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KENYA IMPORTS TWO PROMISING BIOCONTROL AGENTS TO FIGHT THE INVASIVE WEED *PARTHENIUM HYSTEROPHORUS*

One of the world's worst invasive terrestrial plants is the annual shrub *Parthenium hysterophorus* (Asteraceae), native to Central and South America. This plant has rapidly invaded at least 48 countries on African, Asian, and Australian continents and islands in recent decades. Rampant growth, prolific seed production, high viability of relatively long-lived seed banks that reside in the soil, and the production of allelochemicals that inhibit growth of other vegetation, contribute to its invasive capabilities. Without its natural enemies, parthenium weed has spread unchecked in countries into which it has been unintentionally introduced. Severe economic losses have resulted from invasion by parthenium weed as crop yield losses of up to 90% may occur, as well as impacts on available grazing for animal production, meat and milk quality, and loss of biodiversity due to monospecific stands of this plant.

A number of management strategies are available to control parthenium weed, but some pose problems. For example, hand-weeding can cause severe allergic reactions and respiratory issues, and chemical control is often costly for resource poor farmers. Biological control, on the other hand, has proven to be useful in several countries. It employs selected, host specific natural enemies from the origin of the plant to target various parts of the plant. Often, it is not just a single biocontrol agent that provides entire control of an invasive alien plant, but a combination of natural enemies that cumulatively suppress the plant's vegetative and reproductive outputs, under different environmental conditions and habitats.

Since 2005, the USAID-funded Feed the Future Innovation Lab for Integrated Pest Management has built capacity, expertise, and facilities, and facilitated the introduction of host specific natural enemies for the biological control of parthenium weed in East Africa. Led by Virginia Tech and Virginia State University, and together with various national research organizations in each participating country, the project has aided the introduction of biological control agents to assist with the management of parthenium weed in East Africa. Two insect agents, namely the stem-boring weevil *Listronotus setosipennis* (Curculionidae), originally from Argentina, and the leaf-feeding beetle *Zygogramma bicolorata* (Chrysomelidae), originally from Mexico via Australia, were imported from laboratory-reared cultures in South Africa, and evaluated, released, and established in Ethiopia and Uganda, and *Z. bicolorata* in Tanzania. Their establishment has had mixed success, but at field sites with suitable climatic conditions *Z. bicolorata* has extensively defoliated parthenium weed plants, to the extent that other vegetation has replaced parthenium weed at field sites in southern Ethiopia. The stem-boring *L. setosipennis* has also had considerable localized impact, causing internal stem damage, stunting plants, and reducing their vegetative and reproductive capacity.

Most recently, these two biocontrol agents were imported into Kenya from laboratory-reared colonies in South Africa, for purposes of mass production and field release after successful confined rearing, to manage the weed. In late November 2020, 1000 *L. setosipennis* and 550 *Z.*

bicolorata adults were supplied by the Agricultural Research Council – Plant Health and Protection (ARC-PHP) in South Africa to the National Sericulture Research Centre (NSRC) of the Kenya Agricultural and Livestock Research Organisation (KALRO) at Thika, Kenya. Technical guidance on rearing these two biocontrol agents was provided to KALRO by the

Larva of *L. setosipennis* feeding inside the stem of *P. hysterophorus* (left), Larvae of *Z. bicolorata* feeding on leaves of the weed (right)

ARC-PHP. Efforts were made to improve the quality and quantity of nursery-produced parthenium weed plants grown from seed at KALRO, as well as suitable conditions and rearing structures for the two coleopteran colonies, which are all critical elements for successful insect rearing, in addition to trained capacity. Parthenium weed plants that suit the structural requirements for the leaf-feeder and the stem-borer differ and must be tailored and consistently supplied to be able to successfully rear sufficient, healthy insect agents under laboratory, shadehouse, or glasshouse conditions, for research and for field releases.

Since their importation, colonies of both insect agents have been successfully established in a nethouse at KALRO, Thika. Currently, there are more than 1500 *L. setosipennis* and 1000 *Z. bicolorata* individuals at immature and adult stages, with the numbers increasing. It is expected that within the year, the populations of these biocontrol agents will be sufficient for initial releases and progression rearing. While these two insect agents may not solve all of the problems of parthenium weed on their own, they are a promising start to utilizing natural enemies to suppress the plant over time, for sustained, cost-effective management of parthenium weed in Kenya.

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TOMATO GRAFTING TO MANAGE BIOTIC AND ABIOTIC STRESSES

Of the top ten economically most important plant pathogenic bacteria, *Ralstonia solanacearum* ranks second. The *R. solanacearum* species complex has several strains, which infects over 200 plant species in 53 plant families. It causes severe bacterial wilt in tomato, leading to complete crop losses. Although resistant varieties to bacterial wilt is the most appropriate and a promising strategy to manage this disease, limited availability of resistant cultivars makes tomato cultivation difficult to farmers in Southeast Asia during the wet (rainy) season. Grafting tomato onto resistant eggplant rootstocks also provides an alternative and effective solution to manage this devastating disease. World Vegetable Center (WorldVeg) has identified and promoted several resistant rootstocks for tomato grafting. WorldVeg is currently promoting off-season tomato production in Cambodia and Lao PDR. A bacterial wilt resistant rootstock, VI041996 has been recently introduced into Cambodia. The grafted tomatoes were grown at Kbal Koh Vegetable Research Station in Cambodia during the wet season of 2020. Heavy rain drenched Cambodia during the first two weeks of October 2020, and the tomato plots were gradually inundated for five days.

Although 40% of the non-grafted tomato plants wilted due to flooding (picture on the left), grafted tomatoes remained healthy and continued to be harvested (picture on the right). Hence, the bacterial wilt resistant eggplant rootstocks are also able to tolerate short-term flooding. Thus, tomato grafting provides an opportunity for the farmers in Cambodia to produce tomatoes during the off-season, which could increase their income.

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LESS INPUTS, MORE AGROECOLOGY –THE LIMA RESEARCH PROPOSAL TOWARDS THE EUROPEAN GREEN DEAL CALL

The large European Research Alliance Towards a chemical pesticide free agriculture took another step towards achieving its goals. Recently, a large project consortium (LIMA - **L**ess **I**nputs**, M**ore **A**groecology) was set up consisting of 22 economic actors and partners of the retail chain and 30 research organisations working on agricultural knowledge development and innovation support as well as several companies providing innovative technologies. 16 EU countries covering all agroecological zones will take part in this project, which has been submitted for funding to the EU, recently.

In response to the targets of the European Green Deal and the Farm-to-Fork-Strategy the goal of LIMA is to boost reductions of chemical pesticide use (over 50%), chemical fertilizer use (over 20%) and nutrient losses (over 50%) via the uptake of systemic innovations by the actors of a large number of food chains across Europe. In a novel approach, LIMA will strongly collaborate

with all actors of the food chain, reaching from primary production via active engagement of the retail and food chain to creating exchange with consumers and citizens as well as policy makers. The project partners, especially the innovative pilot food chains, consisting of producers and food chain partners, will test and demonstrate combinations of highly promising biotechnical and organizational or social innovations. Those pilots will serve as proof of concept and as catalysts to deploy innovations and best practices on regional, national and European scale. They will steer future innovation in all types of cropping systems in every European region.
The key objective of LIMA is based on the agroecological concept and fosters combinations of ecological, technological, organizational, social and institutional innovations which will ultimately unlock the use of low-input/loss practices at farm-level. Knowledge sharing will be facilitated and push for a transition to foster low-input/low-loss agriculture and innovation uptake by creating, using and disseminating new training guidelines and digital tools for young and future professionals. LIMA will develop new strategies and guidance towards achieving the objectives of the Farm-to-Fork-Strategy.

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IAPPS Mission: to provide a global forum for the purpose of identifying, evaluating, integrating, and promoting plant protection concepts, technologies, and policies that are economically, environmentally, and socially acceptable.

It seeks to provide a global umbrella for the plant protection sciences to facilitate and promote the application of the Integrated Pest Management (IPM) approach to the world's crop and forest ecosystems.

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