

Significance of Star or Bethlehem in WA

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Key messages

Star of Bethlehem is the only plant in WA that carries the sexual stage of barley leaf rust which allows the rust to quickly overcome genetic resistance in barley to this pathogen.

A small infestation has been found at Ravensthorpe in 2013 and is under eradication.

Aims

To update the significance of star of Bethlehem (*Ornithogalum umbellatum*) in WA.

Method

A search of the literature and discussions with colleagues in states infested with star of Bethlehem were used to determine the likely significance of this plant establishing in WA and its characteristics. The distribution in WA was estimated by using herbarium records and surveillance. Plants were collected over the growing seasons to determine if barley leaf rust had infected the population.

Results

Significance

Star of Bethlehem is the only plant in WA that carries the sexual stage of barley rust (*Puccinia hordei*) allowing the rust to quickly overcome resistance genes in the crop and thus cause major yield losses. It acts as an alternative host for the sexual stage of barley leaf rust. In spring, barley leaf rust produces over-summering black bodies (telia) that produce teliospores that can't infect young barley plants but can infect star of Bethlehem. They then produce spores that can infect the following barley crop. Epidemics of barley leaf rust have been associated with star of Bethlehem infestations in Yorke Peninsula in South Australia (Wallwork *et al.*, 1992). In the 1990 outbreak of barley leaf rust, susceptible cultivars had a 26-31% yield reduction and a lower grain quality (Cotterill *et al.*, 1994; Cotterill *et al.*, 1992). Star of Bethlehem therefore has two important effects on barley leaf rust severity:

- 1) It allow sexual reproduction of the rust to produce resistant strains quickly by sexual recombination to produce new pathotypes and
- 2) It allows the rust to survive over summer with the black teliospores that infect star of Bethlehem to produce infectious spores in the following barley crop that subsequently spread across the district causing an epidemic.

Leaf rust has not yet been detected on the star of Bethlehem populations at Ravensthorpe in WA. This may be due to control of infestations removing top growth before symptoms become apparent. This plants ability to rapidly naturalise and establish permanent populations that are resistant to eradication has been well documented in both Australia and North America (Steckel and McClure, 2015; Wallwork *et al.*, 1992). Rust spores are dispersed via the wind and can travel vast distances to infect star of Bethlehem populations. (Brown and Hovmøller, 2002; Nagarajan and Singh, 1990). Barley leaf rust develops rapidly at temperatures between 15-20°C and under moist weather. It is possible that the hot and dry conditions in Ravensthorpe over summer have also limited the development of this disease. Eradication of star of Bethlehem from this site via the use of herbicide application has not been successful so far and alternative methods including microwave treatments are being developed to prevent both the spread of star of Bethlehem to new locations and it becoming a source of infection of Barley leaf rust in the future.

Description and History

Star of Bethlehem was discovered and identified in Western Australia by Elizabeth Sandiford, Greg Keighery and John Moore in 2013 after being collected in a botanical survey of the area proposed for the Ravensthorpe road bypass. It also occurs in New South Wales, South Australia, Tasmania and Victoria (Figure 1). Three other species of *Ornithogalum* also occur in WA and these are:

Lesser Cape lily or Arabs eye (*Ornithogalum arabicum*) which has white flowers with black centres and no green stripe on the back of the petals;

Pregnant onion (*Ornithogalum longibracteatum*) has large bulbs that are partially above the ground and a flowering stem to 1 m tall and, like star of Bethlehem also has white flowers with a green stripe down the back of the petals,

Chincherinchee (*Ornithogalum thyrsoides*) has white flowers with a dark centre and no green stripe down the back of the petals.



Figure 1: Distribution of star of Bethlehem reported by Australia's Virtual Herbarium 2019.



Figure 2: Star of Bethlehem can form fairly thick swards.

Ornithogalum is from the Greek *ornithos* meaning bird and *gala* meaning milk. It is likely that this is the species referred to in the Bible as “Doves Dung” due to the scattered white flowers resembling bird droppings in the distance (Figure 2). *Umbellatum* refers to the umbel-like arrangement of the flower heads and the common name, star of Bethlehem, refers to its star shaped flower and its origin around the Mediterranean.

Control

Star of Bethlehem is tolerant to many herbicides including 2,4-D, amitrole, clopyralid, dicamba, diquat, flumetsulam, fluazifop, glyphosate, imazamox, imazaquin, imazethapyr, mecoprop, metosulam, triasulfuron and triclopyr. It is resistant to pre-emergence herbicides (Skroch *et al.*, 1994) as well as many post-emergence herbicides (Main *et al.*, 2004). Attempts to control the star of Bethlehem infestation within South Australia via a range of herbicide applications have not been successful (Wallwork *et al.*, 1992).

Conclusion

Star of Bethlehem is a new arrival in Western Australia and is only known from a very small area near Ravensthorpe. It is likely to cause major economic impacts on the barley industry. Programs to eradicate the plant or prevent its wider establishment should have very high benefit to cost ratios due to its limited occurrence. People finding plants that look like star of Bethlehem should bring them into the Department of Primary Industries and Resource Development for identification and mapping.

Identification key for star of Bethlehem

Key Characters:

- Aerial stem and inflorescence simple.
- Leaves all basal (Figure 3).
- Inflorescence corymbose, 5-15 flowered.
- Flowers bisexual, pedicellate, always 1 in the axil of each bract.
- 6 'petals' with a green stripe down the back (Figure 4).
- Perianth segments less than 20 mm long.
- Filaments never bearded.
- Bulbs with bulbils (Figure 5).
- Leaves often have a longitudinal white stripe (Figure 6).



Figure 3: A clump of Star of Bethlehem plants in spring at Ravensthorpe.



Figure 4: The flowers of star of Bethlehem showing the green stripe on the back of the petals.



Figure 5: The bulb and bulbil of star of Bethlehem.



Figure 6: Leaves showing the white longitudinal stripe

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Key words

Bulbs, chlorsulfuron, control, eradication, herbicides, imazapyr, microwave, *Ornithogalum umbellatum*, paraquat, star of Bethlehem.

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Project Numbers:

DAWR project – CT-47 88801589. Using microwaves to control gorse seed banks and bulbs.

DPIRD Invasive species program –Priority Weed Response

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