Studies on the mite and Collembolan fauna in protected agricultural habitats at Gharbia Governorate

A Thesis

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(Ecology)

Presented by

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Contents

1. Introduction and Aim of the work

Soil invertebrate populations are influenced by soil factors in a species-specific way, therefore the species composition of the soil invertebrate community may indicate certain aspects of habitat quality. Several workers have demonstrated a relationship between soil factors and microarthropod community composition (Van Straalen *et al*., 1988 and Al-Assiuty *et al*., 1995).

Order Acarina is the most important group of the arachnid orders because of its effect on human economics and human health. It is well known those oribatid mites are very sensitive to any change in the environment, especially temperature, relative humidity, hydrogen ion concentration, and water content. Accordingly one could consider this group of animals as good sensors to the changes occur in the environment.

On the other hand, this group of animals have a marked role for soil fertility. In addition to their roles as intermediate hosts for the infection of farm animals.

Most mites feed on organic deprits of all kinds. Some mites are predaceous, consumers and feed on nematodes, insect eggs, and collembola. Many Zoologists direct their attention entirely to this group of arachnids.

Prostigmata, Mesostigmata, Astigmata, and Cryptostigmata, as their names imply, the adult stages of these groups are distinguished basically on the character of the respiratory system (Wallwork, 1967).

On the other hand, collembolan species which live successfully in many habitats have economic importance because of their feeding on the decomposed leaves and stems of plants. The estimated number of species world wide is about 10000.

They inhibiting soils preferring wet and damp surroundings. Collembola are highly tolerated to a wide range of environmental and industrial pollution.

Springtails (Collembola) are small entognathous, wingless primitive insects. Their primitive nature leads some biologists to exclude them from the class insecta, and placing them in class Collembola.

Collembola has been divided into five groups. Poduoromorpha, Metaxyploena, Neeloploena, Entomobryomorpha and Symphyploena.

The present work aims to record all available oribated mites and Collembola inhabiting different green houses with special reference to:

1- Classification and characteristic features of the recorded oribatid mites and Collembola.
2- Morphological and taxonomical studies of some Egyptian oribatid mites and Collembola.
3- Understanding vertical distribution of the oribatid mite and Collembola fauna in two different green houses, the first received chemical fertilizers and the second received organic fertilizers.

Review of literature

To the best of our knowledge there are a little informations concerning soil microarthropods inside the green house biotopes. Thus the writer had reviewed a paper dealing with different ecological topics in natural habitats besides the data about green houses habitat. Krull (1939) suggested that the soil moisture played an important role in the horizontal distribution of oribatid mites.

Strenzke (1951) mentioned that the humus content is a very important environmental factor to the presence of oribatid fauna. Wafa *et al.* (1965) indicated that oribatid mites could penetrate the soil to more than 12 inches below its surface. Naigima (1976) reported that the human impact seems to be harmful for soil animal inhabiting the forest floor.

Kanko (1985) studied the seasonal changes in community structure of oribatid mites on two different soil types in a cool temperate deciduous forest. Oribatid mite communities were compared in terms of species richness, species composition, diversity and evenness between the two soil types which differed in their organic layer. He reported that the seasonal change in population abundances of total and adult mites showed a similar seasonal change in number in each plot. Diversity of oribatid mite communities was expressed by Shannon-Wiener index (H). The values were rather constant through the study period and mean values of what were 4.067 and 4.419 in the ridge and bottom respectively.

Schenker (1986) investigated the population dynamics for oribatid mites and to extend the information for ecology for different abundant and species and described the seasonal fiuctuationed of them in a forest soil ecosystem. He mentioned that the highest oribatid densities were

observed in autumn with smaller peaks in winter, spring and summer. All species studied showed a high net reproductive rate enabling their populations to increase rapidly when environmental conditions are favorable.

Smrz (1992) studied the influence of ecological factors on the microarthropod community (oribatid) inhabiting the moss-cover, and he found a little influence on the life-cycles, but *Phauloppia luconn* probably does not. Juveniles of this species were rare in moss in comparison to the other oribatids. *Trichoribates triculatus* seemed to be the best adapted microarthrppods in this community.

Al-Assiuty *et al.*, (1993) investigated the influence of vegetation types on seasonal abundance and species composition of soil fauna in two different Governorates in Egypt. The obtained results revealed that species diversity was similar among different vegetation types at the same site. The monthly fluctuation of the total number of oribatid mites showed gradual increases in the orange orchards and gradual decreases in banana orchards. Other acari showed no significant differences in relation to site, vegetation types, time and the interaction among them. Collembola revealed a significant difference between sites. From the results it may be concluded that oribatid as a group are influenced by vegetation type more than by geographical locations, while the reserve was true for Collembola.

Miko (1993) studied the effect of popular windbreak on oribatid communities in heavy soil agroecosystem of east Slovakia. Species composition, community structure, abundance, group dominance as well as diversity and equitability indices of oribatid communities were analysed in different habitat. The windbreak can be considered as an

important interactional element in the agricultural landscape with direct and indirect in fuanunce on the oribatid communities, of the agroecosystem.

Stamou and Argyropoulou (1995) studied the effect traffic exhausts on oribatid mites of the city of Thessalniki. They found that the population density of the main oribatid species increased in polluted area and the total oribatid numbers were decreased due to the reduction on species richness. The highest species diversity was recorded in moderately polluted areas. The morphmetric characteristics as well as certain life history traits did not correlate with the level of traffic influence.

Semczak (1995) investigated the arboreal mites and epiphytes in youngscots pine forest polluted by a copper smelting works at Glasgow, scotland. The concentration of heavy metals in scots pine bark and epiphytes increased toward the pollution source. A high concentration of heavy metal was harmful to mites, especially oribatid. The number of oribatid species decreased towards the pollution source. Among mites, the foil wing categories were distinguished and sensitive to heavy metals, high concentration but tolerant with small concentrations of those metals.

Vangestelca and Vandiepen (1997) mentioned that soil moisture content does not have a great influence on the bioavailability and toxicity of cadmium for the collembolan *Falsomia candida*. Fonseca and Sarker (1997) studied a nee field and a non-cultivated area in area Agrtala (Tripura, India). The temporal fluctuations in the microarthropod abundances of the two sites were compared. Microarthropod abundances were similar in the two ecosystems. The group and temporal diversities were higher in the rice field than in the waste land.

Khalil *et al.*, (1999) studied the effect of converting land annual crop to orchard on the ecology of certain soil inhabiting and determined the community composition of soil microarthropod. In conclusion, the annual crop-orchard substitution has a beneficial effect on soil inhabitants and oribatid mites respond clearly to plant cover. Khalil (1999) stated that the irrigation with the drainage water had a pronounced effect on the oribatid mites both quantitatively and qualitatively and species such as *Scheloribates laevigatus* and *Tectocepheus sarekensis* could be used as good bioindicators for water quality of the irrigation system.

El-Shahawy and Mohamden (2000) studied the impact of lead deposited in arable soil. They found that the element produced from autombile exhausts caused a hazard to soil fauna and affect their distribution. The study was designed at different distances (5, 50 and 100 meters) a way from the highway (Cairo-Alexanderia) beside on the island between the dual-carriage. The deposing of lead in soil and earth worms was decreased when go far from the road. They also indicated that the total soil fauna tented to migrate below 50 m.

Chernova and Kuznetsova (2000) revealed that both stable and fluctuating collembolan communities in Russia can exist in natural ecosystems. Stable collembolan communities are characteristic of moisture conditions, whilst fluctuating communities are typical of either xeric and hygric habitat. Stable collembolan communities are best studied for the bioindication of long-term anthropogenic impacts on a natural ecosystem ; whereas fluctuating communities better reflect short-term environmental changes. Chagnon *et al.*, (2000) studied that the community structure of collembola and their seasonal fluctuations in Quebec Sugar maple forests growing in mull, moder and mor humus types. The mor/ moder type group included *Folsomia penciula*,