

Some remarkable species of Collembola (Insecta, Apterygota) of the Luxembourg sandstone area

Norbert STOMP

Collaborateur scientifique du Musée national d'histoire naturelle de Luxembourg
25, rue Münster L-2160 Luxembourg

Wanda M. WEINER

Institute of Systematics and Evolution of Animals
Polish Academy of Sciences - Stawkowska 17, PL-31 016 Kraków
weiner@isez.pan.krakow.pl

Keywords: soil; sandstone valley; geomorphology; Luxembourg; Collembola.

Most Collembola live in the soil and in ecological niches related directly or indirectly to the soil (caves, springs, litter, stones, rocks, moss, trees ...). Collembola seem to be the only group of apterygota insects that have developed during evolution quite a lot of morphological and sensorial adaptations.

The geomorphology of the Luxembourg sandstone region (Lias Hettangien) is characterized by various structures that have been described by several authors (Heuertz 1969; Molitor 1961). Related to their geographical orientation and other ecological parameters, the slopes and the bottoms of sandstone valleys in Luxembourg shelter highly diversified populations of Collembola. These populations have not yet been studied in detail.

In this paper we present a choice of thirteen Collembola species that were collected in thirteen different ecological niches of typical sandstone valleys. Most of the records are from the Müllertal (Ernz Noire valley). Four species have been collected exclusively in the Luxembourg sandstone area :

Superodontella euro Weiner et Stomp, 2003

Hymenaphorura arantiana Weiner et Stomp, 2001

Orchesella erpeldingae Stomp, 1968

Orchesella hoffmanni Stomp, 1968

The two species belonging to the genus *Orchesella* seem to be endemic to sandstone rocks. One species, *Protaphorura eichhorni* (Gisin, 1954) is only

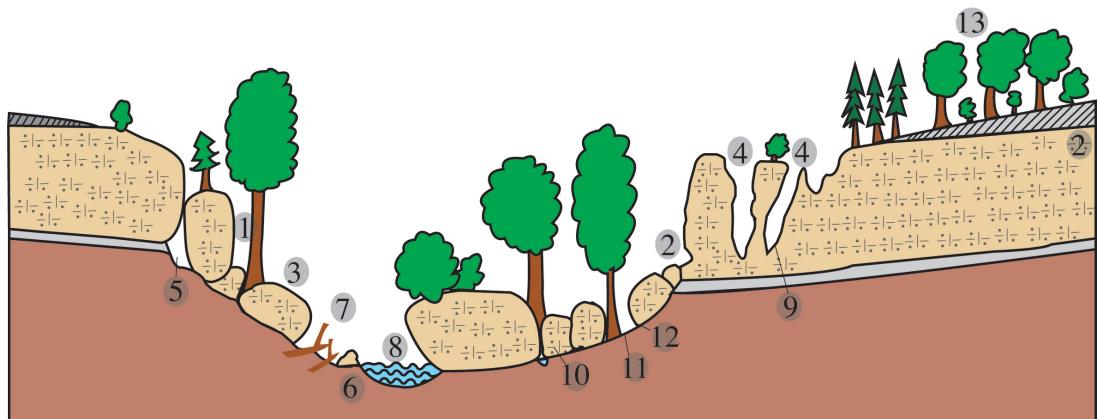


Fig. 1: Diagram of a typical sandstone valley in Luxembourg (after Heuertz 1969; Molitor 1961; Werner 1985).

found in Luxembourg and seems endemic to beech groves. Two species, *Tetracanthella luxemburgensis* Stomp, 1968 and *Pseudosinella hütheri* Stomp, 1971 have been discovered in the Luxembourg sandstone area but have also been found in Germany (Pfalz), in Switzerland and in Austria. Six species occur not only in sandstone areas but are spread in several localities in Luxembourg and other European countries: *Arrhopalites pygmaeus* (Wankel, 1860); *Bilobella braunerae* Deharveng, 1981; *Hypogastrura cf. tullbergi* (Schaeffer, 1900); *Plutomurus unidentatus* (Börner, 1901); *Schaefferia willemi* (Bonet, 1931); *Sminthurinus concolor* (Meinert, 1896).



Fig. 2: *Orchesella hoffmanni* Stomp, 1968

List of ecological niches

1. Rock walls and excavations in rocks, half shade, in deciduous forests
2. Shady rock walls and excavations in rocks, in deciduous forests
3. Blocks of sandstone in half shade, covered with moss
4. Walls of diaclases, in half shade
5. Caves with or without calcarous concretions
6. Litter and alluvial soil near brook
7. Barks of decaying tree trunks on alluvial soil
8. Overhanging rocks in shade
9. Decaying wood at the bottom of diaclase ravine
10. Springs, moss and stones surrounded by dripping water
11. Litter and decaying wood in deciduous forest near the rocks, with underwood of *Ilex aquifolium*
12. Soil under blocks and stones with microcaves on slopes of shaded scree
13. Litter in beech groves

Orchesella hoffmanni Stomp, 1968

Length: 5-5,5 mm

Distribution: this species is only known from Luxembourg. Schoenfels-Mersch: Mamerlayer (Huellay), type locality. Nommern: Noumerlayer (Eilelay). Rollingen/Mersch: Kauschelterlayer. Mullerthal: Dousteschbaach. (Stomp 1968)

and unpublished records). Mamer: Thillsmillen. Haller: Halerbaach. Simmern: Aarlergronn. (Reiffers & Arendt 1995). According to Reiffers & Arendt (1995) *O. hoffmanni* is not rare in moss and litter under the rocks.

Orchesella erpeldingae Stomp, 1968

Length: 3,5-4 mm

Distribution: only in Luxembourg. Berdorf: Zickzackschlöff, type locality; Aesbech. Schoenfels-Mersch: Mamerlayer. Müllertal: Schnellert, Dousteschbaach. Nommern: Noumerlayer. Rollingen/Mersch: Kauschelterlayer. Beaufort: Haupeschbaach. (Stomp 1968; Reiffers & Arendt 1995)



Fig. 3: *Orchesella erpeldingae* Stomp, 1968

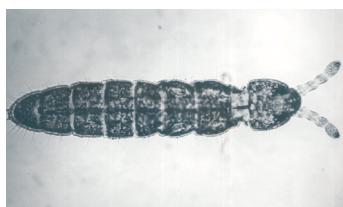


Fig. 4: *Tetracanthella luxemburgensis* Stomp, 1968

***Tetracanthella luxemburgensis* Stomp, 1968**

Length: 1-1,3 mm

Distribution: Luxembourg: Mersch: Tinneslach. Schoenfels: Mamerlayern. Berdorf: Wanterbaach. Mullerthal: Dousteschbaach. (Stomp 1968). Germany: Pfalz (Deharveng 1987; Potapov 2001).

***Sminthurinus concolor* (Meinert, 1896)**

Length: 1,5 mm

Distribution: Luxembourg. Berdorf, near Zickzackschlöff, on humid rock walls covered with algae and lichens, sometimes aggregations of hundreds of individuals (April, May, immature specimens in litter beneath the rocks) (Stomp 1969 and unpublished observations). «In the Palearctic, from N Norway to S Norway and England. Isolated records from Luxembourg, N Austria, S Italy (Lipari Isles), Spain (Balearic Isles, Minorca). In Luxembourg, Austria and Italy it has been collected in humid habitats sheltered from the warmer environment, in Spain under *Phragmites* near sea shore.» (Bretfeld 1999).

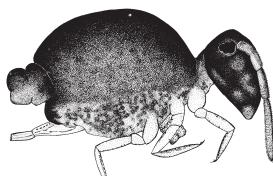


Fig. 5: *Sminthurinus concolor* (Meinert, 1896)

***Arrhopalites pygmaeus* (Wankel, 1860)**

Length: 1,2 mm

Distribution: Luxembourg: cave near Müllerthal (Schnellert), grotte Sainte-Barbe; cave near Kopstal / Direndall, Däiwelslach. (Stomp, unpublished observations) According to Bretfeld (1999) *A. pygmaeus* is a holarctic species that lives in caves in moister climates of Europe (Sweden, Ireland, Germany, France). It can also be found in damp moss and soil of open habitats, thus it is troglobophile. In Switzerland it was found up to 2400 m, in France (Pyrenees) up to 1800 m (Cassagnau 1961). We detected the species in several caves of Belgium (Stomp, unpublished records).

***Hymenaphorura arantiana* Weiner et Stomp, 2001**

Length: 0,7-1,18 mm

Distribution: only known from Luxembourg, Müllertal: near Christnach-Breidweiler and Blumenthal-Müllerthal junction, litter with alluvial soil in deciduous forest near the bank of the Ernz Noire river, undergrowth with *Vinca minor* (Weiner & Stomp 2001).



Fig. 6: *Hymenaphorura arantiana* Weiner & Stomp, 2001

***Bilobella braunerae* Deharveng, 1981**

Length: 3,5-4 mm

Distribution: Luxembourg, near Christnach-Breidweiler and Blumenthal-Müllerthal junction, along the Ernz Noire river under the bark of lying trunk (Weiner & Stomp, unpublished records). This is the most northern location of this species and genus. *B. braunerae* is also known from Austria (Deharveng 1981), Italy (Dallai *et al.* 1986) and Hungary (Traser 2002).



Fig. 7: *Bilobella braunerae* Deharveng, 1981

Hypogastrura cf. tullbergi (Schaeffer, 1900)

Length: up to 1,5 mm

Taxonomy: The taxonomic status of this species is not clearly established. According to Fjellberg and Babenko *Hypogastrura tullbergi* is a «circumpolar» species and all records from continental Europe refer to other species of *Hypogastrura* (Thibaud *et al.* in Dunger 2004).

Distribution in Luxembourg : This is a winter species and extremely frequent from December to April on shady rock walls of the whole sandstone area where large aggregations of hundreds of individuals could be observed. (Stomp, unpublished records).

Pseudosinella hütheri Stomp, 1971

Length: 1,2-1,5 mm

Distribution: known from Luxembourg, Berdorf (Zickzackschlöff) (Stomp 1971), Germany, Switzerland and Austria (Stomp 1986) and Hüther (in litt.).

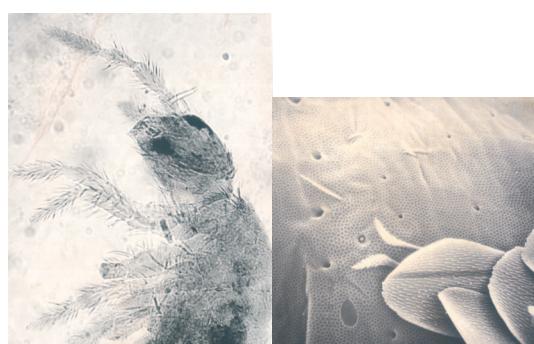


Fig. 8: *Pseudosinella hütheri* Stomp, 1971

Plutomurus unidentatus (Börner, 1901)

Length: 3 mm

Distribution: Luxembourg: This species is bound to very moist habitats and can be found in many localities all over the country: Rollingen/Mersch (Dräibueren), moss close to a brook; Kopstal (Direndall), moss near spring and in scree along the road; Berdorf (Roitzbaach) under wet stones; Vianden : along the road to «Maison de Santé», under schist with dripping water without moss; Oberiesenbach (Holzbichbaach), soil with moss; Lieler (Buch), soil with moss under schistous rock. *Pl. unidentatus* is reported from caves of Europe (Gisin 1960), especially Westfalen (Germany). We examined specimens from caves of Fränkische Alb (Germany) (Dobat 1979) and from Belgium (leg. F. Delhez) (Stomp, unpublished records) but we could not find it in Luxembourg caves (Stomp & Weiner 1994).

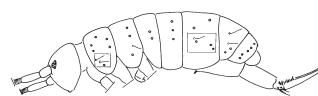


Fig. 9: *Plutomurus unidentatus* (Börner, 1901)

Superodontella euro Weiner et Stomp, 2003

Length: 0,67-0,8 mm

Distribution: This species is only known from Luxembourg: Berdorf (Schnellert), litter near the rocks and dead beech, under *Ilex aquifolium* (Weiner & Stomp 2003).

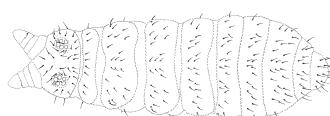


Fig. 10: *Superodontella euro* Weiner & Stomp, 2003

Schaefferia willemi (Bonet, 1931)

Length: 1,1-1,9 mm

Distribution: Luxembourg: In caves: Mullerthal (Schnellert), grotte Sainte-Barbe; Kopstal (Dirndlall), Däiwelslach. In the soil: Müllertal near the bank of the Ernz Noire river; under sandstone blocks in shaded scree (Schnellert), near Berdorf (Stomp & Weiner, unpublished records). Described from a cave in Belgium (grotte de Han et de Rochefort). *Sch. willemi* is spread in Belgium, France, Germany (caves), England (caves and soil), Ireland (soil and under barks), Norway (rotten stumps of wood), Poland (a gravel bed of the river Kamienna), Spain (caves and on snow). (Thibaud *et al.* in Dunger 2004). According to Cassagnau (1961) this species might be a relict of the glaciations that survived in the postglacial period in caves and in soil habitats with subcavernous microclimate.

Protaphorura eichhorni (Gisin, 1954)

Length: 1,49-1,73 mm

Distribution: only known from Luxembourg. Type locality : Strassen (Kleepesch). Numerous localities in the Müllertal (Berdorf: Zickzack-schlöff, Schnellert), litter and soil near sandstone rocks. (Weiner & Stomp 1995, and unpublished records).



Fig. 11: *Protaphorura eichhorni* (Gisin, 1954)

References

- Bretfeld G. 1999. - Symphyleona, in Dunger W. (ed.), *Synopses on Palearctic Collembola*. Staatl. Mus. Naturkunde Görlitz 1-318.
- Cassagnau P. 1961. - Ecologie du sol dans les Pyrénées Centrales. Les biocénoses de Collemboles. Hermann. Paris.
- Dallai R., Fanciulli P. P., Petrucci R. 1986. - Enzyme diversity in the genus *Bilobella* (Insecta, Collembola). Rev. Ecol. Biol. Sol 23: 333-348.

Deharveng L. 1981. - Nouvelles espèces de Neanurinae européens appartenant aux genres *Bilobella* et *Monobella*. Bull. Soc. Hist.Nat. Toulouse 117: 95-102.

Deharveng L. 1987. - Révision taxonomique du genre *Tetracanthella* Schött, 1891. Trav. Lab. Ecobiol. Arthrop. Edaph. 5: 1-151, Toulouse.

Dobat K. 1979. - Die Höhlenfauna der Fränkischen Alb. Ber. der Naturwiss. ges. Bayreuth 16: 11-240.

Gisin H. 1954. - Description de cinq espèces inédites de Collemboles. Mitt. Schweiz. ent. Ges. 27: 49-52.

Gisin H. 1960. - Collembolenfauna Europas. Mus. Hist. Nat. Genève, 312 p.

Heuertz M. 1969. - Documents préhistoriques du territoire luxembourgeois. Le milieu naturel. L'homme et son oeuvre. Publ. Musée d'Histoire Naturelle Luxembourg et Soc. Naturalistes Luxembourgeois, fasc. 1, 295 p., 190 fig.

Molitor J. 1961. - Quelques aspects de la géomorphologie du Grès de Luxembourg. Bull. Soc. nat. luxemb. 66: 13-94.

Potapov M. 2001. - Isotomidae, in Dunger W. (ed.), *Synopses on Palearctic Collembola*. Vol. 3. Staatl. Mus. Naturkunde Görlitz 1-603.

Reiffers J. & Arendt A. 1995. - Contribution à la connaissance de la faune des Collemboles du genre *Orchesella* au Luxembourg (Insecta, Collembola). Bull. Soc. nat. luxemb. 96: 117-120.

Stomp N. 1967. - Les populations de Collemboles des hêtraies du grès de Luxembourg. Mémoire scientifique, unpublished.

Stomp N. 1968. - Deux nouvelles espèces d'*Orchesella* de la région du grès de Luxembourg. (Insecta, Collembola, Entomobryidae). Arch. Inst. G.-D. Sciences 33 (1967): 259-273.

Stomp N. 1968. - *Tetracanthella hygropetrica luxemburgensis* n. sp. de la région du grès de Luxembourg. Bull. Mus. Nat. Hist. Nat. Paris 40: 734-741.

Stomp N. 1969. - *Sminthurinus concolor* (Meinert, 1896) au Grand-Duché de Luxembourg (Insecta, Collembola). Bull. Soc. nat. luxemb. 70 (1965): 175-184.

Stomp N. 1971. - Contribution à l'étude des *Pseudosinella* endogés. Espèces européennes de *Pseudosinella* à 5+5 yeux. Rev. Ecol. Biol. Sol 8: 173-184.

Stomp N. 1986. - Le groupe de *Pseudosinella vandeli* (Insectes, Collemboles) dans les Alpes orientales, in Dallai R. (ed.), 2nd International Seminar on Apterygota. University Siena. p. 82-91.

- Stomp N., Weiner W.M. 1994. - Redescription of *Plutomurus unidentatus* (Börner, 1901) (Collembola, Tomoceridae). Bull. Soc. nat. luxemb. 95: 359-364.
- Stomp N. & Biel C. 2001. - Luxembourg, in Juberthie C. (ed.), Encyclopedia Biospeologica. T. III, P. 1439-1443. Société internationale de Biospeologie. Moulis-Bucarest.
- Thibaud J.-M., Schulz H.-J., da Gama Assalino M. M. 2004. - Hypogastruridae, in Dunger W. (ed.), Synopses on Palearctic Collembola. Staatl. Mus. Naturkunde Görlitz, Vol. 4:1-287.
- Traser G. 2002. - The Collembola of the Fertö-Hansag National Park. The Fauna of the Fertö-Hansag National Park: 259-270.
- Weiner W.M. & Stomp N. 1995. - Redescription of *Protaphorura eichhorni* (Gisin, 1954) (Collembola, Onychiurinae). Bull. Soc. nat. luxemb. 96: 121-126.
- Weiner W.M. & Stomp N. 2001. - New species of *Hymenaphorura* Bagnall, 1949. (Collembola, Onychiuridae) from Luxembourg. Bull. Soc. nat. luxemb. 101: 179-182.
- Weiner W.M. & Stomp N. 2003. - *Superodontella euro* sp.n. (Collembola, Odontellidae) from Luxembourg. Bull. Soc. nat. luxemb. 103: 69-72.

Acknowledgements

We are most grateful to Simone Backes and Karin Scholtes, Service muséologique technique of MnhnL, Marc Meyer, head of department of Invertebrates of MnhnL and Jean-Marc Thibaud of Museum national d'histoire naturelle de Paris.

Résumé de la présentation

Quelques espèces de collemboles (Insecta, Apterygota) remarquables de la région du Grès de Luxembourg

Mots-clés: sol; vallée de grès; géomorphologie; Luxembourg; Collembola; Insecta; Apterygota

La plupart des Collemboles vivent dans le sol et ses annexes directes ou indirectes (grottes, pierres, blocs, rochers, litière, mousses, arbres, ...). Les Collemboles semblent être le seul groupe parmi les insectes aptérygotes à avoir développé de nombreuses adaptations morphologiques et sensorielles.

La géomorphologie de la région du grès de Luxembourg (Lias Hettangien) est caractérisée par de nombreuses structures qui ont été décrites par plusieurs auteurs (Heuertz 1969; Molitor 1961). En relation avec leur orientation géographique et d'autres paramètres écologiques les pentes et les fonds des vallées de grès abritent des populations de Collemboles hautement diversifiées. Les populations n'ont pas encore été étudiées en détail.

Dans ce travail nous présentons un choix de treize espèces de Collemboles qui ont été trouvées dans treize niches écologiques différentes de vallées typiques du grès de Luxembourg. La plupart des relevés proviennent du Mullerthal (vallée de l'Ernz Noire). Quatre espèces

ont été trouvées exclusivement dans la région du grès de Luxembourg :

- *Superodontella euro* Weiner et Stomp, 2003
- *Hymenaphorura arantiana* Weiner et Stomp, 2001
- *Orchesella erpeldingae* Stomp, 1968
- *Orchesella hoffmanni* Stomp, 1968

Les deux espèces appartenant au genre *Orchesella* semblent être endémiques sur les rochers de grès. Une espèce, *Protaphorura eichhorni* (Gisin, 1954) a été trouvée uniquement au Luxembourg et semble être endémique dans les hêtraies. Deux espèces, *Tetraclanthes luxemburgensis* Stomp, 1968, et *Pseudosinella hütheri* Stomp, 1971, ont été découvertes dans la région du Grès de Luxembourg mais ont été également signalées en Allemagne et en Suisse. Six espèces ne se rencontrent pas seulement dans la région du grès mais sont réparties sur plusieurs localités au Luxembourg et dans d'autres pays européens.