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RESEARCH PAPER

Evaluation and Characterization of Dwarf Tenera and *oleifera* Genetic Resources of Oil Palm

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ABSTRACT

As a part of improvement work, evaluation was undertaken in the field gene bank consisting several exotic germplasm collections planted during 1981- 1994 at Directorate of Oil Palm Research, Research Centre, Palode. A tenera palm from exotic collection planted during 1981 and *Elaeis oleifera* of Surinam origin planted during 1988 showed low stem elongation when compared to their counterparts. Nigerian materials were introduced *vide* code No. E130756 through National Bureau of Plant Genetic Resources (NBPGR), New Delhi and Surinam *oleifera* was a chance introduction. These palms were characterized based on IBPGR oil palm descriptor and evaluated for their yield potential. Surinam *oleifera* was also compared with other exotic accessions for their descriptive characteristics. Dwarf tenera had bunch yield of 118kg/palm/year with 9.1 bunch numbers and 24 cm height increment, whereas Surinam had 75kg/year/palm with 6 bunches and 15 cm height increment. It was proved by characterization that both of them had dumpiness *viz*., short trunk, short leaves and other vegetative characteristics. As per bunch analysis, dwarf tenera recorded 20.4 % and 1.08% of Mesocarp oil to Bunch and Kernel oil to Bunch, respectively, where as Surinam *oleifera* had 9.25% and 3.1%. In order to improve the yield and bunch quality components of these compact materials, selfing and *inter se* crossing and back crossing (with *E. guineensis*) was attempted for tenera and *oleifera,* respectively.

Key words : Dwarf tenera, *oleifera*, IBPGR descriptor, bunch yield, characterization

INTRODUCTION

The Oil palm (*Elaeis guineensis*, Jacq) is a commercial crop demanding large tracts of land for its exploitation. High yielding compact palms with slow stem elongation and short leaves become good alternative for prolonging commercial exploitation (Escobar and Alvarado, 2004). Advantage of reduced height increment is only seen after many years, when height starts to have an effect on harvesting cost. Reducing height has always been interest to oil palm industry because of the high cost of harvesting tall palms (Bakoume and Louise, 2007). However, selection for yield will tend to favour taller palms and Corley and Lee (1992) reported that selected Deli dura*s* were 15-22% taller at the same age than unselected material. Dumortier (2000) found a significant positive correlation between progeny means for yield and height. According to Corley and Tinker (2003), finding special small and productive palms with potential commercial value is not an easy task and only a few examples of such palms have been documented worldwide. Jogoe (1952) identified dwarf palm with large girth and slow height increment and subsequently dwarf progenies were generated in Malaysia for possible commercial utilization. Sparanaaj *et al.* (1963) referred Malayan dumpy E206, the Pobe dwarfs, the Yangambi palm 16R as sources of material with low height increment. The wild American species *Elaeis oleifera* is seen as a promising genetic resource for breeding for slow trunk growth. Surinam is considered as one of the centres of diversity of *oleifera* which are found scattered throughout the forest, open pasture along banks of streams. According to Corley and Tinker (2003), *oleifera* stand in Surinam declined considerably and emphasized preservation of collected *oleifera* gene pool. To improve bunch composition, it is generally backcrossed to *E.guineensis.* Nampoothiri (1998) reported dwarf tenera in India and emphasized

usefulness of *oleifera* in breeding for dwarfness. Characterization of genetic resources constitutes the first step to their effective utilization (Simmonds, 1993). Accordingly, present evaluation and characterization was done for reported dwarf palms for their effective utilization.

MATERIALS AND METHODS

Several exotic germplasm collections were made from different oil palm growing countries to India (Pillai, 1994). The Nigerian tenera population with the progenitor of 26.3999 D × 25.380P were introduced to India through National Bureau of Plant Genetic Resources (NBPGR) *vide* code number E 130756 during 1979 which were field planted at Directorate of Oil Palm Research (formerly National Research Centre for Oil Palm) at Palode during 1981. One tenera palm from Nigerian introduction showed dumpy characters (Pillai, 1994; Nampoothiri, 1998) as they recorded low vertical growth compared to similar aged palms. Dwarf tenera was subjected to characterization and yield evaluation as per IBPGR (1989) descriptor with necessary additional characteristics. Bunch Analysis was done as per standard procedures. Five Fresh Fruit Bunches (FFB) from each palm were utilised for bunch analysis and average of the values were presented in the descriptor results in Table 1. Consecutive three year yields were taken for reporting under yield evaluation. Methodology prescribed by Corley *et al*. (1971) was adopted to measure vegetative growth of the palms. A single *oleifera* of Surinam origin planted during 1988 was also subjected to similar evaluation and characterization. This was probably introduced along with commercial planting material as a chance introduction. Descriptive characteristics of Surinam *oleifera* were compared with other exotic *oleifera* populations planted at Palode during 1994 and presented in this paper.

RESULTS AND DISCUSSION

The commercial dura *×* pisifera hybrids grew at faster rate as selection for yield will tend to favor taller palms. Height had a high heritability. Malaysia and ASD Costa Rica have successfully demonstrated production of dwarf varieties or clones by utilizing individual dumpy palms and potential *oleiferas,* respectively (Escobar and Alvarado, 2004). In this present study, identified dwarf tenera recorded an average yield of 118 kg/palm/year with 9.1 bunch numbers and 24 cm height increment. Rajanaidu and Jalani (1994) reported short height increment of 15-25 cm within dwarf populations from Nigerian collections at Palm Oil Research Institute of Malaysia (PORIM). Selfed and crossed progenies of these dumpy inherited reduced annual height increment. Sharma (1999) and Bilal *et al*. (1999) reported 5-10% shorter height in crosses of Nigerian progenies. Vegetative and reproductive characters were assessed and the data is depicted in Table 1. Results revealed that the palm has short rachis length (4.85 m), inter nodal leaflet distance (2.5 to 3 cm), leaflet length (85.33 cm), petiole width (8 cm), petiole depth (2.92 cm), leaflet breadth (4 cm), frond base length (75 cm), frond base width (10 cm) and other vegetative characteristics when compared to commercial tenera of same age planted adjacent to this palm. Its leaf base width (Fig. 1a) showed apparent dwarf character which recorded average 5 cm as per the value recorded in the rachis leaf bases located approximately two feet from the ground level. Similar tenera palm with same age recorded 15 cm leaf base width. High heritability was also recorded for oil palm height increment (Adon *et al.*, 2001). However it has recorded very low oil yield which must be improved by *inter se* cross with elite teneras. Other notable compact characters of this tenera were stunted fronds (85.3 cm) with reduced leaflet length (Fig. 1b), compact crown and dumpy canopy structure and reduced internodal leaflets (Fig. 1c). They recorded low fruit to bunch (48.3 %) and oil to bunch (20.4%) with moderate (77.2 %) mesocarp to fruit. It has medium shell thickness of 1.83 mm with a single fruit and nut weight of 8 and 1.7 g, respectively (Fig. 1d). It may be noted that original *deli* dura had mesocarp to fruit of not more than 50 % with higher figure in latter generations being the result of hybridization and selection (Hartley, 1988). Considering over all dumpy nature, this palm has been subjected to selfing and *inter se* crossing and progenies were established at Directorate of Oil Palm Research, Pedavegi, Andhra Pradesh.

The reported *oleifera* showed shorter height increment (15 cm), short leaves and short inter node (Fig.1e) and showed poor bunch yield (72 kg/palm/year). The bunch composition, vegetative and reproductive characteristics are depicted (Fig. 1B). The leaf base of palm persist only for a short period and leaflets are shorter than those of *E.guineensis*. The present *oleifera* contained short spines in the bunch and fronds leaflets lie in one plane and have no basal swellings. The palm had bunch weight of 12.5 Kg. There are reports of bunch weighing between 8 and 12 kg. According to Ooi *et al*. (1981), the large number of small fruits weighing between 1.7 and 5 g reported in Colombia where as present palm recorded 8.27, 2.83 and 2 g for normal, parthenocarpic and aborted fruits. Ooi *et al.* (1981) also recorded similar results in *oliefera* palms. There are two types of parthenocarpic fruits observed; those with small nut with a liquid filled cavity and smaller fruit with a lignified central core

(Fig. 1g). Oil to fresh mesocarp recorded 37 % in parthenocarpic fruits or aborted fruits. It is generally reported that *oleifera* fruit set ranged from 28-46 % and present *oleifera* recorded 53.36 %. Bunch components of *oleifera* varied with locality and wide variation has been recorded. Notably, it has 76 % mesocarp per fruit with 9 % oil to bunch ratio as against reported value of 35-60 % and 4 % respectively in Brazilian *oleifera* germplasm (Ooi *et al*., 1981). The identified present palm is considered as valuable resources because of less common fruit type which is deep orange to red at maturity and developed from green colour immature fruit turning olive green and pale yellow. Meunier (1975) reported small *oleifera* palms with green colour at immaturity turning orange to red (Fig. 1g) at maturity. As per characterization study of different *oleifera* resources available at Palode and summary of characteristics reported by Richardson (1976) comparison of Surinam palm with other *oleiferas* was made and results reported in Table 2. Notable distinct characters of Surinam palm are early fruit maturity, early disintegration of bunch spathes and long and slender bunch stalk of both male and female inflorescences. Similar results were reported by Escobar (1981). There is no evidence that fruit forms comparable to dura, tenera and pisifera exists in population of *E.oleifera* where as present *oleifera* had thin shell (1.44 mm) and high mesocarp (76 %) per fruit equivalent to tenera fruit form. Sterling *et al*. (1987) described the real compact palm with dumpy characterizations and advocated 'back crossing' for improvement of yield and bunch quality of *oliefera* species. Hence, this palm has been incorporated into breeding programme of Directorate of Oil Palm Research.

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