

## Notas / Notes

### First precise records of *Trox strandi* Balthasar, 1936 (Coleoptera: Trogidae) from Morocco and observations on its habitat and morphological variability

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#### ABSTRACT

*Trox strandi* is a rare species whose taxonomic status has been controversial and so far is only known from the type-locality, Sidi-bel-Abbes, in northwestern Algeria. However, it has been indicated generically from Libya, Tunisia and Morocco, but without providing precise locations or additional material. During surveys in southeastern Morocco in recent years, we have found two specimens ascribable to this species in as many other locations (Tameslemt, in the north foothills of the Eastern High Atlas, and Ksabi, in the upper basin of the Moulouya river), which are the first accurate records for this country. These stations are located in regions with arid and semi-arid bioclimate and scarce vegetation cover. Data on the habitat, diagnostic traits and morphological variability of the species are provided.

**Key words:** geographic distribution; new records; Morocco; arid and semiarid regions; *Trox strandi*.

#### RESUMEN

#### Primeros registros precisos de *Trox strandi* Balthasar, 1936 (Coleoptera: Trogidae) en Marruecos y observaciones sobre su hábitat y variabilidad morfológica

*Trox strandi* es una especie rara cuyo estatus taxonómico ha sido controvertido y hasta el momento únicamente se conoce de la localidad tipo, Sidi-bel-Abbes, en el noroeste de Argelia. No obstante, ha sido señalada genéricamente de Libia, Túnez y Marruecos, pero sin que se aporten localidades concretas o material adicional. En el transcurso de diversos muestreos en el sureste de Marruecos durante los últimos años, hemos hallado dos ejemplares atribuibles a esta especie en otras tantas localidades (Tameslemt, en las estribaciones nororientales del Alto Atlas, y Ksabi, en el tramo alto del río Muluya), que constituyen los primeros registros precisos para este país. Estas localidades se sitúan en regiones con bioclima árido y semiárido y escasa cobertura vegetal. Se aportan datos sobre el hábitat, caracteres diagnósticos y variabilidad morfológica de la especie.

**Palabras clave:** distribución geográfica; nuevos registros; Marruecos; zonas áridas y semiáridas; *Trox strandi*.

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*Trox strandi* Balthasar, 1936 was described on an indeterminate number of specimens from the Algerian locality of Sidi-bel-Abbès (*loc. typ.*), and its author considered it “probably a very rare species” (Balthasar, 1936: 453). One syntype (unsexed specimen; examined by R. Pittino) is preserved in the National Museum of Prague (Czech Republic) (Bezděk & Hájek, 2009), which could be the holotype by monotype (see Zidek, 2013: 17).

Since its description, references to this species are very scarce and its taxonomic status has been controversial. So, Scholtz (1982) considered it an independent species. Pittino (1983) downgraded *T. strandi* to aberration and synonymized with *Trox fabricii* Reiche, 1853. Baraud (1985) treated it as separate species and indicated several diagnostic characters, but later relegated it to variety of *T. fabricii* (Baraud, 1987, following Pittino’s criteria). At the same time, Pittino (1985) included *T. strandi* as valid species within *Trox hispidus* (Pontoppidan, 1763)-group, although without argumentation. Subsequently, this author resurrected *T. strandi* and supported the validity of the species “based on the study of the type and additional material” (not mentioned) (Pittino, 2006a: 26; see also Pittino, 2006b; Zidek, 2013; Pittino & Bezděk, 2016). At last, Pittino (2011) illustrated the aedeagus and prosternal apophysis of *T. strandi*, and pointed out the differential traits between this species and the other two morphologically closer, *T. fabricii*, widely distributed throughout North Africa, southern Iberian Peninsula,

Sicily (Italy) and Maltese islands, and *Trox cyrenaicus* Pittino, 2011, whose known distribution is restricted to Benghazi, northeastern Libya (Baraud, 1985, 1992; Ruiz, 1995; López-Colón, 2000; Pittino, 2006b, 2011; Pivotti *et al.*, 2011; Pittino & Bezděk, 2016).

Pittino (1985), Zidek (2013) and Pittino & Bezděk (2016) ascribe *T. strandi* to the subgenus *Trox* Fabricius, 1775, but according to Strümpher *et al.* (2016) *Trox* is a monotypic genus, based on available phylogenetic evidence.

The only known location for *T. strandi* is the type-locality, in northeastern Algeria (35°12’N-0°38’O, 470 m, Sidi-bel-Abbès province) (Balthasar, 1936; Baraud, 1985; Pittino, 2011). However, Pittino (2006b) and Pittino & Bezděk (2016) cited it, generically, also from Libya, Tunisia and Morocco, but without providing any precise additional records. No data about its habitat and ecology are available.

During surveys at several stations in the Oriental and Fes-Boulemane administrative regions, carried out within the framework of various projects on the entomological diversity of arid lands from Eastern Morocco, supported by the Emirates Center for Wildlife Propagation (ECWP), two specimens of *T. strandi* were collected in as many relatively nearby locations (about 70 km). These are the first precise records for Moroccan territory and extend the known distribution range of the species about 450 km to the southwest (Fig. 1). Specimens were identified according to morphological traits pointed out by

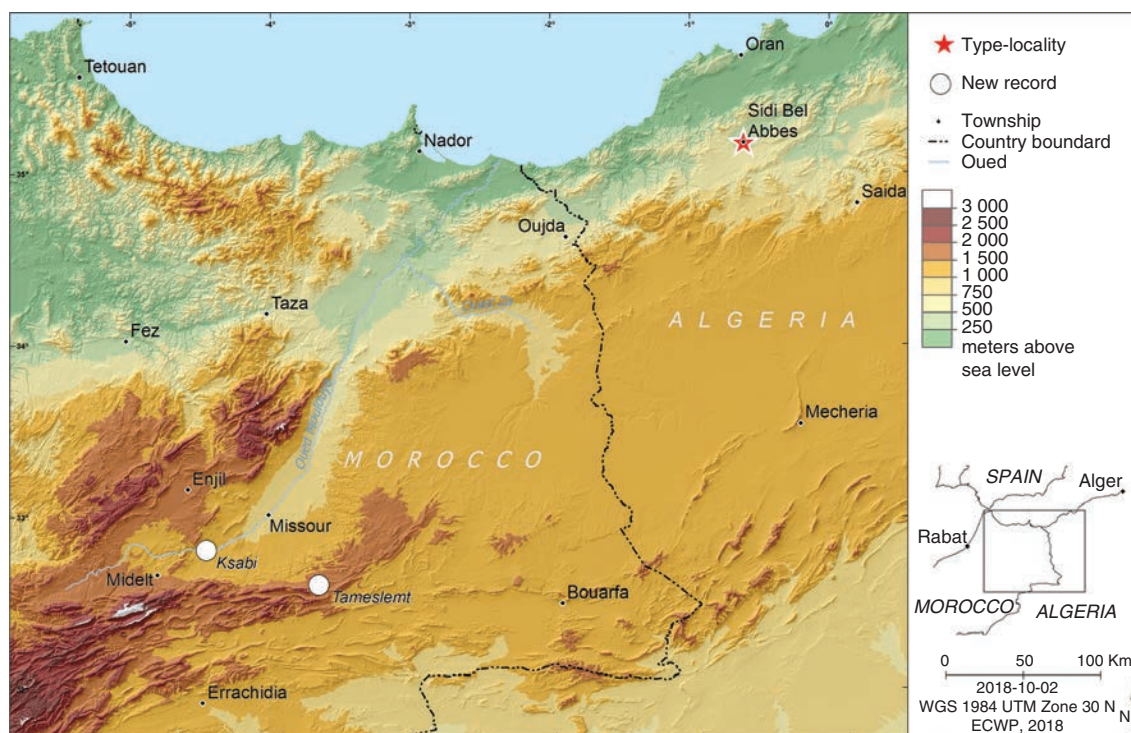


Fig. 1.— Map showing the known localities of *Trox strandi* Balthasar, 1936.

Fig. 1.— Mapa con las localidades conocidas de *Trox strandi* Balthasar, 1936.

Balthasar (1936), Baraud (1985) and Pittino (2011), and confirmed with the examination of male genitalia. Likewise, *T. strandi* specimens were compared with abundant material of *T. fabricii* (the morphologically closest species) from Morocco and the Iberian Peninsula (Appendix 1).

**Material examined of *T. strandi*:** MOROCCO: 1 ♂, 32°49'52"N-4°24'19"W, 1043 m, Ksabi (province of Boulemane, Fes-Boulemane administrative Region), 17-VIII-2017, C. Belamime leg. (in col. Emirates Center for Wildlife Propagation, Missouri, Morocco); 1 ♀, 32°28'05"N-3°37'41"W, 1750 m, Tameslemt (province of Boulemane, Fes-Boulemane administrative Region), 25-III-2012, A. François & F. Soldati leg. (in col. Emirates Center for Wildlife Propagation, Missouri, Morocco).

Tameslemt is found in the north foothills of the Eastern High Atlas mountain range and Ksabi in the upper basin of the Moulouya river. The bioclimate is semi-arid with cold winters in the first station (annual average rainfall: 400–500 mm) and arid with cold winters in the second (annual average rainfall: 100–200 mm), with high continentality in both of them (see Sauvage, 1963; Le Houérou, 1989). In the type-locality, the bioclimate is semi-arid with

cold winters (annual average rainfall: 395 mm) (Le Houérou, 1989).

The location of Tameslemt (Fig. 2) is a loosely open wood of juniper trees [*Juniperus oxycedrus* L. and *Juniperus phoenicea* L. subsp. *turbinata* (Guss.) Nyman], that is characteristic of the cold subunit of the semi-arid bioclimate (Emberger, 1950), with a grazed steppe of *Macrochloa tenacissima* (L.) Kunth, 1829, *Rosmarinus officinalis* L., 1753, and *Artemisia* L., 1753. The specimen was found below a stone. At Ksabi, the vegetation around the village is also a grazed steppe but mostly covered by plants of the Chenopodiaceae family. There, near the Moulouya river, the lower level of the plain is characterised by great formations of *Hammada scoparia* (Pomel) Iljin, favoured by very dry conditions or high grazing pressure (Pujos, 1955; Defaut, 2015). At this location, the specimen was collected manually in a compost pile, in the center of the village, near irrigated fields.

*Trox strandi* is morphologically similar to *T. fabricii* and both differ mainly in the following characters (Baraud, 1985; Pittino, 2011; J.L. Ruiz & A. François, pers. obs.): *T. strandi* presents subequal tubercles on both odd and even elytral inter-striae (tubercles on even inter-striae usually between 1/2–3/4 smaller

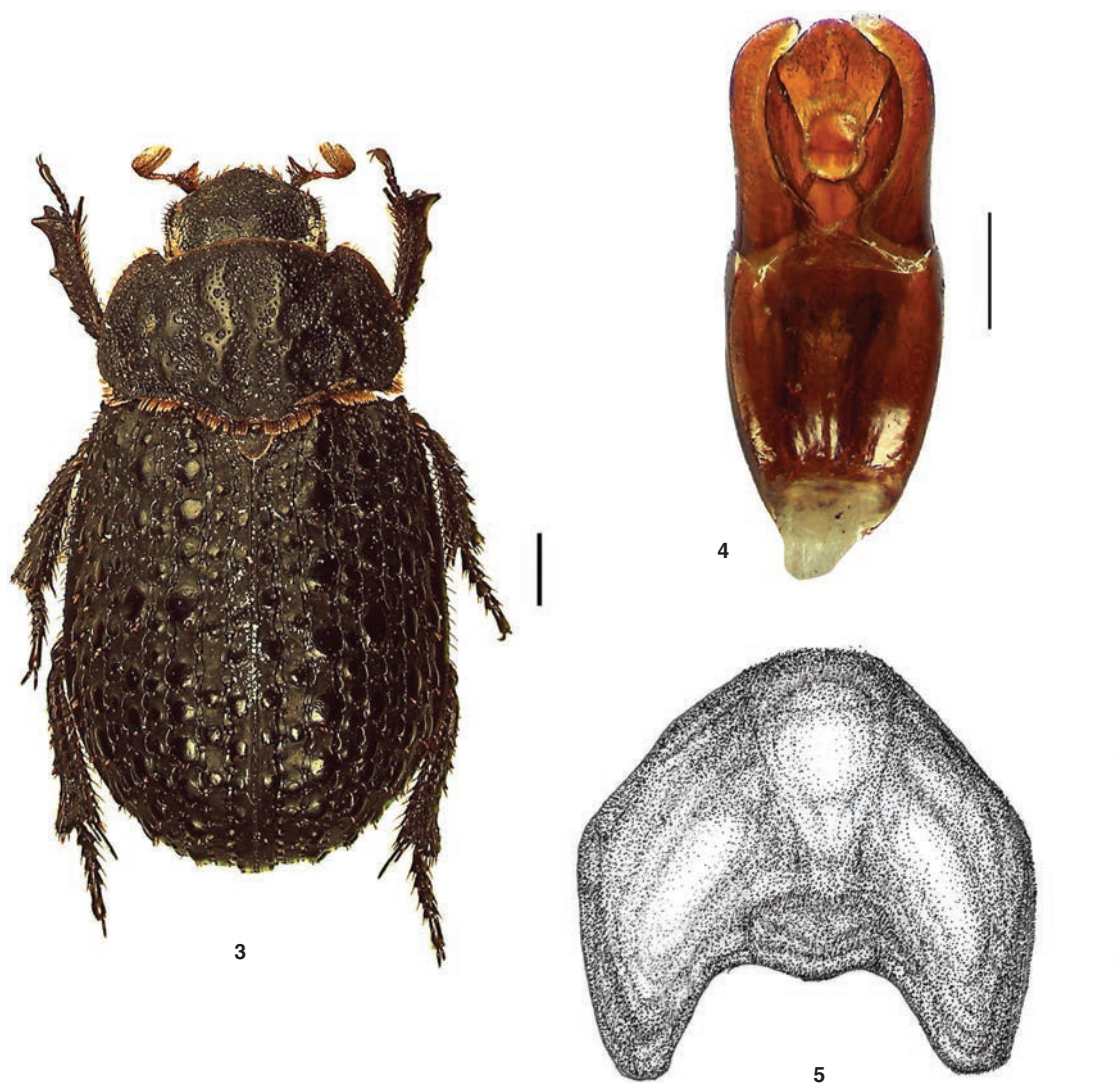


Fig. 2.— Habitat of *Trox strandi* Balthasar, 1936 at Tameslemt (Eastern High Atlas, Morocco).

Fig. 2.— Hábitat de *Trox strandi* Balthasar, 1936 en Tameslemt (Alto Atlas oriental, Marruecos).

than those on the odd, some even of equal size), little and equally convex in all inter-striae, sub-rounded; third inter-stria barely elevated at its base, without alignment of confluent tubercles, not costiform at this level; striae almost straight; even costae just wider than odd and elytral profile uniformly convex dorsally in lateral view with the greatest height at about middle. In contrast, *T. fabricii* shows tubercles on odd elytral costae clearly larger than those on even costae, usually markedly convex, subovoid and elongated (however, elytral sculpture of this species is highly variable); third inter-stria strongly elevated, subcostiform, at its base, with an alignment of confluent elongated tubercles at this level; striae more sinuous; even costae distinctly wider than odd and, in general, dorsal elytral profile basally flat with the greatest convexity clearly behind middle [this last feature,

referred by Pittino (2011), is variable and difficult to weight in some specimens; pers. obs.]. Besides, the prosternal process is different in both species and the male genitalia shows slight differences (see Pittino, 2011: p. 378, figs. 7–8, p. 379, figs. 13–16). In addition, the Moroccan specimens of *T. strandi* present the body tegument matte, even in specimens without almost integumentary wear, while in *T. fabricii* it is clearly brighter; nevertheless, this character and the morphology of prosternal process are difficult to evaluate in old specimens, due to the remarkable wearing because of the strong fossorial activity of *Trox* species (Pittino, 2011; pers. obs.). Likewise, we have observed a high inter- and intrapopulation variability on the prosternal apophysis morphology in *T. fabricii*, which leads us to consider with caution the diagnostic value of this character.



Figs. 3–5.— *Trox strandi* Balthasar, 1936. 3–4. ♂ from Ksabi, Morocco. 3. Habitus in dorsal view. 4. Male genitalia in ventral view. 5. Prosternal process, ♀ from Tameslemt, Morocco. Scale bars: 3 = 1 mm, 4 = 0.5 mm, 5 = 0.1 mm.

Figs. 3–5.— *Trox strandi* Balthasar, 1936. 3–4. ♂ de Ksabi, Morocco. 3. Hábito en visión dorsal. 4. Genitalia masculina en vista ventral. 5. Apófisis prosternal, ♀ de Tameslemt, Marruecos. Escalas: 3 = 1 mm, 4 = 0.5 mm, 5 = 0.1 mm.

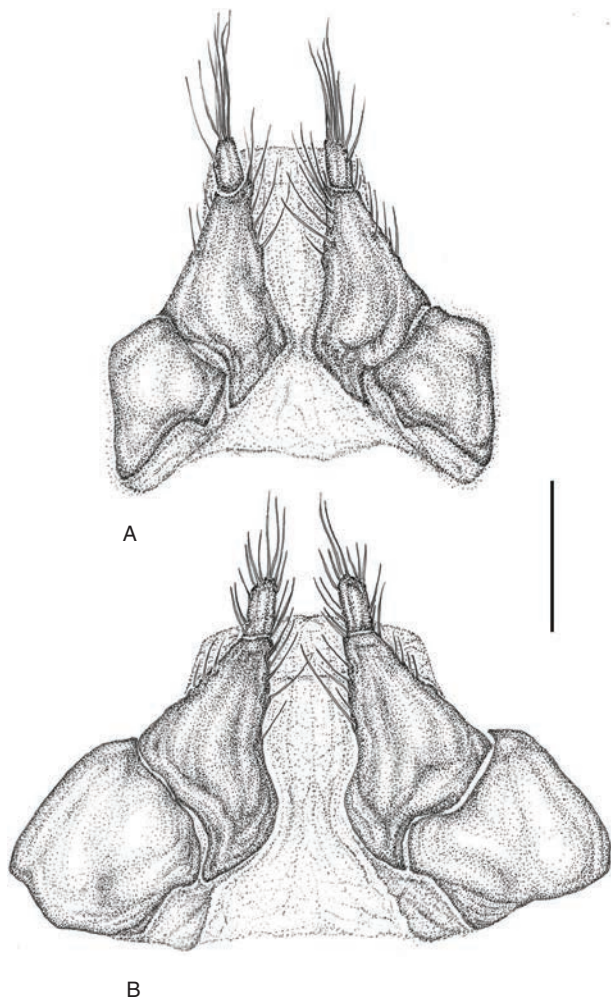


Fig. 6.— Female genital palpi of: A) *Trox strandi* Balthasar, 1936 (Tameslemt, Morocco); B) *Trox fabricii* Reiche, 1853 (Ceuta, Spain, North Africa). Scale: 0.5 mm.

Fig. 6.— Palpos genitales femeninos de: A) *Trox strandi* Balthasar, 1936 (Tameslemt, Marruecos); B) *Trox fabricii* Reiche, 1853 (Ceuta, España, norte de África). Escala: 0.5 mm.

To illustrate the interpopulation variability of the species, images of the habitus, aedeagus (male) and prosternal process (female) of the Moroccan specimens are provided (Figs. 3–5). Likewise, the genital palpi of *T. strandi* female, compared with those of *T. fabricii*, are illustrated (Fig. 6). The length of the studied exemplars ranges from 9.3 mm (♂) – 8.9 mm (♀) (7.5 mm, according to Balthasar, 1936 and Baraud, 1985).

In view of the new Moroccan locations of *T. strandi* and its morphological similarity with *T. fabricii*, it would be interesting to carry out a critical review of the records of the latter species, at least, from eastern Morocco (e.g. Martínez de la Escalera, 1914; Kocher, 1953, 1958; Pardo Alcaide, 1955; Baraud, 1985; Palmer *et al.*, 1999), in order to delimit the area of occupancy (*sensu* IUCN, 2001) of both taxa in this country.

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Appendix 1.— Material examined of *Trox fabricii* Reiche, 1853 (total number of studied specimens: 143). The acronyms used are as follows: ex./exx.: exemplar/exemplars; (JLR): J.L. Ruiz collection (Ceuta, Spain); (ECWP): Emirates Center for Wildlife Propagation collection (Missour, Morocco).

Apéndice 1.— Material examinado de *Trox fabricii* Reiche, 1853 (número total de especímenes estudiados: 143). Las siglas utilizadas son las siguientes: (JLR): colección J.L. Ruiz (Ceuta, España); (ECWP): colección del Emirates Center for Wildlife Propagation (Missour, Marruecos).

**MOROCCO** (27 exx. examined): 3 exx.: “Yebel Alam-Mulay Abdeselam, Beni Aros, Rif occ., 38°18'55"N-5°31'17"W, 1203 m, 13-X-1996, J.L. Ruiz leg.” (JLR); 1 ex.: “Central eléctrica, Tleta-Taghramt, S<sup>a</sup> del Haus, Fahs Anyera, 35°48'40"N-5°27'32"W, 455 m, 4-X-1998, J.L. Ruiz leg.” (JLR); 3 exx.: “Tleta-Taghramt, S<sup>a</sup> del Haus, Fahs Anyera, 35°46'56"N-5°27'55"W, 385 m, 24-III-2002, J.L. Ruiz leg.” (JLR); 2 exx.: “Yebel Alam-Mulay Abdeselam, Beni Aros, Rif occ., 38°18'55"N-5°31'18"W, 1205 m, 6-V-2006, J.L. Ruiz leg.” (JLR); 3 exx.: “Casa Forestal, Asifane, P.N. Talassemthane, Rif, 35°07'31"N-5°04'13"W, 1370 m, 27-I-2008, J.L. Ruiz leg.”; 1 ex.: “Yebel Borya-Agnan, Sierra del Haus, Fahs Anyera, 35°46'09"N-5°26'40"W, 375 m, 23-XI-2008, J.L. Ruiz leg.” (JLR); 1 ex.: “Cèdre Gouraud, Azrou, Moyen Atlas, 33°25'03"N-5°09'20"W, 1754 m, 8-III-2009, J. Dubos leg.” (ECWP); 1 ex.: “Lixus, Larache, 35°11'53"N-6°06'43"W, 19 m, 28-II-2010, M- G<sup>a</sup>-Paris leg.” (JLR); 1 ex.: “Bou-Hachem, Beni Aros, Yebala, 35°15'31"N-5°30'49"W, 1160 m, 21-IV-2012, J.L. Ruiz leg.” (JLR); 1 ex.: “Ben Karrich, Crtra. Tetuán-Chaouen, 35°29'51"N-5°26'09"W, 103 m, 12-V-2012, J.L. Ruiz leg.”; 1 ex.: “Lixus, Larache, 35°11'58"N-6°06'32"W, 50 m, 29-IX-2012, J.L. Ruiz leg.” (JLR); 1 ex.: “El Alwia, S<sup>a</sup> del Haus, Fahs Anyera, 35°39'08"N-5°26'40"W, 574 m, 25-I-2014, J.L. Ruiz leg.” (JLR); 7 exx.: “El Alwia-Fahs Lamhar, S<sup>a</sup> del Haus, Fahs Anyera, 35°39'21"N-5°26'33"W, 581 m, 25-IV-2015, J.L. Ruiz leg.” (JLR); 1 ex.: “Yebel Tisirhen, Bab Berred, Rif central, 35°01'N-4°56'W, 1500 m, 1-V-2016, J.L. Ruiz leg.” (JLR).

**SPAIN** (116 exx. examined, 11 exx. from southern Iberian Peninsula and 105 exx. from Ceuta, North Africa): **ANDALUSIA:** CÁDIZ: 3 exx.: “Laguna de Medina, Jerez de la Frtra. (Cádiz), 36°37'N-6°03'W, 31 m, 4-XII-1982, J. de Ferrer leg.” (JLR); 4 exx.: “Los Barrios, Crtra. CA-221, 36°11'N-5°33'W, 100 m, 26-IV-1991, J.L. Ruiz leg.” (JLR); 3 exx. (*ex ovo*): “La Nava, Chiclana de la Frtra. (Cádiz), 36°23'N-6°00'W, 80 m, 4-VI-2000, P. Coello leg.” (JLR); MÁLAGA: 1 ex.: “El Pinarillo (inmediaciones del área recreativa), Nerja, Sierra Almijara (Málaga), 36°47'58"N-3°50'55"O, 483 m, 4-I-2011, J.L. Ruiz leg.” (JLR). **AUTONOMOUS CITY OF CEUTA (NORTH AFRICA)**: 4 exx.: “Arroyo Calamocarro-Finca Serrano, Ceuta, 35°54'N-5°21'W, 20–85 m, 24-XII-1991, J.L. Ruiz leg.” (JLR); 12 exx.: *idem*, 6-I-1992 (JLR); 2 exx.: *idem*, 16-III-1992 (JLR); 8 exx.: *idem*, 3-X-1992 (JLR); 17 exx.: *idem*, 22-XII-1992 (JLR); 18 exx.: *idem*, 26-XII-1992 (JLR); 32 exx.: *idem*, 20-II-1993 (JLR); 2 exx.: *idem*, 8-XI-1993 (JLR); 2 exx.: *idem*, 28-XI-1993 (JLR); 1 ex.: “Monte Benzú, Ceuta, 35°54'53"N-5°22'15"W, 37 m, 15-X-1997, J.L. Ruiz leg.” (JLR); 2 exx.: “Benzú, OBIMASA, Ceuta, 35°54'45"N-5°22'23"W, 7-III-2005, J.L. Ruiz leg.” (JLR); 1 ex.: “Circunvalación Monte Hacho, Ceuta, 35°53'33"N-5°17'14"W, 80 m, 10-X-2008, J.L. Ruiz leg.” (JLR); 1 ex.: “La Huerta, Monte Hacho sur, Ceuta, 35°53'31"N-5°17'20"O, 75 m, 16-XI-2008, J.L. Ruiz leg.” (JLR); 1 ex.: “Castillo del Desnarigado, Monte Hacho, 35°53'43"N-5°16'53"O, 35 m, 5-IV-2013, J.L. Ruiz leg.” (JLR); 2 exx.: “Cuatro Caminos, Mte. Hacho, Ceuta, 35°53'50"N-5°16'55"W, 74 m, 1-III-2014” (JLR).