Katydids (Orthoptera: Tettigonioidea) of the Grensgebergte Mountains and Kasikasima Region of Southeastern Suriname

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Chapter 6

Katydids (Orthoptera: Tettigonioidea) of the Grensgebergte mountains and Kasikasima region of Southeastern Suriname

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SUMMARY

Fifty two species of katydids (Orthoptera: Tettigoniidae) were recorded during a rapid biological assessment of lowland and mid-elevation forests of the Grensgebergte mountains of SE Suriname. At least six species are new to science, and 26 species are recorded for the first time from Suriname, bringing the number of species of katydids known from this country up to 128. The current survey confirms that the katydid fauna of Suriname is rich, yet still very poorly known. Although no specific conservation issues have been determined to affect the katydid fauna, habitat loss in Suriname due to logging and mining activities constitute the primary threat to the biota of this country.

INTRODUCTION

Katydids (Tettigonioidea) are a large superfamily of orthopteroid insect, which includes approximately 8,600 species distributed worldwide. Based on the rate of discovery and numbers of recently described species of these insects at least 2,000-3,000 species remain to be named. In some areas, especially in the humid areas of the circumtropical belt of the globe, as many as 75% of species found there remain to be collected and formally described. One of such areas is the Guiana Shield, including Suriname, where katydids have never been systematically studied. Despite the recent increase in the faunistic and taxonomic work on katydids of the Neotropical region, forests of Suriname remain some of the least explored and potentially interesting areas of South America. Approximately 200 species of the Tettigoniidae have been recorded from countries comprising the Guiana shield (e.g., Venezuela, Guyana, Suriname, and French Guiana), but this number most likely represents only a small fraction of the regional species diversity, and at least 300–500 species can be expected to occur there. Up to date, 128 species have been reported from Suriname, which includes 29 species collected for the first time in Suriname during a RAP survey in 2010 (Naskrecki 2012), and the species recorded during the present survey. The remainder of these records is based on material collected in the 19th century, and most of the species from Suriname were described in the monographic works by Brunner von Wattenwyl (1878, 1895), Redtenbacher (1891), and Beier (1960, 1962). More recently Nickle (1984), Kevan (1989), Naskrecki (1997), Emsley and Nickle (2001), and Montealegre and Morris (2003) described additional species from the region.

Many katydid species exhibit strong microhabitat fidelity, low dispersal abilities (Rentz 1993), and high sensitivity to habitat fragmentation (Kindvall and Ahlen 1992) thereby making them good indicators of habitat quality and disturbance. These insects produce species-specific acoustic signals, which can be used for non-invasive, remote assessment of species richness and abundance (Diwakar et al. 2007). These insects also play a major role in many terrestrial ecosystems as herbivores and predators (Rentz 1996). It has been demonstrated that katydids are the principal prey item for several groups of invertebrates and vertebrates in Neotropical forests, including birds, bats (Belwood 1990), and primates (Nickle and Heymann 1996).

The following report presents results of a survey of katydids conducted during March 9-28, 2012 at four lowland rainforest sites in the southeastern region of Suriname.

METHODS AND STUDY SITES

During the survey 3 methods were employed for collecting katydids: collecting at an ultraviolet (UV) light at night, visual searches at night and during the day, and detection of stridulating individuals using an ultrasound detector (Petersson D1000X) at night. Representatives of all encountered species were collected and voucher specimens were preserved in 95% ethanol. Voucher specimens of all collected species will be deposited in the National Zoological Collection of Suriname, Paramaribo, while remaining specimens will be deposited in the collections of the Museum of Comparative Zoology, Harvard University and the Academy of Natural Sciences of Philadelphia (the latter will also become the official repository of the types of any new species encountered during the present survey upon their formal description.)

In addition to physical collection of specimens, wing stridulation of several acoustic species was recorded using a Pettersson D1000X digital ultrasound recorder, which allowed for documentation of sound frequencies up to 250 kHz. Virtually all species encountered were photographed, and these images will be available online in the database of the world's katydids (Otte and Eades 2013).

Simpson's Index of Diversity (D_s) was calculated for each site using the formula:

$$D_s = 1 - \sum_1^i [n_i(n_i-1)]/[N(N-1)]$$

where n_i = number of individuals of species i, and N = number of all collected individuals.

Katydids were surveyed at the following four sites:

(**Site 1**) Palumeu Village (N 3.348456, W 55.439417)— 8–9 and 28–29 March 2012— This site was dominated by highly disturbed grassland and a low secondary forest. All katydids found at this site represented genera typical of open, often anthropogenic and disturbed habitats.

(**Site 2**) Upper Palumeu River (Juuru Camp) (N 2.47700 W 55.62941) — 9–19 March 2012— This densely forested site spanned an elevation gradient of 270-500 m a.sl., with the lower portions subject to seasonal inundation by the Palumeu River (including a flood during the survey).

(**Site 3**) Grensgebergte (Rock) (N 2.46554 W 55.77000)— 17–18 March 2012— A large granite inselberg, partially covered by low forest. This site had an exceptionally low diversity and abundance of katydids.

(**Site 4**) Kasikasima Camp (N 2.97731 W 55.38500)— 20–28 March 2012— A lowland, partially inundated site covered with old-growth forest.

RESULTS

Fifty two species of katydids were recorded during the survey, representing 35 genera and 4 subfamilies. At least 6 of the collected species are new to science, including an unusual sylvan katydid lacking the stridulatory organs in the male, which warrants the creation of a new genus. A number of species belonging to genera in need of taxonomic revisions have been identified to the generic level only. A complete list of recorded species and their relative abundance at each site is presented in Appendix 6.1.

Of the four sampling sites, the Kasikasima Camp had the highest number of species (34) followed by the Juuru Camp (29 species); additionally, 5 species were recorded in the Palumeu Village, and only 2 species were collected on the Grensgebergte. Simpson's Indexes of Diversity (D_s) for Sites 1, 2, and 4 were 0.745, 0.9356, and 0.9433, respectively (D_s was not calculated for Site 3 because of an inadequate sampling effort at the site). These results indicate high species richness, combined with low abundance of individual species at Sites 2 and 3, a situation typical of tropical habitats with low levels of disturbance.

Similarly to the previous RAP survey in the Kwamalasamutu region of southern Suriname in 2010 (Naskrecki 2012), during which 78 species were recorded, the abundance of katydids encountered during this survey appeared low compared to that typically encountered in lowland Neotropical forests. Although no formal structured sampling was conducted, the rate of katydid collection was often lower than 1 individual/hour, and during most nights no individuals were attracted to the UV light. This may be related to the fact that the two main sampling sites (Juruu Camp and Kasikasima Camp) were located in a seasonally inundated forest, thus limiting the number of species associated with the forest floor and the lower layers of the forest's understory. It is likely that most of katydid diversity at these sites is concentrated in the forest canopy, a habitat difficult to sample without either direct access to it or the canopy fogging. The use of the UV light within the confines of the camp, where it was largely hidden by the camp's infrastructure, proved quite ineffective for attracting canopy species. Seasonal inundation does not explain, however, the exceptionally low number of katydids found on Grensgebergte, an elevated formation partially covered with dense primary forest that is never subject to flooding. There the low richness and abundance of these insects might be the result of lower temperatures and higher winds than in the surrounding lowlands.

Conehead katydids (subfamily Conocephalinae)

The Conocephalinae, or the conehead katydids, include a wide range of species found in both open, grassy habitats, and high in the forest canopy. Many species are obligate semenivores (seed feeders), while others are strictly predaceous. A number of species are diurnal, or exhibit both diurnal and nocturnal patterns of activity. Fifteen species of this family were recorded, including at least 3 species new to science; 4 species could only be identified to the generic level because of the poor understanding of species boundaries within their genera, which are in dire need of taxonomic revisions.

Moncheca spp.—Two species of this genus were collected during the survey, *M. bisulca* (Serville) and *M*. sp. n. 1. These brightly colored insects, along with species of the closely related genus *Vestria,* are some of the very few katydids known to employ chemical defenses (methapyrazines), which are effective at repelling bird and mammalian predators (Nickle et al. 1996). The compound are released from a dorsal abdominal gland located between the 8th and 9th tergite; in *M.* sp. n.1 the gland was bright red when everted, forming distinctive "lips", which are likely to play an aposematic function. In *M. bisulca* the gland was not colored, but the evertion of the gland's lip was accompanied with fanning of the wings, which revealed striking, brightly yellow coloration of the dorsal surface of the abdomen and red portions of the ovipositor.

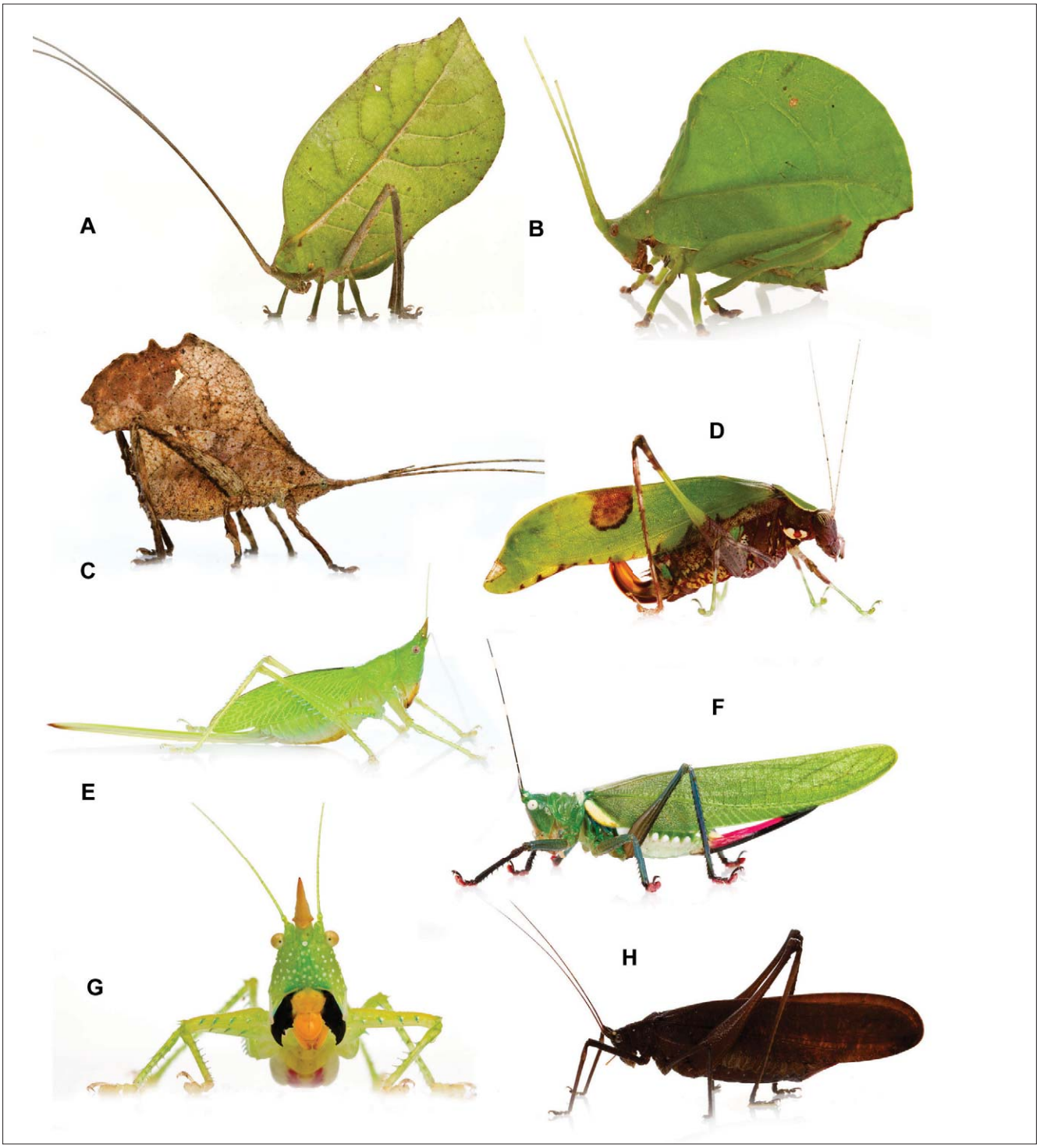

Figure 6.1. Representatives of katydid species recorded during the Grensgebergte Mountains RAP in SE Suriname: (A) *Cycloptera speculata*; (B) *Roxelana crassicornis*; (C) *Typophyllum* sp. 1; (D) *Hetaira smaragdina*; (E) *Copiphora* sp. n.; (F) *Moncheca bisulca*; (G) *Copiphora longicauda*; (H) *Chondrosternum triste*.

Copiphora spp.—Two species of the genus were collected, *C. longicauda* Serville and *C.* sp. 1, and the latter species is new to science. These insects are predators of insects and other invertebrates

Subria sp. 1—This arboreal, predaceous species was collected in the vicinity of both main camps, and is likely new to science.

Artiotonus sp. 1—A single male of this yet undescribed species was collected at the Kasikasima site (see page 24). Interestingly, the genus *Artiotonus* was only described in 2011 (Montealegre et al. 2011) to include 3 species from Colombia and Ecuador. The current record is the easternmost record for this genus.

Leaf katydids (subfamily Phaneropterinae)

The Phaneropterinae, or leaf katydids, represent the largest, most species-rich lineage of katydids, with nearly 2,700 species worldwide, and at least 550 species recorded from South America. All species of this family are obligate herbivores, often restricted to a narrow range of host plants. Probably at least 50–75% of species found in lowland rainforests are restricted to the canopy layer and never descend to the ground (females of many species lay eggs on the surface of leaves or stems, and the entire nymphal development takes place on a single host plant.) For this reason, these insects are difficult to collect, and the only reliable method for their collection is a UV or mercury-vapor lamp, or canopy fogging. Few species can be encountered during a visual or acoustic search in the understory of the forest.

Sixteen species of leaf katydids were recorded during the present survey, virtually all attracted to the UV light at the camps. One species (*Euceraia* sp. 1) is possibly new to science and several species represent records new to Suriname (e.g., *E. abnormalis,* previously known only from Brazilian states Mato Grosso and Minas Gerais.)

Sylvan katydids (subfamily Pseudophyllinae)

Virtually all members of tropical Pseudophyllinae occur only in forested, undisturbed habitats, and thus have a potential as indicators of habitat disturbance. These katydids are mostly herbivorous, although opportunistic carnivory has been observed in some species (e. g., *Panoploscelis*). Many are confined to the upper layers of the forest canopy and never come to lights, and are therefore difficult to collect. Fortunately, many species have loud, distinctive calls, and it is possible to document their presence based on their calls alone, a technique well known to ornithologists and recently applied to monitoring of katydids and other orthopteroid insects (Diwakar et al. 2007). Nineteen species of this family were collected during the present survey.

Gnathoclita vorax (Stoll, 1813)—This spectacular species is a rare example of a katydid with strong sexual dimorphism manifested in strong, allometric growth of the male mandibles. It was found in relative high numbers at both main campsites, especially among the stands of the bamboo *Guadua* sp., the stems of which this species uses as shelter. *G. vorax* is known only from southern Guyana and southern Suriname.

cf. *Macrochiton* sp. 1—Numerous individuals of this new genus and species of sylvan katydids were collected at all three camps of the survey. It is a large, macropterous insect, with exceptionally long appendages (see page 24). The unique feature of this insect is the complete absence of the tegminal stridulatory organs in the male, a condition exceptionally rare among the Tettigonioidea. These katydids, being unable to produce wing stridulation, are therefore silent, or employ yet unknown acoustic communication methods. This is the first case in the Neotropics, and only the third known case in the world, of a fully winged katydid devoid of tegminal stridulatory organs. The reasons for loss of this species' ability to produce acoustic signals is a tantalizing mystery, one that should be explored in the future.

Interestingly, this is not the first time this yet unnamed species has been collected: the University of Nebraska insect collection contains several individuals of this species collected in May 1917 in Mana River, French Guiana. Entomologist Lawrence Bruner, who during that time was the curator of the Nebraska insect collection, recognized the uniqueness of this species and designated the specimens as types, but failed to publish their formal description, and thus the species remains undescribed.

?N. gen. and n. sp. (Homalaspidiini)—A single female of a highly unusual member of the poorly known tribe Homalaspidiini was collected at the Juuru Camp (see page 24). The same species (also a single female) was previously collected at Werehpai during the 2010 Suriname RAP. This species bears no resemblance to any known species of the tribe, but until a male specimen is available it will likely remain undescribed.

CONSERVATION RECOMMENDATIONS

The sites visited by the RAP team in Grensgebergte mountains of SE Suriname belong to some of the most pristine, least populated areas in South America, and the results of this survey confirm that the fauna of katydids of southern Suriname includes a large proportion of species remain unknown and unnamed. Despite the relatively low number of species recorded during the current survey, the species turnover between 2010 and 2012 RAP sites was very high: only 26 species (50%) recorded at the Grensgebergte mountains sites had also been found at Kwamalasamutu sites in 2010. This is indicative of biological uniqueness and a possibly high degree of endemism of the Grensgebergte mountains.

More sampling, combined with comprehensive taxonomic and phylogenetic reviews, are badly needed in order to understand its true magnitude. As with most groups of tropical insects, and unlike large mammals and birds, the principal threat to the survival of katydids in Suriname comes not from hunting or trade but rather from habitat alteration and loss, especially from logging and mining.

These insects may be adversely affected by even the most seemingly insignificant changes to the composition of the forest vegetation or humidity, such as those resulting from opening of new roads and the increase of the forest's edge. While species-level conservation recommendations are currently impossible to make, protecting the existing habitats, or at least major, connected fragments of them, is the most effective way of ensuring their survival.

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Appendix 6.1. A checklist of katydids (Orthoptera: Tettigoniidae) recorded during the SE Suriname RAP 2012.

Family	Species	Site			
		Palumeu Village	Juuru Camp	Grensgebergte	Kasikasima Camp
		Individuals of species per site			
Conocephalinae 9 gen., 16 spp.	*Agraecia viridipennis* Redtenbacher		1		
	Subria grandis (Walker)				3
	Subria sp. 1		3		5
	Uchuca sp. 1				3
	Uchuca macroptera Montealegre et al.				8
	Conocephalus sp. 1	5			
	Conocephalus sp. 2	1			
	Conocephalus (Xiphidion) cinereus Thungberg				1
	Artiotonus sp. 1				1
	Copiphora longicauda Serv.		5		7
	Copiphora sp. 1		3		4
	Graminofolium castneri Nickle		6		1
	Moncheca bisulca (Serv.)		1	1	18
	Moncheca sp. 1		1		
	Neoconocephalus sp. 3 Suriname		1		1
	Neoconocephalus sp. 4 Suriname	1		1	
Listroscelidinae 1 gen., 1 sp.	*Phlugis* cf. *teres*	1			
Phaneropterinae 11 gen., 16 spp.	*Paraphidnia verrucosa* (Br. Watt.)		1		
	Steirodon dentatum (Stål)		2		
	Steirodon degeeri (Stål)		1		2
	Stilpnochlora undulata Emsley				1
	Anaulacomera sp. 1		6		
	Ceraia sp. 1				2
	cf. *Terpnistroides* sp. 1		1		
	Euceraia sp. 1		1		
	Euceraia abnormalis (Br. Watt.)		1		1
	Hetaira smaragdina Br. Watt.		1		
	Parableta sp. 1 Suriname	1			1
	Phylloptera festae Griffini		2		
	Phylloptera neotenella Otte				1
	Phylloptera sp. 1				3
	Phylloptera sp. 4		1		
	Proviadana sp. 1		1		
Pseudophyllinae 15 gen., 19 spp.	*Schedocentrus* sp. 1				2
	Schedocentrus (S.) vicinus Beier		1		1
	Gnathoclita vorax (Stoll)		6		2
	Gen_Homalaspidini sp. 1		1		
	Chondrosternum triste Beier		17		7

table continued on next page

Appendix 6.1. continued

Family	Species	Site			
		Palumeu Village	Juuru Camp	Grensgebergte	Kasikasima Camp
		Individuals of species per site			
	Leptotettix falconarius (De Geer)				2
	cf. *Macrochiton* n. gen and n. sp.		8		3
	Triencentrus sp. 1		1		
	Rhinischia regimbarti (Griffini)				2
	Rhinischia sp. 1		1		
	Cycloptera speculata (Burm.)		1		
	Pterochroza ocellata (L.)				2
	Roxelana crassicornis (STål)		2		
	Typophyllum sp. 1		4		2
	Typophyllum sp. 2		3		1
	Eumecopterus incisus Beier		4		7
	Teleutias sp. 1				1
	Teleutias sp. 2		5		1
	Teleutias surinamus Beier				2
	Total specimens (species)	**12 (5)**	**93 (30)**	**2 (2)**	**98 (34)**