Comparative Studies on *In-vitro* Storage Techniques of Oil Palm Pollen

[1]Ugwoke, C. E. C. and [2]Nzekwe, U.
[1]Department of Pharmacognosy, University of Nigeria, Nsukka.
[2]Department of Botany, University of Nigeria, Nsukka

Corresponding author: Ugwoke, C. E. C. Department of Pharmacognosy University of Nigeria, Nsukka.

Abstract

Comparative evaluation of in vitro storage techniques of oil palm (Elaeis guinensis) pollens collected from the trees at Ikpa Onyekaba palm plantation in Okigwe, Imo State, was undertaken. The pollen samples were stored in three different storage conditions and later made to germinate. Germination counts were taken in an Olympus Tokyo Japan light Microscope. Percentage viabilities of the pollens were determined. Of the three methods evaluated, oven-drying at 37°C for 6 h followed by storage in a deep freezer condition consistently proved to be the most efficient method of storing the oil palm pollens.

Key words: Pollen grains, *Elaeis guineensis*, Germination, Storage techniques, Percentage viability

Introduction

Oil palm (*Elaeis guineensis* Jacq) is the highest oil-yielding crop in the world (Hartley, 1988). The oil yield depends upon the fruit type, which yield palm oil from the mesocarp and palm kernel oil from the seeds. Oil palm is tropical in distribution, found in the wild and cultivated in the equatorial regions of Africa, Asia and South America (Hartley, 1970). In Nigeria, oil palm is predominantly found in the South-Eastern part, covering: Imo, Abia, Enugu, Ebonyi and Anambra States. It is also found in the southern parts of Kogi and Benue states of Nigeria.

The oil palm (Family, Arecaceae) is monoecious, with distinct male and female inflorescences produced separately in the leaf axils of the same plant. The plant is known to be cross pollinated by wind and weevils (Broekmans, 1957b; Hanna and Towill, 1995). The ratio of male to female phases in a plantation of oil palm constantly varies. Thus, a good season in palm oil production heavily depends upon the number of plants in male phase and their ratio to female plants in a population (Broekmans, 1957a; Shivanna and Johri, 1985). Pollination becomes a serious constraint and results in low yield when there are very few plants in male phase in the plantation. However, if fresh pollens can be stored in a viable state and later applied to the female flowers at the correct time, an increased yield may be obtained, while losses due to none pollination of the female flowers will be greatly reduced (Ekaratne and Senathirajah, 1983).

Virtually, all products from oil palm are economically useful (Barnabas and Kovacs, 1997). In Nigeria, at present the demand for palm oil and palm kernel oil for domestic and industrial uses far outstrips their supplies. In view of the ethnomedicinal importance of palm oil and palm kernel oil, the need for their accelerated production becomes apt. Oil from the seed is administered as an antidote for poisons while oil from the kernel is used to treat several skin ailments and convulsion in children (RMRDC, 2004). Consistent yield in palm oil and palm kernel oil can be sustained through assisted pollination during unfavourable conditions. It is the need for assisted pollination that excited the present study on the most suitable and practical storage techniques of oil palm pollen.

Materials and Methods

***Site of sample collection*:** Pollen samples were collected from Ikpa Onyekaba palm plantation, Ubaha Okigwe, Imo State, Nigeria. Male inflorescences with flowers in which the anthers have just begun to dehisce, were used for the study. Pollen grains were randomly collected from freshly opened male inflorescences and pooled, air-dried for 1 h and brought in sealed bottles to the laboratory within 36 h of collection.

Treatment of sample material: Pollen treatment procedure of Ekaratne and Senathirajah (1983) was adopted. Pollens from the male inflorescences were collected on a clean sheet of paper and sieved through a 0.5 mm sieve to exclude foreign matters from the pollen grains. The pure pollens obtained were then divided into three portions and subjected to the following treatments:

a) undried (fresh)
b) Oven dried at 37°C for 5 h
c) Sun-dried for 6 h.

Each sample, after treatment was placed in a dry McCartney bottle. Representative sample from each of the treatments was stored under three different conditions viz:

a) Deep freezer (-15°C)
b) Desiccator with silica gel as desiccant (29.75°C)
c) Desiccator with 50% aqueous glycerol as desiccant (29.50°C)

McCartney bottles containing pollen sample to be stored in the deep freezer were completely sealed in polythene bags to ensure that pollen grains were not exposed to high humidity. A control sample of undried pollens, contained in McCartney bottle was left at the prevailing room temperature, (30°C ± 2°C).

Evaluation of percentage pollen germination: Samples of the pollens stored in the three different conditions above were subjected to germination trials. The pollens were considered germinated by the emergence of the pollen tube. In determining percentage germination, the pollen grains were placed on microscope slides containing few drops of 10% sucrose in 0.5% agar medium (Ekaratne and Senathirajah, 1983). In order to maintain high humidity the microscope slides were enclosed in a covered Petri dish with moist cotton wool. Germination counts were taken in an Olympus Tokyo Japan ordinary light Microscope, Model 272 006, 2 h from the time of transference of the pollens to the germination medium. In each pollen sample, 200 pollen grains were counted.

Results

The results of the study show rapid decrease in the percentage viability of undried pollen grains upon storage under natural conditions at room temperature. Under ambient temperature conditions oil palm pollen grains completely lost viability within 14 days (Fig. 1).

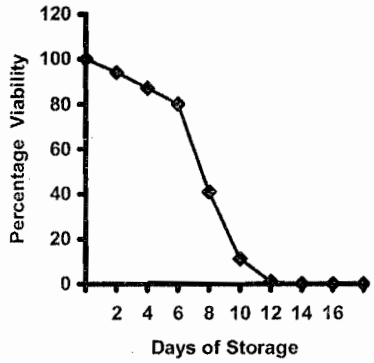

Fig. 1: Viability of undried pollen, stored at room temperature

The results further show that under the three storage conditions, the undried pollens lost viability very rapidly when compared with the dried samples. However, the viability of undried pollens improved when stored under humid conditions. Fig. 2 presents the percentage viability of sun-dried pollens stored under the three different conditions assessed .The results show that pollen longevity was lost by the 20th day for pollens stored in desiccator with glycerol (DG), 30th day for pollens stored in desiccator with silica gel (DS) and 80th day for pollens stored in deep freezer (DF). The results of the study also show that the longevity of the pollen grains increased when the moisture content is reduced to an appreciable level by drying (Fig. 3).

Comparatively, figures 2 and 3, indicate that of the three methods of pollen storage used in this study, oven-drying at 37°C for 6 h followed by storage in a deep freezer conditions appeared to be the best method of prolonging pollen longevity, next is the desiccator with silica gel, before the desiccator with 50% glycerol.

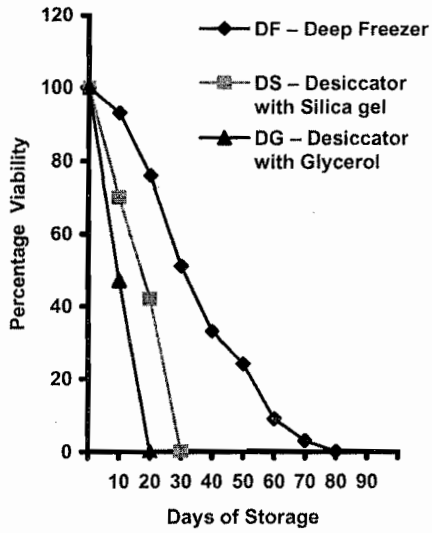

Fig. 2: Changes in percentage viability of sun-dried pollens stored under three different conditions

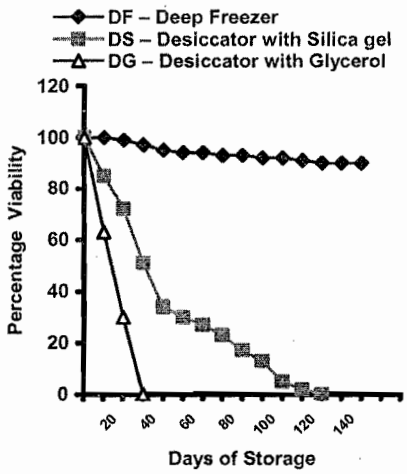

Fig. 3: Changes in percentage viability of the oven-dried pollens stored in three different conditions

Discussion

Pollen grains are known to possess high moisture content (Broekmans, 1957a; Shivanna and Rangaswamy, 1992). Moist condition predisposes organic materials to biodegradation by bacteria and fungi (Hanna and Towill, 1995). The biological activities of these organisms make preservation and storage difficult. The fact that dried pollen maintained viability for longer period than the undried pollens indicates that the reduction in the pollen moisture content helps the pollen to remain viable during storage. This observation agreed with earlier reports (Ekaratne and Senathirajah, 1983).

However, reduction of pollen moisture content beyond a certain critical level, may be deleterious as the protoplasm could become dehydrated (Barnabas and Kovacs, 1997).

In summary, of the three storage methods evaluated, oven-drying at 37^0C for 6 h. followed by storage in deep freezer condition consistently proved to be the most efficient method of storing the oil palm pollens.

References

Barnabas, B. and Kovacs, G. (1997). Pollen Biotechnology for crop production and improvement (Eds Shivanna, K.R. and Sawhney, V.K) Cambridge University press, UK, pp. 293-314.

Broekmans, A.F.M. (1957a). Studies of Factors influencing the success of controlled *pollination* in the oil palm. W.A.I.F.O.R. Journal 2:133-47.

Broekmans, A.F.M. (1957b). Growth, flowering and yield of the oil palm in Nigeria W.A.I.F. or Journal 2: 187-220.

Ekaratne, S.N.R. and Senathirajah, S (1983). Viability and Storage of pollen of the oil Palm. Ann. Bot. 51:661-668

Hanna, W.W. and Towill, L.E. (1995). Plant Breeding Reviews (Ed. Janick, J) John Wiley, Chichester, pp.179-207.

Hartley, C.W.S. (1988). The oil palm, Longman Group Ltd, Uk 3rd ed. 761p.

Hartley, C.W.S. (1970). The oil palm, Tropical Agricultural series, Longman, London 706p.

RMRDC (Raw Materials Research & Development Council) (2004). Report on Survey of Agro Raw Materials in Nigeria on Oil Palm. Federal Ministry of Science and Technology, Abuja. pp. 144.

Shivanna, K.R. and Johri, B.M. (1985). The Angiosperm Pollen: Structure and Function. Wiley Eastern, New Delhi.pp.257.

Shivanna, K.R. and Rangaswamy, N.S. (1992). Pollen Biology: A Laboratory Manual, Springer Verlag, Berlin.