EVOLUTIONARY SIGNIFICANCE OF POLLEN TO OVULE RATIO – A STUDY IN SOME PULSE CROPS

DURING the process of selection, under domestication many undirected but unavoidable changes have been occurring in plants widening the gap between the domesticates and their wild relatives. These domesticate-evolutionary trends may show up either in the vegetative parts of the plant or in the reproductive structures or very commonly in both[1]. However all these changes have been tuned towards a risk free or assured growth under domestication. As a consequence, the plants may have lost or tried to conserve their expendable energy in the process of bringing these changes[2].

Reproductive strategy provides an example where this phenomenon is found to operate. Through domestication, which is associated with the decrease in risks, there has also been a shifting tendency in the reproductive strategy of crop plants[3]. Increased number of pollen per ovule than what is actually needed may be one such process where wild types are expected to produce more than domesticate ones, to stand upto greater risks in their habitats.

This hypothesis was tested experimentally in various crops in four genera comprising of a few cultivated species of pulses and their related wild types or species. A particular species was designated wild, semidomesticated or highly domesticated following Smartt[1]. The number of pollen grains in an anther was counted by squashing individual anthers in 1% acetocarmine stain. A sample of 20 anthers was taken from flowers selected at random of healthy plants grown in pots. The pollen to ovule ratio (P/O) was then computed for each of the species/types using the formula—

P/O = Pollen number per Anther × Anther Number/Number of Ovules per flower

The number of anthers per flower was 10 in all the cases, and the number of ovules was ascertained by counting the number of ovule primordia in the pistil.

The four genera studied, all being autogamous, namely—*Macrotyloma*, *Phaseolus*, *Vigna* and *Glycine* showed similar and parallel trend in the pollen number/anther and pollen to ovule ratio from their wild to domesticated species (Table I). For instance, *Macrotyloma accilare*, a wild species of the highly domesticated *Macrotyloma uniflorus* had twice as high a pollen to ovule ratio as the latter. The latter, an ideal domesticate (as defined by Smartt) is a highly determinant crop with complete annual habit. The semi-domesticate type of *Macrotyloma uniflorus* possessed a P/O ratio in between its highly domesticate type and the wild species.

TABLE I

Pollen number per anther and Pollen to ovule ratio in a few wild and domesticated species of pulses

Sl. No.	Species		Pollen/Anther*	No. of ovules	Pollen : Ovule* ratio
1.	(i) *Macrotyloma uniflorus*				
	(*a*) Determinate	(D)	87·54	5	175·08
	(*b*) Indeterminate	(SD)	140·10	6	233·33
	(*c*) *Macrotyloma accilare*	(W)	248·00	7	354·28
2.	(i) *Vigna sesquipaedalis*	(D)	908·10	20	454·05
	(ii) *Vigna sinensis*	(D)	559·80	12	466·50
	(iii) *Vigna repens*	(W)	1308·75	11	1189·77
3.	(i) *Phaseolus radiatta*	(D)	505·00	10	505·00
	(ii) *Phaseolus mungo*	(D)	505·00	10	505·00
	(iii) *Phaseolus calcaratus*	(SD)	793·25	8	991·56
	(iv) *Phaseolus atropurpureus*	(W)	3377·50	15	2251·67
	(v) *Phaseolus trilobus*	(W)	3764·00	15	2509·33
	(vi) *Phaseolus panduratus*	(W)	1072·00	8	1340·00
4.	*Glycine max*				
	(*a*) Jupitore variety	(D)	225·00	3	750·00
	(*b*) Black Kulti	(SD)	377·00	3	1256·67

D = Domesticated; SD = Semi-domesticated; W = Wild.

* All the variations are significant at 1% level of significance (Analysis carried out for each genus separately).