# The effect of Rutherglen bug (*Nysius vinitor*) on yield and quality of hybrid carrot seed

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## Abstract

The results of variety trials for hybrid carrot seed production in New Zealand, Tasmania and South Australia revealed consistently higher germination percentages for seed produced in New Zealand compared with Australia. The main reason for poor germination of Australian seed was a high proportion of seed with missing or damaged embryos. An experiment was conducted to test the hypothesis that an insect pest present in Australian carrot seed crops, Rutherglen bug (*Nysius vinitor*), could cause embryoless and embryo damaged seed. The results indicate that Rutherglen bug infestation after anthesis can cause high levels of seed with damaged or missing embryos but there was no evidence of an effect on seed yield.

## Key words

Daucus carota, Nysius vinitor, vegetable seed production.

## Introduction

Returns from hybrid carrot seed production in southern Australia are currently unreliable. Whilst some crops have produced high yields of quality seed, many have produced poor yields of seed of low viability. In contrast, seed quality from New Zealand crops grown in similar climatic conditions has generally been acceptable. Little research has focussed on the factors affecting Australian production.

Lygus bug (*Lygus oblineatus*; Miridae) is a major cause of poor carrot seed viability in the United States (Flemion, 1949) but is not found in Australia. Another sap sucking bug, Rutherglen bug (*Nysius vinitor*; Lygaeidae), is present in Australia, but not New Zealand, and infests carrot seed crops during seed development. The results of trials comparing hybrid Nantes type carrot seed production in Australia and New Zealand and assessing the effect of Rutherglen bug on seed quality and yield are reported below.

## Materials and methods

Yield and germination data were collected in accordance with ISTA guidelines (3) for 5 hybrid Nantes lines grown in variety trials at: Mt Gambier, South Australia; Cambridge, Tasmania; and the Kurow Valley, New Zealand. The embryos of seed from each line were examined using the methodology of Gray and Steckel (2).

In a field trial at Cambridge, Nantes (No.27) female plants were caged, sprayed with pyrethroid insecticide and hand pollinated. After pollination, the plants were randomly allocated to 3 treatments: caging to exclude all insects; caging with 5 adult Rutherglen bugs per umbel; and exposure to field conditions (no cage). The treatments were replicated 4 times. Seed was harvested 70 days after anthesis. Yield and quality assessments were as previously described.

## Results

Seed yields varied with line and location from 2.8 to 17.9 grams per plant. Yields for all lines except No. 27 were highest at Cambridge and lowest at Mt. Gambier. Compared to the Kurow Valley, seed germination at the two Australian sites was poor. The main cause of this was a high proportion of seed with missing and damaged embryos. In addition, in such seeds, damage to endosperm tissue surrounding the embryo was commonly observed.

**Table 1. Seed yield and quality data for Nantes hybrid lines grown in variety trials at Mt. Gambier, Cambridge and the Kurow Valley. Standard deviations are given in the brackets. Note that yield calculations are based on total male and female area with a 2:4 Male:Female ratio and do not include spray or irrigator runs.**

| | Line | WO6014 | No. 22 | No. 10 | NO. 27 | 44-5002A |
|---|---|---|---|---|---|---|
| Dry Yield (Kg/ Ha) | Mt Gambier | 224 | 840 | 248 | 1432 | 592 |
| | Cambridge | 880 | 1152 | 824 | 768 | 1240 |
| | Kurow Valley | 424 | 936 | 576 | 1384 | 760 |
| % Germination | Mt Gambier | 58 (2.1) | 48 (5.1) | 52 (16.4) | 50 (15.3) | 58 (9.9) |
| | Cambridge | 23 (4.4) | 67 (4.4) | 39 (5.3) | 72 (3.9) | 43 (5.5) |
| | Kurow Valley | 85 (4.8) | 91 (1.0) | 90 (7.6) | 83 (3.0) | 83 (11.3) |
| % Seeds with | Mt Gambier | 57 (5.7) | 58 (10.4) | 60 (7.6) | 57 (7.6) | 58 (8.6) |
| intact embryos | Cambridge | 38 (4.7) | 76 (10.1) | 42 (6.8) | 78 (3.8) | 49 (8.6) |
| | Kurow Valley | 94 (6.01) | 92 (4.8) | 87 (6.7) | 92 (4.3) | 92 (3.1) |

Exposure of plants to Rutherglen bug had no significant effect on yield, but reduced quality (Table 2). Exclusion of all insects produced the highest level and rate of germination, whilst exposure to Rutherglen bug caused greatly reduced seed viability and a lower rate of germination.

**Table 2. Yield and quality data for seed of Nantes (line No. 22) female plants from 3 treatments: caging to exclude all insects; field conditions (no cage) and; caging to include 5 adult Rutherglen bugs per umbel.**

| Treatment | Dry yield / plant (grams) | 1000 seed dry weight (grams) | % germination | Mean germination time (days) | % seeds with intact embryos | Embryo length (mm) |
|---|---|---|---|---|---|---|
| All insects excluded | 20.9 | 1.80 | 88.4 | 6.73 | 97.2 | 1.54 |
| Field conditions | 13.4 | 2.15 | 71.8 | 7.14 | 77.6 | 1.54 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Rutherglen bug included | 18.6 | 2.22 | 49.2 | 7.51 | 54.8 | 1.76 |
| LSD (P=0.05) | NS | NS | 4.5 | 0.20 | 2.77 | NS |

The reduced viability of seed lots from plants caged with Rutherglen bug and exposed to field conditions was largely due to seed with missing or damaged embryos (Figure 1). These observations are consistent with the cause of poor viability of seedlots from variety trials at Cambridge and Mt. Gambier (Table 1).

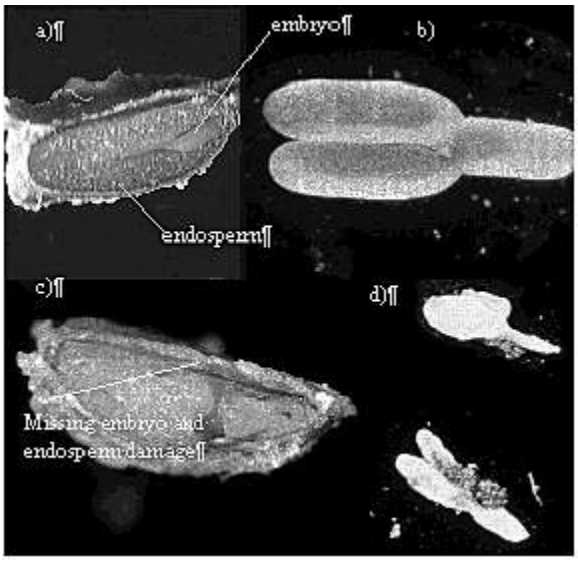


**Figure 1. A healthy seed a) and embryo b) compared to an embryoless seed c) and damaged embryos d) caused by Rutherglen bug. Not to scale. Seed size 2mm, embryo length 1.5mm.**

**DISCUSSION**

In this study, the primary cause of poor seed germination from Australia compared with New Zealand was a high incidence of seed with missing or damaged embryos. Rutherglen bug was shown to damage embryos and cause embryoless seed, but was not observed to affect seed yields. Similar observations have been made for Lygus bug in the United States (1). In Australia, Rutherglen bug is widely distributed and frequently occurs in carrot seed crops. The absence of Rutherglen bug from New Zealand may largely explain the superior quality of carrot seed produced there. The development of an effective control program for Rutherglen Bug is critical for the future of the Australian hybrid carrot seed industry.

**Acknowledgments**

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**References**

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