# INVERTEBRATES OF SCANDINAVIAN CAVES IX. ACARI: MESOSTIGMATA (GAMASINA), WITH A COMPLETE LIST OF MITES

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BIOSPELEOLOGY
GAMASIDA
SCANDINAVIA
TRAPPING
CAVE MITES

SUMMARY: Six caves from Scandinavia — two from South Sweden, two from the Baltic island of Gotland, and two from Norway near the Arctic Circle — were investigated for invertebrates by means of pitfall traps and by hand-picking. 1,765 Gamasina mites were found and determined to species and developmental stages. 37 species in 9 families were identified. One species alone, *Parasitus loricatus*, made up 75.0% of the total number of mites. Six other species, viz. *Poecilochirus carabi, Vulgarogamasus oudemansi, Pergamasus robustus, Vulgarogamasus remberti, Cyrtolaelaps mucronatus* and *Vulgarogamasus kraepelini* made up another 20.2 % of the total number of mites. The numbers of individuals and species in this investigation exceeded by far those usually reported from investigations of caves in Europe, probably due to our use of pitfall traps.

BIOSPÉLEOLOGIE GAMASIDA SCANDINAVIE PIÉGEAGE ACARIENS CAVERNICOLES Résumé: Six grottes de Scandinavie (Suède: 2; îles de la mer Baltique, Gotland: 2; Norvège: 2 proches du Cercle polaire) sont prospectées par piégeage et récolte des invertébrés. 1765 gamasides ont été récoltés et déterminés. Ils appartiennent à 37 espèces de 9 familles différentes. Parasitus loricatus représente plus de 75% des individus et six autres espèces 20% (Poecilochirus carabi, Vulgarogamasus oudemansi, V. remberti, V. kraepelini, Pergamasus robustus et Cyrtolaelaps mucronatus). Les résultats montrent un nombre anormalement élevé d'individus et d'espèces par rapport aux autres prospections de grottes en Europe: il s'agit probablement de la conséquence de l'utilisation de pièges d'interception.

## Introduction

Arthropods in caves have been the subject of several studies in continental Europe (Dobat, 1975; Leruth, 1939; Strinati, 1966; Wolf, 1934–38), Britain (Chapman, 1993; Ford, 1977; Smith & Drew, 1975; Waltham & Sweeting, 1974) and Canada (Peck, 1988). A few Scandinavian caves have been

thoroughly investigated for several groups of invertebrates (see HIPPA *et al.* 1984, 1989 and ØSTBYE *et al.*, 1987, for a full bibliography).

In many of these investigations, invertebrates have been collected by hand-picking under loose stones of the cave floor and walls. This is not a good sampling method for the very small arthropods, such as the acarids. In most studies very few mites were therefore

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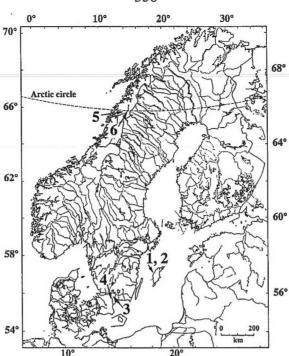


Fig. 1: Scandinavia and Denmark, with the six investigated caves marked.

1 & 2. — Lummelunda and Galgberg caves. 3. — Balsberg cave. 4. — Tykarp cave. 5. — Grönli cave. 6. — Jordbru cave.

obtained. However, HIPPA et al. (1984) used pitfall traps in their studies of Scandinavian caves, and the numbers of mites found were much higher. In the study by HIPPA et al. (1988) sampling of acarids other than the Gamasina produced 14 species of Oribata, 14 species of Prostigmata (Rhagidiidae not included), 3 species of Astigmata and 2 species of Uropodina. HIPPA et al. (1989) presented 9 species of Rhagidiidae. Here we deal with the remaining Mesostigmata, the Gamasina. A complete list of all mites from these investigations is presented in the Appendix.

# CAVES SAMPLED

The investigated caves (Fig. 1) were presented in detail in HIPPA et al. 1984. Here is a brief account:

- Lummelunda cave (57°45'N, 18°25'E), 14 km NNE Visby on the Baltic island of Gotland, Sweden.
- 2. Galgberg cave (57°42′N, 18°20′E), a small cave near the Lummelunda cave.

- 3. Balsberg cave (56°06′N, 14°12′E), 7 km N Kristianstad, province of Scania, Sweden.
- 4. Tykarp cave (56°08'N, 13°47'E), 7 km SE Hässleholm, province of Scania, Sweden.
- 5. Grönli cave (66°26'N, 14°15'E), 11 km N Mo i Rana, Norway
- 6. Jordbru cave (66°15′N, 14°45′E), near Mo i Rana, Norway. No Gamasina mites were found in this cave, and it will not be dealt with any further.

# MATERIAL AND METHODS

Sampling was in most cases done with pitfall traps. Glass jars, 4 or 6 cm in diameter, and a few larger traps, were half filled with a mixture of ethylene glycol and a few drops of detergent. They were buried in the soil of the cave floor, and left for a period of time, as follows:

Lummelunda cave, July 4-October 5, 1975: 94 nights.

Galgberg cave. Hand-picking of visible invertebrates, July 4, 1974.

Balsberg cave, July 6 1975-April 12, 1976: 281 nights.

Tykarp cave, July 8 1975-April 11, 1976: 278 nights.

Grönli cave, July 25-October 8, 1975: 75 nights.

A varied number of traps were used in each cave. In addition, due to flooding and careless handling by

visitors, some traps were destroyed during the period. Hence, the number of trapnights per each cave is difficult to account for.

Mites were individually mounted on microscope slides in Hoyer's medium, and identified under a light microscope. The slides are deposited at the Zoological Museums of Lund and Turku.

Family	Genus	Species	No of caves
Macrochelidae	Macrocheles	decoloratus (C.L.Koch) glaber (Müller)	2 2
Eviphididae	Alliphis	halleri (G. & R. Canestrini)	1
	Crassicheles	concentricus (Oudemans) holsaticus Willmann	2 1
Halolaelapidae	Halolaelaps	sp.	1
Ascidae	Cheiroseius	necorniger (Oudemans)	1
	Arctoseius	resinae Karg semiscissus (Berlese)	2 2
Laelapidae	Hypoaspis	sardoa (Berlese)	2
	Eulaelaps	stabularis (C.L. Koch)	3
	Haemogamasus	hirsutosimilis Willmann hirsutus Berlese liponyssoides Ewing	1 1 1
	Myonyssus	rossicus Bregetova	1
Rhodacaridae	Cyrtolaelaps	mucronatus (G. & R. Canestrini)	3
	Euryparasitus	emarginatus (C.L. Koch)	2
Ologamasidae	Stylochirus	"fimentarium" (Müller)	1
Vegaiidae	Veigaia	nemorensis (C.L. Koch)	1
Parasitidae	Holoparasitus	calcaratus (C.L. Koch) exipuliger (Berlese)	1 1
	Amblygamasus	dentipes (C.L. Koch)	1
	Pergamasus	crassipes (Linnaeus) hamatus (C.L. Koch) holzmannae Micherdzinski robustus (Oudemans) septentrionalis (Oudemans) vagabundus Karg	1 2 1 1 1
	Eugamasus	berlesei Willmann	1 .
	Cornigamasus	lunaris (Berlese)	1
	Poecilochirus	carabi G. & R. Canestrini subterraneus (Müller)	2 1
	Trachygamasus	ambulacralis (Willmann)	1
	Parasitus	loricatus (Wankel)	4
	Vulgarogamasus	kraepelini (Berlese) oudemansi (Berlese) remberti (Oudemans)	2 2 2

Table 1: Mesostigmatic (Gamasina) species in the samples from Swedish and Norwegian caves. Number of caves that each species was found in is indicated.

### RESULTS

Altogether 1,765 Gamasina mites were found in five caves. They were distributed among 37 species in 9 families (Table 1). No species was found in all five caves. Twenty-two species were found in only one cave, twelve species in two, and two species in three caves. One species only, *Parasitus loricatus*, was found in four caves.

Genus	Species	No.
Macrocheles	Aacrocheles decoloratus glaber	
Alliphis	halleri	1 f
Crassicheles	concentricus	1 NII
Halolaelaps	sp.	1 NII
Artctoseius	resinae semiscissus	5 f I f
Hypoaspis	sardoa	1 f
Eulaelaps	stabularis	3 f
Haemogamasus	hirsutosimilis hirsutus	2 f 1 NII
Cyrtolaelaps	mucronatus	7 NII
Euryparasitus	emarginatus	1 NII
Veigaia	nemorensis	10 f
Amblygamasus	dentipes	5 m
Pergamasus	hamatus	3 f
Poecilochirus	carabi subteranus	159 NII 14 NII
Trachygamasus	ambulacralis	3 NII
Parasitus	loricatus	294 f 320 m 20 NI 221 NII 21
Vulgarogamasus	oudemansi remberti	2 f 4 m 9 NII 5 f 7 m 5 NII
	No. species	No. individuals

TABLE 2: Mesostigmatic (Gamasina) species from the Tykarp cave, South Sweden.

*P. loricatus* also dominated by numbers in three of the caves (Tables 2–5). In the Lummelunda cave, there

were a few more individuals of *Vulagarogamasus* kraepelini than of *P. loricatus* (Table 4). In the Galgberg cave no pitfall traps were used, only handpicking on one occasion. The result from this cave is thus not comparable to those obtained from the other caves. Nevertheless, the only gamasine mite found was *P. loricatus*.

Genus	Species	No.
Macrocheles	decoloratus	1 f
Crassicheles	holsaticus	1 NII
Artctoseius	resinae semiscissus	1 NII 1 f
Hypoaspis	sardoa	1 f
Eulaelaps	stabularis	2 f
Haemogamasus	liponyssoides	1 NII
Myonyssus	rossicus	2 f
Cyrtolaelaps	mucronatus	5 NII
Euryparasitus	emarginatus	1 NII
Stylochirus	"fimentarium"	2 NII
Holoparasitus	calcaratus exipuliger	1 f 1 f
Pergamasus	holzmannae sp.	1 m 1 NII
Poecilochirus	carabi	1 NII
Parasitus	loricatus	182 f 181 m 11 NI 86 NII
Vulgarogamasus	kraepelini	2 f 2 NII
	oudemansi	29 f 21 m 54 NII
	remberti	1 f 2 NII
	No. species	No. individuals 594

Table 3: Mesostigmatic (Gamasina) species from the Balsberg cave, South Sweden.

One species alone, *P. loricatus*, made up 75.0% of the total number of gamasine mites, and the seven most frequent species made up 95.2 % (Table 6).

Four species, *Parasitus loricatus*, *Vulgarogamasus oudemansi*, *Pergamasus robustus* and *V. remberti*, were present in more than one developmental stage (Tabes 2–5). They were also among the five most frequent, and constituted the bulk of the gamasine mites in the caves (Table 6).

Genus	Species	No.		
Macrocheles	glaber	1 f		
Cheiroseius	necorniger	1 f		
Eulaelaps	stabularis	2 f		
Pergamasus	crassipes hamatus septentrionalis vagabundus	1 m 1 f 1 f 1 f		
Eugamasus	berlesi	1 m		
Cornigamasus	lunaris	1 NII		
Parasitus	loricatus	1 f 3 m 1 NII		
Vulgarogamasus	kraepelini	1 f 7 m		
	No. species	No. individuals 23		

TABLE 4: Mesostigmatic (Gamasina) species from the l	Lummelunda
cave, Gotland, Sweden.	

Genus	Species	No.	
Crassicheles	concentricus		
Cyrtolaelaps	mucronatus	1 NII	
Veigaia	sp.	2 NII	
Pergamasus	robustus	18 f 14 m 1 NII	
	No. species	No. individuals 37	

Table 5: Mesostigmatic (Gamasina) species from the Grönli cave, Norway.

	Caves .										
total number:	Tykarp 1,109		Balsberg 594		Lummelunda 23		Galgberg 2		Grönli 37		
	No.	%	No.	%	No.	%	No.	. %	No.	%	Σ
P. loricatus	857	77.3	460	77.4	5	21.8	2	100	-	-	1,324
P. carabi	159	14.3	1	0.2	-	-	-	-	-	=	160
V. oudemansi	15	1.4	104	17.5	-	-			-	-	119
P. robustus	-	-	-	-	-	-	-	4 4	33	89.2	33
V. remberti	17	1.5	3	0.5	-	-	1 -	£ _	-	-	20
C. mucronatus	7	0.6	5	0.8	-	-		-	1	2.7	13
V. kraepelini	- 1-		4	0.7	8	34.8	-	-	-	-	12
Σ	1,055	95.1	577	97.1	15	65.2	2	100	34	91.9	1,681

TABLE 6: The most frequent Gamasina species in five Scandinavian caves.

# DISCUSSION

We have found a larger number of Gamasina mites in the Scandinavian caves, compared to what is reported from continental Europe, Britain and Canada (PECK, 1988).

The mesostigmatic mites are probably introduced into the caves from three different sources: Insects, small mammals and free-living mites.

Most of the Gamasina species are associated with insects, like the families Macrochelidae, Eviphididae, Halolaelapidae, Ologamasidae, Ascidae and some of the Parasitidae (genera *Poecilochirus* and *Trachygamasus*) (LUNDQVIST, 1998). It is likely

that they are transported occasionally to the caves. The low number of individuals, the large number of species and the lack of correspondence in species composition between caves, even caves that are closely located, indicate association with insects.

Another source is small mammals. This is most likely the origin of the families Laelapidae and Rhodacaridae. Small rodents and bats, or their traces, were observed in most of the caves.

However, the most frequent species (families Parasitidae and Veigaiidae) are free-living predators. Four species, representing the genera *Parasitus* (*P. loricatus*) and *Vulgarogamasus* (*V. oudemansi*, *V. kraepelini* and *V. remberti*), are obviously reproducing in the

Swedish caves, as they were found in relatively large numbers, both as juveniles and adults (Tables 2–4). In the Lummelunda cave, only a few individuals of these genera were found (Table 4), which could indicate that the populations either do not reproduce, or just had started. However, it should be noted that trapping period in Lummelunda was much shorter compared to those case in the two Scanian caves and did not include wintertime. In the northernmost cave, Grönli, the reproducing species was *Pergamasus robustus*, whereas neither *Parasitus* nor *Vulgarogamasus* species were found. Whether the absence of these genera, that are so common in the southern caves, is due to the high latitude or pure chance cannot be decided.

In species lists of caves from other parts of the world, few mites are generally reported. This is most probably due to the sampling methods. There is no other reason to believe that the Scandinavian caves should be so much richer in these groups.

There are only a few species of Mesostigmatic mites frequently reported from European caves. The most common ones are *Parasitus loricatus* and *Eugamasus magnus* (=berlesei?). They were also found in the Swedish caves, although *E. berlesei* only in low numbers. However, these species, as well as other gamasine mites found in the Scandinavian caves, are also regularly found in other biotopes (e.g. Lundquist, 1974).

#### TAXONOMIC COMMENTS ON THE SPECIES LIST

Alliphis halleri (G. & R. Canestrini, 1881) Syn: A. siculus (Oudemans, 1905)

Stylochirus "fimentarium" (Müller, 1859)

Deutonymphs of this species are known as *Iphidiosoma fimentarium* (KARG, 1971) and are found associated with carabid beetles during the second half of a year. Adults, however, are members of the genus *Stylochirus*, and can be found free living in forest litter during a short period of time in April–May (LUNDQVIST, 1991). The definite name of the species still remains to be settled (KETHLEY, 1983).

Pergamasus crassipes (Linnaeus, 1758)

No attempt has been made to separate this species from *P. longicornis* (Berlese, 1906) (BATTACHARYA, 1963, KARG, 1971).

Eugamasus berlesei (Willmann, 1935)

The sole male keys out to *E. berlesei* according to HYATT (1980), who expressed doubts about differences between this species and *E. magnus* (Kramer, 1876).

#### FAUNISTIC COMMENTS ON THE SPECIES LIST

The laelapid species *Haemogamasus lipponyssoides*, which we found in the province of Scania, was previously known from Sweden and Finland only north of latitude 64° (LUNDQVIST, 1990).

The following fourteen species are new to the Swedish fauna: Crassicheles concentricus, C. holsaticus, Arctoseius resinae, A. semiscissus, Holoparasitus calcaratus, H. exipuliger, Amblygamasus dentipes, Pergamasus hamatus, P. holzmannae, P. septentrionalis, P. vagabundus, Eugamasus berlesi, Poecilochirus carabi and P. subteranus. Crassicheles concentricus is new to the Norwegian fauna.

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APPENDIX. Acari species found in six Scandinavian caves by our team (HIPPA *et al.* 1988, 1989, and present material). Abbreviations for the caves (see map in Fig. 1): 1 = Lummelunda, 2 = Galgberg, 3 = Balsberg, 4 = Tykarp, 5 = Grönli, and 6 = Jordbru.

ACTINOTRICHIDA	
Oribata	
Adoristes sp.	3
Belba sp.	5, 6
Carabodes labyrinthicus (Michael)	3
C. spinosus Sellnick	1
Chamobates cuspidatus (Michael)	1, 3, 5, 6
Damaeus onustus C.L. Koch	3
Euzetes seminulum (O.F. Müller)	1
Hafenrefferia gilvipes (C.L. Koch)	1
Hypodamaeus brevitibialis Bulanova-Zachvatkina	5
H. riparius (Nicolet)	1

Moritziella keilbachi (Moritz)	4
Oribella pectinata (Michael)	4
Paradamaeus clavipes (Hermann)	3
Scheloribates pallidulus (C.L. Koch)	1
Prostigmata	
Anystis baccarum (Linnaeus)	4
Bdella iconica Berlese	4
Cyta latirostris (Hermann)	1
Ereynetes (Anereynetes) sp.	3
Ereynetes cf. gandensis Fain & Bafort	1
Evadorhagidia sp.	3
Foveacheles osloensis (Thor)	4
Leptus sp.	1, 3, 4
Linopodes motatorius (Linnaeus)	3, 4, 5
Pediculaster sp.	4
Penthaleus major (Duges)	3, 4
Poecilophysis faeroensis (Trägårdh)	4
P. pseudoreflexa Zacharda	3
P. spelaea (Wankel)	2, 6
P. weyerensis (Packard)	4
Rhagidia gigas (R. Canestrini)	3
R. ruseki Zacharda	4
Robustocheles robusta Zacharda	4
Scutacarus deserticolus Mahunka [as S. acarorum (Goeze) in 1988; M. Uusitalo pers. comm.]	4
S. ponticolus Mahunka [as Scutacarus sp. in 1988; M. Uusitalo pers. comm.]	4
Thoribdella meridionalis (Thor)	5
T. norvegicus (Thor)	3
Trombidiidae sp.	1
	•
Astigmata	
Caloglyphus berlesei (Michael)	4
Myianoetus diadematus Willmann	1, 4
Tyrophagus similis Volgin	4
Tyrophugus simila vosgai	•
ANACTINOTRICHIDA	
Mesostigmata (Uropodina)	
Dinychopsis catula (Hull)	4
Leiodinychus orbicularis (C.L. Koch)	1
Mesostigmata (Gamasina)	
Alliphis halleri (G. & R. Canestrini)	4
Amblygamasus dentipes (C.L. Koch)	4
Arctoseius resinae Karg	3, 4
A. semiscissus (Berlese)	3, 4
Cheiroseius necorniger (Oudemans)	1
Cornigamasus lunaris (Berlese)	1
Crassicheles concentricus (Oudemans)	4, 5
C. holsaticus Willmann	3
Cyrtolaelaps mucronatus (G. & R. Canestrini)	3, 4, 5
Eugamasus berlesei Willmann	1
Eulaelaps stabularis (C.L. Koch)	1, 3, 4

Haemogamasus hirsutosimilis Willmann	4
H. hirsutus Berlese	4
H. liponyssoides Ewing	3
Halolaelaps sp.	4
Holoparasitus calcaratus (C.L. Koch)	3
H. excipuliger (Berlese)	3
Hypoaspis sardoa (Berlese)	3, 4
Macrocheles decoloratus (C.L. Koch)	3, 4
M. glaber (Müller)	1, 4
Myonyssus rossicus Bregetova	3
Parasitus loricatus (Wankel)	1, 2, 3, 4
Pergamasus crassipes (Linnaeus)	1
P. hamatus (C.L. Koch)	1, 4
P. holzmannae Micherdzinski	3
P. robustus (Oudemans)	5
P. septentrionalis (Oudemans)	1
P. vagabundus Karg	1
Poecilochirus carabi G. & R. Canestrini	3, 4
P. subterraneus (Müller)	4
Stylochirus "fimentarium" (Müller)	3
Trachygamasus ambulacralis (Willmann)	4
Veigaia nemorensis (C.L. Koch)	4
Vulgarogamasus kraepelini (Berlese)	1, 3
V. oudemansi (Berlese)	3, 4
V. remberti (Oudemans)	3, 4
	Total no. species: 79