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Full Length Research Paper

Evaluation of allelopathic action of some selected medicinal plant on lettuce seeds by using sandwich method

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Laboratory experiments were conducted to evaluate allelopathic action of fourteen selected medicinal plants of semi-arid plain areas on lettuce growth through Sandwich method. Toxic (inhibitory) and non-toxic (stimulatory) effects were assessed by recording their effect on germination, radicle and percentage growth of hypocotyl. Both were examined for hypocotyl growth of lettuce seeds under the influence of leaves. However, the extent of inhibitory and stimulatory effect of leaves varied with the plant species. The results showed that *Albizia lebbeck and Broussonetia papyrifera* have strong inhibitory effect on radical and hypocotyl growth of lettuce.

Key words: Allelopathy, medicinal plants, sandwich method, *Albizia lebbeck*, *Broussonetia papyrifera.*

INTRODUCTION

Different varieties of plants had being in use by native people for the treatment of various diseases, although the mode of use varies with the people of different region. Associated with them, are rich tradition and a wealth of indigenous knowledge on their use, either alone or in mixture against a wide range of human body disorders (Singh et al., 2001). The plants have been identified as having a wide array of medicinal properties for one or more of over 300 different ailments and diseases. (Nandakumar, 2009). However, out of 250,000 species of angiosperms, less than 1% has been screened pharmacologically (Grover et al., 2002). The growing recognition of natural products and processes for sustenance of human health increased the importance of medicinal plant sources tremendously. Many of the currently available phyto drugs have been derived from wild resources of plants (Grover et al., 2002).

It is particularly known for wild plants, at least 47 percent of which have medicinal, aromatic, cosmetic or culinary uses. Over exploitation from the natural habitats causes habitat degradation and substantial reduction of wild medicinal population (Gopalan, 1992). This leads to the need of sustainable utilization and conservation of the medicinal plants resources. Conservation by *ex situ* and *in situ* conservation units is the hope to ease the pressure on wild stocks of medicinal plants**.** One of the most important ways to release the pressure from the wild resources is to bring the plant into cultivation. However before introducing them into cultivation, it is one of the primary needs to assess their chemical relationship with other plants (Nandakuma, 2009)

The chemical relationship of the plants is known as allelopathy. The term "allelopathy" was proposed for expressing the harmful, stimulatory enhanced and beneficial effects that one plant species has on another through the formation of chemical (end product and by-product) escaping into the environment (Molisch, 1937).

The allelopathic experiments on medicinal plants were conducted by different scientists. Nazir et al., 2006 evaluated three herbal species (*Rheum emodi*, *Saussaurea lappa* and *Potentilla fulgens*). The allelopathic effects of these three herbs were examined on some traditional food crops. Germination of all the traditional food crops was reduced significantly under aqueous extracts of *S.*

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Table 1. Comparative growth rate (%) of root and hypocotyls of seeds against different concentration of the selected medicinal plant species of arid and semi arid areas.

Scientific Name	Family	5 mg		10 mg		50 mg		Criteria
		R	H	R	H	R	H	
A. lebbeck	Mimosodiaceae	24.33	38.09	41.26	-230.35	58.20	67.85	*****
Al. rosea	Malvaceae	10.97	32.5	7.78	32.60	17.11	-13.76	**
B. papyrifera	Moraceae	37.56	63.09	19.02	-46.92	68.78	73.80	****
C. sativa	Cananbinaceae	-91.84	-76.92	-85.32	-98.46	-26.63	-84.61	*
Cassia fistula	Leguminaseae	37.56	63.09	19.02	-46.92	68.78	73.80	***
C. occidentalis	Caesal pinaceae	-8.69	-49.23	19.02	-46.92	-2.17	15.38	**
H. rosa-sinensis	Malvaceae	-15.08	-8.45	-9.77	-20.65	33.51	18.30	*
J. officinale	Oleaceae	-56-.52	-80	-28. 80	-70.76	-16.84	-63.84	*
J. alba	Oleaceae	0.67	2.17	6.04	-0.54	4.02	-21.01	*
L. indica	Lythraceae	24.33	38.09	41.26	-230.35	58.20	67.85	***
L. camara	Verbenaceae	-53.26	-58.46	-44.02	-63.84	-12.5	-43.07	*
N. oleander	Apocynaceae	17.46	25.35	44.70	30.04	34.12	6.10	***
N. arbo	Oleaceae	-36.24	-25.36	-6.37	4.71	-14.42	29.71	*
P. hysterophorus	Asteraceae	0.67	-30.43	10.40	-33.33	20.13	-9.05	*

Key: ***** = Highly significance, *** = significance,* = Non significance. R = Radical, H = Hypocotyl.

lappa and *P. fulgens.*

In recent years, exploration of the medicinal plants for allelopathic potential is of special interest. Khan et al. (2009), worked to check the allelopathic effects of four medicinal plants by using various methods. The emphasis was on Sandwich and homogenated Sandwich methods. Fujii et al., 2003, worked on 239 medicinal plants for evaluation of allelopathic activity on lettuce by sandwich method. They concluded from the results that 223 species were inhibitory, whereas 17 species were enhancing radicle growth in lettuce. The main objective of Aziz and Fujii, 2005 to examine fourteen medicinal plant species of plain areas with semi arid conditions was for their allelopathic activity on growth of lettuce seed (*Lactuca sativa*) under laboratory conditions by using sandwich method. The specific objective of the present study was to examine fourteen medicinal plant species from the plains of arid and semi arid areas, for their allelopathic activity on growth of lettuce seed (*L. sativa*).

MATERIALS AND METHODS

Plant materials

Fourteen medicinal plant species were collected from arid and semi arid areas of Pakistan, washed with running water to remove dust and all other undesired materials. Fresh leaves were oven dried at 60°C for gradual removal of water. Properly dried leaves were kept in plastic bags for further use. Three different concentrations (5, 10 and 50 mg each) of dried leaves were weighed and were used for experimentation.

Media preparation

Agar powder (Navalai Tasque, Kyoto japans) with gelling temperature 30 - 31°C was used as media. Agar solution (0.75% w/v) was prepared and autoclaved at 121°C for 15 min. Three different concentrations of leaves were placed in multidishes (10 cm^2 area per each dish) (Nalge Nunc Intl., Rosklide, Denmark).Three replicates of each concentration were used. By using a pipette (Gilson co. Ltd, Villiers-le-Bel, France), first layer of agar (5 ml) was applied, as a result, dried plant material rise up and was allowed to dry, on top of which a second layer of agar was applied. In each dish, five seeds of lettuce were placed above agar. Multi dishes were covered by aluminum foil to protect them from light and were kept in growth chamber at 25°C for 72. Length of radicle and hypocotyl was noted after 72 h for each plant.

Tools for data analysis

For each plant species, mean and standard error were calculated to determine the growth pattern of 5, 10 and 50mg of leaves, stem and root of herbal species (Fujii et al., 2003).

Statistical analysis

The data was analyzed by using Software of SPSS v 11 (Statistical analysis of Social Procedure) and Microsoft Excel. As the experimental design was Randomized Complete Split Block Design. The level of significance was 0.05. Percentage growth of radicle and hypocotyl of test plants under the influence of various herbs is represented by line graphs.

RESULTS AND DISCUSSION

Table 1 has shown list of 14 plant species of different families that have been used to check their allelopathic action. In the given species, the more strongly allelopathic action was shown by *Albizzia lebeck, Nyctanthus arbo-tristis. Nerium oleander, cassia fistula, Broussonetia*

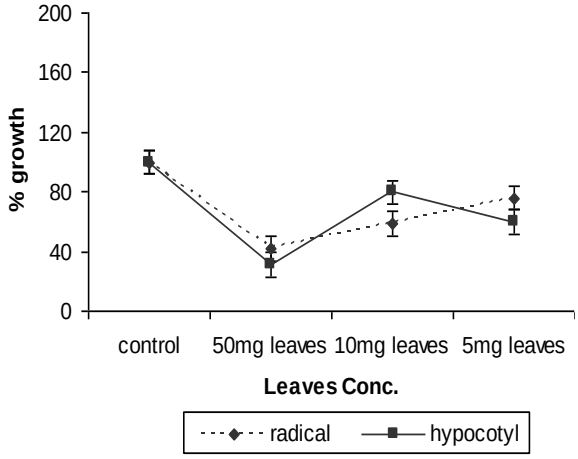

Figure 1. Effect of *A. lebbeck* on growth of hypocotyl and radicle of lettuce.

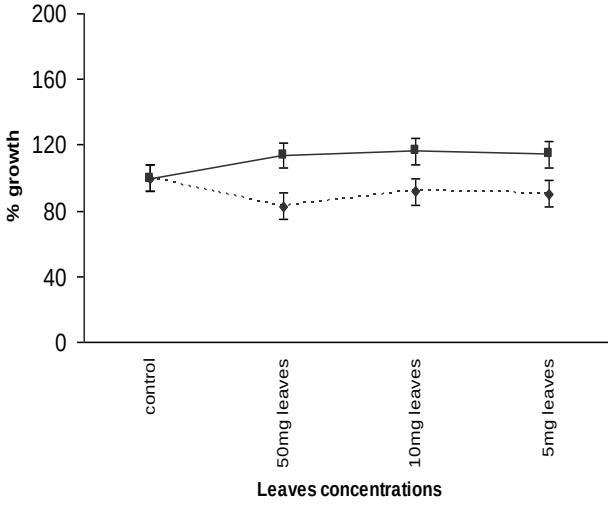

Figure 2. The effect of *A. Rosa* on growth of hypocotyl and radicle of lettuce.

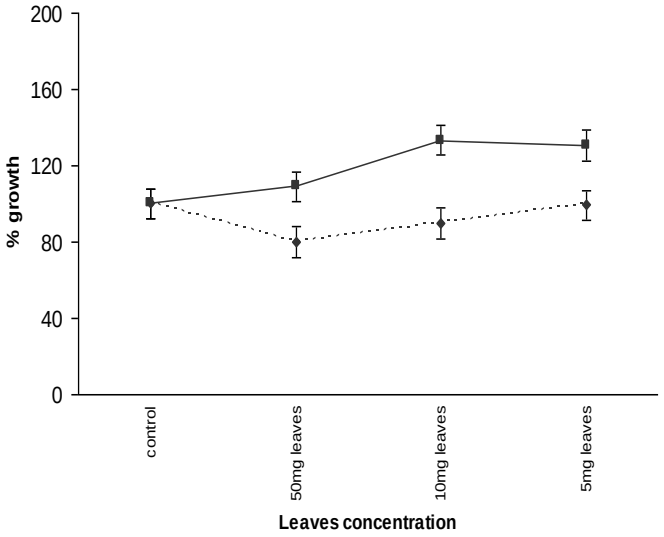

Figure 3. Effect of *P. hysterophorus* on growth of hypocotyl and radicle of lettuce.

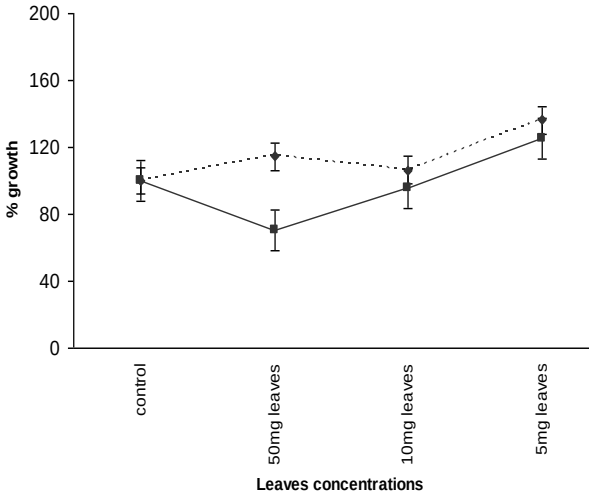

Figure 4. Effect of *N. albo* on growth of hypocotyl and radicle of lettuce.

papyrifera, Lagerstroma indica. The effect of 5 mg concentration of *B. Papyrifera* and *A. lebbeck* on the radicle growth was inhibited up to 70 - 80% (Figures 1-11). At 5 mg of leaves (*Althaea rosea*, *Jasminum alba* and *B. papyrifera)* no hypocotyl was observed (Figures 2, 5 and 11). However the same concentration could not produce any effect on radicle. For *N. oleander and Hibiscus rosa-sinensis* (Figures 9 and 10) all the leaves concentrations, almost have no effect on the growth of radicle, but 80 - 85% inhibition of hypocotyl was observed. In case of *cassia oxidentalis* (Figure 8) 5 - 10% of radicle and 85% hypocotyl were enhanced. In case of *N. arbo-tristis* (Figures 3 and 4), higher leaf concentrations caused reduction in the growth of hypocotyls but as the concentration got lower, enhancement in the growth was observed. However *Parthenium hysterophorus* enhanced the hypocotyls 30 - 40%, but complete suppression was observed in radicle (3).The concentration of *cannabis sativa* (Figure 7) showed stimulatory effects on radicle (70%) and hypocotyl (40%). The hypocotyls length got enhancement up to 10 - 30% by *Lantana camara* and *A. fistula* (Figures 12 and14), whereas no effect on radicle was produced by *A. fistula.* The retarded effect of *L. indica* (Figure 13) on radicle (80%) and10% on hypocotyls was observed. Leguminosae family showed strong inhibitory effects (60 - 79%) on lettuce radicle growth. When 50 mg leaf litter was used, 100% hypocotyl growth inhibition of the lettuce seedling was observed in two plant species belonging to the family Leguminosae

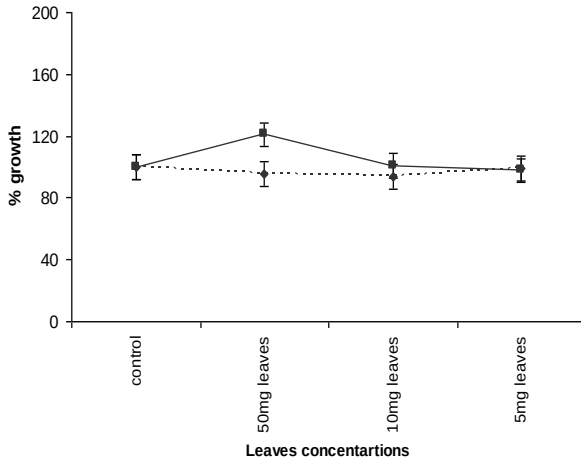

Figure 5. Effect of *J. officinale* on growth of hypocotyl and radicle of lettuce.

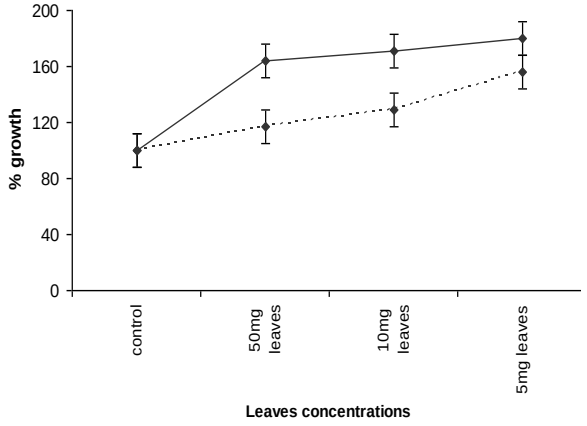

Figure 6. Effect of *J. alba* on growth of hypocotyl and radicle of lettuce.

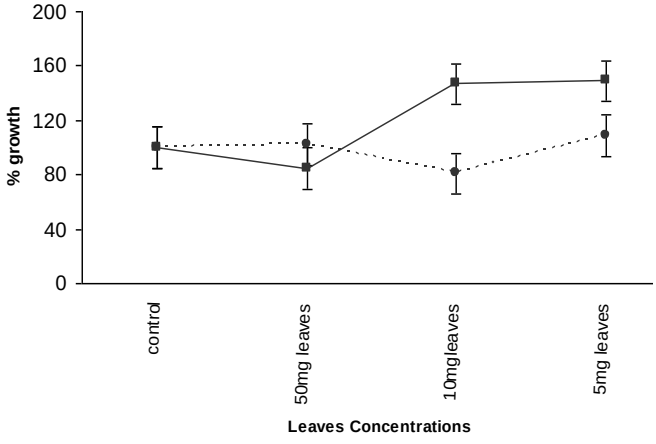

Figure 7. Effect of *C. oxidantle* on the hypocotyl and radicle of lettuce.

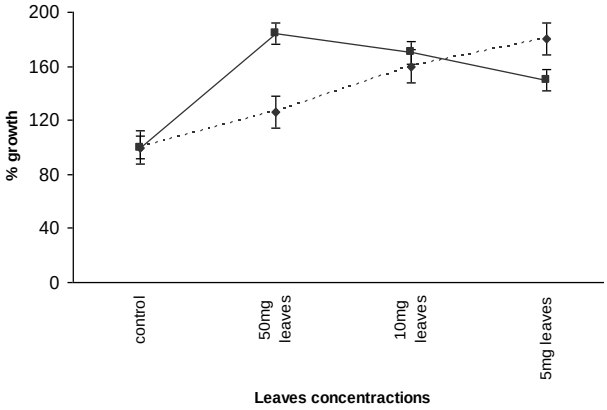

Figure 8. Effect of *C. sativa* on the growth of hypocotyl and radicle of lettuce.

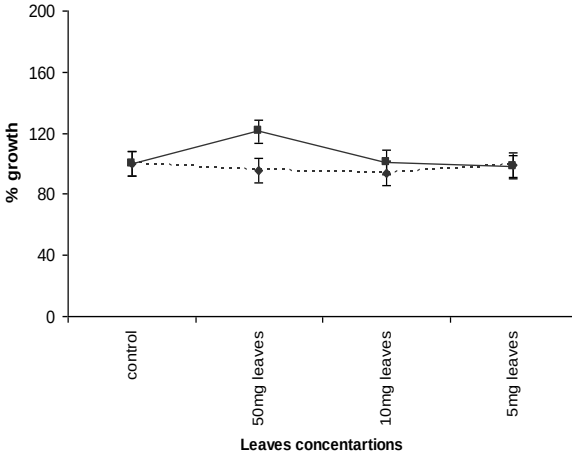

Figure 9. Effect of *H. rosa-sinensis* on growth of hypocotyl and radicle of lettuce.

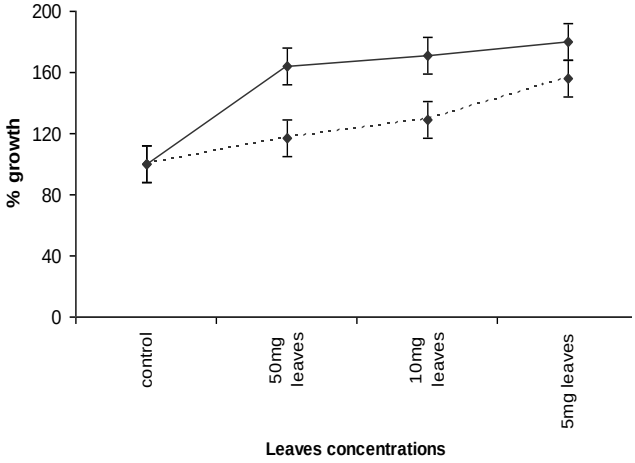

Figure 10. Effect of *N. oleander* on growth of hypocotyl and radicle of lettuce.

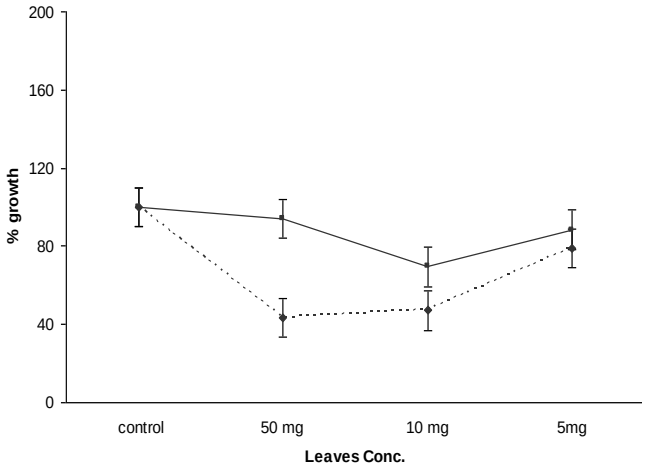

Figure 11. Effect of *B. papyrifera* on growth of hypocotyl and radicle of lettuce.

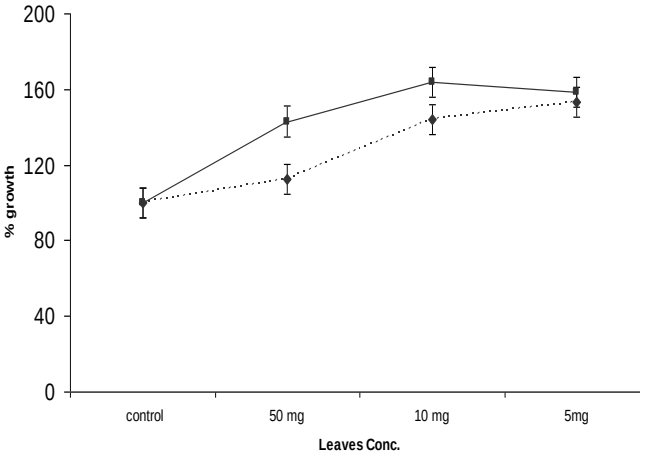

Figure 12. Effect of *L. camara* on growth of hypocotyl and radicle of lettuce.

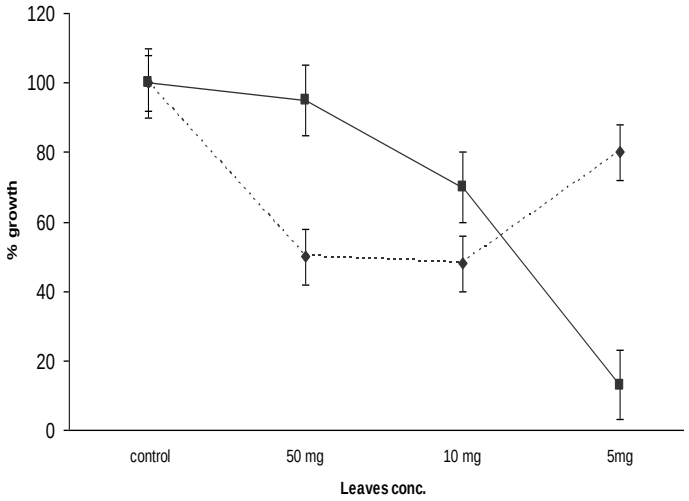

Figure 13. Effect of *L. indica* on growth of hypocotyl and radicle of lettuce.

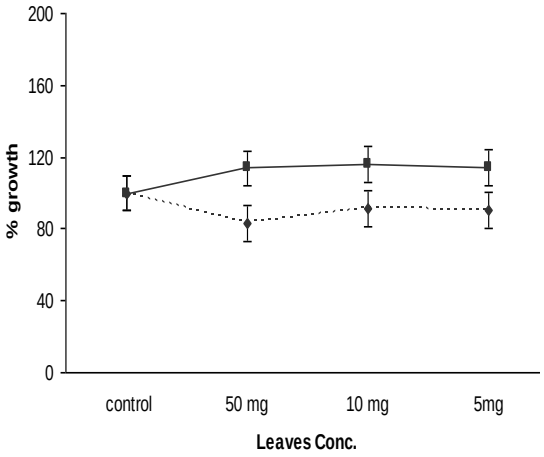

Figure 14. Effect of *C. fistula* on growth of hypocotyl and radicle of Lettuce.

and Myrtaceae (Fujii et al*.,* 2004).

The concentration of 50 mg leaves of *B. papyrifera, A. lebbec*k has an inhibitory effect on radicle growth and the percentage of the effect varies from 70 - 75% (Figures 1 - 11), and 50 - 60% in *L. indica* and *N. oleander* (Figures 10 and 13). The inhibitory effect was also observed in *A. rosea, and P. hysteropherus* in a range of 20 - 30% (Figures 2 and 3). No inhibition was shown by *J. alba, Jasminum officinalae,* and *N. arbo-tristis* (Figures 4, 5 and 6).

Amongst the lower most concentrations of 5 mg leaves has been checked to evaluate the inhibition of hypocotyl and radicle growth. The hypocotyl of lettuce seeds has shown almost inhibitory action when different plant species has been used to check their allelopathic action. As in case of *Hibisucs rosa-sinensis,* only 5 -10% hypocotyls growth was observed (Figure 9).

The 10 mg of *Albizia lebbeck enhanced* the seed. The most concentrated treatment of 50 mg has retarded effect on hypocotyl growth. *B. papyrifera, H. rosa-sinensis* and C*. oxidentalis* have retarded effects up to 95% (Figures 11, 9 and 7). *N. oleander* and *N. arbo-tristis* has 70 - 80% inhibition, but *A. lebbeck* has exceptional case of inhibition in range of 35 - 45%. However, radicle growth in root extracts exhibited inhibit-tory effect in case of all plants and in all concentrations, which is confirmatory to the findings of Choi, 1993.

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