IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 9, Issue 12 Ver. II (Dec. 2016), PP 13-17
www.iosrjournals.org

Overcoming Styler Incompatibility of Triticumaestivuml.

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Abstract: *A study on incompatibility mechanism of Pollen of a boron resistant genotype on the styler tissues of boron susceptible genotypes in bread wheatshowed that the pollen of resistant genotype germinated on the stigmata of susceptible genotypes but the pollen tube growth did not continue beyond the stigma, when boron was sprayed on the florets of susceptible genotypes 48h before pollination and pollinated by the pollen of boron resistant genotype the pollen tube growth was normal leading to successful fertilization and grain formation. Thus boron spray helped in overcoming the styler incompatibility of boron susceptible genotypes.*
Methods: *Two boron susceptible and one boron resistance varieties were taken. Pollens of resistant type were dusted on the stigma of susceptible ones. After dusting florets were collected and fixed in aceto-alcohol. Styles and ovaries were stained in 0.1% cotton blue and recorded for result.*
Result: *Result showed that no pollen tubes of resistant × susceptible crosses penetrate the stylar tissues where as boron treated susceptible × resistance crosses penetrate the styler tissues and ultimately reached the ovules. Seeds were formed.*
Conclusion: *Application of boron can control the sterility of bread wheat. Its yield can be ensured by the boron spraying.*
Keywords: *Styler incompatibility, boron susceptibility, pollen tube growth, fertilization.*

I. Introduction

In terai region of West Bengal, India due to high rain fall and sandy texture of soil most of the micronutrients like boron leached through the soil zone as a result deficiency of this nutrient was seen. Due to this deficiency of boron in soil resulted into partial or almost incomplete grain filling in Mexican semidwarf wheat varieties (Ganguly, 1979, Chatterjee *et al*, 1980, Mandal and Das, 1988). These varieties were classified as boron resistant, moderately resistant and susceptible according to the response of boron. Study had been made that the pollen grains of several varieties of bread wheat growing in this region and reported normal germination of pollen grains on artificial medium (Mandal and Chakraborty, 1988). It had been reported the effect of boron in increasing fertility in wheat (Jost and Durman 1976). It had been found that pollen tube incompatibility in *Secale cereal* was due to callose deposition (Vithanage*etal*, 1980). Study had been made that penetration of styler and ovary wall by pollen tubes and observed that it was severely reduced due to presence of dominant allete of Kr locus (Stich and Snape, 1987) In view of the above facts, the study was undertaken to know the cyrological causes of incomplete grain filling in the spike and method of its overcoming in bread wheat varieties.

II. Materials and Methods

The available boron status of the soil was determined which was 0.31 ppm which was highly deficient. The pH of this soil was 5.6.Two boron susceptibility varieties namely HP 1209 and Janak and a boron resistant variety Sonalika were selected for the present study. Ten spikes were taken for each treatment and emasculation was made on the side of florets spike only. 20 ppm of borax (sodium borate) solution was sprayed on 50% of the emasculated spikes in Janak 48h before pollination. Fresh pollen from Sonalika was dusted on the stigmata of HP 1209 and Janak. After pollination florets of each spike were collected from the middle portion of the spike and fixed on aceto-alchol (1:3) at 3,6,9,15,24 and 48 h in the crosses HP 1209 × Sonalika and Janak × Sonalika. The florets from sprayed and unsprayed spike were fixed separately in the above solution at 24 and 48h after pollination.Cotton blue stain (0.1%) in lactophenol was used to study pollen germination and pollen tube growth by squash technique. Styles from each ovary were dissected and stained in cotton blue. 25 Pistils for each treatment were taken for recording observations.

III. Results

Results of the experiment showed that at 3rd hour pollentube growth continued through the stigmatic papillae (untreated condition) (Fig-1). At 6th hour the same growth continued (Fig-2). At 9^{th} and 15^{th} it was observed the same pattern of growth continued (Fig 3 & 4) in HP 1209 × Sonalika but at 24^{th} hour the growth was stopped (Fig.5) whereas in the cross Janak × Sonalika the germination percentage increased at 48th hour.

From the data it was seen that the rate of pollen tube growth in untreated cross HP 1209 × Sonalika declined after 6th hour. However, the tube growth was insignificant between 24 and 48 hr in Janak × Sonalika hybrid. Pollen tube growth was insignificant after 24 and 48 h in untreated condition but under treated condition there was significant difference of pollen tube length at 24 and 48 h after pollination.

IV. Discussion

There was a marked difference in styler tissue receiving pollen tubes between treated and untreated condition. When boron was sprayed in the florets on Janak and HP 1209 48h beforepollination the pollen grains germinated, tubes passed through the styler tissues and ultimately reached the ovule. As a result at 24h, 12 out of 25 pistils received germinating pollen tube on the varietal tissues. At 48th 40.0% ovaries were transformed into seeds. However, a few number of ovaries were yet in the stage of unfertilized condition. Out of 25 and 12 had germinating pollen tube on the stigmatic tissues and 6 of them crossed the styler tissues.The results indicated that pollen tubes of resistant genotype for boron deficiency could not penetrate the styler tissues of susceptible genotype except for a limited number, thus pollen tube growth is being restricted only to be the stigmata. But when boax was sprayed on the florets of another susceptible genotype (Janak) the pollen tubes of resistant genotype can successfully grow with the help of boron and as quickly as possible penetrate the styler tissues of susceptible genotype (Fig.

6). The penetration of pollen tube in the styles of Janak at 24h after pollination revealed the possibility of success of fertilization since double fertilization in wheat takes place in between 24 and 48 hrs (Brenchley, 1909). The formation of seeds at 48 hour with boron supplementation confirms the pollen tube penetration through the style and ovary and ultimately fertilization. Therefore, it may be concluded that pollen grains are not sterile and non functional but incompatible on susceptible genotypes. At the same time the incompatibility system is not present in the stigmatic tissue as most of the germinated pollen tubes passed through the stigmatic tissues andwere arrested in the styler tissues. On the other hand the incompatibility barrier at the style could be broken by means of borax spraying at lower concentrations. Korolkova [1976] also reported the effect of boron in increasing fertility in wheat. The present study also indicated that the boron not only induces pollen germination but also promotes pollen tube growth rate. The inhibition of pollen tube penetration through the susceptible styler tissues was due to defect in sugar translocation to the growing pollen tubes mediated by boron ((Gauch and Dugger, 1953)

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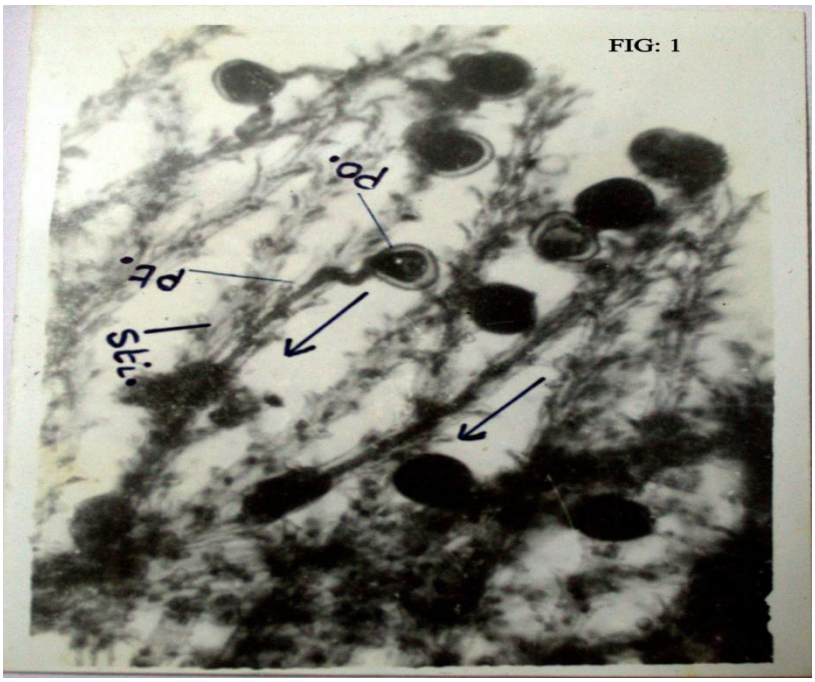
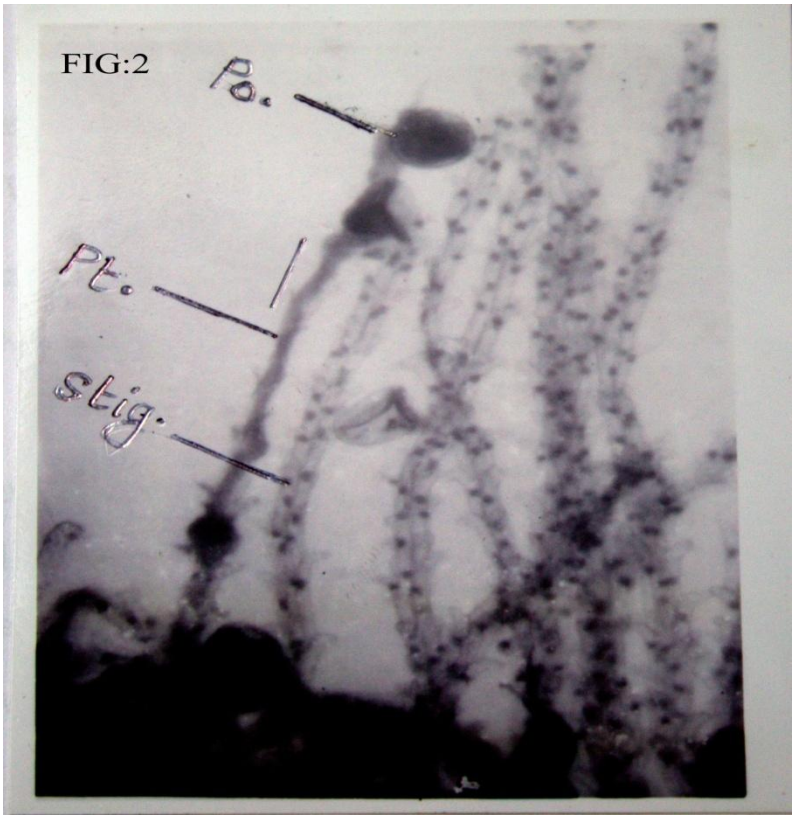
Table 1: Pollen germination, length of pollen tube and seed formation in different crosses of wheat

Cross	Hour	No. of Pistil	Pollen Germination (%)	Pollen Tube Length (μm)	No. of Seed Settings
HP 1209 × Sonalika	3	25	5.9	26.80 ± 1.40	-
	6	25	11.0	31.64 ± 1.63	-
	9	25	15.3	34.44 ± 1.55	-
	15	25	16.9	35.56 ± 1.00	-
	24	25	18.9	37.31 ± 1.34	-
	48	25	18.9	42.24 ± 2.57	-
Janak × Sonalika (without borax treated)	24	25	11.9	29.71 ± 2.51	-
	48	25	17.9	33.07 ± 3.12	1
Janak × Sonalika (borax treated)	24	25	21.4	37.21 ± 1.80	12
	48	25	21.6	43.04 ± 1.54	10

Figure Legends:
Figure -1Pollen tube at 3 hours after pollination in the hybrid HP1209 × Sonalika
Figure -2Pollen tube at 6 hours after pollination in the hybrid HP1209 × Sonalika
Figure -3Pollen tube at 9 hours after pollination in the hybrid HP1209 × Sonalika
Figure -4Pollen tube at 15 hours after pollination in the hybrid HP1209 × Sonalika
Figure -5Pollen tube at 24 hours after pollination in the hybrid HP1209 × Sonalika. Pollen tube just at the junction of stigma and style
Figure -6Pollen tube at 24 hours after pollination in the hybrid HP1209 × Sonalika (Treated)
Po. = Pollen Grain, Sti. = Stigma, Pt. = Polen Tube, Sty. = Style—Pollen tube pathway on the stigma or style





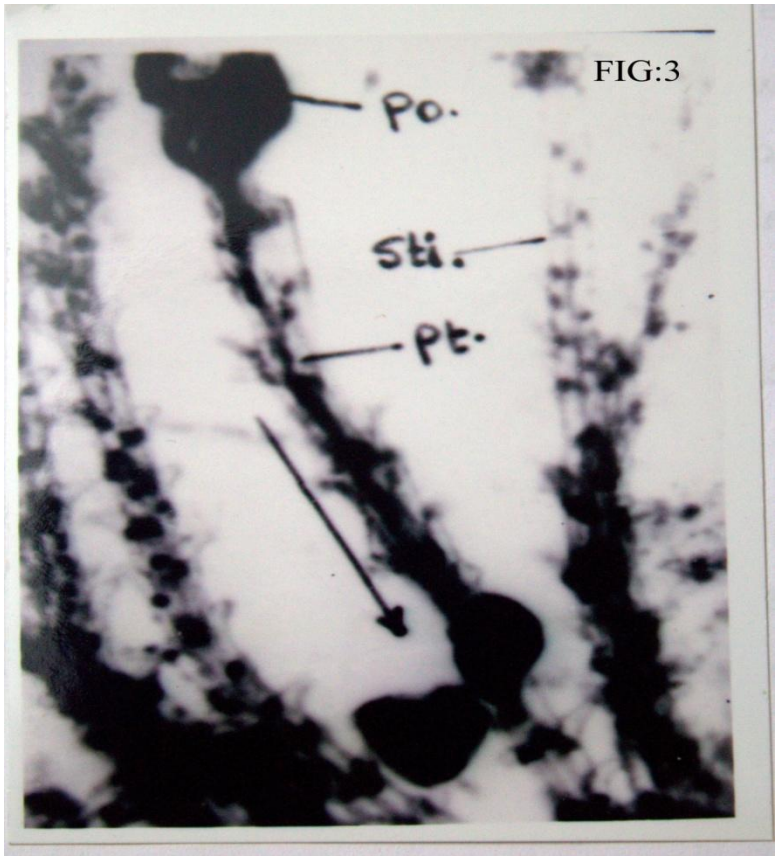


FIG:3

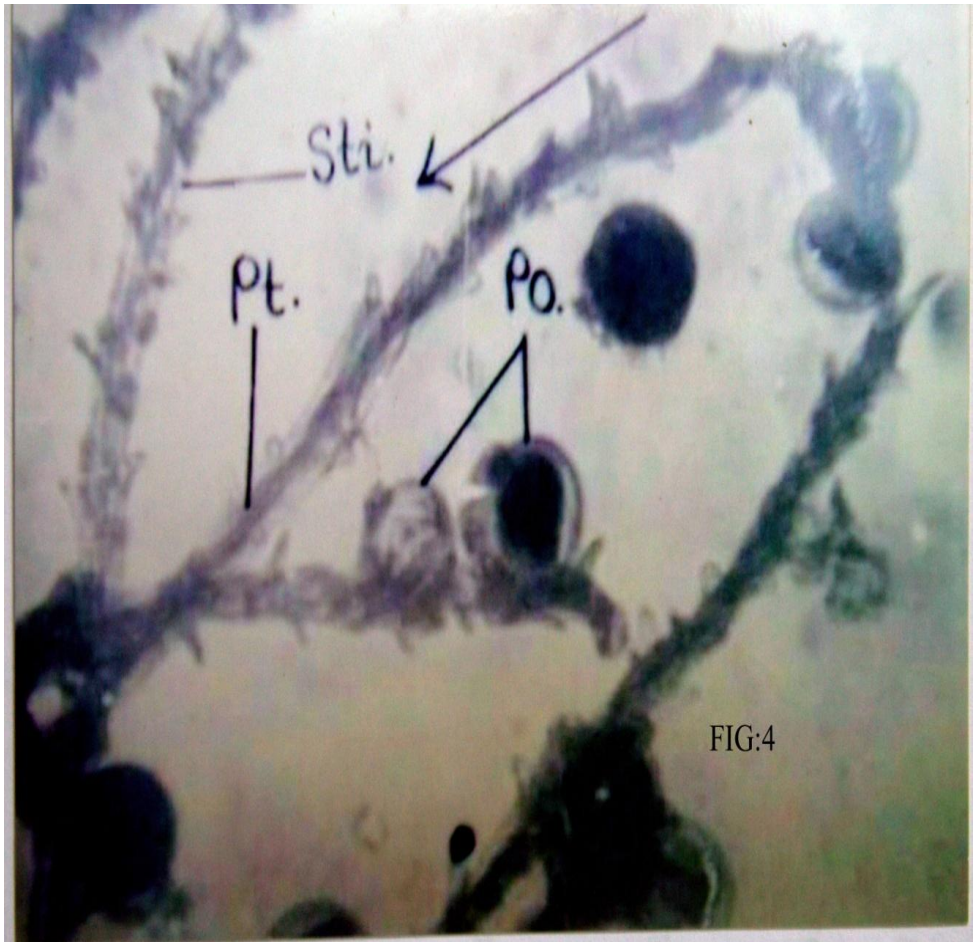


FIG:4

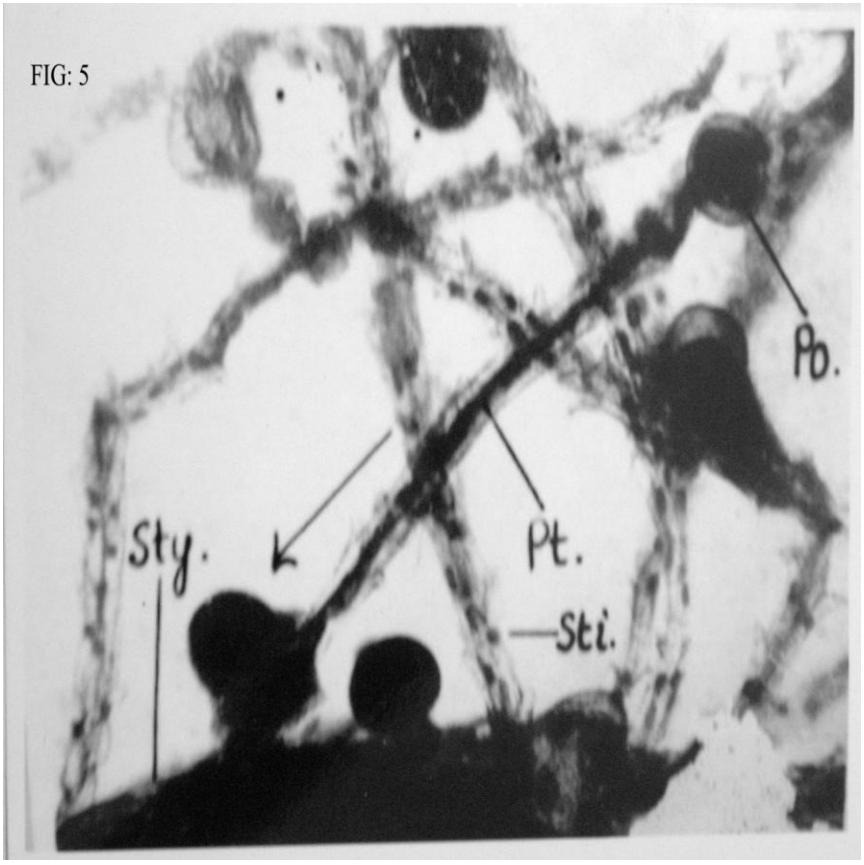
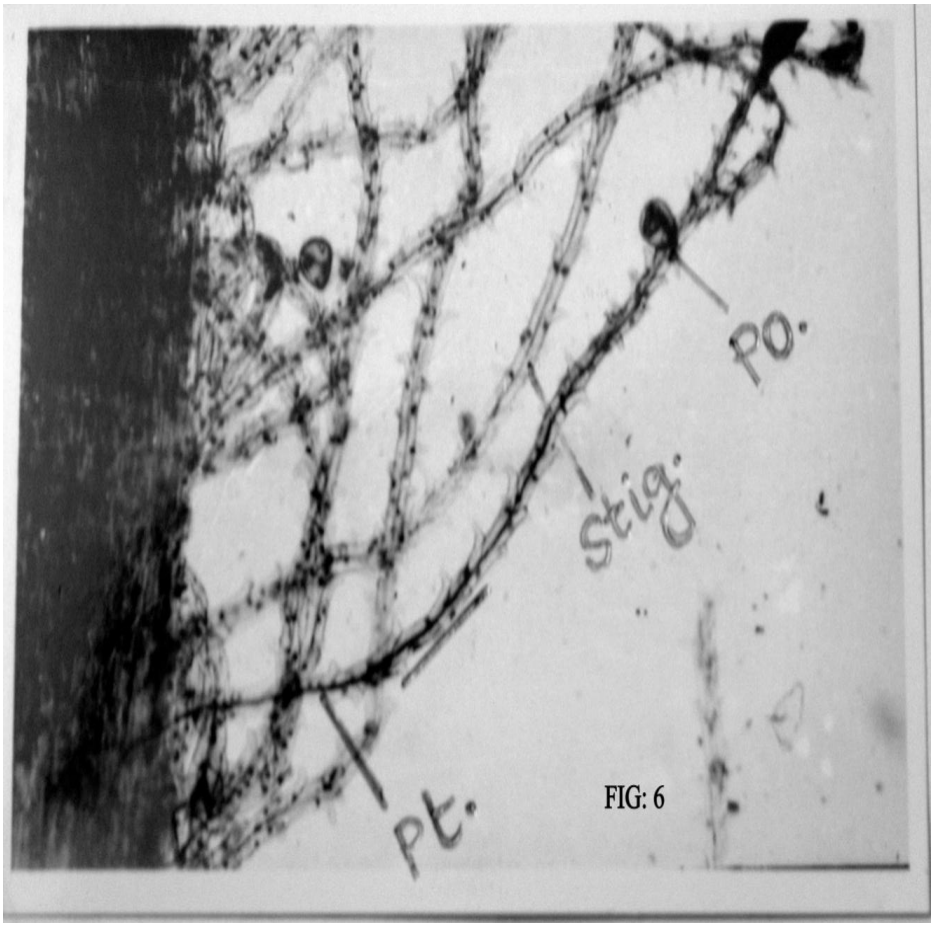


FIG: 5
Po.
Sty.
Pt.
Sti.


Po.
Stig.
Pt.
FIG: 6