



NAPPO

ORGANISATION NORD-AMERICAINE POUR LA PROTECTION DES PLANTES
NORTH AMERICAN PLANT PROTECTION ORGANIZATION
ORGANIZACION NORTEAMERICANA DE PROTECCION A LAS PLANTAS

PEST FACT SHEET

Rottboellia cochinchinensis (Lour.) Clayton

Rottboellia cochinchinensis is an aggressive weed under various ecological conditions, in at least 18 crops, including maize, cotton, sesame, sugarcane, soybean and rice in 44 countries. It is also a weed of bananas, cassava, citrus, cowpeas, papayas, groundnut, pineapple, rice, and sorghum in Cuba, Ghana, Jamaica, the Philippines, Trinidad and Venezuela but there is little reference to it in North American cereal crops. It is primarily a weed of warm-season crops in a variety of habitats around the world but can also be found growing along roadsides and in other open, well-drained sites and is an important species in old field succession. The weed does not occur in Canada but it has established in the lower Midwest and Southern US states and is recorded from Mexico.

Preferred Scientific Name *Rottboellia cochinchinensis* (Lour.) Clayton (1981)

Other Scientific Names *Aegilops exaltata* L.

Manisuris exaltata Kuntze (1891)

Ophiurus appendiculatus Steud.

Rottboellia arundinacea Hochst. ex A. Rich (1851)

Rottboellia denudata Steud. (1854)

Rottboellia exaltata L. f., 1781

Rottboellia setosa J.S. Presl ex C.B. Presl (18930)

Stegosia conchinchinensis Lour., (1790)

Stegosia exaltata Nash (1909)

Common Names English - itch grass, corn grass, Guinea fowl grass, jointed grass, prickle grass, rice grass, sugarcane weed, Itchgrass, Kokomagras, Raoulgrass,

Shamvagrass, lisofya, shamva grass

Spanish - graminea corredora, Caminadora, Cebada fina

French - Herbe queue-de-rat

Cuba - sancarana

Indonesia - bandjangan, doekoet kikisian

India - barsali, bura, dholu, konda panookoo, swooate

Japan - Tsunoaiashi

Philippines - anguigay, annarai, bukal, gaho, girum nagei, sagisi

Portugal - Capim-camalote

Venezuela - paja peluda

Habitat

R. cochinchinensis is a weed of warm-season crops in a variety of habitats around the world, preferring tropical and subtropical climates. It also grows along roadsides and in other open, well-drained sites and

is an important species in old field succession but it can be found in wet places, and even in shallow water. It survives in habitats with full sun, moderate shade, or nearly the full shade of thickets and forests. *R. cochinchinensis* is most troublesome between 800 and 1300 m in elevation. Rainfall is a main limiting factor below 1300 m. Above this elevation, temperature is the main limiting factor (Holm *et al.* 1977).

Distribution List

Asia

China (CABI 2002)
Hong Kong - restricted distribution (EPPO 2002)
Taiwan (Millhollon & Burner 1993)
India - restricted distribution (Christopher *et al.* 1989, EPPO 2002)
Indonesia - restricted distribution (Waterhouse 1993, EPPO 2002)
Japan (Nakama *et al.* 1988)
Korea, Republic of (Kim *et al.* 1993)
Laos (Waterhouse 1993)
Malaysia - restricted distribution (Waterhouse 1993, EPPO 2002)
Myanmar - restricted distribution (Waterhouse 1993, EPPO 2002)
Nepal (USDA, ARS 2003)
Philippines - restricted distribution (Waterhouse 1993, EPPO 2002)
Sri Lanka (Holm *et al.* 1977)
Taiwan (USDA, ARS 2003)
Thailand - restricted distribution (Waterhouse 1993, EPPO 2002)
Vietnam (Waterhouse 1993)

Africa

Angola (Holm *et al.* 1977)
Benin (Lutzeyer & Koch 1992)
Botswana (USDA, ARS 2003)
Burkina Faso (USDA, ARS 2003)
Cameroon (Martin 1990)
Côte d'Ivoire - restricted distribution (EPPO 2002)
Ethiopia - restricted distribution (Holm *et al.* 1977, EPPO 2002)
Gambia (USDA, ARS 2003)
Ghana - restricted distribution (Haizel 1973, EPPO 2002)
Guinea - restricted distribution (EPPO 2002)
Kenya - restricted distribution (Michieka 1991, EPPO 2002)
Liberia (USDA, ARS 2003)
Madagascar - restricted distribution (Holm *et al.* 1977, EPPO 2002)
Mozambique - restricted distribution (Holm *et al.* 1977, EPPO 2002)
Natal (USDA, ARS 2003)
Nigeria - restricted distribution (Okafar & Zitta 1991, EPPO 2002)
Réunion (Millhollon & Burner 1993)
Senegal - restricted distribution (EPPO 2002)
Sierra Leone (Alghali & Domingo 1982)
Somalia (USDA, ARS 2003)
South Africa - restricted distribution (Anon. 1980, EPPO 2002)
Sudan - restricted distribution (Holm *et al.* 1977, EPPO 2002)
Swaziland (USDA, ARS 2003)

Tanzania - restricted distribution (Millhollon & Burner 1993, EPPO 2002)
Transvaal (USDA, ARS 2003)
Uganda - restricted distribution (Millhollon & Burner 1993, EPPO 2002)
Zambia (Holm *et al.* 1977)
Zimbabwe - restricted distribution (EPPO 2002)

North America

Mexico - reported in Tabasco and Yucatan (Davidse *et al.* 1994)

USA

Arkansas (USDA, NCRS 2002)
Florida (Lorenzi and Jeffery 1987)
Georgia (USDA, NCRS 2002)
Indiana (USDA, NCRS 2002)
Louisiana (Lorenzi and Jeffery 1987)
North Carolina (Millhollon and Burner 1993, (USDA, NCRS 2002)
Puerto Rico (USDA, NCRS 2002)
Texas (USDA, NCRS 2002)

Central America

Costa Rica (Cruz *et al.* 1994 EPPO 2002)
Cuba - restricted distribution (Gutierrez & Gonzalez 1993, EPPO 2002)
Dominican Republic - restricted distribution (Ulloa *et al.* 1990, EPPO 2002)
Guadeloupe (Millhollon & Burner 1993)
Guatemala (Jiminez *et al.* 1990, EPPO 2002)
Honduras (Millhollon & Burner 1993, EPPO 2002)
Jamaica - restricted distribution (Holm *et al.* 1977, EPPO 2002)
Panama - restricted distribution (Millhollon & Burner 1993, EPPO 2002)
Puerto Rico (Velez & Semidey 1991)
Trinidad and Tobago - restricted distribution (Holm *et al.* 1977, EPPO 2002)

South America

Argentina (Millhollon & Burner 1993)
Bolivia - restricted distribution (Unterladstatter 1979, EPPO 2002)
Brazil - restricted distribution (Millhollon & Burner 1993, EPPO 2002)
Colombia - restricted distribution (Holm *et al.* 1977, EPPO 2002)
Ecuador (Carcelen 1975, Millhollon & Burner 1993)
Peru - restricted distribution (Pleasant *et al.* 1990, EPPO 2002)
Venezuela - restricted distribution (Holm *et al.* 1977, EPPO 2002)

Oceania

Australia - restricted distribution (Holm *et al.* 1977, EPPO 2002)
New South Wales [e.] (USDA, ARS 2003)
Northern Territory [n.] (USDA, ARS 2003)
Queensland (USDA, ARS 2003)
Papua New Guinea (Vance 1982)

Distribution Notes

R. cochinchinensis is a strongly-growing annual grass, native of the Old World tropics. It is widespread

in tropical Asia and the Pacific Islands, tropical Africa, Asia and Australia. It is common in many parts of west Africa, especially in fallows and waste land in the savannah zone (Ivens *et al.* 1978). It has been introduced into tropical America and now occurs in Central and Southern America, the Caribbean, and in the Gulf Coast Region of the United States (Holm *et al.* 1977). Now widespread in the tropics and subtropics it is found in natural grasslands and woodlands and is becoming an increasingly significant weed of cultivated crops (Holzner and Numata 1982).

The potential ecological range of *R. cochinchinensis* in USA was investigated under controlled conditions in Mississippi (Patterson and Quimby 1979). On the basis of its growth responses to temperature, *R. cochinchinensis* would be likely to reach 75 - 100% of its maximum potential growth in the Gulf Coast states, the lower Midwest, the South Atlantic states and the South-West. *R. cochinchinensis* represents a serious potential weed problem in these regions. Controlled field studies as well as other laboratory experiments conducted in Minnesota have shown that *R. cochinchinensis* can grow and produce seed as far north as St. Paul, Minnesota, USA (Millhollon 1975).

No records have been located for this weed in Canada or in Mexico.

Biology and Ecology

Reproduction of *R. cochinchinensis* is by seed. In the Philippines, the plant flowers all year long, and a single plant may produce 2000 -16000 seeds. Studies in Zimbabwe have shown that dense stands of the plant will produce over 600 kg of seed per season (Holm *et al.* 1977).

Growth of *R. cochinchinensis* is very rapid under favorable conditions. Seed production begins 6 - 7 weeks after emergence and generally continues throughout the growing season. The seeds fall from the plant as they mature, ensuring a continuous supply of new seed on the ground. Seeds require a dormancy period of 5 - 6 months following maturity, with the result that germination occurs in the season following dispersal or in subsequent years. The seed remains viable in the soil for up to 4 years (Thomas and Allison 1975).

The majority of seeds which germinate in any one season, do so in one or two flushes at the onset of the growing season (Richards and Thomas 1970) so that attention to mechanical control early in the season can be effective (Holzner and Numata 1982). It has been suggested by the latter authors that the "success" of this weed in cultivated situations may be due, in part, to certain herbicides and a tendency on the part of laborers to avoid the grass because of the brittle, irritating hairs on leaf sheaths. *R. cochinchinensis* generally produces large amounts of seed that is initially dormant although the dormancy is lost relatively quickly under conditions of soil burial whereupon the seed rapidly loses viability and seems unlikely to persist for any more than two years. Seedlings will emerge from seed resident in soil to a depth of 15 cm but most successful germinates originate in the top 7 or 8 cm of the soil profile. Once dormancy is lost, germination generally takes place quickly at the beginning of the following growing season (Holzner and Numata 1982).

Seeds are spread by water, animals, contaminated crop seeds and harvesting equipment (Holm *et al.*, 1977). In a study in Zimbabwe (Thomas and Allison 1974), 2% of *R. cochinchinensis* seeds fed to leghorn hens were recovered from the droppings and most of them were found to be viable. Feces of the slender mongoose, *Herpestes sanguineus*, were also found to contain many *R. cochinchinensis* seeds. The results suggest that only birds or animals producing feces that are fairly coarse or contain some roughage are likely to disseminate *R. cochinchinensis* (Thomas and Allison 1974).

There appear to be two dormancy mechanisms operating in *R. cochinchinensis* seeds. The major

mechanism is imposed by the covering structures and may prevent entry of oxygen into the seed, which stimulates the pentose phosphate pathway.

The second mechanism appears to be influenced by light (Clavijo 1978) in that light apparently had an inhibitory effect on germination of in-husk seed but no effect on dehusked seed.

In Bolivia, a positive correlation has been shown between rainfall and emergence of *R. cochinchinensis*. The average depths from which *R. cochinchinensis* seedlings emerged were 1.6 cm on heavy soil and 5 cm on light soil. In laboratory trials the optimum temperature for germination was 25°C. Germination was highest in loam soil and lowest in sand soils.

The effect of soil moisture content on germination was dependent on soil type, with the moisture required for germination decreasing with increasing tendency of the soil to water logging (Unterladstatter 1979).

Economic Impact

R. cochinchinensis is an aggressive weed under various ecological conditions, in at least 18 crops, including maize, cotton, sesame, sugarcane, soybean and rice in 44 countries. It is also a weed of bananas, cassava, citrus, cowpeas, papayas, groundnut, pineapple, rice, and sorghum in Cuba, Ghana, Jamaica, the Philippines, Trinidad and Venezuela (Holm *et al.* 1977, Tabora 1979). In addition to its effects on crop yield, *R. cochinchinensis* is a problem to labourers, as the needle-like hairs on the leaf sheaths break off in the skin and can cause painful infections. It is also an alternative host of the viruses causing corn leaf gall and rice leaf gall (Agati and Calica 1949).

In eastern Africa, *R. cochinchinensis* is one of the primary colonizers of disturbed land, and it displaces early perennial colonizers such as Bermuda grass, *Cynodon dactylon* and purple nutsedge, *Cyperus rotundus* in Trinidad (Holm *et al.* 1977). It is regarded as a C4 grass and is abundant at locations with low atmospheric carbon dioxide concentration (Das *et al.* 1993).

R. cochinchinensis is listed as a Federal Noxious Weed in the United States . It is being spread in the Gulf Coast Region of the United States along transportation corridors by trains and other vehicles. Its appearance in south-eastern North Carolina in the early 1980s along the north-south seaboard coastline railroad is an example of this mode of spread (Hall and Patterson 1992).

Seeds of *R. cochinchinensis* have been intercepted as a contaminant of the following imported commodities by border clearance personnel with the United States Department of Agriculture, Animal and Plant Health Inspection Service:

- beans (*Phaseolus* sp.) from El Salvador and Honduras
- false coriander seeds (*Eryngium foetidum*) from Trinidad
- flax seeds (*Linum usitatissimum*) from El Salvador
- mung bean (*Vigna radiata*) from Belize
- salvia seeds (*Salvia officinalis*) from China
- sorghum seeds (*Sorghum bicolor*) from Costa Rica
- sesame seeds (*Sesamum indicum*) from India and Sudan
- turkeyberry fruit (*Solanum torvum*) from El Salvador

Morphology

R. cochinchinensis is an erect annual grass that grows up to a height of 4 m or more. The inflorescence is a cylindrical raceme that is 3 - 15 cm long. The floral units consist of a sessile spikelet, pedicellate spikelet and internode. The pedicel is fused to the swollen floral internode. The spikelets are awnless, 3.5 - 6 mm long, and 2.5 - 3 mm wide. The floral units separate and fall as soon as they mature, from the top of the raceme downwards.

Similarities to other species/conditions

R. cochinchinensis superficially resembles johnsongrass, *Sorghum halepense* and other tall weedy grasses. However, it can be distinguished from other grasses by the trichomes present on the leaf sheaths. Another diagnostic feature is the jointed cylindrical seed head. The seedheads (spikes) are produced on the ends of the ends of the main shoots as well as on axillary branches and tiller shoots.

Control

Cultural Control

In East Africa, *R. cochinchinensis* is controlled by a combination of cultivation followed by fallowing for at least 2 years. The infested site is first burned to destroy the seeds on the surface. Next, it is ploughed to stimulate germination of seeds in the top soil horizon. Following this, deep ploughing is done to bury the seedlings. After this, the land is left fallow until the buried seeds expire and the land is considered clean (Holm *et al.* 1997).

In 1983 - 85, the effect of cultivation every 2, 3 or 5 weeks on *R. cochinchinensis* emergence was studied in a fallow field in the Philippines. After 1 year, the corn grass population had decreased substantially; the greater the frequency of cultivation, the greater the population decrease. By the end of the second year, it had been practically eliminated by cultivation every 2 - 3 weeks, and only a few plants grew on plots cultivated every 5 weeks. Total weed density after 2 years was not reduced in plots rotary cultivated every 5 weeks, but *R. cochinchinensis* was replaced by less competitive weeds (Navarez *et al.* 1987).

In another series of trials in the Philippines, uncontrolled infestations of *R. cochinchinensis* were found to reduce yields of white food corn by about 50%. Two cultivations using draft animals controlled the weed to some extent, but yields were still reduced by 24% and traditional hand-weeding three times per growing season failed to completely reduce the *R. cochinchinensis* infestation. In the production of maize, the best weed control was achieved by two mechanical cultivations + hand-weeding and the best economic return was achieved by inter-cropping maize with mung bean (Fisher *et al.* 1980).

Chemical Control

Chemical control of *R. cochinchinensis* is made difficult in many crops by the resistance of this species to many herbicides in important groups such as the triazines (e.g. atrazine etc.) and chloroacetanilides (e.g. alachlor, etc.) and to others such as metribuzin and terbacil.

In sugarcane plantations in Jamaica, mixtures containing asulam, 2,4-D + ioxynil and the cationic surfactant ethokem (polyethanoxy amine) effectively controlled *R. cochinchinensis* (and several other grasses). The inclusion of ethokem in the mixture provided excellent control of *R. cochinchinensis*, and enabled a reduction in the amount of other ingredients (Anon. 1993).

Field trials were conducted in Louisiana, to compare nicosulfuron, primisulfuron, paraquat and ametryn

treatments to the asulam standard for post-emergence treatment. Nicosulfuron provided the greatest season-long control of *R. cochinchinensis*. Asulam and nicosulfuron did not reduce late-season *R. cochinchinensis* infestation levels when compared to the control, whereas post-emergence applications of paraquat and ametryn reduced late-season infestations by 74 and 52%, respectively. It was concluded that paraquat and ametryn applied post-emergence provided *R. cochinchinensis* control without reducing sugarcane yields (Lencse *et al.* 1992).

Weed control measures in a rice-maize-soybean rotation were studied over 2 years in Peru, to identify weed species resistant to the herbicide program in a continuous cropping system, and to develop effective weed management practices for intensively managed cropping systems in the humid tropics. Composition of first-crop weeds was estimated to be 60% grass, 25% sedges, and 15% broadleaved weeds. *R. cochinchinensis* comprised 85% of the grass infestation. Metolachlor controlled other grasses and most broadleaf weeds in maize and soybean but it did not control *R. cochinchinensis*. Metolachlor alone resulted in a weed population that was 97% *R. cochinchinensis* in the sixth crop. Sethoxydim + bentazone on soybean controlled grasses including *R. cochinchinensis*, but broadleaved weeds increased. Propanil + oxadiazon on rice resulted in a mixed grass population. Rice was more vulnerable to weed pressure than either maize or soybean and appears inappropriate for this high-input rotation because of the high cost of weed control (Pleasant *et al.* 1990).

Experiments were conducted to identify effective systems of controlling *R. cochinchinensis* in maize which would be suitable for adoption by farmers in the Philippines. Treatments which gave yields comparable to a hand-weeded control were: off-barring (mechanical weeding with a tool that throws the earth and weeds away from the crop row into the inter-row) and hand weeding in the row at 12 days after sowing followed by earthing-up at 26 days after sowing band application of trifluralin between the rows, followed by either hand-weeding in the rows at 12 days after sowing, earthing-up at 26 days after sowing, or both; off-barring and hand weeding in the rows at 12 days after sowing followed by paraquat/2,4-D application; and pre-emergence application of atrazine, in combination with either earthing-up or directed paraquat/2,4-D application at 26 days after sowing (Pamplona and Imlan 1977).

Studies in Venezuela for controlling heavy grass weed infestations in potatoes recommended using metribuzin or metobromuron + alachlor. The most effective product for control of *R. cochinchinensis* was found to be pendimethalin (Anon. 1977). Labrada (1994) provides a useful summary of herbicide use in a range of vegetable and other crops, based on trifluralin, pendimethalin, oxadiazon, clomazone, diphenamid, napropamide, fluazifop, haloxyfop and quizalofop.

Biological Control

Isolates of fungi collected from *R. cochinchinensis* have been screened for host specificity and three of them selected for further study as potential biological control agents. An isolate of *Colletotrichum* sp. near *graminicola* from Thailand was tested in the laboratory and in field trials in Thailand as a possible candidate for development as a mycoherbicide. The results were equivocal but a synergistic response was found when a low dose of chemical herbicide was added to the fungal inoculum (Ellison and Evans 1995).

Investigations on *Sporisorium ophiuri*, a systemic head smut, as a possible classical biological control agent, suggested that it may have limited potential because of high inoculum requirements; however, as the sporidia are readily produced in culture, it may be possible to apply them to the soil as a form of mycoherbicide (Reeder *et al.* 1990, Ellison and Evans 1995). A rust, *Puccinia rottboelliae*, causes severe seedling infection in the field and preliminary host-range tests with an isolate from Kenya suggest that it is specific to *R. cochinchinensis*. Thus, this rust may have potential as a classical biological

control agent in the Americas, perhaps involving a management strategy including early-season augmentation (Ellison and Bird 1996).

Integrated Control

In field trials conducted in Costa Rica the effects of manual weed control, disc ploughing, pendimethalin, alachlor and paraquat were evaluated in different combinations for the control of *R. cochinchinensis* in maize-bean [*Phaseolus* spp.] rotations. All weed control treatments reduced *R. cochinchinensis* plant density from untreated control. Pendimethalin resulted in the greatest weed control in the crop (Rojas *et al.* 1993).

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¹Although many references were reviewed for this Pest Fact Sheet, the primary basis for it's construction has been modeled upon a "full datasheet" as provided by CABI (2002) and referenced below.

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