

FORMAT FOR A PRA RECORD (version 3 of the Decision support scheme for PRA for quarantine pests)

	European and Mediterranean Plant Protection Organisation		
	Organisation Européenne et Méditerranéenne pour la Protection des Plantes		
	Guidelines on Pest Risk Analysis		
	Lignes directrices pour l'analyse du risque phytosanitaire		
	Decision-support scheme for quarantine pests Version N°3		
PEST RISK ANALYSIS FOR			
Pest risk analyst:			Acknowledgments to JF Larché (FR), jf-larche@enitab.fr ; S Kurokawa (JP), shunji@affrc.go.jp ; A Taberner (ES), ataberner@gencat.net and JM Tison (FR), jmt6@wanadoo.fr
Stage 1: Initiation			
1 What is the reason for performing the PRA?			<i>Sicyos angulatus</i> is recognized as an invasive plant in Spain and France and in other countries of the world (Japan, Korea, etc.). The “Diari Oficial de la Generalitat de Catalunya” (DOGC nùm. 4315 – 03/02/2005) declares that <i>S. angulatus</i> is officially recognized to be present in the region of Catalunya (ES) and establishes obligatory control measures. This plant could represent a threat for other countries of the EPPO region.
2 Enter the name of the pest			<i>Sicyos angulatus</i> L.
2A Indicate the type of the pest			
2B Indicate the taxonomic position			Kingdom: <i>Plantae</i> Family: <i>Cucurbitaceae</i>
3 Clearly define the PRA area			EPPO region
4 Does a relevant earlier PRA exist?			No

<p>5 Is the earlier PRA still entirely valid, or only partly valid (out of date, applied in different circumstances, for a similar but distinct pest, for another area with similar conditions)?</p>		/
<p>Stage 2A: Pest Risk Assessment - Pest categorization</p>		
<p>6 Specify the host plant species (for pests directly affecting plants) or suitable habitats (for non parasitic plants) present in the PRA area.</p>		<p><i>S. angulatus</i> is found in the following habitats: Irrigated crops: maize, soybean (marginal). Roads and railways, waste lands, gardens, banks of inland waterways and water bodies, swamps, thickets, openings in floodplain forests, moist meadows in floodplain areas, hedges bordering water courses.</p>
<p>7. Specify the pest distribution</p>		<p>EPPO Region: Austria, Bulgaria, Croatia, France (Southwest, weed), Italy (Northern, possibly also in Sicilia, weed), Moldova (invasive alien plant), Romania, Russia, Serbia, Turkey, Ukraine (established in the Western and Central parts).</p> <p>Asia: China, Japan (weed), the Republic of Korea (Andong), Taiwan (naturalized).</p> <p>North America (native): Canada (Ontario, Québec), USA (Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, Nebraska, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin).</p> <p>Central America & Caribbean: Antilles (Guadeloupe, Martinique), Mexico.</p> <p><u>Note:</u> the plant is recorded as casual (meaning transient, not established) in Belgium (Flanders and Walloon) Czech Republic, Germany (e.g. in Berlin), Hungary, Norway and the United Kingdom.</p> <p>The plant was considered an invasive plant in the Generalitat de Catalunya (Spain) and</p>

		has been eradicated. A record in Sweden was a confusion with <i>Echinocystis lobata</i> (Website Walk among the S-weeds). There is also an unconfirmed data in Mexico.
8. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	Yes	
9. Even if the causal agent of particular symptoms has not yet been fully identified, has it been shown to produce consistent symptoms and to be transmissible?	Not relevant	
10. Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?	Yes	It is a harmful weed of agriculture, particularly in maize fields both in its native area (declared a noxious weed in Delaware, Indiana) and in parts of its area of introduction (Japan, Korea, Spain). Along water courses, <i>S. angulatus</i> forms a monospecific cover and is a threat for other species and to the whole ecosystem.
11. Does the organism have intrinsic attributes that indicate that it could cause significant harm to plants?		
12. Does the pest occur in the PRA area?	Yes	See question 7
13. Is the pest widely distributed in the PRA area?	Yes	<i>S. angulatus</i> is naturalized in at least 10 EPPO countries.
14. Does at least one host-plant species (for pests directly affecting plants) or one suitable habitat (for non parasitic plants) occur in the PRA area (outdoors, in protected cultivation or both)?	Yes	All the habitats where the species has been recorded occur in the EPPO region. Although the PRA could stop at this stage since the species has not a limited distribution, this species is only present in a limited number of locations in different countries, and it is considered worthwhile performing a PRA.
15. If a vector is the only means by which the pest can spread, is a vector present in the PRA area? (if a vector is not needed or	Not relevant	

<p>is not the only means by which the pest can spread go to 16)</p>		
<p>16. Does the known area of current distribution of the pest include ecoclimatic conditions comparable with those of the PRA area or sufficiently similar for the pest to survive and thrive (consider also protected conditions)?</p>	<p>Yes</p>	<p>In the USA, the species is present on the east side from Canada till Florida. The climatic conditions where <i>S. angulatus</i> is present are very wide and are comparable with those occurring in the EPPO region. Moreover, in the EPPO region, the species is present in Mediterranean and temperate countries.</p>
<p>17. With specific reference to the plant(s) or habitats which occur(s) in the PRA area, and the damage or loss caused by the pest in its area of current distribution, could the pest by itself, or acting as a vector, cause significant damage or loss to plants or other negative economic impacts (on the environment, on society, on export markets) through the effect on plant health in the PRA area?</p>	<p>Yes</p>	<p><i>S. angulatus</i> is a very aggressive weed of irrigated crops. It can also form monospecific stands on river sides.</p>
<p>18. This pest could present a risk to the PRA area.</p>	<p>Yes</p>	
<p>19. The pest does not qualify as a quarantine pest for the PRA area and the assessment for this pest can stop.</p>		

Section 2B: Pest Risk Assessment - Probability of introduction/spread and of potential economic consequences

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		<p>Note: If the most important pathway is intentional import, do not consider entry, but go directly to establishment. Spread from the intended habitat to the unintended habitat, which is an important judgement for intentionally imported organisms, is covered by questions 1.33 and 1.35.</p>
<p>1.1. Consider all relevant pathways and list them</p>		<p><u>Intentional introduction for ornamental or agricultural purposes as a climber vine</u> The plant was imported into many European countries as a decorative plant in the 19th century, but it is no longer recorded as being sold for such purposes (PPP index, RHS Plant Index). It has been used as a rootstock for cucumbers grown under glasshouses in Europe, but it is not clear how important this is now in practice. M. Steeghs (Dutch NPPO, pers. com., 2006) reports that seed is still used for the Biologically grown cucumber. In the Netherlands there might be 2 producers of biological grown plants. At the moment there is research work going on to find a more suitable <i>Sicyos angulatus</i> selection reducing the increase of the population of the pests of <i>Melodogyne</i> spp. during production. This pathway is considered as unlikely.</p> <p><u>Unintentional introduction with consignments of grains of <i>Zea mays</i>, <i>Sorghum</i> spp. and <i>Glycine max</i></u> <i>S. angulatus</i> has once been recorded in Spain in a sunflower abandoned field, but this data seems anecdotic and is not taken into account. In Norway, it entered as a contaminant of consignments of soybean grain imported from the USA in the 1970s and 1980s (Ouren, 1987), whereas in Japan it probably entered via consignments of feed grain imported from the USA (Kurokawa, 2001). This pathway is further considered.</p> <p><u>Unintentional introduction as a contaminant on footwear and clothes</u> The fruits can easily hang on people's clothes and shoes. This pathway is further considered.</p>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		<p><u>Soil/growing medium (with organic matters) as a commodity</u> Seeds could be present in soil/growing medium used as a commodity. This pathway is further considered.</p> <p><u>Soil as a contaminant on used machinery</u> Infestations by movements of agricultural machineries have been observed in the south-west of France (JF Larché, pers. com., 2006). This pathway is further considered.</p> <p><u>Unintentional introduction as a contaminant of seeds</u> In France, farmers suspect the plant to have entered by seeds coming from North America (JF Larché, pers. com., 2006), but in Japan, a study has shown that the weed has never been found in consignments of seeds (Kurokawa, 2001). Furthermore, the seed is 1 cm long and considering the processes of production of seeds, it is quite improbable that the seed would be a contaminant.</p> <p><i>S. angulatus</i> is quoted as being an oil-seed and bird seed (Clement & Foster, 1994) contaminant. These uses could facilitate the spread of the species in a country. No additional information could be found on this pathway, and it is not considered further.</p> <p>The plant can be introduced and spread by farmers' seeds and hay but it only ensures local and national movements, which is considered in the spread section. The plant can be spread naturally by mammals and birds and also by water, but this pathway is considered in the spread section.</p>
<p>1.3. Select from the relevant pathways, using expert judgement, those which appear most important. If these pathways involve different origins and end uses, it is sufficient to consider only the realistic</p>		<p><u>Unintentional introduction with consignments of grains of <i>Zea mays</i>, <i>Sorghum</i> spp. and <i>Glycine max</i></u></p> <p><u>Unintentional introduction as a contaminant on footwear and clothes</u></p>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
worst-case pathways. The following group of questions on pathways is then considered for each relevant pathway in turn, as appropriate, starting with the most important.		<p><u>Soil/growing medium (with organic matters) as a commodity</u></p> <p><u>Soil as a contaminant on used machinery</u></p>
Pathway n°: 1 This pathway analysis should be conducted for all relevant pathways		Unintentional introduction with grain of <i>Zea mays</i>, <i>Sorghum spp.</i> and <i>Glycine max</i>
1.4. How likely is the pest to be associated with the pathway at origin taking into account factors such as the occurrence of suitable life stages of the pest, the period of the year?	Likely Medium uncertainty	<p><i>S. angulatus</i> is characteristically a weed of maize (mainly), soybean and sorghum crops. Fructification of <i>S. angulatus</i> occurs from August to October in the US, and from September to October in Spain (A. Taberner, pers. com., 2006).</p> <p><i>Zea mays</i> for grain is harvested from October to November, seeds of the weed could be present in the harvest. In south-western France, irrigated maize is the only crop in which <i>S. angulatus</i> is recorded as a weed.</p> <p><i>Glycine max</i> is harvested from July to October, seeds of the weed could therefore occur in the crop. Kurokawa found that one seed of <i>S. angulatus</i> was found in a consignment of soybean from the USA (pers. com., 2006). It is also suspected that the first introduction of the species into the Tama-river (in Tokyo) is derived from the contaminants of soybean (imported) dumped by tofu factory into the river (S. Kurokawa, pers. comm., 2006).</p> <p><i>Sorghum spp.</i> is a spring crop harvested in summer. Fruits of the weed are therefore not likely to be mature while the crop is harvested. The contamination of <i>Sorghum spp.</i> grain has never been reported, this commodity is therefore not considered further in the analysis.</p>
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation practices, treatment of consignments?	Moderately likely Medium	Herbicide treatments in the field could affect the weed and reduce its concentration, but the plant is known to be difficult to control.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	uncertainty	
1.6. How large is the volume of the movement along the pathway?	Major Low uncertainty	Maize: According to FAOSTAT, as an example, in 2007, European Union (27) imported 24680913 tonnes of maize. A great part is supposed to be from North-America where the weed is native. Soybean: According to FAOSTAT, as an example, in 2007, European Union (27) imported 17854959 tonnes of maize. The USA has 35% of the total area harvested and of total world production (CABI Crop Compendium).
1.7. How frequent is the movement along the pathway?	Frequent Medium uncertainty	It is expected that consignments of maize and soybean are imported on a weekly basis into the EPPO region.
1.8. How likely is the pest to survive during transport/storage?	Very likely Low uncertainty	The seeds can survive for long periods in the soil and seed dormancy is likely to be a factor in their persistence (Penn State Weed management Website). Consignments of maize and soybean are transported in favourable conditions for the grain and therefore for the seeds of contaminants such as <i>S. angulatus</i> .
1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?	Very unlikely Low uncertainty	Seeds do not multiply.
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	Very likely Low uncertainty	There are no specific requirements for maize or soybean grain. In Spain, destruction of the plant is mandatory when found growing in Catalonia but there are no inspections of imported consignments of maize or soybean for <i>S. angulatus</i> .
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	Widely Low	Maize: According to FAOSTAT, importations of <i>Zea mays</i> occur in almost all the European Union AND North-African countries.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	uncertainty	Soybean: According to FAOSTAT, many countries import “soybean cakes”. For example, Germany imported in 2004 2,782,000 tones, Austria 483,489 tones, Ireland 305,384 tones, Croatia 132,982 tones, Italy 2,702,949 tones, Finland 80,334 tones, Morocco 31,284 tones, the Netherlands 4,505,524 tones, France 4,244,622 tones, Ukraine 85,482 tones, etc.
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	Yes	The seeds can germinate throughout the entire growing season (Pheloung <i>et al.</i> , 1999). The seeds can survive for long periods in the soil and seed dormancy is likely to be a factor in their persistence.
1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	Unlikely Medium uncertainty	Seeds of the pest may escape during storage and transport of the consignment, but this is considered unlikely.
1.14. In the case of a commodity pathway, how likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	Likely Medium uncertainty	In a study made in Japan on maize (Kurokawa, 2004), the route of exotic weed seeds from the port to the field have been analysed: - At the feed factory, imported grains used as feedstock are processed in many ways: mechanical crushing (>2 mm, pelletized steaming at 70-80°C after crushing, heated under pressure to 130°C, 3 atm). Most grains receive only the first treatment, which does not affect seed viability. It is not known whether the same processes are used in the EPPO region. - Passing the digestive system of animals showed to be promoting the germination of the weed seeds studied, including <i>S. angulatus</i> . - Sometimes animal manure is composted by farmers. If fermentation is not complete or if the manure is applied directly onto fields, no weed seeds are killed.
Pathway n°: 2 This pathway analysis should be conducted for all relevant pathways		Unintentional introduction as a contaminant on people’s footwear and clothes
1.4. How likely is the pest to be associated with the pathway at origin taking into account factors such as the occurrence of suitable life stages of the pest, the period	Moderately likely Low	The fruit has hard spines that very easily hang on footwear and clothes.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
of the year?	uncertainty	
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation practices, treatment of consignments?	Not relevant	
1.6. How large is the volume of the movement along the pathway?	Major Medium uncertainty	People may travel over short distances and even over long distances and therefore locally or internationally spread the plant. International movements of people travelling (ex. for tourism) are high. They may travel by car, train, and plane (ex: from Spain to France).
1.7. How frequent is the movement along the pathway?	Frequent Low uncertainty	Movement of people in the European Union are frequent, but no precise figures are available.
1.8. How likely is the pest to survive during transport/storage?	Likely Low uncertainty	The seeds can survive for long periods. The seeds are likely to be protected by the fruit.
1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?	Impossible/ Very unlikely Low uncertainty	Seeds do not multiply.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	Very likely Low uncertainty	There are no specific requirements for movement of people.
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	Widely Low uncertainty	This is not a commodity pathway, but travellers can go everywhere in the PRA area.
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	Yes	Whatever the time of arrival, seeds can remain viable for several months and wait until suitable conditions to germinate.
1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	Moderately likely Medium uncertainty	The probability for the fruit to be able to transfer from clothes is unlikely but is moderately likely for shoes. The spines of the fruits could fall at maturity, allowing the fruit to stand out.
1.14. In the case of a commodity pathway, how likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	No relevant	
Pathway n°: 3 This pathway analysis should be conducted for all relevant pathways		Soil/growing medium (with organic matters) as a commodity.
1.4. How likely is the pest to be associated with the pathway at origin taking into account factors such as the occurrence of suitable life stages of the pest, the period of the year?	Moderately likely Low uncertainty	<i>S. angulatus</i> mostly grows as a weed of field crops (maize, soybean), or along roads and railways and in waste lands, i.e. in man-managed environments, but it is also found in semi-natural habitats (banks of inland waterways and water bodies, swamps, thickets, openings in floodplain forests, moist meadows in floodplain areas, etc.). If the growing medium is taken from one of these places, it could be contaminated with

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		seeds of <i>S. angulatus</i> . Such pathway has not been recorded before.
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation practices, treatment of consignments?	Moderately likely Medium uncertainty	The plant reproduces by seeds which can be produced in huge quantities (more than 42 000 seeds per plant without competition). Soil sterilization could kill the seeds and roots, but it is not a common practice.
1.6. How large is the volume of the movement along the pathway?	Low to moderate High uncertainty	There is no data available, the volume of soil is considered to be low to moderate.
1.7. How frequent is the movement along the pathway?	Low to moderate High uncertainty	There is no data available, the frequency of soil is considered to be low to moderate.
1.8. How likely is the pest to survive during transport/storage?	Very likely Low uncertainty	The seeds can survive for long periods in the soil and seed dormancy is likely to be a factor in their persistence (Penn State Weed management Website).
1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?	Impossible/ Very unlikely Low uncertainty	Seeds do not multiply.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
<p>1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?</p>	<p>Likely in EU countries Unlikely in other countries where entry of soil is prohibited Low uncertainty</p>	<p>The pest is present in: EPPO Region: Austria, Croatia, France (southwest, weed), Italy (northern, possibly also in Sicilia, weed), Moldova (invasive plant), Romania, Russia, Serbia, Turkey, Ukraine (established in the Western and Central parts).</p> <p>For EPPO EU Countries: Soil or growing media coming from Turkey, Belarus, Moldova, Russia, Ukraine and third countries not belonging to continental Europe, other than Egypt, Israel, Libya, Morocco, Tunisia is prohibited of import. There are no specific requirements for soil or growing media coming from authorised countries where the species occurs (Germany, Hungary, Poland, etc.). Seeds can easily remain undetected as no attention is paid to this species. EU countries are therefore at risk since soil could be imported from countries where <i>S. angulatus</i> is present.</p> <p>In other EPPO countries, import of soil is prohibited, and these countries are not at risk.</p>
<p>1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?</p>	<p>Widely Medium uncertainty</p>	<p>There is no data available, but soil could be traded in the whole European Union.</p>
<p>1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?</p>	<p>Yes</p>	<p>The seeds can germinate throughout the entire growing season (Pheloung <i>et al.</i>, 1999).</p>
<p>1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?</p>	<p>Unlikely Low uncertainty</p>	<p>There is a low probability that seeds will escape from soil during transportation. Seeds are only in the upper layer of soil, so when taking soil, these seeds will be covered by soil which occurred deeper.</p>
<p>1.14. In the case of a commodity pathway, how likely is the intended use of the commodity (e.g. processing, consumption,</p>	<p>Likely High</p>	<p>Whether soil is usually used for planting or other purposes (e.g. constructions) is unknown. When soil is used for planting, it will be used in gardens, road sides, nurseries, fields,</p>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	uncertainty	natural or semi-natural areas, etc. which are suitable habitats for the plant.
Pathway n°: 4 This pathway analysis should be conducted for all relevant pathways		Soil as a contaminant on used machinery
1.4. How likely is the pest to be associated with the pathway at origin taking into account factors such as the occurrence of suitable life stages of the pest, the period of the year?	Likely Low uncertainty	The species occurs in agricultural fields where machinery is used. Fruits ripen from August to October (Website Plants for a future), which are usual periods for the harvesting of crops. The bur-like fruits are small and spiny, 1 to 1.5 cm long. The spines of the fruits could greatly help the plant is hanging on machinery, maybe even without soil. Infestation by movements of agricultural machineries have been observed in the south-west of France (JF Larché, pers. comm., 2006). In the “Diari Oficial de la Generalitat de Catalunya” (DOGC nùm. 4315 – 03/02/2005), machinery is considered a way of spread.
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation practices, treatment of consignments?	Moderately likely Medium uncertainty	The plant reproduces by seeds which can be produced in huge quantities (more than 42 000 seeds per plant without competition). It is assumed that there are rarely requirements for cleaning of agricultural used machinery nor tools and vehicles.
1.6. How large is the volume of the movement along the pathway?	Low High uncertainty	There is no data available, but the volume of used machinery crossing borders is considered to be low.
1.7. How frequent is the movement along the pathway?	Low High uncertainty	There is no data available, the frequency of movement of used machinery crossing borders is considered to be low.
1.8. How likely is the pest to survive during transport/storage?	Very likely Low	The seeds can survive for long periods in soil and seed dormancy is likely to be a factor in their persistence (Penn State website).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	uncertainty	
1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?	Impossible/ Very unlikely Low uncertainty	Seeds do not multiply.
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	Very likely Low uncertainty	Few phytosanitary measures are in place for soil as a contaminant on machinery, and they do not specifically target <i>S. angulatus</i> .
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	Moderately widely Low uncertainty	This is not a commodity pathway, but machinery are moderately likely to be exchanged over large distances, and the movement is supposed to be limited to neighbouring countries.
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	Yes	Whatever the time of arrival, seeds can remain viable for several months and wait until suitable conditions to germinate. The seeds can germinate throughout the entire growing season (Pheloung <i>et al.</i> , 1999), beginning in March.
1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	Likely Low uncertainty	Used machinery are intended to be driven on fields and roadsides, which are suitable habitats for <i>S. angulatus</i> . The species could then be introduced into other fields and roadsides and could then spread very easily to riversides, fallows, etc.
1.14. In the case of a commodity pathway, how likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?		Not relevant, this is not a commodity pathway.

Not relevant

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.15. Do other pathways need to be considered?	No	

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
<p>Conclusion on the probability of entry. Risks presented by different pathways.</p>		<p>The overall probability of entry of the plant is very likely. The plant has already been introduced in many EPPO countries (Austria, Bulgaria, Croatia, the Czech Republic, France (southwest), Germany, Hungary, Italy (northern, possibly also Sicilia), Moldova, Norway, Romania, Russia, Serbia and Montenegro, Spain, Turkey, the United Kingdom).</p> <ul style="list-style-type: none"> - Intentional introduction for ornamental or agricultural purposes: unlikely - Unintentional introduction with grain of <i>Zea mays</i>: likely - Unintentional introduction with grain of <i>Glycine max.</i>: moderately likely - Unintentional introduction with grain of <i>Sorghum spp.</i> : very unlikely - Unintentional introduction as a contaminant on people’s footwear and clothes: moderately likely - Unintentional introduction with soil/growing medium (with organic matters) as a commodity: unlikely - Unintentional introduction with soil as a contaminant on used machinery: moderately likely
<p>1.16. Estimate the number of host plant species or suitable habitats in the PRA area (see question 6).</p>	<p>High Low uncertainty</p>	<ul style="list-style-type: none"> - Intensive and irrigated field crops (mainly maize in Europe, but also recorded in soybean and sorgho in the US), - Along roads and railways and in waste lands, i.e. in man-managed environments, - In semi-natural habitats (banks of inland waterways and water bodies, swamps, thickets, openings in floodplain forests, moist meadows in floodplain areas, etc.). <p>According to the CORINE Land Cover nomenclature, the suitable habitats are:</p> <ul style="list-style-type: none"> - Permanents crops (e.g. vineyards, fruit tree and berry plantations, olive) - Continental waters (water courses, water bodies)

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		<ul style="list-style-type: none"> - Banks of continental water, Riverbanks / canalsides (dry river beds) - Road and rail networks and associated land - Other artificial surfaces (wastelands) - Green urban areas, including parks, gardens, sport and leisure facilities
<p>1.17. How widespread are the host plants or suitable habitats in the PRA area? (specify)</p>	<p>Widespread Low uncertainty</p>	<p>Freshwater bodies and ecosystems abound in the EPPO region, particularly slow-flowing water bodies, ditches, canals, lakes and ponds. see CORINE LAND COVER (2009) in Appendix 1. CORINE Land Cover reports in Europe (http://dataservice.eea.europa.eu/dataservice/viewdata/viewpvt.asp):</p> <ul style="list-style-type: none"> - 807.977 ha of water courses - 3.073.442 ha of water bodies.
<p>1.18. If an alternate host or another species is needed to complete the life cycle or for a critical stage of the life cycle such as transmission (e.g. vectors), growth (e.g. root symbionts), reproduction (e.g. pollinators) or spread (e.g. seed dispersers), how likely is the pest to come in contact with such species?</p>	<p>No Low uncertainty</p>	<p>Flowers are pollinated by insects (bees, flies) which occur in the EPPO region, and flowers are self-fertile.</p>
<p>1.19. How similar are the climatic conditions that would affect pest establishment, in the PRA area and in the current area of distribution?</p>	<p>Very similar Low uncertainty</p>	<p>The plant is already present in Mediterranean climate (Spain, Croatia, Italy, Turkey), Atlantic (south-West of France) and temperate climates (United Kingdom, Hungary, Moldova, etc.). Moreover, the preference of <i>S. angulatus</i> is full or partial sun, and moist conditions. It cannot grow in shade. Its hardiness zone is 9, i.e. it is frost-tender.</p> <p>According to a Climex matching climates with Bordeaux and Barcelona, where the plant is present and considered invasive, the temperate and Mediterranean area of the EPPO region are at high risk (See Appendix 2). The countries considered at risk are: Algeria, Austria, Belgium, Bosnia, Bulgaria,</p>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		Croatia, Czech Republic, France (including Corse), Germany, Greece, Ireland, Hungary, Italy (including Sardinia and Sicilia), Morocco, Serbia, Switzerland, Portugal, The Netherlands, Russia (Black Sea), Tunisia, Turkey, United Kingdom, Ukraine (Black Sea).
1.20. How similar are other abiotic factors that would affect pest establishment, in the PRA area and in the current area of distribution?	Largely similar Low uncertainty	<i>S. angulatus</i> has a preference for loamy or silty fertile soils, but will grow equally on acid, neutral or basic soils. It requires adequate soil moisture. These soils are largely distributed in the PRA area.
1.21. If protected cultivation is important in the PRA area, how often has the pest been recorded on crops in protected cultivation elsewhere?	Never Low uncertainty	No record of infested protected cultivation has been reported.
1.22. How likely is it that establishment will occur despite competition from existing species in the PRA area?	Likely Medium uncertainty	<i>S. angulatus</i> can smother native vegetation as it does for crops, but there is little direct information on this.
1.23. How likely is it that establishment will occur despite natural enemies already present in the PRA area?	Likely Medium uncertainty	In its area of native distribution, <i>S. angulatus</i> is a food plant for insects which feed on its foliage, stems or flowers. In the EPPO region no natural enemies have been reported, and the plant is already established.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.24. To what extent is the managed environment in the PRA area favourable for establishment?	Slightly favourable Low uncertainty	The plant thrives well in managed environments such as agricultural fields, road sides and fallow lands. Human activities such as mowing, cutting of road sides might even spread the plant.
1.25. How likely is it that existing pest management practice will fail to prevent establishment of the pest?	Moderately likely Low uncertainty	Surface tillage destroys most emerged seedlings, but does not prevent further emergences of the seed bank in maize (Larché, 2004). In Japan, <i>S. angulatus</i> has proved difficult to control because currently registered herbicides are not sufficiently effective (Kurokawa, 2001).
1.26. Based on its biological characteristics, how likely is it that the pest could survive eradication programmes in the PRA area?	Moderately likely Low uncertainty	Since <i>S. angulatus</i> is an annual, it should be possible to eliminate localized infestations by immediate treatment ensuring that no seeds are set. If a soil seed bank already exists, it may be difficult to determine whether <i>S. angulatus</i> has been completely eliminated. The seeds can survive for long periods in soil and seed dormancy is likely to be a factor in their persistence (Penn State website). The plant has successfully been eradicated in Spain at a very early stage of infestation. In some countries of the EPPO region, the species is only recorded as casual.
1.27. How likely is the reproductive strategy of the pest and the duration of its life cycle to aid establishment?	Moderately likely Medium uncertainty	<i>S. angulatus</i> reproduces by seeds. In experiments, it was found that intact seeds of <i>S. angulatus</i> failed to germinate and required mechanical scarification or stratification at 4°C for 18 weeks to modify the permeability of seed coat to increase germinability (Phelung <i>et al.</i> , 1999). It is also recorded that the seeds can germinate throughout the entire growing season (Phelung <i>et al.</i> , 1999). <i>S. angulatus</i> is fast growing in early summer (up to 2 m in 3 weeks), capable of producing shoots up to 6 m long. Without competition, early spring (May)-established plants attained a fresh weight of up to 86 kg and could produce an average of more than 42 000 seeds per plant.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.28 How likely are relatively small populations to become established?	Moderately likely Medium uncertainty	There is no data available, but as the plant reproduces by seeds, the plant should be susceptible to genetic diversity. However, the plant has proven to be able to establish and to become invasive in some EPPO countries.
1.29. How adaptable is the pest?	High High uncertainty	The plant is geographically distributed in many different climates. It is also able to colonize different habitats and even semi-natural (unmanaged) habitats, and has an adaptable morphology.
1.30. How often has the pest been introduced into new areas outside its original area of distribution? (specify the instances, if possible)	Occasionally Low uncertainty	It is native from North-America and has been introduced in 15 countries of the EPPO region and in 3 countries in Asia.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.31. If establishment of the pest is very unlikely, how likely are transient populations to occur in the PRA area through natural migration or entry through man's activities (including intentional release into the environment) ?		Permanent establishment is possible.
Conclusion on the probability of establishment	Very high Low uncertainty	Probability of establishment is very high as it is already present in many countries of the EPPO Region.
1.32. How likely is the pest to spread rapidly in the PRA area by natural means?	Moderately likely Low uncertainty	<p>The plant reproduces by seeds which can be produced in huge quantities (more than 42 000 seeds per plant without competition), but seeds have a dormancy.</p> <p>The plant colonizes riverbanks. Seeds of the plant are dispersed by water (S. Kurokawa, pers. comm.; JF Larché, pers. comm., Kil <i>et al.</i>, 2006). This mode of dispersal is confirmed by Kurokawa <i>et al.</i> 2006 who performed ISSR (Inter-Simple Sequence Repeat) analysis on the <i>S. angulatus</i> populations widely distributed in Japan, in order to infer the genetic relationship among populations. Kil <i>et al.</i> (2006) state that heavy rains leading to soil erosion and floods greatly amplify seed export.</p> <p>The fruit has spines which allow it to attach to animals (JM Tison, pers. comm., 2007), but the dispersal of seeds through small mammals and birds are thought to occur over short distances only.</p>
1.33. How likely is the pest to spread rapidly in the PRA area by human assistance?	Moderately likely Low uncertainty	Dispersal can be done by agricultural practices and movement of soil. In the “Diari Oficial de la Generalitat de Catalunya” (DOGC nùm. 4315 – 03/02/2005), machinery is considered a way of spread. The fruit has spines which allow it to attach to people (JM Tison, pers. comm., 2007).
1.34. Based on biological characteristics, how likely is it that the pest will not be contained within the PRA area?	Likely Low	If the invasion is detected at an early stage, the plant could be contained. The plant has been eradicated in Spain.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	uncertainty	
Conclusion on the probability of spread	Moderately likely Low uncertainty	The plant reproduces by seeds only, but they could be spread by natural means (water, animals), and human assistance (machinery, vehicles, movement of soil, attached to people, etc.)
Conclusion on the probability of introduction and spread The overall probability of introduction and spread should be described. The probability of introduction and spread may be expressed by comparison with PRAs on other pests.	High	Probability of introduction is very high as it is already present in many countries of the EPPO Region. Probability of spread is moderately high as the plant only reproduces by seeds.
Conclusion regarding endangered areas 1.35. Based on the answers to questions 1.16 to 1.34 identify the part of the PRA area where presence of host plants or suitable habitats and ecological factors favour the establishment and spread of the pest to define the endangered area.		The following habitats are the most at risk: According to a Climex matching climates with Bordeaux and Barcelona, where the plant is present and considered invasive, the temperate and Mediterranean areas of the EPPO region are at high risk (See Appendix 1). The countries considered at risk are: Algeria, Austria, Belgium, Bosnia, Bulgaria, Croatia, Czech Republic, France (including Corse), Germany, Greece, Ireland, Hungary, Italy (including Sardinia and Sicilia), Morocco, Serbia, Switzerland, Portugal, The Netherlands, Russia (Black Sea), Tunisia, Turkey, United Kingdom, Ukraine (Black Sea).
2. In any case, providing replies for all hosts (or all habitats) and all situations may be laborious, and it is desirable to focus the assessment as much as possible. The study of a single worst-case may be sufficient. Alternatively, it may be		

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
<p>appropriate to consider all hosts/habitats together in answering the questions once. Only in certain circumstances will it be necessary to answer the questions separately for specific hosts/habitats.</p>		
<p>2.1. How great a negative effect does the pest have on crop yield and/or quality to cultivated plants or on control costs within its current area of distribution?</p>	<p>Moderate Low uncertainty</p>	<p><i>S. angulatus</i> is characteristically a weed of maize, soybean and sorgho crops. This is the case in its native range (it is officially classified as a noxious weed in Delaware and Indiana, and as a weed in Kentucky and Nebraska). In Europe it is mainly found in irrigated maize fields. It has not been observed in soybean and sorgho fields as densities of soybean plants are lower than in maize, impeding <i>Sicyos angulatus</i> to climb over the plants, and sorgho is not irrigated. In Japan, it grows in fields of maize and of sorgho for tillage. 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 <i>S. angulatus</i> can pull down 4 rows of maize). Maize stems are broken by the traction and weight of the invasive plant.</p> <p><i>S. angulatus</i> can germinate throughout the growing season. Even at very low population densities (1/m²), it can make maize or soybean fields unharvestable by rapid development at the end of the season, causing collapse of wide areas of the crop (Webb <i>et al.</i>, 1981). Observations made in Japanese maize fields showed that yield was decreased by 80% by a population of 15-20 plants/10 m² and by 90-98% with 28-50 plants/10 m² (Shimizu, 1999). Studies in Japan suggest that the plant may also behave allelopathically (Uraguchi <i>et al.</i>, 2003).</p> <p><i>S. angulatus</i> is also a host of the polyphagous pest <i>Heliothis virescens</i> in North America (which attacks field crops such as cotton, tobacco, legumes and vegetables). It has been suggested that <i>S. angulatus</i> could contribute to build-up early season and over wintering populations of the pest (Pheloung <i>et al.</i>, 1999). A similar situation could arise for <i>Helicoverpa armigera</i> (Lepidoptera) in Europe.</p>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		<p>Recasens <i>et al.</i> (2007) have estimated the cost of the eradication campaigns in Spain between 2004 and 2010 in Catalunya at EUR 78 320, as detailed:</p> <ul style="list-style-type: none"> - 2004: destruction of the infested fields, costs of machinery, transportation, compensation to farmers on 16.000 m², at 0.20 €/m² cost 3.200 € - 2005: monitoring (6 months of a technical officer: 12.000 €), manual eradication (35 days of a technical officer at 60 €/day: 2.100 €) and use of herbicides (120 €) resulted in a total of 14.220 € - 2006: monitoring (6 months of a technical officer: 12.000 €), manual eradication (3 days of a technical officer at 60 €/day: 180 €), resulted in a total of 12.180 € - From 2007 to 2010, estimates are identical to 2006, resulting in a total of 48.720 €
<p>2.2. How great a negative effect is the pest likely to have on crop yield and/or quality in the PRA area without any control measures?</p>	<p>Moderate Low uncertainty</p>	<p>The plant already occurs in the EPPO region. Impacts in areas where the species do not occur are expected to be the same.</p>
<p>2.3. How easily can the pest be controlled in the PRA area without phytosanitary measures?</p>	<p>Moderately easily Low uncertainty</p>	<p>The eradication of the species is currently undertaken in Spain. In some countries of the EPPO region, the species is only recorded as casual, nevertheless, the species is already present in a high number of countries.</p>
<p>2.4. How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area?</p>	<p>Low to moderate Low uncertainty</p>	<p>Part of the crop is impossible to harvest which increases the costs of production. Control costs may involve the use of additional herbicides and of surface tillage. Control of associated insect pest may also increase the production costs.</p>
<p>2.5. How great a reduction in consumer demand is the pest likely to cause in the PRA area?</p>	<p>Minimal Low uncertainty</p>	<p>No reduction in consumer demand is expected.</p>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.6. How important is environmental damage caused by the pest within its current area of distribution?	Minor to moderate Medium uncertainty	Observations made in invaded riversides in Republic of Korea show that massive germination can lead to a 100% cover of the soil layer during the growing season. Average and highest seed densities at full maturation were 748 and 1128 seeds/m ² , respectively. A few seedlings/10 m ² were enough to cover the whole grass mat by July (Kil <i>et al.</i> , 2006). This monospecific cover is a threat for other species and to the whole ecosystem.
2.7. How important is the environmental damage likely to be in the PRA area (see note for question 2.6)?	Minor to moderate Medium uncertainty	The plant already occurs in the EPPO region. Impacts in areas where the species do not occur are expected to be the same.
2.8. How important is social damage caused by the pest within its current area of distribution?	Minimal Low uncertainty	No particular social impacts, positive or negative, have been noted.
2.9. How important is the social damage likely to be in the PRA area?	Minimal Low uncertainty	The plant already occurs in the EPPO region. Impacts in areas where the species do not occur are expected to be the same.
2.10. How likely is the presence of the pest in the PRA area to cause losses in export markets?	Unlikely Low uncertainty	There is already legislation concerning this weed in Spain stating that destruction of the plant is mandatory when found. This internal measure seems sufficient to contain the plant.
As noted in the introduction to section 2, the evaluation of the following questions may not be necessary if the responses to question 2.2 is "major" or "massive" and the answer to 2.3 is "with much difficulty" or "impossible" or any of the responses to questions 2.4, 2.5, 2.7, 2.9 and 2.10 is		-

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
<p>“major” or “massive” or “very likely” or “certain”. You may go directly to point 2.16 unless a detailed study of impacts is required or the answers given to these questions have a high level of uncertainty.</p>		
<p>Degree of uncertainty Estimation of the probability of introduction of a pest and of its economic consequences involves many uncertainties. In particular, this estimation is an extrapolation from the situation where the pest occurs to the hypothetical situation in the PRA area. It is important to document the areas of uncertainty (including identifying and prioritizing of additional data to be collected and research to be conducted) and the degree of uncertainty in the assessment, and to indicate where expert judgement has been used. This is necessary for transparency and may also be useful for identifying and prioritizing research needs. It should be noted that the assessment of the probability and consequences of environmental hazards of pests of uncultivated plants often involves greater uncertainty than for pests of cultivated plants. This is due to the lack of information, additional complexity associated with ecosystems, and variability associated with pests, hosts or habitats.</p>	<p>Medium</p>	<p>The following uncertainties have been identified :</p> <ul style="list-style-type: none"> - the precise longevity, germinability of the seeds and the effect of ingestion by animals; - The ability of the plant to colonize other fields than maize fields in the EPPO region or elsewhere; - The impacts on riparian ecosystems; - The ability to usually used herbicides to limit the establishment and spread of the weed.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
<p>Evaluate the probability of entry and indicate the elements which make entry most likely or those that make it least likely. Identify the pathways in order of risk and compare their importance in practice.</p>	<p>Likely Medium uncertainty</p>	<ul style="list-style-type: none"> - Unintentional introduction with grain of <i>Zea mays</i>: likely - Unintentional introduction with grain of <i>Glycine max</i>: moderately likely - Unintentional introduction as a contaminant on people’s footwear: moderately likely - Unintentional introduction with soil as a contaminant on used machinery: moderately likely - Intentional introduction for ornamental purposes as a climber vine: moderately likely / unlikely - Soil/growing medium (with organic matters) as a commodity: unlikely - Unintentional introduction with grain of <i>Sorghum spp.</i>: very unlikely
<p>Evaluate the probability of establishment, and indicate the elements which make establishment most likely or those that make it least likely. Specify which part of the PRA area presents the greatest risk of establishment.</p>	<p>Very high Low uncertainty</p>	<p>The species is already established in the EPPO region. Cultural practices such as tillage and the use of herbicides may limit the establishment of the weed.</p>
<p>List the most important potential economic impacts, and estimate how likely they are to arise in the PRA area. Specify which part of the PRA area is economically most at risk.</p>		<p>Major impacts recorded are:</p> <ul style="list-style-type: none"> - to be a weed in maize, soybean and sorghum. It is not a strong competitor for light and nutrients, and so does not reduce yields by direct competition. However, as an aggressive vine plant, it pulls maize or soybean plants to the ground, making them impossible to harvest (one plant of <i>S. angulatus</i> can pull down 4 rows of maize). - <i>S. angulatus</i> can smother native vegetation of semi-natural or unmanaged habitats such as riverbanks, canal sides and floodplains and have a negative environmental impact in these wet habitats.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
<p>The risk assessor should give an overall conclusion on the pest risk assessment and an opinion as to whether the pest or pathway assessed is an appropriate candidate for stage 3 of the PRA: the selection of risk management options, and an estimation of the associated pest risk.</p>		<p><i>Sicyos angulatus</i> is very likely to spread further within the endangered area and to cause moderate economic impacts on maize crop. It would also have detrimental environmental effects.</p> <p>Nevertheless, considering :</p> <ul style="list-style-type: none"> - the huge number of pathways, and their low to moderate probability to introduce the pest, - the fact that the species is already widespread in the EPPO region, - the possibility to eradicate and contain the species in the first stages of invasion, <p>internal measures such as monitoring/surveillance and eradication actions are considered more appropriate options than prevention of entry.</p> <p>Internal measures are detailed in the PM9 on <i>Sicyos angulatus</i>.</p>

This is the end of the Pest risk assessment	
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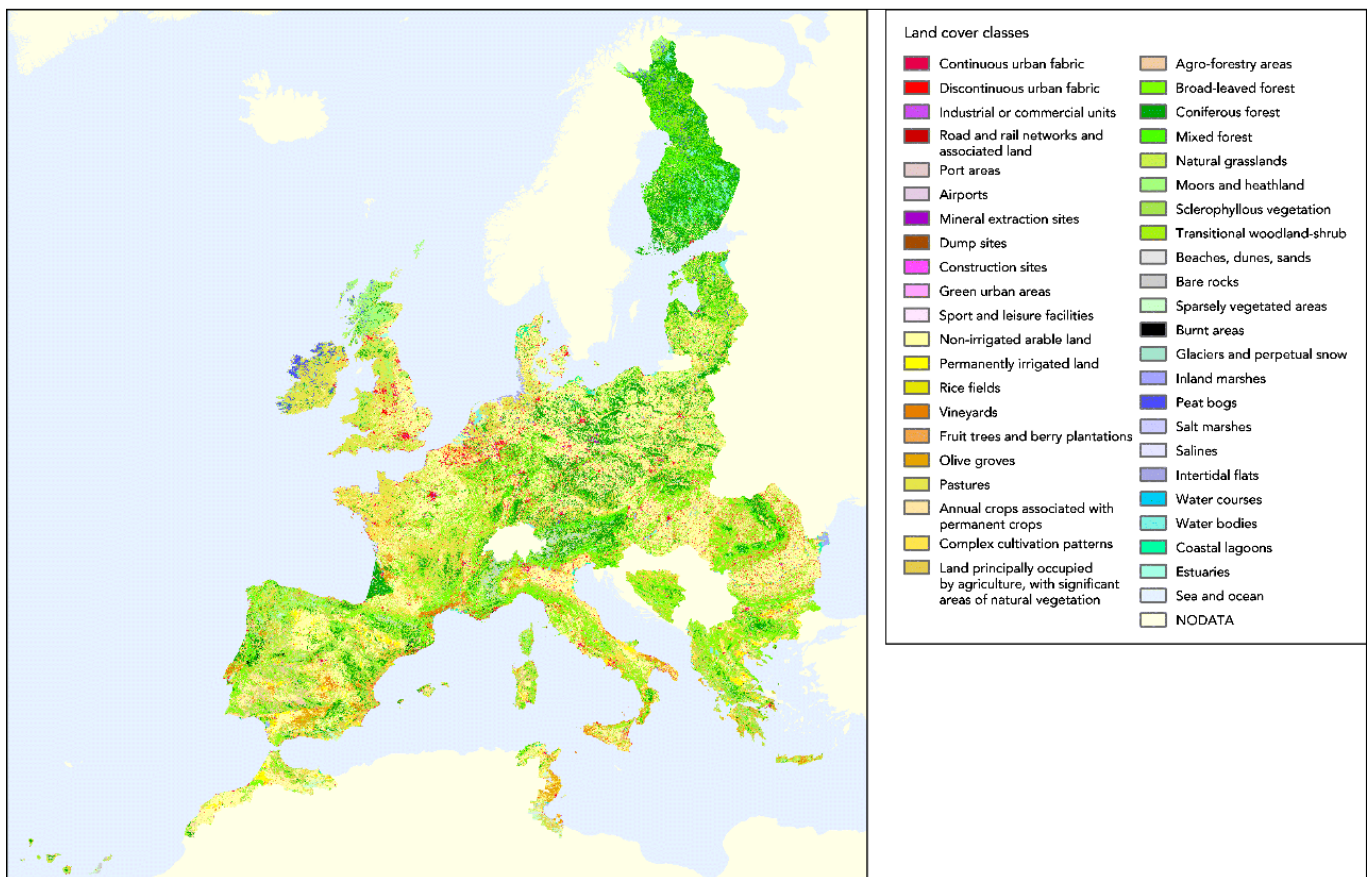
Appendix 1

Appendix 1

Maps relevant for the distribution of *Sicyos angulatus*

CORINE land cover classification

<http://dataservice.eea.eu.int/download.asp?id=5859&type=gif>.



Appendix 2

Climatic prediction on *Sicyos angulatus*

The CLIMEX model is a computer programme aiming at predicting the potential geographical distribution of an organism considering its climatic requirements. It is based on the hypothesis that climate is an essential factor for the establishment of a species in a country.

For *Sicyos angulatus*, a match climate comparison has been undertaken.

1. Geographical distribution of the species and parameters

Sicyos angulatus is present in the following countries:

EPPO Region: Austria, Bulgaria, Croatia, France (southwest, weed), Italy (northern, possibly also in Sicilia, weed), Moldova (invasive plant), Romania, Russia, Serbia, Turkey, Ukraine (established in the Western and Central parts).

Asia: China, Japan (weed), the Republic of Korea (Andong), Taiwan (naturalized).

North America (native): Canada (Ontario, Québec), USA (Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, Nebraska, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin).

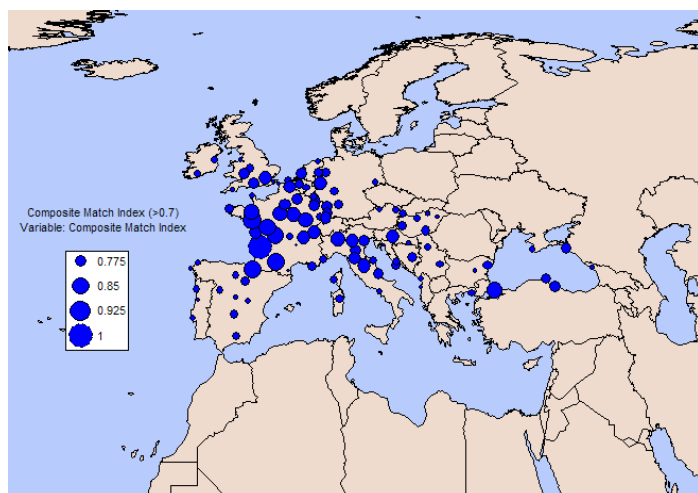
Central America & Caribbean: Antilles (Guadeloupe, Martinique), Mexico.

Note: the plant is recorded as casual (meaning transient, not established) in Belgium (Flanders and Walloon) Czech Republic, Germany (e.g. in Berlin), Hungary, Norway and the United Kingdom. The plant was considered an invasive plant in the Generalitat de Catalunya (Spain) and has been eradicated.

A record in Sweden was a confusion with *Echinocystis lobata* (Website Walk among the S-weeds). There is also an unconfirmed data in Mexico.

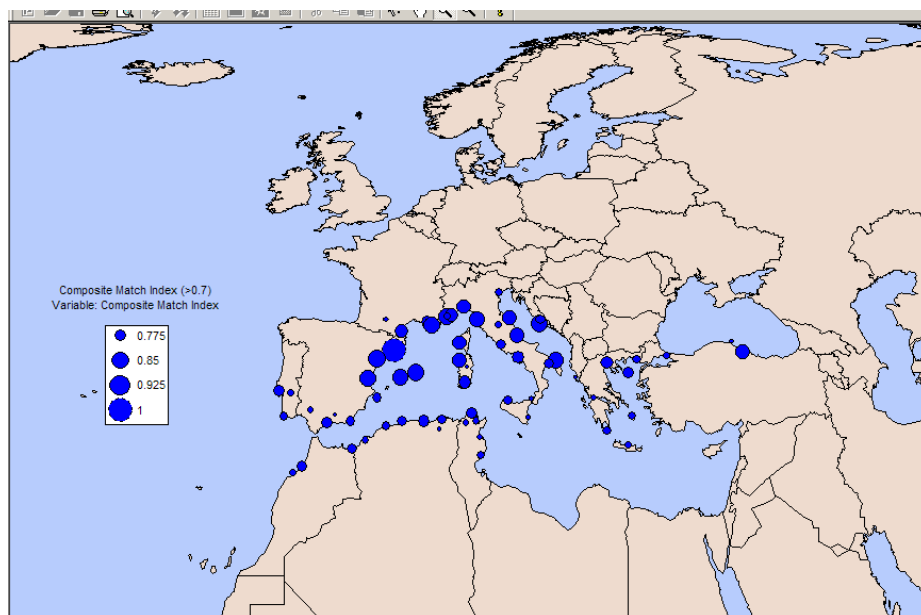
As the species is present and invasive in Barcelona and near Bordeaux, these places have been compared with the EPPO region:

Comparing Bordeaux (France) with Europe, with an Ecoclimatic index of 0.7:



The countries having a similar climate are: Austria, Belgium, Bosnia, Bulgaria, Croatia, Czech Republic, France (including Corse), Germany, Greece, Ireland, Hungary, Italy (including Sardinia), Serbia, Switzerland, Portugal, The Netherlands, Russia (Black Sea), Turkey, United Kingdom, Ukraine (Black Sea).

Comparing Barcelona (Spain) with Europe, with an Ecoclimatic index of 0.7:



The countries having a similar climate are: Algeria, Croatia, France (including Corse), Greece, Italy (including Sardinia, Sicilia), Morocco, Portugal, Tunisia, Turkey.

Taking into account the places having similarities to Barcelona and Bordeaux, the countries at risk are: Algeria, Austria, Belgium, Bosnia, Bulgaria, Croatia, Czech Republic, France (including Corse), Germany, Greece, Ireland, Hungary, Italy (including Sardinia and Sicilia), Morocco, Serbia, Switzerland, Portugal, The Netherlands, Russia (Black Sea), Tunisia, Turkey, United Kingdom, Ukraine (Black Sea).