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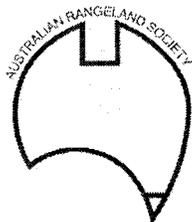
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INVASION OF WARD'S WEED IN THE IVANHOE DISTRICT

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Ward's weed *Carrichtera annua* was first recorded in Australia near Port Pirie in 1915 (Lamp and Collect, 1989). Its spread since then has been spasmodic, being prevalent in years of good winter/spring rainfall. *C. annua* is an inhabitant of the Sahara Arabian area and has some extremely efficient survival mechanisms making it such a good competitor in semi-arid rangelands. It has been described as the "crucifier of semi-arid regions" (Burmil, 1972).

C. annua has been recorded on virtually every soil type in the Ivanhoe area from heavy grey clays through calcareous earths to light red sandy soils. It is most common on lighter soils associated with Mallee, Rosewood/Belah and Bluebush communities. Being an annual herb it provides little ground cover during the dry months when cover is most needed. Insufficient ground cover particularly on light soils leaves them vulnerable to wind and water erosion. The tissue that does remain takes years to decay, unlike native species (McKenzie et al. 1991). This may in effect lock up valuable soil nutrients for many years which in turn may limit growth of other more desirable species.

C. annua is reported to be unpalatable to the extent that the healthiest patches of *C. annua* have been noted even around rabbit warrens and drinking troughs (McKenzie et al. 1991). It is only when biomass levels are extremely low that *C. annua* is eaten by stock. The toxicology of *C. annua* is unknown but evidence suggests it may have been responsible for sheep deaths in the Ivanhoe area. The weed has a pungent odour and is known to taint milk when eaten by cows and also may taint meat (Lamp and Collect 1989).

From observations made on the Nullarbor the invasion of *C. annua* was caused by a combination of grazing (particularly by rabbits), and the shortage of available nutrients (McKenzie et al 1991). Disturbed or degraded pasture are vulnerable to invasion from the weed. Observations in the Ivanhoe district suggest that the spread of *C. annua* is due to several factors. Firstly seeds are spread through sheep dung as sheep consume fruits by default when grazing more desirable species. Vehicle movements particularly graders along roads, and wind breaking off whole dry plants during summer and dragging them over considerable distances may also spread seeds. Heavy runoff after rain may also disperse seeds short distances.

Like the invasion of most weeds, the problem is one of competition. *C. annua* has several traits that maximise its chance of survival in a harsh environment. Ward's weed is a prolific seeder producing thousands of seeds per plant. Seeds are dispersed from the capsules when the fruit is mature with the aid of raindrop impact. The force of a raindrop on impact with the 'beak' of the pod splits the pod open and disperses the seed. The seeds exhibit a mucilage layer which enables the seed to retain moisture and acts to stick the seed to the soil (atelechory). Water thus plays an integral part of seed dispersal and protection in the life cycle of the plant. Like many desert winter annuals *C. annua* flowers and fruits very rapidly taking advantage of the available moisture as quickly as possible.

C. annua exhibits heteroblasty, that is only a portion of seeds germinate even when the conditions are optimal. The germinability of *C. annua* seed depends on the day length at the time of seed maturation (Gutterman 1981). This is an important survival mechanism because a viable seedbank will always be maintained. If drying off after the first germination occurs a percentage of the seed will remain viable. This may help to explain why the distribution of *C. annua* is somewhat sporadic because a particular cohort may have a high germinability followed by one with a low germinability.

Control of *C. annua* is difficult. While herbicides with a 24-D base such as Amine or Amicide are practical for control in cropping areas they are not suitable in grazing areas.

As yet the effects of fire on this weed have not been explored but casual observations suggest that burning during summer will reduce the seed pool and produce a substandard looking crop the next growing season. At present many graziers control weed growth through grazing pressure. While this may be effective in the short term it must be remembered that the problem is one of competition. A grazing pressure heavy enough to remove *C. annua* would have removed all desirable species first that are needed to provide competition. Manipulation through grazing management and fire are two possibilities that need to be researched.

There are no known natural predators of the weed. Maintenance of a healthy perennial pasture is probably the key to the control of this weed.

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