INTERNATIONAL JOURNAL OF ADVANCES IN PHARMACY, BIOLOGY AND CHEMISTRY

Research Article

Annova Test Using SPSS Software to Find Out the Morphological Leaf Traits of Five Different Genera

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ABSTRACT

The leaves of seed plants can be classified as being either simple or compound according to their shape. By comparing tractable of species with different le**af types and evaluating the pros and cons of leaflets** patterning of compound leaves. We performed a simulated experiment to study the variations of leaf morphology. Considering different types of leaves, we chose compound leaves of *Azadirachta indica, Morringa oleifera, Tamarindus indica, Cassia fistula, Melothria sp.,* as the study objects. The morphological parameters we investigated include leaf size, size of leaflet,number of leaf lets, number of leaves which can be easily measured in **the field. Significan**t variations occurred in many parameters due to the effects of the environment and/or allometry. There were broadly consistent trends for leaf morphological variations along the gradients. The leaf size became smaller with a short supply of resources. Leaf elongation and fractions of the lamina area altered to enhance resources acquisition and conservation. **Leaflet**s partially played a role such as leaf teeth, for they are not only individual units, but also a part of the compound leaf. We suggest that more or less the same trends in morphological variations may be an important explanation for coexisting species to adapt to similar habitats and form the niche differentiation. The ANOVA test performed among populations of each species as well as among species showed significant difference ($p<0.05$) for all quantitative characters used. The results of two-way ANOVA also show that the effects of light and water treatments on leaf morphological parameters, using allometric relationships of seedlings**.** Any factor that can influence the number and size of leaf cells may affect the dimensions and size of the leaf.

Keywords: ANOVA, **Leaflets, allometry, compound leaf, morpholog**y.

INTRODUCTION

Leaves are basically flat and usually green. Leaves are borne on cylindrical stems that form twigs or branches in trees and shrubs. With few exceptions, each leaf is associated with a small bud, found in the crotch between the leaf and the stem (called the leafaxil). This axillary bud can later grow out as a new branch or as a flower. Leaves are the most active and conspicuous organs of plants. The most important function of the leaf is absorbing sunlight for photosynthesis. To do this, they expose large amounts of surface area to the environment (Codarin et al., 2006; Koch et al., 2006).. Leaves are the major photosynthetic organs of flowering plants and serve as their prime mediator with the environment above the soil surface. Leaves arise at the flank of the shoot apical meristem (SAM) and feature determinate growth. The major light gathering organ in most plants is the leaf (McLellan, 2000). Evolution has produced a variety of leaves with different shapes, sizes and arrangements that reflect the diverse conditions that plants grow in. The leaves of seed plants can be classified as being either simple or compound according to their degree of complexity (Sattler and Rutishauser, 1992). Simple leaf and compound leaf can be identified by

a. Axillary buds are present only in the axils of primary petioles and absent from the axils of leaflets. The position of the axillary bud it can be used to determine whether a leaf is simple or compound.
b. Another diagnostic hint: orientation. All leaflets of a compound leaf are

oriented in the same plane, whereas if each leaflet were to be a simple leaf instead, they would be oriented in different planes.

Compound leaves are seen as partially indeterminate structures that share properties with both shoots and leaves. Under abiotic stress, plants alter their physiology, morphology and development in response to environmental changes. Leaves are important organs for photosynthesis and play an important role in survival and growth of a plant. The leaf shape and structure are defined mainly in a brief period of primary morphogenesis based on the possible role of reaction–diffusion systems and can be altered by the allometric expansion. There are so many types of leaves in nature, from blades to needles (López-Serrano et al.2005). Differences in leaf size can significantly alter whole-lamina- and whole-leaf-integrated chemical and structural characteristics and thereby modify general scaling relationships between plant structures, chemistry and function [Niinemets U,2007]. A compound leaf consists of several, separated segments called leaflets.The leaflets are usually grouped in pairs around the elongated rhachis that corresponds to the midrib of a normal leaf. Compound leaves are leaves that have been divided into more than 1 blade. What may appear to be a leaf is actually only a part of the bigger leaf attached to a rachis instead of a woody twig.

Different types of compound leaves

1. **Simple leaves -** have a flat, undivided blade, not separated into leaflets, that is supported by a stalk, called a *petiole*. Leaves of plants, such as Zinnia, that lack petioles are called sessile leaves. Redbud, elm, and maple have simple leaves.
2. **Compound leaves -** have blades that are divided into leaflets that form in one plane. Leaflets lack axillary buds, but each compound leaf has a single bud at the base of its petiole. There are two kinds of compound leaves: *pinnately* compound leaves and *palmately* compound leaves.
   - **a. Pinnately compound leaves -** form in pairs along a central, stalk-like *rachis*.eg., Ash, walnut, and rose. Pinnately compound" leaves exhibit wide variety, but in all the leaflets are arranged along the mid-vein. A few are "even pinnate" without a terminal leaflet, while most are "odd pinnate" and bear a leaflet at the end of the rachis five-leaflet eg., Virginia Creeper

     Bipinnately compound leaf – pinnately compound leaf with the leaflets divided pinnately again.
   - **b. Palmately compound leaves -** attach at the same point, mush as the fingers are attached to your palm. Horse chestnut (Aesculus), marijuana (Cannabis), clover (Trifolium) and lupine (Lupinus). In plants with "palmately compound" leaves the leaflets radiate from the end of the petiole, creating a hand-like configuration.

METHODOLOGY

STUDY SITE

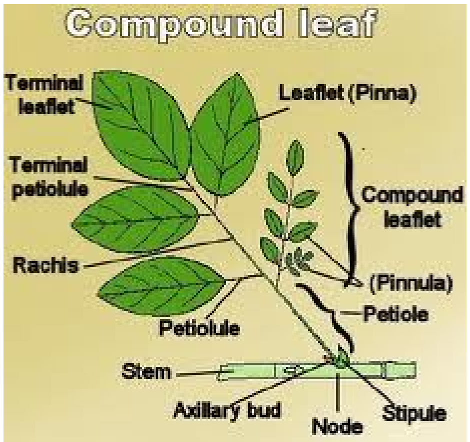
The study was conducted in the colleges campus (Nirmala college for women, Coimbatore) Tamilnadu, South India. The site is characterized by warm temperate monsoon climate, with mean annual temperature of 13±1°C and average annual precipitation of 600–850 mm, falling mostly during the summer. The soil type of this area is Red soil.

SAMPLES

In this study, 5 different plants leaves from *Azadirachta indica, Moringa oleifera, Tamarindus indica, Cassia fistula, Melothria sp.,* for the research in which all belongs to compound leaves . From each tree 20 leaflets were collected to measure the length of the petiole,number of branches in leaflet, number of leaves, and size of the size.

MORPHOLOGICAL MEASUREMENTS

- The petiole is the stalk of the entire leaf; this feature is applied to the leaflet stalk in the case of compound leaves. Petiole length is measured using a measuring scale in centimeters.
- Full length of the leaflet is measured. From the base of the leaflet to tip of the leaflet is measured using a measuring scale in centimeters.
- Total number of branches
- Total number of leaves present in a leaflet



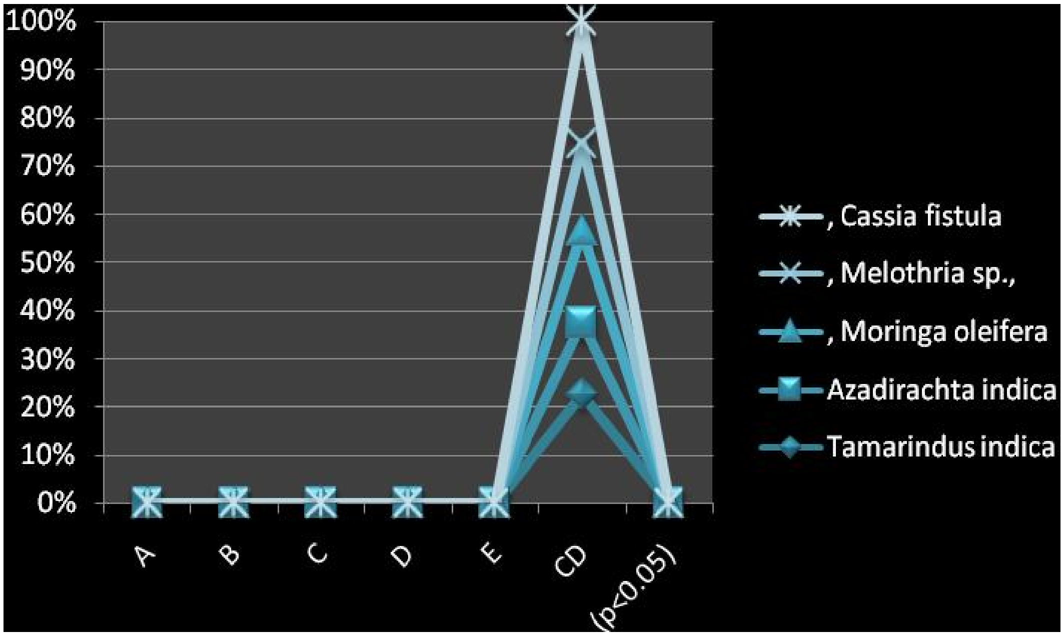
STATISTICAL ANALYSIS

Analysis of variance (ANOVA) was used, followed by Least Significant Test (LSD) was performed. Species or populations considered as fixed factors without transformation. The statistical analysis of the data was carried out using the SPSS version 16.0 and the Stat Graphics Plus version 5.1 statistical packages. Analysis of variance (ANOVA) was used to test for differences between the different plant types and morphological parameters in relation to the leaf length were used as the variate. We used linear and non-linear regression analyses in the form y = a + bx and y = a + b1x + b2x2 to test for statistical relationships between leaf morphological variables and different plant types .Regression fits and associated r2 and P values were given in each panel. All regressions were considered significant at P < 0.05.

RESULTS

	Tamarindus indica	*Azadirachta indica*	*Moringa oleifera*	*Melothria sp.,*	*Cassia fistula*
A	27.97 ± 3.90[a]	30.26 ± 3.47[a]	34.33 ± 3.20[a]	30.68 ± 4.54[a]	53.84 ± 5.84[a]
B	8.30 ± 1.93[c]	8.03 ± 0.36[c]	12.69 ± 2.53[b]	12.60 ± 0.50[b]	15.57 ± 1.76[c]
C	1.45 ± 0.43[d]	1.00 ± 0.00[d]	1.00 ± 0.00[c]	1.00 ± 0.00[d]	0.60 ± 0.21
D	12.50 ± 3.30[b]	-	10.40 ± 0.94[b]	4.00 ± 0.79[c]	22.30 ± 3.48[b]
E	30.75 ± 3.29[a]	13.32 ± 1.10[b]	31.15 ± 3.22[a]	14.55 ± 1.15[b]	13.80 ± 1.01[c]
CD (p<0.05)	4.12	2.69	3.46	3.27	4.62

A= Length of the New Developed leaflet ; B= Length of the New Developed leaf; C= Length of the New Developed petiole;D= Number of Leaflets per Shoot;E= Number of Leaves per Shoot.
Values are mean ± SD of twenty samples in each group
Means followed by a common superscript are not significant at 5% (p<0.05)



To eliminate morphological variations from the selected species for the field study, all measured traits were remarkable. The length of the leaflet of *Cassia fistula* had the largest size of 53.84 while,the leaflet of *Tamarindus indica* shows smaller of 27.97. The length of leaf varies from species to species such as *Tamarindus indica* 8.30 ± 1.93[c,] *Azadirachta indica* 8.03 ± 0.36[c] , *Moringa oleifera* 12.69 ± 2.53[b,] *Melothria sp.,* 12.60 ± 0.50[b] and *Cassia fistula* 15.57 ± 1.76[c].the length of the petiole shows same in *Melothria sp.,* , *Moringa oleifera*, *Azadirachta indica* (1.00 ± 0.00[d]) while the shows the largest petiole of 1.45**.** *Cassia fistula* consists of many number of leaflets when comparied to other species but there was no leaflet in *Azadirachta indica* .*N*umber of leaves per shoot was found to be more or less equal in *Tamarindus indica* and *Moringa oleifera* .There was a high positive correlation between leaf length and petiole length ($p < 0.05$). Increasing the investment in petioles needs to synthesize more xylogens, and longer petioles will lead the leaf to bend (Pickup M, 2006).

DISCUSSIONS

Besides the effects of light and water, air temperature and humidity, habitats can also be expected to affect leaf morphology. The measurements confirmed that leaf size and number of leaves can modify the distribution of leaf venation pattern and leaf functioning (Takenaka et al. 2001). Reduction in leaf size in stressful environments has been explained on the basis of leaf boundary-layer conductance for heat and gaseous transport. So, variations in leaf size along climatic gradients may result from greater evaporative demand of larger leaves due to enhanced thickness of the boundary layer for energy and gaseous exchange . However, leaf size may also decline due to overall resources limitation in stressful environments, making the construction of large leaves with extensive vascular and cell-wall fractions overly expensive. In our study, changes of petiole length were consistent with changes of leaf area and dry mass, which indicated that there was a positive relationship between leaf petiole length and leaf size (Niinemets et al., 2006b).

CONCLUSIONS AND FUTURE RESEARCH

This study of leaf trait differences may contribute to our understanding of optimum habitat conditions and the ecophysiological adaptations of plants. The relationships between leaf morphology and climate are broadly consistent, but do differ in some respects with different leaf types. The leaf can be considered as a microcopy of the plant, and the variations of leaf morphology can reflect the plant capacity to acquire, use and conserve resources. Our research may suggest that the resolution of taxonomy would require the consideration of heterogeneity within the same species based on leaf. However, we recognize that the limited geographical and phylogenetic scope in our research allows only a preliminary assessment of this expectation.

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