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ON THE HARVESTMAN GENUS *LOLA* KRATOCHVÍL (OPILIONES: LANIATORES)

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The species *Lola insularis* Kratochvíl, the sole representative of the genus, is redescribed on the basis of recently collected adult specimens. As the holotype is apparently lost, a neotype is designated from this new material. The previously unknown male and the genitalia of both sexes are described and illustrated for the first time. The genus appears distinct from the known phalangodid genera in both genitalic and somatic characters. Although the relationship of *Lola* Kratochvíl to other genera is not clear, it resembles in some characters both the Palearctic genus *Ausobskya* Martens and the Nearctic genera *Sitalcina* Banks, *Texella* Goodnight & Goodnight, and *Phalangodes* Tellkampf.

Key words: *Lola*, Phalangodidae, Opiliones, troglobitic, cave, Croatia

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Na temelju nedavno sakupljenih odraslih primjeraka ponovno je opisana vrsta *Lola insularis* Kratochvíl, jedini predstavnik roda. Budući da je holotip izgubljen, iz novoprikupljenog materijala uspostavljen je neotip. Po prvi puta je opisan i ilustriran dosad nepoznati mužjak, kao i građa spolnih organa oba spola. Rod *Lola* pokazuje znatnu razliku u odnosu na poznate rodove porodice Phalangodidae, kako po građi genitalija, tako i po tjelesnoj građi. Iako srodnost roda *Lola* Kratochvíl s ostalim rodovima nije jasna, po nekim osobinama ovaj rod podsjeća na palearktički rod *Ausobskya* Martens, kao i na nearktičke rodove *Sitalcina* Banks, *Texella* Goodnight & Goodnight i *Phalangodes* Tellkampf.

Ključne riječi: *Lola*, Phalangodidae, Opiliones, troglobiont, špilja, Hrvatska

INTRODUCTION

The genus *Lola* was described by KRATOCHVÍL (1937) for the new species, *Lola insularis*. This interesting and enigmatic harvestman was the first phalangodid recorded for the Balkan Peninsula and the first troglobitic phalangodid in the Euro-

pean fauna. Kratochvíl based his description on a single adult specimen of uncertain gender, but presumed (correctly) to be female. As he used only somatic characters, the genus was established on the basis of the increased tarsal count and reduced eyes of the holotype. These characters indicate that *Lola insularis* is an obligate cavernicole. These adaptations include not only the complete absence of eyes, including the loss of both the retina and cornea, but also the reduction of the eye-mound to a low rounded dome. As typical of troglobites, these harvestmen are depigmented and have elongated appendages, with a leg II to scute length ratio of 4.6 – 5.0, and a relatively high tarsal count 4-6-5-5. This degree of troglomorphy is uncommon in the Mediterranean phalangodid fauna, being found in only one other species, *Paralola buresi* Kratochvíl (1951) from Bulgaria.

Given that somatic characters are rarely diagnostic for phalangodid genera, the validity of *Lola* was in question, being based upon relatively easily acquired troglomorphic features. However, as the specimen was subsequently lost in the chaos of the World War II (F. Kovarik, pers. comm.) and no additional material collected, the species has remained an enigma. Fortunately, in consequence of recent field surveys by the Croatian Biospeleological Society, fresh topotypic material of both sexes has now become available, permitting a more complete description of the species.

MATERIALS AND METHODS

Specimen preparation and observation follow the format in UBICK & BRIGGS (1989). Leg lengths are given as: total length (femur, patella, tibia, metatarsus, tarsus). All measurements not indicated otherwise are in millimeters. 'Fig.' and 'Figs.' refer to this paper, 'fig' and 'figs' to previously published works.

Specimens are deposited in the Croatian Biospeleological Society (CBS) Collection, at the Croatian Natural History Museum (CNHM), Zagreb.

Taxonomy

Genus *Lola* Kratochvíl, 1937

Type species

Lola insularis Kratochvíl, 1937, by monotypy.

Diagnosis

Lola differs from all other phalangodid genera by the combination of: male genitalia with entire ventral plate and glans with sigmoid folding; female genitalia with ovipositor lacking microspines and having 8 pairs of short apical setae; male sexual dimorphisms including swellings ectobasally on chelicerae and adjacent scutal margins and enlarged labial processes; and a tarsal count of 4-6-5-5.

Included species

Only the type.

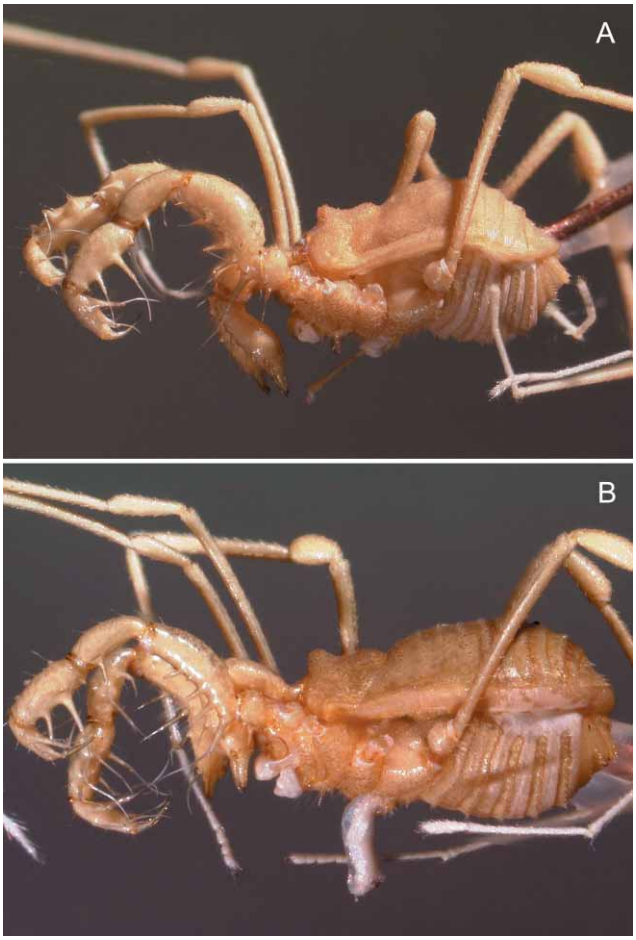

Fig. 1. *Lola insularis*, lateral view. A. Male. B. Female.

Lola insularis Kratochvíl 1937 (Figs. 1–6)

Lola insularis KRATOCHVÍL, 1937:46-51; KRATOCHVÍL 1946:169; KRATOCHVÍL, 1958:388; HADŽI, 1973:8; GUÉORGUIEV, 1977:64-65, 68; MARTENS, 1978:87; RAMBLA & JUBERTHIE, 1994:217, 219; OZIMEC *et al*., 2000:373–374; OZIMEC, 2001:2260–2261; GOTTSTEIN *et al*., 2002:51; OZIMEC, 2002:56; OZIMEC, 2003:17; NOVAK, 2004:244; TVRTKOVIĆ *et al*., 2004:244; BEDEK *et al*., in press.

Material examined

CROATIA: Hvar: Špilja pod Kapelu (syn. Spilja na Smokovniku), UTM XH18, 13.04.03 (R. Ozimec, CBS), 1 female neotype, 1 male (SEM), 1 female (SEM), 3 juveniles; same locality, 02.04.05 (R. Ozimec, CBS), 1 female, 4 males.

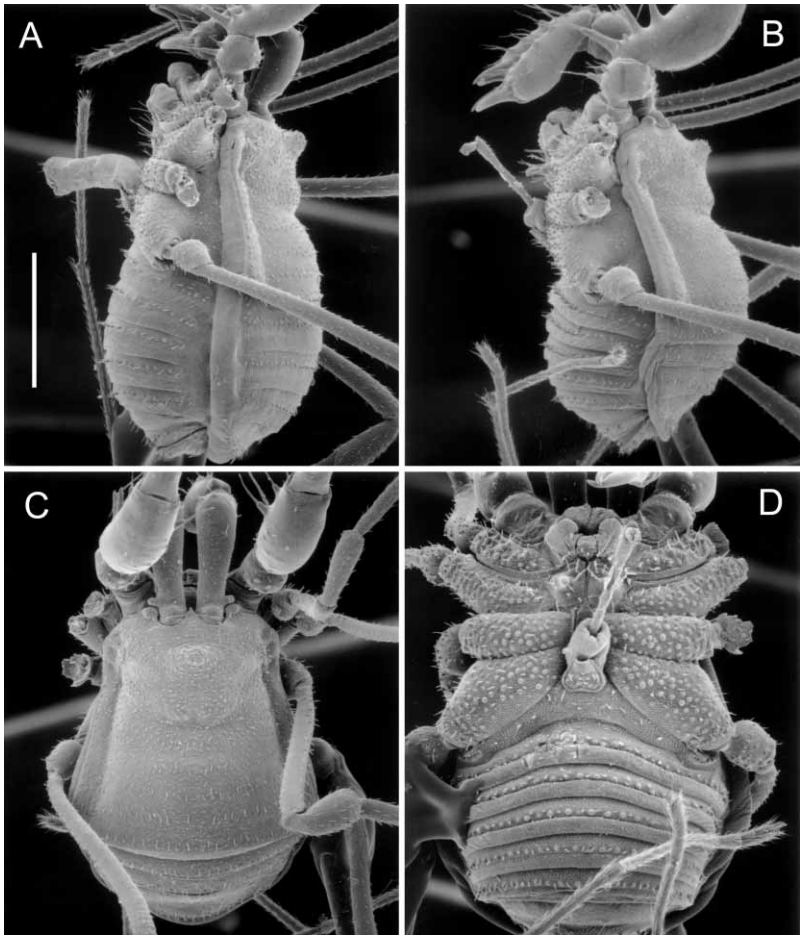

Fig. 2. *Lola insularis*, habitus. A. Female, lateral view. B-D. Male, lateral, dorsal, and ventral views. Scale bar: 750μm (A-C); 600μm (D).

Type

Female holotype from Spilja pri Smokovniku (currently known by the original name, Špilja pod Kapelu), Smokovnik, 2 km N of Hvar City, Island of Hvar, Dalmatia, Croatia, collected by J. Kratochvíl, presumably lost. According to F. Kovarik, Kratochvíl's opilionid types are neither at the Charles University (Prague) nor the Czech National Museum and presumably were lost during WW II (pers. comm.). A female neotype is here designated, from the newly collected topotypic material, and deposited in the CBS Collection at the CNHM, Zagreb.

Diagnosis

Same as for genus.

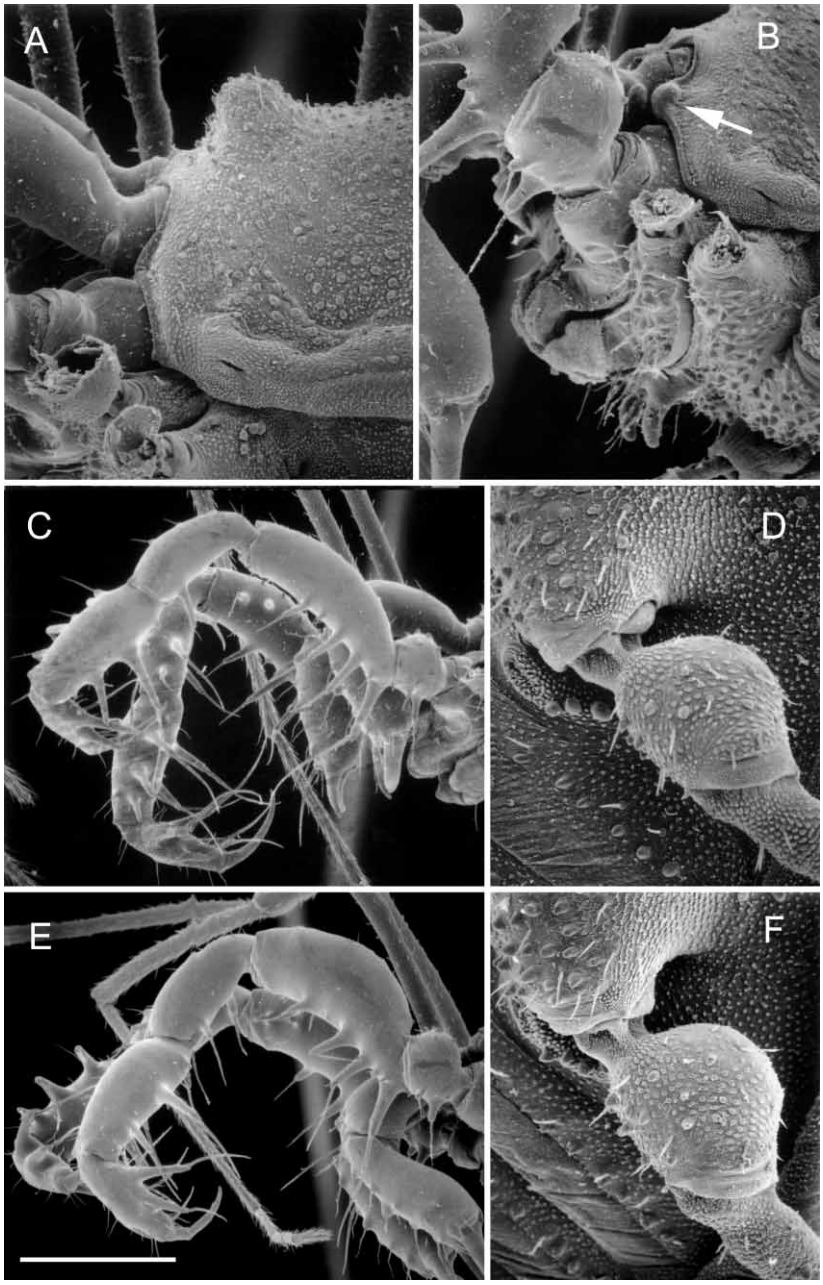

Fig. 3. *Lola insularis*, somatic morphology. A, C, D. Female. B, E, F. Male. A. Anterior of scute, lateral view. B. Anterior of prosoma, lateral view, showing cheliceral and scutal swellings (arrow) and enlarged labial processes. C, E. Palpi, lateral views. D, F. Trochanter IV, lateral views. Scale bar: 600μm (C, E); 300μm (B); 250μm (A); 170μm (D, F).

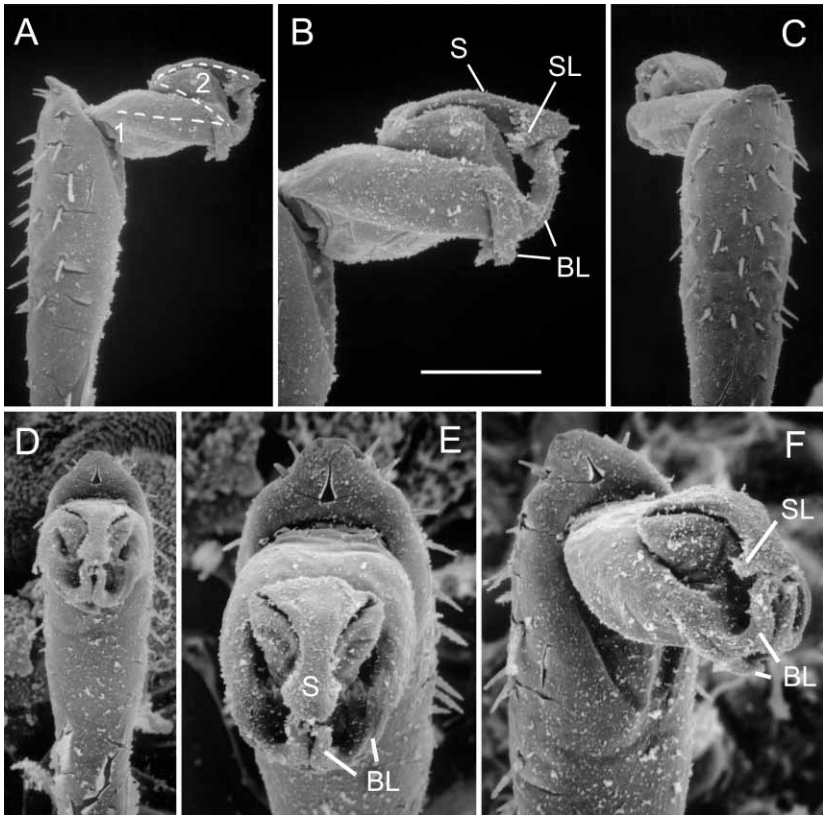

Fig. 4. *Lola insularis*, male genitalia. A. Penis, lateral view, showing sigmoid glans folding (dotted line) with primary (1) and secondary (2) axes indicated. B. Glans, lateral view, showing stylus (S), stylar lobe (SL), and basal lobes (BL). C. Penis, ventral view. D. Penis, dorsal view. E. Glans, dorsal view, showing stylus (S) and basal lobes (BL). F. Glans, dorsolateral view, showing stylar lobe (SL) and basal lobes (BL). Scale bar: 75μm (A, C, D); 43μm (B, E, F).

Description

Color: body orange, abdomen with a greenish tinge sprinkled with white flecks, appendages yellowish, tarsi white. Dorsum slightly tuberculate, cephalic region with small tubercles, thorax and tergal margins smooth; venter with prominent tubercles in coxae and along posterior tergal margins. Cephalothoracic groove deep. Scute margin lacking anterior tubercles. Eyemound small and rounded. Cornea and retina absent. Endites of coxae II with ventral process. Genital operculum relatively small, unarmed: genital operculum width / scute width = 0.18. Chelicera large, proximal segment with ectobasal swelling, distal with setose tubercles along dorsal surface. Palpal megaspines: trochanter 1 ventral; femur 4 ventrobasal, 2 mesodistal; patella 1 ectal, 3 mesal; tibia 2 ectal, 3 mesal; tarsus 2 ectal, 2 mesal. Palpal femur

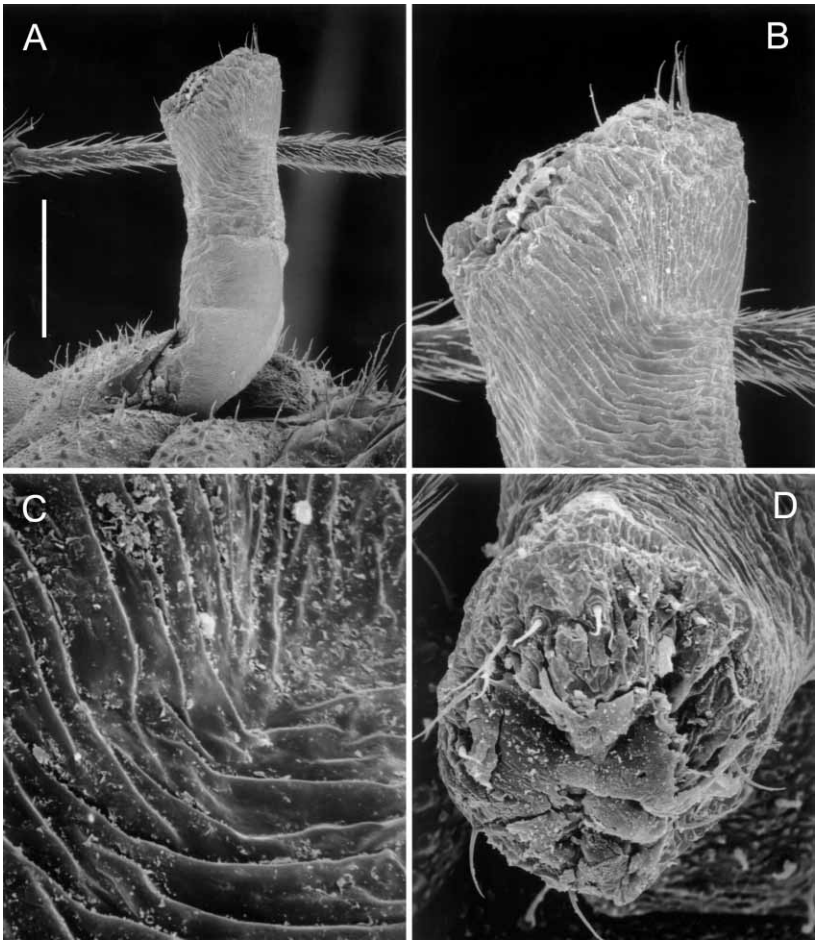

Fig. 5. *Lola insularis*, female genitalia (ovipositor). A. Lateral view. B. Close-up of apical section showing short setae. C. Close-up of cuticle showing fine wrinkles and the absence of microspines. D. Apical view, showing distribution of setae. Scale bar: 250μm (A); 100μm (B); 75 (D); 25 (C).

lacking dorsal tubercles. Trochanter IV with small ventral tubercles. Tarsal count, 4-6-5-5.

Male (topotype): Total body length 2.04. Scute length 1.50; width 1.48. Eyemound length 0.17, width 0.20, height 0.10. Genital operculum length 0.19, width 0.20. Leg II length, 6.98. Leg II / scute length, 4.65. Leg I: 5.02 (1.30, 0.44, 1.00, 1.28, 1.00). Leg II: 6.98 (1.80, 0.58, 1.56, 1.44, 1.60). Leg III: 5.40 (1.40, 0.48, 1.16, 1.50, 0.86). Leg IV: 6.88 (1.76, 0.56, 1.48, 1.88, 1.20).

Penis (Fig. 4) with truncus long and slender, slightly enlarged distally. Ventral plate rounded apically; lacking apical spine; with about 18 pairs of short slender

A

B

Fig. 6. *Lola insularis*, adult (A) and juvenile (B) specimens photographed at Špilja pod Kapelu (R. Ozimec).

setae. Glans of folding type, sigmoid in shape; with pair of branching basal lobes; stylus broad with short apicolateral lobes.

Female (neotype): Total body length 2.15. Scute length 1.30, width 1.35. Eye-mound length 0.21, width 0.23, height 0.13. Genital operculum length 0.16, width 0.20. Leg II length 6.55. Leg II / scute length 5.04. Leg I: 4.60 (1.15, 0.35, 0.95, 1.25,

0.90). Leg II: 6.55 (1.55, 0.45, 1.40, 1.35, 1.80). Leg III: 5.05 (1.15, 0.35, 1.10, 1.45, 1.00). Leg IV: 6.35 (1.50, 0.45, 1.40, 1.80, 1.20).

Female (topotype): Total body length 2.10. Scute length 1.24, width 1.30. Eye-mound length 0.20, width 0.22, height 0.12. Genital operculum length 0.15, width

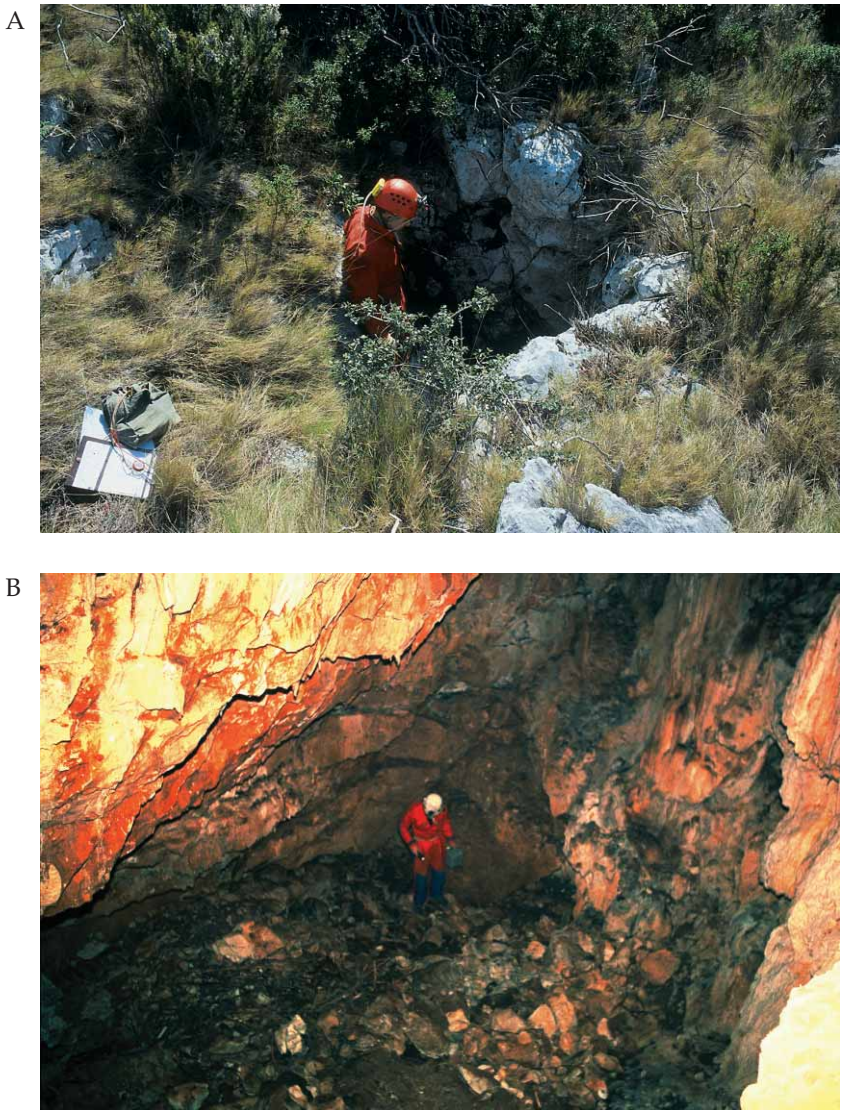

Fig. 7. Špilja pod Kapelu. A. Exterior view showing the karst makija and the cave entrance at the lower right. B. Interior view of the dark zone showing the abundant rocky habitat where *Lola* occurs. Photographs by B. Jalžić and R. Ozimec.

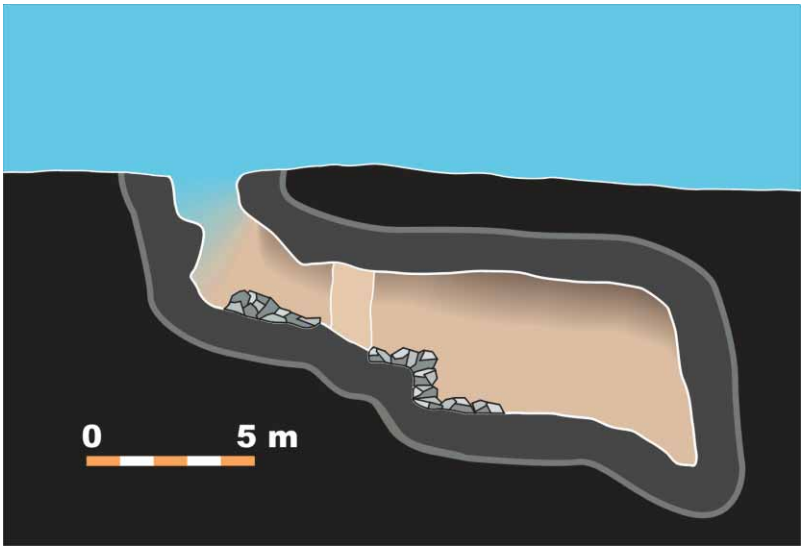

Fig. 8. Špilja pod Kapelu in longitudinal section, showing the location of breakdown. (by Ž. Skala, modified by M. Lukić)

0.20. Leg II length 6.20. Leg II / scute length 5.00. Leg I: 4.32 (1.12, 0.38, 0.90, 1.12, 0.80). Leg II: 6.20 (1.50, 0.50, 1.40, 1.30, 1.50). Leg III: 4.70 (1.20, 0.40, 1.00, 1.30, 0.80). Leg IV: 6.04 (1.52, 0.50, 1.20, 1.72, 1.10).

Ovipositor (Fig. 5) long, bent, and with flattened apex; cuticle with fine wrinkles, lacking microspines; apex with fringe of short slender setae, 5 pairs in dorsal half and 3 pairs in ventral half, lacking apical teeth.

Sexual dimorphism

The male differs from the female in having: 1) a somewhat thicker palpal femur (Fig. 3E, 3C); 2) a longer genital operculum; 3) large ectobasal swellings on the chelicerae (small in female) and adjacent scutal margin (absent in female) (Fig. 3B, 3A); and 4) two large labial processes (tiny in female) (Fig. 3B).

Juveniles

A juvenile specimen, roughly half the length of the adults (1.20) is white with slight yellowish pigmentation on the posterior half of the abdomen; integument smooth; retina and cornea absent; palpal megaspines as in adult; tarsi III and IV with large arolium; and tarsal count, 2-2-3-3.

Ecology

Recent biospeleological research on the Island of Hvar, conducted since 1995, investigated over 20 caves (OZIMEC *et al.*, 2000), of which only one produced specimens of *Lola*. This is the Špilja pod Kapelu (also referred to as Spilja na Smo-

Fig. 9. Map of Croatia showing the distribution of *Lola insularis*

kovniku), located on the extreme western part of the island Hvar at an elevation of 160 m (Fig. 7A). Although this is a small cave, about 14 m long and 4 m deep (Fig. 7B), it has the standard qualities of total darkness, moderate temperature, and high humidity. During the first visit, in April 2003, the cave had an air temperature of 11,7 °C, similar to that of the soil (11,5 °C), with a humidity of 91 %. During the second visit, in April 2005, it was somewhat colder with an air temperature of 11,1 °C, a soil temperature of 11,0 °C, and a humidity of 95 %.

All specimens were beneath deeply embedded stones, and only in places with dripping water, a microhabitat of even higher humidity. This habitat is very similar to that of the other cave phalangodids, for example genus *Banksula* Roewer and *Texella* Goodnight & Goodnight. No doubt, because of the cave's small size, the summer conditions will include both higher temperatures and lower humidity.

The biologically interesting Špilja pod Kapelu is also the type locality of a leptoderine beetle, *Spelaeobates pharensis pharensis* J. Müller, 1901 (BEDEK *et al.*, in press). Other cavernicoles recorded from the cave are: spiders, *Barusia maheni* (Kratochvil

& Miller, 1939), *Hadites tegenarioides* Keyserling, 1862, *Lepthyphanthes spelaeorum* Kulczynski, 1914, and *Nesticus* sp.; pseudoscorpions, *Chthonius* sp. and *Roncus* sp.; isopod, *Alpioniscus kratochvili* Frankenberger, 1939; diplopod, *Apfelbeckia hessei* Verhoeff, 1929; collembola, undetermined onychiurids and tomocerids; and orthopterans, *Dolichopoda araneiformis* (Burmeister, 1838) and *Troglophilus* sp. During recent research in April 2005, undetermined specimens of cave-dwelling pselaphid, scydmaenid and leptoderine coleopterans have been collected. The above species list includes both published records (KRATOCHVÍL, 1938, 1978; LANG, 1938; MÜLLER, 1901) and our recent collections (with determinations by J. Bedek (isopod) and R. Ozimec (others)).

Due to its rarity and relictual status, *Lola insularis* is included in the Red list of threatened plants and animals of Croatia (TVRTKOVIĆ *et al*., 2004).

Distribution

Known only from the type locality (Fig. 9).

Discussion

Our examination of the new material indicates that the genus is indeed distinct from other phalangodids in both genitalic and secondary sexual characters. The penis of *Lola* has a folding glans, the most widespread type, which is present in all genera for which males are known, except the Mediterranean *Ptychosoma* Sørensen and the western Nearctic *Calicina* Ubick & Briggs (UBICK, in press). However, the glans of *Lola* is unusual in having a complex folding mechanism, with a primary axis of folding at the base of the glans *and* a secondary one at the base of the stylus (Fig. 4A). This type of »sigmoid« glans has been recorded in the Nearctic genus, *Texella* Goodnight & Goodnight (UBICK & BRIGGS, 1992). Among the Palearctic fauna, the species contained in *Scotolemon* Lucas seem to have the simple folding glans (for example, figs. 16–21, 38–41, 46–47 in THALER, 1996). The glans of *Ausobskya athos* Martens appears to be more complex (see figs. 10, 14 in MARTENS, 1972), but a closer examination is needed to see if it is comparable to that in *Lola*. The penis of *Paralola buresi* Kratochvíl, the other possible relative, has only been partially described and the folding mechanism remains unknown (STARĒGA, 1976: fig. 1). Apart from the folding mechanism, the penis of *Lola* also has the apparently unique combination of a broad stylus with small apical lobes and a glans with pair of branching basal lobes.

The female genitalia of phalangodids are even less well known to permit comparison. However, the ovipositor in *Lola* shows some differences in having 8 pairs of apical setae (7 pairs recorded in most other species) that are largely clustered along the dorsal half, rather than being evenly distributed (Fig. 5).

Lola is also unique among the Palearctic phalangodids in having a large number of sexual dimorphisms (four), which in itself is further support for the validity of the genus. The unusual male structures of an enlarged cheliceral boss coupled with adjacent scutal swelling (Fig. 3B) have not been recorded previously in phalangodids. Also unique among the European fauna, are the large labial processes in the male (Fig. 3B), although similar structures do occur in the eastern Nearctic *Phalangodes* Tellkampf and related genera.

The relationship of *Lola* to other phalangodids is thus not clear. Perhaps some evidence will come from more detailed study of *Ausobsyka* Martens and *Paralola* Kratochvíl. Also, the unexpected similarities between *Lola* and some Nearctic genera needs closer examination. The labial processes in *Phalangodes* and the sigmoid glans folding in *Texella* certainly suggest relationship. However, both of these genera have a deeply bifurcate ventral plate, interpreted as a synapomorphy for the two genera and *Banksula* Roewer (UBICK & BRIGGS, 1992), which is absent in Palearctic genera. More promising is a possible relationship between *Lola insularis* and »*Sitalcina*« *cockerelli* Goodnight & Goodnight, an epigean species from the northern coast of California. Both species have similar genitalia, including the size and distribution of setae on the male's ventral plate and female's ovipositor. »*Sitalcina*« *cockerelli* also has complex glans folding, although differing in details, and an ectobasal cheliceral boss (UBICK & BRIGGS, in progress). Clearly, more study will be needed to assess the potential synapomorphy of these characters and arrive at a more definitive placement of *Lola*.

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