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SPIRODELA POLYRRHIZA EXTRACT INDUCED CHANGES IN POLLEN GROWTH OF *BARLEY* PLANT

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ABSTRACT
The influence of different concentrations (1, 2, 5 & 10%) of *Spirodela polyrrhiza* extract in distilled water on germination and tube growth of *Hordeum vulgare* has been studied. Pollen grains from fresh flowers of *H. vulgare* were collected early in the morning before anthesis. Obsevations were recorded 60 minutes after pollen culture at 20 ± 0.5ºC and 100% relative humidity. Results showed that lower concentrations (1%, 2% & 5%) enhanced pollen growth. Maximum percentage germination (76.0%) and tube growth (234.509μm) were observed with 5% *S. polyrrhiza* extract in the evening followed by morning and noon. Finally one can conclude that *S. polyrrhiza* extract enhanced pollen germination and tube growth of barley plant.

INTRODUCTION

Spirodela polyrrhiza flourishes well in stagnant small ponds, pools or ditches rich in organic matter or drainage channels or channels receiving effluents of industrial wastes. Lemnoid extract have been known to behave as plant growth substances (Shukla and Agnihotri, 1984; Shukla and Awasthi, 1985). Pollen germination and tube growth have been affected by growth promoting substances (Malik and Mehan, 1975; Bajpai and Sharma, 2002; Lyall and Boswal, 2002; Mishra and Sharma, 2002). However, pollen germination *in-vitro* was inhibited in *Nicotiana tobaccum* with cyano- bacterial alkaloid (Metcalf *et al.*, 2004), in tea with *Aureobasidium* sp. (Shimada *et al.*, 2003) and in *Luffa aegyptica* Mill. and *Momordica charantia* L. with leaf extract (Prajapati and Jain, 2011). The present paper communicates regarding the effect of *S. polyrrhiza* extract on pollen growth of *Hordeum vulgare* under the experimental condition. Induced pollination has its commercial utility in plant breeding for producing hybrid seeds.

MATERIALS AND METHODS

Experimental design

Pollen grains were collected from fresh flowers of *Hordeum vulgare*. For various pollen culture experiments, 0.7M sucrose, 0.2M glucose, 75mgL^{-1} boric acid, 75mgL^{-1} $Ca(NO_3)_2$, 100mgL^{-1} $MgSO_4$, 100mgL^{-1} KNO_3 and 10μm $MnSO_4.H_2O$ were used as basal/control medium. They were germinated using hanging drop technique in cavity slides containing required concentration of *S. polyrrhiza* extract prepared in distilled water. For comparison, pollen grains were similarly germinated in control medium. Before experiments, *S. polyrrhiza* were obtained from nature in fresh condition. Some quantity of *S. polyrrhiza* were taken in a clean and dry beaker. Ten grams of *S. polyrrhiza* were weighed and ground in a clean porcelain mortar with sufficient distilled water. Further distilled water was added to make it 100mL. making 10% *S. polyrrhiza* extract. From this stock solution 5%, 2% & 1% solutions were prepared. Thermo controlled incubators with a glass window for providing light exposures were used for pollen culture. The culturing of pollen was maintained at 20±0.5ºC and 100% relative humidity for 60 minutes.

Determination of pollen germination and tube growth

Effect of *S. polyrrhiza* extract on pollen germination and tube growth were observed at different hours of the day (9:00 a.m., 12:00 noon and 3:00 p.m.).

Statistical analysis

After completion of the experiment, the data were statistically analyzed and significance compared at 5% error probability with the help of analysis of variance.

Analysis of variance

The experiment was conducted in Completely Randomized Design with 5 replications and 5 treatments (Control, 1%, 2%, 5% & 10% *S. polyrrhiza* extracts) and analysis of variance was worked out as explained by Cochran and Cox, 1963.

RESULTS AND DISCUSSION

Percentage germination

The extract of *S. polyrrhiza* (1% to 10%) significantly induced pollen germination when applied in the morning, noon and evening (Table 1). With increase in concentration of *S. polyrrhiza* extract from 1% to 5%, there was a significant

increase in percentage germination. Maximum percentage germination (76.0%) was observed with 5% *S. polyrrhiza* extract when applied in the evening. Fig. 1 shows percentage increase over control of pollen germination with the concentration which induced maximum effect.

Tube growth

With increase in concentration of *S. polyrrhiza* extract from 1% to 5% the tube length increased (Table 1).The increase was significant with all treatments except 1% applied in the morning. The effect of 1% of *S. polyrrhiza* extract on pollen tube growth was best in the morning followed by evening and noon and the effect of 2%, 5% and 10% of *S. polyrrhiza* extracts on pollen tube growth were best in the evening followed by morning and noon. Maximum tube growth (234.509μm) was observed with 5% *S. polyrrhiza* extract in the evening. Fig. 2 shows percentage increase over control of pollen tube growth with the concentration which induced maximum effect.

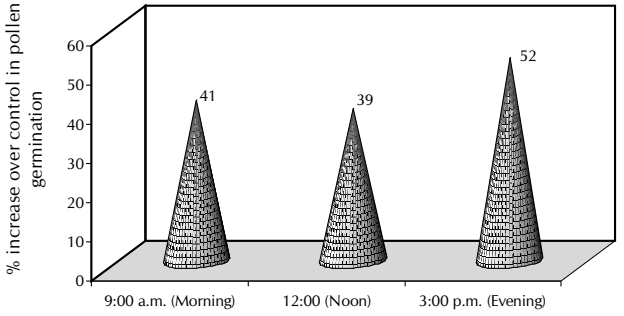

Figure 1: Maximum effect of *spirodela polyrrhiza* extract (5%) on percentage germination of *Hordeum vulgare* pollen

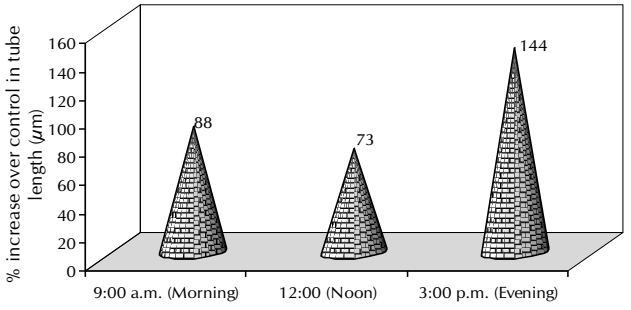

Figure 2: Maximum effect of *spirodela polyrrhiza* extract (5%) on tube length of *Hordeum vulgare* pollen

DISCUSSION

Plant extracts are known to contain growth substances which help in coleoptile and root elongation (Kefford, 1955). Aqueous extracts of some plants of Lamiaceae family increased the biomass of *Yarrowia lipolytica*, an yeast (Karanika *et al.*, 2001). Red and green algal extracts could increase *in-vitro* hyphal growth of *Arbuscular mycorrhizal* fungi and root colonization of papaya and passion fruit indicating presence of stimulatory substances (Kuwada *et al.*, 2006). Algal extracts have induced stomatal and epidermal development in rice leaves (Shukla, 1967) and root and shoot elongation probably due to the presence of algal hormones (Gupta and Shukla, 1969). The beneficial effect of some intracellular compounds derived from micro algae have been found to stimulate growth of water thyme (Kinnear *et al.*, 2008) and improve growth culture of tobacco, pea and beet (Molnar and Ordog, 2005). Influence of *Lemna paucicostata* manure and spraying with its extracts on *Hordeum vulgare* was explored by Pandey (1979) and the study revealed significant effect on fresh dry matter production, yield ascorbic acid, catalase, chlorophyll and epidermal structure of plants. Likewise stimulation in vegetative growth and yield of rice following treatments with water hyacinth extracts has also been reported (Sircar, 1963). However, tea pollen tube growth was inhibited with algal extract of *Spatoglossum pacificum* (Tazaki *et al.*, 1991). Similarly *Petunia hybrida* and *Lilium lankongense* pollens were also inhibited with *Brassica oleracea* tissue extracts (Hodgkin and Lyon, 1983). Enlarged pollen tube elongation was noted *in-vitro* culture of tea pollen with rape seed cakes solution (Konishi and Yakota, 1980).

Present findings of increased germination and pollen tube growth with *Spirodela polyrrhiza* extract further support the view that plant extracts enhance growth of various plant parts.

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Table 1: Effect of *Spirodela polyrrhiza* extract on pollen germination and tube growth of *Hordeum vulgare*

S. No.	Treatments	Morning (9:00a.m.)		Noon (12:00)		Evening (3:00p.m.)	
		Percentage Germination	Tube Length in μm	Percentage Germination	Tube Length in μm	Percentage Germination	Tube Length in μm
1.	Control	52.0	123.426	51.5	102.850	49.8	95.998
2.	1% S.P.E.	58.0*	137.140	56.0*	123.422*	56.0*	123.426*
3.	2% S.P.E	60.0*	185.139*	57.2*	143.994*	57.2*	189.253*
4.	5% S.P.E	73.5*	233.138*	72.0*	178.276*	76.0*	234.509*
5.	10% S.P.E	67.0*	205.710*	67.0*	161.822*	67.0*	212.567*
C.D. at 5%		2.378	13.719	1.527	12.666	2.565	11.443

Results were based on average of 25 samples; Observations were recorded 60 minutes after pollen culture at 20 + 0.5ºC and 100% R.H; S.P.E. = *Spirodela polyrrhiza* Extract; C.D = Critical Difference ; R.H. = Relative Humidity; "*" = Shows significant as compared to control.

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