

ONE HUNDRED MILLIPEDE SPECIES IN SERBIA (ARTHROPODA: MYRIAPODA: DIPLOPODA)

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Abstract – The millipede fauna of Serbia consists of 100 species, 44 genera, 16 families and 7 orders. The most abundant are families Julidae (41 species or 41%) and Polydesmidae (22 species or 22%). Of the total number, 27 species (27%) are endemic to Serbia, while 18 (18%) are endemic to the Balkan Peninsula. All registered species can be related to 15 zoogeographical categories. *Glomeris klugii* Brandt, 1833 (Glomerida: Glomeridae), *Cibiniulus phlepsii* (Verhoeff, 1897) (Julida: Blaniulidae), *Brachyiulus bagnalli* (Brolemann, 1924), *Megaphyllum carniolense* (Verhoeff, 1897), *Typhloiulus incurvatus* Verhoeff, 1899, *Xestoiulus luteus* (Attems, 1951) (all Julida: Julidae), and *Polydesmus renschi* Schubart, 1934 (Polydesmida: Polydesmidae) represent new records for the diplopod fauna of Serbia.

Key words: Diplopoda, Serbia, fauna, biogeography

INTRODUCTION

The Republic of Serbia occupies the central and northern parts of the Balkan Peninsula and lies at the convergence of three large geotectonic units (three main mountain systems): the Rhodopian mass in the middle, the Carpatho-Balkan mountain system in the east and the Dinaric mountain system in the west. The northern part of Serbia occupies the great Pannonian Plain and river lowlands. Its very complex relief, elevation above sea level, exposure to precipitation, orientation of mountain ranges, atmospheric circulation and proximity to the sea affect the climate of Serbia much more than its geographical position in the south of Europe (Ćurčić, 1998; Makarov et al., 2004). Different climatic conditions, geomorphological events in the past, as well as the geographical position of Serbia, have brought

about the appearance of a very diverse fauna, especially Arthropoda.

The myriapod class Diplopoda (Golovatch and Kime, 2009; Sierwald and Bond, 2007) is one of the oldest and most diverse groups of terrestrial animals, with over 12,000 described species and estimated diversity of more than 80,000 species, as well as fossil records dating from the mid-Silurian and Devonian. This arthropod group inhabits almost all natural zones, except the Arctic and Antarctic deserts and driest deserts (Mikhaljova, 2004), with greatest diversity in temperate, subtropical and tropical forests (Golovatch and Kime, 2009). The vast majority of species occurs in leaf litter, surface soil layers or dead wood, but they also inhabit caves, high mountains, deeper soil layers, deserts or even more extreme habitats (Golovatch and Kime, 2009). Many of those that

dwell in atypical habitats (especially high mountains and caves) are endemic. Because of their great diversity, geological age and low vagility, millipedes are important biogeographical indicators (Hopkin and Read, 1992). Most of them are detritivores, feeding on decaying plant material, and they play very important roles in soil-forming processes (Mikhaljova, 2004).

The first data on millipede fauna in Serbia can be found in Latzel's works from the late 19th century, where he reported two (Latzel, 1882), and later seven (Latzel, 1884) species. After that, in papers about myriapods from Albania and Yugoslavia (1929) and from caves on the Balkan Peninsula (1959), Attems quoted 13 and 33 species of millipedes from Serbia, respectively. More detailed data on the distribution of this group in Serbia were given by Karl Strasser (1971). In "Catalogus Faunae Jugoslaviae" he introduced 47 species and subspecies of these arthropods. Describing new forms, the list was extended to 53 taxa by Mršić (1985) and subsequently to 70 by Ćurčić et al. (2002). The last taxonomic survey of Serbian millipede fauna was given by Makarov et al. (2004) in a monograph: "The Diplopods of Serbia, Montenegro and the Republic of Macedonia", where they stated that 80 species of diplopods inhabit the territory of Serbia.

In the last decade, intensive and extensive field studies have resulted in the discovery and description of numerous taxa new to science (Antić et al., 2013; Ćurčić et al., 2005, 2007, 2008; Makarov, 2008, 2008a; Makarov et al., 2005, 2008, 2012, 2013; Sekulić et al., 2013;), as well as the finding of taxa new to Serbian fauna (Makarov et al., 2004; Makarov and Tomić, 2011; present study), so the number of millipede species from Serbia now stands at 100.

MATERIALS AND METHODS

This paper represents a checklist of diplopods from Serbia based on literature records as well as on unpublished data. For species given in the last survey of millipedes in Serbia (Makarov et al., 2004) only a rough distribution is given, with few exceptions. Pre-

cise localities are cited and distributional maps given for species that are new to the Serbian list of millipedes (species described as new to science after 2004, published and unpublished new records, as well as species with changed status: for the last mentioned remarks were given); these species are marked with an asterisk (*) in front of the scientific name. Geographic affiliations are given for all species occurring in the territory of Serbia.

The following abbreviations are used for zoogeographical categories: CAB – Carpathian-Balkan; CEE – Central-East European; CES – Central-East-Southeast European; CEU – Central European; CSE – Central-Southeast European; CWE – Central-West-East European; CWS – Central-West-Southeast European; DIN – Dinaric; ESE – East-Southeast European; EUR – European; HOL – Holarctic; MED – Mediterranean; NME – North Mediterranean; SEE – Southeast European; SEU – South European.

To illustrate the distribution and cartography of millipedes from Serbia we used the UTM system. The map records the presence of the species in 10 km squares of the UTM grid. Sites for all 24 species new to the Serbian millipede list are presented by number or symbol. A circled number on the map or numbers next to a symbol in the map legend correspond to the ordinal number of a species in a checklist.

CHECKLIST OF DIPLOPODA FROM SERBIA

Order POLYXENIDA

Family POLYXENIDAE

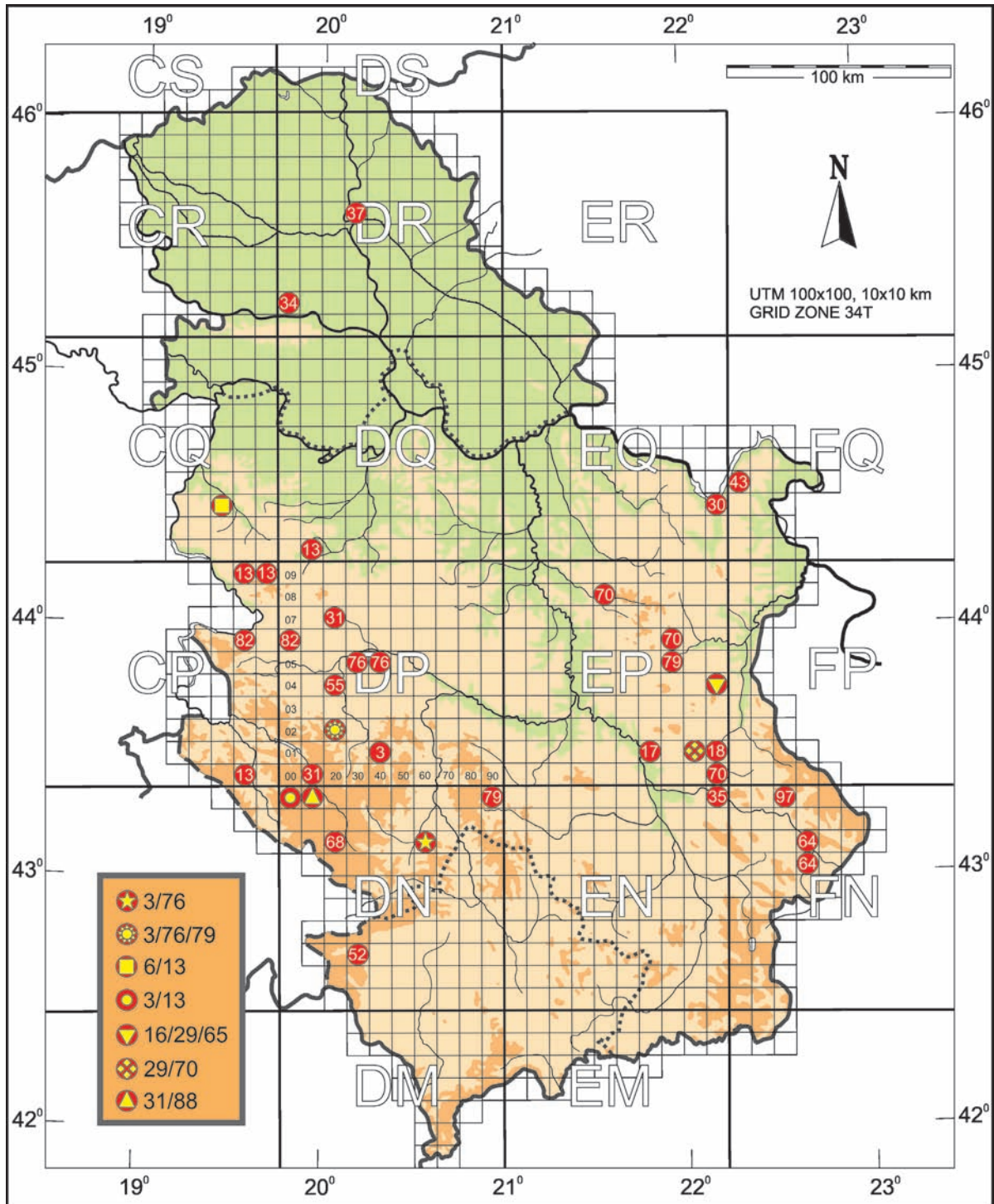
1. *Polyxenus lagurus* (Linnaeus, 1758) (Fig. 1a)

Distribution in Serbia: Widespread (Makarov et al., 2004; present study)

Chorotype: HOL

Order GLOMERIDA

Family GLOMERIDAE



Map 1. Distribution of millipede representatives new to the Serbian diplopod list since last taxonomic survey (see Makarov et al., 2004).

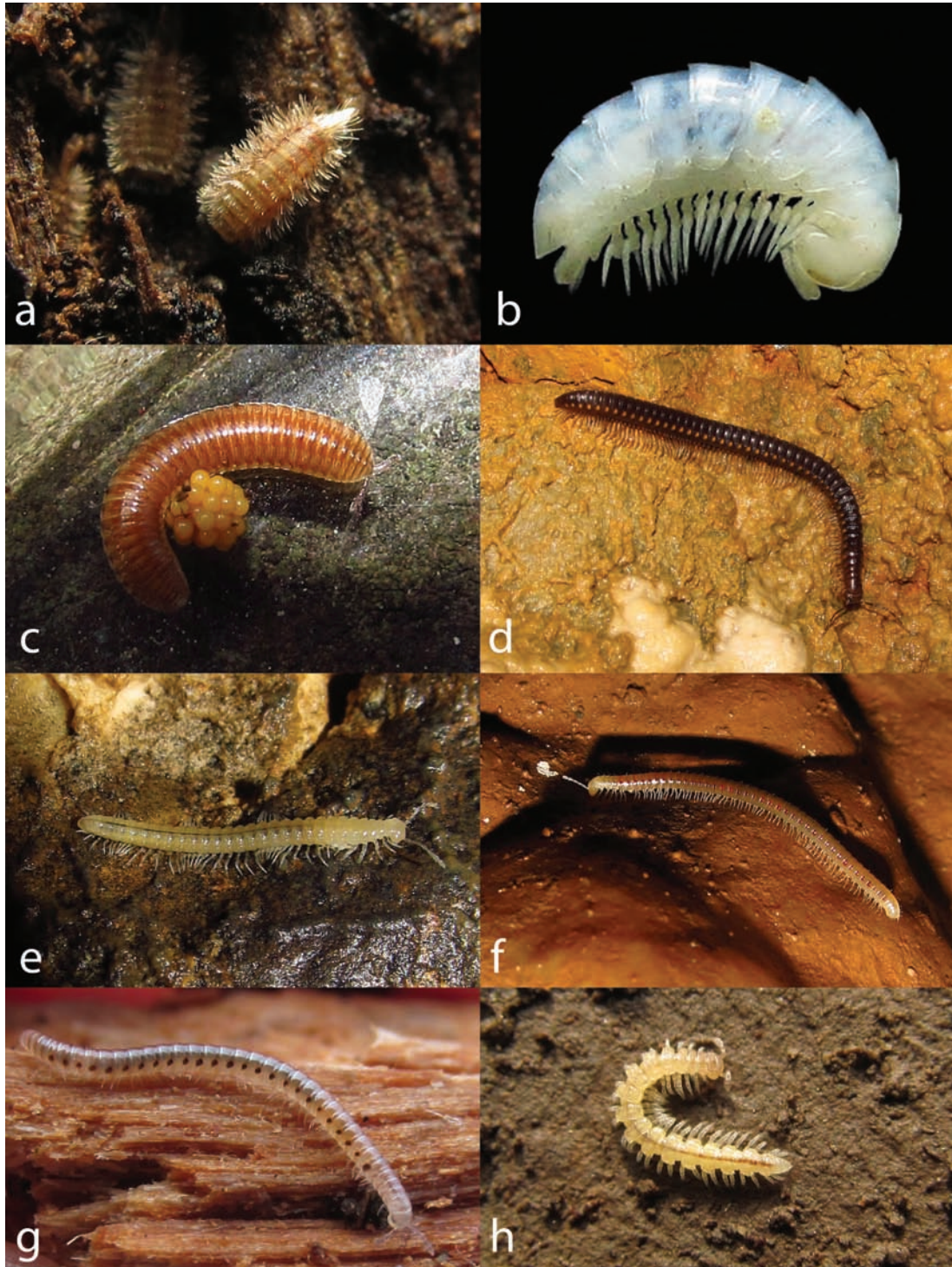


Fig. 1. Some representatives of millipede fauna from Serbia. a) Polyxenida: *Polyxenus lagurus* (Linnaeus, 1758), photo by D. Antić, b) Glomerida: *Hyleoglomeris faberi* Makarov et al., 2013, photo by D. Antić, c) Polyzoniida: *Polyzonium germanicum* Brandt, 1837, photo by D. Antić, d) Callipodida: *Apfelbeckia insculpta* (L. Koch, 1867), photo by D. Antić, e) Chordeumatida: *Perunosoma trojanicum* Ćurčić and Makarov, 2007, photo by D. Antić, f) Julida: *Serboiulus deelemani* Strasser, 1971, photo by D. Antić, g) Julida: *Cibiniulus phlepsii* (Verhoeff, 1897), photo by M. Šćiban, h) Polydesmida: *Brachydesmus avalae* Ćurčić and Makarov, 1997, photo by D. Antić.

2. *Glomeris hexasticha* Brandt, 1833

Distribution in Serbia: Widespread (Makarov et al., 2004; present study).

Chorotype: CES

3. **Glomeris klugii* Brandt, 1833

Material examined – two males and seven females from the village of Izbice, near Novi Pazar, collected during 2012 by D. Z. Stojanović; one male from the village of Bratljevo, near Ivanjica; August, 1998; four males and three females from Suvodolina, village of Štitkovo, near Ivanjica; September, 2003; one female from the Lovačka česma, Mt. Javor; May 27, 2009; three males and two females from the Četanica Plateau, near Prijepolje, August 4, 2012, collected by members of the Biological Research Society “Josif Pančić”, Belgrade.

Distribution in Serbia: Southwest Serbia (Map 1).

Chorotype: CWS

New record.

4. *Glomeris pustulata* Latreille, 1804

Distribution in Serbia: East Serbia (Makarov et al., 2004; present study).

Chorotype: CSE

5. *Haploglomeris multistriata* (C. L. Koch, 1844)

Distribution in Serbia: West and Southwest Serbia (Makarov et al., 2004; present study).

Chorotype: CSE

6. **Hyleoglomeris faberi* Makarov et al., 2013 (Fig. 1b)

Literature record: *Type material* – Holotype male, allotype female, five paratype males, four para-

type females and two paratype juveniles, from the Kovačevića Pećina Cave, village of Cerova, near Krupanj, July 28, 2011; collected by D. Ž. Antić and J. Kulačić (Makarov et al., 2013).

Distribution in Serbia: known only from type locality, West Serbia (Map 1).

Chorotype: DIN

Endemic Serbian species.

7. *Onychoglomeris herzogowinensis* (Verhoeff, 1898)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: SEE

Endemic Balkan species.

8. *Trachysphaera costata* (Waga, 1857)

Distribution in Serbia: Widespread (Makarov et al., 2004; present study).

Chorotype: CES

9. *Trachysphaera lobotarsus* (Attems, 1943)

Distribution in Serbia: Southwest Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Balkan species.

Family GLOMERIDELLIDAE

10. *Typhloglomeris ljubetensis* (Attems, 1929)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Balkan species.

Order POLYZONIIDA

Family POLYZONIIDAE

11. *Polyzonium germanicum* Brandt, 1837 (Fig. 1c)

Distribution in Serbia: Southwest and South Serbia (Makarov et al., 2004); East, West and North Serbia (present study).

Chorotype: EUR

Order CALLIPODIDA

Family DORYPETALIDAE

12. *Dorypetalum degenerans* (Latzel, 1884)

Distribution in Serbia: East and South Serbia (Makarov et al., 2004).

Chorotype: CSE

Family SCHIZOPETALIDAE

13. **Apfelbeckia insculpta* (L. Koch, 1867) (Fig. 1d)

Literature records: Popova Pećina Cave, village of Seljane, near Prijepolje; Tatašnjica Cave, Gornja Trešnjica, Tara Mt; West Serbia (Makarov et al., 2004).

Material examined: numerous specimens from caves in West and Southwest Serbia (present study).

Remarks: Makarov et al. (2004) quoted two species of *Apfelbeckia* Verhoeff, 1896 inhabiting territory of Serbia: *A. subterranea* Verhoeff, 1943 and *A. wohlberedti* Verhoeff, 1909. These two and most of the other previously described species and subspecies of this genus have been synonymized under *A. insculpta* by Stoev and Enghoff (2008).

Distribution in Serbia: West and Southwest Serbia (Map 1).

Chorotype: DIN

Endemic Balkan species.

14. *Callipodella fasciata* (Latzel, 1883)

Distribution in Serbia: South Serbia (Makarov et al., 2004)

Chorotype: SEE

Endemic Balkan species.

15. *Dischizopetalum illyricum* (Latzel, 1884)

Distribution in Serbia: North Serbia (Makarov et al., 2004); East and Southwest Serbia (present study).

Chorotype: SEE

Order CHORDEUMATIDA

Family ANTHROLEUCOSOMATIDAE

16. **Belbogosoma bloweri* Ćurčić and Makarov, 2008

Literature record: *Type material* – Holotype male from Gornja Lenovačka Pećina Cave, village of Lenovac, near Zaječar, Mt. Tupižnica, March 18, 2000, collected by S. Ognjenović; paratype juvenile male, October 31, 1998, collected by S. Ognjenović (Ćurčić et al., 2008).

Distribution in Serbia: known only from type locality, East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

17. **Dazbogosoma naissi* Makarov and Ćurčić, 2012

Literature record: *Type material* – Holotype male, two paratype males and one paratype juvenile from the Cerjanska Propast Cave, village of Cerje, near Niš, October 17, 2010, collected by Iva Njunjić (Makarov et al., 2012).

Distribution in Serbia: known only from type locality, East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species

18. **Perunosoma trojanicum* Ćurčić and Makarov, 2007 (Fig 1e)

Literature record: *Type material* – Holotype male, allotype female, two paratype males, and three paratype juveniles from the Prekonoška Pećina Cave, village of Prekonoga, near Svrljig, July 7, 1998, collected by S. Ognjenović (Ćurčić et al., 2007).

Material examined: *Topotype material* – two females, September 11 – October 27, 2004 (Barber traps), collected by S. Ognjenović; three females and one juvenile, June 25, 2012, collected by D. Ž. Antić; six males, five females and five juveniles, June 25 – September 23, 2012 (Barber traps), collected by D. Ž. Antić; one female and seven juveniles, September 23 – December 2, 2012 (Barber traps), collected by D. Ž. Antić; seven males and five females, December 2, 2012 – May 28, 2013 (Barber traps), collected by D. Ž. Antić. *Other material* – one female from the Golema Dupka Cave, village of Prekonoga, near Svrljig, May 28, 2013, collected by D. Ž. Antić.

Distribution in Serbia: East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

19. *Serbosoma beljanicae* (Ćurčić and Makarov, 1998)

Distribution in Serbia: known only from two caves

on Mt. Beljanica, East Serbia (Makarov et al., 2004).

Chorotype: CAB

Endemic Serbian species.

20. *Serbosoma crucis* (Strasser, 1960)

Distribution in Serbia: known only from type locality, Ravanička pećina Cave, village of Senje, near Ćuprija, East Serbia (Makarov et al., 2004).

Chorotype: CAB

Endemic Serbian species.

21. *Serbosoma kucajensis* (Ćurčić and Makarov, 1998)

Distribution in Serbia: known only from type locality, Resavska Pećina Cave, village of Jelovac, near Despotovac, Mt. Kučaj, East Serbia (Makarov et al., 2004).

Chorotype: CAB

Endemic Serbian species.

22. *Serbosoma lazarevensis* (Ceuca, 1964)

Distribution in Serbia: known from a few caves on Mt. Kučaj, East Serbia (Makarov et al., 2004; present study).

Chorotype: CAB

Endemic Serbian species.

23. *Serbosoma zagubicae* (Ćurčić and Makarov, 1998)

Distribution in Serbia: known only from type locality, Stogrina Pećina Cave, village of Suvi Do, near Žagubica, Beljanica Mt., East Serbia (Makarov et al., 2004).

Chorotype: CAB

Endemic Serbian species.

24. *Svarogosoma bozidarcurcici* Makarov, 2003

Distribution in Serbia: known only from type locality, Savina Propast Cave, Mali Trem, Mt. Suva Planina (Makarov et al., 2004).

Chorotype: CAB

Endemic Serbian species.

Family CHORDEUMATIDAE

25. *Melogona broelemanni* (Verhoeff, 1897)

Distribution in Serbia: North and South Serbia (Makarov et al., 2004); East Serbia (present study).

Chorotype: CSE

Family CRASPEDOSOMATIDAE

26. *Craspedosoma transsylvanicum* (Verhoeff, 1897)

Distribution in Serbia: North, East and Central Serbia (Makarov et al., 2004).

Chorotype: CSE

27. *Dyocerasoma drimicum* Mršić, 1985

Distribution in Serbia: known only from type locality, Beli Drim, South Serbia (Makarov et al., 2004)

Chorotype: DIN

Endemic Serbian species.

28. *Dyocerasoma lignivorum* (Verhoeff, 1899)

Distribution in Serbia: Užice, Mt. Tara, West Serbia (Makarov et al., 2004)

Chorotype: SEE

Family HAASEIDAE

29. **Haasea guidononveilleri* Makarov, 2008

Literature records: *Type material* – Holotype male, allotype female and one paratype juvenile from Jama Tupižnička Ledenica Pit, 1060 m, Mt. Tupižnica, near Zaječar, May 14, 2004, collected by S. Ognjenović. *Other material* – two males, two females and one juvenile from Jezava Cave System, Kalafat, village of Kopajkošara, near Niš, May 11 – October 19, 2005 (Barber traps with rotten meat and 9% solution of vinegar), collected by S. Ognjenović; one female and three juveniles from Samar–Veliki Pešter Cave System, Kalafat, village of Kopajkošara, near Niš, May 5 – October 19, 2005 (Barber traps), collected by S. Ognjenović (Makarov, 2008a).

Distribution in Serbia: East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

30. **Haasea intermedia* Mršić, 1985

Literature record: Golubinja reka, Đerdap, July 21, 1967, collected by Velika Tomić-Jovanović (Mršić, 1985).

Distribution in Serbia: known only from type locality, East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

Remarks: Mršić described this taxon as subspecies *H. lacusnigri intermedia* Mršić, 1985. Makarov et al., (2004) did not include this subspecies in the list of Serbian diplopods due to its uncertain taxonomic status. After revision of the “*lacusnigri*” group, Makarov (2008a) stated that this taxon deserves a full specific level.

31. **Haasea microcorna* Strasser, 1971

Literature records: *Type material* – Holotype male, three paratype males and one paratype female from Ušak Cave System, near Sjenica, Sjenica-Pešter Plateau Serbia, 950 m, July 5, 1970, collected by E. Pretner (Strasser, 1971a). *Topotype material* – 10 males and 10 females, May 30 – August 30, 2002, collected by D. Pavićević and S. Ognjenović. *Other material* – 11 males and 10 females from the Baždarska Pećina Cave (entrance at 1075 m), village of Ursule, near Sjenica, Serbia, May 28 – August 29, 2002, collected by D. Pavićević and S. Ognjenović; four males and five females from the Tubića Pećina Cave (chasm entrance at 1020 m), village of Tubići, near Sjenica, Serbia, May 28 – August 30, 2002, collected by D. Pavićević and S. Ognjenović (Makarov, 2008a).

Distribution in Serbia: Southwest Serbia (Map 1).

Chorotype: DIN

Endemic Serbian species.

Remarks: In “Über Diplopoden Jugoslawiens”, Strasser (1971a) described this taxon as subspecies *Haasea lacusnigri microcornum* Strasser, 1971. Makarov et al., (2004) did not include this subspecies in the list of Serbian diplopods due to the uncertain taxonomic status. After revision of the “*lacusnigri*” group, Makarov (2008a) stated that this taxon deserves a full specific level.

32. *Haasea plasana* (Verhoeff, 1899)

Distribution in Serbia: Petrova Ravan Plateau, Mt. Kopaonik, Central Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Balkan species.

Family MASTIGOPHOROPHYLLIDAE

33. *Mastigona bosniensis* (Verhoeff, 1897)

Distribution in Serbia: East and Central Serbia (Makarov et al., 2004); North Serbia (present study).

Chorotype: CES

Order JULIDA

Family BLANIULIDAE

34. **Cibiniulus phlepsii* (Verhoeff, 1897) (Fig 1g)

Material examined: two juveniles from Novi Sad, bank of the river Danube, April 5, 2013, collected by M. Šćiban; three males, three females and six juveniles from same place, May 24, 2013, collected by D. Ž. Antić and M. Šćiban.

Distribution in Serbia: North Serbia (Map 1).

Chorotype: CEE

New record.

35. **Nopoiulus kochii* (Gervais, 1847)

Literature record: 18 females and six males from the Velika Balanica Cave, village of Sićevo, near Niš, December 6, 2005 (Barber traps), collected by S. Ognjenović (Makarov and Tomić, 2011).

Material examined: 13 females, one male and three juveniles from the Velika Balanica Cave, village of Sićevo, near Niš, May 29, 2013, collected by D. Ž. Antić; one female from the Mala Balanica Cave, village of Sićevo, near Niš, May 29, 2013, collected by D. Ž. Antić.

Distribution in Serbia: East Serbia.

Chorotype: EUR

Family JULIDAE

36. *Acanthoiulus fuscipes* (C. L. Koch, 1847)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: NME

37. **Brachyiulus bagnalli* (Brolemann, 1924)

Material examined: one male from the Nature Park "Stara Tisa", Bačko Gradište, near Bečej, March 2013, collected by M. Šćiban.

Distribution in Serbia: North Serbia (Map 1).

Chorotype: CSE

New record.

38. *Chromatoiulus podabrus* (Latzel, 1884)

Distribution in Serbia: South Serbia (Makarov et al., 2004; present study).

Chorotype: NME

39. *Cylindroiulus boleti* (C. L. Koch, 1847)

Distribution in Serbia: North, Central and South Serbia (Makarov et al., 2004); East Serbia (present study).

Chorotype: CES

40. *Cylindroiulus luridus* (C. L. Koch, 1847)

Distribution in Serbia: Central Serbia (Makarov et al., 2004).

Chorotype: CSE

41. *Enantiulus nanus* (Latzel, 1884)

Distribution in Serbia: North, Central and South Serbia (Makarov et al., 2004); Southwest Serbia (present study).

Chorotype: EUR

42. *Julus terrestris* Linnaeus, 1758

Distribution in Serbia: North, Central and Southwest Serbia (Makarov et al., 2004); North Serbia (present study).

Chorotype: CEE

43. **Lamellotyphlus belevodae* Makarov, 2008

Literature record: *Type material* – Holotype male, four paratype males and five paratype females from the Bele Vode Cave, Iron Gate National Park, Mt. Miroč, July 26, 2004, collected by members of the "Endemit" Ecological Society, Belgrade. *Non-types*: fragments of two males and four females, same place, date, and collectors, taken together with holotype (Makarov et al., 2008).

Distribution in Serbia: known only from type locality, East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

44. *Lamellotyphlus sotirovi* Makarov et al., 2002

Distribution in Serbia: known only from type locality, Buronov Ponor Cave, village of Štrbac, Mt. Miroč, East Serbia (Makarov et al., 2004).

Chorotype: CAB

Endemic Serbian species.

45. *Leptoiulus ivanjicae* Ćurčić and Makarov, 1997

Distribution in Serbia: Southwest Serbia (Makarov et al., 2004; present study)

Chorotype: DIN

Endemic Serbian species.

46. *Leptoiulus macedonicus* (Attems, 1927)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: SEE

Endemic Balkan species.

47. *Leptoiulus sarajevensis* Verhoeff, 1898

Distribution in Serbia: North, West and South Serbia (Makarov et al., 2004); East and Southwest Serbia (present study).

Chorotype: SEE

Endemic Balkan species.

48. *Leptoiulus simplex* (Verhoeff, 1894)

Distribution in Serbia: Southwest Serbia (Makarov et al., 2004).

Chorotype: CWE

49. *Leptoiulus trilineatus* (C. L. Koch, 1847)

Distribution in Serbia: Widespread (Makarov et al., 2004; present study).

Chorotype: CSE

50. *Megaphyllum austriacum* (Latzel, 1884)

Distribution in Serbia: North, Central and East Serbia (Makarov et al., 2004).

Chorotype: SEU

51. *Megaphyllum bosniense* (Verhoeff, 1897)

Distribution in Serbia: North, Southwest and South Serbia (Makarov et al., 2004).

Chorotype: CSE

52. **Megaphyllum carniolense* (Verhoeff, 1897)

Material examined: one male from Serbian part of Mt. Prokletije, August 3, 1996, collected by N. Živić.

Distribution in Serbia: South Serbia (Map 1).

Chorotype: SEE

Endemic Balkan species.

New record.

53. *Megaphyllum crassum* (Attems, 1929)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Balkan species.

54. *Megaphyllum dentatum* (Verhoeff, 1898)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: SEE

Endemic Balkan species.

55. **Megaphyllum montivagum* (Verhoeff, 1901)

Literature record: village of Kruščica, near Arilje (Makarov et al., 2004)

Distribution in Serbia: West Serbia (Makarov et al., 2004).

Chorotype: SEE

Endemic Balkan species.

Remarks: In the last taxonomic survey of Serbian millipedes (Makarov et al., 2004), the list contained *M. macedonicum* (Strasser, 1976), now a synonym

for *M. montivagum* (Lazányi et al., 2012).

56. *Megaphyllum platyurum* (Latzel, 1884)

Distribution in Serbia: North Serbia (Makarov et al., 2004).

Chorotype: CEU

57. *Megaphyllum transsylvanicum* (Verhoeff, 1897)

Distribution in Serbia: North Serbia (Makarov et al., 2004).

Chorotype: CES

58. *Megaphyllum unilineatum* (C. L. Koch, 1838)

Distribution in Serbia: North and East Serbia (Makarov et al., 2004); East and Southwest Serbia (present study).

Chorotype: CSE

59. *Ommatoiulus sabulosus* (Linnaeus, 1758)

Distribution in Serbia: North and South Serbia (Makarov et al., 2004); Southwest Serbia (present study).

Chorotype: EUR

60. *Ophiulus curvipes* (Verhoeff, 1898)

Distribution in Serbia: East Serbia (Makarov et al., 2004).

Chorotype: CSE

61. *Pachyiulus cattarensis* (Latzel, 1884)

Distribution in Serbia: North and South Serbia (Makarov et al., 2004); Southwest and East Serbia (present study).

Chorotype: SEU

62. *Pachyiulus hungaricus* (Karsch, 1881)

Distribution in Serbia: Widespread (Makarov et al., 2004; present study).

Chorotype: SEE

63. *Pachyiulus varius* (Fabricius, 1781)

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: MED

64. **Serboiulus deelemani* Strasser, 1971 (Fig. 1f)

Literature records: *Type material* – Holotype male, six paratype males, nine paratype females and three paratype juveniles from the Vetrena Dupka Cave, village of Vlasi, near Pirot, July 22, 1967, collected by E. Pretner and P. R. Deeleman (Strasser, 1971a). *Topotype material* – nine males, October 16, 2001, collected by D. Pavićević (Makarov et al., 2005). *Other material* – one male from the Držinska Pećina Cave, village of Držina, near Pirot, same date and collectors as for type material (Strasser, 1971a).

Material examined: *Topotype material* – six males, six females and two juvenile males, September 25, 2012, collected by D. Ž. Antić; four males, three females and two juveniles, December 12, 2012, collected by D. Ž. Antić and Đ. Marković.

Distribution in Serbia: East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

Remarks: This taxon was described by Strasser (1971a) as a subspecies *S. lucifugus deelemani*. Because of its uncertain status, Makarov et al. (2004) did not include this taxon in the list of Serbian millipedes. After revision of the genus *Serboiulus* Strasser, 1962, this subspecies was elevated to full specific level by Makarov et al. (2005).

65. **Serboiulus kresnik* Makarov, 2013

Literature record: *Type material* – Holotype male, allotype female, two paratype males and nine paratype females from the Gornja Lenovačka Pećina Cave, village of Lenovac, near Zaječar, Mt. Tupižnica, June 26, 2012, collected by D. Ž. Antić and S. B. Čurčić (Sekulić et al., 2013).

Distribution in Serbia: known only from type locality, East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

66. *Serboiulus lucifugus* Strasser, 1962

Distribution in Serbia: known only from a few caves on Mt. Svrljiške Planine, East Serbia (Makarov et al., 2004; present study).

Chorotype: CAB

Endemic Serbian species.

67. *Typhloiulus albanicus* Attems, 1929

Distribution in Serbia: East and South Serbia (Makarov et al., 2004).

Chorotype: SEE

Endemic Balkan species.

68. **Typhloiulus incurvatus* Verhoeff, 1899

Material examined: one male from the Rešitova Pećina Cave, Hamidova Vrtača Sinkhole, village of Doliće, Pešterska Visoravan Plateau, August 28, 2005, collected by B. P. M. Čurčić and S. B. Čurčić.

Distribution in Serbia: Southwest Serbia (Map 1).

Chorotype: DIN

Endemic Balkan species.

New record.

69. *Typhloiulus nevoi* Makarov et al., 2002

Distribution in Serbia: few caves in Odorovci Karst Field, East Serbia (Makarov et al., 2004; present study).

Chorotype: CAB

Endemic Serbian species.

70. **Typhloiulus serborum* Čurčić and Makarov, 2005

Literature record: *Type material* – Holotype male and paratype male from the Izviđačka Pećina Cave, Canyon of Suvaja, Resava River, Mt. Beljanica, July 2 – July 5, 1992 (Barber traps), collected by I. Karaman (Čurčić et al., 2005).

Material examined: *Other material* – one male from Samar-Veliki Pešter Cave System, Kalafat, village of Kopajkošara, near Niš, June 26, 2012, collected by D. Ž. Antić; one male from same place, December 2, 2012, collected by D. Ž. Antić; two males from same place, October 20, 2005, collected by S. Ognjenović; one male and two females from Modro Bučje, Svrljiške Planine Mt., 1100 m, near Svrljig, May 13, 2005, collected by D. Pavićević; one male from the Devojačka Pećina Cave (Gaura Fečilor), village of Podgorac, near Boljevac, May 27, 2012, collected by S. B. Čurčić and D. Ž. Antić.

Distribution in Serbia: East Serbia (Map 1).

Chorotype: CAB

Endemic Serbian species.

71. *Typhloiulus strictus* (Latzel, 1882)

Distribution in Serbia: North and East Serbia (Makarov et al., 2004).

Chorotype: CAB

72. *Unciger foetidus* (C. L. Koch, 1838)

Distribution in Serbia: North, West and South Serbia (Makarov et al., 2004).

Chorotype: EUR

73. *Unciger transsilvanicum* (Verhoeff, 1899)

Distribution in Serbia: North and East Serbia (Makarov et al., 2004).

Chorotype: CES

74. *Xestoiulus fontisherculis* (Verhoeff, 1899)

Distribution in Serbia: East Serbia (Makarov et al., 2004; present study).

Chorotype: SEE

75. *Xestoiulus imbecilus* (Latzel, 1884)

Distribution in Serbia: East Serbia (Makarov et al., 2004).

Chorotype: CES

76. **Xestoiulus luteus* (Attems, 1951)

Material examined: one male and two females from the village of Virovo, near Arilje, August 23, 1998; one female from the village of Lis, near Guča, August, 1998; five males and 18 females from the village of Močioce, near Ivanjica, August, 1998; one male and five females from the village of Izbice, near Novi Pazar, October 18, 2012, collected by D. Z. Stojanović.

Distribution in Serbia: Southwest Serbia (Map 1).

Chorotype: DIN

Endemic Balkan species.

Remarks: To our knowledge, this is the second record of this species after original description.

New record.

Family NEMASOMATIDAE

77. *Nemasoma varicorne* C. L. Koch, 1847

Distribution in Serbia: North and South Serbia (Makarov et al., 2004).

Chorotype: EUR

Order POLYDESMIDA

Family PARADOXOSOMATIDAE

78. *Strongylosoma stigmatosum* (Eichwald, 1830)

Distribution in Serbia: North, East and West Serbia (Makarov et al., 2004).

Chorotype: CES

Family POLYDESMIDAE

79. **Brachydesmus attemsii* Verhoeff, 1895

Literature record: one male and three females from the Petrova Ravan, Mt. Kopaonik, August 20, 2002 – July 23, 2003 (Barber traps), collected by D. Pavićević (Makarov et al., 2004a).

Material examined: one male from the Jelenja Propast Jama Pit, December 8, 2006, collected by S. Ognjenović; one male found between the village of Božetići and the village of Šitkovo (without precise locality), near Ivanjica, May 2, 2003.

Distribution in Serbia: East, Central and Southwest Serbia (Map 1).

Chorotype: CSE

80. *Brachydesmus avalae* Ćurčić and Makarov, 1997 (Fig. 1h)

Distribution in Serbia: known only from type locality, Mt. Avala, near Belgrade (Makarov et al., 2004).

Chorotype: SEE

Endemic Serbian species.

81. *Brachydesmus dadayi* Verhoeff, 1895

Distribution in Serbia: North Serbia (Makarov et al., 2004); North and East Serbia (present study).

Chorotype: CSE

82. **Brachydesmus femoralis* Makarov, 2008

Literature record: *Type material* – Holotype male, allotype female, 34 paratype males and 55 paratype females from the Bezimena Pećina Cave, village of Šljivovica, Mt. Tara, May 7, 2003, collected by S. Ognjenović (Makarov, 2008).

Material examined: *Other material* – one male and two females from the Mladenovića Megara Cave, village of Stapari, near Užice, June 1, 2003.

Distribution in Serbia: West Serbia (Map 1).

Chorotype: DIN

Endemic Serbian species.

83. *Brachydesmus herzogwinensis* Verhoeff, 1897

Distribution in Serbia: West, Southwest, South Serbia (Makarov et al., 2004).

Chorotype: SEE

Endemic Balkan species.

84. *Brachydesmus jalzici* Mršić, 1988

Distribution in Serbia: known only from type locality, a cave in the village of Duš, near Klina, South Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Serbian species.

85. *Brachydesmus ljubetensis* Attems, 1912

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Balkan species.

86. *Brachydesmus pancici* Makarov and Ćurčić, 2004

Distribution in Serbia: known only from type locality, Petrova Ravan Plateau, Mt. Kopaonik, Central Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Serbian species.

87. *Brachydesmus polydesmoides* Verhoeff, 1895

Distribution in Serbia: North and East Serbia (Makarov et al., 2004).

Chorotype: SEE

88. **Brachydesmus sjenicae* Makarov and Antić, 2013

Literature record: *Type material* – Holotype male, allotype female and two paratype juveniles from the Ledena Pećina Cave (part of Ušak Cave System), village of Ušak, near Sjenica, Pešterska Visoravan Plateau, October 1, 2012, collected by M. Petković and one paratype male from same place, May 23, 2012, collected by D. Stojanović (Antić et al., 2013).

Distribution in Serbia: Southwest Serbia (Map 1).

Chorotype: DIN

Endemic Serbian species.

89. *Brachydesmus subterraneus* Heller, 1857

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: CSE

90. *Brachydesmus troglobius* Dadayi, 1889

Distribution in Serbia: East and West Serbia (Makarov et al., 2004); North Serbia (present study).

Chorotype: CSE

91. *Polydesmus collaris* C. L. Koch, 1847

Distribution in Serbia: Widespread (Makarov et al., 2004; present study).

Chorotype: CSE

92. *Polydesmus complanatus* (Linnaeus, 1761)

Distribution in Serbia: Widespread (Makarov et al., 2004; present study).

Chorotype: EUR

93. *Polydesmus denticulatus* C. L. Koch, 1847

Distribution in Serbia: North and East Serbia (Makarov et al., 2004).

Chorotype: EUR

94. *Polydesmus edentulus* C. L. Koch, 1847

Distribution in Serbia: North and Central Serbia (Makarov et al., 2004).

Chorotype: CSE

95. *Polydesmus ignoratus* Ceuca, 1964

Distribution in Serbia: West and Central Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Balkan species.

96. *Polydesmus mediterraneus* Daday, 1889

Distribution in Serbia: West and East Serbia (Makarov et al., 2004).

Chorotype: ESE

97. **Polydesmus renschi* Schubart, 1934

Material examined: three males and two females from the village of Temska, near Pirot, Mt. Stara Planina, June 2, 2011, collected by D. Ž. Antić.

Distribution in Serbia: East Serbia (Map 1).

Chorotype: CAB

New record.

98. *Polydesmus schaessburgensis* Verhoeff, 1898

Distribution in Serbia: North and Northeast Serbia (Makarov et al., 2004).

Chorotype: CEE

99. *Polydesmus subscabratus* Latzel, 1884

Distribution in Serbia: North, East and Central Serbia (Makarov et al., 2004).

Chorotype: SEE

100. *Polydesmus undeviginti* Strasser, 1971

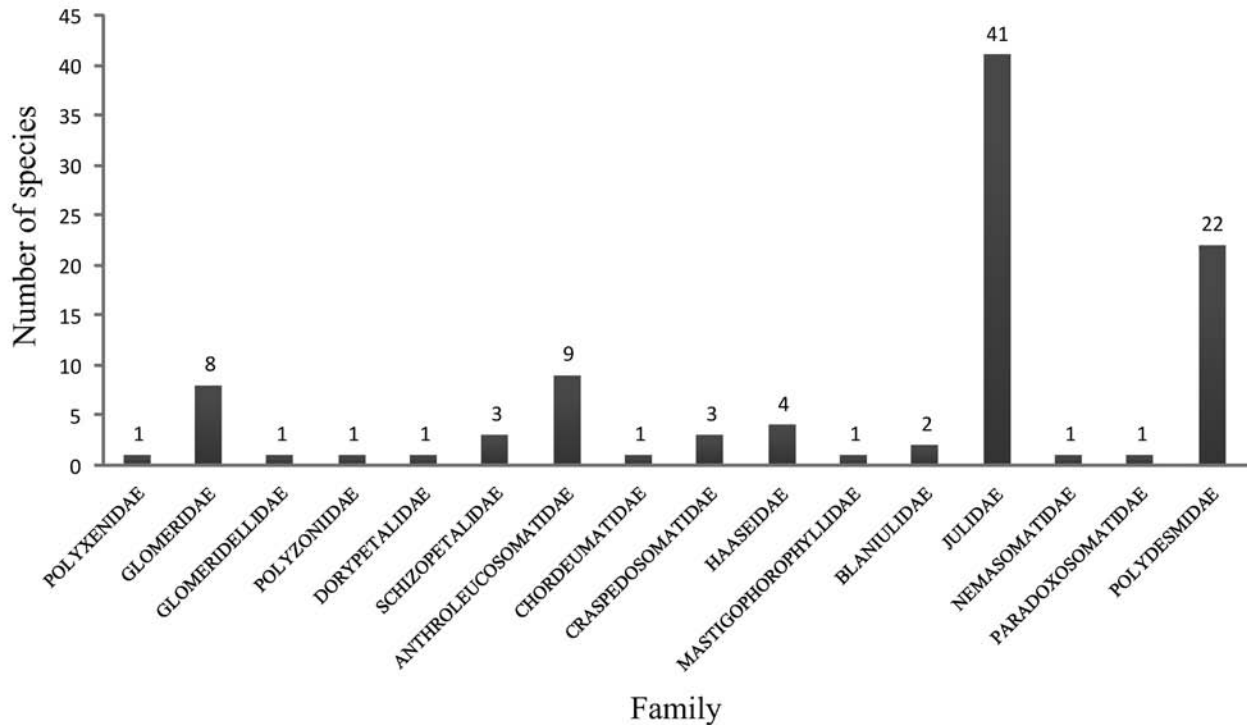


Fig. 2. Millipede families from Serbia with number of species.

Distribution in Serbia: South Serbia (Makarov et al., 2004).

Chorotype: DIN

Endemic Serbian species.

From the new millipede list we have excluded *Glomeris tetrasticha* Brandt, 1833 because of its obvious misidentification.

RESULTS AND DISCUSSION

The millipede fauna of Serbia is represented by a total of 100 species belonging to 44 genera and 16 families. This number of species represents nearly 7% of European and approximately 15% of Balkan millipede fauna. In comparison with neighboring countries, more species have been recorded from Croatia (175), Slovenia (169), Romania (166), Greece (143), Bosnia and Herzegovina (128), Bulgaria (120), and Hungary

(103) (Bogyó et al., 2012; Ceuca, 1992; Mršić, 1994; Strasser, 1971; Stoev, 2007); but fewer species are known from Montenegro (69), Macedonia (61) and Albania (53) (Ceuca, 1992; Makarov et al., 2004).

The families with the greatest number of species are Julidae (41 species or 41%), Polydesmidae (22 species or 22%), Anthroleucosomatidae (9 species or 9%), and Glomeridae (8 species or 8%). Other families are represented by less than five species (Fig. 2). The most diverse genera are *Brachydesmus* (12 species), *Polydesmus* (10 species), *Megaphyllum* (9 species), *Leptoiulus* (5 species), *Typhloiulus* (5 species) and *Serbosoma* (5 species).

The following species are recorded for the first time in Serbia: *Glomeris klugii* Brandt, 1833 (Glomerida: Glomeridae), *Cibiniulus phlepsii* (Verhoeff, 1897) (Julida: Blaniulidae), *Brachyiulus bagnalli* (Brolemann, 1924), *Megaphyllum carniolense* (Verhoeff, 1897), *Typhloiulus incurvatus* Verhoeff, 1899,

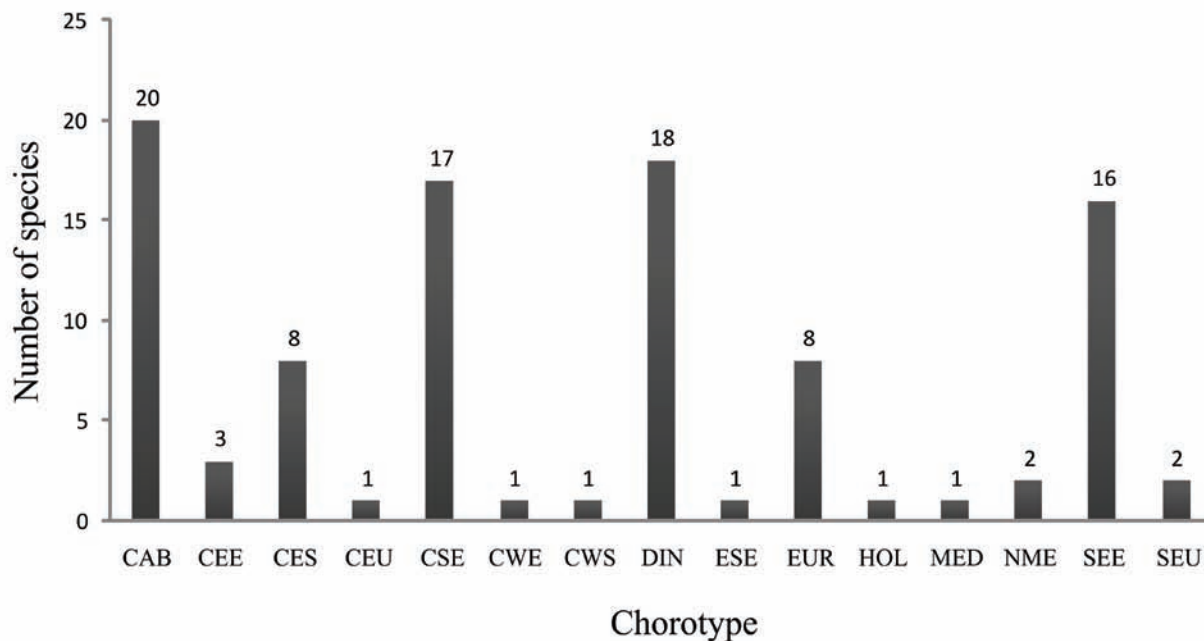


Fig. 3. Chorotypes of millipedes from Serbia.

Xestoiulus luteus (Attems, 1951) (all Julida: Julidae) and *Polydesmus renschi* Schubart, 1934 (Polydesmida: Polydesmidae).

All millipede species from Serbia can be relegated to 15 zoogeographical categories (Fig. 3), whereby most of the species belong to Carpathian-Balkan (20), Dinaric (18), Central-Southeast European (17) and Southeast European (16) chorotypes. Other chorotypes are presented by less than 10 species (Fig. 3).

Of the total number, 27 species (or 27%) are local endemics while 18 (18%) are Balkan endemics, which means that 45 species inhabit the Balkan Peninsula only. Among the 44 genera, five (or 11.36%) are endemic for Serbia.

If we take into account the fact that the territory of the Balkan Peninsula (including Serbia) represents one of the three major glacial refugia in Europe, and the fact that the current number of millipede species in Serbia represents only a small part of the total number of millipedes in Europe, we can expect that

the number of species of this arthropod group in Serbia will be much higher in the future. Numerous species and genera registered in neighboring countries populate different habitats very close to the border with Serbia, so it is expected that some of these taxa will be found on the territory of Serbia. In addition, many parts of Serbia (especially Vojvodina, Central, South and Southeast Serbia) are almost completely unexplored in terms of millipede fauna. The karst areas of Eastern and Western Serbia are very rich in subterranean habitats inhabited by numerous species and genera that are waiting to be discovered.

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