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INVESTIGATION OF SOIL APTERYGOTA (INSECTA) IN MEMORIAL PARK ŠUMARICE (KRAGUJEVAC)

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ABSTRACT. Once monthly during the period September 2004 to September 2005, soil *Apterygota* was collected in Memorial Park Šumarice, in Kragujevac. Samples were taken from different layers (soil depth: 0-10cm and 10-20cm), in oak forest. It was investigated influence of soil temperature and moisture on their vertical distribution. In scope of group *Apterygota*, presence of three different orders was established: *Protura*, *Diplura* and *Collembola*. Determination of orders was conducted to the level of family. Among them the most numerous families were from order *Collembola* (93.73%), then from o. *Protura* (4.74%) and finally from o. *Diplura* (1.53%).

INTRODUCTION

Soil insects which belong to group *Apterygota* are main component of mesofauna (organisms with length 0.2-10mm, and width 0.1-2mm). Dominant members of these community are individuals from the order *Collembola* with nearly 90% [Crossley *et al*., 1999]. Beside them, and the other *Apterygota* (*Protura*, *Diplura*) are very important in processes which take place in the soil. Investigation of soil-microarthropods diversity indicates number of trophic levels, as well as keystone species which have strong impact on decomposition of organic matter [Hattenschwiler *et al*., 2005].

Thereupon, this investigation presents attempt to illustrate relationship among different orders of group *Apterygota* in a ecosystem such as oak forest, and to determine factors which affect on their seasonal dynamics.

MATERIAL AND METHODS

The investigation was conducted in oak forest (in Memorial Park Šumarice), in Kragujevac, during period September 2004 - September 2005. Once monthly, three soil samples from different layers (depth: 0-10cm and 10-20cm) per each of five defferent points were collected. Soil temperature and moisture were measured on these depths to

establish influence of ecological factors on *Apterygota* distribution. In laboratory, for separation of individuals, Tulgren-Berlesse apparatus were used. Material was preserved in 70% ethanol until determination which was conducted to the level of family.

RESULTS AND DISCUSSION

During the research period, total number of collected individuals in oak forest was 42867, whereby presence of *Apterygota* in layer with depth 0-10cm was 71.32%, and in layer with depth 10-20cm was 28.68%. These results were expected, because of the process of decomposition of organic matter has maximum activity on this place and it is known that the most *Apterygota* are feeders of debris organic matters and fungal hyphae [Detsis, 2000]. Presence of *Protura* was 4.74%, *Diplura* 1.53% and *Collembola* 93.73%.

Soil temperature and moisture data are given in Fig.1 and Fig.2.

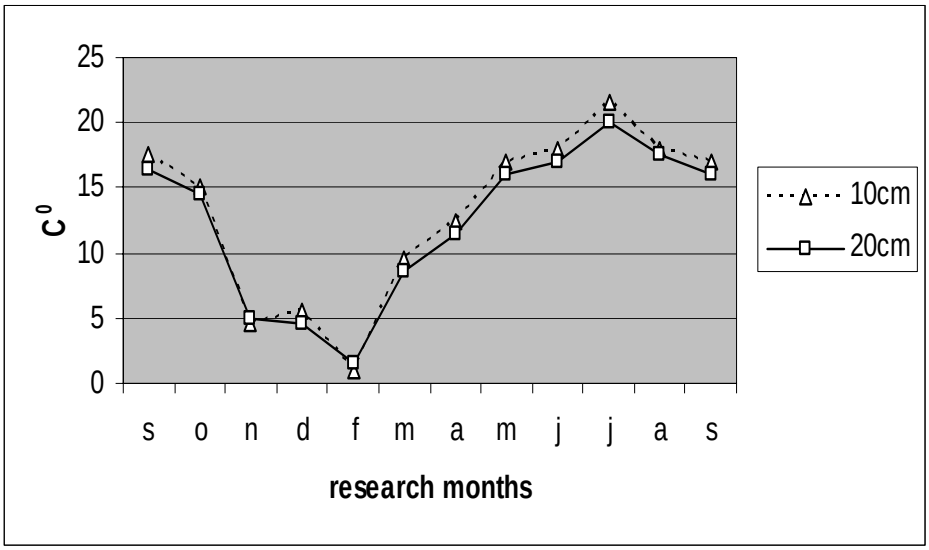

Figure 1. Temperature diagram for different layers
during the period September 2004 - September 2005

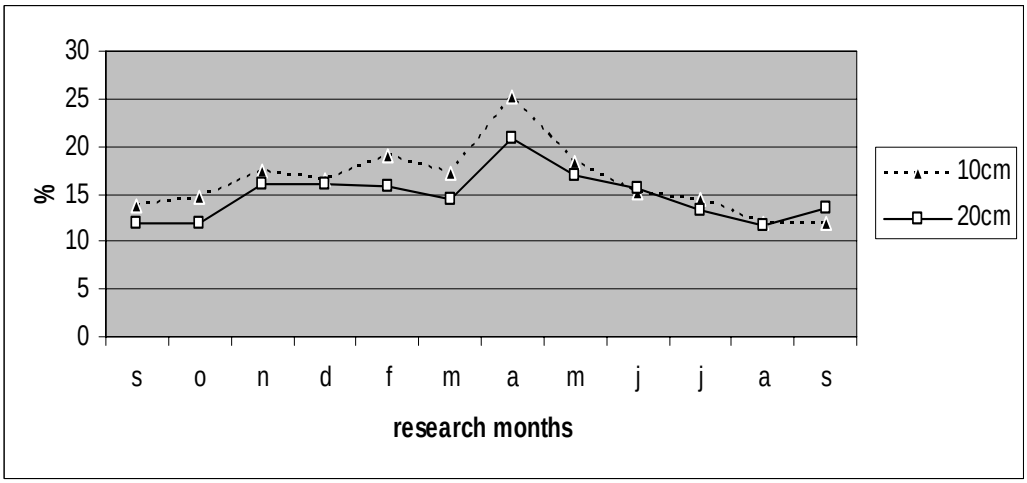

Figure 2. Soil moisture diagram on different layers
during the period September 2004 - September 2005

Insects from the order *Protura* never can be found in greater mass, but they are more numerous in forest litter than in meadow soil [Blesić, 1998, 2002a]. In scope of this order, members of two families were found: *Eosentomidae* and *Acerentomidae*. It was shown on Fig.3 that the individuals are concentrated in upper soil layer. Also, it can be observed that in period September - April number of individuals decreased, and after that, because of optimum ecological factors of environment, it increased. Its rapidly fall was noticed in August, which can be explained by summer drought. With respect that *Protura* are sensible on desiccation, their movement depends from soil moisture.

In scope of the order *Diplura*, presence of two families was established: *Japygidae* (18.73%) and *Campodeidae* (81.27%). The followed factors (Fig.4) influence on their seasonal dynamics. *Diplura* are present in less number than *Protura*, because of they are dominant in meadow soils [Blesić, 2002b].

It was recorded that during IV and V research months (December-February), low soil temperature and moisture influence on vertical migration in deeper soil layers. So, on depth of 20cm, equalization of number of individuals can occur and even its increase in relation to upper layer (0-10cm).

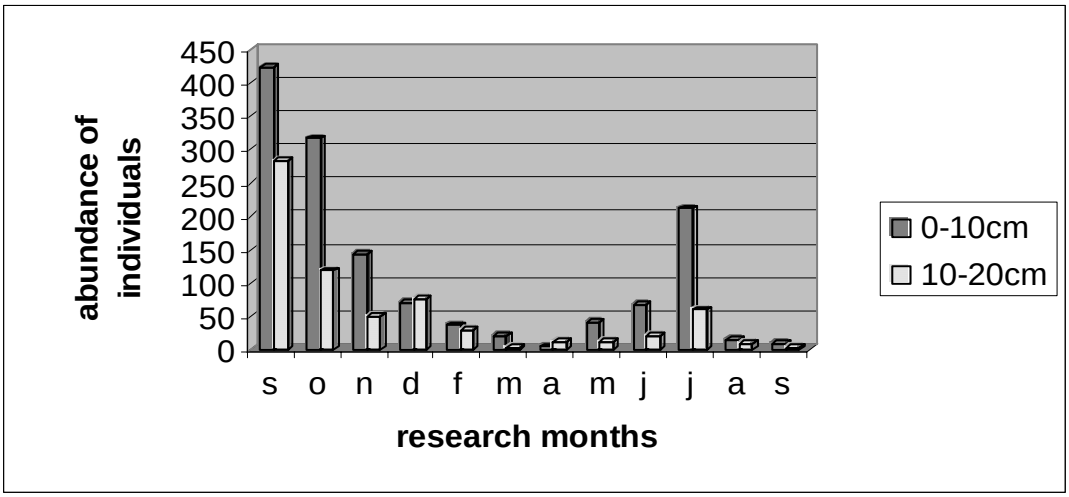

Figure 3.Total abundance of *Protura* during the research months in different layers

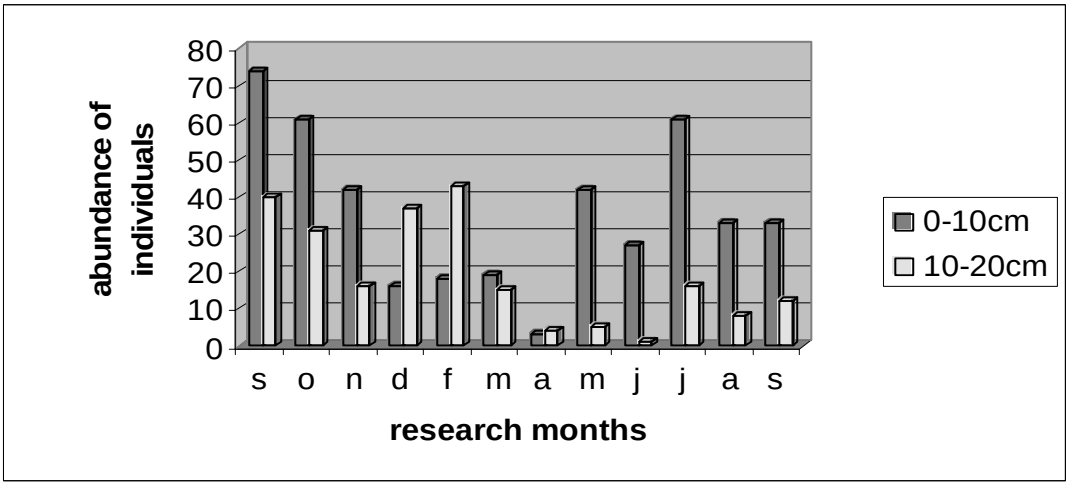

Figure 4.Total abundance of *Diplura* during the research months in different layers

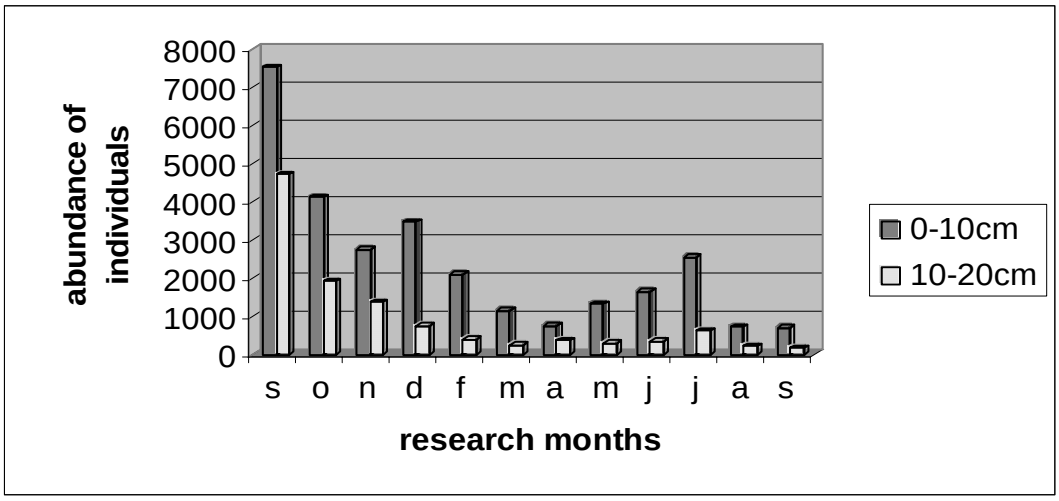

Figure 5. Total abundance of *Collembola* during the research months in different layers

Members of the order *Collembola* with 93.73% of presence are very dominant in soil ecosystem. Therefore, their number, species diversity and life characters are excellent indicators of environment where they are present [De Bruyn *et al*., 2000; Ferguson & Joly, 2002; Blesić & Mitrovski, 2003]. In this order members of next families were found: *Isotomidae* (61.79%), *Entomobryidae* (21.26%), *Poduridae* (4.20%), *Onychiuridae* (11.39%) and *Sminthuridae* (1.36%). In upper layer (0-10cm), their abundance was 71.64% and in deeper layer (10-20cm) was 28.36%. This difference was expected. *Collembola* are fungivores and detritovores, so maximum density of population is in litter, where hyphal mass is more accessible [Detsis, 2000; Castano-Meneses *et al*., 2004]. Fig.5 shows positive and negative effects of soil temperature and moisture on *Collembola* community, as well as that this order has held its dominance owing to its eurivalence.

Finally, we can conclude the fact that the upper soil layer is a result of saprophageous activity (litter decomposition and mixing of mineral and organic matter). Also, it can be noticed that seasonal changes, such as summer drought, winter frost and decreased amount of litter are responsible for cyclic variation of soil Apterygota vertical distribution.

ACKNOWLEDGEMENTS

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