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A NEW INTERSPECIFIC HYBRID OF COTTON *GOSSYPIUM HIRSUTUM* L. VAR, L11—(AD) 1 x *G. NANDEWARENCE* (DERZ) FRYX—(C1-n)

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Abstract

A sterile, cold tolerant triploid of *Gossypium hirsutum* x *G. nandewarence* was obtained which is being reported for the first time in the history of cotton. Cytological studies were carried out and 20.8I, 8.6II and 0.3III recorded at Metaphase-I. Morphological studies showed that the hybrid was vigorous and luxuriant in growth with profuse branching and foliage, intermediate in most of the characters. The most important observation was that the foliage remained ever-green throughout the year, even in the severe cold spell in winter season like *G. nandewarence*.

Introduction

During the last four decades, extensive work has been done throughout the world to elucidate the relationship between the wild diploids and cultivated tetraploid cottons. A series of crosses have been made at this station with a view to determining, the extent of crossability between wild and cultivated species of *Gossypium* and then, utilizing the combinations showing good flow of genes for different desirable characters, *i.e.*, disease resistance, drought resistance, and cold tolerance with an ultimate objective of transferring these characteristics to the cultivated commercial varieties of cotton. One of such crosses, being reported for the first time, was between an Australian wild diploid *G. nandewarence* (Derz.) Fryx. (a newly described species—Fryxell—1965), and the cultivated American tetraploid *G. hirsutum* L. var, Lassani-11. The hybrid obtained was sterile triploid, cytology and morphology of which is presented in this paper.

Review of Literature

From the published literature, it has not been possible to trace out any reference relating to this cross combination, however, a few references available are reviewed as under:—

Skovsted (1937), Patel *et al*, (1947), Ahmed *et al*, (1972) and Malik *et al*, (1974) reported sterile triploids of *hirsutum* x *sturtii* (presently known as *Sturtianum* Willis), with 20.95I—7.8II—0.95III; 34I—2.5II; 30.76I—4.12II and 2484I—5.28, respectively. Webber (1935) reported a triploid of *barbadense* x *sturtii* with 37.9I—0.5II. The hybrids reported by all the research workers were intermediate in morphology. The main cause of sterility as suggested by Skovsted (1937), Webber (1939) and Beasely (1942) seems to be the irregular distribution of univalents at Anaphase-I and Metaphase-II. Moreover, Willis (1947) renamed *G. sturtii* von Muller as *G. sturtianum* Willis with C-1 genome and Dereza (1964) described a new *Gossypium* species as *G. nandewarence* (Derz) Fryzx. with C1-n genome. Fryxell (1965) in his studies recognized 9 species of *Gossypium* endemic to Australia.

Fig. 1. Metaphase-I, Showing 23I—5II—2III.

Fig. 2. Anaphase-I, Showing irregular distribution of chromosomes (17—2—20) & 2-lagging chromosomes and a chromosome bridge.

Fig. 3. Sporad stage, showing cells with varying number (2-10) of sporads.

Materials and Methods

Present studies were carried out at Cotton Research Station/Institute, Multan, during 1972 and 1973. The species used were:—

1. *G. hirsutum* L. var. Lassani-11,-(AD) 1: (2n—52), a local commercial variety.
2. *G. nandewarence* (Derz) Fryx,-(C1-n): (2n—26), and Australian wild diploid species.

The crosses attempted were:—

a. *G. hirsutum* x *G. nandewarence*.

b. *G. nandewarence* x *G. hirsutum*.

For cytological studies, flower buds were fixed in Carnoy's solution and preserved in 70% alcohol. From the acetocarmine squashes, 73 pollen mother cells (PMC's) were studied, but only 36 of those could be clearly analysed at Metaphase-I and some at Anaphase-I.

Observations and Discussion

Morphology

Table I shows that the seeds were obtained only in *G. hirsutium* x *G. nandewarence* combination. The hybrid plants obtained were vigorous and luxuriant in growth, with profuse branching and foliage, showing the phenomenon of heterosis. Stem brown with young portions pinkish green, glabrous, with fewer black glands as compared to the male parent (*G. nandewarence*) and long spreading monopodial

branching. Leaves glabrous, intermediate in size and shape (Fig. 4), between the two parents, deeply lobed, and the leaves remained evergreen throughout the last two years, even in severe cold-spell of winter season. Flowers cup-shaped, showy. intermediate in shape and size of both the parents (Fig. 5), light pink in colour with dark pink (purplish) basal petal spot. Bracteoles 3, intermediate in shape and size

TABLE 1. Crossing data of *G. hirsutum* and *G. nandewarence*.

Germination attempts Sr. No.	Name of Gross	No. of attempts	No. of bolls set	Setting % age	Seed Germination %
1.	*G. hirsutum* x *G. nandewarence* (a)	248	39	15.7	29.67
2.	*G. nandewarence* x *G. hirsutum* (b)	164	—	—	—

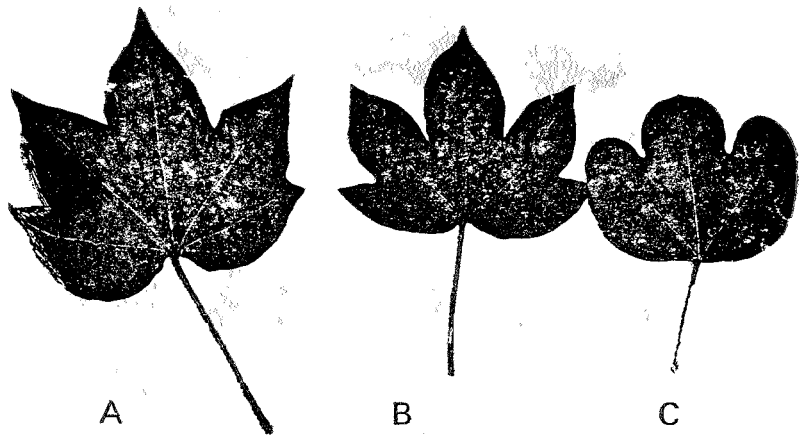

Fig. 4. *LEAVES:* A. Leaf of *G. hirsutum*. B. Leaf of the hybrid. C. Leaf of *G. nandewarence*.

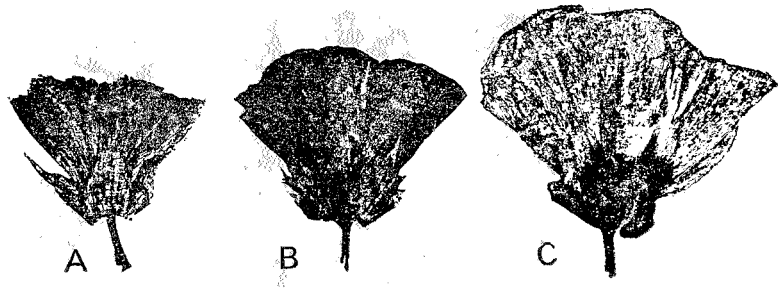

Fig. 5. *FLOWERS:* A. Flower of *G. hirsutum*. B. Flower of the hybrid. C. Fl wer of *G. nandewarence*.

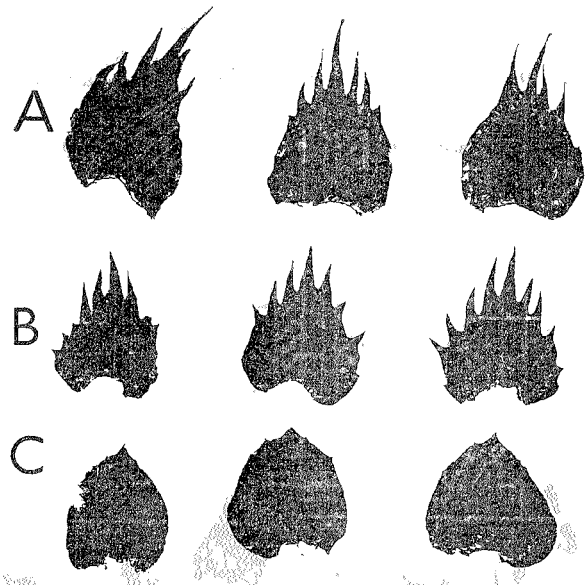

Fig. 6. *BRACTS:* A Bracts of *G. hirsutum.* B. Bracts of the hybrid. C. Bracts of *G. nandewarence.*

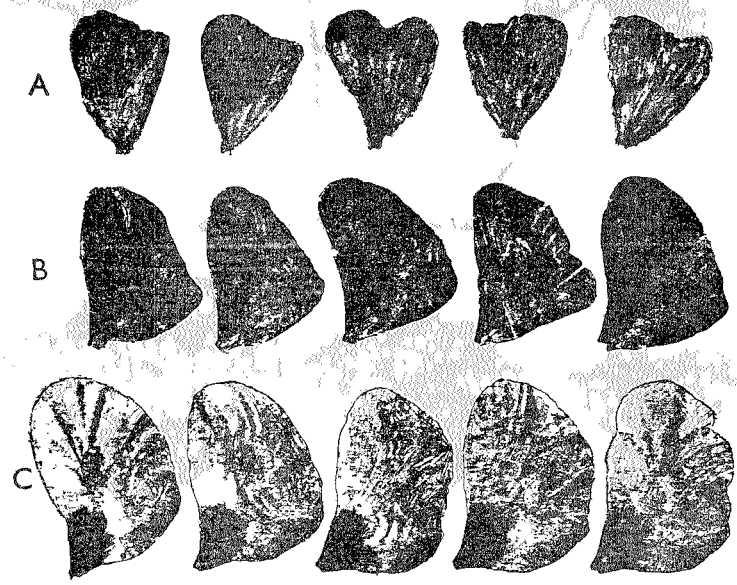

Fig. 7. *PETALS:* A. Petals of *G. hirsutum.* B. Petals of the hybrid. C. Petals of *G. nandewarence.*

of both the parents, with 7-11 deep and pointed dentations (Fig. 6). Sepals 5, gamosepalous forming a cup with 5 prominant pointed teeth (Fig. 8). Petals 5, light pink in colour with yellowish streaks at the basal portion and a dark pink (purplish) spot at the base of each petal, intermediate in size with an average length of 5.8cms, and 5.6 cms breadth (Fig. 7). Staminal column long (Fig. 8) and antheriferous throughout, filaments light pink, anthers creamy white. Stimga united throughout (Fig. 8), with fewer dots or glands than *nandewarence*. This hybrid differs in morphology distinctly in leaf shape than the hybrids of *hirsutum* x *sturtianum* reported by Ahmad *et al* (1972) and Malik *et al* (1974). Other characters differ minutely.

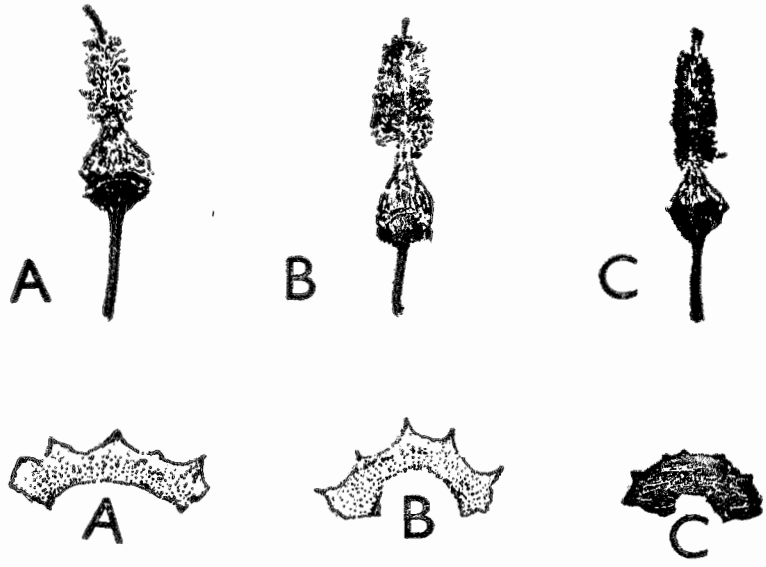

Fig. 8. *SEXUAL PARTS WITH SEPALS:* A. *G. hirsutum*. B. The hybrid. C. *G. nandewarence*.

Cytology

Out of the 73 PMC's studied at Metaphase-I and Anaphase-I. Only 36 plates were clear at Metaphase-I (Fig. 1), and a few at Anaphase-I (Fig. 2) showing 39 chromosome number, the expected number of triploid. The frequency of chromosomes association at Metaphase-I of the triploid is given in Table 2.

From Table 2, it is evident that the triploid plant had mean of 20.8I, 8.6II and 0.33III, which is nearly in close relation to the frequencies reported by Skovsted (1937) in a hybrid of *hirsutum* x *sturtii*. The maximum number of bivalents observed was 12 and that too in 4 cells, in two PMC the number was as low as 4, the range being from 4-12. The number of univalents ranged from 15-25 and the multivalents re-

TABLE 2. Frequency of chromosomes associations at Metaphase-I of *G. hirsutum* x *G. nandewarence*.

S. No.	Material	No. of PMC's	Valents I	II	III	Remarks
1.	*G. hirsutum*	6	21	9	0	At Metaphase-I univalents were scattered and at Anaphase-I, irregular distribution of chromosomes at each pole observed.
2.		6	19	10	0	
3.	x	6	23	8	0	
4.		2	23	5	2	
5.	*G. nandewarence*	4	15	12	0	
6.		2	17	11	0	
7.		4	20	8	1	At sporad stage, cells with 2,3,4,5,6,7,8,9 and 10 sporads with 2.2, 4.1, 49.4, 20.3, 15.2, 6.6, 1.0, 0.6 & 0.6%, respectively were also observed.
8.		4	25	7	0	
9.		2	25	4	2	
	Range:	36	15—25	4—12	0—2	
	Average:		20.8	8.6	0.33	Pollen stainability was 0.29%.

corded were 0.33 per cell. It was also observed that only 49.4% tetrads were normal (4 per cell) and the rest varying in number and size (2-10 per cell), (Fig. 3) from cell to cell, perhaps resulting from an irregular distribution of chromosomes at each pole and Anaphase-II, which also led to the formation of corresponding number of sporads and caused the total sterility of the hybrid.

The formation of 20.8 univalents per cell is an evidence of irregular meiosis which is reflected by the formation of 50.6% abnormal sporads (varying from 2-10 per cell). It is quite likely that this irregular meiosis and sterility of the hybrid may be due to the distant relationship of the genomes (AD)—1 and C1—n. This sterility of the hybrid can be overcome to some extent by applying some improved technique, like colchicine treatments as Malik *et a* (1974) obtained a fertile hexaploid (71.8% pollen stainability) from a sterile triploid of *G. hirsutum* x *G. sturtianum*.

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