Striga or witchweed (multiple crops)

Striga species

Photo: USDA APHIS PPQ Archive, CC BY 3.0 US, www.bugwood.org

Striga hermonthica *flowering on maize.*

Photo: Rob Williams, CABI

Photo: International Institute of Tropical Agriculture, Flickr, CC BY-NC 2.0, http://bit.ly/1JvujUT

Striga gesnerioides *parasitizing roots of cowpea (left); flowers of Striga hermonthica (right).*

SUMMARY: *Striga*, or witchweed, are parasitic weeds which infest millions of hectares of land planted to maize, sorghum, millets, upland rice, cowpea and sugarcane, reducing yields by 30-100%. There are many species in Africa, growing mostly in arid regions of low soil fertility, but four dominate: *S. hermonthica, S. asiatica, S. aspera* and *S. gesnerioides*. Witchweeds tap into the xylem of host plants causing yellowing, stunting and wilting. Seeds are tiny and can spread over long distances, probably in wind-blown soil and over shorter distances in rain run-off, on shoes and hooves of livestock. Management depends on use of resistant varieties and cultural control measures, including crop rotations, weeding, raising the fertility of soils and the use of trap crops.

KEY SIGNS

The common species of witchweed in Africa are *S. hermonthica, S. asiatica, S. aspera* and *S. gesnerioides.* They parasitise cowpea, maize, sorghum, millet, sugarcane, upland rice and wild grasses. Affected plants are stunted, yellow, scorched and wilted, symptoms which are similar to nutritional deficiencies or drought. Although it is sometimes difficult to distinguish between symptoms caused by witchweed and those caused by other environmental factors, if plants wilt when the soil is still moist then this is a sign that witchweed is a likely cause.

MANAGEMENT

Prevention – what to do before signs are seen

Cultural approaches: Host resistance together with cultural control measures offer the best methods. There are now several crops bred for resistance/tolerance. For instance, there are sorghum varieties resistant to *S. asiatica* (released in Tanzania in late 2003) and varieties of maize, upland rice and sugarcane resistant to the same species. Resistance in maize has been more difficult to attain, but varieties are now available. There are also cowpeas resistant to the strains of *S. gesnerioides* in West Africa. There are as yet no witchweed-resistant millet varieties.

Control measures for *S. aspera* are generally comparable to those for *S. hermonthica*, but there are differences in varietal susceptibility and resistance: maize hybrids tolerant of *S. hermonthica* are susceptible to *S. aspera*, while rice varieties resistant/tolerant to *S. hermonthica* are also resistant/tolerant to S. aspera.

Recommended cultural measures to prevent witchweed include: improving soil fertility by, for example, rotations or intercropping with leguminous crops and use of cattle or green manure; delaying planting until seasonal rains have set in to reduce host plant water loss; and use of trap crops. Trap crops stimulate witchweed seed germination, but do not become infected so the witchweed dies, e.g. cotton, cowpea, pearl millet and soyabean are trap crops for *S. asiatica*.

Chemical approaches: Coating maize seed resistant to the herbicide imazapyr (IR maize) with the same chemical has shown promise against S. asiatica and S. hermonthica in Kenya, especially as the maize can be interplanted with legumes, as long as they are at least 15 cm away from the treated seed.

Control – what to do after signs are seen

Cultural approaches: Hand pulling of the larger species, such as *S. hermonthica*, if populations are low, but not *S. asiatica*, which is much smaller and has seeds that mature and are shed faster.

Chemical approaches: There are a number of herbicides that can be used, but in terms of cost and effectiveness, 2,4-D is possibly the best for cereal crops. The disadvantage is that more than one application may be needed and it can damage broad-leaf (e.g. leguminous) crops, if these are intercropped.

CAUSE

Most species of witchweed have bright green leaves and stems 30-100 cm high, with bright flowers and poorly developed roots. *S. gesnerioides* is different – it is totally parasitic, with small, unexpanded leaves and a cluster of fleshy, pale-green or yellow shoots, 10-20 cm high.

Witchweed seeds are tiny: each plant produces hundreds of thousands. They remain viable in the soil for many years, germinating in response to chemicals from the roots of potential host plants. The radicle fastens to a root, penetrates it, growing into the xylem, taking water, minerals, sugars and amino acids needed by the parasite until it emerges and starts to photosynthesise; however, it remains dependent on the host for food, as its ability to photosynthesise is poor. In addition, chemicals that regulate plant growth pass from the parasite to its host. These are chemicals that stunt the growth of shoots, but stimulate growth of roots, all to the advantage of the parasite.

Witchweed seeds are probably spread long distances on the wind, along with soil. Spread over short distances occurs in run-off during heavy rains, on the feet, tools and machinery of farmers, and via the hooves and gut of livestock. There is concern that some species are continuing to spread in Africa.

Witchweeds get their name because symptoms occur before the appearance of the parasite above ground. Because they need a host for germination and early development scientists call them hemiparasites.

IMPACT

The effect of witchweed can be devastating, especially to food crops – legumes, maize, millet, sorghum, sugarcane and upland rice – grown in some of the poorest farming systems of Africa. It is estimated that witchweed affects 40% of the arable savannah region, resulting in losses of up to US$13 billion per annum.

S. hermonthica is responsible for greater crop loss in Africa than any other weed. It is widespread throughout most of the continent, attacking maize, millets, sorghum, sugarcane, upland rice and wild grasses. Estimates of crop losses on sorghum are: Ghana (21%), Nigeria (10%), Gambia (8%) and Benin (6%), but there are also undefined losses in Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Kenya, Mali, Niger, Senegal, Sudan, Togo, Tanzania and Uganda. For maize, it is estimated that 4 million hectares of land is infested, with losses of 30-80%, valued at US$380 million to US$1 billion.

S. asiatica is a serious weed of sorghum, maize, millets, rice, sugarcane, upland rice and many wild grasses. Over one million hectares in Malawi and 250,000 hectares in Angola are infested. In Malawi, average crop losses in maize were put at 28% in infested fields and 4.5% for the country as a whole. Like *S. hermonthica*, it is severe where crops are grown under marginal rainfall and low soil fertility, over a wide range of soil types. In Tanzania the weed is associated with mainly sandy soils. Climate change could assist its further spread in arid regions of North Africa.

S. aspera attacks the same range of crops as *S. hermonthica*, except that it attacks maize more than sorghum, and can parasitise irrigated rice. Where the two species occur together, S. aspera emerges and matures more rapidly.

S. gesnerioides is a serious weed of cowpea across West Africa. Surveys in northern Nigeria and Burkina Faso have shown that farmers rate this weed as highly damaging, and trials have recorded yield losses of 30 to more than 50%.

DISTRIBUTION

Witchweeds occur naturally in Africa, Asia and Australia. S. hermonthica is widespread throughout Africa, but is more common in west, east and central parts of the continent, commonly associated with both sandy and clay soils of low fertility, especially those low in nitrogen. It predominates in savannah regions associated with cereals.

S. asiatica is widespread in East Africa and occurs in numerous countries (as well as in Asia): Togo, southern Ethiopia, Tanzania, Botswana, Malawi, Mozambique, Namibia, South Africa, Swaziland, Uganda, Zimbabwe and Zambia. It occurs mostly in sandy soils. *S. aspera* has a similar distribution to S. *hermonthica*, but is much less common in eastern Africa. *S. gesnerioides* has wide distribution in Africa from north to south of the continent, but only in western Africa (Senegal, Mali, Togo, Burkina Faso, Ghana, Nigeria, Niger, Cameroon and Chad) is it a serious problem on cowpea.

FURTHER READING

Striga asiatica. CABI Crop Protection Compendium: http://www.cabi.org.ezproxy.library.uq.edu.au/cpc/datasheet/51786

Striga aspera. CABI Crop Protection Compendium: http://www.cabi.org.ezproxy.library.uq.edu.au/cpc/datasheet/51848

Striga gesnerioides. CABI Crop Protection Compendium: http://www.cabi.org.ezproxy.library.uq.edu.au/cpc/datasheet/51785

Striga hermonthica. CABI Crop Protection Compendium: http://www.cabi.org.ezproxy.library.uq.edu.au/cpc/datasheet/51849

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