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In This Issue

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Guest Article

Biopesticides: An ecofriendly approach for pest management

Chandrika Dissanayake

The chemical pesticides are continuously accumulating in the environment, harming the ecosystem, causing pollution, and inflicting diseases at alarming levels. Hence, bare necessities to meet food requirements of both present and future populations are to integrate sustainable plant protection techniques into crop production systems. The use of Biopesticides is one such method which utilizes various plant products, macrobials, and semiochemicals to achieve and ensure optimum crop health and has become an important trend. However, production and commercialization of effective biopesticide products require a stranded development process with the collaborations and contributions of multi-disciplinary expertise and considerable time period.

Concept of Biopesticides

Biopesticides are defined as pesticides derived from natural materials such as plants, animals, microbes, and minerals widely used for controlling insects and disease causing pathogens. The USEPA separates biopesticides into three main categories based on the type of active ingredient used, namely, biochemical, plant-incorporated protectants, and microbial pesticides [1] and European Union classify biopesticides into three classes as microorganisms, botanicals (or biochemicals or plant extracts) , and semiochemicals (including pheromones).

At a global level, there is variability in defining the term biopesticide as aforementioned operative definition of the term biopesticide given by USEPA is not followed in the entire world and that is why International Biocontrol Manufacturers' Association (IBMA) and the International Organization for Biological Control [2] promote to use the term biocontrol agents (BCAs) instead of biopesticide [3]. IBMA classifies biocontrol agents into four groups namely macrobials, microbials, natural products, and semiochemicals (insect behavior-modifying agents).

Botanicals as Biopesticides

Botanical pesticides are derived from plants belonging to different families and are either utilized as plant extracts, essential oils or both [4]. Botanical pesticides are acquired from different plant parts such as roots, rhizomes, bulbs, barks, leaves, flowers, seeds, cloves or fruits which are either fresh or dried. Dried plant parts are preferred as they yield more active ingredients than the fresh parts with high concentration of water.

Absolutely, plant kingdom is the main source for diversified secondary metabolites which are synthesized by the plant itself with antibacterial, antifungal, and insecticidal properties and used as defensive weapons against pest attack.

In general, many plants contain a wide spectrum of secondary metabolites such as phenols, flavonoids, terpenoids, quinones, tannins, alkaloids, saponins, coumarins and sterols which show vary in their efficacies against all kind of pest species. Botanical pesticides are prepared from plants and plant parts obtained from the environment, natural or man-made and follow a series of experiments prior to commercializing the products which may take several years (Figure 01).

Microorganisms as Sources of Biopesticides

Potential antagonistic microorganisms for development of biopesticides obtain from naturally existing sources such as cowshed, hay fields, compost, manure, rhizosphere, Exophytic and Endophytic association or genetically altered bacteria, fungi, algae, viruses, or protozoans. The mechanisms of action exhibited by microorganisms against plant pathogens include hyperparasitism, competition, and secretion of volatile compounds, antibiosis and parasitism [5]. Bacterial species that have been utilized as biopesticides include *Bacillus*, *Pseudomonas*, *Burkholderia*, *Xanthomonas*, *Enterobacter*, *Streptomyces* and *Serratia*. Fungi used as biopesticides include species of *Trichoderma*, *Beauveria*, *Metarhizium*, *Paecilomyces*, *Fusarium*, *Pythium*, *Penicillim* and *Verticillium*. *Steinernama* and *Heterarhabditis* are nematode species used to make biopesticides [6]. Production of microbial pesticides starts with isolation of the antagonistic microorganisms from different sources and follows a series of experiments for at least two to four years prior to commercialization of the final products (Figure 01).

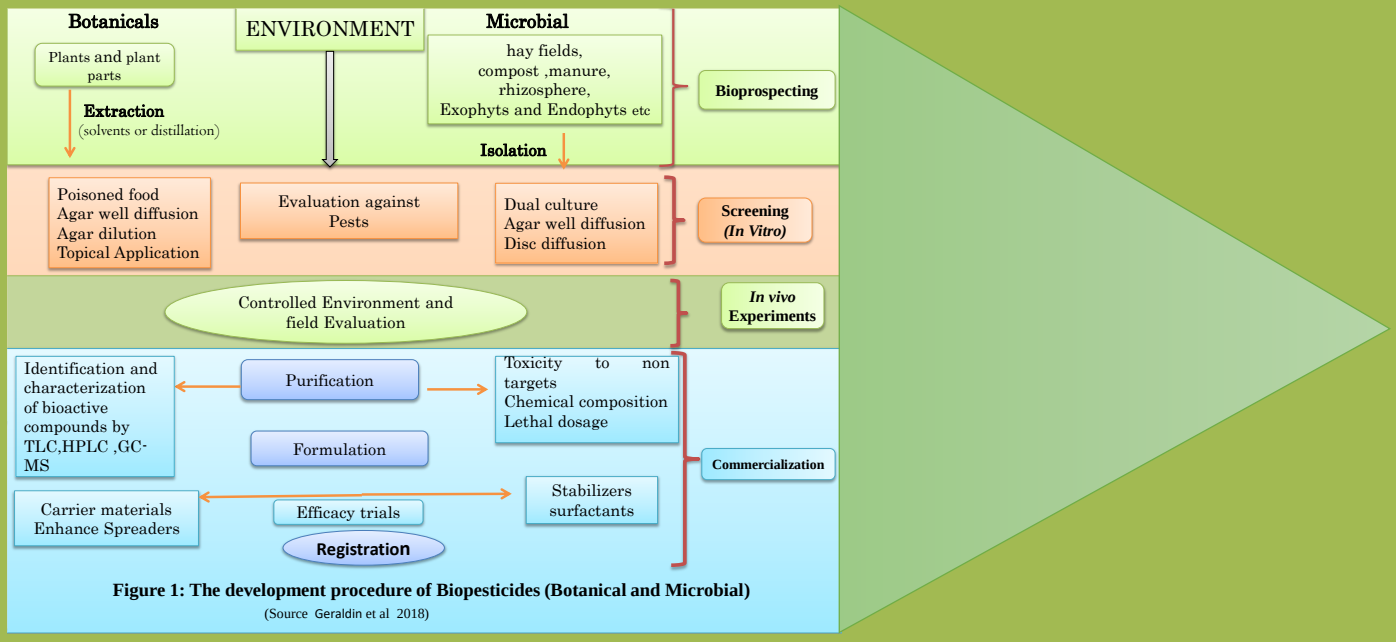

Figure 1: The development procedure of Biopesticides (Botanical and Microbial)

(Source Geraldin et al 2018)

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About the Guest Writer

Professor Chandrika Dissanayake is affiliated to the Faculty of Agricultural Sciences, Sabragamuwa University of Sri Lanka Belihuloya where she has been a faculty member since 2000. She has completed her Postdoctoral Fellowship at Faculty of Agriculture, Yamaguchi University, Japan ad Ph.D. at The United Graduate School of Agricultural Sciences, Tottori University Japan and her undergraduate and M. phil. studies at Faculty of Agriculture, University of Peradeniya. Her research interests lie in the area of screening of antagonistic effects of plant extracts and microbial isolates against plant pathogens and identification of plant pathogenic microbes. Prof. Chandrika is also a life member and an executive committee member of SLAMPP.

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SLAMPP News
December Issue
On or Before
02 November 2021

SLAMPP President's Annual Report 2020/21

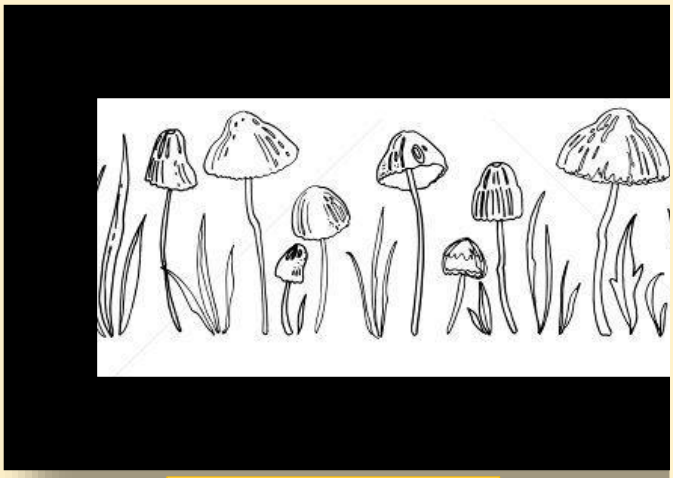
Term of office of the outgoing SLAMPP committee was from 25th July, 2018 to 24th July 2020. However, since we could not organize an AGM within 2020, its term has been extended until 15th May 2021. The last AGM was held on 12th November 2019 at the new lecture theatre, Department of Botany, Faculty of Science, University of Peradeniya. We are happy to note that the membership of the society has increased to 71 with 32 Life, 6 Regular, and 33 Student members.

The Year 2020 was proclaimed by the United Nations as the year of Plant Health. Though SLAMPP had planned several activities to mark the year of plant health, unfortunately they could not be organized, due to the COVID 19 pandemic.

However, SLAMPP was successful in joining hands with the Indian Phytopathological Society and co-organizing the "IPS 7th International Conference on "Phytopathology in Achieving UN Sustainable Development Goals", which was held in New Delhi India from 16th to 20th January 2020.

Four scientific papers were accepted from Sri Lanka and three papers were presented at the event by our scientists. SLAMPP successfully contributed to a Special Issue of the Ceylon Journal of Science (Volume 49, November 2020) on Plant Health 2019 Sri Lanka. The issue included an editorial, 2 review articles, 5 research articles and a short communication. After the last AGM in December 2019, SLAMPP released its 2nd issue of SLAMPP newsletter. Thank you and I look forward to your continued and unstinted support in future activities of SLAMPP.

Dr. Ganga Sinniah
Immediate-Past President SLAMPP (2018-2020)



PLANT HEALTH 2020 –Special Issue of Ceylon Journal of Science (CJS)

The National Symposium, "Plant Health 2019", was held on 30th August 2019 at the Oak Ray Regency Hotel, Kandy with the theme of "Ensuring safer plant produce for human consumption". This was the first symposium of its kind to be held and only the second Plant Pathology Symposium ever to be held in the country's history. The symposium, that coincided with the United Nation declaration of the year 2020 as the "International year of Plant Health", was organized by the SLAMPP. The Special issue of the Ceylon Journal of Science is dedicated to the Proceedings of the National Symposium "Plant Health 2019". SLAMPP wish to thank the CJS editorial board and all the reviewers contributed for the successful completion of the volume.

You can access the papers now @ https://cjs.sljol.info/685/volume/49/issue/5/

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Can the local strains of *Ganoderma lucidum* be cultivated successfully?

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Ganoderma lucidum is an economically valuable mushroom that occurs naturally in many parts of the globe. It is valued for its medicinal properties rather than for its nutrients. This is a popular mushroom commercially cultivated in the tropical and temperate areas of the world. A variety of commercial *G. lucidum* products are currently available in the market in various forms, such as powders, dietary supplements, and capsules. These are produced from different parts of *G. lucidum*, including mycelia, spores, and fruiting body. It is known for its anti-diabetic, immuno-enhancement and hepato-protective effects. Artificial cultivation of this mushroom is required for the production of *G. lucidum* based pharmacological products and other dietary supplements. The global market of this mushroom is valued at US$ 3096 Million in 2019 and predicted to be US$ 5059 Million in 2027 and the demand is increasing in Europe and America. This highlights the immense commercial importance of this mushroom.

These basidiomycetes grow in decaying hardwood trees and morphologically they can be identified using their brownish hard fruiting body, white margin and red-brown coloured spores. There are several species of *Ganoderma* occurring in Sri Lanka. Cultivation of *G. lucidum* has been introduced to the mushroom research and industryof Sri Lanka recently. Yet all the introduced strains are not locally originated and may not be suitable for Sri Lankan climatic conditions. Higher yields can be obtained if local strains are cultivated since temperature, humidity and light intensity are optimal. We have cultivated a local strain of *G. lucidum* to address this issue and have obtained successful results. Rubber saw dust is a good substrate when supplemented with rice bran to cultivate the mushroom. This would enhance various new opportunities in product development and empower national economy if cultivated aiming the export market.

Figure 1. A local strain of *Ganoderma lucidum* cultivated in a fruiting bag

Figure 2. A wild *Ganoderma* sp. in Sri Lanka

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Feature article

Anaerobic Soil Disinfestations (ASD) as an environmental friendly means of controlling soil-borne pathogens

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Agrochemical application has become an essential component in today's agriculture. Heavy agrochemical application started in Sri Lanka after 1977, along with lifting the import restrictions. Even though application of agrochemicals greatly increased agricultural productivity, it also created a series of undesirable effects to the soil, water bodies and both macro and microorganisms. Recent soil metagenomics studies have shown that long-term application of agrochemicals directly affects the microbial biomass, soil microbial community structures and their ecosystem functions.

Given the rising prevalence of agrochemical usage and their negative impacts, Sri Lankan government took a step towards implementing organic agricultural practices. However, it will be very challenging for large-scale farmers to adapt into organic agricultural practices without having effective and alternative means of pesticides. Among various pests and diseases that affect crop productivity, soil-borne pathogen control is particularly challenging due to their wide host ranges and the ability to produce long-lasting survival structures (microsclerotia, sclerotia, chlamydospores or oospores). Hence, soil chemical fumigation is often practised by the developed countries with large-scale agricultural systems. However, Sri Lanka and other developing countries with small-scale agricultural systems are left with only a few options and one of them is drenching of soil with fungicides before planting.

Under such circumstances, Anaerobic Soil Disinfestations (ASD), an eco-friendly approach to control soil-borne phytopathogens is introduced. In our recent publication (Priyashantha, and Attanayake, 2021), we have proposed that ASD can be a game-changer in the tropical agriculture and can be a suitable alternative to chemical fumigations. ASD studies have been independently introduced in 2000 by scientists in Japan, and the Netherlands. Later the technology has been well tested in the USA. During its 20-year history, the method has been proven to be effective in controlling a wide range of soil-borne phytopathogens including fungi, oomycete, nematode and protozoa.

ASD, as the name implies is a process of disinfecting soil by following few simple steps, *viz* -incorporation of organic amendments (which is usually an easily labile carbon source such as; fresh crop and grass residues, rice bran, wheat bran, and grape pomace *etc.*) to the topsoil, wet the soil up to field capacity and covering the soil with a gas-impermeable polyethylene sheet for several weeks to create anaerobic condition. Polyethylene sheet and moisture help creating an anaerobic soil condition. Organic matter amended in soil is degraded initially by aerobic microorganisms in soil and later anaerobic microorganisms promote the degradation. Various toxic gasses released during the microbial activities (e.g., CO_2, NH_3, H_2S, CH_4, and N_2O) are further trapped within the soil. Moreover, various bioactive antifungal and microbial volatile compounds (e.g., alkenes, alcohols, ketones, terpenes, benzenoids, pyrazines, acids and esters) are released due to the microbial community activities and create a more hazardous environment. Ultimately, the population of soil-borne phytopathogens will be reduced and potential mechanisms of pathogen control are proposed in Priyashantha and Attanayake (2021).

Even though organic matter amendment to topsoil is historically practised in Sri Lankan agriculture, no records are available on the application of ASD. The key difference between compost/organic matter amendment to soil and the ASD is the induction of anaerobic conditions to alter soil microbial communities in order to mitigate soil-borne phytopathogens. It is often reported that the careful choice of carbon source (C) plays an important role in ASD.

Sri Lankan upcountry vegetable production system is often attacked by various soil-borne pathogens such as *Sclerotinia sclerotiorum*, *Phytophthora* spp., *Pythium* spp., *Rhizoctonia* spp. and various nematode species. Our preliminary research reported that ASD is effective in mitigating the germination sclerotia, survival structures of *S. sclerotiorum* (Mahalingam *et al.*, 2020 and Priyashantha *et al.*, Unpublished data) in both greenhouse/controlled as well as field studies. We found that up to 96–100% reduction of sclerotial germination (survival structure of the pathogen, *S. sclerotiorum*) was achieved when cabbage and leek cull piles were used as the C source (Mahalingam *et al.*, 2020). Research studies conducted in other countries have reported that ASD is very much effective in controlling diverse groups of fungal pathogens and nematodes. ASD is also advantageous over other traditional techniques such as biological control, flooding, soil pasteurization, hot water treatment, and biofumigation by improving soil properties, targeting a broad range of pathogens, simplicity of the technique and high efficacy.

In summary, ASD could be given immense support to the Sri Lankan farmers to control soil-borne pathogens while improving soil texture, moisture and quality and achieving sustainability. Though, it is proven effective against many other pathogens in other countries, there are no enough studies conducted in Sri Lanka. Therefore, future studies are needed in order to determine the efficacy of ASD on other soil-borne pathogenic species.

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Annual General Meeting of SLAMPP – 2021

The 5th Annual General Meeting of the Sri Lanka Association for Mycology and Plant Pathology (SLAMPP) was SLAMPP AGM 2021: The Annual General Meeting (AGM) 2021 of SLAMPP was held via zoom on 15th May, 2.00 pm. (GMT+5:30) in the presence of majority of its members. The outgoing president Dr. Ganga Sinniah was chaired the meeting. During the AGM, a new executive committee elected were proposed and confirmed. The progress of the past year was reviewed and meeting was closed with the remarks of newly elected president Dr. Dimuthu Manamgoda. All the members appreciate the immediate past/outgoing President, Dr. Ganga Sinniah and Secretary, Dr. Chathurika Karunanayake for their commitments in SLAMPP activities during past two years.

A new threat to Moringa cultivation in Sri Lanka

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Moringa (*Moringa oleifera*) is not usually affected by any serious pests or diseases; however, minor diseases can occur in unfavorable climatic conditions. With the expansion of moringa cultivation, these diseases have become more common. However, no reports of pod rot associated with moringa cultivation have been found in Sri Lanka. Brown color patches on the pods, followed by splitting and rotting of the pods as they mature, have been observed to reduce the moringa seed industry's economic yield. Fungal isolation was done on diseased moringa pods collected throughout the country. We have noticed that pods that have reached maturity have extensive rot. At the start of the disease, elliptical or elongated sunken small spots with raised light brown-reddish color margins were observed on green pods. Due to unfavorable climate conditions, those patches grew larger with maturity, forming a brown color lesion (Pic 01). Lesions were discovered in the immature pods while harvesting the pods as a vegetable. It did not cause critical crop damage at this stage, but it does cause severe crop loss in some cases. If the pathogen infects the premature pods, diseased pods may have thinner stigmatic ends than healthy pods. Those pods can rot and dry up prematurely in the later stages of disease development (Pic 01). However, when the diseased pods matured, extensive rot was observed. Symptoms of the disease can be seen across the entire surface of the pods. Pods prematurely rot and dry in later stages of disease development, leaving uneven raised spots on the surface.

Curvularis hawaiiensis (syn. Bipolaris hawaiiensis (M.B. Ellis), *Drechslera hawaiiensis* (Bugnic.); *Helminthosporium hawaiiense* (Bugnic.)) was identified as the causative organism. Koch's postulates were used to determine pathogenicity. *Curvularia hawaiiensis* pod rot has been identified as a serious problem in this cultivation. In Sri Lanka, this disease appears to be a new finding for moringa. It was discovered to be a new disease of edible moringa pods in Maharashtra, which was identified as *Drechslera*

Fig 1: Infected Moringa pods

This fungus belongs to the Kingdom Fungi. Subkingdom: Dikarya, Division: Ascomycota, Subdivision: Pezizomycotina, Class: Dothideomycetes, order: Pleosporales. Drechslera is a genus in the Pleosporaceae family. The vast majority of planting materials are imported from India. As a result, as the oil extraction industry develops in Sri Lanka, those fungi may move there with the contaminated seeds. In Sri Lanka, the extraction of oil from dry seeds, as well as several value-added products derived from mature moringa, is a thriving industry. As a result, moringa pods should be left in the trees until completely dry before being harvested for their seeds. These brown lesions split and rot the pods as they mature. It served as a breeding ground for a variety of pests and diseases. Those symptoms spread and became severe in high humid rainy climatic conditions. Although it has not been reported, *Curvularia* spp. can infect other food crops such as green grams in Sri Lanka.

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Okra enation leaf curl disease: Another menace to okra cultivation

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Okra (*Abelmoschus esculentus* L.) is one of the most popular vegetables in Sri Lanka. This crop is cultivated in all agro-climatic zones of Sri Lanka, except the up-country wet zone. A recent report of the Department of Census and Statistics says the okra is cultivated in over 8,000 ha with an annual production of about 50,000 mt. The immature okra fruits are consumed mainly as curry, but they also can be used to prepare salads, soups and stews. The nutritive values and ethnopharmacological and medicinal properties of this vegetable have been reported in various studies. Diseases caused by viruses, especially begomoviruses, are a severe problem all over the okra growing countries. In Asia and Africa, diseases like leaf curl, yellow vein mosaic and enation leaf curl are the most common begomovirus diseases. The yield loss caused by these diseases may vary between 30 and 100%, depending on the plant's growth stage at the time of infection.

The genus *Begomovirus* is one of the most important genera of the family *Geminiviridae*. In this genera, each virion is made by assembling a twinned protein coat. Inside the protein coat, they have their genetic material in the form of single-strand circular DNA, which is organised into either monopartite (with DNA-A) or bipartite (with DNA A and DNA B). The monopartite begomoviruses are widely spread in the Old World, and they are associated with satellite molecules (virus-dependent nucleic acids), namely betasatellites, alphasatellites and deltasatellites. These satellite molecules depend on their helper begomovirus for their movement and replication. The role of satellites in disease development varies with the type of satellite molecule and the host-begomovirus systems. Several studies have shown that the βC1 protein encoded by betasatellites plays an essential role in inducing symptoms and suppressing the transcriptional and post-transcriptional gene silencing in the host plant.

Till now, 424 species of begomoviruses have been listed by the International Committee on Taxonomy of Viruses (https://talk.ictvonline.org/), out of this nine species (*Bhendi yellow vein mosaic virus*, *Bhendi yellow vein Bhubhaneswar virus*, *Bhendi yellow vein mosaic Delhi virus*, *Bhendi yellow vein Haryana virus*, *Okra enation leaf curl virus*, *Okra mottle virus*, *Okra leaf curl Oman virus*, *Okra yellow mosaic Mexico virus* and *Okra yellow crinkle virus*) cause diseases in okra.

In Sri Lanka, yellow vein mosaic disease is a severe threat to okra cultivation for many years. The disease has been reported in all okra growing regions in Sri Lanka, but significant losses noted mainly in the dry zone. Recent reports say the recommended varieties such as MI5, MI7 and Haritha also show disease symptoms, but the disease severity varies among the varieties. Some recently introduced hybrid varieties (e.g. Maha F1 and No-521) were resistant to the yellow vein mosaic disease. In 2015, the complete genomes of 12 begomovirus isolates representing different locations in Sri Lanka were sequenced to identify the species associated with the yellow vein mosaic disease. Two distinct monopartite begomovirus species, namely *Bhendi yellow vein mosaic virus* and *Okra enation leaf curl virus* were found in the samples. Both of the species were associated with a common betasatellite species, *Bhendy yellow vein mosaic betasatellite*. Even though the plants carried *Okra enation leaf curl virus*, the plants showed yellow vein mosaic symptom only. Mixed infection of *Okra enation leaf curl virus* and *Bhendi yellow vein mosaic virus* has also been reported earlier in India.

A couple of years later, okra growing in some fields in Northern Province showed symptoms such as leaf and vein thickening, upward leaf curling and stunted plant growth. While this type of symptoms was new to the Northern Province in Sri Lanka, similar symptoms have been well described for the plants affected by the okra enation leaf curl disease in many parts of India. In addition, continuous field studies showed that this new disease affected only the hybrid varieties which were recently introduced as resistant or tolerant to yellow vein mosaic disease. Genome sequence studies further revealed the association of *Okra enation leaf curl virus* with the diseased plants. In addition, the diseased plants also had a betasatellite (*Bhendy yellow vein mosaic betasatellite*) and an alphasatellite (*Bhendi yellow vein mosaic alphasatellite* or *Okra leaf curl alphasatellite*).

The detection of *Okra enation leaf curl virus* in non-symptomatic recommended varieties and development of symptoms only in newly introduced hybrid varieties implies the prior existence of the virus species. The virus species might have already originated from *Bhendi yellow vein mosaic virus* and other related species by recombination and might remained symptomless until it finds a susceptible okra variety. The newly introduced hybrid varieties remained as the major alternative solution for the yellow vein mosaic disease. Nevertheless, the development of okra enation leaf curl disease in these varieties may significantly impact okra production in the future. The findings of this study will be beneficial to plant breeders who are involving in the production of yellow vein mosaic disease resistant okra varieties; now, they also need to consider enation leaf curl disease while they produce new varieties. The presence of okra germplasms that are resistant or tolerant to both types of diseases will greatly benefit breeders.

Fig 1. Symptoms of Okra enation leaf curl virus-infected okra plants in the field; severe upward leaf curling and associated vein thickening.

HOW TO BECOME A MEMBER OF SLAMPP?

For those who are interested in SLAMPP and its activities, and would like to become part of national community who are engaging in scientific, educational and community relations of Mycology and plant pathology can become a member of the team.

Eligibility

(i) **Regular member**

Any person possessing at least a bachelor's degree from a recognized University in Biological, Agricultural Sciences, Mycology, Plant Pathology or any related discipline or Equivalent qualifications is eligible for Regular Membership.

(ii) **Affiliated Member**

Any person or a group of persons associated with Mycology and Plant Pathology or a related discipline or activity and deemed acceptable to the Association on the grounds of training, experience or position is eligible for Affiliated Membership.

(iii) **Student Member**

Bona fide postgraduate students in Mycology, Plant Pathology or a related discipline, who are not employed on a full-time basis, may apply for student membership. Membership should be renewed on an annual basis. Applications must be accompanied by appropriate documentation certified by the Head of the Department of the University/Sectional Head of the Institution.

(iv) **Honorary Member**

Any member of the Association may nominate a person for election as an Honorary Member on the grounds of an outstanding contribution to Mycology, Plant Pathology or to the Association.

Written nominations, proposed and seconded by two members, must be submitted to the Secretary, SLAMPP giving sufficient time before the Annual/Biennial General Meeting to allow inclusion in the agenda.

The nomination shall be announced at the Annual/Biennial General Meeting, and election shall then be by ballot.

The President of The Association shall present Honorary Members with membership certificates at a social function held during the Symposium.

Application can be obtained at: http://slampp.org.lk and by email through slampp@gmail.com

Note: Each application will be individually considered by the Executive Committee and the decision of the Executive Committee will be informed to the successful applicants who will become a member upon payment of the appropriate membership fee. Individual members are entitled to receive SLAMMP Newsletter and attend or participate fully in the meetings, symposia, conferences and any other activity organized for membership by the SLAMPP.

Membership/Subscription fees (for 2020)

Regular/Associate Member	**Rs. 1000/=**
Life member	**Rs. 5000/=**
Student Member	**Rs. 500/=**

Payment of membership fee: Remit money at the Bank of Ceylon, Peradeniya Branch Account No. 8372739 and attach the scanned copy of the deposit slip and send to slampplk@gmail.com. Cheques written in favor of "Sri Lanka Association for Mycology and Plant Pathology' must be sent to the Treasurer/SLAMPP.

UPCOMING INTERNATIONAL CONFERENCES

The International Conference on Multidisciplinary Approaches in Science 2021 (ICMAS – 2021)
Website URL: https://cmb.ac.lk/event/icmas-2021/
Virtual
November 24-26, 2021

Annual Research Conference 2021 - Faculty of Graduate Studies, UOC
Website URL: https://cmb.ac.lk/event/fgs-arc-2021/
August 20, 2021

International Conference on Applied and Pure Sciences 2021 (ICAPS 2021)
Website URL: https://conf.kln.ac.lk/icaps/
October 29, 2021
Faculty of Science, University of Kelaniya

International Conference on Agriculture (ICAG)
Website URL:
http://asar.org.in/Conference/17384/ICAG/
July 05, 2021
Colombo, Sri Lanka

International Conference on Agriculture (ICAG)
Website URL:
http://asar.org.in/Conference/17634/ICAG/
August 05, 2021
Colombo, Sri Lanka

International Conference on Innovation and Emerging Technologies (ICIET 2021)
Website URL:
http://iciet.sjp.ac.lk/
November 25-16, 2021
Homagama, Sri Lanka

Asian Mycological Congress (AMC 2021)
Website URL:
http://iciet.sjp.ac.lk/
December 15-17, 2021
Thailand Science Park Center, Thailand

International Conference on Botany and Plant Pathology, ICBPP 2021
Website URL: https://waset.org/botany-and-plant-pathology-conference-in-august-2021-in-dubai
Dubai, UAE
August 16-17, 2021

International Conference on Phytopathology and Plant Disorders, ICPPD 2021
Website URL: https://waset.org/phytopathology-and-plant-disorders-conference-in-august-2021-in-rome
Rome, Italy
August 23-24, 2021

International Conference on Phytopathology and Plant Diseases, ICPPD 2021
Website URL: https://waset.org/phytopathology-and-plant-diseases-conference-in-october-2021-in-rome
Rome, Italy
October 18-19, 2021

International Conference on Phytopathology and Pathogenic Infections (Digital), ICPPI 2021
Website URL: https://waset.org/phytopathology-and-pathogenic-infections-conference-in-october-2021-in-london
London, UK
October 21-22, 2021

International Conference on Pathogenic Fungi and Mycology (Digital), ICPFM 2021
Website URL: https://waset.org/pathogenic-fungi-and-mycology-conference-in-december-2021-in-kuala-lumpur
Kuala Lumpur, Malaysia
December 06-07, 2021

Plant Health 2021 Online
Website
URL: https://www.apsnet.org/meetings/annual/PlantHealth2021/Pages/default.aspx
August 02-06, 2021

International Conference on Phytopathology and Plant Protection ICPPP (Conference)
Website URL: https://waset.org/phytopathology-and-plant-protection-conference-in-october-2021-in-athens
October 21-22, 2021
Athens, Greece

International Conference on Plant Pathology and Plant Virology ICPPPV
Website URL: https://waset.org/plant-pathology-and-plant-virology-conference-in-november-2021-in-bangkok
November 29-30, 2021
Bangkok, Thailand

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