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Study of fertility in the varietal populations of *Eruca sativa* L. and their hybrids

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Abstract

Fertility, in terms of seed set was studied in three varietal populations of *Eruca sativa* L. and their three hybrids. The population varied greatly among themselves in mean number of ovules/pistil, mean number of seeds/siliqua and fertilization value. Normally the hybrids had significantly higher mean than their respective parents in these parameters. It was concluded that seed set in *Eruca sativa* L. appears to be a function of the genotype. The marked increase in this trait among the hybrids is a case of heterosis, and fertility is perhaps related with heterozygosity.

Keywords: *Eruca sativa* L., Fertility, Heterosis, Varieties.

Introduction

Eruca sativa L. is an edible plant, commonly known as rocket plant or arugula. It belongs to family Brassicaceae. It typically grows on dry, disturbed ground. It is an annual plant growing 20-100 cm. in height, leaves are deeply pinnately lobed with four to ten small lateral lobes and a large terminal lobe. A compound named 4-isothiocyanatobutyl is present inside the plant due to which it behaves like a pesticide. The rocket species are native to Central and Southern Europe, but have also been spread to Northern America. *Eruca sativa* L. is of great economic importance as the whole plant is used in different ways. It is used as a leafy vegetables and open lettuce. It is rich in vitamin 'c' and potassium. In addition to the leaves the flowers, young seed pods and mature seeds are all edible.

Seed set is a character of paramount importance to plant breeders. Therefore, it is essential, at least in case of cross-pollinating crops like *Eruca sativa* L. to know the genetics controlling this character. The number of ovules in the pistil may be regarded as an important component for fertility as they develop into seeds after successful fertilization. In fact, seed set depends upon the ability of these ovules to get fertilized with the pollens. There are some reports in seed set in crucifers (Dayal, 1975; Kumar and Dayal, 1986; Prasad, 1990; Prasad and Shrivastava, 1993) [1-4]. The present work has been undertaken in order to understand the characteristics of seed formation in *Eruca sativa* L.



Fig: *Eruca sativa* L.

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Material and Methods - Three varietal populations of *Eruca sativa* L. viz., TMLC, RTM-314, L.V. (local variety) and their six F₁ hybrids TMLC X L.V.; TMLC X RTM-314; L.V. X RTM-314; L.V. X TMLC; RTM-314 X L.V.; RTM-314 X TMLC constituted the material for the present investigation. Altogether 200 pistils, 10 from each of 20 plants in each variety and hybrids were studied to score mean number of ovules/pistil (MNO), and mean number of seeds/silique (MNS) was based on the study of 200 siliques, 10 from each of 20 plants in each variety and hybrid. Fertilization Value (FV %) was computed by the following formula –

$$\frac{\text{Mean number of seeds/silique}}{\text{Mean number of ovules/pistils}} \times 100$$



TMLC

RTM-314

L.V.

Results And Discussion - The populations varied considerably among themselves in MNO and MNS (Table 1). TMLC demonstrated the highest MNO and MNS, while L. V. exhibited the lowest mean for both and differed significantly from all others. Numbers of ovules in the ovary ranged from 19 to 40. All the three varieties differed considerably in their mean number of ovules. Populations also differed greatly from each other in FV. Lowest FV was the characteristic for L.V.

The hybrids differed significantly from each other in MNO. All of them had significantly higher mean than their respective parents. L.V. X TMLC exhibited the lowest value for both MNO and MNS. Among the hybrids, number of ovules ranged from 22 to 48 and the seeds in silique from 1 to 46. TMLC X L.V. varied significantly from all others in MNS. FV was found greater than their respective parents in all the hybrids except L.V. X RTM-314.

Fertility is a complex character. It is the ultimate product of interaction among a number of quantitative characters which are known to be controlled by different sets of polygenes. It depends on a number of biological processes right from the development of the reproductive organs to the fertilization and embryogeny.

Differences in MNO among the varietal populations indicate their genotypic peculiarities. There are populations with low as well as high number of ovules. It has been shown that the reduced fertility in the inbred lines of radish (*Raphanus sativus* L.) is due to a considerable reduction in FV in comparison to their original populations and the F₁ hybrids; and the ovules of the inbred lines were found functionally less efficient than their original populations and the F₁ hybrids (Dayal, 1975) [1]. A cytoembryological study of the inbred lines, their original populations and F₁ hybrids, have shown a significant reduction in mean tapetal areas, significant variation in the number and distribution of nuclei in the tapetal cells and marked aberration in the embryosac

development in the inbred lines when compared to their original population and F₁ hybrids and it was concluded that the structural abnormalities in tapetum and embryosac development must have contributed greatly to the reduction of fertility in the inbred lines of radish (Kumar and Dayal, 1986) [2]. Different varieties of radish differ genotypically among themselves in MNO, MNS & FV under two modes of pollination (Prasad and Dayal, 1993) [5]. The increasing dose of gamma radiation gradually reduce the FV and seed setting in turnip (Prasad, 1990) [3].

The present investigation indicates that various populations of *Eruca sativa* L. differed remarkably from each other in MNO as well as MNS and thus in FV. In contrast to the varieties, the F₁ hybrids showed noticeable increase in MNO, MNS and FV which may be attributed to heterosis due to increased heterozygosity in them. Seed set in *Eruca sativa* L. appears to be a function of the genotype. The marked increase in seed set among the hybrids is a case of heterosis and the fertility, in terms of seed set, is perhaps related with heterozygosity.

Table 1: MNO, MNS and FV in varietal populations of *Eruca sativa* L. and their F₁ hybrids

Materials	MNO	MNS	FV %
1 TMLC	33.3	30.02	90.15
2 RTM-314	24.93	22.19	89.00
3 L.V.	19.66	16.04	81.58
4 TMLC X L.V.	39.06	35.67	91.32
5 TMLC X RTM-314	32.72	31.64	96.69
6 RTM-314 X L.V.	31.05	28.34	91.27
7 RTM-314 X TMLC	27.08	24.21	89.40
8 L.V. X TMLC	23.82	21.56	90.51
9 L.V. X RTM-314	22.77	19.32	84.84

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