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GROWTH REGULATORY ACTIVITIES OF AQUEOUS EXTRACTS OF FIVE ORNAMENTAL PLANTS

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ABSTRACT

A study was conducted on activities of aqueous extracts of leaves of five ornamental plant species on four summer vegetable crops. The aqueous extract of *Butea monosperma* (parrot tree) leaves markedly enhanced the germination, shoot and root length of all the four vegetable crops. The growth of shoot and root length of these vegetable crop species were enhanced using aqueous leaves extract of *B. monosperma* indicating the presence of growth promoting substance(s). The thin layer chromatography (TLC) examination of chloroform crude extract of *B. monosperma* showed three different compounds at hexane: ethyl acetate (5:1 v/v).

Key words: *Chemical investigation, germination, growth regulatory activity, TLC*

INTRODUCTION

It is difficult for farmers of Bangladesh to buy growth regulating chemicals for increasing crop production. So, investigations need to be carried out to increase efficient food production by using naturally occurring growth promoting substances. Aqueous extract of plant leaves using normal water (Tap water) could be applied to soil to find out whether the same enhances germination and growth of crops in the field. Shil (2007) worked on germination and primary growth rate of some vegetable crops treated with aqueous extracts of several fruit trees and revealed that *Dillenia indica* (Indian dillenia) had positive growth regulatory effect. Study of growth regulatory activities of some ornamental plants is of practical significance in crop farming system for the germination of seeds and also crop growth. With the help of isolation technique, a lot of naturally occurring organic, bioorganic compounds have been isolated from plant. Some of them have effective medicinal, growth regulatory effect, pesticidal/insecticidal values (Roy *et al.*, 2005). Some positive growth regulators (terpenoids, olefinic and ketone compounds) have been isolated from *Dillenia indica* with the help of isolation technique (Shil, 2007). The present study was undertaken to examine whether they have growth regulatory effect of some ornamental plants leaves available in Bangladesh on germination of summer vegetables crop seeds and their primary growth rate or not, and also to isolate and identify the ingredient of growth regulatory substance from aqueous extracts.

MATERIALS AND METHOD

The experiment was conducted at the Laboratory of Agricultural Chemistry and Biochemistry in Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh, during July 2006 to June 2007. The aqueous extracts were prepared from some selected ornamental plants, i.e., *Butea monosperma*, *Artabotrys odoratissimus*, *Tabernaemontana coronara*, *Ixora coecinia* and *Mussaenda erythrephytta* leaves. The freshly prepared aqueous extracts were applied on seeds of country bean (*Lablab niger*), lady's finger (*Hibiscus esculentus*), swamp cabbage (*Impoea aquatica*) and yardlong bean (*Vigna unguiculata*) to observe their germination and subsequent growth performances of seedlings.

Two sheets of filter paper (Whatmann No. 1) were placed on a Petri-dish (10 cm inner diameter). Total 72 Petri-dishes were set for 6 treatments with 4 tested vegetable crop species, while tap water was used for control. Each treatment was replicated for three times. Twenty five seeds of each vegetable crop

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were placed on each Petri-dish moistened with 15 ml aqueous extract of ornamental plant leaves and were kept at 27±2 ^{0}C temperature and 85±2% relative humidity. The filter paper is kept constantly moist with water. The experiment was laid out by completely randomized design while tap water was used for control. Each treatment was replicated for three times. The germination percentage, shoot and root length of seedlings were measured regularly after seed germinating in the Petri-dish. The measurements were taken at seven days after germination. The data were analyzed statistically and the differences between means were compared by LSD followed by DMRT.

The 100 g of leaves powder (previously sun dried) was taken in a 2.5 L bottle containing 500 ml chloroform and kept for 72 h with regular interval of shaking. It was then filtered by using Whatmann filter paper no. 1. The filtrate (450 ml) was collected in a 500 ml bottle and 200 ml chloroform was also poured again to the residue. This process was continued for three times. These collected filtrates were mixed together and was evaporated by using thin film rotary evaporator under reduced pressure. After collecting crude from rotary evaporator, it was used for TLC preparation. TLC was done to detect the presence of compounds in the crude extract.

RESULTS AND DISCUSSION

The effect of ornamental plants extracts on germination of vegetable crops has been presented in Table 1. It shows that the aqueous extract of leaves of *B. monosperma* significantly increased germination of country bean, lady's finger, swamp cabbage and yardlong bean by 20.9%, 35.0%, 26.1% and 4.2%, respectively, over control. The highest germination was observed in country bean, lady's finger, swamp cabbage and yardlong bean by 100%, 81.7%, 78.7% and 100%, respectively, in seeds treated with aqueous extract of leaves of *B. monosperma* compared with others. The aqueous extract of *A. odoratissimus* decreased the germination rate of three vegetable crops except lady's finger. The lowest germination rate of country bean, swamp cabbage and yardlong bean were 15.0%, 32.6% and 40.3%, respectively, in seeds treated with the aqueous extract of *A. odoratissimus* and lady's finger showed 57.9% germination rate treated by *M. erythrephytta* leaves extract. The increased germination rate of the tested vegetable crops was in seeds treated with the aqueous extract of *B. monosperma* could be due to the presence of growth promoting substance(s). Shil (2007) also observed similar result for country bean, swamp cabbage, yardlong bean and lady's finger vegetable crops in seeds treated with the aqueous extract of *Dillenia indica*.

Table 1 shows that the effect of aqueous extract of *B. monosperma* leaves enhanced the growth of shoot and root of these vegetable crops. The growth of shoot length for country bean, lady's finger, swamp cabbage and yardlong bean were increased by 87.2%, 87.9%, 65.4%, and 68.9% and for root length, these also were by 52.0%, 88.4%, 50.6% and 106.7%, respectively. The least shoot length of country bean was 4.83 cm treated by the extract of *M. erythrephytta* and root length was 2.45 cm treated by the extract of *A. odoratissimus*. In case of lady's finger the lowest shoot 2.96 cm was found in seeds treated with *T. coronaria* leaves extracts. The root length of lady's finger was 1.96 cm was treated by the aqueous extract of *M. erythrephytta*. The leaves extract of *A. odoratissimus* decreased the shoot and root length of swamp cabbage and yardlong bean vegetable crops. The highest shoot length of all the four vegetables were observed in seeds treated with the aqueous extract of *B. monosperma* leaves and the highest root length was 5.26 cm, 4.86 cm, 3.99 cm and 7.67 cm, respectively, treated by the same aqueous extract. It is interesting that increasing tendency of germination, promoting of shoot and root length of these vegetable seeds using aqueous extract of *B. monosperma* leaves is of some challenge to us. It is essential to identify the compound(s) responsible for promoting effect. To detect this, powder of leaves of *B. monosperma* was undertaken for chemical investigation. Non-polar crude extract was prepared using chloroform. The Figure 1 shows using crude extract of *B. monosperma*. The TLC of chloroform crude extract using *B. monosperma* leaves had three compounds at hexane: ethyl acetate (5:1, v/v).

Table 1. Germination percentage, shoot and root length of four summer vegetable crops treated with aqueous extracts of leaves from five ornamental plants.

Treatment	Germination (%)			
	Lablab niger	*Hibiscus esculentus*	*Impoea aquatica*	*Vigna unguiculata*
Control	82.67abc	61.67 ab	61.33 ab	96.00 ab
B. monosperma	100.00 a	83.33 a	77.33 a	100.00 a
A. odoratissimus	70.33 c	58.33 abc	41.33 ab	57.33 c
T. coronara	80.00 abc	56.67 abc	60.00 ab	86.67 abc
Ixora coecinia	78.67 abc	31.67 cd	46.67 ab	87.67 abc
M. erythrephytta	96.00 ab	26.00 d	68.00 a	85.33 abc
SD	5.585	6.360	11.15	6.215
	Average shoot length (cm) at 7 days			
Control	5.61 cd	2.98 bc	3.47 a	3.71 cd
B. monosperma	10.50 a	5.60 a	3.07 ab	7.33 a
A. odoratissimus	5.97 bc	3.24 b	1.50 c	2.48 de
T. coronara	6.03 bc	2.96 bc	3.24 ab	5.64 b
Ixora coecinia	6.68 b	2.36 bc	2.36 bc	4.18 bc
Mussaenda erythrephytta	4.83 d	1.96 c	3.16 ab	5.69 b
SD	0.1727	0.06396	0.1741	0.3816
	Average root length (cm) at 7 days			
Control	3.46 cd	2.58 b	2.65 a	3.71 cd
B. monosperma	4.06 a	3.43 a	1.99 ab	7.33 a
A. odoratissimus	2.45 e	2.25 c	1.10 c	2.48 de
T. coronara	3.28 d	2.40 c	2.36 a	5.64 b
Ixora coecinia	3.68 bc	2.11 c	2.16 ab	4.18 bc
Mussaenda erythrephytta	3.89 ab	1.96 c	2.18 ab	5.69 b
SD	0.06396	0.06325	0.1741	0.3816

This result suggested that it contained three distinct compounds designated as P_1, P_2 and P_3 respectively. The R_f values of these compounds were calculated by using the formula (Furniss *et al.*, 1989).

$$R_f = \frac{\text{Distance traveled by the component}}{\text{Distance traveled by the solvent front}}$$

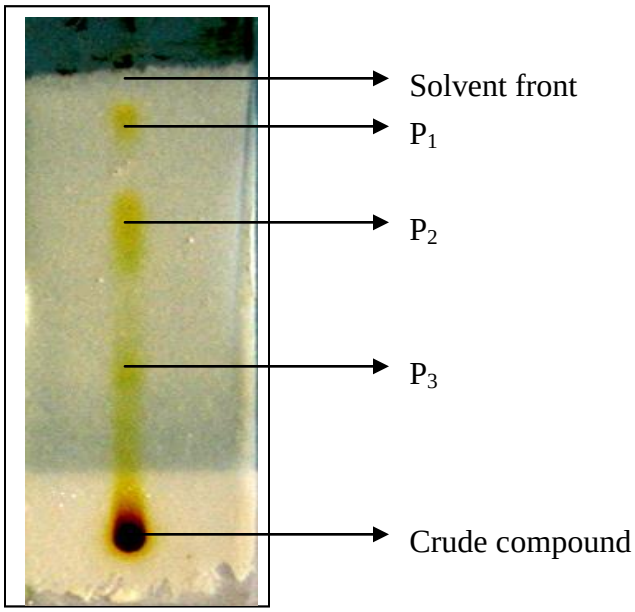

Figure 1. TLC of chloroform crude extract of *B. monosperma* leaves at hexane: ethyl acetate (5:1, v/v)

Table 2. R_f values of three detected components

Name of the plant species	Detected component	R_f value
Butea monosperma	P1	0.86
	P2	0.65
	P3	0.26

Component showing the higher R_f value indicates the most non-polar compound and the least R_f value indicates the most polar compound. Fractions observed on TLC will be isolated by column chromatography and the structure of individual component will be determined by spectroscopic method. Individual component will be further tested for germination and growth effects which will be reported in due course.

From these findings, it is very difficult to draw a definite conclusion but initial results suggest that aqueous extract of leaves of *B. monosperma* enhances the germination and growth of a number of some summer vegetables.

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