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A CASE OF FUNCTIONAL MALE STERILITY IN *SOLANUM INSANUM* L.

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ABSTRACT

Functional male sterility was recorded in a plant of *Solanum insanum* L., a weedy relative of eggplant, *S. melongena* L. The plant showed regular bivalent formation during microsporogenesis, high pollen viability, and normal fruit and seed set on artificial self-pollination. But the anthers were indehiscent and the pollen grains degenerated within the anther locules.

Key words: *Solanum insanum* L., functional male sterility.

Male sterility caused by the inability of anthers to dehisce and release the otherwise normal pollen grains has been referred to as "functional male sterility" [1]. In the genus *Solanum*, functional male sterility has been previously reported in *S. melongena* [2]. The present communication reports the occurrence of this phenomenon in a related species, *S. insanum* L. A functional male sterile plant was observed in a collection of this weedy species grown in the N.B.P.G.R. experimental field.

MATERIALS AND METHODS

Plants from over 60 collections of *S. insanum* were evaluated for various vegetative and reproductive characters. Observation for flower traits during October–November led to the detection of a plant with indehiscent anthers. This plant was studied for microsporogenesis, pollen viability and anther structure. Microsporogenesis was studied from pollen mother cells of freshly harvested anthers smeared in a drop of 1% aceto-orcein. Pollen viability was determined by the FDA test [3]. Details of the anther structure were observed by light and scanning electron microscopy (SEM). For SEM, the anthers were critical point dried, mounted on brass stubs and coated with a thin film of gold using JEOL Ion Sputter JFC-1100. The gold coated anthers were viewed with a JEOL JSM-840A scanning electron microscope at an accelerated voltage of 15 kV.

RESULTS AND DISCUSSION

In plants with normal pollen release, anther dehiscence took place on the day of anthesis. In an undehisced anther, the location of aperture was marked by a brown line running along its tip and to some length along the two sides. This brown line was probably formed by the death and dessication of the cells of anther wall. Under SEM, this line appeared as a depression (Fig. 1) with dehiscence taking place at the anther tip by the rupture of walls within the depressed area (Fig. 2). Widening of this opening resulted in the "apical pore" (Fig. 3), the characteristic mode of anther dehiscence in *Solanum* spp. [4]. Withering of the anther, initiated from its apex, started from the third day of anthesis.

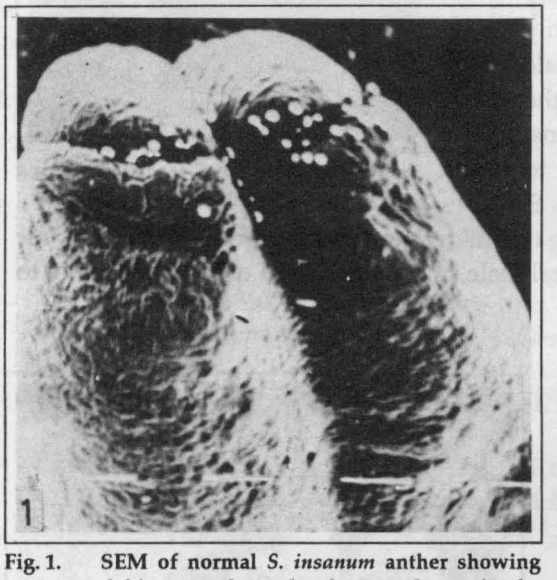

Fig. 1. **SEM of normal *S. insanum* anther showing dehiscence along the depressed area in the anther tip. Bar = 100 μm.**

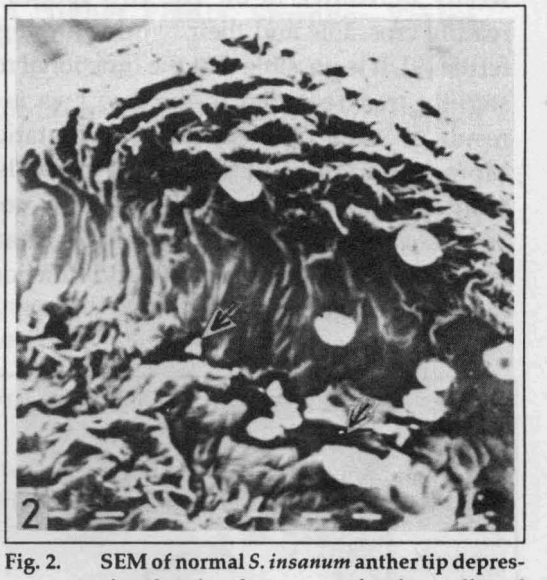

Fig. 2. **SEM of normal *S. insanum* anther tip depression showing the rupture of anther walls and the release of pollen grains. Bar = 10 μm.**

In a plant of accession No. IC-3291, the anthers remained undehisced till at least the fourth day of anthesis (Fig. 4). Male meiosis was normal with 12 bivalents at metaphase I and regular 12:12 anaphase I segregation. At anthesis, viability of the pollen, obtained by tearing open the anthers, was 66.1%. This pollen, when used for self-pollinating the plant, resulted in normal fruit and seed set. These results indicated that the pollen as well as the pistil were functional. Observation of the anthers by SEM revealed that, like the normal anthers, these too had a depressed channel-like area at their tips (Fig. 5). But the anther walls did not rupture for 3–4 days after anthesis and, consequently, the anther locules remained closed. By fifth day after anthesis, when the anthers had more than half withered, some rupture in their walls was observed, thus, providing a chance for the pollen to escape. But,

by then the pollen had degenerated with the viability dropping to 12.5%. Thus, the plant was effectively a male sterile due to the indehiscence of anthers.

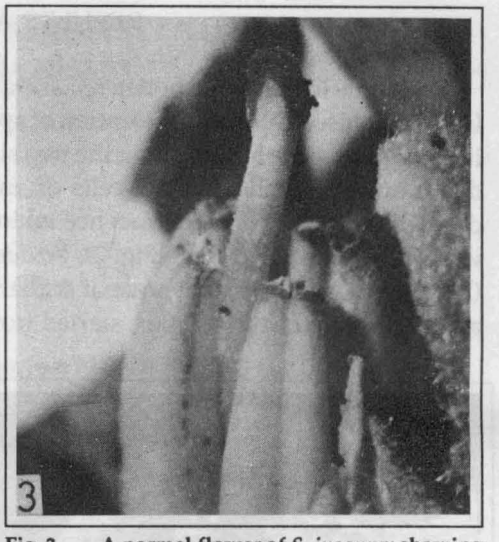

Fig. 3. A normal flower of *S. insanum* showing fully dehisced anthers.

Functional male sterility in eggplant (*S. melongena*) is known to be controlled by a recessive gene [5]. *S. insanum* is closely related to *S. melongena*, the former having been regarded as the latter's immediate ancestor or a weedy derivative [6–8]. The two species are readily crossable and their hybrids are highly fertile [9]. It is possible that the functional male sterility trait recorded in the two taxa is the result of same or identical gene mutations. More importantly, it should be possible to transfer this trait from *S. insanum* to *S. melongena*, which can be exploited for raising commercial eggplant hybrids. Hybrid vigour is well known in eggplant [10] and functional male sterility has been used successfully to raise hybrids in tomato [1].

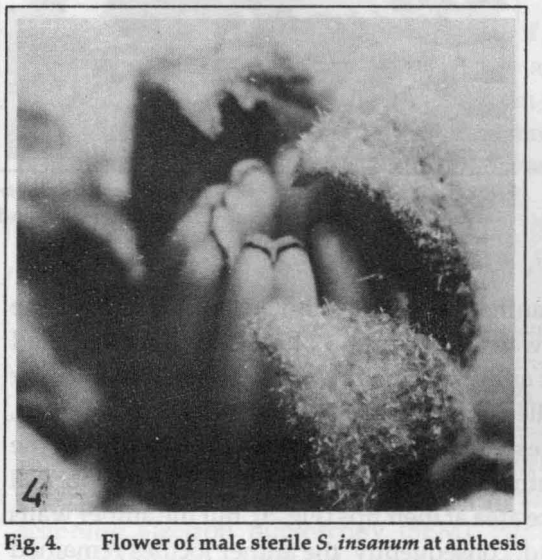

Fig. 4. Flower of male sterile *S. insanum* at anthesis with petals and pistil removed to fully expose the anthers. Note the indehiscent anthers.

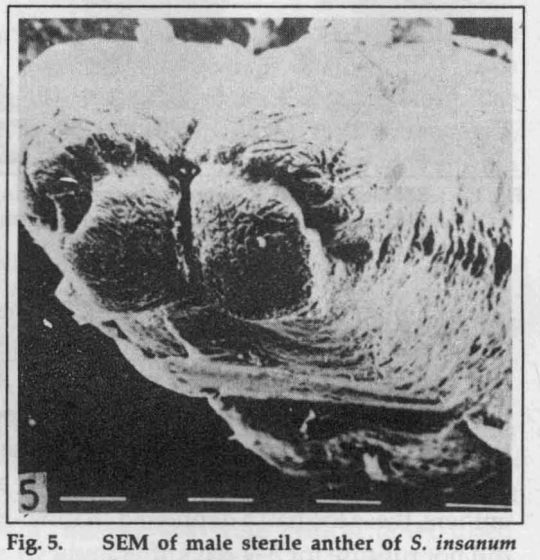

Fig. 5. SEM of male sterile anther of *S. insanum* showing the tip with depression but no rupture of anther walls. Bar = 100 μm.

ACKNOWLEDGEMENTS

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