Current status and distribution of common heliotrope (*Heliotropium europaeum* L.) in New South Wales

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Summary

A survey of local government areas in spring–summer of 1983–84 revealed that *Heliotropium europaeum* was widespread throughout New South Wales. Heaviest infestations were confined to the southern half of the State, in particular the drainage systems of the Lachlan, Murrumbidgee and Murray Rivers.

Introduction

Heliotropium europaeum L. (Boraginaceae) is the most important of the five *Heliotropium* spp. having economic significance in Australia. The other four species are blue heliotrope, *H. amplexicaule* Vahl [=*H.anchusifolium* Poir]; rough heliotrope, *H. asperrimum* R.Br.; smooth heliotrope, *H. curassavicum* L.; and prostrate heliotrope, *H. supinum* L. (Delfosse and Cullen 1980).

H. europaeum, a summer-growing annual of Mediterranean areas is widespread in south-eastern Australia infesting over 10 million ha (Culvenor 1985). It is likely *H. europaeum* was introduced into Australia prior to 1800 from either southern France or Italy. The first recorded collection occurred in 1802 at Spencer's Gulf, South Australia (Delfosse and Cullen 1980). The earliest recording of *H. europaeum* by the National Herbarium of New South Wales (Sydney) was from Parkes (Central West) in March 1899 (R. Lewis, pers. comm. 1986). Prior to the 1920s, 14 specimens had been lodged with the National Herbarium of New South Wales. All these specimens were collected in the central and southern areas of the State, ranging from Forbes and Maryvale in the Central West, Broken Hill (2 specimens) in the Far West, to Corowa in the south on the Murray River (R. Lewis, pers. comm. 1986).

H. europaeum occurs in the Australian Capital Territory, New South Wales, South Australia, Victoria and Western Australia (Delfosse and Cullen 1980) and southern Queensland (Everest 1981). Moore (1956) found that *H. europaeum* occurs in New South Wales and Victoria in the area west and north of the Great Dividing Range respectively and largely within the 300 to 500 mm per annum winter-dominant rainfall zone.

Germination of *H. europaeum* occurs during late spring (late November to early December) with summer fallow conditions being ideal for growth (Moore 1956). However, establishment is dependent on early summer rains (Bull *et al.* 1968) and if these do not occur it may be relatively inconspicuous in grazing areas (Whittet 1968). Once established, *H. europaeum* will grow and thrive under conditions dry enough to stunt or kill most other plants (Walker 1966).

According to Moore (1956), Cunningham *et al.* (1981) and Everest (1981), *H. europaeum* becomes common in areas dominated by winter-growing annuals such as *Hordeum leporinum* (barley grass), *Vulpia* spp. (silver grass) and *Trifolium subterraneum* (sub. clover) or in disturbed areas such as fallows and stubbles, and in degraded winter annual pastures. It is not common in undisturbed areas where native perennial grasses dominate. Pasture composition and conditions are more important than the soil type in the occurrence of the plant.

The problem

The problem aspects of *H. europaeum* are primarily associated with toxicity to grazing livestock. *H. europaeum* contains at least five pyrrolizidine alkaloids which are potentially toxic to livestock (Culvenor *et al.* 1954). Heliotrope poisoning of sheep has been documented by Bull *et al.* (1956). Culvenor (1978) considered it to be the major cause of pyrrolizidine alkaloid related diseases of livestock in Australia. It has been estimated that throughout south-eastern Australia 20 million sheep are at risk to heliotrope poisoning with a total overall loss from mortalities and reduced productive life spans of $\$10 \times 10^6$ annually (Culvenor 1985). A proportion of this loss would be due to *Echium plantagineum* (Paterson's curse) since the two plants occupy approximately the same geographical regions, particularly in southern New South Wales, and the effect of their pyrrolizidine alkaloids is additive (Culvenor 1985). Culvenor (1985) estimated that of this total annual loss from pyrrolizidine alkaloidosis in sheep in south-eastern Australia, $\$7.5 \times 10^6$ could be due to *H. europaeum* and $\$2.5 \times 10^6$ due to *E. plantagineum*.

H. europaeum is also responsible for pyrrolizidine alkaloid poisoning in cattle, although estimates of the overall economic importance are not available. The plant has been reported as poisoning cattle in Victoria (Bull *et al.* 1961; Kinnaird *et al.* 1968), South Australia (McLennan and Dodson 1972) and New South Wales (Bull *et al.* 1961; Wiltjer and Walker 1974; Seaman and Walker 1985). Pyrrolizidine alkaloid poisoning in calves has also been reported due to the contamination of straw bedding by *H. europaeum* (Harper *et al.* 1985).

H. europaeum is also a serious competitor of summer pastures, particularly in disturbed areas. Delfosse and Cullen (1980) state that most farmers cope with *H. europaeum* by a combination of cultural control and livestock management. Seedlings less than 7 cm high can be controlled with non-selective herbicides; however, large plants are quite resistant to herbicides (Anon. 1975). Repeated application of herbicide is necessary to control later germinations (Fromm 1985; Delfosse and Cullen 1980); these herbicides can have a detrimental effect on pasture composition.

Combinations of herbicide and cultivation can be useful, but due to successive germinations successful control is limited (Anon. 1975). Noble (1970, personal communication) demonstrated in the western Riverina area that *H. europaeum* could be completely controlled over three seasons with dense stands of dryland lucerne (21–77 plants m^{-2}). Lucerne stands with popula-

Table 1 Density of infestation of *H. europaeum* in New South Wales on a statistical region basis

Statistical regions	Category (no. of shires)			
	1	2	3	4
1. Sydney	–	–	–	7
2. Hunter	–	1	2	10
3. Illawarra	–	–	–	5
4. Richmond–Tweed	–	–	–	7
5. Mid North Coast	–	–	–	11
6. Northern	–	6	1	13
7. North Western	1	6	6	1
8. Central West	4	2	3	5
9. South Eastern	–	–	5	12
10. Murrumbidgee	3	6	5	–
11. Murray	3	8	2	3
12. Far West	–	–	–	2
Total	11	29	24	76

tions <12 plants m^{-2} proved inadequate in controlling the plant. Other perennial pasture species such as Sirocco phalaris, which is more summer dormant, were also ineffective in controlling *H. europaeum*.

H. europaeum has been nominated as a candidate for biological control. The CSIRO Division of Entomology is currently investigating biological control and Delfosse and Cullen (1980) consider biological control offers the only practical long-term solution to the management of *H. europaeum*.

H. europaeum is not a proclaimed noxious plant under the Local Government Act, 1919 (Anon. 1919). However, the perennial species *H. amplexicaule* is proclaimed noxious in 12 local government areas in New South Wales (Anon. 1919).

Method

A questionnaire survey was conducted by the New South Wales Department of Agriculture's Noxious Plant Advisory Officers in early 1984. Information was sought on the distribution of *H. europaeum* and *E. plantagineum* (Dellow and Seaman 1985) from weed control bodies in 140 local government areas in New South Wales (including ACT). The Sydney metropolitan area was not surveyed.

The area of the individual local government areas surveyed varied in size from Goulburn City, which was the smallest of the non-metropolitan municipalities (54 km^2), to the largest shire, Central Darling (52 000 km^2).

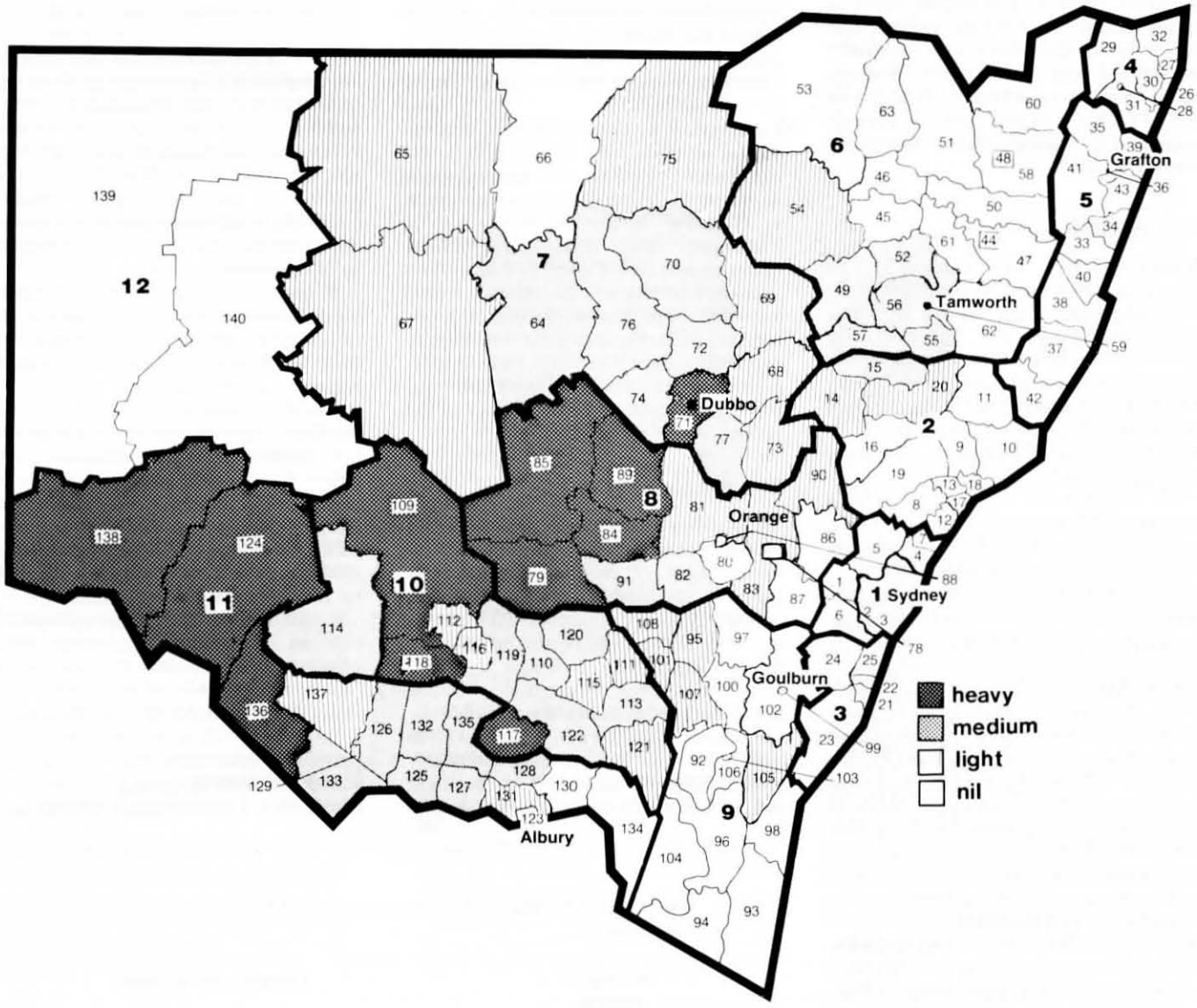

Figure 1 Distribution of *Heliotropium europaeum* in New South Wales on a local government area basis. (Map: Local. Ref.: Government. No.: Area.)

Category 1 (Heavy): 71 Dubbo, 79 Bland, 84 Forbes, 85 Lachlan, 89 Parkes, 109 Carrothool, 117 Lockhart, 118 Murrumbidgee, 124 Balranald, 136 Wakool, 138 Wentworth.

Category 2 (Medium): 15 Murrurundi, 49 Gunnedah, 52 Manilla, 55 Nundle, 56 Parry, 57 Quirindi, 59 Tamworth City, 64 Bogan, 70 Coonamble, 72 Gilgandra, 74 Narromine, 76 Warren, 77 Wellington, 82 Cowra, 91 Weddin, 110 Coolamon, 113 Gundagai, 114 Hay, 119 Narrandera, 120 Temora, 122 Wagga Wagga, 125 Berrigan, 126 Conargo, 127 Corowa, 128 Culcairn, 129 Deniliquin, 132 Jerilderie, 133 Murray, 135 Urana.

Category 3 (Light): 14 Merriwa, 20 Scone, 54 Narrabri, 65 Bourke, 67 Cobar, 68 Coolah, 69 Coonabarabran, 73 Mudgee, 75 Walgett, 81 Cabonne, 83 Evans, 90 Rylstone, 95 Boorowa, 101 Harden, 105 Tallaganda, 107 Yass, 108 Young, 111 Cootamundra, 112 Griffith, 115 Junee, 116 Leeton, 121 Tumut, 131 Hume, 137 Windouran.

***Statistical Regions:* 1 Sydney, 2 Hunter, 3 Illawarra, 4 Richmond–Tweed, 5 Mid North Coast, 6 Northern, 7 North Western, 8 Central West, 9 South Eastern, 10 Murrumbidgee, 11 Murray, 12 Far West.**

By relying on the four Noxious Plant Advisory Officers to contact the weed control officers in their regions, an efficient method was used to ensure a 100% response.

Respondents to the survey were required to indicate the degree of infestation of *H. europaeum* on private property specifying one of four categories, namely:

1. heavy (numerous dense infestations);
2. medium (numerous isolated plants or occasional dense infestations);
3. light (scattered isolated plants, i.e. a recording that it occurs in the shire); and
4. nil (no plants present).

Results

The distribution and density of infestion of *H. europaeum* throughout the 140 local government areas surveyed is given in Figure 1. Table 1 provides a summary of the plant's distribution based on statistical regions.

H. europaeum was present in 46% of the local government areas surveyed in early 1984. Of all *H. europaeum* infestations 64% were located in central and southern New South Wales. As stated by Walker (1966), *H. europaeum* is most widespread and dense in the river drainage systems of the Central West, Murrumbidgee and Murray regions of the State. Of the heavy infestations (category 1) 91% were found in the three regions of central and southern New South Wales (Table 1). These three regions account for 56% of all infestations of *H. europaeum* in New South Wales (Table 1).

Discussion

H. europaeum is now more widely distributed throughout New South Wales than previously recorded (Fig. 1). In addition to all areas identified by Jacobs and Pickard (1981), *H. europaeum* is now also present in the Central Tablelands. The heavy (category 1) infestations of *H. europaeum* in 1984 were mainly confined to the southern half of western New South Wales.

The results provide an estimate of the distribution and abundance of *H. europaeum* in New South Wales in 1984. Previous surveys and censes are historical records showing where *H. europaeum* specimens had been collected over a usually long period. They do not indicate the density of plant population as the records are based on plant specimens lodged with various herbaria and institutions.

Being an annual, population densities of *H. europaeum* greatly fluctuate from year to year depending on climatic conditions and farm management. The rate of spread of the plant throughout New South Wales has not been defined. Keast (1949) stated that the plant appeared to make considerable spread in many areas of the State during the 10 to 15-year period preceeding 1949. The adoption of new farming techniques such as 'conservation tillage', which relies on minimal soil disturbance, retention of stubbles and sometimes the substituting of herbicides for cultivations may have an impact on the spread and density of *H. europaeum*. In areas where the plant is most dense (category 1) the long fallows necessary for successful winter-cereal crops also allow for the establishment of *H. europaeum*. The change in farming techniques coupled with the prevailing weather conditions and the ground cover will determine the continued spread of *H. europaeum*.

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