

INFLUENCE OF SOME AQUEOUS EXTRACTS FROM *ANETHUM GRAVEOLENS* L. ON THE GERMINATION

INFLUENȚA UNOR EXTRACTE APOASE DE *ANETHUM GRAVEOLENS* L. ASUPRA GERMINAȚIEI

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Abstract. *The paper presents the results of a study regarding the influence of aqueous extracts obtained from different organs (stems, leaves, inflorescences, fruits) of *Anethum graveolens* on seeds germination and seedlings growth in *Raphanus sativus* L. and *Cucumis sativus* L. species. The following parameters have been determined: the pH value of aqueous extracts; the pH value, the germination percentage between 24-72 hours, and the average length of the root and the hypocotyl. The results of the investigations that were carried out reveal the germination percentage and the average length of the root and hypocotyl present specific value variations according to the extract's concentration, the type of extract and the test species that was used.*

Key words: aqueous extracts, *Anethum graveolens*, germination.

Rezumat. *În lucrare se prezintă rezultatele unui studiu privind influența extractelor apoase obținute din organe diferite (fructe, frunze, tulpini, inflorescențe) de *Anethum graveolens* asupra germinației semințelor și creșterii preplantulelor la speciile *Raphanus sativus* L. și *Cucumis sativus* L. S-au determinat următorii parametri: pH-ul extractelor apoase; procentajul de germinație în intervalul 24 - 72 ore; lungimea medie a rădăcinii și hipocotilului. Rezultatele investigațiilor efectuate evidențiază următoarele aspecte: extractele apoase au un pH slab acid-neutru; procentajul de germinație și lungimea medie a radiclei și hipocotilului prezintă variații valorice specifice funcție de concentrația extractului, tipul de extract și de specia test utilizată.*

Cuvinte cheie: extracte apoase, *Anethum graveolens*, germinație.

INTRODUCTION

In the specialty literature there are given evidence of multiple cases of ordinary extracts from different vegetal organs (roots, rhizomes, leaves, fruits and seeds) (Plhák, 1971; Sathiyamoorthy, 1990; Peneva, 2007 ; Benias et al., 2010) which belong to species of plants from different families, with effect of inhibition which is not specific to germination and growth in the first ontogenetic stages. These cases are inserted in the biological phenomenon named by Molisch (1937) „allelopathy”, but which is confined to the problem of specific interrelations during the seeds' germination. The above-mentioned effects are due to the presence in the vegetal organs of certain inhibitory +/- specific substances, with a varied chemical nature (aromatic organic acids, terpenoids, phenolic compounds, coumarins,

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furocoumarins, etc) (Bewley and Black, 1978; Bilderback , 1985; Sathiyamoorthy, 1990; Razavi, 2011). The studies in the specialty literature have highlighted that the aqueous extracts obtained from seeds, leaves, stems from different species of umbelliferous plants have an effect of inhibition which is not specific to germination (Mihăilescu, 1958; Fūzi et al., 1966; Lamoureux and Koning, 1998; Stratu et al., 2002) or self-inhibitory effect (Friedman et al., 1982).

Starting from these reasons, in this paper are presented aspects regarding the influence of aqueous extracts obtained from organs different from dill (*Anethum graveolens* L.) regarding the germination of seeds and the growth of preplants at the species of *Raphanus sativus* L and *Cucumis sativus* L.

MATERIAL AND METHOD

As biological material, we used immature fruits, mature fruits, leaves, stems and inflorescences, fresh, harvested from dill plants (*Anethum graveolens* L.). Were studied two test species: seeds of radish (*Raphanus sativus* L.) - Roşioară variety and cucumber (*Cucumis sativus* L.) - Mapamond variety. The seeds were placed to germinate in Petri dishes, on a filter paper humidified with distilled water (control variant) and aqueous extracts of dill (obtained by hot extraction) with different concentrations (5 % and 10 %). For each test species were used 100 seeds / experimental variant. For each test species were made eleven experimental variants: a control and ten treatment variants (table 1).

Table 1.

Experimental variants

Variant	The type of extract
Control (M)	distilled water
V1	The aqueous extracts from immature fruits: concentration 5 %
V2	The aqueous extracts from immature fruits: concentration 10 %
V3	The aqueous extracts from mature fruits : concentration 5%
V4	The aqueous extracts from mature fruits : concentration 10%
V5	The aqueous extracts from stems: concentration 5 %
V6	The aqueous extracts from stems: concentration 10 %
V7	The aqueous extracts from leaves: concentration 5 %
V8	The aqueous extracts from leaves: concentration 10 %
V9	The aqueous extracts from inflorescences: concentration 5 %
V10	The aqueous extracts from inflorescences: concentration 10 %

We analyzed the following indicators: the pH of extracts (a CONSORT C532 multiple parameters were used); the percentage of germinated seeds; the length of root and hypocotyl at 72 hours since the experiment beginning. The data obtained from the length of the root and of hypocotyl were interpreted statistically. It was used the unifactorial Anova test and in order to test the difference between averages the Tukey test was used (Zamfirescu and Zamfirescu, 2008). The germination sample and especially the

length of the roots are frequently used as indicators for detecting the existence of certain substances with allelopathic character.

RESULTS AND DISCUSSIONS

The germination of seeds. The germination percentage increases progressively in the analyzed range. At cucumber (fig.1), after 48 hours from the setting up of the experiment, the germination percentage presented values between 89% - 97 % for the treatment variants and 90% for the witness. After 72 hours, the germination percentage presented values between 91-99 % for treatment variants and 94% for the witness. There were noticed little value variations between the control witness and the treatment variants. At radish (fig.1), after 24 hours from the setting up of the experiment, the germination percentage recorded values between 0-89%. At the variant V10 there were not noticed any germinated seeds. After 72 hours, the germination percentage recorded values between 37-97 % between treatment variants and 98% for the witness. Low values of the germination percentage were recorded at variants V1 (41 %), V2 (46 %), V4 (40 %), V8 (43 %),V9 (52 %),V10 (37 %).

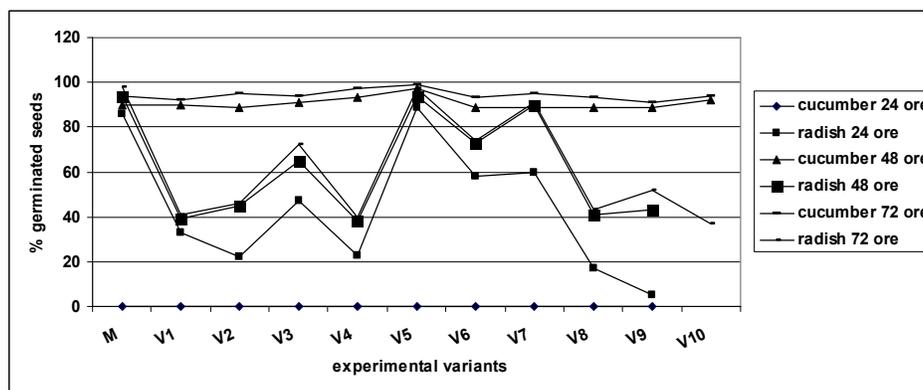


Fig. 1 – The percentaje of germinated seeds of cucumber and radish

From the analysis of the above mentioned results the fact the certain extracts (obtained form inflorescences – both concentrations used: V9, V10; leaves – concentration 10 %: V8; immature fruits - both concentrations: V1, V2; mature fruits – concentration 10 %: V4) slow the germination of seeds at radish.

According to the data from literature, the delay of germination could be due to the substances with inhibitory potential present in different parts of the plant, substances which once entered with the water in the seeds of the test species would determine in the opinion of Mihăilescu (1958) the modification of the activity of enzymes which interfere in the processes of metabolism specific to germination. As determined by Bewey (1978), the natural inhibitors derived from seeds which provoke osmotic effects, pH change, and reduction of respiration, alteration of permeability of the plasmatic membrane, inhibition of the transport of the auxins in the plant and of the synthesis of nucleic acids and proteins. The results obtained might be due to the

chemical composition of the aerial part of the plant, especially to the chemical composition of the volatile oil. The specialty literature mentions the presence in the aerial parts of the plant of a varied range of substances among which we enumerate: volatile oil, fatty acids, proteins, carbohydrates, mineral elements, flavonoids, terpenes, derivatives of the hydroxycinnamic acid, coumarins, furocoumarins, mucilages, etc. (Amin and Sleem, 2007; Ortan et al., 2009). According to Rădulescu and colab. (2010) the main compounds from leaves and flowers are α -felandren, limonene and anetophuran; the concentration of limonene and anetophuran being larger in flowers than in leaves. In fruits, cis-carvone (75,2%) and limonene (21,56%) are the main compounds; cis carvone is also present in flowers. According to Lamoureux S. and Koning, (1998), the carvone from the composition of the volatile oil from the seeds delays the germinations of the salad seeds.

The pH of the extracts used in treatments presented low acid values (6.75 la V10; 6.99 la V6) and neutral, between 7.20-7.53.

The length of the root. At cucumber (fig. 2), the length of the roots presented values between 20.60 mm and 55.37 mm; the witness had the average value of 45.64 mm. At radish (fig.2), the length of the root presented values between 8.53 mm and 29.96 mm (V7); at the witness there were obtained values close to the maximum value (27.89) mm. With the exception of V7 variant, at all the treatment variants the length of the root presented values inferior to the witness, which denotes the fact that at this test species, the root is sensitive to the treatment with dill extracts. At both species analyzed, the lowest values were obtained at V1 and V4 variants, fact which determines us to declare that the aqueous extracts obtained from immature and mature fruits have a marked delay effect on the growth of the root.

The length of the hypocotyl. At cucumber (fig. 3), the length of the hypocotyl presented average values between 4.93mm and 12.26mm; the witness had an average value of 8.4 mm. At radish (fig.3), the length of the hypocotyls presented average values between 5.17mm and 17.03mm; the witness had the average value of 12.78 mm. The lowest values were obtained at variants V4 (6.66mm) and V8 (4.93mm) for cucumber and at variants V4 (5.17mm) and V10 (5.5mm) for radish.

The statistics of unifactorial Anova test (F calculated : 13.54 – length of rootlet at cucumbers; 3.50 – length of hypocotyl at cucumber; 26.83 – length of rootlet at radish; 17.54 – length of hypocotyl at radish) was higher than the critical value 1.86 for length of rootlet at radish and cucumber, length of hypocotyl at radish; 1.89 for the length of hypocotyl at cucumber), fact which indicates that the dill extracts have a significant influence on the growth in length of the root and of the hypocotyl. The results of the Tukey test in the case of cucumber seeds indicates that: the extract of 5% concentration obtained from immature seeds influences significantly, unfavourably the growth in length of the root compared to the witness and with the other treatment variants; the extract of 10% concentration obtained from leaves influences significantly, unfavourably the

growth in length of the hypocotyl compared to the extracts prepared from immature fruits (5%), stems (5%), inflorescences 10%.

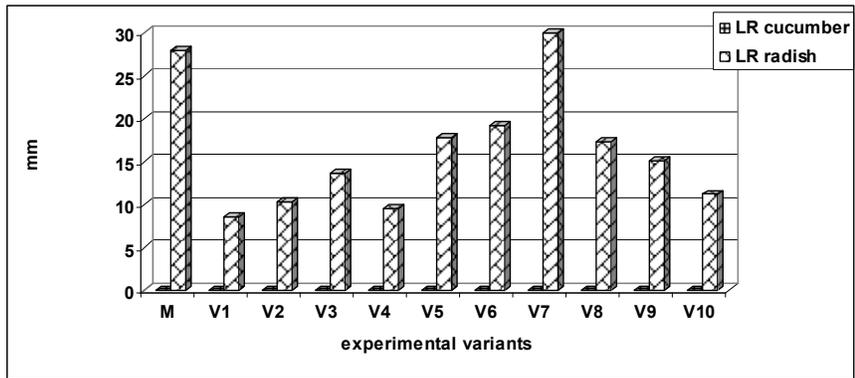


Fig. 2 – The length of the root (LR)

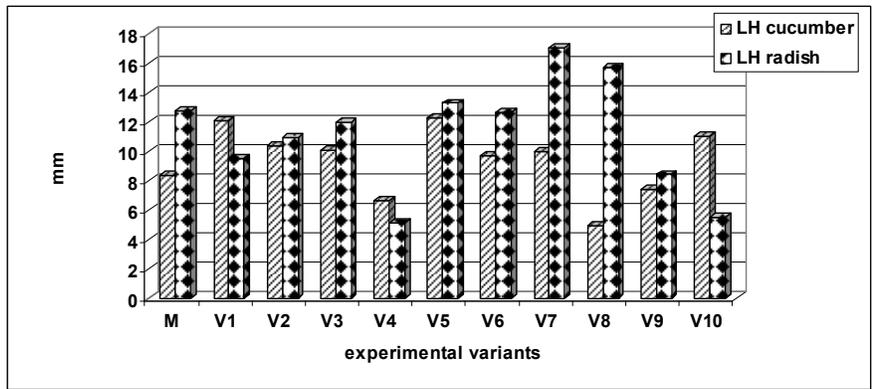


Fig. 3 – The length of the hypocotyl (LH)

The results of Tukey test in the case of radish seeds indicate the fact that: all the extracts (except V7 variant) influence significantly, unfavourably the growth in length of the root compared to the witness; the extracts with a concentration of 10% obtained from immature seeds, 5% and 10% obtained from inflorescences influence significantly, unfavourably the growth in length of the hypocotyls compared to the witness.

CONCLUSIONS

1. The extracts, in the used concentrations influence specifically the germination and growth processes in the first ontogenetic stages. It was noticed a delay of germination at radish and of the growth in length of the root and of the hypocotyl at both species.

2. Between the two analysed species, the radish was more sensitive to treatment with extracts, in the used concentrations.

3. The results obtained confirm the data from the specialty literature regarding the allelopathic effect of vegetal extracts obtained from the plants belonging to the *Apiaceae* family and the other botanical family.

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