Crop Protection Compendium - *Senna obtusifolia* (L.) Irwin & Barneby

Updated by **Pierre Binggeli 2005**

NAMES AND TAXONOMY

Preferred scientific name

Senna obtusifolia (L.) Irwin & Barneby

Taxonomic position
Domain: Eukaryota
Kingdom: Viridiplantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Dicotyledonae
Order: Myrtales
Family: Fabaceae
Subfamily: Caesalpinioideae

Other scientific names
Cassia obtusifolia L.
Cassia tora var. *obtusifolia* (L.) Haines
Emelista tora (L.) Britton & Rosa
Cassia tora L.
Senna tora (L.) Roxb.

BAYER code
CASOB (*Cassia obtusifolia*)

Common names

English:
sicklepod

Australia:
Java bean
Bolivia:
aya-poroto
mamuri
Brazil:
fedegoso
fedegoso-branco
mata pasto
matapasto liso
Colombia:
bichomacho
bicho
chilinchil
Cuba:
guanina
Dominican Republic:
brusca cimarrona
brusca hembra
El Salvador:
comida de murcielago
frijolillo
Guatemala:
ejote de invierno
ejotil
Madagascar:
voamahatsara
Mauritius:
cassepuante
herbe pistache
Pacific Islands:
peanut weed
Paraguay:
taperva moroti
taperva
taperva sayju
Puerto Rico:
dormidera
Venezuela:
chiquichique

Notes on taxonomy and nomenclature

Many recent floras use the new nomenclature which puts many former Cassia spp. including *C. obtusifolia* and *C. tora*, into the genus *Senna*, and the new classification of Irwin and Barneby (1982) is used here. However, where acknowledging these two species as separate (following Irwin and Barneby 1982), in terms of their agronomic importance and control, there is probably little difference between *S. obtusifolia* and *S. tora*, and both are included together for the purpose of this datasheet. Thus, whereas *S. tora* (and *C. tora*) are included here as non-preferred scientific names, they are not strictly synonyms.

There has been much debate on the classification of *S. obtusifolia*. Linnaeus (1753), De Wit (1955) and Randell (1988) recognize Cassia obtusifolia and Cassia tora as separate species but others (Bentham, 1871) recognized them as the same species, and Haines (1922) claims that they are intraspecific taxa within the same species. The Botanical Laboratory of the United States Department of Agriculture advises that Cassia obtusifolia is a synonym of Cassia tora and this was accepted by Holm et al. (1997).

Characteristics proposed to separate *S. obtusifolia* and *S. tora* include glands on the leaf rachis, length of flower pedicel, length and width of petals, degree of fruit curvature, seed coat features, chemical content and smell of crushed foliage (see Morphology section). Randell (1995) studied the taxonomy and evolution of *S. obtusifolia* and *S. tora* and concluded that *S. tora* probably evolved in Asia from plants of *S. obtusifolia*. Upadhyaya and Singh (1986) claim that *S. tora* and *S. obtusifolia* differ in their anthraquinone content and that they also fail to hybridize. Most material described as *S. tora* from Africa and America (north, south and central) is *S. obtusifolia* but both species are found in Asia and Australia. The confused nomenclature is apparent in the literature; *S. tora* is often cited when it should be called *S. obtusifolia* but it is often not possible to be confident about the correct identification where the species co-exist.

The original genus Cassia is from the Greek kasia, derived by Dioscorides (1st century AD) from the Hebrew quetsi'oth, denoting 'fragrant shrubs'; obtusifolia combines the Latin obtusos, meaning 'blunt', with folius, a leaf, and refers to the rounded leaf apices (Parsons and Cuthbertson, 1992).

HOST RANGE

Notes on host range

S. obtusifolia and *S. tora* are weeds of a wide range of crops including: cereals, fibre crops (cotton and jute), legumes, pastures, sugarcane, tobacco, tree crops (citrus, coconut, rubber, etc.) and vegetables. Most crops are likely to be infested when grown within the habitat range of these weeds.

List of hosts plants

Major hosts
Arachis hypogaea (groundnut), *Cocos nucifera* (coconut), *Colocasia esculenta* (taro), *Glycine max* (soyabean), *Gossypium* (cotton), *Oryza sativa* (rice), *Phaseolus vulgaris* (common bean), *Saccharum officinarum* (sugarcane), *Sorghum bicolor* (sorghum), *Zea mays* (maize)

Minor hosts
Capsicum annuum (bell pepper), *Citrus* , *Coffea arabica* (arabica coffee), *Corchorus* (jutes), *Fragaria ananassa* (strawberry), *Helianthus annuus* (sunflower), *Hevea brasiliensis* (rubber), *Ipomoea batatas* (sweet potato), *Manihot esculenta* (cassava), *Musa* (banana), *Musa textilis* (manila hemp), *Nicotiana tabacum* (tobacco), *Phaseolus lunatus* (lima bean), *Vigna unguiculata* (cowpea)

HABITAT

S. obtusifolia and *S. tora* are found in cropped land, pastures, roadsides and waste land. They can grow in a range of soil types, including heavy-textured and well aerated or sandy soils. They grow at an optimum temperature of 25°C and in areas with annual precipitation ranging from 640 mm to 4290 mm, with an optimum of 1520 mm (Holm et al., 1997). While growth is best in moist conditions, there is good tolerance of dry soils (Hoveland and Buchanan, 1973). Good growth is sustained with a soil pH of between 4.6 and 7.9 (Murray et al., 1976).

GEOGRAPHIC DISTRIBUTION

Notes on distribution

C. obtusifolia is a native to tropical South America but has become widespread throughout the tropics and sub tropics. It has been generally confused with *C. tora*, a species confined to Asia from India to China and Fiji, with the possible exception of one Congo specimen and a single specimen from Mafia Island, Tanzania (Brenan, 1967). It was introduced to Australia in the early 1940s (Parsons and Cuthbertson, 1992).

Distribution List

Europe		
Norway	present	Ouren, 1987
Spain	present	Recasens & Conesa, 1995
Asia		
Bangladesh	present	Cock & Evans, 1984
Bhutan	present	Parker, 1992
Cambodia	present	Waterhouse, 1993
China	present	Holm et al., 1979
Hong Kong	present	Holm et al., 1979
Taiwan	present	Department of Agronomy, 1968
[India]		
Maharashtra	present	Kene et al., 1988
Uttar Pradesh	present	Singh & Mishra, 1988
Indonesia	present	Waterhouse, 1993
Israel	present	Joel & Liston, 1986
Japan	present	Holm et al., 1979
Korea, Republic of	present	Holm et al., 1979
Malaysia	present	Barnes & Chan, 1990; Waterhouse, 1993
Myanmar	present	Cock & Evans, 1984; Waterhouse, 1993
Nepal	present	Cock & Evans, 1984
Pakistan	present	Mahmood, 1987
Philippines	present	Moody et al., 1984; Waterhouse, 1993
Sri Lanka	present	Holm et al., 1979
Thailand	present	Cock & Evans, 1984; Waterhouse, 1993
Vietnam	present	Minh-Si, 1969; Waterhouse, 1993
Africa		
Benin	present	Holm et al., 1979
Botswana	present	Wells et al., 1986

Cameroon	present	Martin, 1990
Congo Democratic Republic	present	Holm et al., 1979
Eritrea	present	Thulin, 1989
Ethiopia	present	Thulin, 1989
Gambia	present	Terry, 1981
Ghana	present	Holm et al., 1979
Guinea-Bissau	present	Hutchinson & Dalziel, 1958
Guinea	present	Holm et al., 1979
Liberia	present	Holm et al., 1979
Mali	present	Holm et al., 1979
Mauritius	present	Holm et al., 1979
Namibia	present	Wells et al., 1986
Niger	present	Holm et al., 1979
Nigeria	present	Holm et al., 1979
Senegal	present	Berhaut, 1967; Holm et al., 1979
Seychelles	present	Robertson, 1989
Sierra Leone	present	Hutchinson & Dalziel, 1958
South Africa	present	Wells et al., 1986
Sudan	present	Holm et al., 1979
[Tanzania]		
Zanzibar	present	Brenan, 1967
Togo	present	Hutchinson & Dalziel, 1958
Zambia	present	Vernon, 1983
Zimbabwe	present	Holm et al., 1979
Central America & Caribbean		
Anguilla	present	Fournet & Hammerton, 1991
Antigua and Barbuda	present	Fournet & Hammerton, 1991
Belize	present	Holm et al., 1979
Cuba	present	Holm et al., 1979
Dominica	present	Fournet & Hammerton, 1991
Grenada	present	Fournet & Hammerton, 1991
Guadeloupe	present	Fournet & Hammerton, 1991
Martinique	present	Fournet & Hammerton, 1991
Montserrat	present	Fournet & Hammerton, 1991
Puerto Rico	present	Holm et al., 1979
Saint Kitts and Nevis	present	Fournet & Hammerton, 1991
Saint Lucia	present	Fournet & Hammerton, 1991
Saint Vincent and the Grenadines	present	Fournet & Hammerton, 1991
Trinidad and Tobago	present	Fournet & Hammerton, 1991
North America		
Mexico	present	Holm et al., 1979
USA	present	Lorenzi & Jeffery, 1987
Alabama	present	Lorenzi & Jeffery, 1987

Arkansas	present	Lorenzi & Jeffery, 1987
Connecticut	present	Lorenzi & Jeffery, 1987
Delaware	present	Lorenzi & Jeffery, 1987
Florida	present	Lorenzi & Jeffery, 1987
Georgia (USA)	present	Lorenzi & Jeffery, 1987
Illinois	present	Lorenzi & Jeffery, 1987
Indiana	present	Lorenzi & Jeffery, 1987
Iowa	present	Lorenzi & Jeffery, 1987
Kansas	present	Lorenzi & Jeffery, 1987
Kentucky	present	Lorenzi & Jeffery, 1987
Louisiana	present	Lorenzi & Jeffery, 1987
Maryland	present	Lorenzi & Jeffery, 1987
Mississippi	present	Lorenzi & Jeffery, 1987
Missouri	present	Lorenzi & Jeffery, 1987
New Jersey	present	Lorenzi & Jeffery, 1987
New York	present	Lorenzi & Jeffery, 1987
North Carolina	present	Lorenzi & Jeffery, 1987
Oklahoma	present	Lorenzi & Jeffery, 1987
Pennsylvania	present	Lorenzi & Jeffery, 1987
Rhode Island	present	Lorenzi & Jeffery, 1987
South Carolina	present	Lorenzi & Jeffery, 1987
Tennessee	present	Lorenzi & Jeffery, 1987
Texas	present	Lorenzi & Jeffery, 1987
Virginia	present	Lorenzi & Jeffery, 1987
West Virginia	present	Lorenzi & Jeffery, 1987
South America		
Bolivia	present	Gonzalez & Webb, 1989
Brazil	present	Lorenzi, 1982
Alagoas	present	Lorenzi, 1982
Amazonas	present	Lorenzi, 1982
Bahia	present	Lorenzi, 1982
Ceara	present	Lorenzi, 1982
Espirito Santo	present	Lorenzi, 1982
Goias	present	Lorenzi, 1982
Maranhao	present	Lorenzi, 1982
Matto Grosso	present	Lorenzi, 1982
Minas Gerais	present	Lorenzi, 1982
Paraiba	present	Lorenzi, 1982
Parana	present	Lorenzi, 1982
Pará	present	Lorenzi, 1982
Pernambuco	present	Lorenzi, 1982
Piauí	present	Lorenzi, 1982
Rio Grande do Norte	present	Lorenzi, 1982

Rio Grande do Sul	present	Lorenzi, 1982
Rondonia	present	Lorenzi, 1982
Santa Catarina	present	Lorenzi, 1982
Sao Paulo	present	Lorenzi, 1982
Sergipe	present	Lorenzi, 1982
Colombia	present	Holm et al., 1979
Ecuador	present	Holm et al., 1979
Guyana	present	Irwin & Turner, 1960
Peru	present	Holm et al., 1979
Suriname	present	Irwin & Turner, 1960; Holm et al., 1979
Venezuela	present	Irwin & Turner, 1960
Oceania		
American Samoa	present	Swarbrick, 1989
Australia	present	Parsons & Cuthbertson, 1992
Australian Northern Territory	present	Parsons & Cuthbertson, 1992
Queensland	present	Parsons & Cuthbertson, 1992
Cook Islands	present	Swarbrick, 1989
Fiji	present	Cock & Evans, 1984; Swarbrick, 1989
New Caledonia	present	Swarbrick, 1989
Papua New Guinea	present	Henty & Pritchard, 1975
Samoa	present	Whistler, 1983; Sauerborn & Sauerborn, 1984; Swarbrick, 1989
Solomon Islands	present	Research Division, unda; Cock & Evans, 1984
Tonga	present	Whistler, 1983; Swarbrick, 1989
Tuvalu	present	Swarbrick, 1989
Vanuatu	present	Cock & Evans, 1984

BIOLOGY AND ECOLOGY

Seeds of *S. tora* and *S. obtusifolia* have hard seed coats which need to be mechanically damaged to break dormancy. In dry storage, seeds lose their viability quite rapidly (Doll et al., 1976); seeds stored for three years had an overall germination of 22%. Nine-year-old seed had 9% germination (Ewart, 1908) and 10% of seed buried in the soil for 30 months germinated (Egley and Chandler, 1978). Baskin et al. (1998) report that 90% of seeds are green, hard-coated and dormant while 10% are brown and non-dormant. After scarification, dry heat at 80-100°C, or alternating temperatures, the green seeds would germinate in either light or dark conditions.

Germination can occur between 13 and 40°C (Misra, 1969) and at any time of the year provided moisture is available (Parsons and Cuthbertson, 1992). Seedlings can emerge from a soil depth of 12.7 cm but not from 15 cm (Teem et al., 1980). Emergence from 12.7 cm takes 9 days but 63% emergence takes place within 3 days when seeds are only 2.5 cm deep. Seedling growth is best between 30 to 36°C (Teem et al., 1980). In Australia, seedling growth is slow in early spring but increases rapidly at temperatures over 24°C, primary root growth is optimum at 32°C (Parsons and Cuthbertson, 1992). Holm et al. (1997) state that optimum root growth occurs at 25°C.

Intraspecific competition increases plant height, whilst branching decreases as plant density rises from 1 to 40 plants/m² (Singh, 1969). Photoperiod dramatically affects growth. In India, as the photoperiod increased from 6 to 15 hours plants grew taller. Continuous light, however, results in short plants (Misra, 1969). Turner and Karlander (1975) found that 6-12 hours of light induces 100% flowering and pods are only produced when plants receive between 8 and 11 hours of light (Misra, 1969). Photoperiod responses may vary around the world but it appears that *S. tora* and *S. obtusifolia* are short-day plants. Retzinger (1983) recorded seed production of 2800 to 8200 seeds/plant resulting in an enormous seed bank in the soil.

NATURAL ENEMIES

In view of the very close taxonomic affinities of *S. tora* and *S. obtusifolia*, the natural enemies of these two species will be interchangeable (Cock and Evans, 1984). The principal records of natural enemies found in the literature for *S. tora* and *S. obtusifolia* refer to the Bruchidae (Coleoptera), a relatively small family, consisting mostly of oligophagous seed feeding beetles, most of which specialize on the Leguminosae (Cock and Evans, 1984).

Natural enemies listed in the database

The list of natural enemies has been reviewed by a biocontrol specialist and is limited to those that have a major impact on pest numbers or have been used in biological control attempts; generalists and crop pests are excluded. For further information and reference sources, see About the data. Additional natural enemy records derived from data mining are presented as a separate list.

Natural enemies reviewed by biocontrol specialist			
Natural enemy	**Pest stage attacked**	**Associated plants**	**Biological control in:**
Pathogens:			
Alternaria cassiae	Stems, Leaves	soyabeans	
Endophyllum cassiae	Leaves		
Pseudocercospora nigricans	Leaves		Brazil
Herbivores:			
Anabasis ochrodesma	Leaves		
Caryedon pallidus	Seeds		
Chalcomyza	Leaves		
Phoebis sennae	Leaves		
Sennius fallax	Seeds		
Sennius instabilis	Seeds		
Sennius rufescens	Seeds		
Typhedanus undulatus	Leaves		

IMPACT

Economic impact

If *S. tora* and *S. obtusifolia* are left uncontrolled for 2 to 4 weeks after planting, crop yields are dramatically reduced (Holm et al., 1997). Cotton yields were reduced by 25% when this weed was present at a density of 1.1 plants/m of row (Buchanan and Burns, 1971) and each plant per 15 m of row reduced cotton yield by 40 kg/ha (Buchanan et al., 1980). Murray et al. (1976) concluded that 1, 2 and 3 plants/0.3 m of row reduced yields of cotton by 11, 23 and 46%, respectively. Soyabean yields were reduced by 92 kg/ha for each *S.*

obtusifolia plant/m of row (Thurlow and Buchanan, 1972). Seeds of *S. tora* were found to be one of the commonest contaminants of leguminous cover crop seeds imported into Malaysia (Tasrif et al., 1991).

S. tora or *S. obtusifolia* is an alternative host for the pests Etiella zinckenella in India (Subba Rao et al., 1976) and Aphis craccivora in India (Patel and Patel, 1972) and Uganda (Davies, 1972). In Venezuela, *S. obtusifolia* is a reservoir for tobacco mosaic tobamovirus which is spread by Myzus persicae (Debrot, 1974). It is also a source of Colletotrichum capsici which causes anthracnose on tomato fruit and cotton seedlings (McLean and Roy, 1991) and of C. fragariae which causes anthracnose on strawberries (Howard and Albregts, 1973).

MORPHOLOGY

S. obtusifolia and *S. tora* are erect, bushy, annual or short-lived perennial herbs growing to heights of 1.5 to 2.5 m (Parsons and Cuthbertson, 1992: Holm et al., 1997). The stems are obtusely angled to cylindrical, smooth, often highly branched. The robust taproot is about 1 m long, with several descending laterals. Unlike many legumes, the roots of *S. obtusifolia* and *S. tora* do not support nodules of nitrogen-fixing bacteria.

Two stipules, about 15 mm long, are present where the alternate leaves join the stem. The first true leaves are pinnate with two pairs of leaflets. Leaves in mature plants are even-pinnately compound, 8 to 12 cm long, with three pairs of leaflets. The leaves of *S. tora* are rank-smelling when crushed (Holm et al., 1997) but *S. obtusifolia* is less pungent. Leaflets are obovate to oblong-obovate with asymmetrical bases, increasing in size from the base to the apex of the leaf, up to 6 cm long and 4 cm wide. The tips of the leaflets are bluntly oval to round, with a very small point at the tip of the main vein. A small, rod-like gland is situated on the rhachis between the lower pair of leaflets but, in *S. tora*, a second gland is present between the middle pair of leaflets. A second gland is sometimes present in *S. obtusifolia* but only on lower leaves (Brenan, 1967).

Flowers are solitary or in pairs, in leaf axils, on pedicels 1-3 cm long (1 cm in *S. tora*). The calyx has five free, unequal sepals, keeled on the back. The corolla has five free, spreading, yellow petals, obovate to obovate-oblong, narrowed at the base and rounded at the tip, except for the standard (uppermost petal) which has two lobes. There are 10 stamens of which seven are fertile and three are staminodes. The ovary has numerous ovules. In *S. obtusifolia*, the stigma is oblique with an acute rim; in *S. tora* it is straight with two rolled back lips ACTA, 1986a, b. The fruit is a brownish-green, slender, curved, compressed pod, 10 to 25 cm long and 2 to 6 mm wide, containing 25 to 30 seeds. Pods are slightly indented between the seeds. There are two major variants of *S. obtusifolia* in the Americas, differing primarily in pod type. Plants from the Antilles and the USA have pods 3.5-6 mm in diameter, as do African specimens and those from India, Indo Malaya and China (Irwin and Barneby, 1982). In South America and the Philippines, the pod is narrower (2-3.5 mm) in diameter and strongly curved. Seeds are rhomboidal, 4 to 5 mm long, shiny and yellowish brown to dark red. In *S. obtusifolia*, the areole (marking on the seed coat) is very narrow (0.3 to 0.5 mm wide); in *S. tora* it is large (1.5 to 2 mm wide) (Brenan, 1967).

SIMILARITIES TO OTHER SPECIES

There were over 600 species of Cassia before the division of Irwin and Barneby (1982), of which *S. occidentalis* somewhat resembles *S. tora* and *S. obtusifolia* in morphology, distribution, ecology and biology. However, *S. occidentalis* is normally perennial, and the leaves differ in having 4 to 6 pairs of leaflets (only 3 in *S. tora* and *S. obtusifolia*) and the leaflets are ovate or oblong-lanceolate, with a pointed tip (unlike the blunt or rounded tips of *S. tora* and *S. obtusifolia*).

CONTROL

Cultural Control

Control of *S. tora* and *S. obtusifolia* is difficult and can be obtained only with a sustained combination of all available methods. Although repeated discing of summer fallows favours germination and emergence, and tends to reduce seed numbers in the soil (Bridges and Walker, 1985), cultivation usually spreads rather than controls these weeds. Hence, single plants should be grubbed out before flowering. Hand pulling is difficult because of the deep, curved taproot, and plants can regrow from underground buds in the crown region (Holm et al., 1997). Larger colonies can be slashed but this does not eliminate *S. tora* and *S. obtusifolia*. Slashing reduces plant vigour which, with a programme of top dressing and restricted grazing, enables re-establishment of native pastures (Parson and Cuthbertson, 1992). Zero-tillage land management can lead to increased seed populations compared with conventionally tilled plots (Vencill and Banks, 1994).

Various mulching treatments can be used to control *S. tora* and *S. obtusifolia*: rye mulch is effective in sunflower and soyabeans (Brecke and Schilling, 1996), giving up to 90% early control (Worsham, 1991). Polypropylene fabric mats completely inhibit the growth of *S. obtusifolia* when placed over glasshouse flats (Martin et al., 1987). Browne et al. (1989) have demonstrated the potential for controlling *S. obtusifolia* by soil solarization with clear plastic but they concede that this may only be economical for domestic gardens and small areas of horticultural crops.

Competitive crops offer possibilities for suppressing the growth of *S. tora* and *S. obtusifolia*, for example, Shaw et al. (1997) compared different soyabean cultivars and found that cultivar 9592 Pioneer was more effective in reducing shoot height than Asgrow 5979 when no herbicide treatment was used

Chemical Control

Herbicides that give control of *S. tora* and *S. obtusifolia*, either alone or in mixtures with other products include: 2,4-D amine (rice); 2,4-DB (groundnuts, soyabean); acifluorfen (groundnuts, mung bean, soyabean); alachlor (groundnuts, maize, mung bean, Phaseolus beans, sorghum, soyabean); atrazine (maize, sorghum); butylate (maize); chlorimuron (soyabean); chloroxuron (carrots, onions, soyabean); clopyralid (barley, oats, wheat); dicamba (maize); dichlorprop (cereals); diuron (cotton, oats, soyabean); EPTC (castor, citrus, flax, maize, Phaseolus beans, potato, sorghum, sugar beet, sunflower, sweet potato); flumetsulam (soyabean); fluometuron (cotton); fluridone (cotton); glufosinate (soyabean); glyphosate and glyphosate trimesium (land preparation, minimum tillage, tree crops, vines); imazaquin (groundnut, soyabean); linuron (cotton, potato, soyabean); metribuzin (soyabean); MSMA (cotton); norflurazon (cotton); oxyfluorfen (cotton); pendimethalin (soyabean); picloram (grassland); primisulfuron (maize); prometryn (cotton); pyridate (groundnuts); and vernolate (groundnuts) (Anon., 1998).

Hicks et al. (1998) show that a mixture of pyridate and 2,4-DB acts synergistically on *S. obtusifolia* without increased damage to groundnut.

Biological Control

S. obtusifolia has been a target weed for biological control, particularly in the USA. Alternaria cassiae, formulated as a mycoherbicide, has given >96% control of *S. obtusifolia* and increased the yields of soyabean (Parsons and Cuthbertson, 1992). Granular formulations of A. cassiae mycelia with sodium alginate + kaolin, applied pre-emergence (using approximately 3 kg conidia/500 kg formulation), gave 50% control of *S. obtusifolia* in soyabeans within 14 days and significantly increased crop yield (Walker, 1983). In greenhouse trials, an inoculum concentration of 10,000 spores/ml of A. cassiae gave 100% control of *S. obtusifolia* (Boyette and Walker, 1985). A strain of Fusarium oxysporum isolated from *S. obtusifolia* has potential as a mycoherbicide (Boyette et al., 1993). Pseudocercospora nigricans has also been identified as a potential biological control agent (Hofmeister and Charudattan, 1987). In a review of possibilities for the biological control of *S. tora* and *C. obtusifolia*, Cock and Evans (1984) suggested that the bruchid Sennius instabilis, which attacks *S. obtusifolia* in tropical America, should be considered for introduction against *S. tora* in the Old World, and that three fungi (Pseudocercospora nigricans, Pseudoperonospora cassiae and Ravenelia berkeleyii) should be evaluated for possible use as mycoherbicides or classical biological control agents.

USES

Fermented leaves of *S. obtusifolia* are used as a meat substitute in Sudan (Dirar, 1984) and as a mineral and vitamin supplement by certain tribes in Kenya and Senegal (Becker, 1986). Leaves of *S. tora* and *S. obtusifolia* are high in protein (14.4%) and are highly palatable to poultry (Murty, 1962) but excessive consumption can be detrimental. Modest quantities of *S. tora* and *S. obtusifolia* seeds can be used as dietary supplements in livestock but too much can have adverse effects (Holm et al., 1997). Seeds can be used as a substitute for coffee and as a mordant in dyeing (Ambasta, 1986).

S. tora and *S. obtusifolia* are reported to have a number of medicinal uses, indeed, *C. tora* is reputed to have been used for medicinal purposes as early as 4000 BC (Nickell, 1960). The whole plant, especially the root, has purgative (Ambasta, 1986) and antihelminthic properties and the leaves are used to treat ringworm (Ambasta, 1986) and other skin diseases (Cock and Evans, 1984). Quisumbing (1951) records that *S. tora* is used as a vermifuge and purgative in the Philippines and to treat dysentery and opthalmia in Indo-China.

PESTS

Pests listed in the database

Minor host of:
Cercospora kikuchii (purple seed stain)

Wild host of:
Peanut stripe virus (groundnut stripe disease), *Tobacco etch virus* (tobacco streak)

Host of (source - data mining):
Myrothecium roridum (blight: eggplant)

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