Note on the introduced Asian mud-dauber wasp *Sceliphron curvatum* (F. Smith, 1870) and its prey in Belgium

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Abstract

This note documents the first observations of the prey of *Sceliphron curvatum* (F. Smith, 1870) (Hymenoptera: Sphecidae) in Belgium, recorded in the municipality of Jette (Brussels-Capital Region). The analysis of the paralyzed prey (n = 39) revealed the presence of nine spider species belonging to five families: Anyphaenidae, Araneidae, Philodromidae, Salticidae and Thomisidae. The family Araneidae dominates the trophic spectrum, represented mainly by juveniles of *Araneus diadematus* (Clerck, 1757). Two relatively rare species or species with a restricted regional distribution were identified: *Macaroeris nidicolens* (Walckenaer, 1802) (Salticidae) and *Philodromus buxi* (Simon, 1884) (Philodromidae). These data indicate opportunistic exploitation of spiders associated with upper (vegetation) layers and adaption to anthropized habitats. The lack of marked trophic specialization in *S. curvatum* suggests a low risk of significant impact on native spider populations in Belgium. However, further quantitative studies are needed to assess potential competitive interactions with native arthropod predators.

Samenvatting

Deze nota vermeldt de eerste waarnemingen van de prooien van *Sceliphron curvatum* (F. Smith, 1870) (Hymenoptera: Sphecidae) in België, op basis van observaties in de gemeente Jette (Brussels Hoofdstedelijk Gewest). De analyse van de verlamde prooien (n = 39) toonde de aanwezigheid aan van negen spinnensoorten uit vijf families: Anyphaenidae, Araneidae, Philodromidae, Salticidae en Thomisidae. De familie Araneidae domineert het trofisch spectrum en wordt voornamelijk vertegenwoordigd door juvenielen van *Araneus diadematus* (Clerck, 1757). Twee relatief zeldzame soorten of soorten met een beperkte regionale verspreiding werden geïdentificeerd: *Macaroeris nidicolens* (Walckenaer, 1802) (Salticidae) en *Philodromus buxi* (Simon, 1884) (Philodromidae). Deze gegevens wijzen op een opportunistische predatie op spinnen die geassocieerd zijn met hogere (vegetatie) lagen en door de mens beïnvloede habitatten. Het ontbreken van een uitgesproken trofische specialisatie bij *S. curvatum* suggereert een laag risico op significante impact op inheemse spinnenpopulaties in België. Toch zijn bijkomende kwantitatieve studies nodig om mogelijke competitieve interacties met inheemse arthropodenpredatoren te evalueren.

Résumé

Cette note documente les premières observations des proies de *Sceliphron curvatum* (F. Smith, 1870) (Hymenoptera : Sphecidae) en Belgique, recensées dans la commune de Jette (région de Bruxelles-Capitale). L'analyse des proies paralysées (n = 39) a révélé la présence de neuf espèces d'araignées appartenant à cinq familles : Anyphaenidae, Araneidae, Philodromidae, Salticidae et Thomisidae. La famille Araneidae domine le spectre trophique, représentée principalement par des juvéniles d'*Araneus diadematus* (Clerck, 1757). Deux espèces relativement rares ou à distribution régionale restreinte ont été identifiées: *Macaroeris nidicolens* (Walckenaer, 1802) (Salticidae) et *Philodromus buxi* (Simon, 1884) (Philodromidae). Ces données indiquent une exploitation opportuniste des araignées associées aux strates (de végétation) supérieures et

une accommodation aux habitats anthropisés. L'absence de spécialisation trophique marquée chez *S. curvatum* suggère un faible risque d'impact significatif sur les populations d'araignées indigènes en Belgique. Toutefois, des études quantitatives complémentaires sont nécessaires pour évaluer les interactions compétitives potentielles avec les prédateurs arthropodes indigènes.

Introduction

The genus *Sceliphron* Klug, 1801 (Hymenoptera: Sphecidae) comprises solitary wasps commonly known as "mud-dauber wasps," named for their distinctive nests built from clusters of cylindrical mud cells. These hymenopterans exhibit specialized predatory behaviour: females provision their egg with numerous paralyzed spiders within each cell, serving as the exclusive trophic resource for larval development. In urban environments, the sphecid frequently build nests on the surfaces of buildings or hidden inside buildings, in sheltered locations such as window frames, eaves, or air vents (BOGUSCH 2022). Their prey spectrum spans multiple families of Araneae, including Araneidae, Clubionidae, Hersiliidae, Linyphiidae, Oxyopidae, Philodromidae, Salticidae, Theridiidae, Tetragnathidae, Thomisidae (CRAWFORD 1986; JOCQUÉ 1988; COREY et al. 2021).

In Belgium, three *Sceliphron* introduced species were formally reported (SCHNEIDER et al. 2014; RAVOET et al. 2017; VERHEYDE et al. 2020; DRUMONT et al. 2021): *S. caementarium* (Drury, 1773), and *S. curvatum* (F. Smith, 1870) (these two are certainly reproducing in Belgium) and *S. spirifex* (Linnaeus, 1758). A fourth one, *S. destillatorium* (Illiger, 1807), will be reported shortly (VERHEYDE & DEVALEZ, 2025, in prep.).

Native to the Himalayas (India, Nepal, Pakistan), *Sceliphron curvatum* (F. Smith, 1870), also known as the Asian mud-dauber wasp, first appeared in Europe in 1979 in Austria (VAN DER VECHT 1984) and then gradually spread to Central and South-Western Europe (BITSCH & BARBIER 2006; BITSCH et al. 2020). The species was first recorded in Belgium based on a single specimen collected in 2013 in Brussels (SCHNEIDER et al. 2014), with sporadic observations confirming its local persistence (DRUMONT et al. 2021). Since then, a notable expansion has been observed in Flanders and Brussels, while its detection in Wallonia remains limited (Fig. 1; WAARNEMINGEN.BE 2025), most probably due to sampling bias (J.-L. Renneson, pers. comm.).

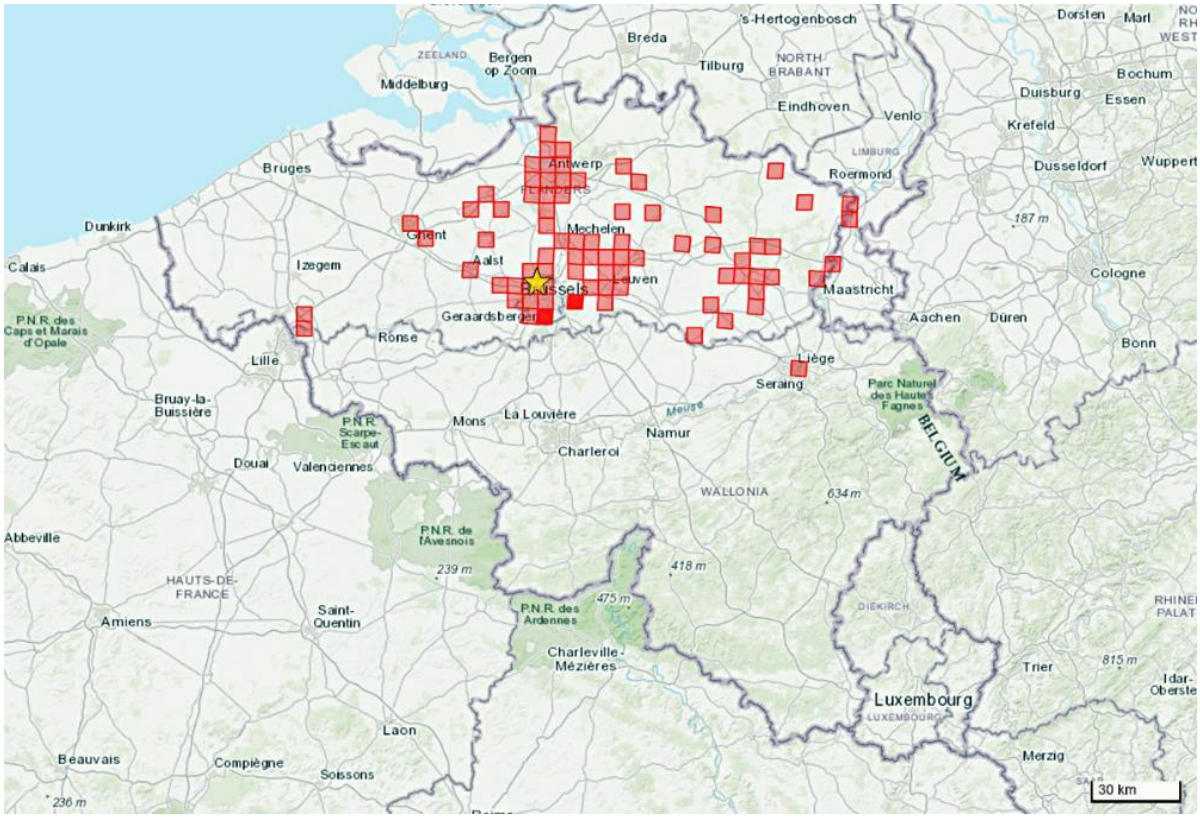

Figure 1: Distribution records of *Sceliphron curvatum* (F. Smith, 1870) in Belgium (from WAARNEMINGEN.BE 2025 © Esri Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community). The star indicates the location of the samples documented in this study.

Morphologically, *S. curvatum* (Fig. 2B–C) is distinguished from other Belgian Sphecidae by its black, curved, and shortened metasomal petiole (≤50% of metasoma length), as well as reddish-brown markings on abdominal segments and legs. In profile view, the uniform curvature of tergites I and II provides an additional diagnostic feature (DRUMONT et al. 2021). Its nests, composed of 10–50 aggregated mud cells, each approximately 20-25 millimeters in length (Fig. 2D), are arranged with all cells oriented in the same direction. They are typically constructed in anthropogenic constructions (buildings, conduits, …) to avoid hydraulic erosion (RAHOLA, 2005). Each cell contains 5 to 20 paralyzed spiders, primarily collected from shrub layers, which serve as the nutritive substrate for the developing larva.

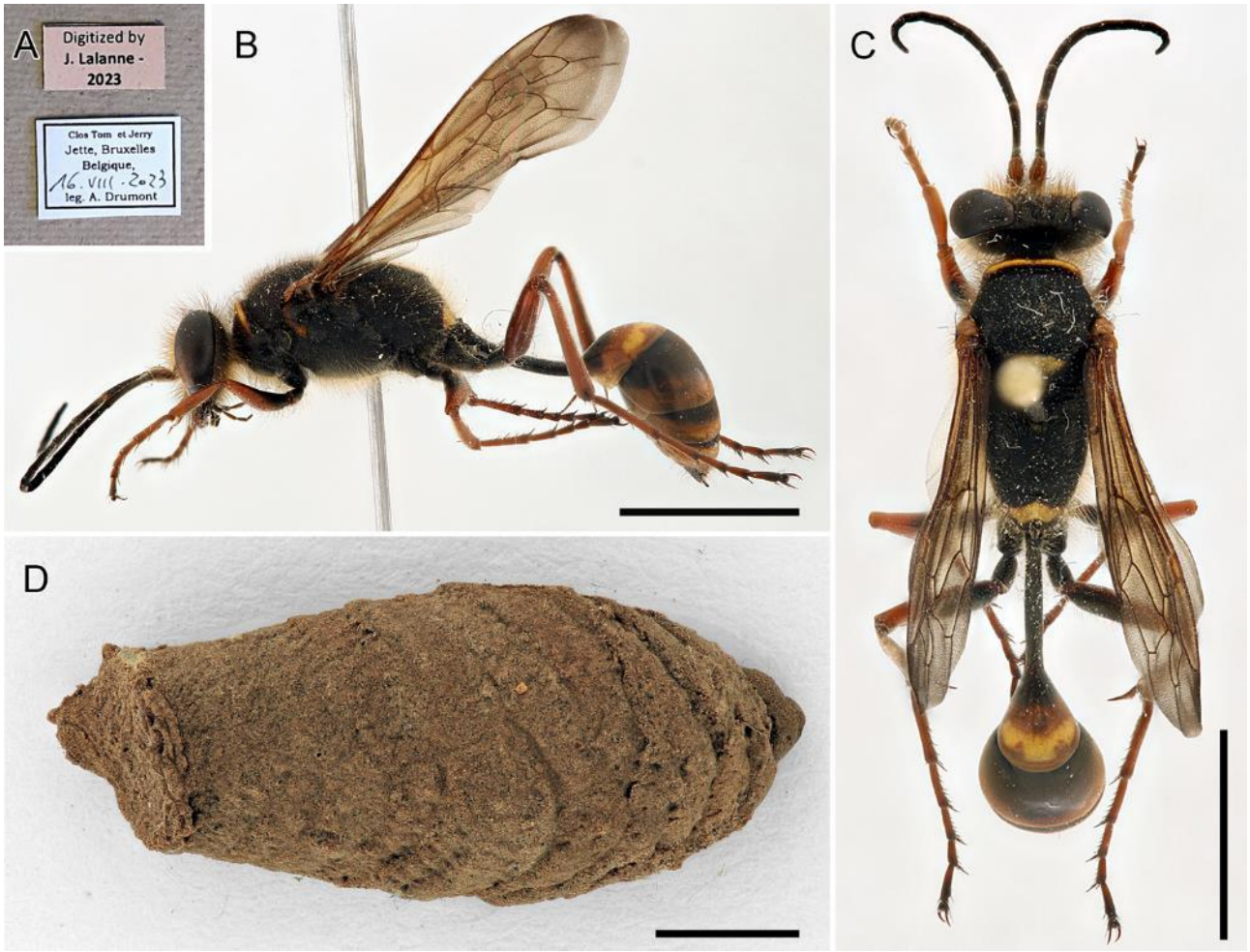

Figure 2: *Sceliphron curvatum* (F. Smith, 1870). **A.** Labels. **B.** Female, habitus, lateral view. **C.** Idem, dorsal view. (Photos © J. Lalanne, RBINS). **D.** One intact nest (Photo © T. Laebens, RBINS). Scale bars = 5mm.

The recent discovery of *S. curvatum* nests in northern Brussels, containing paralyzed spiders, provides an opportunity to assess its trophic ecology in an urban environment. This study aims to characterize, for the first time in Belgium, the prey diversity of this invasive species and evaluate its potential impact on native spider communities.

Material and methods

Sampling

Three living specimens of *Sceliphron curvatum* (F. Smith, 1870) were collected between 2023 and 2024 in an urban area, Clos Tom and Jerry, located in the municipality of Jette, Brussels-Capital Region, Belgium. The specimens were observed inside a bedroom after the window was opened: the first on 16 August 2023 (illustrated in Figures 1A–C), the second on 17 August 2023, and the third on 25 June 2024. The window faces

south-southwest and is fitted with a permanent mosquito net fixed to the window frame. The *Sceliphron* individuals likely entered through ventilation or drainage holes in the frame, presumably seeking a sheltered space, between the net and the window, to construct their nests, protected from rain and environmental exposure. This assumption was confirmed in July 2024, when five freshly constructed nests (one illustrated in Fig. 2D) were discovered attached to both the window frame and the surrounding structure. Most of these nests were inadvertently damaged when the window was opened, after having remained closed for two weeks. The contents of the nests, consisting of spider prey, were retrieved using flexible forceps and immediately preserved in 70% ethanol. The spiders were subsequently sorted for identification, and each was assigned an arbitrary working number (see Table 1). The spider samples are deposited in the alcohol collections of the Royal Belgian Institute of Natural Sciences (RBINS; I.G. number: 34.932).

Photography and Image Processing

The insect was photographed at RBINS using a Canon EOS 700D equipped with a Canon 100 mm macro lens and two Yongnuo YN-560 III flashes. The photography settings were: aperture f/4.0, shutter speed 1/100 s, ISO 100, step size 500 µm, 27 images taken, flash power 1/16. The *Sceliphron* nest was similarly photographed (36 images taken with flash power at 1/8). Image stacks were processed using Zerene Stacker version 1.04 (Build T2023-06-11-1120), with the PMax stacking method to produce fully focused composite images.
The spiders were photographed at the Royal Museum for Central Africa (Tervuren) using a BRESSER MikroCam II 20 MP (1" sensor) microscope camera mounted on a motorized Leica MZ16A stereomicroscope. Image capture and control were performed using MikroCam Lab II software, with focus stacks acquired for each specimen. These were subsequently processed into fully focused composite images using Helicon Focus version 8.3.0 (method B; radius = 15; smoothing = 2).
Illustrations were assembled and edited in Photoshop CS5 (white balance and colour contrast adjusted).

Results

A total of 39 spider specimens were recovered from five *Sceliphron curvatum* nests. The majority (approximately 80%) of these were immature individuals. Eight spider species belonging to five different families were identified (see Table 1): Anyphaenidae (one species), Araneidae (two species), Philodromidae (two species), Salticidae (two species), and Thomisidae (three species). The family Araneidae dominated the prey assemblage, with the most abundant species being *Araneus diadematus* (Clerck, 1757), which accounted for a significant portion of the collected specimens with 22 immature individuals.
Among the identified spiders, two species are noteworthy due to their relative rarity or restricted regional distribution: *Macaroeris nidicolens* (Walckenaer, 1802) (Salticidae), and *Philodromus buxi* (Simon, 1884) (Philodromidae). In addition, one juvenile *Xysticus* sp. (specimen code Scur-05) and several juvenile *Philodromus* sp. (e.g., Scur-10) could not be confidently identified to species level. The habitus of these immature *Philodromus* specimens was clearly distinct from that of *P. buxi*, suggesting they represent different taxa.
In addition to spiders, six wasp larvae were discovered within the nests. Some larvae were found in the alcohol sample studied free in the nest material, while others were still attached to their spider hosts. In all cases where larvae remained attached, they were anchored to the abdomen of the spider (see Fig. 3A–D). One immature *Araneus diadematus* specimen was observed with two wasp larvae simultaneously affixed to its abdomen (Fig. 3A), a rare observation that may suggest multiple oviposition events on a single prey item. These findings provide insight into the prey preferences of *S. curvatum* in this urban context and suggest both opportunistic foraging and a tendency toward targeting small, immature araneid spiders.

Discussion

Understanding the diversity and composition of prey in a predator's diet is essential for assessing its impact on community structure (NAVARRETE & MANZUR 2008), and particularly when invasive species may alter existing food webs. The dietary range of a predator in an introduced environment should reflects both intrinsic hunting strategies and extrinsic factors such as local prey availability and habitat structure (TERRAUBE & ARROYO, 2011; POWELL & TAYLOR 2017). The spider assemblage recovered from *Sceliphron curvatum* nests

in this study comprised a broad spectrum of families and species, suggesting an opportunistic and generalist predatory behaviour. Rather than displaying a marked preference for a specific taxon, *S. curvatum* appears to exploit locally abundant prey across multiple spider families. This observed polyphagous behaviour may mitigate its ecological impact on native spider assemblages, as predation pressure is distributed across a wide array of taxa. In particular, the dominance of immature *Araneus diadematus* among the prey reflects both its local abundance and accessibility during the wasp's provisioning period. While the current data suggest no severe negative impacts on specific, local spider populations, the long-term ecological consequences remain to be assessed. It is also important to keep in mind that are quite a number of hymenopteran spider predators (too numerous to provide a list in this paper) in our regions, so this behaviour exhibited by *Sceliphron* species is not rare. Quantitative studies are needed to assess potential competitive interactions with native arthropod predators, including other spider-hunting wasps (i.e. Pompilidae) and other parasitoids (i.e. Ichneumonidae, Pimplinae), which may face resource overlap in urban habitats.

Although our sample size remains limited, the data align with previous observations indicating that *Sceliphron* species primarily capture spiders inhabiting higher vegetation strata, avoiding ground-dwelling species. Numerous studies have documented a preference for orb-weavers (Araneidae), jumping spiders (Salticidae), and crab spiders (Thomisidae) (MUMA & JEFFERS 1945; EVANS & WEST-EBERHARD 1970; CRAWFORD 1986; COLVILLE 1987; CALLAN 1988; JOCQUÉ 1988), a pattern that is corroborated here.

The repeated observation of *Sceliphron curvatum* specimens at the same site across two consecutive years strongly suggests the presence of an established population within the municipality of Jette. In addition, this represents a new confirmed locality for the species in the Brussels-Capital Region. Its continued presence contributes to the growing body of evidence that the species, along with *S. caementarium*, is actively expanding its distribution range within Belgium, particularly in the Flemish and Brussels-Capital regions (WAARNEMINGEN.BE 2025). This trend is notable given the relatively recent documentation of those species in the country (SCHNEIDER et al. 2014; RAVOET et al. 2017).

Furthermore, it is worth remembering that observations of two additional *Sceliphron* species native to southern Europe, i.e. *S. destillatorium* (Illiger, 1807) and *S. spirifex* (Linnaeus, 1758) have been reported in the citizen science and monitoring platforms WAARNEMINGEN.BE (2025).

Although these records remain to be formally confirmed, they underscore the importance of community-based biodiversity monitoring in detecting range expansions and tracking emerging faunal elements.

Table 1: List of spider species found in the nests of *Sceliphron curvatum* (F. Smith, 1870) found in the municipality of Jette (Brussels-Capital Region). The common/rare status is based on WAARNEMINGEN.BE (2025) criteria.

Working #	Family	*Genus*	*species*	F	juv	Remarks	common-rare
Scur-03	ANYPHAENIDAE	*Anyphaena*	*accentuata*		1		common
Scur-09	ARANEIDAE	*Araneus*	*diadematus*		22	four subadult males; four larvae; one juv. with two larvae	common
Scur-08	ARANEIDAE	*Zygiella*	*x-notata*		1		common
Scur-07	PHILODROMIDAE	*Philodromus*	*buxi*	2		with one larva	rare
Scur-10	PHILODROMIDAE	*Philodromus*	*sp.*		4	habitus different from *P. buxi* specimens	
Scur-01	SALTICIDAE	*Macaroeris*	*nidicolens*	4		with one larva	rare
Scur-02	SALTICIDAE	*Marpissa*	*muscosa*		1	subadult male	relatively common
Scur-04	THOMISIDAE	*Diaea*	*dorsata*	1	1		relatively common
Scur-06	THOMISIDAE	*Misumena*	*vatia*	1			relatively common
Scur-05	THOMISIDAE	*Xysticus*	*sp.*		1		

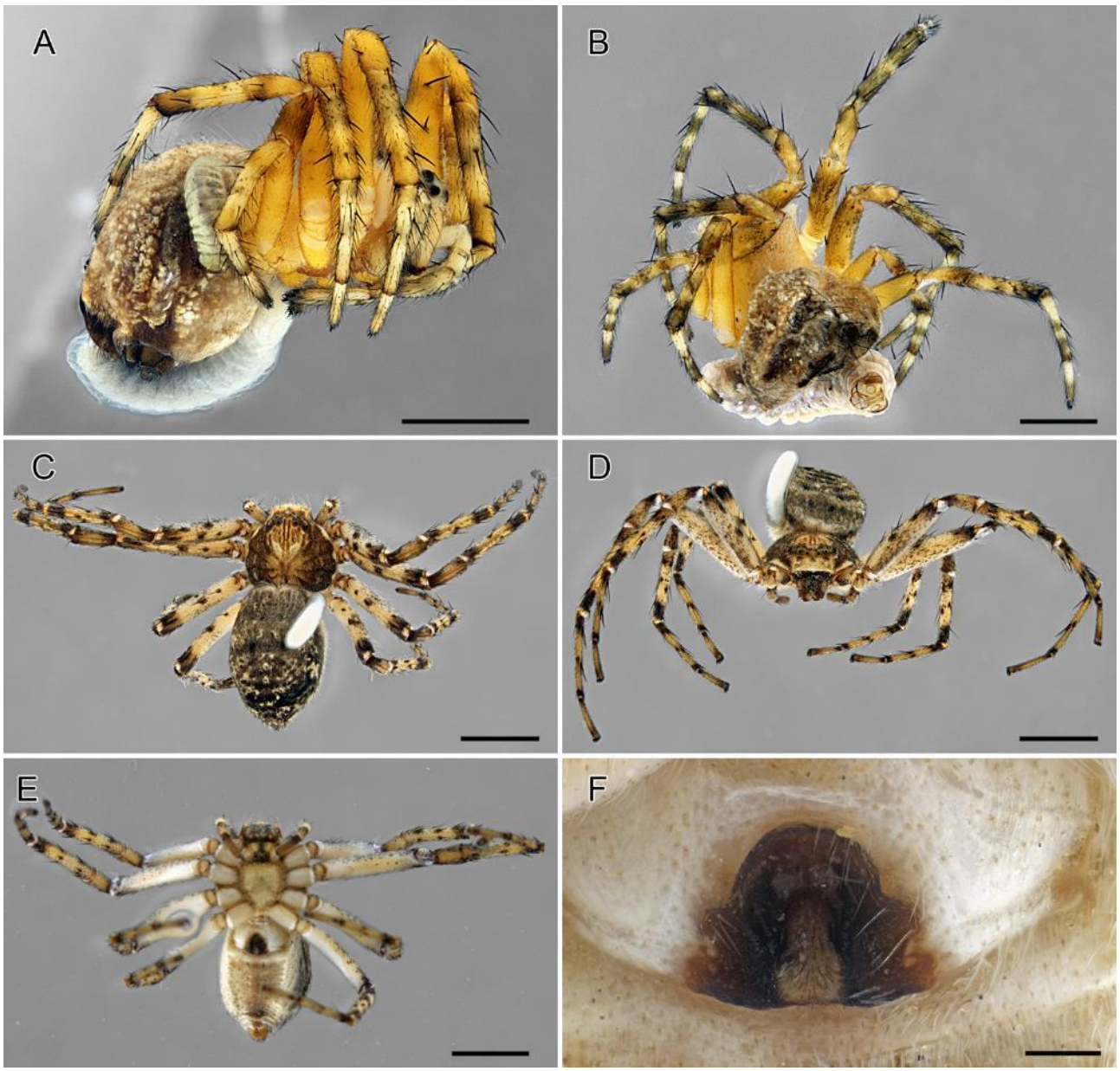

Figure 3: Some prey of *Sceliphron curvatum* (F. Smith, 1870). **A.** *Araneus diadematus* Clerck, 1757, juvenile with two larvae attached to its abdomen, lateral view. **B.** Same species, another individual, with one larvae, posterior view. **C.** *Philodromus buxi* Simon, 1884, female, with one larva, dorsal view. **D.** Idem, frontal view. **E.** Idem ventral view. **F.** Idem, epigyne, ventral view. Scale bars: A-B = 1mm; C-E = 2 mm; F = 0.2 mm. Photo © A. Henrard, MRAC

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