SHORT COMMUNICATION

EFFECT OF PESTICIDES ON *IN VITRO* POLLEN GERMINATION AND GROWTH AND YIELD OF OKRA.

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PESTICIDES have become an essential part of plant protection. Among the vast number of plant protection chemicals some exhibit favourable effects such as better fruit set, seed set etc. Reports regarding the effects of pesticides on pollen germination are meagre[1-5]. This study is an attempt to elucidate some of the unusual features exhibited during *in vitro* pollen germination due to *in vivo* application of pesticides on okra.

Okra/bhendi (*Abelmoschus esculentus* Moench (L) var Pusa Sawani), a member of the family Malvaceae, was selected for the present study. Carbendazim 50 WP 0.05% and monocrotophos 36 WSC 0.1% were applied commencing from 35 days after sowing (DAS). For each treatment 60 m^2 size plot was selected and 30 plants were selected at random and marked for observations. Six applications were given at a 10-day interval. To analyse the effect of pesticides on the growth and development, observations on height of plants, number of leaves/plant, mean number of fruits/plant, mean weight of fruits/plant, mean number of seeds/fruit, and 1000 seed weight were made and details listed in table 1.

For *in vitro* pollen germination, pollen grains of okra were collected 2 hr after pesticide application from the field and germinated on standardized nutrient medium[6]. Counts of germination were taken within an hr after contact with the medium. A minimum of 100 pollen grains per slide and 3 slides per treatment were taken. The pollen viability, percent germination and unusual features, if any, were observed. Photomicrographs were taken with a Carl Zeiss binocular research microscope using 36 mm black and white Ilford FP4 film.

The results exhibit certain unusual features due to pesticide applications. For example, application of monocrotophos revealed multiple pollen tubes (figures 1 A, B). However, in carbendazim multiple pollen tubes were seen only occasionally and the nature of pollen tube and its growth varied exhibiting aberrations such as bursting of pollen tube tips and branching of pollen tubes (primary as well as secondary branching) (figures 1 C, D). Polysiphonous condition is a rare phenomenon in Malvaceae though it is quite common in Solanaceae. Salgare[4] in his evaluation of plant hormone MH and herbicides like 2, 4-D, 2, 4, 5-T, triazines etc for their pollenicidic effects on ornamental chillies at the post-flowering stage at very low dosages (10 to 100 ppm) noticed pollen tube deformities. He stated that monosiphonous and trisiphonous condition as a common feature in *Catharanthus roseus* (= *Vinca rosea*). However,

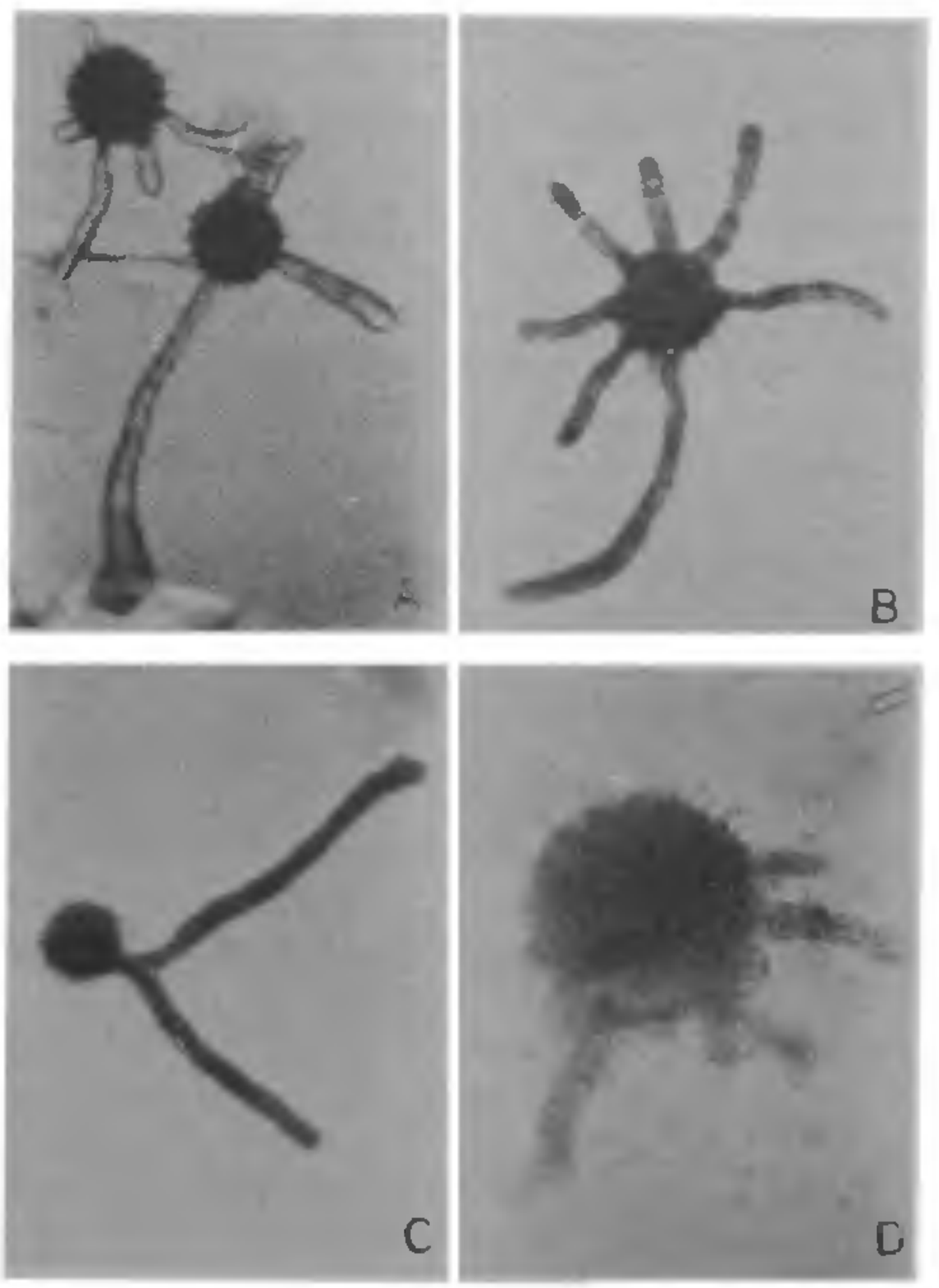

Figure 1. Germination of okra pollen grains exhibiting unusual characteristics revealing **A–B.** Multiple pollen tubes when treated with monocrotophos *in vivo* (A × 32; B × 40). **C.** Primary branching of pollen tube in carbendazim treated pollen grain (× 32). **D.** Germination of pollen as affected by carbendazim treatment revealing multiple pollen tubes and branching of pollen tubes (× 100).

Table 1 *Effect of pesticide applications on growth and yield of okra*

Parameters analysed	Control	Carbendazim 0.05%	Monocrotophos 0.1%
Mean height of plants (cm)	87.0	80.2	92.2
Mean no. of leaves/plant	10.3	10.8	12.7
Mean no. of fruits/plant	6.5	7.4	10.2
Mean no. of seeds/fruit	28.9	25.4	21.6
Mean wt. of fruits/plant (g)	58.4	47.6	58.3
1000 seed wt. (g)	53.9	51.6	60.1

Sudhakaran[7] stated that in *C. roseus* (= *V. rosea*) tetraploid grains frequently produce more than one pollen tube. He noticed branching of pollen tubes in higher concentrations of sugar. In the present study a close correlation between the nature of pollen tube formation, seed set and seed quality has been noticed. It was observed that in monocrotophos treatments there was multiple pollen tubes, better fruit set, and seed quality (table 1). Thus the multiple tubes appear to enhance the chances of fertilization. However, only histological studies revealing the movement of the pollen tube through the stigma and style can provide conclusive result to this aspect.

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OCCURRENCE OF ENDOTROPHIC MYCORRHIZAL FUNGUS IN AGARWOOD PLANT *AQUILLARIA AGALLOCHA* (ROXB)

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OIL from agarwood is used in the perfumery industry as retainer of scents. The oil is considered to be a pathological product produced by fungal invasion of the host. Study of plant/fungal association showed a vesicular arbuscular mycorrhizal (VAM) fungus in roots.

Randomly selected pieces of thin lateral roots were washed, cut into small pieces and cleared by autoclaving in 10% KOH at 5 psi for 10 min and treated with dil. HCl, washed, bleached with H_2O_2 and stained with 0.1% trypan blue[1] for assessing the degree of infection. One cm root bits were mounted on slides and the length of the piece containing the endophyte was recorded[2].

Vesicles were abundant in the entire infected roots, about 3–4 per field (16 × 10), spherical to elliptical 10 μm dia to 13 × 6 μm in size, deeply stained. Some vesicles contained young spore and hyphae running parallel to the long axis of the roots, inter- and intracellular measuring 3.0 μm. No difference was noted in the width of the external and internal hyphae. The root pieces were infected to an extent of 75% of their length. Only the fine lateral branches of the roots, showed the endophyte. In older segments, it was absent or sparsely distributed.

Mycorrhizal associations are of particular importance to plants in nutrient poor soils or at high elevations[3,4]. It has been reported that VAM infection has some relationship with the predisposition of the plant to disease[5]. The VAM symbiosis with *A. agallocha* and quantitative evaluation of oil production in different localities are subjects for future investigation.

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