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From the Editor's

Dear Readers,

In the March issue of our Newsletter, we received several popular articles from diverse fields. All the authors deserve great appreciation for sharing articles in huge numbers. Please continue sending articles to our Publication team and share published newsletter with your friends also.

I would like to thank the Editorial team including Print, Designer and Publication committee for their efforts throughout the edition.

Your suggestions are always welcome for improvement.

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FOREST AND THEIR PROTECTOR

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International Day of Forests is celebrated every year on 21 March. The day was proclaimed by United Nations General Assembly in 2012 to celebrate and raises awareness about the importance of all types of forests. The theme of International Day of Forests 2023 is "Forests and Health" which means healthy forests for healthy people.

Tribals are the most important agents who are responsible to protect and manage forests from their origin. Tribals have a symbiotic relationship with forests. Their livelihood is fully dependent on the forests, these people get food, medicine, and employment, from the forests and depend on forests so much that they treat forests as their God and worship them. They consider forests to be important for their existence and the tribal communities make all efforts for protecting and managing them. As we see from the perspective of India these tribals have also fought and given their lives to protect the forests from outsiders at the time of our Independence.

Now that we know tribals are so much linked to the forests then we explore the tribal communities of the state of Jharkhand which covers 8.3% of tribal populations out of the total tribal populations of India. Jharkhand which means "land of the forests" is the state which was carved out from the state of Bihar on 15th November 2000 and become a separate state on account of the protection of the rights of tribals. The total geographical area of the state is 79,716 sq km which is 2.42% of the total land area of the country. Tropic of Cancer passes almost through the center of states which makes the climate sub-tropical, but the location of state on height along with monsoonal wind makes the climate monsoonal. The average annual temperature of Jharkhand is 25°C and average annual rainfall is 1200 mm. According to India State of Forest Report, 2021 the total forest cover in the state is 23,721.14 sq km. The state ranks 10th among all the States and Union Territories as regards to abundance of area under forest cover. Jharkhand has three types of forest Tropical Moist

Deciduous, Tropical Dry Deciduous Forests and Dry Peninsular Forests. Major trees found in the state are Bamboo, Sal, Shisham, Teak, Semal, Tendu, Shellac, Amaltas, Mahua, Palash, Mango, Jackfruit, Blackberry, Kusum, etc.

There is a total of 32 tribes in Jharkhand and the major ones are Santhal, Oraon, Munda, Ho, Gond, Bhumij, Kharwar, etc. The socio-cultural, religious and economic life of these tribes depends on the forests. For their livelihood purpose they collect forest produce, these people also possess a magnificent skill of making musical instruments, baskets and mats out of the plants. These people make household items from forest produce like wooden stools, cups, plates, cushions, rope, mortar, pestle and oil presses. They also make tools from forests produce like bows and arrows, slings, swords, spears, fishing traps. Their fishing nets are made from twine, umbrellas from landle and ribs of bamboo which are covered by Gungu leaves and their hooded water proof coats are also made from the Gungu leaves. Traditionally, tribals were depended on the forest and forms for their ritual and economic livelihood, but in recent times, a few of them have become mainly settled as cultivators, it is seen that most of these people do not have their own land thus, they are largely dependent on the labour work in the fields in order to earn their livelihood. Most of these people are adapting modern civilization and culture and migrating towards towns for changing their economic activities.



Forest have a very strong relationship with the health of the human being. They are associated with physical, psychological and spiritual health of the people worldwide. Forest helps us to provide clean air, water and good environment to leave. It helps us by reducing the risk of climate change, various disasters and also from some major noncommunicable diseases. We also get various trees and plants from the forests which have medicinal properties and are used for treating various types of diseases. Tribals and people of this region are also very dependent on traditional health care system which are dependent on the forest produce. In this region there are some important person in every tribes who were called as “jan guru” or “ojha” who have knowledge about various trees, plants and etc. for treating various kinds of diseases. Like *Catharanthus roseus* (Nayanthata) used for treatment of diabetes, *Shorea robusta* (Sarjom) used for treatment of Wounds, Carbuncle, Sores, Smallpox, Fever, Eye-problems,

Hydrocele, Cholera, *Datura stramonium* (Datura) use for treatment of Headache, Wounds, Toothache, Rheumatism, Epilepsy, Smallpox, Kala-azar, Hydrocele, *Calotropis gigantea* (Akaona) used for treatment of Rheumatism, *Madhuca longifolia* (Matkom) used for treatment of Intestinal worms and etc. Due to getting various benefits from these trees they are treated as sacred and are protected and not exploited for the economic purposes.

These tribes also celebrate various festivals to show their respect towards forest like Sarhul is a flower festival in which Sal (*Shorea robusta*) flowers full blossom and on this occasion, tribal peoples perform the symbolic marriage of the sky with the earth to ensure the fertility of the mother earth. Karma festival is celebrated in which a young sapling of the Karma tree (*Adina cordifolia*) is planted while singing and dancing. These tribes protect the forests as it is believed that if they don't do then it will lead to a natural calamity.

These tribals have important role in the forest protection because they are not polluting the environment, and they don't use modern polluting materials, they protect certain plants and animals because they worship those plant and animals, they also protect them from external agents and external people does not enter these areas, thus it also protect local flora and fauna from theft, they give information regarding endemic species inside the forest, they supports in various government programs, and they play major role in fighting forest fire too. By looking at the life of these tribes we also get a sense of the Importance of forests in our existence. We also get to know how much important work these tribals are doing for forests protection and management. So it should be our duty also to create awareness among the peoples and to respect their rights. Government should also take various initiatives in which they includes tribals in their protection programs to increase the respect of tribals in the society. So it is not only the work of tribes to protect the forests but it is our duty also to take a step forward in forest protection. We should have to work hand in hand with these tribals to make them believe how much important work they are doing and create awareness about this. So, as we know the theme of this year for International Day of Forests is “Forests and Health” so we should also pledge to protect forests and tribals and provide them everything so they can attain good health because that only will lead to our good health.

A CRISPR WAY FOR ACCELERATING IMPROVEMENT OF CROP PRODUCTIVITY AND AGRICULTURAL SUSTAINABILITY

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Agricultural experts are quite excited about recent advancements in genome editing technology. The rapid development of Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) has contributed to the increased adoption of genome editing. Genome editing using CRISPR-Cas9 is being employed to quickly, simply, and effectively change the genes in a variety of plant species. Plant scientists are employing the genome editing technique CRISPR-Cas9 to enhance crop qualities. Additionally, this method might assist in easing regulatory concerns related to plants that have undergone genetic modification because it does not include foreign DNA. Along with the further development of this genome editing tool, we anticipate that enduring issues in plant science, such as genomic area manipulation, enhance crop productivity, disease resistance plant varieties etc., will be resolved.

Introduction

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology is a powerful gene-editing tool that allows for precise and efficient modifications to an organism's DNA. The CRISPR system is based on a natural defense mechanism used by bacteria to protect against viruses. The system works by using an enzyme called Cas (CRISPR-associated) to cut DNA at specific locations, guided by a short RNA molecule that is programmed to recognize a specific target sequence. CRISPR technology has the potential to revolutionize many fields, including medicine, agriculture, and biotechnology. In medicine, CRISPR could be used to develop new therapies for genetic diseases by correcting or removing disease-causing mutations. It could also be used to create more precise and effective cancer treatments. In agriculture, CRISPR could be used to develop crops that are more resilient to environmental stressors such as drought, pests, and disease, as well as to create crops with improved nutritional content. In biotechnology, CRISPR could be used to create new industrial enzymes, produce biofuels, and develop new materials. Regarding the choice of genome editing toolkit, a variety of methods are available, including zinc finger nucleases (ZFNs), transcriptional activator-like effector nucleases (TALENs), and the most recent CRISPR/CRISPR-associated nuclease 9 (Cas9) system.

Comparable features of plant genome editing approaches

Target DNA is denatured by CRISPR/Cas9 by creating single-strand DNA nicks or double-strand breaks (Cas9

nuclease). By choosing a distinctive crRNA sequence, off-target effects can be reduced. The primary advantage of CRISPR is multiplexing. Multiple genes can be altered simultaneously with the utilization of Cas9 only. A single monomeric protein and chimeric RNA make up the CRISPR system. Target DNA can undergo double-strand breaks as a byproduct of Zinc Finger Nucleases (ZFNs). It produces off-target effects. It is quite difficult to multiplex using ZFNs. ZFNs serve as the only necessary dimeric protein. ZFNs possess the FOKI restriction endonuclease's catalytic domain, which causes a DSB to be produced. Target DNA undergoes DSBs as a result of transcription factor-like effector nucleases (TALENs). Effects that are off target cannot be prevented. Using TALENs, multiplexed genes are incredibly difficult to obtain. The CRISPR-Cas system is a naturally occurring defense mechanism used by bacteria and archaea to protect themselves against invading viruses and plasmids. The system works by storing small fragments of viral DNA or RNA sequences, called "spacers," within the bacterial genome in between repetitive DNA sequences, known as "CRISPR arrays." These CRISPR arrays are transcribed into short RNA molecules called "CRISPR RNAs" (crRNAs), which are then bound to Cas proteins to form an effector complex.

Applications of CRISPR-Cas in agricultural productivity

CRISPR technology has the potential to improve crop productivity by enhancing plant resistance to diseases and pests, increasing yield, and improving the nutritional content of crops.

- ✓ **Disease resistance:** CRISPR can be used to create crops that are resistant to diseases caused by viruses, bacteria, and fungi. This can reduce the need for harmful pesticides and increase crop yields.
- ✓ **Improved nutrition:** CRISPR can be used to enhance the nutritional content of crops. For example, scientists have used CRISPR to create tomatoes that produce more lycopene, an antioxidant that has been linked to a reduced risk of cancer and heart disease.
- ✓ **Drought and heat tolerance:** CRISPR can be used to create crops that can survive in harsh environments. By editing the genes that regulate a plant's response to water and temperature stress, scientists can create crops that can survive droughts and heatwaves.

Increased yield: CRISPR can be used to create crops that produce higher yields. By editing the genes that control a plant's growth and development, scientists can create crops that are more productive and require fewer resources.

AN UNIQUE INITIATIVE TO SENSITIZE PUBLIC ABOUT NATURE

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An exclusive art Exhibition on Bird and Nature, entitled "Golok Dhadda" (Circular Puzzle) was organized between 10-12th August, 2022 by Artist's Canvas at the prestigious Ramkrishna Mission Art Gallery, Kolkata. This unique exhibition highlighted upon the education and awareness of the public towards nature, ecosystem and a wide spectrum of bird biodiversity across the planet. Indeed it was a platform where science and arts fused to give a total new perspective to our understanding of arts and culture in one hand and the environment on the other.

One of the participating artist Ms Soma Bhowmik, a familiar name in the arts circle and who was felicitated at this suggested "...it is indeed a great opportunity for us as artists to connect to the public for such an unique exhibition where we are focusing exclusively on our ecosystem and avian members across the planet. I am proud to be a part of this not only for showcasing my artwork; but, observe and learn from the work of other exceptional artists and how they connecting with nature from their perspectives abs understanding of nature. It is important to create a regular bridge with the audience to help them understand and appreciate the rich planet with share with other living

beings." Indeed the gallery exhibition received a sweeping attention from the audience a significant chunk being School, college abs university students who represent our next generation and must be sensitized about our fragile environment to become responsible citizens in the future.

The spectacular diversity of artworks exhibited captured rich diversity of ecosystems from both India and abroad. The images represented freshwater and marine ecosystems, deserts and vast plains, valleys, mountains, tropics, sub tropics, temperate and polar habitats with use of different colours. Birds such as eagle, hawks, kites, owls, vultures, crows, ravens, falcons, bulbuls, sparrow, parakeets, macaw, cuckoos, pigeon, dove, mynah, kingfishers, common iora, blue peafowls, ducks, geese, cranes, storks, jungle fowls, pelicans, hornbills, toucans, finches, barbets, tree pies, crow pheasant, jungle babbler, tailor birds, orioles and woodpeckers were the eye catchers. Mammals captured commonly on ecosystem based nature themed images include tigers, lions, leopards, cheetahs, wild cat, leopard cat, fishing cat, deers and antelopes, rabbits avid hares, squirrels, elephants, bats, wild ass, snakes, marine and freshwater fishes, crocodiles and turtles. Spectacular pictures of flowers from various biomes were eye catchers. Furthermore, several art exhibited pollinators like the bees, butterflies, moths, beetles, flies, wasps, hornets and ants. The exhibition primarily captured our rich global, regional and local ecosystems, and the spectacular biodiversity of forests, birds and other species.



Artist Soma Bhowmik felicitated for her bird artwork.



With Swamiji, Artist Biman Nag and Soma Bhowmik at the inauguration of an exclusive art Exhibition on Bird and Nature. "Golok Dhadda" at RAMKRISHNA MISSION GALLERY GOLPARK KOLKATA.



Artwork by Soma Bhowmik

Why is such an exhibition important from perspectives other than promotion of art and culture? It is because of the dissemination of education and awareness among the public about nature abs biodiversity. It is most important for

us to realize under the current global circumstances that environmental sensitivity is a serious international issue. It is not always possible for scientists, researchers, academic, conservators, foresters, ecologists to always cater to the



Artwork by Soma Bhowmik

public through conventional approach such as interviews, lectures, articles and demonstrations. But a picture shares a 1000 words in its own form.

Thus it is important that we realize that arts and crafts could be an effective way of communicating about both science and environmental issues, forest, wildlife and biodiversity conservation, and in exploring various rich ecosystems of our planets. I extend my heartiest congratulations to the

organizers and RK Mission Gallery for hosting such an outstanding art exhibition dedicated to nature, ecosystem and avian biodiversity and in creating positive impacts on the public. It is a platform where arts and nature has fused to design an entirely new perspective and narrative helping people to realize the beauty of our planet in which we live and to appreciate the species that we co-inhabit with.

Photo credit: Saikat Kumar Basu

ENROLL YOURSELF TO NESA NEWSLETTER EDITORIAL BOARD MEMBER

Editorial board members of NESA newsletter will be revised for the year 2023. All the interested applicants may send their curriculum vitae to Editor in Chief by **15th June, 2023**.

LANDSCAPE TRANSFORMATION BY SPECTACULAR FLORAL BLOOM

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The spectacular flowering of 'Flame of the Forest (Butea monosperma, Fabaceae) commonly called 'Polash' in Bengali across the entire landscape of Purulia district (West Bengal, India). This legume tree flowers during March/April and transforms the landscape into an amazing dreamland.

This monumental natural beauty of Purulia is a great tourist attraction. With hundreds and thousands of the trees in full bloom with conspicuous red colour of the flower creates a mesmerizing illusion impact of the forests and hill on fire from a distance. Three different colour variations are seen. The most common colour is red followed by occasional yellow varieties and the white flowered are the rarest in nature. In addition to Polash, other Fabaceae family members bearing beautiful bright red flowers such as the coral tee (Erythrina variegata), gulmohor (Delonix regia), krishnachura (Caesalpinia pulcherrima), Asoka (Saraca indica), simul (Bombax ceiba) also flower at the same time.



All these species of trees contribute significantly to naturally beautify the local landscape, dominated by Polash trees. The scenery is once in a lifetime opportunity to enjoy the abundant beauty of our majestic nature in its monumental colour palette. It is therefore important to

conserve such unique ecosystems with unparalleled natural beauty for our next generations.

Photo credit: **Saikat Kumar Basu**

APPLICATION OF NANO-SCIENCE IN AQUACULTURE

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Introduction

Aquaculture is considered one of the most important food production systems both in terms of economic impact and food security, and the ongoing development of this industry is a key factor in the strategy to guarantee global nutritional safety. Nowadays, different types of nanotechnology-based systems have been employed to increase its production, efficiency and sustainability. Nanotechnology has emerged as a promising solution opening the door to new possibilities. Besides conventional toxicological assays, scientists are also using cellular cytotoxicity, apoptosis as well as bioinformatics based interactive tools to narrate nanotoxicity and its remediation applying green nanoparticles in bacteria and fish model. The global nanotechnology market applied to food sector was recently projected to increase at an annual rate of more than 24% during the period 2019–2023, reaching \$ 112.48 billion, the growing applications in nutraceuticals primarily responsible for this market boost ([Technavio, 2016](#)). Currently, the available information suggests that nanofood sector is led by the United States, followed by China, Japan and the European Union (EU) ([Chaudhry and Malik, 2017](#); [Thiruvengadam et al., 2018](#)).

Nanotechnology

In simpler words, nanotechnology is nothing but the changes on matter on an atomic or molecular level. According to United States National Nanotechnology Institute (USNNI) nanotechnology is the understanding and control of matter, where dimensions of roughly 1 to 100 nm are taken. The nanometre scale is found within this range (1-100 nm) in which the crucial rules of chemistry and physics are not pertinent in nanotechnology. In general, most important feature of nanotechnology is the size along with different field of application, predominantly in molecular basis. On the other side, nanotechnology means the study, design, creation and application of functional matter in nanometre scale.

Application of nanotechnology in different frontiers of aquaculture

Enhancement of fish growth

In the aquaculture and seafood industries, nanotechnology has a wide potential for application. Limited information exists about the impact on marine species. Young carp and sturgeon have been shown to grow more rapidly due to the effect of iron nanoparticles. It was also noted that the diet supplemented with nano-selenium could boost fish weight, relative gain rate, and fish antioxidant status, and increase

the activity of glutathione peroxidase and muscle selenium concentrations of crucian carp (*Carassius auratus gibelio*) (Handy et al., 2012).

Water filtration and remediation

For the removal of contaminants from water, nano-enabled technologies are available today. In aquaculture applications for holding aerobic and anaerobic biofilm for the removal of ammonia, nitrites, and nitrate contaminants, nanomaterials in the form of activated materials such as carbon or alumina, with additives such as zeolite and iron-containing compounds, can be used. Ultrafine nanoscale iron powder can also be used as an important method for the cleaning of less toxic, simpler carbon compounds such as trichloroethane, carbon tetrachloride, dioxins, and polychlorinated biphenyls, thereby paving the way for nano-aquaculture (Rather et al., 2011).

Nanotechnology in nutritional aquaculture

Nanoparticle can alter feed consumption pattern by adding flavor, color, or attractants etc. Some water-insoluble vitamins, carotenoids, can be solubilized by processing with nanoparticles and used as a dietary supplement for better bioavailability. Supplementation of selenium nanoparticles with basal diet demonstrated an improvement in weight gain, antioxidant profile, and muscle bioaccumulation in crucian carp. Nanosilver has been found to improve overall growth, protease, and metalloprotease activity in zebrafish (*Danio rerio*).

Nanotechnology for gonadal maturation and breeding of fish

Injection of stimulating hormones like human chorionic gonadotropin (HCG), etc. are delivered from the pre-spawning phase, and fish are met with handling stress, occupational pain, etc. Nano-encapsulated hormonal delivery found to be a more efficacious alternative to this approach. An improved and controlled nano-delivery system was demonstrated to surpass the fundamental dilemma of precise life span of leuteinizing hormone-releasing hormone (LHRH) in blood circulation averting the need of multiple applications of injections in fish.

Nanotechnology in aquaculture biotechnology

Nanoparticles provide an attractive receptor and function as scaffolds for nucleic acids. In fisheries, nanofabricated technology can be utilized in DNA and protein microarray for analysing genetic polymorphism, new biomarker discovery, and differential gene expression, etc. Biochips and microfluidic chips can accomplish high throughput screening and can be employed for developing DNA and protein marker-dependant detection as well as identification systems.

Nanotechnology in fish disease control

The occurrence of disease is one of the major menace to intensive aquaculture system. An antibody-based, highly sensitive immunodiagnosics protocol has been designed by attaching nanoscale gold with alkaline phosphatase (ALP) conjugated secondary antibody titre against white spot syndrome virus (WSSV) strain in shrimp. Nano sensors

are also effective and easy solutions to identify pathogens. Different nano sensors can be effectively used to detect important aquaculture viruses. The antimicrobial and prophylactic properties of nanomaterials like nano silver, zinc oxide nanoparticles are already exploited to reduce the pathogenic load in the aquaculture system.

Nanotechnology for fish quality testing

The freshness of fishery products is a real health and quality concern. To address this issue, a quantum dot-based nano sensor has been designed. The electrochemical output displayed a higher sensitivity, quicker response time, and extensive linear range. Formalin appears as a great menace on modern days 'fish-food safety'. Formaldehyde nanobiosensor was designed applying an enzyme (formaldehyde dehydrogenase) and nanomaterial (carbon nanotubes, chitosan) for precisely detecting this impending human health hazard.

Nanomaterial synthesis from fish-waste and their bioactivity

Throughout the world, a major part of (30-35%) fin and shellfish are discarded as unconsumed waste, which otherwise also works as a center of pathogenic infestation and spread foul smell. Unconsumed fish-waste has been engineered to develop nano materials to open up an attractive market for discarded materials that provide 100% value to productivity as well as sustainability in aquaculture.

Nano-remediation of the aquatic system

The sustainability of aquaculture depends on the quality of the aquatic medium. Development of novel forms of nanomaterials triggers new achievements in the remediation of aquatic environment that might exclude the minute contaminants from water and can design "reactive surface coatings" or "smart materials" with specificity towards certain toxicants.

Aspects of nano-toxicity

As fish lives in aquatic environment, every nanoparticle pass through a water medium before inducing its beneficial impact. Silver in the colloidal form were found to be more toxic than suspended solid form, and increase in nanoparticles size could reduce the toxicity effect as studied in rainbow trout. Nanomaterials showed a great difference in their toxicity impact on the fish system. Selenium nanoparticles showed higher bioavailability and toxicity than selenite in Medaka fish (*Oryzias latipes*). In aquatic medium, addition of nanomaterials leads to direct gill exposure.

Nanotechnology devices for aquatic environment management

The application of nanotechnology in seawater shrimp aquaculture showed that the nanodevice was able to reduce the rate of water exchange and increase both the quality of water and the survival rate of shrimp and thus the yield (Wen et al., 2003). Among several nanodevices, nanonet treatment was the best device; the results showed a 100%

increase in fish survival rate, and a decrease in both water nitrite and nitrate; and nitrite decreased to as low as 1/4 of the control group. Nanotechnology has also increased the pH of water and greatly improved the efficiency of water (Liu, 2008).

Nanotechnology as a new tool in fish diseases

Nanotechnology is capable of observing, measuring, manipulating, and producing things on a nanometer scale. A nanometer (nm) is a SI unit of 10^{-9} duration or one-billionth of a meter distance (Mongillo, 2007). The name "nanomaterial" is built on the word "nano," which comes from the Greek word meaning "dwarf." Usually, the term nanomaterial is used for materials ranging from 1 to 100 nm in size (Rai and Ingle, 2012).

Other applications in aquaculture and marine industries

In the fishery sector, nanotechnologies are widely used for many purposes such as water purification, fish pond sterilization, nanofeed for fish nourishment, and aquatic disease management. Nanotechnologies have been commonly used to treat water and breed fish. The application of nanotechnologies in aquaculture of seawater shrimp showed that the nanosystem was capable of improving water quality, decreasing water exchange rates, and increasing shrimp survival and yield (Wen et al., 2003).

Nanotechnology risk assessment and governance

Currently, the potential toxicity of nanoparticles in biological system is becoming a public concern. Nanomaterials may constitute a new source of pollutants to the environment, and research is being focused on the potential negative impact that they could produce (Moore, 2006; Shah and Mraz, 2019). Owing to its extremely small size, nanoparticles can penetrate through the cell membranes and cause genotoxicity. The intrinsic chemical reactivity of nanomaterials results in higher production of reactive oxygen species and free radicals; and its production is one of the main toxicity mechanisms of nanoparticles. This may produce not only inflammation and oxidative stress, but also damage to proteins and DNA. It has been demonstrated the nanomaterials potential to produce DNA mutation and major structural damage to mitochondria, that could even result in cell death (Majumder et al., 2017; Meghani et al., 2020).

Conclusion

Nanotechnology research and development holds unique, multiple promises to improve and innovate conventional aquaculture practices along with a handful of challenges. The application of nanoparticles also reduces gaseous contaminants, unwanted spreading of algae and diatom in the aquatic ecosystem.

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ACTIVITIES AND SPECIAL DAYS IN THE MONTH OF MARCH 2023

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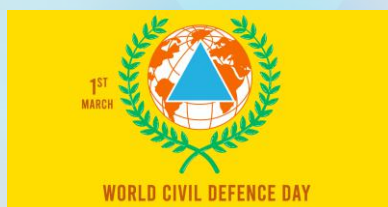
1st March – Zero Discrimination Day

Every year on March 1st, Zero Discrimination Day is observed around the world to ensure that everyone, regardless of age, gender, ethnicity, skin colour, height, or weight, is treated with dignity. The butterfly is the symbol of Zero Discrimination Day. To begin, the United Nations commemorated this day on March 1, 2014.



1st March: World Civil Defence Day

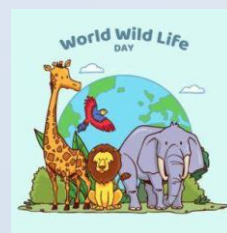
Every year on March 1st, World Civil Defence Day is commemorated to raise public awareness about the significance of civil protection and to honour the efforts, sacrifices, and accomplishments of all services involved in



disaster relief. In 1990, the International Civil Defense Organization (ICDO) decided to commemorate this day.

3rd March - World Wildlife Day

On March 3rd, the world commemorates World Oceans Day, which is directly linked to Sustainable Development Goal 12: Life without Water, which focuses on marine species and highlights the concerns and important issues that marine biodiversity poses to our daily lives.



3rd March - World Hearing Day



Every year on March 3rd, World Hearing Day is commemorated to raise awareness about methods to prevent deafness and promote hearing around the world.

4th March - National Safety Day

The National Safety Council of India commemorates National Safety Day on March 4th. This day is observed to protect people from a variety of troubles such as financial loss, health problems, and other problems that they may encounter in their daily lives.



8 March - [International Women's Day](#)



Every year on March 8th, the world celebrates the social, economic, cultural, and political achievements of

women. It's also a step toward achieving gender parity. Purple is a colour that is associated with women all across the world. Theme of International Women's Day 2023 is "Digit ALL: Innovation and technology for gender equality"

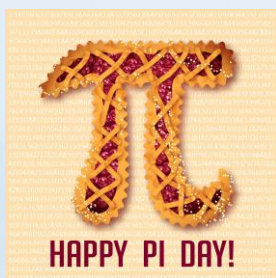
9 March: [No Smoking Day](#) (Second Wednesday of March)

Every year on the second Wednesday in March, No Smoking Day is marked to raise awareness about the adverse health effects of tobacco use and to encourage people all over the world to quit smoking. It falls on March 9 this year.



14 March: [Pi Day](#)

Pi Day is celebrated all across the world on March 14th. Pi is a mathematical constant represented by a symbol.



14 March: [International Day of Action for Rivers](#)

The International Day of Action for Rivers is observed every year on March 14th to raise awareness about river protection and demand better river policies. It's a day to raise awareness about the threats to our rivers and come up with solutions together.



15 March: [World Consumer Rights Day](#)

It is commemorated every year on March 15th to increase global awareness about consumer rights and concerns. This day is a chance to demand that all consumer rights be acknowledged and protected, as well as to protest societal injustices.



16 March: [National Vaccination Day](#)

Every year on March 16, India celebrates National Vaccination Day, also known as National Immunization Day (IMD). When the first dose of Oral Polio Vaccine was delivered on March 16, 1995, it was the first time it was noticed. It is an attempt to raise awareness about the need to eradicate polio from the Earth.



18 March: [World Sleep Day](#)



Every year on the Friday before the Spring Vernal Equinox, World Sleep Day is observed. It will be commemorated this year on March 18, 2023. It's a rallying cry for

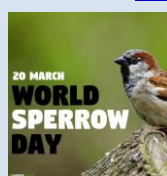
action on critical sleep concerns like medicine, education, social issues, and driving. World Sleep Day's slogan is "Better Sleep, Better Life, Better Planet."

20 March: [International Day of Happiness](#)

Every year on March 20th, the International Day of Happiness is commemorated. This day has been observed by the United Nations since 2013 to commemorate the importance of happiness in people's lives all across the world.



20 March: [World Sparrow Day](#)



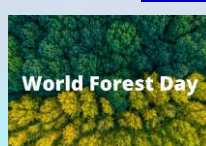
On March 20th, the world commemorates World Sparrow Day to raise awareness about sparrow conservation. This day also honours the human-sparrow bond, encouraging people to love sparrows and recognize their value in our lives.

20 March: [World Oral Health Day](#)

World Oral Health Day is marked on March 20th to raise awareness about oral health. The topic of World Oral Health Day 2023 is "Be Proud Of Your Mouth." To put it another way, you should cherish it and take care of it.



21 March - [World Forestry Day](#)



Every year on March 21st, World Forestry Day or International Day of Forests is commemorated to raise public awareness about the importance, value, and contributions of forests in balancing the earth's life cycle. World Forestry Day was created in 1971 during the European Confederation of Agriculture's 23rd General Assembly.

21 March: [World Down Syndrome Day](#)

Every year on March 21st, World Down Syndrome Day is commemorated. Down syndrome is a chromosomal arrangement that occurs spontaneously in humans and has varying implications on learning methods, physical traits, and health. In December 2011, the United Nations General Assembly proclaimed March 21st as World Down Syndrome Day.



22 March: [World Water Day](#)



Every year on March 22nd, World Water Day is commemorated to raise awareness about the importance of freshwater and to advocate for its sustainable management. It was suggested that the United Nations Conference on

Environment and Development (UNCED) in Rio de Janeiro celebrate it in 1992. The inaugural World Water Day is commemorated in 1993. Theme of the 2023 World Water Day and the World Toilet Day campaign, of the same year will be "Accelerating Change."

23rd March: [World Meteorological Day](#)

Every year on March 23rd, World Meteorological Day is commemorated to draw attention to the importance of weather and climate to society's safety and well-being.



24 March: [World Tuberculosis \(TB\) Day](#)



World TB Day is celebrated every year on 24 March annually to commemorate the date when Dr. Robert Koch announced his discovery of Mycobacterium tuberculosis,

the bacillus that causes TB in 1882. This Day is observed to educate people about TB, its impact around the world.

26 March: [Purple Day of Epilepsy](#)

It's celebrated on March 26th to raise awareness about epilepsy and its effects on people's lives. The day also serves as a reminder to epilepsy sufferers that they are not alone.



PASHANBHEDA (*BERGENIA CILIATA*) : A LESSER KNOWN MEDICINAL PLANT OF HIGH VALUE

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Ayurvedic name: Shailagarbhaja, Pashanbheda

Unani name: Zakhmehayat, Pakhanbed

Hindi name: Pakhanabhed, Pashanbheda

English name: Hairy bergenia

Trade name: Pashanabhed

Parts used: Rhizomatous Rootstock or Rhizome

Saxifragaceae



Bergenia ciliata

Morphological Characteristics

This is a rhizomatic herb with fleshy leaves, growing upto 30 cm tall, having a stout creeping rhizomatous rootstock with scars and intermittent axillary buds. Plant is quite hardy and able to survive frost during winter turning reddish in colour. It is evergreen and flowers in April to June. Its flowers are white pink and purple in colour. Stem is short. The rhizome comes out from the cervices of rocks and hangs in the air in sloppy areas. Leaves are 5-30 cm long, glabrous, sparsely hairy in margins, broadly obovate or elliptic, finely or sparsely denticulate or shallowly sinuate-denate.

Floral Characteristics

The flowers are bisexual, white, pink or purple with long cymose panicles 4-10 cm long. The fruit is a capsule and rounded in shape. Seeds are greyish in colour, minute and numerous in one capsule.

Distribution

The plant is endemic to Northern and Eastern temperate Himalayan region in Himachal Pradesh, J&K, Uttaranchal, Nepal and North Eastern hilly states between altitudes of 2100-3000 meter in the cold or glacial mountain rocky slopes in stone crevices. It is also found in adjoining countries like Pakistan, Afghanistan upto Tibet and China in higher altitudes.

Climate and Soil

Plant grows well under humid, temperate climatic conditions, where temperature generally remains below 20°C. Plant grows well over sandy, slightly acidic soils with high porosity and rich in organic matter or forest humus. However due to its hardy nature, this species can be grown well over medium loamy to clay soils, supplemented with manure. It tolerates light shade and grows well under open sunny conditions. But the vegetative growth has been found better in shade.

Propagation Material

Rhizome Segments: 8-14 cm long and 23-26 gm in weight are used for direct planting; annular segments of 2 cm thickness are preferred for nursery raising.

Seeds: Seed germination is low and seed viability is very poor.

Agro-technique

Nursery Technique

- **Raising Propagules:** It takes about one month to develop a mother nursery which can supply planting material for raising cultivation.
- i) **By Rhizome Segments:** The crop can be raised by direct planting of 7.5-12.5 cm long rhizome segments (average weight: 23-26 gm) with 2-3 nodes as propagation material for quick and faster regeneration in the field in late summer or onset of monsoon. It is treated with 100 ppm IBA solution for two minutes. Raising crop through

rhizome segments can reduce crop cycle by one year in comparison to propagation through seed sown. However, it requires large quantity of rhizome sections for planting. It is noted that the smaller rhizome segments of about 2 cm thickness can be planted at spacing of 10X10 cm in nursery. The rate of growth is slow and as it takes about 18 months time for raising plants in nursery for field planting.



- ii) **By Seed Method:** The seeds are very minute in shape and exhibit poor viability and germination potential. They exhibit slightly recalcitrant nature and need to be used immediately after maturity in spring season (March-April). The seed is stratified for 15 days at 4°C to improve germination. Storing will lose viability. Seeds are sown over top surface of raised beds or poly bags over the moist layer of forest litter or farmyard manure preferably under green house conditions. The seeds take 60-90 days for germination. After germination, the seedlings are picked out at two-three leaved stage and planted in fresh nursery beds at spacing of 10X10 cm and takes a season to grow large before planting in the field in next summer.
- iii) **Propagule Rate and Pretreatment:** About 88,000-90,000 plants are needed to plant one hectare land for which approximately 18-20 quintals fresh biomass of rhizome is required. Before planting, the rhizome segments should be treated with 100 ppm IBA solution for two minutes or soaked in plain water for two hours.

Planting in the Field

- **Land Preparation and Fertilizer Application:** It is a hardy plant hence it can be planted in spring as well as summer in the hills; although the best time for planting is monsoon time (July). Land preparation is as usual for growing crops in hills. Add 35 t/ha of FYM and plough the deep in the soil. After planting, make 9-12 cm raised beds or shallow ridges for intercultural operations. For proper water retention and enhancing the porosity of soil, add sufficient quantity of locally available peat moss or the forest litter. It enriches soil with useful microfauna and micorrhiza, which help growth.
- **Transplanting and Optimum Spacing:** The rooted plants should be transplanted in the field in 12-15 cm raised bed at a spacing of 30X30 cm. While planting in the raised beds, keep at least 5 cm space on each side of bed along the length so that three rows of plants can be adjusted.
- **Intercropping System:** The maximum height of plants which can be achieved under optimum growing conditions may be 30 cm with heavy leaf biomass. Intercropping is possible when the two crops growing together do not compete for same nutrients. Under this study some experimental study was conducted by planting annual crop of *Swertia angustifolia* (Chirayita) plants in a spacing of 15 cm in straight line between the gaps of two rows which showed very encouraging results and it was concluded that because these two crops have different maturity period and crop cycle, hence they can be grown together successfully.

- **Interculture and Maintenance Practices:** The leaves of plants are prone to decay during rainy season. Such leaves must be removed immediately from the plants to avoid any fungal infection. The slope of water drainage can be put toward inner side of field to protect the fertile soil from washing away.
- **Irrigation Practices:** The crop should be given irrigation an interval of 15 days in summer season. Sprinkler irrigation can be tried to keep the humidity level high at canopy level.
- **Weed Control:** Broad leaved weeds and some perennial grasses are common during rainy season which should be uprooted immediately. Six weeding operation are needed per year.
- **Disease and Pest Control:** Leaf hopper and snails generally attack the foliar part of crop. No bacterial and fungal diseases were reported. To check the disease, the extra foliar growth should be removed. Sometimes extreme frost conditions are observed in high hills which lead to leaf and flower decay.

Harvest Management

- **Crop Maturity and Harvesting:** The crops mature in autumn from the second year and onwards. However, it is recommended to harvest roots during third year.
- **Post-harvest Management:** The underground rhizomes are taken out and after removing the leaf and soil debris, they are washed thoroughly under running water and cut it into small pieces of 5 cm long and allowed to dry in partial shade for 8-10 days or till complete drying (4-6% moisture stage). The dry rhizomes are packed in gunny bags and stored in cool and dry conditions.
- **Chemical Constituents:** The rhizome of *Bergenia ciliata* contains Bergenin (0.6%), Gallic acid and Tannic acid (14.2%), Glucose (5.6%, mucilage and wax).
- **Yield and Cost of Cultivation:** The plant yields 7.0-7.2 tonnes rhizomes per hectare (dry biomass) after second year when the crop is raised through rhizome cuttings. The cost of cultivation for one hectare may come to Rs.74,455/-.

Therapeutic Uses

The drug is used as litholytic agent for urinary calculi. It is widely used in the treatment of dysuria, cystitis, crystalluria and renal failure, vertigo and headache. The rhizomes and roots of the plant act as astringent, tonic and have anti-inflammatory effect and are applied as poultice for stiff joints, boils, abscesses and skin infections. The root powder is considered to be a mild diuretic, but in higher doses, it exhibited anti-diuretic action. Various Ayurvedic classical drugs such as *Pashanabhedadi kwath*, *Pashanabhedadi ghrit*, *Pashanabhedadi Churan* etc. are prepared from Pashanbhed rhizome.

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