

Fruit and seed development in *Elaeis oleifera* (HBK) Cortes of Surinam origin

P. Murugesan*, H. Haseela, S. Gopakumar and M.V.M. Shareef

Directorate of Oil Palm Research, Regional Station, Palode, Pacha 695 562, Kerala

ABSTRACT

A dwarf American oil palm (*Elaeis oleifera*) germplasm accession planted at Field Gene Bank of Directorate of Oil Palm Research, Regional Station, Palode, Kerala state was studied for fruit, seed development and maturity. Seeds extracted during matured fruit development stages were tested for germination. The study revealed that the fruit has developed steadily in size and weight from anthesis (0.27 g) to 135 days after anthesis (DAA) (8.62 g). The embryo has matured at 78 DAA and shell became hard and lignified during 113 to 126 DAA. Low moisture content was recorded in mesocarp (29.5%), shell (12.5%), kernel (27.2%) and embryo (59.5%) at 135 DAA with high seed germination (44.4%). Mesocarp oil synthesis initiated (3.91%) at 65 DAA and elevated to 50.9% at 113 DAA onwards and peaked at 135 DAA. Surinam *oleifera* fruit bunches took about 4.5 months (135 DAA) for fruit ripening and harvestable maturity. These experimental results will be utilised for breeding and improvement of dwarf *oleifera* palm of Surinam origin.

Key words: *Elaeis oleifera*, Surinam, seed, fruit maturity, germination.

INTRODUCTION

American oil palm (*Elaeis oleifera*) is endemic to tropical countries of south and central America. A feature of the palm that distinguishes it from African oil palm (*Elaeis guineensis*) is its dwarf and often procumbent trunk which facilitates easy harvesting of ripe bunches. Rao and Chang (4) recorded long anthesis duration, uneven ripening and high number of parthenocarpic fruits in *oleifera* which are undesirable. Hence, the desirable traits in *E. oleifera* are introgressed gradually into existing breeding material through hybridization for which knowledge on seed biology of experimental material in question is essential. With above points in view, investigation was undertaken with an objective to obtain definite duration for fruit maturity associated with morphological changes in Surinam *oleifera*.

MATERIALS AND METHODS

One accession of Surinam origin planted during 1988 at Oil Palm Field Gene Bank of Directorate of Oil Palm Research Regional Station, Palode, Kerala was taken as experimental material which showed very less height increment apart from other desirable traits (Murugesan *et al.*, 1). Out of eight female inflorescences emerged during the study period, six were tagged at the time of anthesis and three bunches each were utilized for bunch analysis and fruit development studies. The bunch analysis was done as per the procedure described by Murugesan and Gopakumar (3). Fruit samples (open-pollinated) were collected at different stages from anthesis to full

ripening *viz.*, 0, 10, 22, 35, 48, 65, 78, 99, 113, 126 and 135 days after anthesis (DAA) and assessed for fruit development and maturity. Three spikelets from the centre portion of the bunches were taken during different developmental stages and average values of different characteristics with respect to fruit, seed and embryo were recorded. Moisture content (fresh weight basis) were determined on samples of whole fruits (whole fruit, seed while present and mesocarp), seeds (endosperm and embryo, while present) after drying at 103°C for 17 h in an oven. The seeds from last stages of seed development phase were extracted manually and tested for germination as per the technique described by Murugesan *et al.* (2). Seeds were tested between moist germination paper towels enclosed in plastic boxes under incubated temperature of 25°C. Three replications of seeds from each bunch were used for germination testing. Oil from dried mesocarp and kernel of different developmental stages were estimated by solvent extraction method using petroleum ether 60-80°C in Soxhlet apparatus.

RESULTS AND DISCUSSION

Generally, *oleifera* shows poor fruit set with a range of 28 to 46% and present Surinam *oleifera* recorded 53.36% with 9.25% oil to bunch. The palm had bunch weight of 12.5 kg with three years average yield of 75 kg/year/palm with 6 bunches and 15 cm height increment. The changes in fruit and fruit weight components are given in the Fig. 1. The fruit between 10 to 35 DAA had no appreciable growth. The rapid phase of fruit development and differentiation observed

*Corresponding author's E-mail: gesan70@gmail.com

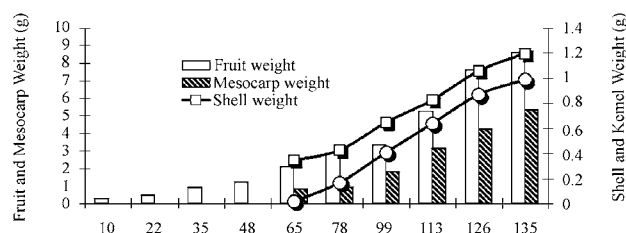


Fig. 1. Changes in average fruit weight components during fruit ripening of Surinam *oleifera*.

48 DAA onwards. This rapid period of activity continued till fruit ripening. During the period from 65 to 126 DAA embryo and endosperm formed and completely differentiate by both size and form; during the same period, the swelling of outer mesocarp and endocarp was observed. The fruit has developed steadily in size and weight from anthesis (0.27 g) to 135 DAA (8.62 g). The kernel was at first liquid (48 DAA) and started solidification at 65 DAA onwards. The embryo has matured at 78 DAA and shell became hard and lignified during 113 to 126 DAA. The changes in average moisture content of mesocarp, shell and kernel is given in Fig. 2. Contrary to fruit weight, moisture content had downward trend which was high during the stages between 65 to 99 DAA. Sudden moisture decrease was recorded at 113 DAA and lowest was at 135 DAA. Low moisture content was recorded in mesocarp (29.5%), shell (12.5, kernel (27.2%) and embryo (59.5%) at this stage. On set of oil formation in mesocarp and kernel was recorded at 65 and 78 DAA, respectively which increased rapidly and reached peak at full ripening stage (Fig. 3). Mesocarp oil synthesis initiated (3.91%) at 65 DAA and elevated high at 113 DAA onwards and peaked at 135 DAA (50.9%). Embryo was visible at 78 DAA but does not explicitly imply that it is viable as germination was recorded only with fully matured fruit at 135 DAA. Shell and kernel formation of the fruit was initiated at 65 DAA stage which showed less shell thickness. Maximum shell thickness was recorded at matured stages (113 and 135 DAA). Endosperm was liquid condition up to 48

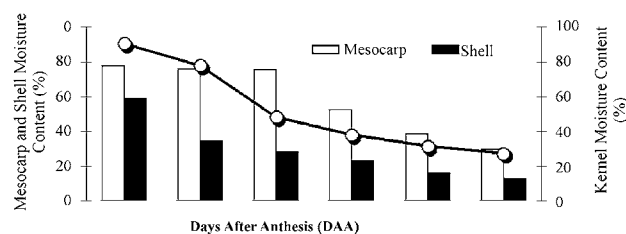


Fig. 2. Changes in average moisture content (%) of mesocarp, shell and kernel during fruit development of Surinam *oleifera*.

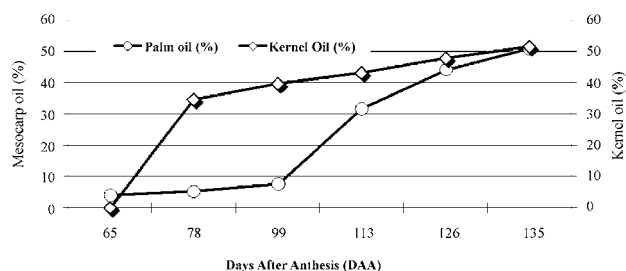


Fig. 3. Changes in mesocarp (CPO) and kernel oil (PKO) during fruit development Surinam *oleifera*.

DAA and filling of kernel with gelatinous endosperm and embryo formation was observed. The kernel was white and soft at 65 DAA stage, it gradually changes from white to brown and dark brown at the end of maturity and shell became hard and lignified. Hardening of shell takes place due to accumulation of tannins which are responsible for the perceptible darkening. Thomas *et al.* (5) obtained similar pattern of fruit ripening in *Elaeis guineensis*. The seeds extracted from matured fruits (135 DAA) showed 44.4% germination whereas other stages showed nil germination. During the initial phase of growth, fruits were very small ivory coloured at pedicellar region and light green at stylar region. The fruit colour became light orange to dark orange at full fruit ripening. During anthesis to 22 DAA, little changes observed in the fruits and during 65 to 126 DAA fruit developed to almost maximum size and last stage of fruit maturity observed at 135 DAA. Beyond 135 DAA, fruits started falling due to detachment from bunches. Surinam *oleifera* fruit bunches takes about 4.5 months (135 DAA) for fruit ripening and harvestable maturity. However, detailed study with different genotypes of *oleifera* is required to confirm correct harvestable maturity for general recommendation.

ACKNOWLEDGEMENT

Senior author acknowledges the Director, Directorate of Oil Palm Research, Pedavegi, Andhra Pradesh for the support.

REFERENCES

- Murugesan, P., Pillai, R.S.N., Gopakumar, S., Mathur, R.K., Nampoothiri, K.U.K. and Kochu Babu, M. 2008. Dwarf oil palms from Nigeria and Surinam-Their characterization and utilization at Palode, India. In: 3rd Indian Horticulture Congress, Orissa University of Agriculture and Technology, Bhubaneswar. pp. 332.
- Murugesan, P., Padma, P., Nagamangala, U., Mathur, R.K. and Kochu Babu, M. 2008. Preliminary investigations on oil palm *tenera inter*

- se progenies with special emphasis to *pisifera*. *Indian J. Hort.* **65**: 214-19.
3. Murugesan, P. and Gopakumar, S. 2010. Variation in phenotypic characteristics of ASD Costa Rica hybrids in India. *Indian J. Hort.* **67**: 152-55.
 4. Rao, V. and Chang, K.C. 1982. Anthesis and fruit set in *Elaeis oleifera* (HBK) Cortes. *Palm Oil Res. Inst. Malaysia, Bull.* **4**: 27-34.
 5. Thomas, R.L., Hang Sew, P., Mok, C.K., Chan, K.W., Easau, P.T. and Ng, S.C. 1971. Fruit ripening in the oil palm *Elaeis guineensis*. *Ann. Bot.* **35**: 1219-25.

Received: April, 2010; Revised: December, 2010;
Accepted : January, 2011