Spontaneous Triploidy in *Hevea brasiliensis* (Willd ex Adr. de Juss.) Muell. Arg.

The genus *Hevea* (Family-Euphorbiaceae) is native to Brazil and has nine species (Schultes, 1970). *Hevea* species are diploids (2n=36) with a basic number of x=18 (Majumder, 1964; Ramaer, 1935). Ong (1981) suggested segmental alloploid origin of the genus. In *Hevea guianensis*, however, a triploid clone (2n=3x=54) was reported (Baldwin, 1947). While screening some of the indigenous and introduced clones of *Hevea brasiliensis*, maintained at the Rubber Research Institute of India (RRII), one spontaneous triploid clone was located for the first time. The meiotic behaviour of the triploid clone has been described and compared with an induced triploid developed at the RRII, Kottayam.

The natural triploid is a seedling selection (mother tree) from Malankara Estate, Thodupuzha, cloned and maintained at the RRII. The induced triploid earlier obtained was through hybridization involving a colchi-tetraploid and a diploid clone, the details of which were described by Saraswathy Amma et al., (1980). For study of meiosis, young male flowers were fixed in Carnoy's fluid. Anthers were stained and squashed in one per cent iron-acetocarmine following the conventional techniques. Fifty five pollen mother cells were analysed in both taxa.

The spontaneous triploid is indistinguishable from the diploids, excepting for the dark green leaves and lack of fruit set. Morphologically, however, the induced triploid showed variation in leaflets from three to five, whereas the diploid showed the typical trifoliate condition. Induced triploid showed more leaf thickness and very prominent veins (Saraswathy Amma et al, 1980).

At metaphase I, various chromosome associations like trivalents, bivalents and univalents were observed (Table I and Figs 1 & 2). In the spontaneous triploid, 14.5 per cent of PMCs showed 18 trivalents, while 16.3 per cent showed

Table I. *Chromosome association in triploid clone of* Hevea brasiliensis *(2n = 54)*

Taxon	III		II		I		't' value for mean trivalents
	Range	Mean ± S. E.	Range	Mean ± S. E.	Range	Mean ± S. E.	
Spontaneons	9–18	15.16 ±0.33	0– 9	2.38 ±0.30	0–10	3.76 ±0.36	computed 16.96**
Induced	7–17	10.07 ±0.24	1–10	6.71 ±0.23	1–17	10.36 ±0.68	table value 0.68

** *significant at* $p < 0.01$.

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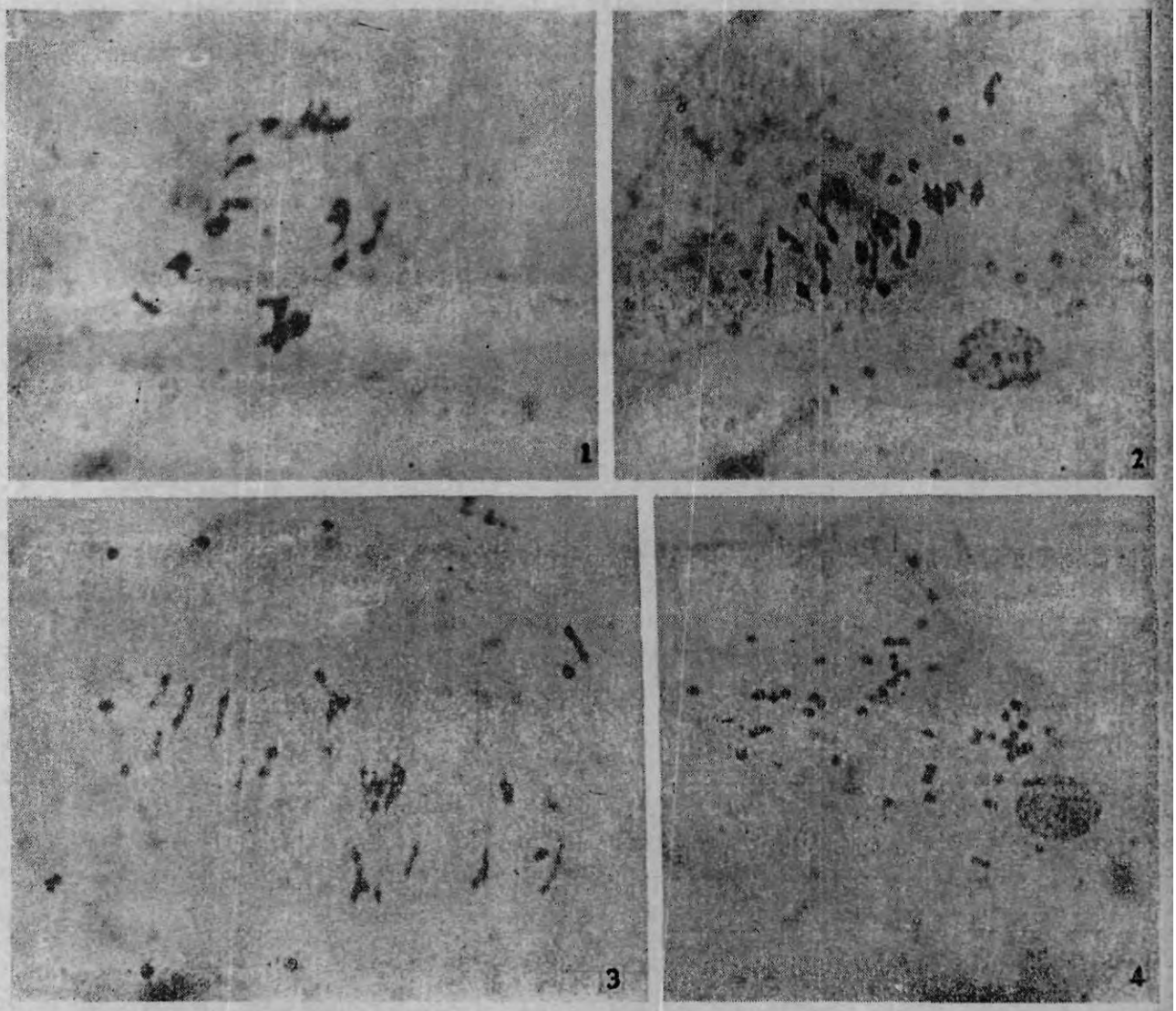
17 III + 1 II + 1 I. In the induced triploid, only 1.8 per cent PMCs showed a maximum of 17 trivalents. The minimum number of trivalents in spontaneous and induced triploids were 9 and 7 respectively. A 't' test for the mean numer of trivalents showed that there is significant difference between the two triploid clones, the natural triploid showing high frequency of trivalents. Precocious separation of trivalents resulting in a large number of bivalents and univalents was noted in the induced triploid (Fig 3). Segregation in anaphase I and in subsequent divisions was irregular in both the clones (Fig 4). The spontaneous triploid was totally pollen sterile and the anther columns were found shrivelled and fell even before maturity. In the induced triploid, 5.5 per cent stainable pollen could be seen. Both clones did not set seeds.



Figs. 1–4. Meiosis in triploid *Hevea* clones. Figs. 1 & 2 M1 spontaneous triploid; Fig. 1. 18 III; Fig. 2. 10 III + 7 II + 10 I; Fig. 3. Late M1. Induced triploid. 5 III + 12 II + 15 I (see precocious separation of bivalents); Fig. 4 A1 spontaneous triploid. unequal segregation (×2000)

From the foregoing account, it is clear that the spontaneous triploid is an autotriploid characterised by the presence of a maximum number of 18 trivalents. In the induced triploid, maximum of only 17 out of 18 possible expected trivalents was found. This may be possibly due to the genetic difference between the genomes involved in its origin or the result of precocious disjunction of trivalents. In nature, triploids may originate either due to crossing between tetraploid and diploid taxa or by fusion of reduced egg cells with two male nuclei, *i. e.*, dispermy or fertilization of unreduced egg cells and male nuclei. In view of the absence of tetraploids in the genus as a whole, and *Hevea brasiliensis* in particular, the present spontaneous triploid might have originated as a result of the fertilization of reduced and unreduced gametes, as observed in *Tulipa* (Newton and Darlington, 1929), *Sansevieria* (Nazeer, 1980) and *Heteropteris* (Nazeer, 1981).

In most of the plants, triploidy is accompanied by seedlessness and in the present triploid there is total lack of fruit set. This may be of special significance since the fruits act as major source of inoculum for abnormal leaf fall disease, which affects yield considerably (Radhakrishna Pillai et al., 1980).

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