

BIOLOGY AND CONTROL OF HOREHOUND, *MARRUBIUM VULGARE*

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Summary. Horehound, *Marrubium vulgare*, is a widespread, perennial proclaimed plant. It colonises bare eroded and overgrazed areas, is a nutritious, drought tolerant pasture plant and persists under heavy grazing. Its fruits contaminate wool and are dispersed on livestock. It competes with lucerne pastures and cereal crops.

DESCRIPTION

Marrubium vulgare L., LABIATAE. The common name in Australia is horehound, elsewhere white horehound is used. Horehound is an woolly to villous erect herbaceous perennial up to 60 cm described by Toelken(33). Hyde-Wyatt and Morris(14) describe the seedling.

HISTORY

Horehound originated in Europe(34), Asia and North Africa(25,31). It spread to North America(13), Australia(25) and New Zealand(24) either as a medicinal herb(6,17) or on sheep(31,34,38).

It was recorded in South Australia by 1841, was naturalised by 1848(17) in SA, and 1870 in Victoria(25). In 1906 it was declared in Vic.(25). In the early 1920's horehound was common in mixed farming areas in SA(16), and was declared under the SA Noxious Weeds Act (1931) when it was widespread(1).

Spread. The spread rate in north-west USA was slow(13). In SA the distribution of horehound has not changed but its importance as an agricultural weed has declined in the past 60 years. In the Mildura region of Vic. horehound is still spreading (McKenzie,pers. comm.), although in 1973 it was already widespread in Victoria(25). In NSW (Milvain,pers. comm.) and WA (Dean, pers. comm.) horehound is remaining static.

DISTRIBUTION & ABUNDANCE

It occurs in all Australian states except NT(34). In Vic. 6 million ha is infested although dense infestations cover only 100 000 ha(18). In SA it occurs in over 20 million ha including all settled and pastoral areas receiving greater than 200mm annual rainfall. Its abundance depends on landuse and soil types (Carter, unpublished report). It is widespread in areas of mallee and less common in red-brown earth soils in SA(16). In WA 13 000 ha are infested mainly in red clay loams (Dean, pers. comm.). In NSW there are no large areas of infestation and most infestations are restricted to a few square metres (Milvain, pers. comm.) although it is common and abundant in the southern Western Division(10), and NSW Tablelands(32). In Qld. it occurs in the Burnett district and on the Darling Downs(15). In Tas. it occurs in improved pasture in the Midlands, elsewhere it is confined to fencelines and around farm buildings, especially shearing sheds(14).

GROWTH & DEVELOPMENT

Germination and emergence. Horehound seeds germinate in autumn and winter (14,25) under cool-moist conditions(38). The majority of seeds are dormant at maturity(31) but this dormancy is rapidly broken. Without cool-moist stratification, seedbed temperatures of 35 to 40°C during the day and above 5°C at night are needed to germinate seed, with maximum germination occurring with day temperatures of 40°C and night of 20°C(38). Burning infested areas will induce germination(25). Exposure to cool-moist conditions at 2°C for 4 to 8 weeks

increases germination by 35-40% and reduces the need for fluctuating temperatures' although 15°C diurnal fluctuation is optimal(38).

The intact calyx does not inhibit germination of seed(38).

Establishment, Reproduction and Perennation. It establishes best in disturbed sites where it does not need to compete with other fast growing and early establishing annual plants (38). Growth is rapid during winter and spring. Some seedlings flower in the first summer (25). The mature plants flower mainly from July to December, but may flower continuously(33).

During summer and times of water stress, mature plants die back to a woody crown near the soil surface, protected by flowering stems. With favourable conditions regrowth occurs from the base.

Horehound plants may be long lived(25), although there is a high mortality during the first few years after establishment(3). It is drought tolerant(30).

Seed production and dispersal. Horehound produces up to 74 000 seeds per plant per year(13). The seeds are contained in a hooked calyx which may remain attached to stems of plants for several months, but readily breaks off when brushed by animals or livestock. The calyces attach to livestock, clothing, or produce dispersing seed. Seeds are found in the vicinity of established plants or are dispersed by livestock, especially sheep(6,38).

HABITAT

Horehound is restricted to highly disturbed areas, where it forms relatively pure stands with a lack of interference from other species(38). Horehound establishes and persists on compacted soil unsuitable for establishment of many plants(3). It occurs mostly on uncultivated ground, on roadsides and stock routes, on wasteland (1,6,10), disturbed remnant native vegetation (5,31) and especially where sheep congregate (1,6,10,24). It is also common in borrow pits(10) and limestone quarries(4).

It is associated with calcareous soils. It is widespread in mallee soil areas(16), red clay-loams in WA (Dean, pers. comm), red-brown earths in SA(16), calcareous sands especially trace element and nutrient deficient shallow, stonier soils over calcrete in SA(12), well drained soils especially loams in Western NSW(10). It is also common on calcareous soils of Europe (21) and North America(27).

Horehound is a classical invader and characteristic of heavily stocked areas(3). It establishes after heavy grazing around water points(3), stock yards(31), rabbit warrens (10), or during drought(25) remove competing plants and the reserves of other pasture plants seed. Horehound may persist even after grazing is stopped due to permanent changes to the environment(4).

Horehound does not persist under frequent cultivation (22,30).

Association with grazing livestock. Sheep not only disperse horehound seed, they also create an environment suitable for its establishment. In semi-arid rangelands it was the only exotic species to invade during the first two years after heavy stocking. Horehound appeared following a decline in grasses and *Atriplex vesicaria*(3).

Some stock avoid grazing horehound presumably due to marrubin, a dipterpenoid lactone which gives the plant a bitter taste (11,25) and the woolly surface. Horehound is encouraged by both heavy grazing (3,25), selective grazing by horses and cattle and intermittent grazing of disturbed areas such as roadsides and waste areas and abandoned farmland(4,29).

Horehound persists in lucerne under rotational grazing.

IMPORTANCE

In SA 2.2% of farmers' considered horehound as the worst weed, while 5.0% mentioned the weed (Crocker & Mitchell, 1985 unpublished report).

Crops It is a minor weed of crops in Southern Australia(16). Its seed contaminates barley (Saint, pers. comm.). Its major importance is in marginal cereal cropping areas, where mature plants are difficult to kill with cultivation. Seedlings are easily controlled in cereal crops with a range of herbicides.

Pastures Horehound has features of a desirable pasture plant and a weed. It is considered a weed of pasture (14,16,25) but is not a problem in well-managed pasture(6). It is a weed of lucerne(2) but only dominates rundown lucerne pastures(35). Horehound is not a serious competitor of sown pastures (16). Seedlings of horehound will not establish in competitive pastures, however, due to selective grazing, domination can occur rapidly in overgrazed pastures(22). Once established, plants are extremely hardy and may prevent other more useful plants from establishing(10).

Horehound is drought tolerant(30) and able to persist under heavy grazing(3).

It does not persist in competitive pastures(23,26,39). It will grow on poor soils and where there is little autumn competition(6,25).

Horehound does better than most pasture species under low fertility(12). Where nutrients are limiting growth of pastures, horehound seedling survival is reduced with the addition of fertilisers to encourage grasses and annual legume growth (Carter, unpublished report) although horehound seedlings establish when pastures are topdressed (McKenzie, pers comm.), re-sown, or treatment with some herbicides(McMillan, pers comm).

Livestock Production The plant taints meat and contaminates wool(25). Horehound leaves and stems are high in protein and metabolisable energy (Carter,1988 unpublished report), and it is a major source of fodder in some seasons (Deakin pers. comm.). The bitter taste and hairiness probably prevents it from being overgrazed. Stock poisoning has not been confirmed(20).

Horehound seed capsules adhere readily to wool and have been reported to reduce the value of fleeces (20,25). In 1986-87 total discounts on gross wool value from SA due to horehound was \$176000 (Carter,1988 unpublished report). Costs due to burr faults are reduced by skirting and separation of burry lines in wool-sheds(19). Horehound was estimated to cost the Australian wool industry \$680 000 per annum(32).

Environment Horehound is a weed of roadsides, waste and neglected areas(6) yet it is a valuable pioneering plant, growing on poor soil and able to colonise bare eroded ground(6,25,26), borrow pits(10) and quarries (4).

Being exotic it is not desirable in conservation areas however where it is removed other undesirable exotic plants replace it(4) and its dominance is indicative of other problems such as high rabbit numbers(4,29) or lack of native plant seed reserves.

Apiculture. Horehound is a source of nectar for bees(36).

CONTROL

Natural enemies. The horehound bug, *Agonoscelis rutila*, is the only host specific insect recorded on horehound in Australia (Bruzese pers. comm). In Europe adults of the flea beetle, *Longitarsus ballotae*, feed on leaves, and larvae feed on roots of horehound. The plume moth, *Pterophorus spilodactylus* larvae feed on and destroy the leaves, and appear specific.(9). Other insects are phytophagous but have not been evaluated(8). The potential benefits from controlling horehound are limited as other exotics may fill in the gaps(4).

Legislation. It is included in noxious weed legislation in all Australian states. In NSW(Milvain, pers. comm.) and parts of WA(Dean, pers. comm.), the aim is to eradicate it, while in SA (SA Animal and Plant Control Commission 1990, unpublished report) and Vic.(McKenzie, pers. comm.) the aim is to minimise spread from infested areas and prevent the introduction of seed to clean areas, although this is not achieved (Carter,1988 unpublished report).

Restrictions also apply to the sale and movement of livestock and produce carrying horehound although they are only enforced in SA and WA. These restrictions shift the supply function in SA store sheep markets and cause inefficiencies (Carter 1988 unpublished report).

Cultural control. Disturbed ungrazed areas can be replaced by direct seeded native vegetation if herbicides are used to control horehound seedlings (Dalton, pers. comm.). Sowing improved pasture and managed grazing can prevent horehound establishing. In arable land, horehound seedlings are easily controlled by cultivation (7,6,25). Mature plants many require blade ploughing, discing or repeated cultivation. Hand-hoeing is used to remove isolated plants preseeding(7).

Topping of horehound will remove flower stems and improve livestock access to pasture below. Topping is often used in lucerne pastures grazed by cattle.

Herbicides. Herbicides registered for control of horehound for selective control in cereal crops include 2,4-D, MCPA, diuron, dicamba, metribuzin, methabenzthiazuron; lucerne: diuron and 2,4-DB; in annual pastures: MCPA, 2,4-DB; in field peas: metribuzin; and in non-crop areas: bromacil, 2,4-D, 2,4,5-T, karbutilate (Registered herbicide labels). In non-crop areas glyphosate, chlorimuron-ethyl, chorsulfuron, 2,4-DP, hexazinone, imazaquin, imazapyr, MCPA, metsulfuron-methyl, sulfometuron-methyl, triasulfuron, triclopyl and fluroxypyr are being evaluated alone and in mixtures for horehound control but these uses are not registered in Australia.

Herbicides are used in conjunction with pasture improvement. MCPA or 2,4-D followed by heavy grazing reduces horehound abundance in pasture.

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