Potential fly pollinators identified for berry crops

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The 5-year cross-industry project **'PH16002 Managing Flies for Crop Pollination'** has finished, and some promising fly pollination species have been identified for Australian berry crops.

There are more than 20,000 native fly species across Australia, and little is known about their lifecycles. This research looked at five species and all show potential as managed pollinators.

These five fly species are excellent pollinators in their own right, but researchers have discovered that they continue to forage and pollinate in cold and drizzly weather when bees are typically inactive, which is promising news in the quest for year-round all-weather pollination services.

Blueberry trials

Over 26 weeks of measuring berry production in glasshouses in WA, the average yield was higher in southern highbush blueberries pollinated with C. *albifrontalis* blow flies (11.3 kg/plant, 1.83 g/berry) compared with plants in an adjacent glasshouse without any insect pollinator (5.00 kg/plant, 1.45 g/berry).

In a second WA glasshouse trial, the yield of southern highbush blueberries pollinated with C. *dubia* blow flies was 18.9 kg per plant compared with 11.2 kg per plant for those pollinated by C. *albifrontalis* blow flies over a 6-month harvest period.

Trials in NSW on southern highbush blueberries that looked at the pollination efficiency of E. *tenax* found that the average weight of berries produced from flowers visited by E. *tenax* was significantly greater (3.57g) than those visited by honeybees (2.81g), even with just 1 or 2 visits.

Blackberry trials

Insufficient pollination of blackberries can cause small misshapen fruit. This is particularly prevalent early in the season when cooler climatic conditions hamper bee activity. Drone fly E. *tenax* was evaluated as an early-season (October-November) pollinator in Tasmanian blackberries (var. *Victoria*) (Figure 1). In enclosed tunnel trials, E. *tenax* proved to be an effective pollinator of the blackberries, producing fruit that was 12% heavier than bee-pollinated fruit (Figure 2).

Figure 1. Assessment of *Victoria* Blackberries pollinated by E. *tenax* at Costa Deloraine. Photo credit: SeedPurity

Promising species report card

Photo credit: Dr Sue Jaggar, DPIRD

Western golden-haired blowfly *(Calliphora albifrontalis)*

Distribution:
- Only found in the south-west of WA

Pollination characteristics
- Large and hairy (so good at transporting pollen)
- Often seen feeding on flowers in native bushland

Tested on blueberries in WA

Trial results to date:
- In glasshouse trials in WA on southern highbush **blueberries**, yields increased by more than 120% and fruit was 26% larger compared to plants where pollinators were excluded

Photo credit: Dr Sue Jaggar, DPIRD

Western blue-bodied blowfly *(Calliphora dubia)*

Distribution:
- Found throughout south-western and central-southern Australia
- Recorded in all states and territories, except Tas
- Common in WA and SA, less common in other states

Pollination characteristics
- Active from late winter through to summer
- Tolerates dry stress and high temperatures
- Has a high demand for nectar so is a regular visitor to many flowers

Tested on blueberries in WA

Trial results to date:
- In glasshouse trials in WA on southern highbush **blueberries**, yields were increased by 52% compared to plants pollinated by Western golden-haired blowfly *(Calliphora albifrontalis)*

Photo credit: Dr Jonathan Finch

Brown blowfly *(Calliphora stygia)*

Distribution:
- Common in south-eastern Australia
- Recorded in the ACT, NSW, Qld, SA, Vic, and Tas

Pollination characteristics
- Active from late winter through to early summer
- Prefer cooler climates
- Spend more than a minute during each flower visit

Tested on strawberries in NSW

Trial results to date:
- In glasshouse trials in NSW, **strawberries** had 60% Grade A and B fruits compared to 8% where pollinators were excluded

Photo credit: SeedPurity

Drone fly *(Eristalis tenax)*

Distribution:

- Throughout Australia

Pollination characteristics

- Spend considerable time foraging flowers
- Visit each flower up to 3 times
- Spend 2.5 to 4 minutes during each flower visit

Tested on blueberries (NSW), blackberries (NSW, Tas), and strawberries (NSW)

Trial results to date:

- In tunnel trials in Tas, **blackberry** (var. *Victoria*) yields increased by 12% compared to bees
- In tunnel trials in NSW, **blackberry** (var. *Victoria*) yields were equivalent to bee-pollinated plants
- In glasshouse trials in NSW, **strawberry** Grade A and B classes were 70% compared to 8% where pollinators were excluded
- In tunnel trials in NSW on southern highbush **blueberries**, fruit was 27% larger (3.57g) than those pollinated by bees (2.81g)
- In tunnel trials in NSW, **raspberries** (var. *Maravilla*) produced larger fruit (3.60g) than those pollinated by honeybees (3.37g)

Photo credit: Tshering Nidup

Golden native drone fly *(Eristalinus punctulatus)*

Distribution:

- Throughout Australia

Pollination characteristics

- Very good at transferring multiple pollen grains during flower visits
- Shorter than bees but more effective in depositing pollen on stigmas

Not yet tested

Trial results to date:

- While no berry trials have been conducted yet, this drone fly has been seen visiting raspberry flowers and laying eggs in the root balls of discarded plants. This species will be included in future research work.

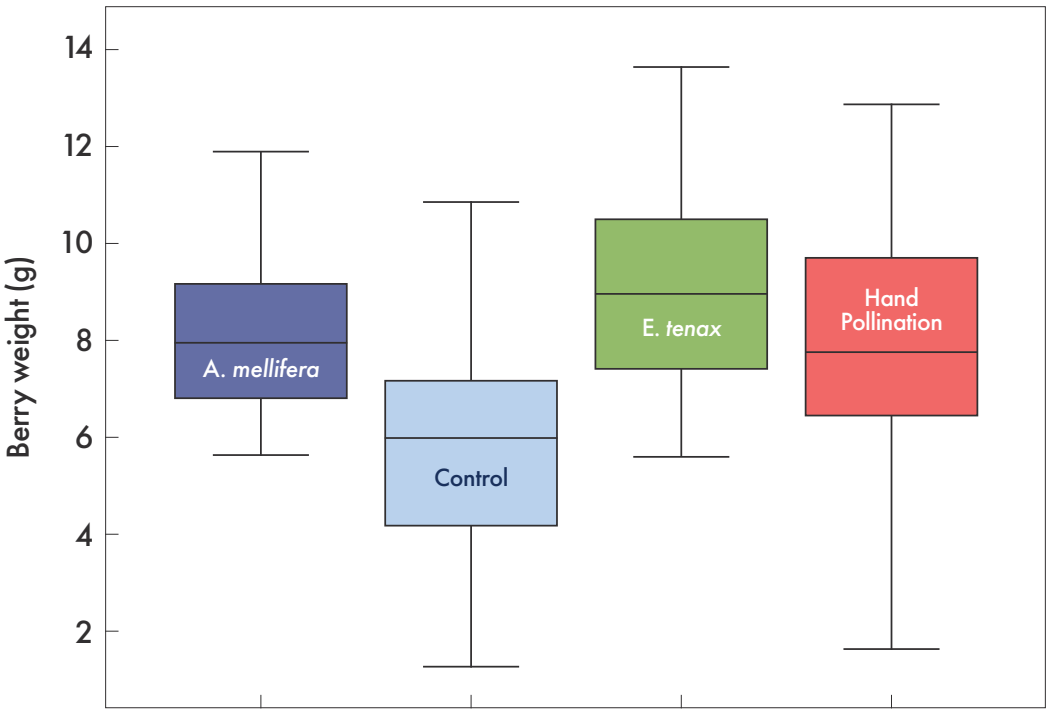

Figure 2. Blackberry (var. *Victoria*) fruit weight comparing different pollination treatments (L-R) Honeybees (A. *mellifera*), Control (pollinators excluded), Drone fly (E. *tenax*), and supplemental hand pollination.

Raspberry trials

With its longer foraging times and more frequent flower visits, Drone fly (E. *tenax*) has been shown to increase pollination and the number of drupelets formed, which increases fruit size. Raspberries (var. *Maravilla*) pollinated by E. *tenax* produced larger fruit (3.60g) than those pollinated by honeybees (3.37g) in tunnel trials in Coffs Harbour NSW. Unlimited pollination by E. *tenax* produced berries that were approximately 50% larger than those visited by brown blowflies (C. *stygia*).

Strawberry trials

In closed glasshouses, where using honeybees for pollination may be less desirable, brown blow fly C. *stygia* and drone fly E. *tenax* may offer a solution. Both species produced high-quality (mainly Grade A and B) strawberry crops with fruit that was heavier and quicker to develop compared to hand-pollination in glasshouse trials in NSW (Figure 3).

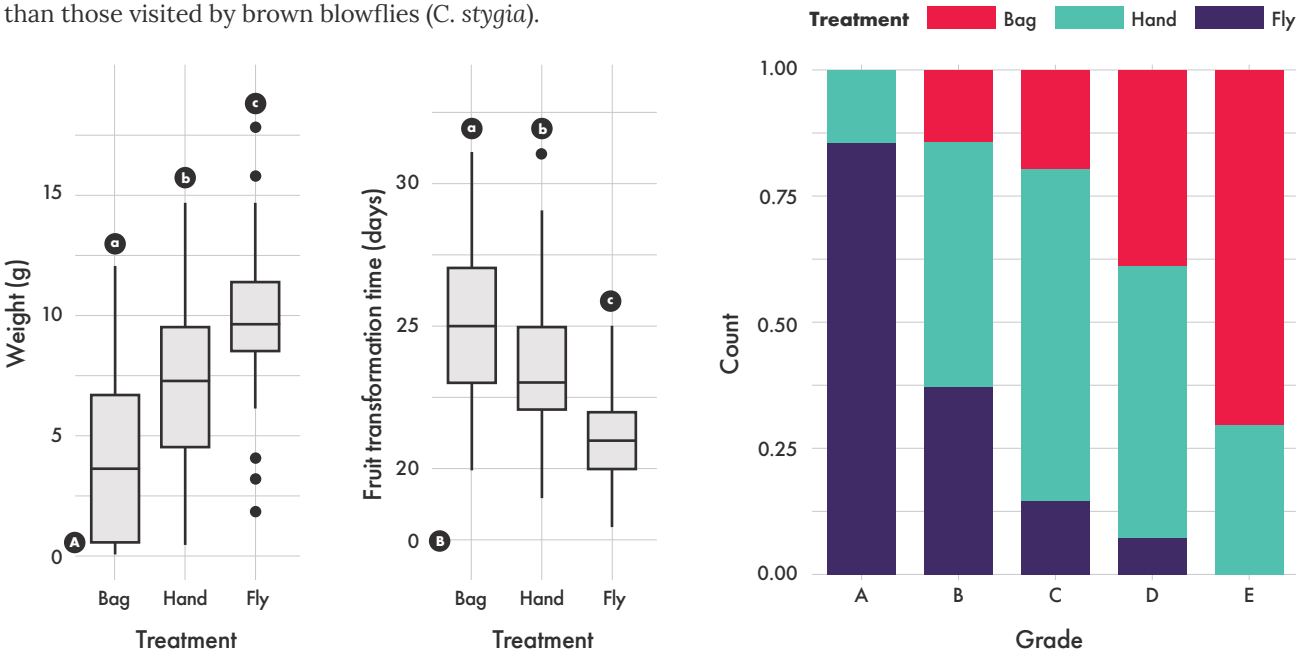

Figure 3. (Left) Pollination outcomes from E. *tenax* glasshouse experiments comparing the impact of bag (pollinator exclusion), hand, and fly pollination on fruit weight, fruit transformation (speed of fruit development), and (Right) fruit visual quality (with Grade A being perfectly formed and Grade E being severely deformed).

Figure 4. (Left) Golden native drone fly (*Eristalinus punctulatus*) and (Centre, Right) eggs laid in the root ball of an old raspberry plant. Photo credit: Abby Davis

Future Research

The continuation of fly pollination research is important for the progression of flies as managed complementary pollinators.

With the increased risk to the honeybee pollination industry from the Varroa mite, a Berries Australia and Hort Innovation project has been developed to continue work on the fly species identified in the now completed project. A strategic levy investment, the project 'Expansion of Flies as Berry Crop Pollinators (MT22007)' is part of the Hort Innovation Blueberry and Raspberry and Blackberry Funds.

This project is based in the Coffs Harbour region of NSW and will test potential pollinators in multiple berry cultivars and seasons. Expected outcomes include:

- Identifying optimal farm management practices that reduce fly losses and improve pollination
- Generating greater pollinator availability and longevity year-round in berry crops
- Determining the optimal composition and placement of co-flowering and other resources to facilitate crop pollination and pollinator health

This work will include research on the additional promising drone fly pollinator *Eristalinus punctulatus* identified but not tested in the previous project (Figure 4).

Acknowledgements

Thanks to all the commercial growers who allowed us to use their plants for assessing pollination by different fly species. Thank you to Helen Newman (WA Berry Industry Development Officer, APC) for your review and editorial assistance with this article.

More information

Watch:

ABC Landline - this segment includes interviews with the researchers and growers that participated in this research (July 2024) at www.youtube.com/watch?v=D-T7NJRBbL4 or scan this QR code:

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