Bats of the Nakauvadra Range, Ra Province, Fiji

Author: Naikatini, Alivereti

Source: A Rapid Biodiversity Assessment of the Nakauvadra Range, Ra Province, Fiji: 60

Published By: Conservation International

URL: https://doi.org/10.1896/054.057.0109

Chapter 8

Insects of the Nakauvadra Range, Ra Province, Fiji

Hilda Waqa-Sakiti

Team members: Tokasaya Cakacaka (IAS), Presly Dovo (IAS)

SUMMARY

In November 2008, an entomological survey of the Nakauvadra Range, Viti Levu was conducted. The entomological qualitative surveys included: light trapping to target nocturnal insects, leaf litter sampling, tree beating, butterfly collections and opportunistic surveys. The surveys were conducted for a period of 10 consecutive days however, adverse weather conditions on some of the days did not allow for insect sampling.

The order Coleopetera (beetles) was the most common insect order encountered through the surveys with a total 18 families. Rare families encountered during the surveys included: Cerambycidae, Lucanidae and Buprestidae. The greatest diversity of insects sampled from the Nakauvadra Range using nocturnal searches, tree beating and butterfly surveys was located within relatively intact, lowland forest near the confluence of the Nabiya and Volivoli Creeks. The highlight of the survey was the discovery of two stick insects known to be endemic and very rare in the Fiji islands, with virtually nothing known about either species: *Nisyrus spinulosus* (syn. *Cotylosoma*) and *Phasmotaenia inermis* (syn. *Hermarchus*) and a shy scorpion *Liocheles australasiae*. These were also found within the lowland forested area.

The isolation of the forest system, and hence the insect fauna, due to the high mountain ranges separating it from neighboring forest systems explains much of the uniqueness and great diversity of insects from the Nakauvadra Range.

INTRODUCTION

The Nakauvadra Range is located on the northern side of Viti Levu and south of Rakiraki town. It runs parallel to the coast about 7 km inland with the highest elevation reaching 866 m a.s.l. The range is comprised of andesitic rocks formed from the eroded rim of the large Rakiraki volcano (Terry 2007).

To date there have been no entomology surveys or records from the Nakauvadra Range. Consequently, the main aims of this survey were to: (a) conduct a baseline entomology survey of the Nakauvadra Range using a variety of survey techniques, (b) identify significant species or taxa (including accurate GPS positions for any significant findings) and (c) collect voucher specimens to be housed at the SPR Herbarium, USP.

METHODS

Leaf litter surveys

Leaf litter surveys were conducted targeting the altitudinal range (250-550m a.s.l.). Four 50 m transects marked at 5 m intervals were set up (Map 8). One-m2 quadrats were used to sample leaf litter at 5 m intervals along the transects. Leaf litter was sieved through 12 mm mesh and transferred into Winkler bags. The bags were then hung out for at least two whole days to dry out. Collected specimens were stored in ethanol (80%) in tightly sealed labeled vials for further sorting and identification in the lab.

Nocturnal surveys

Nocturnal collections for other insect groups were conducted using light traps. These were set up every night where possible when the weather was fine and left to run from 18.00-06.00. Collected specimens were stored in ethanol (80%) in tightly sealed labeled vials for further sorting and identification in the lab.

Other surveys

A few shrub trees were randomly selected for beating. At least 3-4 trees of the same species were sampled using this method. Opportunistic surveys were also conducted whilst carrying out surveys of other taxa. Butterflies and damselflies were also sampled opportunistically in open grassland areas along the Volivoli Creek and Nabiya Creek using handheld nets during days with good weather. Voucher specimens were collected for identification. Identification of

Table 8.1. Insects collected during leaf litter sampling

Taxa		Location			
Order	**Family**	**LL 1**	**LL 2**	**LL 3**	**LL 4**
Coleoptera	Curculionidae	1		1	2
	Carabidae	1			1
	Nitidulidae	2			3
	Scolytidae				1
	Chrysomelidae			1	
Orthoptera				3	
Hymenoptera		9		11	15
Thysanoptera		3		3	1
Dermaptera		1			
Hemiptera		2	4		
Scorpiones		2			
Opiliones		6	3	5	6
Acari					1
Indeterminate		2			

Locality data:
LL 1: 178 05 45E, 17 26 27S; 541 m a.s.l
LL 2: 178 05 35E, 17 27 29S; 503 m a.s.l
LL 3; 178 05 55E, 17 27 25S; 328 m a.s.l
LL 4; 178 07 45E, 17 27 47S; 253 m a.s.l

butterfly species was based on Prasad and Waqa-Sakiti (2007). All specimens are currently being curated and catalogued at the SPR Herbarium, USP.

RESULTS AND DISCUSSION

Taxa results

Leaf litter sampling

A total of 93 individuals from nine insect orders were collected during leaf litter sampling (Table 8.1). The order Coleoptera (beetles) recorded five families (Curculionidae, Carabidae, Nitidulidae, Scolytidae and Chrysomelidae). The most common taxa encountered were Hymenoptera: Formicidae (ants). The greatest diversity was sampled from Transect 1 at a mid altitude of 541 m a.s.l. which confirms that mid-altitudes harbour the greatest diversity for insects due to fewer natural disturbances and relatively mild climatic conditions. Overall, there were few insects sampled from leaf litter due to the fact that the leaf litter layer was very thin and dry, which is unfavourable for insects.

Nocturnal sampling

Nocturnal sampling was carried out on four nights when weather conditions permitted. A total of 166 individuals representative of seven orders were recorded (Table 8.2). The orders Homoptera: Cicadidae (cicada, Plates 13, 14) and Coleoptera (beetles) were the most common taxa encountered

Table 8.2. Insects collected during light trap sampling

Taxa		Location			
Order	**Family**	**LL 1**	**LL 2**	**LL 3**	**LL 4**
Coleoptera	Scaraebidae	7	12	2	1
	Eucnemidae		2	1	2
	Lampyridae		1		
	Scolytidae		1	3	
	Cerambycidae	1			1
	Elateridae	6			
	Scolytidae	2			
	Tenebrionidae	2			
	Carabidae	6	1	2	5
	Lucanidae	1			
	Curculionidae	1			
Homoptera	Cicadidae	35	22	22	10
Orthoptera	Crickets	1		1	4
	Katydid	4			
Hemiptera		3			
Tricoptera		4			
Lepidoptera	Moths	Abundant			
Hymenoptera			1		

Locality data:
LL 1 & 3: 178 05 52E, 17 27 20S; 327 m a.s.l
LL 2: 178 05 56E, 17 27 21S; 309 m a.s.l
LL 4; 178 07 43E, 17 27 47S; 249 m a.s.l

during the nocturnal surveys. The order Coleoptera was well represented recording 11 families including rare families such as Cerambycidae and Lucanidae. The greatest diversity was sampled on the first night of the nocturnal survey at an altitude of 327m a.s.l located adjacent to Nabiya Creek.

Opportunistic sampling

Butterflies were sampled from five different locations on five days with fine weather. A total of 25 individual butterflies were collected and around 12 others sighted within these locations (Table 8.3). Butterflies sampled were from eight different species, three of which are endemic to Fiji i.e. *Papilio schmeltzi* (Plate 15), *Polyura caphontis* and *Hypolimnas inopinata*. Butterflies from the genus *Euploea* were the most common taxa encountered and are quite widespread throughout Fiji. Interestingly, the endemic Fijian swallow tail butterfly (*P. schmeltzi*) was abundant in location BC3 which was located downstream on Volivoli Creek from Camp 1 at an altitude of 330 m a.s.l.

Other opportunistic surveys encountered 58 individuals representative of five orders (Table 8.4). The most common taxa encountered were the order Coleoptera with a total of seven families amongst which was a rare member of the family Buprestidae (jewel beetles). The family Curculionidae (weevils) was the most common taxa encountered.

Tree beating sampling

Tree beating surveys yielded 58 individuals representative of five orders (Table 8.5). The order Coleoptera (beetles) was the most common taxa encountered representing five families. The family Curculionidae (weevils) was the most represented family from tree beating mainly because these are herbivorous taxa. Hymenoptera: Formicidae (ants) were also amongst common taxa from tree beatings.

Taxa Discussion

Insecta: Coleoptera (beetles)

Catches from light traps displayed the greatest diversity in the coleopteran assemblage i.e. in both

Table 8.3. Butterflies collected during hand-net sampling. * Endemic to Fiji.

Taxa	Location				
	BC 1	BC 2	BC 3	BC 4	BC 5
Euploea boisduvali boisduvali	3	7		4	
E. tulliolus forsteri	2	2		2	
*Papilio shmeltzi**	1 sighted	1 sighted	5 sighted		1
Danaus hamata neptunica		2			
D. plexipus		2 sighted	3 sighted		
Xois sesara		sighted			
*Polyura caphontis**					1
*Hypolimnas inopinata**					1

Locality data:
BC 1: Entry into the Nakauvadra ranges from Vatukacevaceva Vlg
BC 2: Along Nabiya Creek near base camp1
BC 3: Downstream Volivoli creek near base camp 1
BC 4: Along Vunimakadra creek, near base camp 2
BC 5: Forest edge, exit Nakauvadra ranges to Narara village

richness and relative abundance with a total of 18 coleopteran families. Rare families were encountered including: Cerambycidae (long-horn beetles), Lucanidae and Buprestidae (jewel beetles). The high diversity of the coleopteran fauna especially from the first site is an excellent and positive indication of the health of the forest system as beetles are the main drivers of forest ecosystem functions including pollination, herbivory, decomposition and the recycling of nutrients. Compared to the results of the nocturnal surveys, leaf litter and tree beating sampling did not show much diversity due to length of surveys i.e. in hours/days and number of days. Future surveys with more sampling effort and in better conditions may produce a higher diversity using these other methods.

Insecta: Lepidoptera *(butterflies)*

A total of eight Lepidopteran species were found of which three are endemic to Fiji namely: *Papilio shmeltzi*, *Polyura caphontis* and *Hypolimnas inopinata*. The Fijian endemic swallowtail butterfly, *Papilio schmeltzi* was frequently encountered within the survey area suggesting that the forest is still well intact. Its larval host plant, *Micromelum minutum* was also identified.

Insecta: Phasmatodea *(stick insects)*

Significant finds from the Nakauvadra Range were mainly from the order Phasmatodea commonly known as the stick insects and locally known as '**ucikau**' which literally means resembling a stick. One in particular is the female of *Nisyrus spinulosus* (synonym to *Cotylosoma*, Plate 16). This species was first described in 1877. The only specimen to have been previously collected from which original descriptions were made (i.e. holotype) by Stal in 1877 is housed in the Natural History Museum in Stockholm, Sweden. The locality data shows it being collected from Viti Levu, Fiji. This recent find would probably be the second specimen ever to be collected. Interestingly, nothing is known about *N. spinulosus* except that it is endemic to the Fiji islands with an unknown distribution within the country (Brock, pers. comm. 2008). The significance of this phasmid is its amazing body shape (i.e. cupped body, thought

Table 8.4. Insects collected during opportunistic sampling.

Taxa		Location	
Order	**Family**	**OS 1**	**OS 2**
Coleoptera	Curculionidae	4	31
	Dytiscidae	5	
	Scaraebidae		3
	Carabidae		1
	Buprestidae		1
	Cleridae		1
	Brentidae	1	
Hemiptera			5
Orthoptera		3	
Phasmatodea		2	
Opiliones		1	

Locality data:
OS 1: 178 05 44 E, 17 26 23S; 534 m a.s.l
OS 2: 178 07 43E, 17 27 47S; 249 m a.s.l.

Table 8.5. Insects collected during opportunistic sampling.

Taxa		Location	
Order	**Family**	**TB 1**	**TB 2**
Coleoptera	Curculionidae	10	2
	Eucnemidae	2	
	Chrysomelidae	2	4
	Mordellidae	1	
	Cerambycidae	1	1
	Indeterminate		1
Hymenoptera	Formicidae	17	2
Orthoptera		4	5
Araneae		4	1
Opiliones			1

Locality data:
TB 1: 178 05 52E, 17 27 20S, 327 m a.s.l.
TB 2: 178 05 56 E, 17 27 21S; 309 m a.s.l.

to have enabled it to cling to the side of rocks), thus when another species of the same genus was first described from a specimen at the Natural History Museum in London, it was thought as being semi-aquatic (i.e. having the capacity for dual breathing system in both water and land). However, this was later confirmed to be false and considered a myth. Whilst in captivity, *N. spinulosus* did not show any form of aggressive behavior and made no attempt to escape. It also refused to feed while in captivity. This particular insect was found well camouflaged to the bark of the native dakua tree (*Agathis macrophylla*) with a diameter at breast height (dbh) of approximately 30 cm covered with lichens.

Another unique find was a female of *Phasmotaenia inermis* (synonym to *Hermarchus*, Plate 17) first described in 1908. This species is an island endemic to Viti Levu and so far only been recorded from Korovou, Baulevu and Nadarivatu, thus this is also a first record from the Nakauvadra Range (Brock pers. comm. 2008). Very little is known about this species.

Class Arachnida: Order Scorpiones *(scorpions)*

The scorpion *Liocheles australasiae* (Plate 18) was encountered during the survey. This is a very docile and shy scorpion and was found foraging on leaf litter. This species in particular is not venomous; *Liocheles* are some of the least venomous scorpions in the world and rarely sting in defense (Leeming pers. comm. 2008). This is one of the four scorpions recorded for Fiji and also a first record for the Nakauvadra Range.

CONCLUSIONS AND RECOMMENDATIONS

Conservation significance

The Nakauvadra Range is an important site for insect conservation in Fiji. Its isolation bordered by high mountain ranges makes it a unique forest system and habitat for insects. Entomological surveys in the area found a high diversity of coleopteran assemblages (which are key components of forest ecosystem functions) and significant finds included the endemic Fijian swallowtail butterfly, the phasmids *N. spinulosus* and *P. inermis* and the rarely encountered shy scorpion *L. australasiae* (Appendix 6). Also abundant along the creeks were damselflies in the genera *Melanesobasis* and *Nesobasis*, the former which are native to Fiji and Vanuatu and the latter endemic to Fiji.

Recommendations for conservation and future work

- The rare, endemic and possibly endangered species particularly *N. spinulosus* and *P. inermis* should be monitored throughout the year and between years to provide data on population numbers, local distribution patterns and seasonality patterns for the development of appropriate conservation and protection strategies;
- More intensive and thorough entomological sampling using malaise trapping and active searches targeting the overall diversity of insects and rare and endemic species should be conducted in good weather over a longer timeframe to acquire a complete checklist of the different insect groups found in the Nakauvadra Range;
- Environmental awareness workshops should be conducted for resource owners on the significance of the native fauna and the need to conserve forested areas i.e., to minimize activities leading to habitat destruction.

REFERENCES

Brock, P. Entomologist - Phasmatodea, The Natural History Museum, London. Personal communication on December 10, 2008.

Leeming, J. Taxonomist - Scorpiones, Spider Club of South Africa. Personal communication on December 4, 2008.

Naskrecki, P. Director - Invertebrate Diversity Initiative Conservation International, Museum of Comparative Zoology, Harvard University. Personal communication on March 11, 2009.

Prasad, S. R. and H. Waqa-Sakiti. 2007. Butterflies of the Fiji Islands. University of the South Pacific, Suva, Fiji.

Terry, J. P. 2007. Tropical Cyclones. Springer, New York.