Research Report

Insects associated with pecan trees, Carya illinoinensis: characterisation, impact and control

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Project overview (December 2013 to June 2017)

Three research areas were addressed during this project: (1) bi-monthly surveys, at three sites, to determine the complex of pestiferous and beneficial insects associated with pecan production in the Vaalharts region, (2) field trials to quantify the damage caused by the bark stinkbug, Coenomorpha nervosa and (3) field trials to investigate the impact of different insecticide application frequencies on nut set and development at three sites. Following, a brief overview of each research area.

1. Surveys to characterise insect complex.

During the past four years, bi-monthly surveys were conducted at three sites (Bull Hill, Tadcaster and Magogong) in the Hartswater area to characterise the species complex of pestiferous and beneficial insects associated with pecan trees. In total, 21 surveys were conducted with 47 444 insects collected (Fig. 1). By pooling all data (sites and years) and characterising the insects as non-pestiferous (beneficial and 'neutral' species combined) versus pestiferous, the pestiferous insects were out-numbered by the non-pestiferous insects at a ratio of 1.6:1 (62% v 38%; Fig. 2). The monthly prevalence/distribution of the different insect types is presented in Fig. 3.

The most prevalent pests represent five families, comprising of stinkbugs (Pentatomidae), snout weevils (Curculionidae), yellow pecan aphid (Aphididae), citrus leafhopper (Cicadellidae) and plant bugs (Miridae). A strong natural enemy complex was also revealed during these surveys, including ladybird beetles, lacewings, praying mantids and antlions. In addition, the entomopathogenic fungus, Beauveria bassiana (Hypocreales: Cordycipitaceae), was isolated from several insect cadavers collected and processed during the project.

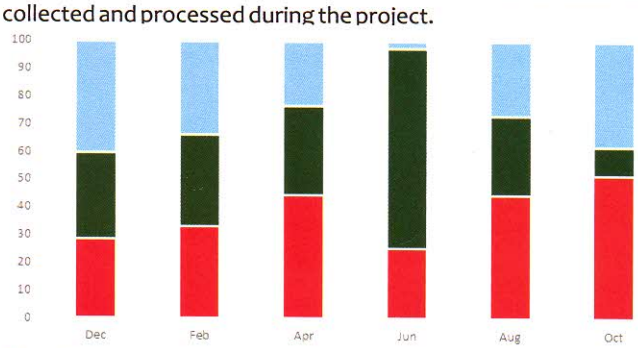

Fig. 1. Percentage (Y-axis) pest (red bars), beneficial (green bars) and 'neutral' (blue bars) insect types recorded during the project (pooled average from Dec 2013 – Jun 2017)

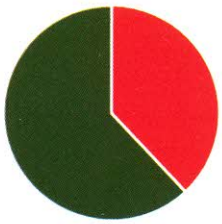

Fig. 2. Percentage non-pestiferous (green) versus pestiferous (red) insect types recorded during the project (pooled average from Dec 2013 – Jun 2017)

Fig. 3. Average number (Y-axis) of pestiferous, beneficial and neutral insect types per tree in the Hartswater region (pooled data for Bull Hill, Tadcaster and Magogong from Dec 2013 – Jun 2017). Extrapolated data for months of July, September, November, January, March and May

2. Field trials to quantify damage by bark stinkbug (Fig. 4)

Field trials were conducted during 2014, 2015 and 2016, during which nut clusters were caged during February, followed by the release of 1 or 3 mid-instar to adult C. nervosa per cage. Control cages received no bugs. All nuts were collected during June and two parameters measured, i.e., (1) percentage spoiled nuts (C. nervosa known as a fungal vector) and (2) nut weight. For the first measurement, control nuts (pooled data, totalling 277 nuts) suffered 8% spoilage, while nuts exposed to 1 bug (pooled data, totalling 102 nuts) suffered 9% spoilage and nuts exposed to 3 bugs (pooled data, totalling 230 nuts), suffered 16% spoilage. Given the 8% natural spoilage measured in controls, this percentage was used in a calculation to correct of control spoilage, yielding actual figures of 1.1% and 8.7%, for the 1 and 3 bug exposures, respectively. Working on an average of 2 800 nuts per 8/9-year old tree, with an average of 5 nuts per cluster, each tree could contain 560 clusters. The area-wide surveys indicated an average of 9.7 stinkbugs per survey per tree, of which around 80% comprised C. nervosa. This implies about 7 C. nervosa per tree, or 80 nut clusters per stinkbug. Such figures suggest an unlikely scenario of significant damage being inflicted by C. nervosa.

Fig. 4. Adult bark stinkbugs

For the second measurement, the average in-shell nut weight for control cages (pooled data, totalling 181 nuts) was 6.28g per nut, compared with 6.67g (pooled data, totalling 170 nuts) and 6.45g (pooled data, totalling 166 nuts) per nut for the 1 bug and 3 bug cages, respectively. The average meat weight for the above treatments was 2.31g, 2.64g and 2.41g per nut, respectively. Although none of these comparisons (in-shell and meat weight) showed statistical differences among the treatments and control, there was a slight increase in weight where bugs were involved. Seemingly, insect feeding may be acting as trigger for the plant to overcompensate in response to