THE EFFECT OF SEVERAL RHIZOSPHERIC MICROORGANISMS ON THE CONTENT OF STARCH IN MAIZE (*ZEA MAYS* L.) CARYOPSES DURING THE IN VITRO GERMINATION

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Abstract: One of the most extensively studied positive effects of the rhizospheric microbiosis is plant growth stimulation by rhizobacteria. Our efforts were pointed out to the influence of some rhizobacterial strains on the content of starch in *Zea mays* L caryopses during in vitro germination. α-amylase maximum activity was recorded for the test in the 12th day of germination and for the control in the 11th day. During the entire *in vitro* germination of maize caryopses, α-amylase activity was characterized by an increase in intensity, not only in the test lot, but also in the control one.

INTRODUCTION

In spite of the fact that some aspects of the interaction between microorganisms and plants at the level of the root-soil interface are not known yet or are controversial, there are some observations which support a series of beneficial effects of the activity of rhizospheric microorganisms. The most extensively studied positive effects of the rhizospheric microbiosis are: nitrogen fixation, mycorrhiza-type associations, plant growth stimulation, and degradation of nutrients which are inaccessible to plants.

At present, efforts are being made towards a better understanding of the interactions between plants and rhizospheric micro-organisms; major objectives have been proposed, such as rhizosphere modification and management with a view to improving plants' health and to limiting the risk of disease occurrence.

THE AIM OF INVESTIGATIONS

Our paper, in line with this context, aimed at pointing out the influence of some bacterial strains (isolated from the rhizosphere of maize cultivars) on the content of starch in *Zea mays* L caryopses during in vitro germination.

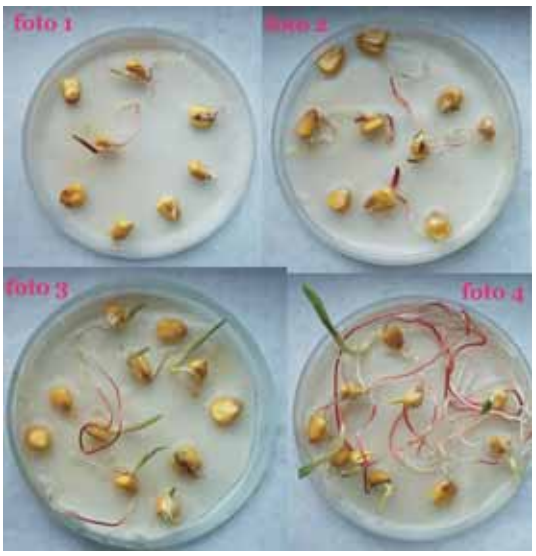
MATERIAL AND METHODS

A suspension was prepared from the bacterial strains isolated from the roots of mature plants (the beginning of fructification) of *Zea mays* L. in sterile distilled water, further used as inoculum. After all the maize grains (hybrid "Oana") have been sterilised, inoculation was performed, by submerging only of the test caryopses lot. Both lots (control and test) were subjected to germination under similar conditions, using sterile materials (12 cm Petri dishes, filter paper moistened with distilled water), at room temperature, +19°C (Photo….).

The germination process was monitored for 13 days, between 04. and 16.02.2003, while the caryopses were tested every 24 hours. Immediately after sampling, the test grains were washed with sterile distilled water for several times in order to remove microorganisms from their surface.

The content of starch was determined by the polarimetric Ewers method, the results being expressed as percentage of starch.

α-amylase activity was determined by the Noelting-Bernfeld methods (Artenie, Tănase, 1982), the results being expressed as μmol maltose/g of plant material.



RESULTS AND DISCUSSIONS

Variation of the starch content

Before performing the experiment, an assay of the starch content was carried out on the grains subsequently used in the experiment; the content found was 63.47% of starch.

Starting from the beginning of germination (time t_0 - 4.02.2003) and until the end (16.02.2003) a physiologically normal, gradual decrease, in the content of starch was recorded on the whole, both in the test grains and the control ones (Fig. 1). Thus, in the last day of germination, the control grains had a starch content of 37.65% while the test ones had a starch content of 33.88%.

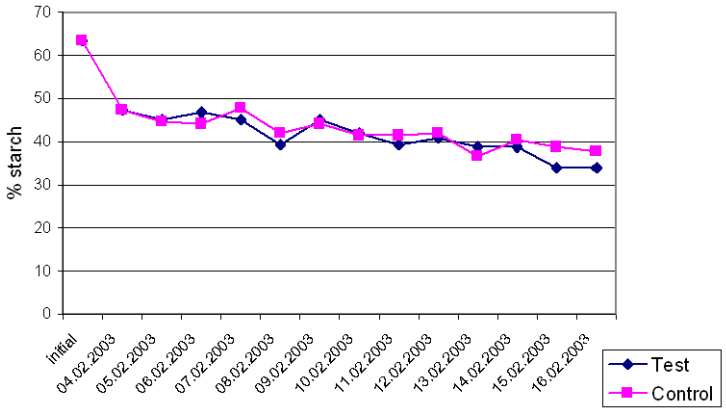


Fig. 1 – Evolution of the content of starch in the maize grains during in vitro germination

The difference between the test lot and the control one are generally insignificant; however, they tend to accentuate towards the end of germination when, in the 12th day, the content of starch in test grains is 5% smaller as compared to the control grains. This decrease is correlated with α-amylase activity which reaches the maximum in the same period. We may assume that these differences are due to the influence of rhizospheric microorganisms since the other factors involved were constant.

α-amylase activity

Throughout the entire period of in vitro germination of the maize caryopses, α-amylase activity was characterised by an increase in intensity, both in the test lot (219.33 – 1418.519 μmol maltose/g of plant material) and in the control lot (233.77 – 1264.88 μmol maltose/g of plant material) – Fig. 2.

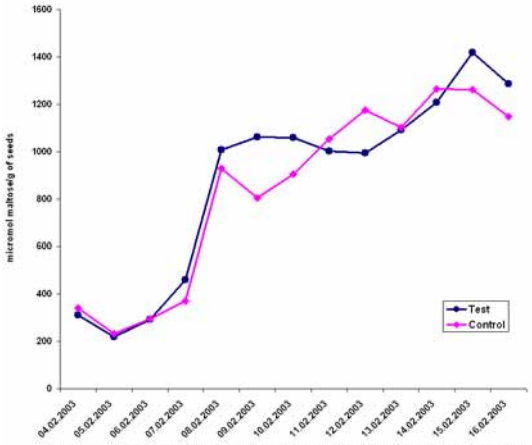


Fig. 2 – Influence of rhizospheric microorganisms on α-amylase activity during germination of maize (*Zea mays* L.) caryopses

On the whole, between α-amylase activity and the variation of the starch content there is a direct correlation maintained during the entire period of germination, not only in the test caryopses but also in the control ones.

α-amylase maximum activity was recorded for the test in the 12th day of germination and for the control in the 11th day.

In general, the intensity of α-amylase activity in the test grains had slightly higher values than in the control grains, except for the middle of the germination period (8th, 9th, and 10th days) when the situation reversed; this period corresponds to the apparition of the first radicles. Towards the end of germination, α-amylase activity in the test grains exceeds again the one in the control grains.

CONCLUSIONS

On the whole, there is a close connection between α-amylase activity and the variation of the starch content in the grains, which maintains throughout the entire period of germination, both in the test caryopses and in the control ones.

From the beginning of germination until its end, a gradual decrease – physiologically normal – in the starch content was noted, both in the test and in the control grains.

During the entire in vitro germination of maize caryopses, α-amylase activity was characterized by an increase in intensity, not only in the test lot, but also in the control one.

The potential quantitative variations, non-conforming to the general evolution of the phenomena examined by dynamics may be associated to the different degree of homogeneity of the biologic material used.

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