

Male-specific leg modifications in five species of European millipedes (Diplopoda, Julida)

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Introduction

- Millipedes (Diplopoda) are sexually dimorphic in various morphological, behavioral and post-embryonic development traits.
- Morphological intersexual variation in members of the diplopod order Julida encompasses the presence of gonopods (male specialized appendages that are involved in sperm transfer), the presence of glands that open on the coxae of the second leg-pair and modifications of gnathochilarium, mandibles and legs.
- In order to examine fine morphology of the latter mentioned sexually dimorphic trait in five julidan species [*Cylindroiulus boleti* (C. L. Koch, 1847), *Megaphyllum bosniense* (Verhoeff, 1897), *M. unilineatum* (C. L. Koch, 1838), *Ommatoiulus sabulosus* (Linnaeus, 1758) and *Pachyiulus cattarensis* (Latzel, 1884); Fig. 1], we dissected anterior (including the first) leg-pairs in males of mentioned species and examined them using light and scanning electron microscopy.

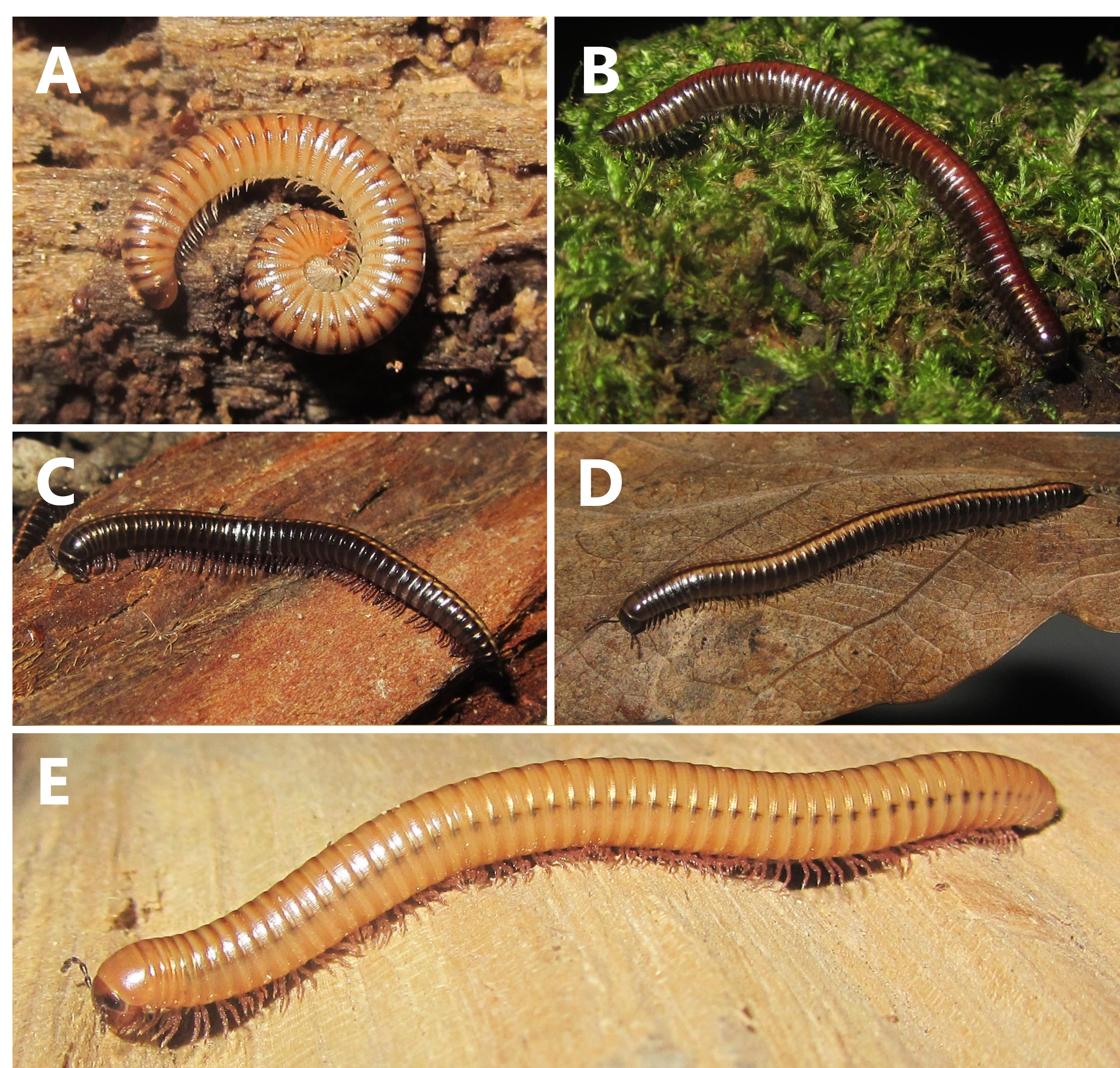


Fig. 1. Examined millipede species: (A) *Cylindroiulus boleti*; (B) *Megaphyllum bosniense*; (C) *M. unilineatum*; (D) *Ommatoiulus sabulosus* and (E) *Pachyiulus cattarensis*. Photographs: B. Ilić.

Materials and Methods

- After dissections, anterior legs were examined using Nikon SMZ1270 binocular stereomicroscope and JEOL JSM-6460LV scanning electron microscope (University Center for Electron Microscopy, Department of Biology and Ecology, University of Novi Sad, Serbia).
- Animals used in this study are preserved in 70% ethanol and represent part of the myriapod collection of the Institute of Zoology, University of Belgrade – Faculty of Biology (IZB).

Acknowledgements. This work was supported by the Serbian Ministry of Science, Technological Development and Innovation (Grants Nos. 451-03-136/2025-03/200178 and 451-03-137/2025-03/200178).

Results and Discussion

- Our results show that the first leg-pair in analyzed species shares common features – legs are reduced in size (compared to other walking legs), consisted of only three segments and are hook-like (Fig. 2).

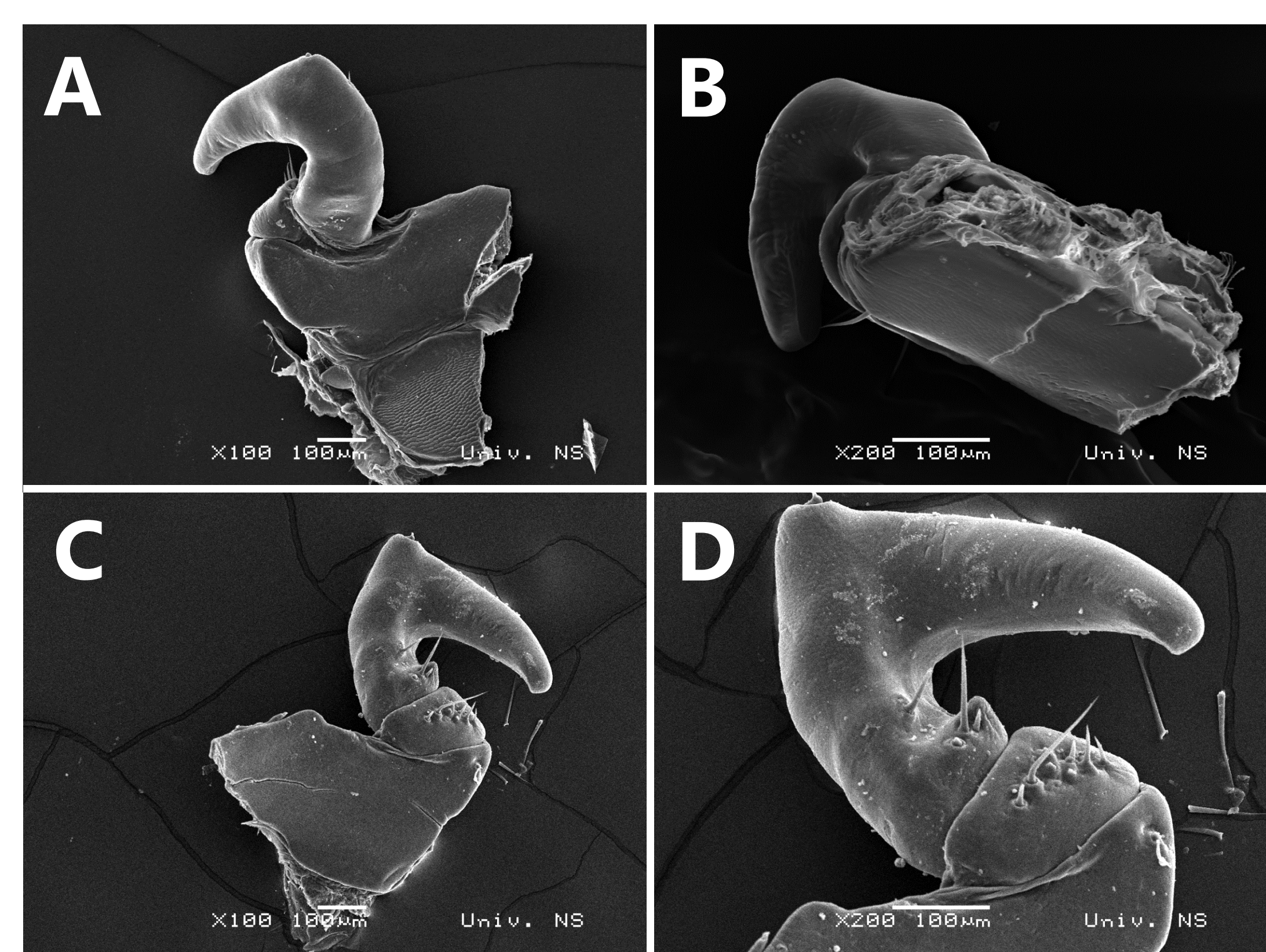


Fig. 2. The first leg-pair in: (A) *Cylindroiulus boleti*; (B) *Megaphyllum bosniense*; (C and D; D is detail of C) *Pachyiulus cattarensis*.

- Other analyzed legs are characterized by the presence of adhesive pads on the ventral surface of tibia and tarsi (Fig. 3).
- Adhesive pads are of 'smooth' type – they are made of thin layer of cuticle with more or less pronounced striations (Figs. 3C, 3E, 3G-3I).

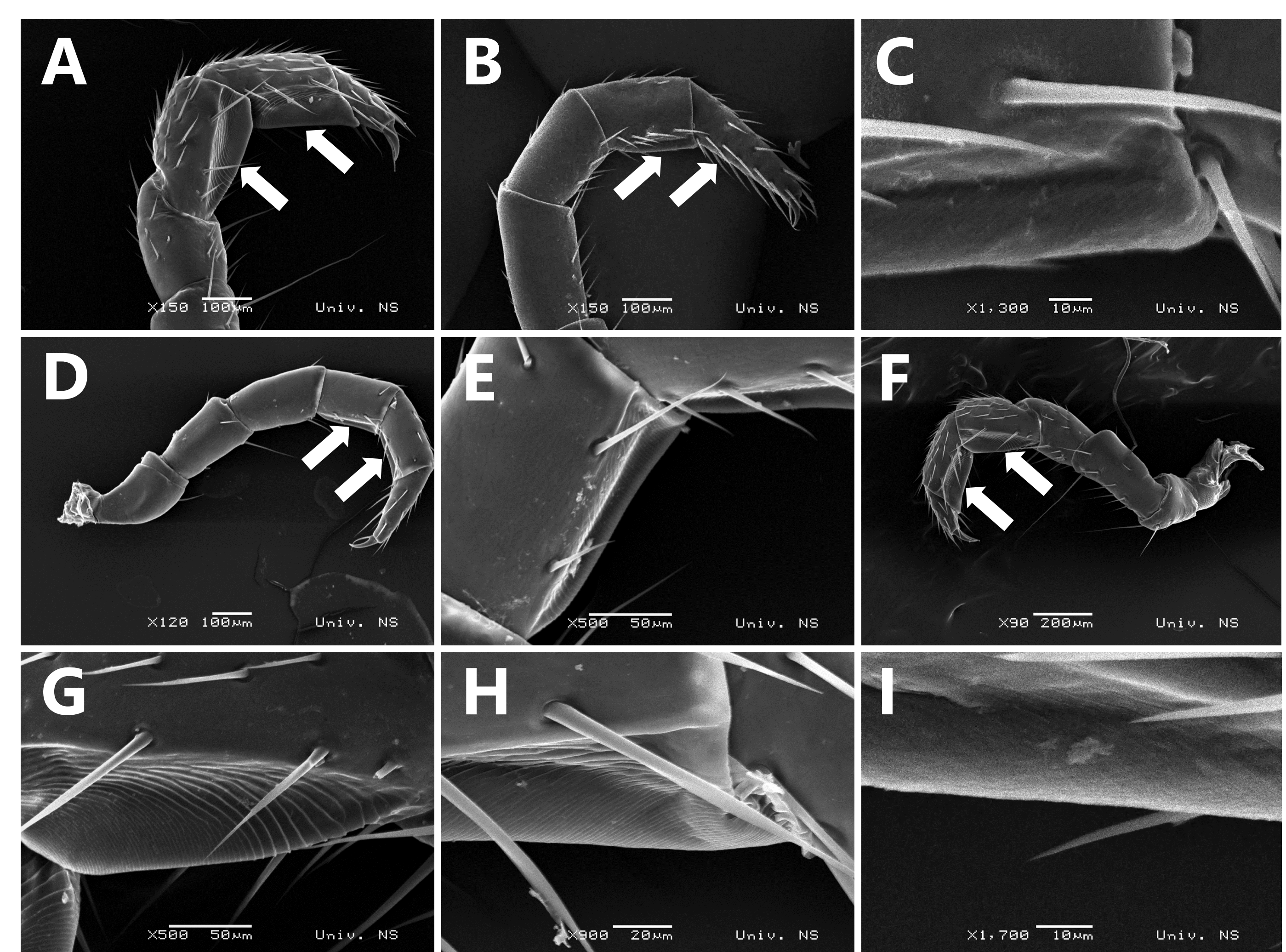


Fig. 3. The second (Figs. A-C) and the eleventh leg-pairs (Figs. D-I) in: (A) *Megaphyllum bosniense*; (B and C; C is detail of B) *Ommatoiulus sabulosus*; (D and E; E is detail of D) *Cylindroiulus boleti*; (F) *M. bosniense*. Adhesive pads on the eleventh leg-pairs in: (G) *M. bosniense*; (H) *M. unilineatum* and (I) *Pachyiulus cattarensis*. Arrows indicate adhesive pads.

Conclusion

- Observed modifications of walking legs are present only in males of analyzed species; we propose that these structures enable male to achieve firmer grip of the female head (hook-like legs of the first pair) and to hold onto female during mating (walking legs with adhesive pads).