

論 説

Effect of stigma and its extract on pollen germination

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Introduction

Many researches have already proved the marked effect of stigma or its extract on pollen germination. East and Park, (1918) and Richer (1902) claimed an acceleration of pollen germination in presence of stigma slice. Lidfors (1896), Sen and Verma (1959) and Raghavan and Barauan (1956) reported that the addition of stigma exudation or extract of stigma, style, or ovary to the culture medium favourably influences germination. Slices of fresh mature stigma and of adjacent tissue have been found to stimulate pollen germination in *Lilium longiflorum* (Rosen, 1959). Schmucker (1932, 1933, 1935) observed that pollen of *Nymphaea* hardly germinated in 1% glucose but showed satisfactory germination on addition of stigmatic extracts to the medium. He also observed after analysing the stigma extract, the presence of appreciable quantities of boric acid in it. With all these positive results of the influence of stigma slices or stigma extracts on the pollen germination, there are some discouraging observations. Sasaki (1919), Yasuda (1945) and Iwanami (1959) reported that there was no favourable influence of stigma on pollen germination, when they experimented on maize, *Petunia* and other species respectively.

To ascertain the positive or negative effect of stigma or its extract on pollen germination in our Indian plants, some experiments were conducted on the same line as those by the above workers.

Following plants were selected for the present study.

Materials and Method

- (1) *Solanum melongena* Linn.
- (2) *Momordica charantia* Linn.
- (3) *Cassia siamea* Lam.
- (4) *Murraya exotica* Linn.
- (5) *Tecoma stans* HBK.
- (6) *Vinca rosea* Linn.

This selection was done, from the species which were already studied for general pollen physiology (Saoji 1972). Pollen grains of these plants were obtained from anthers just after their anthesis, and stigmas were taken from castrated flowers when they just bloomed.

Following media were used to observe the effect of stigma and its extract on pollen germination. Observations were made by using hanging drop technique in the different media as under.

- (1) Control medium (in which best germination was obtained *in vitro*, which already studied in pollen physiology).
- (2) Distilled water with stigma scraping.
- (3) Distilled water with a small slice of stigma.
- (4) Stigmatic extract of one stigma (stigma was crushed thoroughly in minimum quantity of distilled water).
- (5) Stigmatic extract of two stigmas.
- (6) Stigmatic extract and control medium in equal proportions.
- (7) Stigmatic extract, 0.01 per cent boric acid and control medium in equal proportions.

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Experimental results

The data of percentage germination and length of pollen tube are presented in Table I.

It is clear from the table that stigmatic extract of two stigmas as well as the slice of stigma, enhanced pollen germination in case of *Solanum melongena*. Here it was noticed that the pollen germination was doubled and the pollen tube length was increased 4-5 times more as compared to the control, whereas with the addition of boric acid, a decrease in the percentage germination and tube length was observed. In *Momordica charantia* also, there was increase in the percentage germination and tube length, when a slice of stigma was introduced in the medium, while 0.01% boric acid proved ineffective. In the rest of the cases, stigma, its extract or boric acid had no stimulatory effect on pollen germination and many a time there was marked decrease in the percentage germination as well as in the tube length.

Discussion

From the present study, it is clear that the phenomenon of acceleration or retardation in pollen germination is due to the certain kind of substance present in stigma or stigmatic extract.

The composition of the stigma exudate varies with the species. It is shown by many worker that the substances chiefly found are of a lipid (Konar and Linskens, 1966; Martin, 1969) and phenolic glycosides (Martin, 1969; Martin and Brewbaker, 1969). Free sugars, amino acids, proteins and peptides commonly occur but in small amount (Konar and Linskens, 1966; Martin, 1968).

Calcium is reported in *Snapdragon* pistil (Masca-renhas and Machlis 1962). The stigma and style of many plants contain boron (Bertrand and Silberstein, 1938; Bobko and Zerling, 1938; Gartel, 1952; Thomas, 1952; Schmucker, 1932, 1933, 1935). On quantitative analysis it was found by them that pollen grains required almost the same concentration of boric acid as was present in stigmatic secretion for

satisfactory germination and tube elongation. Schmucker (1935) further observed that 0.001 or 0.01% boric acid promoted growth of pollen tube in number of plants. Polysaccharide of high molecular weight found in the stigmatic extract of Easter Lily (Labarca et al. 1969) promoted pollen germination and tube elongation in *Easter Lily* (Rosen 1964, Kroh et al, 1969).

While considering this problem in the present experiment on *S. melongena* and *M. charantia*, it was noticed that 0.01% boric acid has no stimulatory effect on pollen germination (as seen from the Table I) whereas the slice of stigma and stigmatic extract in control medium proved effective. It may be concluded from this that some chemicals other than boron are secreted from the stigma or are present in the stigmatic extract which are responsible for the enhanced growth.

In other cases, where the stigma slice, or its extract had no stimulatory effect, it may be that some unknown inhibitory factor might be responsible for these negative results. Further investigations are needed on this problem.

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TABLE 1.

Name of the plant	Percentage of germination and pollen tube length indifferent media.														Stigmatic extract with 0.01% borac acid and control medium	
	Control			Distilled water with stigma scraping		Distilled water with slice of stigma		Stigmatic extract of one stigma		Stigmatic extract of two stigmas		Stigmatic extract with control medium				
	medium	%	L	%	L	%	L	%	L	%	L	%	L	%	L	
<i>Solanum Melongena</i>	15%	SS	46.6	180	000	000	94	825	36.4	225	92.5	450	93.6	138	7.3	255
<i>Momordica charantia</i>	10%	SS	4	45	7.7	60	18.1	60	5.1	45	9	45	15.2	90	14.8	60
<i>Cassia siamea</i>	10%	SS	52	625	2.5	15	4.8	53	3.5	30	10	60	30.2	40	44	540
<i>Murraya exotica</i>	25%	SS	55.9	300	7.1	30	14.3	60	000	000	00	00	20.5	80	15	60
<i>Tecoma stans</i>	5%	SS	55.5	1,050	000	00	00	00	000	000	00	00	25.2	200	20.1	150
<i>Vinca rosea</i>	20%	SS	90	1,500	000	00	00	00	000	000	00	00	78	900	87.5	450

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