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MALE STERILITY IN *HEVEA BRASILIENSIS* (WILLD. EX ADR. DE JUSS.) MUELL. ARG.

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GT 1 is a male sterile clone of *Hevea brasiliensis* (Willd. ex Adr. de Juss.) Muell. Arg. Hybrids of two cross combinations involving this clone as the female parent and RRIC 100 and RRII 105 as the male parents were studied. All the male flowers produced on clones established from the F1 progenies were totally devoid of fertile pollen, indicating cytoplasmic male sterility.

Key words – *Hevea brasiliensis*, Clones, Tetrad, Pollen, Cytoplasmic male sterility.

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INTRODUCTION

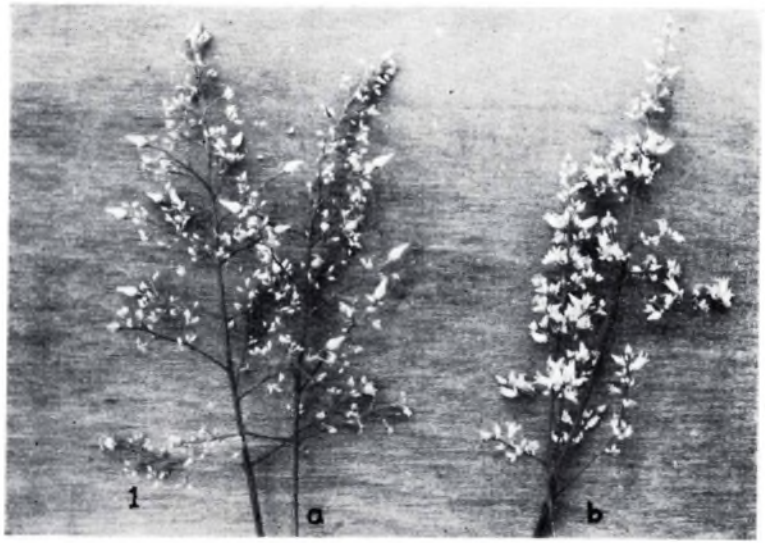
Hevea brasiliensis, the Para rubber tree, belonging to the family Euphorbiaceae is monoecious. Female flowers are limited in number and are restricted to the tip of the panicles. The male flowers are far more numerous. Male sterility has been reported in the clone GT 1 by Ramaer (1935), Majumder (1964) and Leconte and Nicolas (1985). The Rubber Research Institute of India has also reported male sterility in the clone GT 1 (Anon. 1983). Further, male sterility has also been observed in two other clones Ch 2 and D 15.

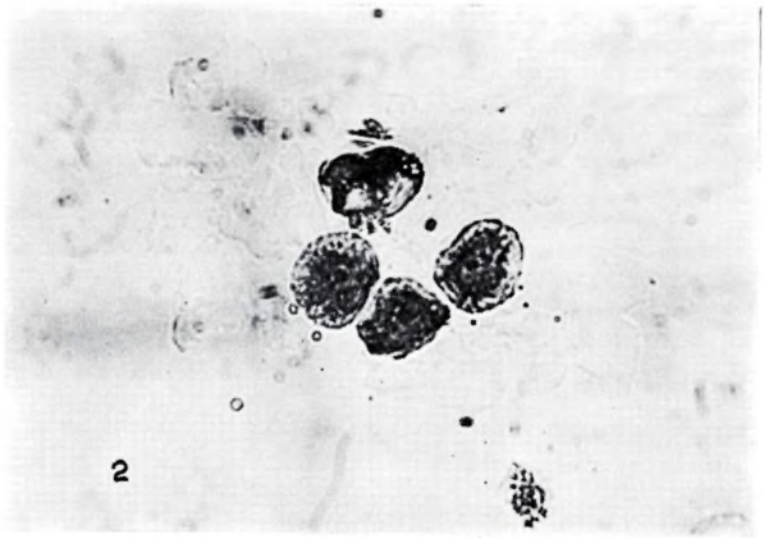
MATERIALS AND METHODS

GT 1 is a primary clone evolved in Indonesia by selection in a seedling population of Gondang Tapen estate. Two cross combinations involving GT 1 as the female parent and the fertile clones RRIC 100 and RRII 105 as male parents were chosen for the study. The cross combination between two fertile clones RRII 105 and PR 107 was used as control. Clones were established through vegetative multiplication from seven resultant progenies, three belonging to GT 1 x RRIC 100 and four to GT 1 x RRII 105. Two clones were also similarly established from the progenies of the control (RRII 105 x PR 107). Early flowering was induced (Saraswathyamma, 1975) in these materials, when the budgrafts were of two years' growth. Necessary prophylactic measures were carried out to protect the flowers. Male flowers at the appropriate stages were collected and fixed in modified Carnoy's fluid (3 : 1 : 1) for cytological study. Pollen fertility was studied employing fresh flowers and anthers were squashed in 1 : 1 glycerine – acetocarmine.

RESULTS AND DISCUSSION

All the ring-barked plants showed flower initiation after nine months from the time of ring-barking. The male flowers of the F_1





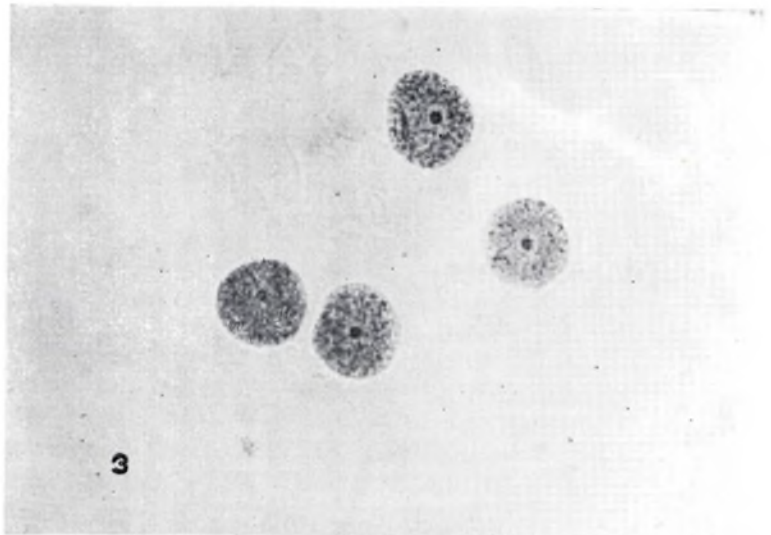


Fig. 1 (a) Inflorescence showing well developed female flowers and poor development of male flowers of GT 1. (b) Well developed male and female flowers of RRII 105. Fig. 2. Degenerating microspores in GT 1×1200 Fig. 3 Developing microspores of male fertile clone RRII 105×1200 Fig. 4 Degenerating microspores in F_1 clone involving GT 1 as female parent × 1200

clones involving GT 1 as the female parent did not reach normal size as seen in F_1 of male fertile clones (Fig. 1). They were reduced in size and fallen by abscission as seen in the case of GT 1. The perianth was light yellow in colour and flowers did not open. The anther column was completely dry and fertile pollens were totally absent. The mode of flower development was similar to that in GT 1. Flower development and pollen production were normal in the control clones (Fig. 3). As in the case of GT 1 parent, the male flowers of the hybrids showed normal meiosis up to the tetrad stage. But pollen grains were found to be empty. After the tetrad stage the microspores showed abortion (Figs. 2 & 4) and further development was completely blocked.

Since the hybrid clones were male sterile, the genetic control of male sterility could be totally determined by cytoplasmic factors which are transmitted through the egg. The cytoplasmic control of male sterility in *Hevea brasiliensis* was previously unknown.

The clone GT 1 was reported to be male sterile (Majumder, 1964, Anon. 1983 and Leconte and Nicolas, 1985). But this clone was reported to be male fertile (Olopade and Salawu, 1986) in Nigeria. The difference in fertility may be due to the influence of environmental factors. There have been numerous studies to correlate the influence of various environmental factors on anther development and male sterility (Mayer, 1969; Edwardson, 1970). Peterson (1958) noted that in cytoplasmic male sterile *Capsicum*, sterility is accentuated at temperatures above normal and that certain environmental conditions act on some internal systems by either promoting or inhibiting auxin like substances which influence pollen formation and break down of tapetum leading to total sterility. The effects of environment on cytoplasmic male sterility in sorghum and rape were reported by Kidd (1961) and Fan and Stefansson (1986).

Since F_1 clones studied are totally male sterile, the sterility in GT 1 is inferred to be due to cytoplasmic factors. However, further detailed genetic investigations are underway to confirm whether any nuclear genes are involved in the mechanism of sterility in this clone. Male sterile plants with desirable attributes are useful in *Hevea* to set up hybrid seed garden.

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REFERENCES

Anonymous, (1983). Annual Report, Rubber Research Institute of India.

Edwardson, J. R. (1970). Cytoplasmic male sterility. *Botanical Review*. **34**: 341–420.

Fan, Z. & Stefansson, B. R. (1986). Influence of temperature on sterility of two cytoplasmic male sterile system in rape (*Brassica napus* L). *Canadian Journal of Plant Science*. **66**: 221–227.

Kidd, J. J. (1961). The inheritance of restoration of fertility in cytoplasmic male sterile Sorghum—A preliminary report. *Sorghum Newsletter* **4**: 47-49.

Leconte, A. & Nicolas, D. (1985). Male sterility in *Hevea* GT 1 clone. *Revue Generale des Caoutchoucs et Plastiques*. **649**: 127–129.

Majumder, S. K. (1964). Chromosome studies of some species of *Hevea*. *Journal of Rubber Research Institute of Malaya*. **18**: 269–275.

Mayer, V. C. (1969). Some effects of genes, cytoplasmic and environment on male sterility of cotton. *Crop Science*. **9**: 237–241.

Olopade, E.O. & Salawu, R. A. (1986). Influence of flowering and fruiting patterns on Rubber (*Hevea brasiliensis*) seed production. In: *Industrial utilisation of Natural Rubber* (*Hevea brasiliensis*) *seed, latex and wood*. (ed. Ephraim E. Enabor), *Rubber Research Institute of Nigeria, Iyanomo, Benin City*. 72–77.

Peterson, P. A. (1958). The cytoplasmic inheritance of male sterility in *Capsicum*. *American Naturalist*. **90**: 111–119.

Ramaer, H. (1935). Cytology of *Hevea*. *Genetica*. **17**: 193.

Saraswathyamma, C. K. (1975). Induction of early flowering in *Hevea*. *Rubber Board Bulletin*. **12**: 6.