

Introduction to Botany. Lecture 21

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1 Questions and answers

2 Leaf

- Leaf morphology
- General characters
- Repetitive characters
- Terminal characters
- Leaves in nature



1 Questions and answers

2 Leaf

- Leaf morphology
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- Repetitive characters
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Previous final question: the answer

Why do poikilohydric plants not need rhizoderm?



Previous final question: the answer

Why do poikilohydric plants not need rhizoderm?

- Because they do not care about water



Leaf

Leaf morphology



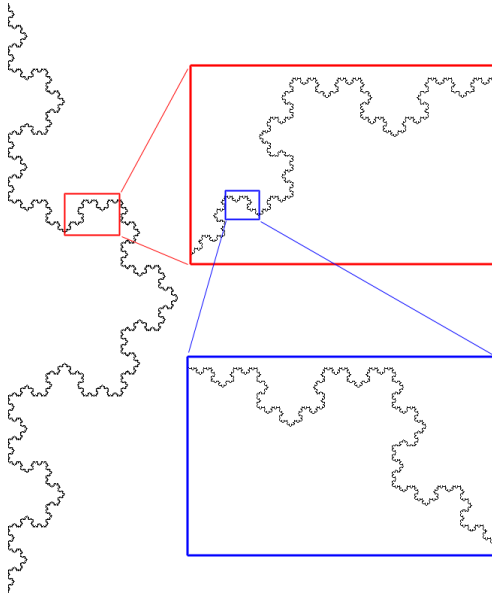
Hierarchy



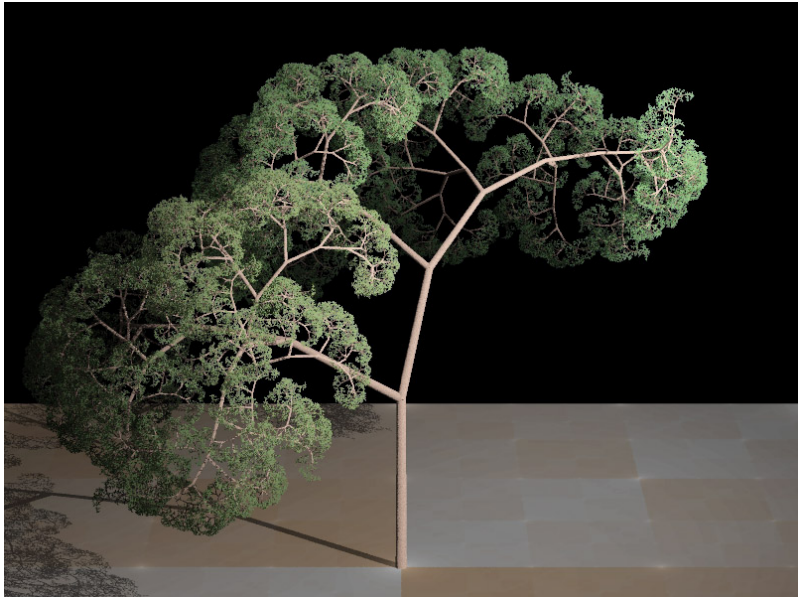
Fractals are hierarchical, with levels

 $n = 0$  $n = 1$  $n = 2$  $n = 3$  $n = 4$ 

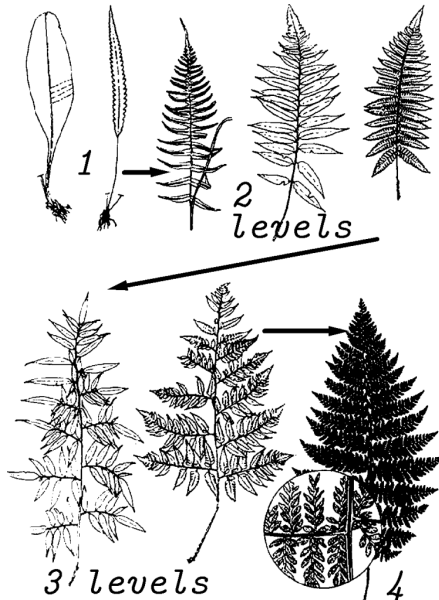
Fractals are self-similar



Fractals could be just like plants



And leaves could be just like fractals, with levels



Types of leaf characters

- General: applicable only to the whole leaf
- Terminal: applicable only to the terminals (e.g., terminal leaflets)
- Repetitive: repeating on each level of hierarchy



Hierarchy in leaf morphology

- **General** and **terminal** characters do not depend on hierarchy
- **Repetitive** characters may be different on each step of hierarchy
- Therefore, leaf description should state that “on first level of hierarchy, the shape is ..., on the second level, the shape is ...”
- It is possible that each level has different repetitive characters



Leaf

General characters



General characters

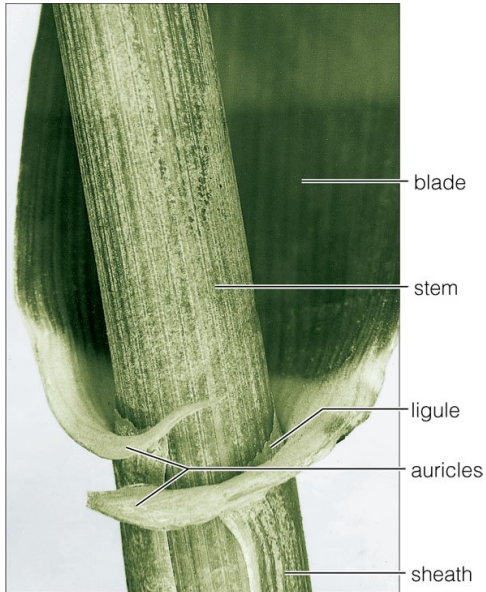
- General characters apply to the whole leaf
- Stipules (present or not, how many etc.)
- Other leaf base organs (sheath, ocrea, ligules etc.)



Stipules



Leaf base



Leaf

Repetitive characters



Repetitive characters

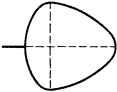
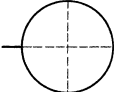
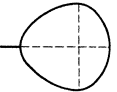
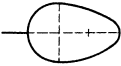
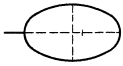
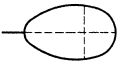


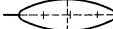

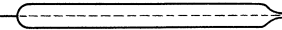
Repetitive characters are the same on each level of leaf hierarchy:

- Shape
- Dissection
- Petiole (stalked/non-stalked etc.)






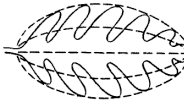


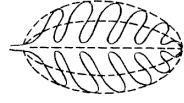
Repetitive characters of same type may combine



Shape

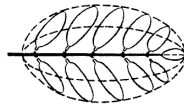
	Maximum width closer to leaf base	Maximum width in the middle	Maximum width closer to the apex
Length = width or slightly more	 Deltate	 Circular	 Cuneate
Length > 1-1.5 x width	 Ovate	 Elliptic	 Obovate
Length > 3-4 x width	 Narrowly ovate	 Lanceolate  Oblong	 Narrowly obovate
Length > 5 x width	 Linear		

Dissection

		Tri-	Palmately	Pinnately
Simple leaves	Lobed (from 1/4 to 3/4)			
				
	Dissected (from 3/4 to midrib)			

Compound leaves

(leaflets stalked, with joints)



Leaf

Terminal characters



Terminal characters

Terminal (leaflet) characters are applicable only to terminal parts (normally, leaflets) of leaves:

- Form of base
- Form of tip
- Type of margin
- Surface
- Venation



Terminal characters: base of leaf blade

- Rounded
- Truncate (straight)
- Cuneate
- Cordate
- Sagittate



Terminal characters: leaf apex

- Rounded
- Mucronate
- Acute
- Obtuse
- Acuminate
- Retuse



Terminal characters: leaf margin

- Without teeth: smooth
- With teeth
 - Dentate
 - Serrate
 - Crenate
- Could be double-dentate, triple-serrate etc.



Terminal characters: leaf venation

Main vein Lateral veins	No	One	Several
	Apodromous	Hypho-	Acro-
No			
Several	...	Ptero-	Actino-



Plan of leaf description

- ① General characters (leaf as a whole):
 - A. stipules (present / absent, deciduous / not);
 - B. base (sheath / no sheath, ligule / no ligule, auricles / no auricles)
- ② First level of hierarchy: repetitive characters:
 - A. symmetry (symmetrical / asymmetrical);
 - B. shape;
 - C. dissection;
 - D. petiole (length)
- ③ Second level of hierarchy
- ④ Third level of hierarchy and so on
- ⑤ Terminal characters (leaflets):
 - A. base [of leaf blade] (rounded, truncate, cuneate, cordate, sagittate);
 - B. apex (rounded, mucronate, acute, obtuse, acuminate, retuse);
 - C. margin (whole, dentate, serrate, crenate; degree of order);
 - D. surface (color, hairs etc.);
 - E. venation (apo-, hypho-, acro-, ptero-, actinodromous)



Leaf

Leaves in nature



Heterophyly

- Juvenile and adult leaves
- Water and air leaves
- Sun leaves and shade leaves



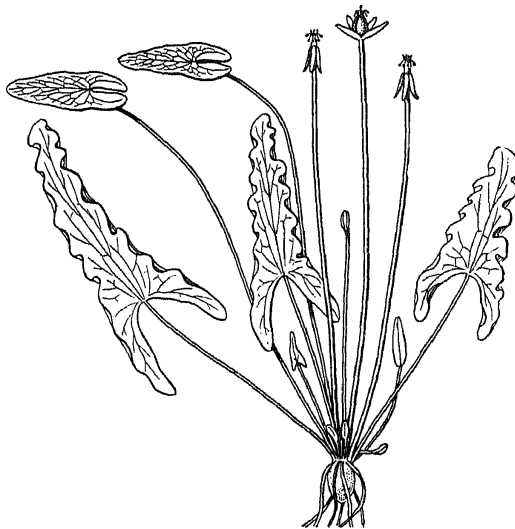
Juvenile leaves of *Juniperus* sp.



Juvenile leaves of *Eucalyptus* sp.



Submerged and floated leaves of *Ondinea*



Leaf mosaic

- Distribution of leaves of plants in a single plane, usually perpendicular to light rays
- Provides the least shading of leaves by one another



Leaf mosaic of red maple (*Acer rubrum*)



Final question (2 points)



Final question (2 points)

How many levels of hierarchy has this leaf?



Summary

- Leaves have **general**, **repetitive** and **terminal** characters



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2015.

Mode of access:

http://ashipunov.info/shipunov/school/biol_154

