

## **Foliar epidermal anatomy of four species of dioscorea**

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### **ABSTRACT**

*Cuticular study of the foliar epidermis of four species of Dioscorea was carried out in order to supplement our present taxonomic knowledge of the four members of this genus. Dioscorea alata, D. cayenensis, D. domentorum and D. rotundata were collected from farmland within Kogi State University Campus. Five leaf samples of each species were harvested, from which cuticular samples were prepared by maceration, stained and mounted on slides. Abaxial and adaxial cuticles were prepared separately. A total of 40 slides were prepared and viewed in 10 fields of view using Leica binocular microscope at x40 objective. Collected data for numbers and types of Trichome and stomata were subjected to one way analysis of variance (ANOVA), Descriptive analysis, Test of Homogeneity and Multiple comparison tests. There were significant variations in all the species for all the parameters studied. The possibility of the use of these parameters in taxonomic delineation was discussed.*

**Key words:** anatomy, epidermis, taxonomy, trichome, stomata.

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### **INTRODUCTION**

In West Africa, yam serves as a staple food. The commonest species of yam cultivated in Africa are *Dioscorea rotundata*, *Dioscorea cayenensis*, *Dioscorea alata*. In 1974, the world annual production was estimated to be 19 million tonnes of which about 15 million tones was produced in Nigeria representing about 79%, 1.5 tones in Cote D’evair representing about 8% while the combination of Benin Republic, Ghana and Togo produced 0.5 tonnes representing about 3% [12]. *Dioscorea* (yam) is a genus of 600 species of flowering plants in the family Dioscoreaceae, native throughout the tropical and warm temperate regions of the world. The vast majority of the species are tropical with only a few species extending into the temperate climates [9].

Cuticular studies and its uses have been proven to be important in plant anatomy. It has been used variously to determine habitat condition and suitability of revegetation plants, phenotypic plasticity, and taxonomical delineations [1,2,3,4,7,8,10,11,14,15,17,18,19,20]. The assertion by

Cook [6] that difficulties in distinguishing phenotypic plasticity from genetic variability has led to a good number of “paper species” which are taxonomically not valuable is a taunt that must continue to evoke experimental exercises that will prove every encountered or envisaged case in taxonomy on its merit.

The present investigation involves the cuticular study of the foliar epidermis of four species of *Dioscorea*: *Dioscorea alata*, *D. cayenensis*, *D. dometorum* and *D. rotundata*. This is with a view to supplement our present taxonomic knowledge of the four members of this genus.

## MATERIALS AND METHODS

Fresh leaf materials of *Dioscorea alata*, *D. cayenensis*, *D. dometorum* and *D. rotundata* were collected from farm land within Kogi State University Campus. Five leaves were taken from median portion (midway between the tip and the leaves) of the plant species. Fresh cut of 3mm<sup>2</sup> of each species were made and put into Jeffrey’s Maceration (Nitric acid) for 4 – 5 hours. Each sample was then washed thoroughly in water with 4 – 5 changes. The abaxial and adaxial epidermal cuticular layers were separated using spatula head and dissecting needle. The cuticular epidermal layers were stained in 1% Safranin for ten minutes, washed with water to remove excess stain and mounted with a drop of glycerol. Each prepared specimen was viewed in 10 fields using Leica binocular microscope at X40 objective. The numbers of trichome and stomata were counted. Stomatal types were identified and trichome categories were also observed and recorded. The collected data were subjected to one way analysis of variance (ANOVA) with Descriptive analysis, Test of Homogeneity and Multiple Comparison test.

## RESULTS

The stomata in each of the four species studied were hypostomatic. These parameters studied were the numbers of trichome on the adaxial surface, numbers of trichome on the abaxial surface, types of trichome on the adaxial surface, types of trichome on the abaxial surface and numbers of stomata. The analysis of variance (ANOVA), Descriptive analysis, Homogeneity test and Multiple Comparison test indicated significant differences both between and within groups of species for all parameters considered.

### Numbers of Trichome (adaxial)

Descriptive analysis result for number of trichomes on the adaxial surface of the four species showed significant variation in the mean value. Test of Homogeneity of variance showed significant differences in the four species. ANOVA showed significant variation between the four species. Multiple Comparisons result showed significant difference between *Dioscorea rotundata* and *D. dometorum* but showed no significant differences with *D. cayenensis* and *D. alata*. *Dioscorea dometorum* is widely set apart from *D. cayenensis* and *D. alata*. *Dioscorea cayenensis* showed affinity with *D. alata*. *Dioscorea dometorum* showed significant difference with others.

### Numbers of Trichome (abaxial)

Descriptive analysis for number of trichomes on the abaxial surface of the four species also showed significant variations in the mean value. Test of Homogeneity and ANOVA also showed

significant variation between the four species. Multiple Comparisons result showed that *Dioscorea rotundata* had significant difference with *D. dometorum*. *Dioscorea alata* showed no significant variation with *D. rotundata*. *Dioscorea dometorum* and *D. cayenensis* are widely set apart from others.

#### **Types of Trichome (adaxial)**

Descriptive analysis showed significant difference in the mean adaxial value for types of trichome of the four species. Test of Homogeneity and ANOVA indicates differences in all the species studied. The Multiple Comparisons result showed significant difference between *Dioscorea rotundata* and *D. dometorum*. *Dioscorea rotundata* showed no significant difference between with *D. cayenensis* and *D. alata*. *Dioscorea dometorum* is widely set apart from *D. cayenensis* and *D. alata*. *Dioscorea cayenensis* showed difference affinity with *D. alata*.

#### **Types of Trichome (abaxial)**

Descriptive analysis indicates significant difference in the abaxial mean value of types of trichomes observed in the four species. Test of Homogeneity and ANOVA showed variation in all the species. Multiple Comparison indicate significant differences in the interactions of the four species studied.

#### **Numbers of Stomata (hypostomatic)**

Descriptive analysis showed significant difference in the mean value of the four species. Test of Homogeneity, ANOVA and Multiple Comparison indicates significant variations among the four species studied.

#### **Types of Stomata**

The four species studied showed anomocytic stomatal complex type. The stomata are restricted to the abaxial surface alone, being surrounded by 3 – 6 epidermal cells.

### **DISCUSSION**

The leaf provides variety of anatomical features that can be of taxonomic utility [5]. Leaf anatomical features have also been proven to be of taxonomic importance by [1,11,16,19]. The stomata complex type found in all *Dioscorea* species for this study were of the anomocytic type, following Metcalfe and Chalk [13]. Uduak and Akpabio reported amphistomatic conditions with heterogeneous stomata complex types which were paracytic, diacytic, tetracytic and anisocytic on the epidermal studies in seven species of *Dioscorea* [19].

The numbers of trichome on the adaxial surface is closely related with the types of trichome on the adaxial surface whereas on the abaxial surface, there is a greater affinity between *Dioscorea alata* and *Dioscorea cayenensis*, but there is significant variation between the two species on the abaxial surfaces. Greater differences are recorded for types of trichome on the abaxial surfaces as against the adaxial surfaces. This variability in anatomical features of the adaxial and abaxial surfaces gives credence to the need to study the abaxial and adaxial surfaces separately, as this could lead to the needed clues in the delineation of anatomical characters of the species under study.

There is significant difference in the numbers of stomata in the four species. This shows that there is no homogeneity or interaction among all the species, implying possible taxonomic significance of the numbers of stomata, types of stomata, numbers of trichome and types of trichome in taxonomic delineation.

### CONCLUSION

The four parameters mentioned in this study, viz the numbers of trichome, types of trichome, numbers of stomata and types of stomata could be of taxonomic importance. However, against such report as given by Uduak and Akpabio [19], more investigations are needed in the area of the leaf anatomy of Dioscoreaceae in order to confirm the various claims before their eventual use in taxonomic delineation. It must also be mentioned that environmental conditions which may play significant role in observed features were not taken into consideration.

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