J. Sci. Engr. Tech. 4(2), 780-786, Oct. 1997

COMPARATIVE ANALYSIS OF LIPID CONTENT AND GROWTH STUDIES OF *HIBISCUS ROSA-SINENSIS* AND *ABELMOSCUS ESCULENTUS*

K.E. Akpabio and G.J. Esenowo*
Department of Botany and Microbiology
University of Uyo
Uyo. Nigeria.

ABSTRACT

The growth parameters and lipid content of the leaves of three species of ***Hibiscus rosa-sinensis*** *viz. Species 1 (tiny leaves), Species II (variegated leaves) and Species III (large leaves) and two species of* ***Abelmoscus esculentus*** *viz. Species A (white leaves) and Species B (red leaf stalk) were studied in the field for 4 weeks. The aim of this study was to find the parental species based on their differences. The total lipids of Species I. II. and III of* ***H. rosa-sinensis*** *were 18.0. 53.0 and 13.3 respectively. The range of the value for neutral lipids. glycolipids and phospholipids were 7.0 to 30.3. 3.3 to 13.3 and 0.6 to 7.0 mg l respectively. The total lipids content of Species A and B of* ***A. esculentus*** *were 24.5 and 10.4 while the range for neutral lipids. glycolipids and phospholipids were 7.3 to 15.6. 2.5 to 5.7 and 0.6 to 4.1 mg l respectively. Numerically. the mean growth parameters of species I. II. and III of* ***H. rosa-sinensis*** *were 35.30. 40.5 and 51.14 while Species A and B of* ***A. esculentus*** *were 11.28 and 7.55. Based on these results. species III of* ***H. rosa-sinensis*** *and species A of Okro were suggested as the parental species of these genera.*

INTRODUCTION

Hibiscus rosa-sinensis and _Abelmoscus esculentus_(Okro) belong to the family Malvaceae, which includes annuals and parental herbs, shrubs and small trees. They are large groups of dicotyledonous flowering plants

---

*** *To whom all correspondence should be addressed***

containing about 75 genera and 1000 species grown in most parts of the world (1). *H. rosa-sinensis* is generally used as ornamental plant. It is cultivated as a state flower in Hawaii and used for wreath making. *H. rosa-sinensis* is also used to stain eyebrows and blacken shoes (2). *Abelmoscus esculentus* is widely cultivated in the tropics for its fruits which is used as a vegetable both in the fresh and dried states. The stem also produces fibres which is used for many purposes but not on a commercial scale. The leaves are also eaten as vegetable (3).

Some members of the family Malvaceae are not single species but polytypic complex plants which exhibit high polyploidy and hibridity (4). These plants are death on information on their parental species which are yet to be determined (4). Cytogenetic studies on the genus is limited and largely centres around chromosome counts (4). The use of chromosome numbers were confusing and has not been able to elucidate correctly their parental species (4). Therefore a more detailed system is needed to classify the many varieties and lines that are found in this family. Usually flowers and leaves are the most conspicuous features of this family and have played significant role in their evolution (5). Growth parameters and lipids have been used successfully to confirm the parental species of other plants (6). The present study aims to determine the parental species of *H. rosa-sinensis* and *A. esculentus* using both leaf parameters and their lipid contents.

MATERIALS AND METHODS

Fresh leaves of *H. rosa-sinensis* were collected from a park, while four weeks old plants of *A. esculentus* were collected from a garden within the University of Uyo campus. The collections were screened for consistency. Ten leaves of *H. rosa-sinensis* and three leaves of *A. esculentus* were first weighed and heated in an oven at 80°C for 36 hours. The difference between the fresh and dry weights was known as the moisture content. Three grammes of the *Hibiscus* and 20 grammes of the Okro were used for lipid extraction. Samples were homogenized in the Waring type homogenizer using small aliquots of chloroform/methanol (2:1 V/V) and purified (7). Butylated hydrotoluene (0.005% W/V) was added as antioxidant to protect the polysaturated fatty acids. The organic layer of the lipid extract which excluded all moisture retained in the aqueous layer was used for lipid analysis.

Lipid Analysis

Authentic lipid standard and controls were obtained from Sigma Chemical (St. Louis, MO.). The solvents used were analytical grades and were redistilled before use. Teflon lined screw cap vials were used in all instances. All extractions were carried out at 0°C and the extracts kept in solution at all times. The total lipids were determined gravimetrically in aliquots of the purified extracts. The total lipids (TL) were fractionated into neutral lipids (NL), glycolipods (GL) and phospholipids (PL) on Silicic acid column using chloroform, acetone and methanol successfully (8). Thin layer chromatographic separation of the liquid was done according to the method of Smith (9).

Growth Parameters

Growth parameters (the leaf length, leaf width, stalk and internode lengths) were recorded in cm. Leaf area was determined according to the methods of Hoytd and Bradfield (10). Leaf area = Length (L) × width (W) × 0.75 ---- (1). The leaf length width ratio was determined using the method of West et al (11). Length width ratio = leaf length/leaf width.

RESULTS AND DISCUSSION

The total lipids of Species III of *H. rosa-sinensis* was 53.0 mg/1 whereas Species I and II were 18.0 and 13.3 mg/1 respectively. The neutral lipids and the glycolipids of the three species of *H. rosa-sinensis* were the major components. In all cases, Species II had the highest lipids content (Table 1). Similarly the total lipids of *A. esculentus* (Species A and B) were 24.5 and 10.4 mg/1 respectively. The neutral lipids of Species A and B were 15.6 and 7.3 mg/1. The neutral glycolipids also formed the major components while phospholipids were the minor components. Species A was leading in all respects (3). The neutral lipids (NL) of all the samples tested were greater than glycolipids (GL) and phospholipids (PL). Non-polar lipids of dry soybeans represented 90% of the total lipid while the GL and PL represented 6.4 and 3.6% respectively (12). The colour for the lipids extracted from the leaves were yellow and are solid at room temperature. The characteristic yellowish colour of most fat and oil is due to the presence of various carotenoid pigments which are highly unsaturated hydrocarbon chains (13).

Variations occur in the classes of lipids identified. The total lipids of *H. rosa-sinensis* were classified into triglyceride, cholesteryl esters, free fatty acids, galactosyl and tetragalactosyl diglycerides while those of *A. esculentus* were classified into cholesteryl esters, triglycerides, free fatty acids and sterol, using their Rf values. Similar classifications were reported by Marfo (14) who was able to separate crude papaya seeds into six classes. The extracted lipids are important constituents of all biological membranes and play a central role in the molecular organisation of these plants (12). There were permanent increases in all the growth parameters tested in all the plants. This similarity points to the fact that. *H. rosa-sinensis* and *A. esculentus* belong to the same family.

There were variations in most of the growth parameters studied. Slight variations occur in length and width of *H. rosa-sinensis*. Species I had the highest ratio of 1.82 while Species II and III had 1.69 and 1.59 respectively. Variations also occur in the leaf area stalk and internoae lengths, fresh and dry weights and moisture content. Species III was leading in all the parameters studied (Table II). In *A. esculentus*, variations also occur in all the growth parameters tested and Species A was also leading (Table II). The detailed measurements of growth parameters show that variations exist in the morphology of leaves, leaf area, stalk and internode lengths, fresh and dry weights. This study agrees with the work of Bassey, et al (6) who used the differences in leaf morphology of *Lagenaria siceraria* L. to classify these plants. Moreso, Ito and Akihana (15) classified rice varieties on the basis of plant height, leaves morphology and colour of various parts and they observed variations in the parameters studied. The reason for these differences could be genetical or ecological or both. *H. rosa-sinensis* and *A. esculentus* were grown in a common environment and the differences that existed suggested that variation is genotypic. Based on the lipid content and growth parameters studied this work suggests that Species III of *H. rosa-sinensis* and Species A of *A. esculentus* were regarded as the parental species.

Table 1. Lipids Fraction of Three Species of *H. Rosa-Sinensis* and Two Species of *A. Esculentus* in MG/L

		Species I	Species II	Species III
Hibiscus rosa-sinensis	Total lipids	18.0	53.0	13.3
	Neutral lipids	10.0	30.3	7.0
	Glycolipids	7.4	13.3	3.3
	Phospholipids	0.6	7.0	3.0

		Species A	Species B
A. esculentus	Total lipids	24.5	10.4
	Neutral lipids	15.6	7.3
	Glycolipids	5.7	2.5
	Phospholipids	4.1	0.6

Table II: Growth Parameters of *H. rosa-sinensis* and *A. esculentus* (in cm) Grown and Studied for Four Weeks

H. rosa-sinenesis	Growth parameters	Species I	Species II	Species III
	Leaf length	6.48	6.95	7.66
	Leaf width	3.55	4.15	4.79
	Length-width ratio	1.82	1.67	1.59
	Leaf Area (in sq cm)	18.50	22.36	28.25
	Stalk length	2.51	2.92	3.92
	Internode length	2.02	1.93	3.39
	Fresh weight (g)	0.21	0.26	0.82
	Dry weight (g)	0.073	0.10	0.25
	Moisture content	0.137	0.16	0.47
	$\overline{X}$	3.92	5.50	5.68

A. esculentus	Growth parameters	Specimen A	Specimen B
	Leaf length	9.74	7.28
	Leaf width	7.55	5.94
	Length-width ratio	1.30	1.20

Table II continued

Leaf Area (sq cm)	55.93	33.78
Stalk length	12.12	6.92
Internode length	4.55	3.25
Fresh weight (g)	5.21	4.52
Dry weight (g)	0.951	0.713
Moisture content	4.17	3.81
$\overline{X}$	11.28	7.55

Significant at $p = 0.05$

REFERENCES

1. Lawrence, G. H. Taxonomy of Flowering plants. New Encyclopaedia Britanica. William Benton Pub. U.S.A. 1951.

2. Navak, F. A. The Pictorial Encyclopaedia of Plants and lowers. Artid and Paul Hamlyn Ltd., New York, USA. 1977

3. Anayanwu, A. Textbook of Agriculture. African Education Press, Ibadan. Nigeria. 1979.

4. Summond, N. W. Paper Thinlayer Chromatography and Electrophoresis. 2nd ed. Shandon Scientific Company Ltd., London. 1965.

5. Wolff, I. A. Seed lipids. Science. 145:1140 - 1149. 1966.

6. Bassey, M.E., Ndukwu, B. C. and Umoh, N. Varieties of Gourds (*Lagenaira siceraria)* in Akwa Ibom State. The Nigerian Field. 56:115 - 119. 1991.

7. Folch, J., Lees, N. and Stanley, G.H. A simple method for isolation and purification of total lipids from animal tissues. J. Biol. Chem. 226: 497 - 509. 1957.

8. Rouser, G., Kritchevasky, G. and Yamamata, A. In. Marmet, G. V. (ed.) Lipid Chromatographic Analysis Vol. 1. Marcel Dikker, New York. 1967.

9. Vines, A. E. and Rees, N. Plant and Animal Biology. Pitman Publ. Ltd. London. 1984.

10. Hoytd, P. and Bradfield, R. Effects of varying leaf area by defoliation and plant density on dry matter production of corn. Agronomy J. 54: 523 - 525. 1961.

11. West, C., Brigg, G. E. and Kidd, F. Method and significant relation in a quantitative analysis of plant growth. New Physiologist 19: 200 - 207. 1920.

12. Opute, F. I. Seeds lipid of the grain of *Amaranthus* sp. J. Exp. Botany. 30: 601 - 611. 1979.

13. Essien, E. U., Esenowo, G. J. and Akpan, M. I. Lipid composition of lesser known tropical seeds. Plant foods for Human Nutrition. (In press). 1995.

14. Marfo, E.K. Chemical and nutritional studies of *C. papaya* seeds. Ph.D. thesis. Obafemi Awolowo University, Ile-Ife. 1985.

15. Ito, I. and Akihama, R. Varieties of rice grown in United States of America. Agric. Newsletter. 179(3): 112-117. 1989.

(Accepted 07 November 1996)