African Research Review

An International Multi-Disciplinary Journal, Ethiopia
Vol. 3 (4), July, 2009
ISSN 1994-9057 (Print) ISSN 2070-0083 (Online)

Fruiting Efficiency of *Pentaclethra Macraphylla* Benth: A Case Study in Ekpoma and Onne South-south, Nigeria

(Pp. 234-240)

Omokhua, G. E. - Department of Forestry and Wildlife Management, Faculty of Agriculture, University of Port Harcourt, Nigeria.
E-mail: omokhuag@yahoo.co.uk

Chima, U. D. - Department of Forestry and Wildlife Management, Faculty of Agriculture, University of Port Harcourt, Nigeria.

Abstract
The influence of location on fruiting efficiency and gynoecium-drop of P.macrophylla was investigated in Ekpoma and Onne between 2004 and 2007. Ten sample trees of P. macrophylla were randomly selected in a traditional agroforestry plantation in Ekpoma. Similarly, another ten sample trees were randomly selected in compound farms at the Institute of Agricultural Research and Training, Onne. Twenty inflorescences were randomly selected per tree in each location. Fruiting efficiency was calculated for each site by expressing the mean number of fruits set per inflorescence as a percentage of the pooled mean number of flowers produced per inflorescence. P.macrophylla had regular fruiting pattern in both locations with no inter-annual variability. The mean fruiting efficiency per inflorescence in Ekpoma and Onne were 0.061% and 0.063% respectively. Similarly, the mean gynoecium–drop per inflorescence was 99.94% for both locations. Competing sinks for photosynthate during flowering, fertilization and pollination failures are suggested as contributory factors to the very low fruiting efficiency in P. macrophylla.

Keywords: *Pentaclethra macrophylla,* fruiting efficiency, gynoecium abortion, inflorescence number.

Introduction

The oil bean tree (*Pentaclethra macrophylla* Benth is one of the indigenous forest fruit trees in Nigeria. It belongs to the family *Leguminosae.* It is often cultivated in homestead. The tree can attain a height of about 21m and up to 6m in girth (Keay,1989). The species is rich in protein and of high commercial value especially in the southeastern part of Nigeria. Its seed is an essential component of the popular "African salad" served in homes, wedding ceremonies, birth day occasions and other social gatherings. It is also used as a soup thickener and could be eaten raw after processing.

One of the major problems of *P. macrophylla* is the threat of extinction mainly due to deforestation of the tropical rainforest. The ecological consequences of deforestation have been reported by many authors (Akachuku, 1997, 1999, 2006; Adedire, 1991; Ojo, 1996). Secondly, existing stands are mainly in the wild and homestead. The species has not been widely cultivated in plantations.

A study on aspects of the reproductive biology of *P. macrophylla* will provide adequate information on it's fruiting efficiency and gynoecium abortion for selection of the species with desirable traits in tree improvement, conservation and plantation development programmes.

Therefore, the objective of this study is to determine the influence of location on fruiting efficiency and abortion rate in *P. macrophylla*.

Materials and Methods

Study Area

The study was conducted in two locations of the South-south geopolitical region of Nigeria. The locations were Ekpoma (Latitude 6^0 45^1N and Longitude 6^0 08^1E) and Onne (Latitude 4^0 50^1N and Longitude 7^0 03^1E) Mean annual rainfall is 2500mm and 1500mm, for Onne and Ekpoma respectively. Similarly, mean temperature range is 27^0C to 35^0C for Ekpoma and 25^0C to 29^0C for Onne respectively.

Data Collection and Analysis

Ten sample trees of *P. macrophylla* were randomly selected in a traditional agroforestry plantation in Ekpoma. Similarly, another ten sample trees were randomly selected in compound farms at the Institute of Agricultural

Research and Training, Onne. Twenty inflorescences were randomly selected per tree. Mean fruiting efficiency and abortion rate per inflorescence were evaluated between 2004 and 2007 flowering seasons respectively. Fruiting efficiency was calculated for each site by expressing the mean number of fruits set per inflorescence as a percentage of the pooled mean number of flowers produced per inflorescence.

Fruiting efficiency and abortion rate were determined as:

$$\text{Fruiting efficiency per inflorescence (\%)} = \frac{\text{Number of fruit Set} \times 100}{\text{Number of flowers produced}}$$

$$\text{Gynoecium abortion per inflorescence (\%)} = \frac{\text{Number of gynoecium – drop} \times 100}{\text{Number of gynoecium produced}}$$

Data collected were subjected to the t-test of comparison of means as follows

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{S_2P\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Where, t = t-test

$\bar{X}_1$ = mean fruiting efficiency or mean abortion rate of gynoecium in location 1

$\bar{X}_2$ = mean fruiting efficiency or mean abortion rate of gynoecium in location 2

n_1 = sample size in location 1 (10)
n_2 = sample size in location 2 (10)
S_2P = pooled variance

Results and Discussion

Table 1 shows the mean fruiting efficiency per inflorescence in *P. macrophylla* at Onne and Ekpoma respectively. The influence of location on fruiting efficiency and abortion rate of the species was not significant at 5% level of probability, using the t-test analysis for the comparison of the two

independent samples. The mean fruiting efficiency of *P. macrophylla* in Ekpoma and Onne were 0.061% and 0.063% respectively. Similarly, the mean gynoecium –drop per inflorescence were 99.94% for Ekpoma and Onne respectively (Table 2).
The t-test analysis conducted on the data showed that location did not affect the fruiting efficiency and gynoecuim –drop of *P. macrophylla* in Onne and Ekpoma respectively. The species was consistent in yearly fruiting pattern without inter annual variability, with very low fruiting efficiency and high gynoecium-drop rate in both locations.

Several authors have reported on the fruiting efficiency of tropical plants (Omokhua and Koyejo, 2008a, 2008b, 2008c; Wright *et al,* 2005 Koenig *et al*, 2003; Sakai 2002; Sakai, 2001; Keonig and Knops 2000; Asada, 1999; Kelly, 1994; Jenkins *et al,* 1990, Ashton *et al,* 1988). Most tropical tree species have low fruiting efficiency primarily due to pollination limitation and fertilization failures involving the shedding of pollen grains before stigma receptivity (Bawa and Webb, 1984; Carthew, 1993).

In this work, the ultimate causes of the very low fruiting efficiency and high abortion rate of gynoecuim is not fully understood. There may be dangers in overgeralizing across locations in Nigeria. However, the observed low fruiting efficiency and high gyneocuim–drop could be attributed to poor pollen viability, pollination limitation, fertilization failures and competing sinks for photosynthate during flowering.

Conclusion

Extensive flowering phenology of tropical plant species is a necessary step in tree improvement and conservation programmes. There appears to be competing sinks for photosynthate in *P. macrophylla* during flowering, leading to very low fruiting efficiency and high rate of gynoecuim abortion. However there may be danger in overgeneralization across locations, since the factors involved may be biological or environmental. Artificial pollination and use of vegetative growth retardant sprays are recommended for improving the very low fruiting efficiency of *P. macrophylla*.

References

Adedire, M.O. (1991): Saving the declining fortunes of tropical forest through conservation. Paper presented at the 1991 *Biennial Conference of the Ecological Society of Nigeria,* University of Lagos. Akoka Lagos. 18th – 21st August, 1991.

Akachuku, A.E. (1997): Prospects and constraints of biodiversity. In I.A. Ayua and O. Ajayi (eds) Implementing the biodiversity convention: Nigerian and African perspectives. Published by Nigeria Institute of Advance Legal Studies, Lagos. Chap. 13,Pp 138-152.

Akachuku, A.E. (1999): Prospects and constraints of biodiversity conservation is South-western Nigeria. In PC. Obiaga, K.E. Abu (eds): Natural Resources and Threatened Environment *Proc. Forestry Ass. Nigeria*. Pp. 200-211.

Akachuku, A.E. (2006): Disappearing forests, the consequences and the challenge of sustainable development of Nigeria. *Pro. of Forest Ass. of Nigeria.* Pp 48-61.

Asada, T. (1999): Studies on yield efficiency of fruiting units in "Fuji". Apple Trees. *Journal of Japanese Soc. For Horticultural Science*. Vol. 68; No.6, pp 10084-1089.

Ashton, P.S; Givnish, T.J: and Appanah, S. (1988) Staggered flowering in the *dispterocarpaceae*, new insight into floral induction and the evolution of mast fruiting in the aseasonal tropics. *Am. Nat*. 132-44-66.

Bawa, K.S. and C.J. Webb (1984): Flower, fruit and seed abortions in tropical forest trees: implications for the evolution of maternal and paternal reproductive patterns. *American Journal of Botany*. 71:736-751.

Carthew, S.M. (1993): Patterns of flowering and fruit production in a natural production of *Banksia spinulosa. Anstrialian Journal of Botany. 41:468-480.*

Jenkins, J N; Mc Carty, Jr. and W. L. Parrott (1990) Fruiting Efficiency in Cotton: Boll size and Boll set percentage. *Crop Science Society of America* 30:857- 860

Keay, R.W.J. (1989): *Tree of Nigeria*. Oxford Science Publications Clarendon Press Oxford. 476pp.

Koenig W.D.; Kelly. D; Sork, V.L; Duncai, R.P. and Elkinton, J.S. (2003): Dissecting components of population –level variation in seed production and the evolution of masting behaviour. *Oikos* 102:581-591.

Keonig, W.D. and J.M.H. Knops (2000): Patterns of annual seed production by Northern Hemisphere trees: A global perspective *Am. Nat.* 155:59-69.

Kelly, D. (1994). The evolutionary ecology of mast seeding .*Trends Ecol*. Evo. 9:465 – 470.

Omokhua, G. E. and A.O. Koyejo (2008a) Fruiting Patterns of *Syzyigium guineense var littorale* (Keay). *Obeche Journal* 26 (2): 1-3.

Omokhua, G. E. and A.O. Koyejo (2008b) Flowering Patterns of *Irvingia gabonensis* (O'Rorke) *Obeche Journal* 26 (2): 32-35

Omokhua, G. E. and A.O. Koyejo (2008c) Fruiting Patterns of Teak (*Tectona grandis* Linn. F.) *Obeche Journal* 26 (2): 56 -58.

Ojo, O. (1996): Socio-economic and socio-cultural impact of climate and sea-level rise in west and central Africa. In Robert W. Steel (ed) Global change and the Commonwealth. Hong Kong: the Chinese University Hong Kong.

Sakai, S (2001) Phenological diversity in tropical forests. *Pop Ecol*. 43:77-86.

Sakai, S. (2002) General flowering in lowland mixed *dipterocarp* forests of Southeast Asia. *Biol. J. Linn. Soc*. 75:233-247.

Wright, S. J; Muller-Landau, H.C. Calderon, O. and Hernandez, A (2005): Annual and spatial variation in seed fall and seedling recruitment in a Neotropical forest. *Ecology* 86:848-860.

Table 1: Mean fruiting efficiency (%) per inflorescence of *P. macrophylla* in Ekpoma and Onne.

Location	Mean inflorescence 2004/05	Flowering Season 2005/06		2006/07	Mean number
Ekpoma	20	0.055	0.064	0.060	0.061a
Onne	20	0.052	0.071	0.065	0.063a

Means with same letter do not differ at 5% level of probability

Table 2: Mean Abortion rate (%) of gynoecium per inflorescence of *P. macrophylla* in Ekpoma and Onne.

Location	Mean inflorescence 2004/05	Flowering Season 2005/06		Mean number 2006/07		
Ekpoma	20	99.95	99.94	99.94	99.94a	
Onne	20	99.95	99.93	99.94	99.94a	

Means with same letter do not differ at 5% level of probability.