



## HETEROBLASTIC DEVELOPMENT AND PHENO-RESPONSES IN POPULATIONS OF *ACALYPHA CRENATA* AND *A. FIMBRIATA* FROM NIGERIA

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### ABSTRACT

Two fundamental biological phenomena of seedling development and pheno-responses were investigated in *Acalypha crenata* and *A. fimbriata*. Cotyledon features were identical in the two species. The leaf showed heteroblastic changes with eophyll serving as interface for cotyledon and metaphyll for morphological traits. The phenotypic responses varied from one area of growth to the other. Adult plants showed vegetative and reproductive qualitative features that were analogous, quantitative characteristics varied among populations. Phenotypic stability level was 90-100% for plant height and inflorescence length whereas it was 10-45% for leaf size and petiole length. Reproductive characters were most stable. Generic grouping of the species would be adequate, based on similarities in seedling traits. Plant taxonomists can employ the approach in proffering solution to taxonomic intricacies and weed scientists will recognise the plants in the juvenile stage.

**KEY WORDS:** Seedling development, pheno-responses, *Acalypha crenata*, *A. fimbriata*, Nigeria

### INTRODUCTION

Experimental cultivation has long been used to establish taxonomic relationships in plants. Seedlings have been connected with systematics and phylogeny as they demonstrate a recapitulation of form and other characters of ancestral types (Bruggeman, 1957; Davis & Heywood, 1963; Duke, 1965; Leenhouts, 1968; Olowokudejo, 1980).

The phenotypic traits of two species of *Acalypha* were studied for understanding their taxonomic relationships. Traits of the plants cultivated in the experimental ground and glasshouse were compared with those in the wild. Leaf, stem, fruit and seed morphology were investigated using genetically identical plants as transplants, stem cuttings and seeds. Past workers have enunciated the role of pheno-responses in plant development (Mather, 1955; Davis & Heywood, 1963; Bradshaw, 1974; Stace, 1989; Kevin & Eric, 2000; Manske, 2004). Other documented advantages of this biological phenomenon include ensuring plant success by allowing adjustment to the varying environment and giving way to formation of genetically different ecotypes or races which may form the basis of a taxonomic subspecies or variety (Jones & Luchsinger, 1986).

### MATERIALS AND METHOD

The experiment was conducted in the Botanic garden of the University of Lagos, Nigeria. Genetically identical plants as transplants, stem cuttings and seeds were

Table 1:

Species	Collector's Accession No.	Location	Date
<i>Acalypha fimbriata</i>			
Schum. & Thonn.	Kadiri 2	Ibadan	9.viii. 2000
	Kadiri 15	Ibadan	9. viii. 2000
	Kadiri 12	Ibadan	9.viii. 2000
	Kadiri 29	Ijebu-Ode	26. x. 2000
	Kadiri 55	Iwo	6. vii. 2001
	Kadiri 57	Ibadan	6. vii. 2001
<i>A. crenata</i>			
Hochst. ex A.Rich	Kadiri 5	Ibadan	8. vii. 2000
	Kadiri 6	Ibadan	26. vii. 2000
	Kadiri 10	Ibadan	04. viii. 2000
	Kadiri 31	Lagos	14. iii. 2001
	Kadiri 49	Abeokuta	20. iii. 2001
	Kadiri 62	Lagos	20. viii. 2001

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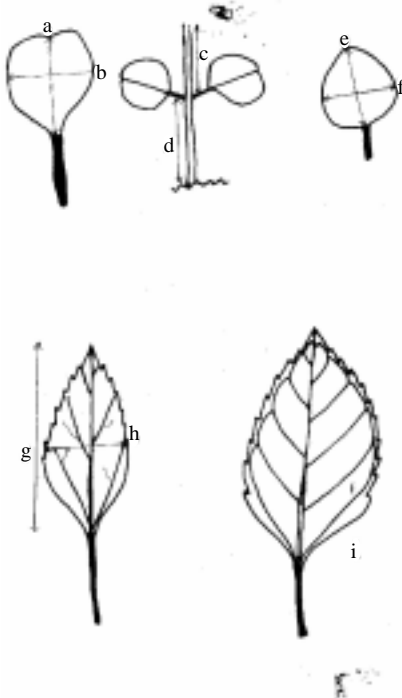


Fig. 1: Cotyledon length (a), Cotyledon width (b), Epicotyl length (c), Hypocotyl length (d), Eophyll length (e), Eophyll width (f), Metaphyll length (g), Metaphyll width (h), Whole leaf (i)

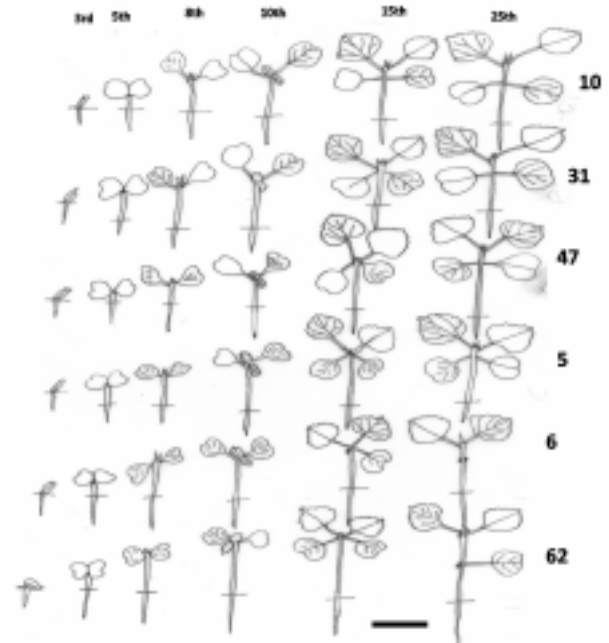


Fig. 2: Seedling characteristics of *A. crenata* complex. The figures are collector's accession numbers. Scale bar is 8.5cm

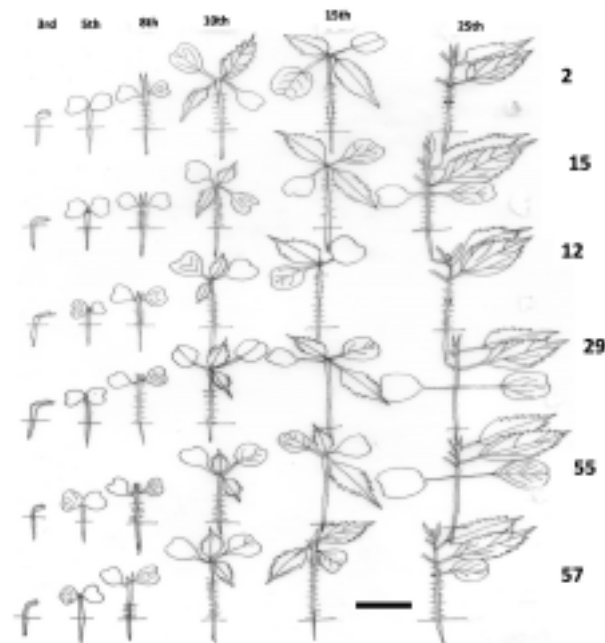


Fig. 3: Seedling characteristics of *A. fimbriata*. The figures are collector's accession numbers. Scale bar is 8.5cm

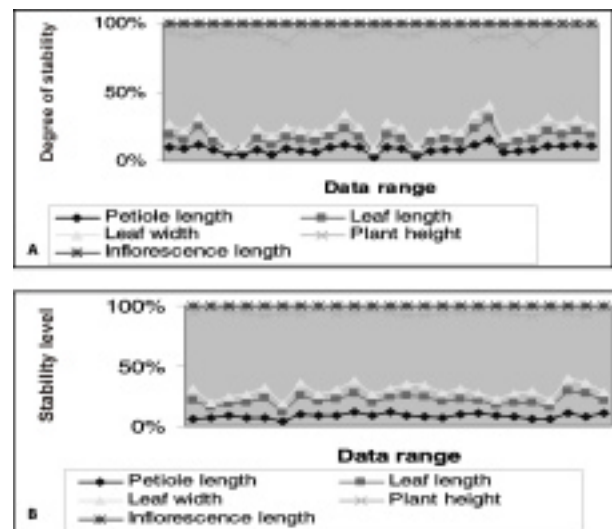


Fig. 4: Stability pattern of some morphological characters of the plants cultivated in the Natural, Experimental ground and Glasshouse environments. A: *A. crenata*. B: *A. fimbriata*. Aggregate means of data were used for plotting

cultivated under different growth conditions in experimental field and glasshouse according to the relevant procedures (Duke, 1965, 1969; Leenhouts, 1968; Bokdam, 1977; De Vogel, 1978, 1980). Seeds were sown 30 cm apart on ridges, made 60 cm apart. Duplicate seeds were raised in humus-rich soil in the glasshouse in 15.0 cm x 13.5 cm bottom perforated polythene bags. On the 15<sup>th</sup> day, the seedlings were transferred into 52.0 cm x 42.5 cm bottom-perforated polythene bags. A total of one to ten populations comprising ten to twenty individuals were raised and phenotypic traits of leaf apex, base, margin, shape and size, petiole length, plant height and inflorescence length were studied both quantitatively and qualitatively. Provenances of the populations sampled in south west Nigeria, the area of highest occurrence of the plants are presented in the Table.

## RESULTS

Seed germination was phanerocotylar and occurred 5-7 days after sowing in both species. The cotyledons were of the macaranga type, emerged from the soil with deep yellow colour and turned green when fully spread to utilise sunlight, showing quantitative morphological uniformity, were generally caducous with glabrous surface, retuse apex, entire margin and opposite arrangement. Cotyledon base and shape were truncate and ovate respectively. In *A. crenata*, the cotyledons fell off from 15<sup>th</sup>-30<sup>th</sup> day whereas in *A. fimbriata*, from 10<sup>th</sup>-30<sup>th</sup> day (Fig. 1). Mean cotyledon size ranged from 5.0mm x 5.0mm-10.0mm x 8.0mm. Eophyll emerged two-three weeks after planting, arrangement was opposite but shape was ovate in *A. crenata* and lanceolate in *A. fimbriata*. Eophyll apex was round in *A. crenata*, acute in *A. fimbriata* and obtuse in other species. Eophyll base was oblique or truncate, margin serrated while surface pubescent in *A. fimbriata* and glabrous in other species. On the 30th day, mean size of eophyll varied from 2.0mm-3.0mm x 1.0mm-8.0mm in *A. crenata*, 12.0mm-35.0mm x 7.0mm-20.0mm in *A. fimbriata*. Mean length of hypocotyl and epicotyl ranged from 3.8cm and 2.4cm in *A. crenata* to 1.8cm and 1.7cm in *A. fimbriata*. Metaphyll characters showed a more or less similar variation pattern as eophyll except leaf arrangement that was alternate (Figs. 2 & 3). Growth rate, leaf size and petiole length were rather plastic in the changing environments of natural and glasshouse habitats but inflorescence length was stable (Fig. 4).

## DISCUSSION

The study investigates plant responses to

environmental factors, light, temperature, spacing, nutrient, shading and moisture as well as seedling development. Seedling identification is important to horticulturists, plant breeders, ecologists, weed scientists and other plant users. The morphological traits of the seedlings, especially qualitative, were identical supporting the generic grouping of the species. The varying quantitative characteristics can be linked to the effect of environmental factors.

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