Studies on the Stomata of Some Rubiaceae

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ABSTRACT

Twelve taxa comprising six herbs, four shrubs and two liane were documented with descriptions for the nature of stomata. The epidermal cells are generally arched as found in 9 taxa with the remaining 3 taxa waxy. Anomocytic, paracytic and mixed-anomocytic and paracytic stomata were observed with preponderance of paracytic type- 8 taxa, anomocytic-1 and mixed anomocytic–paracytic- 3 taxa. Stomata size ranges from 20.16µm± 0.22 x 13.44µm± 0.21 in Mussaenda chippii to 43.24µm± 0.29 x 31.92µm± 0.58 in Borreria ocymoides. Stomata index values vary from 5.70% in Diodia scandens to 25% in Oldenladia affinis.

Keywords: Leaf Epidermis, Stomata Type and Size, Rubiaceae

INTRODUCTION

The family Rubiaceae comprises 500 genera and 6,500 species of world wide distribution (Sharma, 2008), represented by 95 genera and 540 species in West Africa (Hutchinson and Dalziel, 1963), they are mostly of shrubby and arboreal habits, sometimes lianous or herbaceous (Lawrence, 1951). Leaves with opposite intra or inter-petiolar stipules. Flowers gamopetalous tetra or pentamerous, ovary inferior and bicarpellary. Fruit a berry, a capsule or drupe (Olorode, 1984). Members are important economically as beverages, dyes, medicines, ornamentals and as noxious weeds (Gill, 1988).

Stomata serve for gaseous communication between the internal and external environments of a higher green plant (Swarthout, 2008). Stomata are minute functional pores on the leaf and some stem epidermis (Roberts, 1978). Physiological functions like photosynthesis, respiration and transpiration take place with the help of stomata as it is through them that inter-change of gases such as oxygen, carbon-dioxide and water vapour pass between the inter-cellular space system of the internal tissues of the higher green plant and the outer atmosphere (Pandey and Chadha, 2006). Stomata can also be diagnostic as a systematic tool in the classification of problematic higher plants taxa (Ogbe and Osawaru, 1988). Earlier contributors on phytodermology include Solereder (1908) Metcalfe and Chalk (1950a), Singh et al., (1975) Matthew and Sivarajan (1987), Patil and Patil (2011). In spite of the importance of the stomatal apparatus in plant physiology and taxonomy, information on it's structure and size in Nigerian taxa is scanty, this study reports stomatal structure and size in some Nigerian Rubiaceae.

MATERIALS AND METHODS

Leaf specimens collected and later deposited as voucher materials at the University of Benin Herbarium were used for the study. The designation HIO and HORW are leaf samples from Okomu oil palm and Iyanomo Rubber plantations respectively by Onyibe 1987, 1990. OBM collections were made by the present author, all collections within Edo State, Nigeria.

Abaxial leaf surface records only were taken because of confinement constancy of stomata on lower leaf surface. The leaf portions were decolourised by immersion in 90% alcohol and

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were washed in 5 changes of distilled water, after which they were immersed in 5% sodium hydroxide and introduced to boiled distilled water at 100^0C for ten minutes to further enhance leaf de-colorization and later washed in 5 changes of distilled water after which they were mounted.

Terminologies of stomata complex types used after Metcalfe and Chalk, (1950a, 1979), Van-Cotthem (1970) Rasmussen, (1981). Measurements were carried out on 50 stomata for each taxon investigated with ocular graticule using a Swift Collegiate light microscope. The number of stomata per field of view was recorded.

Stomata index (SI) after Dilcher (1974) was estimated using the formula.

$$S.I = \frac{S}{E+S} x \frac{100}{1}$$

Where

S = Number of stomata per unit area

E = Number of epidermal cells in the same unit area.

RESULTS

Table 1. Qualitative Stomatal Characters of the species of Rubiaceae

S/N	*Taxon*	*Habit*	*Foliar Material*	*Epidermal Cell*	*Stomata Type*
1.	Bertiera racemosa Schum.	Shrub	HORW-079	Arched	Paracytic and Anomocytic
2.	Borreria ocymoides (Burm) DC.	Herb	OBM-47	Arched	Paracytic
3.	Chassalia kolly Hepper.	Shrub	HORW-095	Arched	Paracytic and Anomocytic
4.	Diodia scandens Sw.	Herb	HORW-162	Arched	Paracytic
5.	Geophila obvallata (Schum.) F. Didr.	Herb	HIO-62	Arched	Paracytic and Anomocytic
6.	Mitracarpus hirtus (L.) DC.	Herb	OBM-100	Arched	Paracytic
7.	Mussaenda chippii Wernham.	Shrub	HORW-165	Arched	Paracytic
8.	M. elegans Schum and Thonn.	Shrub	HIO-159	Wavy	Paracytic
9.	M. landolphiodes Wernham.	Liana	HORW-075	Wavy	Paracytic
10.	Oldenladia affinis Roem and Schult.	Herb	HORW-138	Arched	Paracytic
11.	O. corymbosa L.	Herb	HORW-151	Wavy	Anomocytic
12.	Sabicea calycina Benth.	Liana	HORW-055	Arched	Paracytic

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Table 2. Quantitative Stomatal Characters of the species of Rubiaceae (S.E = Standard Error)

S/N	*Taxon*	*Stomata Length (µm)± S.E.*	*Stomata Breadth (µm)± S.E.*	*Pore Lenght (µm)± S.E.*	*Stomata Per Field of View*	*Stomata Index*
1.	Bertiera racemosa Schum.	35.28±0.21	23.52±0.29	20.160.22	10	11.00
2.	Borreria ocymoides (Burm) DC.	43.24±0.29	31.92±0.19	35.95±0.58	20	21.00
3.	Chassalia kolly Hepper.	27.38±0.32	15.62±0.23	15.12±0.22	3	5.70
4.	Diodia scandens Sw.	26.88±0.27	17.30±0.25	20.16±0.34	25	11.00
5.	Geophila obvallata (Schum.) F. Didr.	30.74±0.28	18.48±0.24	20.66±0.26	5	10.00
6.	Mitracarpus hirtus (L.) DC.	39.14±0.26	14.78±0.21	23.18±0.29	17	22.07
7.	Mussaenda chippii Wernham.	20.16±0.22	13.44±0.21	12.77±0.21	15	13.00
8.	M. elegans Schum and Thonn.	33.60±0.21	20.83±0.24	19.82±0.19	10	9.50
9.	M. landolphiodes Wernham.	23.52±0.24	18.06±0.18	19.15±0.20	10	9.09
10.	Oldenladia affinis Roem and Schult.	24.53±0.28	16.13±0.17	16.13±0.16	4	25.00
11.	O. corymbosa L.	18.14±0.29	14.70±0.26	13.10±0.23	27	21.20
12.	Sabicea calycina Benth.	32.26±0.29	19.15±0.31	20.83±0.25	6	13.00

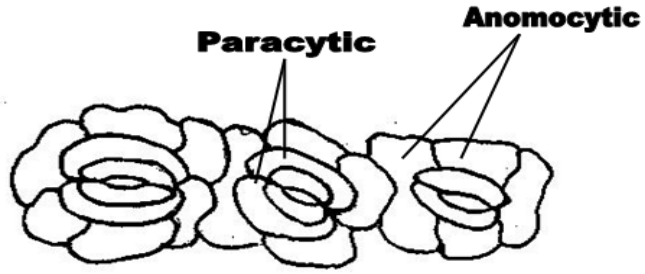

Figure 1. *Bertiera racemos*: Paracytic and Anomocytic Stomata

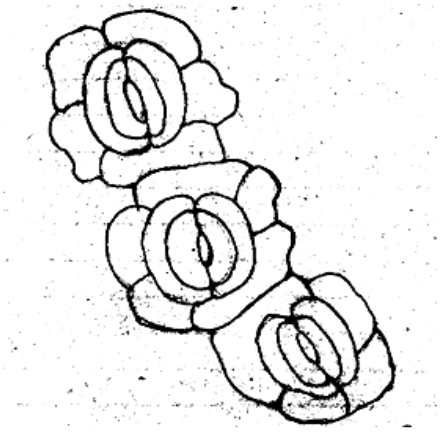

Figure 2. *Borreria ocymoides*: Paracytic Stomata

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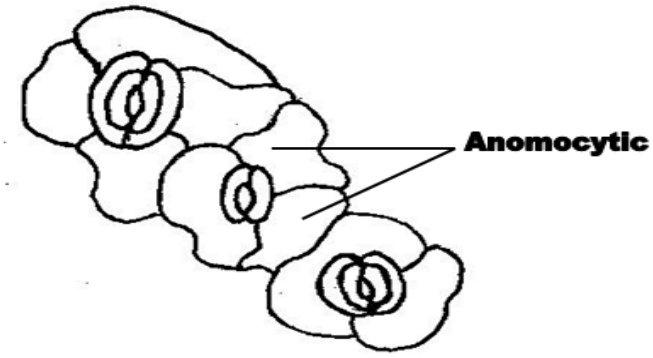

Figure 3. *Chassalia kolly*: Paracytic and Anomocytic Stomata

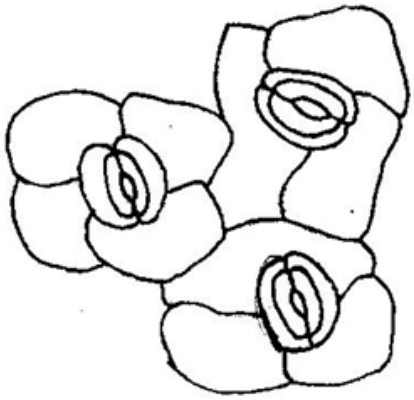

Figure 4. *Diodia scandens*: Paracytic Stomata

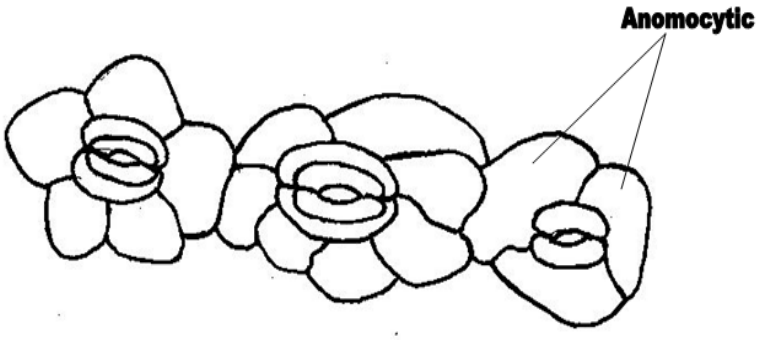

Figure 5. *Geophila obvallata*: Paracytic and Anomocytic Stomata

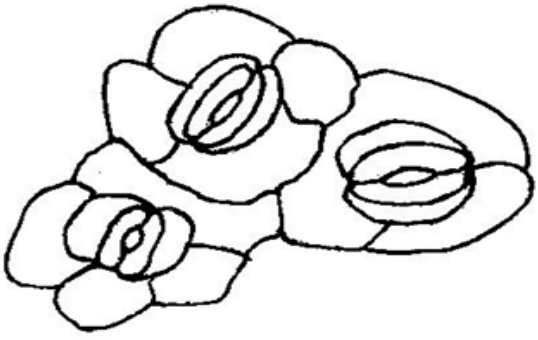

Figure 6. *Mitracarpus hirtus*: Paracytic stomata

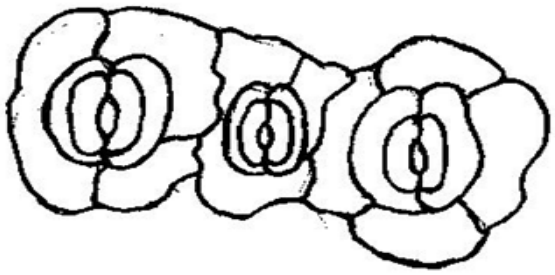

Figure 7. *Mussaenda chippii*: Paracytic Stomata

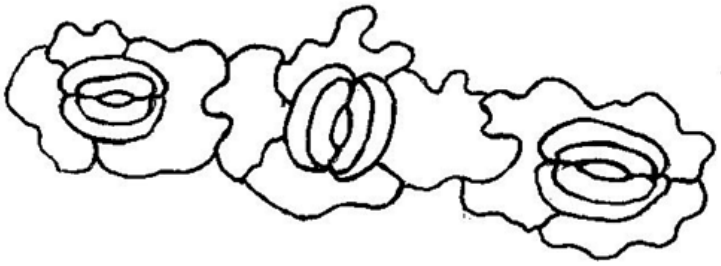

Figure 8. *M. elegans*: Paracytic Stomata

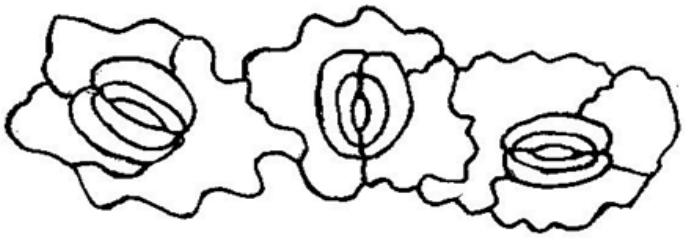

Figure 9. *M. landolphiodes*: Paracytic stomata

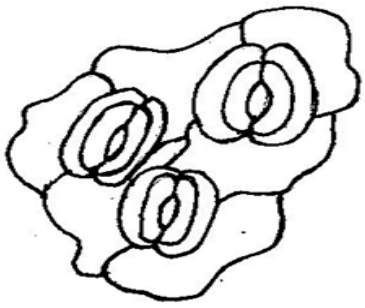

Figure 10. *Oldenladia affinis*: Paracytic Stomata

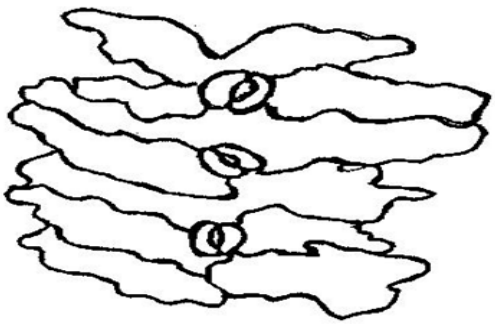

Figure 11. *O. corymbosa*: Anomocytic Stomata

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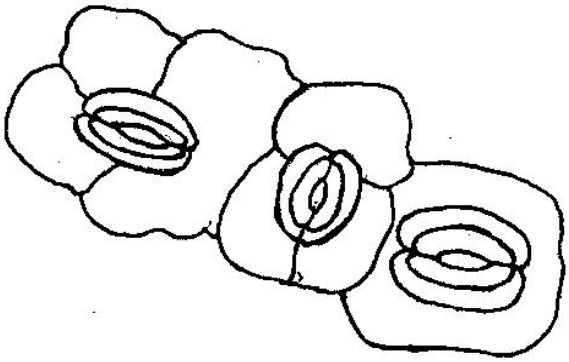

Figure 12. *Sabicea calycina*: Paracytic Stomata

DISCUSSION

The paracytic stomata type sensus Metcafe and Chalk (1950a) has been typified as Rubiaceous by Vesque (1889) and is widely documented in the family with a rare occurrence of other types such as anomocytic, anisocytic and hexacytic on records (Patil and Patil, 2011). The present author observed solely paracytic stomata in 8 out of the 12 studied species.

Stomata size, though largely quantitative in nature is note worthy. Pataky (1969) suggested stomata size of less than 15µm as small and larger ones being more than 38µm of which *Borreria ocymoides* and *Mitracarpus hirtus* with stomata size of 43.24µm±0.29 x 31.92µm±0.58 and 39.14µm±0.42 x 20.66µm ±0.25 respectively fell into the large category.

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