

# Introduction to Botany

Alexey Shipunov

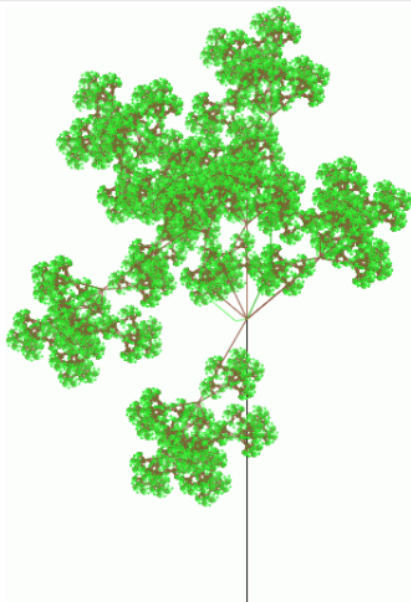
Minot State University

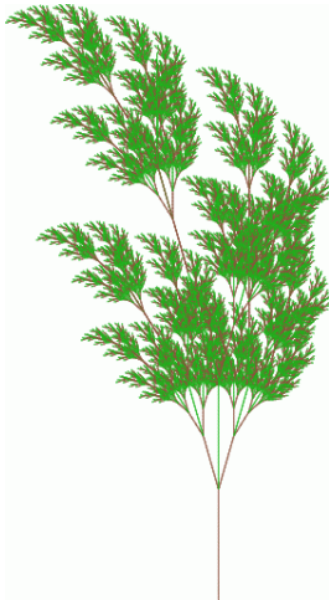
Lecture 22

1

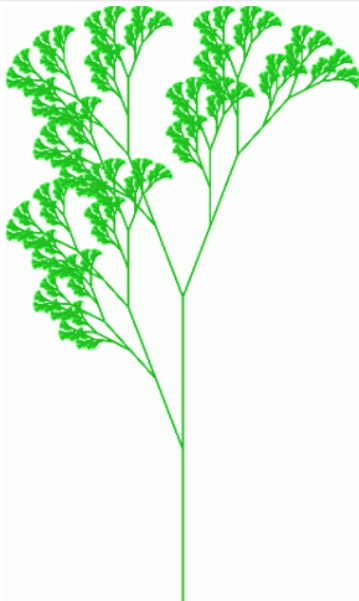
## Leaf

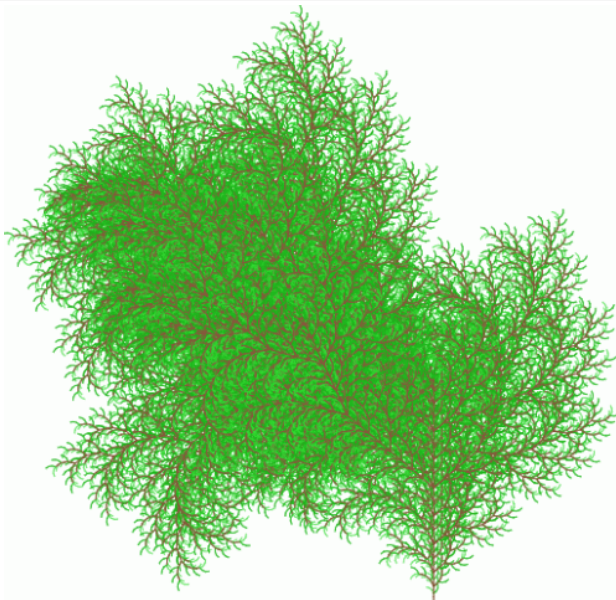
- Leaf in general
- Leaf morphology
- General characters
- Repetitive characters
- Repetitive characters
- Terminal characters

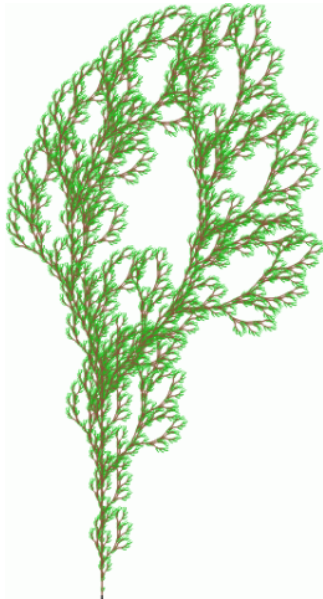




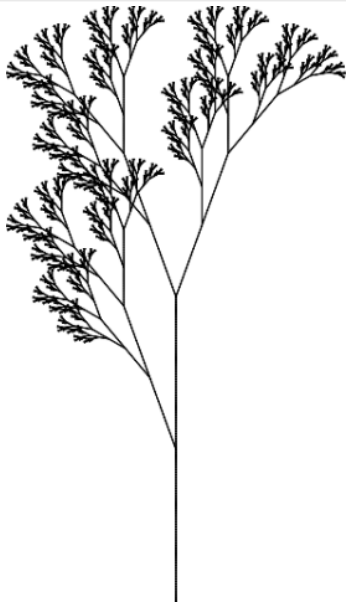




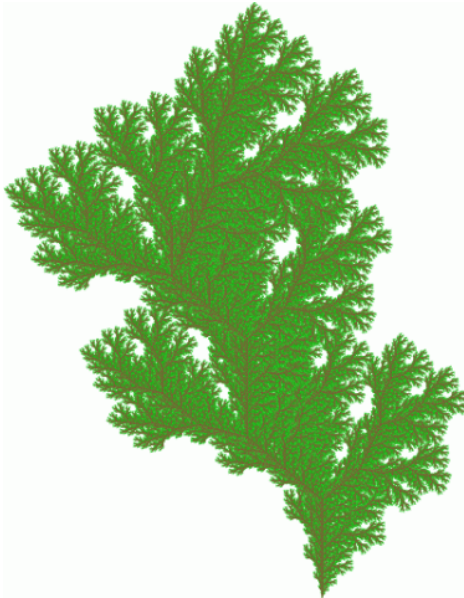


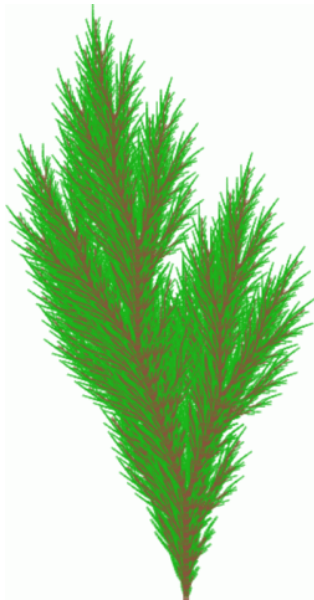


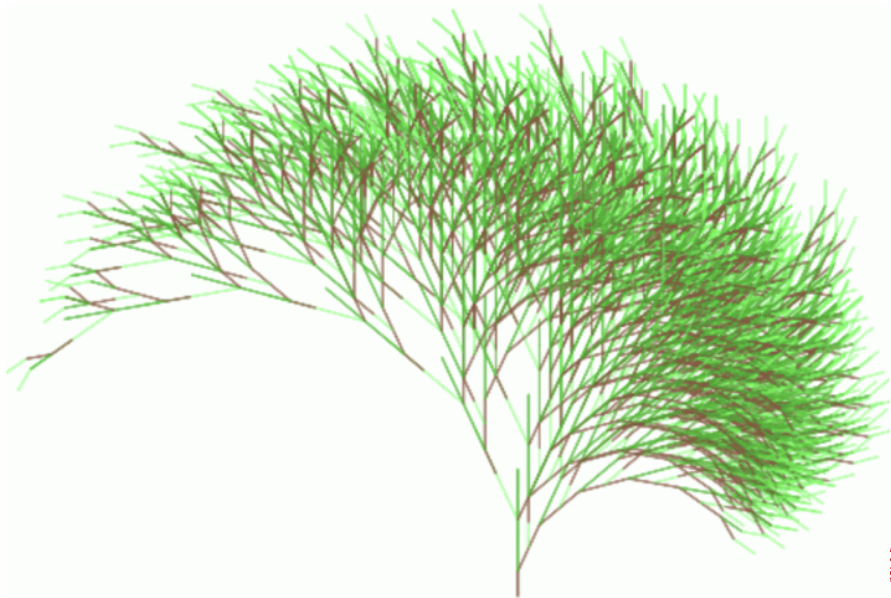


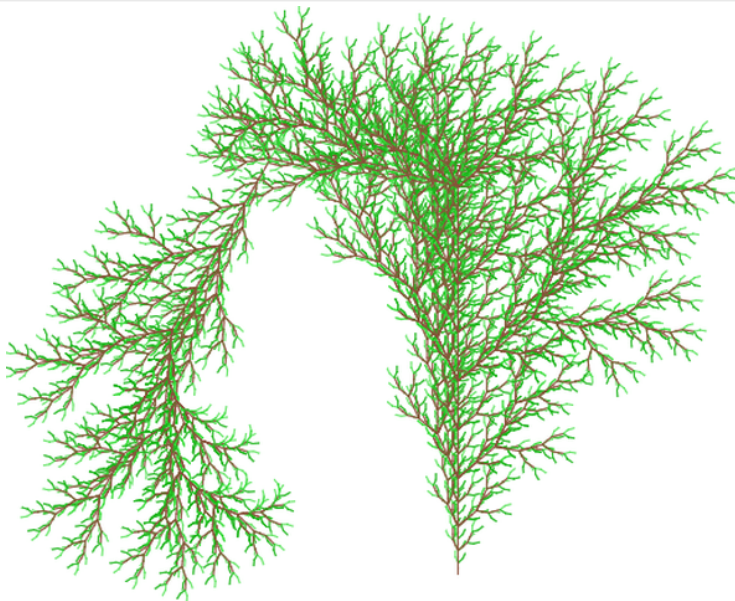




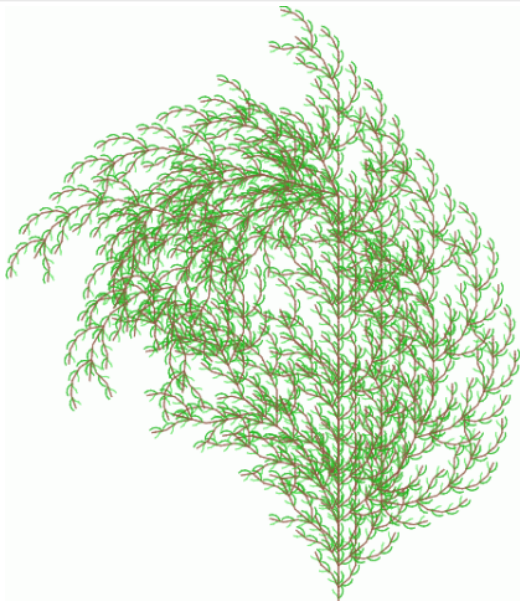






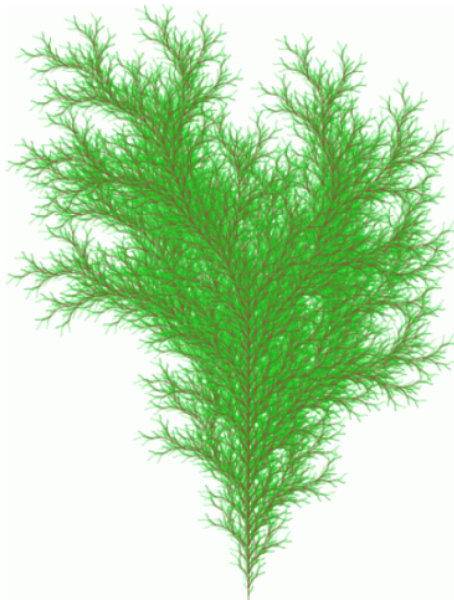


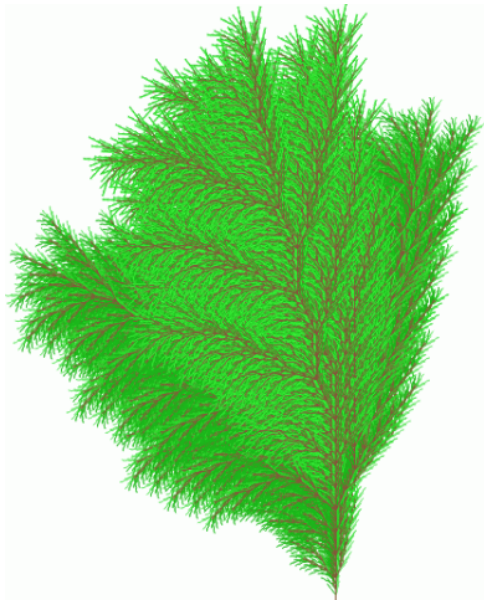


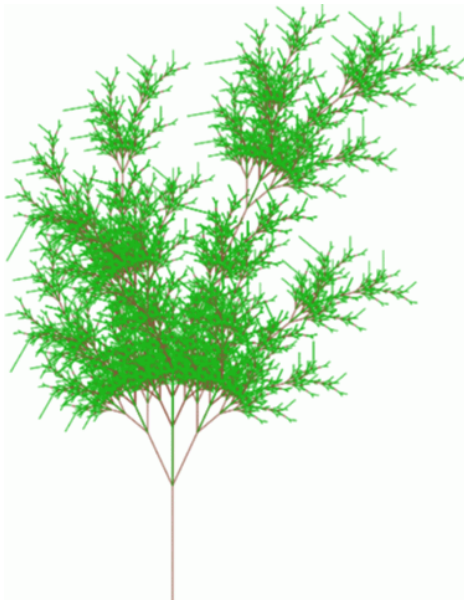


















# Leaf

## Leaf in general



# Definition, functions and features

- Lateral flattened organ of shoot with restricted growth
- Functions:
  - Photosynthesis
  - Respiration
  - Transpiration
  - Synthesis of secondary chemicals
- Features:
  - Have bud in the axil (remember compound leaves)
  - Do not grow by apex
  - Do not produce new leaves
  - Have hierarchical (fractal) morphology

# Leaf

## Leaf morphology

# Hierarchy



# Fractals are hierarchical

$n = 0$



$n = 1$



$n = 2$



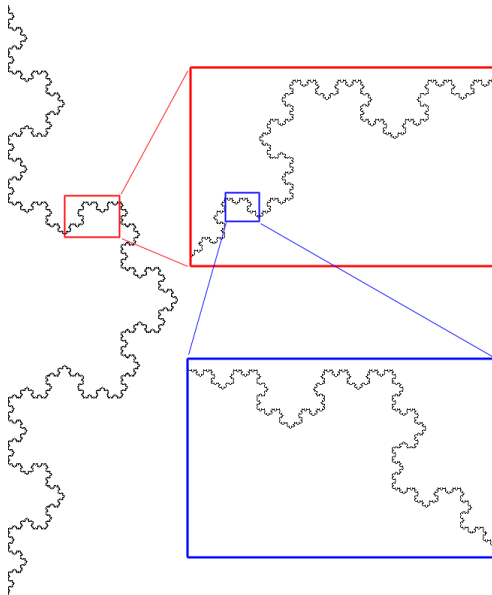
$n = 3$



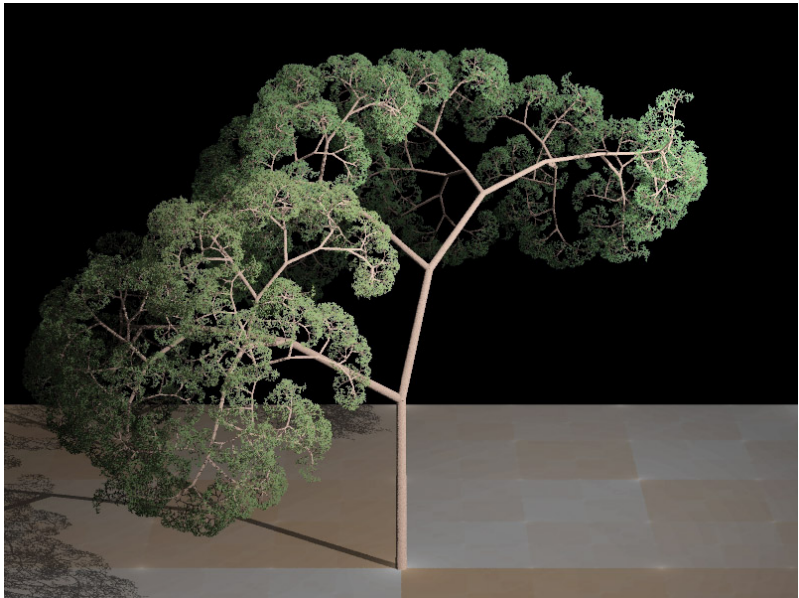
$n = 4$



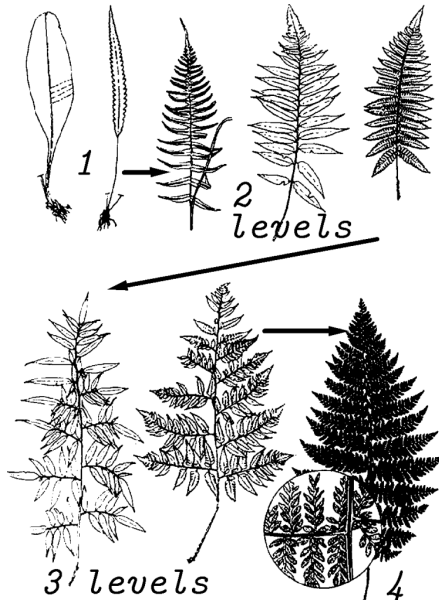
# Fractals are self-similar



# 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

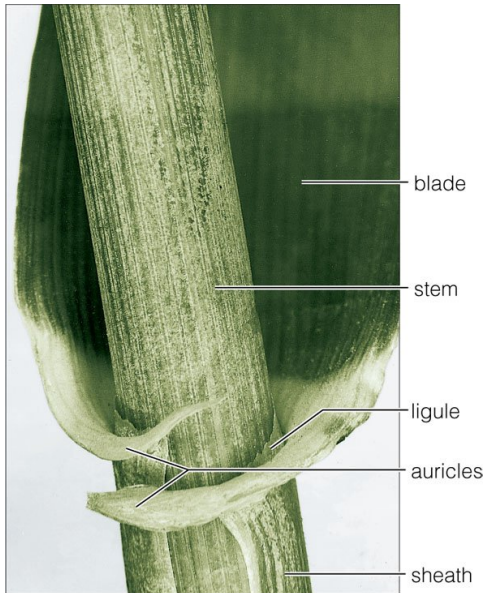
# General characters

- 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

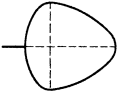
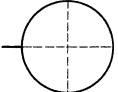
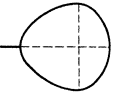
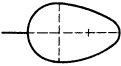
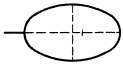
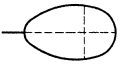

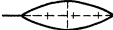
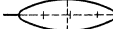

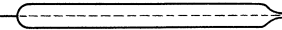
# Repetitive characters

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		



# Leaf

## Repetitive characters

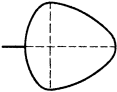
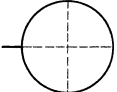
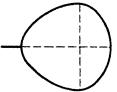
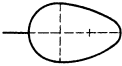
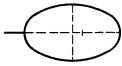
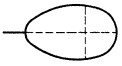


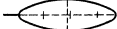
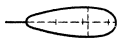
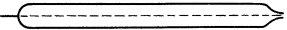
# Repetitive characters

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


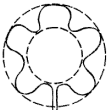
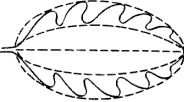





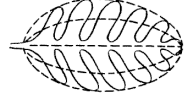
- Shape
- Dissection
- Petiole (stalked/non-stalked etc.)

Repetitive characters of same type may combine

# Shape

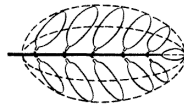
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Length = width or slightly more	 Deltate	 Circular	 Cuneate
Length > 1-1.5 x width	 Ovate	 Elliptic	 Obovate
Length > 3-4 x width	 Narrowly ovate	 Lanceolate  Oblong	 Narrowly obovate
Length > 5 x width	 Linear		

# Dissection

		Tri-	Palmately	Pinnately
<b>Simple leaves</b>	<b>Lobed</b> (from 1/4 to 3/4)			
				
	<b>Dissected</b> (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
	No	Apodromous	Hypho- Acro-
Several	Dichotomous	Ptero-	Actino-

# Plan of leaf description

- Ⓐ General characters (leaf as a whole):
  - A. stipules (present / absent, deciduous / not);
  - B. base (sheath / no sheath, ligule / no ligule, auricles / no auricles)
- Ⓑ First level of hierarchy: repetitive characters:
  - A. symmetry (symmetrical / asymmetrical);
  - B. shape;
  - C. dissection;
  - D. petiole (length)
- Ⓒ Second level of hierarchy
- Ⓓ Third level of hierarchy and so on
- Ⓔ 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)

# Summary

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

# Quiz question (... points)

# Quiz question (... points)

...

# For Further Reading



A. Shipunov.

*Introduction to Botany* [Electronic resource].

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_154](http://ashipunov.info/shipunov/school/biol_154)