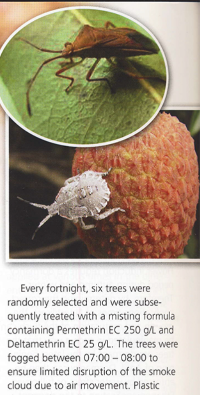

STINK BUGS ON LITCHIS:
Disrupting the migration cycle

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Introduction

The observation of Waite (1990) regarding severe early fruit losses ranging from 24.8 – 98.5% induced by two stink bugs closely related to the coconut bug in Australia prompted further investigation. Stink bug induced damage on early aborted fruit ranging up to 67% was subsequently recorded in the Mpumalanga province. Upon closer inspection the coconut bug *Pseudotheraptus wayi* Brown was discovered on the trees. Subsequent trials indicated that feeding by *P. wayi* induced symptoms on litchis similar to those observed on prematurely aborted fruits. Visual inspections of the orchards however revealed significant quantities of other stink bugs and in order to clarify the situation, it was decided to undertake a more comprehensive follow up study.

Heteropterans are also polyphagous and can move from crop to crop with relative ease if conditions become unfavourable on a specific host. The main aim of this trial was to quantify the status of litchi trees as hosts for stink bugs, especially the polyphagous pest *P. wayi*. It is expected that this information can be used to disrupt the seemingly endless migration cycle between various subtropical fruit host plants.

Materials and methods

Mature (33 years old) litchi trees (cv. Mauritius) on the premises of the Agricultural Research Council's Institute for Tropical and Subtropical Crops at Nelspruit (ARC-ITSC) (25°27'01.39S 30° 58'20.84E) were surveyed with a thermal fogging machine (Dyna Fog model: Superhawk). The trees were in good condition and no insect management occurred in the orchard prior or during the trial. Glyphosate was used in the orchard rows to restrict weed encroachment. The 1 ha. orchard was planted at a spacing of 10 x 10 m (100 trees/ha) and was surrounded by other litchi orchards on three sides with mature unsprayed pecan trees on the remainder. The survey was initiated on the 2nd of May 2013 and concluded on the 18th of July 2014.

Every fortnight, six trees were randomly selected and were subsequently treated with a misting formula containing Permethrin EC 250 g/L and Deltamethrin EC 25 g/L. The trees were fogged between 07:00 – 08:00 to ensure limited disruption of the smoke cloud due to air movement. Plastic sheeting (± 5 m^2) were placed underneath each tree. Dead insects were collected ± 1 hour after application of the misting formula. Insects were preserved in 70% alcohol and were subsequently identified by the Agricultural Research Council's Plant Protection Research Institute (ARC-PPRI) in Pretoria.

Results

Litchi appears to be a good host for stink bugs as 669 insects representing 22 species were recovered from 126 trees over 21 weeks. The eight most numerous insects comprised approximately 86% of the total number of stink bugs that were recovered during the survey.

Although Schoeman & Mohlala (2013) reported the incidence of the notorious polyphagous pest, *P. wayi* for the first time on litchi, Fig. 1 indicates that it was only the 4th most abundant pest in the current survey as it comprised only 4.16% of the eight most numerous stink bugs and 3.74% of all the individuals that were recovered.

According to Fig.1, *Coenomorpha nervosa* Dallas was numerically the most dominant stink bug. Together with *Pseudatelus raptoria* (Germar) both species represented 78.87% of the eight most numerous insects and ± 71% of the total number of individual stink bugs recovered from this crop during the trial.

The two most numerous bug species (*C. nervosa* and *P. raptoria*) were also the only two stink bugs able to breed in litchis and the majority of individuals that were recovered, were immature (Fig. 2 A & D). Early in the season (September – November) adults of both species were more prevalent while nymphs appeared to be more numerous during the late season (December – April). Results portrayed in Figs 2A & D indicate that only one generation of both heteropteran species occurred on litchis per annum. Because nymphs are flightless, they were essentially trapped on the trees during the latter part of the season when no fruit is available, and presumably only migrated to more suitable hosts upon reaching maturity.

Mizell *et al*. (2008) indicated that the life cycle of many stink bugs is dependent on host plant phenology. In South Africa litchi trees flower from June – September and fruit is normally available from September – January. A cursory examination of Figs 2A & D supports Mizell *et al.*'s (2008) observation as peak abundance of *C. nervosa* and *P. raptoria* coincided with availability of fruit in the orchards. However the situation is not that simple as quite the opposite is evident if the relative seasonal abundances of species portrayed in Figs 2 (B, C, E, F, G & H) are considered.

Adults of *P. wayi* were only present in litchi trees during the autumn and winter (April – July) and may only utilize litchis as an alternative overwintering host. *Nezara prunasis* Dallas, *Halydicornis* sp, *Cletus* sp., as well as the unidentified pentatomid and coreid did not breed in litchi and only adults were recorded (Figs 2B, C, E, F, G & H). These insects were primarily recorded from February – October when no fruit were available in the orchards.

Above observations indicate that two distinct groups of stink bugs occurred on litchis in South Africa. The first group is numerically dominant, occurs when fruit is available and is able to breed successfully in this crop while the second group occurs in smaller numbers, do not breed in litchis and occurs only when no fruit is available in the crop.

The numerically dominant group is probably better adapted to exploit a finite niche (fruit) and is possibly the species that should be implicated for fruit damage observed previously. Gause's law of competitive displacement states: "different species having identical ecological niches (ecological homologues) cannot coexist for long in the same habitat (DeBach 1966). Yet *P. raptoria* and *C. nervosa* appear to utilise the same

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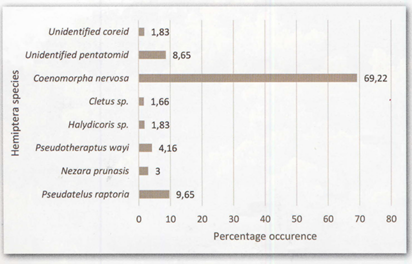

Figure1. Abundance of eight most numerous stink bugs (Coreidae & Pentatomidae) recovered from mature litchi trees (cv. Mauritius) at Nelspruit from the 2nd of May 2013 to the 18th of July 2014

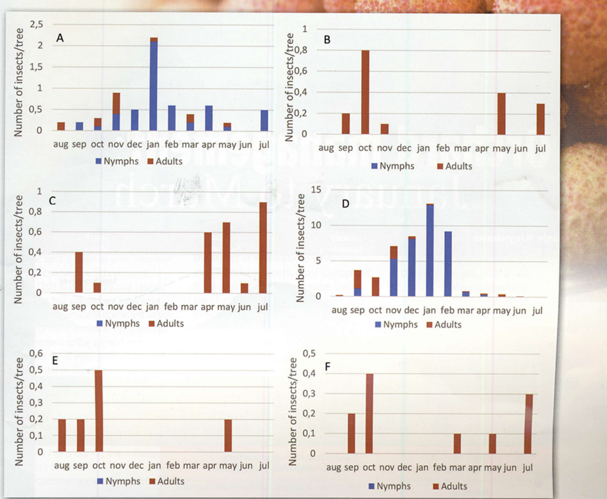

Figure 2. Seasonal abundance of adults and nymphs of the most common stink bugs found on litchi (*Litchi chinensis*) during a 15 month period in the Mpumalanga Province: *Pseudatelus raptoria*, B: *Nezara prunasis*, C: *Pseudotheraptus wayi*, D: *Coenomorpha nervosa*, E: *Halydicornis* sp., F: *Cletus* sp., G: Unidentified pentatomid & H: Unidentified coreid

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habitat. A corollary of the competitive displacement law further states that coexistence is only possible if both species have different ecological niches. Upon closer inspection this is possible as Van den Berg *et al*. (1999) mentioned that *P. raptoria* is possibly a bark feeder and may even be an obligate parasitoid.

Conclusions

Litchi is a good host for heteropterans and appears to be a good alternative overwintering host for the serious economic pest *P. wayi* as well. However, damage observed by Schoeman & Mohlala (2013) is possibly not caused by this pest but rather by *C. nervosa* which was numerically dominant when litchi fruits were available on the trees. Litchis appears to be a good overwintering host for *P. wayi* and where litchis are cultivated in close proximity to other economically important subtropical fruit tree hosts of *P. wayi* such as macadamias, avocados, mangoes or guavas, a spray on this crop during winter could reduce the risk of *P. wayi* damage in alternative hosts during the subsequent production season.

The economic impact of stink bugs are difficult to quantify. Litchi fruits has been produced in South Africa for decades without the use of disruptive chemicals. Schoeman & Mohlala (2013) proved that during substantial yields, the portion of stink bug damage in aborted fruit decreased statistically significantly if treated with a contact insecticide. However, trees appeared to compensate for early damage as no statistically significant effect on yield was observed. Piercing of the pericarp by the stylets of heteropterans may however introduce opportunistic saprophytic fungi which could compromise shelf life of affected fruit. Damage may also predispose fruit to exploitation by other litchi pests such as *C. peltastica* or *T. leucotreta* as Newton (1998) observed higher incidence of oviposition by *T. leucotreta* where fruit were damaged. These are important research questions which could affect both the quality and quantity of exportable fruit and should be addressed during future research.

References

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Boordbestuur: Januarie tot Maart

			January *Januarie*	February *Februarie*	March *Maart*
Tree management	*Boombestuur*	**Flush Control** ***Blaargroeistuwing-beheer***			Control late autumn flush with Ethapon Girdling for flush control after last desired post-harvest flush hardened (optional) *Beheer laatherfs vegetatiewe groei met Ethapon* *Ringelering vir groeistuwing-beheer na laaste verlangde na-oes groeistuwing afgehard is (opsioneel)*
		Land preparation ***Grondvoorbereiding***	Start fertiliser program according to soil analysis when trees are actively growing *Begin met bemestingsprogram volgens grondontleding terwyl bome aktief groei*		
		Post harvest ***Na-oes***	Sulphur fumigation directly after harvest. Cold storage at 1°C Prochloraz treatment directly after harvest for local market (sulfur-free) *Swaelberoking direk na oes. Koue-opberging teen 1°C* *Prochloras-behandeling direk na oes vir plaaslike mark (swaelvry)*		