

## Notes on the biology and ecology of *Tribolium uniolae* (L.f.) Renvoize and its spread in south-western Australia

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### Introduction

*Tribolium uniolae*, an introduced South African perennial grass, is likely to have been introduced into south-west Western Australia in the 1940s. In recent decades this species has started to invade shrublands and woodlands of the Swan Coastal Plain around Perth, Western Australia. A study on possible control methods over the last three years has revealed information on biology, ecology and ecological impacts of this invasive and potentially wide spread weed. This note summarizes what is known about biology and ecology of *T. uniolae*, discusses its potential spread and impacts on bushland in south-western Australia and discusses control measures.

### Methods

Information on reproductive biology, mechanisms of spread, response to fire and ecological impacts was based on data and observations collected mainly in the Brixton Street Wetlands 20 km south east of Perth (32°01'18"S, 115°58'10"E) where a three year study on control methods was carried out (Brown and Brooks 2002, 2003). Additional information was collected from Jarrah (*Eucalyptus marginata*) forest and Wandoo (*E. wandoo*) woodland along the Darling Plateau near Perth and from shrublands and woodlands in the Talbot Road Bushland (31°52'20"S, 116°2'44"E). At Brixton Street Wetlands the extent of the *T. uniolae* population was mapped and at other sites brief notes were taken on the extent of populations, associated vegetation and soils. A search of the international literature and advice from South African colleagues provided information on where *T. uniolae* occurs naturally, and also locations where it has become naturalized.

### Results and discussion

#### Plant description

*Tribolium uniolae* (Figure 1) is a caespitose, occasionally shortly rhizomatous, tufted, upright perennial C<sub>3</sub> grass growing to around 60 cm. Leaf blades are usually around 3 mm wide and up to 20 cm long and the inflorescence a green spike to 7 cm long. The distichous spikelets are 5–9

flowered with flowers produced from late winter through to early summer. Seeds are approximately 2 mm long (Gibbs *et al.* 1990).

*Tribolium uniolae* is a quite variable taxa in the Cape Floristic Region of South Africa, different forms being associated with differences in soil type and altitude. It also shows a remarkable variation across its range, possibly the result of hybridization with the closely related *T. brachystachyum* (Linder and Davidse 1997). In south-western Australia *T. uniolae* undergoes a dormant period over summer with active growth occurring again with the first autumn rains.

#### History and distribution

**Native range – South Africa** *Tribolium uniolae* is wide spread in southern Africa and is common in the Cape Floristic Region. It is known to occur from 31° to 16°S and between longitude 18° and 26°E (Linder and Davidse 1997).

**South-western Australia** The species was first collected from a naturalized population in Maddington, approximately 20 km southeast of the centre of Perth, in 1951. Records from CSIRO show the species was trialled at the nearby Kelmsott CSIRO pasture testing station sometime between 1943 and 1971 (Rogers *et al.* 1979). It seems highly probable that the station is the source of current infestations invading natural areas around Perth. At present *T. uniolae* can be found invading bushland on the eastern side of the Swan Coastal Plain, and woodlands on the Darling Scarp and Plateau near Perth. A recent discovery, in November 2000, of a population 200 km south of Perth and two collections from near Esperance, 400 km southeast of Perth in 1976, suggest *T. uniolae* has the potential to become wide spread in south-west Western Australia (Anon. 1998).

**Elsewhere** Outside of south-western Australia *T. uniolae* has only been recorded as naturalized from a single population in the Jolimont rail yards in Melbourne,



**Figure 1. *Tribolium uniolae*.** Reproduced from *Memoirs of the Botanical Survey of South Africa No. 58*, p. 339, with the kind permission of the South African National Biodiversity Institute, South Africa.

Victoria (Walsh and Entwisle 1994). However three other species of *Tribolium* have become naturalized or are known to be invasive in natural areas. *Tribolium obliteratum* has been recorded from the southern

Jarrah forest from one roadside population. It is also a common weed of woodland from Mt. Lofty in South Australia to Melbourne, Victoria (Sharp and Simon 2002). This species has also recently been recorded from a site in California where it is spreading in an eroded gully and through a restoration site (Anon 2001). *Tribolium obliterum* has also been recorded as naturalized on St. Helena and the Ascension Islands (Linder and Davidse 1997). *Tribolium echinatum* is another species recorded from south-western Australia presently known from two populations (Anon 1998). A third species, *T. acutiflorum* is a weed of seasonal wetlands, grassy woodlands and lowland grassland in Victoria. It also occurs in South Australia (Carr *et al.* 1992, Sharp and Simon 2002).

#### Habitat

**South Africa** In South Africa, *T. uniolae* is very common in the Cape Floristic Region where it prefers richer, well drained soils derived from granite, sandstone, shales or limestone. Occurring at altitudes from 1 to 1000 m it is found in all major vegetation types, especially fynbos and renosterveldt. It successfully invades disturbed ground, is often found on road verges and appears to be common after scrub fires. (Linder and Davidse 1977, Gibbs *et al.* 1990, N. Barker personal communication, P. Linder personal communication.).

**South-western Australia** *Tribolium uniolae* is naturalized on clays and loams on road verges and in Jarrah forest and Wandoo woodland on the Darling Plateau. It is also found on clays, loams and gravelly sands on road verges and in bushland and wetlands on the eastern side of the Swan Coastal Plain. In the clay based Brixton Street Wetlands it is invading the herb rich shrublands of the drier flats and *Eucalyptus calophylla* woodlands growing on the deeper well drained soils. An isolated population has been found in the Talbot Road Bushland, north east of Perth, naturalized in *E. calophylla* woodlands on gravelly brown sands.

#### Reproductive biology, dispersal and growth.

**South-western Australia** Reproduction is predominantly by seed from flowers produced in July through to November. With most populations established on road verges or on the edge of bushland reserves it appears that seed is being dispersed by machinery such as graders and slashers involved in roadside maintenance. The location of a population on an old gravel pit also suggests seed is being transported with gravel used for roadworks. Once established a number of factors appear to facilitate the spread of *T. uniolae* into relatively undisturbed bushland. The diaspores have no obvious

features for dispersal, apart from light-weight and small size and it appears seed are often spread by water. On the Darling Scarp plants were observed spreading from a road verge, down a drainage line and into relatively undisturbed Jarrah forest.

Fire is another factor playing a significant role in the spread of *T. uniolae*. Although an average of 74% of plants were killed by an unplanned summer fire at Brixton Street (Brown and Brooks 2003), massive seedling recruitment was observed. Many seedlings were able to exploit the space light and nutrients made available by the fire, establishing early and displacing regenerating native species.

Ants may also play a role in spreading seed with in the bushland with seedling recruitment observed around a number of ant nests. Although small pereneating buds have been observed to break off from the base of plants and go on to produce new plants, this does not appear to be a significant mechanism for dispersal.

Plants occurring in vegetation that has not been burnt for a number of years have large quantities of dead material, with only a few green shoots. Over the very dry 2000/2001 summer season many of these older plants, (50% in plots) died. The following autumn, seedlings were observed germinating in between the dead clumps.

#### Ecological impacts

*Tribolium uniolae* has the potential to seriously impact the few remaining vegetation remnants on the heavier soils on the eastern side of the Swan Coastal Plain. Although it appears to be a weed in the early stages of invasion, its invasiveness in rare and restricted plant communities suggests impacts could be serious. In the Brixton Street Wetlands it is invading *E. calophylla* – *Kingia australis* woodlands and herb rich shrublands, both recognized as threatened ecological communities (Gibson *et al.* 1994). Where *T. uniolae* is invading it forms dense clumps and appears to displace much of the herbaceous flora. Almost 50% of the 307 native taxa present in the Brixton Street Wetlands are annual or perennial herbs (Keighery and Keighery 1995); 12 of those taxa are considered rare or threatened (Atkins 2003). Given the susceptibility of this component of the flora to replacement by the weed, it is clear that *T. uniolae* poses a significant threat to the biodiversity values of the reserve as a whole.

The population in Talbot Road Bushland is small and localized, but it also occurs in a critically threatened ecological community, the eastern shrublands and woodlands. It has the potential to spread and is a serious threat to much of the significant and poorly known flora at the site.

On the Darling Plateau *T. uniolae* has been recorded invading very open

Wandoo woodland. In the Jarrah forest it is still found mainly along road verges, in old gravel pits and in highly disturbed sites. But as these populations continue to spread they will provide a seed source for invasion into adjoining, less disturbed areas, particularly after fire.

#### Control and management

In the Brixton Street Wetlands *T. uniolae* grows closely among the native vegetation and methods of control specific to the grass are required. Physical removal by cutting below the base with a sharp knife is appropriate in small isolated populations when the soil is moist, but is labour intensive and impractical on a larger scale. Also, as the grass grows very closely among native plants it is difficult to remove without damaging native vegetation. Observations suggest that any small ramets left behind quickly go on to produce new plants.

Herbicide trials showed some success controlling *T. uniolae* with the grass selective herbicide Fusilade®. Young vigorously growing plants could be controlled with Fusilade (10 mL L<sup>-1</sup> + Pulse® 2 mL L<sup>-1</sup>) if applied before flowering (August). Older senescing plants were effectively controlled by Fusilade (15 mL L<sup>-1</sup> + Pulse 2 mL L<sup>-1</sup>) when applied later in the season (Brown and Brooks 2003).

Plants resprouting following summer fire were very effectively controlled by the herbicides Roundup® (10 mL L<sup>-1</sup> + Pulse 2 mL L<sup>-1</sup>) or Fusilade (10 mL L<sup>-1</sup> + Pulse 2 mL L<sup>-1</sup>) applied in the autumn. Very little native vegetation had commenced active re-growth at the time of application and the resprouting *T. uniolae* plants were highly visible and easy targets. Although fire appears to facilitate the spread of this invasive grass, it also offers opportunity for very effective control.

#### Conclusion

Although it does not appear to be wide spread at present, *Tribolium uniolae* has the potential to have serious impacts on the native flora and plant communities of the heavier soils on the eastern side of the Swan Coastal Plain. The weed is not well known and populations such as the one in Talbot Road Bushland suggest that it is probably more wide spread than currently recognized. Land managers working on bushland reserves on the eastern side of the coastal plain need to be made aware of the weed and new populations controlled before they are able to establish and spread.

*Tribolium uniolae* also has the potential to have a serious impact on the flora of the Jarrah forest and Wandoo woodlands of the Darling Plateau. A population found 200 km south of its known distribution within the Jarrah Forest indicates *T. uniolae* is probably also more widespread here than is currently recognized.

The real extent of *Tribolium uniolae* in the Jarrah Forest and on the eastern side of the Swan Coastal Plain needs to be determined, outlying populations controlled and its spread contained.

#### Acknowledgments

The Friends of Brixton Street Wetlands assisted with fieldwork and Neil Gibson and Mark Garkaklis provided valuable comments on a first draft of this manuscript. We thank Greg Keighery and Malcolm Barker for providing information on the spread and impacts of *T. uniolae* in south-western Australia. This work was completed as part of a project that was funded through a grant from the Natural Heritage Trust to the Environmental Weeds Action Network.

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