Helping Workitu Eirgu and Other Rural Women in Ethiopia Tackle the Scourge of the Invasive Weed Parthenium

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Rural Women and the Parthenium Scourge

In Ethiopia and in the rest of Sub-Saharan Africa, weeding is an agricultural task designated as "women's work." For women in rural households, this task is in addition to other numerous tasks they undertake daily, including preparing family meals, caring for infants, fetching water, raising poultry, tending home gardens and selling milk and vegetables in markets to generate income. Rural Ethiopian women were already occupied with household and agricultural tasks when the noxious alien invasive weed parthenium (*Parthenium hysterophorus* L.) arrived in the country in the mid-1970s.

The noxious weed parthenium has invaded Workitu Eirgu's homestead (land around her residence) and farm as it has throughout Ethiopia. Parthenium displaces all grasses and broadleaf plants and becomes the only plant species around.

Parthenium, known locally as "Farmasissa," which means sign away your land, disproportionally affects rural women compared to men. Since its entry into Ethiopia, parthenium has greatly increased women's workload because, unlike other weeds, it emerges several times during the

same rainy season and therefore requires weeding multiple times. Cows' milk is tainted when they feed on it, which reduces the milk's market value. It invades land around dwellings where women grow vegetables for consumption and to sell in local markets to generate income for their families. Consequently, there is less produce and reduced income-earning opportunities. Observations in Ethiopia and elsewhere also indicate that women develop allergies and skin rashes more than men when they come in contact with the parthenium plant and its pollen.

Biological Control to the Rescue

In its native range in Central and Southern America, natural enemies keep parthenium by feeding on it. When parthenium invaded Africa, it spread because there were no natural enemies that could have curbed its spread. The Parthenium Project led by Virginia State University (VSU) and funded by the U.S. Agency for International Development (USAID) through the Integrated Pest Management Innovation Lab (IPM IL) at Virginia Tech has introduced two of these natural enemies—a leaf-feeding beetle, *Zygogramma bicolorata* and a stem-boring weevil, *Listronotus setosipennis*—in Ethiopia to abate the spread of this invasive weed.

The larvae (left) and the adult (right) of the beetle (*Zygogramma bicolorata*) feed on parthenium leaves and flowers.

The adult beetle and its larvae feed on the parthenium leaves and defoliate it. Repeated defoliation by several beetles weakens parthenium and allows the natural vegetation to come

back. By contrast, the weevil kills it from the inside. The adult weevil lays its eggs on the parthenium flower and the larvae that hatch enter the stem to feed. Five or six larvae feeding inside the stem can kill a parthenium plant.

Female weevils (*Listronotus setosipennis*) lay eggs on parthenium flower and cover it with frass (black spots). The eggs then hatch and the larvae enter into the stem to feed (right).

Both natural enemies were tested in Ethiopia to determine if they feed and reproduce on any plant other than parthenium. The test results indicated that the natural enemies are specific to parthenium and do not attack other plants. The beetle has been effectively deployed against parthenium in Australia and India for more than 30 years and in South Africa for five years with no reported damage to any other plant. Similarly, the weevil has been released in Australia and South Africa to control parthenium without any reported damage to other plant species. The beetle and the weevil are now reared and being released throughout Ethiopia.

Pregnant Workitu Eirgu and her son Tesfa Kifle were happy to see Parthenium Project staff members Kassa Urgi and Demeku Zewide release the weevil around their property to control parthenium.

Release of Zygogramma and Listronotus at Workitu's Property

Workitu Eirgu resides in Wollenchiti in central Ethiopia with her husband Tekele Bekele and six children. The family grows teff, beans, sorghum and maize on a-half hectare (1.25 acres) of land. Workitu and her husband own a cow that produces milk for their children to consume and for sale in the market. Like all her neighbors, Workitu's homestead and farms are heavily infested by parthenium. Currently, the main method of parthenium control is hand weeding using family and hired labor that costs 100 Birr (3.50 USD) per day for 15 days each year. Since teff is an important food crop, fields planted to this crop are weeded regularly; if there is money or labor available, other crops will also be weeded. Workitu said that parthenium reduces the yield of crops like teff, and when cows feed on the weed their milk is tainted and children refuse to drink it. She also stated that weeding parthenium keeps her busy during the rainy season. When Parthenium Project staff informed Workitu about the possibility of controlling parthenium using natural enemies, she asked that they release them on her property.

On August 2, 2017, Parthenium Project staff members Lidya Alemayehu, Kasu Urgi and Demeku Zewide released 200 adult weevils around Workitu's house (homestead). On the same day, staff released 500 adult beetles at a nearby land that was also invaded by the weed.

What Happened at Workitu's Property 48 Days after the Release of the Natural Enemies?

The beetle was released on parthenium on August 2, 2017, (left), and by September 18, 2017, the grass vigorously came back (right) after the parthenium was weakened by the defoliation. (The arrow on the right shows some of the damaged parthenium).

When Parthenium Project staff members returned to Workitu's property on September 18, 2017, to evaluate the conditions of the insects and parthenium, they noticed the beetle on parthenium plants growing by the road far from the release site. On average, the adult beetles have moved 16±1.5 m (53 feet) away from the release site. By the beginning of January 2018, the beetles were spotted 41.8±3.5 m (138 feet) away. At the location where the beetles were released, staff noticed defoliated parthenium with eggs and larvae. They scored the damage as 5 (0 means no damage and 5 means more than 80 percent of the parthenium leaves show feeding symptoms). The presence of eggs and larvae on parthenium leaves indicate that a new generation of the beetle has emerged since the release. On average, there were 32±3 eggs, 43±4 larvae and 9±1.3 adults per quarter meter square area. The average numbers reported here are ± standard error (p <005).

Kassa released the weevils at Workitu's homestead on August 2, 2017, (left) and by September 18, 2017, the parthenium was damaged by the insect allowing broadleaf plants to reemerge (right).

Parthenium Project staff also visited the nearby homestead where the weevils were released. Most of the parthenium was either dead or wilting as a result of weevil damage. The damage by the weevil was scored as 5. Staff members noticed black spots on the flower of the few remaining parthenium plants, a sign of the adult weevils laying eggs. They uprooted some of the dead parthenium and dissected the stem where they found several weevil larvae, which indicated the cause of parthenium's demise. But the weevil was not detected outside of the release location. The weevil is only active in the evening and hides during the day on leaves. The weevil is known to fly a very short distance and spreads mainly by the larvae hiding inside pieces of the parthenium stem or by moving water.

The beetle and the weevil were released at adjacent locations. Each bio-agent damaged parthenium, albeit in different ways. The beetle fed on the leaves and flowers, while the weevil killed parthenium by burrowing inside the stem. Regardless of the mode of damage, both natural enemies weakened parthenium and allowed the grass and the native broadleaf plants to reemerge. Although the beetle proved to be more mobile than the weevil, both are effective and only a small number of weevil are required for release as its larvae are protected from the elements by residing inside the parthenium stem.

Impact

Controlling parthenium using the natural enemies has the following impacts:

- Workitu didn't have to spend time weeding parthenium during her pregnancy.
- Once the bio-agents establish, Workitu will save at least 1,500 Birr (53 USD) by not hiring local help to weed parthenium.
- The land around Workitu's house became available to grow vegetables for the family and for sale to generate income for the household.
- Workitu's exposure to the parthenium plant and its pollen was reduced, thereby minimizing her risk of allergies and skin rashes.
- Workitu's children will have milk that is not tainted.

The Future

After the rains stop and the parthenium plant ceases to emerge in November, both bio-agents will enter the soil to spend the dry season there. The following season when it rains and parthenium starts to emerge, the natural enemies will also come out to start feeding on the weed. This cycle will repeat itself once the bio-agents establish in the area. Neither the beetle nor the weevil needs to be reintroduced every year at Workitu's homestead. They will reemerge and start to control parthenium with no cost to Workitu. If conditions are favorable, the beetle and the weevil will reproduce and move to nearby homesteads and crop fields where parthenium is found. As a result, the entire neighborhood will benefit.

Once established at an area, the bio-agents will provide long-term sustainable control of parthenium with no cost to farmers. However, this effort is just starting at Wollenchiti and needs to be repeated in all parthenium-infested regions of Ethiopia. It took 10 years for the beetle to establish in Australia and four years in India. In South Africa it was released in 2013 and has not yet established. The weevil took 10 years to become prevalent in Australia and in South Africa it has yet to have an impact since its release in 2013.

Ethiopia has varied ecological zones separated by mountain ranges and dry areas, which may impede the migration of the beetle and the weevil from the areas where they are released. Due to these physical barriers, the beetle and the weevil have to be reared in large numbers in different parts of the country and released over several years. Consequently, it may take years of focused effort before the natural enemies establish and have an impact in Ethiopia.

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