Contributions to the centipede fauna of Tunisia with three first records for the country (Myriapoda: Chilopoda)

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Abstract. During two 14-day field trips in Tunisia in 2015 and 2016, 92 specimens from 22 centipede species were collected. Most of the species (10) belong to Geophilomorpha, 6 to Lithobiomorpha, 5 to Scolopendromorpha, and 1 to Scutigeromorpha. Three species, *Geophilus* cf. *piae* Minelli, 1982, *Lithobius* cf. *crassipesoides* Voigtländer, Iorio, Decker & Spelda, 2017, and *Lithobius microdon* Latzel, 1886 are new for the centipede fauna of Tunisia. Short, illustrated descriptions of all species are given. For the Tunisian specimen of *Lithobius* cf. *crassipesoides* a molecular analysis was performed with partial COI mtDNA.

Keywords. Arthropoda, barcode, faunistic, morphology, North Africa

1 Introduction

The Mediterranean North African region came into the focus of research on myriapods at the middle of the 19th century (BRANDT 1841, LUCAS 1846).

The first records of Tunisian centipedes were given by POCOCK (1892) and SILVESTRI (1896), followed by other authors describing new species based on material collected by different people, mostly preserved in museum collections. Particularly noteworthy here are the works of ATTEMS (1899, 1903a, 1908, 1927a), VERHOEFF (1891, 1893, 1899, 1901, 1936, 1938), and especially BRÖLEMANN (e. g. 1904, 1924a, b, 1930, 1931a, b, 1932). The latter carried out intensive research on the exploration of the North African myriapod fauna and was also the first to summarize all data of this group in checklists of Morocco, Algeria, and Tunisia (BRÖLEMANN 1921). Some years later, he also provided an identification key for centipedes from these countries (BRÖLEMANN 1932).

In the second half of the 20th century, only a few works by TURK (1955), DOBRORUKA (1968), SERRA (1979), ZAPPAROLI (1984a, b, 1985a, b), and LEWIS (1986), were published. Only in recent years, research on the Tunisian myriapod fauna has received a significant boost again (AKKARI 2005, 2010, and references below). Currently, extensive work has been published on the fauna of Diplopoda (e. g. AKKARI et al. 2010, AKKARI 2013), but also on the Scolopendromorpha of Tunisia (AKKARI et al. 2008). A summary of the knowledge on the Geophilomorpha is in progress (AKKARI et al., in prep.).

Over the last 150 years, the systematics and taxonomic status of many species recorded in Tunisia underwent an eventful history of changes. However, revisions are still pending for many species and species

groups. It is also likely that the species spectrum of Tunisia is far from being completely discovered. Recent studies have repeatedly provided new records and and many new species have been described (e. g. AKKARI & VOIGTLÄNDER 2007, AKKARI & ENGHOFF 2008, 2011, 2012, AKKARI & MAURIÈS 2018). Therefore, it can be expected that each comprehensive collection will yield new insights into taxonomy, systematics, faunistics or into ecology of the Tunisian species. Especially urban and agricultural habitats are still yet unexplored.

Therefore, the two 14-day field trips in 2015 and 2016 were primarily aimed to further clarify the distribution of the species within the country as well as to increase knowledge about their ecological preferences.

2 Material and Methods

2.1 Specimen collecting, sample sites and preservation

The material derives from two field trips to Tunisia in March to April 2015 by Hans Pohl and October 2016 by Hans Pohl and Hans Reip. In 2015, centipedes were found at 7 of 12 and in 2016 at 8 of 19 visited locations (Fig. 1).

The climate zones of Tunisia are diverse and ranging from humid to arid and desertic. According the I.N.R.G.R.E.F. Carte Bioclimatique de la Tunisie (I.N.R.G.R.E.F. 2002), the material was mainly collected in the middle and lower semi-arid zone around Nabeul and Zaghouan (Fig. 1B), in the lower arid zone around Matmata (Fig. 1C) and in the upper Saharian zone south of Douz (Fig. 1C).

Sites are listed and described according to the following standard: consecutive number (bold): Tunisian government region; locality, possible details; GPS (WGS84) position; altitude in metres above sea level (masl); habitat – microhabitat; sampling date; collector(s). The sites are sorted from North to South which means from Mediterranean to arid areas.

Site 1: Nabeul; Cap Bon, west of Menzel Horr; 36.729°N, 10.931°E; 10 masl; swamp, slope with *Eucalyptus*; 3.-4.IV.2015; leg. H. Pohl.

Site 2: Nabeul; Cap Bon, Somâa, W Parcous de santé petite boucle; 36.525°N, 10.731°E; 100 masl; older *Pinus pinea* forest – in litter; 20.X.2016; leg. H. Reip & H. Pohl.

Site 3: Nabeul; Cap Bon, Ain Kmicha; 36.510°N, 10.667°E; 160 masl; young *Pinus pinea* forest on sandy soil – in litter; 19.X.2016; leg. H. Reip & H. Pohl.

Site 4: Zaghouan; Parc National Djebel Zaghouan, northwestern border, below escarpment; 36.374°N, 10.092°E; 400 masl; *Quercus ilex* mixed forest – in leave litter between stones; 18.X.2016; leg. H. Reip & H. Pohl.

Site 5: Zaghouan; Parc National Djebel Zaghouan, street towards summit; 36.365°N, 10.108°E; 670 masl; *Quercus ilex* mixed forest – in leave litter between stones; 18.X.2016; leg. H. Reip & H. Pohl.

Site 6: Zaghouan; southeast of Parc National Djebel Zaghouan, El Jouff; 36.331°N, 10.158°E; 300 masl; overgrazed slope with stones and little soil cover; 18.X.2016; leg. H. Reip & H. Pohl.

Site 7: Sousse; Hammam Bent Djedidi towards Hammamet, on the outskirts; 36.399°N, 10.390°E; 130 masl; lime-sandstone-dry slope with *Tetraclinis articulata*, *Olea europaea* and others – under stones and in litter; 19.X.2016; leg. H. Reip & H. Pohl.

Site 8: Kairouan, east of Oueslatia; 35.832°N, 9.655°E; 500 masl; *Pinus* forest with diverse deciduous shrubs – in litter and under stones; 17.X.2016; leg. H. Reip & H. Pohl.

Site 9: Gabès; Matmata, surroundings; 33.551°N, 9.970°E; 400 masl; rocky slope; 30.-31.III.2015; leg. H. Pohl.

Site 10: Gabès; Matmata towards Matmata Nouvelle, on the outskirts; 33.550°N, 9.970°E; 400 masl; steep, sandy desert/dry landscape with plant tussocks – under stones, 15.X.2016; leg. H. Reip & H. Pohl.

Site 11: Gabès; Matmata, west of Tamezret; 33.526°N, 9.819°E; 310 masl; rocky wadi; 31.III.2015; leg. H. Pohl.

Site 12: Gabès; Matmata, northeastern of Techine; 33,495°N, 10.035°E; 400 masl; rocky wadi, small pond; 1.-2.IV.2015; leg. H. Pohl.

Site 13: Medenine; southeastern of Toujane; 33.350°N, 10.162°E; 480 masl; rocky slope, sparse vegetation; 1.IV.2015; leg. H. Pohl.

Site 14: Kebili; Douz, south of Parc National de Jbil; 33.000°N, 9.043°E; 130 masl; dunes; 25.-27.III.2015; leg. H. Pohl.

Site 15: Kebili; Tataouine, Ksar Ghilane, east of Parc National de Jbil nearby Fort; 33.006°N, 9.610°E; 220 masl; dunes, dense stand of *Aristida pungens*; 29.III.2015; leg. H. Pohl.

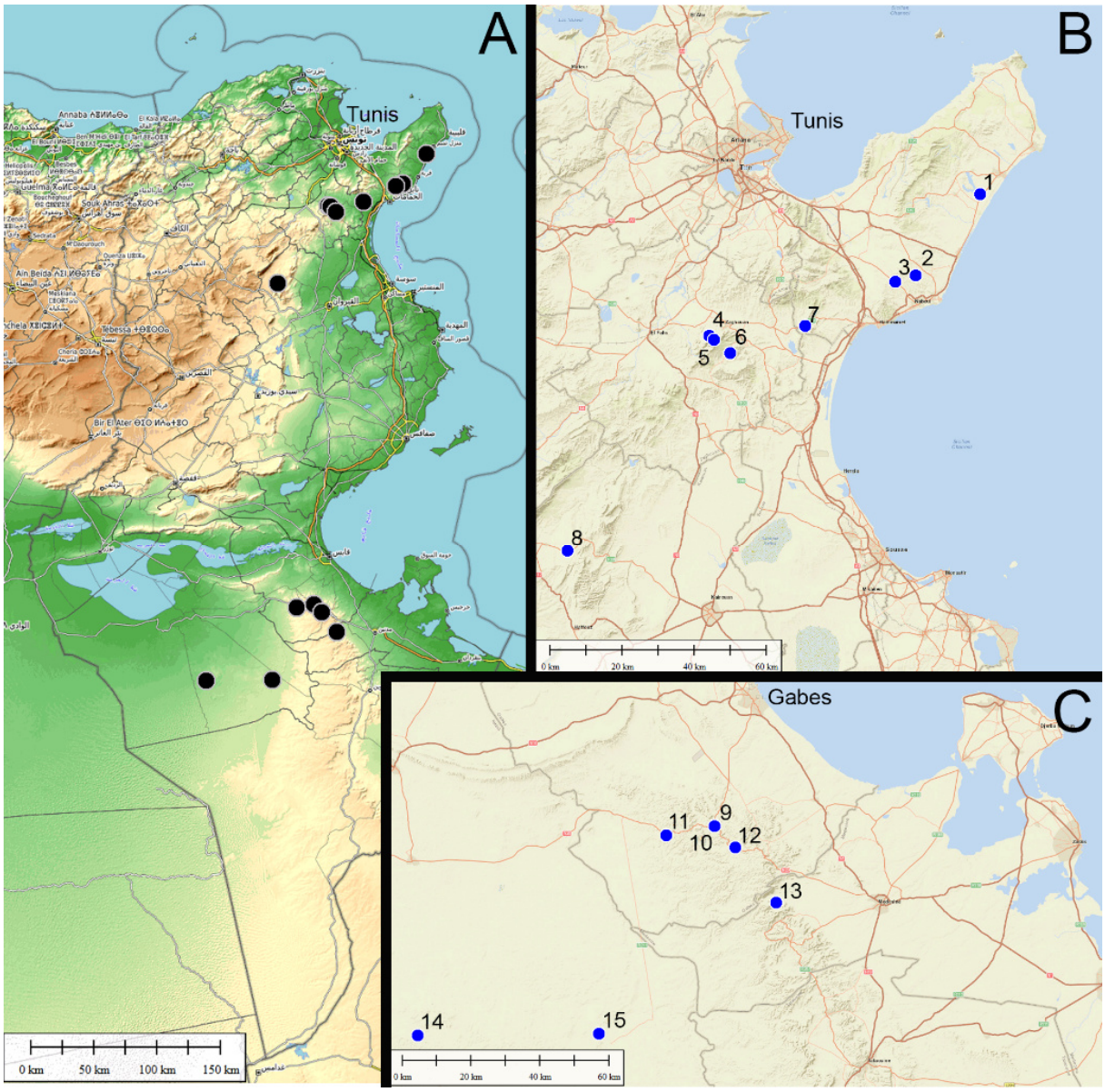

Figure 1: Collection sites in Tunisia. **A** Overview. **B** sites around Nabeul and Zaghouan. **C** sites around Matmata and Douz.

All material was collected by hand, stored in 70% ethanol and after determination partially transferred into 96% ethanol.

The material collected by H. Reip and H. Pohl is deposited in the Senckenberg Museum of Natural History Görlitz (labeled with SMNG-VNR) and the material solely collected by H. Pohl is deposited in the collection of the Phyletic Museum Jena (JPM, without number).

2.2 Illustrations

Preserved specimens were imaged and measured with a Leica DM5500B DIC microscope and Leica M165C stereomicroscope, both with Leica DFC295 camera. Focus-stacked images were assembled from 25-40 source images using the software package Leica® Application Suite 4.5. All images and plates were processed and assembled with Adobe Photoshop CS6.

Collection site distribution maps were produced with Global Mapper 18 and edited with Adobe Photoshop CS6.

2.3 Terminology

The terminology of external morphology follows BONATO et al. (2010).

2.4 General descriptions

The General descriptions of Geophilomorpha and Scolopendromorpha combine morphological characters following ATTEMS (1929, 1930), ChiloKey (BONATO et al. 2014) and AKKARI et al. (2008). Cases of divergence of the examined Tunisian animals are specifically listed (noted as: Individual description). Drawings are based on our specimens, if not mentioned separately. In Geophilomorpha, the number of leg pairs is given 1st for the species in general (according to ATTEMS 1929) and 2nd specially indicated for Tunisian specimens (according to AKKARI et al. in prep.).

2.5 Abbreviations

In the following text we used the subsequent abbreviations:
lp = leg pair(s),
VaC = ventral-anterior spine of coxa of leg pair 15,
VmC = ventral median spine of coxa,
DaP = dorsal anterior spine of prefemur,
T = tergite.

2.6 DNA extraction and molecular analysis

DNA was extracted from 2 legs each of one female specimen of *Lithobius* cf. *crassipesoides* (SMNG-VNR 017298-1). Total genomic DNA was extracted using the Qiagen DNAeasy Blood & Tissue kit following the standard protocol except that tissue was incubated for 48 h. All specimens were later deposited in the collections of the SMNG.

Polymerase chain reaction (PCR) was used for amplifying the COI barcode fragment using the primer pair LCO1490 and HCO2198 (FOLMER et al. 1994). The following thermocycling profile was used to amplify fragments of COI: predenaturation at 95 °C for 1 min, 35 cycles of 40 s at 94 °C, 40 s at 51 °C, and 1 min at 72 °C, final extension step for 5 min at 72 °C. All PCR mixes had a total volume of 10 µL and contained 1 µL template, 0.1 mM of each primer, 4 × 0.15mM dNTPs [Peqlab], 1 × PCR Buffer containing 2 mM MgCl2

[Peqlab], and 0.2u Polymerase [Peqlab]. All fragments were sequenced in both directions by Biodiversity and Climate Laboratory Centre, Frankfurt, Germany.

The new sequence was deposited in GenBank (accession number MZ321819).

2.7 Alignment and molecular COI-analysis

The sequences were aligned by hand in ClustalX ver. 1.83 (CHENNA et al. 2003). The previously 36 sequences used in VOIGTLÄNDER et al. (2017) were used and an additional sequence for *L. crassipes* from Hungary (GANSKE et al. 2020) was downloaded from GenBank. The final dataset for the molecular analysis included 38 sequences and the alignments consisted of 657 bp (COI mtDNA).

The clustering analyses were conducted in MEGA X (KUMAR et al. 2018). The relationship tree (Fig. 6) was inferred using the Neighbor-Joining method (SAITOU & NEI 1987). The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the tree. The evolutionary distances were computed using the p-distance method (NEI & KUMAR 2000) and are in the units of the number of base differences per site. Codon positions included were 1st+2nd+3rd. All ambiguous positions were removed for each sequence pair (pairwise deletion option). The final tree was edited using Adobe Illustrator. Mean uncorrected pairwise distances between terminals (transformed into percentages) were determined using MEGA X.

3 Results

During the two 14-day field trips, 92 individuals from 22 centipede species were collected. Most of the species (10) belong to Geophilomorpha, 3 to Lithobiomorpha, 5 to Scolopendromorpha, and 1 to Scutigeromorpha. Table 1 gives an overview of the species distribution on the sites.

Order Geophilomorpha

Family Dignathodontidae

Dignathodon microcephalus (Lucas, 1846)

Material examined: Site 10: 1 ♂ (75 lp), 2 ♀♀ (77, 79 lp) SMNG-VNR 017293-3.

General description: According to ATTEMS (1929: 240-241, fig. 201) and ChiloKey (BONATO et al. 2014). Light-yellow to reddish-yellow, head and forcipules darker. Length up to 60 mm, width up to 1.2 mm. Number of leg pairs 65-85 (♂) / 68-89 (♀); in Tunisia 79-83 (♂) / 85-87 (♀). Anterior body part fibre-like, abounding, but short bristled. Head very small, wider than long (Fig. 2A). Intermediate part of labrum with subconical and stout tubercles. First maxillae without telopodital lappets, coxal projections distinctly separated. Pretarsus of second maxillae very small. Forcipular coxosternite with chitin-lines (Fig. 2B), reaching the condyles. Forcipules not reaching to the margin of the head. Tarsungulum with 2 long denticles near the tip. Forcipular tergite as wide as body. Tergites without furrows, sometimes with a week median line. Sternites longer than broad, without pore groups or carpophagous pit. Coxal organs of terminal part of trunk open into pits covered by lateral margin of metasternite (Fig. 2C). Metasternite of the ultimate leg-bearing segment wider than long, trapezoid. Tarsus of ultimate leg pairs bipartite with or without pretarsus. Ultimate leg pairs strongly swollen in both sexes.

Table 1: Species distribution and number of specimens at the Tunisian sites investigated. Grey marked = most species-rich sites and most frequent species. n_{ind}. = number of individuals; n_{site} = number of sites inhabited.

	Sites																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	n_{ind}	n_{site}
Dignathodon microcephalus (Lucas, 1846)										3						3	1
Henia pulchella (Meinert, 1870)					7											7	1
Gnathoribautia punctiventris (Newport, 1844)				4	3			1								8	2
Pachymerium ferrugineum (C. L. Koch, 1835)	4	1			5		2		3	3	2					20	7
Geophilus cf. *piae* Minelli, 1983					1											1	1
Himantarium mediterraneum Meinert, 1870									1	1						2	2
Mesocanthus albus Meinert, 1870										4						4	1
Polyporogaster tunetana Verhoeff, 1899														1		1	1
Orya barbarica (Gervais, 1835)	1								3	6	2	1	2			15	6
Nannophilus eximius (Meinert, 1870)										1						1	1
Eupolybothrus nudicornis (Gervais, 1837)	1															1	1
Lithobius microdon Latzel, 1886										3						3	1
Lithobius castaneus Newport, 1844	1			1	1											3	3
Lithobius cf. *lusitanus* Verhoeff, 1925					8											8	1
Lithobius forficatus (Linnaeus, 1758)			1													1	1
Lithobius cf. *crassipesoides* Voigtländer et al., 2017			1													1	1
Scolopendra canidens Newport, 1844										2						2	1
Cormocephalus gervaisianus (C. L. Koch, 1841)						1	1									2	2
Otostigmus spinicaudus Brölemann, 1902									2	1	1				2	6	4
Cryptops punicus Silvestri, 1896	1			1	3			1								6	4
Cryptops trisulcatus Brölemann, 1902	1				3											4	2
Scutigera coleoptrata (Linnaeus, 1758)									1							1	1
∑ Number of specimens	9	1	2	6	31	1	3	2	10	24	5	1	2	1	2	92	
∑ Number of species	6	1	2	3	8	1	2	2	5	9	3	1	1	1	1	22	

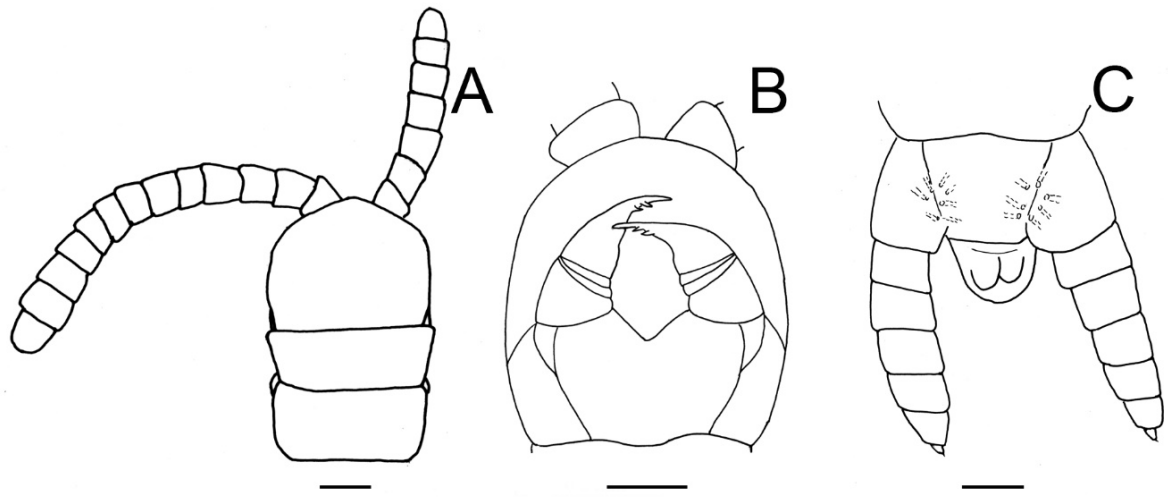

Figure 2: *Dignathodon microcephalus*: **A** Anterior body dorsal (right antenna deformed). **B** Head ventral, forcipular coxosternite and forcipules. **C** Terminal segments and ultimate leg pair, ♀, ventral. Scale bar: 100 µm (**A**, **B**, **C**).

Henia pulchella (Meinert, 1870)

Material examined: Site 5: 2 ♂♂ (57 lp), 5 ♀♀ (59, 3x 61, 65 lp) SMNG-VNR 017227-1.

General description: According to ATTEMS (1929: 234) and ChiloKey (BONATO et al. 2014). Yellow, adults with 2 to 4 dorsal dark longitudinal stripes. Number of leg pairs 53 (♂) to 63 (♀); in Tunisia 54-55 (♂) / 55 (♀), the present records extend the number of leg pairs up to 65 (♀). Length up to 32 mm. Head wider than long, with transverse suture. First maxillae with coxal projections distinctly separated. Pretarsus of second maxillae without spines or filaments. Forcipular coxosternite much wider than long, anterior margin concave without denticles; chitin-lines reaching the condyles. Forcipules do not reach the anterior margin of the head and the cephalic shield covers them lateral completely. Intermediate part of labrum with strong denticles (Plate 1A). Trunk metasternites with centered pore-fields (with exception of the penultimate) mostly biscuit-shaped, at the lateral margins accompanied by a furrow. Without carpophagus pit. Ultimate leg pairs about as long as the penultimate, distinctly swollen in male. Without pretarsus, at most a minute spine.

Family Geophilidae

Gnathoribautia punctiventris (Newport, 1844)

Material examined: Site 8: 1 ♀ (81 lp) SMNG-VNR 017294-2; Site 4: 3 ♂♂ (75, 75, 75 lp), 1 ♂ (73 lp) SMNG-VNR 017296-1; Site 5: 2 ♀ (75, 77 lp), 1 juv. (75 lp) SMNG-VNR 017227-3.

General description: According to ATTEMS (1929: 307-308, as *Geophilus bonensis* Meinert, 1870) and ChiloKey (BONATO et al. 2014). Reddish-yellow, head and T1 brownish. Length 30 to 55 mm and width 1.8 mm. Number of leg pairs 71-79; in Tunisia 73 (♂) / 73-75 (♀). The present records extend the number to

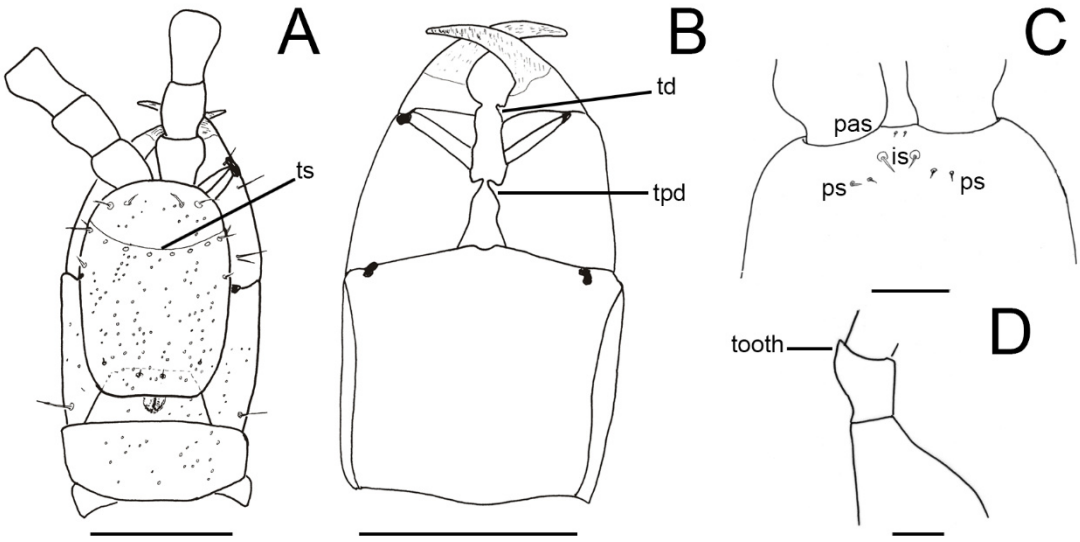

Figure 3: *Gnathoribautia punctiventris*: **A** Head dorsal with transverse suture (ts). **B** Forcipules, trochanteroprefemur with strongly prominent denticle (tpd), tarsungulum with a small denticle (td). **C** Clypeus (ventral view) with post-antennary setae (pas), intermediate setae (is), posterior setae (ps). **D** Article II of 2nd maxillae. Scale bars: 1 mm (**A**, **B**), 0.2 mm (**C**, **D**).

up to 81 in females. Head much longer than wide, with distinct transverse suture (Fig. 3A). Forcipules (Fig. 3B) considerable surmount the margin of the head, concavity smooth; tarsungulum with a small denticle, trochanteroprefemur with strongly prominent denticle; coxosternite without chitin-lines. Clypeus (Fig. 3C) with two very small post-antennary setae (pas) directly of the edge of clypeus, a pair of intermediate setae (is), each arising from a rounded, unpigmented clypeal area and beside each two setae (ps) in smaller unpigmented areas. Labrum at the intermediate part with about 12 tubercles, on the lateral part with bristles. First maxillae with 2 pairs of long telopodital lappets. Article II of the second maxillae lateral with a distal tooth (Fig. 3D). Ultimate leg pairs densely pilose, without pretarsus, distinctly swollen in both sexes.

Remark: CRABILL (1962) synonymized the older name *Necrophloeophagus punctiventris* Newport, 1844 with the younger name *Geophilus bonensis* Meinert, 1870 and already moved it implicitly to the genus *Gnathoribautia*. According to the Opinion 2452 (Case 3680) of the International Commission of Zoological Nomenclature is *Necrophloeophagus punctiventris* Newport, 1844 a senior synonym of *Geophilus bonensis* Meinert, 1870 and the latter can't be retained as valid (ICZN 2020a, b).

Pachymerium ferrugineum (C. L. Koch, 1835)

Material examined: Site 2: 1 ♂ (51 lp) SMNG-VNR 017299-1; Site 5: 3 ♂♂ (51, 53, 53 lp), 2 ♀♀ (55 lp) SMNG-VNR 017227-4; Site 7: 1 ♂ (53 lp), 1 ♀ (53 lp) SMNG-VNR 017297-1; Site 10: 2 ♂♂ (53 lp), 1 juv. (53 lp) SMNG-VNR 017293-1; Collection JPM: Site 1: 2 ♂♂ (49 lp), 2 ♀♀ (53 lp); Site 9: 3 ♀♀ (55 lp); Site 11: 2 ♂♂ (53, 55 lp).

General description: According to ATTEMS (1929: 245-246, figs 202, 203, 205) and ChiloKey (BONATO et al. 2014). Reddish-yellow, head brownish. Length 30 to 42 mm and width 0.7 to 1.3 mm. Number of leg pairs 41-55 (♂) / 43-57 (♀); in Tunisia 47-57 (♂) / 49-63 (♀). Head much longer than wide (Fig. 4A); without transverse suture, but a yellowish band with puncta runs transversely on the anterior part of the head and posterior are rows of spots lying in two longitudinal, light coloured, shallow depressions (Fig. 4B). Forcipules considerable surmount the margin of the head, concavity smooth; trochanteroprefemur with short denticle, tarsungulum with small basal denticle. Forcipular coxosternite moderately wider than long with very abridged chitin-lines pointing lateral to the condyles; anterior margin with two prominent denticles (Fig. 4C). Intermediate part of labrum with about 4 to 6 tubercles and 4 fringed denticles on each side, lateral parts with up to 15 bristles (Fig. 4D). First maxillae with 2 pairs of long telopodital lappets. Second maxillae with subconical, curved and apically pointed pretarsus. Clypeus (Fig. 4E) with one pair of post-antennary (pas), a pair of intermediate setae (is), each setae arises from a rounded, unpigmented clypeal area, and 3 groups of posterior setae (ps) with 2+2 or 3+3 lateral setae and a pair of more distant posterior pair of setae, which is located further posteriad than in *Geophilus*. Trunk metasternites without carpophagus pit, with pore-fields as a transverse, elliptic band in the posterior part and a paired pore-field in the anterior part. Metasternite of the ultimate leg-bearing segment about as long as wide, wider than penultimate metasternite, posteriorly narrowed. Ultimate leg pairs very long, much longer than penultimate, distinctly swollen in male; coxal pores very numerous (more than 10), distributed over the whole surface of coxopleuron; telopodite with pointed claw.

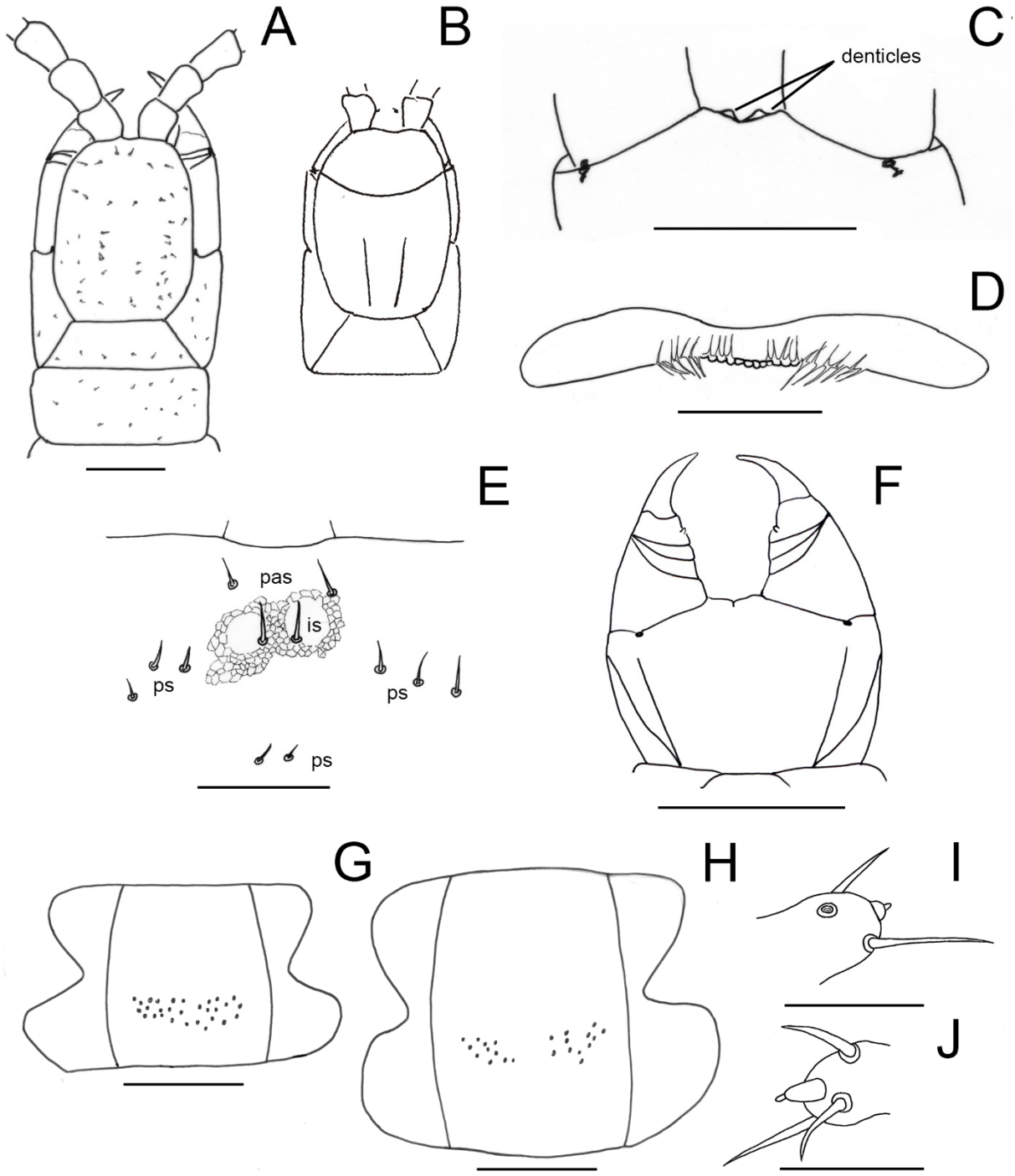

Figure 4: A-E *Pachymerium ferrugineum*: **A** Head dorsal **B** Scheme of the "lines" of the head. **C** basal part of forcipular coxosternite with two denticles. **D** Labrum. **E** Clypeal area with post-antennary (pas), intermediate (is) and posterior setae (ps). **F-J** *Geophilus* cf. *piae*: **F** Forcipules. **G** Sternite IV. **H** Sternite XIII. **I-J** Distal part of 2nd maxilla: **I** right, ventral view. **J** left, ventromedial view. Scale bars: = 0.5 mm (**A**, **C**, **F**, **G**, **H**), 0.1 mm (**D**), not to scale (**B**).

Geophilus cf. *piae* Minelli, 1983

Material examined: Site 5: 1 ♂ (37 lp) SMNG-VNR 017227-1.

General description: According to MINELLI (1983: 6-8, figs 1, 2) and ChiloKey (BONATO et al. 2014). Yellow. Length 9 mm and width 0.35 mm. Number of leg pairs 35-37. Head about as long as wide. Antennae less than 3 times as long as the head width. Clypeus with 4 pairs of setae, no clypeal area. Labrum with tubercles on the intermediate part only, no bristles on the lateral parts. First maxillae with 2 pairs of lappets. Pretarsus of second maxillae small, nearly as long as it's wide. Forcipular coxosternite wider than long (Fig. 4F). Forcipules do not reach the tip of the head; tarsungulum with a small denticle and smooth inner edge. Chitin-lines pointing lateral to the condyles. Trunk metasternite with a pore-field in form of a transverse band in the posterior part of the metasternite (Fig. 4G). This band dissolves between segments 10 to 13 (in our specimen 13) into two separate, lateral fields with a strongly reduced number of pores (Fig. 4H). Pore-fields present also on the posterior part of the trunk (in contrast to our specimen. – see below). Some anterior metasternites with a carpophagus pit. Metasternite of the ultimate leg-bearing segment trapezoidal. No anal pores. Ultimate leg pairs in males extremely swollen and hirsute with a very short pretarsus, in females not so much inflated and pretarsus longer than in males (Plate 1B). Coxopleuron of ultimate leg pairs with 2 ventral pores.

Taxonomical remark: Our specimen agrees in main characteristics with the original description of *Geophilus piae* given in MINELLI (1983). *G. piae* is very similar to *Geophilus minimus* Verhoeff, 1928, which is only known from Italy (MINELLI 1983). It differs in characteristics summarised in Table 2. The number of leg pairs and the number of coxal pores of ultimate leg pairs overlap. The pretarsus of the second maxillae is reduced in both species (Table 2) but differs in its shape: reduced to a small hook (*G. piae*) or longer than wide (*G. minimus*). Unfortunately, MINELLI (1983) provides no figure for this characteristic. Our material does not show a hook, but differences depending on the angle of view: In ventral view it seems to look like a small wart, not longer than wide (Fig. 4I), but in ventromedial view it is clearly longer than wide, as this distal end is projected more dorsally (Fig. 4J). Although the pore field on the posterior sternites is missing (characteristic for *G. minimus*), the rest of MINELLI's description of *G. piae* corresponds to our specimen: On sternite IV it consists of approximately 14 pores (on each side) in a more or less elliptical field (Fig. 4G). More posteriorly the sternites each bears two separate pore fields of reduced size (Fig. 4H). In contrast, the pore field of *G. minimus* should be similar to that of *Geophilus alpinus* Meinert, 1870. Therefore, when comparing all the characteristics, it must be concluded that our specimen agrees more with *G. piae* than *G. minimus*. However, as the description of *G. minimus* by VERHOEFF (1928) is incomplete, a more detailed redescription of the type would be necessary to clarify the status of this species.

Remark: First record for Tunisia. *G. piae* has been recorded from all around the Tyrrhenian Sea (also in Sicily), and it is not too much surprising that the species is more broadly present around the western Mediterranean, including Tunisia. On the other hand, it is also possible that disjunct areas are inhabited by allopatric distinct sibling species, even though similar to each other. Based on the current morphological uncertainty, we term our specimen as *Geophilus* cf. *piae*.

Table 2: Differential characteristics of *Geophilus piae* (according to MINELLI 1983) and *G. minimus* (combined according to VERHOEFF 1928, ATTEMS 1929, MINELLI 1983 and BONATO et al. 2014). Grey – characteristics of the Tunisian male specimen.

Geophilus piae Minelli, 1983	*Geophilus minimus* Verhoeff, 1928
Males with 35, females with 37 leg pairs	Males with 33-37 leg pairs (Tunisian male 37)
Head about as long as wide	Head distinctly longer than wide
Forcipular tergite not distinctly narrowing forwards throughout its length	Forcipular tergite distinctly narrowing forwards
Pore-fields present also on the posterior part of the trunk; the most posterior pore-fields not distinctly larger than preceding pore-fields	Pore-fields lacking on the posterior part of the trunk
Coxopleuron with only 2 ventral pores	Coxopleuron with usually 2-5 ventral pores
Sternite of the ultimate leg-bearing segment very restricted caudad, trapezoidal	Sternite of the ultimate leg-bearing segment feeble restricted caudad
In male pretarsus of ultimate leg very short and bent backwards	In male pretarsus of ultimate leg well developed
Pretarsus of the second maxilla reduced to a very small hook	Pretarsus of the second maxilla reduced but still longer than wide
Pore areas as in description by MINELLI (1983)	Pore areas as in *Geophilus alpinus*

Family Himantariidae

Himantarium mediterraneum Meinert, 1870

Material examined: Site 9: 1 ♂ (137 lp) SMNG-VNR 017978-4; Site 10: 1 ♀ (137 lp) SMNG-VNR 017293-4.

General description: According to BONATO & MINELLI (2014: 62-63) and ChiloKey (BONATO et al. 2014). Length up to 140 mm, width up to 4 mm. Number of leg pairs 113 (♂) to 159 (♀); in Tunisia 113-155 (♂) / 121-149 (♀) [as *Himantarium hispanicum africana* Attems, 1899: 129-131 (♂) / 131-137 (♀), length up to 165 mm and width 3.5 mm]. Head distinctly wider than long. Antennae moderate thickened, tapering. Intermediate part of labrum with numerous small teeth curved mesally (Fig. 5A). First maxillae with indistinct articulated telopodites and small telopodital lappets. Pretarsus of secondary maxillae well developed, apically spatulate. Forcipular coxosternite much wider than long, with complete chitin-lines reaching the condyles. Trunk metasternites (with exception of the first and the last) with a circular pore-field. Metasternite of ultimate leg-bearing segment distinctly wider than long, with distinct mid-longitudinal groove. In contrast to the closely related species *H. europaeum* (Chalande & Ribaut, 1909) with pleurites separated from the pleurotergite of the last leg-bearing segment, *H. mediterraneum* has a complete pleuropretergite (BONATO & MINELLI 2014). Ultimate leg pairs about as long as the penultimate, slender in both sexes (vs. *H. europaeum* with swollen ultimate legs in both sexes).

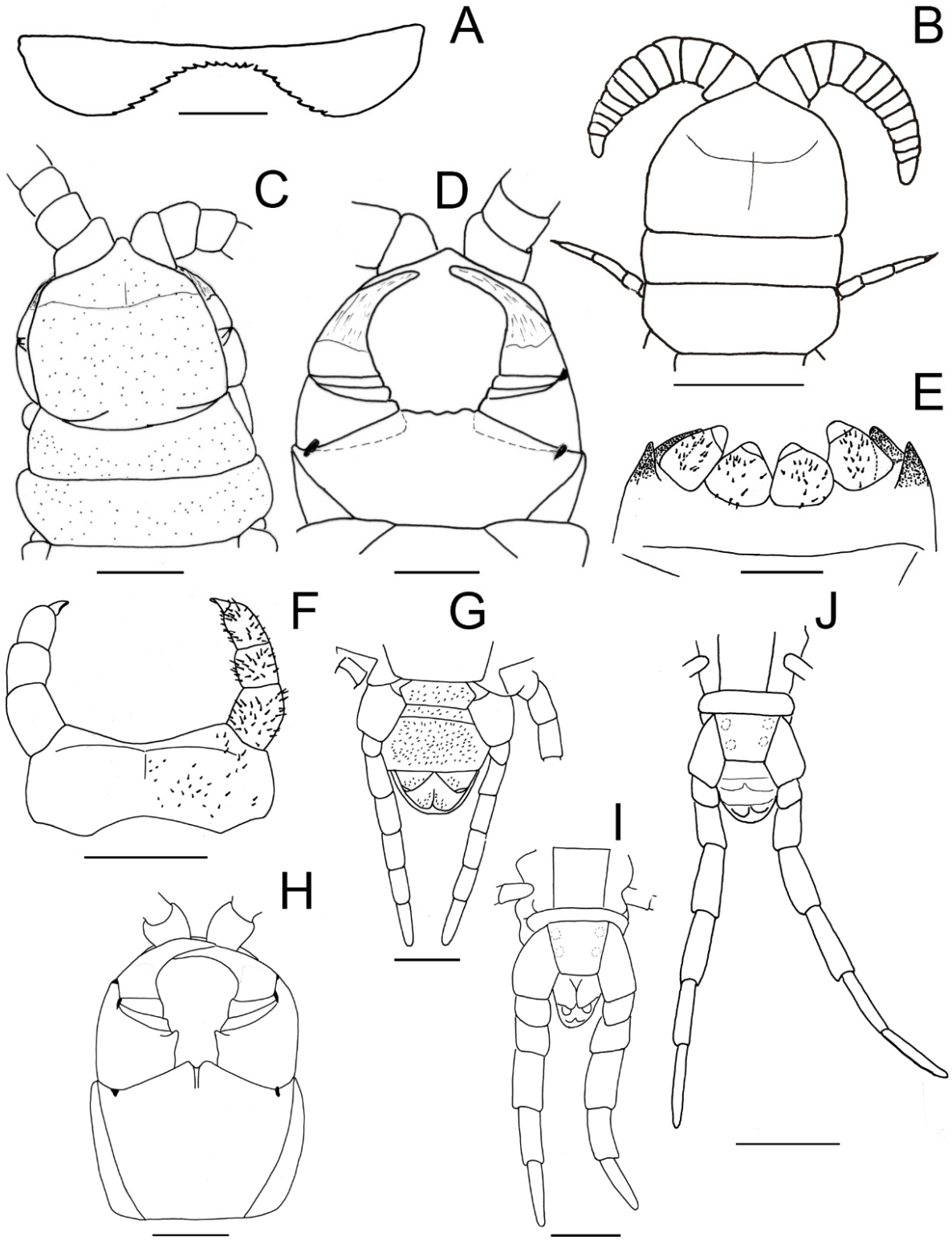

Figure 5: A *Himantarium mediterraneum*: Labrum (according to ATTEMS 1929: fig. 44). **B** *Mesocanthus albus*: Anterior body part dorsal. **C-G** *Orya barbarica*: **C** Head dorsal. **D** Forcipules. **E** 1st maxillae. **F** 2nd maxillae (left side drawn without hairs). **G** Terminal segments and female gonopods. **H-K** *Nannophilus eximius*: **H** Forcipules. **I** Terminal segments with ultimate leg pair, ♂, ventral. **J** Terminal segments with ultimate leg pair, ♀, ventral. Scale bars: not to scale (**A**), 0.5 mm (**B, C, D, F, I, J**), 0.2 mm (**E, H**).

Mesocanthus albus Meinert, 1870

Material examined: Site 10: 3 ♂♂ (79, 83, 85 lp), 1 ♀ (83 lp) SMNG-VNR 017293-2.

General description: According to ATTEMS (1929: 52, fig. 70). Length up to 64 mm and width 1.4 mm. Number of leg pairs 71 (♂) to 91 (♀); in Tunisia 85 (♂). Head rounded laterally, straight posterior and attenuated anterior; antennae very short (Fig. 5B). From the second to the penultimate trunk metasternite with a transversally-oval pore-area, which becomes smaller towards to the end of the trunk. Sternite of ultimate leg-bearing segment triangular with a median longitudinal sulcus. Ultimate leg pairs thickened in both sexes, in males' articles broader than long (Plate 1C).

Polyporogaster tunetana Verhoeff, 1899

Material examined: Site 14: 1 ♀ (79 lp) SMNG-VNR 017984.

General description: According to ATTEMS (1929: 51, fig. 69) and LEWIS (1986: 22, figs 8-15). Number of leg pairs 85-95; in Tunisia 91 (♂) / 99 (♀). Length up to 94 mm. Head wider than long. Antennae short. The terminal antennal segment with two dorsolateral groups of sensilla. Forcipular sternite with complete chitin-lines. Intermediate part of labrum without or only indicated denticles. First maxillae without telopodital lappets. Pretarsus of second maxillae on the base with two strong bristles. Trunk metasternites (with exception of the first and the last) with bean-shaped pore-field occupying about one third of the sternite wide (Plate 1D). Spiracles almost round. Sternite of the ultimate leg-bearing segment not markedly narrowed posteriorly. Coxal pores opening into a pit covered by lateral margin of tergite. Ultimate leg pairs distinctly swollen in male, no pretarsus.

Individual description of female SMNG-VNR 017984: 79 lp, 81 mm. Head width : length ratio = 1 : 0.8, antennae approx. 1/5 longer than width of head.

Family Oryidae

Orya barbarica (Gervais, 1835)

Material examined: Site 1: 1 ♀ (121 lp) SMNG-VNR 017983-6; Site 9: 1 juv. ♂ (97 lp), 2 ♀♀ (107 lp) SMNG-VNR 017978-3; Site 10: 2 ♂♂ (97 lp), 1 ♀ (105 lp), 1 juv. ♂ (97 lp), 2 juv. ♀♀ (107, 107 lp) SMNG-VNR 017293-7; Site 11: 1 ♀ (107 lp), 1 juv. ♀ (107 lp) SMNG-VNR 017979-1; Site 13: 1 juv. ♂ (97 lp), 1 ♀ (107 lp) SMNG-VNR 017982-1; Site 12: 1 ♀ (107 lp) Collection JPM.

General description: According to ATTEMS (1929: 110-111, figs 22, 26, 27, 121, 122) and ChiloKey (BONATO et al. 2014). Ochre. Very robust species. Length up to 220 mm. Number of leg pairs 107-125; in Tunisia 93-113 (♂) / 105-123 (♀). Head wider than long. Cephalic plate with transversal suture and fine punctuated over the whole surface (Fig. 5C). Forcipules without denticles, forcipular coxosternite much wider than long, anterior margin without denticles (Fig. 5D). First maxillae with well-developed and pilose coxal projections, telopodites and coxal projections both terminating in a hyaline tip; coxosternal and telopodital lappets well developed and covered with short hairs (Fig. 5E). Second maxillae (Fig. 5F) with a broad coxosternite, its anterior margin concave; all articles of the telopodite complete pilose ventrally. Trunk metasternite with pore-fields, without carpophagus pit. Metasternite of the ultimate leg-bearing segment in males wide rounded off, in females very short and broad, posterior straight or slightly concave. Ultimate leg pairs distinctly swollen in male, no pretarsus, at most a minute spine. Female gonopods (Fig. 5G) with two articles, the distal one is extremely small.

Family Schendylidae Cook, 1896

Nannophilus eximius (Meinert, 1870)

Material examined: Site 10: 1 ♀ (67 lp) SMNG-VNR 017293-5.

General description: According to ATTEMS (1929: 70, figs 7, 82) and ChiloKey (BONATO et al. 2014). Yellow, head brown. Length up to 50 mm. Number of leg pairs 65-67 (♂) / 65-71 (♀); for Tunisian material no information. Head as long as wide, without distinct clypeal area, without transversal sulcus. Forcipular coxosternite moderately wider than long, anterior margin without denticles. Forcipules reaching or overtop the upper margin of the head (Fig. 5H), tarsungulum smooth. Labrum emarginated with strong denticles curved mesally. First maxillae without coxosternal or telopodital lappets. Pretarsus of second maxillary telopodite well-developed, with two combs of filaments. Trunk metasternites without carpophagus pits; with pore-fields: first sternite without pore area, second sternite with some indistinct pores, sternites 3 to 22 with round or little transversally-oval pore-area, lacking on the posterior trunk; anterior metasternites little wider than long, posterior metasternites much longer than wide. Metasternite of ultimate leg-bearing segment very large, distinctly wider than long, wider than penultimate metasternite; the anterior part with long bristles, posterior densely and very short bristled. Ultimate leg pairs much longer than penultimate leg, a little swollen in males (Fig. 5I), slender in females (Fig. 5J); coxopleuron with 2 ventral pores; without pretarsus at most as a minute spine.

Order Lithobiomorpha

Family Lithobiidae

Eupolybothrus (*Allopolybothrus*) *nudicornis* (Gervais, 1837)

Material examined: Site 1: 1 ♀ SMNG-VNR 017983-3.

General description: According to BRÖLEMANN (1930a: 247-248, figs 391, 392, as *Bothropolys elongatus* subsp. *alpinus*), JEEKEL (1967: 169 for the subgenus), IORIO (2008: 41, key), IORIO (2010: 88 key, 93 table 2, fig. 130). Tawny-brown species. Length 35-58 mm and width about 3.5 mm. Head as long as broad; 12-16 ocelli. Tergite rugose and moderately glossy. Antennae long, sometimes reaching half of body length, with of 43-48 articles. Forcipular coxosternite broad with 5+5 to 7+7 teeth. Posterior triangular projections on tergites 11 and 13, rudimentary on tergite 9. Coxae of last four leg pairs ventral concave, with numerous (at least 10), irregularly arranged pores (Plate 2A). Leg pair 15 with VaC, without VmC, without accessory apical claw. Males: prefemur ventral and dorsal with a longitudinal sulcus, distal with conical projection, which is strongly bristled (Plate 2B); genital region strongly bristled; gonopods very short and single-segmented. Females: gonopods slender, bristled, claw pointed, without ventral or dorsal denticles.

Individual description of female SMNG-VNR 017983-3 (only deviating characteristics are mentioned):

Length 23 mm; due to conservation in alcohol the whole body is strongly lightened; right ocelli 1+4,3,3, left 1+4,3,2; antennal articles left 45, right 41; forcipular coxosternite 6+6 teeth.

Lithobius (*Lithobius*) *castaneus* Newport, 1844

Material examined: Site 1: 1 ♀ SMNG-VNR 017983-5; Site 4: 1 ♀ SMNG-VNR 017296-2; Site 5: 1 ♂ SMNG-VNR 017227-6.

General description: According to KOREN (1992: 78-80, figs 23 a-f). Robust orange-brown or amber species; smooth and shiny. Length about 15-33 mm. Head as long as broad, insignificant broader as tergite 1, anterior distinct acuminated; 18-26 ocelli in 4-6 irregular rows. Antennae reach about tergites 3 to 5, with 23-33 articles. Forcipular coxosternite broad with 2+2 minute teeth (Plate 2C), porodonts conspicuous. Large tergites with 2 short paramedian sulci, without posterior projections. Gonopods slender, with 2+2 spurs, second and third article each dorsolateral with 2 fine setae; claw very acuminated, barely curved, with one small ventral denticle. Leg pairs 14 and 15 inconspicuous thickened in both sexes, without special modifications, femur and following articles with pores; coxae of last four leg pairs each with 4-8 round to oval pores; VaC strongly developed; without accessory apical claw.

Lithobius (*Lithobius*) *forficatus* (Linnaeus, 1758)

Material examined: Site 3: 1 juv. (12 lp) SMNG-VNR 017298-2.

General description: According to KOREN (1992: 45-48, figs 13 a-f). Robust, tawny, rust-red or chestnut-brown species. Length 18-32 mm and width up to 3.8 mm. Head a little broader than long, as broad as tergite 3; 20-24 ocelli in 5-8 irregular rows. Antennae rather short with 28 to 53 articles. Forcipular coxosternite with 5+5 to 7+7 teeth, porodonts inconspicuous, without shoulders. Posterior triangular projections on tergites 9, 11 and 13. Coxae of last four leg pairs each with 6-8 (10) mostly oval pores; leg pair 15 without accessory apical claw, without VaC, non-thickened in both sexes. Males: gonopods of two articles; second genital sternite with 2 or 3 setae. Females: gonopods with 2+2 conical spurs, strongly bristled, article II with 5-7 stout and straight setae in a row and a few more minute setae on either side, claw with distinct dorsal and ventral denticle.

Lithobius (*Lithobius*) cf. *lusitanus* Verhoeff, 1925

Material examined: Site 5: 3 ♂♂, 5 ♀♀ SMNG-VNR 017227-5, det. E. Iorio.

General and individual description: According to ATTEMS (1927b: 245-246, figs 1-3, as *Archilithobius stramineus*), SERRA (1978: 36-39, figs 1-4, as *A. stramineus*), EASON (1982: 19), VOIGTLÄNDER & REIP (2013: 231-232), and IORIO & VOIGTLÄNDER (2019: 27-29, figs 26-27). Colour varies from pale and light buff, head and body end and some or all tergites more or less dark on posterior margin, antennae brownish but becoming paler towards to the end. Ventral side and legs whitish to yellowish. Length up to 18 mm, width 1.6 mm, about as wide as tergite 3. Head somewhat broader than long with 11-13 ocelli arranged in 3 fairly regular rows, posterior ocellus larger than the others. Antennae about one third of body length, 38-43 articles. Forcipular coxosternite: anterior border with 2+2 teeth, upper part broad, bristled, lateral borders without shoulders, without porodonts, middle notch broad and not deep (like an equilateral triangle). Posterior border of tergite 9 right-angled, sometimes with slight "traces" of projections, tergite 11 with blunt, tergite 13 with more prominent projections (Plate 2D). Coxal pores round, 2 or 3 on each coxa. Leg pair 15 without VaC; accessory apical claw small. Leg pairs 14 and 15 slightly thickened in both sexes, a little more in males;

in males without special structures. Males: gonopods uni-articulate. Females: gonopods with 2 + 2 (seldom 3+3) relatively stout spurs, article II without dorsomedial setae, claw tridentated. Table 3 gives the plectrotaxy of one male (Ind. a, VNR 017227-5) of site 5. Gonopods of one female (Ind. b, VNR 017227-5) of site 5: Basal article with 3+3 not serrated spurs on each side; the smallest (interior) about 1/3 of the length of the largest; no dorsomedial setae on article II; all articles with long setae; claw unidentate (Plate 2E).

Taxonomical remarks: The described specimens can be clearly assigned to the species group *lusitanus-lapidicola-valesiacus* (incl. *L. deserti* Verhoeff, 1908 and even *L. salicis* Verhoeff, 1925), whereby *L. lusitanus* is the closest species. Most characteristics of the material investigated here fully agree with the description or are within the variation range given by the authors cited above. From the species description deviating characteristics are: slightly smaller body size (length 9.5-11.5 mm), smaller number of ocelli from 7 to 8 and 3+3 spurs of female gonopods. If the characteristics prove to be constant when testing a larger number of animals, it could be regarded as a new species. The investigations show clear differences in the gonopods (claw and spurs) as well as in plectrotaxy of legs, but these characteristics can have very different taxonomic values for different species. In some species like *L. pyrenaicus* Meinert, 1872 or *L. mononyx* Latzel, 1884 the unidentate claw is a very regular thus clearly distinctive criterion. In other species (e. g. *L. tricuspis* Meinert, 1872) we sometimes have transitions from tridentate claws to bidentate to almost unidentate claws. The same applies to 3+3 spurs (e. g. *L. crypticola* Ribaut in Jeannel, 1926 can have sometimes 2+2 instead of 3+3). As shown in SERRA (1978), the plectrotaxy of *L. lusitanus* shows a wide range of variation. Thus, it cannot yet be decided whether the differences present here (especially in ventral plectrotaxy of leg pairs 1-11) are still within the usual range of variation. Much more material will be helpful as well as molecular studies to confirm the observed morphological differences and to clarify the status of this population (possibly a new species).

Table 3: *Lithobius* cf. *lusitanus*: Plectrotaxy of one male (Ind. a, VNR 017227-5) of site 5. C – coxa, t – trochanter, P – prefemur, F – femur, T – tibia, * – very small.

Leg pair	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
1					m			p*	a	a
2				m	m			p	ap	ap
3				m	m			p	ap	ap
4				am	m			p	ap	ap
5				am	m			p	ap	ap
6				am	am			p	ap	ap
7				am	am			p	ap	ap
8				am	am			p	ap	ap
9			m*	am	am			p	ap	ap
10			m	am	am			p	ap	ap
11			m	amp	am			p	ap	ap
12			amp	amp	am			amp	ap	ap
13			amp	amp	am			amp	ap	ap
14		m	amp	amp	m	a		amp	p	p
15		m	amp	amp		a		amp	p	

Lithobius (*Lithobius*) *microdon* Latzel, 1886

Material examined: Site 9: 1 ♂ SMNG-VNR 017978-1 and cf. 1 ♀ (damaged), det. M. Zapparoli; Site 10: 1 ♀ SMNG-VNR 017293-6, det. M. Zapparoli.

General description: According to ZAPPAROLI (1984a: 230-236, figs 1-7). A species of medium size, length 10-15 mm. Head a little wider than long, as wide as tergite 3, with 2 or 3 rows of mostly 5-8 ocelli. Antennae long, 34-38 articles. Forcipular coxosternite with 2+2 tiny teeth. Tergite 9 without projections, projections of tergite 11 sometimes small but distinguishable, tergite 13 angulated but not sharply pointed (Plate 2F). Coxal pores round, 3-5 on each coxa. Leg pair 15 without VaC; with accessory apical claw. Males: leg pair 14: femur with 2 parallel furrows, tibia without special structures; leg pair 15: femur similar to 14; tibia dorsal with drop-shaped depression, appr. two third of the tibia. Females: Gonopods with 3+3 or 2+2 robust and elongated spurs, in some specimens all of equal length while in others the inner one can be a little shorter and burlier, lateral margin smooth; claw unidentated, narrow and slightly curved, sometimes wider and more curved.

Taxonomical remark. *L. microdon* varies widely. Differences are mainly in the plectrotaxy of the legs, in the shape of the coxosternum and in the number of spurs of the female gonopods. Most characteristics of the material investigated here fully agree with the description or are within the variation range given by ZAPPAROLI (1984a). The following differences could be seen in the female from site 1 (VNR 017293-6): ocelli: 10 (1+3,3,2); female gonopods: 4 dorsolateral setae on article II instead of 5. A notable difference is the tridentated claw instead of unidentated. Plectrotaxy see Table 4. The male from site 11 (VNR 017978-1) shows following differences: ocelli 9: 1+3,3,2. Indeed the tibia of leg pair 15 shows a drop-shaped depression of 2/3 of its length, but no subdorsal groove. Femora of leg pairs 14 and 15 have no grooves, only darker stripes, as well as the prefemur of leg pair 15.

Table 4: Plectrotaxy of one female of *Lithobius microdon* (VNR 017293-6) from site 1. C – coxa, t – trochanter, P – prefemur, F – femur, T – tibia.

Leg pair	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
1			p	amp	m			mp	ap	a
2			p	amp	am			mp	ap	ap
3			p	amp	am			amp	ap	ap
4			p	amp	am			amp	ap	ap
5			mp	amp	am			amp	ap	ap
6			mp	amp	am			amp	ap	ap
7			mp	amp	am			amp	ap	ap
8			mp	amp	am			amp	ap	ap
9			mp	amp	am			amp	ap	ap
10			mp	amp	am			amp	ap	ap
11			mp	amp	am			amp	ap	ap
12		m	mp	amp	am			amp	ap	ap
13		m	amp	amp	am			amp	p	p
14		m	amp	amp	am			amp	p	p
15	missing									

Remark: First record for Tunisia. It is known from Morocco, Algeria and Spain (LATZEL 1886, BRÖLEMANN 1932, ZAPPAROLI 1984a).

Lithobius (*Monotarsobius*) cf. *crassipesoides* Voigtländer, Iorio, Decker & Spelda, 2017

Material examined: Site 3: 1 ♀ SMNG-VNR 017298-1.

General and individual description: General description according to VOIGTLÄNDER et al. (2017: 1-38, figs 12-16 each A). Small member (length 6.4–11.0 mm) of the subgenus *Monotarsobius*, slightly fusiform, light ochre to light brown, last third of the body and usually also the head a little darker. Head roundish, mostly as broad as long or little broader than long and head broader or as broad as T5. 5–11 ocelli, mostly 8 or 9, in two or three rows with one larger posterior ocellus. Antennae with 20 articles, short, 2.6 times longer than head, 1/4 of body length. Forcipular coxosternum with 2+2 teeth, lateral borders without shoulders, middle notch narrow to moderate width. Posterior angles of tergites 9, 11 and 13 mostly obtuse or rounded with no trace of lobes or triangular projections. Leg pairs 14 and 15 thickened in both sexes, much more so in males; plectrotaxy see Table 5; leg pair 15 without accessory apical claw, in males with a depression in the posterior half of tibia. Female gonopod claw tridentate.

Taxonomical remark on morphological data: The morphology of the Tunisian female matches extensively with the description of *L. crassipesoides* in VOIGTLÄNDER et al. (2017) (see above General description) and differs clearly from *L. crassipes* L. Koch, 1862 in plectrotaxy. It differs from this species in the presence of DaP earliest from leg pair 12, while almost always present in *L. crassipes* on leg pairs 10 to 15, (frequently

Table 5: Plectrotaxy of the female of *Lithobius* (*Monotarsobius*) cf. *crassipesoides* (SMNG-VNR 017298-1). C – coxa, t – trochanter, P – prefemur, F – femur, T – tibia.

Leg pair	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
1				am	m			p	a	a
2				am	m			p	ap	a
3				am	m			p	ap	a
4				am	m			p	ap	a
5				am	m			p	ap	a
6				am	m			p	ap	a
7				am	m			p	ap	a
8				am	am			p	ap	a
9				amp	am			p	ap	ap
10				amp	am			p	ap	ap
11				amp	am			mp	p	ap
12			mp	amp	am			mp	p	p
13			mp	amp	am	a		mp	p	p
14		m	mp	amp	m	a		mp	p	
15		m	amp	am		a		amp		

on leg pair 9, rarely also on leg pairs 7 and 8). Following GANSKE et al. (2020), we checked the structure and spinulation of the mandibles as a further species-differentiating character. GANSKE et al. restudied morphologically the two specimens of Spanish *L. crassipesoides* with the highest p-distance to each other (12.7 % to 13.3 %). These specimens showed significant differences in chaetotaxy of mandibles, but no other significantly morphological differences in the morphometric studied by VOIGTLÄNDER et al. (2017). Therefore, beside the Tunisian specimen we restudied 3 specimens of *L. crassipesoides* from Spain. They showed no (SMNG-VNR 14786-3 b) or 3 to 4 (SMNG-VNR 14773-1 b, d) shaving brush like bristles on the internal side of mandibles. For comparison, four *L. crassipes* from Germany (without collection IDs) were examined. In these specimens we found a high variety in number and shape of the bristles of mandibles (1 to 9 bristles, shaving brush like bristles with shorter or slender shafts). According to the preliminary investigations, the obviously high and overlapping variability of this trait appears unsuitable for the differentiation of the two species, and must be verified by further, statistically validated investigations.

Taxonomical remark on molecular data: The molecular COI-analysis (Fig. 6) in the *L. crassipesoides* female from Tunisia shows a clear difference to *L. crassipes* (p-distance ranges from 17.4 % to 19.4 %), but also to the *L. crassipesoides* from Spain (p-distance ranges from 17.2 % to 19.3 %). In contrast, it forms a clade with a specimen of *Lithobius* from a population in Hungary (but still with a p-distance of 10.5 %), determined in GANSKE et al. (2020) under expressing of doubts as *L. crassipes*. But already in this publication, the authors themselves revealed hints for a cryptic species within the *L. crassipes-crassipesoides* species complex from morphological (plectrotaxy, body length, number of coxal pores) and molecular analyses of specimens of a Hungarian population. The possibility of a cryptic speciation within *L. crassipesoides* was further supported by the difference in the spinulation of the mandibles by GANSKE et al. (2020). However, this character seems to be unsuitable for differentiation (see above).

Conclusion: So far, only *L. crassipes* has been recorded for Tunisia (SILVESTRI 1896 as *L. atrifrons*, ATTEMS 1908, BRÖLEMANN 1921). These older records need verification. As both the studies by GANSKE et al. (2020) and us support the hypothesis of another new cryptic species within the *L. crassipes-crassipesoides* species complex.

Order Scolopendromorpha

Detailed descriptions, figures and a key to the scolopendromorphs of Tunisia can be found in AKKARI et al. (2008) and ATTEMS (1930).

Family Scolopendridae

Scolopendra canidens Newport, 1844

Material examined: Site 10: 2 ind. SMNG-VNR 017293-8.

General description: According to ATTEMS (1930: 35-36) and LEWIS (1986: 24-26). Images of different body parts relevant for the determination and further information about distribution, habitat can be found in AKKARI et al. (2008: 80-83, figs 1-7). Yellowish to olive-green species. Length about 50 mm. Head without sutures and with fine punctuations; with 4 ocelli. Antennae with 18-22 articles, 6 basal articles glabrous. Forcipular coxosternum with 2-3 more or less fused teeth. Complete paramedial sutures start on the second tergite up to tergite 20; tergite 21 with complete median suture. Sternites 2-20 with longitudinal sutures. Spiracles triangular. Leg pair 1 with 2 tarsal spurs, the following with 1 spur. Coxopleural process generally long, with at least 6 spines situated laterally. Prefemur with 2 rows ventrolaterally of 11-14 spines, ventromedially of 6-11 spines and dorsomedially with 7-8.

Cormocephalus gervaisianus (C. L. Koch, 1841)

Material examined: Site 6: 1 ind. SMNG-VNR 017295-1; Site 7: 1 ind. SMNG-VNR 017297-2.

General description: According to ATTEMS (1930: 102-103, figs 121, 122) and AKKARI et al. (2008: 86-89, figs 14-17). Yellowish to olive-green species. Length 40-65 mm. Head with two paramedian sutures on the posterior half. Antennae with 17 articles, 6 basal articles glabrous. Tergites 1-20 with 2 paramedian sulci (on tergite 1 incomplete), tergite 21 with a complete median suture. Sternites 2 to 20 with two complete paramedian sutures. Spiracles very small. Ultimate leg pair: Coxopleuron with one lateral spine and long and slender process bearing 2 terminal spines; length of coxopleural process varies considerably. Prefemur with 2 ventrolateral rows of 3-5 spines, and 8-10 ventromedial and medial teeth and 2-6 dorsomedial ones. Pretarsus longer than tarsus 2, ventrally finely serrated.

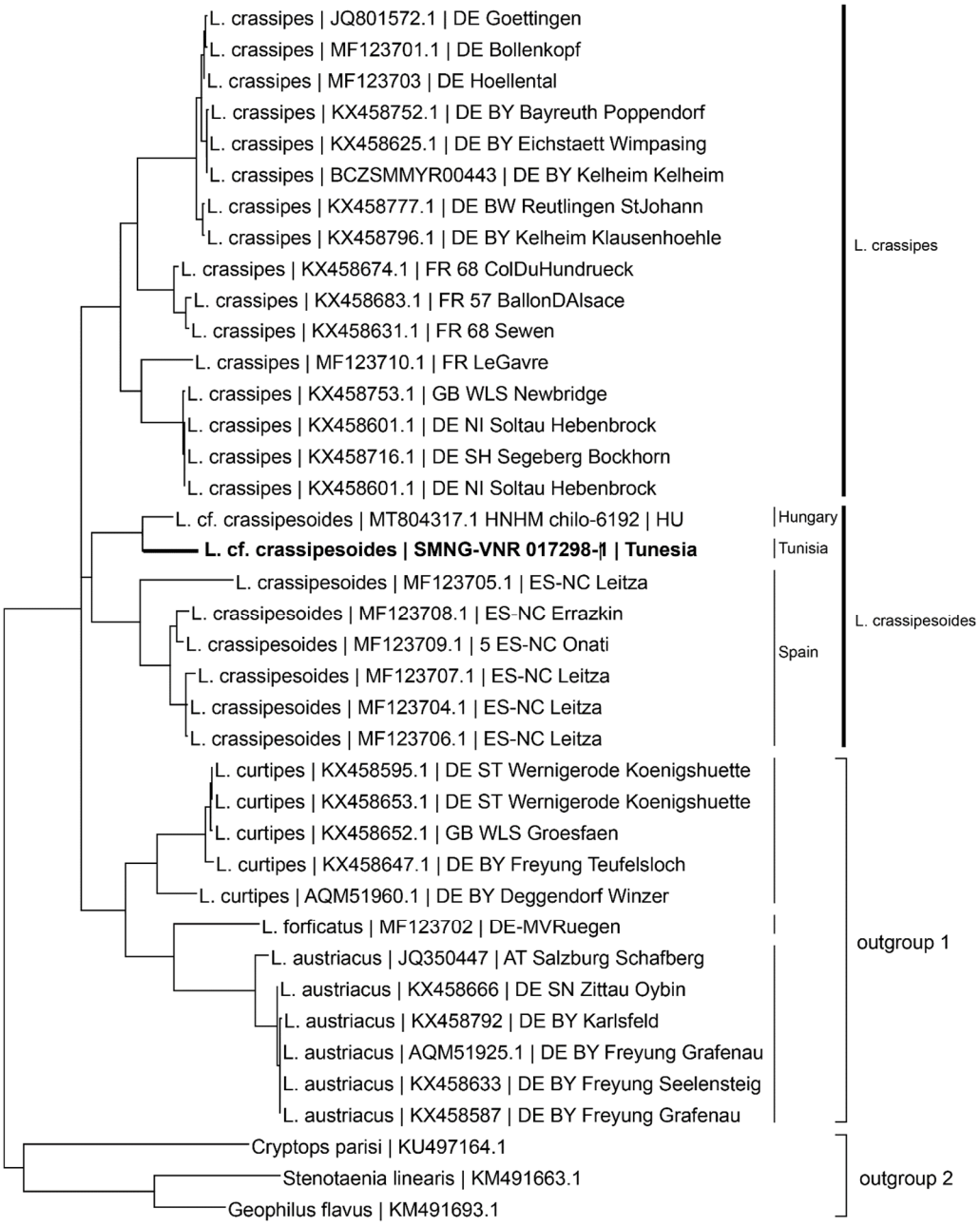

Figure 6: Results of the mitochondrial cytochrome c oxidase I (COI) analysis. Neighbor-joining tree.

Otostigmus spinicaudus (Newport, 1844)

Material examined: Site 9: 2 ind. Collection JPM; Site 10: 1 ind. SMNG-VNR 017293-9; Site 11: 1 ind. SMNG-VNR 017979-2; Site 15: 2 ind. SMNG-VNR 017980-1.

General description: According to LEWIS (2000: 434-436, figs 1-10) and AKKARI et al. (2008: 89-92, figs 18-25). Green yellowish species. Length: 30-53 mm. Posterior border of the head covered by the anterior border of tergite 1. Antennae composed of 17 articles, 3 basal articles glabrous. Two paramedial sulci on the tergites, starting on tergite 4 or tergite 5. Sternites with two longitudinal sutures. First spiracle (of leg-bearing segment 3) oval, the others round. Ultimate leg pair: Prefemoral process showing a conical extend, characteristic for this species, and 3-4 spines. Coxopleural process long with 5 spines. Prefemur ventrolateral and medial with 3 spines, dorsal with one very large spine. Tarsal spurs present. Pretarsus markedly shorter than tarsus.

Family Cryptopidae

Cryptops trisulcatus Brölemann, 1902

Material examined: Site 1: 1 ind. SMNG-VNR 017983-2; Site 5: 3 ind. SMNG-VNR 017227-7.

General description: According to ATTEMS (1930: 225, figs 289-292) and AKKARI et al. (2008: 92-94; figs 26-27). Clear brown species. Length up to 35 mm. Head eyeless, slightly longer than broad, with 2 inclined, short sutures at the anterior border and 2 abridged paramedian sutures at the posterior border. Forcipular coxosternum rounded and slightly prominent, with 2+2 setae. Tergite 1 with 3 sutures: one complete curved transverse and 2 longitudinal ones intersecting ahead the transversal one. Ultimate leg pair: Tibial saw with 6-13 teeth. Tarsal saw with 3-5 teeth.

Cryptops punicus Silvestri, 1896

Material examined: Site 1: 1 ind. Collection JPM; Site 4: 1 juv. SMNG-VNR 017296-3; Site 5: 3 ind. SMNG-VNR 017227-8; Site 8: 1 ind. SMNG-VNR 017294-1.

General description: According to AKKARI et al. (2008: 94-97, figs 28-31). Clear brownish species with a dense punctuation and setation. Length 22-28 mm. Head as long as broad, eyeless, anterior with 2 paramedian, incomplete sutures. Forcipular coxosternum rounded and slightly prominent, with more than two setae. Tergite 1 with one complete curved transverse suture. Tergite 2 with incomplete paramedian sutures, becoming complete from the third. Ultimate leg pair: Tibial saw with 11-13 teeth. Tarsal saw with 5-7 teeth.

Order Scutigeromorpha

Family Scutigeridae

Scutigera coleoptrata (Linnaeus, 1758)

Material examined: Site 9: 1 juv. ♀ Collection JPM.

General description: A detailed description and figures can be found among others in EASON (1964: 266-267, figs 488-494).

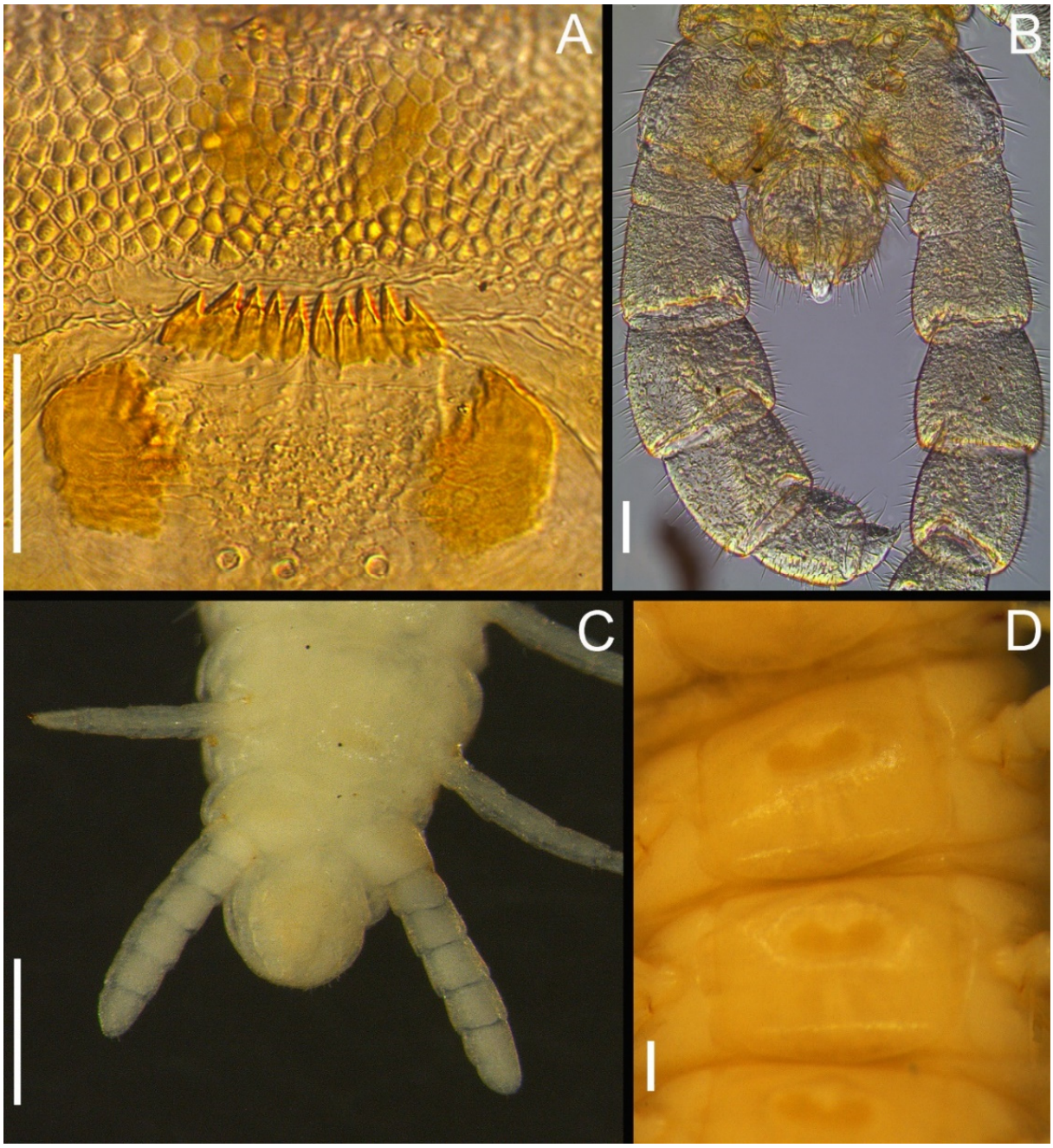

Plate 1: A *Henia pulchella*: Labrum. **B.** *Geophilus* cf. *piae*: Terminal segments with ultimate leg pair, ♂. **C** *Mesocanthus albus*: Terminal segments with ultimate leg pair, ♂. **D** *Polyporogaster tunetana*: Trunk sternites with bean-shaped pore-fields. Scale bars: 50 µm (**A, B**), 500 µm (**C**, **D**).

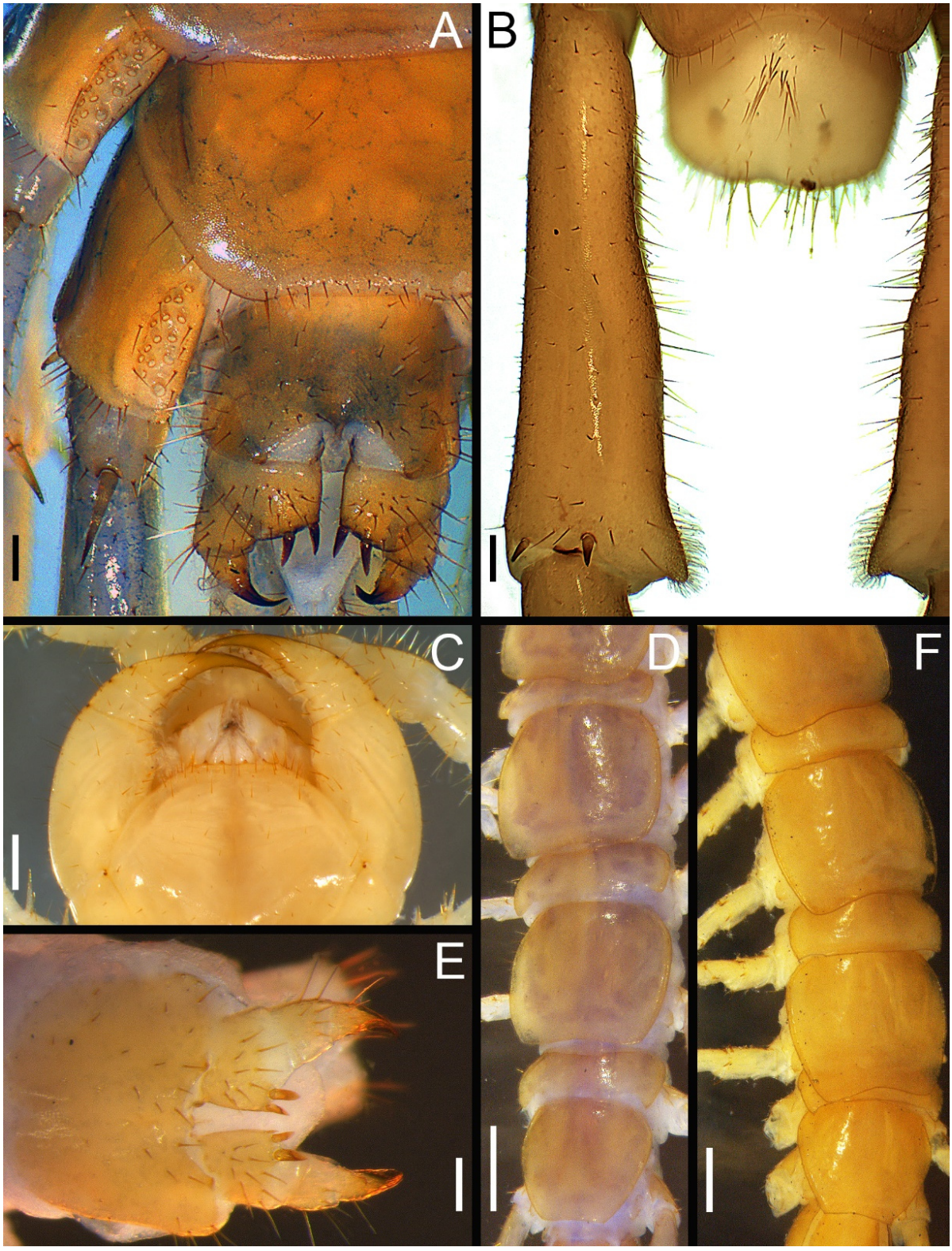

Plate 2: A-B *Eupolybothrus nudicornis:* **A.** Last body-segments with gonopods, ♀, ventral (from IORIO & VOIGTÄNDER 2019). **B.** Prefemur of leg pair 15, ♂, ventral (copyright E. Iorio). **C** *Lithobius castaneus*: Head ventral. **D-E** *Lithobius* cf. *lusitanus*: **D** Tergites 8 to 14. **E.** Last body-segments with gonopods, ♀, ventral. **F** *L. microdon*: Tergites 8 to 14. Scale bars: 200 µm (**A**, **B**, **C**, **E**) 1 mm (**D**, **F**).

Discussion

To date, 48 chilopod species have been recorded for Tunisia: 33 Geophilomorpha (AKKARI et al., in prep.), 7 Lithobiomorpha (Lithobiidae), 6 Scolopendromorpha (AKKARI et al. 2008) and 2 Scutigeromopha. Compared to the country's overall species list, the number of species found at only 15 sites in only a few days is very high (Table 1).

Amongst Geophilomorpha these were 10 species (30%) (2 Dignathodontidae, 3 Geophilidae, 3 Himantariidae, 1 Oryidae, 1 Schendylidae). This includes a new record of *Geophilus* cf. *piae*, which however should be verified by further samplings. Remarkable are the records of specimens of the Tunisian species *Nannophilus eximius* and *Polyporogaster tunetana*. Both species are only known from a few sites in Tunisia (SILVESTRI 1896, ATTEMS 1903b, VERHOEFF 1899, TURK 1955). Here we give new localities: *N. eximius* was found at Matmata (site 10) and *P. tunetana* in the Parc National de Jbil (site 14), both under stones (Table 1).

Of the 7 Lithobiidae known so far, 3 species (43%) have been confirmed. The species *Lithobius microdon*, *L.* cf. *crassipesoides,* and *L.* cf. *lusitanus* were recorded for the first time in Tunisia, of which only *L. microdon* was known from North Africa (LATZEL 1886, BRÖLEMANN 1924b, 1932, ZAPPAROLI 1984a). The under-representation of the family Lithobiidae is most likely methodological. As relatively small and very agile runners, they escape more easily from hand sampling than the mostly larger or sluggish other species.

Scolopendromorpha had the highest rate of rediscovery with 5 of 6 species (83%). From the 2 Scutigeromorpha species *Scutigera tonsoris* Würmli, 1977 and *Scutigera coleoptrata*, only the latter and more common species has currently been recorded.

The most frequently recorded species were *Pachymerium ferrugineum* with 20 individuals at 7 sites and *Orya barbarica* with 50 individuals at 6 sites. Unsurprisingly, the species *P. ferrugineum* appears to be the most frequent geophilomorph species, found in all bioclimatic zones and all kind of habitats of Tunisia (AKKARI et al., in prep.). Its frequency and ecological plasticity are also well demonstrated here (Table 1). *O. barbarica* was also collected frequently in large parts of Tunisia (AKKARI et al., in prep). *Otostigmus spinicaudus* and *Cryptops punicus* were each found at 4 sites with 6 individuals.

Based on the relatively few data available, it is hardly possible to say anything about the ecological preferences of the species. Information on this topic in the literature is also sparse.

Our findings of *Gnathoribautia punctiventris*, *Lithobius castaneus*, *Cormocephalus gervaisianus, Cryptops punicus* and *C. trisulcatus* indicate an affinity to forest biotopes. Also, our data shows that *C. trisulcatus* occurs syntopically with *C. punicus* (AKKARI et al. 2008). *Scolopendra canidens* seems to be quite euryecious (AKKARI et al. 2008). According to NEGREA (1997) it is known as a thermophilous, eurythermic and xerophilous species. Our only record (under stones at the open, arid site 10) is consistent with this. The well-known thermophily of *Otostigmus spinicaudus* (AKKARI et al. 2008) is also reflected in the occurrence of the species at the arid and desertic sites 9, 10, 11, and 15.

Site 10 and 5 as well as 9 and 1 proved to be the most species-rich sites.

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