Breeding sites of major coconut beetle pest *Scapanes australis* Boisd. (Coleoptera: Scarabaeoidea, Dynastinae) in East New Britain, Papua New Guinea

P. Gende[1], T. Kakul[2], S. Laup[1] and S. Embupa[1]

Abstract

An intensive field survey for breeding sites of *Scapanes australis* was conducted on the Gazelle Peninsula, East New Britain Province, Papua New Guinea (PNG) in 2000–2002 on both large-scale commercial plantations and smallholder coconut plots. *Gliricidia sepium* is prominently used as a temporary shade tree for cocoa where cocoa and coconut are intercropped, a farming system widely adopted by farmers in PNG. Population monitoring using olfactory trapping systems indicated that there are still large reservoirs of unexploited breeding sites including *Gliricidia* stumps sustaining considerable populations of *Scapanes australis grossepunctatus*.

Introduction

The Melanesian rhinoceros beetle, *Scapanes australis* Boisd. (Col: Scarabaeoidea), is one of the major coconut beetle pests of Papua New Guinea (PNG). It is endemic to PNG, Solomon Islands and Indonesia (Irian Jaya) (Prior et al. 2000). Four subspecies are recognised (Endrôdi 1957): *S. australis australis* Boisd. occurs on the mainland west of Huon Gulf (including Karkar Island) and through West Irian; *S. australis brevicornis* Sternberg occurs on the mainland east of Huon Gulf and Ferguson Island; *S. australis grossepunctatus* Sternberg occurs on the Bismarck Archipelago; and *S. australis solomonensis* Sternberg occurs on Bougainville and the Solomon Islands.

There are few records of investigations on the breeding and larval development sites *of S. australis*. Lepesme et al. (1947) recorded *Scapanes* larvae inside the rotten trunks of different species of trees (Beaudoin-Ollivier et al. 2001), while Bedford (1976) observed most *S. australis* larvae under rotting logs at the soil interface and in the base of a decayed sago palm stump (*Metroxylon sagu* Rottb.), and *S. australis grossepunctatus* under rotting cocoa pods.

Beaudoin-Ollivier et al. (2001) comprehensively described the larval development sites of *S. australis australis* and *S. australis grossepunctatus.* On the mainland, particularly Karkar Island, *S. australis australis* immature stages were common in wildfowl (*Megapodius freycinei* Abbotti) nests associated with breadfruit (*Artocarpus altilis* (Parkinson)) tree roots. On the island regions of the Bismarck Archipelago, particularly the Gazelle Peninsula (East New Britain), *S. australis grossepunctatus* was common in rotting *Gliricidia sepium* (Jacq.) Steud. stumps. This is of concern, because *G. sepium* is widely used as a shade tree in cocoa and coconut intercropping systems.

[1] PNG Cocoa and Coconut Institute, PO Box 1846, Rabaul, East New Britain Province, Papua New Guinea.
[2] PNG Cocoa and Coconut Institute, Stewart Research Station, PO Box 642, Madang, Madang Province, Papua New Guinea.

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Methods and materials

An intensive field search for breeding sites of *S. australis* was conducted on both large commercial plantations and smallholder coconut plots on the Gazelle Peninsula, East New Britain between 2001 and 2002.

Commercial plantations

Two large commercial plantations (Tavilo Plantation, owned by the PNG Cocoa and Coconut Institute, and Gunanur Plantation owned by Coconut Products Limited) were searched for breeding sites, by inspection of rotting cocoa and coconut stumps and heaps of rotten cocoa pods. *Gliricidia sepium* stumps and other unidentified bush tree stumps were dug up. Fallen, rotted logs in the vicinity of the plantations were searched thoroughly at the log–soil interface.

Smallholder coconut plots

Three smallholder coconut plots at Napapar II, Putanagororoi and Vunapalading were also inspected. High-yielding hybrid coconut seedlings were distributed and planted on these sites before the search. Napapar II and Putanagororoi had some old tall coconuts and *G. sepium* scattered within adjacent cocoa blocks and bushes. Vunapalading is a recently cleared secondary forest area.

All suspected breeding sites were searched, while rotten *G. sepium* stumps and other unidentified tree stumps were dug up and inspected.

Other tree species within and at the periphery of the smallholder coconut blocks were randomly sampled. Twenty trees were searched for each suspected breeding site.

All coleopteran larvae collected were directly identified in the field using a simplified key developed by Beaudoin-Ollivier et al. (2000). Associated scarabaeoid larvae about which there was uncertainty were taken to the laboratory for confirmation using a key devised by Bedford (1974). The sample sizes for each suspected breeding sites varied between locations, so 20 suspected breeding sites were randomly selected for analysis.

Results

Tavilo plantation

At Tavilo Plantation, the population of *S. australis grossepunctatus* larvae per rotten *G. sepium* stump on two coconut blocks was higher than the populations of other, associated scarabaeoid larvae (mainly elephant beetle, *Xylotrupes gideon* L., with some larvae from the Cetonidae and Lucanidae families). Fewer *Scapanes* were found on cocoa and other hosts (Table 1).

Gunanur plantation

Scapanes larvae were present in all the suspected breeding sites examined (Table 1). However, *Gliricidia* had the highest mean number of larvae per stump (2.1).

Smallholder coconut plots

The mean number of *S. australis* larvae was higher for *G. sepium* stumps for each of smallholder coconut blocks (Table 1) with the maximum at Vunapalading, a recent resettlement area. Other suspected breeding sites within the sampled area had low incidences of *Scapanes* larvae.

Discussion

Previous work has shown that *S. australis* had a wide range of breeding sites (Lepesme et al. 1947; Bedford 1976; Beaudoin Ollivier et al. 2001).

Our results from Tavilo Plantation and on several smallholder coconut blocks on the Gazelle Peninsula, East New Britain in 2000–2002 have confirmed the results of Beaudoin-Ollivier et al. (2001) that *Scapanes* larval populations occur under rotting *G. sepium* stumps.

The observations by Beaudoin-Ollivier et al. (2001) and the results from our work clearly demonstrated a shift of breeding sites from forest areas to farms and plantations where coconut and cocoa are intercropped, with *G. sepium* used as temporary shade tree for cocoa.

Records from the Department of Agriculture and Livestock indicated that *G. sepium* was introduced into PNG in the 1950s (from Sri Lanka in 1955 and from the National Botanical Gardens, Trinidad by the Department of Forestry in 1959). It thus appears that *S. australis* has gradually established its breeding sites in dead *G. sepium* stumps over the past 20 years as *Gliricidia* became widely promoted, distributed and established as a shade tree for cocoa as more land was cleared for farming. *Scapanes australis* therefore now poses a threat to the rehabilitation and/or replanting of coconuts in East New Britain, PNG.

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Table 1. Mean numbers of larvae of *Scapanes australis*, *Xylotrupes gideon* and other scarabaeoids recorded in surveys of breeding sites on *Gliricidia sepium* stumps and other hosts in commercial and smallholder intercropped coconut plantations in Gazelle Peninsula, East New Britain from 2000 to 2002

Plant	Location/date	Mean no. of larvae/stump or site		
		Scapanes	*Xylotrupes*	Other
Gliricidia	Tavi#10, July 2001	2.3	0.8	0.2
	Tav#9, Oct 2000	0.5	0.2	0
	Tav#12, 2002	0.6	0.1	0
	Tav#11	0.3	0.1	0
	Tav#13, May 2001	1.2	0	0
	Tav#6, May 2001	0.6	0	0.1
	Guanur,	2.1	0.1	0
	Vunapalading, May2001	0.2	0.3	0.2
	North Coast, May 2001	0.6	0	0
	Napapar II, June 2001	0.3	0.1	0
Cocoa	Tavilo1	0	0	0
	Tavilo2	0	0	0
	Tavilo3	0	0	0
	Tavilo4	0.1	0	0
	Guanur	0.2	0.1	0
	Vunapalading, May 2001	0.1	0	0.1
	North Coast, May 2001	0.1	0.1	0
	Napapar II, June 2001	0.1	0	0
Others	Tavilo1	0	0	0
	Tavilo2	0	0.1	0.1
	Tavilo3	0.6	0	0
	Tavilo4	0.2	0.3	0.1
	Guanur	1	0.2	0.1
	Vunapalading, May 2001	0	0.1	0
	North Coast, May 2001	0.1	0	0.1
	Napapar II, June 2001	0.3	0	0.2
Coconut	Guanur	0.2	0	0.6
	North Coast, May 2001	0.1	0	0.3

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