ISSN: 2582-8118 ***Volume 2, Issue 5; Sept 2022***

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYSIS IN SCIENCE AND ENGINEERING

Web: https://www.iarj.in/index.php/ijrase/index

5. A Study on Diversity of Plant Viruses, Bacteria, Fungi and Algae

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ABSTRACT

This article discusses the properties of plants, fungi, bacteria, and viruses. Green plants, fungi, bacteria, and viruses were all treated as plants for a long time. We will begin with a study of plants because they are the most familiar to everyone and because they are the foundation of almost all life. Mosses and liverworts are today's simplest land plants, aside from some algae. The first land plants may have been similar to them, but there is no fossil evidence for this. The development of conducting tissues—vascular tissues—was critical to the successful colonisation of the land. Spores were used to disperse the first vascular plants. Spores are single-celled reproductive bodies. Fungi are saprophytic and parasitic organisms with a network of branched threads as their body.

KEYWORDS:

Plant viruses, Bacteria, Fungi and Algae.

Introduction:

The composition of the microbial community differed between shoots, roots, and soil. While plant species richness increased fungal and bacterial species richness in shoots, no correlation was found between plant and microbial diversity in roots and soil. Chemistry, as well as the spatial location of the sampled site, were significant predictors of bacterial and fungal community composition in soil. [1] The effects of plants on the microbiome composition appeared to be limited to shoot-associated taxa in this species-rich grassland; however, the microbiomes of roots or soil were not affected. The findings support our hypothesis that the impact of plants on microbiome composition decreases as they progress from shoots to roots and soil.

Viruses cause nearly a thousand different plant diseases. Mosaic diseases inhibit chlorophyll production in a predictable pattern, often along veins. Beans, cucumbers, peas, peaches, sugar beets, sugar cane, tobacco, turnips, rice, potatoes, tomatoes, and wheat are all affected by mosaic diseases. Rice necrosis causes rice plants to grow slowly. Mosaic diseases include aster yellows, potato paracrinkle, potato leaf role, sugar beet curly top, and tomato bushy stunt. Leaf hoppers and aphids are commonly used to spread such diseases from one plant to another. [2] Nematodes can also spread viral diseases from plant to plant. Viruses have no effect on these insect vectors. Viral diseases can also be spread mechanically, through injury or grafting.

Bacteria:

Bacteria are the most common microorganisms that can be found almost anywhere. They are called prokaryotes. The dimensions range from 0.15 to 700 m. While the majority of bacteria are beneficial to us, some are pathogenic and cause diseases in plants and animals. Toxins can be produced or a strong immune response can be elicited, causing host cells to be damaged. Pp[3] Bacteria have the following important characteristics:

- Bacteria have prokaryotic cells. They lack a nucleus and other membrane-enclosed organelles.
- The bacterial genome is housed in the cytoplasm in an irregularly shaped region known as the nucleoid.
- Electron transport occurs through the plasma membrane during processes such as respiration and photosynthesis.
- Bacteria are classified as Gram-positive or Gram-negative based on their reaction to the Gram stain and the structure of the cell envelope.
- Gram-positive bacteria have an extremely thick cell wall. It is made up of teichoic acid and thick peptidoglycan layers.
- The cell wall of Gram-negative bacteria is thin. It is composed of a thin peptidoglycan layer as well as lipopolysaccharides.
- A layer of glycocalyx surrounds the cell wall and forms the cell envelope's outermost layer. The structure and constituents of the glycocalyx layer differ between bacteria. It can take the form of a loosely held slime layer or a thick and tough capsule.
- Flagella are found in many bacteria. It is used to promote motility.

Viruses:

Viruses are not thought to be living organisms. They are only capable of replicating within the host. They have a genome made up of DNA or RNA that is encased in a protein coat. [4] They are extremely small, with virus sizes ranging from 20 to 300 nm. Viruses have the following important characteristics:

- Viruses are obligate parasitic organisms.
- The genetic material is either DNA or RNA, and it is inactive outside of the host cell. The genome can be either circular or linear.
- The genetic material could be RNA or DNA, single or double-stranded. Plants are typically infected with single-stranded RNA viruses, whereas animals are infected with single-stranded RNA or double-stranded DNA viruses.
- The genetic material is found within the protein coat known as the capsid.
- Many viruses have a lipid-based outer envelope.
- Bacteriophages are viruses that infect bacteria.

Fungus:

Fungi are eukaryotes that digest food and absorb nutrients directly through their cell walls. The majority of fungi reproduce through spores and have a body (thallus) made up of microscopic tubular cells called hyphae. Fungi are heterotrophs, meaning they get their carbon and energy from other organisms. Some fungi, known as biotrophs, obtain their nutrients from a living host (plant or animal); others, known as saprotrophs, obtain their nutrients from dead plants or animals. Some fungi infect a living host but kill host cells to obtain nutrients; these are known as necrotrophs.

Plant Pathology:

Plant pathology (also known as phytopathology) is the scientific study of plant diseases caused by pathogens (infectious organisms) and environmental factors. Pathogen identification, disease etiology, disease cycles, economic impact, plant disease epidemiology, plant disease resistance, how plant diseases affect humans and animals, pathosystem genetics, and plant disease management are all part of plant pathology. [5] A plant disease is typically defined as abnormal plant growth and/or dysfunction. Diseases occur as a result of a disruption in the plant's normal life process. Diseases can be caused by both living and non-living factors. Living organisms cause biotic diseases (e.g., fungi, bacteria, and viruses). A plant disease symptom is a visible effect of the disease on the plant. [6] As a plant responds to the pathogen, it may exhibit visible changes in colour, shape, or function. Leaf wilting is a common symptom of verticillium wilt, which is caused by the fungi Verticillium albo-atrum and V. dahliae.

Review of Literature:

India has a total land area of approximately 329 million hectares and a coastline of over 7500 kilometres. The country's ecological or ecosystem diversity is enormous, ranging from sea level to the world's highest mountain ranges; hot and arid conditions in the northwest to cold arid conditions in the trans-Himalayan region; tropical wet evergreen forests in Northeast India and the Western Ghats; Sundarbans mangroves and fresh water aquatic to marine ecosystems (Sharma & Singh, 2000)[7].

With over 130 species of primitive angiosperms, Northeast India is also known as the "cradle of flowering plants" (Takhtajan, 1969)[8]. India is also known as the "Hindustan Centre of Origin of Crop Plants" (Vavilov, 1951)[9], one of the world's 12 Vavilovian centres of origin and diversification of cultivated plants. At least 167 important agri-horticultural crops and 320 wild relatives from 116 genera and 48 families are known to have originated here (Arora & Nayar, 1984)[10].

Rice has 50,000 to 60,000 land races in India, and other economically important crops like wheat, sugarcane, legumes, sesame, eggplant, citrus, banana, mango, jute, ginger, turmeric, pepper, cinnamon, and cardamom have a high level of diversity as well. It is estimated that approximately 3000 species of angiosperms have medicinal potential, of which ca. 1300 species are widely used in various traditional medical systems such as Ayurveda, Siddha, and Unani, as well as in Allopathy.

Objectives:

- Research the number of plant species and their status in the world and in India.
- To investigate the number and diversity of plant-associated viruses.
- Researching plant diseases caused by viruses, bacteria, and fungi
- Researching plant pathology

Research Methodology:

The data used to prepare this paper are secondary in nature, gathered from various published resources. The information for this paper was gathered from various relevant websites. A close reading and detailed analysis of secondary sources is required in order to apply the analytical and descriptive methods to the research. It is critical to obtain additional perspectives in order to expand on the textual analysis, which would necessitate close reading analysis of a few secondary materials.

Result and Discussion:

Table 1: Shows Plant Diseases Caused by Bacteria

Name of the Crop/Plant	Bacterial Disease
Beans, Rice	Blight
Cotton	Black Arm
Tomato	Canker
Potato	Ring Rot, Brown Rot

Fungi, oomycetes, bacteria, viruses, viroids, virus-like organisms, phytoplasmas, protozoa, nematodes, and parasitic plants are among the organisms that cause infectious disease. Ectoparasites such as insects, mites, vertebrates, and other pests that consume plant tissues are not included. [11]

Table 2: Plant Diseases Caused by Fungi

Name of the Crop/Plant	Fungal Disease
Sugarcane	Red Rot
Bajra (Pearl Millet)	Ergot, Green Ear, Smut
Pigeon Pea, Cotton	Wilt
Ground Nut	Tikka
Rice	Blast
Paddy, Papaya	Foot Rot
Wheat	Rust, Powdery Mildew
Coffee	Rust
Potato	Late Blight
Grapes, Cabbage, Cauliflower, Bajra, Mustard	Downy Mildew
Radish, Turnip	White Rust

The diseases caused by fungi in plants are shown in the table above.

Table 3: Shows the Diseases Caused by Viruses in Plants

Name of the Crop/Plant	Viral Disease
Potato	Leaf Roll, Mosaic
Banana	Bunchy Top
Papaya	Leaf Curl
Tobacco	Mosaic
Carrot	Red Leaf

The viruses that cause plant diseases are listed in the table above.

A total of 245 viruses produced 202 complete genomes or 49 nearly complete genomes (sequence length > 70% of the genome), including 5 segmented RNA viruses. [12]

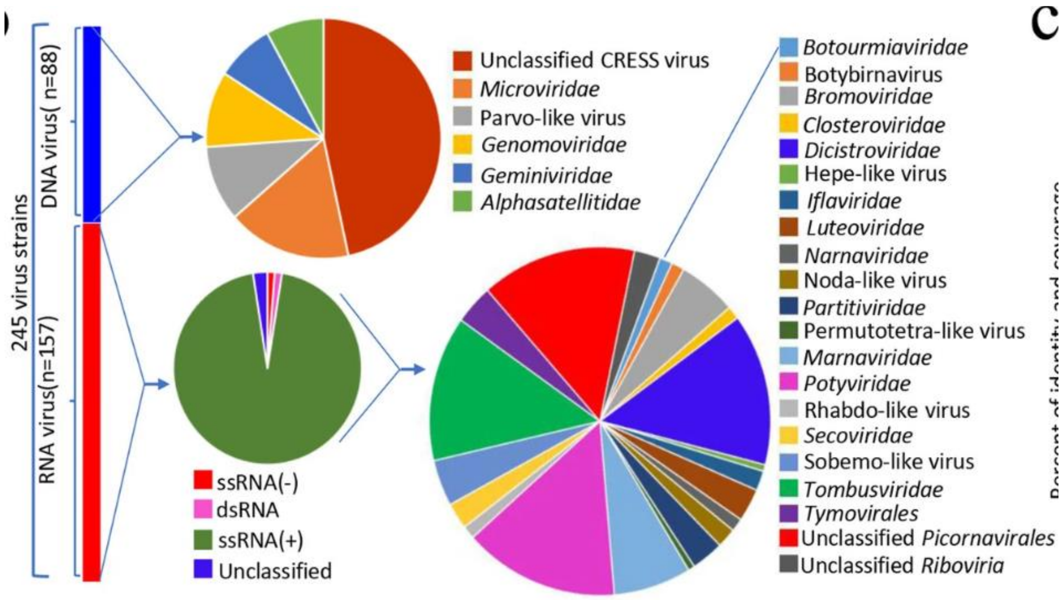

Figure 1: depicts the number and diversity of plant-associated viruses. The left histogram displays the number of DNA viruses (blue bar) and RNA viruses (red bar). The right pie charts depict the virus classification discovered in this study. [13]

Table 4: summarises the total number of plant species (including viruses, bacteria, algae, fungi, and lichens) and their distribution in the world and in India.

Sl. No.	Type	Number of known Species		Percentage of Occurrence in India	Number of Endemic Species	Number of Threatened Species
		World	India			
I	**Flowering Plants**					
1.	Gymnosperms	1021	74	7.35%	8	7
2.	Angiosperms	268600	18043	6.72%	ca. 4036	1700
III	**Non-flowering Plants**					
1.	Bryophytes	16236	2523	15.54%	629	ca. 80
2.	Pteridophytes	12000	1267	10.57%	47	414
III	**Others**					
1.	Virus and Bacteria	11813	986	8.77%	Not Known	Not known
2.	Algae	40000	7284	18.21%	1924	Not known
3.	Fungi	98998	14883	15.09%	ca. 4100	ca. 580
4.	Lichens	17000	2401	14.12%	ca. 520	Not known
Total		**465668**	**47513**	–	**11273**	**2781**

Table 4 provides a comparative account of plant species from India and around the world, including viruses, bacteria, algae, fungi, and lichens. [14] The table also indicates the approximate number of species that are considered endemic to India. आवश्यक सूचना वनस्पति विज्ञान की सभी छात्राओं को सूचित किया जाता है कि उनके प्रोजेक्ट का प्रेजेंटेशन बुध एवं बृहस्पतिवार को बात नहीं लैब में होगा जिसमें सभी छात्राओं की उपस्थिति अनिवार्य है सभी छात्राएं अपने प्रोजेक्ट को अच्छे से पढ़ कर आएगी और 3 से 5 मिनट के बीच में है उसे प्रस्तुत करेंगे

Conclusion:

Several viruses that were genetically close or identical were found in plants of different species, implying cross-plant species transmission or multiple hosts of the same virus. In this study, there was no significant difference in virus composition between the cultured plant group and the wild plant group in the same ecosystem, reflecting the influence of the ecosystem on the virus composition of local plants.

We cannot tell whether the plant viruses detected here came from remote areas or only from this plant location because plant viruses can be transmitted through various media such as arthropod, insect, water, or even wind.

Because plants account for more than 80% of all biomass on Earth, plant viruses are likely to have a greater impact on ecosystem stability and function than viruses from other kingdoms. Some plant viruses may promote host adaptation to changing environments in addition to preventing overgrowth of genetically homogeneous plant populations such as crop plants. Estimates of the extent and frequency of such mutualistic interactions, however, remain contentious.

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