Comparative foliar epidermal studies of genus *Pericopsis* (*Papilionaceae*) in Nigeria

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Received: October 04, 2011 ▷ Accepted: March 22, 2012

Abstract. A comparative foliar epidermal study of two species of genus *Pericopsis* found in Nigeria was performed by means of light microscopy, with a view of elucidating their taxonomic significance and present complementary data, which would aid identification of the species even when only leaf fragments are available. Species diagnostic features, including amphistomata and trichomes, were observed in the leaf section of *P. laxiflora,* whereas these were lacking in *P .elata.* The cell shape was polygonal and irregular on both surfaces and either polygonal or irregular on any of the two surfaces of the leaf. Anticlinal wall was either straight or curved in *P. elata* but only straight in *P. laxiflora*.

Key words: Foliar morphology , *Pericopsis,* taxonomy

Introduction

The genus *Pericopsis* Thwaites (syn *Afromosia*) (*Papilionaceae*) is represented by four species: three in Africa and one in Asia (Michael 2006). Two of these species are found in Nigeria. These are *P. elata* (Harms) Meeuwen and *P. laxiflora* (Benth.) Meeuwen. Both species are geographically isolated (allopatric) in Nigeria. *P. laxiflora* is a most common species in dry savannah areas, while *P. elata* is found in the forest zone of West Africa (Hutchison & Dalziel 1963; Keay 1989).

Pericopsis elata is classified by the World Alliance for Nature (IUCN) as Endangered species (CITES 2003). Its wood (trade names: afrormosia,) is highly valued on the international market as it is considered a substitute for teak. It is used mainly for furniture making, decorative veneer, interior and exterior joinery, stairs, flooring and boat building. Species of *Pericopsis* are also commonly used in African traditional medicine. The pulped bark of *P. elata* is applied after scarifications for localized pain in Congo (Burkill 1994).

Periscopsis laxiflora bark is often used to cure snake bites, rheumatism, joint pains and teething pains in children (Arbonnier 2002). The importance of anatomical data in traditional taxonomy has been recognized and documented (Karatela & Gill 1984), since variations within the species, genera or a family are usually reflected in anatomical features. Foliar epidermal characters were used to provide an artificial taxonomy key, in order to facilitate identification of the species of *Khaya* in Nigeria (Olowokudejo & Nyananyo 1990).

Furthermore, the correlations between some epidermal features and chemical constitutes in the family of Pteridaceae were examined by Wollenweber & Schneider (2000). Kadiri & al. (2005) worked on epidermal morphology of *Cylicodicus gabunensis* and reported that leaf sample of this plant can be

identified even when in fragments and can be useful for the purpose of pharmacognostic research. Stomata associated with epidermal cells provide an increasingly important source of taxonomic characters. The structural features of individual stoma may be important, but equally valuable is their pattern of distribution, while presence or absence of stomata on the upper leaf surface is often a good diagnostic feature (Sonibare & al. 2005). The taxonomic significance of stomata distribution and morphology of several plant species have been reported by several researchers (Watson 1962; Ayodele & Olowokudejo 2006). The study thus aims at obtaining reliable taxonomic characters for easy identification and delimitation of the two species of *Pericopsis,* even when the leaf material is fragmented.

Material and methods

Fresh specimens of the species were obtained from the Forestry Research Institute of Nigeria, Ibadan and along eruwa road, also in Ibadan, Oyo State where the species are well distributed. They were then authenticated at the Forest Herbarium Ibadan (F.H.I.). Epidermal preparations were obtained after Ayodele & Olowokudejo (2006). Fresh plant specimens were used for this species. Each sample was macerated in concentrated trioxonitrate (v) acid for 2–4 hours. The sample was then transferred to water in Petri-dish, while abaxial and adaxial epidermises were carefully separated with forceps and dissecting needle. The inner parts (mesophyll tissue) of leaves were carefully cleared with a Carmel hair brush, and the isolated epidermal layers were washed in water several times before being transferred to 50 % alcohol for 1 or 2 minutes for hardening. The tissue was then moved to a clear–glass microscopic slide and stained after draining off the excess water with safranin for less than 4 minutes. The excess staining was washed off by a dropping pipette for adding and removing water from the tissue. Subsequently, the preparation was mounted in glycerin on a slide, with edge of the cover slip ringed with nail varnish to prevent dehydration and to seal the cover slips to the slides. The slides were labeled appropriately and examined under the light microscope, while photomicrographs were taken (× 400) with cx31 Olympus Biological microscope, fitted with and Olympus E–330 digital SLR camera and E 330–ADU 1.2 microscope adapter.

Results and discussion

The leaf epidermal features of the two investigated *Pericopsis* species are summarized in Table 1. The shape of epidermal cells is polygonal in *P. elata* (adaxial and abaxial surfaces) and polygonal / irregular in *P. laxiflora*. The polygonal cells in *P. elata* on both surfaces are mostly 4–5 sided. Anticlinal walls are straight in *P. elata* and either straight or curved in *P. laxiflora* (Fig. 1 A and B). The number of stomata ranges from 28–42 per view on the abaxial no stomata on the adaxial surface of *P. elata,* while in *P. laxiflora,* it ranges from 10–25 and 20–40 per view on the adaxial and abaxial surfaces respectively. The paracytic stomata type is prominent in this genus and common to both species: while *P. elata* is hypostomatic, *P. laxiflora* is amphistomatic (Fig. 1 C and D). Unicellular non-glandular trichomes were also recorded on both surfaces of *P. laxiflora,* while no trichome was found on any of the surfaces of *P. elata* (Fig. 1 E, F and A, B). According to Winkinson (1979), the taxonomic significance of similarity of the stomata apparatus in a mature leaf often provides a reliable diagnostic character, especially when ontogeny of the stomata is unknown or different. The similarities, however, have indicated that the species are related and their grouping in the same genus is equally supported by the presence of paralytic stomata. Trichomes are useful in plant adaptations to varying ecological factors and for prevention of herbivory (Stace 1965; Inamdar & Gangadhara 1977; Heywood & Moore 1978; Jones & Luchsinger 1986). Non-glandular unicellular trichomes on both adaxial and abaxial surfaces are considered interesting and the density of hairs was more abundant on the abaxial surface. The high density of thick and coated hairs probably serves to reduce the rate of transpiration in plants and this supports the importance of trichomes in taxonomy as a diagnostic tool, as it was emphasized by Stace (1980) for the family of *Combretaceae*. However, this feature distinguishes the two species: unicellular non-glandular trichomes are present only in *Pericopsis laxiflora.* A survey of epidermal mor-

Table 1. Combined qualitative and quantitative features of the epidermal morphology of two species of genus *Pericopsis*.

Taxa	Leaf surface	Stomatal types	Epidermal cell shape	Anticlinal wall pattern	Trichome Type	Epidremal cell length(µm)	Epidermal cell width (µm)	Stomatal length (µm)	Stomatal width (µm)
P. elata	Adaxial	Absent	Polygonal	Straight/curve	Absent	14–17.5 *15.05±0.54	10.5–14 *12.6±0.57	Absent	Absent
	Abaxial	Paracytic	Polygonal	Straight/curve	Absent	17–28 *21.34±1.10	14–21 *16.8±0.87	21–28 24.5±0.82	10.5–14.0 *11.6±1.03
P. laxiflora	Adaxial	Paracytic	Polygonal	Straight	Unicellular, non glandular	25.5–31.5 *25.9±0.71	14–21 *16.8±0.87	28–31.5 32.5±0.87	17.5–21 19.6±0.57
	Abaxial	Paracytic	Polygonal Irregular	Straight	Unicellular, non glandular	21–31.5 *28.00±1.56	14–21 *18.2±0.87	24.5–31.5 26.95±0.91	14–21 *15.4±0.77

*Significant (P< 0.05).

Table 2. List of taxa studied.

Taxa	Name of collector(s)	Date of collection	Herbarium Number	Distribution in Nigeria
Pericopsis elata	Adeniji K.A. & Ariwaodo, J.O	6/6/2011	FHI 109028	Oyo
	B.O. Daramola	7/4/1976	FHI 77466	Oyo, Nig
	L.J. Masun	1/9/1960	FHI 50881	Benin
	A.E Ettah	6/12/1960	FHI 32701	Ogoja
	Usang Felix	2/2/2005	FHI 107127	Oyo
	J.O Amachi	27/5/1958	FHI 38274	Ogoja
	Fagbemi & Osanyinlusi	19/2/1977	FHI 81330	Niger
Pericopsis laxiflora	Adeniji K.A. & Ariwaodo, J.O	6/6/2011	FHI 109028	Oyo
	H.D. Onyeachusim	7/3/1966	FHI 158135	Ilorin
	R.W.J. Keay	6/5/1950	FHI 25725	Zaria
	G.A. Adesida	10/5/1975	FHI 73084	Oyo
	A. Binuyo	11/7/1950	FHI 26656	Kabba
	J.A.D Jackson	6/9/1957	FHI 31551	Ilorin
	Oguntayo & Fagbemi	19/11/1976	FHI 79971	Niger

phology revealed that the anticlinal cell wall varies from the straight/curved wall in *P. elata* to a straight wall in *P. laxiflora*.

Conclusion

The comparative studies of genus *Pericopsis* show some significant differences in characters which could be used to delimit this species even when they are sterile or fragmentary. Irregular to polygonal cell shape, stomata distribution, and amphistomata, as well as the presence of trichomes are useful characters which can be employed in taxa delimitation. The information provided by this study not only widens the spectrum and scope of taxonomy, but also provides an efficient approach to identifying the plant scraps, which otherwise would have required complete information on the plant specimen for its correct identification.

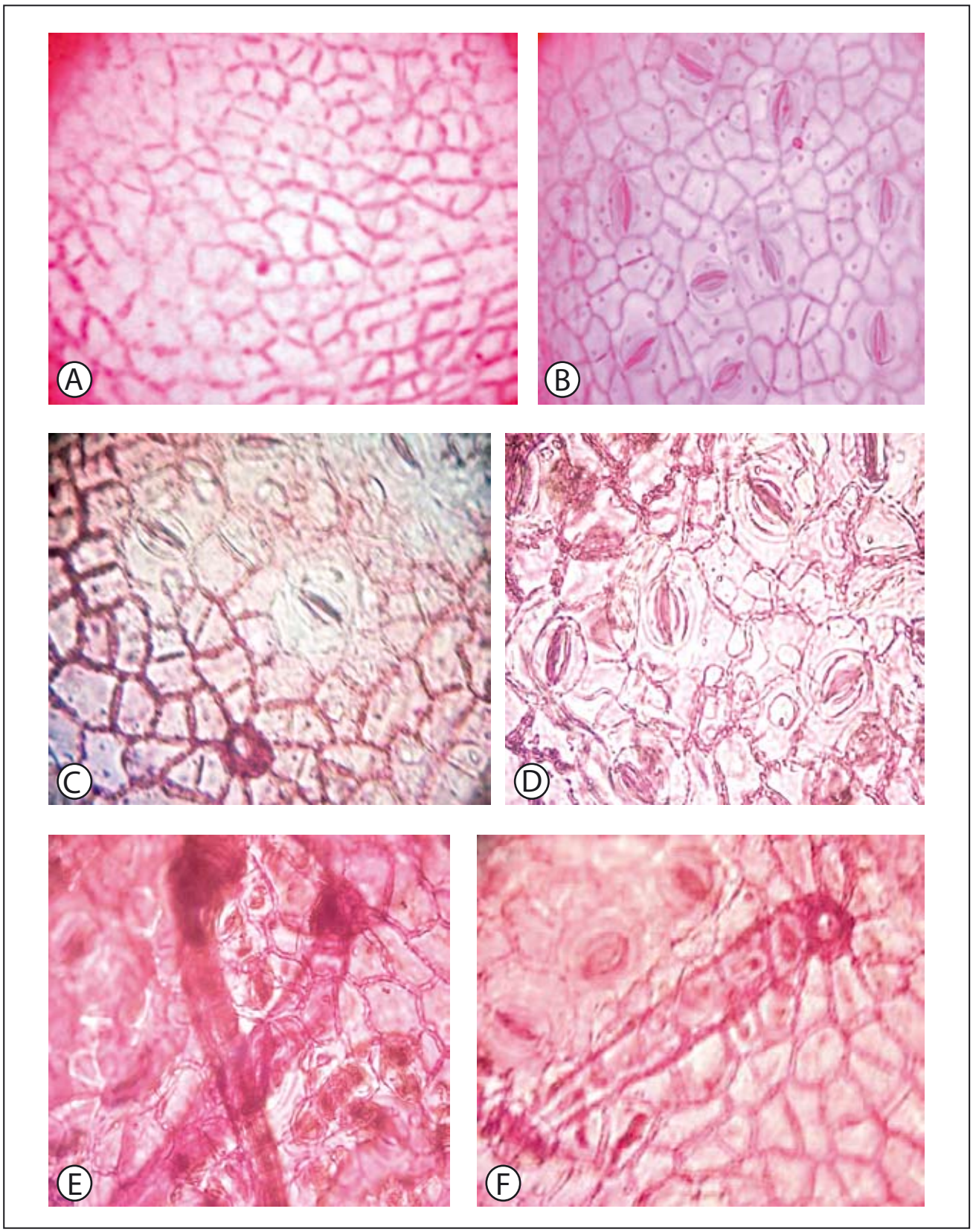

Fig. 1. Photomicrographs (×400) of leaf surfaces of the genus *Pericopsis.* **A,** Adaxial surface of *P. elata* showing polygonal cell shape and straight/curved anticlinal wall. **B,** Abaxial surface of *P. elata* showing polygonal cell shape and straight/curved anticlinal wall. **C,** Adaxial surface of *P. laxiflora* showing polygonal cell shape and straight anticlinal wall with paracytic stomata. **D,** Abaxial surface of *P. laxiflora* showing paracytic stomata. **E & F**, Trichomes of *P. laxiflora.*

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