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Seasonal patterns of onion thrips in onion – mass invasions or gradual population build-up?

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Introduction

Onion (*Allium cepa* L.) is the favoured host of onion thrips (*Thrips tabaci* Lindeman). Wherever onion is planted, large numbers of onion thrips (more than 20 per plant) will likely appear in the crop at some stage. However, not long before the occurrence of peak numbers, onion thrips are almost undetectable. Where do the big numbers come from? To answer this question, seasonal patterns of onion thrips in onion were monitored in New South Wales (NSW) and South Australia (SA) during 2004–2005, growth potentials of onion thrips populations in onion during the period were analysed, and alternative hosts of onion thrips in surrounding weeds and non-onion crops were surveyed.

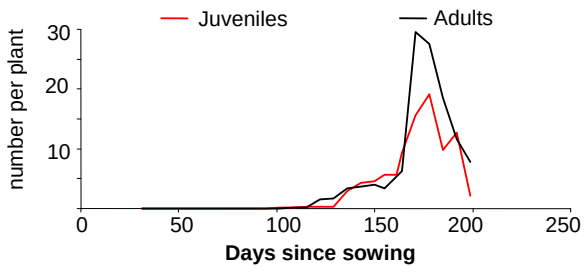

Figure 1. Seasonal patterns of numbers of juvenile and adult onion thrips in an unsprayed onion field in NSW in 2005.

Observed patterns

In a typical onion season in southern NSW and SA, onion thrips density started with a non-detection period of 56–119 days, followed by a slow-increasing period of 28–35 days, a rapid increasing phase of 14–21 days, and finally a rapid-decreasing phase of 21–28 days (figure 1). At its peaks the density of both adult and juvenile onion thrips exceeded 15 per plant. No sudden mass invasions were detected in either plant samples or sticky traps during the study period in either state.

Likely mechanisms

The increasing phases of the seasonal patterns were well described by exponential growth, suggesting that population growth within onion fields could have been responsible for the observed seasonal patterns.

To test this hypothesis, a simulation model of onion thrips population was built using published information on the biology of the insect. The model was driven by daily maximum and minimum temperatures, which determines whether cohorts of individuals of the same age (in days) would survive the current day, advance to the next day of the same stage, advance to the first day of the next stage, or lay eggs if they are mature adults. Simulation results showed that high numbers of onion thrips (20–30/plant) late in the crop season could have arisen from small invasions of one thrips per 100 plants per day early in the crop season (figure 2). Mass invasions at any stage of crop development failed to account for the observed patterns.

Field evidence of gradual invasions was found in data collected from directional sticky traps around the perimeter of onion fields in both NSW and SA. The sticky trap data showed that onion thrips were

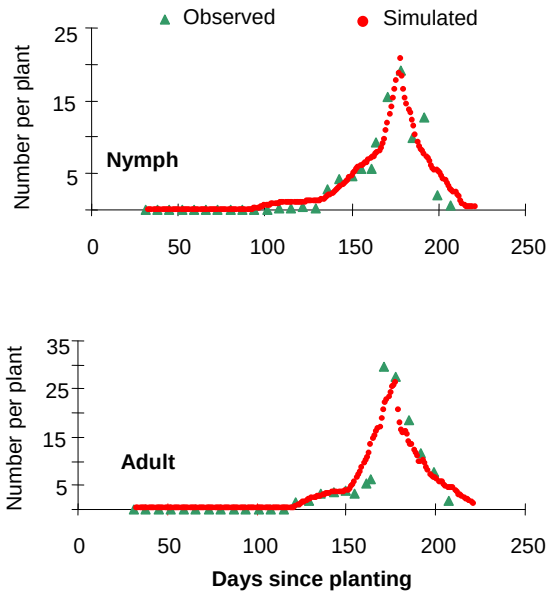

Figure 2. Observed and simulated numbers of juvenile and adult onion thrips under small-gradual-invasion scenario.

moving into the onion fields long before the first thrips were detected in onion plants. The eventual collapse of the onion thrips populations in mature onion crops appears to be due to the drying out of onion leaves.

Invasion sources

Adult onion thrips were found in almost all plants in the surrounding vegetations of onion fields in NSW and SA surveyed in the two months leading to the first detection of onion thrips in onion during 2004–2005. Survey during the pre-invasion phase in 2006 in NSW revealed the following breeding hosts for onion thrips, based on the presence of juveniles:

- Onion weed (regrowth from last season's bulbs)
- Shepherd's purse (*Capsella bursapastoris*) (Brassicaceae)
- Indian hedge mustard (*Sisymbrium orientale*) (Brassicaceae)
- Twiggy turnip (*Brassica fruticulosa*) (Brassicaceae)
- Paddymelon (*Cucumis myriocarpus*) (Cucurbitaceae)
- Blackberry nightshade (*Solanum nigrum*) (Solanaceae)
- Bokhara clover (*Melilotus alba*) (Fabaceae)
- Hedge mustard (*Sisymbrium officinale*) (Brassicaceae)
- Milk thistle (*Sonchus oleraceus*) (Asteraceae)
- Garden marigold (*Calendula officinalis*) (Asteraceae)
- Cat head (*Tribulus terrestris*) (Zygophyllaceae)
- Paterson's curse (*Echium plantagineum*) (Boraginaceae)
- Faba beans (*Vicia faba*) (Fabaceae)
- Flaxleaf fleabane (*Conyza bonariensis*) (Asteraceae)
- Fat hen (*Chenopodium album*) (Chenopodiaceae).

Of these, onion weed and brassica weeds appear to be the major breeding hosts.

Implications for management

The above findings have several implications in the management of onion thrips in onion.

- Control measures that can reduce the success of establishment of early thrips invaders in onion will delay the onset and significantly reduce the size of peak onion thrips populations.
- Foliar insecticides are best applied prior to the rapid increasing phase of onion thrips population in onion, which often occurs soon after bulb initiation.
- Brassica weeds and onion weed surrounding onion fields should be controlled to reduce the size of source populations of onion thrips.

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