THE INFLUENCE OF THE UV-B TYPE RADIATION, CONCERNING THE PRODUCTION OF POLLEN FOR THE ZEA MAYS L.

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Abstract

The plants' physiological and development processes are affected by the UVB radiation, the UVB radiation level and also by the production of pollen. Despite the reduction and mitigation mechanisms of these effects and a finite ability to adapt to a high level of UVB radiation, the plants' growth can be directly affected.. The diversity of protection mechanisms against the UVB radiations depends on the species and varieties of plants..

In this study we want to highlight the importance of mineral salts in the case of plants, which in turn may influence the pollen quality of Zea mays L., and by default the quality of the bee products. The results conclude that the samples taken from the area lacking in mineral salts, exhibits the lowest concentration of carbohydrates and lipids, therefore reducing the quality of the maize pollen.

Key words: pollen, HPLC method, carbohydrates, lipids, nitrogen, magnesium

INTRODUCTION

Anemophilous plants represent the major source of pollen, small sized pollen grains are carried away by the wind at great distances from the source. Typically, pollen contains a variety of chemical compounds, such as polyphenols, flavonoids, phenolic acids and their esters, terpenoids, steroids and amino acids (Pallag A. et al, 2011, Adam et al, 1995). The pollen's composition varies, depending on the collection areas and different altitudes (Aldrich, 1988).

Pollen contains substances such as: vitamins (provitamin A, vitamin A, vitamin B1, B2, B3, B5, B6, B12, vitamin C, D, E, F, H, K, PP and folic acid), minerals (calcium, phosphorus, potassium, iron, copper, iodine, zinc, sulfur, sodium, chloride, magnesium, molybdenum, selenium, bromine, silicium and titanium), amino acids, carbohydrates, fatty acids, enzymes, co-enzymes and various fats, minerals necessary to the body, even those that cannot be usually found in the dietary supplements sold in pharmacies (Alscher et al, 2002, Ambasht et al, 1997, Bungău, 2015, Bungău et al, 2011, Bungău et al, 2003, Popescu, 1978).

The plants' physiological and development processes are affected by the UVB radiation, the UVB radiation level and also by the production of pollen (Gregson et al, 1994, Han et al, 2004, Hausman et al, 1994).

Despite the reduction and mitigation mechanisms of these effects and a finite ability to adapt to a high level of UVB radiation, the plants' growth can be directly affected (Haszpra et al, 2005, Hausman et al, 2005, Has et al, 2004, Houghton et al, 2001).

Although UV-B is a minor component of sunlight, it has a disproportionately damaging effect on higher plants. Ultraviolet-sensitive targets include DNA, proteins and membranes, and these must be protected for normal growth and development. DNA repair and secondary metabolite accumulation during exposure to UV-B have been characterized in considerable detail, but little is known about the recovery of photosynthesis, induction of free-radical scavenging and morphogenic changes (Jansen M. et al, 1998).

The diversity of protection mechanisms against the UVB radiations depends on the species and varieties of plants (Hochholdinger, 2008, Ghidra et al, 2004).

We wanted to highlight the importance of mineral salts in the case of plants, which in turn may influence the pollen quality of *Zea mays L.*, and by default the quality of the bee products (Horneck et al, 1995, aebi, 1984).

MATERIALS AND METHOD

The pollen samples were collected as raw material, weighing approximately 4,715 mg/batch of dry granules, from different areas and altitudes, which have been exposed to an irradiation with ultraviolet rays of different wavelengths, and have been extracted with ethanol at a temperature of 60ºC for 24 hours, by beekeepers from different regions of the country, thus creating a comparative study regarding the concentration of mineral salts which determine changes in the growth of the cells, tissues, of the plant as a whole, in conjunction with the radiation effect due to the UV type radiation.(Hochholdinger et al, 2004, Holmes et al, 2004, Heloir et al, 1996)

The samples were extracted with ethanol, and the final mixtures were analyzed with the HPLC method (Horneck, 1995).

The pollen is well ground, each in a mortar (to increase the contact surface with the alcohol and to facilitate the extraction); for every 3 pollen parts, 10 parts of ethanol of 80º-90º must be added.

These mixtures are to be left in a water bath, at a temperature of 65ºC, for 24 hours.

The ethanolic suspensions were then separated by centrifugation, for 10 minutes at 1000 to 1500 rev/min, after which the mixtures obtained were filtered under vacuum and subjected to a chromatographic analysis with the HPLC method (high performance liquid chromatography).

RESULTS

One pollen sample from each of the soils in which the maize, subjected to our experiment was grown, have been analyzed with the HPLC method, in order to emphasize the pollen content of the carbohydrates and lipids that can improve the feed which the animals consume.

The obtained results can be found in the table 1 and figure 1.

Table 1.

The change in the content of carbohydrates and lipids for different altitudes

Pollen samples from *Zea mays L*	The average quantity at 50-100 m altitude [µg]	The average quantity at 100-200 m altitude [µg]	The average quantity at 250-300 m altitude [µg/L]
Carbohydrates	22.023	23.458	36.321
Lipids	1.0212	2.219	2.978

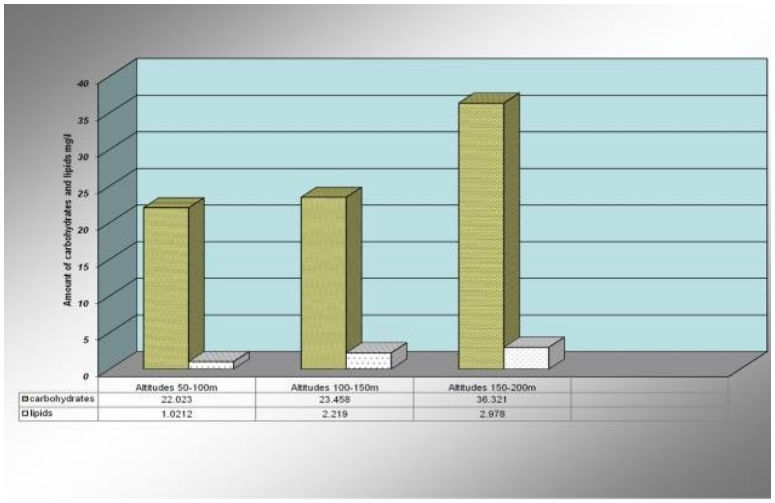

Fig. 1. The UV-B influence regarding the carbohydrates and lipids content, at different altitudes

The results conclude that the samples taken from the area lacking in mineral salts, exhibits the lowest concentration of carbohydrates and lipids, therefore reducing the quality of the maize pollen.

CONCLUSIONS

The effects of the ultraviolet radiation on the maize crops differ, depending on the altitude, because at high altitudes the ultraviolet radiations that reach the plants are lower, consequently the amount of carbohydrates and lipids increases; in samples collected from a medium altitude region, where the ultraviolet radiation has a more intense effect on the crops, one may notice a decrease in the amount of carbohydrates and lipids; in the samples collected from the lower altitude region, where the ultraviolet radiation is very intense on the maize crops, one can notice an even greater decrease in the amount of carbohydrates and lipids.

In the case of the maize and other plants growing in the field, the ultraviolet radiations reach into the tissue of small leaves, in the cellular wall, where free radicals are formed. Once there, the ultraviolet radiations react with the alkene group (isopropene, ethylene, fatty acids).

The oxidative stress caused by radiations induces the shut down and accumulation of salt in the stomatitis, which translates into the leaves' and the whole plant's degradation.

Elevated ultraviolet radiations lead to premature aging of the plants, perhaps the loss of the attacked leaves and the destruction of the corn fruit, but at the same time, it stimulates the plant's self-defense, increasing the energy consumption which will be used in the photosynthesis, leading to a decrease in biomass production.

The physiological and developmental processes of the plants are affected by the lack or presence of too much fertilizer in the soils where they're grown. Despite the reduction or mitigation mechanisms of these effects, and a finite ability to adapt to a high level or the lack of fertilizer, the plants' growth can be directly affected.

The UV-B effects are different, depending on the soil in which the maize crops were planted, the numbers obtained from the measurements carried out showing that, the samples coming from the best fertilized area, in terms of growth regulators, exhibit the highest content of carbohydrates and lipids and the best anti-oxidant activity.

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