fois en Belgique, à partir de deux mâles adultes découverts dans une pelouse calcaire à Nismes. Les auteurs fournissent un bref résumé sur la manière de distinguer cette espèce des autres espèces européennes d'*Anyphaena*. L'écologie de *Anyphaena furva* ainsi que sa distribution à travers l'Europe sont brièvement discutées.

Introduction

On May 10, 2024, we visited the chalk grassland of Tienne Breumont at Nismes, Viroinval. While examining a human-made stack of rocks surrounded by sparse vegetation (Fig. 1), the second author discovered an unfamiliar-looking male spider of the genus *Anyphaena*. The specimen was strikingly dark and lacked any clear markings on the abdomen (Fig. 2A), including the two pairs of angled black abdominal spots typical of *Anyphaena accentuata* (Walckenaer, 1802), the only known species of this genus in Belgium. The spider was collected and later identified by the first author as *Anyphaena furva* Miller, 1967, a species never recorded before in Belgium. Later that day, a second male, similar in appearance, was observed on the leaves of *Viburnum lantana*, a common shrub species at the site. The authors propose the Dutch name "Roetstruikspin", which literally translates to "soot shrub spider" in English. The name, suggested by the third author, refers to the strikingly dark appearance of the observed males.

While this is, at time of writing, the only confirmed observation of *Anyphaena furva* on Belgian soil, it is likely that the species is present at additional locations. Several years ago, on May 18, 2018, the first author observed a male *Anyphaena* near the Beauchâteau quarry at Senzeilles, Cerfontaine, that closely resembled the very dark and unmarked appearance of the confirmed individual. Unlike the recent observation in a sparsely vegetated area, this specimen was found on shrubs at the edge of a forest on calcareous soil. It should be noted that this individual was not identified based on its genital structures, so caution is warranted regarding its identification. Nonetheless, we are confident that it was highly likely to be *Anyphaena furva*, suggesting that the species may have multiple established populations, at least within the Viroin region.

Figure 1: Capture site of the adult *Anyphaena furva* male at Tienne Breumont, Nismes. © Garben Logghe

Identification

Currently, six species of *Anyphaena* have been recorded in Europe. Besides the two Belgian species, *Anyphaena accentuata* and *Anyphaena furva*, three other species have been recorded in neighbouring countries: *Anyphaena numida* Simon, 1897 and *Anyphaena sabina* L. Koch, 1866 are present in both France and the United Kingdom, while *Anyphaena alboirrota* Simon, 1878 is known exclusively from southern France (HARVEY 2017; LE PERU 2007). The sixth European species, *Anyphaena pontica* Weiss, 1988, seems to be restricted to Eastern Europe and Turkey (NENTWIG et al. 2024). Identifying male *A. furva* is not difficult, as the shape of the bulbus (Fig. 2C) differs noticeably from the other species' (VIDAL & TABERLET 2018). The species that most resembles *A. furva* is *A. accentuata,* but males can easily be distinguished by examining the spination on the pedipalp: *A. furva* possesses a proximal group of strong dorsal spines on the palpal tibia (Fig. 2B), while lacking the long ventral spines on the palpal femur that are typical of *A. accentuata* (RŮŽIČKA 2001; VIDAL & TABERLET 2018). Females can easily be distinguished from other *Anyphaena* by the general shape of the epigyne, with *A. accentuata* again showing the strongest resemblance to *A. furva*. The difference lies in the margin of the sclerotized anterior epigynal pocket, which is (almost) completely horizontal in *A. furva*, while it is strongly concave in *A. accentuata* (RŮŽIČKA 2001).

While *A. furva* typically appears darker and less conspicuously marked compared to other *Anyphaena* species, a high level of intraspecific variation has been noted in both sexes (BAUCHHENSS 2009). Females, in particular, can strongly resemble *A. accentuata*, including having the typical black spots on the abdomen (BAUCHHENSS 2009). Furthermore, RŮŽIČKA (2001) noted that individuals from Central Bohemia differ in colouration from those originating from Slovakia, with the former appearing darker grey rather than brown. This indicates that habitus is not a reliable characteristic for identifying *A. furva*, especially in females.

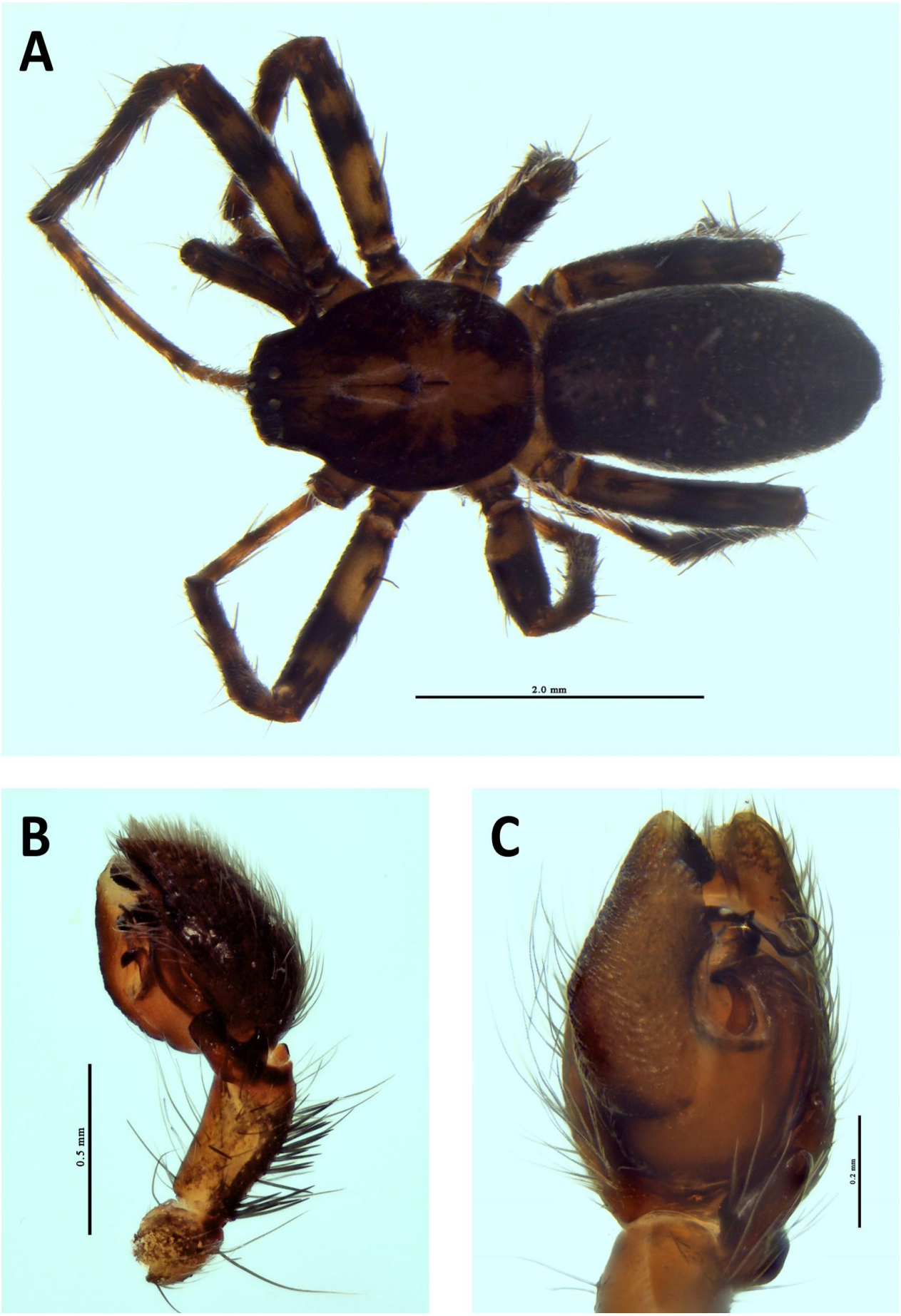

Figure 2: Male *Anyphaena furva*, captured at a chalk grassland in Nismes, Belgium **A.** Habitus, dorsal view **B.** Male palp, retrolateral view **C.** Same, ventral view. © Pierre Oger

Ecology

Like other *Anyphaena* species, *Anyphaena furva* primarily inhabits trees and shrubs. However, it appears to show a strong preference for xerothermic habitats with a discontinuous cover of woody plants (RŮŽIČKA 2001). This is also reflected in its darker colouration compared to other *Anyphaena* species. The known habitat aligns with the potential finding at Senzeilles, where the individual was observed at a sun-exposed forest edge near a xerothermic grassland. Conversely, the observation at Tienne Breumont appears to contradict this, as few trees were present in the immediate vicinity. While there have been some observations of *A. furva* on scree fields and sun-exposed rocks (RŮŽIČKA 2001), it is more likely that these spiders are indeed tree-dwelling, since a recent extensive pit fall survey at the same site did not detect the species (KEKENBOSCH 2023). A plausible explanation is that *A. furva* is more prevalent near the edges of Tienne Breumont, where more trees are present. In that case, the male found on the rocks might have been dispersing, using the pile as a stepping-stone during ballooning (Koen Van Keer, pers. comm.).
Throughout its range, adult males have almost exclusively been collected in May (BAUCHHENSS 2009; RŮŽIČKA 2001). The Belgian observations align with this finding, suggesting that males have a short period of adulthood. This was further supported by a more intensive search for the species at the same location in June, which yielded no results. In contrast, females exhibit a broader phenology, with adults recorded from May to July (BAUCHHENSS 2009; RŮŽIČKA 2001).

Distribution

Anyphaena furva has a predominantly Central-Eastern European distribution, making its discovery in Belgium somewhat surprising. The species was initially described from a single male found in Slovakia (MILLER 1967) and has since been recorded in other Central-Eastern European countries, including Czechia, Georgia, Russia and an unverified record from Romania (NENTWIG et al. 2024). In the neighbouring countries of Belgium, the species has been found in Uffenheim, Germany (BAUCHHENSS 2009) and the French region of Hauts-de-France (VIDAL & TABERLET 2018). These sites are located approximately 600 and 200 kilometres away from the Belgian site, respectively. *Anyphaena furva* appears to be a very rare species across its entire range, likely due to its specific habitat requirements. This is probably also the case within Belgium, as the distinctive dark colouration of the males makes past confusion with *Anyphaena accentuata* rather unlikely.

Acknowledgments

We would like to thank Pierre Oger for taking pictures of the collected *Anyphaena furva*. Special thanks to Pallieter De Smedt and Jinze Noordijk for their valuable comments on a previous version of the manuscript.

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Enoplognatha mandibularis (Lucas, 1846) (Araneae, Theridiidae), a new species for the Belgian and Dutch spider fauna

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Abstract

During arthropod sampling surveys in 2022 at the West Coast of Belgium, and in 2023 in "het Zwin", the Netherlands, *Enoplognatha mandibularis* (Lucas, 1846) was collected and added as new to the Belgian and Dutch spider fauna. At the Belgian West Coast, two populations were discovered in nature reserves 'De Westhoek' and 'Ter Yde', indicating that the species is established there. In the Netherlands, only a single individual was found.

Samenvatting

Tijdens bemonsteringscampagnes van arthropoden in 2022 aan de Westkust (provincie West-Vlaanderen) in België, en in 2023 in "het Zwin" (provincie Zeeland) in Nederland, werd *Enoplognatha mandibularis* (Lucas, 1846) verzameld. Deze soort is nieuw voor de Belgische en Nederlandse spinnenfauna. Aan de Belgische Westkust werden twee populaties gevonden, in de natuurgebieden 'De Westhoek' en 'Ter Yde', met vangstaantallen die erop wijzen dat de soort daar gevestigd is. In Nederland werd één enkel individu gevangen.

Résumé

Lors d'échantillonnages à grande échelle en 2022 dans la côte Ouest (la province de Flandre Occidentale) en Belgique et dans la réserve naturelle "het Zwin", province de Zeeland, aux Pays-Bas, une nouvelle espèce a été trouvée pour la faune belge et néerlandaise: *Enoplognatha mandibularis* (Lucas, 1846). Deux populations ont été trouvées sur la côte ouest belge, dans les réserves naturelles « De Westhoek » et « Ter Yde », ce qui indique que l'espèce y est établie. Aux Pays-Bas, un seul individu a été capturé.

Introduction

BOSMANS & VAN KEER (2017) cited six species belonging to the genus *Enoplognatha* in their catalogue of Belgian spiders. *Enoplognatha ovata* (Clerck 1757)*, Enoplognatha latimana* Hippo & Oksala 1982 and *Enoplognatha thoracica* (Hahn 1833) are common species occurring in a wide variety of habitats, *Enoplognatha caricis* (Fickert 1876) and *Enoplognatha mordax* (Thorell 1875) are less common and prefer bogs, swamps, sea coasts and salty grasslands. *Enoplognatha oelandica* (Thorell 1875) is very rare in Belgium and occurs in sunny warm places as dunes and sandy dry heathland. The Netherlands has a different history with the genus *Enoplognatha*. In his catalogue of 1999, VAN HELSDINGEN (1999) cites five species. DE KONINCK (2009) listed *Enoplognatha oelandica* as new to the Dutch spider fauna from a locality in the province of Noord-Brabant, in the south of the Netherlands, and recently IJLAND (2023) found a female of *Enoplognatha diversa* inside a foil wrapped cauliflower from Spain. It is the first record of *E. diversa* in the Netherlands. It is considered an introduction and it is unlikely that it will establish itself in the country. We report a new species for the Belgian and Dutch spider fauna: *Enoplognatha mandibularis* (Lucas, 1846).

Material and methods

During the period April-November 2022, Natuurpunt Studie and INBO carried out a monitoring research of drifting sand restoration on the West Coast commissioned by the ANB (Agentschap voor Natuur en Bos) (PROVOOST et al. 2024). This survey was carried out in "De Westhoek" (De Panne) and "Ter Yde" (Koksijde) in the province of West-Vlaanderen (Belgium). De Westhoek is the largest nature reserve in the Belgian coastal dunes (ca. 350 hectares). It is also the eldest nature reserve in Flanders (Flemish part of Belgium). Ter Yde is another fairly large coastal dune nature reserve (ca. 260 hectares) and is also rich in biodiversity. Restoration of drift sand was taking place in both areas and our research aimed to find out what this provided for the characteristic spider and carabid beetle fauna of open sandy areas.

The area was investigated by using pitfall traps in five locations in "De Westhoek" and five locations in "Ter Yde", each location containing two traps. The sampling period started on March 22th and ended on November 29th (Ter Yde) and December 9th (De Westhoek) 2022. At all sites, pitfall traps were placed as close as possible to the restored drift sand to sample the characteristic drift sand fauna (Figs 1, 2A-B). It should be noted that it would not be relevant to place pitfall traps directly in the drift sand, as they would quickly fill with windblown sand and become ineffective. The Fig. 1 illustrates this for 'De Westhoek', but it was also the case in 'Ter Yde'. All captured specimens are housed in the collection of Johan Van Keer.

Figure 1: five locations surveyed with pitfall traps in the Westhoek (WH1 - WH5). The material from both pitfall traps per location was pooled when the traps were emptied. This aerial photograph shows the pitfall traps placed as close to the drifting sand as possible.

In an inventory of "Het Zwin" in 2023, also commissioned by the ANB, pitfall-traps were placed by Natuurpunt Studie and Nature-ID both on Belgian and Dutch territory (COSYNS et al. 2024). This nature reserve is characterised by inland tidal floodplains with mud flats and salt marshes. The largest part of this nature reserve is situated in Belgium, and a smaller part in the Netherlands. In 2014 and 2021, a survey was conducted on spiders in the Belgian part of Het Zwin (COSYNS et al. 2015; 2022; LAMBRECHTS et al. 2016), which yielded a new spider for the Belgian fauna, *Porrhomma cambridgei* (VAN KEER et al. 2016). In 2023, a similar survey focused on the Dutch part. On seven distinct locations, of which six on Dutch territory, two pitfall traps were installed. The specific location where we found *Enoplognatha mandibularis* was a moist dune valley, with only sparse

vegetation (Fig. 2C-E). This inner plain with pioneer vegetation only floods occasionally with salt water and consequently receives both saline and freshwater influences. This vegetation has developed here under the influence of wind dynamics, recreation and sporadic flooding. The vegetation is characterised by a large population of *Glaux maritima* (Fig. 2D) and *Anagallis arvensis* (Fig. 2E) with occasional some stands of *Limonium vulgare.* At the transitions to the dunes *Honckenya peploides* occurs. These habitat conditions with accompanying vegetation do not occur in Flanders over a significant area.

Figure 2: Sampled habitats. **A.** Picture of the restored drift sand in de nature reserve 'De Westhoek'. 16 August 2024. **B.** Picture of the habitat of *Enoplognatha mandibularis* with restored drift sand in the background in the nature reserve Ter Yde. 16 August 2024. **C.** View of the two pitfall traps at the site in 'Het Zwin' where the first *Enoplognatha mandibularis* for the Netherlands was collected. As one can see, this was a large, bare, moist sandy area at the time when the pitfall traps were placed. 4 April 2023. **D.** View of the same location on 4 June 2022 with flowering *Glaux maritima*. **E.** View of the same location on 21 August 2023 with flowering *Anagallis arvensis*. © Maarten Jacobs (A-B, D); Jorg Lambrechts (C).

Results and discussion

During the survey at 'De Westhoek' and 'Ter Yde', we found *Enoplognatha mandibularis* in high numbers, clearly indicating the presence of a local population. In "De Westhoek", *Enoplognatha mandibularis* occured in all five sites investigated, with a total of 22 specimens (19 males, 3 females), while it was also present in all five sites surveyed in "Ter Yde", with 11 specimens (10 males, 1 female).

Phenology

One male was caught in the period 22th March -5th April 2022 in Ter Yde. All other individuals were caught in October and November: 12 males in the period 16th October -5th November 2022 and 7 males and 3 females in the period 5th November – 19th November 2022 (and none in in the period 19th November – 9th December 2022) in 'De Westhoek' and 2 males in the period 18th October -1th November 2022 and 5 males and 1 female in the period 1th November – 15th November 2022 and 2 males in the period 15th November – 29th November 2022 in Ter Yde. In the period 9th -25th October 2023, one male of *Enoplognatha mandibularis* was collected with a pitfall trap in our study area in 'Het Zwin' in the Netherlands. The traps in 'Het Zwin' were collected on 25th October 2023. This survey thus ran for over a month less than the survey at the Western coast and possibly that is why only one specimen of *Enoplognatha mandibularis* was caught. Indeed, our phenology date show that most individuals at the Western coast were caught in November, after the traps had already been removed in 'Het Zwin'.
Our phenology data indicate that the species can be found in the winter semester in Belgium and the Netherlands. In southern Europe and North Africa males and females were found from October to July (Bosmans & Van Keer 1999).

Identification

We refer to Bosmans & Van Keer (1999) for figures and description of *E. mandibularis*. However, the main features to distinguish the species from its congeners are summarized. Males (Fig. 3B, D-G) are easily distinguished by the presence of a strong tubercle on the median apophysis of the palp, which is absent in all other species (Fig. 3F), and by the short comma-shaped embolus (Fig. 3G), which is further only present in the sibling species *Enoplognatha gemina* Bosmans & Van Keer, 1999. Females (Fig. 3A, H) are less readily distinguished but differ from related species by the heavily sclerotised dark median depression and contrasting unsclerotised posterior margin of the epigyne (Fig. 3H).

Ecology

All specimens were captured in sandy areas with very sparse vegetation, all Belgian specimens in rather dry situations, the Dutch male in a moister habitat. On the location where the specimen of *Enoplognatha mandibularis* in 'Het Zwin' in the Netherlands was collected, the most numerous spider species in the pitfall traps was *Arctosa perita* (Latreille 1799). This species is very typical for bare sand. On all the 10 surveyed locations in 'De Westhoek' and 'Ter Yde', we found a community of rare spider species, mostly typical for dunes and dry, oligotrophic grasslands. Of the 15 spider species that were most numerous, 12 species are on the Flemish Red List (Maelfait et al. 1998) in the categories 'vulnerable', 'endangered' or 'critically endangered'. In order of abundance these are *Haplodrassus dalmatensis* (L. Koch 1866), *Zelotes longipes* (L. Koch 1866), *Pardosa monticola* (Clerck 1757), *Psammitis ninnii* Thorell 1872, *Psammitis sabulosus* (Hahn 1832), *Zelotes electus* (C.L. Koch 1839), *Arctosa perita* (Latreille 1799), *Xerolycosa miniata* (C.L. Koch 1834), *Styloctetor romanus* (O. Pickard-Cambridge, 1873), *Micaria dives* (Lucas 1846), *Agroeca cuprea* Menge, 1873 and *Parapelecopsis nemoralioides* (O. Pickard-Cambridge, 1884). Only two species are listed as 'least concern' on the Red List, more specifically *Xysticus kochi* Thorell, 1872 and *Tenuiphantes tenuis* (Blackwall, 1852). The 14th most numerous spider species in the whole survey was *Enoplognatha mandibularis* (33 ex.). Although the Red List is outdated (De Smedt et al. 2024), this still indicates a community of rare spider species is present on the locations where *Enoplognatha mandibularis* was found.
In the Mediterranean region, the species has always been collected under stones in a wide variety of habitats such as dunes, *Pinus* forest, grasslands and dry riverbeds.

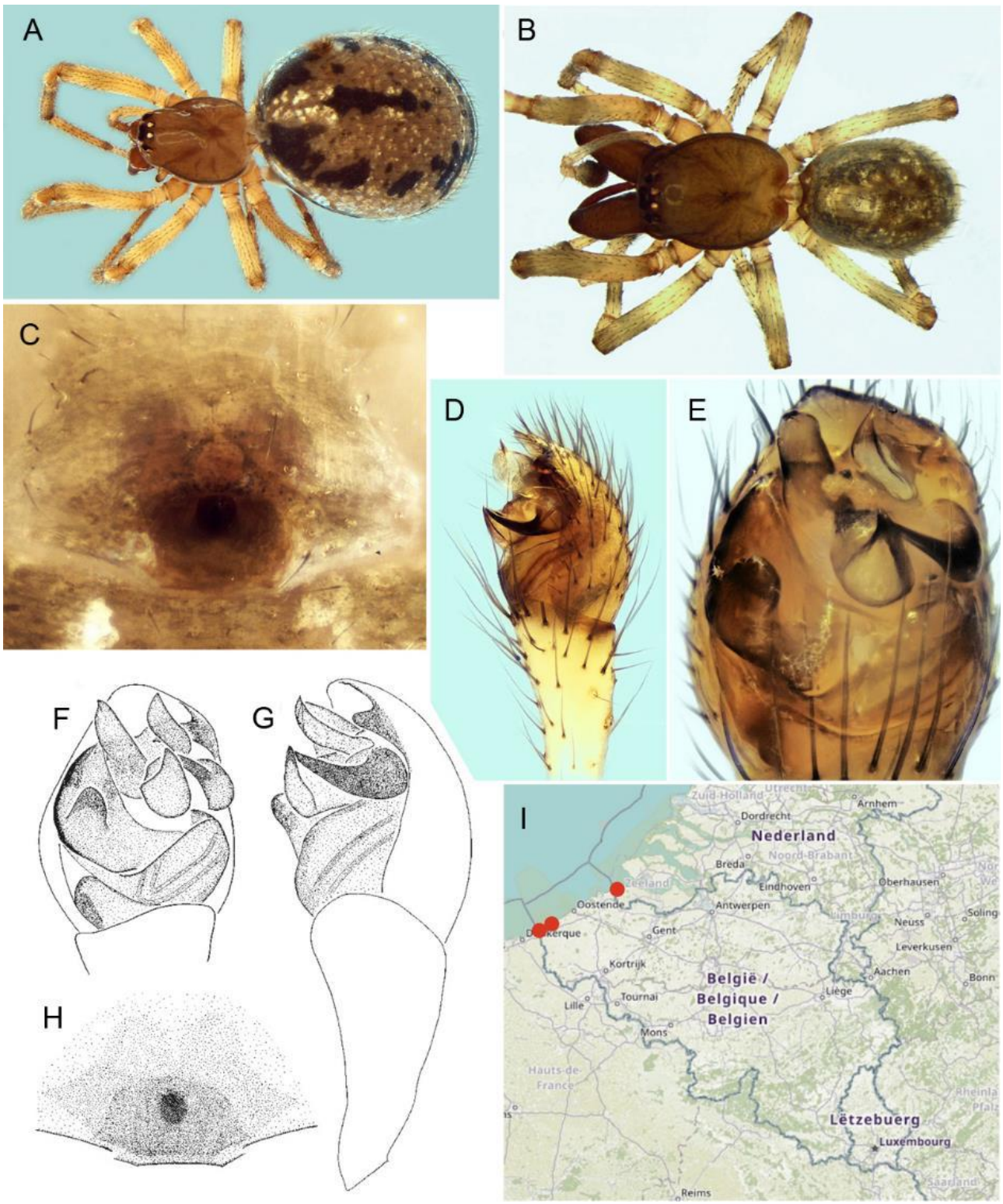

Figure 3: **A.** Female habitus, **B.** Male habitus, **C.** Female epigyne, **D.** Male palp retrolateral view, **E.** Male palp ventral view, **F.** Male palp ventral view, **G.** Male palp retrolateral view, **H.** Female epigyne, **I.** Known distribution of *E. mandibularis* in Belgium and The Netherlands. No scale bars provided. Photos A-E by Pierre Oger; illustrations F-H after Bosmans & Van Keer 1999.

Distribution

Enoplognatha mandibularis has a mainly Mediterranean distribution pattern. Bosmans & Van Keer (1999) examined specimens from Morocco, Algeria, Tunisia in North Africa and from Portugal, Spain (including Balearic Islands), France (including Corsica), Italy (including Sardinia), Croatia and Greece.

Albania (Vrenozi & Jäger 2012), Bulgaria (Blagoev et al. 2018) Hungary (Samu & Szinetar 1999), Malta (Pfliegler et al. 2017), Russia (Ponomarev 2022) and Turkey (Danisman et al. 2024) are more recent and new localities where the species has been collected. There is also an older citation from St. Helena (Benoit 1977) where it has probably been introduced. Chen & Zhang (1991) published drawings of *Enoplognatha mandibularis* from China of the male and female, but only the male referred to *Enoplognatha mandibularis*, the female is a different species.

The locations in Belgium and the Netherlands (Fig. 3I) are the northernmost in Europe for the moment. Indeed, as no published record of the citation in Lithuania is found (Ivinskis & Rimsaite, pers. comm.), this remains an unconfirmed record. Lecigne (2016) reported one male *Enoplognatha mandibularis* from the French department Nord in Bray-Dunes near the Belgian border. This indicates that the species is expanding its range from the south via the coast. This illustrates again that the Western coast of Belgium is a gateway for species that expand their range from the south. This was previously established for *Diplocephalus graecus* (O.P.-Cambridge, 1872) (Bonte et al. 2002). It has also been recorded for the dragonfly *Coenagrion scitulum* (Rambur, 1842) (Vanderhaeghe 1998, 1999).

It is expected that *Enoplognatha mandibularis* will further increase in number of populations, and in numbers, in Belgium and the Netherlands, in the future, and also that it will expand its range further up north. Also, it is expected to occur in more different habitat types in Belgium and the Netherlands in the future. The discovery in the Netherlands one year after the discovery of the species in Belgium, may indicate that the area expansion is continuing at a high rate. But it is also possible that the species was already present but recorded later because the survey was done later…

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First observation of the jumping spider *Carrhotus xanthogramma* (Latreille, 1819) in Belgium

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Abstract

Carrhotus xanthogramma (Latreille, 1819) is recorded for the first time in Belgium. The authors describe how to identify the species in the field and briefly discuss its ecology and distribution. This jumping spider is likely another example of a species expanding its range as a result of climate change.

Samenvatting

De Tweekleurige springspin, *Carrhotus xanthogramma* (Latreille, 1819), wordt voor het eerst gemeld in België. De auteurs beschrijven hoe de soort in het veld te identificeren en bespreken kort de ecologie en verspreiding. Deze spin is waarschijnlijk een nieuw voorbeeld van een soort die zijn verspreidingsgebied uitbreidt als gevolg van klimaatsverandering.

Résumé

La Saltique orangé, *Carrhotus xanthogramma* (Latreille, 1819), est signalée pour la première fois en Belgique. Les auteurs décrivent comment identifier l'espèce sur le terrain et discutent de son écologie et de sa répartition. Cette araignée est probablement un autre exemple d'une espèce qui étend son aire de répartition en raison du changement climatique.

Introduction

On May 11, 2024, the second author discovered an unfamiliar male jumping spider near the Raymond Mayné nature reserve in Torgny, the southernmost village in Belgium. The spider was observed hunting among lichens on the central structure of a stone monument, which was elevated from street level and shaded by surrounding trees (Figs. 1A-B). Several attempts were made to identify the spider using ObsID, which consistently pointed to *Philaeus chrysops* (Poda, 1761). Although this southern Salticidae species has occasionally been recorded from Belgium as an accidental import (WAARNEMINGEN.BE 2024), there were clear differences in this spider's appearance. To clarify, the iNaturalist's image recognition tool was employed, identifying the spider as *Carrhotus xanthogramma* (Latreille, 1819). Since this species had not previously been documented in Belgium, the spider was collected and preserved in ethanol for verification. Upon later examination of this collected individual, the first author confirmed that it was indeed an adult male *Carrhotus xanthogramma*, marking the first recorded occurrence of this species in Belgium.

We propose the Dutch vernacular name "Tweekleurige springspin", which means "bicoloured jumping spider" in English. The name refers to the striking contrast in colour between the male's prosoma and opisthosoma, as well as the pronounced sexual dimorphism within the species. Additionally, it is a reference to the species' original designation as *Aranea bicolor* Walckenaer, 1802 (WSC 2024).

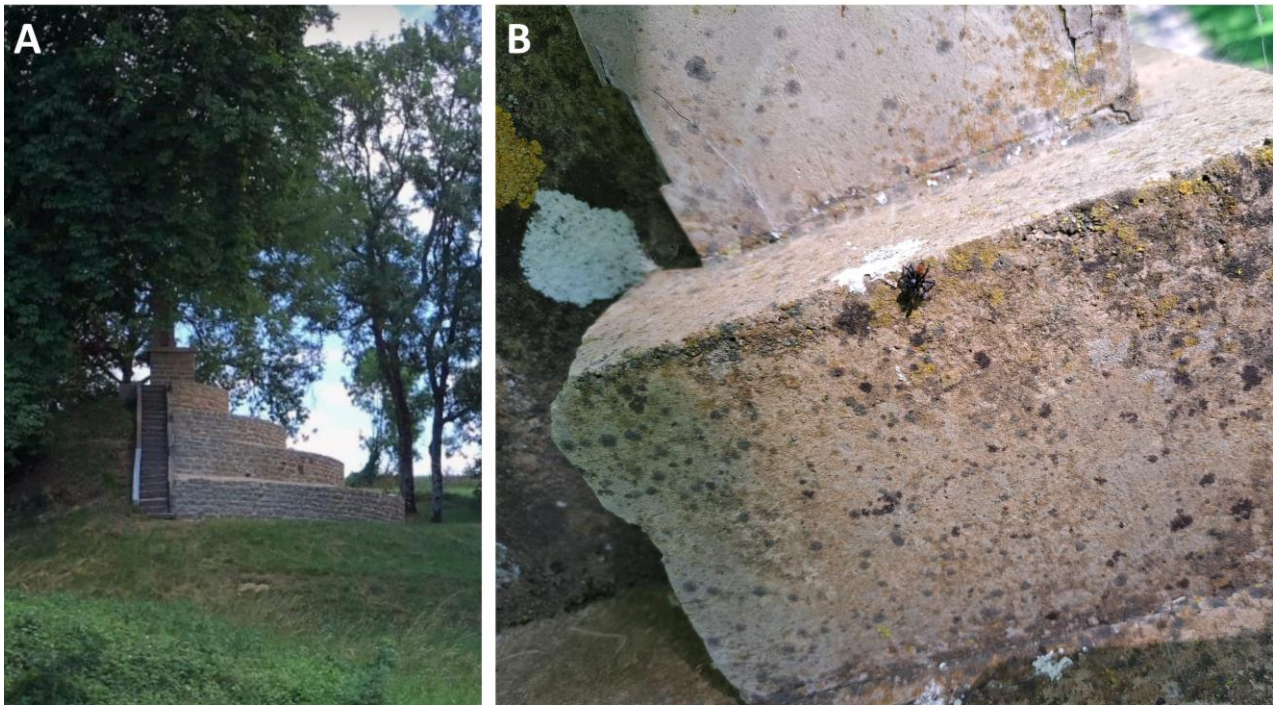

Figure 1: Capture site of *Carrhotus xanthogramma* at Torgny **A.** Stone monument where the spider was discovered **B.** Detail of the central structure, showing the male *Carrhotus xanthogramma* hunting on the lichen-covered stones.

Identification

The genus *Carrhotus* Thorell, 1891 currently includes 37 distinct species, most of which have been recorded in regions of Eastern and Southern Asia (WSC 2024). However, within Europe, the genus is monotypic, with *Carrhotus xanthogramma* being the sole representative (NENTWIG et al. 2024). This simplifies identification, as confusion with other European Salticidae is highly unlikely. Furthermore, both males and females are uniquely coloured, making them stand out from other European Salticidae. Males possess a glossy black prosoma that contrasts sharply with the brownish red opisthosoma (Fig. 2A). The front of the abdomen has a white margin that transitions to black towards the middle, and there are characteristic tufts of brown hairs beneath each of the posterior eyes (BREITLING et al. 2016). The female opisthosoma is typically bright yellow to orange, with black markings that vary in shape and contrast among individuals. The colour of the female's prosoma is quite variable but generally darker than the abdomen, as seen in males. Yellow spots and lines are usually present on the prosoma, though their shape, size and arrangement can vary significantly. Despite this variability, few Salticidae species in Europe closely resemble *Carrhotus xanthogramma*, making its habitus generally reliable for identification. However, this applies primarily to observations within Europe, as other *Carrhotus* species documented worldwide may bear a closer resemblance to *C. xanthogramma*.
Given the species' variability in appearance, it is advisable to examine the genitalia if there is any uncertainty. The genitalia of both males and females are quite distinctive, particularly in comparison to other European Salticidae species. Male palps are characterized by a prominent chisel-like tibial apophysis and are densely covered with dark hairs (Figs. 2B-C), while the female epigyne features two characteristic depressions that set it apart from other European Salticidae (NENTWIG et al. 2024).

Ecology

Carrhotus xanthogramma is primarily considered an arboreal species, typically found by beating the branches of trees or shrubs (NENTWIG et al. 2024; YOSHIDA & SUZUKI 1981). It has been documented in a variety of habitats, including anthropogenic environments like orchards (MEZŐFI et al. 2019). At first glance, the discovery in Torgny on a stone monument might seem inconsistent with its known habitat. This could suggest that the individual was a vagrant, possibly landing on the stones during ballooning. However, since the

monument was surrounded by trees, it is also likely that the spider fell from a nearby tree and a reproducing population is present at the site. Additional targeted searches using beating sheets or arboreal pit fall traps around the Raymond Mayné reserve could help determine whether this is indeed the case. Typical for European Salticidae, *Carrhotus xanthogramma* is diurnal and adult in spring and early summer (MEZŐFI et al. 2019; NENTWIG et al. 2024). Adult males are found from April to July, while adult females can be observed until August.

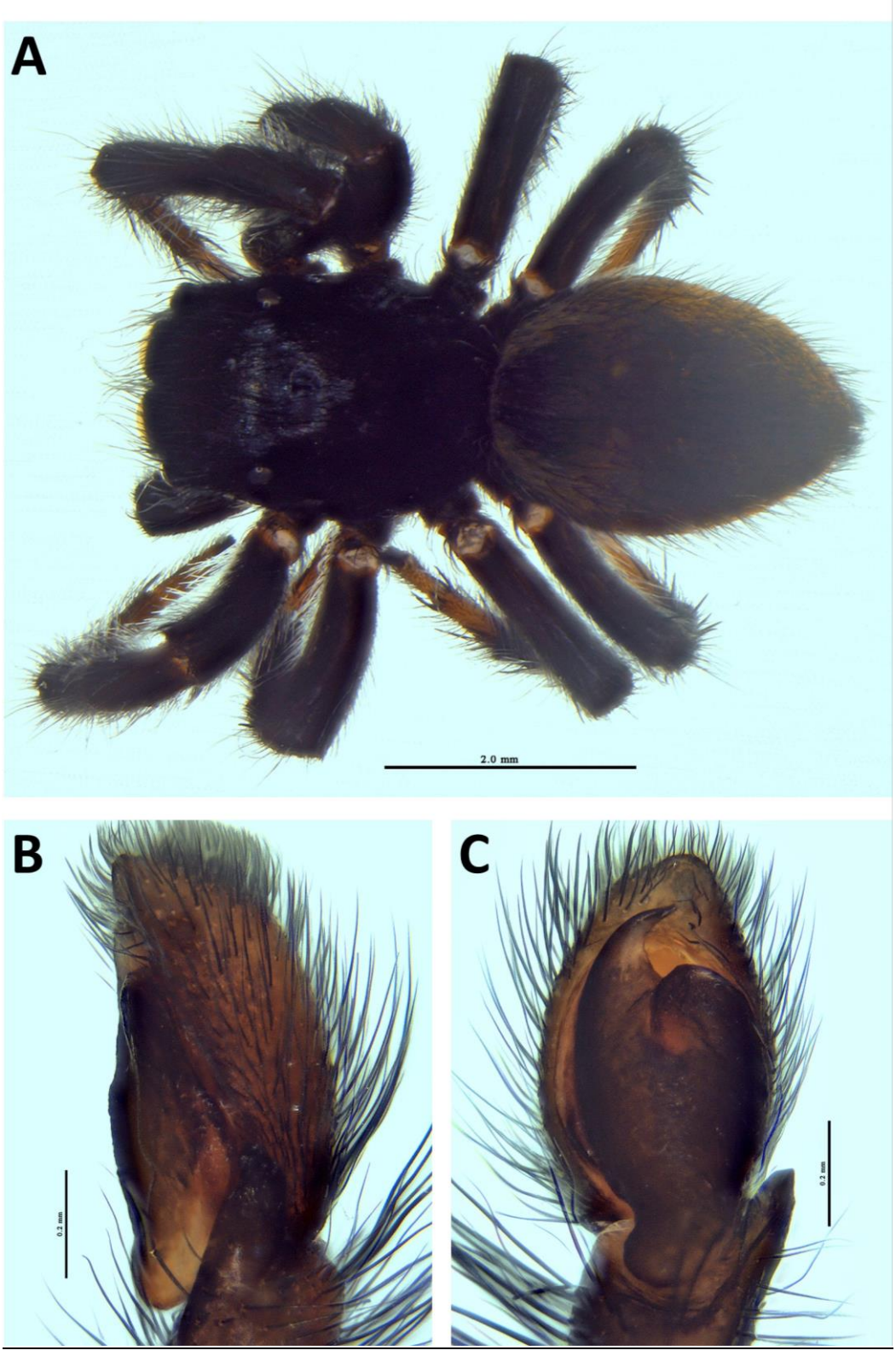

Figure 2: Male *Carrhotus xanthogramma*, captured near the Raymond Mayné reserve in Torgny **A.** Habitus, dorsal view **B.** Male palp, retrolateral view **C.** Same, ventral view © Pierre Oger

Distribution

The distribution of *Carrhotus xanthogramma* is Palearctic, with the species occurring across most of Europe, extending to the Middle East and even Far Eastern countries like China and Japan (NENTWIG et al. 2024). As a thermophilic species, it is notably absent from the colder northern regions of Europe. It seems likely that *C. xanthogramma* is able to expand its range due to climate change, similar to the now widespread orbweaver *Argiope bruennichi* (Scopoli, 1772) (KUMSCHICK et al. 2010). In this context, a first arrival in Torgny would be logical, as it is the southernmost point in Belgium and a haven for rare thermophilic species such as *Cheiracanthium punctorium* (Villers, 1789) (VAN KEER 2019). Time will tell whether *C. xanthogramma* will successfully colonize the warming northern regions.

Acknowledgments

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First record of *Nigma puella* (Simon, 1870) in Belgium, validated by genetic identification (Araneae, Dictynidae)

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Abstract

The presence of the bleeding heart spider *Nigma puella* (Simon, 1870), a member of the Dictynidae family, had not been formally confirmed in Belgium until now. The species was recorded in Tihange in 2023 through a photograph posted on Observations.be / Waarmeningen.be, the Belgium participatory platform for monitoring biodiversity. Subsequently, in 2024, two males and a female were captured at the same site. Their identity is now confirmed through sequencing a fragment of their cytochrome *c* oxidase I (COI) gene and examining their morphological characteristics. A list of key characters is also presented for the three species of *Nigma* Lehtinen, 1967 found in Belgium. The list of Dictynid species occurring in Belgium is updated.

Samenvatting

De aanwezigheid van het bont kaardertje *Nigma puella* (Simon, 1870), een lid van de familie Dictynidae, was tot nu toe in België niet formeel bevestigd. De soort werd in 2023 in Tihange waargenomen via een foto die werd geplaatst op Observations.be / Waarmeningen.be, het Belgische participatieve platform voor het monitoren van biodiversiteit. Vervolgens werden in 2024 op dezelfde locatie twee mannetjes en een vrouwtje gevangen. Hun identiteit wordt nu bevestigd, op basis van de sequentiebepaling van een fragment van hun cytochroom *c* oxidase I (COI) gen en op het onderzoeken van hun morfologische kenmerken. Er wordt ook een lijst met sleutelkenmerken gepresenteerd voor de drie soorten van *Nigma* Lehtinen, 1967 die in België gevonden zijn. De lijst met in België voorkomende Dictynidae-soorten is bijgewerkt.

Résumé

La présence de l'araignée dictyne fille *Nigma puella* (Simon, 1870), apparentant à la famille des Dictynidae, n'avait jusqu'à présent pas été formellement confirmée en Belgique. L'espèce a été recensée à Tihange en 2023, via une photographie postée sur Observations.be / Waarmeningen.be, la plateforme participative belge pour la surveillance de la biodiversité. Par la suite, en 2024, deux mâles et une femelle ont été capturés sur le même site. Leur identité est maintenant confirmée par le séquençage d'un fragment de leur gène de la cytochrome *c* oxydase I (COI) et l'examen de leurs caractéristiques morphologiques. Une liste de caractères clés est également présentée pour les trois espèces de *Nigma* Lehtinen, 1967 rencontrées en Belgique. La liste des espèces de Dictynidae présentes en Belgique est mise à jour.

Introduction

Dictynidae is a family of small cribellate spiders, well distributed around the world and containing 461 species spread amongst 52 genera (WORLD SPIDER CATALOG 2024). Most species build irregular tangle webs among leaves of vegetation, on walls or on the ground. Since the spider checklist of BOSMANS & VAN KEER (2017), was published which included 17 species and nine genera of Dictynidae occurring in Belgium, some taxonomic

changes have occurred. The genus *Cicurina* Menge, 1871, containing the species *C. cicur* (Fabricius, 1793), was first moved to the Hahniidae by WHEELER et al. (2017) and then to its own family, Cicurinidae, by GORNEAU *et al*. (2023). The genus *Mastigusa* Menge, 1854, comprising the species *M. arietina* (Thorell, 1871) and *M. macrophthalma* (Kulczyński, 1897) was transferred from the Dictynidae to the Hahniidae by WHEELER et al. (2017) and then to the Cybaeidae by CASTELLUCCI et al. (2023). In the meantime, the latter species was removed from the Belgian spider checklist (CASTELLUCCI et al. 2024; NENTWIG et al. 2024). Finally, the species *Argyroneta aquatica* (Clerck, 1757) was transferred from the Cybaeidae to the Dictynidae by WHEELER *et al*. (2017), although its placement is still debated (ONO & OGATA 2018).

Among Dictynidae occurring in Belgium, the genus *Nigma* Lehtinen, 1967 currently includes two species: *N. flavescens* (Walckenaer, 1830) and *N. walckenaeri* (Roewer, 1951). The species *Nigma puella* has only recently been observed in Belgium and documented for the first time, based on a photograph taken on 01/06/2023 near the Tihange Nuclear Power Station and published in OBSERVATIONS.BE / WAARMENINGEN.BE (https://observations.be/observation/275136815/). The photo was also published in issue 117 of the Natagora magazine (November 2023; https://www.natagora.be/nos-publications).

In June 2024, adult specimens were collected from the same locality, and subsequently identified by DNA-barcoding and morphological characterization. Using both identification methods, this paper formally confirms the presence of *N. puella* in Belgium. Therefore, the Belgian checklist of the family Dictynidae is updated and now includes 16 species distributed across eight genera (Table 1).

Table 1: *Species list of Dictynidae found in Belgium. 'Shade' indicates the species sequenced during this study.*

Genus	***Species***
Argyroneta	*aquatica* (Clerck, 1757)
Altella	*lucida* (Simon, 1874)
Argenna	*patula* (Simon, 1874)
	subnigra (O. Pickard-Cambridge, 1861)
Brigittea	*civica* (Lucas, 1848)
	latens (Fabricius, 1775)
Dictyna	*arundinacea* (Linnaeus, 1758)
	major Menge, 1869
	pusilla Thorell, 1856
	uncinata Thorell, 1856
Emblyna	*brevidens* (Kulczyński, 1897)
Lathys	*humilis* (Blackwall, 1855)
	stigmatisata (Menge, 1869)
Nigma	*flavescens* (Walckenaer, 1830)
	puella (Simon, 1870)
	walckenaeri (Roewer, 1951)

Material and Methods

Material studied

Nigma puella (Simon, 1870) (Aranae, Dictynidae):

BELGIUM • 1 ♂; Tihange, Rue de la Justice, car park near the nuclear power plant; 50°31'57.4"N 5°15'52.6"E; 21.VI.2024; A. & L. Henrard leg.; Beating vegetation; Field number: AH_20240621_01; GenBank (COI): PQ002554; RBINS_IG 34838/01. • 1 ♀; same data as previous; Field number: AH_20240621_02; GenBank (COI): PQ002555; RBINS_IG 34838/02. • 1 ♂; same data as previous; Field number: AH_20240621_03; GenBank (COI): PQ002556; RBINS_IG 34838/03.

DNA-based species identification

Individual DNA was extracted from four legs of each specimen and a fragment of the mitochondrial cytochrome *c* oxidase subunit I (COI) gene was subsequently amplified using using the same methodology as described in HENRARD et al. (2024). Additionally to the LCO1490 and HCO-700ME primer pair (FOLMER et al. 1994; BRETON et al. 2016) Forthe present investigation was complemented with amplicons obtained using the primers C1-J-1718-spider (5'-GGNGGATTTGGAAATTGRTTRGTTCC-3') and C1-N-2776-spider (5'-GGATAATCAGAATANCGNCGAGG-3') (VINK et al. 2005). Further purification, Sanger sequencing and in silico processing of the raw data were as described in HENRARD et al. (2024). Generated consensus sequences were generated for each specimen, and subsequently compared against the Identification System of BOLD, with Species Level Barcode Records option (www.boldsystems.org).
Additionally, a Neighbour-Joining (NJ) tree (Tamura-Nei distance model, 1000 bootstrap replicates) was constructed to examine the clustering support of each species of the *Nigma* genus. To this end, the generated sequences were first aligned with all publicly available COI sequences of *Nigma* species downloaded from BOLD and GenBank (https://www.ncbi.nlm.nih.gov/genbank/), using MUSCLE in Geneious Prime®. Then, duplicates (i.e., identical sequences) were discarded per species to limit the size of the database. For this analysis, the final alignment comprised 24 unique COI sequences. Our sequences were trimmed to the universal 658 bp barcoding region of the COI gene to ensure consistency, as all currently available *Nigma* COI sequences from online repositories are limited to this length (see Appendix 1 Table A1). Among these, the COI sequence of *Ajmonia gratiosa* (Simon, 1881) was included, as this species was recently re-transferred from the genus *Nigma* to *Ajmonia* Caporiacco, 1934 (WUNDERLICH 2022). Additionally, the COI sequences of *Dictyna uncinata* and *Dictyna arundinacea* were included to root the NJ tree.

Examination and illustration

Photographs of the specimens and genitalia immersed in ethanol 70% were taken with a DFC500 camera mounted on a Leica MZ16A and piloted with the Leica Application Suite software (LAS ver. 4.13). The epigyne was removed from the abdomen and digested using half a tablet of Total Care Enzima product (Abbott Medical Optics, Santa Ana, CA) in a few millilitres of distilled water overnight, then immersed back in 70% ethanol to be photographed. Some photos are available on the website "Les araignées de Belgique et de France" by Pierre Oger (https://arachno.piwigo.com/).

Results

DNA-based analyses

The generated sequences (1229 bp) were unique and deposited on GenBank with accession numbers PQ002554-PQ002556. Eight sites were polymorphic between the three generated sequences (S = 8; average number of nucleotide differences, k: 5.3), all of them synonymous. Using the Identification System of BOLD, high matches (99.69 - 100%) were obtained with representatives of the species *Nigma puella* (Table 2).

Table 2: *Results of the match in BOLD (closest similarity given in %), with collection code and GenBank accession numbers (GB number) of the generated sequences for the specimens collected in Tihange (Belgium).*

Collection code	GB number	BOLD similarity (%)
RBINS_IG 34838/01	PQ002554	99.69% *Nigma puella* (UMAAI2864-22)
RBINS_IG 34838/02	PQ002555	99.85% *Nigma puella* (private sequence) 99.84% *Nigma puella* (UMAAI2864-22)
RBINS_IG 34838/03	PQ002556	100% *Nigma puella* (FBARB1125-16)

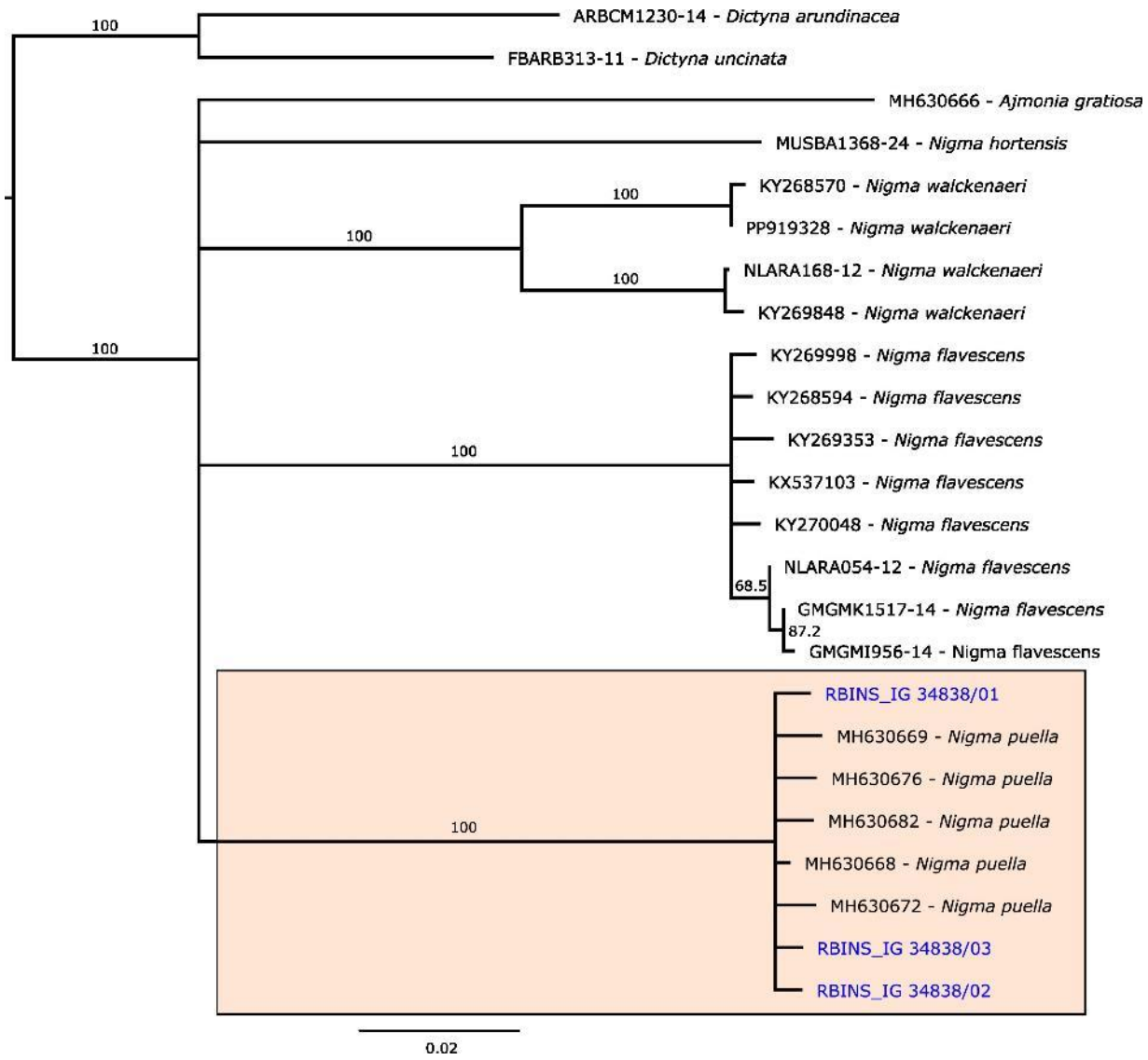

Figure 1: Neighbour-Joining tree including five species of the genus *Nigma* based on the cytochrome *c* oxidase subunit I (COI), with *N. flavescens*, and *N. walckenaeri* being species occurring in Belgium (Tamura-Nei distance model; 648 bp fragment; 1000 bootstrap replicates), and with *Dictyna uncinata* (FBARB313-11) and *Dictyna arundinacea* (ARBCM1230-14) as outgroups. The bootstrap values are shown at the branch points (COI sequences of query specimens highlighted in blue). Minimum branch support displayed is 65, other branches are collapsed.

The identification was further supported by the NJ tree construction, with a 1000 bootstrap support of the cluster including the generated sequences nested with other *Nigma puella* sequences downloaded from the online DNA repositories (Fig. 1).

Morphological identification

The identification of the specimens is based on LOCKET & MILLIDGE (1951: p. 64, figs. 23b, 26a-b, e, 27a), ROBERTS (1995: p. 86, figs.), BREITLING (2020: p. 342, fig. 7C) and REHFELDT & CASSAR (2024: p. 22, figs. 7a-b, 40d). The typical habitus of the female leaves little doubt as to its identification: an overall whitish colour with an abdomen contrastingly decorated dorsally with reddish markings interspersed by greenish patches (Fig. 2C, D-E).

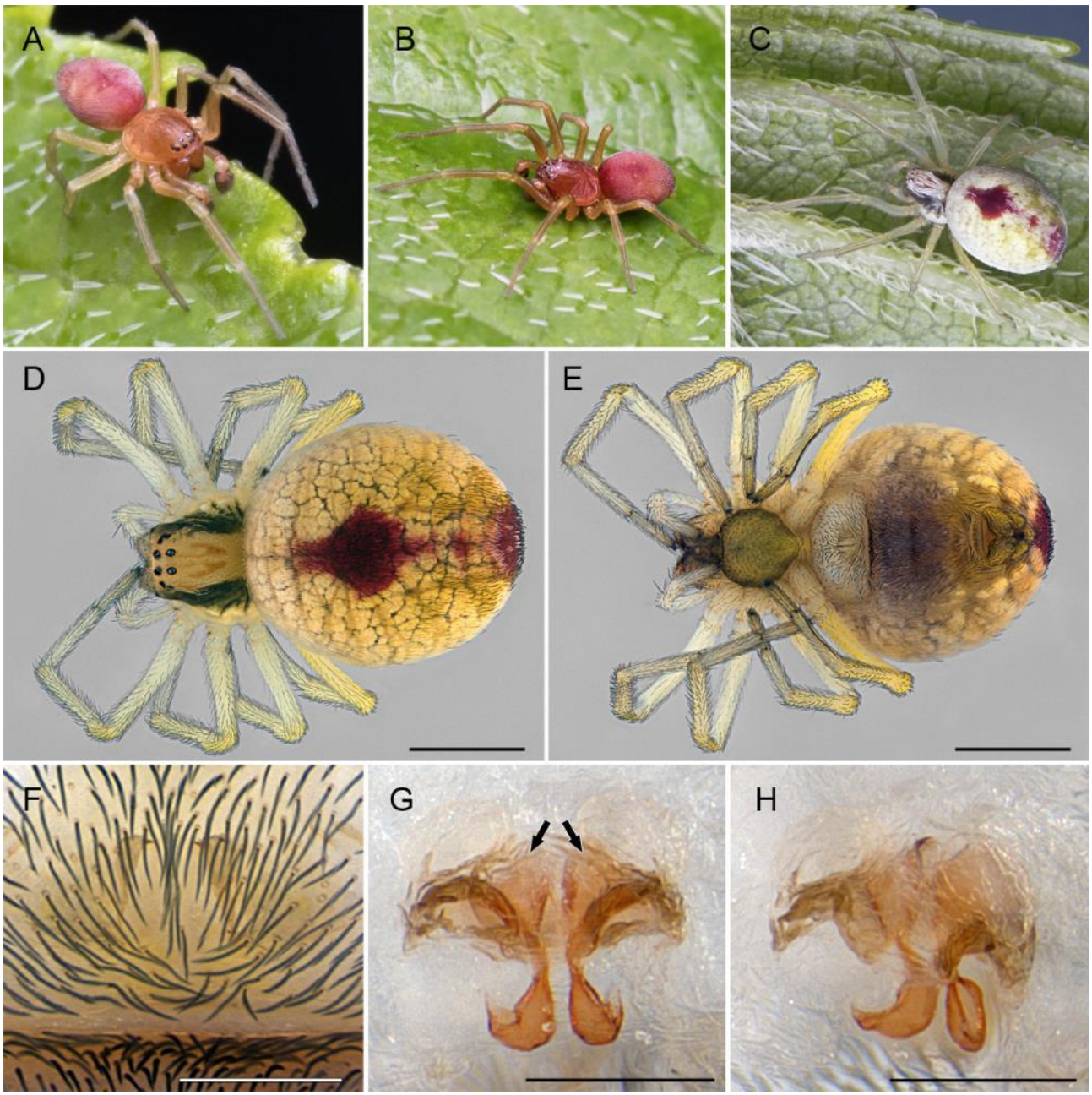

Figure 2: *Nigma puella* (Simon, 1870), specimens collected in Tihange (Belgium). **A-B.** Males (RBINS_IG 34838/01 and RBINS_IG 34838/03). **C-H.** Female (RBINS_IG 34838/02). **A-C.** Habitus *in vivo*. **D.** Habitus in 70% alcohol, dorsal view. **E.** Idem, ventral view. **F.** Epigastric region, ventral view idem. **G.** Vulva, ventral view. The arrows pointing to the large conical sclerite. **H.** Idem, slightly lateral view. Scale bars: D-E = 0.8 mm; E-F = 0.16 mm.

The female genitalia (Fig. 2F-H) are furthermore consistent with illustrations provided in BREITLING (2020: p. 342, fig. 7C) and REHFELDT & CASSAR (2024: p. 22, fig. 7a-b). The males of *Nigma puella* present a reddish pink colouration of the habitus (Figs. 2A-B, 3A-D) and a palpal conformation (Fig. 3E-H) that are very similar to that of *N. flavescens* (Fig. 4A, E). The male of *N. puella* can be distinguished by the broadly rounded basal bulge of the chelicerae (Fig. 3B) (vs. hump with two smaller conical prongs pointing medially in *N. flavescens*, Fig. 4D), and the palp with an embolus course only slightly deviating sub-apically (Fig. 3E-H) (vs. strongly deviating in *N. flavescens*, Fig. 4E) (see also the Key character list hereafter).

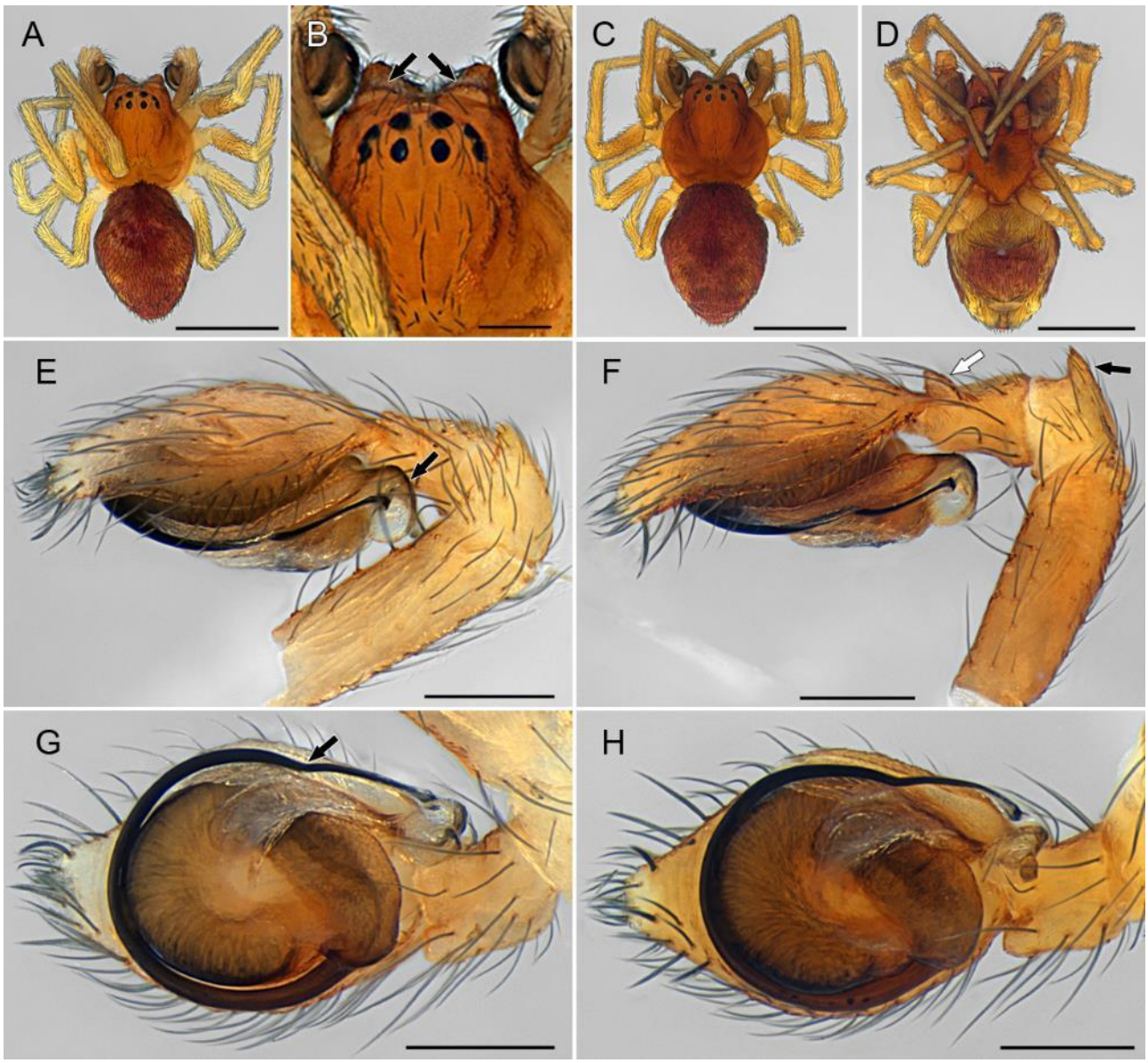

Figure 3: *Nigma puella* (Simon, 1870), male specimens collected in Tihange (Belgium). **A-B, E, G.** Male RBINS_IG 34838/01. **C-D, F, H.** Male RBINS_IG 34838/03. **A, C.** Habitus, dorsal view. **B.** Detail on carapace, dorsal view. The arrows point to the cheliceral bulges. **D.** Habitus, ventral view. **E-F.** Palp, retrolateral view. On E: the black arrow points to the rounded tip of conductor. On F: the black arrow points to the patellar apophysis and white arrow points to the tibial apophysis. **G-H.** Palp, ventral view. On G: the black arrow points to the slight deviation of the embolus course. Scale bars: A-D = 0.8 mm; E-H = 0.16 mm.

Key character list of Nigma species found in Belgium

Remark: since only three species occur in Belgium, we do not provide an identification key. Instead, we present a list of the main characteristics for recognising each species. Diagnostic character combinations are highlighted in italics and underlining.

Nigma puella (Simon, 1870)

- **Body length.** Male: 2.0–2.8 mm; female: 2.5–3.4 mm.
- **Cephalothorax.** Male (Figs. 2A-B, 3A, C): in living specimen, orange-brown to reddish with shades of pink-brown with lateral margins paler, orange-brown in alcohol; female (Fig. 2C-D): cephalic region yellowish-white, with dense cover of white setae, thoracic region darker and lateral margins white.
- **Abdomen.** Male (Figs. 2A-B, 3A, C): pale reddish pink with faint yellow spots dorso-laterally; female (Fig. 2C-D): whitish, decorated *dorsally with reddish markings* and greenish patches in-between.
- **Male chelicerae.** *Sub-basal bulge broadly rounded*.

- **Male pedipalp.** Patella and tibia provided with pointed conical apophysis, *embolus course with slight subapical deviation*, *tip of conductor rounded*, with *small terminal apophysis* (Fig. 3E-H).
- **Female genitalia.** Vulva with *large conical sclerites* (Fig. 2G-H).
- **Phenology.** Male from April to August; female from April to September (NENTWIG et al. 2024).
- **Habitat.** Cribellate web on leaves of trees and shrubs or in herbs in various environments: gardens, lawns, wasteland, meadow, undergrowth of deciduous forest or pine forest, moors, scrubland, vineyard, pond or river edge, back dune, ... (ROBERTS 1995, 1998; LE PERU 2007).

Nigma flavescens (Walckenaer, 1830)

- **Body length.** Male: 2.25–2.5 mm; female: 2.5– 4.0 mm.
- **Cephalothorax.** Male (Fig. 4A): in living specimen, reddish-orange-brown with lateral margins pale orange, similar in alcohol; female (Fig. 4B-C): variable, reddish-brown to dark green with two rows of white setae converging posteriorly and lateral margins almost white.
- **Abdomen.** Male (Fig. 4A): pale reddish, uniform or with faint pattern showing a faint trident marking anteriorly and chevrons posteriorly; female: variable, similar to the male but more contrasted (Fig. 4B) or whitish yellow with marbling pattern and dark anterior patch (Fig. 4C).
- **Male chelicerae.** Sub-basal hump with *two small conical prongs pointing medially* (Fig. 4D; LOCKET & MILLIDGE 1951, fig. 27C).

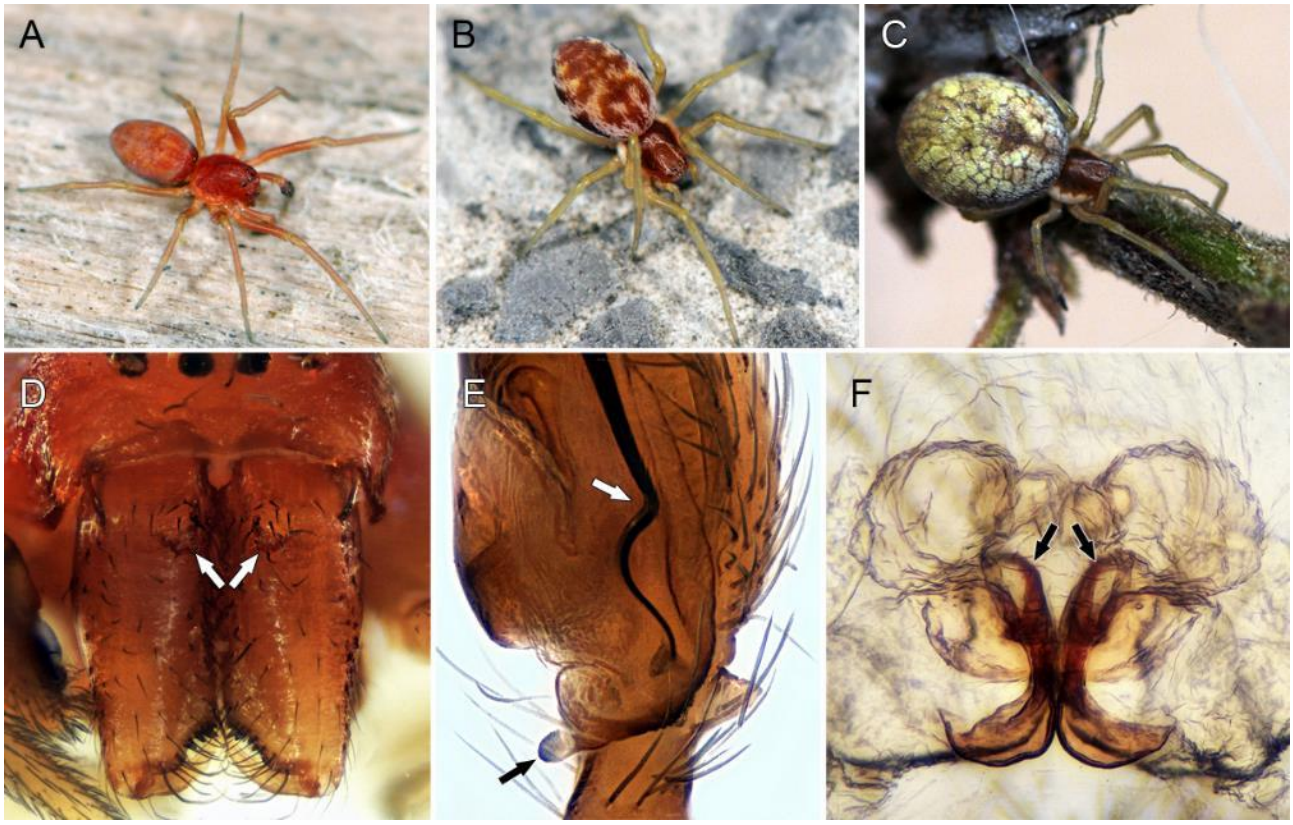

Figure 4: *Nigma flavescens* (Walckenaer, 1830). **A.** Male specimen from Waret-l'Évêque, Belgium (coll. Pierre Oger). **B-C.** Female specimens from Waret-l'Évêque, Belgium (coll. Pierre Oger). **D.** Male from Le Bourget, France (coll. A. Miquet), chelicerae frontal view. White arrows point to the small bulge prongs. **E.** Idem, palp, detail on the conductor, retrolateral view. The white arrow points to the sinuous embolus course, the black arrow points to the stout conductor apophysis. **F.** Female vulva, dorsal view. Black arrows pointing to the conical, curved sclerite. No scales provided. All photos from Pierre Oger.

- **Male pedipalp.** Patella and tibia provided with small, blunt conical apophysis, *embolus course strongly sinuous* sub-apically, tip of conductor rounded, with *stout terminal apophysis* (Fig. 4E).
- **Female genitalia.** Vulva with *slender, curved conical sclerites* (Fig. 4F).
- **Phenology.** Male from April to August; female from April to September (NENTWIG et al. 2024).
- **Habitat.** Especially on leaves of low vegetation, trees and shrubs in forests and forest edges, riparian woodland and riverbanks (ROBERTS 1995, 1998; LE PERU 2007).

Nigma walckenaeri (Roewer, 1951)

- **Body length.** Male: 3.0–4.0 mm; female: 4.0–5.0 mm.
- **Cephalothorax.** Male (Fig. 5A-B): in living specimen, reddish-brown, cephalic region with rows of white setae converging posteriorly, and lateral margins paler, similar in alcohol; female (Fig. 5C): greenish-yellow, cephalic region with rows of white setae converging posteriorly and lateral margins white.
- **Abdomen.** *Green to yellowish-green in male and female* (Fig. 5A-C).
- **Male chelicerae.** Sub-basal bulge with large conical humps (Fig. 5D).
- **Male pedipalp.** Patella with small triangular apophysis, tibia with blunt apophysis, embolus course with faint subapical deviation, *tip of conductor angled*, with thin terminal apophysis (Fig. 5E).
- **Female genitalia.** Vulva anteriorly with *pair of tube-shaped structures* and small, notched conical sclerites, widely separated from each other (Fig. 5F; HENRARD et al. 2024, fig. 2F).
- **Phenology.** Male from August to December; female in May and from August to January (NENTWIG et al. 2024).
- **Habitat.** Frequent on leaves of herbs and bushes, also on the ivy covering the walls of houses. Mostly in gardens and forest edges (ROBERTS 1995, 1998; LE PERU 2007).

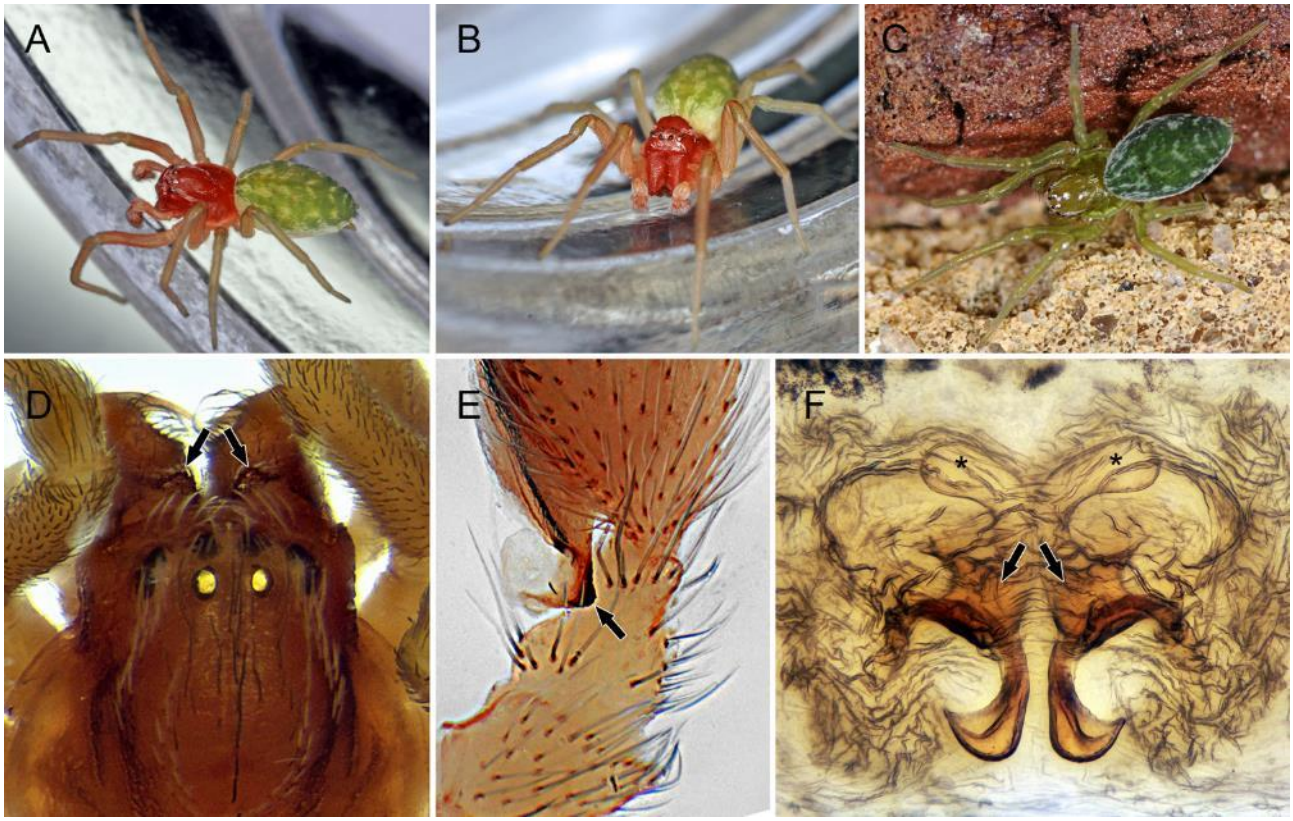

Figure 5: *Nigma walckenaeri* (Roewer, 1951). **A-B, E.** Male specimens from Houx (Yvoir), Belgium (photos & Coll. AH_20100910_01). **C.** Female specimens from Waret-l'Évêque, Belgium (photo & coll. Pierre Oger). **D.** Male from Saint André, France (photo Pierre Oger, coll. G. Melotti), chelicerae dorsal view. The arrows point to the bulge prongs. **E.** Palp, detail on the angled conductor (arrow), retrolateral view. **F.** Female vulva, dorsal view. The arrows point to the conical sclerites, the stars indicate the tube-shaped structure. No scales provided.

Discussion

While much of the Belgian's spider fauna has been well catalogued, including over 700 species (BOSMANS & VAN KEER 2017), ongoing fieldwork and research continue to uncover new species. Even in recent years, previously undocumented species have been identified within Belgium's borders (JANSSEN & CREVECOEUR 2020; HENRARD and DRUMONT 2022; LAMBRECHTS & VAN KEER 2023; HENRARD 2023). Some of these discoveries may represent species that are naturally rare, inhabit previously unexplored regions or habitats. Others could be

the result of shifts in species' geographic ranges, possibly influenced by climate change, while certain non-native species might be introduced through human activities (VAN KEER 2007, 2022).
Given the distribution of the species in the neighbouring countries of Belgium (Fig. 6A-B), it was only a matter of time before the species was reported in our country. *Nigma puella* was first described from Corsica by SIMON in 1870. A few years later, he mentioned its presence in several localities in France, including Honfleur in Normandy (SIMON 1874), which is located less than 300 km from Belgium.

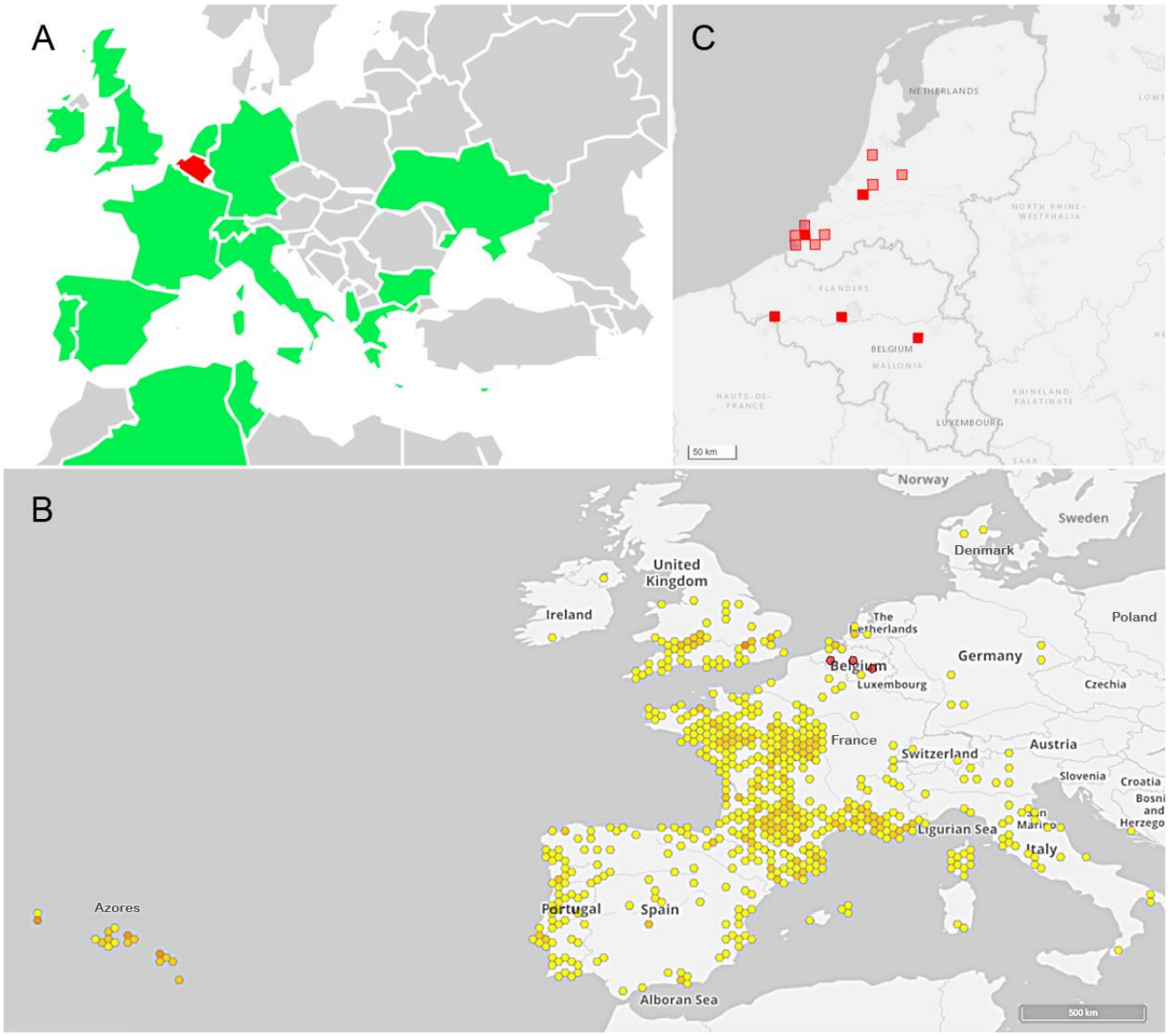

Figure 6: Distribution maps of *Nigma puella* (Simon, 1870). **A-B.** Global distribution: Azores, Madeira, Canary Is., Europe (including Belgium: new records in red), Algeria, Tunisia (A: map after NENTWIG et al. 2024; B: global distribution of records from GBIF 2024, modified). **C.** Detail of the distribution of validated records in Belgium (from OBSERVATIONS.BE / WAARMENINGEN.BE) and Netherlands (from WAARNEMING.NL).

Regarding British records, *Nigma puella* is mentioned in BRISTOWE's *The Comity of Spiders*, Volume II (1941), indicating it was recognized as present in Great Britain at that time. However, the Spider Recording Scheme website notes even earlier records of this species, dating back to 1909 and 1912 (BRITISH SPIDERS 2024; see maps at https://srs.britishspiders.org.uk/portal.php/p/Time+Series+Maps/s/Nigma%20puella). It is likely that even older data exists, as confusion between these species has been common, and synonymies have not always been clear (see Simon, 1914, p. 63). PICKARD-CAMBRIDGE (1894, p. 466) and LOCKET & MILLIDGE (1951, p. 64) refer to *Dictyna puella* as synonymous with *Dictyna variabilis* C. L. Koch, 1836, and *Ergatis pallens* Blackwall, 1859 (see also BLACKWALL, 1861), which the WSC currently lists as *Nigma flavescens*. Some

identifications are likely erroneous, such as the individuals from Codford, Wiltshire, found in 1878, whose description given by PICKARD-CAMBRIDGE (1881, p. 466) perfectly matches *N. puella*.

The detection of *N. puella* in Germany occurred much later, with RENNER (1992), and PLATEN *ET AL.* (1995) mentioning the PhD thesis of D. NÄHRIG (1987) as the first record for the country. Finally, the species was only recently recorded for the first time in the Netherlands (VAN DE PUTTE 2018). Since then, multiple sightings have been recorded on various biodiversity monitoring platforms, such as the Global Biodiversity Information Facility (GBIF, 2024) and the Atlas of the European Arachnids (ARACHNOLOGISCHE GESELLSCHAFT 2024). It is also worth noting that the northernmost records were sporadically reported in Denmark, in 1998 and 2022 (ARTER 2024).

Since the first Belgian observation, several records of *N. puella* are now listed on OBSERVATIONS.BE / WAARMENINGEN.BE (https://observations.be/species/80093), all representing females identified from photographs. In 2023, it was seen in Tihange (Liège province), Sint-Martens-Lennik (Vlaams-Brabant) and in 2024 in Aalbeke (West-Vlaanderen). One of the latest records in Aalbeke shows a female with spiderlings (https://observations.be/observation/320411527), implying that populations are well established in Belgium. These findings suggest a broad distribution in Belgium and the new records align with the species' global distribution. Following the framework proposed by VAN KEER (2007, 2022), when declaring a species as new to Belgium, and in the absence of strong evidence indicating introduction, the species can be considered as part of the Belgian list.

Based on habitus alone, the adult female *N. puella* is easily distinguishable from other closely related species found in Belgium. However, the same is not true for the males, which have a reddish-pink coloration very similar to that of *Nigma flavescens*. Therefore, aside from *Nigma walckenaeri*, which has a distinct red/green colouration, *N. flavescens* or *N. puella* males must be based on microscopic examination of the palpal structure. However, with advancements in computing technology, one can hope that AI-based taxonomic identification applications utilizing deep learning may one day offer a reliable method for identifying males of this species group.

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Author contributions

LB produced the first photograph of *Nigma puella*, posted on Observations.be / Waarmeningen.be and published in Natagora magazine. GL collected the juvenile individuals (08/08/2023) and AH collected the adult specimens (21/06/2024) analysed in this paper. AA made the first attempt at DNA-barcoding on the juveniles collected by GL. NS, MV & AH performed the DNA analyses on the specimens of this study. AH produced photographs, photomicrographs and plates. AH wrote the first draft of the manuscript and edited the revised manuscript. NS wrote the DNA-based species identification and DNA-based analyses sections. GL, LB, MV, NS, AA and KVK commented and edited the revised manuscript.

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Appendix 1. List of COI sequences

Table A1: List of COI sequences and species used in the Neighbour-Joining tree reconstruction, including voucher numbers, GenBank and/or BOLD accession numbers, and references. 'Shade' indicates the specimen sequenced during this study.

Species	Voucher ID	GenBank	BOLD	Reference
Dictyna uncinata Thorell, 1856	BC ZSM ARA 00313	KX536847	FBARB313-11	Astrin et al. 2016
Dictyna arundinacea (Linnaeus, 1758)	BIOUG14290-H07	KP653531	ARBCM1230-14	Blagoev et al. 2016
Ajmonia gratiosa (Simon, 1881)	UB-MD3340	MH630666	IBARA2422-18	Crespo et al. 2018
Nigma hortensis (Simon, 1870)	MNCN-ADN-200018	/	MUSBA1368-24	Unpublished
Nigma walckenaeri (Roewer, 1951)	ZFMK-TIS-20911	KY268570	GBBSP1028-15	Astrin et al. 2016
	ZFMK-TIS-7091	KY269848	GBBSP881-15	Astrin et al. 2016
	RMNH.ARA.12594	/	NLARA168-12	Unpublished
	RBINS_IG.33.177	PP919328	/	Henrard et al. 2024
Nigma puella (Simon, 1870)	UB-MD1916	MH630669	IBARA938-18	Crespo et al. 2018
	UB-MD1928	MH630668	IBARA951-18	Crespo et al. 2018
	UB-MD3341	MH630682	IBARA2423-18	Crespo et al. 2018
	UB-MD399	MH630676	IBARA2638-18	Crespo et al. 2018
	UB-MD1929	MH630672	IBARA952-18	Crespo et al. 2018
	RBINS_IG 34838/01	PQ002554	/	This study
	RBINS_IG 34838/02	PQ002555	/	This study
	RBINS_IG 34838/03	PQ002556	/	This study
Nigma flavescens (Walckenaer, 1830)	ZFMK-TIS-18513	KY268594	GBBSP216-15	Astrin et al. 2016
	ZFMK-TIS-2516845	KY269998	GBBSP1439-15	Astrin et al. 2016
	BC ZSM ARA 00304	KX537103	FBARB304-11	Astrin et al. 2016
	ZFMK-TIS-7169	KY269353	GBBSP936-15	Astrin et al. 2016
	ZFMK-TIS-20892	KY270048	GBBSP365-15	Astrin et al. 2016
	RMNH.ARA.12510	/	NLARA054-12	Unpublished
	BIOUG17117-A01	/	GMGMI956-14	Unpublished
	BIOUG17226-F06	/	GMGMK1517-14	Unpublished

Spiders and harvestmen on large solitary trees along rural-to-urban gradients across Europe

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Abstract

The biodiversity and distribution of many groups of arthropods living on the trunk and in the canopy of large trees is still relatively little described at the European scale. Pan traps are commonly used to assess pollinators in various ecosystems but have been less used to monitor spiders and harvestmen in trees. Here, we report on the diversity and abundance of spiders and harvestmen caught using pan traps in large solitary trees. Sampling took place on *Quercus robur, Fraxinus excelsior,* and *Tilia* sp. along rural-to-urban gradients in nine European cities. Most spiders and harvestmen were caught in rural areas, but the total amount of collected specimens varied considerably across the sampled cities. *Salticus zebraneus,* a species that frequently inhabits old trees, was the most abundant spider, while *Dicranopalpus ramosus* was the most frequently recorded harvestman. Our results demonstrate that using pan traps for sampling tree-inhabiting spiders and harvestmen can be a valuable low-cost and low-effort method.

Samenvatting

Gekleurde vangschalen worden vaak gebruikt om bestuivers in verschillende ecosystemen te onderzoeken, maar worden zelden gebruikt om boom- en boomstambewonende spinnen en hooiwagens te monitoren. In dit onderzoek rapporteren we over de diversiteit en abundantie van spinnen en hooiwagens die met deze methode werden gevangen in grote solitaire bomen. De bemonstering vond plaats bij *Quercus robur, Fraxinus excelsior,* en *Tilia* sp. langsheen gradiënten van ruraal naar urbaan gebied in negen Europese steden. De meeste spinnen en hooiwagens werden gevangen in ruraal gebied, maar er waren grote verschillen tussen de steden in totale hoeveelheid gevangen individuen. *Salticus zebraneus,* een soort die vaak op de stam van oude bomen wordt teruggevonden, was de meest voorkomende spinnensoort in dit

onderzoek, terwijl *Dicranopalpus ramosus* de meest voorkomende hooiwagen was. Onze resultaten tonen aan dat gekleurde vangschalen een waardevolle, goedkope en eenvoudige vangsttechniek kunnen zijn voor het bemonsteren van boom-bewonende spinnen en hooiwagens.

Résumé

La biodiversité et la répartition de nombreux groupes d'arthropodes vivant dans le couvert et sur le tronc des grands arbres est encore relativement peu décrite à l'échelle européenne. Les pièges à insectes colorés sont couramment utilisés pour inventorier les pollinisateurs dans divers écosystèmes. Nous présentons ici la diversité et l'abondance de deux groupes taxonomiques, les araignées et les faucheux, capturés à l'aide de pièges à couleurs placés dans la canopée de grands arbres isolés ou solitaires. Des échantillons ont été prélevés sur *Quercus robur*, *Fraxinus excelsior* et *Tilia* sp. le long de gradients de ruralité, entre le cœur de ville et la campagne avoisinante, dans neuf villes européennes. La plupart des araignées et des faucheux ont été capturés dans les zones rurales, mais le nombre total de spécimens recueillis varie considérablement selon les régions inventoriées. *Salticus zebraneus*, une espèce qui vit dans les vieux arbres, était l'espèce d'araignée la plus abondante, tandis que *Dicranopalpus ramosus* était l'espèce de faucheux la plus souvent enregistrée. Nos résultats démontrent que l'utilisation de pièges à insectes de couleurs peut s'avérer une méthode d'échantillonnage rentable et peu coûteuse pour inventorier l'abondance et la fréquence des espèces d'araignées et de faucheux qui vivent dans la canopée des grands arbres solitaires.

Introduction

Large solitary trees are often old trees that do not directly interact with neighboring trees due to their spatial isolation. These trees have a high cultural and ecological value and are often seen as keystone elements in many landscapes due to their associated biodiversity and large influence on the local environment (MANNING et al. 2006). However, the biodiversity and distribution of many groups of arthropods living on the trunk and in the canopy of large trees is still relatively little described at the European scale.

Pan traps are frequently used to assess flower-visiting species such as hoverflies and bumblebees, which are attracted by the specific colors of the traps (CHAMORRO et al. 2023). These traps are typically filled with water mixed with a detergent to trap arthropods. This trapping method mainly targets pollinators, but other organisms can end up in these traps as well. Applying this method is simple, low-cost, and low-effort, and does not require sophisticated equipment (CHAMORRO et al. 2023). Although pan traps are not the conventional method to sample spiders and harvestmen (DE SMEDT et al. 2023), it is worth assessing the method's possible applications. Additionally, flower-visiting insects receive a lot of attention, hence pan traps are increasingly used. Therefore, data from pan-trap studies are likely available for those studies' non-target groups (i.e., non-pollinators), also in locations where these groups are understudied.

Pitfall traps are the most commonly used method to sample ground-dwelling spiders and harvestmen, and methods such as suction sampling, sweep netting, or beating branches are conventionally used to sample species that prefer trees, shrubs, and low vegetation (BURRASCANO et al. 2021). The number of spiders and harvestmen sampled with these methods is higher compared to the number caught with pan traps as individuals need to crawl into the traps (BUDDLE & HAMMOND 2003, CRISTOFOLI et al. 2010). In this study, the pan traps were placed in a wooden structure allowing arthropods to crawl into them, mirroring the functioning of pitfall traps. However, little is known about the effectiveness of this trapping method for assessing tree-dwelling spiders and harvestmen, and it is unclear which species and families are trapped most. The elevated pan traps were installed against the trunks of large solitary trees at a height of approximately three meters to asses arthropod diversity across rural-to-urban gradients in Europe. We selected nine cities along a latitudinal and longitudinal gradient, from France (Amiens) over Belgium, Poland and Germany to Sweden and Norway (Trondheim). We report on the diversity and abundance of spiders

and harvestmen collected using pan traps, aiming to test the method's application in surveying tree-related arachnid biodiversity.

Material and methods

This study is part of the CoolTree research project where we investigate the biodiversity and ecosystem functions related to large solitary trees, with a specific focus on assessing the effects of urbanization on these important landscape elements (MOREIRA et al. 2024). We assessed arthropod diversity on 216 large solitary trees in and around nine European cities (Fig. 1). In each city, we selected eight pedunculate oaks (*Quercus robur*), eight European ash trees (*Fraxinus excelsior*), and eight lime trees (*Tilia* sp.) along a gradient ranging from the city center to the rural outskirts. The trees' position along the rural-to-urban gradient was summarized by the amount of built-up area in a 100m radius around the tree (ESA WorldCover map of 2021; resolution 10m; ZANAGA et al. 2022). The amount of built-up area varied from 0% in the most rural areas to 99% in the most urban areas (10th percentile: 0%, 90th percentile: 66%). Trees were similarly distributed along the urbanization gradient in the different sampling cities (Appendix 1, Table A1.1). We aimed to select trees with a minimal trunk diameter of 50cm that had no other trees in their immediate neighborhood (i.e., no other trees in a radius equal to the height of the focal tree, no touching crowns). More details on the sampling locations can be found in Appendix 1.

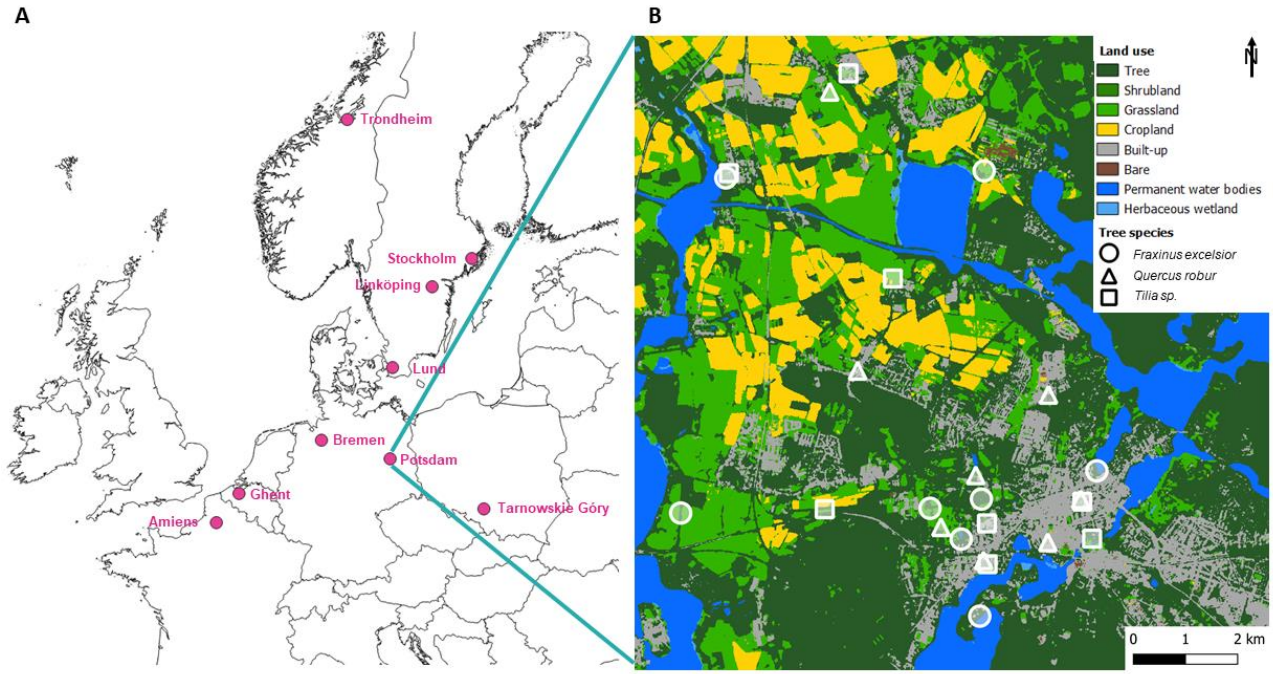

Figure 1: Overview of the sampling locations with the cities where sampling took place, and an example of the rural-to-urban gradient covered around each city. **A.** The nine studied cities from south to north: Amiens, Tarnowskie Góry, Ghent, Potsdam, Bremen, Lund, Linköping, Stockholm, and Trondheim. **B.** The sampling locations along the rural-to-urban gradients in Potsdam as an example. The background map visualizes the different types of land cover (from: https://esa-worldcover.org/en, year: 2021, resolution: 10 m).

We installed three differently colored pan traps per tree (blue, yellow, and white; diameter: 11cm; Fig. 2). The pan traps were filled with tap water in which we added a drop of soap to lower the surface tension, and salt (0.5kg per 10l) to lower evaporation rates. The traps were placed in a wooden structure that was secured on the south-side of the tree trunk at a height of approximately three meters. Hence, spiders and harvestmen could fall into the traps (cf. pitfall traps) without having to crawl upwards first. Special care was taken to ensure no branches or epiphytes obscured the visibility of the traps or limited their accessibility. The order of the pan trap colors was chosen randomly, eliminating location-biased results. Additionally, drainage holes at the top of the traps prevented loss of specimens during rainfall as the traps could not overflow. Traps were operational for approximately two weeks during the middle of the summer of 2022

(to catch peak summer species) and early summer 2023 (for spring and early summer species). The specific dates can be found in Appendix 2. The contents of the traps were preserved in a solution of 70% ethanol, and sorted into different species groups. Adult spiders and harvestmen were then identified up to species level, whereas juveniles could only be identified up to genus or family level. Some individuals were severely damaged and could only be identified to family level.

For the statistical analysis, we pooled specimens of both trapping periods in order to obtain one list of species occurrences and abundance per sampled tree. We investigated the difference in number of spiders between the different tree species and pan trap colors using a generalized linear mixed-effects model with a poisson log-link function. For the harvestmen, we used a similar model structure but applied a negative binomial model with a log-link function to avoid overdispersion. We used the amount of built-up area (%BUA) in a 100m radius around the sampling locations, the tree species, and the color of the pan trap (PT) as explanatory variables (Eq. 1). We included the sampling city as random effect. We did not account for spatial autocorrelation as the average distance between trees within the same sampling city was larger than 4 km, limiting spatial autocorrelation for species with limited goal-oriented mobility. All analyses were performed in R (R CORE TEAM, 2024; version 4.4.1). Model assumptions were checked and met.

$$Local\ abundance = \%BUA + tree\ species + PT + (1\,|city) \quad \text{(Eq. 1)}$$

Figure. 2: Set up of the arthropod inventory. On the north side of the tree (left in the picture), a microclimate logger measuring the air temperature and relative humidity is visible. Pheromone traps for inventorying adults of the saproxylic beetle *Elater ferrugineus* are depicted in the middle. The colored pan traps are placed in a wooden structure against the south side of the tree. © Karlien Moeys.

Results

In total, 778 spider individuals were caught: 614 adults and 164 juveniles. Almost all juveniles were caught in summer 2022 (160 ind.). There were no spiders caught on 25 out of 216 trees. Specimens originated from 16 families, 60 genera, and 84 species. However, 14 individuals (2%) could not be identified at the family level, 40 (5%) were only determined up to family level and 107 (14%) up to genus level. All of these were juveniles or severely damaged adults. The Linyphiidae was the most abundant family, followed by the Salticidae and the Theridiidae, with a total of 157 (20%), 137 (18%), and 127 (16%) recorded individuals, respectively. Together, these three families accounted for more than half of the specimens collected. In contrast, the families Mimetidae and Zodariidae were represented by only a single individual each. Additionally, the Linphiidae, Theridiidae, and Araneidae were the most species rich families, representing

25, 14, and 10 species, respectively. *Salticus zebraneus* was the most abundant species (94 ind., 15% of total catch), followed by *Theridion mystaceum* (55 ind., 9% of total catch). All other species represented less than 6% of the catch. 27 species occurred only once. A species list including abundance per city and per tree species can be found in Table 2 and Appendix 3, respectively.

Most spiders were caught in Tarnowskie Góry (151 ind., 19%), followed by Amiens (143 ind., 18%), and Ghent (110 ind., 14%). The fewest spiders were caught in Linköping (31 ind., 4%). The number of spiders captured per tree followed a similar trend (Fig. 3a). In Tarnowskie Góry, Ghent, Potsdam, Bremen, and Linköping, *Salticus zebraneus* was the most abundant species. Notably, only in Trondheim was *Theridion mystaceum* the most abundant species. Despite these regional differences, generally more spiders per tree were caught in areas with less than 30% built-up area (i.e., rural areas), followed by urban areas (i.e., more than 60% built-up area). The fewest spiders per tree were caught in areas with an intermediate amount of built-up area (Fig. 3b). Additionally, increasing the amount of built-up area by 10% resulted in more than 6% less spiders trapped per tree ($p<0.05$, Fig. 3b, Table 1). This negative influence of urbanization was also present when ballooning species (i.e., the Linyphiidae) and juveniles were excluded.

Significantly more spiders were caught on oak (306 ind., 39%) than on lime (217 ind., 28%; $p<0.05$, Table 1). The number of individuals caught on ash was intermediate (255 ind., 33%), and not significantly different from the number of spiders collected on oak and lime (Fig. 3c; $p>0.05$, Table 1). *Salticus zebraneus* was the most abundant spider on the three tree species. On lime, *Clubiona* sp. were the second most abundant species, followed by *Theridion mystaceum*. The latter was the second most abundant spider on oak and ash.

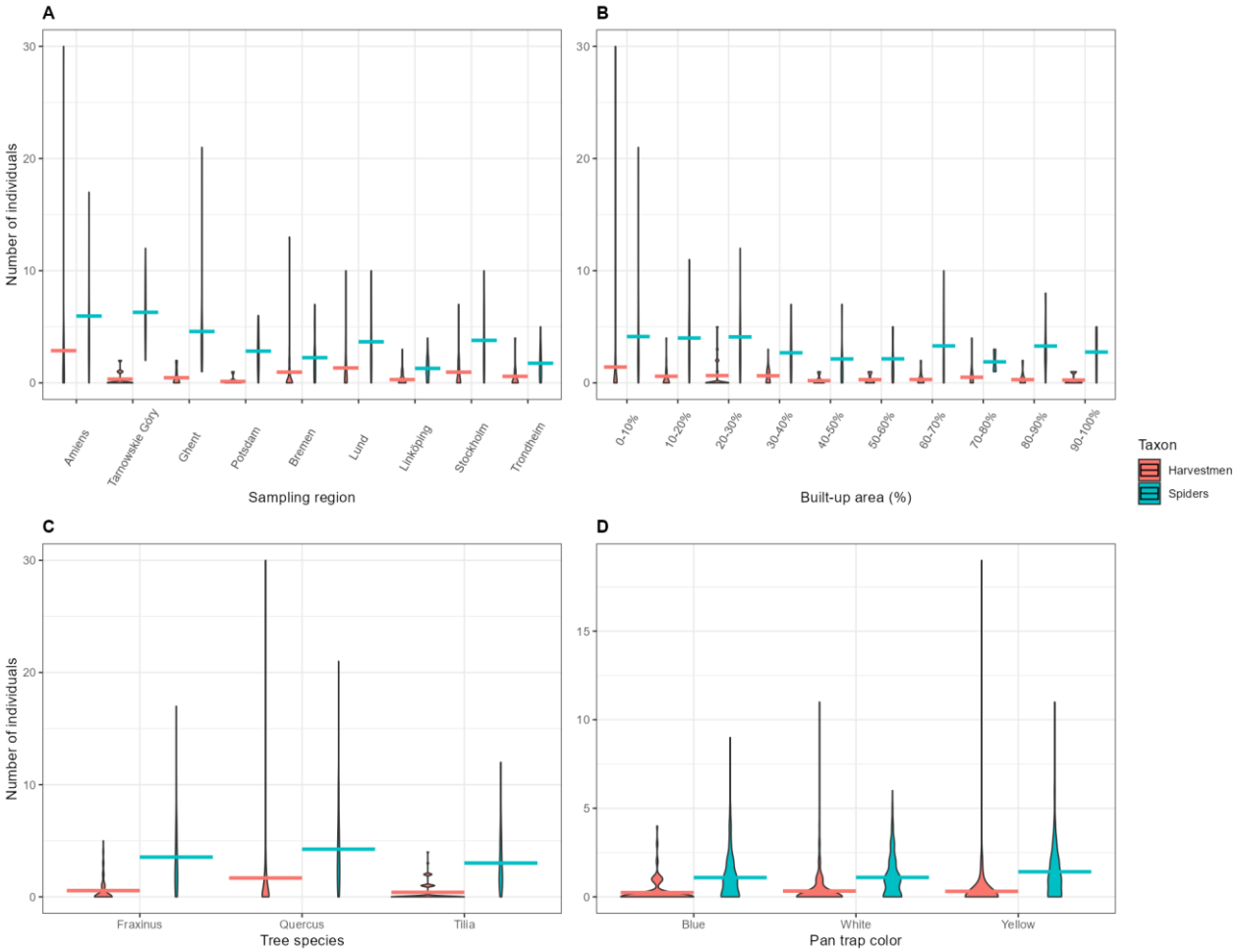

Figure 3: A. Number of individuals of spiders and harvestmen caught per tree in the different cities along the south-north latitudinal gradient (ranked from south to north). **B.** Number of individuals of spiders and harvestmen caught per tree across the rural-to-urban gradient. **C.** Number of individuals of spiders and harvestmen caught per tree per tree species. **D.** Number of individuals of spiders and harvestmen caught per tree per pan trap color. The average number of individuals is represented by the horizontal lines.

The yellow pan traps were significantly more successful in trapping spiders (306 ind.), while blue (235 ind.) and white (237 ind.) traps seemed to be less effective (Fig. 3d; $p<0.05$, Table 1). The Linyphiidae were most abundantly present in the yellow pan traps, i.e., 70 specimen (45%) compared to only 46 individuals (29%) in blue traps, and 41 individuals (26%) in white traps. Out of 16 families, 9 families were more abundantly present in the yellow traps than in the blue and white traps, including the Salticidae and Theridiidae. The difference in effectiveness of the yellow traps is likely not caused by one species. Within the Linyphiidae, *Tenuiphantes tenuis* and *Moebelia penicilla* were the most abundant species in the yellow traps. However, we caught similar amounts of individuals in the white and blue traps. Nine species belonging to this family (representing 11 ind.) were sampled with the yellow traps that were not present in the blue or white traps. The same applied to the Salticidae where *Salticus zebraneus* (yellow: 39 ind., blue: 25 ind., white: 30 ind.) was the most abundant, and the Theridiidae where *Theridion mystaceum* (yellow: 26 ind., blue: 12 ind., white: 17 ind.) was the most abundant. Hence, the yellow pan traps were also more effective in trapping non-Linyphiidae species. The difference between the trap colors remained significant when excluding the Linyphiidae and juveniles, but the difference with the blue and white traps was less pronounced.

Additionally, 190 harvestmen were caught of which 36 adults and 154 juveniles. All specimens belonged to the Phalangiidae. In total, we recorded seven genera of harvestmen and eight species. 25 individuals could not be identified at the genus level and 27 to the species level. *Dicranopalpus ramosus* was the most abundant species (72 ind.; 52% of total identified catch), followed by *Opilio canestrinii* (29 ind.; 21% of total identified catch) which was also the most widespread species as it occurred in all but one sampling city. Most harvestmen were caught in Amiens (69 ind.), followed by Lund (32 ind.) and Bremen (23 ind.). Fewest harvestmen were caught in Potsdam (3 ind.; Fig. 3a). However, as was the case with the spiders, most harvestmen were caught in rural areas (Fig. 3b). Similarly, significantly more harvestmen were caught on oak (121 ind., 64%), than on ash (40 ind., 21%) and lime (29 ind., 15%; $p<0.05$, Table 1). 52 individuals of *Dicranopalpus ramosus* were captured on oak, while only 15 individuals were found on ash, and 5 on lime. All species except for *Oligolophus hanseni*, *Mitopus morio*, and *Oligolophus tridens* were caught more on oak than on lime and ash. We found no effect of pan trap color ($p>0.05$; Table 1). The species list can be found in Table 2 and Appendix 3.

Table 1: Impact of the amount of built-up area (%BUA) in a 100m radius around the sampled tree, tree species, and pan trap color on the local abundance of spiders and harvestmen along rural-to-urban gradients across Europe. *Quercus robur* and the blue pan trap were used as reference levels. The abundance model is based on 778 spiders and 190 harvestmen. Significance is indicated as followed: * = $p<0.05$, ** = $p<0.01$, *** = $p<0.001$.

	Abundance spiders	**Abundance harvestmen**
intercept	0.24 (0.18)	-0.86 * (0.33)
%BUA	-0.66 *** (0.16)	-1.55 ** (0.53)
Tree species: Fraxinus	-0.14 (0.09)	-0.91 *** (0.26)
Tree species: Tilia	-0.27 ** (0.09)	-1.12 *** (0.28)
Pan trap: white	<0.01 (0.09)	0.33 (0.27)
Pan trap: yellow	0.26 ** (0.09)	0.12 (0.27)

Table 2: Number of individuals and species per city. Specimen of which the family could not be identified are not included. Spiders are listed first (above the dotted line), followed by the harvestmen (below the dotted line). Sampling cities from south to north: Amiens (AMI), Tarnowskie Góry (TG), Ghent (GHE), Potsdam (POT), Bremen (BRE), Lund (LUN), Linköping (LIN), Stockholm (STO), and Trondheim (TRO).

Family	Species	AMI	TG	GHE	POT	BRE	LUN	LIN	STO	TRO	Total
Agelenidae	*Agelena labyrinthica*		1	1							2
	Tegenaria sp.	1									1
	Textrix denticulata			2		2	8				12
	Textrix sp.						1				1
Anyphaenidae	*Anyphaena accentuata*	2	3	3	1	2					11
	Anyphaena sp.		1								1
Araneidae	*Araneus diadematus*								1		1
	Araneus sturmi					1					1
	Araneus triguttatus		1								1
	Araniella cucurbitina						2				2
	Araniella opisthographa	1			1	1	1		1		5
	Gibbaranea gibbosa	3		1							4
	Larinioides ixobolus		2								2
	Larinioides sp.					1					1
	Leviellus stroemi				1				1	1	3
	Nuctenea sp.	1			3	4				1	9
	Nuctenea umbratica	1	4		2	3	5	1	2	4	22
	Zygiella sp.	1			1		1				3
	Zygiella atrica									2	2
	Araneidae sp.		1								1
Clubionidae	*Clubiona brevipes*	10		4	2	1	2	1	2		22
	Clubiona comta					1					1
	Clubiona corticalis	1		1	1	3	1	1	1		9
	Clubiona marmorata		1								1
	Clubiona pallidula	3	2	1			1		1		8
	Clubiona sp.	2	10	2	1	2	2		12		31
Dictynidae	*Brigittea civica*	1									1
	Dictyna pusilla	1	1	1	1						4
	Dictyna uncinata	5	1								6
	Lathys humilis	4		1			1		18		24
	Nigma flavescens		1	5	1						7
Gnaphosidae	*Micaria subopaca*	2	7	1	1	1	4	2	2		20
	Gnaphosidae sp.		1				2		1		4
Linyphiidae	*Agyneta decora*					1					1
	Agyneta mollis		1								1
	Agyneta rurestris	3		4	1	1	2	2			13
	Araeoncus humilis			1							1
	Bathyphantes gracilis			2			2				4
	Diplocephalus graecus	1									1
	Drapetisca socialis	1							2	4	7
	Entelecara acuminata									1	1
	Erigone atra	1	2			2				1	6
	Erigone dentipalpis	3		1		1					5
	Gongylidiellum vivum			1							1
	Hypomma cornutum	1	1			1	2	1			6
	Lepthyphantes leprosus					1				1	2
	Lepthyphantes minutus					1			1	1	3
	Lepthyphantes sp.	1			1			1		1	4
	Mermessus trilobatus	1									1
	Micrargus subaequalis	1									1
	Moebelia penicillata	3	9	9	1	2	6		3	2	35
	Parapelecopsis nemoralis	1									1
	Pelecopsis elongata									2	2
	Porrhomma microphthalmum		1								1
	Porrhomma pygmaeum		1				1			1	3
	Prinerigone vagans			1							1
	Tenuiphantes flavipes	1		1	1	1					4
	Tenuiphantes sp.		1		1						2
	Tenuiphantes tenuis	17		9	5		3		1		35
	Trematocephalus cristatus		2								2
	Linyphiidae sp.		3	3	3		1		1	2	13
Lycosidae	*Alopecosa sp.*						1				1
	Pardosa sp.					1					1
	Trochosa ruricola	1									1
	Lycosidae sp.				1						1
Mimetidae	*Ero aphana*	1									1

Family	Species	AMI	TG	GHE	POT	BRE	LUN	LIN	STO	TRO	Total
Philodromidae	*Philodromus albidus*	7	5	3	5	2	1	1			24
	Philodromus aureolus		2			1	2	2			7
	Philodromus buxi			1							1
	Philodromus cespitum		3	1					2		6
	Philodromus collinus				1		1				2
	Philodromus praedatus	7		2	1	1	1	1			13
	Philodromus rufus	1	1	5							7
	Philodromus sp.	1	2	3				1	2		9
	Philodromidae sp.	1	2						1		4
Salticidae	*Ballus chalybeius*	4			2						6
	Macaroeris nidicolens			3							3
	Marpissa muscosa	6		2							8
	Salticus cingulatus	1							3		4
	Salticus sp.		3		4			6	5	1	19
	Salticus zebraneus	10	28	18	13	6	4	7	8		94
	Synageles venator				1						1
	Salticidae sp.			2							2
Segestriidae	*Segestria senoculata*					2	8		2	4	16
	Segestria sp.				1						1
Tetragnathidae	*Tetragnatha obtusa*					2					2
	Tetragnatha sp.		1				2				3
	Tetragnathidae sp.							1			1
Theridiidae	*Anelosimus vittatus*	3	1								4
	Dipoena melanogaster	1	1		3						5
	Dipoena sp.								1		1
	Paidiscura pallens	1									1
	Parasteatoda lunata					2	3				5
	Parasteatoda sp.		5				2				7
	Phylloneta impressa	1					1	1			3
	Platnickina tincta	1	5	2		1	2		2		13
	Sardinidion blackwalli	1			1			1			3
	Steatoda bipunctata								2	2	4
	Steatoda grossa			1							1
	Steatoda sp.		3						1		4
	Theridion familiare	4					1				5
	Theridion melanurum		1								1
	Theridion mystaceum	14	12	6	1		4	1	7	10	55
	Theridion pinastri				1		1				2
	Theridion sp.		3				1				4
	Theridion varians	1		1		1				1	4
	Theridiidae sp.		3						2		5
Thomisidae	*Ebrechtella tricuspidata*		1								1
	Xysticus lanio					1	2				3
	Xysticus sp.	1	1		1		1				4
	Xysticus ulmi	1									1
	Thomisidae sp.		7	1		1					9
Zodariidae	*Zodarion italicum*				1						1
Phalangiidae	*Dicranopalpus ramosus*	55		3		8	6				72
	Lophopilio palpinalis		1								1
	Mitopus morio						1		1	4	6
	Oligolophus hanseni								2	7	9
	Oligolophus sp.	3				6	6	4	4	3	26
	Oligolophus tridens					1	1				2
	Opilio canestrinii	5	3	1	1	5	9	3	2		29
	Opilio sp.		1								1
	Phalangium opilio	1	1		1		3		1		7
	Rilaena triangularis	1	1	1	1	1	6		1		12
	Phalangiidae sp.	4	1	6		2			12		25
Total	**Harvestmen**	69	8	11	3	23	32	7	23	14	190
	Spiders	143	148	106	66	54	86	31	88	42	764

Discussion

Although pan traps are usually placed on the ground, or at 1 m above the ground or above crops, we used elevated pan traps placed in a wooden frame (cf. pitfall traps) attached to the trunk of large solitary trees. Because of this placement, many of the spiders and harvestmen in the traps are likely to inhabit the trees themselves (i.e., the stem, branches or foliage) or are aeronautic spider species capable of dispersal by ballooning. Despite this, we also recorded non-ballooning species that are typically associated with open habitats and grasslands, such as *Zodarion italicum* (BRITISH SPIDERS 2024e), and species linked to urban environments such as *Lepthyphantes leprosus* (BRITISH SPIDERS 2024a). However, these species were not always collected in their expected position along the rural-to-urban gradient (e.g., urban-linked species in rural areas and vice versa).

The most abundant families were the Linyphiidae and Salticidae. The Linyphiidae are a family of ballooning species (even in the adult stage), known to be able to disperse over large distances using silk threads, making them among the first colonisers of newly available habitat (THOMAS et al. 2003). Their dispersal capacities make them common in agricultural areas, where they are seen as important biological control agents (HARWOOD & OBRYCKI 2005), but also explain their abundance on isolated trees. In contrast, the Salticidae family is characterised by its highly developed and complex eyes, which is their main strategy for hunting (RICHMAN & JACKSON 1992). Species within this family can occur in diverse habitats, including urban environments and on different vegetation layers. Hence, it is not surprising that they were abundant in tree canopies too.

The most common species were *Salticus zebraneus* and *Theridion mystaceum. Salticus zebraneus* is a tree-dwelling species that can be found on the trunks of old trees such as oaks, willows and limes. The species occurs in ancient woodlands, pastures and hedgerows but can also be found in tree- and shrub-rich habitats such as gardens, parks and tree rows. The species tends to hide in fissures or beneath loose bark, suggesting that the characteristics of the bark are more important than the tree species itself (BRITISH SPIDERS 2024c). As large solitary trees are often characterized by well-structured barks, it is no surprise that the species is often found on these trees (LINDENMAYER & LAURANCE 2017). *Theridion mystaceum* constructs webs on, among others, tree trunks and foliage (BRITISH SPIDERS 2024d).

In Belgium (around Ghent), we recorded five species listed on the Red List of MAELFAIT (1998) as endangered or geographically restricted. We caught five individuals of *Philodromus rufus*, a geographically restricted species that mainly occurs on shrubs and low tree branches. According to the ARADAT observation database (ARADAT-DATABANK, ARABEL), only 54 individuals of this species have been observed since 2000. Additionally, we recorded *Philodromus albidus*, an endangered species that, while somewhat more widespread, also occurs on shrubs and lower branches. *Philodromus praedatus* was found on one oak and one lime tree, further confirming its association with tree habitats (BRITISH SPIDERS 2024b). Furthermore, we caught one individual of *Dictyna pusilla*, also classified as endangered, with only nine recorded observations in the past 24 years (ARADAT-DATABANK, ARABEL). One individual of *Philodromus buxi* was also collected. Importantly, our specimens of *Philodromus rufus, Philodromus praedatus* and *Dictyna pusilla* were all sampled in areas with no recorded observations of these species, indicating that employing pan traps can be complementary to the established sampling procedures. This also highlights gaps in spider monitoring programs and the need for an updated Flemish Red List for spiders. Additionally, these findings demonstrate that using pan traps in tree canopies (on the trunk) can provide a valuable low-cost and low-effort method for sampling spiders associated with tree habitats.

We found a strong negative effect of urbanization on the local abundance of spiders and harvestmen. This finding can be explained by the isolated nature of our study objects. Solitary trees are spatially isolated, which may limit habitat connectivity for less mobile species, effectively rendering these trees as insular islands within a large urban matrix. In contrast, NAGY et al. (2018), who conducted their sampling in forests, and DAHIREL et al. (2018), who studied broader landscapes, did not observe this trend. This further supports the idea that habitat connectivity plays a critical role in shaping arachnid abundance in urban environments.

Only a few temperate spiders (e.g., *Misumena vatia*) are attracted to flowers and actively hunt on flowers, so we cannot directly explain why spiders appeared to prefer the yellow-colored pan traps as this preference was not limited to a single species. A previous study on spiders caught with pan traps suggested a preference for blue-colored traps, though no significant differences with other colors were found (De Smedt et al. 2023). It is possible that spiders were not directly attracted to the traps themselves but were instead drawn to the targeted insects caught in the yellow traps. Overall, more specimens were caught with the yellow traps than with the blue and white traps. Certain families, such as the Thomisidae, are known to use flowers as hunting grounds, waiting to ambush prey (De Smedt et al. 2023). Thereby, they display a clear preference for certain types of flowers. However, as we only captured 18 individuals (2%) from this family, it seems unlikely that this hypothesis accounts for the overall result.

Long-legged harvestmen species such as representatives of Phalangiidae are known to be the dominant family on vegetation across Europe (De Smedt & Jactel 2023). These species are excellent hunters on vertical surfaces such as tree trunks (Pinto-Da Rocha et al. 2008). The most common species, *Dicranopalpus ramosus* and *Opilio canestrinii*, are relatively new in most European countries and have expanded their range northwards in the last decennia (Martens 2021). De Smedt & Jactel (2023) did not sample *D. ramosus* and only few *O. canestrinii* on an extensive sampling campaign of tree branches across Europe in 2012-2013, only ten years ago. They are hardly recorded using conventional methods such as pitfall traps (De Smedt et al. 2019, De Smedt et al. 2020), but these larger species are widely recorded via citizen science platforms (see e.g., Van de Poel et al. 2021). Although many harvestmen species that increase their distribution range are probably aided by human transport (Martens 2021), we show that they might actually prefer more natural habitat as they were more abundant further away from cities. The preference for oak trees is not easy to explain. *D. ramosus* may find more suitable preys, like aphids or small caterpillars, on oak trees, or it might be that the rough bark of oak trees provides better shelter or a more suitable substrate for egg deposition.

In sum, ballooning spiders were most abundantly present, while long-legged species linked to vegetation surfaces were the dominant harvestmen. This study demonstrates that pan traps can be a valuable and complementary method for sampling tree-dwelling spiders and harvestmen. The presence of Red List species in our samples, along with individuals from previously unrecorded populations, highlights the need for renewed and nation-wide monitoring and conservation strategies.

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Appendix 1. Studied trees and the surrounding areas along the rural-to-urban gradients.

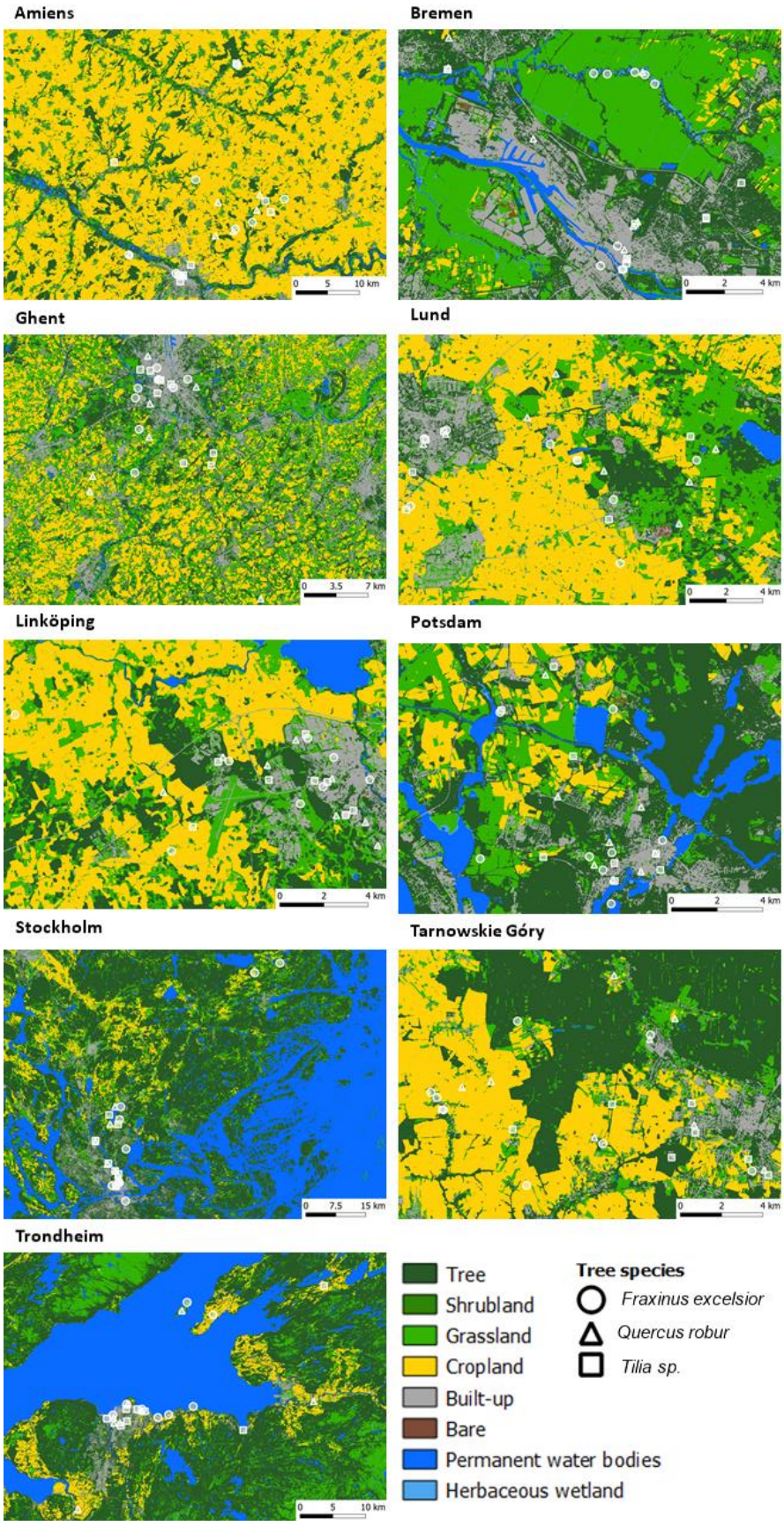

Figure A1.1: Maps of the studied trees and the surrounding areas along the rural-to-urban gradients. *Quercus robur* is shown as a triangle, *Fraxinus excelsior* as a circle and *Tilia* sp. as a rectangle. The background map visualises the different types of land cover (from: https://esa-worldcover.org/en, year: 2021, resolution: 10m. Scales were adjusted per panel.

Table A1.1: Amount of built-up area (%) in a 100m radius around the studied trees expressed as the minimum, 10th percentile, average, 90th percentile, and maximum amount of built-up surfaces (%).

	Minimum (%)	10th quantile (%)	Average (%)	90th quantile (%)	Maximum (%)
Amiens	0	0	29	85	95
Bremen	0	0	12	32	41
Ghent	0	1	34	77	87
Lund	0	0	13	31	48
Linköping	0	1	40	76	99
Potsdam	0	0	20	46	96
Stockholm	0	0	19	44	79
Tarnowskie Góry	0	3	23	44	83
Trondheim	0	3	24	56	80

Appendix 2. Operational period of the pan traps.

Table A2.1: Operational period of the pan traps.

City	2022		2023	
	Start	**End**	**Start**	**End**
Amiens	13/06	28/06	19/05	02/06
Tarnowsky-Góry	15/07	30/07	04/06	18/06
Ghent	20/06	04/07	22/05	05/06
Potsdam	10/07	25/07	05/06	19/06
Bremen	24/07	08/08	02/06	16/06
Lund	29/07	10/08	15/06	28/06
Linköping	03/08	18/08	22/06	03/07
Stockholm	07/08	23/08	14/05 (*Quercus* and *Tilia*) 20/06 (*Fraxinus*)	28/05 (*Quercus* and *Tilia*) 04/07 (*Fraxinus*)
Trondheim	12/08	30/08	02/07	16/07

Appendix 3. Individuals and species caught per tree species.

Table A3.1: Number of individuals and species caught on each tree species. Specimen of which the family could not be identified are not included.

Family	Species	Fraxinus	Quercus	Tilia	Total
Phalangiidae	*Dicranopalpus ramosus*	15	52	5	72
	Lophopilio palpinalis		1		1
	Mitopus morio	3	2	1	6
	Oligolophus hanseni	4	3	2	9
	Oligolophus sp.	5	21		26
	Oligolophus tridens	1		1	2
	Opilio canestrinii	5	15	9	29
	Opilio sp.			1	1
	Phalangium opilio	1	4	2	7
	Rilaena triangularis	1	10	1	12
	Phalangiidae sp.	5	13	7	25
Agelenidae	*Agelena labyrinthica*	1	1		2
	Tegenaria sp.		1		1
	Textrix denticulata	1	2	9	12
	Textrix sp.			1	1
Anyphaenidae	*Anyphaena accentuata*	1	5	5	11
	Anyphaena sp.			1	1
Araneidae	*Araneus diadematus*		1		1
	Araneus sturmi			1	1
	Araneus triguttatus			1	1
	Araniella cucurbitina	1	1		2
	Araniella opisthographa		4	1	5
	Gibbaranea gibbosa	2	2		4
	Larinioides ixobolus		2		2
	Larinioides sp.		1		1
	Leviellus stroemi	1	1	1	3
	Nuctenea sp.	4	2	3	9
	Nuctenea umbratica	11	3	8	22
	Zygiella sp.		1	2	3
	Zygiella atrica		1	1	2
	Araneidae sp.	1			1
Clubionidae	*Clubiona brevipes*	9	10	3	22
	Clubiona comta	1			1
	Clubiona corticalis	2	5	2	9
	Clubiona marmorata		1		1
	Clubiona pallidula	2	2	4	8
	Clubiona sp.	6	9	16	31
Dictynidae	*Brigittea civica*		1		1
	Dictyna pusilla	1	3		4
	Dictyna uncinata	4		2	6
	Lathys humilis	5	15	4	24
	Nigma flavescens		4	3	7
Gnaphosidae	*Micaria subopaca*	10	6	4	20
	Gnaphosidae sp.	3	1		4
Linyphiidae	*Agyneta decora*			1	1
	Agyneta mollis		1		1
	Agyneta rurestris	8	3	2	13
	Araeoncus humilis	1			1
	Bathyphantes gracilis	2	1	1	4
	Diplocephalus graecus		1		1
	Drapetisca socialis	1	1	5	7
	Entelecara acuminata			1	1
	Erigone atra	5		1	6
	Erigone dentipalpis	4	1		5
	Gongylidiellum vivum	1			1
	Hypomma cornutum		6		6
	Lepthyphantes leprosus		1	1	2
	Lepthyphantes minutus			3	3
	Lepthyphantes sp.		2	2	4
	Mermessus trilobatus		1		1
	Micrargus subaequalis		1		1
	Moebelia penicillata	9	19	7	35
	Parapelecopsis nemoralis		1		1
	Pelecopsis elongata		1	1	2
	Porrhomma microphthalmum	1			1

Family	Species	Fraxinus	Quercus	Tilia	Total
	Porrhomma pygmaeum	1	2		3
	Prinerigone vagans	1			1
	Tenuiphantes flavipes		2	2	4
	Tenuiphantes sp.		1	1	2
	Tenuiphantes tenuis	16	10	9	35
	Trematocephalus cristatus	1		1	2
	Linyphiidae sp.	6	5	2	13
Lycosidae	*Alopecosa sp.*			1	1
	Pardosa sp.	1			1
	Trochosa ruricola			1	1
	Lycosidae sp.	1			1
Mimetidae	*Ero aphana*	1			1
Philodromidae	*Philodromus albidus*	6	9	9	24
	Philodromus aureolus	3	3	1	7
	Philodromus buxi		1		1
	Philodromus cespitum	3	3		6
	Philodromus collinus		1	1	2
	Philodromus praedatus	1	10	2	13
	Philodromus rufus	1	4	2	7
	Philodromus sp.	2	5	2	9
	Philodromidae sp.	2		2	4
Salticidae	*Ballus chalybeius*	5		1	6
	Macaroeris nidicolens	2	1		3
	Marpissa muscosa	5	2	1	8
	Salticus cingulatus	2	1	1	4
	Salticus sp.	8	8	3	19
	Salticus zebraneus	33	35	26	94
	Synageles venator		1		1
	Salticidae sp.		2		2
Segestriidae	*Segestria senoculata*	3	5	8	16
	Segestria sp.		1		1
Tetragnathidae	*Tetragnatha obtusa*		2		2
	Tetragnatha sp.		2	1	3
	Tetragnathidae sp.			1	1
Theridiidae	*Anelosimus vittatus*	1	3		4
	Dipoena melanogaster	4		1	5
	Dipoena sp.		1		1
	Paidiscura pallens		1		1
	Parasteatoda lunata		5		5
	Parasteatoda sp.	3	3	1	7
	Phylloneta impressa	2		1	3
	Platnickina tincta	2	6	5	13
	Sardinidion blackwalli	1	1	1	3
	Steatoda bipunctata		1	3	4
	Steatoda grossa			1	1
	Steatoda sp.	1	1	2	4
	Theridion familiare	3	1	1	5
	Theridion melanurum		1		1
	Theridion mystaceum	19	24	12	55
	Theridion pinastri	1	1		2
	Theridion sp.			4	4
	Theridion varians		3	1	4
	Theridiidae sp.	4	1		5
Thomisidae	*Ebrechtella tricuspidata*	1			1
	Xysticus lanio		2	1	3
	Xysticus sp.		3	1	4
	Xysticus ulmi		1		1
	Thomisidae sp.	1	5	3	9
Zodariidae	*Zodarion italicum*	1			1
Total	**Harvestmen**	40	121	29	190
	Spiders	246	305	213	764

Spiders resembling worms: notes on *Ariamnes* Thorell, 1869 (Araneae: Theridiidae) with the description of a new species from Papua New Guinea and the female of *A. petilus* Gao & Li, 2014

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Abstract

The spider genus *Ariamnes* Thorell, 1869 of the family Theridiidae is investigated and redefined. A new species from Papua New Guinea, *Ariamnes papua* sp. nov., is described based on material of both sexes. The female of *A. petilus* Gao & Li, 2014 is described for the first time and newly recorded from Borneo. The following new combinations are proposed: *Rhomphaea* birgitae (Strand, 1917) comb. nov., *Meotipa rufopictus* (Thorell 1895) comb. nov., and *Rhomphaea triangulus* (Thorell, 1887) comb. nov. Some other species currently placed in *Ariamnes* probably belong to *Rhomphaea*; these are *A. setipes* van Hasselt, 1882, *A. triangulatus* Urquhart, 1887, *A. campestratus* Simon, 1903, *A. russulus* Simon, 1903. However, they will remain incertae sedis until the type material has been studied. The species described from Hawaii should be placed in a separate genus but remain incertae sedis for the time being. *A. cylindrogaster* Simon, 1889 is recorded for the first time from Sulawesi.

Samenvatting

Het spinnengenus *Ariamnes* Thorell, 1869 van de familie Theridiidae wordt onderzocht en opnieuw gedefinieerd. Een nieuwe soort uit Papoea-Nieuw-Guinea, *Ariamnes papua* sp. nov., wordt beschreven op basis van materiaal van beide geslachten. Het vrouwtje van *A. petilus* Gao & Li, 2014 is voor het eerst beschreven en vermeld van Borneo. De volgende nieuwe combinaties worden voorgesteld: *Rhomphaea birgitae* (Strand, 1917) comb. nov., *Meotipa rufopictus* (Thorell 1895) comb. nov., en *Rhomphaea triangulus* (Thorell, 1887) comb. nov. Enkele andere soorten die momenteel in *Ariamnes* worden geplaatst, behoren waarschijnlijk tot *Rhomphaea*; dit zijn *A. setipes* van Hasselt, 1882, *A. triangulates* Urquhart, 1887, *A. campestratus* Simon, 1903, *A. russulus* Simon, 1903. Ze zullen echter incertae sedis blijven totdat het typemateriaal is bestudeerd. De vanuit Hawaï beschreven soorten zouden in een apart genus moeten worden geplaatst, maar blijven voorlopig incertae sedis. *A. cylindrogaster* Simon, 1889 wordt voor het eerst vermeld uit Sulawesi.

Résumé

Le genre d'araignées *Ariamnes* Thorell, 1869 de la famille Theridiidae est examiné et redéfini. Une nouvelle espèce de Papouasie-Nouvelle-Guinée, *Ariamnes papua* sp. nov., est décrite sur la base des deux sexes. La femelle d'*A. petilus* Gao & Li, 2014 est décrite et l'espèce est signalée pour la première fois de Bornéo. Les nouvelles combinaisons suivantes sont proposées : *Rhomphaea birgitae* (Strand, 1917) comb. nov., *Meotipa rufopictus* (Thorell 1895) comb. nov., et *Rhomphaea triangulus* (Thorell, 1887) comb. nov. Certaines autres espèces actuellement placées dans *Ariamnes* appartiennent probablement à *Rhomphaea* ; il s'agit de *A. setipes* van Hasselt, 1882, *A. triangulates* Urquhart, 1887, *A. campestratus* Simon, 1903, *A. russulus* Simon, 1903. Cependant, ils resteront incertae sedis jusqu'à ce que le matériel type ait été étudié. Les espèces

décrites à Hawaï devraient être placées dans un genre distinct, mais restent pour le moment incertae sedis. *A. cylindrogaster* Simon, 1889 est signalé pour la première fois de Sulawesi.

Introduction

Argyrodinae, like most subfamilies of the Theridiidae, are clearly understudied and are likely to contain many undescribed species. The study of VANUYTVEN et al. (2024) specifying the taxonomic situation in the subfamily as well as describing two new genera illustrates this statement. The same applies to *Ariamnes* Thorell, 1869 (type species *Ariadne flagellum* Doleschall, 1857 from Ambon).

So far, 34 extant species have been attributed to the genus which is present on all tropical realms including Hawaii and New Zealand (WORLD SPIDER CATALOG 2024). This distribution may be questioned for different reasons. Several species have probably been misplaced including the eleven species from Hawaii. These have been described by SIMON (1900) and GILLESPIE & RIVERA (2007) but are quite different from the other *Ariamnes* (see below) and should be placed in a separate genus. Seven species have been described without illustrations and for fifteen only one sex is known where one of them is described from a juvenile spider. This also applies to most Southeast Asiatic species which also lack good descriptions. Eleven extant species are mentioned from Southeast Asia and India, but only three of them, *A. columnaceus* Gao & Li, 2014, *A. cylindrogaster* Simon, 1889 and *A. petilus* Gao & Li, 2014, are well described with illustrations of the copulatory organs. Only *A. cylindrogaster* is known from both sexes, but drawings of the genitalia were only provided in later descriptions, and it is not certain that these are indeed of the same species.

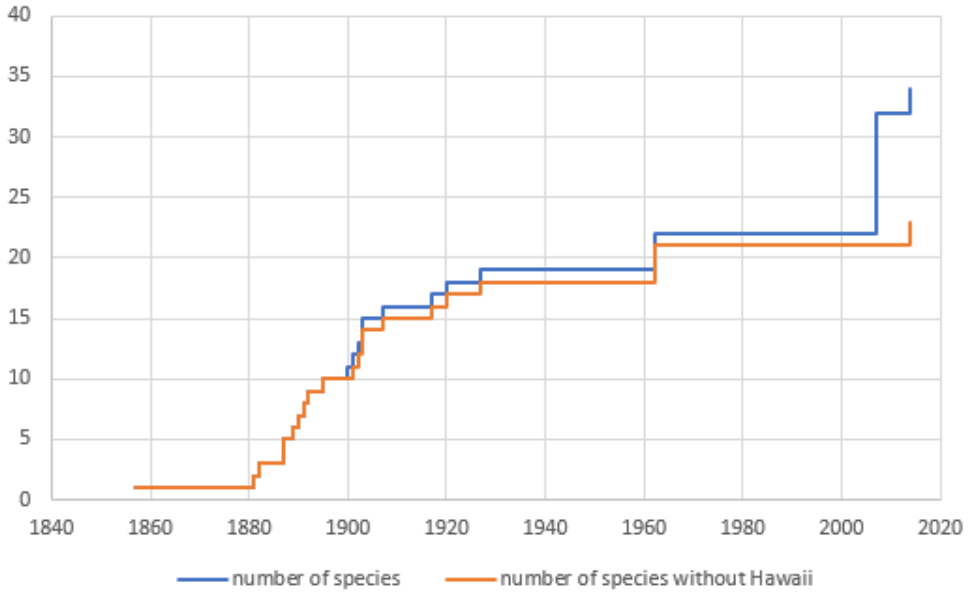

Figure 1: Number of described *Ariamnes* species per year.

In Figure 1 we see that almost all *Ariamnes* species were described before 1930. When we make abstraction of the species from Hawaii, only EXLINE & LEVI (1962) and GAO & LI (2014) added resp. three and two new species which brings the number of *Ariamnes* s.s. to 23.

In this study we propose a clearer definition of the genus, and we transfer several misplaced species to other genera. *Ariamnes birgitae* Strand, 1917 = *Rhomphaea birgitae* (Strand, 1917) comb. nov., *Ariamnes rufopictus* Thorell 1895 = *Meotipa rufopictus* (Thorell 1895) comb. nov. and *Ariamnes triangulus* Thorell, 1887 = *Rhomphaea triangulus* (Thorell, 1887) comb. nov.

Four species clearly belong to other genera, but the holotypes need to be examined to determine in which genus they belong. These species are *Ariamnes setipes* van Hasselt, 1882, *Ariamnes triangulatus* Urquhart, 1887, *Ariamnes campestratus* Simon, 1903 and *Ariamnes russulus* Simon, 1903.

In this paper, *A. papua* sp. nov. from Papua New Guinea is described together with the female of *A. petilus* Gao & Li, 2014.

Material and methods

The specimens were examined in 70% denatured ethanol with a Leica Wild M8 stereo microscope. Vulvae were examined with an Olympus Medilux 12 microscope. Photographs were taken with a Bresser Microcam, Zerene Stacker was used, and the pictures were edited with Paint Shop Pro version 7. For measurements an eyepiece micrometer was used. Epigynes were cleared with a solution of an Oté Wiper Enzymatic cleaning tablet and then immersed in clove oil. For scanning electron micrographs (SEM), specimens were first transferred to 100% ethanol overnight and then dried at room temperature. The dried samples were glued to aluminium stubs using double-sided copper tape, sputter coated with gold and then examined and photographed with a JEOL 6480 LV scanning electron microscope. All measurements are in millimeters.

Abbreviations

ALE – anterior lateral eyes; **AME** – anterior median eyes; **AME-ALE** – distance between AME and ALE; **AME-AME** – distance between AME; **C** – conductor; **Cd** – copulatory ducts; **Co** – copulatory openings; **Cy** – cymbium; **E** – embolus; **EA** – embolus apophysis; **Fd** – fertilization ducts; **MA** – median apophysis; **PLE** – posterior lateral eyes; **PME** – posterior median eyes; **PME-PLE** – distance between PME and PLE; **PME-PME** – distance between PME; **S** – spermathecae; **SEM** – digital scanning electron micrographs; **ST** – subtegulum; **T** – tegulum; **TTA** – theridiid tegular apophysis.

Institutions

RBINS – Royal Belgian Institute for Natural Sciences (W. Deconinck); **RMNH** – National Museum of Natural History (Naturalis), The Netherlands (J. Miller); **THNHM** – Natural History Museum of Thailand (NHM, T. Jeenthong) at the National Science Museum, Thailand (NSM).

Results

Class Arachnida Lamarck, 1801
Order Araneae Clerck, 1757
Family Theridiidae Sundevall, 1833
Genus *Ariamnes* Thorell, 1869

Type species

The genus name *Ariadne* was introduced by DOLESCHALL (1857) and replaced with *Ariamnes* by THORELL (1869) because of homonymy. The type species is *Ariamnes flagellum* (Doleschall, 1857) from a female found on Ambon Island (Indonesia).

Ariamnes flagellum (Doleschall, 1857)

Ariadne flagellum **DOLESCHALL, 1857**: 411, pl. 1, f. 1 (Df).
Ariamnes flagellum **SIMON, 1894**: 498, f. 506 (f).
Ariamnes flagellum **THORELL, 1895**: 74 (f).
Ariamnes flagellum **WORKMAN, 1896**: 61, pl. 61 (f). Singapore
Ariamnes flagellum **DYAL, 1935**: 163, pl. 14, f. 89 (f). From Pakistani Punjab
Ariamnes flagellum **AGNARSSON, 2004**: 478 (T from *Argyrodes*).

Remarks

DOLESCHALL (1857) shows a habitus drawing of this spider and a schematic one of the eye position but no drawing of the epigyne is given. However, the species cannot be distinguished from other species of *Ariamnes* without clear drawings of the epigyne.
Thanks to J. Miller (RMNH) and W. Deconinck (RBINS) we had the opportunity to investigate the holotype (Fig. 2A-B). It is in very bad condition: only the abdomen is preserved and is broken off near the epigyne which is blocked by a mating plug which could not be removed.

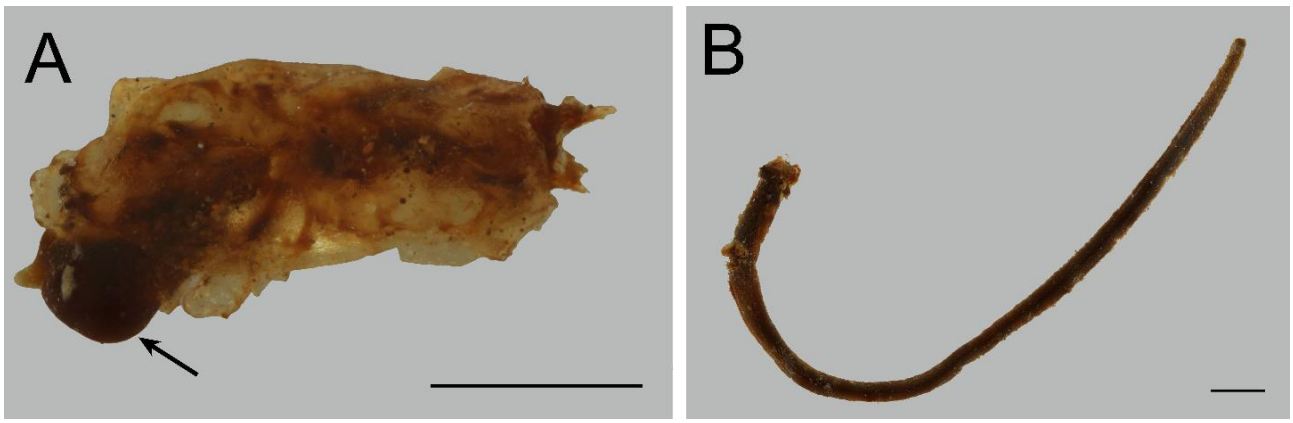

Figure 2: *Ariamnes flagellum* (Doleschall, 1857), ♀, holotype. **A.** Part of abdomen with epigynal plug (arrow); **B.** Rest of abdomen. © W. Deconinck. Scale bars = 1 mm.

Other authors also described spiders as being *Ariamnes flagellum*. THORELL (1895) gives a description of specimen from Tharrawaddy (Myanmar), WORKMAN (1896) from Singapore and DYAL (1935) from Lahore (Punjab, Pakistan). None of them provides drawings of the epigyne; the male is still not described. All these locations are far from Ambon Island and none of these authors mentioned that they compared their specimen with the one of DOLESCHALL. Therefore, we cannot conclude whether their specimens do indeed belong to *A. flagellum*.
Since the holotype specimen is in bad shape it is impossible to discern any characteristics to distinguish it from other species of this genus. We therefore provide the complete original description with English translation to support our interpretation of the genus definition.

DOLESCHALL (1857) gave the following description:
"*Ariadne flagellum*, n. sp. *Laete viridis, abdomine utrinque punctis minimis aureo nitentibus persito, apice abdominis rufescente. Longit. 18'". Lat. 1'".*"
Which can be translated as: "*Ariadne flagellum*, n. sp. Bright green, the abdomen on both sides with small shining golden points, the tip of the abdomen is red. Length 18'''. Width 1'''."
The given length and width correspond to 38 mm long and 2 mm wide.

The Dutch part of the description translated to English: "The anterior median eyes are black, the rest yellowish; the mouthparts very small. The cephalothorax is elongated and pointed forward. The abdomen nearly 16 times as long as the cephalothorax, scarcely wider at its anterior part than this, gradually extending into a long, pointed tail; the spinnerets small, placed at the front part of the abdomen. Thorax and abdomen grass green; the latter somewhat yellowish in the middle, this one strewn with numerous fine gold-shining specks on both sides; the tip reddish, imperceptibly hairy. The legs are green, the first pair brownish, the 3rd much shorter than the 1st, all slightly hairy. A very remarkable spider, which bears no resemblance to any known hitherto, and is characterized above all by the extraordinary length of the abdomen."

The extraordinary length of the abdomen is the only clear characteristic for *Ariamnes* in this description. VANUYTVEN (2021) lists a number of characteristics for this genus but some of them seem to be only valid for a part of the species now under *Ariamnes*. As EXLINE & LEVI (1962, p.76) write, many of the larger *Argyrodes* have been described as *Rhomphaea*, and species have been placed indiscriminately into either *Ariamnes* or *Rhomphaea*. Indeed, several species placed under *Ariamnes* do not meet the condition that the abdomen should be very long and thin, they are only a few millimetre long and most likely are *Rhomphaea* species. AGNARSSON (2004, p.478) provides some putative synapomorphies that differentiates *Ariamnes* from other argyrodines. However, these are based on *A. attenuatus* O. Pickard-Cambridge, 1881 (Fig. 3A-D) and are not accurate for all species. Two of these synapomorphies are the elongated spermathecae and the sturdy setae on male metatarsus and tarsus I. These are not found in *A. papua* sp. nov. and *A. petilus* Gao & Li, 2014 which have the spermathecae elliptical and which lack the sturdy setae on the legs. AGNARSSON (2004, fig. 34) shows also an embolic apophysis (EA) and ridges on the embolus base. This EA can be seen in Fig. 3D, but was not found in the other species here examined although It might be hidden by the embolus. The ridges on the

base of the embolus are absent in *A. papua* sp. nov. (Fig. 5A). In his paper about the genus *Rhomphaea* from Japan, YOSHIDA (2001) gives a key to the genera of Argyrodinae where he distinguishes *Ariamnes* from the other genera with "Abdomen tubular and very long; more than six times as long behind as anterior to spinnerets".

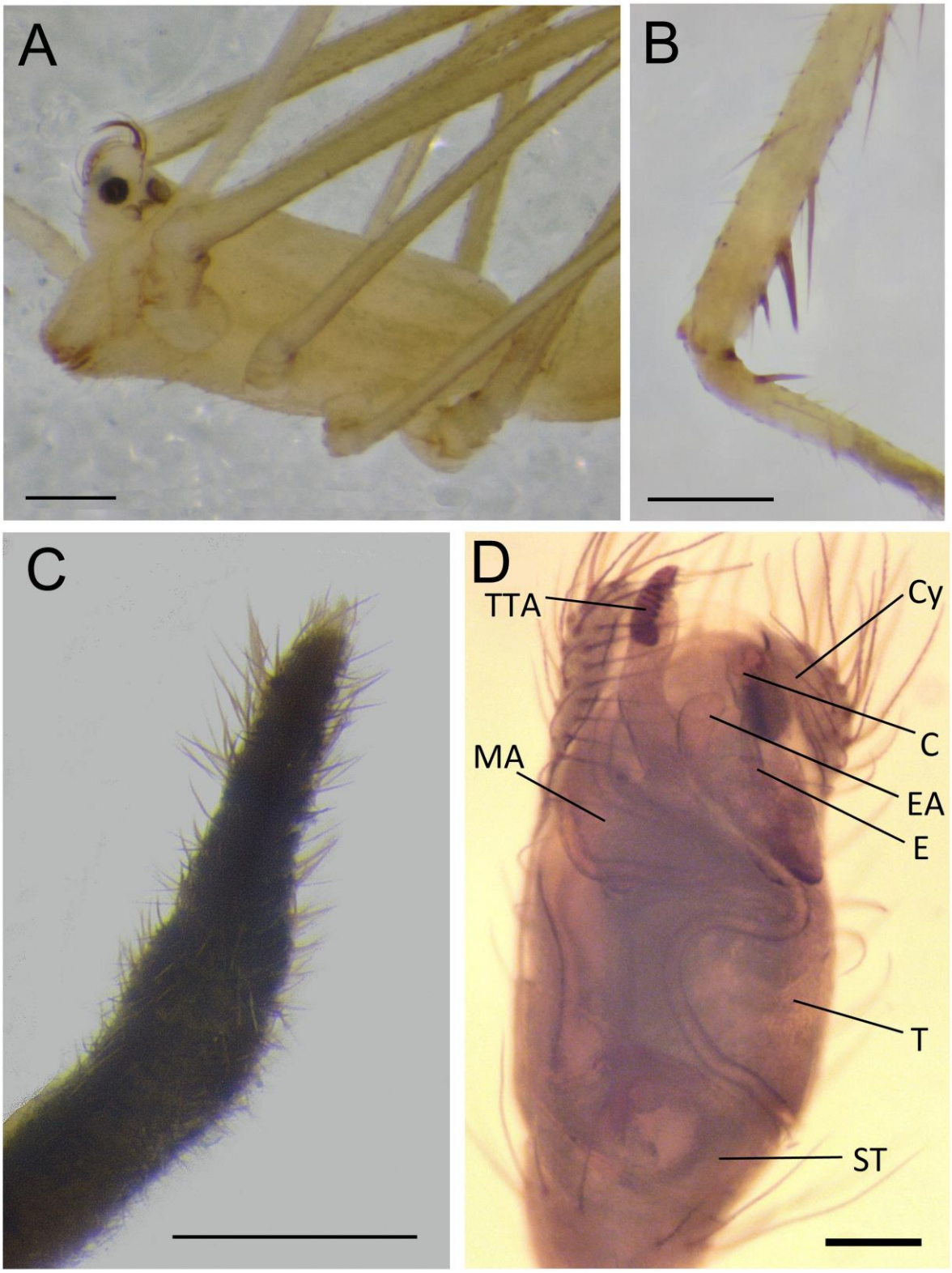

Figure 3: *Ariamnes attenuatus* O. Pickard-Cambridge, 1881, ♂, specimen from Panama. **A.** Cephalothorax, lateral view. **B.** Setae on tibia and metatarsus I. **C.** End tip of abdomen. **D.** Right palp, ventral view. Abbreviations: C, conductor; Cy, cymbium; E, embolus; EA, embolus apophysis; MA, median apophysis; ST, subtegulum; T, tegulum; TTA, theridiid tegular apophysis. Scale bars: A - C = 0.2 mm; D = 0.1 mm.

Diagnosis
We conclude that *Ariamnes* can be distinguished from other theridiid genera by the following combination of characters:
Abdomen tubular and very long; part behind spinnerets more than five times as long as in front of spinnerets. Eye region projecting beyond the clypeus, with short elevation and sometimes long, curved setae, clypeus bulging but without protrusion and not slanting, AME larger than other eyes.
Other characteristics of *Ariamnes*:
TTA elongate with distal part grooved, waffled, or comb-shaped. Legs very long, leg formula 1423. The posterior tip of the abdomen can be of different shapes, it can be pointed as in *A. cylindrogaster* Simon, 1889 (Fig. 12A). In *A. attenuatus* O. Pickard-Cambridge, 1881 the pointed extremity is covered with strong setae (Fig. 3C). In other species it is rounded as in *A. papua* sp. nov., (Fig. 7C) or club-shaped as in *A. petilus* Gao & Li, 2014 (Fig. 9D).

***Ariamnes papua* sp. nov.**

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(Figs. 4-8)

Diagnosis
The females of this species can be distinguished from those of other *Ariamnes* species by the shape of the epigyne (Fig. 8). The male palp (Figs. 5, 6) is very similar to that of *A. columnaceus*, but the sperm duct trajectory in the tegulum is different, the conductor is further from the tip of the embolus, the base of the TTA is more bulging and the tip is bigger, in *A. columnaceus* the ventral side of the TTA tip is waffled, in *A. papua* sp. nov. it is set with rows of teeth. The tip of the abdomen is rounded, while it is club-shaped in *A. petilus* and pointed in *A. cylindrogaster*.

Etymology
The species name is a noun in apposition taken from the type locality: Papua New Guinea.

Material examined
Holotype
PAPUA NEW GUINEA • ♂; Baiteta forest (4 km inland of the North Coast, 40 km north of Madang Town) in remnant patch of lowland mixed tropical rainforest (total surface of forest: 20km²); 5°01'S, 145°45'E. Fogging tree (*Pometia pinnata*, Sapindaceae) at 37m height. 6 May 1993. Leg. Olivier Missa. RBINS IG 34514/37.

Paratypes
PAPUA NEW GUINEA • 1♀; as holotype. RBINS IG 34514/38. • ♂; fogging tree (*Dracontomelum doa*); 30 March 1993; further as holotype; Missa. RBINS IG 34514/39; • ♂; Fogging tree (*Dracontomelum doa,* Anacardiaceae) at 25m height; 8 June 1995; further as holotype; RBINS IG 34514/40; • 1♀; *Piteleocarpus indicus* (Fabaceae); 26 July 1995; further as holotype; RBINS IG 34514/41; • 1♀; as holotype; fogging tree (tree species not known); 15 May 1996. further as holotype; THNHM-Ar-00000066.

Description
Male (RBINS IG 34514/37, Figs. 4-6). Body length 23; abdomen 21; carapace 2.2, width 1.1; AME 0.12, ALE 0.06, PME 0.07, PLE 0.06, AME-AME 0.08, AME-ALE 0.03, PME-PME 0.06, PME-PLE 0.04.

Colouration (in ethanol): brownish due to long preservation in alcohol; original colour not known.

Cephalothorax (Fig. 4): eyes on protrusion of carapace. Clypeus bulging. Carapace with depression. Sternum much longer than wide, extending between coxa IV.

Legs (Fig. 4A): legs I thicker than other legs.

Table 1: Leg measurements for *Ariamnes papua* sp. nov. holotype, male.

Leg	femur	patella	tibia	metatarsus	tarsus	total
I	5,1	0,6	4,3	4,3	1.2	15,5
II	3,0	0,5	2,2	1,9	1,1	8,7
III	1,8	0,3	1,1	0,8	0,6	4,6
IV	5,1	0,5	3,5	3,1	1.2	13,4

Abdomen (Fig. 4): posterior tip of abdomen rounded and lighter coloured, faded silver spots on lateral and ventral sides of abdomen.

Male palp (Figs. 5-6): Cymbium with prolateral ventral flap; distal tip with a few small dentated setae; conductor (C) subquadrangular with pointed anterior retrolateral corner, at some distance of embolus tip; sperm duct trajectory in median apophysis (sensu AGNARSSON 2004; SAARISTO 2006) and tegulum parallel with sclerite margin; base of TTA bulging, distal part large, with rows of small teeth; embolus base on prolateral side, caudal of conductor, curved anteriorly, slightly widened just behind sharp tip.

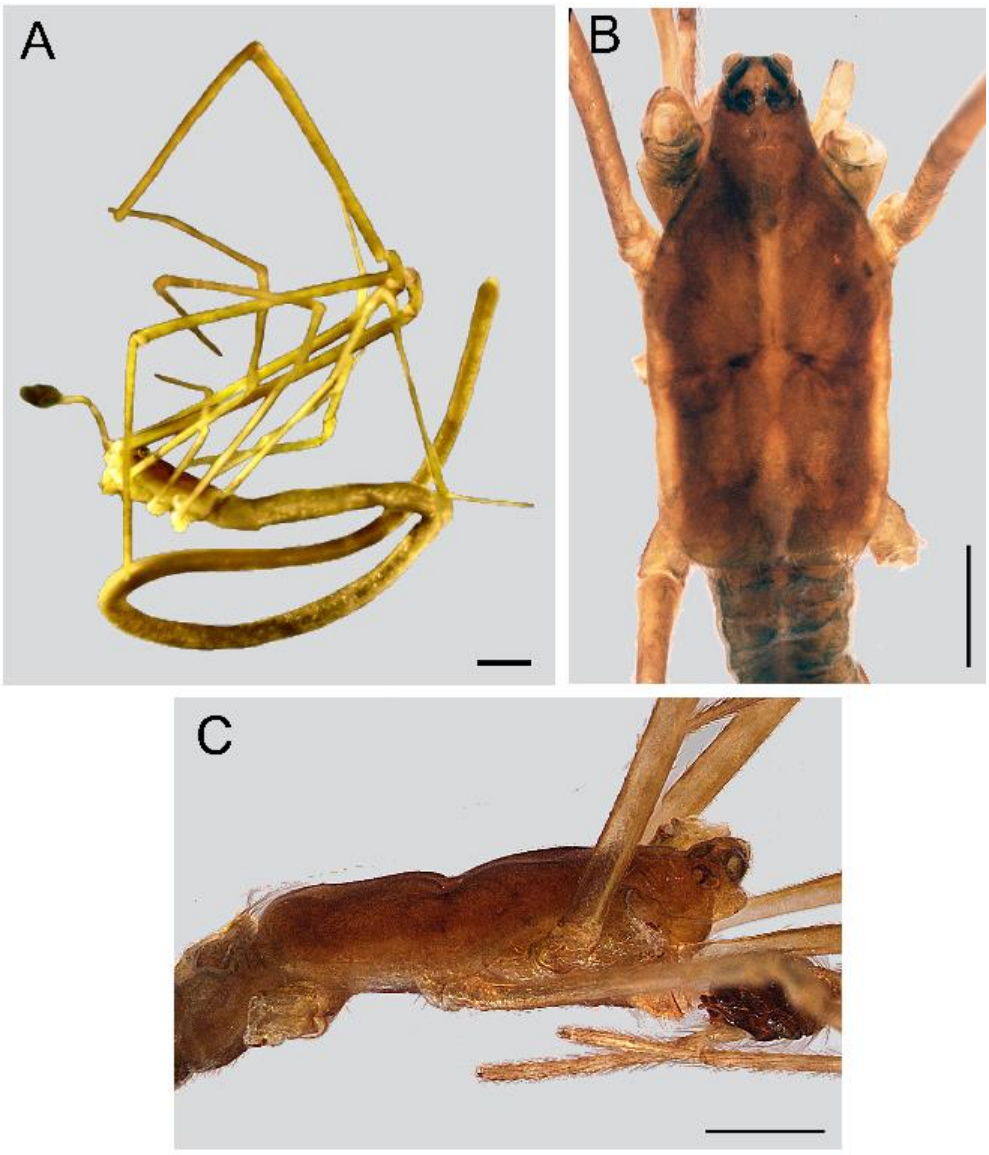

Figure 4: *Ariamnes papua* **sp. nov.,** ♂, **A.** Holotype, ♂, habitus, lateral view. **B.** Paratype RBINS IG 34514/39, ♂, cephalothorax, dorsal view. **C.** Paratype RBINS IG 34514/39, ♂, cephalothorax, lateral view Scale bars: A = 1 mm; B–C = 0.5 mm.

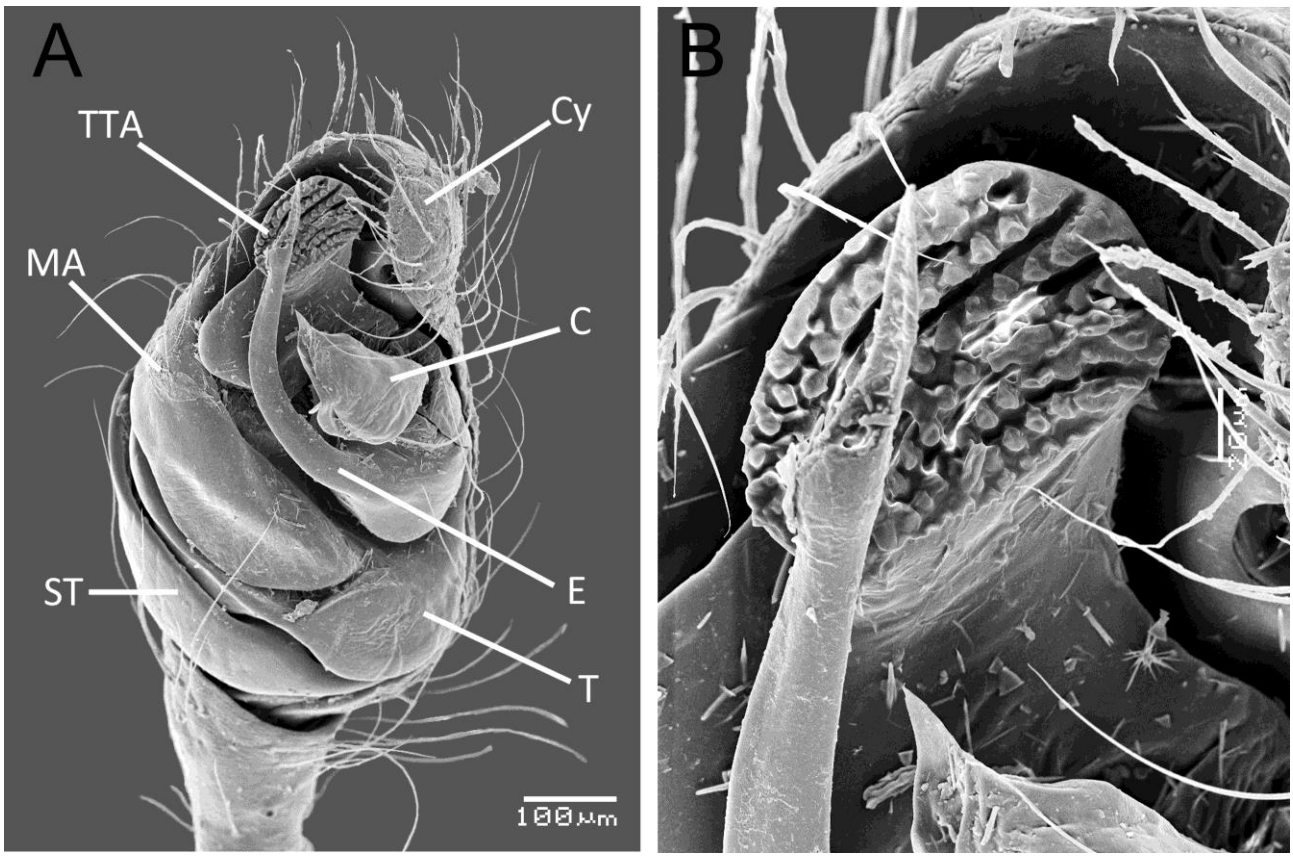

Figure 5: *Ariamnes papua* **sp. nov.,** ♂, paratype RBINS IG 34514/39. **A.** SEM, left palp, ventral view. **B.** Same, detail. Abbreviations: C, conductor; Cy, cymbium; E, embolus; MA, median apophysis; ST, subtegulum; T, tegulum; TTA, theridiid tegular apophysis.

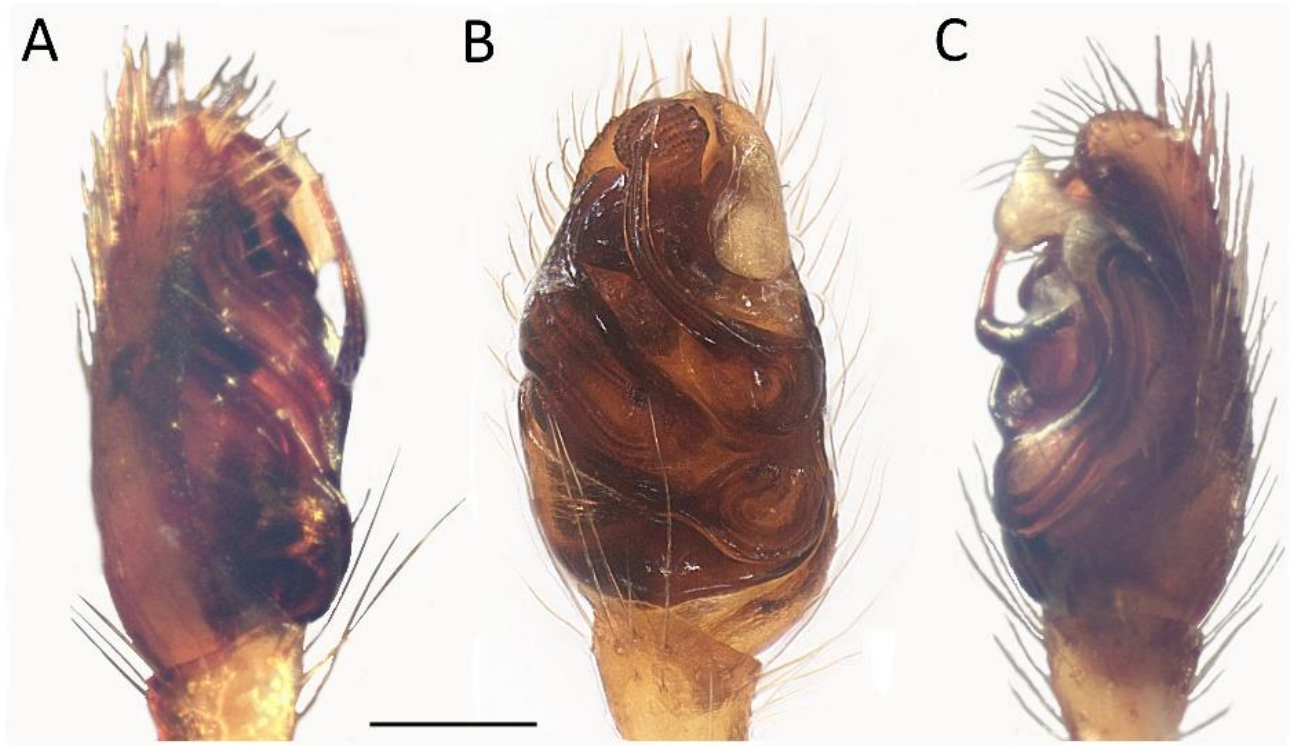

Figure 6: *Ariamnes papua* **sp. nov.,** ♂, holotype. **A.** Palp, retrolateral view; B**.** Same, ventral view; **C.** Same, prolateral view. Scale bar = 0.2 mm.

Female (paratype, RBINS IG 34514/38, Figs. 7-8). Body length 33; abdomen 30; carapace 3.0; AME 0.12, ALE 0.07, PME 0.09, PLE 0.07, AME-AME 0.10, AME-ALE 0.04, PME-PME 0.07, PME-PLE 0.04.

Cephalothorax (Fig. 7B): eyes on protrusion of cephalic area. Clypeus bulging. Carapace with depression at fovea. Sternum much longer than wide, extending between coxa IV.
Legs (Fig. 7A): Leg formula 1423, legs IV almost as long as legs I but the latter thicker.

Table 2: Leg measurements of *Ariamnes papua* sp. nov., paratype THNHM-Ar-00000066, female.

Leg	femur	patella	tibia	metatarsus	tarsus	sum
I	6.6	0.9	5.0	5.4	1.7	19.6
II	3.7	0.7	2.5	2.5	1.0	10.4
III	2.2	0.4	1.2	1.2	0.6	5.6
IV	6.6	0.7	4.2	4.6	1.7	17.8

Abdomen (Fig. 7A, C): colour and shape as in male but about 1.5 times as long, posterior tip rounded and paler.

Epigyne (Fig. 8): with inverted heart shape; copulatory ducts running forward, diverging, coiled before entering oval spermathecae, fertilization ducts short, directed towards centre.

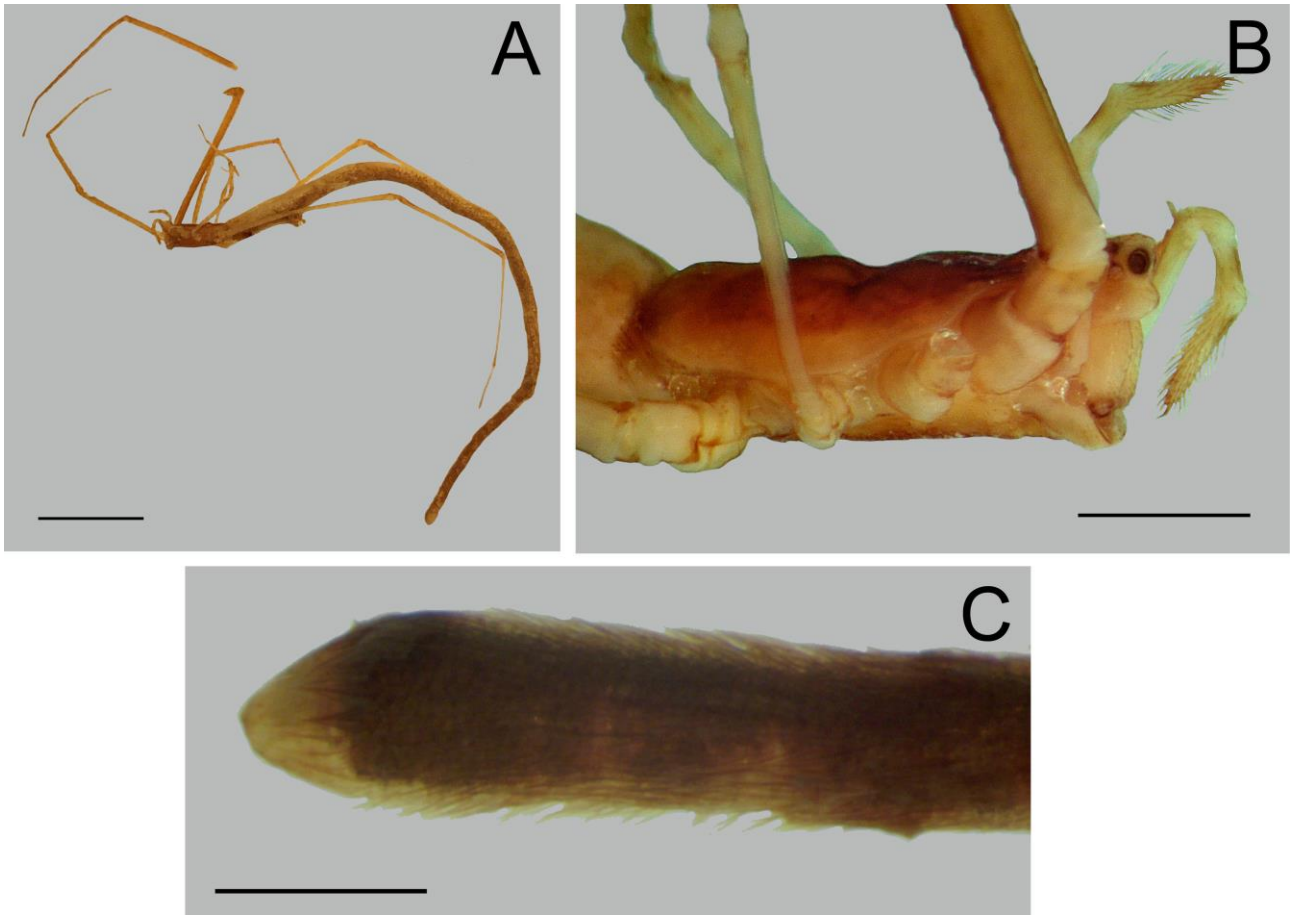

Figure 7: *Ariamnes papua* **sp. nov.**, ♀, paratype, RBINS IG 34514/38. **A.** Habitus, lateral view. **B.** Cephalothorax, lateral view. **C.** Tip end of abdomen, dorsal view. Scale bars: A = 5 mm; B=1 mm; C=0.5 mm.

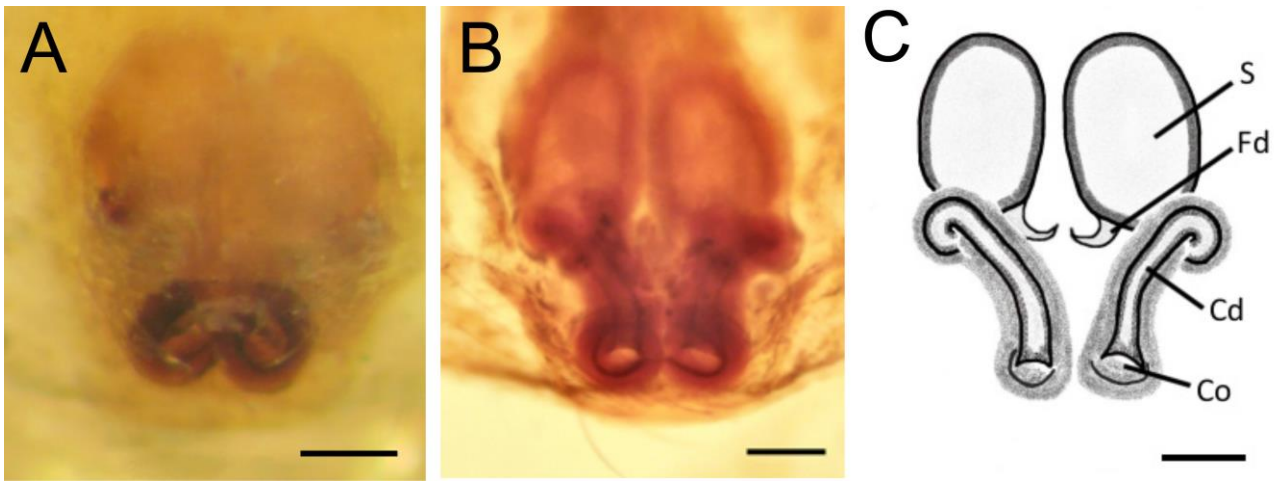

Figure 8: *Ariamnes papua* **sp. nov.,** ♀, paratype, RBINS IG 34514/38. **A.** Epigyne, ventral view. **B.** Vulva, ventral view. **C.** Vulva, ventral view. Abbreviations: Cd, copulatory duct; Co, copulatory opening; Fd, fertilization duct; S, spermatheca. Scale bars = 0.1 mm.

Variation
Female paratype THNHM-Ar-00000066: Total length 36; abdomen 33; carapace 3.

Distribution
Only known from the type locality in Papua New Guinea.

***Ariamnes petilus* Gao & Li, 2014**
(Figs. 9-11)

Material examined
MALAYSIA • 1♂; N. Borneo, Sabah, Keningau Crocker Range; twenty year old isolated secondary forest; 5°26'N 116°08'E; fogging tree (*Melanolepis*, Euphorbiaceae). 18 February 2001. Leg. A. Floren. RMNH ARA 18335. • 1♀; N. Borneo, Tawau Hills; N4°24.021'N 117°53.411'E; fogging tree (*Symplocos sp*., Symplocaceae); 5 September 2009; Leg. A. Floren; RMNH ARA 18336. • 2♀♀; N. Borneo, Tawau Hills; 4°24.396'N 117°53.549'E; 8 September 2009; Leg. A. Floren. THNHM-Ar-00000067.

Description
Female (RMNH ARA 18336, figs. 10-11). Body length 18.5; abdomen 16; carapace 2.5 width 1.5; AME 0.10, ALE 0.08, PME 0.06, PLE 0.08, AME-AME 0.09, AME-ALE 0.07, PME-PME 0.10, PME-PLE 0.08.

Cephalothorax (Fig. 10): eyes on protrusion of cephalic area; clypeus bulging; carapace with depression at fovea. Sternum much longer than wide, extending between coxa IV.

Legs (Fig. 10): Leg formula 1423, legs IV almost as long as legs I but the latter thicker.

Table 3: Leg measurements for *Ariamnes petilus*, RMNH ARA 18336, female.

Leg	femur	patella	tibia	metatarsus	tarsus	sum
I	7.5	0.8	5.1	5.8	1.2	20.4
II	3.7	0.7	2.5	2.5	1.1	10.5
III	1.8	0.4	1.0	1.2	0.4	4.8
IV	6.6	0.8	4.5	5.0	1.2	18.1

Abdomen (Fig. 10): posterior tip club-shaped.

Epigyne (Fig. 11): poorly delimited; spermathecae oval.

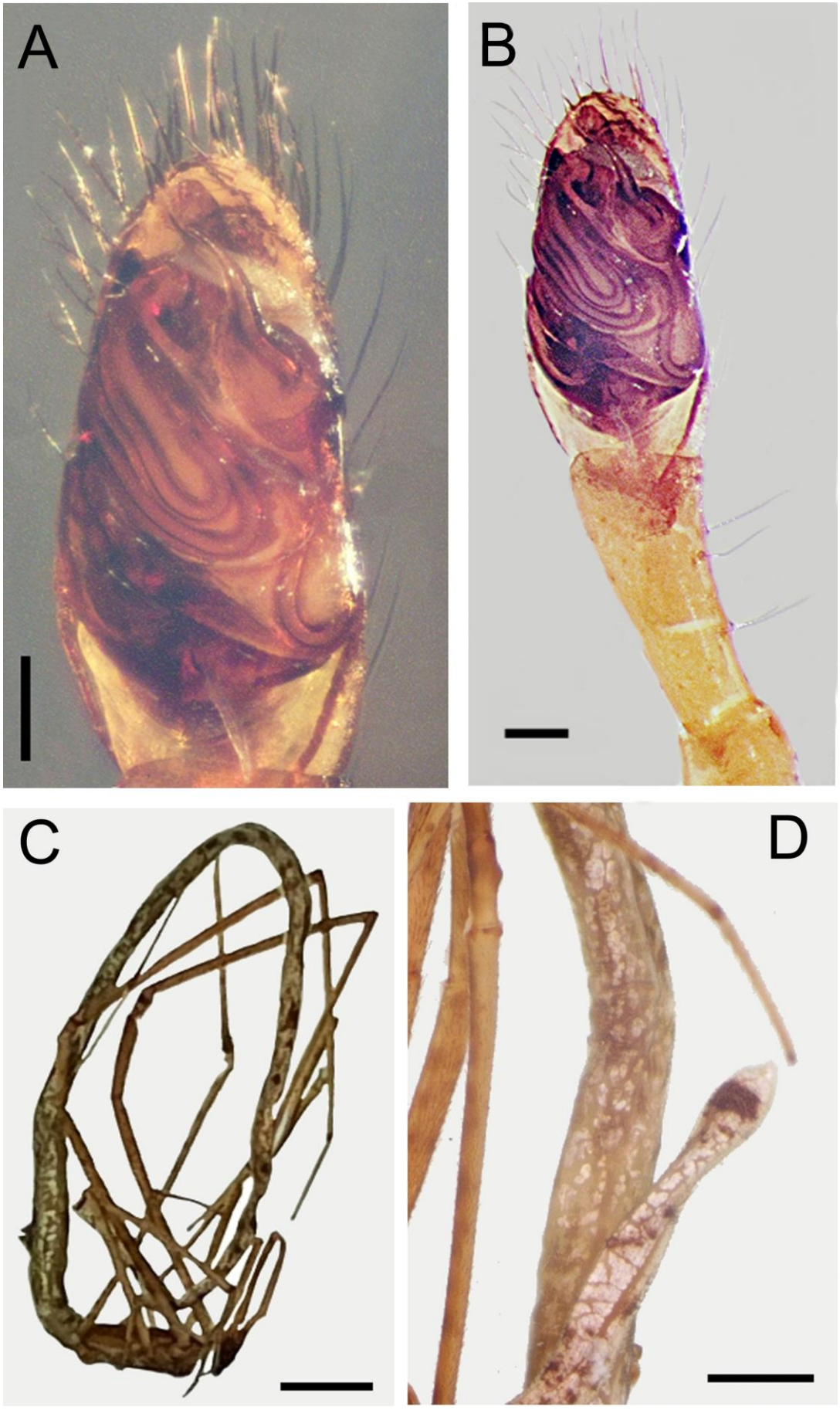

Figure 9: *Ariamnes petilus* Gao & Li, 2014, ♂, RMNH ARA 18335. **A.** Right palp, ventral view. **B.** Same, less enlarged. **C.** Habitus, lateral view. **D.** Abdomen, tip. Scale bars: A-B=0.1 mm, C=2 mm, D=1 mm.

Figure 10: *Ariamnes petilus* **Gao & Li, 2014**, ♀, RMNH ARA 18336. Habitus, lateral view. Scale bar: 2 mm.

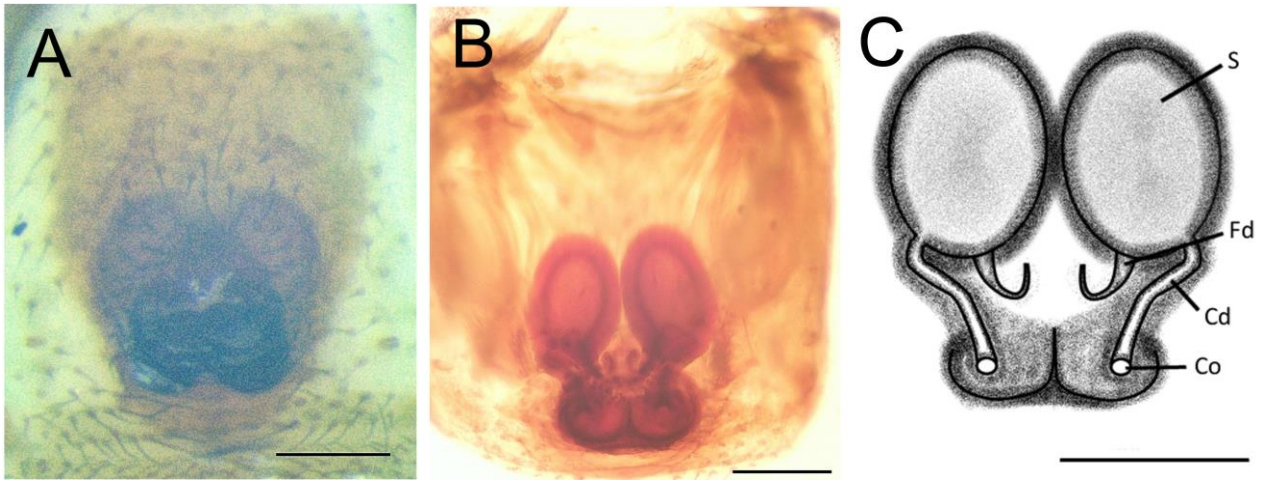

Figure 11: *Ariamnes petilus* **Gao & Li, 2014**, ♀, THNHM-Ar-00000067. **A.** Epigyne, ventral view. **B.** Vulva, ventral view. **C.** Vulva, ventral view. Abbreviations: Cd, copulatory duct; Co, copulatory opening; Fd, fertilization duct; S, spermatheca. Scale bar: 0.2 mm.

Distribution
Southern China and Malaysia (North Borneo, new record).

Notes on other Ariamnes species

***Ariamnes cylindrogaster* Simon, 1889**
SIMON (1889) described this species from Yokohama (Japan). Other authors described it later from Japan, Korea, East and South China, Taiwan and Laos (WSC 2024).

BÖSENBERG & STRAND (1906) in "Japanische Spinnen" write:
"Daß diese Art diejenige Simons ist, möchte ich bestimmt annehmen, trotzdem daß seine Exemplare nur 12,5 mm lang waren; aus den oben angegebenen Zahlen sieht man, daß die Größe dieses Tieres zwischen weiten Grenzen schwankt. — Die Beschreibung und Abbildung von Ar. *colubrinus* Keys, in „Die Arachniden Australiens" paßt so gut auf unsere Tiere, daß ich *colubrinus* Keys. 1890 als Synonym zu cylindrogaster Sim. 1888 ziehen möchte (Strand)."

Which can be translated as:
"That this species is that of Simon, I am sure, although his specimens were only 12.5 mm long; from the figures given above it can be seen that the size of this animal varies between wide limits. — The description

and illustration of *A. colubrinus* Keys, in "The Arachnids of Australia" fits our animals so well that I would like to use *colubrinus* Keys. 1890 as a synonym of *A. cylindrogaster* Simon, 1888."

That their species is indeed *A. cylindrogaster* cannot be concluded for sure since SIMON (1988) did not provide any pictures of the copulatory organs. However, no other species have been found in Japan so far. We therefore consider it to be the same species.
We add a new locality for *A. cylindrogaster*: 1♂ 4juv. Indonesia, N-Sulawesi, Palu, Lore Lindu Reserve. 14 July 1982. Leg. C.L. & P.R. Deeleman. RMNH ARA 18351.

Figure 12: *Ariamnes cylindrogaster* **Simon, 1889.** ♂, RMNH ARA 18336. **A.** Abdomen, end tip. **B.** Left palp, ventral view. Scale bars: A: 0.1 mm, B: 0.5 mm.

The Hawaiian species

The following species have been described from Hawaii: *Ariamnes alepeleke* Gillespie & Rivera, 2007; *A. corniger* Simon, 1900; *A. hiwa* Gillespie & Rivera, 2007; *A. huinakolu* Gillespie & Rivera, 2007; *A. kahili* Gillespie & Rivera, 2007; *A. laau* Gillespie & Rivera, 2007; *A. makue* Gillespie & Rivera 2007; *A. melekalikimaka* Gillespie & Rivera, 2007; *A. poele* Gillespie & Rivera, 2007; *A. uwepa* Gillespie & Rivera, 2007 and *A. waikula* Gillespie & Rivera, 2007.

SIMON (1900) placed *A. corniger* in the genus *Ariamnes* but noticed that this species was very different from other species in the genus. As also stated by GILLESPIE & RIVERA (2007), there are considerable morphological differences between these spiders and all other *Ariamnes* species. They write: "the abdominal shape and

genitalic structure (in particular that of the male palp) place it closer to *Rhomphaea*. The arrangement of the primary sclerites (embolus, conductor, median apophysis, theridiid tegular apophysis) of the male palp of *Rhomphaea* (Agnarsson 2004) is similar to that of the Hawaiian *Ariamnes*." On the base of unpublished DNA sequences they state (p. 12) that their species do not belong in any of the Argyrodine genera, including *Ariamnes.* Until further studies, the species will remain incertae sedis.

We consider the following species to belong to *Ariamnes* s.s.: *A. attenuates* O. Pickard-Cambridge 1881; *A. colubrinus* Keyserling, 1890; *A. columnaceus* Gao & Li, 2014; *A. flagellum nigritus* Simon, 1901; *A. helminthoides* Simon, 1907; *A. jeanneli* Berland, 1920; *A. longissimus* Keyserling, 1891; *A. patersoniensis* Hickman, 1927; *A. pavesii* Leardi, 1902; *A. petilus* Gao & Li, 2014 *A. simulans* O. Pickard-Cambridge, 1892.

Species belonging in other genera (incertae sedis)

The following species are mistakenly placed in *Ariamnes*, they are very small and the abdomen is not worm-like. Most of them are probably *Rhomphaea*-species. However, they are here declared *incertae sedis* until further studies confirm their placement.

Ariamnes birgitae (Strand, 1917)

The length of the abdomen of this species from Myanmar is only 4 mm and the abdomen is comparable with that in *Rhomphaea*.

Strand writes:
"Mas singulus ad Tharrawaddy est captus. A. nasico, Sim., ad formam abdominis (non vero cephalothoracis) sat similis est; caret procursu illo frontali, quo munitus est A. nasicus."

Which translates as:
"A single male was captured at Tharrawaddy. *A. nasico*, Simon, is quite similar to the form of the abdomen (but not of the cephalothorax); it lacks that frontal course with which *A. nasicus* is fortified."

Both species mentioned here, *Ariamnes nasica* Simon, 1873 and *A. nasicus* Simon, 1881 are already transferred to *Rhomphaea*. It is clear that also *A. birgitae* Strand, 1917 should be transferred, it becomes *Rhomphaea birgitae* (Strand, 1917) comb. nov.

Ariamnes campestratus Simon, 1903

The length of this female spider from sub-Saharan Africa is only 3.5 mm and SIMON wrote:

"Abdomen compressum, breve, sed altissimum, in conum verticale longum elevatum, fulvo testaceum, utrinque in declivitate macula confusa dilutiore vel albida notatum."

Which translates as:
"Abdomen compressed, short, but very high, raised into a long vertical cone, cream yellow, marked on both sides with a large poorly delimited whitish spot."

Ariamnes rufopictus Thorell, 1895

THORELL (1895) writes about this species from Myanmar:
"Feminam singulam detritam examinavi. Aculeis illis pedum lanceolatis sive anguste foliiformibus valde notabilis est haec aranea, fortasse generi proprio adscribenda."

Which translates as:
"I examined the only damaged female. This spider is very remarkable for its lanceolate or narrowly leaf-shaped spines, perhaps belonging to its own genus."

The only genus with such leaf-shaped spines is *Meotipa*.

Ariamnes rufopictus Thorell 1895 becomes *Meotipa rufopictus* (Thorell 1895) comb. nov.

Ariamnes russulus Simon, 1903
This female spider from Equatorial Guinea is only 3 mm long and SIMON (1903) wrote:

"Abdomen convexum, vix longius quam latius, subglobosum sed postice in tuberculum modice longum, crassum, sed apice sat abrupte angustius et letiver sursum curvatum …"

Which translates as:
"Abdomen convex, hardly longer than wide, subglobose but posteriorly elongated into a moderately long tubercle, thick, but abruptly narrower at the apex and gently curved upwards …"

Ariamnes setipes van Hasselt, 1882
This spider from Indonesia (Sumatra) is only 7 mm long and the abdomen as shown in the drawing by VAN HASSELT (1882) is not cylindrical.

Ariamnes triangulatus Urquhart, 1887
This spider from New Zealand is only about 2 mm long and the abdomen is subtriangular seen from the side according to the illustration (URQUHART 1887, fig. VIII, 6).

Ariamnes triangulus Thorell, 1887
The described female from Myanmar has an abdomen from about 5.5 mm and according to THORELL (1887) the species is very close to *Ariamnes longicaudata* O. Pickard-Cambridge, 1872, which is later transferred to *Rhomphaea longicaudata* O. Pickard-Cambridge, 1872. This species should also be transferred to *Rhomphaea* and becomes *Rhomphaea triangulus* (Thorell, 1887) new comb.

Discussion

The genus *Ariamnes* was poorly defined and several of the species assigned to it apparently belong in other genera. It is often difficult to decide in which genus because many species are insufficiently described. From most of these species only one sex was collected and described, and/or no illustrations of the genitalia are provided. This makes it impossible to distinguish them from possibly related species. *Ariamnes* thus clearly needs further investigation and clean up.
Probably the most remarkable character of the genus is the shape of the abdomen, which makes it look like a worm. It is certainly not a coincidence that SIMON named one of the species *A. helminthoides* Simon, 1907. A quick glance at a vial with specimens of the genus indeed provides the impression that it contains helminth worms. If it would be evolutionary advantageous, it would be a unique kind of mimicry or camouflage in the animal kingdom. But although certain worms occur in trees and shrubs (POWERS ET AL. 2009, ROBAINA ET AL. 2015), it is hard to figure how this could work. We therefore assume that the peculiar abdominal shape is a kind of camouflage it shares with some insect species resembling small sticks and thus known as 'stick insects'. Arnaud Henrard (pers. comm.) has collected *Ariamnes* sp. on Mayotte and was struck by their similarity with small sticks. The *Ariamnes* he caught kept their abdomen straight, clearly not behaving as a worm.

Acknowledgements

We wish to thank Wouter Deconinck of KBIN/IRSNB who gave us the opportunity to examine the spiders of Papua New Guinea and for taking the pictures of the holotype of *Ariamnes flagellum.* We are indebted to J. Miller of Naturalis for making the holotype of *Ariamnes flagellum* available for examination at KBIN/IRSNB. We are indebted to the anonymous referees for their comments which contributed to the quality of the submission.

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Indirect kleptoparasitism or bibiocommensalism between *Misumena vatia* (Araneae, Thomisidae) and *Aphanotrigonum trilineatum* (Diptera, Chloropidae)

True flies or Diptera of at least eight families are known to include kleptoparasitic species (see Table 1 in HILL et al. 2020). These insects are considered parasitic because they profit of spider prey. Since the stealing occurs without direct contact with the predator it is called 'kleptoparasitism' or 'clandestine parasitism'. One of these fly families is the Chloropidae (frit flies or grass flies) where kleptoparasitic species have been recorded in the genera *Anomoeoceros*, *Guarax*, *Olcella*, and *Trachysiophonella* (SIVINSKI et al. 1999; BRAKE & VON TSCHIRNHAUS 2010; GILLUNG & BORKENT 2017).

On 28 June 2022, in a garden in Sint-Agatha-Rode (50.7599°N, 4.6394°E) (province of Flemish-Brabant, Belgium), we observed a female crab spider of *Misumena vatia* (Clerck, 1757) (Araneae, Thomisidae) on a flower of bindweed (*Calystegia sepium* (L.) R.Br.) in the course of consuming an unidentified winged insect (Fig. 1A). Immediately after the spider had dropped the prey, a small female fly that had apparently been sitting underneath the spider, appeared and started to lick the spot where the prey had touched the flower (Figs 1B,C). A second fly specimen was sitting in the bottom of the flower.

The fly that was probably feeding on the spider prey liquids or remains was collected and stored in absolute ethanol (Fig. 1D). One of the mid-legs was used to extract DNA for barcoding. Procedures for DNA extraction and sequencing of the 647 bp DNA barcode region of the mitochondrial cytochrome *c* oxidase subunit I followed JORDAENS et al. (2015). The DNA barcode was submitted to GenBank (accession PQ198556) and used to construct a neighbor-joining (NJ) tree (SAITOU & NEI 1987), using p-distances in MEGA v.11 (TAMURA et al. 2021), and other related DNA barcodes downloaded from GenBank. The specimen was morphologically identified as *Aphanotrigonum trilineatum* (Meigen, 1830), a species of the family Chloropidae (DELY-DRASKOVITS 1981). This identification was confirmed by DNA barcoding, since the DNA barcode clustered together with those of the same species in the NJ-tree, showing a very low mean p-distance (0.05%) with conspecific DNA barcodes (Fig. 2). Interestingly, the DNA barcodes of another species, *Aphanotrigonum nigripes* (Zetterstedt, 1848), clustered with the DNA barcodes of *A. trilineatum,* with a mean interspecific p-distance of 0.05%. Some of the DNA barcodes of both species were even identical (p-distance=0.04%). It remains to be investigated how these apparently morphologically different species have such low interspecific differentiation in their mitochondrial DNA.

We did not see the flies feeding directly on the prey of the spider, but only on the flower corolla where liquids of the prey, possibly mixed with spider digestive juices, were deposited. However, the phenomenon of flies profiting of spider prey, feeding either directly on the prey or on substances covering it, has been documented by photos on other occasions elsewhere in Belgium (Koen Van Keer, pers. comm.) but the fly specimens were not collected and remain unidentified. Clear cases of kleptoparasitism have been reported in several genera of Chloropidae (SIVINSKI et al. 1999; BRAKE & VON TSCHIRNHAUS 2010 ; GILLUNG & BORKENT 2017). However, our observation does not depict a case of true kleptoparasitism since it does not involve consumption of part of the prey to the detriment of the spider but only of (liquid) remains that are probably not part of the spider's diet. This may explain why this behaviour, called bibiocommensalism (ROBINSON & ROBINSON 1977), involving species of the genus *Aphanotrigonum*, has remained unnoticed. Our observation is the first report of foraging flies in this genus of Chloropidae feeding on remains of spider prey.

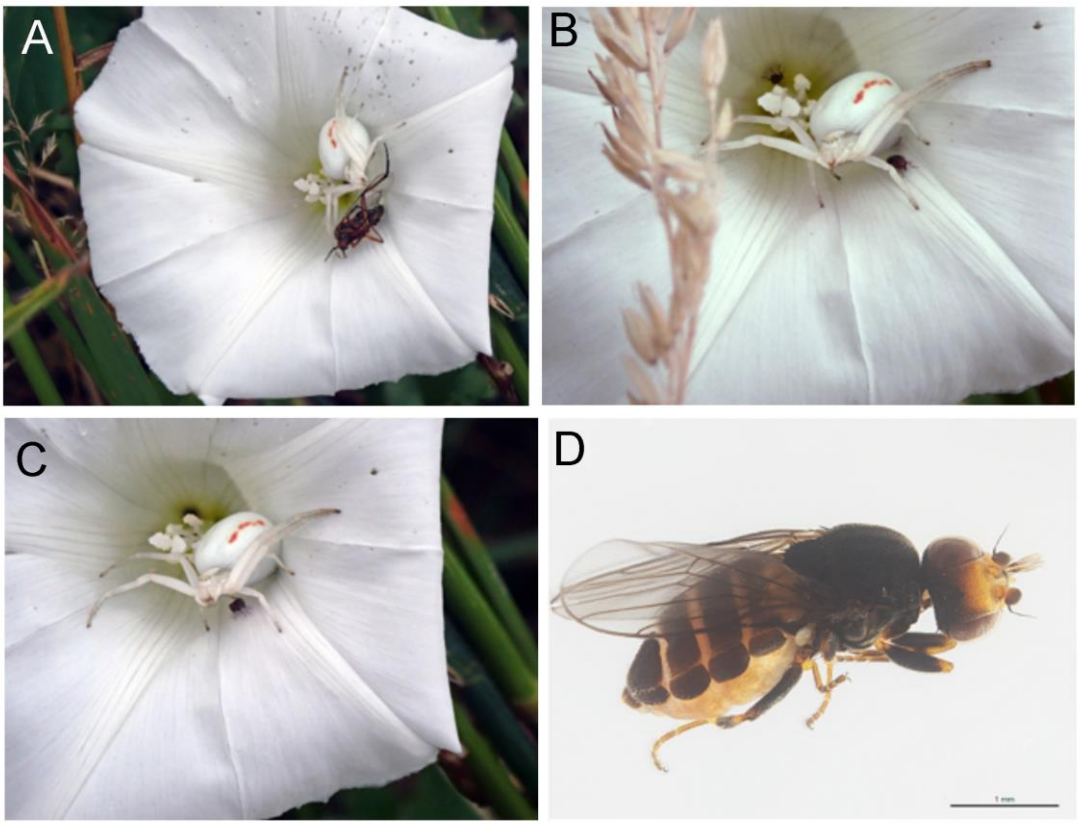

Figure 1: A. *Misumena vatia* (Araneae, Thomisidae) with an unidentified winged prey on bindweed, **B.** *Misumena vatia* in the company of two, apparently commensal flies (Insecta, Diptera), **C.** As previous, one of the flies now near the spot where the prey had been consumed, **D.** The fly specimen of *Aphanotrigonum trilineatum* (Diptera, Chloropidae) that was collected feeding on the spider prey fluids on the flower corolla.

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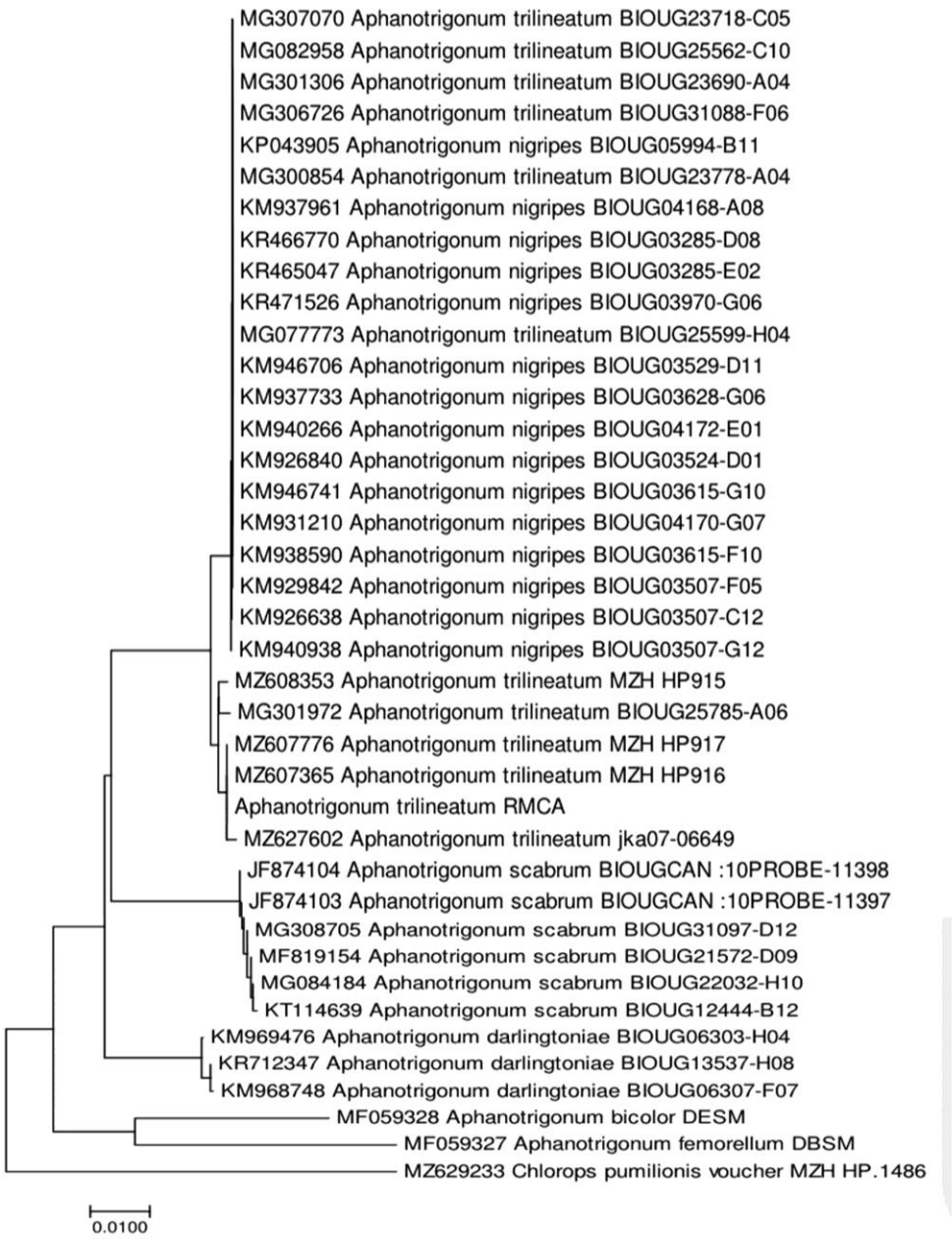

Figure 2: Neighbour-Joining tree of a selection of DNA barcodes of the family Chloropidae retrieved from GenBank and the DNA barcode of the specimen depicted in Fig. 1D.

Abstract

Chloropid flies *Aphanotrigonum trilineatum* (Diptera, Chloropidae) were observed feeding on liquid remans of the prey of *Misumena vatia* (Araneae, Thomisidae).

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On the female specimen *Nigma walckenaeri* (Roewer, 1951) misidentified as *Nigma puella* (Simon, 1870)

Erratum for " Henrard, A., Baert, L., De Smedt, P., Gardini, G., Vanhercke, L., Jocqué, R., Oger, P., Kekenbosch, R., Van Nieuwenhove, C., Lock, K. & Drumont, A. (2022). On the arachnofauna of the Jean Massart botanical garden (Brussels-Capital Region, Belgium). *Journal of the Belgian Arachnological Society* 37(2): 122-137 "

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Abstract

An erratum for HENRARD et al. (2022) is presented. The female dictynid specimen collected in the Jean Massart Botanical Garden (Brussels-Capital Region, Belgium), originally published as *Nigma puella* (Simon, 1870), has been morphologically re-examined and subjected to DNA-barcoding (COI) for species identification. The present investigation demonstrates that the specimen was misidentified, and is re-assigned to *Nigma walckenaeri* (Roewer, 1951).

Samenvatting

Een erratum voor HENRARD et al. (2022) wordt gepresenteerd. Het vrouwelijke exemplaar van het kaardertje verzameld in de botanische tuin Jean Massart (Brussels Hoofdstedelijk Gewest, België), oorspronkelijk gepubliceerd als *Nigma puella* (Simon, 1870), is morfologisch opnieuw onderzocht en onderworpen aan moleculaire barcoding (COI) voor genetische identificatie. De huidige studie toont aan dat het exemplaar verkeerd geïdentificeerd werd en eigenlijk *Nigma walckenaeri* (Roewer, 1951) betreft.

Résumé

Un erratum pour HENRARD et al. (2022) est présenté. Le spécimen femelle de dictynide collecté au Jardin botanique Jean Massart (Région de Bruxelles-Capitale, Belgique), publié à l'origine sous le nom de *Nigma puella* (Simon, 1870), a été réexaminé morphologiquement et soumis au barcoding moléculaire (COI) pour une identification génétique. La présente étude démontre que le spécimen a été mal identifié et qu'il s'agit en fait de *Nigma walckenaeri* (Roewer, 1951).

Introduction

The Jean Massart Botanical Garden, located in the Brussels-Capital Region of Belgium, displays an exceptional biodiversity. Previous studies have highlighted the impressive diversity of insects and other arthropods within this garden (PAULY 2019; DEKONINCK et al. 2019, 2023; GROOTAERT & DRUMONT 2022, 2023). This extensive biodiversity is also reflected in the arachnid fauna, with 239 species documented to date (HENRARD et al. 2022). Within the spider community found in the Jean Massart Botanical Garden, HENRARD et al. (2022) listed seven species for the family Dictynidae: *Brigittea latens* (Fabricius, 1775), *Dictyna arundinacea* (Linnaeus, 1758), *Dictyna pusilla* Thorell, 1856, *Dictyna uncinata* Thorell, 1856, *Lathys humilis* (Blackwall, 1855), *Nigma flavescens* (Walckenaer, 1830), and *Nigma puella* (Simon, 1870). However, *Nigma puella* is not yet included in the Belgian spider checklist (BOSMANS & VAN KEER 2017) and its identification in HENRARD et al. (2022) could potentially represent a new record for the Belgian arachnofauna that was previously overlooked.

The present study aims to validate this potential new record. Therefore, the specimen found in the Jean Massart Botanical Garden identified as *Nigma puella* has been re-examined. This study involves both morphological and DNA-based identification techniques.

Material and Methods

Material examined

Nigma walckenaeri (Roewer, 1951) (Aranae, Dictynidae):
BELGIUM • 1 ♀; Brussels, Oudergem, Jean Massart Botanical Garden; 50°48'50"N 4°26'17"E; 24.VIII.2016; C. Dekuijper, L. Dahan, H. Raemdonck & A. Drumont leg.; Beating vegetation; GenBank (COI): PP919328; RBINS_IG.33.177.

DNA-based species identification

DNA was extracted from two legs of the specimen using the QIAamp DNA Micro Kit (Qiagen, Venlo, the Netherlands) following the manufacturer's protocol (elution volume: 50 µl). The DNA extract was dried using the GenTegra technology after investigation and stored at room temperature at the Royal Belgian Institute of Natural Sciences (RBINS). The mitochondrial cytochrome *c* oxidase subunit I (COI) gene was amplified using the primers LCO1490 (5'-GGTCAACAAATCATAAAGATATTGG-3') and HCO-700ME (5'-TCAGGGTGACCAAAAAATCA-3') (Folmer et al. 1994; Breton et al. 2006), targeting a 664 bp long fragment. PCR conditions and protocol were as described in Bork (2015). PCR product and negative control were checked on a 1.5% agarose gel, using a UV transilluminator and the MidoriGreen™ Direct method (NIPPON Genetics Europe, Dueren, Germany). Positive COI amplification was subsequently purified using the ExoSAP-IT™ protocol (following manufacturer's instructions) and sequenced in both directions by Macrogen Europe (the Netherlands). Paired bi-directional strands were then trimmed and checked for stop codons using Geneious Prime® (Biomatters Ltd. Auckland, New Zealand). A consensus sequence was generated for the specimen, and subsequently compared against the Identification System of BOLD, with Species Level Barcode Records option (www.boldsystems.org).
Additionally, a Neighbour-Joining (NJ) tree (Tamura-Nei distance model, 1000 bootstrap replicates) was constructed to examine the clustering support of each species of the *Nigma* genus. To this end, the generated sequence was first aligned with all publicly available COI sequences of *Nigma* species downloaded from BOLD and GenBank (www.ncbi.nlm.nih.gov/genbank), using MUSCLE in Geneious Prime®. Then duplicates (i.e., identical sequences) were discarded per species to limit the size of the database. The final alignment comprised 18 unique COI sequences (see Appendix 1 for details). Among these sequences, the COI sequence of *Ajmonia gratiosa* (Simon, 1881) was included, as this species was recently retransferred from the genus *Nigma* to *Ajmonia* Caporiacco, 1934 (Wunderlich 2022). Additionally, COI sequences of *Dictyna uncinata* (FBARB313-11) and *Dictyna arundinacea* (ARBCM1230-14) from the Dictynidae family were included to root the NJ tree.

Examination and illustrations

The sample identified as "*Nigma puella*", a female specimen deposited at the Royal Belgian Institute of Natural Sciences (collection number RBINS_IG.33.177), was re-examined. Photographs of the specimen and genitalia immersed in ethanol 70% were taken with a DFC500 camera mounted on a Leica MZ16A and piloted with the Leica Application Suite software (LAS ver. 4.13). The epigyne was removed from the abdomen and digested using half a tablet of Total Care Enzima product (protein removal system originally for cleaning contact lenses and containing subtilisin A-0,4 mg per tablet; Abbott Medical Optics, Santa Ana, CA) in a few millilitres of distilled water overnight, then immersed back in 70% ethanol to be photographed. Some photos are available on the website "Les araignées de Belgique et de France" by Pierre Oger (https://arachno.piwigo.com/).

Results

DNA-based analyses

Using the Identification System of BOLD, a maximal match (100%) was obtained with a representative of the species *Nigma walckenaeri,* a voucher specimen collected in Germany (FBARB987-15; ASTRIN et al., 2016). The identification was further supported by the NJ tree construction, with a 1000 bootstrap support of the cluster including the generated sequence nested with other *Nigma walckenaeri* COI sequences downloaded from the online DNA repositories (Fig. 1). The generated COI sequences (1060 bp) is available on GenBank under the accession number PP919328.

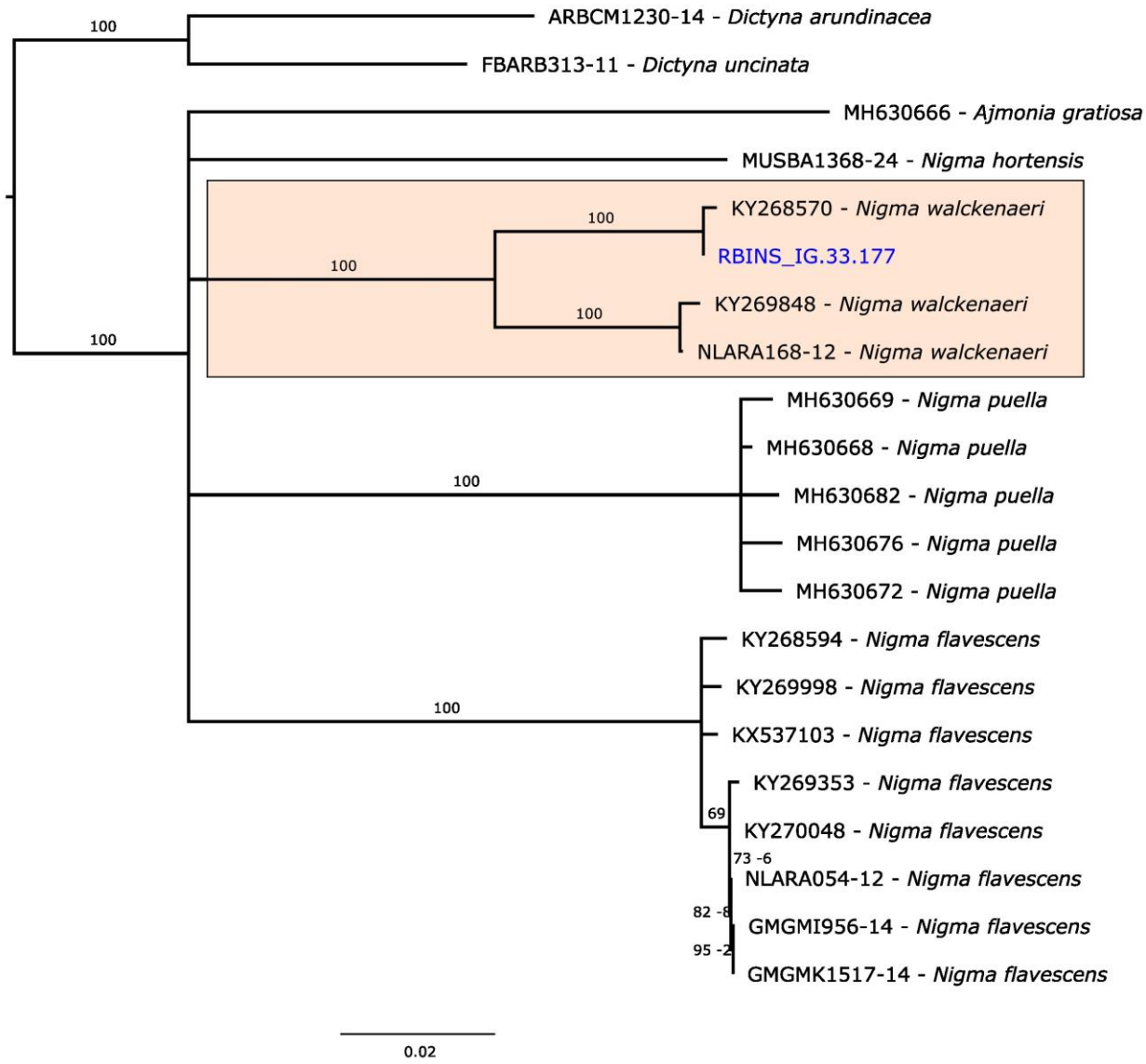

Figure 1: Neighbour-Joining tree including five species of the genus *Nigma* based on the cytochrome c oxidase subunit I (COI), with *N. flavescens*, and *N. walckenaeri* being the only species recorded in Belgium (Tamura-Nei distance model; 648 bp fragment; 1000 bootstrap replicates), and with *Dictyna uncinata* (FBARB313-11) and *Dictyna arundinacea* (ARBCM1230-14) as outgroups. The bootstrap values are shown at the branch points (sequence of query specimen highlighted in blue). Minimum branch support displayed is 65, other branches are collapsed.

Morphology

Morphological examination of the specimen preserved in alcohol reveals a very pale, yellowish-white coloration of the habitus (Fig. 2A-B). The observation of the genitalia required the dissection of the vulva (Fig. 2C-F). After clearing through the digestion process, it became more evident that the vulva corresponds to

Nigma walckenaeri, as seen in WIEHLE (1953: p. 80, fig. 171b) and LOKSA (1969: p. 39, fig. 30A). The vulva is provided with a pair of semi-translucent, tube-shaped structures and small, notched conical sclerites, widely separated from each other (see Figs 2C-F; vs. in *N. puella*, vulva with large conical sclerites, see BREITLING 2020: 342, fig. 7C and REHFELDT & CASSAR 2024: 22, fig. 7b).

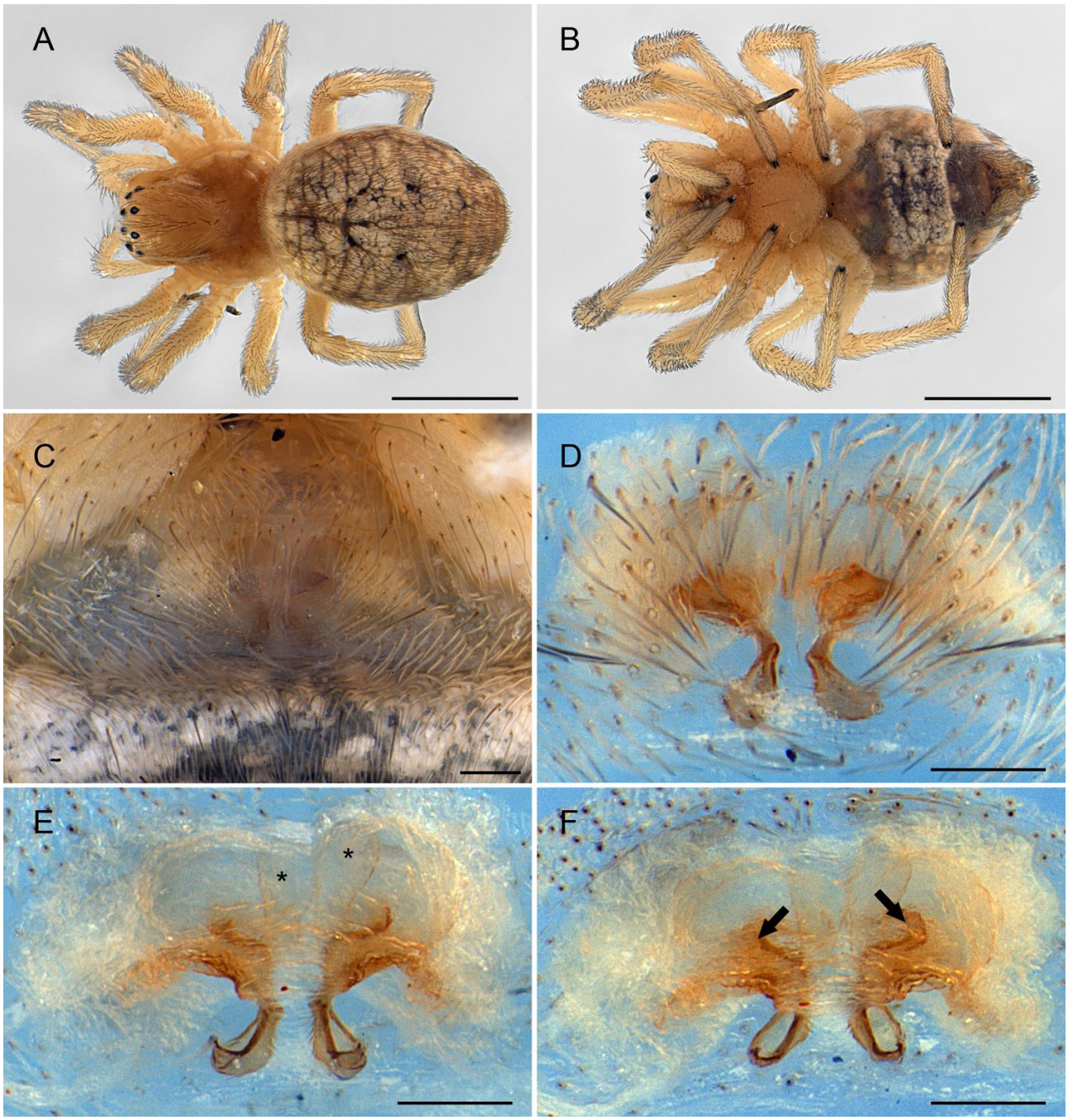

Figure 2: *Nigma walckenaeri* (Roewer, 1951), female specimen RBINS_IG.33.177) collected in the Jean Massart botanical garden (Brussels-Capital Region, Belgium). **A.** Habitus, dorsal view. **B.** Idem, ventral view. **C.** Epigastric region, ventral view. **D.** Vulva, ventral view. **E.** Idem, dorsal view. **F.** idem, slightly anterior view. The stars indicate the semi-translucent, tube-shaped structures and the arrows point to the notched conical sclerites. Scale bars: A-B = 1 mm; E-F = 0.1 mm.

Discussion

The specimen RBINS_IG.33.177 collected from the Jean Massart Botanical Garden exhibits a very pale coloration (Fig. 2A-B), which is often observed in *Nigma puella* and likely led to the initial misidentification. In contrast, living female specimens of *N. walckenaeri* typically display a distinctive flashy greenish coloration (Fig. 3A), with males also featuring a contrasting reddish prosoma (Fig. 3B). This vivid coloration strikingly

faded in the specimen due to its preservation in alcohol. The male is further identifiable by its palp with minute patella and tibial apophyses (Fig. 3D; see also ROBERTS 1995: p. 87), the embolus course with only a very faint subapical deviation (Fig. 3C) and the angular shape of conductor tip (Fig. 3D).

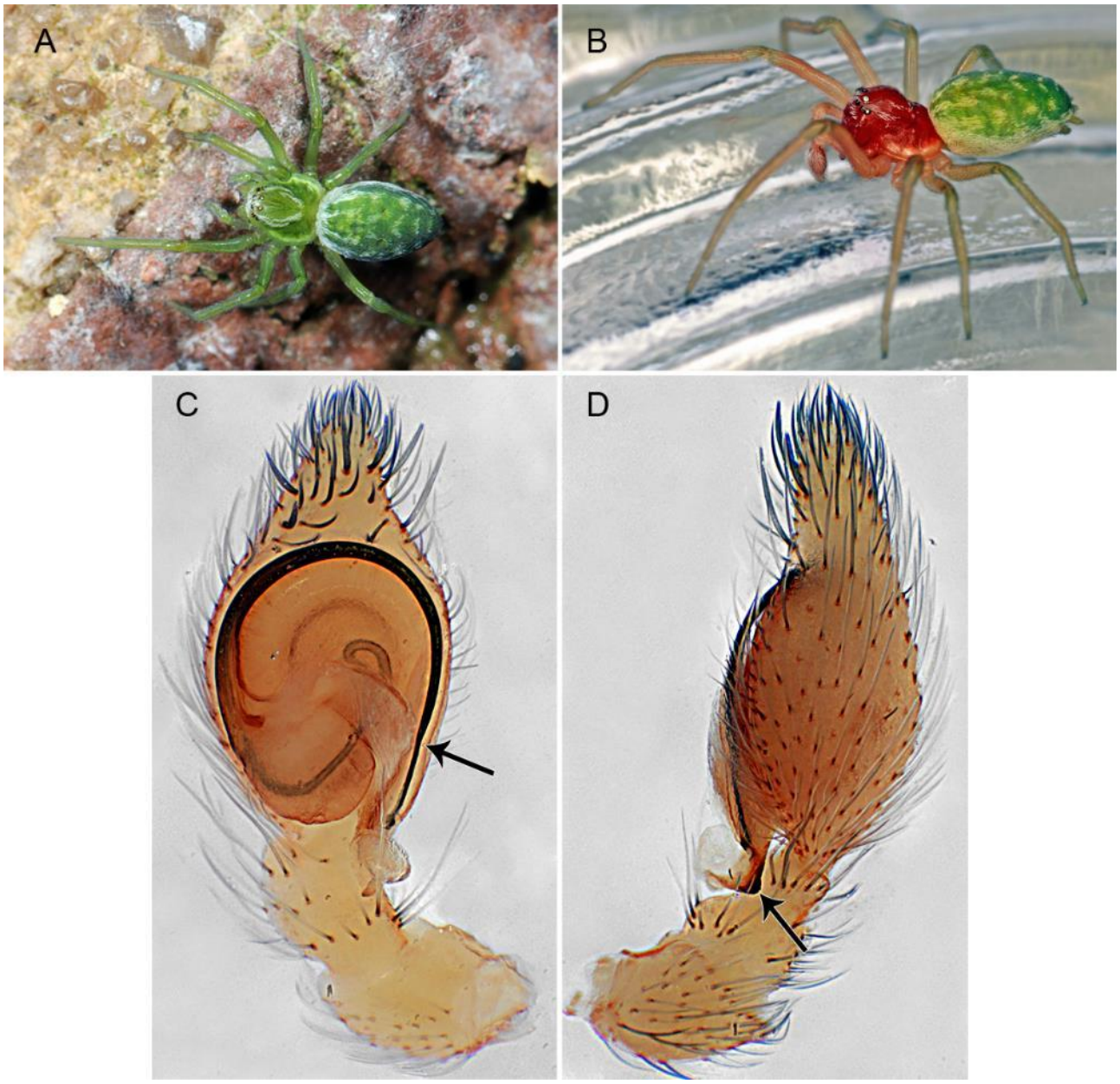

Figure 3: *Nigma walckenaeri* (Roewer, 1951). **A.** Living female from Waret-l'Évêque (Photo & coll. Pierre Oger). **B.** Living male from Houx (Yvoir) (Coll. AH_20100910_01). **C.** Idem, palp ventral view, the arrow pointing to the very faint subapical deviation of the embolus. **D.** Idem, retrolateral view, the arrow pointing to the angular shape of conductor.

The epigynes of *Nigma* species are challenging to interpret, and it is often necessary to rely on habitus information or to dissect the genitalia to examine the vulva's characteristics. Upon examining the vulva of the specimen, it became apparent that it did not align with the expected genital morphology of *N. puella*. Moreover, the habitus of *N. puella* typically features a contrasting dorsal red marking on the abdomen, which is absent in this specimen. These observations were validated by DNA-based identification techniques, resolving the ambiguity and conclusively identifying the specimen as *N. walckenaeri*. Although this remains the first mention for the botanical garden (the other recorded species being *N. flavescens*), this species is well-established in Brussels capital. It was even reported in 2020 in the vicinity of the Jean Massart Botanical Garden, in Oudergem, as documented on OBSERVATIONS.BE/WAARMENINGEN.BE (2024) (see https://observations.be/species/8724/observations/?date_after=200-01-01&date_before=2024-07-09&country_division=19&search=Oudergem&user=&location=&sex=&month=&life_stage=&activity=&met

hod=). It is also worth noting that the adult activity periods of these two species differ (NENTWIG et al. 2024). *Nigma puella* is a spring/summer maturing species, with peak adult activity in May and June, while *N. walckenaeri* mostly matures in the autumn, with peak adult activity in September and October. The two species have only a slight overlap in their adult periods at the end of summer, which coincides with the collection date of the analysed specimen. In addition, both *Nigma* species built cribellate web on leaves of trees and shrubs in various environments (ROBERTS 1995, 1998; LE PERU 2007). However, *N. walckenaeri* seems to especially have a strong affinity for gardens and parks (ROBERTS 1995; Tony Russels-Smith, pers. comm.).

The Belgian checklist currently counts 15 Dictynid species (BOSMANS & VAN KEER 2017; NENTWIG et al. 2024; HENRARD et al. 2024), including two *Nigma* species: *N. flavescens* (Walckenaer, 1830) and *N. walckenaeri*. The species *Nigma puella* appears largely distributed in Europe (NENTWIG et al. 2024; (WORLD SPIDER CATALOG 2024), and it could only have been a matter of time before this species was reported from our country. Finally, its discovery in Belgium was documented based on a photograph taken by Louis Bronne the 01/06/2023 and uploaded on OBSERVATIONS.BE/WAARMENINGEN.BE (https://observations.be/observation/275136815/). The photo was then published in the issue 117 nov. dec. 2023 of the NATAGORA magazine. With new specimen collected in this locality by the first author, its presence in Belgium is now formally confirmed in the present journal issue, also validated by DNA-barcoding (HENRARD et al. 2024).

Acknowledgments

We are grateful to Pierre Oger for the use of his photographs of living female specimens of *Nigma walckenaeri*. We thank Tony Russell-Smith and Garben Logghe for proofreading this article. We also thank Pallieter De Smedt for his dedicated editorial contributions. The Barcoding Facility for Organisms and Tissues of Policy Concern (BopCo – https://www.bopco.be/) is financed by the Belgian Science Policy Office (Belspo). The molecular data that support the findings of this study are openly available in GenBank at https://www.ncbi.nlm.nih.gov/genbank/, accession number: PP919328.

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Appendix 1. List of COI sequences.

Table 1: *List of COI sequences and species used in the Neighbour-Joining tree reconstruction, including voucher numbers, GenBank and/or BOLD accession numbers, and references. 'Shade' indicates the specimen sequenced during this study.*

Species	Voucher ID	GenBank	BOLD	Reference
Dictyna uncinata Thorell, 1856	BC ZSM ARA 00313	KX536847	FBARB313-11	Astrin et al. 2016
Dictyna arundinacea (Linnaeus, 1758)	BIOUG14290-H07	KP653531	ARBCM1230-14	Blagoev et al. 2016
Ajmonia gratiosa (Simon, 1881)	UB-MD3340	MH630666	IBARA2422-18	Crespo et al. 2018
Nigma hortensis (Simon, 1870)	MNCN-ADN-200018	/	MUSBA1368-24	Unpublished
Nigma walckenaeri (Roewer, 1951)	ZFMK-TIS-20911	KY268570	GBBSP1028-15	Astrin et al. 2016
	ZFMK-TIS-7091	KY269848	GBBSP881-15	Astrin et al. 2016
	RMNH.ARA.12594	/	NLARA168-12	Unpublished
	RBINS_IG.33.177	PP919328	/	This study
Nigma puella (Simon, 1870)	UB-MD1916	MH630669	IBARA938-18	Crespo et al. 2018
	UB-MD1928	MH630668	IBARA951-18	Crespo et al. 2018
	UB-MD3341	MH630682	IBARA2423-18	Crespo et al. 2018
	UB-MD399	MH630676	IBARA2638-18	Crespo et al. 2018
	UB-MD1929	MH630672	IBARA952-18	Crespo et al. 2018
Nigma flavescens (Walckenaer, 1830)	ZFMK-TIS-18513	KY268594	GBBSP216-15	Astrin et al. 2016
	ZFMK-TIS-2516845	KY269998	GBBSP1439-15	Astrin et al. 2016
	BC ZSM ARA 00304	KX537103	FBARB304-11	Astrin et al. 2016
	ZFMK-TIS-7169	KY269353	GBBSP936-15	Astrin et al. 2016
	ZFMK-TIS-20892	KY270048	GBBSP365-15	Astrin et al. 2016
	RMNH.ARA.12510	/	NLARA054-12	Unpublished
	BIOUG17117-A01	/	GMGMI956-14	Unpublished
	BIOUG17226-F06	/	GMGMK1517-14	Unpublished

Meeting report ARABEL
October 5, 2024

Aanwezig – Présent: Mark Alderweireldt, Leon Baert, Rop Bosmans, Jan Bosselaers, Arthur Decae, Arnaud Henrard, Rudy Jocqué, Robert Kekenbosch, Gassen Kmira, Garben Logghe, Ruben Mistiaen, Marc Janssen, Johan Van Keer, Koen Van Keer

Verontschuldigd – Excusé: Christa Deeleman, Pallieter De Smedt, Bert Vanderkrieken, Lut Van Nieuwenhuyse

NL De vergadering gaat door in de VIP-zaal en wordt geopend om 14u. 20.

1. Arnaud Henrard: "Radiation within the Ant-Eating Cryptothelinae (Araneae, Zodariidae) in the Vanilla Islands".

De spreker geeft een overzicht van een groot aantal soorten die verwant zijn met het genus *Aschema* Jocqué, 1991 (Cryptothelinae). Het gaat in totaal om 22 soorten waarvan slechts twee bekend maar de meerderheid alleen gekend van één sekse. Het blijkt dat er nieuwe genera moeten gecreëerd worden gezien de grote variatie in de structuur van de genitalia.

2. Rop Bosmans "Wie is Yannis Gavalas?".

Het gaat om een Griekse natuurkenner – aspirant arachnoloog die op het kleine cycladen-eiland Iraklia (Ηρακλιά) woont en daar de spinnen-fauna heeft geïnventariseerd. Niet minder dan 215 soorten werden er gevonden. Vijf daarvan zijn nieuw voor de wetenschap, alle vijf behorend tot het genus *Harpactea*.

3. Rop Bosmans "Perikelen in verband met de opmaak van catalogi van de spinnen van Noord Afrika."

De spreker heeft een lange ervaring met teams in alle landen van N.-Afrika. Het verschijnen van checklists van de spinnen van Algerije en Marokko met talloze fouten en onvolkomenheden was dan ook een verrassing. Een update van die lijst van Algerije met de nodige verbeteringen is ter publicatie ingediend.

4. Athur Decae. "*Nemesia*-soorten in Catalonië".

De spreker geeft een verslag van zijn recente excursie naar Catalonië waarvan 3 soorten *Nemesia* bekend zijn. De bedoeling was de wijfjes te vinden van een ongekende soort die door Jan Bosselaers in bodemvallen is gevonden. Hij beklemtoont de problemen met het detecteren van de holen die perfect gecamoufleerd zijn met een aangepaste klapdeur. De studie van de verzamelde specimina moet nog aangevat worden.

5. Jan Bosselaers & Johan Van Keer: "Beschrijving van vier nieuwe *Steatoda* soorten (Araneae: Theridiidae) uit het Middellandse zeegebied en commentaar over enkele verwante soorten".

JB geeft een gedetailleerd verslag van een studie van *Steatoda* soorten uit de westelijke mediterrane streken met beschrijving van vier nieuwe soorten. Hij beschrijft de taxonomische problemen met een aantal gekende soorten die nu zijn opgelost.

6. Arnaud Henrard: Verslag en fotoreportage van het arachnologisch congres in Rennes.

De spreker geeft een algemeen beeld van het congres, vermeldt een aantal merkwaardige voordrachten en toont foto's (selfies) van enkele gekende arachnologen.

7. Varia.

- Een korte discussie (AH, JVK, RJ) over de noodzaak een nieuwe internet provider te vinden voor de website, rekening houdend met de relatief hoge kost van die service. Volgens de penningmeester is er geen dingende noodzaak om van provider te veranderen op voorwaarde dat geleverde diensten volstaan.

- Er bestaat blijkbaar consensus over het feit dat leden die niet langer hun lidmaatschap betalen ook geen correspondentie van de vereniging meer hoeven te krijgen.

- Arthur Decae vermeldt dat de arachnologe die voor het moment een doctoraat doet in Wageningen eventueel kan uitgenodigd worden voor de toespraak op de jaarvergadering in januari 2025.

- Rudy Jocqué toont “Spiders of the Kalahari” en de “Field Guide to the spiders of South Africa’ van A. Dippenaar-Schoeman met de versies van 2014 en 2023. In de laatste versie zijn de auteurs van taxa weggelaten.

- Jan Bosselaers merkt op dat het bureau in 2025 moet vervangen worden (de mandaten lopen maar voor 4 jaar). Hij toont de een exemplaar van van een nieuw spinnenboek : Domènech, M., Bellvert A. & Arnedo, M. A. 2024. Els Aràcnids de Catalunya. Brau eds. 192 p. en van Nelson, Ximena 2024. The lives of spiders – A natural history of the world’s spiders. Princeton University Press, 288 p.

- Garben Logghe doet enkele voorstellen voor excursies * Gemmenich (deelgemeente van Plombières), vlak bij het drielandenpunt; bij voorkeur in de lente op zoek naar *Pardosa cf. wagleri*, daar gevonden; * heidegebied De Teut in Zonhoven; bij voorkeur in de late zomer, op zoek naar *Eresus kollari.*

In verband met de tijdschriften stelt hij voor om publicerende ARABEL-leden die niet verbonden zijn aan een wetenschappelijk instituut als affiliatie de vereniging te laten gebruiken. In dezelfde context zouden referees die artikels nazien voor onze publicaties de aflevering moeten krijgen waarin de artikels die ze hebben gerefereed zijn verschenen. De vergadering gaat met beide voorstellen akkoord. Rudy Jocqué merkt op dat de plaats van het abstract en van de auteurs op het einde van ‘short notes’, nogal ongewoon is en verwarrend.

- Marc Janssen meldt de vondst van enkele zeldzame soorten: *Abacoproeces saltuum* (Bree), *Episinus maculipes* (Voeren), *Erigone dentosa* (Hoeselt). *Diplocephalus graecus* is ondertussen zeer algemeen geworden.

De vergadering wordt gesloten om 17h05.

F La réunion a lieu dans la salle VIP et est ouverte à 14h20.

1. Arnaud Henrard : “Radiation within the Ant-Eating Cryptothelinae (Araneae, Zodariidae) in the Vanilla Islands”.

L'orateur donne un aperçu d'un grand nombre d'espèces apparentées au genre *Aschema* Jocqué, 1991 (Cryptothelinae). Cela concerne au total 22 espèces, dont seulement deux sont connues, mais la majorité n'est représentée que par un seul sexe. Il semble que de nouveaux genres doivent être créés étant donné la grande variation dans la structure des organes génitaux.

2. Rop Bosmans « Qui est Yannis Gavalas ? ».

Il s'agit d'un naturaliste - arachnologue grec qui vit sur la petite île d'Irakleia (Ηρακλειά) dans les Cyclades et qui y a inventorié la faune d’araignées. Pas moins de 215 espèces y ont été recensées. Cinq d’entre elles sont inédites, toutes cinq appartenant au genre *Harpactea*.

3. Rop Bosmans « Questions liées à la préparation des catalogues des araignées d'Afrique du Nord.»

L'orateur possède une longue expérience auprès d'équipes dans tous les pays d'Afrique du Nord. La publication surprenante d'une check-list des araignées d'Algérie et du Maroc par des non-arachnologues contient de nombreuses erreurs et imperfections. Une mise à jour de la liste d'Algérie avec les corrections nécessaires a été soumise pour publication.

4. Arthur Decae. « Les espèces de *Nemesia* Catalanes ».

L'orateur raconte sa récente excursion en Catalogne, d'où 3 espèces de *Nemesia* sont connues. L'objectif était de retrouver les femelles d'une espèce inédite dont le mâle est trouvé dans les pièges Barber de Jan Bosselaers. Il souligne les difficultés de détection des terriers parfaitement camouflés par une porte battante modifiée. L'étude des spécimens collectés n'a pas encore été entamée.

5. Jan Bosselaers & Johan Van Keer : "Description de quatre espèces inédites de *Steatoda* (Araneae: Theridiidae) de la région Méditerranéenne avec commentaires sur quelques espèces proches".

JB fournit un compte rendu détaillé d'une étude des espèces de *Steatoda* des régions occidentales de la Méditerranée avec des descriptions de quatre espèces inédites. Il décrit les problèmes taxonomiques d'un certain nombre d'espèces connues qui ont maintenant été résolus.

6. Arnaud Henrard : Compte rendu et reportage photo du congrès arachnologique à Rennes.

L'orateur donne une idée générale de la conférence, mentionne quelques présentations remarquables et montre des photos (selfies) d' arachnologues de renom.

7. Varia

- Il se déroule une brève discussion (AH, JVK, RJ) sur la nécessité de trouver un nouveau 'provider' internet pour le site web, compte tenu du coût relativement élevé de ce service. Selon le trésorier, il n'est pas nécessaire de le changer à condition que les prestations fournies soient suffisantes.
- Il semble y avoir un consensus sur le fait que les membres qui ne paient plus leur cotisation ne recevront plus la correspondance de l'association.
- Arthur Decae mentionne que l'arachnologue qui effectue actuellement un doctorat à Wageningen pourrait éventuellement être invitée pour le discours lors de l'assemblée annuelle de janvier 2025.
- Rudy Jocqué présente "Spiders of the Kalahari" et le « Field Guide to the spiders of South Africa » de A. Dippenaar-Schoeman avec les versions de 2014 et 2023. Dans cette dernière version, les auteurs des taxons ont été omis.
- Jan Bosselaers note que le bureau doit être remplacé en 2025 (les mandats ne durent que 4 ans). Il montre une copie du nouveau livre d'araignées : Domènech, M., Bellvert A. & Arnedo, M. A. 2024. Els Aràcnids de Catalunya. Brau éd. 192 p. et de Nelson, Ximena 2024. The lives of spiders – A natural history of the world's spiders. Princeton University Press, 288 p.
- Garben Logghe propose quelques suggestions d'excursions * Gemmenich (sous-commune de Plombières), proche de la pointe des trois pays ; de préférence au printemps
à la recherche de *Pardosa cf. wagleri* qui y a été trouvé; * Lande 'De Teut' à Zonhoven ; de préférence à la fin de l'été, à la recherche d'*Eresus kollari*. Concernant les publications, il propose de permettre aux membres éditeurs d'ARABEL non affiliés à un institut scientifique d'utiliser celle de l'association comme affiliation. Dans le même contexte, les referees qui révisent les articles de nos publications devraient recevoir le numéro dans lequel les articles qu'ils ont évalués sont parus. La réunion accepte les deux propositions. RJ constate que la

position de l'abstract et des auteurs à la fin des « Short notes» est assez inhabituelle et déroutante.

- Marc Janssen rapporte la découverte de plusieurs espèces rares : *Abacoproeces saltuum* (Bree), *Episinus maculipes* (Voeren), *Erigone dentosa* (Hoeselt). *Diplocephalus graecus* est désormais devenu très commun.

La réunion se termine à 17h05.

Rudy Jocqué (secretaris - secrétaire)
Jan Bosselaers (voorzitter - président)