DEVELOPMENT OF AN INTEGRATED PEST MANAGEMENT STRATEGY AGAINST SELECTED INSECT PESTS ON PECAN NUT TREES

YEAR 1 (1 October 2013 – 30 September 2014)

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Introduction

A successful insect control programme depends on a thorough knowledge of the target organism in terms of its biology, behaviour and phenology. Modern-day pest control is characterised by the integration of two or more strategies, typically incorporating natural antagonists thus reducing the reliance on chemical interventions *per se*. Although some information is available on the identity of insect pests associated with pecan nut trees, less is known about their phenology (seasonal occurrence), biology, ecology (including natural enemy complex) and behaviour. The unique life-cycle of every insect pest presents a most suitable life-stage for control, albeit by means of a biorational, chemical and/or cultural approach. This so-called 'weakest link' in the life cycle of the insect should then be exploited in an attempt to contain the insect below economic injury levels.

The following activities were initiated/performed during Year 1 of the project:

(1) Establishment of stinkbug, *Nezara viridula* (Pentatomidae), colony under glasshouse conditions at ARC-SGI. A starter colony was obtained from a private entomology lab in Nelspruit, Mpumalanga, and the insects introduced into cages at ARC-SGI (Fig. 1). The insects were reared on cowpea plants,*Vigna unguiculata,* and pecan nuts.During April 2014, an entomopathogenic fungal (EPF) infection was noted causing the colony to collapse. Infected insects were processed for extraction of the pathogen, with cadavers yielding two species of entomopathogenic fungi: *Beauveria bassiana* (Fig. 2) and *Isaria fumosorosia*. Both fungi were isolated in pure culture and are currently being cultured *in vitro.*Cultures are periodically harvested and conidia stored at 5°C for future use in assays once the *N. viridula* colony has been restored. With the onset of summer, longer day-length is expected to promote insect development to speed-up colony recovery. **(2) Source and test entomopathogenic fungi against the (fig tree) stem borer, *Phryneta spinator* (Coleoptera: Cerambycidae).** Adult beetles (Fig. 3) were sourced from a fig farm in the Western Cape and shipped to ARC-SGI via overnight courier; received 23 January 2014. The beetles were introduced (32 groups of 5 beetles per group) into 3-liter glass jars and provided with fresh willow twigs as food source. Two treatments were administered: (1) direct topical inoculation and (2) indirect inoculation by treatment of the twigs prior to release of the insects. Three species of EPF were extracted from the ARC-SGI EPF Culture Collection and cultured *in vitro* for harvesting of conidia. The three species comprised *Beauveria bassiana, Beauveria brongniartii* and *Metarhizium anisopliae*. A total of 30 EPF strains were tested against the beetles under glasshouse conditions.Fungal concentrations were prepared by conidial weight (mg) and spraying done by means of a hand-held pressure sprayer. Beetles were inspected daily for mortality and all dead beetles surface sterilized and plated on water agar to facilitate the development of overt mycosis. The best-performing strains were re-isolated from the beetle cadavers (Fig. 4) and cultured *in vitro* for harvesting of conidia (again stored at 5°C). These isolates comprised *B. bassiana* (B28A, SGI924) and *M. anisopliae* (CADZW110, MAL20). **(3) Initiate field surveys to collect insects from pecan trees in the Vaalharts area (characterise species complex at 2-monthly intervals).** Surveys were initiated on 11 and 12 December 2013 (Survey 1). Follow-up surveys were conducted on 25–27 February 2014 (Survey 2), 23-25 April 2014 (Survey 3),

25-27 June 2014 (Survey 4), 20-22 August 2014 (Survey 5). Three localities were surveyed: Locality 1 –Bull Hill (Mr Jaco Hamilton), Locality 2 – Tadcaster (Mr Jan Human), and Locality 3 – Mogogong (Mr Douglas Crawford). During the first three surveys an insecticidal fogger (Fig. 5) was used to fumigate 9 trees per locality. During the June survey trees were shaken with standard harvesting equipment as no insecticides were to be applied directly prior to harvesting. During the August survey trees were treated with a mistblower (Stihl 420). In addition, three light traps were constructed and commissioned to collect flying insects. All insects were classified according to family, genus and/or species (where possible). Data from the first 5 surveys indicate a large number of beneficial insects present in the orchards, peaking at 71% during the June survey. The dominant beneficial species during that survey was the coccinellid, *Hippodamia variegata*. During the February 2014 survey, 46% of insects were considered pest species, comprising mainly stinkbugs (21%) and snout weevils (18%).

Future research (Year 2)

The two-monthly surveys will continue during Year 2 of the project to secure at least two-year's data, although a three year period would be more accurate. Selected insect samples will be identified to species level. The greenbug colony is currently being restored following the collapse thereof due to infection with entomopathogenic fungi. Once enough insects are available, bioassays will be conducted with the fungi mentioned above. Additional field work entail pest-exclusion studies whereby some nut clusters will be caged to prevent damage by stink bugs. This activity is being planned to confirm damage signs and symptoms associated with stink bugs versus nut diseases. The light trapping needs to be optimized (cleaning, swopping of containers etc.) and strategies are being discussed with Mr Hardus Du Toit.

Fig. 1. Caged stinkbugs

Fig. 2. Fungus-infected stinkbug

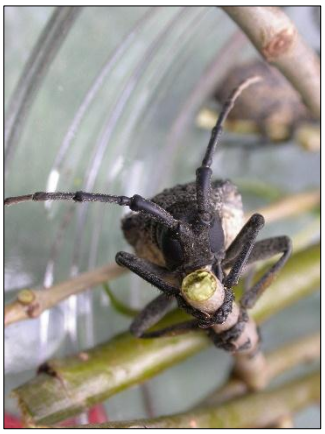

Fig. 3. Adult fig tree borer

Fig. 4. Fungus-infected fig tree borer

Fig. 5. Tree fogging to collect insects