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Male sterility in *Plantago ovata* Forsk.

Male sterility has been reported in several plants like maize, sorghum, rice, wheat, beans, brassicas¹, *Plantago ovata*^{2,3}. However, no detailed investigations have so far been done on this aspect in *P. ovata*. The species is economically important as its seed husk called isabgol in Hindi and blond psyllium in English, is a highly effective laxative. Besides this, it has many other commercial applications and is exported to several foreign countries, fetching our country foreign exchange worth several crore rupees annually.

During the present study, detailed investigations on male sterility in the species were conducted. The seeds of *P. ovata* were sown in experimental plots and the morphological observations

were recorded on 674 plants. Pollen viability, pollen ovule ratio, stigma receptivity, seed set, male and female biomass were studied by following the methods of several researchers^{4,5}. Studies on breeding system of this species enabled us to classify them into three broad categories:

- i) Male fertiles (hermaphrodites) 97%: high pollen fertility and low seed set.
- ii) Male steriles (females) 0.7%: very high seed set.
- iii) Partially male steriles (intermediate types) 2.2%: low pollen fertility and moderate seed set.

Although three types of plants resemble each other morphologically, they vary with respect to their reproductive

features (Table 1). The size of pistil, stigma, ovary and ovule show an increasing trend in the male sterile plants while the partially male sterile plants show intermediate values.

Such populations where the male fertiles transmit genes both through ovules and pollen, whereas male steriles contribute to the next generation only through ovules are called gynodioecious populations. For male steriles to be maintained in a population, their lack of male function has to be compensated for by a higher female fitness, i.e. higher seed production and/or production of offsprings of higher quality. Male steriles have been observed to produce more seeds than male fertiles⁶. The same holds true in *P. ovata* as well. Two main hypotheses have been formulated to explain higher female fitness in gynodioecious populations⁷⁻¹⁰. The first hypothesis applies to self-compatible species that show inbreeding depression and states that females are at an advantage because their flowers are all out-crossed, while the seeds formed by hermaphrodites are at least partly likely to be the product of self-fertilization. The second hypothesis is essentially a resource allocation argument which states that since the male steriles lack a male function, they are able to allocate more resources to seed production than the male fertiles. *P. ovata* being self-compatible, both these mechanisms may be occurring simultaneously in this species.

Table 1. Reproductive features of three types of plants in *Plantago ovata*

Character	Fertile	Partially male sterile	Male sterile
Anther size (mm)			
i) Length	2.06 ± 0.15	1.34 ± 0.46	1.43 ± 0.16
ii) Breadth	1.20 ± 0.22	0.78 ± 0.96	0.36 ± 0.08
Stigma length (mm)	4.75 ± 0.51	6.44 ± 1.09	7.98 ± 0.72
Ovary length (mm)	1.06 ± 0.18	1.09 ± 0.12	1.11 ± 0.24
Ovule length (mm)	0.85 ± 0.10	0.84 ± 0.08	0.92 ± 0.06
Seed size (mm)			
i) Length	2.06 ± 0.15	2.57 ± 0.37	2.85 ± 0.25
ii) Breadth	1.20 ± 0.22	1.37 ± 0.20	1.46 ± 0.13
Seed set/spike	78.98 ± 20.8	86.62 ± 8.43	91.82 ± 6.88
Seed weight/100 seeds (mg)	162.00 ± 22.2	179.7 ± 26.8	181.20 ± 29.4

Intermediate plants (with a partially reduced male function) have been observed in many gynodioecious species. The fitness of the intermediates can be useful for the maintenance of male sterility under some genetic models^{11,12}. The frequency, seed and pollen output of intermediate plants have seldom been studied^{12,13}. Utility of PMS plants in *P. ovata* in maintenance of gynodioecy is being investigated at present.

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MEETINGS/SYMPOSIA/SEMINARS

Xth International Congress of Immunology

Date: November 1998
Place: New Delhi

The Congress themes include: Immunocyte development, Immunocyte activation, Effector immune mechanisms, Immunity and disease and Beneficial aspects of immunology.

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FAO Workshop on Sustainable Beekeeping Development and All India Honey Festival

Date: 25-29 May 1998
Place: Dharwad

The Workshop topics include: Income generation from beekeeping and honey hunting, TSBV disease and its control, Worthwhile beekeeping with *Apis cerana*, Queen rearing in *Apis cerana*.

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