BIOLOGICAL CONTROL OF WEEDS PROGRAMS FOR WESTERN AUSTRALIA

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Summary: A review of biological control of weeds programs in Western Australia is given. Insects from Europe and South Africa have been introduced onto doublegee and little jack, but so far without controlling these weeds. A search for insects against dock and sorrel has been completed in the western mediterranean region and a number of possible biological control agents are proposed. A search for biological control agents against Parkinsonia has started and work is continuing on the other weeds.

INTRODUCTION

Attempts to control weeds by the introduction of insects from the weed's original habitat are not new in Western Australia. The first attempt with this method of weed control was against St John's Wort (*Hypericum perforatum*) when two chrysomelid beetles, *Chrysomela hyperica* and *C. quadrigemina* were released between 1947 and 1953. These insects came from eastern Australia, the original source being Europe. Although believed to be established in W.A., this work was not continued, possibly because the weed was not an important problem. The next attempt at the biological control of weeds was in 1974 with the release of *Perapion antiquum* for the control of doublegee (*Emex australis*) (Moulden, 1981). At present work is being conducted on four species of dock, plus sorrel, doublegee and its relative little jack, all of which are weeds in the south west region of W.A. Work has also started on Parkinsonia, a weed from the north west of W.A. In this review I give an account of the progress in the biological control of these plants.

DOCKS AND SORREL

Four species of dock (*R. conglomeratus*, *R. crispus*, *R. obtusifolius*, and *R. pulcher*) and sorrel (*R. acetosella*) have been accepted by the Australian Weeds Committee as being suitable for biological control. The species of dock are all closely related and are found in the subgenus *Rumex*, while sorrel belongs to the subgenus *Acetosella*. Recent work by Rechinger (1984) showed that there are eight species of native *Rumex* and nine species introduced into Western Australia. Most of these species, including the five above are found in the south west (Moore and Scott, unpublished observations).

The search for biological control agents started in 1981 and concentrated on both fiddle dock (*R. pulcher*), since this is the most important dock in Western Australia (Allen, 1974, 1975), and the western mediterranean region (Morocco, Portugal, Spain, France and Italy), since this is the most likely original habitat of the weed. Fiddle dock is the dominant dock species in the non mountainous areas of this region. However populations of the plant are relatively difficult to find, occurring usually in recently abandoned vineyards and wheat fields. The plants do not persist, usually being replaced by other vegetation after a few years. One of the causes of this change is mortality of docks due to insects.

Insects of 37 species were found to feed on fiddle dock and an additional 14 species occurred on other species of *Rumex* (Scott and Sagliocco, unpublished observations). Most of these insects proved to be polyphagous and hence not specific to the host plant genus. No insects were found which were specific only to fiddle dock or another dock species. In general, the maximum degree of known host plant specificity was to a subgenus in the genus *Rumex*. Hence insects exhibiting this level of specificity and which might be suitable biological control agents against fiddle dock, would also be useful against the other dock species but not sorrel, and vice versa.

Table 1 lists those species which might be useful against fiddle dock (and subsequently other dock species). The list includes five weevil species (*Apion*, *Lixomorphus* and *Lixus*), two diptera (*Pegomya*) and two lepidoptera (*Bembecia* and *Chamaesphecia*).

Table 1. Possible biological control agents for fiddle dock.

Insect species	Part of plant attacked
Apion (Perapion) hydrolapathi	stem
Apion (Perapion) violaceum	stem
Apion (Erythrapion) miniatum	stem
Bembecia chrysidiformis	root
Chamaesphecia doryliformis	root
Lixomorphus ocularis	root
Lixus ferrugatus	stem
Pegomya bicolor	leaf
Pegomya nigritarsis	leaf

The species which seem to have the most damaging effect on fiddle dock are the two lepidoptera. These sesiid moths have almost identical biologies except that *B. chrysidiformis* is found in France and Italy and the northern half of Spain and Portugal while *C. doryliformis* is found in Morocco and southern Spain and Portugal and the southern tip of Italy. The adults lay eggs on the stem after the formation of the seeds at the start of summer. The larvae descend and attack the root, eating out the taproot during summer. In winter the plants often die, presumably due to rots associated with the insect attack. There is one generation of the moths per year and the level of attack is often very high. Initial host specificity testing has been carried out with *B. chrysidiformis* and further testing on both species is continuing.

The adult of the root attacking weevil (*L. ocularis*) feeds on dock rosettes. Larval development is completed in the root during spring and the remainder of the year is passed as an adult weevil. Initial studies on this species have been undertaken at the U.S.D.A. laboratory in Rome (Spencer, 1981) and work is continuing on the biology (Campobasso, personal communication, 1984). This insect has a low dispersal ability and egg production is limited, factors possibly restricting its suitability as a biological control agent.

The leaf mining flies (*Pegomya* spp.) have many generations a year, attacking leaves during spring and autumn. Winter is passed as a pupa and summer probably as the adult. Host specificity testing is planned for this year.

The remaining weevil species all attack the stem. *Lixus ferrugatus (=L. cribricollis)* has already been introduced into Australia for doublegee control and insects originating from dock should increase the likelihood of attack on this weed. The three *Apion* species have one or two generations a year and the larvae feed in the stems of dock during seed formation. Host specificity testing is in progress with these species.

So far sorrel (*R. acetosella*) has only one species which appears suitable as a biological control agent. This weevil, *Apion (Erythrapion) frumentarium* feeds on the leaves when an adult, the larvae feed inside the stem and root causing death of the plant. Only preliminary studies have been made with this species.

DOUBLEGEE AND LITTLE JACK

Both doublegee (*Emex australis*) and little jack (*E. spinosa*) are accepted for biological control by the Australian Weeds Committee. The first attempted biological control of these weeds was the release of *Perapion antiquum* onto doublegee (Gilbey and Weiss, 1980; Moulden, 1981). This insect from South Africa was known to control this species in Hawaii (Fullaway, 1958) but has not become established in Western Australia. A subsequent attempt was made using *L. ferrugatus* and releases are still being made (Richards, 1981).

New work on the possibilities for the biological control of doublegee has recently started in South Africa by the Victorian Department of Conservation, Forests and Lands and will soon start by the C.S.I.R.O. Division of Entomology. Further possible biological control agents exist for little jack in the western mediterranean region, especially the root attacking weevil *Conicoleonis excoriatus* (Vayssieres, personal communication, 1984) and the pathogen *Peronospora rumicis* (Hasan, 1981).

PARKINSONIA

Parkinsonia (*Parkinsonia aculeata*) is under consideration by the Australian Weeds Committee for suitability as a target for biological control. The weed is found in northern Australia especially alongside rivers. Its original distribution is southern U.S.A., Mexico and central America and it is in this region that a search for biological control agents has recently started as a cooperative program between Western Australia, Northern Territory and Queensland. It is still too early to know if suitable agents can be found for this weed (Woods, personal communication, 1984).

OTHER WEEDS

A number of weeds present in Western Australia have already been examined for biological control agents in their native habitats. Examples are blackberry, Heliotrope and skeleton weed. The results of this work could be applied relatively inexpensively in Western Australia. Other weeds which might be suitable for biological control but have not yet been studied in detail are Oxalis and Homeria.

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LITERATURE CITED

Allen, J.M. 1974. W.A. Dept. Agric. Tech. Bull. 23.

Allen, J.M. 1975. J. Agric. W.A. 16: 67-71.

Fullaway, D.T. 1958. Proc. Hawaii Ent. Soc. 16: 356-360.

Gilbey, D.T. and Weiss, P.W. 1980. J. Aust. Inst. Agric. Sci. 1980: 221-228.

Hasan, S. 1981. Proc. Vth Int. Symp. Biol. Control Weeds 1980: 333-340.

Moulden, J. 1981. J. Agric. W.A. 22: 70-71.

Rechinger, K. 1984. Nuysia 4 (in press).

Richards, K.T. 1981. J. Agric. W.A. 22: 58.

Spencer, N.R. 1981. Proc. Vth Int. Symp. Biol. Control Weeds 1980: 125-151.

Wilson, F. 1960. C.I.B.C. Tech. Comm. No. 1: 1-102.