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Breeding behaviour of triploids in back crosses with *Arachis hypogaea*

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Abstract: The diploid (2n=20) wild species of *Arachis* are the potential sources of resistance to many pests and diseases. The diploid wild sp. *A. cardenasii* was hybridized with CV. VRI 2 of *A. hypogaea* (2n=40). The resultant triploids (2n=30) were partially fertile. The pollen of the triploids were utilised for back crossing again with *A. hypogaea*. There were three distinct form of plants obtained in BC_1F_1. The pollen of the BC_1F_1 were utilized for back crossing again with *A. hypogaea*. The resultant BC_2F_1 were studied. The complete fertility restoration was observed in form I in the immediate back cross, whereas it was observed in the second back cross in form II. Hence, triploids is also a potential source for genetic introgression in groundnut. *(Key words: Groundnut, Triploid, Back cross, Fertility).*

Yield losses in groundnut is common due to many diseases and pests. Wild relatives of crop species have been found to be potential sources of a number of desirable characters, especially resistance to diseases and pests (Knott and Dvorak, 1976). Number of such wild species exist in the genus *Arachis*. The genus has been divided into seven sections based on morphological affinities and cross compatibility (Gregory *et al.* 1973). Among which the section *Arachis* comprises the cultivated tetraploid species, *A. hypogaea*, and a number of compatible diploid wild species. The diploid species are good sources of resistance to many diseases, such as rust, leaf spots (Subrahmanyam *et al.* 1983); insect pests, such as thrips and aphids (Amin, 1985).

While the diploid wild species of section *Arachis* was hybridized with tetraploid *A. hypogaea*, the resultant triploid hybrids were partialy fertile. It may be due to unequal chromosome segregation resulting in the formation of haploid to hyperdiploid gametes and spindle breakdown resulting in the formation of restitution nuclei and unreduced gametes. Fertilization between such viable gametes results in the partial fertility of triploids. The gametic fertility of triploids suggests that they can also be used directly in back crossing to recipient cultivars to obtain pentaploids (Simpson and Davis, 1983) and also tetraploid *A. hypogaea like* progenies as in wheat (Kerber and Dyck, 1973). So, the triploids is a potential source for the genetic improvement of groundnut. The present study was conducted to understand the breeding behaviour of triploids in back crosses.

Materials and Methods

A diploid (2n=20) wild species *A. cardenasii* belonging to section *Arachis* was selected for the study. It belongs to perennial group and is prostrating in habit. It is highly resistant to rust, early and late leaf spot diseases, and sucking pests *viz.* thrips and leafhopper (Stalker and Moss, 1987). The cultivar VRI 2 of *Arachis hypogaea* L. (2n=40) was utilized as female parent and hybridized with the pollen of *A. cardenasii* during summer 1995 season at Regional Research Station, Vridhachalam . The crossed seeds were raised during *kharif* 1996 season. The resultant triploid (2n=30) hybrids were studied. During summer 1997 season the pollen of the triploid plants were utilized for back crossing with CV. VRI 2 of *A. hypogaea*. During *kharif* 1997 season the BC_1F_1 generation was studied and the pollen were utilized for second back crossing with VRI 2. The resultant BC_2F_1 plants were studied during summer 1998 season. The schematic representation of the crosses are presented in Fig. 1.

Results and discussion

The triploid plants were vigorous, prostrating with profuse branches. The morphological traits recorded are presented in Table 1. There were abundant flowers in the triploids, however, the peg formation was rare. The pollen fertility was only 12.5 per cent. The pods of triploids were resistant to foliar diseases *viz.*, rust and late leaf spot diseases as was also observed by Company *et al.* (1982). The pollen of the triploids were utilized, for hybridization with VRI 2 of *A. hypogaea*. In BC_1F_1 three forms of plants were obtained (Table 2).

BC_1F_1 (Form I)

Three plants were obtained in this category. The vigour of the plants was much reduced and hence the plants were compact. The branches

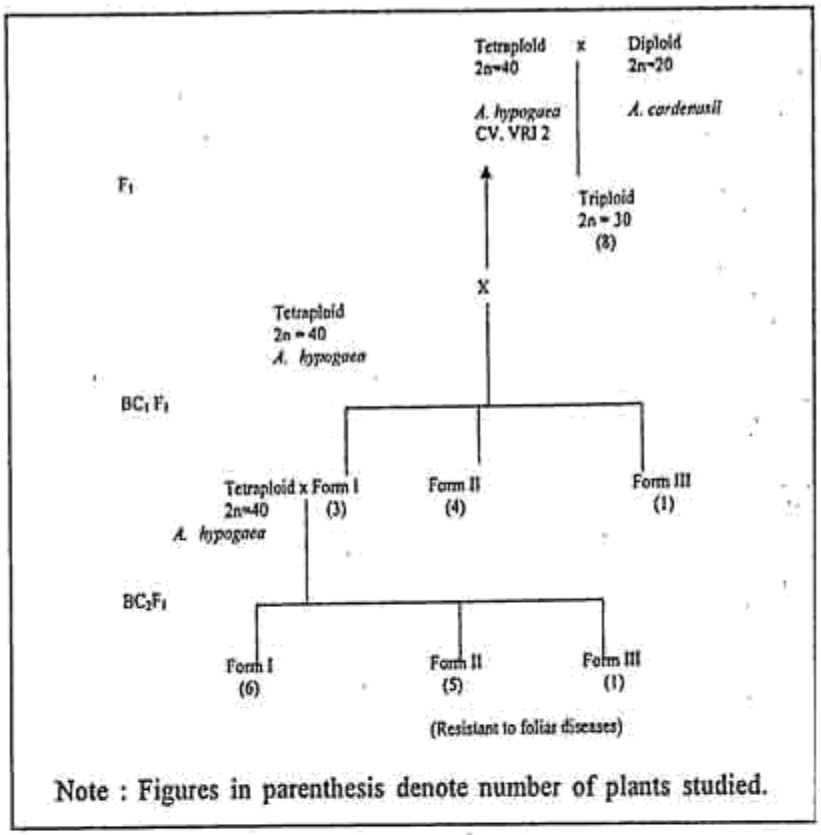

Fig. 1. Schematic representation of interspecific hybridization between *Arachis hypogaea* and *A.cardenasii.*

were limited and tended to trail on the ground. The leaves were broader and light green resembling VRI 2 plants. The pollen fertility was 95.7 per cent and the peg formation and pod setting was normal. The pods were very small with deep constriction. *In situ* germination of the pods revealed the absence of seed dormancy.

BC_1F_1 (Form II)

Four plants were obtained in this category. The plants were vigorous and trailing in habit. The leaves were medium size with dark green colour and flowering started only 70-80 days after sowing. They were perennial in habit with profuse flowering and pollen fertility of 5.2 per cent and no peg formation.

BC_1F_1 (Form III)

One plant was obtained in this type. The plant was vigorous and spread in a circular fashion. The leaves were medium in size and light green in colour. The pollen fertility was 13.6 per cent and the peg formation was rare and few pods were formed. The pods were single seeded and very small in size.

The pollen of all the three forms of BC_1F_1 were utilized for hybridization with VRI 2 and the resultant BC_2F_1 were studied.

BC_2F_1 (Form I)

The plants were spreading in habit, compact with bushy appearance. The branches were limited. The size of the leaves and flowers were medium. The pollen fertility was 99.0 per cent. The pods were small but all the pods were two seeded in nature. However, the kernels were small but plumpy with rose testa colour.

BC_2F_1 (Form II)

The plants were semi-spreading and bushy in appearance. They branched profusely. The size of the leaves and flowers were medium. The pollen fertility was 98.3 per cent. The pods were also medium in size and mostly two seeded in nature. However, the constriction was very deep. The kernels were small but plumpy with rose testa colour.

BC_2F_1 (Form III)

The plants were spreading in a circular fashion as that of BC_1F_1. The leaves were medium

Table 1. Biometrical observations recorded on parents and different forms of interspecific hybrid derivatives

Characters	*A. cardenasii* 2n=20	VRI 2 2n=40	Triploid 2n=30	Form I		Form 11		Form III	
				BC_1F_1	BC_2F_1	BC_1F_1	BC_2F_1	BC_1F_1	BC_2F_1
Height of main stem (cm)	27.0	35.0	43.3	38.5	29.0	28.0	33.0	30.0	28.5
No.of primary branches	*	4	7	4	4	*	6	5	5
No.of secondary branches	*	1	42	10	4	*	23	31	24
No.of tertiary branches	*	-	93	43	9	*	38	89	63
Length of primary branches (cm)									
Mean	*	34.0	143.3	71.5	39.2	*	64.0	118.7	110.0
Range	*	30-36	77-210	60-90	32-46	*	50-90	80-135	70-128
Length of secondary branches (cm)									
Mean	*	17.0	117.0	58.6	21.7	*	42.3	95.4	84.0
Range	*	15-19	26-162	54-84	14-32	*	12-48	70-115	60-112
Length of tertiary branches (cm)									
Mean	*	-	62.2	40.3	15.2	*	15.8	52.3	48.5
Range	*		30-109	30-52	10.23	*	6-18	35-62	30-55
Leaf size (L x B) (cm)	2.3 x 1.1	5.5 x 2.4	5.5 x 2.4	2.8 x 1.6	3.9 x 2.1	4.9 x 2.4	3.0 x 1.7	2.2 x 1.5	2.2 x 1.5
Standard Petal size (L x B) (cm)	1.1 x 0.9	1.3 x 1.1	1.1 x 1.0	1.3 x 1.2	1.4 x 1.2	1.3 x 1.0	1.5 x 1.1	0.6 x 0.4	1.8 x 1.4
Pollen fertility (%)	96.3	99.2	12.5	95.7	99.0	5.2	98.3	13.6	15.8
No.of pods/plant	*	15	7	25	23	-	23	5	4
Pod size (LxB) (cm)	0.8 x 0.5	3.8 x 1.2	1.5 x 0.8	1.8 x 1.0	2.1 x 1.0	-	2.3 x 0.9	1.4 x 0.6	1.5 x 0.6
Kernel size (LxB) (cm)	0.7 x 0.4	1.5 x 1.0	1.0 x 0.4	1.3 x 0.7	1.4 x 0.7	-	1.8 x 0.5	1.0 x 0.3	1.0 x 0.3
Hundred kernel weight (g)	5.4	46.5	10.0	22.0	25.0	-	26.0	13.5	14.8
Kernel colour	Rose	Rose	Rose	Rose	Rose	-	Rose	Rose	Rose
Reaction to diseases (1-9 scale)									
Rust	2.0	7.0	3.0	3.5	3.0	2.0	3.0	3.5	3.5
Late leaf spot	2.5	7.5	3.5	4.0	4.0	2.5	3.5	4.0	4.0

Note : * Perennial and indeterminate growth habit

in size and light green in colour. The flowers were medium in size with a pollen fertility of 5.8 per cent. The peg formation was rare and few pods were formed. The pods were single seeded and very small in size.

The plants of BC_1 and BC_2 of all the three forms were highly resistant to rust and leaf spot diseases indicating the transfer of genes conferring resistance from *A. cardenasii*. Similar gene transfer has also been reported by Stalker (1985), Murthy and Jahnavi (1985)in groundnut. The complete fertility restoration was obtained in BC_1 itself in Form I plants. The plants resembled spreading groundnut. Whereas, in Form 11 complete fertility restoration was observed in BC_2. Further, in Form III plants fertility restoration was not attained even in BC_2. However it is evident that direct utilization of triploids is also a potential source in genetic introgression of groundnut.

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