#team 20048

Summary

Contents

The Secrets of Leaves

Abstract

1.Restatement and clarification of the Problem

In general, different types of trees have different characteristics, there are also differences between the different leaves of the same plant trees. We need to address the following issues：

Problem 1:Explain why the leaves have different shape.

Problem 2:Try to make out whether the shape of the leaves had have made to maximize exposure rate tendency。The number of leaves in the trees and their branch distribution would affect the shape of the blade

Problem 3:Make it clear that the profile of tree or branch structure for the influence of the blade shape.

Problem 4:The study how to determine a relationship between the quality and shape of the vane and the tree of the tree leaves the basic characteristics (height, mass, volume).

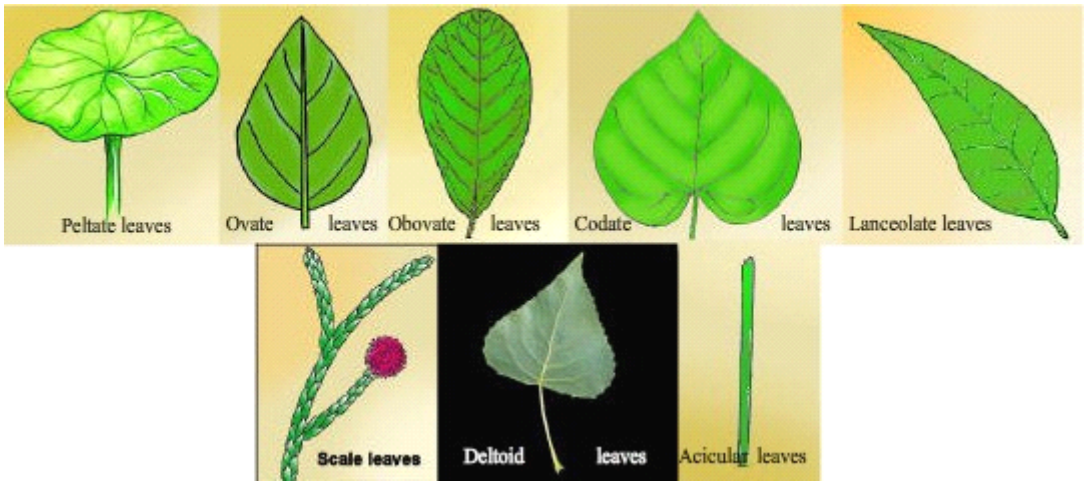
In addition to one page summary sheet we need to prepare a one page letter to an editor of a scientific journal outlining your key findings.

2.Introduction

2.1 leaf shape

Leaf shape,also called leaf form or leaf type，any of the various shape that leaves of plants can assume.In botany there are many terms, usually derived from Latin, used to describe the shape of a plant leaf. The following are some of the basic ones dealing with leaf blade shapes - General overview[1]:

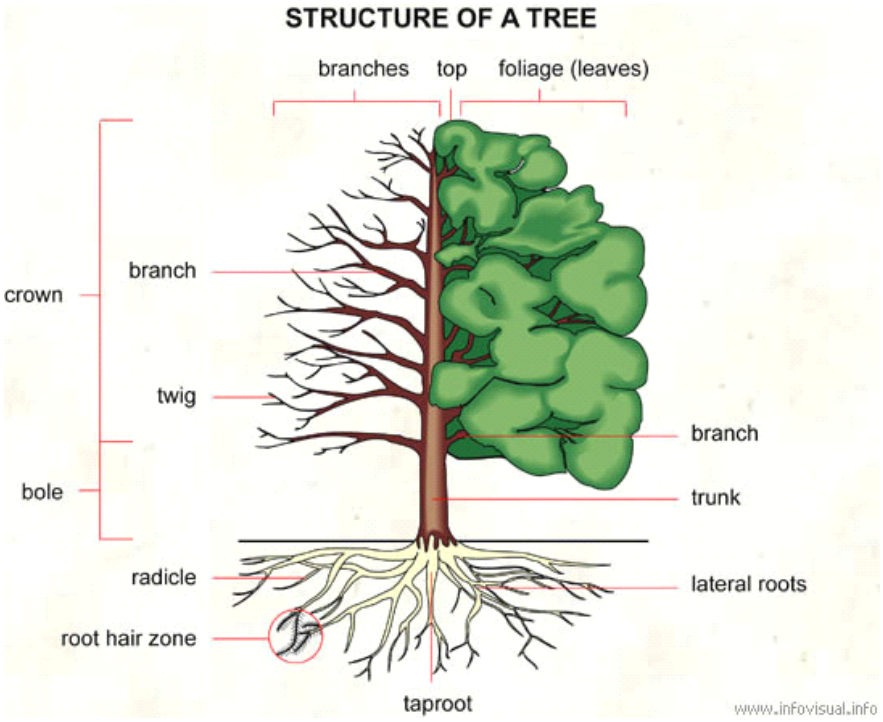
Acicular: Having the shape of a needle
Cuneate: Broad and truncate at the summit, narrowly triangular, and tapering toward the base;
Deltoid: Triangular in outline, suggesting a capital delta.
Lanceolate: Lance-shaped, tapering from a broad base to an apex; much longer than wide
Ovate: Egg-shaped with the broadest part toward the base (note that obovate is the reverse relative)
Obovate: Stem attaches to tapering point petiole attachment to the blade)
Cordate: Heart shaped with a basal sinus.
Peltate: Shield shaped with the petiole not attached at the blade margin (peltata): Rounded, stem underneath
Scale leaf: Small sharp-pointed leaf with a broad base. They usually overlap on the stem.



Until now, botanists have proposed two mechanisms to explain leaf forms. The first mechanism is based on localised enhancements and reductions of growth of the free margin of the embryonic leaf [2-3], which create the peaks and the valleys of the leaf border [4-5]. The second mechanism is the death of patches of cells (programmed cell death, PCD) that forms perforations in the leaf during the lamina development. When perforations are positioned near the leaf contour, the marginal tissue eventually breaks, as in *Philodendron Monstrosa* (Araceae, monocotyledon), resulting in a deeply dissected blade (pinnatisect) [6]. A particular case has been described for the dissected shape of palm leaves (Arecaceae, monocotyledons). The leaf first develops with many folds, where PCD eventually takes place, crea
ting cuts [7].

2.2 characteristics of the tree

To begin with,the structures are a different among different types of trees,the leaves in a tree often demonstrate not all the same.in this paper,the structure above taproot will be the core of the study.



Model of leaf shape and tree structure

Different tree possess different leaf types,in this paper,we take the ovate leaves for example to match the tree structure.we define p ,where p equals to exposure ratio.we have:

$$p = \frac{shadow\ area\ of\ leaves}{total\ area\ of\ leaves}$$

Aiming at finding the most probable tree structure that a specific type of leaf belong to,we assume that the tree have the tendence to maximum it's exposure.

model testing and sensitivity analysis

Strength and Weakness

Model of leaf shape description and classification

Strength

Weakness

Further Work

A letter to Scientific Journal Editor

Dear editor,

In the contest, we developed models to analyze leaves, including description and classification, their relations with overlap, distribution and branching structure, as well as leaf mass estimation. We solved a series of problems on leaf shapes and leaf mass, and here are our key findings on these problems as listed below, and hopefully they have scientific value

Since our findings are gained through both mathematical analysis and biological mechanism analysis, we really hope they will benefit the science research on tree leaves. Finally, thanks for your time.

BestRegards,

Team # 20048

Restatement and clarification of the problem: State in your own words what you are going to do.

Explain assumptions and rationale/justification: Emphasize the assumptions that bear on the problem. Clearly list all variables used in your model.

Include your model design and justification for type model used or developed.

11.References

[1].http://www.cactus-art.biz/note-book/Dictionary/Dictionary_L/dictionary_leaf_shape.htm
[2]. Arunika, H. L., Gunawardena & A. N. , Dengler, N. G. Alternative modes of leaf dissection in monocotyledons. *Bot. J. Linn. Soc*. **150**, 25-44. (2006)
[3]. Hagemann, W. & Gleissberg S. Organogenetic capacity of leaves: the significance of marginal blastozones in angiosperms. *Plant. Systemat. Evol.* **199**, 121-152.(1996)
[4]. Franks, N. R. & Britton, N. F. The possible role of reaction-diffusion in leaf shape. *Proc. R. Soc. Lond. B* **267**, 1295 -1300. (2000)
[5]. Marder, M., Sharon, E. , Roman, B., & Smith, S. Theory of the edge of leaves. *E.P.L.* **62** 498-504 (2003).
[6]. Melville, R. & Wrigley, F. A. Fenestration in the leaves of Monstera and its bearing on the morphogenesis and colour patterns of leaves. Bot. J. Linn. Soc. **62**: 1-16. (1969)
[7]. Kaplan, D. R. , Dengler, N. G. & Dengler, R. E. The mechanism of plication inception in palm leaves: problem and developmental morphology. *Can. J. Bot.* **60** , 2939-2975.(1982)

12.Apendix