BIO NEWS

Quarterly e-newsletter of the Institute of Biology, Sri Lanka

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COVER STORY
Our cover page depicts a photograph of a Common Shrub Frog (*Pseudophilautus popularis*) which is endemic to Sri Lanka. This species is distributed in many localities within the lowland wet zone of Sri Lanka. The male frog possesses a vocal sac that out pockets the floor of the mouth and it helps them to amplify & intensify their mating or advertisement call.
Source https://amphibiaweb.org/species/6494. Accessed 10th April 2022

CONTENTS

Winners of Sri Lankan Biology Olympiad 2021

Sri Lanka Biology Olympiad Competition 2021 was organized by the Institute of Biology Sri Lanka to select participants for the International Biology Olympiad Challenge. The competition was held as an online examination with Zoom proctoring on the 16th of January 2022. Among all the winners there were 10 Gold medalists, 14 Silver medalists, and 15 Bronze medalists. W. A. T. M. P. C. Thennakoon of Ananda Maithreya College, Balangoda won first place in the examination. The second place was won by R. K. Pravin from D. S. Senanayake College while A. Harshan of Jaffna Hindu College and P. G. Wanniarachchi of Hambanthota Rajapaksha Central College won joint third place. Ten students selected from Gold and Silver Medalists will be trained by the Institute of Biology Sri Lanka resource personnel from the Universities of Colombo, Sri Jayewardenepura, and Kelaniya, to compete in the International Biology Olympiad Challenge 2022, which will be conducted in Armenia in July this year.

1st Place

W. A. T. M. P. C. Thennakoon
Ananda Maithreya College
Balangoda

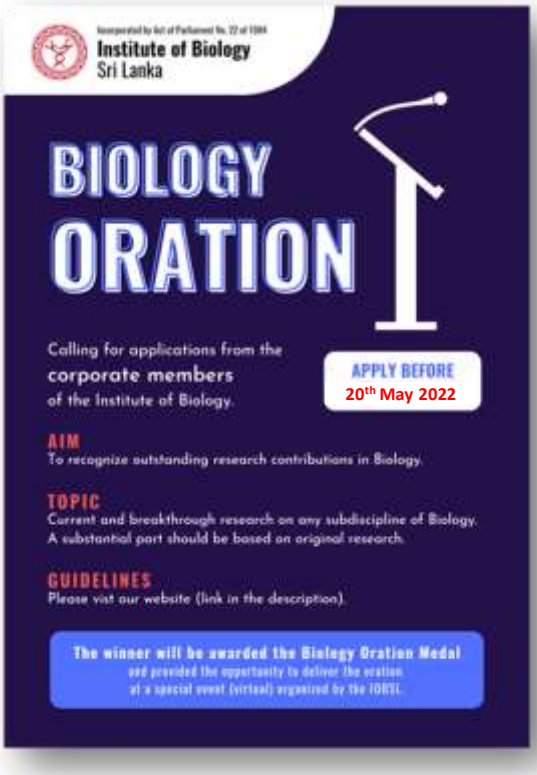
2nd Place

R. K. Pravin
D. S. Senanayake College

3rd Places

A. Harshan
Jaffna Hindu College

P. G. Wanniarachchi
Hambanthota Rajapaksha Central College



Biology Oration

The Institute of Biology, Sri Lanka is organizing a '**Biology Oration**' with the objective of recognizing outstanding research contributions in biology. Additionally, the Biology Oration is expected to provide a platform to promote awareness of the Institute of Biology among relevant stakeholders-in the field of biology in Sri Lanka. The corporate members of the Institute are eligible to apply for the Biology Oration. A judging panel of experts from subdisciplines of biology will assess the applications. The winner/winners will be awarded the Biology Oration Medal and will be provided with the opportunity to deliver the oration at a special virtual event to be held in July 2022. All information on the Biology Oration will be available through the IOBSL website

IOBSL Inter-University Biology Quiz Competition

IOBSL has conducted an annual national-level Inter-University Biology Quiz Competition for undergraduates of state universities for a number of years. The competition aims at providing undergraduates with a novel educational experience while enhancing their interest in biology. The competition will also provide an ideal opportunity for collaboration and inspiration among students, academics and universities across the country. The competition consists of two stages. Stage I will be held on 24th May 2022 and consists of a 1-hour paper with MCQs/short questions. This will be held in an online mode and will screen the participants for the second round. Stage II is planned to be held as a live quiz competition on 27th June 2022. All information on the quiz will be available through the IOBSL website.

Institute of Biology Photography Competition

This year the IOBSL will organize a national competition on biology photography. Highlighting the ever-increasing anthropogenic threats to biota, and their survival struggle, the competition in 2022 is on the theme of '***Nature's battle: A struggle to thrive in a polluted world***'. Only photographs of animals and plants carrying a message to the general public relevant to the given theme will be accepted for the competition, which will be open to professional, amateur, and youth photographers in Sri Lanka irrespective of their age, and when the photos were taken. Entries will be judged by a panel of experts in photography, publishing, education and conservation aspects. The winning images will be selected on overall appeal, technical quality, originality, and artistic merit. Images that pass onto the semifinal round will be published on the IOBSL official Facebook page as entries for the popularity contest which will select the most popular photograph through viewer voting. All information on the competition will be available through the IOBSL website.

Annual Sessions of IOBSL

The inauguration of the 42nd Annual Sessions of IOBSL will be held on 30th September 2022 at the Marino Beach Hotel, Colombo 03. This year's theme "***A paradigm Shift in Biology***" will explore the recent discoveries, advances and applications of biology while focusing on how they can be integrated to improve the Sri Lankan economy. The abstracts are called on four tracks: Plant and Environment Sciences, Zoological Sciences, Molecular Biology, and Biotechnology, and Microbiology and Chemical Biology. A panel of judges consisting of renowned researchers will assess each presentation. The best presenter of each track will be recognized with the Best Presenter Award at the closing ceremony that will be held at the end of the Annual Sessions. The deadline for abstract submission is 24th June 2022. Registrations for the annual sessions will be open soon. Please visit the IOBSL website at Annual Sessions - Institute of Biology, Sri Lanka for more details.

Young Scientist Award by the Institute of Biology

We are excited to announce the launch of the Young Scientist Award by the Institute of Biology. This award will recognize outstanding contributions and achievements in research of the early career corporate members of the Institute. The application deadline for the award is the 31st of May 2022. The applications will be reviewed by an external panel of experts in biology and the award will be presented to the winner during the Inauguration Ceremony of the Annual Sessions of the IOBSL.

IOBL Research Stories: A New Addition to Our Social Media Platforms

The Institute of Biology, Sri Lanka web page, and Facebook are now open for the publication of research news stories of its membership. The initiative is aimed to recognize the valuable contribution made by the institute membership toward research and development. It will also bridge the gap between researchers and the general public by taking such valuable research news to more popular and public-friendly social platforms. To achieve these objectives, IOBSL has established a research news writing team consisting of several volunteer students and associate members of the institute. They are trained to convert the meticulous research articles to stories that are tangible for a non-specialized audience and will work under the guidance of both the IOBSL council and the respective researchers. Alternatively, the researchers themselves can compose their own research stories if they prefer to do so. The IOBSL invites its members to share their exciting research news with the public using this valuable opportunity. Contact Dr. Dewanmini Halwathura at devan.halwatura@zoology.cmb.ac.lk for more details. The latest research story can be viewed on the IOBSL website.

Quinoa (*Chenopodium quinoa* Willd.): An ancient food crop

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History and Origin

Quinoa (*Chenopodium quinoa* Willd.) is a pseudocereal/pseudograin belonging to the family Amaranthaceae. Native to the Andes Mountains of South America, quinoa was referred to as the "**mother grain**" by the ancient Inca civilization. For thousands of years, it has been the staple food for the Incas and their indigenous descendants and considered as a sacred food. According to legend, each year, the Incan Emperor used to ceremonially plant the first quinoa seeds.

Distribution

Originally, quinoa was domesticated in southern Peru and Bolivia and its cultivation dates back to 7500–8000 years. In the past, quinoa has been widely cultivated by inhabitants of the valleys in drier and colder (average 12 ºC) areas of the Andean region and in different agro-ecological zones of Peru, Chile, Bolivia and Ecuador. Marginalization and replacement of this crop began with the Spanish conquest and the introduction of cereals such as barley and wheat led to its neglect among the urban population of the region for economic and social reasons. Quinoa was reintroduced to the modern world and in recent years cultivation of this crop has been expanded to South America, United State of America, China, Europe, Canada, and India. In 1996, quinoa was classified by the Food and Agriculture Organization of the United Nations (FAO) as one of humanity's most promising crops. In recognition of the importance of preserving quinoa as food, the United Nations General Assembly declared 2013 as the 'International Year of Quinoa'. The promotion of quinoa is part of a broader FAO strategy to encourage the cultivation of traditional or forgotten crops as a means of contributing to food security.

Morphology and Diversity

Quinoa is an annual herbaceous plant and shows high morphological variability depending on the variety/cultivar and environment that they grow. The height of the plant varies from 1 to 3 m. The woody stem is branched or unbranched and depending on the variety, stem colour can be green, pink/red, purple or grey/black. The leaves are arranged as alternate. Incomplete, sessile, small flowers are arranged as clusters on racemose inflorescences and flowers can be hermaphrodite, pistillate and androsterile (Figure 1). Small seeds (diameter about 2 mm) are produced in achene fruits and can be of white, red, yellow, purple, brown, or black colour (Figure 1). The quinoa plant has a deep and branching taproot system.

There are more than six thousand cultivated varieties or ecotypes of quinoa. Genetic variability assessment studies categorize quinoa into five major groups according to the altitudinal gradient and geographic adaptation. They are; valley quinoas grown at 2000 to 3500 mean above sea level (masl), Altiplano grown at high altitudes of more than 3500 masl, salt flat quinoas (Salares) grown in the salt flats and having a high tolerance to salinity, sea-level quinoas grown in the low-altitude areas and subtropical/ Yungas grown at the low-altitude.

Nutritional value

The unique benefits of quinoa are related to its high nutritional value and ancient populations recognized the rich nutritional properties of this food and called quinoa as the "golden grain". Quinoa is a very rich source of carbohydrates, proteins, essential fatty acids, vitamins and minerals. The protein quantity and quality of quinoa are generally higher than to those of cereal grains, while being gluten-free.

Figure 1: Quinoa **(a)** adult plants (different varieties), **(b)** inflorescences and **(c)** mature seeds. (Opensource/FAO)

Quinoa is rich in a variety of amino acids and 100 g contains nearly five-fold lysine, more than double isoleucine, methionine, phenylalanine, threonine, valine, and much larger amounts of leucine than found in 100 g of wheat. Quinoa seed is high in carbohydrates and contain 58-68% starch and 5% sugar. It is rich in several minerals with more calcium, phosphorus, magnesium, potassium, iron, copper, manganese, and zinc than wheat, barley or corn. It is also rich in essential fatty acids such as linoleic and alpha-linolenic acids and contain a significantly high amount of Omega 6 (linoleic acid). Quinoa is considered a good source of vitamins such as, vitamin A and E, and water-soluble vitamins such as thiamin, riboflavin, niacin and ascorbic acid. It contains antioxidants such as tocopherol in high concentrations.

Considering the excellent nutritional and nutraceutical properties, it has the potential to improve global nutritional security. Flour, soup, breakfast cereal, and alcohol can be made from quinoa. Quinoa flour performs well as a starch extender when combined with wheat flour or grain, or cornmeal, in making biscuits, bread, and processed food.

Adaptation to stresses and climate change

The quinoa plant has remarkable adaptability to grow in different agro-ecological regions in the world and produce seeds in semi-arid and arid environments. It can withstand temperatures ranging from -4 °C to 38 °C and is resistant to low soil moisture and low mineral nutrition in a broad range of marginal agricultural soils of highly acidic and alkaline nature.

The plant can also adapt to a variety of other abiotic stresses such as high and low air temperature, UV-B radiation, frost, waterlogging, and heavy metal contamination. Its high adaptability to climate variability and its efficient use of water, make quinoa an excellent crop in the face of climate change and quinoa seeds are ranked among one of the most resistant seeds to climate change. Taking into consideration the nutritional quality, genetic variability, adaptability to adverse climate and soil conditions and low production cost, quinoa, although an ancient crop, can be considered a strategic future crop.

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Insect conservation psychology: To like or not to like

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As children, we appreciated the colourful butterflies flying from flower to flower, the red and black ladybird beetles glistening under the warm sunlight, green grasshoppers jumping in and out through long grasses and the swarms of fireflies that lit up the night skies. However, as we became adults the insects of our childhood got replaced by dirty flies that spoiled our food, vicious mosquitoes that bit and caused diseases, nasty cockroaches that infested dark corners of our clean homes, and swarms of ants and termites that destroyed our books, gardens and other belongings. Therefore, our perception of insects changed, and we developed a dislike for many insects which can be termed as "entomophobia". So, for many of us, insects are out of sight, out of mind, and are not worthy of our consideration and conservation, and their services are taken for granted.

However, with their representativeness to the variety of life, role in nutrient cycling, pollination, being bio-control agents of pests, provision of new medicines and acting as tourist attractions in the wild, it is evident that we need insects in our lives. Therefore, it is essential that people are connected to insects in a positive manner, and that "entomophobia" is replaced by "entomophilia", love and appreciation for insects. Thus, a relatively new field of research, which aims to understand the behavior of people to insects and to promote the behavior that protects them, insect conservation psychology, has originated.

Insect Conservation Psychology

Insect conservation psychology is a circular process, of us caring for insects, and insects inadvertently caring for us. As insects gain recognition as essential members of ecosystems and human existence, plans and actions to mitigate the negative trends in insect abundance and diversity will be implemented. To achieve this objective two approaches are suggested – firstly, by adjusting the attitudes of the public on insects and thereby increasing the support for conservation activities, and secondly by promoting the creation of insect-friendly habitats.

Adjusting the attitudes of the public to insects

In many countries, the public is largely unaware of the benefits and services that insects provide, and negative perceptions of insects are widespread. Such perceptions are amplified by fictional works such as films, television episodes, video games, children's books and novels depicting large, scary insects that frighten and horrify people using a variety of motifs and devices.

Although commercially successful, most are not grounded on scientific evidence and are highly misleading. Such works can be replaced by films and shows that display an appreciation for insects, and species can appear having common names with positive connotations such as "the magical bug", "rainbow grasshopper". Public attitudes can also be changed by formal or informal teaching and discussions that increase awareness and appreciation for insects; in getting involvement of the public in activities that support insect-friendly environmental policies at government level; nature-based tourism that involves insects and construction of butterfly gardens.

Creating insect-friendly habitats

The change in public attitudes on insects is important for being mindful of the impacts of our daily actions and decisions. Avoiding some behaviours and adopting others will contribute both directly and indirectly to insect conservation. For example, a simple action such as limiting the use of exterior lighting can benefit nocturnal insect populations. Artificial lights attract most nocturnal insects, who are killed before sunrise due to exhaustion or predation. Further, artificial lights are known to reduce reproductive success of nocturnal insects due to the obstruction of mating signals. To reduce harm to insects, people can turn off unneeded lights, dim necessary light sources and switch to bulbs that produce amber- or red-coloured light which produce wavelengths that are less attractive to insects. Reducing pesticide and herbicide use could also greatly benefit both terrestrial and aquatic insect communities. Many pesticides are applied for cosmetic purposes for improving the appearance of non-agricultural green spaces such as lawns, gardens and parks.

The public can be encouraged to use simple control measures that are non-chemical and ecologically sound. Conversion of lawns into diverse natural habitats that support insects and growing native plants that provide food and nesting sites for native insects can be practiced by the public and incorporated into activities of conservation organizations and university extension programmes.

The present synopsis is indeed not adequate in addressing such a broad, significant, and far-reaching research area as "insect conservation psychology". However, it intends to show the importance of connecting the public with insects and nature, and "re-wilding" the people, especially the economically active adults, as the younger and older generations are more engaged in environment-friendly activities. You do not need to board the "Rainbow Warrior" to do your bit for the Earth. Preserve open spaces with natural vegetation, set aside small areas in your gardens to promote local insect diversity, adopt and plant flowers for the bees. Time is short for conserving the necessary insect diversity to sustain us.

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Estrogen pollution: A growing peril leading to a silent epidemic in the modern world

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Introduction

Occurrence and environmental fate of hormonally active chemical pollutants such as DDT (Dichloro-diphenyl-trichloroethane) came into the limelight in 1962 with **Rachel Carson's** ground-breaking book, *Silent Spring*. Ever since, an increasing number of industrial chemicals with the potential of disrupting natural hormonal pathways of living organisms has been reported from natural ecosystems. Any exogenous agent that interferes with natural hormone production and its signaling pathways are considered as an endocrine disrupting chemical. As endocrine signaling is a vital component of life, any disruption can cause serious life consequences. Since the dawn of single-use plastic culture and the inception of global industrialization, an alarming increase in the levels of environmental estrogens such as bisphenols, diethylstilbestrol and ethinylestradiol have been noted worldwide. Bisphenol A (BPA) is a synthetic estrogen and type-I endocrine disrupting chemical due to its ability to interfere with estrogen signaling pathways. The most confounding fact about BPA is that it is the most abundant environmental estrogen and its presence has been reported even in remote Antarctica and in the atmosphere several kilometers above the ground. Biomonitoring studies have identified detectable levels of BPA in tissues of wildlife and humans. Thus, BPA has been identified as an emerging crisis in modern times that can critically affect all ecosystems and life forms including humans.

Bisphenol A and its molecular mechanism of action

Bispenol A or 4,4′-dihydroxy-2,2-diphenylpropan (CAS No. 80-05-7) is a high production volume chemical used in the production of polycarbonate plastics and epoxy resins. The global demand for BPA is predicted to increase up to 10.6 million metric tons by 2022. BPA is highly used in the production of many consumer and industrial appliances including plastic containers, toys, baby feeding bottles, automobile parts, electronic appliances, linings of food cans, dental products, thermal receipts, and in flame retardants. BPA can be released from these materials and migrates into food, air and water in dependence of time, temperature and pH. BPA has been shown to enter the bodies of living organisms through skin, ingestion and inhalation.

The xenoestrogen BPA mimics the endogenous natural hormone estrogen both *in vitro* and *in vivo*. BPA binds to both estrogen receptor beta and estrogen receptor alpha with an affinity weaker than the natural hormone, 17-beta estradiol. However, with high circulating concentrations of BPA it has shown to regulate steroid hormone biosynthesis, extranuclear physiological activities and epigenetic modulations being equipotent with natural hormones. BPA is also an anti-androgen, in that it binds to the androgen receptor and blocks the normal action of androgens. BPA also interferes with thyroid receptors and as a result of binding, function and regulation of thyroxin and insulin is disrupted. BPA binding to peroxisome proliferator-activated receptors have raised concerns on early onset of obesity and metabolic syndrome. Other nuclear receptors with putative binding to BPA are estrogen-related orphan receptors, 7-transmembrane estrogen receptor-GPR30, constitutive androstane receptor, and pregnane X receptor. In consequence to altered hormone signaling pathways, perturbations in growth, development, reproduction, and behavioral changes of living organisms have been recorded.

In addition, BPA exposure induces mutagenic, genotoxic, neurotoxic, immunotoxic, and carcinogenic effects in living organisms.

Environmental prevalence of BPA

With the urban sprawl, thriving nature of plastic industry and plastic consumption patterns, BPA concentrations in terrestrial and freshwater habitats have increased over time in Asia, North America and Europe. BPA has a low potential to accumulate and it degrades relatively quickly in the freshwater environment when compared with marine habitats. However, owing to high production volume, continuous effluent discharges and plastic waste accumulation, BPA has become a ubiquitous environmental pollutant. In addition to environmental emissions, fluctuations in physiochemical parameters have been seen to accelerate BPA leaching from BPA-based products into freshwater and terrestrial environments. Levels of BPA in Europe, North America, and some parts of Asia are under continuous scrutiny through environmental and bio monitoring studies. Nearly 50% of the surface water bodies assessed in Europe and North America has reported to exceed Canadian Predicted No Effect Concentrations (PNEC) of BPA for aquatic life. However, BPA data from developing part of the world and specifically the south Asian region of the world is underrepresented. 80% of surface water courses assessed for BPA levels in Asia have reported to exceed PNEC. Wastewater, hazard waste landfills, incineration of domestic waste, e-waste recycling sites, and industrial effluents have been identified as rich sources of BPA, paving the path to long-range atmospheric and environmental transfer.

Environmental impact of BPA exposure

Since aquatic and terrestrial habitats serve as BPA sinks, the ability of BPA to assimilate in the body and to enter food webs at different trophic levels is a particular concern. BPA has been detected in tissues of fish, amphibians, mollusks, gastropods, crustaceans, aquatic insects, polychaetes, algae, and diatoms. It is taken up by marine and freshwater organisms via the gills, ingestion, cutaneous uptake or plant root absorption. BPA exposure has led to a wide variety of developmental and reproductive disorders in aquatic species. The most common pathological conditions include, feminization, malformations, developmental, and behavioral abnormalities. Early life BPA exposures even for short periods has shown to cause lasting consequences on life history both *in vitro* and *in vivo*.

Human health risks of exposure to BPA

Human exposure to BPA is frequent and widespread, and more than 90% of individuals have detectable amounts of BPA in urine as reported by biomonitoring studies conducted in the United States, Germany, and Canada. Prenatal, infancy, and childhood are considered as critical windows with increased exposure risk and sensitivity to BPA. Epidemiological, *in vivo*, and *in vitro* studies have proven the obesogenic nature of BPA which leads to lipid and glucose dysregulation, obesity and metabolic syndrome. Intriguingly, early life exposure to BPA has increased the risk of breast and prostate cancers. Exposure to BPA has shown to associate with a reduced proportion of male births and with increased infertility and subfertility levels in many populations. Moreover, prenatal and early-life BPA exposure have shown to link with anxiety, depression, aggression, hyperactivity, and conduct problems in children. Higher circulating BPA levels have been linked with higher implantation failure, recurrent miscarriages, premature delivery, and polycystic ovarian syndrome in females. Non-communicable diseases have become a silent epidemic in the modern world and increasing exposures to environmental estrogens are considered as major contributory factors. Recent studies in USA have suggested associations between higher levels of circulating BPA with increased risk of long-term all-cause mortality. Given the importance, routine biomonitoring and risk assessment studies are being carried out in most of the developed countries. However, the toxicological studies and human biomonitoring studies are lacking in most of the developing countries in the world including Sri Lanka.

BPA in Sri Lanka

The likelihood of environmental prevalence and exposure to BPA could be high due to unplanned urbanization, poor industrial and household waste management practices, high plastic usage and due to the ever-increasing plastic pollution in Sri Lanka. However, only a limited number of studies have been carried out in this respect in Sri Lanka. The public awareness on exposure routes and health impacts of BPA in Sri Lankan communities is scarce. The only scenario of BPA used in common practice is through the use of "BPA-free" labelled baby feeding bottles. Polycarbonate baby feeding bottles are popular choices among parent communities in Sri Lanka. Despite, the label claiming "BPA-free", several brands of imported baby feeding bottles from Sri Lankan market has shown to carry detectable levels of BPA during a study carried out by University of Kelaniya, during the 2018-2019 period. This necessitates the importance of more comprehensive research and legislative measures to safeguard children's health in Sri Lanka.

Regulatory measures of BPA

Heightened research interest and expanding scientific knowledge has resulted in increased public awareness as well as legislative measures to minimize the exposure and emissions of BPA worldwide. European Food Safety Authority has estimated tolerable daily intake of BPA to 4 micrograms per kilogram of body weight per day. Several countries worldwide have taken regulatory measures to limit usage and environmental emission of BPA. As an example, U.S. Food and Drug Administration has banned BPA from baby feeding bottles, sippy cups , and infant formula packaging since 2012. These regulations and toxicological endpoints are routinely being monitored and upgraded based on risk assessments to ensure the safe use of BPA.

In conclusion, BPA is a widely used industrial chemical due to its important material attributes. Its omnipresent nature together with estrogenic properties has made BPA a major environmental estrogen. Increasing environmental levels of BPA has caused deleterious impacts on ecosystem health. Human exposure to BPA have linked with serious health consequences. Thus, routine biomonitoring studies, field-based assessments and toxicological analysis are obligatory in each geographical regions of the world to mitigate environmental emissions and human exposure to BPA through well-timed regional legislations.

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Development of a self-controlled orchid pot with modular units of assembly

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Orchids are attractive flowering plants that have high demand in the export market. Both cut flowers and potted plants are popular due to their vivid flower colors and longer blooming duration compared to other flowering plants. However, orchids need extensive care for maintaining healthy and quality flowers. This includes optimum growth conditions such as humidity levels (40%-70%), management of fertilizer, and light intensity which can be difficult to provide.

Generally, orchids are kept indoors such as in-office spaces, hotel lobbies, or living rooms that do not have enough natural lighting and humidity levels for their growth and for blooming. Also, less attention is given to the maintenance of orchids. Hence, there is a preference for an apparatus that could provide automatic watering/moisturization and lighting.

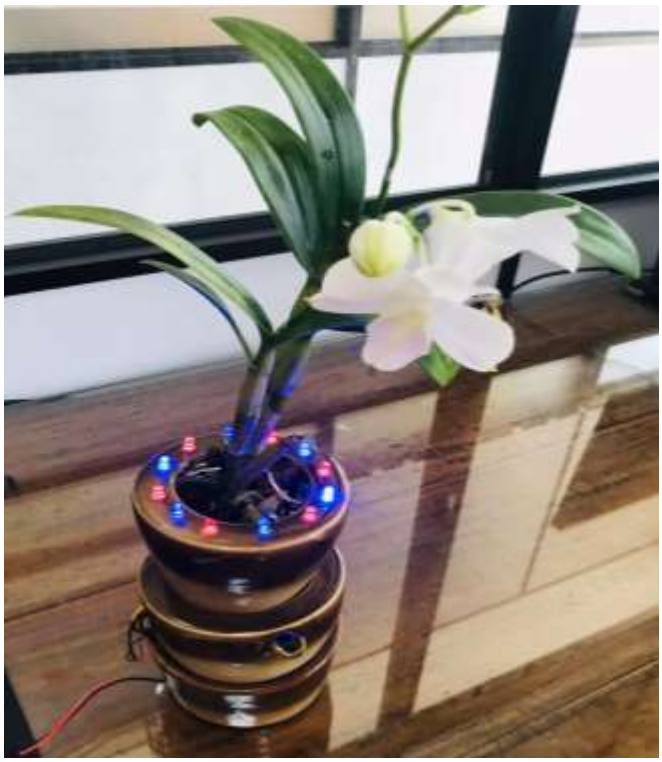
As a possible solution, our group developed a self-controlled plant pot that automatically provides the optimum growth requirement for orchids. This pot is automated with moisture (humidity levels) and temperature controllers. It is also automated for light intensity to maintain plant health. This invention can be used in indoor ornamental equipment as maintenance-free orchid pots and can be kept in closed rooms which have no natural lighting conditions. Further, this automated system will increase the lifespan of the orchid plant and artistic effects can be achieved with mist and lightning pattern changes.

Design

This invention is a design with several modular units. The design is made with the plant holder (1), water container pot (2), and a bottom plate (3) in its outer design as shown in figure 1. The top plant container is designed to hold the plant and the lighting modules. The plant is placed inside the plant holder (1) which has a mesh bottom structure that is made up of a plastic net to withstand water-based corrosion. The plant holder (1) is placed on top of the water container pot (2). The water container consists of a cup-like structure to contain water and a water level identifier with a transparent sealed window laced at the side of the water container pot (2). This window is made from acrylic material.

Figure 1: Design of the Orchid pot

The atomizer is placed on top of a floating table inside the water container pot (2) which prevents the atomizer from sinking to the bottom of the water container pot (2). The floating table occupies 80% of the water surface. The floating table has short legs which prevent the atomizer from touching the bottom surface of the water container pot (2) when no water is present inside. If this technique was not used, the atomizer will stick to the bottom of the water container pot due to the surface tension of the water and prevent floatation when refilling the water container using the water inlet. The distance between the top pot and the water container pot (2)'s water level ranges from 2 to 2.5 inches. This height gives the optimized level of moisture absorption into the planting medium for orchid roots. A rubber beading is introduced between the top plant holder and the water container pot to minimize the escape of moisture out of the seam and to tightly fit each other.



The bottom plate is designed to contain the circuit boards and power cords. The circuit is designed with two segments which consist of two circuits: an atomizer operating circuit and the lighting circuit. The atomizer circuit is designed with an Arduino mini microcontroller which contains an algorithm that provides instructions to keep the temperature and humidity to the standards of greenhouses. The humidity is kept in ranges from 70-80 % which varies according to the room temperature and humidity.

For the operation of the pot, a 230V ~ to 5V DC charger adapter should be connected. The power operates the two electronic circuitries. One of them is a temperature and humidity sensor DHT 11 type placed inside the top pot near the plant roots. The function of this temp/moisture sensor is to detect the moisture and temperature levels and it functions to match the moisture level which is needed for the plant and automatically triggers the atomizer giving a mist when the humidity is lower that 70%. The mist follows an upstream flow and is absorbed into the cultivation medium on top of the mesh structure. For the effective functioning of photosynthesis, the top pot is fixed with a red and blue LED (Light Emitting Diodes) array which is focused on the leaves. The total light lux which emits here ranges from 1600-4100 lumens. The light diode array has an automatic dimming functionality timed at 10-second intervals. To control the dimming timer a circuit with a programmable ATMEGA 328 microcontroller and a crystal oscillator with a capacitor has been installed. In the lightning, circulatory system red and blue LED s are being used. The ATMEGA328 microcontroller with crystal and capacitor is used with this and the same 5V voltage is used to power the lighting circuit. Input Arduino code is used to generate blink LEDs to slowly vary with seconds.

This ‘smart’ plant pot has been designed specifically considering the orchid plant requirements with the levels of humidity, and lighting adjusted based on the experiment conducted when designing an indoor orchid pot. It is seen that the orchid flower has a longer vase life when this pot is placed indoors. Similar pots can be made for other plant varieties as well, based on the optimum plant requirements.

Can consuming fenugreek help lower blood sugar and cholesterol?

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Diabetes and hyperlipidemia represent major non-communicable diseases seen worldwide and their global burden has increased over the past 30 years. At present, approximately 537 million adults of the world's population are living with diabetes while hyperlipidemia affects 28.5 million adults. These diseases are now common not only in the developed world but also in other parts of the world.

Diabetes is a chronic disorder of glucose metabolism while hyperlipidemia results from the elevation of serum total cholesterol and/or triglyceride or reduced high-density lipoprotein (HDL) cholesterol. Both these conditions are high-risk factors for the development of coronary heart diseases. These two conditions are often treated with modern anti-diabetic and anti-hyperlipidemic drugs which are associated with side effects such as liver, renal and neural toxicities. Hence, the quest continues to investigate an effective and safe alternative medication.

Figure - fenugreek leaves and seeds
(Creative Commons License)

For over a thousand years herbal remedies have played a vital role in keeping the lives of people secure and safe from various diseases. By virtue of the improvement of the drug development research field in recent years, many traditionally used herbal remedies have become modern medicines.

Recently, food-based interventions that have been recommended in traditional medicine are gaining popularity due to their long-term effectiveness in normalising metabolic pathways as well as their low cost, and fewer side effects.

Fenugreek (*Trigonella foenum-graceum*) is a legume used extensively for a multitude of purposes. It belongs to the family Fabaceae and is cultivated worldwide as a semi-arid crop. There could be as many as 260 species within the *Trigonella* genus. Since ancient times fenugreek has been used as a spice, a food additive or to enhance the quality of foods. Moreover, in Ayurveda and other traditional medicine, fenugreek is claimed as a remedy for many ailments. Both seeds and green leaves of fenugreek are used as a food additive as well as in medicinal applications. Commercially fenugreek is used in food production as a stabilizer, adhesive, and emulsifying agent. The seeds possess bitterness and are aromatic. They are popularly eaten raw or cooked. The bitterness of fenugreek seeds is due to the oil, saponins, steroids and alkaloids. The fiber portion consists of both an insoluble (30%) and soluble fraction (20%), which is mostly galactomannan. The 7.5% lipid present in the seed consists of mainly neutral lipids such as triglycerides and phospholipids. Fenugreek is also an excellent source of minerals and vitamins. Fenugreek seeds have a long shelf life and can be used in cooking in numerous ways. Incorporating this functional food into the daily diet can have a positive effect on health. Therefore, in addition to its use as a food additive, soaked fenugreek seeds have been claimed as a powerful nutraceutical for diabetes and hyperlipidemia.

Over the years a plethora of research has scientifically validated the anti-glycemic and anti-lipidemic activities of fenugreek seeds. Several animal and human studies have reiterated that among treatments, the consumption of the soaked seed is most effective in combating both glucose and total cholesterol levels. The scientific evidence establishes that the fenugreek seeds can be used as a treatment for both type 1 and 2 diabetes. The seeds also contain substances that stimulate the pancreas to release digestive enzymes, thereby aiding the digestion process. Consumption can also aid in comforting patients with gastritis and gastric ulcers. Fenugreek seeds are also rich in potassium which is helpful in maintaining the blood pressure in a healthy range and reducing the risk of heart diseases and strokes. Recent studies conducted in Sri Lanka and in other countries have established that the consumption of fenugreek seed not only lowers the glycemic, and lipidemic levels but also modulates the immune responses of Wistar rats.

Fenugreek seeds contain various types of reducing sugars, tannins, terpenoids, saponins, and flavonoids, suggesting their role in anti-glycemic and anti-lipidemic activity. Fenugreek seeds contain about 0.1–0.9% of diosgenin; steroidal sapogenins which inhibits cholesterol absorption by forming large fat micelles that are difficult to absorb by the digestive tract. In this light, the blood cholesterol levels will be lowered. This potent steroidal saponin diosgenin in the seeds can be exploited further for drug development. Seeds are also rich in polyphenol compounds, such as rhaponticin and isovitexin. Several alkaloids such as trigonelline, gentianine, and carpaine are present in fenugreek seeds and are known to decrease blood glucose levels post-consumption. The anti-diabetic activity of fenugreek seeds is mainly attributed to their fibre content. Fenugreek seeds contain 45% dietary fibre and it has been revealed that these fibres can blunt glucose after a meal. However, the underlying mechanisms are yet to be investigated.

In general, the consumption of nutraceuticals has been accepted as a promising therapeutic mode against many chronic diseases due to their relative safety and tolerance. In many countries, traditionally acclaimed herbal preparations have been developed as nutraceuticals or dietary supplements and which are available as over-the-counter products. Fenugreek supplements made from powdered seeds are also available in the market. Accumulating evidence suggests that the consumption of soaked fenugreek seeds is well tolerated and causes few side effects. However, a few studies have also found that overconsumption of fenugreek may be associated with neuro toxicities. Also, fenugreek might cause allergic reactions in people allergic to peanuts or chickpeas. Hence, it is prudent to use the recommended quantities of fenugreek as a food additive to daily meals or as soaked water to protect your family from the onset of chronic illness.

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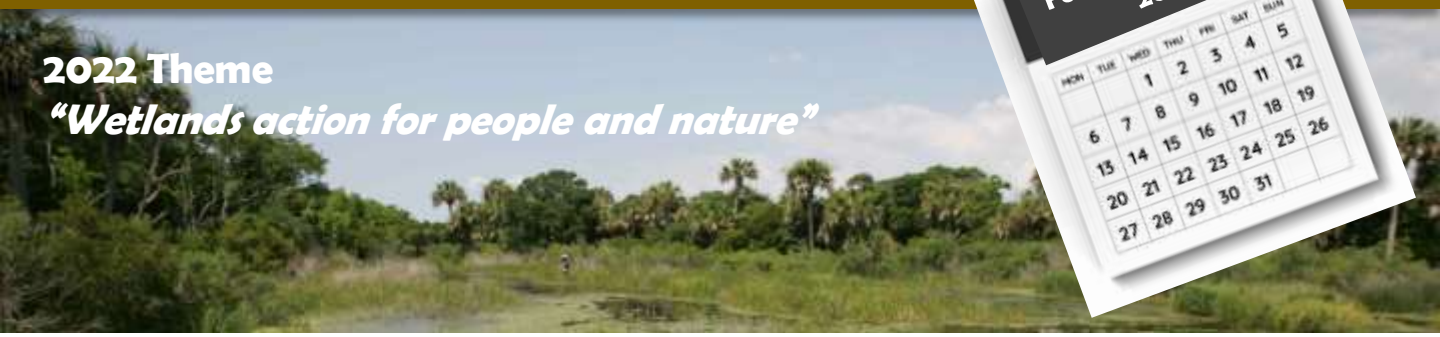
Biology Calendar

World Wetland Day– 2nd February



A wetland is a unique ecosystem where the land is seasonally or perennially flooded by water. There are five main types of wetland; marine, tidal, lacustrine, palustrine, and riverine which are categorized based on their hydrological features, landscape position, and vegetation type. Wetlands provide numerous ecosystem services such as stabilizing water supplies, cleansing polluted waters, protecting shorelines and sustaining rich biodiversity. On 30th August 2021, the UN General Assembly declared 2nd February as World Wetlands Day with the aim of raising global awareness of the importance of wetlands and promoting their conservation and restoration.

World Wildlife Day – 3rd March

Animals living in their natural environment without domestication are referred to as *Wildlife*. Wildlife helps to maintain the ecological balance of nature and without them, the ecosystems are in peril. Thousands of wild species face the danger of extinction due to the loss of their habitats, pollution, climate change, and human activities such as culling and poaching. World Wildlife Day is celebrated on the 3rd of March aiming to draw attention to the conservation and management of-endangered wildlife worldwide.

International Day of Forests – 21st March

One-third of the Earth's landmass is covered with forests. Forests are homes for more than 80% of the terrestrial species of animals and plants and exhibit incredible biological diversity. Forests play a vital role as a "carbon sink" and approximately 7.6 billion metric tonnes of CO_2 per year is absorbed by forests. Moreover, one-fifth of the global population depends on the forests for their livelihoods, food, shelter, medicines, and fuel. In this light, annually 21st of March is dedicated to appreciating the ecological, socio-economic, and health benefits of all types of forests and to encouraging local, national, and international efforts for sustainability.

World Water Day– 22rd March

Water is the most precious resource in the world and it is a prime requirement of life. People living in arid regions of the world completely depend on groundwater. Groundwater also facilitates the healthy functioning of aquatic/semi-aquatic ecosystems, such as rivers and wetlands. However, groundwater is being overexploited in many parts of the world. Hence, global attention should be drawn to taking necessary actions to recharge the groundwater supplies. The World Water day is annually celebrated on 22nd March and this year special emphasis has been given to the sustainable use of the invisible treasure of groundwater for the benefits that are visible everywhere.

World Earth Day- 22nd April

The Earth is our home, and it is something that we all have in common. It is the only planet that supports life, and the availability of water and oxygen are the two unique features that sustain life on earth. In the past few decades we have witnessed dramatic climatic changes and biodiversity loss on Earth. Overpopulation, change in land-use patterns, and pollution are the key human factors that have contributed to these changes. Annually World Earth Day is celebrated on the 22nd of April to spark global conversations on protecting nature and safeguarding the Earth.

Source
http://unescocenterforpeacenys.org/international-days-celebration/ Accessed 28 March 2022

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Systomus asoka (Asoka Barb, අසෝක පෙතියා)

The Asoka barb is only found in the upper reaches of the Sitawaka river around Deraniyagala and the upper reaches of the Kelani river around the Kithulgala area. It is hence considered range-restricted and critically endangered. These fish are fast swimmers and prefer fast-flowing water with gravel and sandy substrates with no shade.

Mr. Tharindu Ranasinghe (St. Biol)
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Source

Fernado, M., Kotagama, O., de Alwis Goonatilake, S. (2019). "*Systomus asoka*". *IUCN Red List of Threatened Species. 2019*: e.T18883A150838859. doi:10.2305/IUCN.UK.2019 3.RLTS.T18883A150838859.en. Accessed 16 February 2022

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