COULD MICROALGAE ENHANCE THE GERMINATION OF TRIBULUS TERRESTRIS L. SEEDS?

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ABSTRACT
Seeds of Tribulus terrestris L. were sown in transparent plastic leaky boxes, at a depth of 4-5 mm in sand. The transparent pots were put on plates, where water has been added through the bottom holes and capillary ascending to the surface. The temperature of soil was 20-37 °C, temperature of air 20-40 °C. Either the soil microalgae, or preliminary grown microalgal suspension, single added with the water has been thriving at these conditions. At all experiments, the first seeds germinated exactly 3 days after they have been sown. Above 90 % of the seeds germinated to 7-9 day and single of them to 20 day. Inside, on the wall of the pots, green colour appeared due to microalgae and significantly later mosses appeared, too. Having worked with seeds from Pazardzhik a germination of 31 ± 1.2 % was achieved (74 seeds). Seeds gathered from nature, Black Sea coast, Zarevo, have germinated 7 of 10 in a single experiment. The manner of work is in consistency with a possible breeding of the plant as greenhouse seedlings.

Keywords: Tribulus terrestris, seeds, microalgae, germination

Introduction
Even a quick tentative run through the ethnopharmacological literature sources or study of people’s ethnomedical customs says that the plant puncture vine, Tribulus terrestris L. had been used in days of yore. At the present time the healing properties of the plant have been used at a lot of illnesses and aberrations from the norm (1, 2, 3, 10, 13).

Breeding of the plant in large scale is bound with some drawbacks as low germination of the seeds and high period of dormancy (5, 7). The concentration of active substances is higher in the period of seed-immaturity coming in a heavy contradiction with production of seeds. In the wild, T. terrestris grows on bare places. Being tended as a field culture, T. terrestris does not occupy the whole planted ground but it keeps cropping up on patches. A good germination rate of 35 % was achieved after a series of heavy rains (5). Otherwise, the plant is definitely thermophilic and dwells southern, even desert regions.

On the other hand, the desert sandy soils are full of photosynthetic microorganisms. The cyanobacterium Arthronema africanum is an important resident of the deserts soils (9). It has been studied in laboratory and pointed as a highly tolerant to temperature and light variations (8). A cytokinin-like activity of Arthronema was described and isopentenyladenine, a cytokinin, was isolated (11, 15). One of the manners to increase the soil fertility is when add cyanobacteria or microalgae. Usually, there is natural abundance of them in the rich fertile soils. Many cyanobacteria, for example Anabaena, Aulosira, Calotrix, Cylindrospermum, Nodularia, Nostoc, Oscillatoria, Plectonema, Scytonema, Tolypothrix are described to stimulate the growth of higher plants (4, 14, 16, 17).

As a matter of fact, there is an interaction between higher plant and soil photosynthetic microorganisms. The aim of this preliminary study, save increasing the germination of Tribulus terrestris L. seeds, is to improve the whole technology, especially when greenhouse seedlings are used for breeding of the plant on field.

Materials and Methods
Seeds of Tribulus terrestris L. were sown in transparent...
plastic leaky boxes, at a depth of 4-5 mm in sand. The boxes were made of polyethylene glycol terephthalate, (PET) with 92 % transmittance in the range 380-710 nm. The sand layer was 10 cm. The transparent pots were put on plates, where water has been added through the bottom holes and capillary ascending to the surface. The temperature of soil was 20-37 °C, temperature of air 20-40 °C. The seeds were produced near the town of Pazardzhik and planted as described above in a green house in Sofia. Seeds from the wild nature were collected near to the Black Sea coast, Zarevo (42°09’35’’N; 27°51’46’’E). Nutrition medium described by Petkov (12) was added once, fortnight after planting.

Results and Discussion

At all experiments, the first seeds germinated 3 days after they have been sown. Above 90 % of the seeds were germinating to 7-9 day and single of them to 20 day. The soil microalgae throve at these conditions. Inside, on the wall of the pots, green colur appeared due to microalgae, significantly later mosses appeared, too. Having worked with seeds from Pazardzhik a germination of 31 ± 12 % was achieved (74 seeds). Seeds gathered from nature, Black Sea coast, Zarevo, have germinated 7 of 10 in a single experiment (see Table 1).

<table>
<thead>
<tr>
<th>Date</th>
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<th>Germinated</th>
<th>Percentage</th>
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<td>8</td>
<td>21</td>
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<tr>
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<td>Pazardzhik</td>
<td>18</td>
<td>5</td>
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<td>8</td>
<td>44</td>
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<tr>
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<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>20.II 2010</td>
<td>Own production</td>
<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>20.II 2010</td>
<td>Zarevo</td>
<td>10</td>
<td>7</td>
<td>70</td>
</tr>
</tbody>
</table>

The peculiarities of the plant, such as high temperature requirement, small and delicate roots, short life cycle, small and delicate roots, short life cycle, steer to the idea that the plant can successfully be grown as greenhouse seedlings and then on the field. The proposed manner of work is in consistency with a greenhouse-to-field breeding at the temperate zone, latitude more than N 42°, where appears to trail the natural limit of the plant. The manner allows dense occupation of the field, planting the bare patches, or producing second yield. According to the fact that the concentration of active substances is higher in the period of seed-immaturity, the production of crop seeds can be carried out separately. The method mentioned here is relevant in order to prevent undesired dissemination of seeds.

Acknowledgments

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REFERENCES