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EFFECTS OF GIBBERALLIC ACID (GA_3) ON *IN VITRO* POLLEN GERMINATION AND POLLEN TUBE GROWTH IN *LUFFA AEGYPTICA* MILL.

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ABSTRACT:

Luffa aegyptica Mill. (Spongy gourd) is the member of the family Cucurbitaceae. Pollen was sown in modified germination media that included 1 ppm, 2 ppm, and 3 ppm gibberellic acid (GA_3). In *Luffa aegyptica* Mill the optimum percentages of germinating pollen grains (65.02%) and the tube growth (45.60%) with minimum percentage of bursting (17.60%) are reported at 40 min stage in the medium containing 1ppm GA_3. The results suggest that gibberellic acid had adverse effects on pollen germination of spongy gourd.

KEY WORDS: *Pollen germination, Growth inhibitor, Gibberellic acid.*

INTRODUCTION:

Luffa aegyptica Mill. is a large, monoecious, annual, climbing herb, mostly cultivated for vegetables which belong to family Cucurbitaceae. *In vitro* germination of pollen has been used as powerful tool for genetical, physiological, biochemical and cytochemical studies for a wide range of plant species belonging to different families (Heslop-Harrison and Heslop-Harrison, 1992). (GAs) are essential endogenous regulators of plant growth and development. GAs are involved in many aspects of plant development, including seed germination, trichome development, stem and leaf elongation, flower induction, anther development and fruit and seed development (Yamaguchi et al., 1998; Kamiya and Garcia-Martinez, 1999; Hedden and Phillips, 2000; Acar et al., 2010). GAs also, are present in developing pollen after anthesis and numerous studies have reported the effect of GA application on pollen tube growth *in vivo* or *in vitro*(Singh et al., 2002). Depending on the species examined and the concentration used, GAs can promote, inhibit or have no effect on pollen germination and tube growth *in vitro* (Bhandal and Malik, 1979; Setia et al., 1994; Acar et al., 2010). An Effect of auxin, gibberellins and cytokinins on pollen germination and tube growth has been studied by number of workers (Mascarenhas, 1975; Malik and Chhabra, 1978; Dabgar, 2002; Jha, 2002; Patel et al., 2003 and Kovaleva, 2005).

MATERIAL AND METHODS:

Flowers open early in the morning. Anthers dehisce about two hours before anthesis and optimum viability of pollen and receptivity of the stigma are attained at anthesis. **Gibberellins** - 0.186%, 50 gm Powder, M/S ACME ORGANICS PVT LTD.

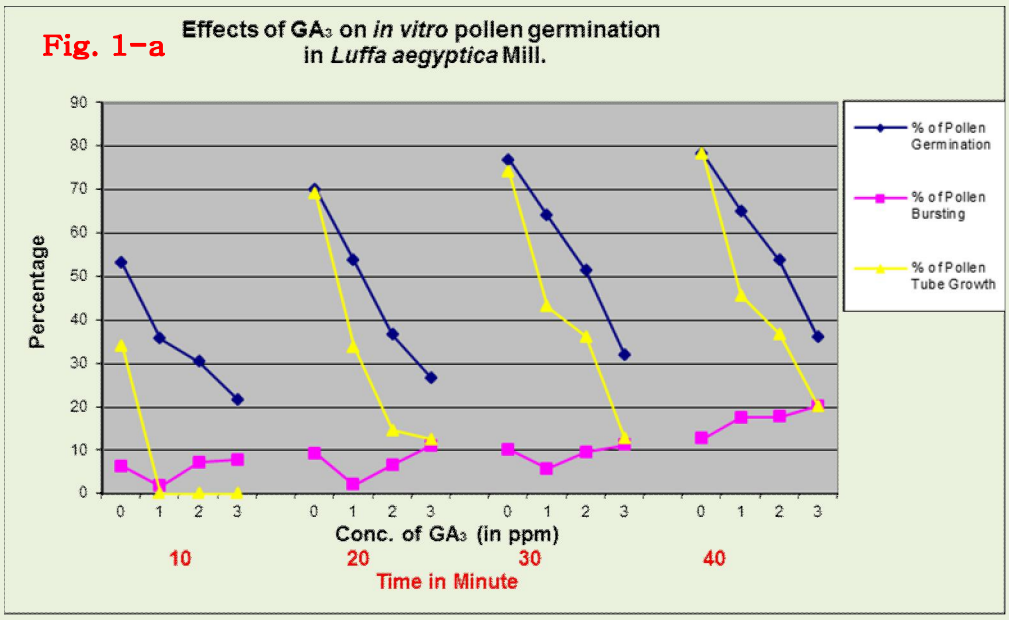
The flowers were collected during the dehiscence of anthers and the pollen grains were incubated in non-corrosive cavity dishes containing modified basal media having different concentrations of gibberellin (i.e. 1 ppm, 2 ppm, and 3 ppm). Reading from five replicates of each concentration were noted down at every 10 min interval upto 40 min. Later on the percentage of germinated pollen grains, pollen showing tube growth and pollen bursting are calculated and compared with control.

RESULTS AND DISCUSSION:

In *Luffa aegyptica* Mill. the modified culture medium (Brewbaker and Kwack, 1963) having 10% sucrose, 35mg/100ml $Ca(NO_3)_2.H_2O$ and 5mg/100ml H_3BO_3 and 20mg/100 ml $MgSO_4.7H_2O$ is used and the different concentrations of GA_3 i.e., 1 ppm, 2 ppm and 3 ppm are taken and their effects on pollen germination are studied.

In present study, the optimum percentages of germinating pollen grains (65.02%) and the tube growth (45.60%) with minimum percentage of bursting (17.60%) are reported at 40 min stage in the medium containing 1ppm GA_3. As concentration of

Fig. 1-a Effects of GA_3 on *in vitro* pollen germination in *Luffa aegyptica* Mill.



GA_3 in the medium increases from 2ppm to 3ppm, the percentage of germinating pollen grains (53.70% to 36.09%) and percentage of pollen showing tube growth (36.73% to 20.30%) gradually decreases. 1 ppm GA_3 proved to be good to get optimum result. However, in the control medium the percentage of pollen germination is more than that of in the

medium having 1 ppm GA_3. The percentages of pollen germination (78.43%) and pollen tube growth (78.43%) are maximum in the control medium. The percentage of bursting pollen grains (12.74%) is minimum in the control medium. As the time approaches from 10 to 40min, the percentage of pollen germination is also increases (Table 1 and Figure 1-a).

Pollen grains are rich in hormones, vitamins and amino acids (Stanley and Linskens, 1974). In *Luffa aegyptica* Mill., the effect of GA_3 was studied during pollen germination and tube growth. In this plant species, the optimum percentages of germinated pollen grains and pollen showing tube growth were found in the medium having 1 ppm GA_3. These were less than those observed in control. However, if the concentration of GA_3 increases in the medium, percentages of pollen germination and pollen tube growth and the length of pollen tube decrease. Similar results were also reported in *Muscat Bailey* A. (Kimura et al., 1996) and in *Datura metal* L. (Patel, 2002).At 10 min stage, not single pollen shows tube growth in the media having 1 to 3 ppm GA_3 in *Luffa aegyptica* Mill.

Stimulation of pollen tube growth by IAA, Kinetin, and GA_3 is reported in *Calotropis* (Shukla and Tiwari, 1973), *Annona* (Wee and Rao, 1979), and *Arachis* (Malik and Chhabra, 1978). However, IAA, 2, 4-D and Kinetin had no significant effect either on germination or on tube growth.

GA_3 acts as strong stimulator in pollen germination and tube elongation in *Abelmoschus esculentus* (Dabgar, 2002). Except ABA all other growth regulators (IAA, GA_3, Kn and Eth) increased both germination and tube growth at all the concentration used in *Cicer orientinum* (Setia et al., 1985).

According to Tosun and Koyuncu (2007), 10 ppm gibberellic acid was determined as promoter in pollen germination and tube growth of sweet cherries and lower concentrations (0.05) of GA_3 and boric acid also stimulated pollen germination and tube growth in apricot, while the higher concentrations had inhibitory effects (Bolat et al., 1999).

The observed inhibition of pollen germination of *Luffa aegyptica* Mill. by high concentrations of GA_3 is consistent with the result of previous studies(Sindhu et al., 1986; Singh et al., 2002; and Tosun and Koyuncu, 2007, Acar et al., 2010) in which high GA_3 concentrations have been shown to inhibit pollen germination and pollen tube growth.

In conclusion, *in vitro* pollen germination of *Luffa aegyptica* Mill. was greatly inhibited by increased gibberellic acid concentration in the germination medium.

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Table 1: Effect of Gibberellic acid on *in vitro* pollen germination in *Luffa aegyptica* Mill.

Sr. No.	Time in min	Conc. of Gibberellic acid in the B.M. in ppm.	*Luffa aegyptica* Mill.		
			Percentage of germinated pollen grains	Percentage of bursting pollen grains	Percentage of tube growth
1	10	0	53.16	6.32	34.17
		1	35.65	1.73	0.00
		2	30.40	7.20	0.00
		3	21.73	7.82	0.00
2	20	0	70.10	9.27	69.07
		1	53.79	2.06	33.79
		2	36.66	6.66	14.66
		3	26.77	11.02	12.59
3	30	0	76.85	10.18	74.07
		1	64.02	5.75	43.16
		2	51.41	9.60	36.15
		3	32.00	11.20	12.80
4	40	0	**78.43**	**12.74**	**78.43**
		1	**65.02**	**17.60**	**45.60**
		2	**53.70**	**17.68**	**36.73**
		3	**36.09**	**20.30**	**20.30**