

ABSTRACT

A study of intergeneric hybridisation between *Theobroma cacao* L. and *Herrania* species

Romina Doodnath

Intergeneric hybridisation was attempted using eleven *Herrania* genotypes and eight *Theobroma cacao* accessions located at the St. Augustine campus of the University of the West Indies, during 1990-1994.

Pollination studies, enzymatic assays (esterase test, peroxidase test) and fluorochromatic tests of cell membrane integrity indicated that the ideal time for pollination was around midday on the day of anthesis, when the stigmas of *T. cacao* were most receptive and *Herrania* pollen most viable.

Crossability studies indicated unilateral incompatibility with crosses being successful only when *T. cacao* was used as the female parent. Although both maternal (*T. cacao*) and paternal (*Herrania*) parental effects determined the extent of crossability the effect of the former was more dramatic. *T. cacao* acc. PA46 was identified as the best female parent.

Tracing pollen tube growth down the style using Fluorescence Light Microscopy confirmed the entry of *Herrania* pollen tubes into the ovaries of *T. cacao*, albeit at a delayed sequence. However, rates of fertilisation ascertained by histological sectioning of cacao ovaries, 72 hours after pollination, showed 90% fertilisation, which was not significantly different from that in compatible intraspecific crosses of *T. cacao*.

Embryo development monitored by sequential harvesting of intergeneric pods indicated two phases of embryo abortion, the first phase occurring early in embryo

development often as early as 40 days after pollination, at the onset of embryo development; the other 80 - 90 days later. Again the female parent (*T. cacao*) had the greatest effect on the percentage (0-40%) of unaborted beans obtained, although male parents effects were also significant. Further, there was a significant effect of specific cross combinations on quality of unaborted beans obtained, suggesting that intergeneric hybridisation programmes can be made more fruitful by investing resources on identifying ideal cross combinations.

Apart from embryo abortion, hybrid inability, manifested as retarded embryo development and hybrid inviability demonstrated by the inability of putative hybrid embryos to germinate, were features of post-zygotic development. The embryos obtained from intergeneric crosses were a third of the size of normal embryos or smaller and were found in various stages of development.

In vitro studies to rescue embryos were successful in generating shoot development in a basal medium consisting of half strength MS macronutrients, micronutrients of Morel (1950) and vitamins of Heller (1953), supplemented with 0.25 mg l⁻¹ BAP, but rooting was erratic. The abnormal smooth type embryos early in development did not show any significant advantage.

The shoots and seedlings showed varying degrees of hybrid necrosis and often after several subcultures. Methods to overcome this problem are suggested. Pedigree analysis using RAPD and isozymes confirmed that the shoots arising from abnormal beans were infact hybrids.