Controlling the 'famine weed'

Integrated management is needed to control parthenium, a member of the Asteraceae family and a noxious weed that threatens food security, biodiversity and human and animal health. **Robyn Joubert** reports.

LORRAINE STRATHIE

The invasive *Parthenium hysterophorus* is spreading rapidly across KwaZulu-Natal, Mpumalanga and North West. Unless urgent steps are taken to control this weed, it will invade croplands and game reserves, and interfere with animal and human health.

"Parthenium has formed dense infestations, particularly in northern KZN, eastern Mpumalanga, North West and, to a lesser extent, Limpopo. It is rampant throughout Swaziland, and present in Mozambique, Zimbabwe and many east African countries," says Lorraine Strathie, researcher at the Agricultural Research Council – Plant Protection Research Institute (ARC-PPRI).

Much of sub-Saharan Africa is climatically suitable for invasion by parthenium, a white-flowering annual plant from Central and South America. It was first recorded in South Africa in 1880 but became more prevalent in the 1980s, after cyclone Demoina.

"Both density and spread have increased since then and will continue to do so," explains Strathie. "In Ethiopia, the local name for parthenium means 'sign off and leave your land'. In South Africa, it has been named 'famine weed' due to the severe and extensive impacts that it can cause."

Parthenium is a prolific seed producer with a rapid growth rate. The adult plant can generate up to 25 000 viable seeds, which can mature to flowering plant stage in four weeks. The weed poses huge risks to agriculture, impacting on crop and animal production.

"In India, parthenium causes a yield decline of up to 40% in some agricultural crops. In Ethiopia, sorghum grain yield was reduced by between 40% and 97% where parthenium was left uncontrolled. In Australia, about 170 000 km^2 of prime grazing country in Queensland was infested by 1994, causing economic losses of A$16,8 million a year," says Strathie.

THE WEED CAN BE MANAGED THROUGH A COMBINATION OF CONTROL METHODS

The plant produces allelochemicals, which inhibit the growth of surrounding plants and increase its invasive capacity. It also causes human health problems such as asthma, bronchitis, dermatitis and hayfever, and taints the milk and meat of animals. Parthenium in animal feed causes dermatitis with pronounced skin lesions, and can kill cattle and buffalo if it makes up between 10% and 50% of their diet.

Subsistence farmers in particular can be badly affected when the weed invades grazing and arable land. Chemical control methods may be beyond their financial means and hand-weeding carries the human health risks associated with contact with parthenium.

CONTROL OPTIONS

The weed can be successfully managed through a combination of control methods including biological and chemical control, containment strategies, and the utilisation of competitive plants.

Ezemvelo KZN Wildlife has compiled a draft strategy to control current parthenium infestations in their protected areas. Invasion can be curbed by reducing seed introduction and spread, addressing various high-risk activities and following through on appropriate management decisions.

The KZN Department of Agriculture and Environmental Affairs' Invasive Alien Species Programme offers landowners a herbicide assistance programme for parthenium control.

"The South African National Biodiversity Institute's (Sanbi) Invasive Species Programme has a containment project directed at chemical control of parthenium south of Richards Bay. Follow-up herbicide application is required to provide effective suppression," explains Strathie.

Landowners should improve their land management practices. "High stocking rates lead to overgrazing, which leaves the soil bare and allows parthenium to invade. Eventually, this leads to monospecific stands of parthenium, which are not palatable to animals. Farmers can significantly reduce the effect of parthenium by reducing stocking rates and maintaining good grass cover."

New outbreaks of the weed have been linked to earthworks, road construction and maintenance, agricultural machinery, vehicles, and transport of stock, fodder and grain from infested areas.

"Seed is dispersed via vehicles, water, animals, machinery and wind," says Strathie. "Disturbed habitats, such as roadsides and railway tracks, stockyards, building surrounds and fallow agricultural lands, are particularly suitable due to high levels of disturbance and a lack of interspecies competition."

It is difficult to prevent the spread of seed. However, measures such as cleaning equipment before moving it, and setting up spray booths to wash down vehicles and machinery at entry points to farms and game reserves

An SA parthenium identification kit has been developed to increase awareness of the weed . It is available in English and Zulu on the Invasive Species South Africa website (www.invasives.org.za/resources/downloadable-resources)

can help. The sludge that is washed off may contain seed and should be collected and treated with herbicide.

In 2003, ARC-PPRI initiated a biological control research programme, funded by DEA Natural Resource Management's Working for Water Programme. This made South Africa the first African country and the third country worldwide to implement an active biological control programme against parthenium.

A suite of agents is needed to achieve effective biological control of the plant under different environmental conditions, seasons and habitats. Following research by ARC-PPRI, the rust fungus *Puccinia xanthii* var. *parthenii-hysterophorae*, which affects the leaves of the weed, was released in 2010.

In June 2013, DAFF granted approval to release the stem-boring weevil *Listronotus setosipennis* and the leaf-feeding beetle *Zygogramma bicolorata*. These insects are natural enemies of the plant in its native range and, when present in high densities, can structurally damage the stems (*L. setosipennis*) or defoliate the plants (*Z. bicolorata*).

"These agents are mass-reared and released in sites in KwaZulu-Natal and Mpumalanga at the moment. They'll be released as widely as possible through the invasive range of parthenium in South Africa. Other promising insect agents are also under investigation in quarantine for future use," says Strathie.

It is widely acknowledged that biological control is integral in the sustainable, long-term management of parthenium.

"Biological control will not eradicate parthenium but will reduce populations to manageable levels. As it will take time for biological control to kick in, it's essential that interim steps are taken to curb the spread of parthenium using other control options where appropriate. Landowners must familiarise themselves with the weed and improve their land management practices to lower the risk of invasion by this plant and reduce current densities," concludes Strathie.

• *Source:* Current and potential geographical distribution of the invasive plant *Parthenium hysterophorus* (Asteraceae) in eastern and southern Africa. *McConnachie AJ, Strathie LW, Mersie W, Gebrehiwot L, Zewdie K, Abdurehim A, Abrha B, Arayat T, Asaregew F, Assefa F, Bere-Tsadik R, Nigatu L, Tadesse B, Tana T.* Weed Research. *2011 51(1).*

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1. A dense stand of parthenium. The weed poses a risk to agriculture, affecting crop and animal production, biodiversity conservation and human and animal health.

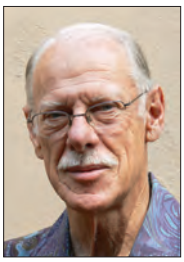
2. Parthenium biological control: the stem-boring weevil, *Listronotus setosipennis.*

3. The leaf-feeding beetle, *Zygogramma bicolorata.*

PHOTOS: LORRAINE STRATHIE

BIO MONITOR

Crucial rice genes identified



WYNAND VAN DER WALT

Expression of some genes is controlled by a single gene, and some traits by a number of genes. Other traits are affected by genes that switch them on or off. Chinese researchers have discovered genes in rice that control major characteristics.

Locating specific genes is often based on natural or induced mutations that may lead to undesirable traits. Locating the mutant gene will indicate the position of its normal counterpart. It will also help locate beneficial mutated genes. Newly discovered genes are recorded on a global databank.

The Chinese researchers looked at mutations in ancient landraces, or those that occurred more recently, and compared them with modern varieties, showing the impact of farmers' selection over thousands of years. Some of their key gene discoveries were:

• The ancestral black hull grain had a small deletion in its Bh4 gene code, leading to a pale white hull linked to a non-shattering grain trait: a two-in-one selection benefit.

• The deep root mutation, DR01, adds drought tolerance. Crossed with a high yield variety, the hybrid suffered only 10% drought tolerance loss compared with the 60% loss in conventional varieties.

• The PROG1 gene changed plant habit from prostrate to erect and increased the number of tillers due to one altered amino acid mutation during domestication.

• The GIF1 gene was selected by ancient farmers for starch production and storage during grain-filling. Its mutated version produced small seeds, overcome by genetic modification that causes over-expression of the GIF1 gene for large grain yield potential.

• *Source CIAT, October 2013.*

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