

INTERNATIONAL TRADE AND PARASITIC CROP WEEDS – IMPLICATIONS OF THE CURRENT STATUS OF WITCHWEED AND BROOMRAPE IN AUSTRALIA

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Summary Indigenous witchweed (*Striga* spp.) and broomrape (*Orobanche* spp.) are not weeds of agriculture. Many authors perpetuate confusion between the native Australian species *Striga curviflora*, *S. squamigera*, *S. parviflora*; *Orobanche cernua* var. *australiana* and weedy relatives. *O. minor* is scattered widely in south-west and south-east Australia, but is an insignificant weed. *O. ramosa* is subject to an eradication program. Reports of *Striga asiatica*, *S. hermonthica*, *S. aspera*, *O. cernua* var. *cernua* and *O. cernua* var. *cumana* are erroneous. They do not occur in Australia.

The presence of native *O. cernua* and *Striga* species in Australia has major trade implications, especially as trading partners look at new ways to comply to world trade agreements.

We need to ensure that trading partners are aware of the true status of witchweeds and broomrape to ensure export markets are kept open.

We argue that Australia's freedom from the major weed species of *Orobanche* and *Striga* warrants more stringent requirements on imported produce, especially seed than is required for trade within Australia.

INTRODUCTION

Due to the recent European settlement, and stringent quarantine standards, Australia remains free of many weedy parasitic species within the genera *Striga* and *Orobanche*. In South Australia, the Animal and Plant Control Commission and local control boards eradicate or contain all introduced broomrape species.

In some cases names of weedy species have been misapplied to their native relatives. These errors in the literature have trade implications. Importers of produce potentially carrying seed of weeds such as non-native *Striga*, and *Orobanche* consequently argue that these weeds are already in Australia, and based on the international trade agreements (World Trade Organization 1994), import restrictions should not apply. Similarly, countries importing produce, especially seed, from Australia may impose unnecessarily high levels of testing to ensure produce is free of these parasitic weeds.

This paper reports on the current status of *Striga* and *Orobanche* species in Australia, and the discusses the strategies we need to ensure weedy species do not establish in Australia.

MATERIALS AND METHODS

We consulted the literature, herbarium databases and weed control authorities, to determine Australian records of *Striga*, and *Orobanche*. One of us, Barker, conducted extensive field and taxonomic studies on Australian *Striga* and *Orobanche* collections. Further discrepancies in names were resolved where possible by viewing source herbarium specimens.

RESULTS AND DISCUSSION

Table 1 includes the species reported from Australia, including former and illegitimate names.

Striga All *Striga* species in Australia are indigenous. A recently described scale-leaved species, *S. squamigera* W.R. Barker, with smaller flowers than *S. curviflora* (R.Br.) Benth. extends across subtropical northern Australia. *S. squamigera* may be closely allied to *S. gesnerioides* (Willd.) Vatke ex Engl. of Africa and India. The remaining Australian assemblages of populations are traditionally treated as three species, *S. curviflora* (R.Br.) Benth., *S. multiflora* (R.Br.) Benth. and *S. parviflora* (R.Br.) Benth, but the species with longer corollas were combined, reducing *S. multiflora* to *S. curviflora* (Barker 1992). Whether *S. parviflora*, with short corollas, is distinct from this requires further work. There is no documentation of these indigenous species affecting economic plants in recent times. Old reports, describe *S. parviflora* as a weed of sugar-cane (Hughes 1960) and maize (Kleinschmidt and Johnson 1977) in Queensland. Today we believe *S. parviflora* is not associated with sugar-cane in Queensland.

Striga asiatica (L.) Kuntze (syn. *S. lutea* Lour.) does not occur in Australia. Recent publications (Hnatiuk 1990, Lazarides and Hince 1993) include the names

S. asiatica and *S. lutea* for Australia, based on misidentification of the native *S. curviflora*. *Striga hirsuta* Benth. was included by Bentham (1869) on the basis of a single record and has not been collected in Australia since.

The source of the reference by Holm *et al.* (1979) to *S. gesnerioides* in Australia is unclear. There are no specimens in Australian herbaria, or references in regional checklists.

Orobanche The introduced *O. minor* is a weed of subterranean clover pastures in south western and south eastern Australia but is only a problem in seed crops and has become an insignificant weed in grazed pastures. *O. minor* is parasitizing *Vicia ervilia* (L.) Willd. at several sites (Enneking personal communication 1995) and may also parasitize the sandplain lupin (*Lupinus cosentinii* Guss.).

We contained the one remaining infestation of *O. ramosa* in South Australia. The infestation totals less than 3000 m² which we fumigated with methyl bromide. We have not found any trace of an early (1911) record of *O. ramosa* despite extensive collecting in the area and it is believed to be extinct.

The distinction of the native species, *O. cernua* Loefl. var. *australiana* (F.Muell. ex Tate) J. Black ex G. Beck, from *O. cernua* var. *cernua* and var. *cumana* (Wallr.) G.Beck of Europe and Asia, requires taxonomic and

genetic investigation. In the past it has been recognised as a separate species, *O. australiana* F.Muell. ex Tate, but in the absence of obvious morphological characters, Barker (1986) reduced it to a variety of *O. cernua*. All records of this uncommon indigenous plant suggest that it is probably genetically different from extra-Australian *O. cernua* as it parasitizes only native species, mainly of Asteraceae. Reports from Western Australia referring to *O. australiana* as a weed of subterranean clover are erroneous. All collections from that State in the Western Australian Herbarium are *O. minor*.

The potential of *O. cernua* var. *australiana* to become a crop weed in Australia should not be totally dismissed. In eastern Europe, the Old World plant *O. cernua* adapted to the New World crops sunflower and tobacco within 50–70 years of cultivation. Today *O. cernua* is one of the major pests of sunflowers in Eastern Europe and the Mediterranean region. Similarly, if varieties of vetch susceptible to *O. minor* are promoted we expect the range, abundance and impact of this minor weed to increase.

Trade issues The presence of native *O. cernua* and *Striga* species in Australia are likely to be used by trading partners as a way of restricting imports of Australian commodities.

Under international agreements Australia must not place greater restrictions on imports than is placed on

Table 1. Native and weedy species of *Orobanche* and *Striga* reported to occur in Australia (see Carter *et al.* 1996 for a full reference list).

Species	Names used in error or previously	State ^A	Status
<i>Striga</i>			
<i>curviflora</i> Benth.	<i>multiflora</i> Benth.	NT,Q,W	native
<i>gesnerioides</i> (Willd.) Vatke ex Engl.	<i>orobanchoides</i> (R.Br.) Benth.		never recorded
<i>asiatica</i> (L.) Kuntze	<i>lutea</i> Lour		record erroneous
<i>hirsuta</i> Benth.		Q	one record, extinct
<i>parviflora</i> Benth.		NT,Q,W	native, insignificant weed
<i>squamigera</i> W.R. Barker		NT,W	native
<i>Orobanche</i>			
<i>aegyptiaca</i> Pers.			never recorded
<i>cernua</i> Loefl			
var. <i>australiana</i> (F.Muell. ex Tate)		N,S,T,V	native, widespread, rare
J.Black ex G.Beck			
var. <i>cernua</i>			never recorded
<i>crenata</i> Forsk.			never recorded
<i>minor</i> Sm.	<i>australiana</i> auct.	N,S,T,V,W	minor weed, widespread
<i>ramosa</i> L.	<i>mutelii</i> F.W. Schultz	S	eradication in progress

^A.N=New South Wales includes Australian Capital Territory, NT=Northern Territory, Q=Queensland, S=South Australia, T=Tasmania, V=Victoria, W=Western Australia.

equivalent domestically produced commodities. This means for instance, as we do not require inspection for broomrape or witchweed or fumigation of locally

Table 2. Major crops which host *Orobanche* spp.

Aster	<i>Lathyrus</i> spp.
Broccoli	Lentil
Capsicum	Lettuce
Caraway	Lupin
Carrot	Muskmelon
Chamomile	Niger seed
Chickpea	Peanut
Clovers	Potato
Cucumber	Safflower
Cumin	Sage
Egg plant	Squash
European vervain	Sunflower
Faba bean	Sweet basil
Fenugreek	Tobacco
Gazania	Tomato
Geranium	Turnip
Horseradish	Vetch

Table 3. Crops and other plants affected by witchweed. Monocots host *Striga asiatica*, *S. asper* and *S. hermonthica*. Dicots host *S. gesnerioides*.

Monocots	Dicots
<i>Ageratum conyzoides</i>	Cowpea
<i>Andropogon auriculatus</i>	<i>Euphorbia</i> spp.
<i>Aristida hysterix</i>	<i>Hygrophila</i> spp.
<i>Axonopus compressus</i>	<i>Indigofera</i> spp.
<i>Brachiaria</i> spp.	<i>Ipomea</i> spp.
<i>Cymbopogon</i> spp.	<i>Lepidagathis</i> spp.
<i>Dactyloctenium aegyptium</i>	<i>Pterodiscus</i> spp.
<i>Echinochloa</i> spp.	<i>Rhynchosia subulata</i>
<i>Eleusine indica</i>	Sweet potato
<i>Eragrostis teff</i>	<i>Tephrosia</i> spp.
Tobacco	
Finger millet	
Fonio (<i>Digitaria exilis</i>)	
<i>Ischaemum afrum</i>	
Maize	
<i>Panicum walense</i>	
<i>Paspalum</i> spp.	
Pearl millet	
<i>Pennisetum</i> spp.	
Rice	
<i>Rottboellia cochinchinensis</i>	
<i>Setaria</i> spp.	
Sorghum	
Sugarcane	
<i>Urochloa trichopus</i>	

produced commodities, we should not require these inspection or fumigation of imports.

We need to ensure that trading partners are aware of the true status of witchweeds and broomrape in Australia and the reasons why different restrictions are needed for entry of commodities into Australia. We similarly need to inform trade partners of the freedom from weedy species in Australia.

High entry risk for broomrape or witchweed The more important issue for Australia is the maintenance of our current status. The most likely method for entry and establishment of broomrape and witchweed is as a contaminant of seed. Currently seed is not microscopically examined, consequently these small seeds (size 150–300 µm) escape detection.

At risk products, especially seed, from regions where witchweed or broomrape occurs should be microscopically examined or fumigated sufficient to kill witchweed and broomrape seed.

Broomrape is widespread especially in Europe, Asia, Central America and North Africa. Seed of a wide range of crops that host broomrape are regularly imported. Table 2 shows the high risk crops for broomrape. All seed of these crops should be prohibited from entry unless it comes from a region free of *O. crenata*, *O. ramosa*, *O. aegyptiaca*, *O. mutellii*, *O. cernua*, and *O. foetida*. Similar requirements for plants in Table 3 should apply unless regions are free of *S. asiatica*, *S. asper*, *S. hermonthica* and *S. gesnerioides*.

A second option is for certification of field freedom plus microscopic examination of samples. A protocol will need to be developed for this examination.

International obligations require Australia to treat domestic produce in the same manner as imported produce. Restrictions such as requiring microscopic inspection of imported seed from high risk crops such as vegetable and aromatic plant seed are seen by importers as an unnecessary cost, especially as similar domestic products are not required to undergo similar testing.

We argue that Australia's freedom from the major weed species of *Orobanche* and *Striga* warrants more stringent requirements on imported produce, especially seed, than is required for trade within Australia. Lowering standards is not necessary to comply to International trade agreements.

Awareness of parasitic weeds Even with quarantine procedures, broomrape and witchweed will enter Australia and establish periodically. A major barrier to early location of these weeds is the lack of recognition by farmers. This has been perpetuated by lack of knowledge

within Government agencies and industry organizations.

In parts of Western Australia, New South Wales and Victoria, where *O. minor* is common, farmers are familiar with the transient appearance of the flower stem and will probably overlook areas of *O. crenata*, *O. cumana* or *O. cernua* until they become abundant.

Whenever broomrape occurs in a crop it is likely that it is not the native *O. cernua* var. *australiana*, or the widespread introduced *O. minor*. It is essential that specimens are collected and lodged with a herbarium, and containment programs are implemented.

CONCLUDING REMARKS

Australia is free of the major weedy *Orobanche* and *Striga* species. We must maintain and improve quarantine measures to maintain our status. A strategy is needed to locate and eradicate any incursions.

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