

RIZVI COLLEGE OF ARTS SCIENCE AND COMMERCE

Chap 3 – Systematics of Living organisms

Class : **FYJC Science**

Mrs. Madhuri Mane
Sr. Teacher (Biology Department)
Junior college

Systematics

Scientific study of **similarities** and **differences** among different kinds of organisms and it also includes their identification, nomenclature and classification.

Taxonomy

Branch of biology which deals with the **collection, identification, nomenclature, description** and **classification** of plants and animals.

Classification:

Coined by A.P. de Candolle.

Arrangement of organisms or groups of organisms in distinct categories in accordance with a particular and well established plan.

The three Domain of life.

Carl Woese(1990)

According to this system organisms are classified into :

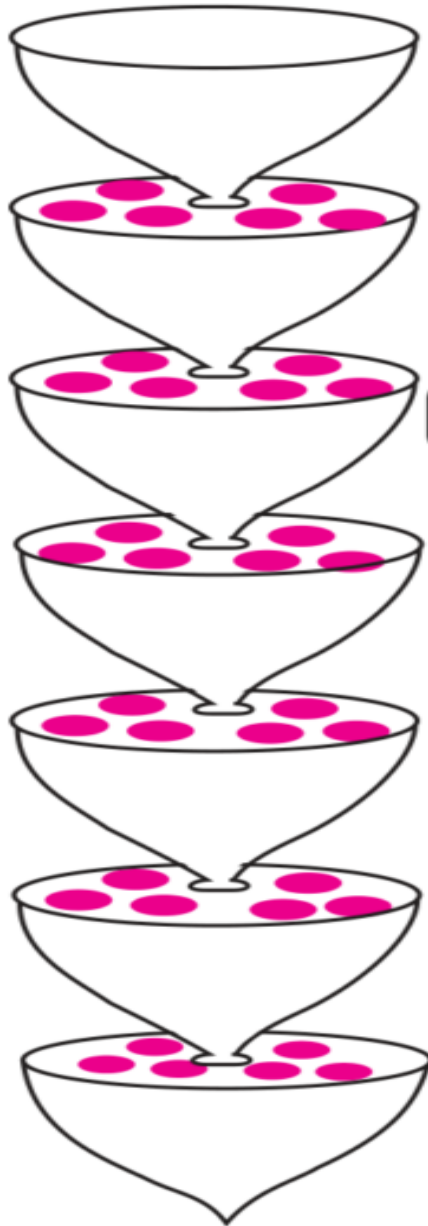
THREE DOMAINS AND SIX KINGDOMS.

1. Three Domains – Archaea, Bacteria and Eukarya.
2. Domain Archaea and Bacteria include **prokaryotic organisms** and include only **one kingdom** each ie. **Archaeobacteria** (ancient bacteria) and **Eubacteria** (true bacteria).
3. Domain **Eukarya** include all **eukaryotes**.
4. The four kingdoms under this domain are
 - kingdom Protista
 - kingdom Fungi
 - kingdom Plantae
 - kingdom Animalia
5. All three domains have very **unique ribosomal RNA**.
6. Archaea are known for their **survival in very extreme conditions like high temp., salinity, acidic conditions**, etc..
7. Bacteria, though are prokaryotes differ from Archaea in structure of **cell wall**.

Taxonomic Hierarchy

Taxon – A taxon is a taxonomic group of any rank or level in the system of classification.

UNITS OF CLASSIFICATION



Species

A group of individuals with similar morphological characters, which are able to breed among themselves and produce their own kind.

Genus

Group of related species which resemble one another in certain correlated characters. Monotypic genus has only one species whereas polytypic genus may have more than one species.

Family

It includes one or more related genera, differentiated from other related families by certain characteristic differences.

Order

It includes one or more related families.

Class

It includes one or more related orders.

Phylum

It includes all organisms belonging to different classes having a few common characters. Botanists use the term Division for Phylum.

Kingdom

It includes all organisms that share a set of distinguishing common characters. Plants are put in Plant Kingdom while animals are included in Animal Kingdom. This is the highest taxonomic category.

<u>Category</u>	<u>Taxon</u>	<u>Taxon</u>
Kingdom	Plantae	Animalia
Division	Angiospermae	Chordata
Class	Dicotyledonae	Reptilia
Sub-Class	Polypetalae	Diapsida
Series	Thalamiflorae	-----
Order	Malvales	Squamata
Family	Malvaceae	Elapidae
Genus	Hibiscus	Naja
Species	Rosa-sinensis	naja

NOMENCLATURE (Nomen- Name , Clare- To call)

The art of naming an object is in fact a science called nomenclature.

Two main purposes:

→ **As an aid to communicate**

→ **To indicate relationship.**

1. Vernacular names.

2. Scientific names.

Binomial Nomenclature (Carolus Linnaeus)-Species Plantarum

1. A system of nomenclature of plants and animals in which the **scientific name** consists of **two words** or parts is called binomial nomenclature.
2. Eg. *Helianthus annuus*
Mangifera indica
Azadirachta indica
3. Scientific name consist of **two words**.
4. It is written in **Latin** or **Greek**.
5. **First word** indicate **genus**(generic name) and **second name** indicates **species** (specific name).
6. **Generic name** starts with **capital letter** (Helianthus) and **specific name** starts with **small letter**.
7. **Generic name** indicates **simple noun** and **specific name** indicates **descriptive adjective**.

8. **Scientific name** should be **underlined separately** if **hand written** and must be in **Italics** if **printed**.
9. **Generic and specific names** does not have **less than 3** and **more than 13 letters**.
10. Name of the **author**, is written in **full** or in **abbreviated** form after the **scientific name**. (***Mangifera indica L.*** - **L** stands for **Linnaeus**)
11. Mention of author's name after the species name is called **Citation**.
12. To avoid confusion, **no two generic names** in any kingdom be same.

Five Kingdom system of Classification

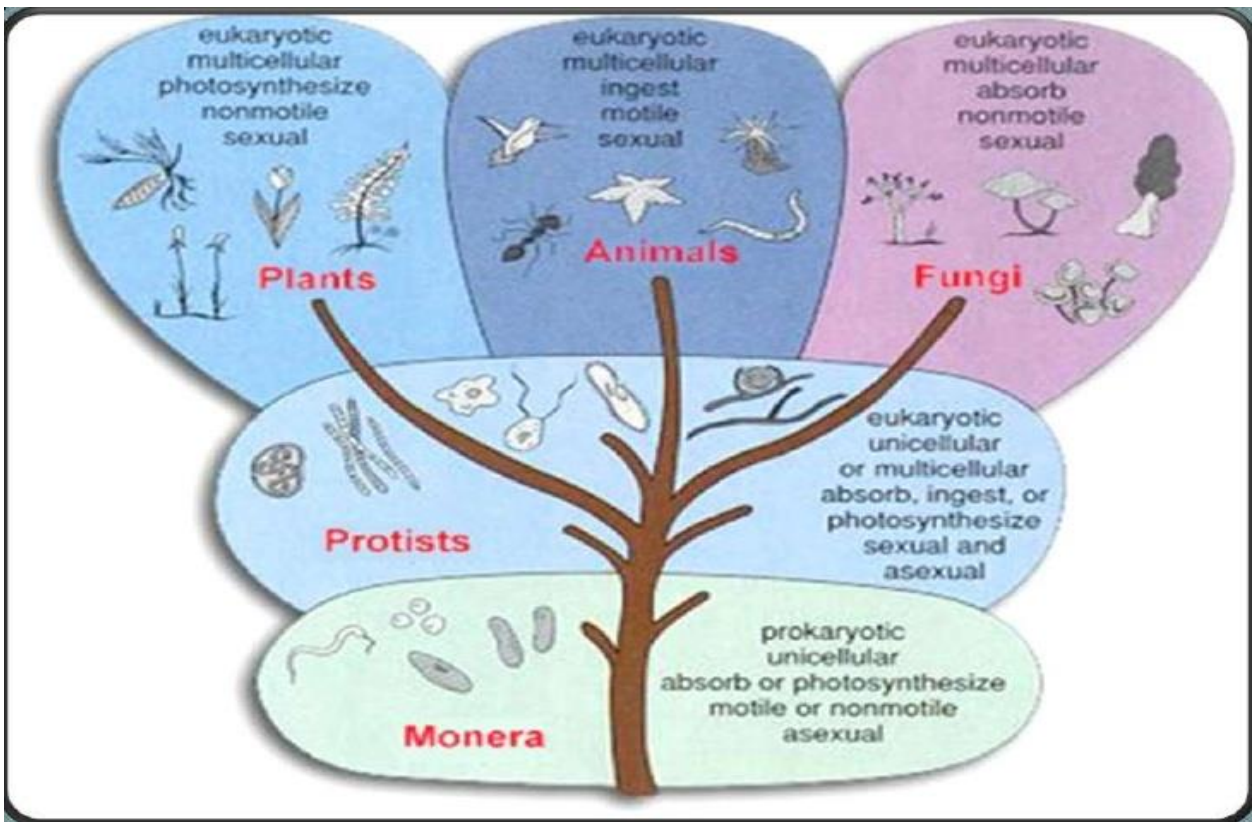
Two kingdom system of classification – **Carl Linnaeus.**

Five kingdom system of classification – **R.H. Whittaker (1969)**

- 1. Kingdom Monera**
- 2. Kingdom Protista**
- 3. Kingdom Fungi**
- 4. Kingdom Plantae**
- 5. Kingdom Animalia**

The criteria used by Whittaker in system include:

- I. Cell organization – Prokaryotic or Eukaryotic
- II. Body organization – Unicellular or Multicellular
- III. Mode of Nutrition – Autotrophic or Heterotrophic
- IV. Life cycle – Producer, Consumer or Decomposer



1. Kingdom -- Monera

1. Unicellular organisms with prokaryotic organization.
2. Omnipresent.
3. Found in all types of environment not inhabited by other organisms.
4. Few photoautotrophs and chemoautotrophs, majority heterotrophic.
5. Well define nucleus absent.
6. **DNA** – Simple double stranded circular single chromosome called nucleoid.
7. **Plasmids** – Small Extra-chromosomal genetic elements.
8. **Cell wall** – Peptidoglycan (sugar + amino acid).
9. Membrane bound organells absent.
10. **Reproduction** – Sexual , asexual, binary or budding.

Kingdom Monera



ARCHEBACTERIA

1. Extremophiles – Bacteria found in extreme environments. (Volcanic craters, salty lakes and hot springs)
2. Halophiles – Bacteria that can withstand high salinities (salt).
3. Thermophiles – Bacteria that can withstand high temperature (Methanogenic bacteria found in gut of ruminants).

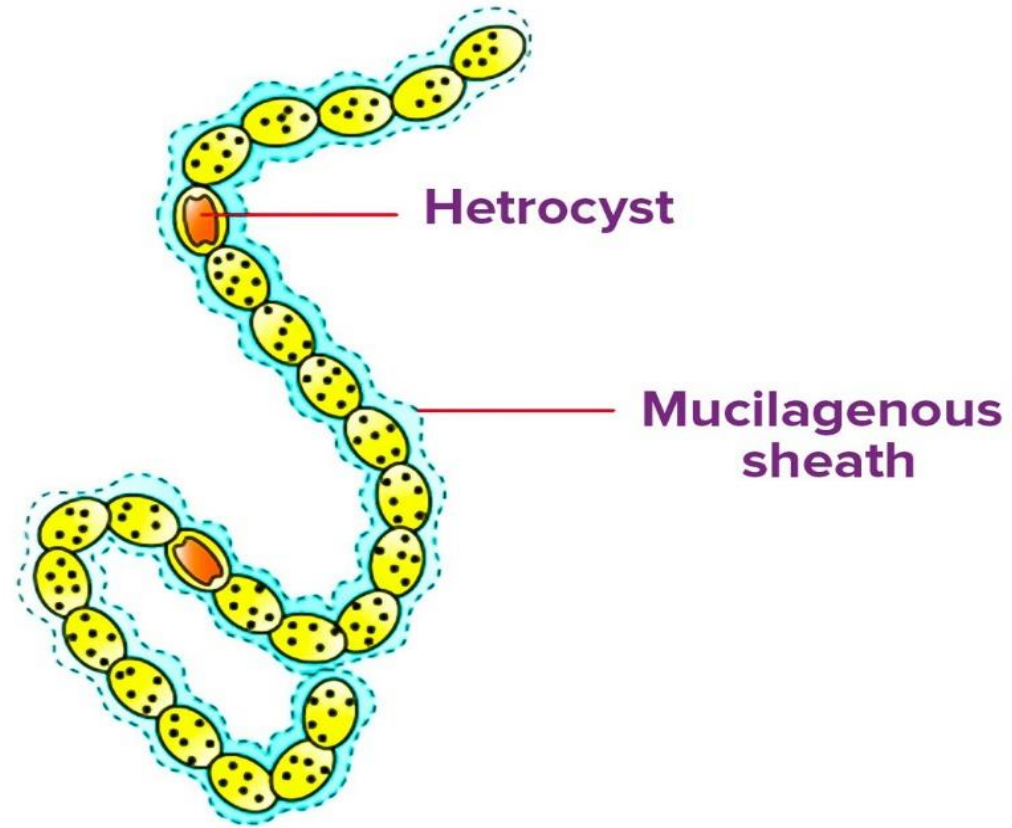
EUBACTERIA (TRUE BACTERIA)

1. **Cell wall** – Peptidoglycan.
2. **Autotrophs** – Photosynthetic like Chlorobium and Chromatium. Chemosynthetic like Sulphur bacteria.
3. **Multicellular filamentous** form found in fresh water.
4. Body covered by **mucilaginous sheath**.
5. **Photosynthetic pigments**- Chl a, Chl b, carotenes and xanthophylls.
6. Filament shows **heterocyst** which helps in nitrogen fixation.
7. Heterotrophs are the most abundant like....

Sr No.	A	B
1	Curdling of milk	Lactobacilli
2	Fixation of nitrogen	Azotobacter
3	Antibiotic production	Streptomyces

Cyanobacterium (Nostoc)

NOSTOC



Plant like protista

1. **Chrysophytes** – major producer in ocean.
2. **Microscopic and photosynthetic.**
3. **Diatoms** – Body wall made up of **two soap-box** like fitting silica covers.
4. **Diatomaceous earth** is nothing but these shells left behind for so many years.
5. Granular hence finds use in **polishing** and **filtration.**

Animal like protista

1. Protozoans.

2. Lack cell wall.

3. They are heterotrophs.

4. Entamoeba – Amoebic dysentery

Trypanosoma – Sleeping sickness

Plasmodium -- Malaria

Dinoflagellates

1. Aquatic and photosynthetic.
2. Cell wall made of cellulose stiff plates.
3. Posses pair of flagella
4. Wide range of photosynthetic pigments yellow, green, brown, blue and red.
5. *Gonyaulax* – Responsible for famous 'RED TIDE'.
6. It makes even sea appears red.

Fungi like protista

1. Myxomycetes.
2. Saprophytic organisms found on decaying leaves.
3. Cells aggregate to form a large cell mass called plasmodium.
4. Spores produced by plasmodium are very tough and survive even very harsh conditions.

Euglenoids

1. They lack cell wall but have tough covering of proteinaceous pellicle.
2. Posses two flagella, one short and other long.
3. Show photosynthesis in presence of light and behave as heterotrophs in absence of light.

Kingdom plantae

1. Autotrophs.
2. Semi-autotrophic members – Insectivorous plants like.....
Venous fly trap, pitcherplant, bladderwort.
3. Parasitic plant - *Cuscuta*



Kingdom Plantae

Has no seeds

Cryptogams

Has seeds

Phanerogams

Has no true roots, stems or leaves



Algae
Chlorophyta

Has some root and leaf-like structures



Mosses and liverworts
Bryophyta

Has roots, stems and leaves



Ferns and Horsetails
Pteridophyta

Has no flowers

Gymnosperms

Has flowers

Needle-like leaves



Conifers
Pinophyta

Wide leaves



Ginkos
Ginkgophyta
and
cycads
Cycadophyta



Angiosperms
Magnoliophyta

Kingdom -- Fungi

1. Unique kingdom of **heterotrophic organisms** showing **extracellular digestion**.
2. **Organisms may be :**
 - Unicellular** – Eg. Yeast
 - Multicellular and filamentous** – Eg. Penicillium.
3. **Unicellular organisms** –
 - Protoplast with **many nuclei**. Eg. Rhizopus
 - Protoplast with **single nuclei**. Eg. Yeast.
4. **Filamentous organisms** – Body is called **mycelium** with number of **thread-like** structures called **hyphae** are present.
5. **Hyphae** may be with **septa** or **without septa**.

6. **Uni or multi-nucleated.**
7. Non-septate multinucleated hyphae are called **coenocytic hyphae.**
8. **Cell wall – Chitin or fungal cellulose.**
9. **Well organized membrane bound cell organelles.**(except chloroplast).
10. **Mode of nutrition – Saprophytes, parasites , predators or symbiotic.**
11. **Reproduction – Vegetative, asexual or sexual.**

LICHENS (Theophrastus-300BC)

1. Lichens are **slow growing, long living** organisms.
2. Lichens are formed by close association of **two different partners(organisms)**.
3. One of which is an **algal component** and the other **fungus component**.
4. The algal component is called **phycobiont or photobiont**. (They provide food to fungus component).
5. The fungus component is called **mycobiont**. (They provide shelter to algal component)
6. Found in extreme climatic conditions – **Dry exposed rocks** and snow covered **Arctic and Antarctic poles**.
7. Sensitive to **air pollutin** and generally do not grow near the cities.
8. Plant body **thalloid** (**Greenish** or **Bluish green** in colour).

Viruses and Viroids

1. Viruses are **acellular, ultramicroscopic, disease causing entities.**
2. Size – **10 nm to 2000 nm.**
3. Viruses are **smaller than bacteria.**
4. Viruses are **obligatory parasites** and can **multiply** only within the **living host cells.**
5. They have **capacity to transmit the disease** from diseased to healthy organisms.
6. Simple structure i.e. a **nucleic acid core** surrounded by a **protein coat(capsid)** to form nucleocapsid.
7. Genetic material – **either DNA or RNA (but never both).**
8. Viruses can be **crystallised.**
9. Viruses are **host specific.**
10. They show the characteristics of **both living and non-living.**

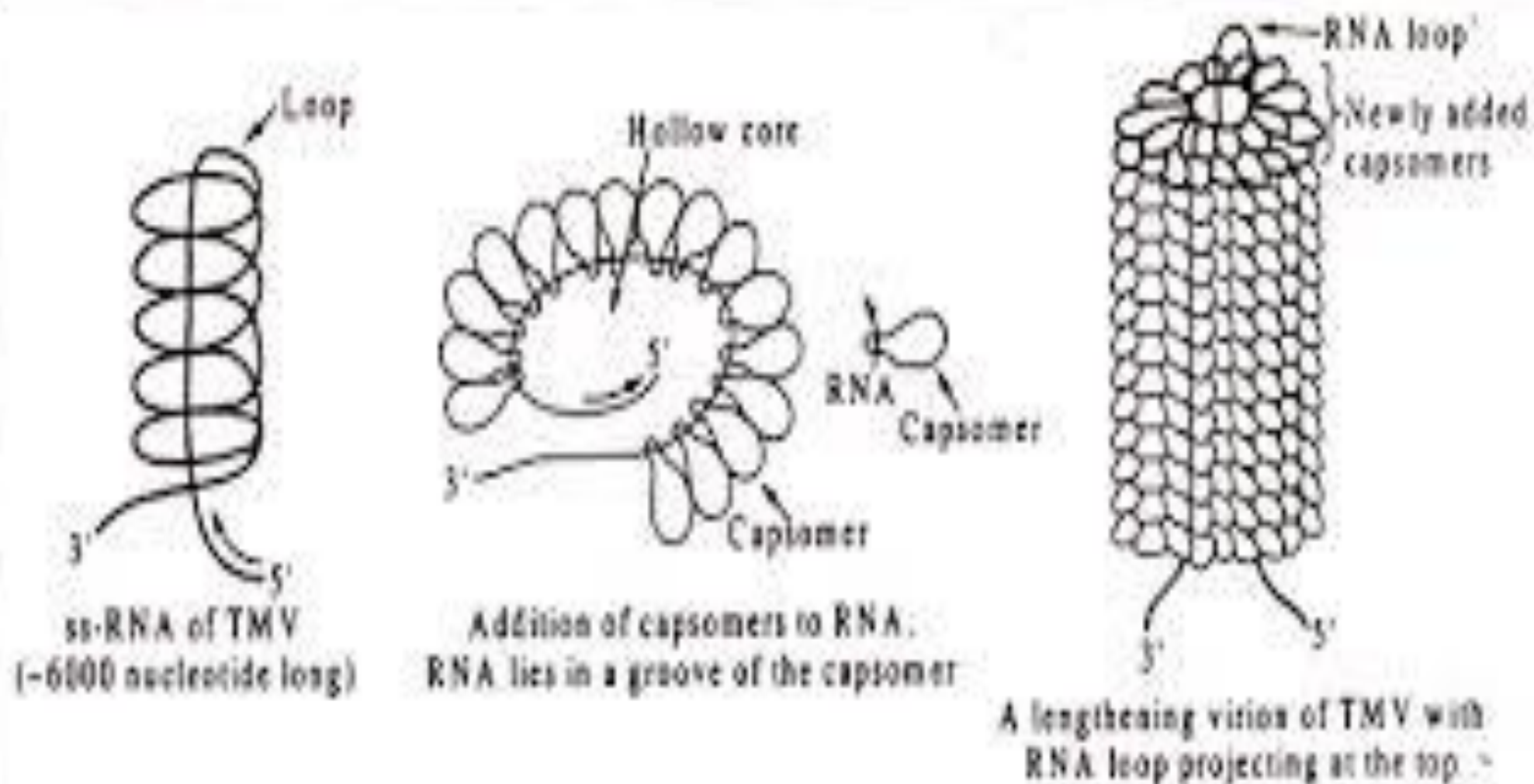


Fig. 6.15 : Assembly of TMV. Completed virion measures 18 x 300 nm

Viroids:

1. These are very **small, circular, single stranded RNAs** which are **not complexed with any protein.**
2. They are **single stranded linear RNA.**
3. The **first viroid** discovered was the **potato spindle tuber viroid(PSTV).**
4. It has composed of **359 nucleotides** and has **ten times less genetic material** than the smallest known virus.
5. **Low molecular weight RNA .**
6. **These infectious RNA strands are called viroids.**

A top-down photograph of a white card with the words "Thank you" written in purple cursive. The card is placed on a light-colored marble surface. To the left of the card is a bouquet of purple flowers. To the right is a black pen with a white polka-dot grip and a small gift wrapped in white paper with a red and white striped ribbon. A spool of red and white striped twine is also visible in the upper right corner.

Thank
you