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Research Article

CHARACTERIZATION OF SELECTED *PISIFERA* PALMS IN OIL PALM

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Abstract: Twenty-two accessions of different sources indigenously collected from India were planted in ICAR-Indian Institute of Oil palm Research Pedavegi during 2009 and evaluated for 2016-17, 2017-18 and 2018-19 and among the 257 palms, 20 *pisifera*, 109 *Tenera* and 128 *Dura* were identified. Among the *pisifera* palms two *pisifera* palms IC0610027-20 (TTD-1) is having 98.5 % sterility and IC0610024-47 (AND-24) is having parthenocarpic *pisifera* palm with 68.62 % fruit set. Average height increment of the palms per year was 39.03 and 50.67 cm, respectively.

Keywords: *Oil palm, Pisifera, Sterile, Parthenocarpic, FFB*

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Introduction

In oil palm three distinct types of fruits are recognized *viz*., *dura* (2-8 mm endocarp), *Tenera* (0.5 to 4 mm endocarp) and *pisifera* (no endocarp). Presence/absence of endocarp (shell) is controlled by single gene with co dominance and the genotype of *dura*, *pisifera* and *Tenera* represented by Sh+ Sh+, Sh- Sh-, Sh+ Sh-, respectively. Significant yield improvement in oil palm has been obtained by exploring this monogenetic character to produce hybrid called *Tenera* with more mesocarp and large quantity of oil in commercial plantations. Thodupuzha *dura* × *pisifera* material was the base breeding material for Indian oil palm industry which has narrow genetic base [1]. Genetic resources collected exotic sources and their diversity and multivariate analysis for characterization was done in these sources [2,3]. To broaden the oil palm genetic base, genetic resources collected from different locations [4].

Investigations on *pisifera* palms characterization and other components were reported by Pillai and Nampoothiri (1981) [5]. As a part of hybrid seed production, characterization of *pisifera* palms was undertaken in a *Tenera* inter se matted progeny population [6]. Two sterile *pisifera* and one fertile *pisifera* were identified and characterized by Murugesan and Mandal, 2010. There is a need to introduce new and genetically diverse *pisifera* sources into the ongoing programme to further add to existing *pisifera* gene pool. Identification of potential *pisifera* is important for its use as pollen parent in hybridization programme for hybrid seed production and development of hybrid. Availability of *pisifera* palms need to broaden genetic base by identification and characterization is crucial to strengthen the breeding programme.

Materials and Methods

Twenty-two oil palm germplasm accessions planted during 2009 in the field gene bank at ICAR-Indian Institute of Oil palm Research Pedavegi and all the individual palms were evaluated for fruit types, vegetative and bunch characteristics, for two *pisifera* palms as per IBPGR (1989) descriptor (whichever characters possible for *pisifera* fruit form) [7]. These palms were maintained in sandy loam soil with moderate water holding capacity and good organic content and hot humid weather and average rainfall was 800-900 mm, but this crop maintained in irrigated condition and recommended package of practices.

The *pisifera* palms were classified either as fertile producing ripe bunches with high fruit set or semi fertile with partially fruit set or sterile palms. Bunch analysis was done for three bunches during peak season as per the procedure described by Blaak *et al* (1963) [8]. Methodology described by Corley *et al* (1971)[9] was followed to measure vegetative growth of the palms. Number of leaves were recorded every quarterly and pooled. Seventeenth frond was taken for estimating leaf character and other vegetative characters recorded during April month every year and averaged of three years (2016-17 to 2018-19). Similarly, bunch production and number of bunches were recorded as and when bunches are ripened throughout the year and average of three years were reported.

At global level the narrow genetic base of oil palm, *pisifera* in particular is major bottleneck in breeding for hybrids with this view the present study was undertaken to characterize the identified *pisifera* for future use in oil palm heterosis breeding programme.

Result and Discussion

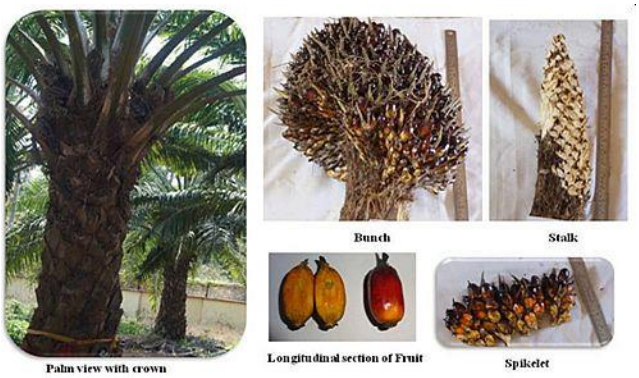
The fruit form analysis revealed that out of 257 individual palms of 22 accessions, 20 *pisifera*, 109 *Tenera* and 128 *dura* palms were identified in field gene bank of ICAR-Indian Institute of Oil palm Research (ICAR-IIOPR) Pedavegi. The *pisifera* palms were further evaluated for vegetative and bunch characteristics. *Pisifera*s are often unproductive and many of them were partially female sterile, generally shows abortion in the inflorescence after anthesis. Based on the fertility trait, *pisifera*s were classified as 3 groups [10]. They were 1. Fertile palms producing large number of normal fruits and shelless kenels 2, partially sterile with only few fertile fruits per bunch and 3, sterile giving few fruits occasionally. The present study revealed that one *pisifera* (IC0610027-20) showed fertile character which recorded normal bunch and fruit development, where as other *pisifera*s (IC0610024-47) showed developed bunches with parthenocarpic fruits (no shell and no kernel) throughout the evaluation period. The illustration consisting palm view, bunch, spikelet, fruit cross section of *pisifera*s IC0610027-20 and IC0610024-47 are given in Fig 1a and 1b, respectively. Murugesan and Mandal (2010) [11] reported three *pisifera* palms with mature bunches and Wonky- Appiah (1987) [12] reported some *pisifera* palms with mature ripe bunches regularly under natural condition.

Table-1 *Fresh fruit bunch, bunch number and sterility % and parthenocarpic fruit set percentage of different genetic resources*

Traits		2016-17	2017-18	2018-19	Average
IC0610027-20 (TTD-1)	Number of bunches per year	8	10	7	8.33
	FFB yield (kg/palm/year)	117.21	147.30	106.65	123.72
	Bunch weight (kg)	18.25	14.37	10.64	15.38
	Total number of fruits	1200	1405	1035	1275.66
	Number of sterile fruits	1181	1399	1011	860
	Sterility %	98.41	99.57	97.68	98.55
IC0610024-47 (AND-24)	Number of bunches per year	14	26	8	16
	FFB yield (kg/palm/year)	111.66	220.23	77.19	136.36
	Bunch weight (kg)	9	10.42	7.22	8.88
	Total number of fruits	632	788	805	741.66
	Number of Parthenocarpic fruits	347	578	625	516.66
	Number of sterile fruits	285	210	180	225
	Parthenocarpic fruit set %	54.90	73.35	77.63	68.62

Table-2 *Characterization of pisifera palm from different germplasm lines*

Characteristics of Pisifera	IC0610027-20 (TTD-1)				IC0610024-47 (AND-24)			
	2016-17	2017-18	2018-19	Average	2016-17	2017-18	2018-19	Average
Flower colour	White				White			
Fruit form	Pisifera (sterile)				Pisifera (Parthenocarpic)			
Tree form	Normal				Normal			
Fruit colour	Nigrescence				Nigrescence			
Mesocarp Pigmentation	Normal				Normal			
Height increment(cm)	37.14	35.75	44.20	39.03	45.7	50	56.32	52.67
Rachis length (m)	640	506	575	574	583	556	548	562.33
Petiole width (cm)	11.2	12	11.7	11.6	10.1	10.2	9.3	9.87
Petiole depth (cm)	9.1	9.2	8.95	9.08	7.7	8.5	6.6	7.60
No. of leaflets	346	290	342	326	306	300	340	315.3
Leaflet length (cm)	113	105	114	110.1	125	121	103	116.3
Leaflet width (cm)	5.9	5.1	5.3	5.4	5.1	5.4	5.5	5.3
Frond production per year	24	24	24	24	24	24	24	24



a. IC0610027-20 (TTD-1)

b. IC0610024-47 (AND-24)

Fig-1 Palm view, Bunch, stalk, spikelets and cross section of pisifera and parthenocarpic pisifera palm

The reported sterile *pisifera*s (nigrescence) had three years (2016-17 to 2018-19) average fresh fruit bunch yield of 123.72 kg/year, 8.33 bunch numbers. Parthenocarpic *pisifera* palm (IC0610024-47) recorded 16 bunch numbers with 136.36 kg FFB [Table-1]. The vegetative parameters in terms of rachis length, petiole width, petiole depth and number of leaflets, leaflet length, leaflet width, frond production and other characters showed no significant results for comparing *pisifera*, but annual height increment of IC0610027-20 was less as compared to IC0610024-47. Characterizations of pisiferas genetic resources are present in [Table-2]. Based on the present study, present materials could be grouped into two and IC0610027-20 comes under sterile *pisifera* category and IC0610024-47 is parthenocarpic *pisifera*s. Fertile *pisifera*s are undesirable as they showed fairly good fruit set. A study from Nigerian Institute for Oil Palm Research (NIFOR) indicated that fertile *pisifera*s when used to produce *Dura* x *Pisifera* gave *Tenera* with thicker shells and hence fertility in *pisifera* is an undesirable trait [13]. Sterile *pisifera*s when used to produce *Dura* x *Pisifera* gave *Tenera* with thinner shells and we can get more oil yield due to high mesocarp content in fruit of oil palm. So Sparnaaij (1969) [14] has advocated lowest or zero fruit set. for ideal *pisifera* and hence IC0610027-20 could be considered as ideal one provided their combining ability should be tested with *dura* mother palms before proceed to hybrid seed production and supply to farmers.

Conclusion

Two *pisifera* palms, one with sterile *pisifera* with 98.5 % sterility and other one parthenocarpic *pisifera* palm with 68.62 % fruit set were identified from the base population of the genetic resources available at field gene bank of ICAR-Indian Institute of Oil palm research Pedavegi. Sterile *pisifera* palms could be utilized in oil palm molecular breeding programme aim at developing linkage maps. The pisifera IC0610027-20 could be utilized in breeding programme on developing Tenera hybrids for further evaluation.

Application of research

The *pisifera* IC0610027-20 could be utilized in breeding programme on developing Tenera hybrids and Parthenocapic *pisifera* IC0610024-47 could be used in molecular breeding programme aim to develop linkage mapping and further evaluation.

Research Category: Oil Research

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Study area / Sample Collection: ICAR-Indian Institute of Oil Palm Research, Pedavegi, West Godavari, 534 450, Andhra Pradesh, India

Cultivar / Variety name: *Dura, pisifera and Tenera*

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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