VERTICAL DISTRIBUTION OF SOIL MITES (ACARI) IN DALAMAN (MUĞLA PROV.-TURKEY)

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ABSTRACT: In this study, the vertical distributions of soil mites were investigated at five sampling areas. In the sampling areas 3277 individuals belonging to four orders were obtained. The amount of the orders are as follows: 83.5% Oribatida, 13.9% Gamasida, 2.2% Actinedida, 0.4% Acaridida. It was determined that the maximum population density was in the litter (34%) and the minimum population density was at the depth of 10-15cm (14%). The soil mites abundance and seasonal differences ($P<0.001$), depth ($P<0.001$), different plant species ($P<0.001$) were statistically significant. These results are discussed and recommendations for future work are proposed.

KEY WORDS: Acari, Dalaman, Vertical Distribution, Soil Mites, Turkey.

Soil mites are one of the important groups with species and abundance in the soil. They have an important role in the biologic produce of the soil by adding to the decomposition of organic matter, humus synthesis, defense biologic elements and reminding the bacteria and fungus metabolism. Microorganisms decompose organic matter quickly with mites (Ghilarov, 1963).

There are some studies on the vertical distribution of soil mites in different habitats (Drift, 1951; Macfadyon, 1952; Wallwork, 1959; Lebrun, 1965, 1971; Block, 1966; Anderson, 1971; Luxton, 1972, 1981a, b; Price, 1973; Usher, 1971, 1975; Pande and Berthet, 1975; Mitchell, 1978; Edsberg and Hagvar, 1999). There are a few studies on the vertical distribution of mites at citrus (Abo-Korah, 1979; Leetham and Milchunas, 1985; Whelan, 1978; Perdue and Crossley, 1990). Sheals (1957) investigated the seasonal distribution of Oribatida in uncultivated citrus soil. This researcher reported that mites migrate to other habitats to reproduce. There are a few studies on the vertical distribution of soil mites in our country. (Ayyıldız, 1987; Koç and Ayyıldız, 1992; Ayyıldız and Koç, 1994).

The aim of this study is investigate the vertical distribution of soil mites at stations in Dalaman (Turkey).

MATERIALS AND METHODS

This study was conducted in Dalaman (Muğla-Turkey). We choose five stations; three of them were on Baldırmaz-Kocagöl road, two of them were around the Eska houses. These stations are as follows; First station: The area with carob trees near Kocagöl, Second station: The forest area (Pinus brutia) near Kocagöl, Third station: The area with maquis

(Quercus sp.) near Baldırmaz Lake, Fourth station: The forest area (Pinus brutia) near Kükürtlü Lake and Fifth station: The rocky area with Phylloria latifolia at the east of Eska houses (Fig. 1).

During the year 2003, at the middle of every month litter and soil samples were taken with a soil iron sampler volume 1000cc. In every sampling soil samples were taken from litter at a depth of, 0-5cm, 5-10cm and 10-15cm. They were put in nylon bags, labeled and brought to the laboratory. Mites were extracted over a 7-day period on modified high-gradient Tullgren funnels into 70% alcohol. Then they were counted and identified as soon as possible. Population estimates were obtained monthly.

RESULTS

In the sampling areas 3277 individuals belong to 4 orders were obtained. Samples of Acari collected were belonged to Oribatida 83.5%, Gamasida 13.9%, Actinedida 2.2% and Acaridida 0.4% (Fig. 2).

When all depths were considered, seasonal differences in soil mite abundance were significant for four orders (X^2: 449,560, DF: 33, P< 0,001) (Fig. 3).

Generally mites are known to occur in the soil upper layer but in our study there were differences between the orders. The maximum population density occurred in the litter (34%), the minimum population density occurred at 10-15cm (14%). When we examined the relation between the depth and soil mite abundance statistically, it was significant (X^2: 68,501, DF: 9, P< 0,001) (Fig. 4).

At the sampling areas there were different plant species. The soil mites abundance changed according to the plant species in our study (X^2:100,235, DF: 9, P< 0,001) (Fig. 5).

The Orders Obtained in the Sampling Areas

Gamasida

456 individuals were obtained in the sampling areas. At the litter 126, at 0-5cm 112, at 5-10cm 156 and at 10-15cm 62 individuals were obtained. It reached the maximum density at 5-10cm and minimum density at 10-15cm. This order reached the maximum density in January. At the first half of the year there were more individuals than the second half (Fig. 6).

Oribatida

2736 individuals were obtained in the sampling areas. At the litter 961, at 0-5cm 675, at 5-10cm 713 and at 10-15cm 388 individuals were obtained. It reached maximum density at litter and minimum density at 10-15cm. At the first half of the year there were more individuals than the second half like Gamasida (Fig. 7).

Actinedida

71 individuals were obtained in the sampling areas. At the litter 44, at 0-5cm 18, at 5-10cm 2 and at 10-15cm 7 individuals were obtained. It reached maximum density at litter and minimum density at 5-10cm.

Maximum individuals were obtained in September and October. In February no individual was obtained (Fig. 8).

Acaridida

It was presented with 14 individuals in the sampling areas. At the litter 1, at 0-5cm 1, at 5-10cm 5 and at 10-15cm 7 individuals were obtained. This order had the minimum density at the stations. The individuals of this order were obtained only in April and in July. In April it was obtained at litter and 0-5cm, in July the order was obtained at 5-10cm and 10-15cm (Fig. 9).

DISCUSSION

In spite of some mites presence on trees or rocks, on liken, on moss and rarely on special microhabitats generally their presence is at maximum level with variety and number at organic layers of soil. A few mites choose the mineral layers of the soil (Koç, 1991).

In a previous study (Leetham and Milchunas, 1985) in which a vertical distribution to the mineral layers of soil was observed, the presence of mites was correlated with root biomass and soil moisture.

Some researchers reported that some mites' presence is widespread at some layers and most of them adapted to move to the narrow holes in soil pores (Haarlov, 1960; Evans et al., 1961; Holt, 1981; Koç, 1991). In spite of the mites with a small body present at all layers of the soil, the mites with a big body present densely at upper layers of the soil (Holt, 1981; Leetham and Milchunas, 1985; Koç, 1991). The findings of this study are appropriate to these researchers' results. Gamasida and Oribatida orders reached the maximum density at litter (Figs. 6, 7).

Some researchers reported that soil mites reached maximum density in spring and winter and a minimum density in summer (Marshall, 1974; Mitchell, 1978; Holt, 1981; Whelan, 1978; Perdue and Crossley, 1990; Al-Assiuty et al., 1993; Edsberg and Hagvar, 1999). In this study, the density of mites reached a maximum in winter. The individuals of Gamasida and Oribatida orders were in maximum in the first half of the year.

Soil mites migrate both daily and seasonally. This condition is connected with the changes at the heat and moisture of the soil (Usher, 1971, 1975; Whelan, 1978; Perdue and Crossley, 1990; Al- Assiuty et al., 1993). Mites may migrate to escape adverse environmental conditions at the soil surface (Usher, 1975; Perdue and Crossley, 1990). Leetham ve Milchunas (1985) reported that some soil mites have high dryness tolerance at arid area conditions and some soil mites adapted to the arid conditions. In our study, we reported Acaridida order only in April and July. This order reached maximum density in July. So we can conclude that this order adapted to arid conditions.

Our studies showed that there are both seasonal and vertical distributional differences among 4 orders. To understand these differences clearly, future studies should be undertaken in family or genus level. However these finding indicate different mite abundance in

different plant species, resulting in these groups possibly having different food choices. We think differences among plant species should be considered in future ecological studies.

LITERATURE CITED

Abo-Korah, S. M. 1979. Distribution and seasonal abundance of the soil mites associated with citrus trees in Monoufeia Governorate, Egypt. Bull. Soc. Ent. Egypte 62: 263-267.

Al-Assiuty, A. I. M., Bayoumi, B. M., Khalil, M. A. & Van Straalen, N. M. 1993. The influence of vegetational type on seasonal abundance and species composition of soil fauna at different localities in Egypt. Pedobiologia 37: 210-222.

Anderson, J. M. 1971. Observations on the vertical distribution of Oribatei (Acarina) in two woodland soils. IV. Collguum Pedobilogiae. DIJON. 14/19-IX-1970. Published in: Annales de Zoologie- Ecologie Animale Numero Hor- Serie / 1971: 257-272.

Ayyıldız, N. 1987. Erzurum Ovası Oribatidlerinin (Acari) bitki örtüsü ve toprak yapısıyla ilişkileri. Türkiye I. Entomoloji Kongresi. İzmir.

Ayyıldız, N. & Koç, K. 1994. Atatürk Üniversitesi çam koruluğunda toprak akarlarının (Acari) dikey dağılımı üzerine bir çalışma. XII. Ulusal Biyoloji Kongresi. 160-166, Edirne.

Block, W. 1966. Seasonal fluctuations and distribution of soil mite populations in Moorland Soils, with a note on biomass. J. Anim. Ecol. 35: 487 -503.

Drift, J., Van Der. 1951. Analysis of the animal community in a Beech Forest Flor. Tijdschr. Ent. 94: 1-168.

Edsberg, E. & Hagvar, S. 1999. Vertical distribution abundance, and biology of oribatid mites (Acari) devoloping inside decomposing spruce needless in a podsol soil profile. Pedobiologia 43: 413-421.

Evans, G. O., Sheals, J. G. & Macfarlane, D. 1961. The terrestrial Acari of the British Isles. Alden Pres, Oxford, England, vol. 1: 219 pp.

Ghilarov, M. S. 1963. In " Soil Organism " I. doeksen and van der Drift, (eds.), North Holland Publ. Co., Amsterdam, 255-259.

Haarlov, N. 1960. Microartropods from danish soils: Ecology, Phenology. Oikos suppl. 3: 1-176.

Holt, J. A. 1981. The vertical distribution of cryptostigmatic mites, soil organic matter and macroporosity in Three North Queensland Rainforest Soils. Pedobiologia 22: 202-209.

Koç, K. 1991. Atatürk Üniversitesi çam koruluğunda oribatid akarların (Acari) dikey dağılımı üzerine bir çalışma. Atatürk Üniv. Fen Bilimleri Enstitüsü, Biyoloji Anabilim Dalı, Yüksek Lisans Tezi, 40 pp.

Koç, K. & Ayyıldız, N. 1992. Atatürk Üniversitesi Kampüsü'ndeki çam koruluğunda oribatid akarların (Acari: Oribatida) dikey dağılımı. Tr. J. of Zoology 16: 361-384.

Lebrun, P. 1965. Contributon a l' etude ecologque des oribatides de la litiere dans une foret de Moyene-Belgique. Mem. Roy. Soc. Nat. Belg. 133: 1-96.

Lebrun, P. 1971. Ecologie et Biocoenotigue de Quelques Peuplements d'Arthropodes Edaphigues. Instç R. Sci. Nat. Belgique. Memorie 165: 1-203.

Leetham, J. W. & Milchunas, D. G. 1985. The composition and distribution of soil microarthropods in the Shortgrass Steppe in relation to soil water, root biomass, and grazing by cattle. Pedobiologia 28: 311-325.

Luxton, M. 1972. Studies on the oribatid mites of a danish beechwood soil. Pedobiologia 12: 434-463.

Luxton, M. 1981a. Studies on the oribatid mites of a danish beechwood soil V. vertical distribution. Pedobiologia 21: 359-380.

Luxton, M. 1981b. Studies on the oribatid mites of a danish beechwood soil VI. vertical distribution. Pedobiologia 21: 387- 409.

Macfadyen, A. 1952. The small arthropods of a molinia fen at Cothill. J. Anim. Ecol. 21: 87-117.

Marshall, V. G. 1974. Seasonal and vertical distribution of soil fauna in a thinned and drea- fertilized douglas fir forest. Can. J. Soil Sci. 54: 491-500.

Mitchell, M. J. 1978. Vertical and horizontal distributions of oribatid mites (Acari: Cryptostigmata) in an Apsen Woodland Soil. Ecology 59 (3): 516-525.

Pande, Y. D. & Berthet, P. 1975. Observations on the vertical distribution of soil oribatei in a woodland soil. Trans. R. Ent. Soc. Lond. 127 (3): 259-275.

Perdue, J. C. & Crossley, D. A. 1990. Vertical distribution of soil mites (Acari) in conventional and no- tillage agricultural systems. Biology and Fertility of Soils 9: 135-138.

Price, D. W. 1973. Abundance and vertical distribution of microartropods in the surface layers of a California pine forest soil. Hilgardia 42 (4): 121-148.

Sheals, J. G. 1957. The Collembola and Acarina of uncultivated soil. J. Anim. Ecol. 26: 126-134.

Usher, M. B. 1971. Seasonal and vertical distribution of soil arthropods: Mesostigmata. Pedobiologia. 11: 27-39. Usher, M. B., (1975). Seasonal and vertical distribution of soil arthropods: Cryptostigmata. Pedobiologia 15: 364-374.

Wallwork, J. A. 1959. The distribution and dynamics of some forest soil mites. Ecology 40: 557-563.

Whelan, J. 1978. Acarine succession in grassland on cutaway raised bog. Scientific Proceedings, Royal Dublin Society, Series A, Volume 6.

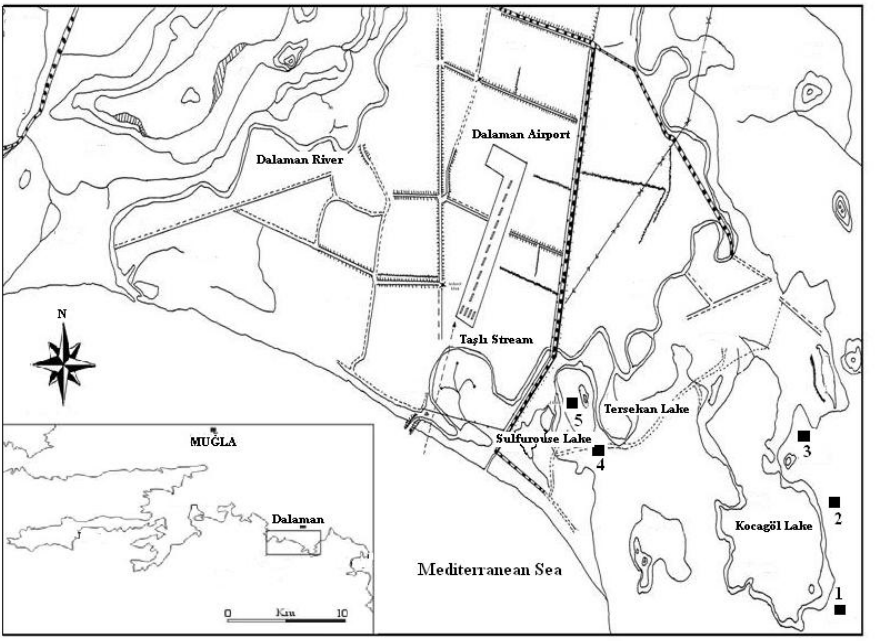

Fig. 1. Map of Study Area (1. First station, 2. Second station, 3. Third station, 4. Fourth station, 5. Fifth station)

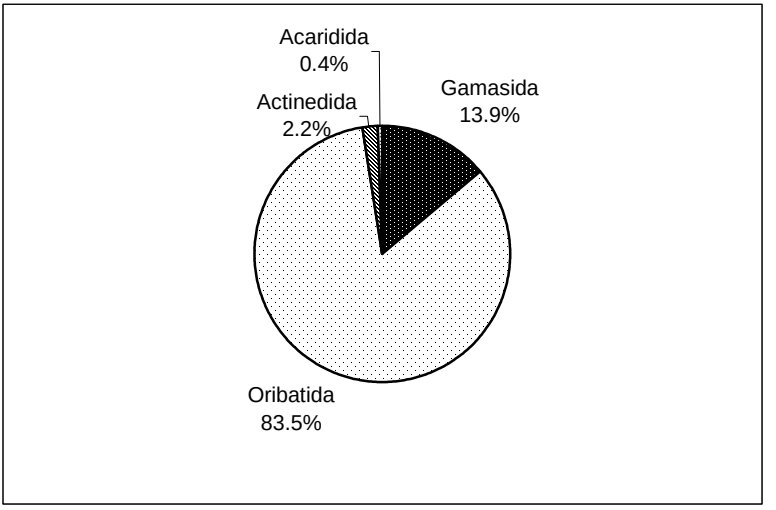

Fig. 2. The percentage (%) distribution of individuals according to their orders

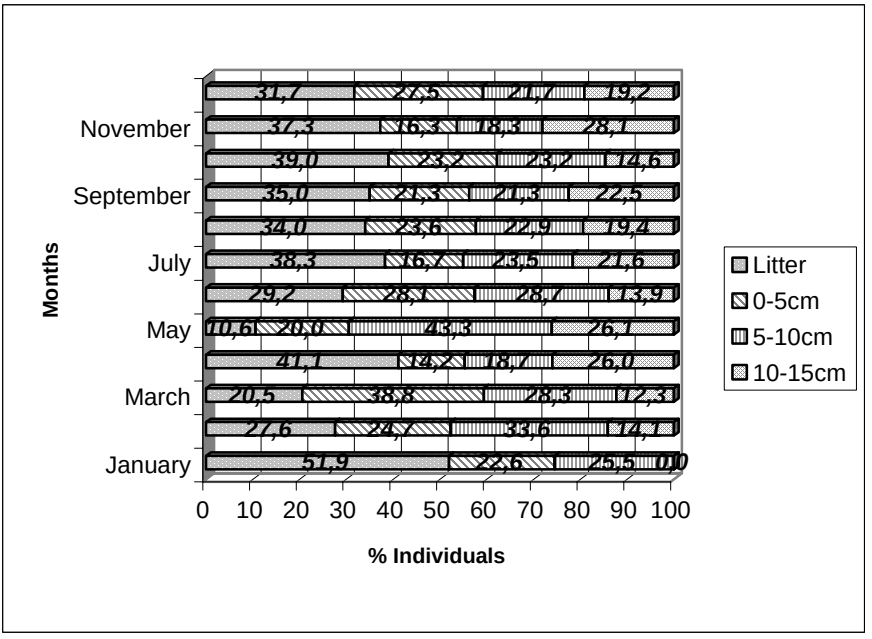

Fig. 3. The vertical distribution of individuals according to months

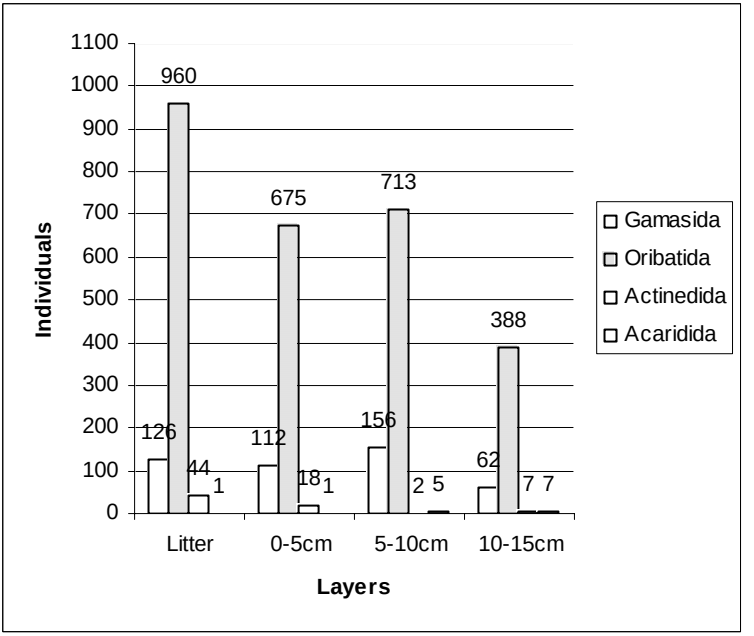

Fig. 4.The vertical distributions of orders according to layers

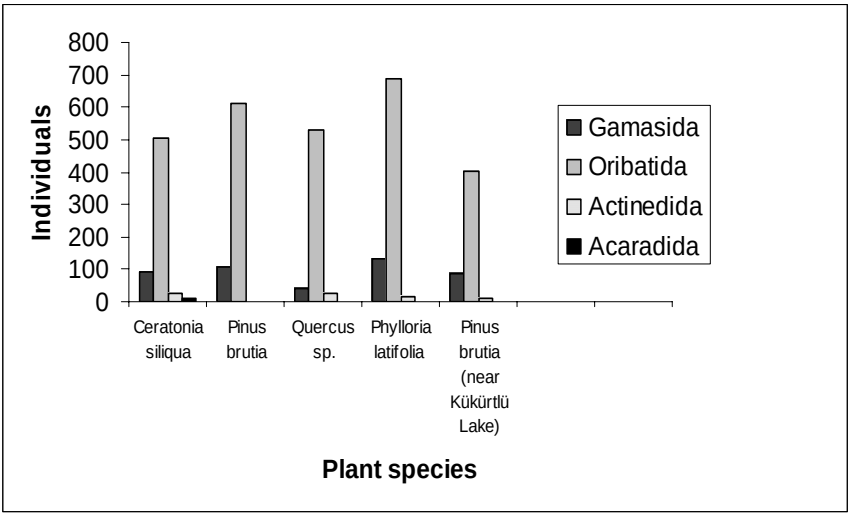

Fig. 5. The individuals of orders according to plant species

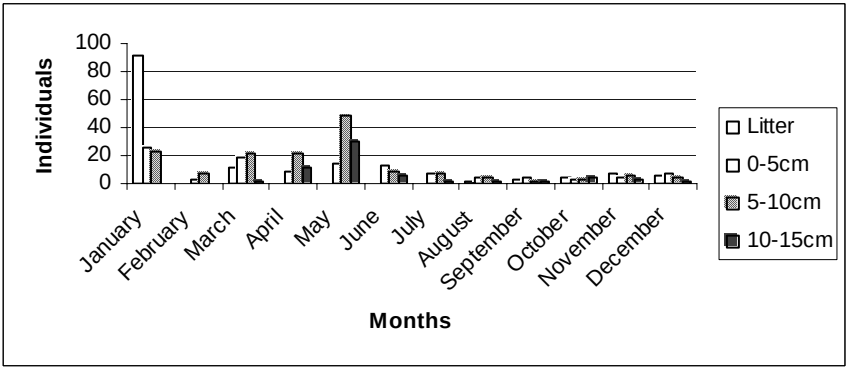

Fig. 6. Individuals of Gamasida order according to months and layers

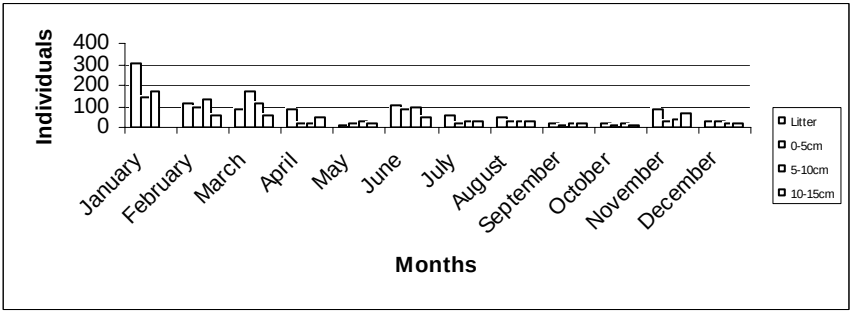

Fig. 7. Individuals of Oribatida order according to months and layers

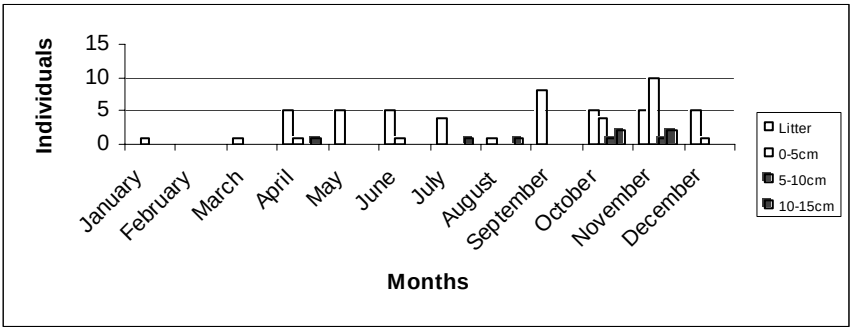

Fig. 8. Individuals of Actinedida order according to months and layers

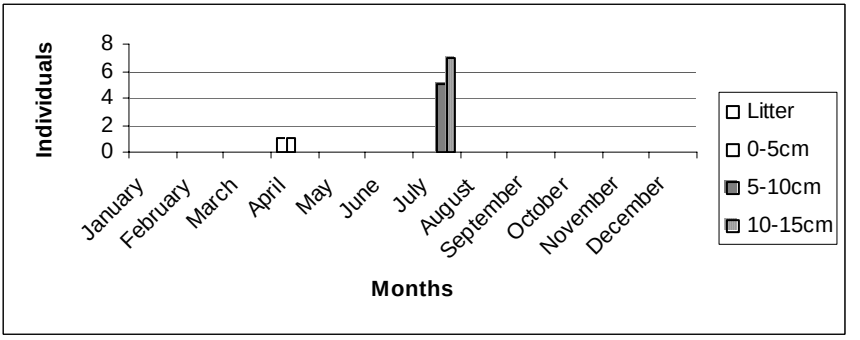

Fig. 9. Individuals of Acaridida order according to months and layers