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New and rarely collected digger wasps from Morocco with description of two new species (Hymenoptera, Spheciformes)

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A b s t r a c t : *Lindenius tissintensis* SCHMID-EGGER & LIEBIG nov.sp. and *Miscophus smaraensis* SCHMID-EGGER nov.sp. are newly described from Morocco. *Entomognathus fortuitus* (KOHLE, 1915) and *Spilomena canariensis* BISCHOFF, 1937 are recorded for the first time for the fauna of Morocco. The male of *Carinostigmus marocensis* TSUNEKI, 1956 is described for the first time, the species is only known from Morocco so far. A strongly yellow-colored form of *Entomognathus brevis* (VANDER LINDEN, 1829) from Morocco is described.

K e y w o r d s : Hymenoptera, Spheciformes, Crabronidae, *Carinostigmus*, *Entomognathus*, *Lindenius*, *Solierella*, Morocco, West Sahara, new species.

Introduction

In March 2024, the authors went on a collecting trip to the south of Morocco including West Sahara. West Sahara is a politically unstable and therefore less examined region. Due to the current drought in southern Morocco that has persisted for several years, which has already left visible damage everywhere, the results were very poor. Nevertheless, we found some exciting species, including two undescribed digger wasps. The outstanding finds of this excursion should be described here. Some older findings collected otherwise are also added.

Material and methods

The mentioned material was collected by the authors and is stored in their private collection. Holotypes will finally be stored in the Zoologische Staatssammlung München and are temporarily kept in the collection of CSE.

Morphological terms are used according to BOHART & MENKE (1976). The following abbreviations are used in the morphological descriptions:

- ACM.....Apical clypeal margin
- AS.....Antennal segments, segments are counted from the first segment (scape) = AS1
- S.....Metasomal sternum
- TMetasomal tergum

Acronyms of depositories

CSE.....private coll. C. Schmid-Egger
 Liebig.....private coll. W.-H. Liebig

Species description

Carinostigmus marocensis (TSUNEKI, 1956) – description of male (figs 1-3, 21)

Stigmus marocensis TSUNEKI, 1956: 263, ♀. Holotype: ♀, Morocco: Agadir (RMNH).

Material examined: ♂ 23.iii.2024 Morocco, Dakhla-Oued Ed-Dahab, Dakhla town 27.168N 15.920W (CSE).

Remark: *Carinostigmus* is a small genus, and most species are distributed in southern and eastern Africa and in southeastern Asia, a few also in the Palaearctic region. Species from the Ethiopian region can be identified with LECLERQ (1959), southeastern Asian species with TSUNEKI (1954a) and others. Three species are known from the western Palaearctic region, and only one, *C. marocensis*, in northwest Africa. It was therefore only known by the female paratype, described from Agadir. The male is here described for the first time. It agrees in general with the female description.

With the identification key of LECLERQ (1959), the male keys out with *C. gueinzii* (R. TURNER, 1912). This species could not be examined. However, according to the description, the only detectable difference in the male are the setae on the underside of the mandible, which are said to be arranged in clusters in *C. gueinzii*, but are solitary in *C. marocensis*. Otherwise both agree. As *C. gueinzii* is widespread in southern Africa and known from West Africa and also reaches the Cape Verde Islands (PULAWSKI 2024), both species should be compared and it is not entirely impossible that *C. marocensis* is synonymous with *C. gueinzii*.

Description of male: 4.0 mm. **Color:** Black. Mandible except brown apex, labrum and pronotal lobe yellow. AS 1-2, AS 3-8 below, fore- and midtarsi and – tibiae brownish-yellow (fig. 1). **Morphology:** Apex of mandible with two teeth, mandible below with 6 pale setae, as long as mandibular diameter. Labrum medially deeply emarginate, ACM slightly rounded, clypeus finely crosswise striae. Frons below scape deeply impressed, with small spine, crosswise striate. Inner eye margin with strong furrow, ending at level of foreocellus, clearly cross-ribbed (fig. 3). Head divergent behind eye. Occipital carina strong. Gena striate. AS 3-9 widened downwards to roundish. Pronotum 0.3x as long as apical width. Anteriorly with strong lamella, mediolaterally each with 5 coarse oblique rugae. Large (cross-ribbed) part of notauli short, ending at the top at the end of the arch of the mesonotum, prolonged by a thin line until mid-mesonotum. Mesonotum apically with triangular impression, including 3 rugae. Base of scutellum with deep furrow, also distinctly fielded. Propodeal dorsum anteriorly and medially fielded and shiny, laterally with large polished areas. Petiole somewhat longer than hindtibia (7:6), dorsally somewhat impressed with lateral edge. Tergites polished and shiny.

Distribution: Only known from the type location Agadir and from Dakhla in Morocco (fig. 21). It can be expected that the species occurs also in other places along the coast of the Atlantic Ocean and can also be found further south.

H a b i t a t : The specimen was caught in a small garden area at the western border of Dakhla town on flowering plants.

***Entomognathus brevis* (VANDER LINDEN, 1829) (fig. 4)**

Crabro brevis VANDER LINDEN, 1829: 72, ♀, ♂. Syntypes: Belgium: Bruxelles and Italy: Bologna (Inst. Roy. Sci. Nat. Belgique, Bruxelles).

M a t e r i a l e x a m i n e d : ♂ 16.4.2015 80 km NE Agadir, Talmakant, 30.834N 8.956W (CSE); ♀ 24.4.2020 Sidi Slimane, 34.388N 5.914W (CSE).

R e m a r k : *Entomognathus brevis* was already mentioned for the fauna of Morocco by some authors (see PULAWSKI, 2024), but it seems to be very rare. We could only examine two specimens. The specimens from Morocco differ distinctly by colour pattern from the European population (fig. 4). Morphology is similar in all details. Therefore, there is no reason to see two species here. The first genetic barcoding (with the CO1 gene) of the Moroccan specimens results in a separate clade compared to examined specimens from Germany, which however is closely related with European species (SCHMID-EGGER et al. 2018). These results therefore do not justify a separate species status. SCHMID-EGGER et al. (2018) found 4.1% intraspecific distance in the species with a separate BIN of single moroccan specimens, but a second barcode of another specimen from Morocco even shifts the result and only gives a common clade with the European specimens with a minimal gap in between (Schmid-Egger, unpubl.).

D e s c r i p t i o n : Color pattern of male and female from Morocco: Black, with the following parts yellow: AS1 (scape), tibiae, tarsi (the latter dark yellow), apical half of fore- and midfemora, apex of hindfemur, pronotum and pronotal lobe, scutellum, metanotum. European and Asian specimens have usually mesosoma all black except pronotal lobe and tegula, AS1 is only yellow below, femora are black and tibiae partly black (fig. 4).

***Entomognathus fortuitus* (KOHLE, 1915) – new record for Morocco (figs 5-6, 21)**

Crabro fortuitus KOHLE, 1915: 314, ♀. Holotype: ♀, Spain: no specific locality (NHMW)

M a t e r i a l e x a m i n e d : ♀ 19.3.1997 Ht. Atlas, 10 km SE Ait Ourir 31.55N 7.60W (leg. S. Blank, coll CSE).

R e m a r k : *Entomognathus fortuitus* was previously only known from Spain and Portugal. The present record is the first in Morocco and Africa (fig. 21). The species can be identified with BITSCH et al. (2020). It is unique among western Palaearctic species by the lack of the epicnemial carina (fig. 6). Mesopleuron is basally therefore rounded, and also mate, compared to the shiny mesopleuron in remaining species.

***Lindenius tissintensis* SCHMID-EGGER & LIEBIG nov.sp. (figs 7-13, 22)**

Holotype: ♂ 27.iii.2024 Morocco, Souss-Massa, 2 km S Tissint 29.879N 7.317W (leg. et coll. CSE).

Paratypes: ♂ same date as holotype; ♂ 29.iii.2024 Morocco, Drâa-Tafilalet, 16 km NW Zagora 30.469N 5.921W (leg. et coll. CSE). ♀ 29.iii.2024 Morocco, Drâa-Tafilalet, Zagora 30.328N 5.833W, in water trap, hotel garden (leg. et coll. Liebig).

R e m a r k : The genus *Lindenius* was revised and keyed by de BEAUMONT (1956) in the western Palaearctic region, and by LECLERQ (1989) in the old world. There is no further processing.

D i a g n o s i s : The male of *L. tissintensis* keys out with *L. effrenus* in the key of de

BEAUMONT (1956) and LECLERQ (1989). It differs by an all black mesosoma (fig. 7, at least pronotum and metanotum yellow in *L. effrenus*) and by a straight medial part of ACM (fig. 9, more or less waved in *L. effrenus*). The special shape of ACM is also a good character to distinguish the new species from the other small species of *Lindenius* in the species group with antennal segments yellow below and normally rounded in males.

The female keys also out with *L. effrenus*. It differs by a reduced yellow color pattern: pronotum with two yellow spots, pronotal lobe yellow, scutellum black, femora yellow on extreme apex only (fig. 10), whereas pronotum has a long yellow band, scutellum is all yellow and femora are largely yellow in apical forth in *L. effrenus*. Also, medial lamella of ACM is large and straight in *L. tissintensis* (fig. 13), shorter and rounded in *L. effrenus*.

Description of male: 3.5 mm. **Color:** Black, with the following parts pale yellow. Mandible except red/black apex, AS1 (scape), remaining antennal segments below, extrem apex of femora, tibiae, tarsi (mid- and hindtibiae with black spot below) (fig. 7). Tegula pale transparent, basal sclerite of wing black with yellow margin. Apical margin of tergites reddish pale. S7 reddish, apex transparent. **Morphology:** Mandible below with lamella in apical half, shape similar as in *L. pygmaeus*. ACM: middle section of middle slat is pulled forward in steps, middle section is somewhat wide than the side sections (fig. 9). Flagellomeres rounded. Gena without tooth, hypostomal carina weak. Orbital foveae weakly impressed, for remaining proportions of head see fig. 8. Medial impression of pronotum as large as midocellus. Mesonotum and scutellum distinctly punctured, punctures approximately. a diameter apart. Upper half of mesopleuron shiny and smooth, remaining part with a few minute punctures. Praepectus (sensu LECLERCQ 1989) consists of a row of dense and coarse punctures. Propodeal enclosure basally distinctly longitudinally striate, in apical half smooth with a few indistinct striae (fig. 11). Demarcation to the back wall of the propodeum unclear. T1-6 with indistinct punctation, T7 with some larger punctures. Legs without abnormalities, hindbasitarsus narrow.

Female: 4.1 mm. Agree in general aspects in colour and morphology with the male, except: scape with long brown spot ventrally, Pronotum with two lateral yellow spots, pronotal lobe yellow (fig. 10). Apex of T2-5 transparent yellowish, pygidial area reddish. ACM: middle section of middle slat is pulled forward in steps, middle section is twice as wide as the side sections (fig. 13). Shape of face see fig. 12.

Distribution: Southern Morocco, south of Anti Atlas mountains (fig. 22).

Habitat: All specimens were found in palm gardens, the males by netting in small wheat fields, the female in a yellow pan trap.

Etymology: *Lindenius tissintensis* is named after the finding place of the holotype, Tissint, a small village near the Algerian Border in southern Morocco.

***Miscophus smaraensis* SCHMID-EGGER nov.sp. (figs 14-18, 22)**

Holotype: ♂ 21.iii.2024 Morocco, Laâyoune-Sakia, Smara 26.746N 11.681W (leg. et coll. CSE).

Remark: The genus *Miscophus* from the Palaearctic region is under revision by the senior author. During this project, types of most species are examined, and also species from West Africa are included into this revision. The present species is described here in

advance to make it available for science. For definition of species groups, see SCHMID-EGGER & AL JAHDHAMI (2022). The description of *M. smaraensis* is based on a single male. Therefore, some group characters which refer to female characters are not available. However, it is unmistakable within the genus due to a unique combination of characteristics and can therefore be easily recognized. It is to be expected that the female will have the same characteristics.

D i a g n o s i s : *Miscophus smaraensis* is characterized by a completely black and extremely shiny body (fig. 14). Only on the propodeum are transverse wrinkles pronounced in the front area (fig. 15). No other species of the genus is so shiny and completely black. The propodeum slopes backwards at a right angle to the posterior wall and thus differs from the species of the *M. bytinski* group, which has a blunt-angled transition there.

D e s c r i p t i o n o f m a l e : 4.0 mm. C o l o r : All black, very glossy, apex of mandible red, wing venation with exception of the black costa brown. Lower part of face with dense silver pubescence, hiding integument (fig. 14, 16). M o r p h o l o g y : AS1 (scape) finely longitudinal striate, AS3 somewhat shorter than AS1, AS2 half as long as AS1, AS4-10 similar in length, somewhat shorter than AS3 (seen from below) (fig. 17), with distinct short white bristles. Frons and tergites with sparse indistinct punctation, mesoscutum and scutellum with more dense but indistinct and fine puncture, punctures here approximately a diameter apart. Mesopleuron shiny without punctation. Propodeal dorsum with distinct medial longitudinal keel, laterally in basal half with indistinct diagonal striae, in apical half without sculpture. Propodeum laterally with a few distinct striae. S8 with lateral tooth-like corners, medially with two blunt teeth (fig. 18). Last tergites laterally with short black bristles.

F e m a l e : Unknown.

D i s t r i b u t i o n : Only known from the type location in southwest Morocco, West Sahara, close to the border with Mauritania (fig. 21).

H a b i t a t : The type specimen was caught on a flowering *Tamarix* shrub, at the western border of the town, in a semiarid and very dry area.

E t y m o l o g y : *Miscophus smaraensis* is named after the type area, Smara, a small town in the desert of West Sahara.

***Spilomena canariensis* BISCHOFF, 1937, new record for Morocco (figs 19-20, 21)**

Spilomena canariensis BISCHOFF, 1937b: 2, ♀, ♂. Holotype: ♀, Spain: Canary Islands: Tenerife: Orotava (Zool. Mus. Univ. Helsinki.).

M a t e r i a l e x a m i n e d : ♀ 21.iii.2024, Laâyoune-Sakia, Smara 26.746N 11.681W (CSE).

R e c o g n i t i o n : The species can be identified with DOLLFUSS (1986). The female is unique by having a distinct emargination on ACM, mandible is brown with a reddish apex, propodeal enclosure is not surrounded by a keel, and T6 has two longitudinal keels (fig. 19, 20).

D i s t r i b u t i o n : *Spilomena canariensis* was previously considered endemic to the Canary Islands (DOLLFUSS, 1986). It has now also been discovered on Madeira (SMIT 2000). This is the first record for Morocco and thus for the African mainland (fig. 21). For detailed records of Canary Islands see HOHMANN et al. (1993).

H a b i t a t : The specimen was caught on a flowering *Tamarix* shrub, at the western border of the town, in a semiarid and very dry area.

Zusammenfassung

Lindenius tissintensis SCHMID-EGGER & LIEBIG nov.sp. und *Miscophus smaraensis* SCHMID-EGGER nov.sp. werden aus Marokko neu für die Wissenschaft beschrieben. *Entomognathus fortuitus* (KOHL, 1915) und *Spilomena canariensis* BISCHOFF, 1937 werden erstmals für die Fauna von Marokko nachgewiesen. Das Männchen von *Carinostigmus marocensis* TSUNEKI, 1956 wird erstmalig beschrieben, die Art ist bisher nur aus Marokko bekannt. Eine stark gelb gefärbte Form von *Entomognathus brevis* (VANDER LINDEN, 1829) aus Marokko wird beschrieben.

Acknowledgements

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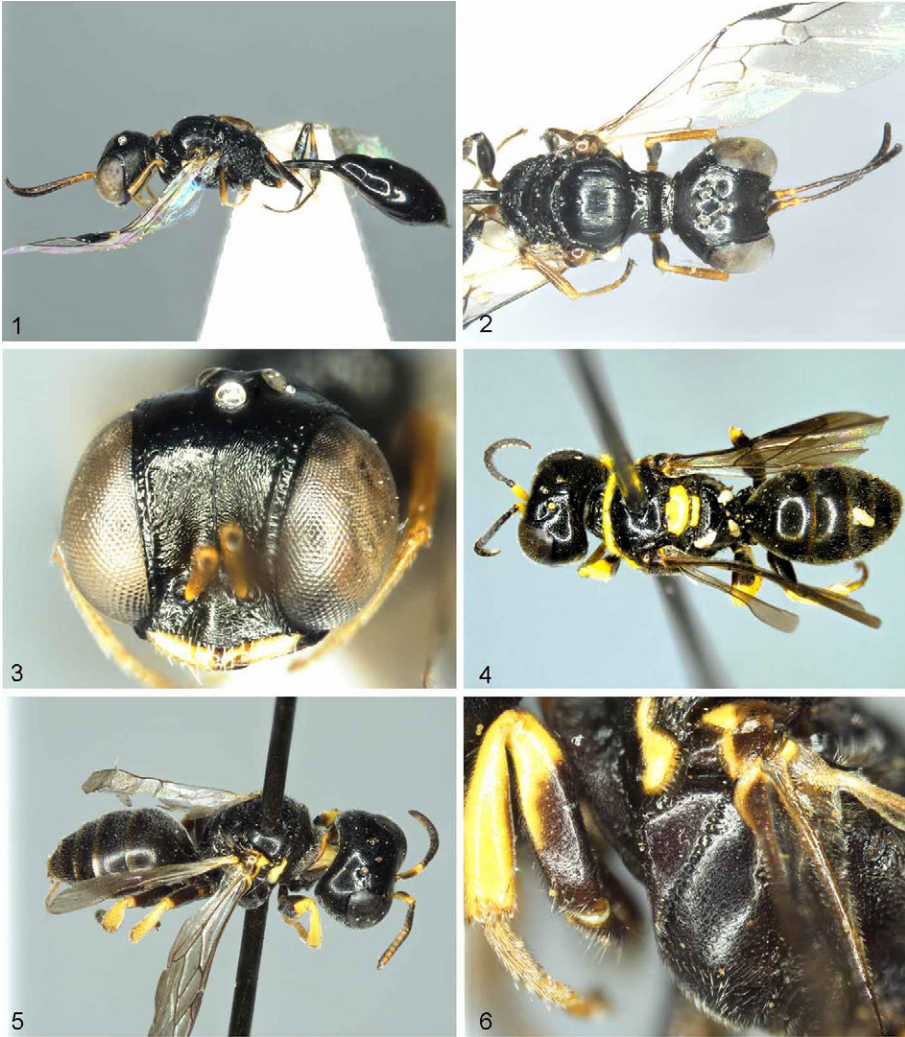
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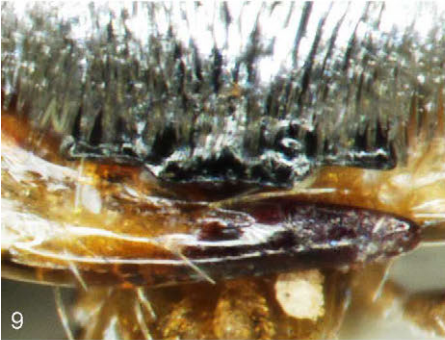
Figs 1-6: (1) *Carinostigmus marocensis*, ♂ lateral; (2) *Carinostigmus marocensis*, ♂ dorsal; (3) *Carinostigmus marocensis*, ♂ face; (4) *Entomognathus brevis*, ♂ dorsal; (5) *Entomognathus fortuitus*, ♀ dorsal; (6) *Entomognathus fortuitus*, ♀ mesopleuron.



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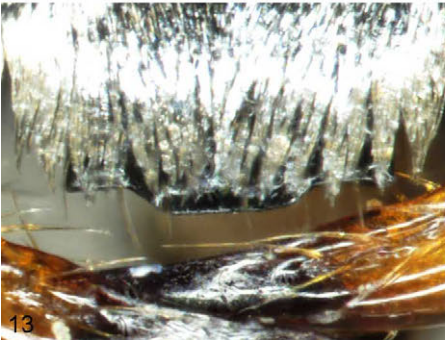
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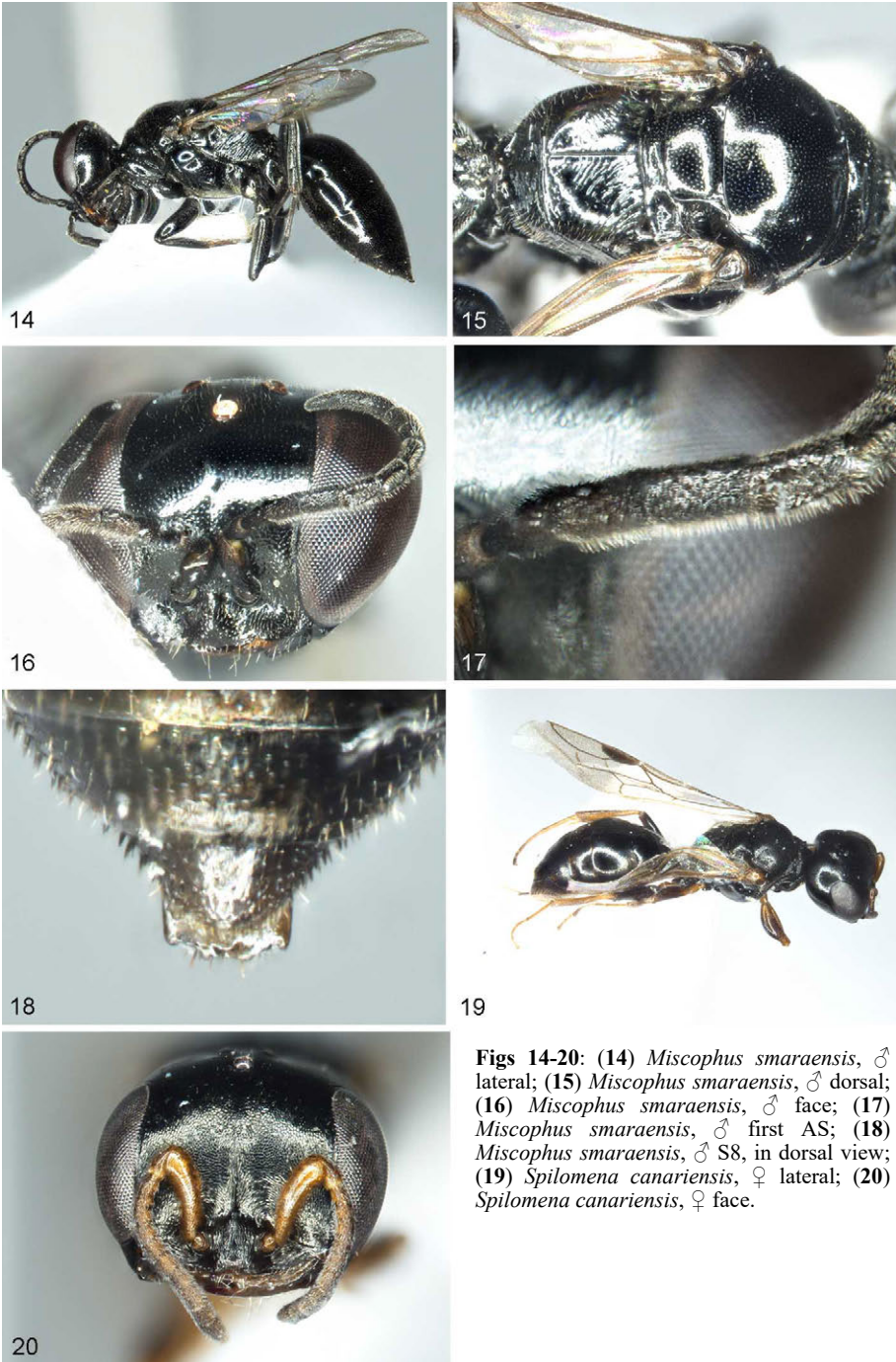


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Figs 7-13: (7) *Lindenius tissintensis*, ♂ dorsal; (8) *Lindenius tissintensis*, ♂ face; (9) *Lindenius tissintensis*, ♂ clypeus; (10) *Lindenius tissintensis*, ♀ dorsal; (11) *Lindenius tissintensis*, ♀ propodeum; (12) *Lindenius tissintensis*, ♀ face; (13) *Lindenius tissintensis*, ♀ clypeus.



Figs 14-20: (14) *Miscophus smaraensis*, ♂ lateral; (15) *Miscophus smaraensis*, ♂ dorsal; (16) *Miscophus smaraensis*, ♂ face; (17) *Miscophus smaraensis*, ♂ first AS; (18) *Miscophus smaraensis*, ♂ S8, in dorsal view; (19) *Spilomena canariensis*, ♀ lateral; (20) *Spilomena canariensis*, ♀ face.

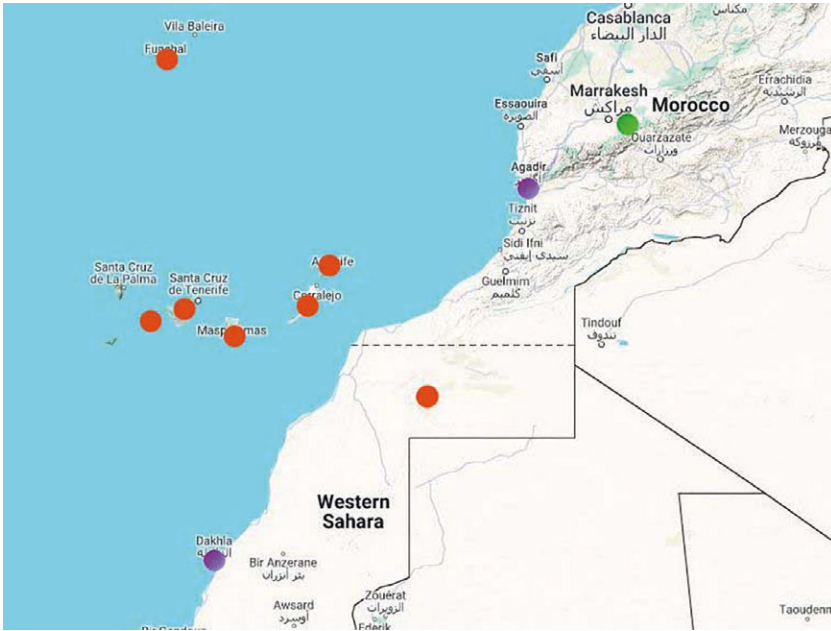


Fig. 21: Distribution of *Carinostigmus marocensis* (blue), *Spilomena canariensis* (red) and the African distribution of *Entomognathus fortuitus* (green).

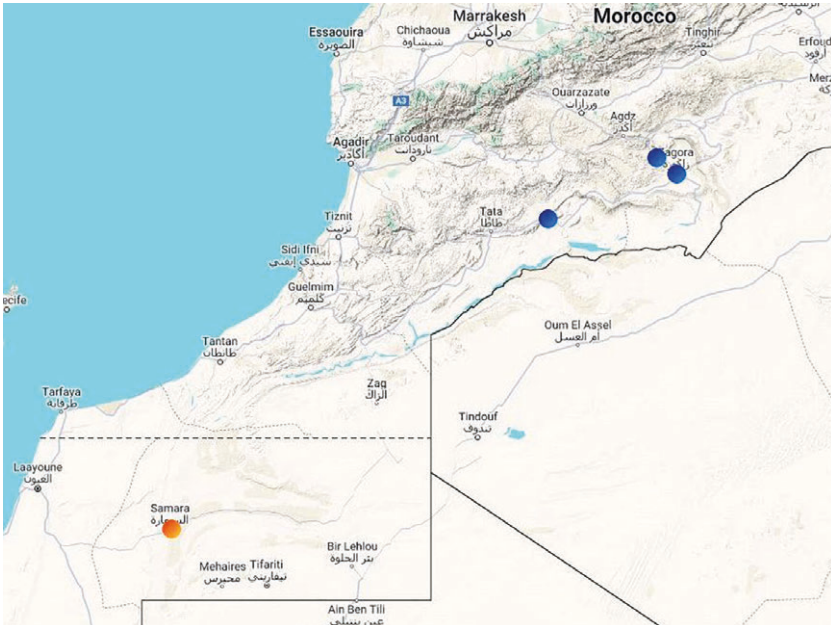


Fig. 22: Type locations of *Lindenius tissintensis* (blue) and *Miscophus smaraensis* (red).

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