EFFECTS OF ENVIRONMENTAL FACTORS ON THE DENSITY AND BIOMASS OF *Octolasion lacteum* SPECIES

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Abstract. It is important for environmentalists to know the relationship body-environment, especially the feedback, physiological aspects and behaviours of organisms. For this purpose, the present work is a study on the effects of environmental factors on the monthly biomass density of *Octolasion lacteum* species (Oligochaeta-Lumbricidae) at different levels (0-40cm) of forest soil (deciduous, spruce, grassland), belonging to Cândeşti Piedmont (Argeş County) from March to October 2007. *Octolasion lacteum,* the dominant species in the three analysed soil types had a different monthly biomass depending on the soil type and environmental conditions. The largest amount of biomass was generated by the deciduous forest soil (9.99%) and grassland (16.53%) at levels S1 (10cm) and S2 (20cm). The largest amount of biomass in the spruce forest soil was found at level S1 (23.35%). The effect of temperature on density caused the latter increase; as the temperature decreased the relative humidity of the soil led to the species overcrowding in places where it was moderate, but generally insignificant, whereas the soil pH caused a decrease in the biomass.

Keywords: *Octolasion lacteum*, deciduous, spruce, grassland, biomass, environmental factors.

Rezumat. Efectele factorilor de mediu asupra densităţii şi biomasei speciei *Octolasion lacteum*. Pentru ecologi este importantă cunoaşterea relaţiei organism – mediu şi în special reacţia de răspuns, aspectele fiziologice şi comportamentul organismelor. În acest scop, în prezenta lucrare a fost realizat un studiu privind efectele factorilor de mediu asupra densităţii biomasei lunare la specia *Octolasion lacteum* (Oligochaeta-Lumbricidae) la diferite niveluri (0-40cm) de sol forestier (foioase, molid, pajişte), aparţinând pădurilor situate în Piemontul Cândeşti (Judeţul Argeş), în perioada martie-octombrie 2007. *Octolasion lacteum* - specie dominantă în cele trei tipuri de sol analizate, a realizat o biomasă lunară diferită în funcţie de tipul de sol şi condiţiile de mediu. Cea mai mare cantitate de biomasă a fost realizată în solul pădurii de foioase (9,99%) şi în pajişte (16,53%) la nivelurile S1 (10cm) şi S2 (20cm). În solul pădurii de molid cantitatea cea mai mare de biomasă s-a constatat la nivelul S1(23,35%). Influenţa temperaturii asupra densităţii a determinat o creştere a acesteia pe măsură ce temperatura a scăzut, umiditatea relativă a solului a determinat aglomerarea speciei în locurile unde aceasta a fost moderată dar în general a fost nesemnificativă, pH-ul solului a determinat o scădere a biomasei.

Cuvinte cheie: *Octolasion lacteum*, foioase, molid, pajişte, biomasa, factori de mediu.

INTRODUCTION

The activity of the edaphic system is of great scientific interest in relation to the management, use and conservation measures. Soil is a complex system resulting from the interaction of different elements. The edaphic fauna, specifically earthworms is especially important (EDWARDS & BOHLEN, 1996; LAVELLE & SPAIN, 2001). BOLOGH (1970) stated that the soil fauna biomass of the Earth is about 20 times higher than the human biomass. This illustrates the need for greater attention to the ecology of soil animals, especially lumbricidae. In many ecosystems, earthworms are highly beneficial to the soil processes (HENDRIX & BOHLEN, 2002). Earthworms are keystone detritivores that can act as “ecosystem engineers” and have the potential to change fundamental soil properties, with cascading effects on the ecosystem functioning and biodiversity (FRELICH et al., 2006; EISENHAUER et al., 2007; ADDISON, 2009). SPAIN & LAVELLE (2001) reported that since earthworms live in direct and continuous contact with the soil matrix and the soil solution, their persistence, propagation and activity are greatly affected by the chemicals (pH, dissolved ions) characteristics of the soil. Based on their sensitivity to soil pH, earthworms are grouped into acidophilic species (able to thrive below pH 6 such as in organic forest litter), neutrophil species (they prefer soil pH 6 to 7) and basophilic species (prefer basic soils). Aspects related to ecology, such as the influence of abiotic factors (temperature, humidity, pH), fauna composition, population dynamics, frequency of species have been studied by researchers as TILMAN & DOWNING (1994), TILMAN (1996), SMITHEL et al. (1998), NOMBELA et al. (1999), CURRY (2004).

Also, BUTT (1991), BUTT et al. (1992) investigated the effects of factors such as temperature and soil moisture and food source of the species *Lumbricus terrestris* and found out that the fastest growing and developing of cocoons and offsprings occurred at a temperature of 20° C, but the largest annual production was possible at 15° C. Earthworms are therefore connected to moisture and, during drought periods, they sink into the soil, going out in the upper layers after rain. They bear well very acidic forest soil reaction and are a factor of neutralization. The research areas are part of the high and medium hills of the Southern Sub-Carpathians and Cândeşti Piedmont, located at altitudes ranging between 360 and 441m. The climate is temperate continental specific to low plateaus and plains in the southern areas. The soils are alluvial-clay with a distribution imposed by the relief. The studied area comprises regosol and coluvic alluviosol. The predominant reaction is acidic, the base saturation degree rarely reaches the eubasic and the base sum values fit into the small-middle class.

MATERIAL AND METHODS

The Lumbricidae samples were taken randomly, from March to October 2007, by making ten holes in the station, using a metal frame with sides of 25/25 cm. The sample units were built on depth levels, namely: L = litter; S_1 = 10cm; S_2 = 20cm; S_3 = 30cm; S_4 = 40cm. The earthworms were manually extracted from the samples, immediately after making the holes and put in tightly closed containers of 90^0 alcohols. The containers had labels containing: sampling place, date (day, month and year), depth of the soil, sample number. The faunistic material was collected monthly, from March to October 2007. The determination of species was made in the laboratory by means of determination-keys (EASTON, 1983; POP, 1949). Simple correlations were made to express the influence of abiotic factors (temperature, rainfall, soil moisture, pH), on the density and biomass of lumbricid earthworms in different soil layers from 0-10cm (S1) to 30-40cm (S3 - S4). It was calculated the simple correlation coefficient "r" and its significance, using SPSS 10, 0 For Windows. The trend line equation was also calculated. The biomass was calculated by the ratio of individual and dry weight of each individual of the species (mg.d.s./m^2). Individual live weight and individual weight after drying were determined by weighing on analytical balance. To remove water from the body, the faunistic material was dried in a drying cabinet, at a temperature of 105° C. Drying was complete, when, by successive weighings, after 48 hours, the weight of the individuals remained constant.

RESULTS AND DISCUSSIONS

The monthly dynamics of the soil biomass in the three ecosystems, for *Octolasion lacteum* species in 2007 (Fig. 1) revealed that the highest values were recorded in the deciduous forest (2.06 mg dry substance/m^2), representing 9.99%, grassland (2.012 mg.d.s/m^2), representing 16.53% at levels S1 and S2. The highest value of the biomass in the spruce forest was recorded at level S1 (16.89 mg.d.s/m^2), representing 23.35%. A high density of the species biomass was recorded in spring and autumn months. The total biomass of *O. lacteum* species in 2007 was the highest in April, in the deciduous forest, 876 mg.d.s/m^2, which is a percentage of 53.96%. The highest value in the spruce forest was 25.52 mg.d.s./m^2 in May, representing a percentage of 35.28%. The highest value of the biomass in the grassland is 36.35 mg.d.s./m^2, representing 29.87 % of the total biomass.

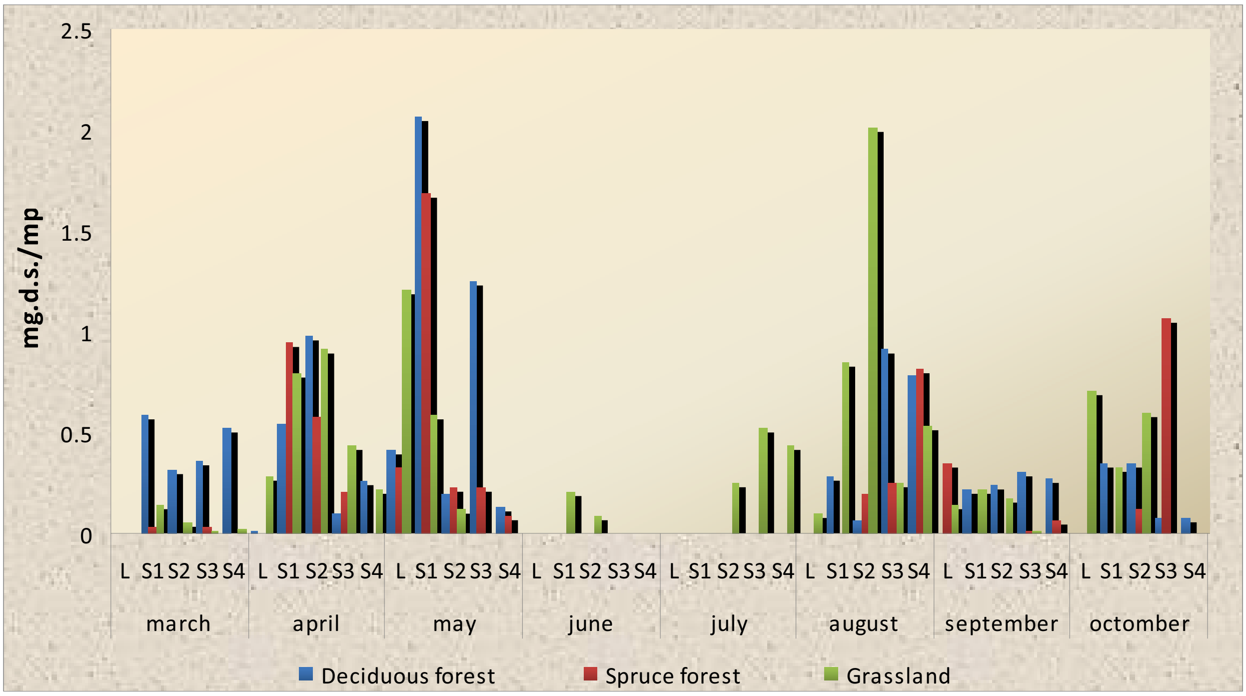

Figure 1. Monthly dynamics of *Octolasion lacteum* species biomass in soil layers, from March to October 2007.

The influence of temperature on the density of *O. lacteum* species caused its increase as temperature decreased; the correlation is negative but insignificant for $p < 0.01$ (Fig. 2). The density of this species in 2007 shows a linear trend with respect to rainfall, with a positive, but insignificant correlation (Fig. 3).

The soil moisture in the litter showed a negative correlation, insignificant for $p < 0.01$, while the pH caused a decrease in density; in this case the correlation was significant for $p < 0.05$ (Figs. 4-5). At level 1 (0-10cm), the correlation was negative, insignificant for $p < 0.01$ (Fig. 6). For a pH between 4.6 and 5.2, the density of this species at level 1 (0-10cm) showed a slight increase, the correlation coefficient "r" indicating in this case, a negative correlation, insignificant for $p < 0.01$ (Fig. 7).

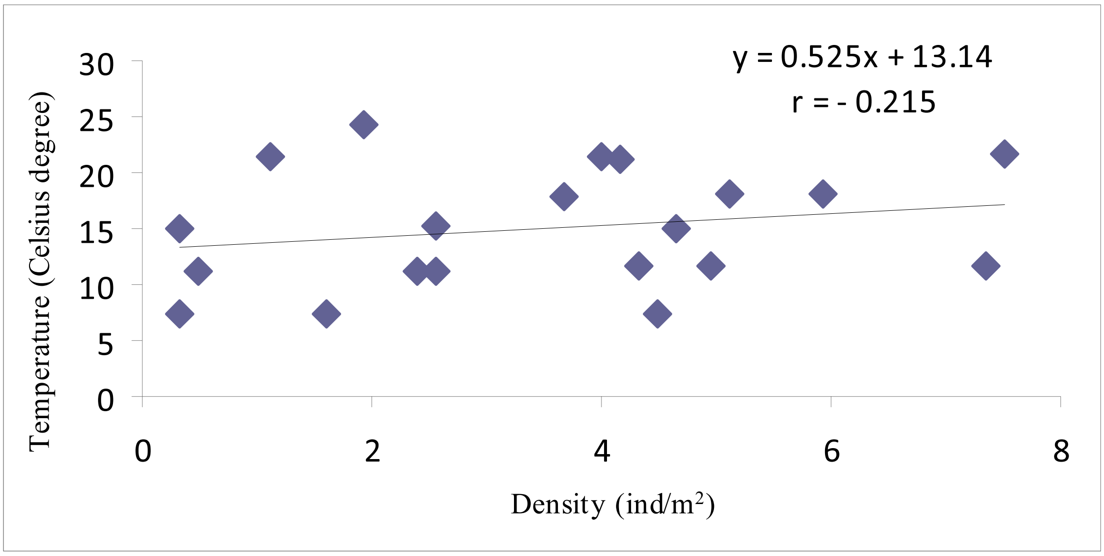

Figure 2. The correlation between density (ind/m^2) and temperature (C^0) for *Octolasion lacteum* species in 2007.

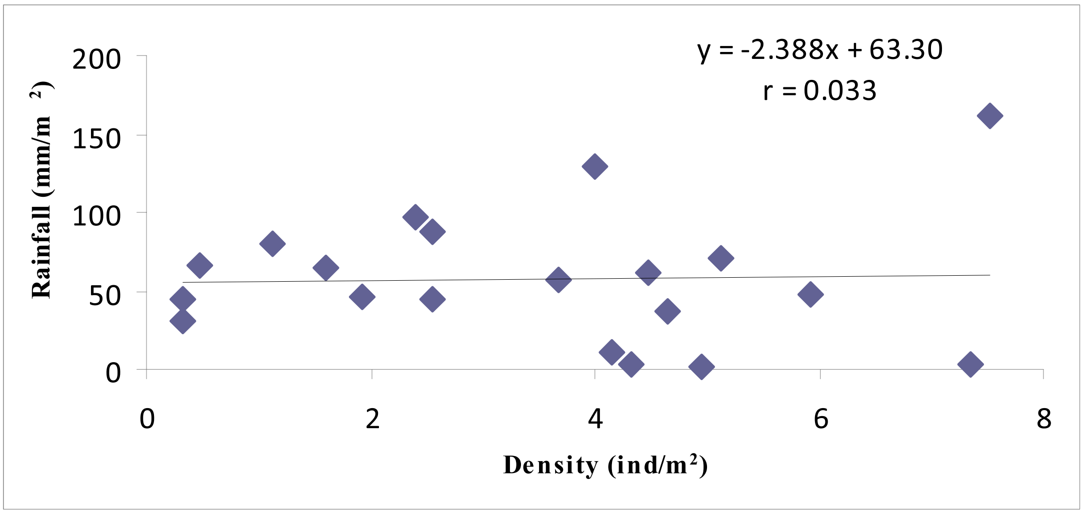

Figure 3. The correlation between density (ind/m^2) and rainfall (%) for *Octolasion lacteum* species in 2007.

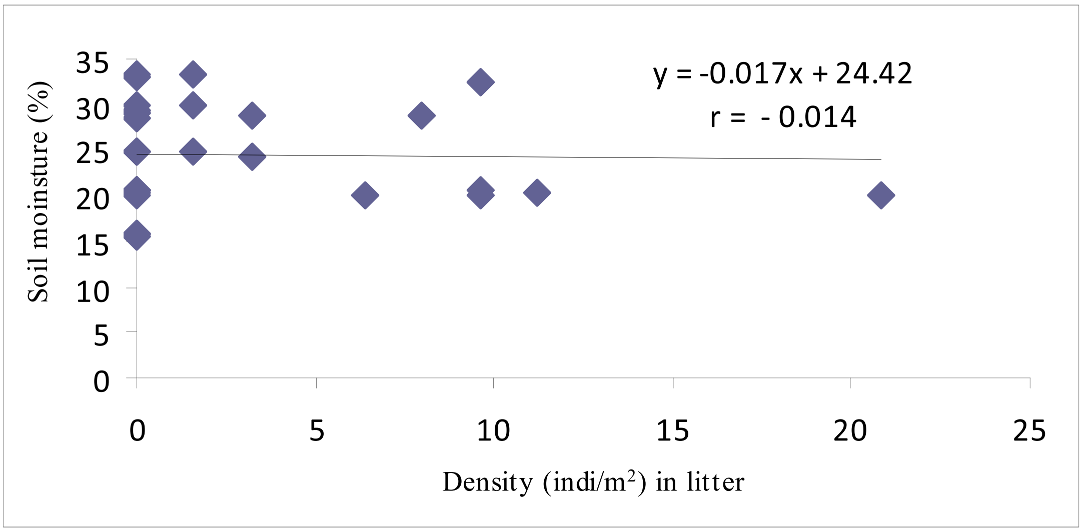

Figure 4. The correlation between density (ind/m^2) and soil moisture (%) in the litter for *Octolasion lacteum* species in 2007.

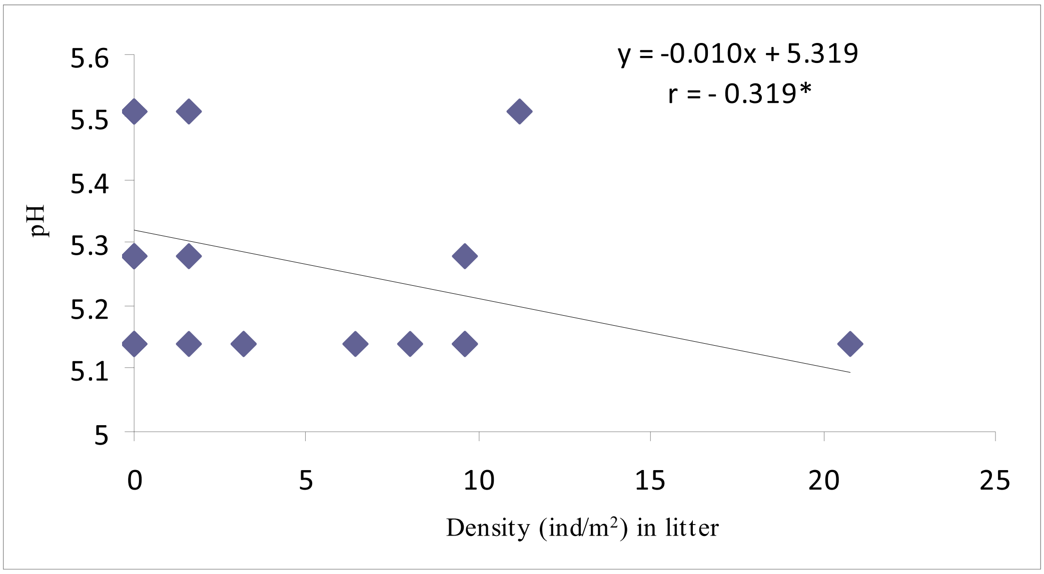

Figure 5. The correlation between density (ind/m^2) and soil pH in the litter for *Octolasion lacteum* species in 2007 (* - the correlation is significant for $p < 0.05$).

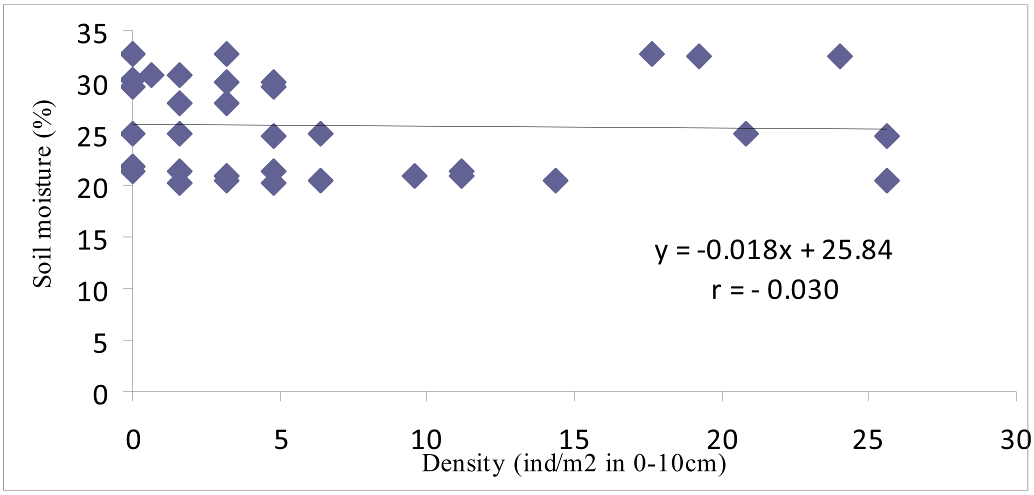

Figure 6. The correlation between density (ind/m^2) and soil moisture (%) at 1 (0-10cm) for the species *Octolasion lacteum* in 2007.

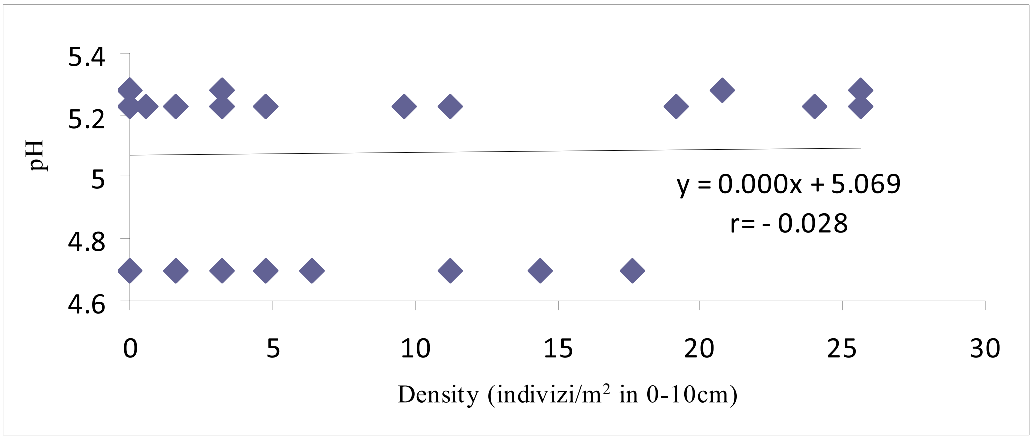

Figure 7. The correlation between density (ind/m^2) and soil pH level 1 (0-10cm) for the species *Octolasion lacteum* in 2007.

At soil level 2 (10-20cm), the trend showed a slight decrease in density in relation to humidity, with a negative correlation, insignificant for $p < 0.01$ (Fig. 8). However, the pH recorded an increase of species density, with a negative correlation, insignificant for $p < 0.01$ (Fig. 9). The soil moisture at level 3 (20-30cm) and level 4 (30-40cm) caused a decrease in the density of correlations. It was negative and insignificant for $p < 0.01$ (Figs. 10-11). pH at level 3 indicated a negative insignificant correlation for $p < 0,01$, whereas at level 4, the inclination on the right showed a positive, insignificant correlation for $p < 0.01$ (Fig. 12).

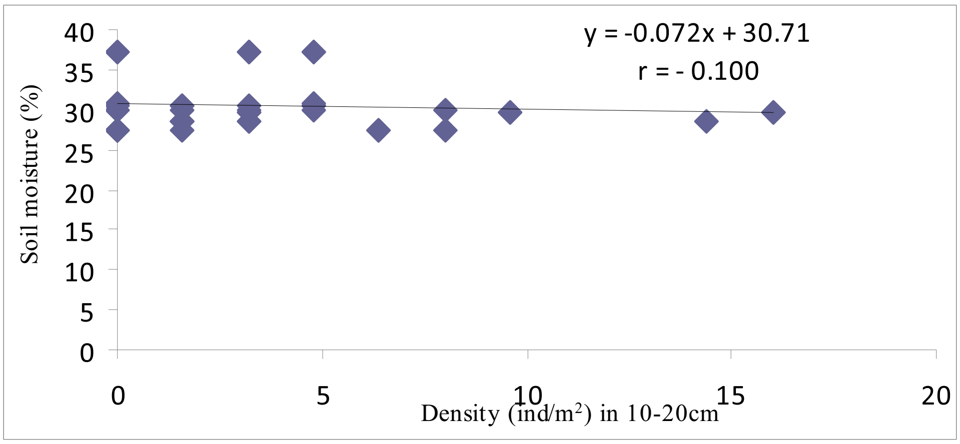

Figure 8. The correlation between density (ind/m^2) and soil moisture (%) at level 2 (10 to 20cm) for the species *Octolasion lacteum* in 2007.

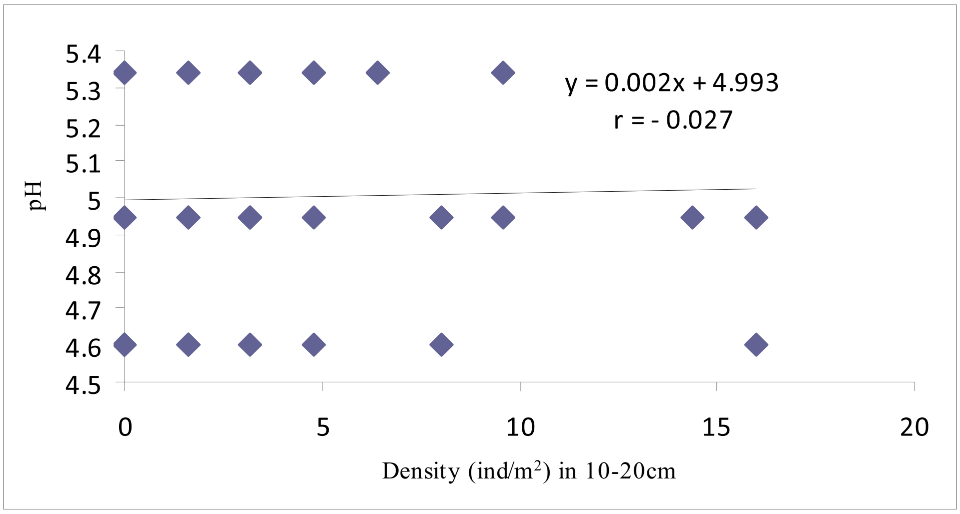

Figure 9. The correlation between density (ind/m^2) and soil pH Level 2 (10 to 20cm) for the species *Octolasion lacteum* in 2007.

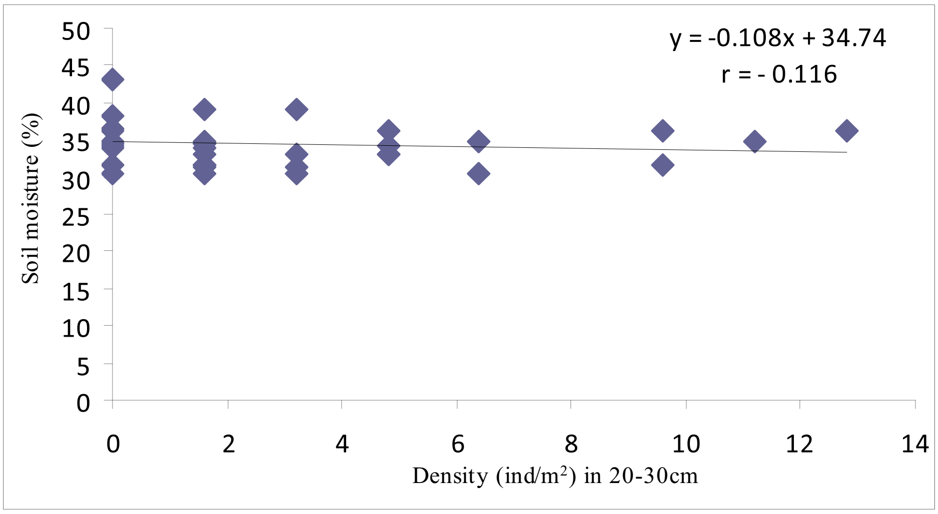

Figure 10. The correlation between density (ind/m^2) and soil moisture (%) at level 3 (20 to 30cm) for the species *Octolasion lacteum* in 2007.

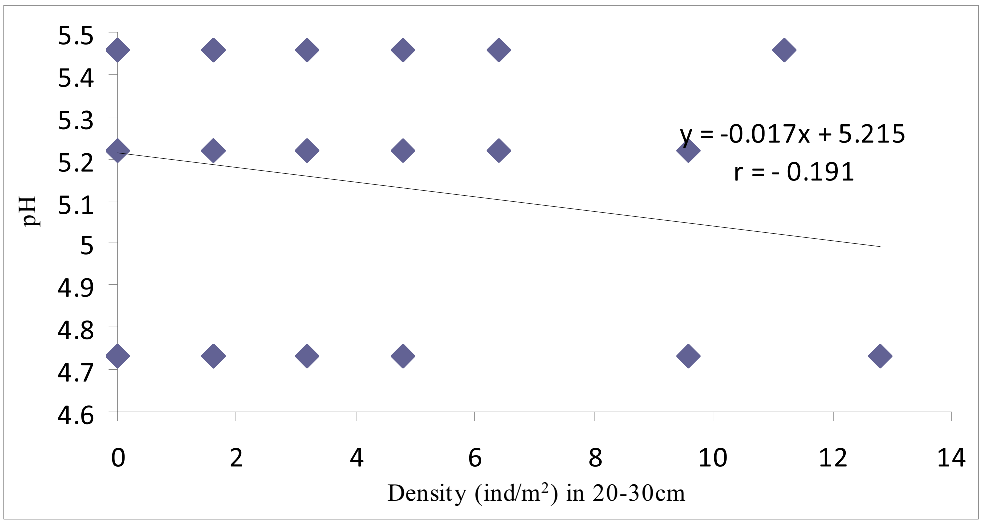

Figure 11. The correlation between density (ind/m^2) and soil pH level 3 (20-30cm) for the species *Octolasion lacteum* in 2007.

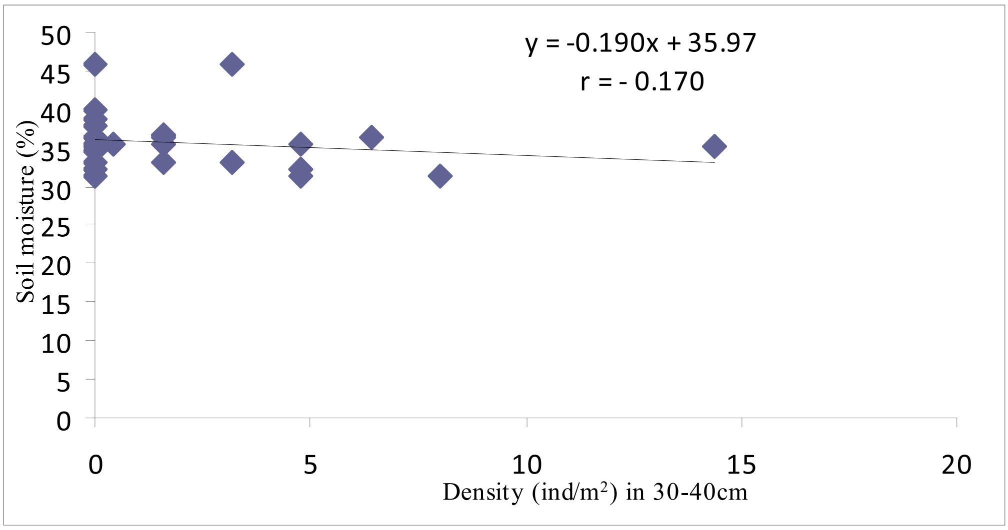

Figure 12. The correlation between density (ind/m^2) and soil moisture (%) in 4 (30-40cm) for the species *Octolasion lacteum* in 2007.

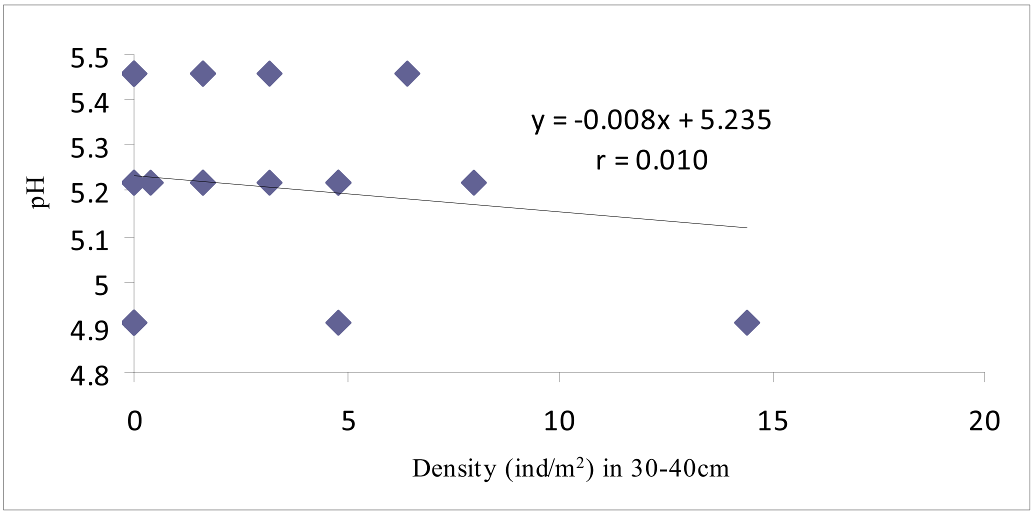

Figure 13. The correlation between density (ind/m^2) and soil pH level 4 (30-40cm) for the species *Octolasion lacteum* in 2007.

CONCLUSIONS

Of the biomass and correlation analysis, we conclude that *Octolasion lacteum* species prefers deciduous forest and grassland soils. The high temperatures induced a decrease in the biomass especially in June and July in deciduous and spruce forest. The influence of soil moisture was insignificant, whereas the pH caused a decrease in the biomass.

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Received: March 31, 2013
Accepted: July 7, 2013