



Research Journal of
Botany

ISSN 1816-4919



Academic
Journals Inc.

www.academicjournals.com

Biosystematic Studies in Annonaceae II. Vegetative and Floral Morphological Studies of Some Genera of Annonaceae in Nigeria

A.E. Folorunso and O. Olorode

Department of Botany, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria

Abstract: A vegetative and floral morphological study of the species of Annonaceae found in Nigeria was conducted in search of intergeneric characters that may be of taxonomic value in the identification and classification of the species. Life plants, fruits, flowers and seeds were studied from mature plants in the experimental garden. Both qualitative and quantitative characters were recorded. The intergeneric relationships among and between the species of Annonaceae were reported and similarly, additional features that may be of taxonomic value in the classification and identification in the family are apocarp, syncarp, phyllotaxy, monopody, sympody, fruit type and fruit shape have been provided.

Key words: Vegetative, floral, intergeneric, phyllotaxy, apocarp, syncarp, taxonomic

INTRODUCTION

Annonaceae belongs to the class Magnolideae in the order Magnoliales. Mabberley (1987), Brummitt (1992) and Folorunso and Olorode (2006a) reported that the family consists of 2,050 species in 125 genera and they are found mainly in the tropics.

The economic, nutritional and medicinal importance of the genera of Annonaceae cannot be over-emphasized. The fruits and seeds of *Xylopia aethiopica* are hot to taste and are sold as a spice and as a substitute for African black pepper (*Piper nigrum*). The crushed seeds rubbed on the forehead cure headache and neuralgia; a decoction of the fruit is used as a lotion for boils and eruptions. An extract of the bark is used in Hausaland as an ointment for sores (Irvine, 1961). The oil from *Xylopia aethiopica* is semi-dry, with relatively high saponification values and used for making alkyl resins which could be used for making paints (Ajiwe *et al.*, 1998). After roasting and grinding, the seeds of *Monodora tenuifolia* are rubbed on the skin for unspecified skin diseases (Irvine, 1961).

Although the Annonaceae as a family is well circumscribed, its infra-familial categories have always been problematic. Classification at these levels are far from being comparable with one another, although they all contain valuable insights (Kessler, 1995).

A lot of work has been done on the family by several workers including Morawetz (1984), Kessler (1995), Johnson (2003) and Folorunso and Olorode (2006a) but detailed study has not been carried out in respect of some genera (*Monodora*, *Dennettia*, *Xylopia* and *Greenwayodendron*) that are being investigated in this study. The aim of this study therefore is to carry out a detailed vegetative and floral morphological studies on the afore-mentioned genera with a view to providing additional features that may be of taxonomic value in the identification and classification in the family.

MATERIALS AND METHODS

Life plants, fruits, flowers and seeds of ten to fifteen specimens each of *Monodora*, *Cleistopholis*, *Dennettia*, *Xylopia* and *Greenwayodendron* which are largely the available genera found in Nigeria were studied from mature plants between 2000 and 2005 within the experimental garden of Obafemi

Awolowo University Campus, Ile-Ife, Nigeria. The seeds were germinated in plastic buckets and transplanted directly into the soil in the experimental garden. The habit and habitat of the different species were noted. Qualitative morphological characters studied include the shape, base, apex, margin, veins and petioles of leaf, phyllotaxy, presence of stipule, growth type, fruit type, shape and fruit colour when ripe. Also studied are colours of the petals, petal texture, sepal colour, number of stamen and flower type.

The quantitative morphological characters measured are length and breadth of leaves, length and breadth of sepals, length and breadth of petals, length and breadth of fruit, length and breadth of seed, petiole length and pedicel length. Counts were taken of number of veins, seeds, sepals and petals. Free-hand diagrams of morphological characters of each species used for the study were also made to highlight some intergeneric differences.

RESULTS

The vegetative, floral, fruit and seed characteristics of the species studied are also shown below:

Monodora tenuifolia

Habit: A small tree

Habitat: Fairly open area, level location, soil humid in remnant secondary forest.

Leaf: Alternate, elliptic, chartaceous, apex acute, base acute, margin entire.

Venation: Eucamptodromous

Phyllotaxy: Distichous

Petiole: Inflated, circular in cross section

Growth: Sympodial

Stipule: Absent

Flower: Chasmogamous

Epicalyx: Absent

Sepal: Green, pubescent at edge, 3 in number, margin entire.

Petal: Leathery, light yellow with golden spots, margin wavy, outer petals ovate, inner petals clawed, 6 in number

Fruit: Yellow with white patches, syncarpous, round, thick smooth skin (Fig. 1).

Greenwayodendron suaveolens

Habit: A shrub

Habitat: Cultivated for ornament

Leaf: Alternate, lanceolate, less glabrous on the adaxial surface, apex attenuate, base acute, margin wavy.

Venation: Eucamptodromous

Phyllotaxy: Spiral

Petiole: Inflated, circular in cross section

Growth: Monopodial

Stipule: Absent

Flower: Chasmogamous

Epicalyx: Absent

Sepal: Green, 3 in number, margin entire.

Petal: Fleshy, light green, margin entire, lanceolate, 6 in number, rather flimsy at maturity

Fruit: Purple, globose carpels, apocarpous, oval, smooth skin (Fig. 2).

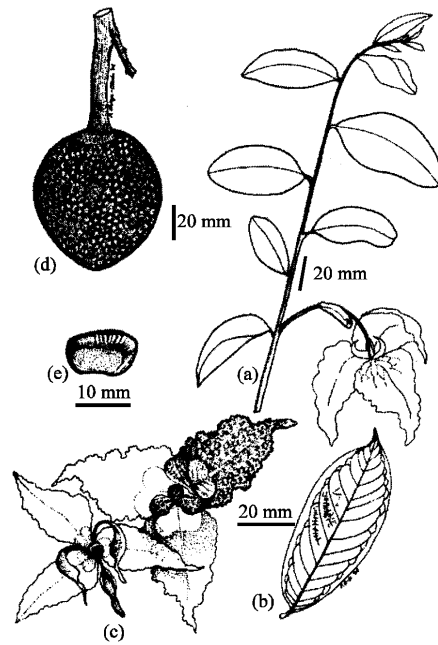


Fig. 1: Diagram of some morphological features of *Monodora tenuifolia* (a) Branch, (b) Leaf, (c) Flower, (d) Fruit and (e) Seed

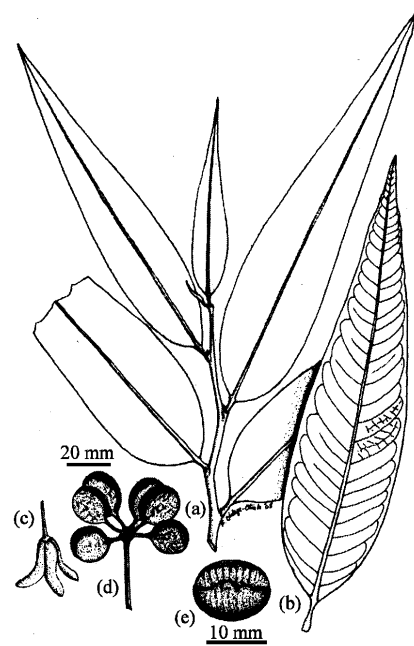


Fig. 2: Diagram of some morphological features of *Greenwayodendron suaveolens* (a) Branch, (b) Leaf, (c) Flower, (d) Fruit and (e) Seed

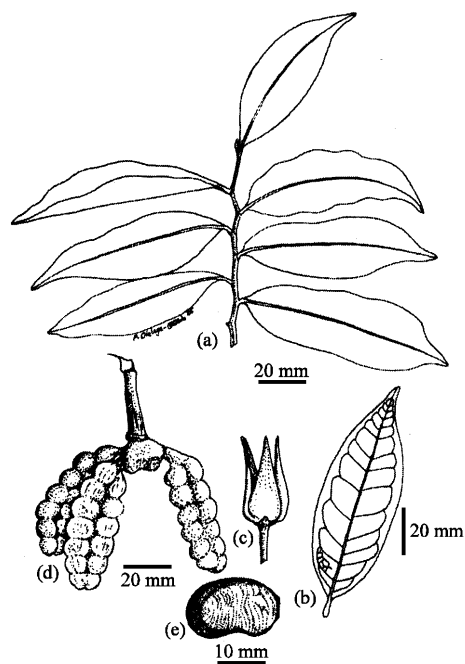


Fig. 3: Diagram of some morphological features of *Dennettia tripetala* (a) Branch, (b) Leaf, (c) Flower, (d) Fruit and (e) Seed

Dennettia tripetala

Habit: Medium-sized tree

Habitat: Forest

Leaf: Alternate, oblong, coriaceous, apex acuminate, base cuneate, margin entire.

Venation: Eucamptodromous

Phyllotaxy: Spiral

Petiole: inflated, circular in cross section

Growth: Sympodial

Stipule: Absent

Flower: Chasmogamous

Epicalyx: Absent

Sepal: Green, very broad, pubescent, 3 in number.

Petal: Fleshy, light green, margin entire, lanceolate, 3 in number.

Fruit: Light yellow, apocarpous (Fig. 3).

Xylopi aethiopia

Habit: Medium-sized tree

Habitat: Secondary forest

Leaf: Alternate, oblong, coriaceous, apex acuminate, base acute, margin entire.

Venation: Eucamptodromous

Phyllotaxy: Spiral

Petiole: inflated, circular in cross section

Growth: Sympodial

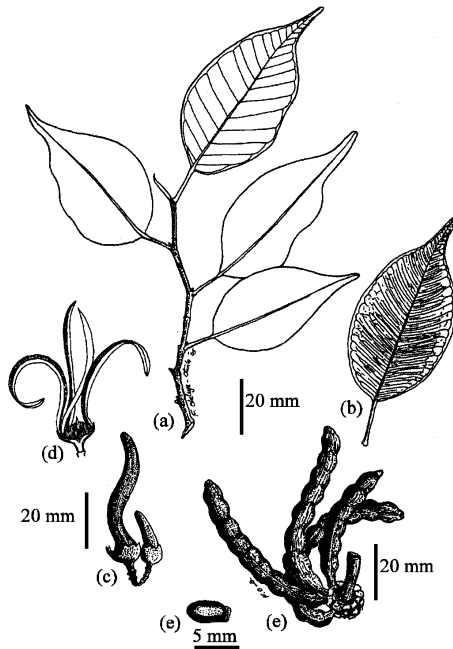


Fig. 4: Diagram of some morphological features of *Xylopiya aethiopica* (a) = Branch, (b) = Leaf, (c) = Flower, (d) = Fruit and (e) = Seed

Stipule: Absent

Flower: Chasmogamous

Epicalyx: Absent

Sepal: Green, 3 in number, margin entire

Petal: Fleshy, light green, margin entire, lanceolate, 6 in number.

Fruit: Black, apocarpous (pod like) (Fig. 4).

Cleistopholis patens:

Habit: Tree

Habitat: Secondary forest

Leaf: Alternate, lanceolate, coriaceous, adaxial surface glabrous glossy, apex attenuate, base obtuse, margin entire.

Venation: Eucamptodromous

Phyllotaxy: Distichous

Petiole: inflated, circular in cross section

Growth: Monopodial

Stipule: Absent

Flower: Cleistogamous

Epicalyx: Absent

Sepal: Green, small, 3 in number

Petal: Fleshy, green, margin entire, spatulate, 6 in number

Fruit: Green, apocarpous, round; one seed per carpel (Fig. 5).

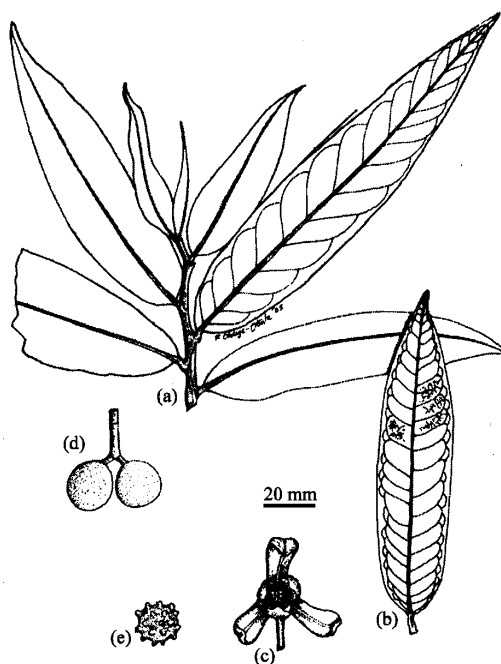


Fig. 5: Diagram of some morphological features of *Cleistopholis patens* (a) Branch, (b) Leaf, (c) Flower, (d) Fruit and (e) Seed

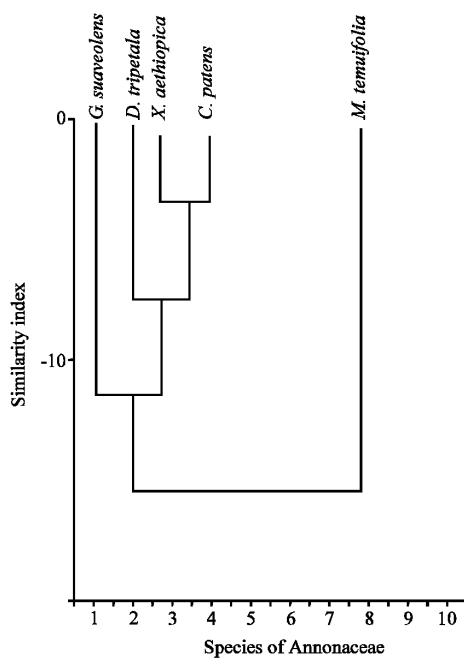


Fig. 6: Dendrogram based on quantitative attributes of vegetative parts of the species of annonaceae

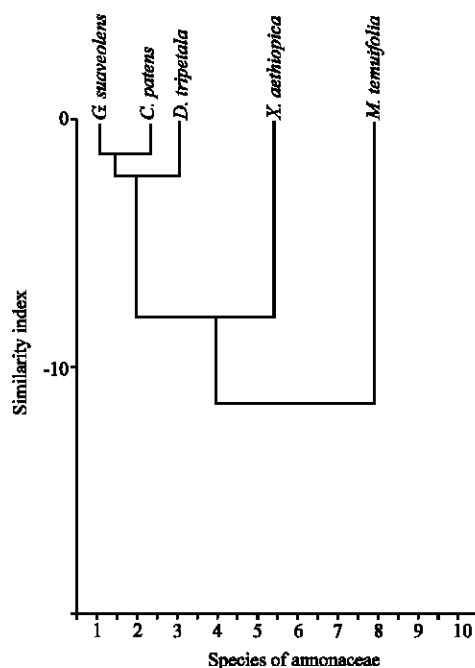


Fig. 7: Dendrogram based on quantitative attributes of floral parts of the species of Annonaceae

Quantitative attributes of vegetative parts of the species of Annonaceae shown in Fig. 6. Based on the type of carpels, there are two main clusters, the first main cluster comprises of *Greenwayodendron suaveolens*, *Demmettia tripetala*, *Xylopiya aethiopica* and *Cleistopholis patens* species, all these species are apocarpous. The second main cluster consist of *Monodora tenuifolia* species that are syncarpous. On the basis of phyllotaxy, *Cleistopholis patens* and *Monodora tenuifolia* being distichous are intergenerically related, similarly, *Greenwayodendron suaveolens*, *Demmettia tripetala* and *Xylopiya aethiopica* have spiral phyllotaxy and are intergenerically related. In the cluster of *Greenwayodendron suaveolens*, *Demmettia tripetala* and *Xylopiya aethiopica*, the last two species shared similar growth pattern that is sympodial and are more closely related, *Greenwayodendron suaveolens* have monopodial growth pattern.

Greenwayodendron suaveolens, *Cleistopholis patens*, *Demmettia tripetala* and *Xylopiya aethiopica* maintains their apocarpous position while *Monodora tenuifolia* species maintain their syncarpous position. Based on fruit shape, *Greenwayodendron suaveolens* and *Cleistopholis patens* are in a cluster while *Demmettia tripetala* and *Xylopiya aethiopica* are in another cluster (Fig. 7).

DISCUSSION

Leaf morphology has remained a virtually unexploited tool for systematic studies of the dicotyledons (Hickey, 1973). Distichous phyllotaxy as it appears in *Monodora tenuifolia* and *Cleistopholis patens*, with spiral phyllotaxy in *Greenwayodendron suaveolens*, *Demmettia tripetala* and *Xylopiya aethiopica* are generally encountered in the family Annonaceae (Johnson, 2003). In his study of architectural pattern in Annonaceae, Johnson (2003) observed that phyllotaxy is correlated with orientation of the apical meristem of the primary shoot. In plants with spiral architecture the apex is erect, in plants with distichous architecture the apex is horizontal or drooping. He concluded that Annonaceae are an ecologically important group across the humid tropics, where individuals may be

readily identified to the family level because of the distichous arrangement of the entire, simple, exstipulate leaves on the lateral branches and the aromatic secondary compounds. Folorunso and Olorode (2006a) reported distichous phyllotaxy and sympodial growth as primitive characters in Annonaceae. Hence, the presence of distichous phyllotaxy in *Monodora tenuifolia* species and *Cleistopholis patens* species make them to be primitive species while *Greenwayodendron suaveolens*, *Dennettia tripetala* and *Xylopia aethiopica* species are advanced.

A consideration of the vegetative and floral morphological characters revealed intergeneric relationships between these genera of Annonaceae. Folorunso and Olorode (2002 and 2006b) earlier in their study of the family reported that the presence of common bands among the genera of Annonaceae shows evidence of common evolutionary origin in them. Leaf shape is a strong factor in the clustering of the genera of Annonaceae (Folorunso and Olorode, 2006b). *Cleistopholis patens* and *Greenwayodendron suaveolens* have lanceolate leaves, while *Xylopia aethiopica* and *Dennettia tripetala* present oblong leaves, *Monodora tenuifolia* had elliptic leaves.

The intergeneric relationships between the genera of Annonaceae have been revealed. The characters responsible for these intergeneric relationships are apocarp, syncarp, phyllotaxy, monopod, sympod, fruit type and fruit shape.

In this study, additional features that may be of taxonomic value in the classification and identification in the family have been provided and the intergeneric relationships among and between the species of Annonaceae have been reported.

REFERENCES

- Ajiwe, V.I.E., C.A. Okeke, J.O. Ogbuagu, U. Ojukwu and V.I. Onwukeme, 1998. Characterization and applications of oils extracted from *Canarium schweinfurtii*, *Vitex doniana* and *Xylopia aethiopica* fruit/seeds. Bioresour. Technol., 64: 249-252.
- Brummitt, R.K., 1992. Vascular Plant Families and Genera. Kew: Royal Botanic Gardens.
- Folorunso, A.E. and O. Olorode, 2002. Electrophoresis of crude protein of seeds of some genera of Annonaceae. Nig. J. Hort. Sci., 7: 6-9.
- Folorunso, A.E. and O. Olorode, 2006a. Biosystematic studies in Annonaceae I. Vegetative and floral morphological studies of some species of *Annona* in Nigeria. Res. J. Bot., 1: 118-124.
- Folorunso, A.E. and O. Olorode, 2006b. Crude protein electrophoresis of some species of *Annona* in Nigeria. Ife J. Sci., 8: 15-18.
- Hickey, L.J., 1973. Classification of the architecture of dicotyledonous leaves. Am. J. Bot., 60: 17-33.
- Irvine, F.R., 1961. Woody Plants of Ghana with Special Reference to Their Uses. Oxford University Press, London.
- Johnson, D.M., 2003. Phylogenetic significance of spiral and distichous architecture in the Annonaceae. Am. Soc. Plant Taxonom., 28: 503-511.
- Kessler, P.J.A., 1995. Subdivision and relationships of the Asiatic Australian genera of Annonaceae. Rheedeia, 5: 97-102.
- Mabberley, D.J., 1987. The Plant Book. A Portable Dictionary of the Higher Plants. Cambridge University Press, Cambridge.
- Morawetz, W., 1984. How stable are genomes of tropical woody plants? Heterozygosity in C-banded karyotypes of *Porcelia* as compared with *Annona* (Annonaceae) and *Drimys* (Winteraceae). Plant Syst. Evolut., 145: 29-39.