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The ground beetle tribe Cyclosomini s.l. in Israel

(Coleoptera, Carabidae)

Thorsten Assmann, Estève Boutaud, Jörn Buse, Vladimir Chikatunov, Claudia Drees, Ariel-Leib-Leonid Friedman, Werner Härdtle, Katharina Homburg, Tamar Marcus, Ittai Renan & David W. Wrase

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The members of the carabid beetle tribe Cyclosomini s.l. in Israel and adjacent regions (Lebanon, Syria, Jordan and Egypt) are studied in terms of taxonomy, ecology (including the traits power of dispersal, especially hind wing development, and phenology), and distribution patterns. Material from museum collections and the authors' field trips is analysed. The delineation of the tribe Cyclosomini s.l. is discussed and the genus *Graphipterus* Latreille, 1802 is excluded, but the corsyrine ground beetles are included. An illustrated key is presented for the identification of the species known from the Levantine countries (twelve species from the genera *Anaulacus* W. S. MacLeay, 1825, *Somoplatus* Dejean, 1829, *Discoptera* Semenov, 1889, *Tetragonoderus* Dejean, 1829, *Atlantomasoreus* Mateu, 1984 and *Masoreus* Dejean, 1821; seven species from Israel). A new species from the northern Negev is described: *Atlantomasoreus groneri* spec. nov. This species can be differentiated from the two African species of this genus by short antennae, a well-developed gonosubcoxite which is also found in the genus *Masoreus*, the shape of the pronotum and characters of the aedeagus, especially the large copulatory pieces and the shape of the median lobe. Due to the characters of *A. groneri* spec. nov. we assume that the genera *Masoreus* and *Atlantomasoreus* form a monophyletic lineage. The genus *Atlantomasoreus* shows a disjunct distribution range and is an element of the peri-Saharian zone. Israel has a national responsibility for the conservation of the new species *A. groneri* spec. nov. which lives in shifting sand dunes, an increasingly endangered habitat.

Thorsten Assmann (corresponding author), Estève Boutaud, Werner Härdtle, Katharina Homburg & Tamar Marcus, Institute of Ecology, Leuphana University Lüneburg, Scharnhorststr. 1, 21314 Lüneburg, Germany;
e-mail: assmann@uni.leuphana.de

Jörn Buse, Ecosystem Analysis, Institute for Environmental Sciences, University of Koblenz-Landau, Fortstr. 7, 76829 Landau, Germany

Vladimir Chikatunov, Claudia Drees, Ariel-Leib-Leonid Friedman & Ittai Renan, Tel Aviv University, Department of Zoology, The National Collections of Natural History, Ramat-Aviv, Tel Aviv, 69978, Israel

Claudia Drees, Biocentre Grindel and Zoological Museum, University of Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany

David W. Wrase, Dunckerstr. 78, 10437 Berlin, Germany

Introduction

Lebiine ground beetles represent a large proportion of overall ground beetle diversity (Lorenz 2005). One group of these beetles, the Cyclosomini – easily recognizable by long spurs at the posterior margin of meso- and metatibiae – seems not to be rich in species. Even for Israel, a country at the interface between strikingly different climatic and biogeographic regions (Furth 1975, Yom-Tov & Tchernov 1988), the Palaearctic Catalogue of carabids lists only one species (Löbl & Smetana 2003).

However, the evaluation of the specimens preserved in The National Collections of Natural History at Tel Aviv University and our field surveys revealed the existence of several species. Surprisingly, a member of the genus *Atlantomasoreus*, which has previously been known only from northwestern Africa, was also discovered in the northwestern Negev. The new records and the undescribed species highlight the necessity for a systematic-taxonomic synopsis of these ground beetles for Israel and the adjacent regions. In general, the countries of the Levant are not well-studied from a carabidological point of view (Schuldt et al. 2009). We thus incorporated most species records from the neighbouring countries of Israel and here we present an identification key for all Cyclosomini species of the Levant. We also added basic information about habitat preferences and distributional data as well as ecological traits because these data are important for many modern ecological and conservation biological analyses of ground beetles (Ribera et al. 2001, Schuldt & Assmann 2010, Homburg et al. 2013).

Material and methods

Collections, distribution records

This study is based on the examination of specimens collected during (i) the authors' field trips to Israel, Jordan, Egypt and other Mediterranean countries, (ii) ecological and conservation biological surveys in Israel (Buse et al. 2008, Timm et al. 2009, Buse et al. 2010), and/or (iii) specimens stored in entomological collections (incl. historical collections). Additionally we used a literature survey to determine the distribution ranges in the Levant (e.g. Schatzmayr 1936, Bodenheimer 1937, Mateu 1984, Hosni et al. 2003). We studied approximately 300 individuals from Israel, Jordan, Lebanon and Syria.

The material is stored in the following collections:

CAB Working collection Assmann, Bleckede, Germany (part of the Zoological State Collection Munich, ZSM, Germany)
CBL Collection Buse, Landau, Germany
CHD Collection Hetzel, Darmstadt, Germany
COK Collection Orbach, Kiryat Tiv'on, Israel (will be transferred to TAU, Israel)
CRM Collection Renan, Midreshet Ben-Gurion, Israel (will be transferred to TAU, Israel)
CSW Collection Starke, Warendorf, Germany (will be transferred to Westfälisches Landesmuseum Münster, Germany)
CWB Working collection Wrase, Berlin, Germany (part of the Zoological State Collection Munich, ZSM, Germany)
NHMP Entomology Department, National Natural History Museum Paris (Muséum National d'Histoire Naturelle Paris), Paris, France
TAU National Collections of Natural History, Tel Aviv University, Tel Aviv, Israel
ZMHB Entomology Collections, Natural History Museum of the Humboldt University (Museum für Naturkunde der Humboldt-Universität), Berlin, Germany
ZSM Zoological State Collection Munich (Zoologische Staatssammlung München), Munich, Germany

Where possible, the nomenclature follows the last Palaearctic Catalogue or the world list of ground beetles (Löbl & Smetana 2003, Lorenz 2005). Deviations are discussed.

Measurements and photography

Total body length (BL) was measured from the tip of the mandibles to the apex of the right elytron as the maximum linear distance; the width of the head (HW) as the maximum linear distance across the head, including the compound eyes; the length of the pronotum (PL) from the anterior to the posterior margin along the midline; the length of the elytra (EL) from the posterior tip of the scutellum to the apex of the right elytron as the maximum linear distance; the maximum width of the pronotum (PW) and elytra (EW); the width of the pronotal base (PBaW) between the tip of the hind angles at insertion of seta.

These measurements, made at magnifications between 25× and 60×, using an ocular micrometer in a Leica MZ 95 stereobinocular microscope, were combined as ratios as follows:

HW/PW width of head/width of pronotum
PL/PW length/width of pronotum
PW/PBaW width of pronotum/width of the pronotal base
EL/EW length/width of elytra

Microsculpture was examined at a magnification of 100×. Dissections were made using standard techniques; genitalia were preserved in "Lompe mixture" (Lompe 1989) or Euparal on acetate labels, and pinned beneath the specimens from which they had been removed. The photographs were taken with an Olympus E-330 digital camera in combination with a Leitz MZ 95 or with a Zeiss Discovery V20 in combination with a Power Shot G9 camera. To achieve sufficient depth of focus, up to 40 planes were captured; these were copied to separate layers, and the out-of focus planes are masked by a stacking program (Combine Z5 or Combine ZP).

Nomenclature of male and female genitalia follows Deuve (1993) and Ball & Shpeley (2002). Terms for surface of median lobe of male genitalia follow conventional usage.

Dispersal power

We dissected up to 20 individuals per species to determine hind wing development (brachyptery and macroptery; e.g. Desender 1989). Records from light trap or flight interception trap surveys (e.g. Chikatunov et al. 2006, Buse et al. 2010, Buse et al. 2013) are mentioned: Being caught in light or flight interception traps implies the ability to fly. Contradictions between the published catches in such traps and brachyptery are discussed.

Habitat selection

Information about the species' habitats is taken from our ecological surveys (traps and hand picking, also in other Mediterranean countries).

Phenology

For some species we summarize the seasonality of the catches (larger series in the collections and/or automatic trap catches) and – if possible – the reproduction cycle. Any records of newly hatched beetles (e.g. with soft exoskeleton) are also mentioned.

Distribution data

The distribution data for the species' ranges are taken from the Palaearctic catalogue of ground beetles (Bousquet 2003a,b), further literature (e.g. Mateu 1984, Hosni et al. 2003), and, especially for Israel, the largely unpublished data pool from museum collections (especially TAU). The characterization of the distribution range within Israel follows several publications on geographical and climate regions (Jaffe 1988, Klein 1988, Yom-Tov & Tchernov 1988). To avoid confusion regarding the names of localities (cf. Freidberg & Yarom 2002) we use both the official spelling of locality names (Survey of Israel 2000) and (mostly in parentheses) the spelling used in the "Israel Road map" (MAPA's GIS Department 2010), which is frequently used by foreign entomologists.

For further methodological details see Assmann et al. (2008, 2012). All trait and distributional data are incorporated in the dynamic, freely accessible online database www.carabids.org (Homburg et al. 2014).

Results

Delineation of the lebiomorph assemblages with "cyclosomine" morphological characters

Only few suprageneric taxa of Carabidae are so controversially discussed in terms of their systematics and phylogeny as the lebiomorph assemblages with "cyclosomine" or "masoreimorph" character states (e.g. spurs on the meso- and/or metatarsi). This is true (at least) for the following groups (here listed as tribes): Corsyrini, Cyclosomini, Graphipterini, Masoreini, Aephnidiini, Sarothrocrepidini, and Somoplatini. It is possible to find nearly all ranks from subtribe to subfamily or even superfamily for some of these suprageneric taxa (e.g. Chaudoir 1871, Chaudoir 1876, Jeannel 1941/42, Freude 1976, Ball & Bousquet 2001, Ball & Shpeley 2002, 2003).

According to several authors (e.g. Ball & Shpeley 2002, Lorenz 2005) and our own records the following genera of the Levant belong to this group:

Anaulacus MacLeay, 1825, *Atlantomasoreus* Mateu, 1984, *Discoptera* Semenov, 1889, *Graphipterus* Latreille, 1802, *Masoreus* Dejean, 1821, *Somoplatus* Dejean, 1829, and *Tetragonoderus* Dejean, 1829.

The main problem for a satisfactory classification seems to be the lack of complex character states: The most important "cyclosomine" or "masoreimorph" character, the tibial spurs, long appendices at the end of the meso- and metatibia, differs from those of other ground beetles mainly with respect to their length. This simple character state can evolve independently as an adaptation to a specific way of life (e.g. on shifting and soft sand). For this reason, Ball & Shpeley (2001: 109) considered it unlikely that the above-mentioned taxa form a monophyletic group.

Important, and partly surprising, insights come from a current molecular phylogeny of the harpaline ground beetles which suggests a common ancestor, at least for some of the genera (six supraspecific taxa of this group studied): (1) The (sub-) genera *Aephnidius*, *Anaulacus*, *Tetragonoderus*, *Masoreus* and *Sarothrocrepis* are included in the (non-monophyletic) lebiine clade. (2) These (sub-) genera do not form the sister group of graphipterines. (3) The genus *Graphipterus* belongs to a strongly supported clade with orthogoniines and pseudomorphines. (4) *Anaulacus* and *Aephnidius* are related to each other but they seem to represent an independent lineage because they are not associated with other cyclosomines in the cladistic analysis (Ober & Maddison 2008).

In our synopsis we exclude the genus *Graphipterus* (as the representative of the harpaline tribe Graphipterini) because it clearly does not belong to the lebiine Cyclosomini s.l. For the other taxa in the Levant, it seems premature to suggest a new classification, because three genera from the Levant (*Atlantomasoreus*, *Discoptera*, *Somoplatus*) and no Old World species of *Anaulacus* are yet included in a molecular phylogeny (cf. Ober & Maddison 2008). Therefore, we position all Levantine genera in the tribe Cyclosomini s.l. (knowing that this must be preliminary). This delineation of the tribe Cyclosomini s.l. seems to coincide with the systematics presented by Bouchard et al. (2011, but without the subtribes).

Some authors listed *Tilius* Chaudoir, 1876 as a member of the Cyclosomini s.l. (Csiki 1932, Schatzmayr 1936, Alfieri 1976) but we agree with Lorenz (2005) and some other authors that this genus belongs to the lionychines rather than to the cyclosomines.

Identification key to the Cyclosomini s.l. species from Israel and the adjacent countries Egypt, Jordan, Lebanon and Syria

The following identification key incorporates all species of the above-mentioned groups known from Israel and adjacent regions. As the carabid fauna of the Middle East has only been poorly studied we cannot exclude the possibility that further species occur. If the probability of occurrence is high, we incorporate the given species in the key or mention it in the taxonomic notes. *Tetragonoderus aegyptiacus* Jedlička, 1952 is not incorporated (see the taxonomic remarks on *T. arcuatus* for a justification). Species without verifiable records from Israel are given in parentheses.

From a morphological point of view the members of the Cyclosomini s.l. are easily recognizable by a combination of the following characters: (1) spurs of meso- and metatarsi long, distinctly longer than half of the tarsomere 1; (2) outer margin of tibia with strong spines; (3) truncate apex of elytra; (4) mesepimeron not connected to mesocoxal cavities (Müller-Motzfeld 2006: fig. 4b, p. 7); (5) procoxal cavities closed posteriorly (Ball & Bousquet 2001: fig. 12.6, p. 37); and (6) antennae with insertion not on frons but in line with and posteriad adjacent to base of mandibles. However, one genus with the above-mentioned characters must be excluded from the Cyclosomini s.l. (see explanation above): *Graphipterus*. The representatives of this genus in the Levant share the characters (1) to (6) with the members of Cyclosomini s.l. but can be differentiated from them by their black body with (a) spots of white hairs on the elytra and (b) one of the two metatibial spurs is spoon-shaped with a pointed end (Fig. 4a) (see also fig. 2c in Basilewsky 1977).

The habitus photographs presented here (Figs 1 and 2) provide further help in identification. However, the identification of some Cyclosomini s.l. requires experience. For reliable identification, particularly of the species *Masoreus affinis*, *M. wetterhallii* and *M. aegyptiacus*, the male genitalia have to be examined.

1 Elytra pubescent; a dark transverse band in the apical half. Mentum with a tooth. Yellow to brown. BL 7.5–9 mm. ..... (3. *Somoplatus peregrinus* Mulsant & Godart, 1869)

– Elytra only with the regular setae (series umbilicata, discal setae), not pubescent. Mentum with or without tooth. 2

2 Upper side with (sometimes weak) metallic lustre (in general green or bronze) and yellow bands or spots on the elytra. Males with dilated pro- and mesotarsomeres 1–4, on the ventral side with adhesive setae. Pronotum with protruding hind angles and posterior margin not distinctly lobate (Fig. 1f). Labial mentum toothed. Apical long spurs of meso- and metatibiae serrulate or fimbriate (Fig. 4b). 3

– Upper side without metallic lustre or yellow bands or spots on the elytra. Males only with dilated protarsomeres 1–3 or 1–4, on the ventral side with adhesive setae. Hind angles of pronotum not protruding, posterior margin of pronotum not sinuate or lobate. Labial mentum with or without tooth. Apical long spurs of meso- and metatibiae smooth or serrulate or fimbriate (Figs 4c,d). 5

3 Larger, BL > 6 mm. Longitudinal band on each elytron, basal part extends from fourth to seventh interval; at the apex from fourth to eighth. Antenna, tibia and tarsi yellow to red-brown, femur darker. 7 mm. .... (7. *Tetragonoderus assuanensis* Mjöberg, 1905)

– Smaller, BL > 6 mm. Preapical spots on the elytra forming bands or subquadrats. 4

4 Elytra with a yellow preapical transverse band consisting of seven spots, usually ranging from second to eighth interval, within the coloration smaller on the inner three intervals than those within the outer ones. First two antennomeres yellow-brown, following ones darker; femur and (to a lesser extent also) tibia darker, tarsi brightened. BL 4.0–5.3 mm. Figs 1f, 3c. .... 5. *Tetragonoderus arcuatus* Dejean, 1829

– Elytra with a yellow preapical subquadrate consisting of four spots, usually within the fifth to eighth intervals. First three antennomeres and legs yellow-brown. BL 3.2–4.5 mm. .... (6. *Tetragonoderus sericatus* Dejean, 1829)

5 Larger, BL 7.3–11.8 mm. Posterior margin of pronotum not sinuate or lobate. Spurs of mesotibia long, as long as the first two tarsomeres together (Fig. 4c). Labial mentum with tooth. Apical long spurs of meso- and metatibiae serrulate or fimbriate (Fig. 1a) (see also fig. 35.6 in Ball & Bousquet 2001: 39). BL 7.5–12 mm. Figs 1d,e, 3b, 5 left. .... 4. *Discoptera arabica* Fairmaire, 1896

– Smaller, BL < 7.5 mm. Posterior margin of pronotum lobate or broadly sinuate laterally. Spurs of mesotibia shorter than the first two antennomeres together. Labial mentum without tooth. Apical long spurs of meso- and metatibiae smooth, not serrulate or fimbriate. 6

6 External margin of mesotibia with small range of dense yellow-brownish hairs ("setal brush", in males more pronounced than in females, Fig. 4e). Elytral striae shallowly impressed, the first clearly visible; intervals flat. Mandibles dorsally enlarged, lateral margin broadly rounded, scrobe not visible in dorsal aspect. Upper surface dull due to strong microsculture with isodiametric meshes. The only species known from Israel is black with brightened appendices. 7

– External margin of mesotibia without a small range of yellow-brownish hairs, only the regular spines. All elytral striae clearly visible and well impressed; intervals more or less convex. Mandibles dorsally with a raised ridge, scrobe visible in dorsal view. Upper surface with microsculpture but shiny. Yellow to brownish species, also bicoloured with brightened elytral basis, rarely black with brightened appendices. 8

7 Elytral stria 1 normally developed, subsequent striae weak but visible. Apical margin of pronotum weakly sinuate and lobate. Body black, sometimes dark brownish, appendices brightened. BL 5.5–7 mm. Figs 1a, 3a, 4e. .... 1. *Anaulacus ruficornis* Chaudoir, 1850

– Only elytral stria 1 visible, others reduced. Apical margin of pronotum continuously rounded. Yellow-brown or reddish. BL ~ 4.5 mm. Fig. 1c. ..... (2. *Anaulacus rutilus* Schaum, 1863)

8 Metepisternum short (almost as long as wide) and abdominal sternites III to VI with numerous setae of different length (both characters in side view visible, also on individuals mounted on cards). Posterior angles of pronotum almost obliterate. Elytra short and oval with humeri completely rounded. BL 4.0–6.2 mm. Figs 1i, 2a, 5 right, 6a–e. .... 8. *Atlantomasoreus groneri* spec. nov.

– Metepisternum longer than wide and abdominal sternites with the usual pair of setae. Posterior angles of pronotum well developed. Elytra longer and oval or shorter and parallel, in all species with distinct humeri. 9

9 Large, BL > 6.2 mm (BL 6.2–7.8 mm). Head with small longitudinal grooves close to the supraorbital setae. Pronotum strongly transverse. Claws smooth, not denticulate. Apical part of protibia grooved. Figs 2b, 3d. .... 9. *Masoreus orientalis* Dejean, 1828

– Smaller, BL < 6.4 mm. Head smooth without clearly visible furrows on frons (sometimes shallow impressions). Pronotum in general wider than long but less transverse (Figs 2c–f). Claws denticulate or smooth. Apical part of protibia smooth. 10

10 Claws smooth, sometimes with small teeth. Aedeagus slender with large copulatory pieces (Fig. 3e). Microsculpture well developed, on the elytra with weakly transverse meshes. Body brown or dark reddish, basal half of elytra and often pronotum (and head) pale. BL 4.0–6.2 mm. Fig. 2c. ..... 10. *Masoreus affinis* Chaudoir, 1843

– Claws clearly denticulate, two to four teeth per claw. Aedeagus (Figs 3f, g). Microsculpture variable. Body of similar coloration or yellow-brown to reddish. 11

11 Aedeagus spindle-shaped with a small copulatory piece (Fig. 3g). Body yellow-brown to reddish, sometimes with infuscate dark apical half. Elytral microsculpture with weakly transverse meshes (about two to three times as wide as long). BL 5.0–6.3 mm. Figs 2e, f. .... 12. *Masoreus aegyptiacus* Dejean, 1828

– Aedeagus to the preputial field enlarged, apex somewhat obtuse, with a small copulatory piece (Fig. 3f). Body piceous brown or dark brown, base of elytra and often pronotum pale, appendices brightened. Elytral microsculpture with strongly transverse meshes (usually more than three times as wide as long). BL 4.5–6.0 mm. Fig. 2d. .... (11. *Masoreus wetterhallii* (Gyllenhal, 1813))

Remarks on the species

1. *Anaulacus* (*Aephnidius*) *ruficornis* Chaudoir, 1850

Dispersal power: Macropterous, flight active (personal observation).

Habitat selection: Wetlands and humid habitats, both shaded and unshaded. Abundant in the *Tamarix jordanis* marshes of the Sea of Galilee and in swamps of the Hula Valley but also close to the Mediterranean Sea in habitats with freshwater or brackish ground water table lying close to surface. Many of the habitats are flooded during winter and the beetles seem to re-colonize them by flight. We believe that specimens from gardens or parks (e. g. in Sedé Boqer = Sde Boqer) are vagrants.

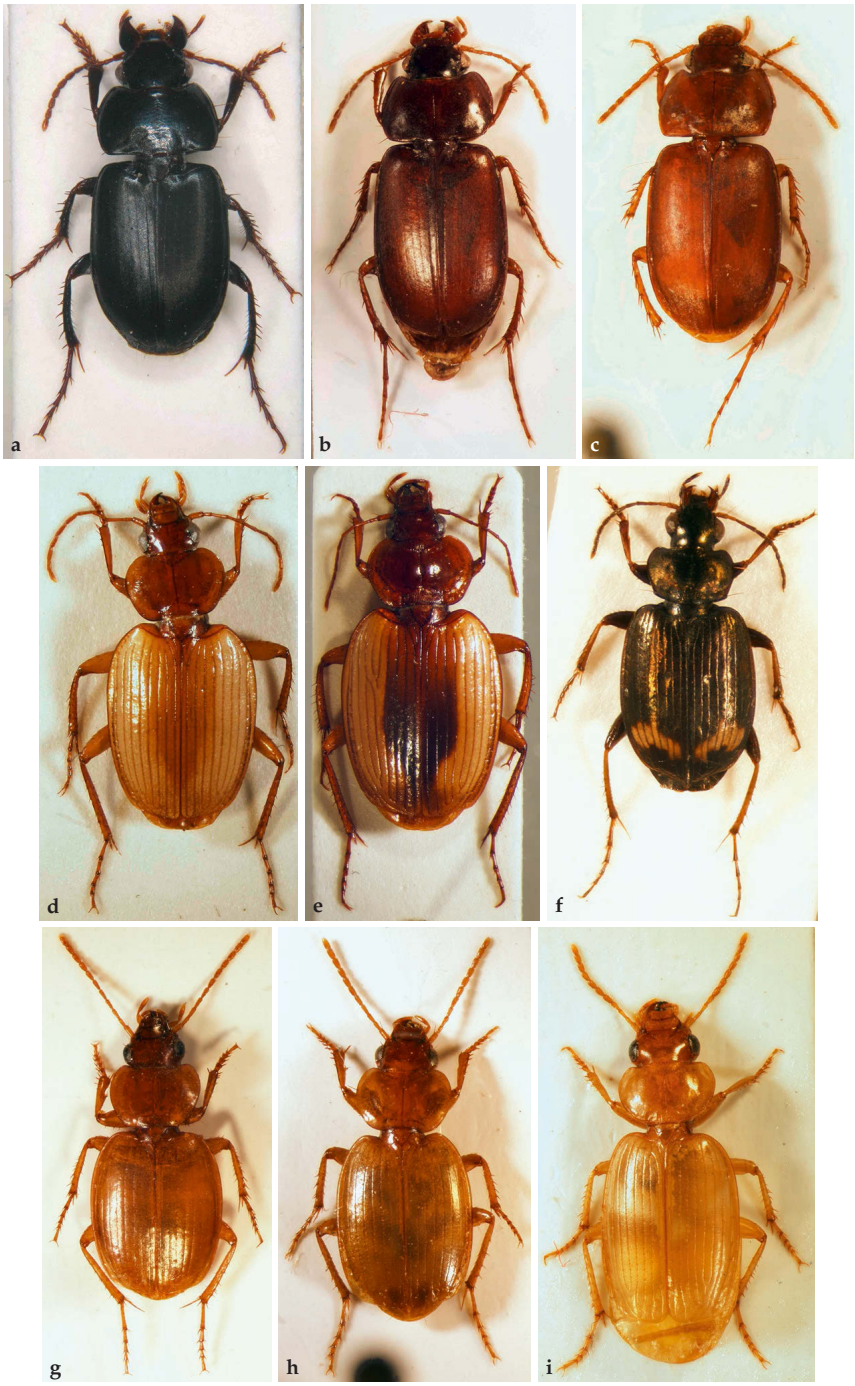

Fig. 1. Habitus of **a.** *Anaulacus ruficornis*, male (Israel, Sea of Galilee); **b.** *Anaulacus barbarus*, female (Algeria, El Bayad); **c.** *Anaulacus rutilus*, female (Sudan, Khartoum); **d, e.** *Discoptera arabica*, males (Israel, Agur Dunes); **f.** *Tetragonoderus arcuatus*, male (Israel, En'Avedat); **g.** *Atlantomasoreus orbipennis*, male (Morocco, Aglu); **h.** *Atlantomasoreus desertorum*, male (Morocco, Tarfaya); **i.** *Atlantomasoreus groneri* spec. nov., female (paratype; Israel, Holot Haluza = Khalutsa Sands).

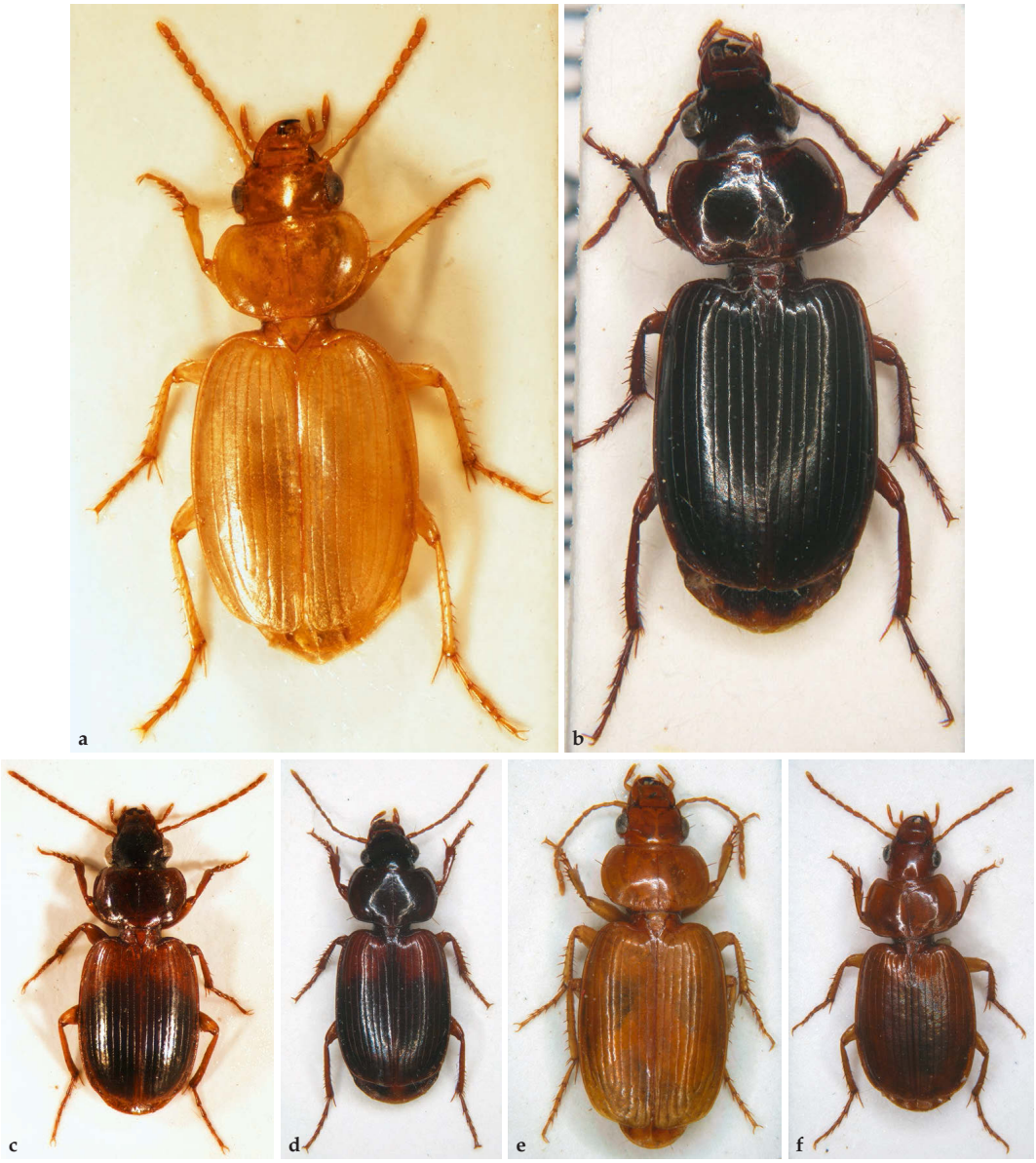

Fig. 2. Habitus of **a.** *Atlantomasoreus groneri* spec. nov., male (paratype; Israel, Holot Haluza = Khalutsa Sands); **b.** *Masoreus orientalis*, female (Israel, En Gedi = Ein Gedi); **c.** *Masoreus affinis*, male (Israel, Negev); **d.** *Masoreus wetterhallii*, female (Spain, Mallorca); **e, f.** *Masoreus aegyptiacus*, females (Egypt, Alexandria and Israel, Holot Ashdod = Ashdod Dunes).

Phenology: In the floodplain ranges of the Sea of Galilee, reproduction takes place in spring (April and May) and hibernation as an adult outside the wetlands. The related species *Anaulacus* (*Aephnidius*) *adelioides* MacLeay, 1825 also overwinters as an adult (Habu 1967).

Distribution range: From Egypt (Alfieri 1976) and Turkey to Iraq, Saudi-Arabia and Yemen (Bousquet 2003b).

Distribution in Israel: From the Mediterranean coast (Wrase 2009) to Galilee in the north and to Sedé Boqer (= Sde Boqer) in the south.

Taxonomic notes: This species is listed in the Palaearctic Catalogue under the generic name *Aephnidius* MacLeay, 1825. In their revision of the neotropical subgenera and species of the genus *Anaulacus* MacLeay, 1825, Ball & Shpeley (2002) downgraded the taxon *Aephnidius* to a subgenus. The type species of *Aephnidius* is *A. adelioides* MacLeay, 1825 which occurs from eastern Asia to Australia (Csiki 1932). We studied *A. adelioides* and some other species of the genus (incl. some from tropical Africa and America) and support the ranking of the supraspecific taxa as suggested by Ball & Shpeley (2002). – *Anaulacus barbarus* (Bedel, 1904) is a similar species described from Algeria and Tunisia. It is clearly differentiated from *A. ruficornis* by its smaller body size (BL ~ 4.5 mm), brownish coloration, slender elytra and more rounded lateral margin of pronotum (cf. Fig. 1b).

2. *Anaulacus* (*Aephnidius*) *rutilus* (Schaum, 1863)

Dispersal power: Macropterous.

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: Known from Egypt (Schaum 1863, Bousquet 2003b): Delta and Lower Nile Valley, Mediterranean coast, and Sinai Peninsula (Abdel-Dayem 2012). We saw specimens from Sudan and East Africa which were unknown to Bousquet (2003b) and Abdel-Dayem (2012).

Distribution in Israel: No record but occurrence possible especially because of the records nearby in Egypt.

Taxonomic note: The specimen from Fig. 1c was compared with two syntypes in ZMHB (labels: <Sudan / Khartoum / VII.1977 / Dr. V. Seichert> <*Aephnidius* / *rutilus* Schaum / Wrase det. 2008> <compared with / two syntypes / in MNHUB / Wrase 2012>).

3. *Somoplatus peregrinus* Mulsant & Godart, 1869

Dispersal power: Macropterous.

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: Described after specimens transported from Egypt to Marseille (Jeannel 1941/42). No records from Egypt (Alfieri 1976), probably not a Palaearctic species.

Distribution in Israel: No record.

Taxonomic notes: This species is not well known. Further species of the genera *Somoplatus* and *Microus* Chaudoir, 1876 live in tropical Africa and are sometimes transported to Europe (e. g. Jeannel 1941/42). Chaudoir (1876) and Trautner & Geigenmüller (1987) provide identification keys and short descriptions. Jeannel (1949) presents drawings of both *Somoplatus* and *Microus* species.

4. *Discoptera arabica* Fairmaire, 1896

Dispersal power: Brachypterous (n = 14). Chikatunov et al. (2006) mentioned the species from a light trap survey but we do not know of winged individuals.

Habitat selection: Inhabitant of sparsely vegetated sand dunes in semi-desert areas, especially under bushes of the crest of shifting dunes (Fig. 7b: foreground and center, left side), less catches in the interdune areas with biological crusts (Fig. 7b, center and background with grey semi-shrubs, right side) and on the slopes of shifting dunes (Fig. 7b: fore- and middle ground). A more detailed description of the habitat preference will be given by Renan (in prep.). The species co-occurs with *Atlantomasoreus groneri* spec. nov. For a more detailed characterization of the habitat see Danin (1988), Veste et al. (2005) and Breckle et al. (2008). – The night active agile beetle moves skilfully and "submerges" itself in the upper horizons of soft sand when it tries to escape after disturbance during the day. When the beetle digs into the sand it leaves no hole as known from many other inhabitants of this habitat (e. g. *Scarites* species of the *striatus* group or *Anthia sexmaculata*).

Phenology: Reproduction in late autumn/winter. Tenerals are known from spring (February to April).

Distribution range: Not well known. The species is described from Hedjaz (= Hijaz) in the western Arabian Peninsula (Fairmaire 1896), and Bousquet (2003a) lists it only from Saudi-Arabia. But Schatzmayr (1936) and Alfieri (1976) indicate the record of one specimen from Toussoun (close to Suez Canal). Chikatunov et al. (2006) published the first records for Israel.

Distribution in Israel: Exclusively in western Negev Sands (Holot Agur = Agur Sands, Holot Haluza = Khalutsa Sands, Holot Shunera = Shunra Sands but not known from Ya'ar Ramat Beka = Nokdim (= Beka) Plateau).

Taxonomic notes: The species is very variable in terms of body size, coloration and proportions (Figs 1d, e). We were not able to compare specimens

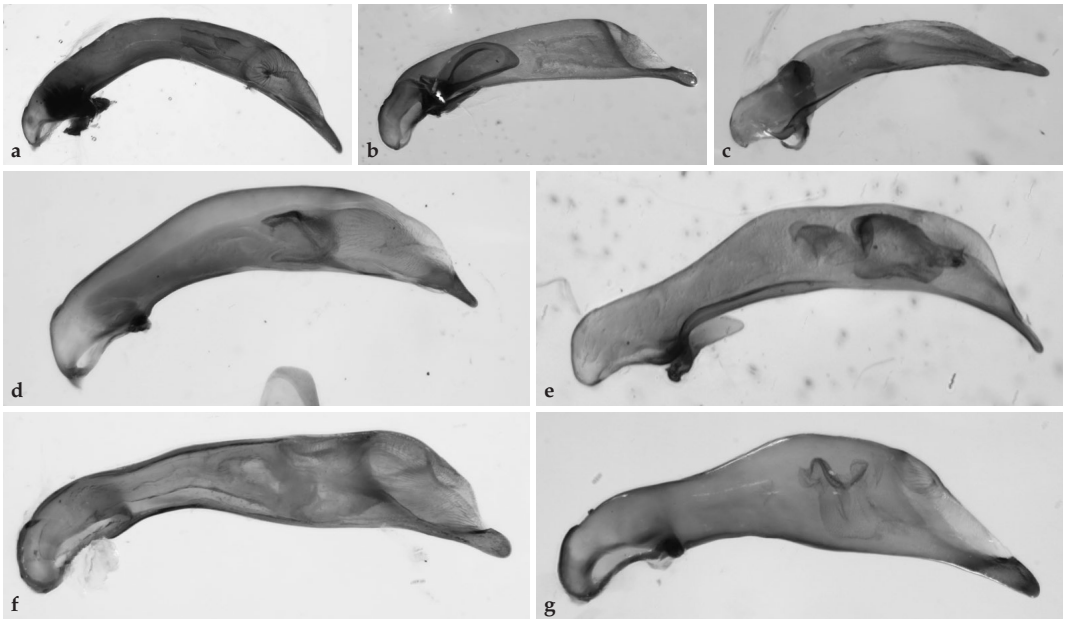

Fig. 3. Male genitalia (median lobe) of **a.** *Anaulacus ruficornis*; **b.** *Discoptera arabica*; **c.** *Tetragonoderus arcuatus*; **d.** *Masoreus orientalis*; **e.** *Masoreus affinis*; **f.** *Masoreus wetterhallii*; and **g.** *Masoreus aegyptiacus*.

from Israel with the type but compared them with a specimen from type locality preserved in ZMHB (labelled "Hedjaz Arabica"). The two long spurs of meso- and metatarsi are constantly serrulate or fimbriate but in some individuals the shorter spur seems to be smooth.

5. *Tetragonoderus arcuatus* Dejean, 1829

Dispersal power: Macropterous, flight active (own observation).

Habitat selection: On heavy soils close to water in semi-desert areas (Fig. 7a).

Phenology: Records from November to August with a maximum during winter (December, February) and spring (March, April). Perhaps a winter breeder which starts reproduction after the first strong rainfalls, with larval development until spring.

Distribution range: From Egypt to southeastern Asia and eastern Africa (Bousquet 2003a, Felix 2009).

Distribution in Israel: Known only from northern Negev and Arava Valley (Retamim, Yeroham (Yerokham), En Avdat (= Ein Ovdat) and En-Zin (= Ein Zin or Ein Tsin), Samar).

Taxonomic note: We compared individuals from Israel with the type specimen preserved in NHMP and did not find any notable differences. We are not able to distinguish this species from *T. intermedius* Solsky, 1874 (but see Felix 2009) which is recorded from southwestern and central Asia (Kryzhanovskij et al. 1995, Bousquet 2003b). Also, the specific rank of *Tetragonoderus aegyptiacus* Jedlička, 1952 is still unclear. The whole genus needs a revision, which should deal with both the African and the Palaearctic species because of the partial overlap of species stocks.

6. *Tetragonoderus sericatus* Dejean, 1829

Dispersal power: Macropterous (n = 6).

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: Eastern Africa from Egypt to South Africa (Csiki 1932, Felix 2009). The species was described from historical Egypt by Dejean (1829) without any further information about the location. Listed by some authors for Egypt (Csiki 1932, Schatzmayr 1936, Alfieri 1976) but not by Bousquet (2003b).

Distribution in Israel: No record.

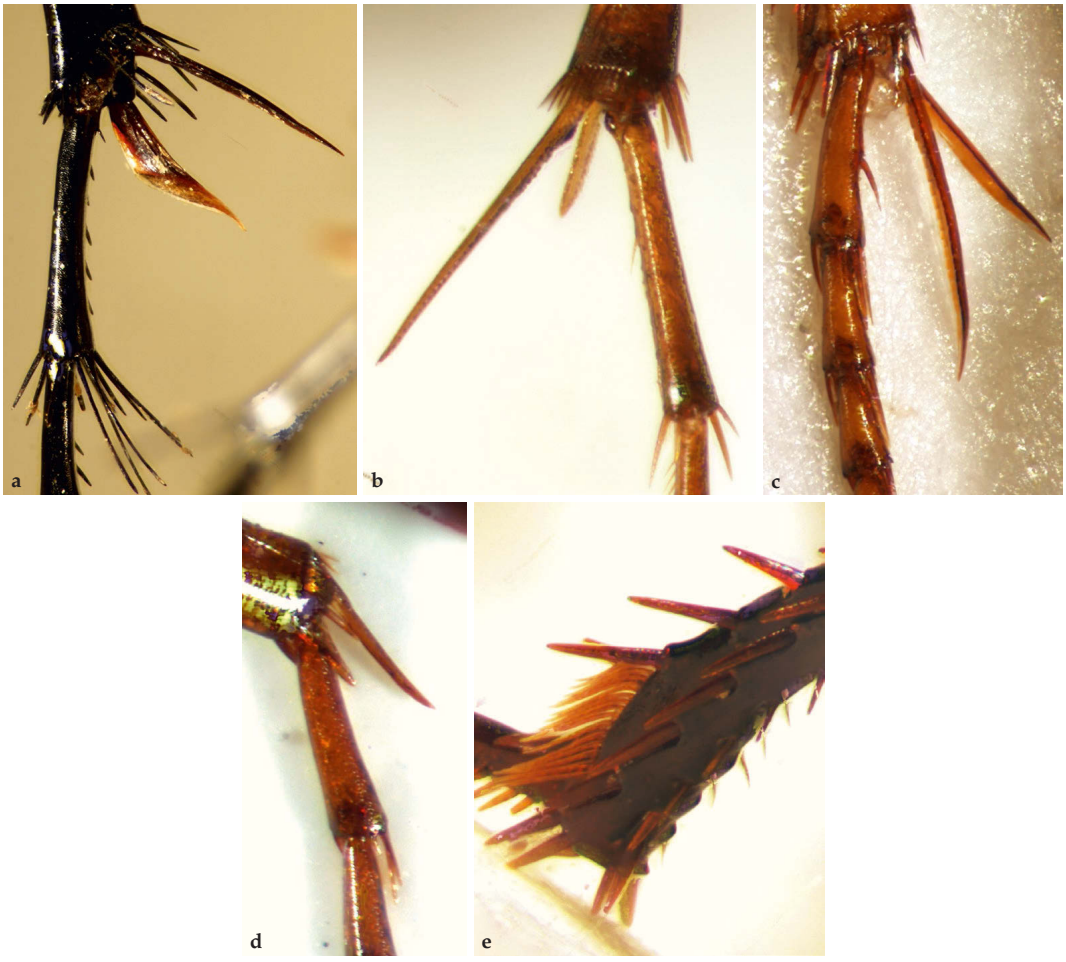

Fig. 4. Tibial spurs and setal brush of **a.** *Graphipterus* spec. (metatibia and tarsomeres 1 and 2, spur spoon-shaped with a pointed end); **b.** *Tetragonoderus arcuatus* (metatibia and tarsomeres 1 and 2, serrulate spurs); **c.** *Discoptera arabica* (mesotibia and -tarsus, long spur serrulate, shorter one not); **d.** *Masoreus affinis* (metatibia and -tarsus, spur smooth); and **e.** *Anaulacus ruficornis*, male (mesotarsus and tarsomere 1, setal brush).

7. *Tetragonoderus assuanensis* Mjöberg, 1905

Dispersal power: Unknown.

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: Two specimens known from Aswan (Mjöberg 1905).

Distribution in Israel: No record.

Taxonomic note: See remarks by Schatzmayr (1936: 94).

8. *Atlantomasoreus groneri* spec. nov.

Dispersal power: Brachypterous.

Habitat selection: Stenotopic species of shifting sand dunes in semi-arid climate (see "Habitat" in the species description below) (Fig. 7b).

Phenology: Reproduction in late autumn/early winter (after rainfall), larval development during winter. Tenerals known from March.

Distribution range: Up to now known only from Northern Negev Sands but occurrence in eastern Egypt is probable.

Taxonomic note: See description below.

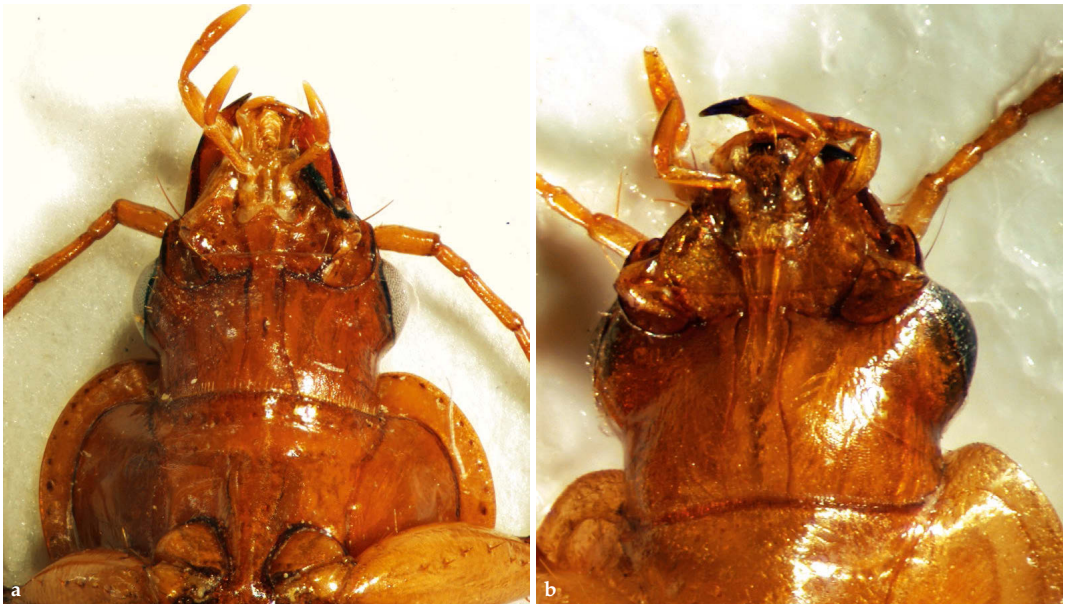

Fig. 5. Lower side of forebody of *Discoptera arabica* (mentum with tooth, left) and *Atlantomasoreus groneri* (mentum without tooth, right).

9. *Masoreus orientalis* Dejean, 1828

Dispersal power: Macropterous, flight active (personal observations, Chikatunov et al. 2006).

Habitat selection: Eurytopic species of habitats with good water availability in semi-arid and arid regions: from gardens and parks (e. g. areas around the apartments of the Field School En Gedi = Ein Gedi) to natural-like floodplain woodlands with *Tamarix* spec., springs or wadis (e. g. Nahal Boqeq, En'Avedat = Ein Ovdat).

Phenology: Unknown. We found the species mainly in early spring. We do not know tenerals.

Distribution range: From the Macaronesian Islands and continental North Africa, the Middle East to southern Asia; also south of the Sahel Zone (e. g. Chad) (Machado 1992, Bousquet 2003b, own observation).

Distribution in Israel: Verifiable records only from northern Negev to Arava Valley (esp. Dead Sea region but not from the Mediterranean region, cf. Chikatunov et al. 2006).

Taxonomic note: The nominate subspecies occurs in Israel; two endemic subspecies reported from the Macaronesian Islands (Mateu 1984).

10. *Masoreus affinis* Chaudoir, 1843

Dispersal power: Dimorphic (macropterous and brachypterous, Mateu 1984).

Habitat selection: A typical species of steppe habitats in the semi-arid zone on heavy soils (not on pure sand, but the soil can contain a proportion of sand) (cf. Danin 1988: 144 and 145; Fig. 8a). The species also lives in the wadis and the small plantations of exotic tree species close to the mentioned main habitat. In Israel the species is accompanied by some ground beetles (e. g. *Cymindis setifeensis* group, *C. suturalis* group, *Orthomus berytensis*, rarely *Ophonus syriacus*, the latter prefers soils with some sand content). A very similar species composition can also be found outside of the Levant (e. g. in central Tunisia, own observations).

Phenology: Reproduction in late autumn/early winter (after rainfall), larval development during winter. Tenerals known from February to April.

Distribution range: From the Canary Islands and Sicily throughout continental North Africa (from Morocco to Egypt) to the Levant.

Distribution in Israel: Several records from the northern Negev (where the species is abundant and widespread), southwards to Makhtés Ramon (= Makhtesh Ramon) (TAU and Wrase 2009), one

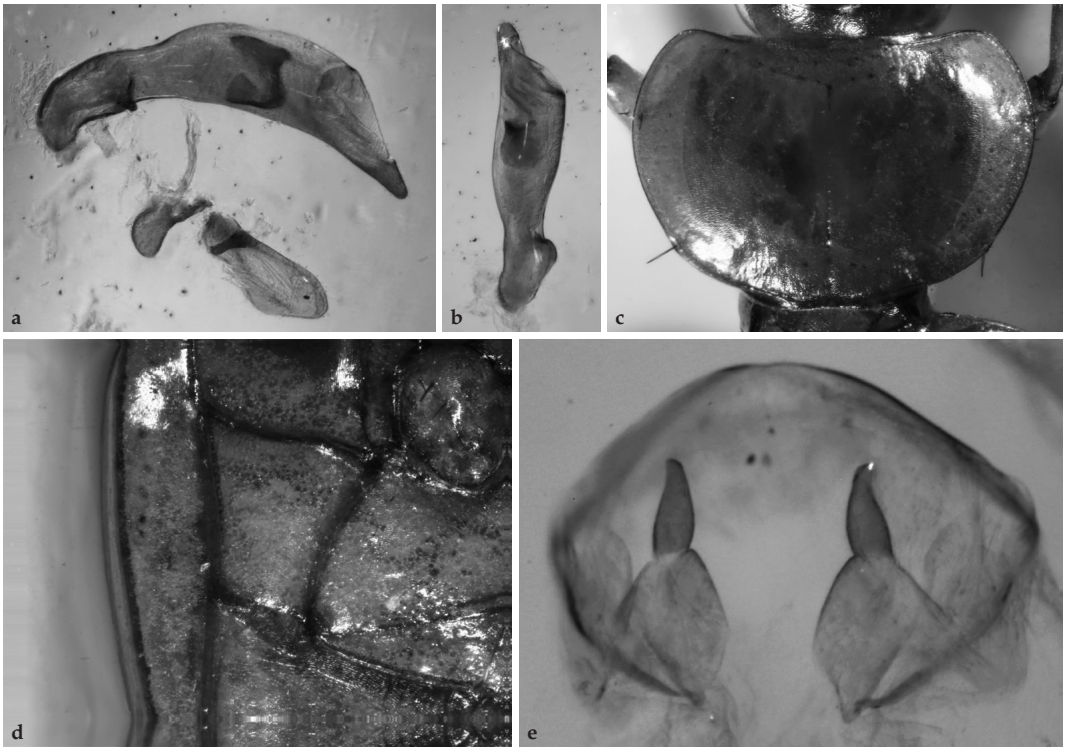

Fig. 6. *Atlantomasoreus groneri* spec. nov. **a.** male genitalia (median lobe), lateral view of left side; **b.** male genitalia (median lobe), dorsal view; **c.** pronotum; **d.** metepisternum; **e.** female genital (IXth) segment with gonocoxites and subgonocoxites.

old record from the Arava Valley (<Palestine / Ein Horb / 12.6.19 / leg. Bytinski-Salz>, TAU).

Taxonomic notes: In the Levant the nominate subspecies. On the Canary Islands the subspecies *arenicola* Wollaston, 1863. Species is similar to *Masoreus wetterhallii* (see below for further information).

11. *Masoreus wetterhallii* (Gyllenhal, 1831)

Dispersal power: Dimorphic (macropterous and brachypterous). At least in Central Europe, brachypterous individuals dominate (Lindroth 1985/1986, Desender 1989).

Habitat selection: In Europe a xerophilic species of dunes and poor sandy grassland, in Morocco also in the high mountains on compact soils (e. g. Jebel Tazzeka, 1900 m, own observation).

Phenology: Autumn breeder, larval development during winter, tenerals in spring and early summer (Lindroth 1945).

Distribution range: Palaearctic species, southwards to Northwest Africa (incl. Tunisia) and Greece.

Distribution in Israel: No verifiable record. The specimens listed by Bodenheimer (1937) under *M. wetterhallii* "var. *aegyptiacus* Dej." probably refer to *M. aegyptiacus*. Many records published prior to Mateu's (1984) revision must be carefully evaluated.

Taxonomic note: To help prevent misidentifications possible records of *M. wetterhallii* in the Levant must be evaluated by a study of the aedeagus. This species can easily be confused with *M. affinis* and *M. aegyptiacus* due to similarity and morphological variability of the exoskeleton of all three species. Mateu (1984) lists distinguishing external characters but not all of these are useful for reliable identification. *Masoreus wetterhallii* is a variable species with three known subspecies which are also characterized by (minor) differences in the male genitalia (Mateu 1984).

12. *Masoreus aegyptiacus* Dejean, 1828

Dispersal power: Dimorphic (macropterous and brachypterous, Mateu 1984).

Habitat selection: In sand dune habitats, not only on shifting sand but also in the shade of *Tamarix* spec. and *Retama raetam* and on interdunes with a biological crust (Fig. 8b).

Phenology: Reproduction in late autumn/early winter (after rainfall), larval development during winter. Tenerals known from February to April.

Distribution range: From Italy and Tunisia to Syria and Saudi-Arabia (Bousquet 2003b), also in Greece (Arndt et al. 2011).

Distribution in Israel: Verifiable records only from the dunes around and south of Tel Aviv (especially Holot Ashdod = Ashdod Dunes) to the northern Negev (e.g. Ezuz in the west, Bor Mashash = Be'er Mashas and Ya'ar Ramat Beka, Nokdim (= Beka) Plateau, in the east) and Arava Valley (Hazeva = Khatseva). Mateu (1984a) also indicates records north of Tel Aviv. In TAU one specimen from Tel Baruch Beach (29.8.1987, leg. Y. Hadar).

Taxonomic note: *Masoreus aegyptiacus* shows variable coloration and morphology (cf. Figs 2e,f), this is also true for the microsculpture and some other characters given by Mateu (1984). Without the study of the aedeagus an identification is difficult (or even impossible).

Atlantomasoreus groneri Assmann, Renan & Wrase, spec. nov.

Figs 1i, 2a, 5 (right), 6a–e, Table 1

Types. Holotype, male (TAU), and 56 paratypes (25 males and 31 females).

<Israel / Agur dunes / Oct. 2006 / Ittai Renan> (holotype), same data but <… / April 2006 / …> and <… / m 2006 / …>; <Israel / Holot Agur / 17.1.2008 / Ittai Re-

Table 1. Morphological characterization of the two Northwest African (N.A.) *Atlantomasoreus* species (*A. desertorum* and *A. orbipennis*), *Atlantomasoreus groneri* spec. nov. and *Masoreus* species.

Character	*Atlantomasoreus* species from N.A.	*Atlantomasoreus groneri* spec. nov.	*Masoreus* species
Antennae (length)	medium	short	medium
Pronotum shape	moderately transverse	strongly transverse	transverse
Posterior angles of pronotum	rounded	almost obliterate	pronounced
Posterior margin of pronotum	rounded or straight, not lobate	rounded, distinctly lobate	broadly sinuate laterally, strongly lobate
Metepisternum	short	short	long
Abdominal sternites	with hairs (about a dozen per segment)	with hairs (about a dozen per segment)	one pair of usual hairs per segment
Elytra	short-oval; humeri completely rounded	short-oval; humeri completely rounded	long-oval or short-parallel; humeri distinct
Profemur (ventral side, anterior margin)	3–4 bristles	3–5 bristles	2 bristles
Mesofemur (see profemur)	4 bristles (and transitions to spines)	4 bristles (and transitions to spines)	2 bristles
Metafemur (see profemur)	3–4 bristles	4–6 bristles	2 (1–3) bristles
Mesotibia, length of spurs	as long as tarsomere 1 or slightly longer	longer than tarsomere 1	shorter than tarsomere 1
Metatibia (posterior margin)	6–7 spines	3–6 spines	1–4 spines
Tarsal claws	smooth	smooth	smooth or denticulate (with few teeth)
Gonosubcoxid	large, weakly sclerotized	normal size, normally sclerotized	normal size, normally sclerotized
Gonocoxid	reduced	normal size	normal size
Bursa copulatrix / Receptaculum seminis	small	normal size	larger, form diverse

Fig. 7. Habitats of *Tetragonoderus arcuatus* (**a.** wadi with temporary ponds, Nature Reserve En'Avedat), *Atlantomasoreus groneri* spec. nov. and *Discoptera arabica* (**b.** sand dune landscape, Holot Haluza = Khalutsa Sands).

Fig. 8. Habitats of *Masoreus affinis* (**a.** steppe in northern Negev on cohesive soil, Nature Reserve Pura) and *Masoreus aegyptiacus* (**b.** coastal dunes, Holot Ashdod = Ashdod Dunes).

nan>; <Israel / Holot Haluza / 1.3.2008 / Ittai Renan>, same data but <... / 22.3.2008 / …>, <… / 5.4.2008 / …>, <… / 26.2.2011 / …> and <… / 1.4.2012 / …>; <Israel / Holot Haluza / 1.3.2008 / Ittai Renan>; "SW-Israel, Halutsa Sands, Holot, sw of Be'er Sheva / dunes, ~N 31°00', E 034°33' / 200-300 m, 22.III.2008, leg. Th. Assmann, 279"; <SW-Israel: northern Negev / Shunra Sands n of Shivta / 19.3.2013, sand dunes / leg. Th. Assmann>; "SW-Israel: Ya'ar Nakhal Sekher / sw Be'er Sheva, dunes / N 31°07', E 034°48' / ~300–350 m, 5./6.XII.2007 / leg. Th. Assmann, 266"; "SW-Israel, Agur Dunes: 222 / Be'er Milka near kmehin/Nizana / southwest of Be'er Sheva / dunes, N 30°56', E 34°24', 18.III.2007, leg. Th. Assmann" (CAW); <Israel (South distr.) / Negev, Khalutsa Sands / nr. Cerem Shalom vill. / SW Be'er Sheva 200 m / 31.066 N/34.466 E (dunes / under plants / in root balls) / 22.III.2008 D.W. Wrase [26].

Paratypes in TAU, CHD, COK, CRM, CSW, and ZSM (incl. CAB, CWB).

Diagnosis. A medium-sized, yellow-brownish and brachypterous species of Cyclosomini s. l.; antennae short; pronotum transverse, hind angles strongly rounded; elytra oval; metepisternum almost as long as wide; abdominal sternites III to VI with numerous setae; gonocoxite and gonosubcoxite of female genitalia well developed; median lobe of male genitalia with a large, strongly sclerotized copulatory piece.

Description

BL 4.0–6.2 mm, EW 2.2–4.0 mm. Whole body yellow-brownish, head in few individuals somewhat darkened; dorsal side dull, ventral side, especially abdominal sternites slightly shining and iridescent. Head moderately large, about ⅔ of width of pronotum (HW/PW: 0.67–0.76). Eyes protruding, their diameter twice as long as the scape (first antennal segment). Frontal furrows shallow. Clypeus more than twice as wide as long; anterior margin slightly concave. Labrum transverse; anterior margin concave, with 6–8 setae. Mandibles dorsally and laterally enlarged, with raised ridge; scrobe visible in dorsal view. Antennae short, 1/6 longer than pronotum wide; antennomere 1 with 1 regular seta (length of seta can exceed the length of the antennomere); antennomeres 2 and 3 with a ring of small apical setae; antennomeres 4–11 with apical ⅔ setose (pubescent). Distinct microsculpture with isodiametric to slightly transverse meshes; sculpticells flat to slightly convex. Mentum without tooth (Fig. 5). Penultimate maxillary palpomere at the base constricted and distally strongly enlarged, about half the length of the last palpomere (Fig. 5).

Pronotum strongly transverse (PL/PW: 0.61–0.68) (Fig. 6c). Anterior margin weakly concave; posterior margin strongly convex, slightly sinuate laterally, lobe slightly developed; hind angles almost obtuse, rounded; lateral margins strongly rounded, in front of hind angles straight. Distance between posterior setae ¼ shorter than distance between lateral setae (PW/PBaW: 1.2–1.3). Anterior and posterior margins beaded laterally, but not medially; lateral margins strongly beaded throughout length. Sulcus (median longitudinal impression) slightly impressed medially, obsolete to anterior and posterior margin. Basal foveae reduced; some shallow longitudinal grooves medially at the posterior margin. Distinct microsculpture with isodiametric to transverse meshes.

Elytra strongly convex, with completely rounded humeri, apex obliquely truncate, but slightly sinuate (EL/EW: 1.2–1.3). Striae impressed, slightly punctuated, intervals flat to slightly convex. Basal margin almost complete, sinuate. Microsculpture with isodiametric and longitudinal to transverse meshes concentrically orientated on small punctures.

Legs robust und short (Figs 1i, 2a and 5). Pro-, meso- and metafemora on the ventral anterior side with 3–5, 4 and 4–6 setae, respectively. Metatibia at posterior margin with 3–6 spines. Spurs of pro-, meso- and metatibia smooth and longer than tarsomere 1. In males, protarsi 1–3 slightly dilated and with biseriate adhesive vestiture ventrally. Claws smooth on the inner side.

Metepisternum weakly longer than wide (Fig. 6d). Abdominal sternites III to VI with numerous setae (5–15) spread over the entire sternite, some of them (especially at the posterior edge of each segment) long, exceeding the length of the given sternite. Abdominal sternite VII with one pair of long setae.

Median lobe of aedeagus (Figs 6a,b) constricted at the base and enlarged in the middle part, tip rounded; copulatory piece strongly sclerotized. Parameres relatively large, both broadly rounded at tip. Both gonocoxite and gonosubcoxite (gonocoxites 2 and 1 in the sense of Ball & Shpeley 2002) of female abdominal sternum IX well developed. Receptaculum seminis of normal size.

Comparisons. Members of the genus *Atlantomasoreus* Mateu, 1984 are listed in older literature under the genus name *Masoreus* but they differ by a set of character states (Mateu 1984a): (i) short metepisterna, (ii) yellow coloration, (iii) lobe at the posterior margin of pronotum short, (iv) elytra strongly rounded, (v) abdominal sternites with numerous setae (and not with a pair as in *Masoreus* species), (vi, vii) specific set of bristles and setae at the distal end of tibiae and the anterior ventral side of femora, respectively, (viii) weakly sclerotized gonapophysis with reduced parts. *Atlantomasorus groneri* spec. nov. shares most of these characters

with the other members of this genus (character states (i) to (vii)). Therefore, the affiliation of the new species as a member of the genus *Atlantomasoreus* is indisputable. However, the new species does not share the character states of the weakly sclerotized and (at least partly) reduced gonapophysis which is highlighted by Mateu (1984) but the female genital tract resembles representatives of the genus *Masoreus* (cf. Table 1).

Atlantomasoreus groneri spec. nov. can be distinguished from *A. desertorum* and *A. orbipennis* (Figs 1g,h) by numerous character states, especially (1) transverse pronotum, (2) wide head, (3) aedeagus of differing shape and with a large sclerotized copulatory piece, and (4) normally developed gonocoxites and gonosubcoxites (cf. Mateu 1984).

The new species is differentiated from the other cyclosomine species in the Levant by numerous character states (e. g. body size, lack of mental tooth, coloration, aedeagus shape and copulatory piece; see also identification key).

Etymology. It gives us great pleasure to dedicate this new species to our friend and coleopterologist Dr. Elli Groner, Ben Gurion University, who inspired generations of enthusiastic students for both entomology (especially coleopterology) and desert ecology in Israel.

Distribution. The species is only known from the Northern Negev Sands but we believe that it also occurs in the Isthmic Desert (Northeast Egypt: Sinai). The Egyptian-Israeli border crosses the sand dunes of the given region and there seems to be no reason for a natural delimitation of the distribution range west of Nizzana (= Nitsana). At least in Israel *Atlantomasoreus groneri* spec. nov. co-occurs with *Discoptera arabica* which is also recorded in eastern Egypt (Alfieri 1976).

Habitat. Stenotopic species of shifting sand dunes, especially on their slopes (Fig. 7b: foreground and center). The catching rates in un-baited pitfall traps were lower on the shifting crest and much lower on the interdunes with biological crusts (Fig. 7b: middle and background, right side). Catches under the canopy of shrubs and semi-shrubs, a specific microhabitat, were higher than apart from them (for a detailed characterization of the abiotic conditions under shrubs in the sand desert see Kidron 2010). A detailed description of the habitat will be given by Renan (in prep.). – A foregut analysis from two specimens revealed a predatory way of life (remnants of small arthropods, but not of plants).

Atlantomasoreus groneri spec. nov. co-occurs on the shifting sand dunes with the following ground beetles: *Discoptera arabica*; *Paradromius vagepictus*; *Anthia sexmaculata* (only on Ya'ar Nakhal Sekher and Shifta Dunes); at least one species each of the species groups of *Scarites striatus*, *Graphipterus serrator* and *Cymindis suturalis*.

Discussion

Exploration of the cyclosomine ground beetle fauna in the Levant

The first systematic overview of the beetle fauna of Israel is given by Bodenheimer (1937) who listed only two species of Cyclosomini s.l. (*Masoreus orientalis* and *M. aegyptiacus*, the latter still ranked as a "variation" of *M. wetterhallii*). For a long time, this group of ground beetles seems to have been ignored by carabidologists studying the fauna of Israel. In the Palaearctic Catalogue (Bousquet 2003a,b), for example, only one species of cyclosomines is listed for Israel (*Masoreus aeagyptiacus*). Chikatunov et al. (2006) and Wrase (2009: 912f) cite three additional species (*Discoptera arabica*, *Anaulacus ruficornis* and *Masoreus affinis*). Our survey based on field trips and the study of museum material revealed seven species altogether. A comparable recent "increase of species number" (and the discovery of a new species) is also known from the tribe Trechini in Israel (Assmann et al. 2012). Both results highlight the classification of Israel as less well-studied, at least in terms of carabidology (Schuldt et al. 2009). With the exception of *Atlantomasoreus groneri* spec. nov. which was detected in 2006 by one of us (IR) all other species are already represented by material in TAU, at least part of which was collected decades ago. Again, the situation for the tribe Trechini is very similar, as all species with the exception of *Trechus dayanae* Assmann & Wrase, 2012 were already documented by records in TAU. This finding highlights the importance of the TAU collection for the zoological inventory of Israel (and adjacent countries in the Levant).

Systematic position of *Atlantomasoreus groneri* spec. nov.

Mateu (1984) established the genus *Atlantomasoreus* for two species from northwestern Africa. The affiliation of *A. groneri* spec. nov. to this genus seems to be indisputable due to the numerous character states it shares with the two African species (e. g. Table 1). The similarities in the female genital tract of *A. groneri* spec. nov. place the genus *Atlantomasoreus* closer to the genus *Masoreus*. Therefore it is possible that *Atlantomasoreus* and *Masoreus* form a phylogenetic lineage which can be clearly separated at the morphological level from *Anaulacus* (bristles at the basis of antennomere 1, mesotibial setal brush,

mandible form etc., see identification key and Ball & Shpeley 2002). We therefore suggest the following systematic relationship: *Anaulacus* (*Masoreus* + *Atlantomasoreus*). This systematic concept differs from the one given by Ball & Shpeley (2002: 279) who believe that *Atlantomasoreus* is a sister taxon of a group comprising *Anaulacus* and the two genera *Masoreus* and *Leuropus*. The two alternative hypotheses can be tested by molecular studies which can incorporate further cyclosomine species from the Levant – also to resolve basal splits within the tribe.

Biogeography of Cyclosomini s. l. taxa in the Levant

Taxa which occur in the semi-arid zone around the core Saharian region are elements of the "peri-Saharian" zone (Vachon 1952). The members of this biogeographic group do not live in the extremely arid areas of the Sahara and many of the genera show remarkable range disjunctions. An example might be the scorpion genus *Microbuthus* which occurs in two species in Morocco and Mauritania; the other three species populate the eastern edge of the Sahara region in Eritrea, Djibouti and Egypt (Lourenço & Duhem 2009).

Atlantomasoreus shows a similar disjunct distribution range and is restricted to a habitat in the semi-arid zone. Despite the fact that the species is probably overlooked in eastern Egypt, a large distribution range (e. g. west of the Nile) seems to be unlikely because North Africa is relatively well-studied from a carabidological point of view (see also species accumulation curves in Schuldt et al. 2009 and Homburg et al. 2013). For most of the North African countries, annotated species lists of carabids as well as identification keys for many ground beetle groups have been available for a long time (e. g. Bedel 1895–1925, Peyerimhoff 1907, Schatzmayr 1936, Alfieri 1976, Mateu 1984, El-Moursy et al. 2001, Abdel-Dayem 2004, Zalat et al. 2008, Abdel-Dayem 2012). Therefore, we do not hesitate to classify the genus *Atlantomasoreus* as a biogeographical element of the peri-Saharian zone with a disjunct distribution range.

Anthia sexmaculata (which co-occurs on one site with *A. groneri* spec. nov.) and *Masoreus affinis* also live in the peri-Saharian zone. The latter shows a more continuous distribution range – from the Canary Islands to the Levant (Mateu 1984, Bousquet 2003b). At least one species belongs to the Mediterranean elements (*Masoreus aegyptiacus*). The distribution ranges (and/or the systematics) of other taxa (e. g. *Tetragonoderus arcuatus*, *Discoptera arabica*, *Masoreus orientalis*) are not well known and we cannot classify the species as members of specific biogeographical distribution types.

Conservation biology

The discovery of a new Cyclosomini s. l. species in the dunes of the Northern Negev which are connected to large sand areas in the Sinai and thus to those of the Sahara was surprising, as the other Levantine species of this tribe were already described long ago. Obviously, the large sand areas in southwestern Israel seem to be a neglected region, at least in terms of zoology, because even a new reptile species, the Negev tortoise (*Testudo werneri*), was described just a decade ago (Perälä 2001). This critically endangered species is restricted to a distribution range from the Nile through northern Sinai to northwestern Negev (Perälä 2006). A similar distribution range is possible for *Atlantomasoreus groneri* spec. nov. However, we believe that the range is smaller because of (i) the lack of records from northern Africa (see above) and (ii) the stenotopy of the species in combination with the low power of dispersal. The species is brachypterous and shows a low tendency for locomotory activity. Both traits are, in general, determinants for small distribution ranges in ground beetles (Brandmayr 1991, Homburg et al. 2013).

Israel hosts the only known populations of *A. groneri* nov. spec. and therefore has a national responsibility for the worldwide conservation of this species (for concept of national responsibility in nature conservation see Schnittler & Günther 1999, Gauthier et al. 2010). Several threats endanger the sand dunes in the southwestern part of Israel which form the habitat of *A. groneri* spec. nov. (sand quarrying, expansion of agricultural area, intensive grazing and lack of grazing, urbanization and "oasis effects"; Bouskila 2004, own observation). Dunes without vegetation as a result of overgrazing (for overgrazing of the Egyptian part of the dune complex see Seifan 2009) as well as habitats with a thick biological crust seem not to be colonized by the carabid (see above). Therefore, long-term preservation of *A. groneri* spec. nov. and of other species in its habitat (e. g. the ground beetles and endangered reptiles mentioned above) will depend on the extensive grazing of sand dunes and the general end of sand dune habitat loss.

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