

PRELIMINARY INVESTIGATIONS ON *PISIFERA*
WITH SPECIAL REFERENCE TO THE GENETIC
IMPROVEMENT OF OIL PALM (*ELAEIS GUINEENSIS*
JACQ.) IN INDIA

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ABSTRACT

Seeds of the oil palm hybrid *tenera* is being imported for commercial planting in India. However, recent investigations show that suitable mother palms (*dura*) and the pollen parent (*pisifera*) are available in the country. In a *tenera* × *tenera* plantation, 11 fertile and 11 sterile *pisifera* palms were identified. Fifty-nine *dura* palms yielding above 100 kg fresh fruit bunches annually per palm have also been located. Preliminary results on *tenera* produced by using these *dura* mother palms are encouraging. Feasibility of indigenous production of genetically superior *tenera* hybrids is discussed.

INTRODUCTION

Oil palm (*Elaeis guineensis*) is not indigenous to India. Although it has been introduced in small numbers in the early thirties (Sayeed, 1955; Kunjan, 1968), it did not receive due attention as a potential oil yielding crop till recently. A systematic plantation of oil palm was established in India during 1962 at Thodupuzha (Kerala) with *dura* and *tenera* materials introduced from Malaysia and Nigeria.

The major constraint encountered in the establishment of large oil palm plantations in the country is the non-availability of parent palms involved in the hybrid seed production. The required hybrid seeds are therefore being imported from Malaysia, Ivory Coast, Nigeria, Zaire and Papua New Guinea. Attempts made to isolate the pollen parent *pisifera* and to identify suitable mother palms of *dura* to produce the commercial hybrid *tenera* using the available indigenous genetic stock are reported in this paper.

MATERIALS AND METHODS

Isolation of *pisifera* was done in a *tenera* × *tenera* population of 140 palms produced from *tenera* palms of Malaysian origin and planted in 1967 at the Oil Palm Station, Thodupuzha, Kerala State. Fruit forms were studied for all the palms by cutting open and examining individual fruits; *dura*, *tenera* and *pisifera* forms were identified. In some cases where fruits were not normally produced, parthenocarpy was induced by spraying 2-(2, 4, 5-trichloro phenoxy)-propionic acid (Thomas, 1973).

The magnitude of variability of *dura* palms was assessed from five populations available at the oil palm station, Thodupuzha. The materials were introduced from Malaysia and planted during 1962. Cumulative data for three years on bunch production and bunch weight recorded on 733 palms were used in this study.

Performance of *tenera* palms was evaluated from an experiment consisting of 11 d × p combinations laid out in RBD with three replications and 16 palms per plot at CPCRI (RC) Palode during 1976. These *teneras* were produced by crossing selected *dura* palms of the Oil Palm Station, Thodupuzha with the pollen of four *pisifera* imported from NIFOR, Nigeria. Observations on height, girth at the collar, number of leaves, first flowering, number of male inflorescences and number of female inflorescences were recorded for individual palms.

RESULTS

In the 140 *tenera* × *tenera* palms the following fruit forms were identified.

Table 1. Details of *pisifera* palms in the t × t population

Fruit form	Description	No. of palms	% in the population
<i>pisifera</i>	Endosperm with kernel and embryo, no shell	11	7.9
<i>pisifera</i>	Endosperm with kernel alone, no embryo and shell	11	7.9
<i>dura</i>	Thick shell	66	47.1
<i>tenera</i>	Thin shell	52	37.1

In certain palms, fruit set was obtained only when spraying was undertaken with 2, 4, 5-TP. Single bunch weight of *pisiferas* varied from 7.3 to 18.6 kg.

The yield distribution of 733 *dura* palms was as follows :

Table 2. Yield distribution of *dura* palms

Yield group Wt. of bunches (Kg/palm/year)	No. of palms	Percen- tage	Yield group (No. of bun- ches palm year)	No. of palms	Percen- tage
<75	587	79.9	<3	508	69.3
75-100	87	11.9	3-5	64	8.7
100-125	38	5.2	5-7	105	14.3
125-150	7	1.0	7-9	41	5.6
>150	14	2.0	>9	15	2.0

The *tenera* hybrids planted in 1976 are performing well under the South Kerala conditions.

DISCUSSION

Three distinct types of fruits are recognized in oil palm viz., *dura* where the fruits have a thick endocarp (2 to 8 mm), *tenera* fruits with a thin endocarp (0.5 to 4 mm) characterised by a fibrous ring surrounding the endocarp and *pisifera* where the fruits have no endocarp. A palm bears only one of the above three types of fruits. Presence of shell is controlled by a single gene, the genotype of *dura*, *pisifera* and *tenera* being $Sh^+sh^-sh^-$ and Sh^+sh^- respectively. Significant yield improvement in oil palm has been obtained by exploiting this monogenic character. The hybrid, *tenera* is preferred for commercial planting as it has more mesocarp and therefore can produce larger quantity of oil.

Classification of *pisifera* is done into three groups based on fertility (Gascon, 1956). These are (i) fertile palms producing large number of shell less fruits the proportion of such palms are few (ii) partially sterile—only a few fertile fruits per bunch occur (iii) sterile-giving few fruits occasionally. In such fruits there is

either no development of the ovule or the ovular development is retarded (Hartley, 1977). Arasu (1970) observed that many apparently well developed *pisiferas* lacked embryos and that those fruits which appear to be well formed show very low percentage of germination (3 to 28 %).

Obasola (1973) reviewed the classification on the basis of the nature of fruit development and grouped the *pisifera* palms into 4 categories viz. fertile, blind, sterile and super sterile palms. Obasola and Okwuagwu (1978) later classified *pisiferas* into eight groups considering the degree and nature of fruit development as well as the pattern of yield simultaneously.

Such classification of the 22 *pisifera* palms identified in the present study was not possible because it requires more detailed observations for at least 2 or 3 years. Therefore these palms were grouped into two major categories. (i) Fertile *pisifera*: Palms which bear fruits with kernel and embryo. The proportion of such fruits in a bunch varies, (ii) sterile *pisifera*: Palms producing bunches with few fruits. The fruits have no embryo and may or may not contain endosperm. One of the palms included in this category produced fruits only when sprayed with 2, 4, 5-TP. These parthenocarpic fruits developed from flowers which would have become under-developed fruits in natural conditions. Such development of parthenocarpic fruits have been reported by other workers (Obasola and Okwuagwu, 1978; Jacquemard and Ahizi, 1981).

The proportion of *dura*, *tenera* and *pisifera*, in the $t \times t$ population used in this study was 3:2:1 as against an expected ratio of 1:2:1. It may be pointed out that the classification of palms into *dura* and *tenera* needs confirmation, as fruits with thick shell and fibre ring as well as those with very thin shell without any fibre ring could be observed. Deviations from normal segregation ratios have been reported from Zaire although similar instances have not been recorded on a large scale elsewhere and no fully satisfactory explanation has been provided (Hartley, 1977). It is known that variation within each fruit type is polygenically controlled (Harden, 1976).

The performance of *dura* palms (Table 2) shows that high yielding mother palms (above 100 kg bunches per palm per year)

are available indigenously though their proportion in a population may be low (less than 10%). The prospects of using these mother palms is indicated by the encouraging early performance of *teneras* produced by using indigenous *dura* palms. Some of the hybrid combinations gave more than 14 inflorescences and produced about 27 leaves per year. It was also encouraging to note that 10% of *tenera* palms flowered within an year and another 53.4% during the second year compared to the average number of months needed for flowering in oil palm from the time of field planting is reported to be 22 to 35 months in Nigeria (Obasola and Nampoothiri, 1978) and 24 months under Kerala conditions (Kunjan, 1968). The variation between different hybrid combinations for various characters indicate the need for identifying the best combiners.

It is therefore necessary to have more number of *pisifera* and *dura* palms of tested production potential for a successful oil palm breeding programme. Since it is not possible to raise *pisifera* plantations from its own seeds, it becomes necessary to identify them from a large population of *tenera* × *tenera* or *tenera* × *pisifera* progenies. Embryo culture can be used to shorten the time required for this purpose; as fertile *pisiferas*, though few, are available. Suggestions for assessment of individual *pisiferas* on the basis of morphology of the female inflorescences (Thomas, 1970) or on the morphology of parthnocarpic fruits (Menendez, 1967) have not yet been put to practical use. Selection on the basis of vegetative or physiological characters is another possibility. Further studies on the available *pisifera* palms to categorise them and evaluation of *tenera* using different d × p combinations are essential.

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