LAND SNAILS IN NEST CLEANINGS OF THE BLACK HARVEST ANT

MESSOR EBENINUS IN NETZER SERENI, ISRAEL

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Abstract: Cleanings of 11 nests of the Black Harvest ant *Messor ebeninus* in Kibbutz Netzer Sereni, Israel, were checked for the presence of land snails. In this way a minimum number of 2779 specimens was obtained. They belonged to 17 different species of land snails however the number of species differed considerably between the nests and ranged between a minimum of three and a maximum of nine species. Nests situated in irrigated areas turned out to contain large numbers of invasive species. Only three species: *Euchondrus* species, *Monacha syriaca* and *Xeropicta vestalis joppensis*, all autochthonous species, were found in all the nest cleanings. A study of ant nest cleanings may turn out into a simple and quick method for estimating the micro land snail species living in a particular habitat.

Key words: Hymenoptera, Formicidae, *Messor ebeninus*, nest cleanings, land snails, Israel.

Introduction

Ants and snails: at first sight it looks a strange combination, but entering both words in a search engine results in more than six million references. Most are referring to quite accidental encounters like both groups of animals are sharing the same habitat, cause damage to the same plants or fruits, are predated upon by the same natural enemies, etc., others are referring to more close interactions between ants and snails. At least three types of close interaction may be recognized.

-**Predation** in which ants are actively searching for land snails in order to feed on them. Most studied are cases of tropical ant species preying on juvenile specimens of the Giant African snail *Lissachatina fulica* (Bowdich, 1822), usually named *Achatina fulica*. The literature dealing with such cases of predation have been reviewed by Mead (1961 & 1979). However predation of snails by ants is not confined to the Giant African snail. Van der Meer Mohr (1931a-b) reported on cases of predation on *Subulina octona* (Bruguière, 1792) and *Bradybaena similaris* (Férussac, 1821) (as *Eulota similaris*) in Indonesia. His photographs (van der Meer Mohr, 1931a, figs. 1-2) of the leftovers of the shells are rather instructive. Marikovskii (1974a-b) mentioned attacks on juvenile specimens belonging to *Bradybaena* spec. by three species of ants in Kazachstan. Most recently Páll-Gergely & Sólymos (2009) did not rule out the possibility that snail collecting Harvest ants i.e. *Messor* species in Turkey are actually feeding on species belonging to the genus *Monacha*. Shells of *Monacha cartusiana* (Müller, 1774) present in ant nests in France and showing a similar damage as those mentioned by Páll-Gergely & Sólymos (2009) were considered by Bertrand (2010) also as possible victims of predation activities carried out by *Messor bouvieri*.

-Commensalism in which snails are living within an ant nests without being attacked. This type of interaction between ant and snail is known as myrmecophily. One of the first cases of myrmecophily has been described most probably by Heynemann (1868) when he described a new species of a slug from the West African island Principe as *Veronicella myrmecophila* Heynemann, 1868. Verdcourt (1957) mentioned living and dead specimens of a *Curvella* species in an ant nest in Tanganyika. It lasted another 45 years until Verdcourt (2002) described it as *Curvella myrmecophila* Verdcourt, 2002. In the same year another species

from the Family Subulinidae was described from Malaysia as *Allopeas myrmekophilos* Janssen & Witte, 2002, which name had already been used a month earlier by Witte et al. (2002) in their extensive description of the interactive behaviour of ant and snail. Most recently Bertrand (2010) reported on the presence of living specimens of another Subulinid species *Ferussacia folliculus* (Gmelin, 1791) in nests of *Messor bouvieri.*

-**Hoarding** in which ants are collecting any small item, edible or not, present in the vicinity of their nest and hoard it usually temporarily within the subterranean compounds of their nest. This habit is especially developed in Harvest ants (*Messor* species) but may also occur among other species. Here only a few examples are given. Butot (1952) reported on ants carrying snails to their nest in a garden in Bogor, Java, Indonesia. The 43 snails obtained in this way turned out to belong to three species: *Allopeas gracile* (Hutton, 1834) (as *Opeas gracile*) – 40 specimens, *Huttonella bicolor* (Hutton, 1834) (as *Gulella bicolor*) – 2 specimens and one specimen of *Geostilbia moellendorffi* (Pilsbry, 1908). The latter turned out to be the first record of any *Geostilbia* from Java. Urbanski (1965) found more than 100 empty shells of a Clausiliid species *Bulgarica thessalonica* (Rossmässler, 1839) in a single nest of *Messor rufitarsus* in Bulgaria. In form and size these shells resembled that of a grain of wheat, but juvenile shells of several larger snail species were also present. Mienis (1974) reported the presence of thousands of snails representing 11 snail species in nest cleaning of *Messor semirufus* on a kurkar (=local sandstone) hill in Kibbutz Netzer Sereni, Israel. Seidl (1987) encountered 1559 shells in a single nest of *Lasius niger* in Bayern, Germany. Nine different species were involved, all tiny species and juvenile shells of a single larger species. Extremely common in the nest were *Pupilla muscorum* (Linnaeus, 1758)–598 specimens, *Vallonia costata* (Müller, 1774)–739 specimens and *Vallonia pulchella* (Müller, 1774) – 149 specimens. Páll-Gergely & Sólymos (2009) studied the presence of shells in cleanings of ant nests of *Messor oertzeni* and *Messor caducus* in the fields of the Dumlupinar University, Kütahya, in Turkey. Of the eleven species found under natural circumstances in the field nine species were encountered in the nest cleanings. The shells found near the ant nests belonged again to tiny species or juveniles of the larger species. Among others they reached the conclusion that the shell collecting activities of Harvest ants may help malacologists to collect difficult to find species.

From this short review of interactions between ants and snails it appears that especially the study of shells present in the cleanings of ant nests might produce unexpected results. Therefore one of us (HKM) decided to repeat such a survey once again in Kibbutz Netzer Sereni in order to check whether a study of ant nest cleanings might give us a simple tool for surveying the micro snail fauna of a random region.

Material and methods

On 11 August 2010 and 4 September 2010 respectively 5 and 6 samples of Harvest ant nest cleanings were taken from 11 different nests of *Messor ebeninus* in Kibbutz Netzer Sereni, Israel. At all the localities the soil consisted of hamra, a local red sand. Three samples were taken from areas which are regularly irrigated; two samples were taken from non-irrigated areas and six samples were taken from dry areas in former avocado (*Persea americana*) and mango (*Mangifera indica*) orchards which at the time of sampling were used for growing Paulownia (*Paulownia tomentosa*) trees. The samples ranged from a minimum of 0.5 kg to a maximum of 2 kg. They formed always only a small part of the entire ant nest cleanings. They were taken to the Mollusc Collection of the Tel Aviv University (TAU MO) where each

sample was sorted into three different size classes: < 1 mm, 1-2.5 mm and > 2.5 mm, in order to allow a more efficient screening of the material. All three samples of a single locality were screened for the presence of shell remains by one of us (SV), who made also the initial identifications. The results were checked by HKM who also divided the material into complete adults, complete juveniles, top fragments, fragments of the aperture and other fragments. Finally the minimum number of shells belonging to each species was established. Only the latter numbers are presented in this report. Most of the material has been lodged for permanent preservation in the collection of the Tel Aviv University.

Results

Cleanings of eleven Harvest ant nests at as many different localities in Kibbutz Netzer Sereni were sampled at random. All the nests turned out to belong to the Black Harvest ant *Messor ebeninus* according to the description given by Ofer (2000). The sampled sites were divided into three groups.

-Irrigated areas:

Locality 1: Netzer Sereni, west of the sport hall under pine trees, leg. H.K. Mienis, 11.08.2010;

Locality 2: Netzer Sereni, east of sport hall near irrigated lawn, leg. H.K. Mienis, 11.08.2010;

Locality 3: Netzer Sereni, south of "Hurshat Liron" along the road, leg. H.K. Mienis, 11.08.2010.

-Non-irrigated areas:

Locality 4: Netzer Sereni, east of "Hurshat Liron", leg. H.K. Mienis, 11.08.2010;

Locality 5: Netzer Sereni, east of sport hall, north of the waste containers, leg. H.K. Mienis, 11.08.2010.

-Non-irrigated areas in former irrigated orchards:

Locality 6: Netzer Sereni, at the southern edge of the *Paulownia* plantation east of the kibbutz, leg. H.K. Mienis, 04.09.2010;

Locality 7: Netzer Sereni, in the centre of the *Paulownia* plantation east of the kibbutz, leg. H.K. Mienis, 04.09.2010;

Locality 8: Netzer Sereni, in the center of the *Paulownia* plantation east of the kibbutz, leg. H.K. Mienis, 04.09.2010;

Locality 9: Netzer Sereni, in the northern part of the *Paulownia* plantation east of the kibbutz, leg. H.K. Mienis, 04.09.2010;

Locality 10: Netzer Sereni, along the northern edge of the *Paulownia* plantation east of the kibbutz, leg. H.K. Mienis, 04.09.2010;

Locality 11: Netzer Sereni, along the northern edge of the *Paulownia* plantation east of the kibbutz, leg. H.K. Mienis, 04.09.2010.

The results of the studied samples are given in Table 1.

Table 1: Minimum number of shells encountered in 11 different nest cleanings of the Black Harvest ant *Messor ebeninus* in Kibbutz Netzer Sereni, Israel.

Localities	1	2	3	4	5	6	7	8	9	10	11
Species											
Vallonia excentrica	4	-	-	-	-	-	-	1	-	-	-
Gastrocopta rupicola	7	6	0	9	7	3	-	1	1	-	-
Euchondrus species	29	131	25	37	5	58	183	93	165	225	100
Cristataria species	-	-	-	-	1	-	-	-	-	-	-
Calaxis hierosolymarum	-	-	-	-	-	-	-	-	-	-	2
Paralaoma servilis	14	15	11	-	-	-	1	1	2	-	-
Hawaiia minuscula	30	26	-	-	-	-	-	-	-	-	-
Sphincterochila aharonii	-	5	-	-	-	-	-	-	-	-	-
Caracollina lenticula	-	1		-	-	6	2	-	1	-	-
Prietocella barbara	17	-		-	-	-	-	-	-	-	-
Microxeromagna lowei	-	137	8	-	16	2	2	2	14	64	4
Monacha syriaca	3	26	12	5	7	3	5	3	3	6	1
Xerocrassa davidiana	-	-	-	-	2	-	-	1	-	5	-
Xeropicta vestalis joppensis	12	8	6	17	104	18	15	71	53	60	10
Xerotricha conspurcata	7	-	-	-	-	-	-	-	-	-	-
Helix engaddensis	-	-	-	-	6	-	1	2	1	1	1
Theba pisana	-	-	-	-	2	-	-	-	-	-	-
Total minimum number of shells	876	446	65	59	143	87	209	175	240	361	118
Total number of taxa	9	9	6	3	8	5	7	9	8	6	6

Discussion

Most of the molluscs recovered from the samples were small, varying in size from one to a maximum of 5 mm. From the larger species like *Sphincterochila*, *Helix* and *Theba*, only tiny juveniles were found.

The total minimum number of snails encountered in the eleven ant nest cleanings turned out to be 2779. The size of the individual samples did not influence the minimum number of snails per locality, which ranged from 59 (Loc. 4) to 876 (Loc. 1). They turned out to belong to 17 different species (Table 2). The lowest number was encountered at locality 4, which yielded only 3 different species; the highest diversity: 9 species, was recorded at the localities 1, 2 and 8.

Local faunal elements are represented by 11 species, however only three species among them were encountered at all 11 localities: *Euchondrus* species, *Monacha syriaca* and *Xeropicta vestalis joppensis.* The unidentified *Euchondrus* species was by far the most common species: it was represented by a minimum number of 1051 specimens. In the past this species has been usually identified as *Euchondrus ovularis* (Olivier, 1801), however that is a Turkish species, which does not occur in Israel. The rather similar species from the coastal and inner coastal regions of Israel will be described by Dr. R. Bank (the Netherlands) as a new species. The presence of *Sphincterochila aharonii* and *Xerocrassa davidiana* among the material is somewhat puzzling. They are typical inhabitants of a biotope consisting of kurkar rocks, which are not present at the surface of any of the eleven localities.

The non-local species are represent by six taxa of which five are of foreign origin: *Gastrocopta rupicola* and *Hawaiia minuscula* have their origin in North America, *Prietocella*

barbara and *Xerotricha conspurcata* are typical circum-Mediterranean species of which natural populations are absent not only in Israel but also in Egypt, *Vallonia excentrica* is a typical holarctic species however absent from Israel. Noteworthy is the fact that almost all the non-local material was found at localities receiving regular irrigation.

The presence of a fragment of a *Cristataria* species at locality No. 5 is even more puzzling than any other species.

It belongs without doubt to one of the ribbed species known to occur in the hilly regions of Israel however the fragment is too small to allow any further identification. Maybe that species arrived in the kibbutz in the same way as other rock-dwelling snails like *Levantina* and *Buliminus* i.e. by the transfer of large rocks from the hills to gardens in the kibbutz.

Table 2: Systematic list of species encountered in nest cleanings of the Black harvest ant *Messor ebeninus* in Kibbutz Netzer Sereni, Israel. Non-local species are indicated by an asterisk (*). The minimum number of specimens is given in brackets.

Family Valloniidae
**Vallonia excentrica* Sterki, 1893 (5)
Family Chondrinidae
**Gastrocopta rupicola* (Say, 1821) (862)
Family Enidae
Euchondrus species (1051)
Family Clausiliidae
**Cristataria* species (1)
Family Ferussaciidae
Calaxis hierosolymarum (Roth, 1855) (2)
Family Punctidae
Paralaoma servilis (Shuttleworth, 1852) (44)
Family Oxychilidae
**Hawaiia minuscula* (Binney, 1840) (56)
Family Sphincterochilidae
Sphincterochila aharonii (Kobelt, 1913) (5)
Family Trissexodontidae
Caracollina lenticula (Michaud, 1831) (10)
Family Cochlicellidae
**Prietocella barbara* (Linnaeus, 1758) (17)
Family Hygromiidae
Microxeromagna lowei (Potiez & Michaud, 1838) (249)
Monacha syriaca (Ehrenberg, 1831) (74)
Xerocrassa davidiana (Bourguignat, 1863) (8)
Xeropicta vestalis joppensis (Schmidt, 1855) (374)
**Xerotricha conspurcata* (Draparnaud, 1801) (7)
Family Helicidae
Helix engaddensis Bourguignat, 1852 (12)
Theba pisana (Müller, 1774) (2)

Still noteworthy is the fact that none of the numerous tiny shells like *Gastrocopta rupicola*, *Paralaoma servilis* and *Hawaiia minuscula* showed any trace of predation by the ants.

Conclusion

The study of ant nest cleanings for the presence of shells turned out a rather lucrative event: a minimum number of 2779 specimens representing 17 different species, most of them so-called micro-species, were retrieved in this way. The three irrigated areas provided not only half of the specimens (1387) but also almost all the material belonging to non-local species (944 out of a total of 949 specimens).

Extremely common in the irrigated area was a tiny North-American species: *Gastrocopta rupicola*. Although it had been collected already in Kibbutz Netzer Sereni, it was a real surprise that it occurred in such large numbers (760 specimens) at locality 1. This and other micro-species like *Vallonia excentrica*, *Paralaoma servilis* and *Hawaiia minuscule*, are so small that if it had been the intention of the ants to use them as food, then they had to open the shells in order to feed on the snail's meat.

However none of the shells showed any damage of gnawing by ants. It remains therefore a riddle why Harvest ants, in this case *Messor ebeninus*, are hoarding snail shells in their nests.

Whatever the reasons of this hoarding may be, ant nest cleanings may provide the malacologist with a wealth of material for rapidly obtaining an idea about the presence and diversity of difficult to collect tiny snail species in a given locality.

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