ROLE OF FUNGI IN STUDYING HUMAN EVOLUTION

FROM THE EDITOR'S DESK

Greetings and a cordial welcome to the second edition of the 'GULMOHAR NEWSLETTER' for the year 2023-24.
Fungi play a vital role in the ecosystem as decomposers, food, nutrient recyclers and symbiotic organisms. Fungi also produce important bioactive compounds which possess many medicinal properties, thus contributing to the pharmaceutical and nutraceutical industry. Fungi also impact the plants and agriculture which indirectly affects humans.

Thus exploring and understanding fungal biodiversity, their importance and their relationships may open up new avenues for us humans. Let us join together on this journey of understanding fungi!
I am hopeful that you will find this content interesting and that you will eagerly anticipate our upcoming editions .

Stay curious, stay engaged!
HAPPY READING!

Editor,
Priya Vishwkarma

IN THIS EDITION.....

We explore the remarkable role played by these often overlooked organisms ie Fungi. Join together on a journey uncovering the profound connections between fungi and humans. Let us delve into their symbiotic relationships, their unusual traits and also their negative impacts. Get ready for an amazing exploration of fungi and their profound implications for our understanding of human evolution. Also immerse yourself into the captivating review of the acclaimed documentary 'The Fantastic Fungi' .Don't miss the captivating photo gallery at the end!!

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NATURE ALONE IS ANTIQUE, AND THE OLDEST ART A MUSHROOM

~Thomas Carlyle

Fungi-Animal Interactions

The interaction between fungi and animals is a complex web of relationships that have shaped ecosystems and influenced evolution. These relationships range from mutualistic to parasitic interactions playing a very important role in nature.

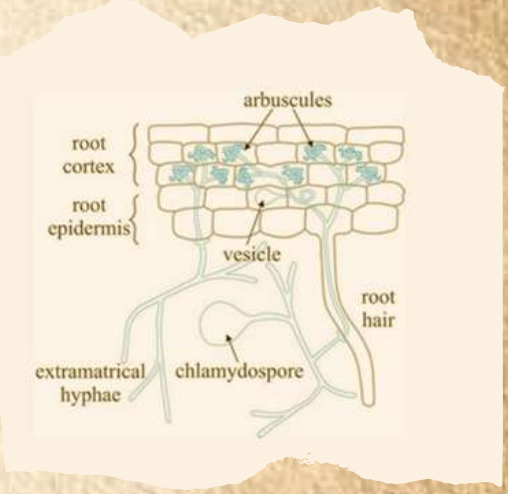
INTRODUCTION:

Symbiosis is a type of long-term close biological relationship between two or more species. These relationships can be:

- Mutualistic (association between organisms of two different species wherein both are advantaged)
- Commensalistic (association between two organisms wherein one is benefitted and the other is neither harmed nor advantaged.)
- Parasitic (association between two organisms wherein one is advantaged and the other is harmed.)
- Amensalistic (association between two organisms wherein one is harmed and the other remains unaffected.)

SOME EXAMPLES OF FUNGI-ANIMAL INTERACTIONS ARE AS FOLLOWS:

1.One of the most common interactions is the mycorrhizal associations.Mycorrhizal fungi develop symbiotic relationships with the plant roots, which helps in increasing the nutrient uptake by the plants and in return the fungi receive essential carbohydrates. This mutual relationship helps in enhancing the plant growth and benefits significantly to the ecosystem. Mycorrhizas are present in 92% of plant families studied. Animals indirectly benefit from this association as they depend upon plants for their nutrition.



2. Leaf-cutting ants in Central and South America engage in farming fungi. They harvest leaf discs from plants, creating gardens where they cultivate fungi. These fungi break down cellulose in the leaves, a task the ants can't accomplish. After the fungi convert the cellulose into smaller sugar molecules, the ants consume the fungi as their meal. Additionally, the ants protect their gardens by eliminating competing fungi. This mutual relationship benefits both the ants and the fungi: the fungi receive a constant leaf supply and protection from rivals, while the ants sustain themselves by consuming the cultivated fungi.

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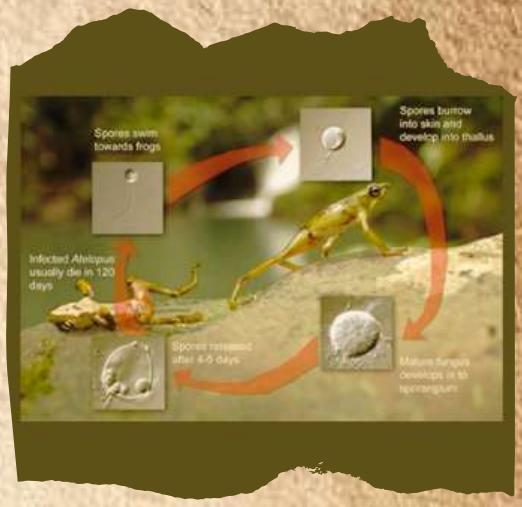
Fungi-Animal Interactions

3.Certain fungi show parasitic relationships with animals. These fungi may lead to diseases or infections in animals. Examples include dermatophytes causing skin infections in animals and fungi contributing to the declines in the amphibian population worldwide. Amphibian chytridiomycosis is an infectious fungal disease that can be fatal to amphibians. As the disease spread globally beginning in the 1970s, many populations declined greatly and species became extinct.



Chytridiomycosis is a skin disease in amphibians caused by two species of amphibian chytrid fungus. They are called *Batrachochytrium dendrobatidis* and *Batrachochytrium salamandrivorans*. Both species of the amphibian chytrid fungus are native to southern Asia. Some epidemics of the disease, particularly in the 1980s through mid-2000s, have caused serious declines in native amphibian populations.

4.Another example of fungi animal interaction is the fact and animals from insects to mammals consume fungi as a source of food. Humans also consume fungi either as the primary source of food or even derive products from them such as pharmaceuticals and nutraceuticals. Many fungi have been used in preparation of traditional Chinese Medicine since generations. For example, various nutraceuticals like *Ophiocordyceps sinensis* capsules, *Tremella* capsules, Reishi-Max capsules are available in the market.

CONCLUSION:

Fungi are at the interface between life and death. They form an important part of our microbiome, with symbiotic relationships ranging from commensalism to parasitism. The depth of symbiotic relationship between humans and fungi is often underestimated and lacks thorough exploration. Studying these interactions will shed light on the diverse mechanisms through which fungi and animals coevolve. Understanding these interactions is fundamental not only to study the functioning of ecosystems but also to appreciate the complexities of evolution in the natural world!!

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Unravelling the Mystery: Horizontal Gene Transfer Sheds Light on the Unusual Traits of *Armillaria* Fungi

INTRODUCTION:

Armillaria fungi, commonly known as honey fungi, have long intrigued scientists due to their peculiar and diverse traits. Recent research has unveiled a key mechanism behind these unusual characteristics—horizontal gene transfer (HGT). This article explores the significance of HGT in shaping the genetic landscape of *Armillaria* fungi and how it contributes to their distinctive features.

UNDERSTANDING HORIZONTAL GENE TRANSFER:

Horizontal gene transfer is a process by which organisms acquire genetic material from other species rather than inheriting it vertically from their ancestors. In the case of *Armillaria* fungi, HGT has emerged as a vital mechanism for the exchange of genetic information.

THE ROLE OF HGT IN ARMILLARIA ADAPTABILITY:

Armillaria fungi are notorious for their adaptability to various environments and host species. HGT enables them to swiftly acquire advantageous genes related to pathogenicity, resistance to environmental stressors, and the utilization of diverse substrates. This adaptability contributes to their ability to colonize and thrive in different ecosystems.

GENETIC ARSENAL OF ARMILLARIA:

Through HGT, *Armillaria* fungi have incorporated genes that enhance their capacity to break down complex organic compounds, allowing them to decompose a wide range of substrates. This genetic arsenal provides a competitive edge in the ecological niche they inhabit, influencing their role in nutrient cycling and ecosystem dynamics.

UNRAVELLING UNUSUAL TRAITS:

The unique traits of *Armillaria* fungi, such as bioluminescence and extended vegetative growth, find their origins in the genetic diversity acquired through HGT. Researchers are delving into the specific genes involved in these traits to decipher the molecular mechanisms behind their expression and functionality.

IMPLICATIONS FOR MYCOLOGY AND BEYOND:

Understanding the impact of HGT on *Armillaria* fungi not only sheds light on their biology but also has broader implications for the field of mycology and evolutionary biology. Insights into HGT mechanisms in fungi may have applications in various areas, including biotechnology and agriculture.

AUTHOR: SHRADDHA GAUTAM NANDEPALLI

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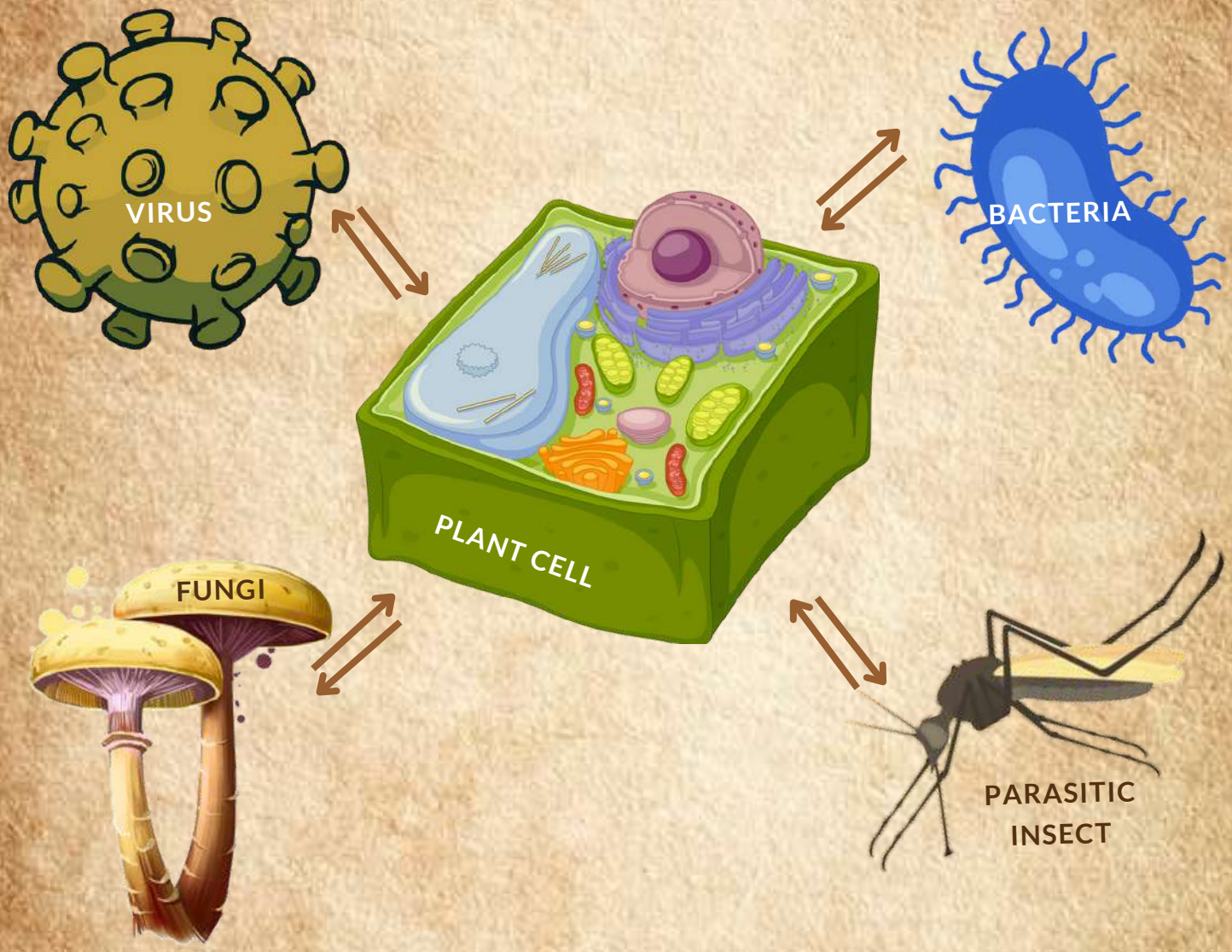
Unravelling the Mystery: Horizontal Gene Transfer Sheds Light on the Unusual Traits of *Armillaria* Fungi

CONCLUSION:

Horizontal gene transfer emerges as a pivotal factor in explaining the unusual traits exhibited by *Armillaria* fungi. This mechanism, facilitating the rapid exchange of genetic material, contributes to their adaptability and unique features. Unravelling the intricacies of HGT in *Armillaria* opens new avenues for exploring the dynamic interplay between fungi and their environment, with implications reaching beyond the fungal kingdom.



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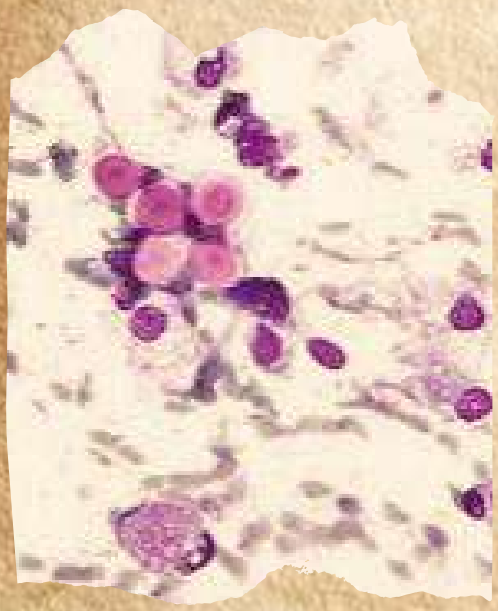
The Spectrum of Fungi that infects Humans

Fungal pathogens cause more than a billion human infections every year, resulting in more than 1.6 million deaths annually.

Our understanding of the natural history and evolutionary ecology of fungi is helping us in understanding the ongoing development of characteristics important to illness. The evolution of fungal pathogenicity has been facilitated by a variety of genetic variation types and processes, and distinct genetic distinctions set pathogens apart from non-pathogens. Understanding the characteristics, genetic components, and ecological and genetic processes that have shaped fungal pathogenicity is essential for creating plans to anticipate the emergence of fungal infections and create medications to fight them.

After animals and plants, the kingdom of fungi is the least well known of the "big" three eukaryotic kingdoms, with about 150,000 species known to science and maybe up to a few million more waiting to be discovered. But just as important to the world and human existence as animals and plants are, fungi are also. Despite their close ties to human civilization, fungi are nevertheless mostly overlooked and understudied.

Fungal pathogens have not been as well studied in relation to human illness as bacterial and viral pathogens have. It is estimated that a billion people worldwide suffer from superficial fungal infections (skin, hair, nail, and eye infections), 135 million from mucosal infections (oral and vaginal), and millions more from allergic infections. Despite this, recent data suggest that the annual burden of fungal disease worldwide is enormous.



FUNGI THAT INFECT HEALTHY HUMANS

A.ENTOMOPHTHOROMYCOTA

Effective pathogens for insects are found in the entomophthoromycota. Although they are common all throughout the planet, only tropical and subtropical areas have been identified as their sources of invasive human infection. It is possible to separate the human pathogenic species of Basidiobolus and Conidiobolus from plant detritus and soil, particularly in the rainy months (Bittencourt 1988). Recent work by Kwon-Chung (2012) has shown how evolutionary distance separates these fungi from both Mucorales, with whom they were formerly placed in the Zygomycota, and from one another.

AUTHOR: ANITH JOSHIEA MARTIN

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The Spectrum of Fungi that infects Humans

B .ASCOMYCOTA

Pathogenic Onygenales A number of ascomycete species that live in soil, called Onygenales, have evolved to parasitize mammals and infect them systemically. They are now categorized under the Ajellomycetaceae family. These fungi cause disease that starts in the lungs without any symptoms and develops into frank pneumonia or an illness resembling the flu.

The following are some of the different organ predilection of the various genera: Blastomyces in bones, joints, and skin, Histoplasma in multiple organs, including the gastrointestinal tract and adrenal glands, and Paracoccidioides in oral and respiratory mucous membranes. They can also disseminate to distant sites, persist, and reactivate.

C .BASIDIOMYCOTA

Cryptococci A type of basidiomycete yeast that is widely distributed, have rarely infected humans in the past century (Molez 1998). When AIDS began to spread around the Congo River in the 1950s, there were an increasing number of reports of cryptococcal meningoencephalitis from central Africa. These cases are now thought to have been sentinels of the disease (Molez 1998). The majority of cases of cryptococcosis still occur in the context of AIDS estimates for 2006 showed that there were 957,900 cases of cryptococcal meningitis linked to AIDS, which translated into . 624,700 deaths. A

CONCLUSION

Humans with healthy immune systems show strong resistance to fungus-related illnesses. Scientific medicine has recently emerged as a result of human social evolution, and as it has developed, a sizable population is now vulnerable to infections with fungi that were not thought to be human pathogens even a century ago.The example of AIDS suggests that human social evolution may have reached a point where allocating resources in a way that makes sense in order to comprehend fungal biology and successfully develop several new classes of antifungals.Less than 20 years ago, a significant research effort led to the development of effective antiretroviral therapy. If human society progresses to the point where it values every human life equally, AIDS could be nearly eradicated, just as HIV mother to child transmission has been virtually eliminated in wealthy nations (Siegfried).

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CLICK HERE FOR REFERENCES

Increasing threat of spread of antimicrobial-resistant fungus *Candida auris*

Aspergillus

INTRODUCTION

Antifungal drugs treat fungal infections by killing or stopping the growth of dangerous fungi in the body. Fungi can develop resistance to antifungal drugs the same way bacteria can develop resistance to antibiotics. Resistance happens when germs develop the ability to defeat the drugs designed to kill them. That means the germs are not killed and continue to grow.

Currently, only a small number of antifungal drug types exist, so resistance can severely limit treatment options. Some types of fungi, like *Candida auris*, can become resistant to all the antifungal drugs normally used to treat these infections. Resistance is especially concerning for patients with invasive fungal infections—severe infections that affect the blood, heart, brain, eyes, or other parts of the body

SPREAD OF ANTIMICROBIAL-RESISTANT FUNGUS CANDIDA AURIS

Candida auris is a newer species of *Candida* that is particularly resistant to antifungal drugs and can spread quickly in healthcare settings. *Candida auris (C. auris)*,as an urgent AR threat, because it is often resistant to multiple antifungal drugs, spreads easily in healthcare facilities, and can cause severe infections with high death rates.*C. auris* is not a threat to healthy people. People who are very sick, have invasive medical devices, or have long or frequent stays in healthcare facilities are at increased risk for acquiring *C. auris*.

C. auris has spread in the United States since it was first reported in 2016, with a total of 3,270 clinical cases and 7,413 screening cases reported through December 31, 2021.

Candida auris

AUTHOR: VRUTIKA WAGHELA

CLICK HERE FOR REFERENCES

CONCLUSION

C. auris case counts have increased for many reasons, including poor general infection prevention and control (IPC) practices in healthcare facilities. Case counts may also have increased because of enhanced efforts to detect cases, including increased colonization screening, a test to see if someone has the fungus somewhere on their body but does not have an infection or symptoms of infection. The timing of this increase and findings from public health investigations suggest C. auris spread may have worsened due to strain on healthcare and public health systems during the COVID-19 pandemic.

DOCUMENTARY REVIEW

FANTASTIC FUNGI

(THE WORLD OF FUNGI)

"Fantastic Fungi" is a captivating exploration of the mysterious and enchanting world of mushrooms, seamlessly blending scientific inquiry with breath taking cinematography. The documentary, directed by Louie Schwartzberg, takes audiences on a visually stunning journey through the fungal kingdom, revealing the intricate networks that fungi form beneath our feet.

The film combines time-lapse cinematography, CGI, and interviews in an overview of the biology, environmental roles, and various uses of fungi. The film features interview segments with Paul Stamets and Michael Pollan, and is narrated by Brie Larson.

The film delves into the pivotal role fungi play in ecosystems, showcasing their symbiotic relationships with plants and trees. Through mesmerizing time-lapse sequences, viewers witness the intricate dance of mycelium, the hidden thread connecting vast stretches of nature. "Fantastic Fungi" succeeds in demystifying these often-overlooked organisms, portraying them as architects of life rather than mere decomposers.

With a rich tapestry of interviews featuring mycologists, ecologists, and even renowned figures like Paul Stamets, the documentary weaves together scientific insights and personal narratives. Stamets, in particular, emerges as a charismatic guide, sharing his deep reverence for mushrooms and their potential to heal both ecosystems and human health.

DOCUMENTARY REVIEW

FANTASTIC FUNGI

(THE WORLD OF FUNGI)

The film transcends the scientific realm, exploring the spiritual and cultural significance of fungi. It highlights the historical use of mushrooms in various cultures for rituals and medicine, drawing parallels between ancient wisdom and modern scientific understanding. This holistic approach adds depth to the narrative, making “Fantastic Fungi” not just informative but also emotionally resonant.

The visual effects elevate the documentary to a cinematic masterpiece, with sequences reminiscent of an otherworldly fantasy. The filmmakers employ a blend of macrophotography and computer-generated imagery to bring the fungal kingdom to life, creating a visual spectacle that is both awe-inspiring and educational.

“Fantastic Fungi” serves as a rallying cry for environmental stewardship, emphasizing the urgent need to protect and preserve fungi-rich ecosystems. It skillfully advocates for the interconnectedness of all life on Earth, positioning mushrooms as unsung heroes in the fight against climate change.

In conclusion, “Fantastic Fungi” is a triumph in documentary filmmaking, seamlessly blending science, art, and spirituality. It not only educates viewers about the marvels of the fungal world but also instills a profound sense of wonder and appreciation for the interconnected web of life that mushrooms help sustain. This cinematic journey is a must-watch for anyone curious about nature’s hidden wonders and the potential for transformative change that lies beneath the forest floor.

~Sayyed Bushra

PHOTO GALLERY

NAME- *Ceropegia vincaefolia*
LOCATION-GOREGAON FLIMCITY
PHOTOGRAPHER-VEDANT KHOKRALE
COLLEGE-SIES COLLEGE,SION WEST

NAME- *Tabernaemontana divaricata*
LOCATION-PALASDHARI
PHOTOGRAPHER-ASWATHY NAIR
COLLEGE-SIES COLLEGE,SION WEST

NAME- *Melanthera biflora*
LOCATION-SRI SRI RADHA VRINDAVAN BIHARI MANDIR,PALGHAR
PHOTOGRAPHER- KANAK SONI
COLLEGE-SIES COLLEGE,SION WEST

NAME- *Calotropis gigantea*
LOCATION-KARAD TALUKA,SATARA DISTRICT
PHOTOGRAPHER-ARYAN SHEWALE
COLLEGE-S.S JUNIOR COLLEGE SEAWOODS, NAVI MUMBAI

PHOTO GALLERY

NAME- *Hydrangea macrophylla*
LOCATION-KODAIKANAL
PHOTOGRAPHER-K.SELVAMATHI
COLLEGE-SIES COLLEGE,SION WEST

NAME-*Strobilanthes callolsa*
LOCATION-SANJAY GANDHI NATIONAL PARK,THANE
PHOTOGRAPHER-FELIX SEKAR

NAME-*Musa laterita*
LOCATION-SANJAY GANDHI NATIONAL PARK
PHOTOGRAPHER-VAZISHTA ROHINTON MAHUVAWALA
COLLEGE-SIES COLLEGE,SION WEST

NAME- *Ceropegia attenuata*
LOCATION-SANJAY GANDHI NATIONAL PARK, BORIVALI
PHOTOGRAPHER-FELIX SEKAR

PHOTO GALLERY

NAME- *Echinops echinatus*
LOCATION-KARAD TALUKA,SATARA DISTRICT
PHOTOGRAPHER-ARYAN SHEWALE
COLLEGE-S.S.JUNIOR COLLEGE,SEAWOODS,NAVI MUMBAI

NAME-*Bauhinia purpurea*
LOCATION-L.D.SONAWANE COLLEGE KALYAN WEST
PHOTOGRAPHER-MRUNMAYEE BHOIR
COLLEGE-L.D.SONAWANE COLLEGE KALYAN WEST

NAME-*Wedelia chinensis syn.Sphagneticola calendulacea*
LOCATION-L.D.SONAWANE COLLEGE SION WEST
PHOTOGRAPHER-MRUNMAYEE BHOIR
COLLEGE-L.D.SONAWANE COLLEGE KALYAN WEST

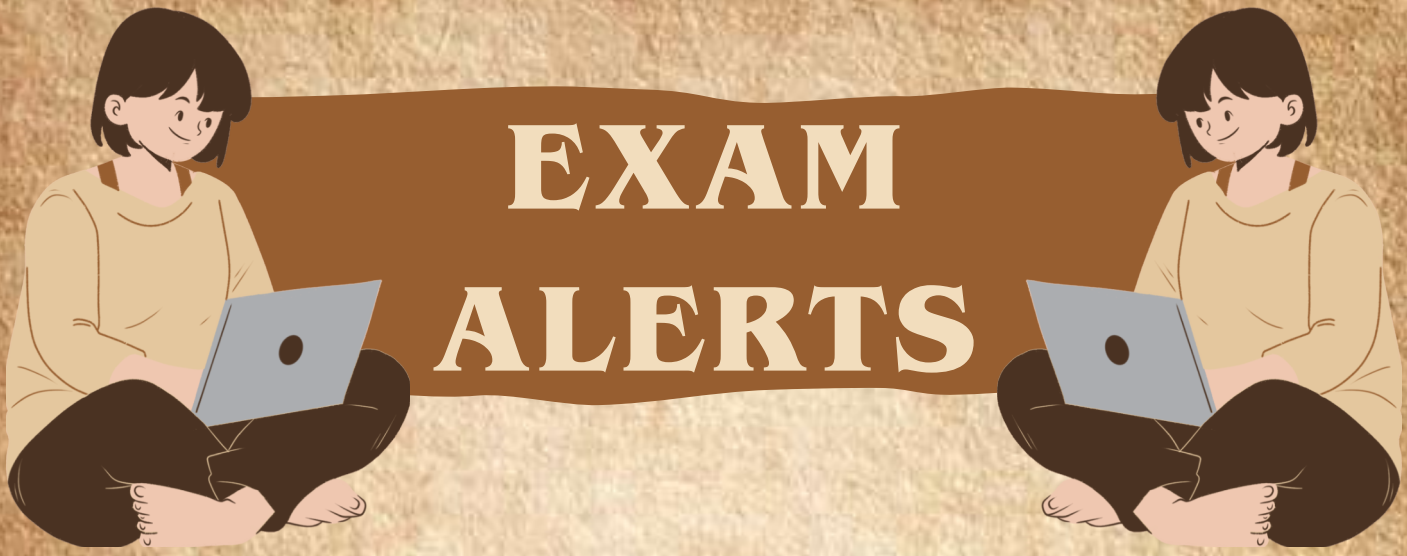
NAME- *Quisqualis indica*
LOCATION-BHIWANDI MURBAD ROAD,KALYAN WEST
PHOTOGRAPHER-MRUNMAYEE BHOIR
COLLEGE-L.D.SONAWANE COLLEGE,KALYAN WEST

PHOTO GALLERY

NAME-*Pancratium caribaeum*
LOCATION- KARAD TALUKA,SATARA
PHOTOGRAPHER-ARYAN SHEWALE
COLLEGE-S.S.JUNIOR COLLEGE,SEAWOODS,NAVI MUMBAI

NAME- *Catharanthus roseus*
LOCATION-KARAD TALUKA,SATARA DISTRICT
PHOTOGRAPHER-ARYAN SHEWALE
COLLEGE-S.S.JUNIOR COLLEGE,SEAWOODS, NAVI MUMBAI

NAME- *Podoscypha petalodes*
LOCATION-SANJAY GANDHI NATIONAL PARK
PHOTOGRAPHER-SHRADDHA NANDEPALLI
COLLEGE-SIES COLLEGE,SION WEST



EXAM ALERTS

NAME OF THE EXAM	SCHEDULED EXAM DATE	EXAM CONDUCTING BODIES
TIFR GS 2024	December 10 2023	Tata Institute of fundamental Research http://main.tifr.res.in
IGNOU TEE 2023	December 1, 2023 to January 9, 2024	Indira Gandhi National Open University. http://ignou.ac.in
CUET PG 2024	January 24 Application process	National Tasting Agency (NTA) cuet.nta.nic.in
LPU NEST 2023	20 January 2024 - 5 February 2024	Lovely Professional University http://www.lpu.in
BITSAT 2024	January 24 Application form	BITS Pilani bitsadmission.com

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