8 days of incubation in the case of *Rhizobium* and *Azospirillum*, respectively. The regeneration frequencies observed by this method were relatively much higher than what has been reported in other bacteria[8, 10, 14]. On plates of pure hypertonic medium no colony appeared from protoplasts even after 20 days of incubation. With regard to the method of protoplasting, the sucrose cation lysozyme method used for protoplast preparation in *Pseudomonas putida*[10] was found to be less suitable as compared to the tris-sucrose-EDTA lysozyme method used in *E. Coli* and *providentia*[8, 9] although there were variations from strain to strain.

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MORPHOLOGICAL VARIATION AND INHERITANCE IN A PIGEONPEA INTERGENERIC HYBRID

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AN intergeneric cross between *Cajanus cajan* ($2n = 22$) and *Atylosia albicans* ($2n = 22$) yielded hybrid progeny in 7% of the pollinations. These hybrids were very luxuriant with profuse branching and thick leaf canopy. The *Cajanus* parent has an erect habit while *A. albicans* is a twiner. The F_1 had a twining (semi-sreading) habit. The leaflets in *C. cajan* are lanceolate with an acute tip while those in *A. albicans* are obovate with an obtuse tip. The hybrids were intermediate for leaf shape and leaf texture in their initial stages of growth, which continued for about 100 days. During this period the leaf tip was obtuse (figure 1b). The leaves in some of the hybrid branches (figure 1a–2) which appeared after 100 days resembled the *Cajanus* parent, having an acute tip (figures 1c: 4–6), while leaves developed on other branches were obtuse (figures 1a–1, 3, 4, 5, 6). However, as the plant grew further, the remaining branches also developed leaves similar to those of the *Cajanus* parent. Though the change in leaf shape was observed in all the three leaflets it was more pronounced in the terminal ones which enabled an easy classification. The texture of the leaves produced after 100 days also resembled the *Cajanus* parent. Scanning electron microscopic studies of the upper surface of the terminal leaflets revealed similarities between the leaf surfaces of the *Cajanus* parent (figure 1d) and the *Cajanus*-like leaves produced on the hybrid (figure 1g). Both the leaf surfaces exhibited long trichomes which were uniformly spread over the surface. Leaves of the *A. albicans* parent had a very dense population of trichomes (figure 1e) whereas the initial intermediate type leaves had sparse population of short trichomes (figure 1f) when compared to the leaves of the *Cajanus* parent and the *Cajanus*-like leaves in the hybrid. Floral initiation took place only on those branches which had developed leaves similar in shape and texture to the *Cajanus* parent.

The development of leaves similar to the *Cajanus* parent initially led us to look for the possibility of selective chromosome elimination similar to that of *Nicotiana*[2] or *Hordeum* interspecific[5] and intergeneric[1] hybrids. But our cytological investigations[3]

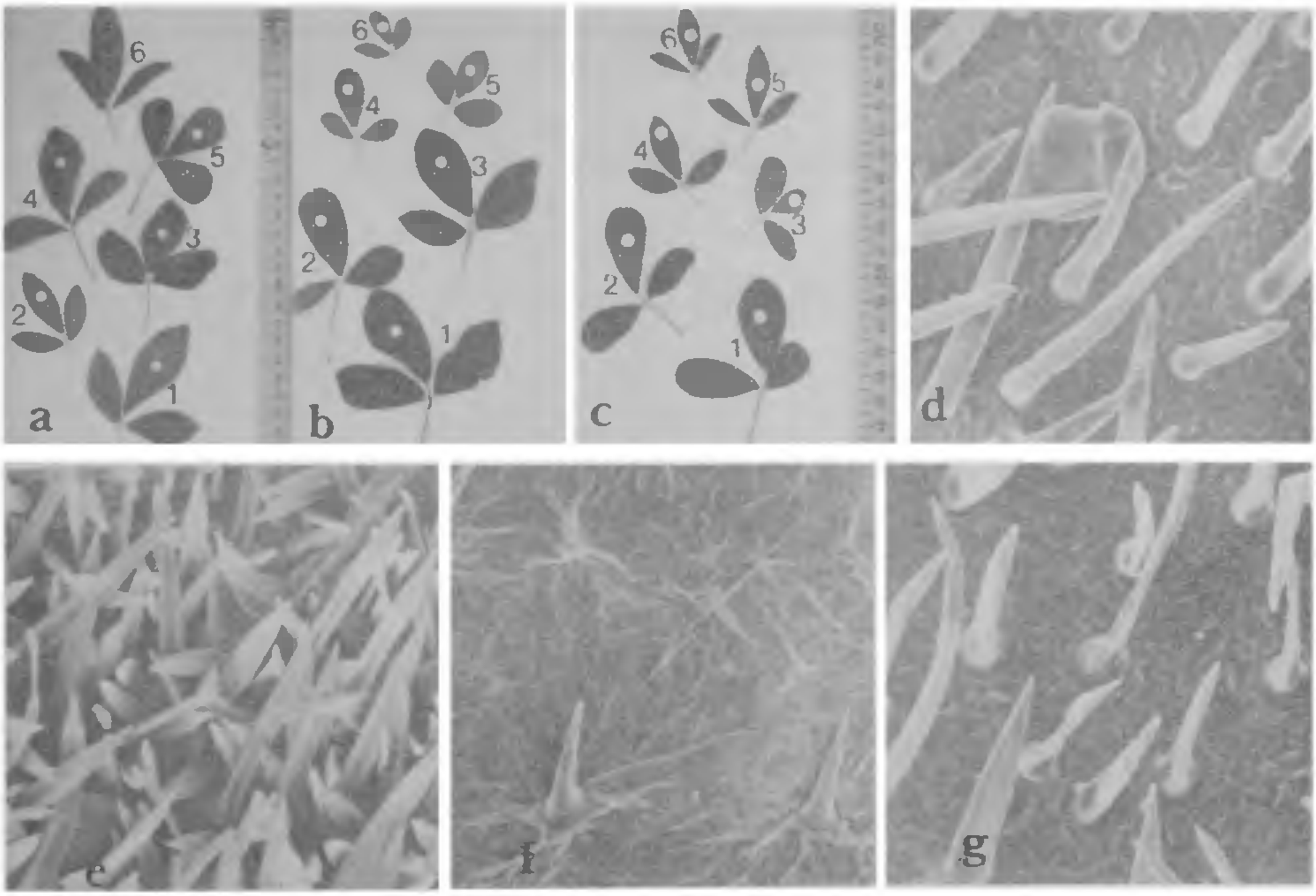

Figure 1a. Leaves from different branches (1 to 6 from the bottom) of a typical *Cajanus cajan-Atylosia albicans* hybrid. (Note distinct leaf shape from the branch two). **b.** Leaves from bottom to top of a branch, which did not show discernible variation upto 5 months. **c.** Leaves from bottom to top of a branch which showed differently shaped leaves after 100 days. **d.** Leaf surface scan of *Cajanus cajan* **e.** Leaf surface scan of *Atylosia albicans*. **f.** Intermediate type leaf surface scan. **g.** *Cajanus* type leaf surface scan.

revealed eleven bivalents and regular meiotic disjunction. This could be taken as evidence to rule out the possibility of chromosome elimination or in support of chromosome doubling following chromosome elimination. A detailed meiotic analysis[3] revealed nucleolar variation in the meiotic products indicating the hybrid nature of the material. Thus it was concluded that the variation in leaf morphology accompanied by flowering is a consequence of differential gene expression in different branches. Since floral initiation occurred only in the branches on which *Cajanus*-like leaves started developing, it is likely that these two processes are temporal events in gene expression.

Somatic variation in *Cajanus cajan* was reported to be chimeral[4] which appeared from the seedling stage. Thus it is different from the variation in the present *Cajanus-Atylosia* hybrid.

Pod characters in the F_1 hybrid were similar to those in the *A. albicans* parent. In *C. cajan* the strophiole is rudimentary, whereas in *A. albicans* a prominent strophiole is present on the seed. The F_1 had a strophiole.

The F_2 generation was raised from this hybrid to study the segregation pattern for leaf shape and other qualitative traits (table 1). Among the 182 F_2 plants examined for leaf shape 39 were of *Cajanus*-type, 90 intermediate type and 53 *A. albicans* type indicating a simple Mendelian 1:2:1 ratio exhibiting incomplete dominance. The progeny with the intermediate leaf-shape at seedling stage later developed leaves similar to that of *Cajanus* parent before the onset of flowering in a manner similar to that of the F_1 hybrid. Each of the other characters was found to be controlled by two loci. Genes controlling seed mottling exhibited complementary interaction while those for seed strophiole

Table 1 *Inheritance pattern of morphological traits in C. cajan × A. albicans hybrid.*

Character	*C. cajan* (♀)	*A. albicans* (♂)	F_1	F_2 generation		Expected ratio	Probability
				Observed No.			
Leaflet shape	Lanceolate	Obovate	Intermediate	Lanceolate	39		
				Intermediate	90	1:2:1	0.25–0.1
				Obovate	53		
Seed strophiole	Absent	Present	Present	Present	140		
				Absent	42	13:3	0.25–0.1
Seed mottles	Absent	Present	Present	Present	101		
				Absent	81	9:7	0.75–0.5
Habit	Erect	Twining	Twining	Twining	150		
				Erect	32	13:3	0.75–0.5

and for twining habit indicated inhibitory interaction. All these four traits showed independent assortment.

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SALT TOLERANT DINANATH GRASS (*PENNISETUM PEDICELLATUM* TRINN.) AS C_4 PLANT—A NEW RECORD

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IN recent years, electron microscopy and biochemistry of C_3 and C_4 plants have been extensively studied. Hatch and Slack[1] of Australia reported some dicots, sugarcane and several other members of Graminae and Cyperaceae to be C_4 plants. The most distinguishable anatomical feature of leaf of C_4 plants is the Kranz anatomy *i.e.*, the occurrence of dimorphic chloroplasts. A perusal of literature reveals that little is known about the anatomy and pathway of photosynthetic CO_2 fixation in Dinanath grass—a grass of arid and semi-arid zones. The present study was undertaken to

Figures 1A–C. A. Bundle sheath cell chloroplast from leaf tissue of Dinanath grass showing very few grana (G) and frequent appearance of stroma lamellae (SL). **B.** Mesophyll cell chloroplast showing well developed several grana (G) and prolamellar bodies (PB). **C.** Cross section through a mature leaf of Dinanath grass showing well differentiated bundle sheath and mesophyll cell layer.