Incidence and growth of prickly lettuce (*Lactuca serriola* L.) in dryland crops in the Victorian Wimmera

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Summary

Prickly lettuce (*Lactuca serriola* L.) seedlings emerge in autumn and winter with a smaller peak in spring. Plants growing in the absence of competition had up to 15 lateral branches and persisted throughout the year, whereas those growing in competition with crops had few if any branches and many died.

In the Wimmera, prickly lettuce is an annual with most of its growth occurring in late spring. Its frequency of occurrence (85%) in commercial wheat crops just prior to harvest is higher than that of the other main weeds, *Polygonum aviculare, Sonchus oleraceus, Sisymbrium orientale* and *Picris echioides*.

Information from this and other studies indicates that weed control combined with agronomic practices that maintain soil fertility and crop vigour should reduce the population of prickly lettuce to very low levels.

Introduction

The increasing incidence of *Lactuca serriola* L. (prickly lettuce, wild lettuce, whip thistle) in dryland crops in the Victorian Wimmera is due, possibly, to the extensive use of trifluralin for weed control in cereals rather than of post-emergence herbicides such as 2,4-D that previously kept it under control (Amor and de Jong 1983).

Although the presence of prickly lettuce does not reduce yield in cereals or grain legumes, the harvested flower buds are difficult to screen out of the grain. Consequently, grain-handling authorities sometimes discount the value of infested grain. Furthermore, the thick stems contain a white latex which can clog harvesting machinery and raise the moisture content of harvested grain to unacceptably high levels.

This paper reports studies on the incidence, seasonal emergence, growth and development of prickly lettuce in the Victorian Wimmera between 1981 and 1983.

Methods

Unless specifically mentioned the studies were carried out on grey self-mulching soils (Ug 5.2) (Northcote 1979) at the Cereal Experimental Centre, Dooen, Vic., which has an average annual rainfall of 416 mm. The annual rainfall in 1981 and 1983 was 461 mm and 542 mm, respectively, but a drought (180 mm annual rainfall) in 1982 severely affected plant germination and growth.

Seasonal emergence

One thousand seeds collected from plants at Dooen in January 1982 were raked into the soil at a depth of 1 cm within a 1-m² quadrat on 16 February 1982. Seedlings were counted and removed as they emerged over a 2-year period. Secondly, volunteer prickly lettuce seedlings on an unsown fallow at Blackheath, 23 km from Dooen and with a similar soil type and rainfall, were counted and removed monthly between July and November in 15 permanent 1-m² quadrats.

Population changes in stubble, fallow and crop

Chickpea stubble. The density of prickly lettuce plants was recorded monthly from July 1981 to December 1981 in 25 permanent 0.25-m² quadrats located in a chickpea stubble. A heavy infestation of Indian hedge mustard (*Sisymbrium orientale* L.) and ox-tongue (*Picris echioides* L.) was hand weeded in late October.

Unsown fallow and in a wheat crop. The density of prickly lettuce was recorded at monthly intervals between July and October in 40 permanent 1-m² quadrats on an unsown fallow surrounding a wheat trial in 1981. Similar counts were also made in unsprayed wheat plots within the trial, using five permanent 1-m² quadrats per plot in each of four replicates.

Growth and development

Unsown fallow. During 1981, the emergence of volunteer prickly lettuce plants, periods of stem elongation, leaf formation, branch formation, flowering, presence of plants with seeds and senescence were recorded in 40 permanent 1-m² quadrats on an unsown fallow.

In wheat and mown oats. Similar measurements were made in 20 permanent 1-m² quadrats in a rotation trial in 1981. The development of prickly lettuce was recorded in a wheat crop in a fallow–wheat rotation and in an oat crop mown in spring in a fallow–wheat–oat mown rotation.

Surveys of the incidence of prickly lettuce

On Wimmera farms. The incidence and growth habit of prickly lettuce in 27 wheat crops on Wimmera farms was surveyed on 21–22 December 1981, just prior to harvest. The sampled crops were located at random around the perimeter of a 31 by 12-km rectangle north of Horsham between Wail (lat. 36°30′S., long. 142°07′E.) and Murtoa (lat. 36°37′S., long. 142°19′E.). Soils in the area are mainly alkaline, grey, self-mulching clays (Ug 5.2) and brown clays (Ug 5.3) included in Association Unit H.1 of Badawy (1977). The average annual rainfall in the area surveyed is 400–425 mm.

In each crop, fifteen 1-m² quadrats were randomly placed in a circle of 100 m diam. Crop height, presence of other weeds, and the density, height, number of leaves per plant and percentage of prickly lettuce plants which had formed branches at the base were then ascertained.

At the Cereal Experimental Centre, Dooen. In 1981 and 1983, the density of prickly lettuce was recorded in crops or stubbles in several rotations and field trials. Most of the measurements were made in trials in which the treatments were replicated four times. The number and size of quadrats used depended on weed density and varied from twenty 0.25-m² quadrats per plot at high densities to thirty 1-m² quadrats per plot, at low densities. The counts were made at various times during the growing season and the averages for trials or fields are presented below.

Results

Seasonal emergence

There was an 11% establishment of plants during 1982 and 1983 from the seed sown at Dooen. Under the drought conditions in 1982, prickly let-

Table 1 Seasonal emergence of prickly lettuce in sown and volunteer populations

	Monthly emergence expressed as a percentage of annual emergence							
	Apr	May	June	July	Aug	Sept	Oct	Nov
	Population sown in 1982 (Dooen)							
1982	–	46	29	25	–	–	–	–
1983	50	19	16	–	6	9	–	–
	Volunteer population (Blackheath)							
1983	A	A	A	64[B]	20	5	11	0

A, not measured; [B] includes seedlings emerged in previous months.

tuce emerged only between May and July, but in the more normal 1983 season, 85% of the annual emergence occurred between April and June with a smaller peak in August to September (Table 1).

Total emergence throughout 1983 in the volunteer population of prickly lettuce at Blackheath was 3.7 plants m^{-2}. The first count was made in late July and by then, 64% of the total annual emergence had occurred. There was also a small peak in October.

Population changes in stubble, fallow and crop

The density of prickly lettuce in the weedy chickpea stubble was 221 plants in m^{-2} in July but declined dramatically until November, after which a few new seedlings emerged (Figure 1). Between 11 August 1981 and 14 October 1981, the density of prickly lettuce was a constant 7.6 plants m^{-2} on the unsown fallow but during the same period within the adjacent wheat crop the density declined from only 2.0 plants m^{-2} to 0.6 plants m^{-2}.

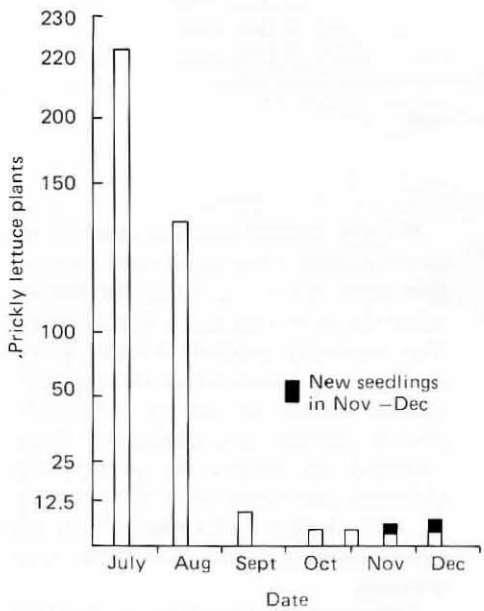

Figure 1 Changes in prickly lettuce density in a chickpea stubble between July and December 1981 at Dooen (plants m^{-1}).

Growth and development

Stem elongation of prickly lettuce growing on the fallow occurred from early July but rapid growth of stems and leaves did not take place until mid-October (Figure 2). The final height on 23 December was 800±40 mm (s.e.). One characteristic of these plants growing with little competition was that 50% had up to 15 lateral branches arising from the lower part of the stem. Seed was present on the plants until senescence at the end of April.

Most prickly lettuce growing in the adjacent wheat crop had a single stem only and the average height at peak growth was 350±70 mm. Branching occurred mainly after the wheat was harvested.

In the oat crop mown in spring, all prickly lettuce plants formed lateral branches and were very leafy; there was an average of 45 leaves per plant in early December compared with 13 leaves per plant on the weed in the wheat crop.

Irrespective of location, all prickly lettuce plants had died by the end of April.

Surveys of incidence of prickly lettuce

Prickly lettuce was the most frequent weed (85% occurrence) in the wheat crops surveyed. The other weeds found were wireweed, *Polygonum aviculare* L. (52%); common sowthistle, *Sonchus oleraceus* L. (33%); Indian hedge mustard, *Sisymbrium orientale* (30%); ox-tongue, *Picris echioides* (15%); poppy, *Papaver* spp. (11%); wild oat, *Avena fatua* L. (11%); spear thistle, *Cirsium vulgare* (Savi) Ten. (4%); and

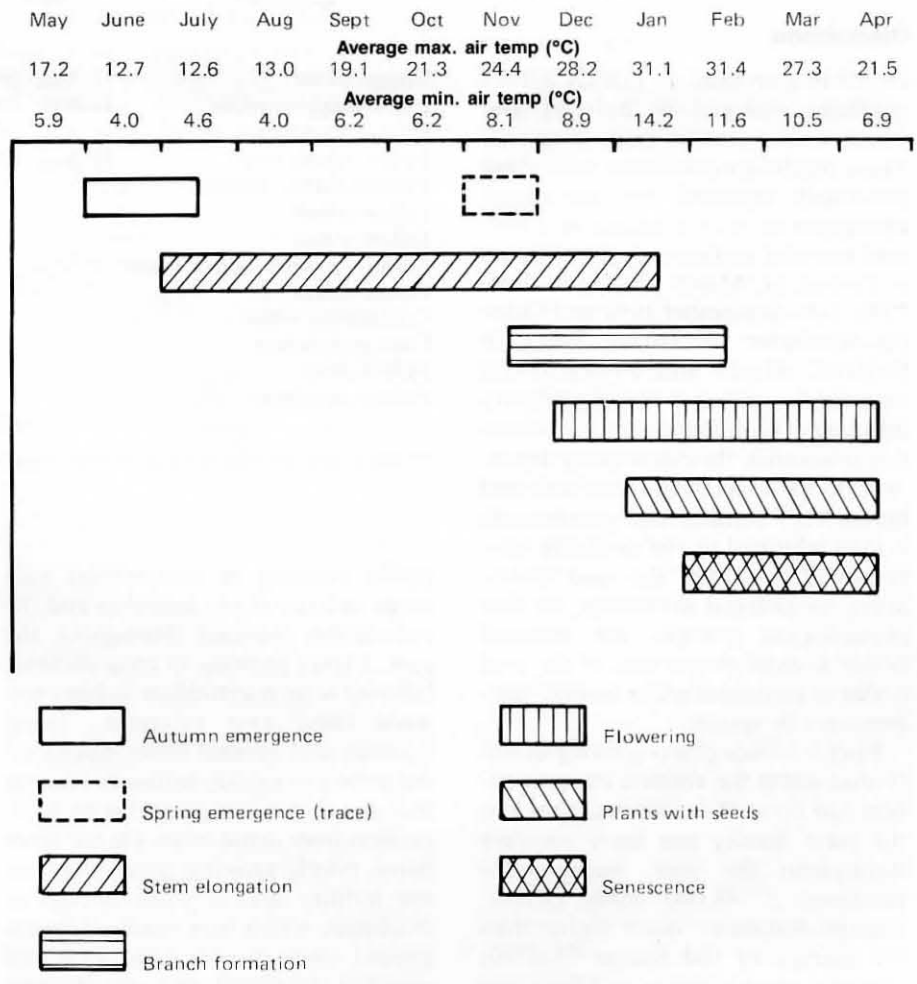

Figure 2 Phenology of prickly lettuce growing on an unsown fallow at Dooen in 1981/82.

yellow burr weed, *Amsinckia* spp. (4%).

Of the 27 crops inspected, prickly lettuce was absent in four crops and only occasional in 12 crops. In the remaining 11 crops the crop height was 859±35 mm (range 700–1000). The prickly lettuce reached a height of 712±84 mm (range 275–1190), a density of 1.1±0.3 plants m^{-2} (range 0.3–3.6) and the percentage of plants with branches was 9.1±3.7 (range 0–38). Few prickly lettuce plants had commenced flowering.

The density of prickly lettuce in stubbles at Dooen varied widely during 1981 and 1983 within fields and between treatments within trials (Table 2). In 1982, because of the severe drought, prickly lettuce like most other weeds failed to establish. The highest densities were recorded in a fallow–wheat–wheat rotation, oats-grazed stubbles and a pea stubble in 1981, and in the stubbles of 1982 pea and rapeseed crops which failed in the drought. High densities were also associated with low soil fertility.

The density of prickly lettuce in crops was lower than in stubbles and declined between August and December (Table 3).

Table 2 Density of prickly lettuce in crop stubbles at Dooen

Rotation[A]	Date	Prickly lettuce (plants m^{-2})
Fallow-*wheat*	14 Jul. 1981	13
Fallow-*wheat*	14 Jul. 1981	29
Fallow-wheat-*wheat*	14 Jul. 1981	330
Fallow-wheat-*oats grazed*	14 Jul. 1981	302
Fallow-wheat-oats-*oats grazed*	14 Jul. 1981	93
Fallow-wheat-*oats*	14 Jul. 1981	37
Fallow-wheat-*pasture*	21 Jul. 1981	5.0
Fallow-barley-*pasture*	21 Jul. 1981	1.2
Pasture-fallow-*peas*	14 Jul. 1981	221
Lupins-fallow-*chickpeas*	10 Jul. 1981	2.0
Fallow-wheat-fallow-*peas*(low)[B]	24 May 1983	259
Fallow-wheat-fallow-*wheat*(low)	24 May 1983	35
Fallow-wheat-fallow-*wheat*(high)[C]	24 May 1983	16
Fallow-wheat-fallow-*rape*(high)	24 May 1983	111
Fallow-wheat-pasture-*pasture*(high)	24 May 1983	38
Pasture-pasture-fallow-*wheat*(high)	24 May 1983	38
Fallow-*wheat*	1 June 1983	2.5
Fallow-wheat-*oats grazed*	1 June 1983	3.5
Fallow-wheat-*oats*	1 June 1983	9.3
Fallow-wheat-*oats grazed*	1 June 1983	2.3
Fallow-*wheat*(low)	13 Sep. 1983	28
Fallow-*wheat*(high)	13 Sep. 1983	9

[A] Crops in italic are those prior to the year of the plant counts.
[B] Low soil fertility site.
[C] High soil fertility site.

Table 3 Density of prickly lettuce in crops at Dooen

Rotation[A]	Date	Prickly lettuce (plants m^{-2})	Date	Prickly lettuce (plants m^{-2})
Fallow-*wheat*	11 Aug. 1981	5.6	7 Dec. 1981	2.6
Pasture-fallow-*wheat*	11 Aug. 1981	2.0	12 Dec. 1981	0.9
Fallow-wheat-*oats grazed*	11 Aug. 1981	4.0	12 Dec. 1981	1.7
Fallow-wheat-*oats*	11 Aug. 1981	5.9	12 Dec. 1981	3.0
Pasture-fallow-*wheat*			17 Sep. 1981	3.9
Fallow-*wheat*			15 Aug. 1981	0
Fallow-*wheat*			19 Aug. 1981	1.2
Pasture-pasture-fallow-*wheat*			19 Aug. 1981	0
Fallow-*wheat*			10 Aug. 1983	0.1
Continuous *wheat*			10 Aug. 1983	0.4
Oats-peas-*wheat*			10 Aug. 1983	1.2
Fallow-*peas*			7 Dec. 1981	1.1
Fallow-*chickpeas*			7 Dec. 1981	0.8

[A] Crops in italic are those in which the plant counts were made.

Discussion

Depending on rainfall, prickly lettuce seedlings emerged in autumn and winter with a smaller peak in spring. These results are consistent with those previously reported for percentage emergence of prickly lettuce in a watered pot trial maintained out of doors at Dooen, i.e. March 1%, April–June 79%, July–September 19% and October–November 1% (Amor 1985). In England, Marks and Prince (1982) reported that the seeds have no primary dormancy, enabling a rapid germination in autumn, the extent being dependent on the vegetation cover and seed burial. They consider that germination is then inhibited by the declining temperatures in winter, the seed undergoing an induced dormancy, so that physiological changes are required before a small proportion of the seed is able to germinate under warmer temperatures in spring.

Prickly lettuce plants growing in cultivated soil in the absence of competition had up to 15 lateral branches and the plant density was fairly constant throughout the year. Such plants produced *c.* 48 000 seeds (Amor, unpublished data), much higher than the average of 904 (range 75–2349) seeds per plant reported by Marks and Prince (1981) in England. However, plants growing in competition with crops had few if any branches and the population declined throughout the year. Plants growing in crop stubbles behaved in an intermediate fashion between these two extremes. These findings and general observations on the growth of prickly lettuce in Victoria indicate that it is susceptible to competition from dense crops. On the other hand, poorly growing cereal crops on low fertility land or crops of peas or chickpeas, which have relatively sparse ground cover, provide conditions well suited to the growth and reproduction of the weed.

Prickly lettuce emerges mainly in autumn–winter but rapid stem elongation does not occur until late spring when the plants are more readily seen. This probably explains a belief common among farmers, that most germination occurs in spring. Although prickly lettuce has sometimes been reported to behave as a biennial (Abrams and Ferris 1960; Clapham *et al.* 1962; Lamp and Collet 1976), all plants studied in the Wimmera were annuals.

The weed communities in dryland crops in the Wimmera have previously been only broadly documented (Wells

and Lyons 1979; Amor and de Jong 1983) as most studies tend to concentrate on the control of specific weeds. The results of the survey described here, which is the first describing the occurrence of weeds in Wimmera wheat crops just prior to harvest, indicate the frequent occurrence (85%) of prickly lettuce compared with the other main weeds at that time: hogweed, milk thistle, Indian hedge mustard and oxtongue. The weed flora in December is composed mainly of species resistant to the applied herbicides or of those that have avoided the herbicides by late germination. (Some fields may not have been treated with herbicides.)

It is concluded that the production of seed mainly after harvest, when the only control exerted is that provided by grazing sheep, has enabled prickly lettuce to spread throughout the Wimmera. The spread has been assisted by its staggered germination which enables some plants to avoid the effects of herbicides commonly applied to cereal and grain-legume crops. Recently, it has been reported that prickly lettuce in wheat can be selectively controlled by application of MCPA, dicamba, 2,4-D, chlorsulfuron and metribuzin plus methabenzthiazuron and in chickpeas by cyanazine, metribuzin and metribuzin plus methabenzthiazuron (Amor 1986). Marks and Prince (1982) consider that in England the half-life of the buried prickly lettuce seeds may be as little as 18 months. If seed longevity is similar in Australia, then weed control, rigorously applied, together with those agronomic practices that maintain soil fertility and crop vigour should reduce the population of prickly lettuce to very low levels.

Acknowledgments

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