Journal of Plantation Crops 18 (Supplement) : 43–46

CHARACTERISATION OF *PISIFERA* PARENTS AND ITS RELEVANCE TO OIL PALM IMPROVEMENT

R. S. N. PILLAI and K. U. K. NAMPOOTHIRI
Central Plantation Crops Research Institute, Research Centre Palode 695 562, *Thiruvananthapuram, Kerala, India*

ABSTRACT

Twenty eight *Pisifera* palms were identified from *tenera* x *tenera* population. These palms were critically studied for morphological features and individual fruit characters. The percentage of fruits containing kernel and embryo (fertile), those with kernel or mesocarp alone and fruits with half filled kernel or having cavity alone varied highly from palm to palm. Fertility status of *Pisifera* is known to influence the yield potential of *Tenera* hybrids (*dura* x *pisifera*) which is the only planting material used for commercial cultivation of oil palm. The significance of characterising *Pisifera* palms for selection as pollen parent for the production of good quality oil palm hybrids is discussed.

INTRODUCTION

In oil palm, three distinct fruit forms are observed *viz.*, the thick shelled *dura*, the shell-less *pisifera* and thin shelled *tenera*. *Tenera* is a hybrid between *dura* and *pisifera* and by virtue of its higher oil yield it is the only variety commercially cultivated. Non-availability of *tenera* hybrid seeds has been the major constraint in the large scale cultivation of oil palm in India. Attempts made during 1980–'81 to isolate the parent lines resulted in the identification of 43 *dura* and 28 *pisifera* palms which were not reported in the country earlier (Pillai and Nampoothiri, 1981). Since then, *dura* and *pisifera* palms were being critically studied for various characters to identify individual palms for generating the best *tenera* hybrid combinations for commercial cultivation.

Selection of *dura* mother palms for breeding is made based on bunch yield, mesocarp percentage and oil content. But such direct selection methods cannot be applied for selection of the male parent – *pisifera* since they are usually female sterile. Hence the potential of *pisifera* is harder to gauge than that of the *dura*. It appears likely that the range of sterility is associated with genes modifying shell thickness thus regulating the quality of *teneras* obtained from *dura* x *pisifera* crosses. Although the influence of *pisifera* parents on the performance of the hybrid is evident, this aspect has not been thoroughly investigated. An attempt is made in this paper to classify the *pisifera* palms critically for identifying sterile palms for direct use, suggesting breeding for fertile *pisiferas* using those palms showing less sterility and to design a proper trial to test the influence of the range of fertility of the *pisifera* palms on the shell-thickness in *dura* x *pisifera* crosses of oil palm.

MATERIALS AND METHODS

A population of 226 *tenera* x *tenera* palms (Malaysian origin) available at the Oil Palm Station, Thodupuzha, Kerala was used for the isolation of *pisifera* palms. From the segregating population 28 *pisifera* palms were identified during 1981 and since then these palms were critically studied for

various morphological and yield characters. For studying the bunch characters, mature bunches were harvested and fresh weight of individual bunches was recorded. Individual spikelets were separated from these bunches to extract the fruit and longitudinal section of fruits were examined for different fruit characters. The fruits were then classified into the following seven categories.

1. Fruits with endosperm and embryo; 2. Fruits with endosperm and no embryo; 3. fruits with half-filled endosperm and no embryo; 4. Fruits with empty endosperm cavity and no endosperm; 5. Fruits with endosperm cavity, endosperm liquid and no endosperm; 6. Fruits with a linear shell-streak and no endosperm and 7. Fruits with only mesocarp and no endosperm.

A total of 24 bunches were analysed from the 18 palms and the actual values were converted to percentage for comparison. The study was confined to 18 palms since the rest of the palms did not yield any mature bunches during the period.

RESULTS

Proportion of different fruit types along with the mean weight of FFB for individual palms are presented in Table I. All the palms showed a wide variability with respect to the mean bunch weight and all other characters. Bunch weight varied from 5 kg to 23 kg which is lower than that of *dura* and *tenera* of comparable age. Among 18 palms, one palm (Palm No. 5) was totally sterile while palm nos. 98 and 113 showed very low fertility percentage varying from 1.9 to 3.2% and the rest of the palms were fertile to varying degrees. Among the categories of fruits within the sterile group the ones with endosperm (without embryo) were more. But there were no definite relationships between the various categories; neither was there any relationship between the yield (bunch weight) and the extent of sterility.

DISCUSSION

Pisifera is the pollen parent used in the production of high yielding *tenera* hybrid. Vander Weyen (1952) observed that in majority of *pisifera* palms all the fruits get aborted. Hartley (1977) also reported that the yield of *pisifera* is more or less strongly associated with abortion of female inflorescences. It is believed that the quality of the *tenera* obtained from *dura* x *pisifera* crosses can be influenced by the type of the pollen parent used. Several attempts have been made to classify *pisifera*. Based on fertility Gascon, (1956) has classified them to 1. fertile palms producing large number of shell less fruits; 2. partially sterile producing only a few fertile fruits per bunch and; 3. sterile palms producing only few fruits occasionally. In such sterile fruits there is either no development of the ovule or the outer shell development is retarded (Hartley 1977). Arasu (1970) observed that many apparently well developed *pisifera* palms lacked embryos and 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 mature fruit development and grouped the *pisifera* palms into four categories *viz.*, fertile, blind, sterile and super sterile palms. Obasola and Okwuagwu (1978) later classified *pisifera* into eight groups considering the degree and nature of fruit development as well as the pattern of yield simultaneously. Pillai and Nampoothiri (1981) identified 22 *pisifera* palms from a *tenera* x *tenera* population and classified these into two major categories *viz.*, 1. fertile palms which bear fruits with kernel and embryo and; 2. sterile palms producing bunches with few fruits. They stressed the need for a wider choice of *pisifera* palms for a successful oil palm breeding programme. In the present study spread over a period of eight years, *pisifera* palms are classified

Table I. *Classification of* Pisifera *palms – Proportion of different fruit types*

Sl. No.	Palm No.	Mean weight of FFB (Kg)	Fertile				Sterile		
			Fruits with endosperm and embryo %	Fruits with endosperm and no embryo %	Fruits with half-filled endosperm and no embryo %	Fruits with empty endosperm cavity and no endosperm %	Fruits with endosperm cavity, endosperm liquid and no endosperm %	Fruits with linear shell-streak and no endosperm %	Fruits with only mesocarp and no endosperm %
1	5	6.00	Nil	46.40	5.90	7.30	4.60	3.70	31.80
2	13	5.25	16.05	47.93	Nil	1.45	5.00	29.51	Nil
3	51	9.75	8.45	30.85	0.38	0.85	7.80	24.30	27.35
4	98	10.00	1.90	40.90	6.10	5.90	1.91	Nil	43.00
5	100	7.00	14.70	32.90	Nil	Nil	Nil	6.12	46.10
6	111	13.20	12.90	58.00	0.38	3.56	2.73	4.64	14.76
7	113	13.00	3.20	65.30	12.1	8.90	Nil	7.21	2.42
8	120	23.40	10.90	37.60	Nil	4.21	Nil	19.50	28.50
9	152	14.00	19.50	32.20	Nil	2.91	2.52	Nil	43.30
10	214	12.70	9.80	73.60	Nil	5.12	Nil	0.73	10.60
11	223	22.25	8.75	41.81	1.75	8.85	4.85	2.52	34.12
12	242	5.50	12.20	36.32	Nil	Nil	5.91	Nil	45.41
13	245	15.30	34.75	34.55	3.65	3.20	1.61	19.00	2.10
14	266	8.00	11.80	63.10	3.60	14.41	1.30	1.30	5.20
15	283	12.50	19.90	34.12	6.41	7.40	6.90	7.71	17.20
16	310	9.00	12.60	31.62	0.78	4.10	1.81	11.00	38.00
17	313	18.50	10.30	51.71	2.71	4.11	0.71	9.60	20.20
18	458	12.00	14.30	32.90	Nil	Nil	Nil	26.30	26.50

into two major categories *viz.*, sterile and fertile with five sub-classes of the sterile fruits. Such a detailed classification is very important since sterile *pisifera* palms are assumed to be the best category for the production of superior *tenera*. Obasola (1973) presumed that sterility is linked with shell thickness in the resultant *tenera* progeny. This theory however remains to be proved through field trials. It is therefore essential to elucidate the influence of the degree of sterility of individual palms on the shell thickness of the hybrid.

Results obtained in the present study revealed the presence of one palm which is fully sterile producing fruits without embryos. Two other palms were more or less sterile (96.8 to 98.1%). Sterile pisiferas produce extremely thin shelled *tenera* fruits when crossed with dura, and hence these palms could be employed in the large scale hybrid seed production.

Out of the 28 *pisifera* palms identified so far, only 18 were classified, as the rest of the palms did not produce bunches with developed fruits for analytical purpose. There are a good number of palms which have high proportion of fertile fruits (upto 34%) and good bunches (upto 23 Kg) which is generally uncommon (Gascon, 1956, Anonymous, 1986). Fertile pisiferas classified by high bunch numbers, good fruit set, high mesocarp to fruit content and good oil to mesocarp content could form the base population for breeding fertile pisiferas. Malaysian plant breeders have evinced optimism in using fertile pisiferas to complement the conventional D x P hybrids.

Oil palm breeders have been so far concentrating on the association of sterility with the quality of the resultant hybrids. Owing to the fact that there are sub-classes of fruits other than completely fertile or sterile ones it is necessary to study the relationship of all the fruit forms with shell thickness of the hybrid combinations on a field scale. Hybrid progenies involving 43 selected *duras* and 11 *pisiferas* of different classes have been planted at the Chithara estate of Oil Palm India Ltd. in 1988.

The strategy for *pisifera* in oil palm breeding as envisaged now can be summarised as follows:

1. Use of only sterile *pisifera* for *tenera* production for immediate commercial cultivation; 2. Testing the relationship of various categories of *pisiferas* with shell thickness in the *dura* x *pisifera* combinations; 3. Classification of all the *pisifera* palms in the available population; 4. Production of more pisiferas for a wider choice of male parents from *tenera* x *tenera* and *tenera* x *pisifera* populations belonging to different countries of origin; 5. Using the already identified *pisifera* palms as a base population for breeding fertile pisiferas on a larger scale.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Central Plantation Crops Research Institute, Kasaragod, Kerala for providing the facilities for conducting the study. We are grateful to the Director of Agriculture, Kerala and the Superintendent, Oil Palm Station, Thodupuzha for their co-operation in the field observations at the Thodupuzha Farm. The authors express their sincere thanks to Mr. P. S. Ravindran and Mr. Thomas Mathew for their help in the collection of data.

REFERENCES

ANONYMOUS, 1986. *The International Society for Oil Palm Breeders* Vol. **3**: 3–4.

ARASU, N. T. 1970. A note on the germination of *pisifera* (shell less) oil palm seeds. *The Malayan Agic. J.* **47**: 524–527.

GASCON, J. P. 1956. Etudessur pisiferas etleser oisement dura x pisifera. *Bull Agron. Minist. Fr d outremer.* No. **14**: 45–58.

HARTLEY, C.W.S. 1977. *The Oil Palm.* Longman, London. pp. 245.

OBASOLA, C. O. 1973. Female sterility and fertility in variety *pisifera* and shell thickness in progenies *dura* x *pisifera* crosses of the oil palm (*Elaeis guineensis*, Jacq.) *J. Nigerian Inst. Oil Palm Res*, **18**: 37–41.

OBASOLA, C. O. and OKWUAGWU, 1978. Selection among *pisifera* for production of *tenera* in the oil palm (*Elaeis guineensis* Jacq.) *Ann. Conf. Agric. Soc.* Nigeria.

PILLAI, R.S.N. and NAMPOOTHIRI, K.U.K. 1981. Preliminary investigations on *pisifera* with special reference to the genetic improvement of oil palm (*Elaeis guineensis* Jacq.) *Proc. PLACROSYM IV*: pp. 308–313.

VANDER WEYEN, R. 1952. Law propection des palmeraies Congolaises et ses premiers resultates. *Bull: Inf I. I.N.E.A.C.*, pp. 357.