Leaf Epidermal Studies of two Species of Syzygium in Jos Plateau State Nigeria

J.J. Azila[1*], Mbah J.J.,[2] A.O.Shoyemi-Obawanle,[3] Akintunde S.,[4] Shoyemi Aduratola Olubunmi.,[5] Mafolasire S.,[6] Jeridas D.D.,[7]

[1,2,4,5,6]Federal College of Forestry Jos, Plateau State, Nigeria.

[3]National Center for Remote Sensing, Jos Plateau State, Nigeria.

[7]Intergrated Dairies Limited (Farmfresh) No. 6, Keana Road Jos, Plateau State, Nigeria.

***Corresponding author:** J.J. Azila
Phone: +2347037712042 **Email:** jjazila39@gmail.com

ABSTRACT

The foliar epidermal and stomata study of the Syzygium species in Jos Plateau State Nigeria was carried out using standard anatomical procedure. The genus belong to family Myrtaceae and has two species in it which are present in the region. They include: Syzygium guineense var.guineense and Syzygium guineense var.macrocarpum.The study showed that epidermal cell shape,stomata type and stomata shape on both the adaxial and abaxial surfaces of the two plants were almost similar with little variation. Other systematically useful characters are stomata index, guard cell area and the shape of the anticlinal cell walls can also be used for distinguishing the species.

KEYWORDS: *Shere hills, Myrtaceae, Syzygium, Stomata, Foliage*.

INTRODUCTION

Myrtaceae is a family of dicotyledonous plants placed within the order Myrtales. Myrtaceae arose between sixty and fifty-six million years ago during the Paleocene era. Pollen fossils have been sourced to the ancient supercontinent Gondwana (Thornhill *et al*.,2015).Recent estimates suggest the Myrtaceae include approximately 5,950 species in about 132 genera. The family has a wide distribution in tropical and warm-temperate regions of the world, and is common in many of the world's biodiversity hotspots (Christenhusz *et al*., 2016). Plant belonging to Myrtaceae are often hard to identify and classify and it is for this reason on that a large number of species still remains undescribed (Thornhill *et al*., 2015). Myrtaceae is the eighth largest family of angiosperms in terms of number of species (Snow *et al*., 2011) and is regarded as economically important, as source of edible fruits, essential oils, wood and honey (Wilson, 2011).The family has a postulated origin in Gondwana (Johnson and Briggs,1984; Sytsma *et al*.,2004) and is mainly distributed in the southern hemisphere, with a high diversity in South America, Central America and Australia (Ladiges *et al*., 2003). Areas with significantly fewer species of Myrtaceae are subequatorial Africa and adjacent Madagascar, the Mediterranean, China, India, Mexico and Florida (Wilson,

2011).The species occur in a wide range of habitats, including seasonally dry areas, coastal sands, rainforests, tropical moist forests, savannahs and mangroves (Biffin *et al*.,2010; Wilson,2011).

At times Syzygium was confused taxonomically with the genus Eugenia. Many species formally classed as Eugenia are now included in the Syzygium (A.P.G,2009).Syzygium species are characterized by caduc petals, terminal or sometimes lateral inflorescences that are cymes, independent cotyledons in fruit reported as a drupe (Akoegninou *et al*., 2006). Syzygium guineense (Willd.) DC. Is a tree of 10 to 15 m high, with a thick and tortuous bole, generally low branching, with a fairly dense
crown and drooping branches (Arbonnier, 2008). It has a mixed system of sexual reproduction (allogamous and self-pollinated); pollination is essential for the massive fruiting of this species (Djonwangwe *et al*., 2011).The plant has entomophilous pollination; moreover it can cross with neighboring Syzygium species (Orwa *et al*., 2009)

Syzygium guineense subsp. macrocarpum (Engl.) F. White is a synonym of Syzygium pratense Byng (WCSP, 2020). It has terminal and lateral inflorescences at the top of often defoliated branches; leaves are obovate-elliptic to broadly elliptic, coriaceous with a system of veins highly salient below, and a long petiole; fruits are globose, up to 3 cm in diameter (Akoegninou et al., 2006)

Syzygium guineense subspb guinnense is an extremely variable species with a complex taxonomy. It occurs in a wide range of vegetation types and shows a large variety of growth forms, ranging from a lofty forest tree with large plank buttresses to a rhizomatous undershrub. The flowers, however, are rather uniform and the fruits show only slight difference in shape. Variation in leaf shape and size seems to be continuous, and much of the variation appears to be closely correlated with ecology and habit. The taxonomic situation is further complicated by hybridization with Syzygium cordatum Hochst. ex C. Krauss and backcrossing with the parents. Primarily on the basis of the leaf shape, 11 subspecies have been recognized for Africa as a whole (Maroyi, 2008).

MATERIALS AND METHODS

Collection and Identification of Plants

Fresh leaf of two species of Syzyguim (S.guineense var.guineense and S.guineense var.macrocarpum) were collected in shere Hills Jos Plateau State Nigeria and identified at Forest Herbarium Jos (FHJ).

MATERIALS

The material used for these experiment are as follows: New razor blade, 1percent of aqueous of safranin, soft camel hair brush, ethanol, light microscope, working bench, distill water, synthetic plastic, masking tape, sodium chloride, petri-dish, permanent slide, digital camera, cover slip and nail polish.

ANATOMICAL PROCEDURE

Matured and well-expanded leaves of the two Syzygium species were obtained from standard median level and were washed with distill water Thereafter, the working bench was disinfected with ethanol. New razor blade was used in scraping the abaxial and adaxial surfaces of the two leaves. After scraping, leaves were obtained into smaller pieces so as to replicate them. They were divided into four replicated. They were soaked in hydrochloride solution for three (3) days. Hence, the loose cells were washed away from the epidermal peels with the aid of soft camel hair brush to obtain crystal clean of the leaves. The epidermal peels were stained in 1% aqueous solution of Safranin for 10 minutes and rinsed carefully in distill water to remove excess stain and mounted in 10% on slide and covered with slide cover. Nail polish was used as a precaution to protect the cover slip. The slides were examined under the light microscope at x 40 objective magnification. The stomata was photographed using digital camera. Guard cell area was calculated by multiplying their length and width by Francós constant which is 0.7854. The stomatal index was determined according to (Metcalfe and Chalk,1979).All microscopic measurements were made with the aid of an ocular micrometer; these measurements were converted by the ocular constant with respect to the power under which they were taken with a Motic microscope version 2.0ml.

RESULTS

Table 2 shows the various foliar epidermal features of the two Syzygium species. The table indicates that the abaxial cell of Syzygium guineense var.macrocarpum (90.55 µm) are higher than the adaxial cell of Syzygium guineense var.guineense (90.39 µm) while the adaxial surface of Syzygium guineense var.guineense (90.48 µm) was higher than that of the adaxial surface of Syzygium guineense var.macrocarpum (90.35 µm).Stomata width (µm) was also highest on the abaxial surface of S. guineense var.macrocarpum (0.81mm) and lowest on the adaxial surface of S. guineense var.guineense (0.73mm). More so, stomata length (µm) was highest on the abaxial surface of S. guineense var.macrocarpum (0.14) and lowest on adaxial surface of S. guineense var.guineense (0.10).Finally, the stomata number is higher on the abaxial surface of S. guineense var.macrocarpum (18) and lowest on the abaxial surface of S. guineense var.guineense (13) while the adaxial surfaces of S. guineense var.macrocarpum (15) is higher than that of S. guineense var.guineense (12) which is the lowest in total.

Table 1: Quantitative Epidermal Feature of the two Syzygium Species

Treatment	Stomata No.	Stomata Length (µm)	Stomata width (µm)	Stomata Size (µm²)
Syzygiun guineense var. guineense. (Abaxial)	13	0.10	0.73	90.39
Syzygiun guineense var. guineense. (Adaxial)	12	0.12	0.78	90.48
Syzygiun guineense var. macrocarpum (Abaxial)	18	0.14	0.81	90.55
Syzygiun guineense var. macrocarpum. (Adaxial)	13	0.11	0.72	90.35

Table 2: Quantitative foliar epidermal characters of the two species of syznium

Species	Epidermal cell shape		Stomata types		Stomata distribution	
	Adaxial	Abaxial	Adaxial	Abaxial	Adaxial	Abaxial
S.guineene var. guineense	Polygonal and irregularly arranged	Polygonal and irregularly arranged	Anisocytic	Anisocytic	Hypoamphistomatic and scanty	Hypoamphistomatic and abundantly distributed
Syzium guinease var. macroparpum	Polygonal and irregularly arranged	Polygonal and irregularly arranged	Anonacytic	Anonacytic	Hypoamphistomatic and scanty	Hypoamphistomatic and abundantly distributed

DISCUSSION

Epidermal cell on abaxial and adaxial surfaces are mainly polygonal and irregularly arranged is against the findings of Nilchero and Wilkinson (2001). Anticlinal cell wall of the abaxial surfaces of S. guineense var.guineense are undulate while the adaxial surfaces are straight to slightly undulating. The distributions of stomata on the adaxial surfaces of both S. guineense var.guineense and S. guineense var.macrocarpum is hypoamphistomatic and is scanty similarly, the distribution of stomata on both the abaxial surfaces of S. guineense var.guineense and S. guineense var.macrocarpum is hypoamphistomatic and is abundantly distributed. This how ever support the findings of Dashti *et al*.,(2003).The abundantly found stomata on the daxial surfaces of S. guineense var.guineense is anisocytic but it varies in length and width with the adaxial surfaces.On the other hand, stomatal frequency varies from one leaf to the other and these were observed among the species in the family of many plants studied (Oyeleke *et al*.,2004)

Stomata size on both the abaxial and the adaxial surfaces of S. guineense var.macrocarpum are mainly polygonal and are irregularly arranged in various sizes and shapes. Anticlinal cell wall of the abaxial (90.39 µm) is high undulate while the adaxial (90.48 µm) surfaces is slightly undulating, this there for agrees with the report from Mbajwu et al.,(2007). Anonacytic stomata type is found on both the abaxial and adaxial surfaces of S. guineense var. macrocarpum while the distribution of stomata is hypoamphisyomatic (stomata abundant on the abaxial surfaces and scanty on the adaxial surfaces) which is in agreement with Mbagwu et al.,(2007).Guard cell length and width on the adaxial surfaces of S. guineense var. macrocarpum (90.14 and 0.81) are bigger than the abaxial surface (0.11µm and 0.72) respectively is against the findings of Metalf and Chalk (1950).The foliar epidermis is one of the most significant taxonomic characters from the biosystematic point of view and the taxonomic studies of a number of families of leaf epidermis have been evidential (Bhatia, 1984; Adedeji, 2004).

The overall results show that leaf epidermal features could be said to be taxonomically significant because of discontinuities that occurred within and between genera and within family. The leaf epidermal features observed in all the two species of Myrtaceae were enough taxonomic characters which could be implored to support hitherto external morphological characters used to classify plants in this family. In addition, based on epidermal features, some members of the family Myrtaceae can readily be distinguished from one another. Such epidermal features as in stomata were thus useful tools for diagnostic and taxonomic works.

CONCLUSION

The overall results from the study shows that leaf epidermal characters are of taxonomic significance in the classification and delimitation of the two *Syzygium* species. They can be distinguished based on their stomata, epidermal cells as these features are being influenced by ecological factor. Hence, the epidermal cells and stomata which are the micro morphological factors are present on the leave epidermal surface can be used to identify or differentiate plant species.

RECOMMENDATION

There is need for further study on other species of myrtaceae as plants belong to myrtaceae are often had to indentify and classify hence, large of species still remain undescribed.

REFERENCES

Adedeji, O (2004). Leaf epidermal studies of species of Emilia cass. (Senecionea, Asteraceae) in Nigeria-Botanica

Angiosperms Phylogeny Group (2009).An update of the Angiosperms Phylogeny Group Classification for the orders and families of flowering plants.

Bhatia, R.C (1984). Foliar Epidermal Studies of Heliotropium supinum L. Folia Geobotanica Phytotaxon.

Biffin, E.,Lucas,E.,Craven, L.,Ribeiro da Costa, I.,Harrington, M., Crisp, M. 2010.Evolution of exceptional species richness among lineages of fleshy-fruited Myrtaceae.
Annals of Botany 106: 7

Christenhusz, M. J. M.; Byng, J. W. (2016). "The number of known plants species in the world and its annual increase". Phytotaxa. Magnolia Press.261 (3): 201–217.doi:10.11646/phytotaxa.261.3.1.

Maroyi,A.,2008.Syzygium guineense (Willd.) DC. In: Louppe, D.,Oteng-Amoako,A.A.& Brink, M. (Editors).PROTA (Plant Resources of Tropical Africa /Ressources végbtales de lAfrique tropicale),Wageningen,Netherlands. Accessed 15 July 2021.

Metcalfe, CR and Chalk, L,Anatomy of Dicotyledons . 2nd Edition. Oxford: Clarendon Press, 1979.

Mbagwu, F. N. and H.D Edeoga (2007). Observations on the vegetation and flora morphology of some Vigna Species.

Nilchero H.D and C.T. Wilkinson (2001). Comparative morphology of leaf epidermal in three species of Boerhevia L.J. Econ.Tax,Bot,19-197-205.

Metalfe, C. R and Chalk, L. (1950). Anatomy of the Dicotyledons, vol 1, Oxford University Press, Oxford. 724pp. (19):381-385. Lithuanica, 10(2):121-133.

Thornhill, Andrew H.; Ho, Simon Y.W.; Külheim, Carsten; Crisp, Michael D. (December 2015). "Interpreting the modern distribution of Myrtaceae using a dated molecular phylogeny". Molecular Phylogenetics and Evolution. 93: 29–43.doi:10.1016/j.ympev.2015.07.007. ISSN 1055-7903. PMID 26211451

Snow, N., McFadden, J.,Evans, T., Salywon,A.,Wojciechowski, M.,Wilson,P. 2011. Morphological and molecular evidence of polyphyly in Rhodomyrtus (Myrtaceae: Myrteae).Systematic Botany 36(2):390-404.

Sytsma, K., Litt, A., Zjhra, M., Pires, C., Nepokroeff, M., Conti, E., Walker, J., Wilson, P.2004. Clades, Clocks and Continents: Historical and biogeographical analysis of Myrtaceae, Vochysiaceae, and relatives in the southern hemisphere. International Journal of Plant Sciences 165: 85-105.

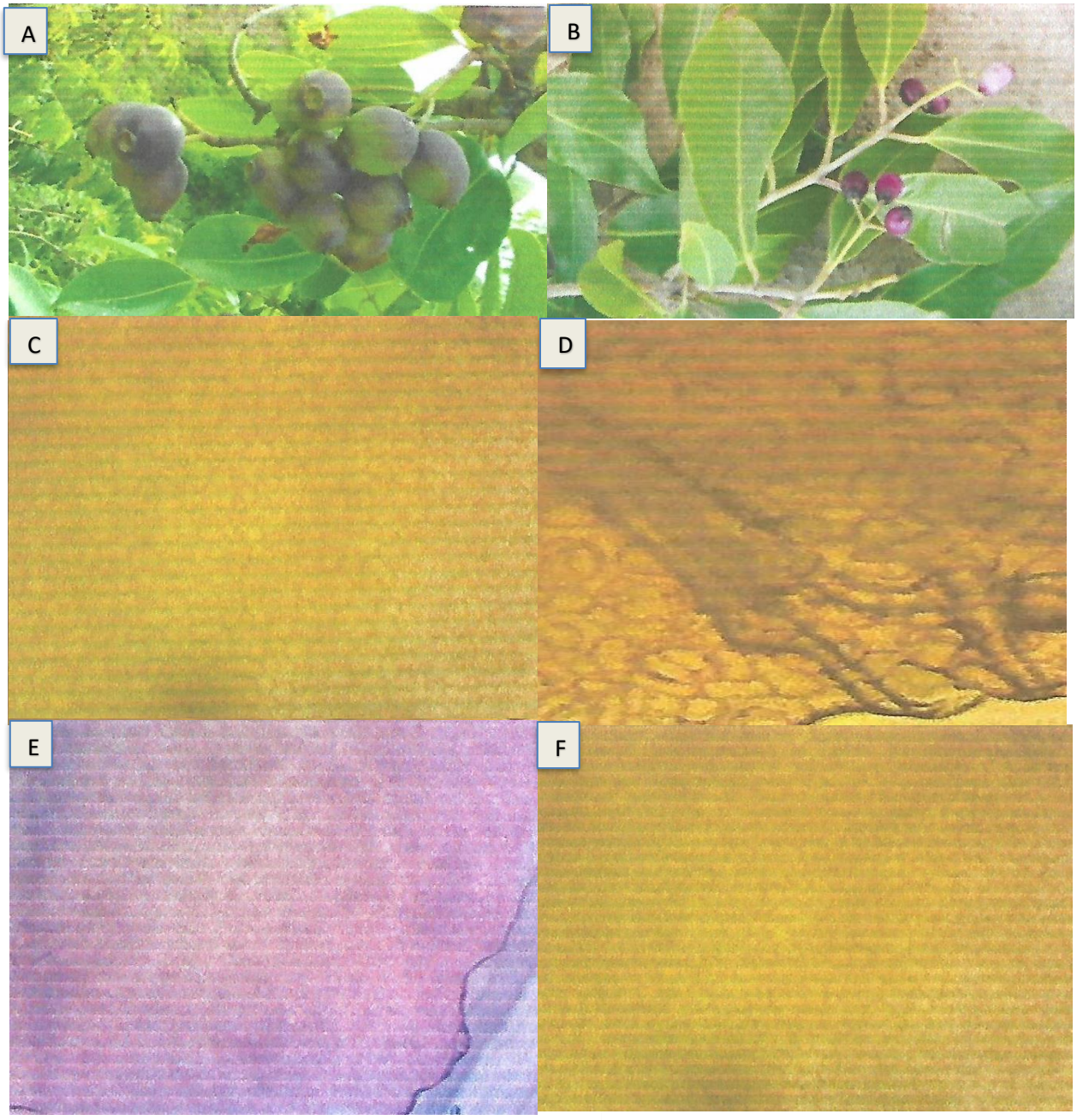
Ladiges, P., Udovicic, F., Nelson, G. 2003. Australian biogeographical connections and the phylogeny of large genera in the plantbfamily Myrtaceae. Journal of Biogeography 30:989-998.

Johnson, L., Briggs, B.1984.Myrtales and Myrtaceae – a phylogenetic analysis. Annals of the Missouri Botanic Garden 71:700-756.

Oyeleke, M.O; Abdulrahaman, A.A and Oladele, F.A (2004). Stomatal anatomy and transpiration rate in some afforestation species. NISEB Journal. 4:83-90.

Wilson,P.2011.Myrtaceae.In:Kubitzki, K. (Ed.) The families and genera of vascular plants vol. X.Sapindales, Cucurbitales, Myrtaceae.Springer. pp. 212-271.

Wilson, P. 2011. Myrtaceae. In: Kubitzki, K. (Ed.) The families and genera of vascular plants vol. X.Sapindales, Cucurbitales, Myrtaceae.Springer. pp. 212-271.



A. Syzygium guineense var. macrocarpum B. Syzygium guineense var. guineense C. Syzygium guineense var. macrocarpum abaxial surface D. Syzygium guineense var. macrocarpum adaxial surface. E. Syzygium guineense var. guineense abaxial surface F. Syzygium guineense var. guineense adaxial surface.