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Collembola (Insecta) collected in Belgium by the Laboratory for Ecology R.U.G.

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Summary

The present study summarizes the data on the distribution of 52 species of Collembola in Belgium that we collected from 1972 onwards. At least one of 5 techniques (pitfall trapping, extraction of litter or soil, sweeping of the vegetation with a net, aspiration from tree trunks or the soil surface, collecting individuals with a suction device) was used in each of 34 U.T.M. squares (10 x 10 km). We sampled in dunes, in grasslands, in woods, on shrubs or solitary trees and in ponds or reservoirs. The majority of the captured species belong to the families Sminthuridae (24 species) and Entomobryidae (20 species).
Key-words : Collembola, distribution, Belgium

Samenvatting

We geven een overzicht van de distributie van 52 springstaartensoorten die we sinds 1972 in België verzamelden. Met 1 tot 5 verzameltechnieken (bodemvallen, extracties van strooisel of aarde, slepen van de vegetatie met een net, bemonsteren van de schors van bomen of het bodemoppervlak met een stofzuigertje, aspiratie van de bodem of het wateroppervlak) bemonsterden we in totaal 34 U.T.M. hokken (10 x 10 km). We bemonsterden vooral in duinen, graslanden en bossen, op struiken en alleenstaande bomen en in vijvers of reservoirs. De meeste gevangen soorten behoren tot families Sminthuridae (24 soorten) en Entomobryidae (20 soorten).
Trefwoorden : Collembola, distributie, België

Introduction

In 1942 MARLIER deplored the fact that Collembola were virtually ignored by Belgian entomologists. This situation has not substantially changed over the past 40 years. The approximate number of collembolan species that can be found in Belgium is unknown and with the exception of some well-studied local faunas (ANDRÉ, 1983; HEUNGENS & VAN DAELE, 1973) no serious attempt has been made to study the distribution of Collembola in Belgium. In our opinion two major obstacles hinder such a study :

1) Collembola can reach very high densities and even small surveys can produce a lot of material (DESENDER et al., 1984). Accordingly, sorting through the material in order to detect the different species takes an unusually large amount of time.

2) The taxonomy of Collembola is not stable and there are frequent revisions of genera or even entire families. This is in part due to the somewhat late recognition of phenomena such as cyclomorphosis, or the periodic change in external morphological appearance of springtails (LEINAAS, 1981). Furthermore, the exact identification of these small animals is often based on internal key characters that require an elaborate microscopical handling of the specimen. The logical effect is that identification of the material becomes even more time consuming.

In this communication we present some data on the distribution of Collembola that we collected in Belgium from 1972 onwards. As our research mainly dealt with the phenology and ecology of springtails in a few areas, the list of Collembola and the data on their distribution in Belgium that we submit here is acknowledged to be incomplete.

Material and methods

The identification of the species is either based on FJELLBERG (1980) or on GISIN (1960). We followed the taxonomy of Collembola according to FJELLBERG (1980) and grouped the species into 5 families; namely Poduridae, Isotomidae, Entomobryidae, Onychiuridae and Sminthuridae. The first 4 families make up the suborder of the Arthropleona, while the suborder of the Symphypleona consists of the family Sminthuridae only. The basic morphological difference between the suborders is that Arthropleona have a more or less cylindrical and elongated body, whereas Symphypleona have a spherical and more compact body.

We applied 5 different techniques to sample the collembolan fauna in a total of 34 U.T.M. squares (Figure 1). Pitfalls were used in 15 squares. In a pasture located in Melle (ES55), a time-sorting pitfall (∅ 35 cm, 12 samples per week) was in continuous operation for 4 months (DESENDER et al., 1984). In the same pasture,

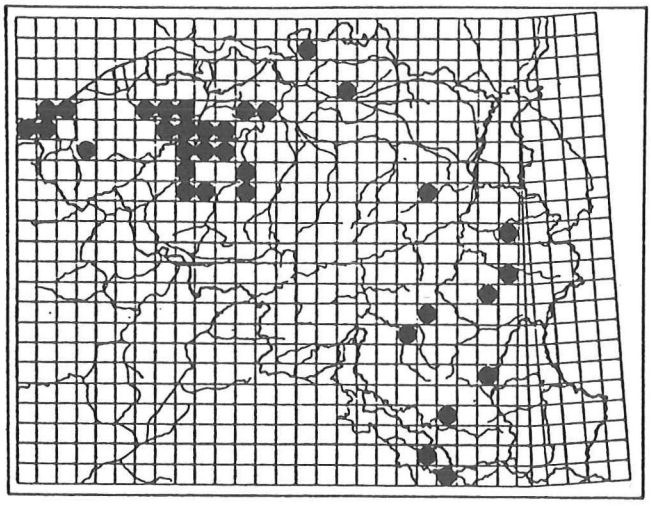

Figure 1 : Overview of the sampled U.T.M. squares.

small pitfalls (∅ 14 mm, 50 to 70 samples per week) were used for 1 year (VAN KERCKVOORDE, 1983) and large pitfalls (∅ 10 cm, 40 samples) were used for one week (BERBIERS et al., 1989). In dune slacks located in squares DS65 and DS75, respectively 18 and 12 large pitfalls (30 samples per fortnight) were used for 13 months (MERTENS et al., 1982). A road verge in square ES76 was sampled for 1 year with 10 small pitfalls (10 samples per 3 days), but only the captures of *Sminthurides pumilis* were analyzed (BLANCQUAERT et al., 1982). In square ES54, pitfalls (∅ 64 mm, 30 samples per fortnight) were used for 10 weeks in a small wood (RUYSSEN, 1983). In another wood in square ES45, the same type of pitfall (15 samples per fortnight) was used for 6 weeks (RUYSSEN, l.c.). A slope of a dune located in square DS86 was sampled for a fortnight with 200 small pitfalls. In the remaining 8 squares, 1 to several large pitfalls were dug in for 1 day to 1 week at the most. They were placed in pastures or hayfields (ES46, ES64, ES65, FQ69, FQ78), in a grassy road-verge (ES86), under shrubs (ES73) or in a wood (FR66).

Collembola were extracted from litter or soil that was collected in 17 squares. In square ES55 soil samples (∅ 5 cm, 30 samples per week) were taken for 1 year in a pasture. In the other squares, sampling consisted of extracting 1 to 5 bags of litter. These bags were collected in dune slacks (DS65, DS75), woods (DS94, ES64, ES72, FR71, FR93, FS27), heathland (FS09), grassy road-verges (ES26, ES76, FR66) and pastures or hayfields (ES45, ES64, ES65, FS62, GS00). *Hypogastrura viatica* was extracted from a compost heap (ES65). All samples were extracted on a Tullgren-funnel for 1 to 2 weeks at room temperature.

A battery-driven aspirator was used in a total of 15 U.T.M. squares. In 15 squares, we aspirated for 1 to 2 minutes the bark of 1 to 6 trees (DS65, DS75, DS76, ES35, ES36, ES42, ES43, ES44, ES45, ES52, ES54, ES55, ES64, ES65, ES76). Some of these results have been published elsewhere (BERBIERS & MERTENS, 1988). In squares ES55 and ES64, the soil surface of respectively 1 and 3 grasslands, was sampled once a month for 12 consecutive months (DE CLERCQ, 1984). In 6 squares (ES45, ES55, ES64, ES65, ES76, FR97) we swept a net for 3 to 15 minutes through the vegetation of grasslands. In squares ES55 and ES64 vegetation sweeps were done once a month for 12 consecutive months in respectively 1 and 3 grasslands (DE CLERCQ, l.c.).

Collembola were also hunted on sight and collected with a suction device from the surface of ponds or reservoirs in 3 squares (ES55, ES65, ES76) and from litter in grasslands (DS86, ES45) and in woods (FR55, GR08). *Seira domestica* was found in the laboratory (ES55).

Results

Table 1 summarizes for each U.T.M. square the number of species belonging to each family that we collected with the different techniques. In a total of 52 collected species, we identified 24 species of Sminthuridae, 20 species of Entomobryidae, 5 species of Isotomidae, and 3 species of Poduridae. Entomobryidae were found in 29 out of 34 U.T.M. squares, Sminthuridae in 27 squares, and Isotomidae and Poduridae in 7 and 4 squares, respectively. That no Onychiuridae were found does not mean that this family is absent from the Belgian fauna (HEUNGENS & VAN DAELE, 1973; THIBAUD & MASSOUD, 1977), but it merely indicates that our techniques were not suitable to detect the presence of species of this family. As all Onychiuridae live exclusively within the soil pores, the extraction of soil samples is essential to capture them. Although we used this technique in U.T.M. square ES55, no Onychiuridae were found.

The number of different species that was captured in any one square varies between 1 and 25 species and generally increases with an increased sampling effort (number of samples or number of techniques) in that square. Keeping in mind that no Onychiuridae were found, and that in most U.T.M. squares only a small number of samples was taken in a limited number of biotopes, the total number of collembolan species is probably larger in most squares. HEUNGENS & VAN DAELE (1973), for example, found 62 species after extraction of soil samples originating from horticultural nurseries in the vicinity of Gent and ANDRÉ (1983) observed not less than 21 species on the bark of trees in St-Mard and Ruette (FQ89).

Tables 2 and 3 give the distribution data of the Arthropleona and of the Symphypleona. These data, added to the scarce citations in the literature, permit only preliminary conclusions about the distribution of some species. We found *Entomobrya nivalis* (21 squares), *Lepidocyrtus cyaneus* (12 squares), *L. lanuginosus* (12 squares), *Sminthurides pumilis* (12 squares) and *Allacma fusca* (10 squares) in U.T.M. squares that are scattered over Belgium. *Entomobrya nivalis* and

Table 1 : Summary of species of each family captured in each U.T.M. square with the different techniques. Abbreviations : (S) Sminthuridae ; (P) Poduridae ; (E) Entomobryidae ; (I) Isotomidae ; number of different species added. For cross-reference of individual species see Tables 2 and 3.

U.T.M. square	METHODS					No. of species per per U.T.M. square
	Pitfalls	Extraction of litter or soil	Aspiration	Vegetation sweeps	Suction device	
DS65	S1,E4	S2	E1	-	-	7
DS75	S1,E4	S2	S1,E1,I1	-	-	9
DS76	-	-	S2,E2,I2	-	-	6
DS86	E7,I2	-	-	-	S1	10
DS94	-	S1	-	-	-	1
ES26	-	S1	-	-	-	1
ES35	-	-	S1,E5	-	-	6
ES36	-	-	E3	-	-	3
ES42	-	-	E1	-	-	1
ES43	-	-	E2	-	-	2
ES44	-	-	E7	-	-	7
ES45	S2,E8,I2	S6	E2	S1	I1	20
ES46	E5	-	-	-	-	5
ES52	-	-	E6	-	-	6
ES54	S4,P1, E10,I2	-	E4	-	-	18
ES55	S4,E5, I2,P1	S5,E7, I5,P1	S5,E7,I4 P1	S3,E3,I4 P1	S3,E1	25
ES64	E1	S6	S4,E9,I4 P1	S4,E5,I4 P1	-	23
ES65	S3,E1	S1,P1	S1,E2	S1	S1	10
ES72	-	S2	-	-	-	2
ES73	E3	-	-	-	-	3
ES76	S1	S4	E3	S2,E1	S1	10
ES86	S2,E1	-	-	-	-	3
FQ69	S3	-	-	-	-	3
FQ78	S1,E1	-	-	-	-	2
FR55	-	-	-	-	S1,E2	3
FR66	S3,E6	S1	-	-	-	9
FR71	-	S7,E3	-	-	-	10
FR93	-	S3,E1	-	-	-	4
FR97	-	-	-	S4,E2	-	6
FS09	-	S6,E1	-	-	-	7
FS27	-	S1,E2	-	-	-	3
FS62	-	S2	-	-	-	2
GR08	-	-	-	-	S3,E3	6
GS00	-	S1,E2	-	-	-	3
Total No. of species	S11,E17 P2,I5	S16,E6 P2,I5	S6,E11 P1,I4	S6,E6 P1,I4	S8,E5 I1	S24,E20 P3,I5

Table 2 : Distribution of the Arthropleona (Collembola) collected by the Laboratory for Ecology, R.U.G.

Species	U.T.M. squares
Family Poduridae	
Hypogastrura cavicola (Börner, 1901)	ES55, ES64
H. viatica (Tullberg, 1872)	ES65
Neanura muscorum (Templeton, 1835)	ES54
Family Isotomidae	
Folsomia candida (Willem, 1902)	ES55
Isotomina bipunctata (Axelson, 1903)	ES45, ES54, ES55, ES64
Isotomurus palustris (Müller, 1776)	DS76, DS86, ES45, ES54, ES55, ES64
Isotoma olivacea Tullberg, 1871	DS75, DS76, DS86, ES55, ES64
I. viridis Bourlet, 1839	ES45, ES55, ES64
Family Entomobryidae	
Cyphoderus albinus Nicolet, 1841	ES55
Entomobrya albocincta (Templeton, 1835)	ES35, ES36, ES44, ES45, ES52, ES54, ES64, ES76
E. corticalis (Nicolet, 1841)	ES42, ES43, ES44, ES52, ES54, ES55, ES64
E. multifasciata (Tullberg, 1871)	DS86, ES35, ES36, ES44, ES46, ES54, ES55, ES64, ES73
E. muscorum (Nicolet, 1841)	ES65, FR66, GR08
E. nicoleti (Lubbock, 1867)	ES46, ES54
E. nivalis (Linnaeus, 1758)	DS65, DS75, DS76, DS86, ES35, ES36, ES43, ES44, ES45, ES52, ES54, ES55, ES64, ES76, FR55, FR66, FR97, FS27, FQ78, GR08, GS00
E. spectabilis Reuter, 1890	FR97
Heteromurus nitidus (Templeton, 1835)	ES55
Lepidocyrtus cyaneus Tullberg, 1871	DS86, ES35, ES44, ES45, ES52, ES54, ES55, ES64, ES65, ES73, FR66, FR71
L. lanuginosus (Gmelin, 1788)	DS86, ES44, ES45, ES54, ES55, ES86, FR66, FR71, FR93, FS09, GR08, GS00
Orchesella bifasciata Nicolet, 1841	FR71
O. cincta (Linnaeus, 1758)	DS65, DS75, DS76, DS86, ES35, ES44, ES45, ES46, ES52, ES54, ES55, ES64, ES65, ES73, ES76, FS27
O. flavescens (Bourlet, 1839)	FR55, FR66
O. quinquefasciata (Bourlet, 1843)	ES46
O. villosa (Geoffroy, 1764)	DS65, DS75, DS86, ES45, ES46, ES54, ES55, ES64, FR66
Seira domestica (Nicolet, 1841)	ES55
Tomocerus longicornis (Müller, 1776)	ES45, ES52, ES54, ES64
T. minor (Lubbock, 1862)	DS65, DS75, DS86, ES54, ES55, ES64
Willowsia platani (Nicolet, 1841)	ES45

Table 3 : Distribution of the Symphypleona (Collembola) collected by the Laboratory for Ecology, R.U.G.

Species	U.T.M. squares
Family Sminthuridae	
Allacma fusca (Börner, 1906)	DS75, DS76, DS94, ES35, ES65, ES86, FQ78, FR66, FS27, GR08
Arrhopalites sericus Gisin, 1947	DS65, DS75, ES45, ES76
A. principalis Stach, 1945	FR93
Bourletiella sulphurea (Koch, 1840)	FR55
B. hortensis (Fitch, 1863)	GR08
Deuterosminthurus repandus (Ågren, 1903)	ES76, FR93, FR97
D. bicinctus (Koch, 1840)	FR66, FR97, GR08
D. pallipes (Bourlet, 1843)	FR97
Dicyrtoma fusca (Lucas, 1842)	FR71, FR93
D. minuta (O. Fabricius, 1783)	DS76, ES45, ES54, ES65, FQ69
D. ornata (Nicoleti, 1841)	ES54, FQ69
D. saundersi (Lubbock, 1862)	ES45
Heterosminthurus claviger Gisin, 1958	FR71
H. bilineatus (Bourlet, 1842)	FR71
Neelus minimus (Willem, 1900)	DS65, DS75, ES45, ES55, ES64, ES76
Sminthurides aquaticus (Bourlet, 1843)	ES55, ES65, ES76
S. malmgreni (Tullberg, 1876)	ES45, ES55, ES64, FS09
S. pumilis (Krausbauer, 1898)	DS65, DS75, ES26, ES45, ES54, ES55, ES64, ES65, ES72, ES76, FR66, FS09
S. parvulus (Krausbauer, 1898)	ES45, ES55, ES64, ES65, FS09, FR71, GS00
S. schoetti (Axelson, 1903)	ES45, ES64, FS09
Sminthurinus aureus (Lubbock, 1862)	ES54, ES55, ES64, ES72, ES76, FQ69, FR71, FS09, FS62
S. elegans (Fitch, 1863)	ES55, ES64, FR71, FS09
Sminthurus viridis (Linnaeus, 1758)	DS86, ES45, ES55, ES64, ES65, ES76, ES86, FR97, FS62
Sphyrotheca lubbocki (Tullberg, 1872)	ES64, FR71

Orchesella cincta (16 squares) were also reported in St-Mard and Ruette (FQ89) by ANDRÉ (1983). In addition, the latter species was found in Plombiéres (GS02) by VAN STRAALEN (1985) and in Flémalle-Haute (FS70) by THIBAUD & MASSOUD (1977). As the above mentioned species were found in such different biotopes as dunes, woods and grasslands, this suggests that they are probably widely distributed in Belgium.

Concluding remark

The data on the distribution of 52 collembolan species in Belgium were obtained from ecological and phenological research in a small number of U.T.M. squares on the one hand and from some occasional sampling in a larger number of U.T.M. squares on the other hand. Although in all, only 34 U.T.M. squares were sampled, this is the largest data set on the distribution of Collembola in Belgium that has yet been produced. With only a small number of sampled squares at hand, no definite conclusions may be drawn regarding the occurrence or absence of any one species.

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References

ANDRÉ, H.M., 1983. Notes on the cology of corticolous epiphyte dwellers. 2. Collembola. *Pedobiologia* 25: 271-278.

BERBIERS, P., MAELFAIT, J.-P. & MERTENS, J., 1990. Evaluation of some sampling methods used to study Collembola (Insecta, Apterygota) in a pasture. *Revue d'Ecologie et de Biologie du Sol,* in print.

BERBIERS, P. & MERTENS, J., 1988. Distribution of corticolous Collembola (Insecta, Apterygota) in East and West Flanders. *Bulletin & Annalen van de Koninklijke Belgische Vereniging voor Entomologie.* 124 (X-XII): 279-281.

BLANCQUAERT, J.-P., MERTENS, J. & COESSENS, R., 1982. Annual cycle of *Sphaeridia pumilis* (Collembola). *Revue d'Écologie et de Biologie du Sol,* 19: 605-611.

DE CLERCQ, M., 1984. Populatieoecologie en voedseldoorstroming van Collembola in enkele graslanden. *Licentiaatsverhandeling.* R.U.G.: 156 pp.

DESENDER, K., MERTENS, J., D'HULSTER, M. & BERBIERS, P., 1984. Diel activity patterns of Carabidae (Coleoptera), Staphylinidae (Coleoptera) and Collembola in a heavily grazed pasture. *Revue d'Écologie et de Biologie du Sol,* 21 (3): 347-361.

FJELLBERG, A., 1980. Identification keys to Norwegian Collembola. *Utgitt av Norsk Entomologisk Forening,* 152 pp.

GISIN, H., 1960. Collembolenfaunas Europas. *Musée d'Histoire Naturelle,* Genève, 312 pp.

HEUNGENS, A. & VAN DAELE, E., 1973. Collembolenfauna in de Gentse sierteelt. *Mededelingen Fakulteit Landbouwwetenschappen Gent*, 38 (1): 136-141.

LEINAAS, H.P., 1981. Cyclomorphosis in the furca of the winter active Collembola *Hypogastrura socialis* (Uzel). *Entomologia Scandinavica,* 12: 5-38.

MARLIER, G.J., 1942. Notes sur les Collemboles, I. - La faune des Collemboles de la Belgique. *Bulletin du Musée royal d'Histoire Naturelle de Belgique,* XVIII (8): 1-11.

MERTENS, J., COESSENS, R. & BLANCQUAERT, J.-P., 1982. Population structure of *Orchesella cincta* (Collembola) in the field based on instar determination. *Pedobiologia.* 23: 9-20.

RUYSSEN, T., 1983. Arboricole Collembola : Diversiteit en distributie. Licentiaatsverhandeling R.U.G., 143 pp.

THIBAUD, J.-M. & MASSOUD, Z., 1977. Comparaison entre la faune des Collemboles épigés et cavernicoles de Ramioul (Belgique). *Nouvelle Revue d'Entomologie,* VII (1): 5-7.

VAN KERCKVOORDE, M., 1983. Ontwikkeling, levenscyclus en populatiestructuur van *Isotoma viridis* (Collembola) in een begraasde weide. *Licentiaatsverhandeling.* R.U.G. : 102 pp.

VAN STRAALEN, N.M., 1985. Dynamiek van zware metalen in populaties van bodemdieren. *Vakblad voor biologen*, 65: 71-74.

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