National regulatory control systems
Systèmes de lutte nationaux réglementaires

Sicyos angulatus

Specific scope

This standard describes control procedures aiming to monitor, contain and eradicate *Sicyos angulatus*.

Specific approval and amendment

First approved in 2010-09.

Introduction

Sicyos angulatus (Cucurbitaceae) is an annual herbaceous vine native to North America. It is also present in Asia, where it is considered a weed. Within the EPPO region, at present, the species is recorded in at least 10 European countries. It is thought to have been introduced for ornamental purposes during the 19th century, although it is no longer used as such. The species may also have been accidentally introduced as a contaminant of maize seeds imported from the USA (Larché, 2004). The species has also been found as a contaminant in bird seed. The plant reproduces by seeds, and thousands of seeds are produced (Smeda & Weller, 2001), which are spread by water, small mammals, birds and machinery. It does not seem to tolerate drought, preferring loamy and silty fertile soils, and requires adequate soil moisture.

Sicyos angulatus is mainly a weed of maize, but can also colonize soybeans. It is not a strong competitor for light and nutrients, and so does not reduce yields by direct competition. However, as an aggressive vining plant it pulls maize or soybean plants to the ground, making them impossible to harvest (one plant of *S. angulatus* can pull down four rows of maize), and may also cause harvest difficulties for other crops (e.g. tea). It also invades river banks, where it can cover 100% of the soil. This monospecific cover is a threat for other species and to the whole ecosystem. This species is therefore considered a risk in managed and unmanaged ecosystems.

Details on the biology, distribution and economic importance of *Sicyos angulatus* can be found in EPPO (2010).

EPPO member countries at risk are advised to prepare a contingency plan for the surveillance, eradication and containment of this pest.

This standard presents the basis of a national regulatory control system for the monitoring, eradication and containment of *S. angulatus*, and describes:

- elements of the monitoring programme that should be conducted to detect a new infestation or to delimit an infested area
- measures aiming to eradicate recently detected populations (including an incursion)
- containment measures to prevent further spread in a country or to neighbouring countries, in areas where the pest is present and eradication is no longer considered feasible.

Regional cooperation is important, and it is recommended that countries should communicate with their neighbours to exchange views on the best programme to implement, in order to achieve the regional goal of preventing further spread of the pest.

For the efficient implementation of monitoring and control at national level, cooperation between the relevant public bodies (National Plant Protection Organizations, Ministries of Health, Ministries of Environment, Ministries in charge of transport, water management, etc.), as well as with other interested bodies (associations), should be established.

Monitoring of *Sicyos angulatus*

Sicyos angulatus is easily confused with other species (*Bryonia* spp., *Cucumis melo*, *Cucumis sativus* and *Echinocystis lobata*). Staff should be trained to recognize the plant.

Regular delimiting surveys (according to International Standard for Phytosanitary Measures 6 *Guidelines for surveillance*) are necessary to determine the geographical distribution of the plant and its prevalence. Monitoring should concentrate on areas that are most vulnerable to colonization (maize fields, silos, riversides).

Eradication of *Sicyos angulatus*

The eradication programme for *S. angulatus* in the case of recently detected populations (including an incursion) is based on the delimitation of an area within the country and the application

of measures to both eradicate and prevent further spread of the pest. The feasibility of eradication for *S. angulatus* depends on the size of the area infested, the density of the plants and accessibility of the site.

Measures are described in Appendix 1.

Containment of *Sicyos angulatus*

The containment programme for *S. angulatus* in the case of established populations is based on the application of measures to prevent further spread of the pest in the country or to neighbouring countries. These measures are described in Appendix 2.

Communication

Professionals (administration, farmers) should be informed about the threat to agriculture and about preventive measures.

References

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Appendix 1 – Eradication programme

The eradication process involves four main activities:

- surveillance to investigate fully the distribution of the pest
- containment to prevent the spread of the pest
- treatment and/or control measures to eradicate the pest when it is found
- verification of pest eradication.

Surveillance

A delimitation survey should be conducted to determine the extent of the pest distribution. Infested areas and adjacent areas that might receive seed should be monitored.

In North America, *S. angulatus* is called a 'flush weed' as new plants emerge throughout the growing season after rainfall events. Growers may have to monitor crops for new flushes.

Containment

Unintentional transport of seeds through the transfer of soil material, human activity and by vehicles should be avoided. Movement of soil from infested fields should be prohibited. Equipment and machinery should be cleaned to remove soil before moving to an uninfected area.

Treatment and control programme

Chemical control

There is considerable experience of the use of herbicides to control *S. angulatus* in crops in North America, but little in the EPPO region. In Japan, *S. angulatus* has proven difficult to control because currently registered herbicides are not sufficiently effective (Kurokawa, 2001).

Pre-emergence treatments Maize: For mildly infested plots, pre-emergence herbicide treatments containing atrazine or simazine have been shown to be sufficient to control the weed in maize crops (Larché, 2004; Messersmith *et al.*, 1997).

According to Esbenshade *et al.* (2001), pre-emergence herbicide treatments are generally less effective than post-emergence treatments in maize, though the efficacy of pre-emergence atrazine treatment is equal to that of some post-emergence treatments with other herbicides. In these studies, good control levels were also observed with glufosinate in glufosinate-resistant maize, and under these conditions, application timing and row spacing had little influence on control.

Soybean: Combinations of sulfentrazone, chlorimuron, metribuzin, imazethapyr, pendimethalin, imazaquin have been used in soybean plantations (Messersmith *et al.*, 1997).

Post-emergence treatments Maize: For heavy infestations, it is better to use post-emergence herbicides, or to follow a pre-emergence treatment by (a) post-emergence treatment(s). Recommended products containing the following active substances are recommended for post emergence control: atrazine, primisulfuron, bromoxynil, chlorimuron, dicamba, glufosinate, glyphosate, prosulfuron, thifensulfuron, tribenuron (Messersmith *et al.*, 1997).

Soybean: Since *S. angulatus* tends to emerge over a long period in soybean, sequential herbicide application has the most success for control. Field trials have shown that a pre-emergent application of metribuzin followed by a post-emergent application of thifensulfuron or chlorimuron can provide good control

of *S. angulatus* in conventional soybean. In 'roundup-ready' soybean, glyphosate is effective if sequentially applied.

Regardless of management strategy, maximum efficacy applying chemical control methods is achieved by using products with known residual activity, and using them in tank mixes with recommended adjuvants (see product labels). In France, efficient chemical management in maize will be efficient only before the six true leaves stage (J. F. Larché, pers. comm., 2007). Pennsylvania State University recommends post-emergence application in crop when *S. angulatus* is <30 cm long and has not yet vined (Messersmith *et al.*, 1997).

It should be noted that all products should be used following the label instructions and in line with the relevant plant protection product regulations. In the European Union, atrazine, chlorimuron imazethapyr, primisulfuron and simazine are not available as they did not gain Annex I listing during the active review process. Of the remaining active substances, availability varies significantly from country to country, and the current product approvals are subject to change under the EU review process for plant protection products.

Mechanical control

Current intensive agricultural practices may be employed for control (Kil *et al.*, 2006). Emergence is reduced at increasing depth, with only limited emergence occurring at a depth of 15–16 cm (Pheloung *et al.*, 1999). Thus, good production practices (e.g. deep tillage) will reduce populations. Surface tillage destroys most emerged seedlings, but does not prevent further emergences of the seed bank in maize (Larché, 2004).

In the 'Diari Oficial de la Generalitat de Catalunya' (DOGC nùm. 4315 – 03/02/2005), after the destruction of a maize field, farmers are requested not to grow following maize or sunflower so that the fields are free in summer to facilitate the destruction of *S. angulatus*. Winter crops or any perennial crop such as alfalfa are recommended as several cuttings in summer will eliminate *S. angulatus*.

Verification of pest eradication

Chemical or mechanical measures should be conducted until no sign of *S. angulatus* is found. As the seeds have a longevity of about 3 years, such preventive measures in infested fields are recommended for at least 3 years (A. Taberner, pers. comm., 2007). In Spain, monitoring campaigns have been planned for 5 years. Eradication is considered to be achieved when no new emergences or regrowth have been observed.

Appendix 2 – Containment programme

In the case of an established population, eradication is difficult to achieve. Containment measures, aiming to prevent further spread of the pest to endangered areas or to neighbouring countries, should be applied.

Surveillance

Large populations along water courses should be managed as a priority in order to prevent the dispersal of seed.

Containment measures

Chemical control and mechanical control (as described in Appendix 1) in managed fields, as well as integrated cultural practices along river banks (see below), could be conducted. In fields growers may have to monitor crops for new flushes and make late herbicide applications with residual activity.

Integrated cultural control

Information on integrated cultural control was only found from the Republic of Korea. *Sicyos angulatus* was prominent on riverbanks of slow-flowing streams. Riverbank vegetation composed of *Typha angustifolia*, *Phragmites japonica* and *Phragmites communis* could successfully prevent seeds of *S. angulatus* from accessing riversides. Such thick and tall riparian vegetation could therefore be used as a management tool to prevent invasions. Routine management of riversides for landscaping will prevent colonization by *S. angulatus*. Moreover, *S. angulatus*, when submerged, goes into rapid lysis, and extended submersion of invaded riversides or fields proved to be highly effective to control the plant. Nevertheless, the efficiency and the impacts of the methods need to be assessed. Ensuring seed-free water drains, and that large populations are destroyed before fruiting in watersheds upstream of rivers or lakes, is recommended (Kil *et al.*, 2006).