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**Mites (Acari) and flies (Insecta : Diptera)
from natural edible mushrooms (Morchella : Ascomycetes)
in Ankara, Turkey**

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Abstract

The mites (Acari) and the Diptera (Insecta) occurring on Morel (Morchella-Ascomycetes) plantations in Ankara and Çamlidere, Turkey, were studied. Thirteen species of phytophagous, predaceous or saprophagous mites were found, during the surveys of spring and summer 1994-1995. Two representative sampling sites were chosen for the surveys, i.e. the towns of Ankara and Çamlidere. The mite species were: Tyrophagus perniciosus ZACHVATKIN, Saprosecans baloghi KARG*, Geholaspis mandibularis (BERLESE)*, Androlaelaps fahrenheitsi (BERLESE)*, Hypoaspis aculeifer (CANESTRINI)*, Eugamasus butleri HUGHES, Proctolaelaps pomorum (OUDEMANS)*, Macrocheles punctatissimus BERLESE*, Ramusella inculpta (PAOLI), Ramusella clavipectinata (MICHAEL)*, Lauroppia cf. fallax (PAOLI)*, Medioppia subpectinata (OUDEMANS)* and Pygmephorus spp. Ten of them are new for the Turkish acarofauna. All these mite species are recorded for the first time on Morchella mushrooms in Turkey. The flies belong to the species: Docosia gilvipes (HALIDAY) and Rymosia cretensis LUNDSTROM. The mite and fly species marked with an asterisk are new for the Turkish fauna.*

Key words: Harmful mites (Acari) and Diptera. Edible mushrooms. *Morchella*. Turkey.

Résumé

Les acariens (Acari) et les diptères présents sur les plantations de morilles (Morchella-Ascomycetes) à Ankara et Çamlidere, Turquie, ont été étudiés. Treize espèces d'acariens phytophages, prédateurs ou saprophages y ont été récoltées lors des relevés de printemps et d'été 1994-1995. Deux sites repré-

sentatifs ont été choisis, l'un dans la ville d'Ankara, l'autre dans la ville de Çamlidere. Les acariens récoltés appartiennent aux espèces suivantes : Tyrophagus perniciosus ZACHVATKIN*, Saprosecans baloghi KARG*, Geholaspis mandibularis (BERLESE)*, Androlaelaps fahrenheiti (BERLESE)*, Hypoaspis aculeifer (CANESTRINI)*, Eugamasus butleri HUGHES, Proctolaelaps pomorum (OUDEMANS)*, Macrocheles punctatissimus BERLESE*, Ramusella insculpta (PAOLI), Ramusella clavipectinata (MICHAEL)*, Lauroppia proche de fallax (PAOLI)*, Medioppia subpectinata (OUDEMANS)* and Pygmephorus spp. Dix d'entre-elles sont nouvelles pour la faune de Turquie. Toutes ces espèces d'acariens sont mentionnées pour la première fois sur Morchella en Turquie. Les diptères récoltés font partie des espèces Docosia gilvipes (HALIDAY) et Rymosia cretensis LUNDSTROM.

Introduction

Morels (Ascomycetes, Pezizales, Morchellaceae: genus *Morchella*) are called after the Turkish word for "belly of lambs" (Kuzu gobegi). They are growing naturally in various parts of country, in the flora of *Pinus* sp. forest in early spring. They are collected by the natives to eat as delicacy and also for exportation to some European countries. This crop is attacked by a wide range of mite and fly species.

There are some reports available about the flora of *Morchella* spp. (SUMER, 1987; ODER, 1972; GUCIN, 1992; BAYTOP, 1994). *Morchella conica* (PERS.), *Morchella deliciosa* (FR.), *Morchella distans* (FR.), *Morchella elata* (FR.), *Morchella esculanta* (L.), *Morchella rotunda* (PERS.) were reported as edible natural mushroom species in Turkey (GUCIN, 1992). They grow in the forests, orchards and in grassland ground cover. *Morchella* species prefer the area beneath coniferous, apple and other forest trees. They start fructification above 10 C, 58-77 % relative humidity and 20% soil moisture (GUCIN, 1992). Optimum conditions occurred on the Çamlidere plateau (Ankara) for these mushroom species in 1994 and 1995. This plateau is widely covered by *Pinus* forest.

Some mite species, especially those belonging to the families Pyemotidae, Acaridae and Histiosomatidae, are reported as harmful for cultivated mushrooms (*Agaricus* spp.) (TOROS & COBANOGU, 1985; ONDER *et al.*, 1995; RAMARAJU & MADANLAR, 1997).

Mites and flies are exclusively phytophagous pests of the Morels. The mites pierce the mushroom caps and cause discoloration. Both mites and flies are known to mine in stems and caps of Morels and cause severe loss. The mite infestation may also cause brown patches on the external surface of the plants. Although these two groups are important pests, there were so far no available data concerning this problem in Turkey. This paper will fill in this important gap.

The Morels were identified as *Morchella conica* (PERS.) and *Morchella esculanta* (L.) by Dr. Oguz ARIKAN (University of Hacettepe, Biology Department-Ankara, Turkey).

Material and methods

Samples were collected under the surface of vegetation of the *Pinus* trees in Çamlidere and from apple orchards vegetation in Ankara, during the spring months of the years 1994 and 1995. The *Morchella* belong to the species *Morchella conica* (PERS.) and *M. esculanta* (L.).

The *Morchella* samples were pulled out from the soil with roots and the mites extracted with Berlese – funnel method and examined. The mites samples were also collected from the plant samples by using a stereomicroscope. Collected mites were preserved in 70% alcohol and clarification was done by keeping them in lactophenol solution for about 12 hours at 30-35 C and mounted in Hoyer's medium for study.

Identification was based on HUGHES (1976), SMILEY (1978), SMILEY & WHITHAKER (1984), KARG (1971, 1993); SUBIAS (1980) and SUBIAS & ARILLO (1991).

The specimens have been deposited in the collection of S. C. in Ankara University.

The fly samples were collected at the larval stages in the mushroom plants and brought into the laboratory, they were kept in the refrigerator (4C) for about two weeks and then transferred to the growing chambers in the following conditions: 24-25C, 16 hour light and 60-65% humidity until their hatching. Adult flies were preserved in 70% alcohol.

Results and Discussion

Thirteen mite species were identified, ten of them are new for the Turkish acarofauna. They are marked with asterisks in table 1. Rearing larvae of the flies allowed to obtain two species, i.e. *Docosia gilvipes* (HALIDAY) or *Rymosia cretensis* LUNDSTROM. The phytophagous mites belong to the families Acaridae and Pygmephoridae. The rest of them are saprophagous or predacious. Cryptostigmatic mites are mostly considered as edaphic species. All these mite and fly species are recorded for the first time from Morels.

Table 1. List of the mites and flies found on Morels in Turkey.

Acari	Families	Species	Number of specimens	
			Ankara	Camlidere
Astigmata	Acaridae	<i>Tyrophagus perniciosus</i> *	-	9♀♀, 1♂
Cryptostigmata	Oppiidae	<i>Ramusella insculpta</i>	-	1♀
		<i>Lauroppia cf. fallax</i> *	-	1♀
		<i>Medioppia subpectinata</i> *	-	2♀♀
		<i>Ramusella clavipectinata</i> *	1♀	-
Mesostigmata	Halolaelapidae	<i>Saprosecans baloghi</i> *	-	2♀♀
	Macrochelidae	<i>Geholaspis mandibularis</i> *	9♀♀	9♀♀
		<i>Macrocheles punctatissimus</i> *	1♀	-
	Laelapidae	<i>Androlaelaps fahrenheitzi</i> *	2♀♀	2♀♀
		<i>Hypoaspis aculeifer</i> *	5♀♀	-
	Ascidae	<i>Proctolaelaps pomorum</i> *	3♀♀	-
	Parasitidae	<i>Eugamasus butleri</i>	-	2♀
Prostigmata	Pygmephoridae	<i>Pygmephorus</i> sp.	-	19♀♀
Diptera	Mycetophilidae	<i>Docosia gilvipes</i>	-	1♀, 1♂
		<i>Rymosia cretensis</i>	-	6♀♀, 6♂♂

*New records for Turkey

Acari**Mesostigmata****Family Laelapidae BERLESE, 1892*****Androlaelaps fahrenheitzi* (BERLESE, 1911)**

This species is characterized by the shape of the *pilus dentilis*, very long and flattened. It is distributed in Palaearctic region and North America (KARG, 1971).

Records: On *Morchella* sp., 25.IV.1995, Ankara.

This is the first record from Turkey.

***Hypoaspis aculeifer* (CANESTRINI, 1883)**

H. aculeifer is a very common predacious mite species in the compost and humus of green houses and growing chambers. It is associated with colonies of nematods, collembolas, mites and larvae of insects (KARG, 1994).

Distribution: Europe, Asia, North and South America (KARG, 1994).

Records: Ankara, 25.IV.1995.

This is the first record from Turkey and also the first time that this species is found on Morels.

Family Ascidae VOIGTS & OUDEMANS, 1905***Proctolaelaps pomorum* (OUDEMANS, 1929)**

This species is distributed in Europe and Australia (KARG, 1994).

Some *Proctolaelaps* species are well known in Turkey, especially *Proctolaelaps pygmaeus* (MULLER), a very effective predacious species attacking the harmful stored products mites (OZER *et al.*, 1989).

Records: Ankara, 30.III.1994.

This is the first record of *P. pomorum* from Turkey and also from Morels.

Family Halolaelapidae KARG, 1965***Saprosecans baloghi* KARG, 1964**

The habitat of this species is soil. It has been recorded from Middle European countries (KARG, 1971).

Records: Camlidere at 25.IV.1995.

This is the first record from Turkey.

Family Macrochelidae VITZTHUM, 1930***Geholaspis mandibularis* (BERLESE, 1904)**

Holotaspis mandibularis BERLESE, 1904

Macrocheles minimus HULL, 1918

This species can easily be identified by its long chelicerae.

This species is common in compost and humus. It is distributed all over Europe (KARG, 1971).

Records: On *Morchella*, 25.IV.1995, Ankara.

This is the first record from Turkey.

***Macrocheles punctatissimus* BERLESE, 1918**

Macrocheles pulcherrimus WILLMAN, 1951

This species spreads all over Europe (KARG, 1994), it is characterized by the punctated structure of the sternal plate.

Records: cultivated mushroom heads (*Agricus bisporus*), Ankara, 8.XI.1983. This species had been collected before the 1994 & 1995 surveys of the *Morchella* spp. acarofauna and kept in our collections for identification.

This is the first record from Turkey.

Family Parasitidae OUDEMANS, 1901

Eugamasus butleri HUGHES, 1948

This is a very common species in Turkey, it is a predacious mite and attacks the harmful mites of the stored products (OZER *et al.*, 1989).

Records: Çamlidere, 25.IV.1995.

This is the first record from Morels.

Prostigmata

Family Pygmephoridae CROSS, 1965

The identification of the Pygmephorid species of our collection is not achieved up to now and our list is therefore incomplete.

Pygmephorus spp.

Pygmephorus species cause severe loss to the mushroom cultivation. These mites pierce mushroom cups and cause discoloration. The mite infestation causes brown patches on the external surface of the caps. In Turkey, *Pygmephorus allmanni* KRCZAL and *Pygmephorus sellnicki* KRCZAL were identified on the cultivated mushrooms, in the province of Ankara (TOROS & COBANOGLU, 1985). However to date, there is no data available on the *Pygmephorus* species which causes damage on *Morchella* mushrooms, in Turkey.
Records: Çamlidere, 23.V.1994.

Astigmata

Family Acaridae EWING & NESBITT, 1942

Tyrophagus perniciosus ZACHVATKIN, 1959

This species causes brown spots and splitting on the heads and tunneling in to the heads lamellas of the mushrooms. This is a not very common species in Turkey, but the other members of this genus, such as *Tyrophagus putrescentiae* (SCHRANK), are very common on stored products in Turkey (OZER *et al.*, 1989). This is the first record of *T. perniciosus* from Turkey and from Morels.

Records: on *Morchella* spp., 25.IV.1995, Çamlidere.

Cryptostigmata

The Cryptostigmata fauna of the Eastern part of Turkey is fairly well documented in contrast with that of Central and Western part of country which is still poorly known (AYYILDIZ, 1988; KOC & AYYILDIZ, 1992). Three of the following identified Cryptostigmata species are new for Turkey and also all of them are new records for *Morchella* mushrooms.

Family Oppiidae GRANDJEAN, 1954

***Ramusella (Insculptoppia) insculpta* (PAOLI, 1908)**

Dameosoma insculptum, PAOLI, 1908 nec SUBIAS, 1980

Oppia insculpta BALOGH, 1943 nec SUBIAS, 1980

This edaphic palaeartic species, has been reported from Southern Palaearctic, Iberian, East of Western Mediterranean and Maghrebian countries (SUBIAS & GIL-MARTIN, 1997).

Records: Çamlidere, 11.V.1995.

***Lauroppia cf. fallax* (PAOLI, 1908)**

This species is very close to *Leuroppia fallax* (PAOLI), but can be distinguished by the number of the genital setae (SUBIAS & ARILLO, 1991).

Records: Çamlidere, 23.V.1994.

This is the first record for Turkish fauna.

***Medioppia subpectinata* (OUDEMANS, 1900)**

Oppiella subpectinata (OUDEMANS, 1900)

This edaphic species (WOAS, 1986), is known from Iberian, East of Western Europe (SUBIAS & GIL-MARTIN, 1997).

Records: Çamlidere, (23.V.1993: 25.V.1995) .

This is the first record from Turkey.

***Ramusella (Ramusella) clavipectinata* (MICHAEL, 1885)**

Ramusella (Ramusella) assimilis (MICHELICIC, 1956)

Oppia assimilis MICHELICIC, 1956

Oppia insculpta BERNINI, 1969

Oppia taminae RIABNIN, 1975

This is a holarctic and edaphic species (SUBIAS, 1980).

Records: Ankara, 25.IV.1995.

This is the first record from Turkey.

Insecta: Diptera

The larvae of the flies damage the caps and lamellae of mushrooms. The direct damage is caused by the presence of larva. The larvae of flies infest the *Morchella* caps, and feed inside the mushroom tissue.

It was reported that the fly population mainly *Megaselia halterata* (WOOD) (Phoridae) may significantly reduce the mushroom yield. Two generations of phorids were may observed during the cropping period (RINKER & SNETSINGER, 1984).

Family Mycetophilidae

Docosia gilvipes (HALDAY)

Records: on *Morchella conica* caps, Çamlidere, 11.V.1995.

Rymosia cretensis LUNDSTRAM

From *Morchella conica* caps, Çamlidere, 15.V.1995, 3 females, 3 males; 11.V.1995, 3 females, 3 males.

The larvae of flies were found on the heads of mushrooms living in galleries and causing damage. Their population density is not very high and it seems that these species are not serious pests of edible natural mushrooms at least for those collected in Ankara and Çamlidere.

The relationship between the fly larvae of *Bradysia tritici* infesting *Agaricus bisporus* (cultivated mushrooms) and the amount of damage caused was studied. The larvae feed and emerge in the developing heads and damage the pickable mushrooms, thus reducing the yield (BRAR & SANDHU, 1990).

Family Sciaridae

The number of specimens was too small for identifying them at the species level.

FREEMAN (1983), reported that *Lycoriella solani* and *Lycoriella auripila* have been implicated as the pests of mushrooms.

Records: 25.IV.1995 (two females).

The fly larvae were not affected by storage in a refrigerator, kept at 1°C for 14 days followed by transfer to an incubator kept at 25°C. This observation suggests that larvae can survive within mycelia of the edible fungus when kept in cold storage. YUKAWA & HIGASHI (1989) expressed the same opinion.

Discussion

This is the first study dealing with the mites and flies harmful for edible morels in Turkey. Thirteen species of mites were identified: Among them two species are harmful (*T. perniciosus* and *Pygmephorus* sp.), and seven are probably predacious on the other mites or on the larvae and eggs of flies (*S. baloghi*, *G. mandibularis*, *A. fahrenheiti*, *H. aculeifer*, *E. butleri*, *P. pomorum*, *M. punctatissimus*). The four other species belonging to the Cryptostigmata (*R. insculpta*, *L. cf. fallax*, *M. subpectinata* and *R. clavipectinata*), are mainly soil inhabiting mites. Pygmephoridae have high population densities but unfortunately their identification was not possible up to now. Ten of the species are new for the Turkish fauna and all the species are recorded for the first time from Morels in Turkey.

In Turkey 5 harmful and one predacious species of mites had already been mentioned i.e.: *Pygmephorus sellnickii* KRCZAL, *Pygmephorus almanni*

KRCZAL, *Caloglyphus rhizoglyphoides* ZACHVATKIN, *Mycetoglyphus fungivorus* OUDEMANS, *Histiostoma sapromyzae* (DUFOUR), *Arctoseius* spp. from the mushroom house on the cultivated *Agaricus bisporus* (TOROS & COBANOGU, 1985). It has been reported that *Parasitus consanguineus*, the most common predacious mite species in the mushroom house in Punjab – Pakistani, was found to feed on the eggs and larvae of the Sciaridae and Phoridae species and on eggs of *Collembola* spp (GILL *et al.*, 1988).

Two fly species in the family Mycetophilidae were identified. Their population densities were not very high. This is the first record of these species on the Morels in Turkey. It is considered that seven species were predacious on the other mites and eggs and larvae of flies. This suggests that it is not necessary to use any chemicals for controlling the fly species, the predacious mites species keep the population density of the pest species at an acceptable level.

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**Additional notes and records on the subgenus
Ceratitis (Pardalaspis) BEZZI, 1918
(Diptera : Tephritidae)**

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Summary

Additional distribution and host plant data are given for representatives of the subgenus Ceratitis (Pardalaspis) (Diptera, Tephritidae), as a follow up on an earlier revision of the subgenus by the author. Type material of C. breinii and C. punctata could be studied and was compared with the redescription given earlier. The male and host plant of C. semipunctata are recorded for the first time.

Key words : Tephritidae, *Ceratitis*, *Pardalaspis*, Afrotropical.

Introduction

DE MEYER (1996) revised the subgenus *Pardalaspis* BEZZI, 1918 as part of a comprehensive revision of the genus *Ceratitis* MACLEAY. The subgenus *Pardalaspis* comprises 10 species, all with Afrotropical distribution. Since this publication, the author had the change to study some additional collections including type material of *C. breinii* GUÉRIN-MÉNEVILLE and *C. punctata* (WIEDEMANN) from the following institutions :

CIRAD : Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier, France (J.F. VAYSSIERES);

KMMA : Koninklijk Museum voor Midden Afrika, Tervuren, Belgium;

MNHN : Muséum National d'Histoire Naturelle, Paris, France (L. MATILE);

NMSA : Natal Museum, Pietermaritzburg, South Africa (D. BARRACLOUGH);

USNM : United States National Museum, Washington D.C., U.S.A. (A. NORRBOM);

ZMK : Zoological Museum, University of Copenhagen, Denmark (R. MEIER).

This resulted in some additional taxonomic, distributional and host plant data.