

# Collembola of the Šumava National Park, Czech Republic

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## Abstract

Historical review of the Collembola research in the Šumava National Park (Bohemian Forest) is given. More attention was paid to the research of Collembola in this mountain ridge just recently. Kholová, Nosek, Rusek and Materna contributed substantially to the knowledge of the collembolan fauna here. Now, 174 species of Collembola are known from these mountains. Collembola of the Šumava National Park are more related to the Alps than to other districts in Bohemia. To the fauna of the Alps belong *Protaphorura austriaca*, *P. parallata*, *P. illaborata*, *P. humata*, *P. cf. prolata*, *P. stiriaca*, *P. cf. stiriaca*, *P. cf. subnemorata*, *P. subuliginata*, *P. s-vontoernei*, *Tetracanthella stachi*, and others. The collembolan fauna of the Bohemian Forest is distinctly different from the Czech basin, Sudetic and Carpathian Mountains. In the Šumava National Park do not occur the Carpatho-Sudetic *Tetrodontophora bielensis* and *Deharvengiurus denisi*. The occurrence of the species *Anurida sensillata*, *Pseudosinella bohémica*, *Folsomia inoculata*, *F. sensibilis*, *F. tesari* and *Neelides folsomii* is interesting, too. Surprising is the discovery of new species of the genera *Doutnacia*, *Karlstejnina* and *Wankeliella*, as well as of many new *Protaphorura* species.

*Key words:* Collembola, history of research, faunistic records, ecological notes, relation to Alps

## INTRODUCTION

The Šumava National Park (Bohemian Forest) in the southern part of Bohemia, Czech Republic, was for a long time a neglected mountain range concerning zoological research. The same situation was here also in the faunistic and ecological investigation of Collembola and other soil fauna. Only two common Collembola *Orchesella flavescens* and *Allacma fusca* were recorded in the well-known monograph of the Bohemian Apterygota by UZEL (1890) from the Bohemian Forest. The next contribution to Collembola in Bohemian Forest appeared after a long period of almost 70 years, when KHOLOVÁ (1958) published results of her faunistic and ecological investigations in the Boubín primeval forest. She paid attention to edaphic as well as atmobiotic life-forms, but her samples gave mainly a qualitative picture of the springtail fauna in this protected forest area. She reported 62 species of Collembola from the Boubín Mount.

NOSEK'S (1957, 1960b, 1961, 1962, 1964) few faunistic records (14 species) from the Šumava are based on occasional samples from the Boubín Mount sent him by other zoologists. Nevertheless, he described a new species *Arrhopalites gisini* Nosek, 1960 from this material (NOSEK 1960a). The material of Collembola from quantitative soil samples collected by KUNST during his grassland soil fauna investigation at Mústek during 1958–1959 was determined and evaluated by RUSEK. He published only a species list (37 spp.) used for comparison of collembolan communities in grasslands from different regions of Europe (RUSEK 1984).

A more extensive and ecologically oriented investigation of soil fauna in the Šumava National Park in the 1980ies and later, brought a more complex view on the qualitative, as well as quantitative structure of collembolan communities in beech, spruce and mountain elm forests, their microhabitats and clearings. RUSEK (2001b) has elaborated material of Collembola from a field experiment with the impact of boric acid on soil mesofauna in a primeval *Ulmeto-Aceretum* forest on the Stožec Mount and described from there a new species *Odontella (Superodontella) delamarei* Rusek, 1991. The evaluation of the boric acid experiment with a description of the collembolan community is in press (RUSEK 1991, 2001b). The grant project No. A606702 GA AV "Structure and function of soil meso- and microfauna communities in microhabitats of beech and spruce forests" contributed to the faunistic (49 spp.) knowledge of Collembola in the Šumava National Park, too. Especially the locality Smrčina Mount was of concentrated ecological interest during these investigations (MATERNA 1999, RUSEK 2001a). A large area of climax spruce forests attacked and damaged by the bark beetle outbreak was studied in the Šumava National Park in 1999–2001 in the frame of the grant project No. 206/99/1416 GA ČR. These studies comprised undamaged, damaged and dead spruce forest stands, as well as their differently old clearings.

This project brought outside the ecological results also a large amount of faunistic and community structure data, which comprise more than 30 new species of Collembola, too. Their descriptions are prepared for publication in soil zoological journals. The papers cited above, together with the contributions in press and not yet published manuscripts, have included the Šumava National Park to the best investigated districts in Bohemia concerning Collembola. Now, 174 species of Collembola are known from the Šumava National Park. Most of them belong to the family Onychiuridae (59 spp.) and Isotomidae (31 spp.) that is reflecting the main method of soil sample extraction used for soil zoological studies in this territory. Less represented are members of the Entomobryomorpha (28 spp.), Neelipleona and Symphypleona (23 spp.) and Neanuridae (22 spp.). It is surprising that Hypogastruridae with 11 spp. only are the least represented group in the Šumava Mountains. In comparison with other districts of the Czech Republic, the number of established collembolan species is high here. Nevertheless, their fauna is not yet completely recorded. The peat lands, alder forests, grasslands, pioneer ecosystems on rock outcrops are completely unknown as habitats of Collembola here. A rich material of epigeic Collembola from pitfall traps is now determined. More attention should be paid in the future to the atmobiotic Collembola living on higher vegetation, too.

The fauna of Collembola of the Šumava National Park is more related to the Alps than to other districts in Bohemia. To the Alpine fauna belong *Protaphorura austriaca*, *P. parallata*, *P. illaborata*, *P. humata*, *P. cf. prolata*, *P. stiriaca*, *P. cf. stiriaca*, *P. cf. subnemorata*, *P. subuliginata*, *P. s-vontoernei*, *Tetracanthella stachi* and others. The fauna of the Bohemian Forest is distinctly different from the Czech basin, Sudetic and Carpathian Mountains. In the Šumava National Park do not occur the Carpatho-Sudetic *Tetrodonthophora bielansensis* and *Deharringiurus denisi*. The occurrence of the species *Anurida sensillata*, *Pseudosinella bohemica*, *Folsomia inoculata*, *F. sensibilis*, *F. tesari* and *Neelides folsomi* is interesting, too. Surprising is the discovery of new species of the genera *Doutnacia*, *Karlstejnina* and *Wankeliella*, as well as of many new *Protaphorura* species.

## LIST OF COLLEMBOLAN SPECIES FROM THE ŠUMAVA NATIONAL PARK

The species list is arranged according the main families or higher taxonomic units. Alphabetic arrangement of genera and species is used in these units. Species with \* need a taxonomic revision because of a doubtful determination or a recent taxonomic development. Some species have the **cf.** (= confer) abbreviation behind the generic name. It means that they are close

to the given species (they are mostly new species in this contribution). Numbers with letters in the second column (behind the species name and dash) are the paper numbers (see References) where the species are cited, and the following locality abbreviations: B – Boubín, ČS – Čertová Stěna, JS – Jezerní Stěna, M – Mústek, Mo – Modrava, S – Smrčina, St – Stožec.

## 1. Hypogastruridae

1. *Ceratophysella armata* (Nicolet, 1841) – 1B; 13Mo
2. *Ceratophysella denticulata* (Bagnall, 1941) – 2S; 5B; 11S; 13Mo
3. *Ceratophysella succinea* (Gisin, 1949) – 12St
4. *Ceratophysella* sp. – 12St
5. *Ceratophysella longispina* Tullberg, 1876 – 1B; \*
6. *Hypogastrura socialis* (Uzel, 1890) – 1B; 13Mo
7. *Willemia anophthalma* Börner, 1901 – 2S; 11S; 12St; 13Mo
8. *Willemia aspinata* Stach, 1949 – 2S; 11S; 12St
9. *Xenylla acauda* Gisin, 1947 – 12 St
10. *Xenylla boernerii* Axelson, 1905 – 2S; 11S; 13Mo
11. *Xenylla brevisimilis* Stach, 1949 – 13Mo

## 2. Neanuridae

1. *Anurida ellipsoides* Stach, 1949 – 2S
2. *Anurida granaria* (Nicolet, 1847) – 5B; 12St
3. *Anurida granulata* Agrell, 1943 – 2S; 11S; 13M
4. *Anurida sensillata* Gisin, 1953 – 12St
5. *Anurida tullbergi* Schött, 1891 – 1B
6. *Brachystomella parvula* (Schäffer, 1896) – 1B; 9M
7. *Deutonura conjuncta* (Stach, 1926) – 1B
8. *Deutonura stachi* (Gisin, 1952) – 13Mo
9. *Friesea claviseta* Axelson, 1900 – 1B; 12St
10. *Friesea mirabilis* (Tullberg, 1871) – 1B; 13Mo
11. *Friesea truncata* Cassagnau, 1958 – 2S; 9M; 11S; 13Mo
12. *Friesea* sp. – 11S
13. *Micranurida* sp. – 11S; 12St; 13Mo
14. *Micranurida forsslundi* Gisin, 1949 – 2S
15. *Micranurida pygmaea* Börner, 1901 – 1B; 2S
16. *Neanura incolorata* (Stach, 1951) – 1B; \*
17. *Neanura muscorum* (Templeton, 1935) – 1B; 2S; 9M
18. *Neanura tetrophthalma* (Stach, 1951) – 1B; \*
19. *Odontella delamarei* Rusek, 1991 – 10St; 12St
20. *Pseudachorutella assigillata* (Börner, 1901) – 1B
21. *Pseudachorutes parvulus* Börner, 1901 – 2S; 9M; 11S; 13Mo
22. *Xenyllodes armatus* Axelson, 1903 – 5B; 2S; 11S

## 3. Onychiuridae

1. *Doutnacia* sp. – 12 St
2. *Hymenaphorura sibirica* Tullberg, 1876 – 8 B; 1 B; 12 St;
3. *Kalaphorura burmeisteri* (Lubbock, 1873) – 2 S
4. *Karlstejnina* sp. – 12 St
5. *Mesaphorura* cf. *krausbaueri* Börner, 1901 – 12 St
6. *Mesaphorura* cf. *hylophila* Rusek, 1982 – 12 St
7. *Mesaphorura* cf. *italica* (Rusek, 1971) – 12 St
8. *Mesaphorura* cf. *jarmilae* Rusek, 1982 – 12 St
9. *Mesaphorura italica* (Rusek, 1971) – 2 S

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| 10. <i>Mesaphorura krausbaueri</i> Börner, 1901              | - 9 M; 12 St                   |
| 11. <i>Mesaphorura macrochaeta</i> Rusek, 1976               | - 2 S; 11 S; 12 St; 13 Mo      |
| 12. <i>Mesaphorura</i> sp.                                   | - 11 St                        |
| 13. <i>Mesaphorura tenuisensillata</i> Rusek, 1974           | - 2 S; 11 S; 12 St; 13 Mo      |
| 14. <i>Metaphorura affinis</i> (Börner, 1902)                | - 9 M                          |
| 15. <i>Micraphorura absoloni</i> (Börner, 1901)              | - 1 B; 2 S; 11 S; 13 Mo        |
| 16. <i>Protaphorua armata</i> (Tullberg, 1869)               | - 1 B; 9 M; 11 S; 12 St; 13 Mo |
| 17. <i>Protaphorua austriaca</i> (Butschek, 1948)            | - 13 Mo; 11 S                  |
| 18. <i>Protaphorua cancellata</i> (Gisin, 1956)              | - 11 S; 13 Mo                  |
| 19. <i>Protaphorua</i> cf. <i>armata</i> (Tullberg, 1869)    | - 11 S                         |
| 20. <i>Protaphorua</i> cf. <i>aurantiaca</i> (Ridley, 1880)  | - 2 S                          |
| 21. <i>Protaphorua</i> cf. <i>gisini</i> (Haybach, 1960)     | - 11 S                         |
| 22. <i>Protaphorua</i> cf. <i>parallata</i> (Gisin, 1952)    | - 11 S; 13 Mo                  |
| 23. <i>Protaphorua</i> cf. <i>prolata</i> (Gisin, 1956)      | - 13 Mo                        |
| 24. <i>Protaphorua</i> cf. sp.1                              | - 13 Mo                        |
| 25. <i>Protaphorua</i> cf. <i>stiriaca</i> (Stach, 1946)     | - 13 Mo                        |
| 26. <i>Protaphorua</i> cf. <i>subnemorata</i> (Gisin, 1957)  | - 13 Mo                        |
| 27. <i>Protaphorua</i> cf. <i>subparallata</i> (Selga, 1962) | - 11 S; 13 Mo                  |
| 28. <i>Protaphorua</i> cf. <i>vontoernei</i> (Gisin, 1957)   | - 2 S; 11 S                    |
| 29. <i>Protaphorua conlata</i> (Gisin, 1962)                 | - 11 S                         |
| 30. <i>Protaphorua humata</i> (Gisin, 1952)                  | - 9 M                          |
| 31. <i>Protaphorua illaborata</i> (Gisin, 1958)              | - 9 M; 13 Mo                   |
| 32. <i>Protaphorua parallata</i> (Gisin, 1952)               | - 2 S; 11 S; 13 Mo             |
| 33. <i>Protaphorua pseudovanderdrifti</i> (Gisin, 1957)      | - 13 Mo                        |
| 34. <i>Protaphorua</i> sp.                                   | - 11 S                         |
| 35. <i>Protaphorua</i> sp. 1                                 | - 13 Mo                        |
| 36. <i>Protaphorua</i> sp. 10                                | - 13 Mo                        |
| 37. <i>Protaphorua</i> sp. 11                                | - 13 Mo                        |
| 38. <i>Protaphorua</i> sp. 2                                 | - 13 Mo                        |
| 39. <i>Protaphorua</i> sp. 9                                 | - 13 Mo                        |
| 40. <i>Protaphorua</i> sp. B                                 | - 13 Mo                        |
| 41. <i>Protaphorua</i> sp. C                                 | - 13 Mo                        |
| 42. <i>Protaphorua</i> sp. D                                 | - 13 Mo                        |
| 43. <i>Protaphorua</i> sp. E                                 | - 13 Mo                        |
| 44. <i>Protaphorua</i> sp. F                                 | - 13 Mo                        |
| 45. <i>Protaphorua</i> sp. XY                                | - 13 Mo                        |
| 46. <i>Protaphorua</i> sp. Z                                 | - 13 Mo                        |
| 47. <i>Protaphorua stiriaca</i> (Stach, 1946)                | - 13 Mo                        |
| 48. <i>Protaphorua subcanellata</i> (Gisin, 1963)            | - 11 S                         |
| 49. <i>Protaphorua subhumata</i> (Selga, 1963)               | - 11 S                         |
| 50. <i>Protaphorua subparallata</i> (Selga, 1962)            | - 11 S                         |
| 51. <i>Protaphorua subuliginata</i> (Gisin, 1956)            | - 9 M; 1 S                     |
| 52. <i>Protaphorua s-vontoernei</i> (Gisin, 1957)            | - 12 St                        |
| 53. <i>Protaphorua tricampata</i> (Gisin, 1956)              | - 2 S; 11 S                    |
| 54. <i>Protaphorua trilata</i> (Gisin, 1963)                 | - 2 S                          |
| 55. <i>Protaphorua triparallata</i> (Gisin, 1960)            | - 11 S                         |
| 56. <i>Protaphorua vanderdrifti</i> (Gisin, 1952)            | - 9 M                          |
| 57. <i>Stenaphorura quadrispina</i> (Börner, 1901)           | - 9 M; 12 St                   |
| 58. <i>Supraphorura furcifera</i> (Börner, 1901)             | - 8 B; 1 B                     |
| 59. <i>Wankeliella</i> sp.                                   | - 12 St                        |

#### 4. Isotomidae

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| 1. <i>Agrenia bidenticulata</i> (Tullberg, 1876) | - 1 B |
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2. *Anurophorus laricis* Nicolet, 1942 – 1 B
3. *Anurophorus* sp. – 13 M
4. *Cryptopygus bipunctatus* (Axelson, 1903) – 9 Mo
5. *Desoria* sp. – 13 Mo
6. *Desoria fennica* (Reuter, 1895) – 9 M
7. *Desoria hiemalis* (Schött, 1893) – 13 Mo
8. *Desoria violacea* (Tullberg, 1876) – 1 B; 2 S; 12 St
9. *Folsomia diplophthalma* (Axelson, 1902) – 1 B
10. *Folsomia fimetaria* (Linné, 1758) – 1 B
11. *Folsomia inoculata* Stach, 1947 – 2 S; 1 S
12. *Folsomia ksenemani* Stach, 1947 – 1 B; 9 M
13. *Folsomia nana* Gisin, 1957 – 6 B
14. *Folsomia penicula* Bagnall, 1939 – 9 M
15. *Folsomia pseudodiplophthalma* Stach, 1947 – 9 M; 12 St
16. *Folsomia quadrioculata* (Tullberg, 1871) – 2 S; 9 M; 11 S; 12 St; 13 Mo
17. *Folsomia sensibilis* Kseneman, 1936 – 2 S; 11 S; 13 Mo
18. *Folsomia* sp.n. – 13 Mo
19. *Folsomia tesari* Dunger, 1970 – 2 S; 11 S; 13 Mo
20. *Isotoma viridis* Bourlet, 1839 – 9 M
21. *Isotoma minor* (Schäffer, 1896) – 1 B; 2 S; 9 M; 11 S; 12 St; 13 Mo
22. *Parisotoma notabilis* (Schäffer, 1896) – 1 B; 2 S; 9 M; 11 S; 12 St; 13 Mo
23. *Proisotoma minima* (Absolon, 1901) – 9 M
24. *Proisotoma minuta* (Tullberg, 1871) – 1 B
25. *Pseudanurophorus binoculatus* Ksen., 1934 – 1 B; 2 S; 13 Mo
26. *Pseudisotoma sensibilis* (Tullberg, 1876) – 1 B; 2 S; 9 M; 11 S; 13 Mo
27. *Tetracanthella afurcata* Handschin, 1919 – 1 B
28. *Tetracanthella brevifurca* Stach, 1930 – 1 B
29. *Tetracanthella stachi* Cassagnau, 1959 – 2 S; 11 S; 13 Mo
30. *Vertagopus cinereus* (Nicolet, 1841) – 11 S
31. *Vertagopus westerlundi* (Reuter, 1897) – 2 S

## 5. Entomobryomorpha

1. *Cyphoderus albinus* Nicolet, 1841 – 1 B
2. *Entomobrya corticalis* (Nicolet, 1841) – 1 B; 2 S; 12 St
3. *Entomobrya lanuginosa* (Nicolet, 1841) – 2 S; 9 M
4. *Entomobrya marginata* (Tullberg, 1871) – 1 B
5. *Entomobrya multifasciata* (Tullberg, 1871) – 1 B
6. *Entomobrya muscorum* (Nicolet, 1841) – 1 B
7. *Entomobrya nivalis* (Linné, 1758) – 1 B; 11 S; 13 Mo
8. *Entomobrya* sp. – 13 Mo
9. *Heteromurus nitidus* (Templeton, 1835) – 9 M
10. *Lepidocyrtus curvicolis* Bourlet, 1839 – 9 M; 11 S
11. *Lepidocyrtus cyaneus* Tullberg, 1871 – 1 B; 9 M; 12 St
12. *Lepidocyrtus lanuginosus* (Gmelin, 1788) – 1 B
13. *Lepidocyrtus lignorum* (Fabricius, 1781) – 2 S; 9 M; 12 St; 13 Mo
14. *Lepidocyrtus violaceus* (Lubbock, 1873) – 2 S;
15. *Oncopodura crassicornis* Shoebottom, 1911 – 2 S;
16. *Orchesella alticola* Uzel, 1890 – 1 B;
17. *Orchesella bifasciata* Nicolet, 1841 – 1 B
18. *Orchesella flavescens* (Bourlet, 1839) – 1 B; 14 ČS; 14 JS
19. *Orchesella villosa* (Geoffroy, 1764) – 1 B
20. *Orchesella* sp. – 2 S
21. *Pogonognathellus flavescens* (Tullberg, 1871) – 1 B; 2 S; 9 M; 11 S; 13 Mo

22. *Pogonognathellus longicornis* (Müller, 1776) – 1 B
23. *Pseudosinella alba* (Packard, 1873) – 2 S
24. *Pseudosinella bohémica* Rusek, 1979 – 11 S
25. *Tomocerus minor* (Lubbock, 1862) – 1 B; 2 S
26. *Tomocerus minutus* Tullberg, 1876 – 1 B; 2 S; 11 S; 12 St; 13 Mo
27. *Tomocerus vulgaris* (Tullberg, 1871) – 1 B
28. *Willowsia nigromaculata* (Lubbock, 1841) – 13 Mo

## 6. Neelipleona and Symphypleona

1. *Allacma fusca* (Linnaeus, 1758) – 1 B; 11 S; 14 ČS; 14 JS
2. *Arrhopalites gisini* Nosek, 1960 – 4 B; 7 B; 13 Mo
3. *Arrhopalites principalis* Stach, 1945 – 2 S
4. *Arrhopalites* sp. – 11 S
5. *Deuterosminthurus pallipes* (Bourlet, 1842) – 12 St
6. *Deuterosminthurus bicintus* (Koch, 1840) – 1 B
7. *Deuterosminthurus repandus* (Bourlet, 1842) – 9 M
8. *Dicyrtoma fusca* (Lubbock, 1873) – 12 St
9. *Dicyrtoma* sp. juv. – 1 B
10. *Dicyrtomina minuta* (Fabricius O., 1783) – 2 S
11. *Dicyrtomina ornata* (Nicolet, 1842) – 11 S
12. *Heterosminthurus bilineatus* (Bourlet, 1842) – 13 Mo
13. *Lipothrix lubbocki* (Tullberg, 1872) – 1 B; 2 S; 12 St; 13 Mo
14. *Ptenothrix atra* (Linnaeus, 1758) – 1 B
15. *Sminthurinus aureus* (Lubbock, 1862) – 2 S; 9 M
16. *Sminthurinus niger* (Lubbock, 1868) – 1 B;
17. *Sminthurinus signatus* Krausbauer, 1902 – 11 S; 13 Mo
18. *Sminthurus nigromaculatus* Tullberg, 1871 – 13 Mo
19. *Sminthurus viridis* (Linnaeus, 1758) – 9 M
20. *Sphaeridia pumilis* (Krausbauer, 1898) – 9 M; 13 Mo
21. *Megalothorax minimus* Willem, 1900 – 7 B; 1 B; 2 S; 9 M; 11 S; 13 Mo
22. *Neelides folsomi* Caroli, 1912 – 12 St
23. *Neelus murinus* Folsom, 1896 – 1 B

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(The numbering corresponds with the numbers in the species list.)

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