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DECOMPOSITION RATE IN THE FOREST OF SCHOOL YARD: A DIDACTIC INTERVENTION

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Abstract: For the preparation of theoretical instruction of the concept of natural decomposition, and the teaching research through an annual project for the paper decomposition rate in soil, utilized, in a Lyceum, variety of teaching tools and techniques. For the demands of the teaching, was searched the synonymous and linked terms to decomposition and decomposers into the Curricula of the Lyceum Biological courses and textbooks. Papers, sealed in perforated plastic bags, buried in the soil periodically during the school year, and with their haul, dried, weighed and thus exported their weight reductions as result of the action of soil decomposers. During the decomposition are taking place many and varied changes relating to and affected by many factors. These are the effects particularly of the temperature influences the speed of the chemical reactions occurring in the degradable materials and on the microorganisms that carry out it, the effects of moisture, since water hydrolyzes biological macromolecules of the organic matter degraded to smaller, and generally any changes in the structure and synthesis of the molecules of the decomposing organic materials. The rate of reduction of the initial paper weight shows that cellulose degradation has different rates in different seasons. Decomposition was faster in the early autumn, when drought ceased to be a limiting factor and in late spring when the temperature no longer was a limiting factor. In Mediterranean climates, like Crete, where the sun and wet winters alternating with warm, long and dry summer, intense decomposing activity observed at the time of the high temperature associated with water availability, high soil moisture, and even the moisture preceded, that the chemical bonds in molecules of paper cellulose to weaken and break down readily.

Keywords: Paper decomposition, school project, didactic research

Introduction

As ecosystems are continuously fed with energy from the sun, the energy captured by the producers, after converted into chemical, flows one way, through food chains in the upper levels of consumers and into the decomposers. Degradation has final aim the mineralization of organic matter and return the chemical constituents in the environment, so that they can be reused by plants, autotrophic organisms, the producers. Degradation process closes the biogeochemical cycles in nature as follows (Adamantiadou et al, 2005): both plants and animals leave in the ground dead organic matter and excreta containing nitrogen, phosphorus, sulfur etc. All these substances are cleaved by soil decomposers through a process that results in the production of other substances which are ultimately converted into ions which, dissolved in water and are taken up by plants. Decomposition is the degradation of complex organic molecules of dead plant and animal organisms or waste into minerals, ultimately to mineralization of organic matter resulting in the recovery of chemical compounds in the environment, so they can be reused by plants, generally by autotrophic producers. This cleavage of chemical compounds into simpler compounds and chemical elements becomes in ecosystems with chemical, physical and biological processes, closing the biogeochemical cycles in nature (Lykakis, 1997).

The main component of paper is cellulose, an organic compound, a widespread polysaccharide, convenient and renewable, since it is the main component of the cell wall of plants (Kapsalis et al, 2000). The paper, even is easily degrading and, generally, does not burden the environment as polluting substances (such as oxygen consumption in aquatic ecosystems), its production and disposal cost to the environment (energy, water, biomass, biodiversity, ecosystem disturbance, waste, etc.) while recycling is not a panacea (Lambrou et al, 2005).

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Methods

Didactic Methodology, Investigation Axes. During the school year 2005-2006, the method of Research Essay or Research Project, known as Method Project (Frey, 2005) was developed with theoretical and research teaching, educational visits, indoor and outdoor for the students of B class of Meleses Lyceum. To prepare the theoretical teaching of the issue of 'Degradation' were used various teaching tools and techniques. The course was "Principles of Environmental Sciences" (Athanasakis et al, 1999). It was studied in depth the curricula, the textbooks and the teacher's book of the courses a. "Principles of Environmental Sciences", b. "Biology", c. "Management of Natural Resources" with their Laboratory guides and the corresponding circulars with teaching guidelines (Argyris et al, 1994; Barona et al, 1999; Kapsalis I et al, 2000; Adamantiadou et al, 2005; Athanasakis et al, 2005).

For the experimental approach of the degradation process, it was measured the decomposition rate of buried papers in the soil, following the described exercise protocol in the Laboratory Guide of Biology C Class of Lyceums (Barona et al, 1999). The speed of decomposers' work can be measured by various methods, such as the release of carbon dioxide from the soil as well as the applied laboratory exercise. In a more holistic approach, emphasizing to the sustainable management of pollution in the future proposed a walk in the countryside and in the city, where students recorded and photographed data referred to the inquiring terms. Throughout the school year were discussions in the classroom on the research findings and the method process.

In the field, apart from the measurement of the decomposition rate, students visited a biological refining Station and a landfill space. At the end of the school year was given to the students an Evaluation Questionnaire, based on the Sheet of Periodic Self-Assessment of student (KEE-YPEPTH, 1999) with questions concerning how they felt on the course and the project involved, what was difficult for them, what they liked, what suggestions they make to improve themselves and the educational process for the next school years.

Results and Findings

Teaching of the term 'degradation' in the cognitive objects of Natural Sciences in Lyceum. Navigating the syllabus of Natural Sciences courses of Lyceum were found very few references. In Chemistry C Class Positive Direction school book highlighted the definition of 'molecules degradation that the carbon chain becomes smaller by one carbon atom', in syllabus of B' Lyceum had referred 'a reaction that allows such degradation and this is decarboxylation'. In the school book of Biology of class C Positive Direction (Aleporou, 2001) are three references to the term 'degradation'.

The Rate of Decomposition. During the process of decomposition in nature take place many and varied changes related to, and affected many factors. Particularly, temperature influences more the speed of the chemical reactions occurring in the degradable materials and the functions of microorganisms that carry it out. Also moisture effect the decomposition rate, since water hydrolyzes the biological macromolecules degrading into smaller, and offers the environment of all the chemical and biological changes take place in the structure and synthesis of the molecules of the decomposing organic materials.

The results of data analysis illustrate the changes in the weights of the buried papers during the research period. As it is apparent from the measured values, wet weights are higher in winter and spring, once the soil is too wet due to the rain. The average dry weight of the sample ranged from 1,31g (5/5/06) to 4,18/4,52g (12-10-05/2-2-05) with the highest value of the decomposition rate to be 80,22 on 20-3-06 and 72,92 on 18-9-05 mg/day, spring and winter, when the soil moisture is high because of the rainfalls and the temperature relative high. The lowest values were recorded in winter, obviously affected significantly by the very low temperatures, were 13.71 mg/day on 2-2-06. In Crete, January and February are, generally, very cold months. As for the variation in the seasonal rate of decomposition, it is clear that the daily rate significantly depends on the seasonal variations of temperature and soil moisture, with the prerequisite of high humidity exist. The rate reaches at the lowest prices in winter, increases in early spring, and in the autumn rises again significantly. During the summer there were no survey data because the schools were closed.

Conclusion

In the research project, studied the decomposition rate of paper sealed in perforated plastic bags which buried in the soil periodically, during the school year. The calculated seasonal rate of the decomposers' action showed seasonal variations following the variations of temperature and soil moisture, with the prerequisite of high humidity exist.

Recommendations

The implementation of Projects in Schools contribute to changing traditional attitudes of teaching, learning, practices, roles and culture in schools. Associated with teaching objectives of school curricula, can be approached subjects of other courses, of different areas in schools, with interdisciplinary approaches and contribution of different specialties of teachers and scientists.

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