A Preliminary Survey of the Ants of the Kwamalasamutu Region, SW Suriname

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Chapter 7

A preliminary survey of the ants of the Kwamalasamutu region, SW Suriname

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SUMMARY

Over 100 species of ants (Hymenoptera: Formicidae) were recorded around the Werehpai caves during the RAP biological assessment of the Kwamalasamutu Region, Suriname in September 2010. While analysis of the ant data is ongoing, preliminary results indicate that the forests around Kwamalasamutu contain a diverse and abundant ant fauna. The presence of many dacetine species typical of closed-canopy rainforest indicates that the forests are in good condition. The ant fauna of Suriname is still very poorly known, as few locations have been sampled for ants. Data on the ant fauna of the Kwamalasamutu area are valuable for eco-tourism and can help to inform tourists about the hidden fauna of the rainforest and their important roles in ecosystem function and conservation.

INTRODUCTION

When people think of the biodiversity of a tropical rainforest, many think first of the colorful parrots and macaws, the elusive yet alluring jaguars and ocelots, and the majestic towering tropical trees. However, the majority of biodiversity in a tropical forest lies in the hidden and overlooked fauna of invertebrates. Ants in particular make up over 15% of the biomass of animals in a tropical forest (Fittkau and Klinge 1973) due to their high abundance. With over 12,000 described species of ants in the world, and their social lifestyle consisting of colonies ranging in size from just a few individuals to millions of workers, ants are a dominant force in all terrestrial ecosystems, especially tropical rainforests. Due in part to their social nature, ants play many critical roles in the functioning of the tropical terrestrial ecosystem, including dispersing seeds, tending mutualistic Homoptera, defending plants, preying on other invertebrates and small vertebrates, and modifying the soil by adding nutrients and aeration (Philpott et al. 2010). Another critical function provided by ants is that of scavenging; ants are often the first animals to arrive upon a dead animal and start the decomposition process. Ants are particularly important to plants since they move soil along the soil profile through the formation of their mounds and tunnels, which directly and indirectly affects the energy flow, habitats, and resources for other organisms (Folgarait 1998).

In addition to their ecological importance, ants have several features that make them especially useful for conservation planning, including: 1) they are dominant members of most terrestrial environments; 2) they are easily sampled in sufficiently high numbers for statistical analysis in short periods of time (Agosti et al. 2000); 3) they are sensitive to environmental change (Kaspari and Majer 2000); and 4) they are indicators of ecosystem health and of the presence of other organisms, due to their numerous symbioses with plants and animals (Alonso 2000).

Ants are also useful organisms for the promotion of eco-tourism. Much of eco-tourism focuses on sightings of birds and large mammals, which are elusive and often very hard to find or see in the dense rainforest. Ants, on the other hand, are ubiquitous and can be seen as soon as one sets foot in almost any forest around the world. Ant behavior and ecology are fascinating, and local guides who can share ant stories will attract and educate many eco-tourists.

STUDY SITE

Ants were studied only at the third RAP site, Werehpai (camp at N 02° 21' 47", W 056° 41' 52"), from 4–7 September 2010. The camp was located on the north bank of the Sipaliwini River on an abandoned farm, and the habitat immediately surrounding the camp was mostly tall second-growth forest with a dense understory. Further from camp along the 3.5-km trail to the Werehpai caves, the habitat was primarily tall terra firme forest, with a few palm swamps and many spiny palms (*Astrocaryum sciophilum*) in the understory. Ants were sampled in the forests along the main trail between camp and the Werehpai caves and along short side trails that ran off the main trail.

METHODS

Ants from the ground, leaf litter, and vegetation were sampled by hand collecting along the main trail and into the forest, as well as around camp. Ants from the leaf litter were also sampled using two sifting methods. The first method was the "David sifter", a plastic tray (20 cm × 30 cm) with an imbedded mesh screen placed over another plastic tray. Leaf litter was collected by hand (using gloves) and placed on the mesh screen. The tray was then shaken back and forth to move ants and other small invertebrates out of the leaf litter, which then fell through the screen and into the tray below. Ants were then collected out of the bottom tray using forceps.

The second sifting method used was the Ants of the Leaf Litter (ALL) protocol (Agosti et al. 2000). Four one-hundred-meter linear transects were sampled at the following locations: 1) near the Werehpai caves (~10:00h, warm and sunny, fairly dry), 2) at the botanical team's 1-ha plot (see plant chapter for coordinates; ~14:00h, warm and sunny, dry), 3) along the trail between camp and the caves (N 02 22'06" W 56 41'23.7", 09:00h), and 4) perpendicular to the main trail (N 02 22'04.9" W56 41'25.1", 11:00h). Along each transect, a 1x1-m quadrat was set up every 10 m (for a total of 10 quadrats per transect). The leaf-litter, rotten twigs, and first layer of soil present in the quadrat were collected into a cloth sifter and shaken for about a minute. Within the sifter was a wire sieve of 1-cm^2 mesh size which allowed small debris and invertebrates such as ants to fall through the mesh into the bottom of the sifting sack. The sifted leaf litter was then placed in a full-sized Winkler sack, which is a cotton bag into which four small mesh bags containing the leaf litter are placed. Due to their high level of activity, ants run out of the litter and the mesh bag and fall to the bottom of the sack into a collecting cup of 95% ethanol. The Winkler sacks were hung in the field lab for 48 hours. The ant specimens were then preserved in 95% ethanol and sorted to morphospecies. Specimens were identified to species level, when possible, by L. Alonso and J. Sosa-Calvo using ant taxonomic literature, AntWeb (www.antweb.org), and the ant collection at the National Museum of Natural History in Washington, D.C.

RESULTS

Due to the high diversity and large sample size of ants collected, the ant samples were still being processed at the time of this publication. However, preliminary results based on many of the hand collecting samples and the ALL transect sampled near the Werehpai caves indicate a high diversity of ant species typical of a pristine lowland tropical forest, with 105 ant species documented so far. The ALL transect revealed at least 62 ant species, including many species of the tribe Dacetini, and many species of the tribe Attini (fungus-growing ants; Appendix). The most species-rich genus within the ALL transect was *Pheidole*, with at least 20 species, which is consistent with most tropical studies. Other species-rich genera included *Solenopsis*, *Pachycondyla,* and *Odontomachus*. The ants from three of the ALL transects have yet to be sorted and identified; thus more species are likely to be added to the list when these samples have been processed.

Preliminary analysis of some of the hand-collected Davis sifter samples revealed an additional 44 species of ants, many of which were not collected in the litter sample due to their arboreal habits or their ability to escape rapidly when pursued. These included many large ants that were commonly seen in the forest, including the arboreal species *Daceton armigerum*, *Cephalotes* spp., and *Camponotus* spp., the large-eyed terrestrial *Gigantiops destructor*, and several species of army ants (Appendix). Many ant-plants were found in the area, including *Triplaris* sp. and many *Cecropia* sp., which house obligate ant mutualists. *Pseudomyrmex* sp. was collected from *Triplaris* near the RAP camp, and *Azteca* sp. was collected from *Cecropia* along the Sipaliwini River.

Some of the ant species collected are likely new to science and/or new records for Suriname. However, due to the ongoing process of identifying the specimens from the RAP survey, this information is not yet available, but will be published at a later date.

DISCUSSION

Few previous studies of the ants of Suriname have been conducted. Thirty-six ant species were reported by Borgmeier (1934) from coffee plantations around Paramaribo. Kempf (1961) recorded 171 species (54 genera) from primary forest, plantations, and pastures. Most of the ant collections in the interior of Suriname were made by G. Geyskes sporadically between 1938–1958, in Paramaribo and Brownsberg Nature Park.

Prior to the RAP survey of the Lely and Nassau plateaus in eastern Suriname in 2005 (Sosa-Calvo 2007), a total of 290 ant species had been recorded for Suriname (Kempf 1972, Fernandez and Sendoya 2004). Sosa-Calvo (2007) documented a total of 169 species from Lely and Nassau Plateaus, at least half of which are probably new records for Suriname. Thus, 370 ant species is a conservative estimate of the number recorded in Suriname so far. However, given the low effort of ant sampling in Suriname and the few localities sampled, there are likely many more ant species present in Suriname. Tropical lowland rainforests typically harbor a high diversity of ants. For example, Longino et al. (2002) found over 450 ant species in an area of approximately 1500 ha in Costa Rica, and LaPolla et al. (2007) reported 230 species from eight sites in Guyana. A recent RAP survey in Papua New Guinea (Lucky et al. 2011) reported 177 ant species from the lowland site (500 m). Long-term surveys of several tropical faunas regularly record new ant species over time, demonstrating that ants are typically undersampled (i.e. Brühl et al. 1998, Fisher 2005). More studies of ant diversity throughout Suriname are needed to estimate the country's ant diversity, and thereby provide important baseline data for conservation and management of Suriname's biodiversity.

The genus *Acanthomyops* was common in the leaf litter samples but was only recently recorded in Suriname (Sosa-Calvo 2007). Based on its distribution, this genus would be expected to be present in Suriname. Its documentation on the RAP survey highlights the need for continued sampling of ants within Suriname.

With a high diversity and visibility at the Werehpai RAP site, ants certainly play many important roles in the ecosystem. *Pseudomyrmex* and *Azteca* ants protect their host trees (*Triplaris* sp. and *Cecropia* sp., respectively) from herbivores. High ant activity in the leaf litter suggests that ants are playing a key role in scavenging, soil turnover, and predation. Ants also serve as a key food source for many other rainforest animals, including frogs, snakes, small mammals, birds, and other invertebrates. Ants have been found to be the source of the poison in many poison dart frogs. Army ants in particular play a key role as predators in tropical lowland rainforest. Army ant species, such as *Eciton burchelli*, conduct large swarm raids in which millions of workers spread out through the forest, capturing everything they can to bring back to their colony as food. These ants are key to keeping populations of many invertebrates in check. While ferocious and seemingly untouchable, army ants are at high risk from habitat fragmentation since they need large tracts of forest to support their enormous colonies (Gotwald 1995).

Leaf-cutting ants in the genus *Atta* also play a critical role in tropical forests. These ants can be considered "ecosystem engineers" since they have a large impact on their ecosystem and other organisms, primarily by moving soil as they create and maintain their large underground nest chambers. *Atta* spp. cut leaves to grow a fungus garden (see below). While *Atta* spp. are considered a pest by many agricultural growers (including those in Kwamalasamutu) due to their tendency to cut the leaves of crops such as cassava, their role in the forest is irreplaceable. A single colony of *Atta sexdens* was documented to move 40 tons of soil to the surface in a forest in Brazil (Autori 1947). *Atta* structure the environment as they move soil, integrate nutrients, and aerate the soil for their large nests (Costa et al. 2008). In the rainforest, *Atta* do not tend to defoliate entire sections of forest due to the high density and diversity of tree species, from which they can selectively choose which leaves to cut. Crop monocultures are often hit hard when an *Atta* colony finds and cuts the plants. Planting a diverse selection of crops has been demonstrated to reduce the impacts of *Atta*. Other suggestions include 1) growing crops such as citrus (which *Atta* like) in another area to lure the *Atta* away from the main crops during growing season, and 2) mapping out the *Atta* colonies in an area before planting food crops. *Atta* spp. have very large, stationary nests that remain in the same place for many years (*Atta* queens can live for over 10 years). They also forage away from the nest on permanent trunk trails that are used for several years. Thus by mapping out the nests and trunk trails, gardens can be placed away from *Atta* foraging grounds. Poisons such as Mirex may work to kill an individual *Atta* nest, but they will also poison many other organisms and thus have a negative effect on the soil fauna. In addition, there are many sources of new *Atta* nests, such that poisoning them all is not possible (or advisable!).

Threats to the ants of the region and how to protect them

Like many tropical taxa, many ant species and populations face a range of threats. The most immediate and widespread threat comes from the loss, disturbance, or alteration of habitat. Fragmentation studies have revealed that ant species richness and genetic diversity can be affected even in large forest patches of 40 km^2 (Brühl et al. 2003, Bickel et al. 2006). Nomadic ant species such as army ants need large expanses of habitat to find enough food to feed their exceptionally large colonies (Gotwald 1995). Likewise, deforestation and forest fragmentation can cause local extinctions of the neotropical swarm-raiding army ant *Eciton burchellii* and other army ants (Boswell *et al*. 1998, Kumar and O'Donnell 2009).

Invasive ant species are a huge threat to native ant species. These aggressive species out-compete native ant species for food and other resources, or kill them directly, especially on islands and in degraded habitats. No invasive ant species were documented at the Werehpai RAP site but there were colonies of *Solenopsis geminata* and other ant species that proliferate in disturbed areas in the village of Kwamalasamutu and along the river near the RAP campsite. Care must be taken not to facilitate the spread of these ant species into the pristine forest.

Global climate change is likely already affecting the distribution of many ant species. For example, Colwell et al.

(2008) predict that as many as 80% of the ant species of a lowland rainforest could decline or disappear from the lowlands due to upslope range shifts and lowland extinctions (biotic attrition) resulting from the increased temperature of climate change.

A lack of information on ant species distributions, particularly for tropical regions such as Suriname, makes identifying rare and threatened species very difficult. Moreover, ants are small and easily overlooked by both the general public and conservationists, and are often perceived as pest organisms rather than focal species for conservation. While there are a few ant species that have become widespread invasive pests, most of the more than 12,000 described ant species are unobtrusive and beneficial to natural ecosystems and humans. Much conservation action is based on the assumption that other taxa, such as plants, birds or mammals, can serve as surrogates for the conservation needs of invertebrates and other lesser-known taxa (Rodrigues and Brooks 2007, Gardner et al. 2008). However, few studies or analyses of surrogacy have included ants; those that have generally indicate that ant diversity patterns and responses of ants to disturbance are not the same as those of most "umbrella taxa" (Alonso 2000). Ant species richness and distribution generally correlate best with other terrestrial, ground dwelling invertebrates (Alonso 2000) but these taxa are also not usually included in conservation planning.

Charismatic Ants

Given that ants are highly conspicuous and abundant around the Werehpai caves, they should be a key component of nature walks and eco-tourism visits to the site. Several ant species found in the Werehpai area are large enough to attract the attention and admiration of tourists. These ant species are common and conspicuous and have fascinating life histories and behaviors that give them "personalities" that tourists will find fascinating. Theses ant species can thus serve to highlight the key roles that ants play in the ecosystem. The most charismatic species around Werehpai include the following (see photos of these beautiful ants in the photo section):

Gigantiops destructor—the Jumping Ant—is a large black ant common on the forest floor in the Werehpai area. These ants have extremely large eyes with which to see and avoid their predators and their prey. They move very quickly and actually jump around on the leaf litter, which is unusual for an ant. Despite its name—*destructor*—these ants are timid, so you have to sneak up on them carefully. They do not bite or sting but defend themselves by spraying formic acid from their gaster (abdomen). These ants forage for small invertebrates in the leaf litter and are often found nesting near *Paraponera clavata* nests, possibly to benefit from the aggressive defense of the larger ants.

Daceton armigerum—the Canopy Ant—is a beautiful golden-colored ant that lives high in the canopy of trees near the Werehpai caves. They have large heads with strong muscles that power their sharp mandibles. Their eyes are under their head so that they can see below them as they walk along branches in the treetops. Another key to their success in the canopy is that their claws are very clingy and can keep a tight hold on branches and tree trunks.

Cephalotes atratus—the Turtle Ant, or Gliding Ant, lives high up in the tree canopy. With its flattened body and large turtle-shaped head, it lives within rotting twigs and branches and blocks the entrance to its nest with its head. Living so high in the canopy, these ants face the threat of falling out of their tree into the terrestrial territories of other, more ferocious ants. Thus they have evolved a way to avoid falling to the forest floor. If they fall from their tree, these ants stretch out their bodies and legs to glide (Yanoviak 2005). They can detect the tree trunk by the relative brightness against the dark greenery and twist in the air to point their abdomen toward their host tree, making a safe landing back home.

Eciton burchelli—the Army Ant—has very large colonies with millions of workers that move through the forest in a swarm raid, capturing everything in their path. These ants do not have a permanent nest but have a "bivouac"- a temporary nest site consisting of a giant ball of ants, usually found under a rotting log or in the hollow of a tree. These ants sting and bite and are very aggressive, even to humans, so one needs to watch where they step around these ants. It is very interesting to watch an army ant swarm since many other creatures can be seen jumping and running to get out of the path of the ants, and some specialized antbirds follow the swarm to catch these invertebrates for their meal. The soldiers of *E. burchelli* have very long mandibles which are used to suture wounds by some indigenous peoples. In addition to their swarms for catching food, these ants are also often seen moving their colony to a new bivouac (which is necessary when they run out of food in an area), carrying their larvae and pupae slung under their bodies.

***Odontomachus* spp.**—Trap-Jaw Ants—are large ants common on the forest floor. These ants hold the world record for the fastest reflex in the animal kingdom. They forage by walking around with their mandibles (jaws) wide open. They have small trigger hairs between the mandibles which detect prey items (such as small invertebrates) and trigger the mandibles to snap shut very quickly to capture the prey. These ants often nest in the leaf litter trapped in small palm trees, in the terrestrial leaf litter, or in the soil. They are long, sleek, elegant ants, but have a nasty sting, so care must be taken to avoid touching them.

Paraponera clavata—the Bullet Ant or Congo Ant—is famous for its very powerful and painful sting. It is one of the world's largest ant species and is common in Neotropical lowland rainforests. These ants nest in the ground at the base of trees but forage up in the tree-tops on nectar and invertebrates. While they forage solitarily, they often have a relay of ants for passing large nectar droplets from the treetops to the nest, from one ant to another. These ants are one of the few ant species that make sound to communicate with one another. They can "stridulate" by rubbing their legs along their thorax to make a high-pitched squeaky sound.

***Atta* sp.** — the Leaf-cutting Ant — is well known for its unique and fascinating agricultural lifestyle. *Atta* are fungus-growers- the workers cut pieces of leaves from a wide variety of trees to bring back to their nest where the leaves are chewed up by smaller workers and inserted into a large fungus garden, which the ants tend and cultivate. The ants do not feed on the leaves. Instead, they feed the fruiting bodies of the fungus to their larvae. Their nests are very large with many large underground chambers. It is fun to watch the workers cutting leaves and carrying them over their head back to the colony. *Atta* are parasitized by tiny phorid flies, which lay their eggs on the ants. When a fly larvae hatches, it burrows into an ant's head and develops inside, thereby killing the ant. Small *Atta* workers are often seen hitching a ride on the leaf carried by a larger worker- it is thought that these small ants serve to ward off attacking phorid flies.

***Pseudomyrmex* spp.** — the Tree-dwelling Ants — are also arboreal ants. Many species live in the rotting, hollow twigs and branches up in the trees. They often fall from the trees, landing on the top of tents and even on your shirt, especially after a wind blows through the forest. Some species are specialized, obligate inhabitants of ant-plants, which provide a hollow cavity and sometimes food bodies or nectar for the ants. In exchange, the ants protect the plant by capturing and eating herbivorous insects that may eat the plant. These ants have large eyes and very long, slender bodies (their body form is distinctive) and a painful sting, so it's best to take care when observing them.

Ants and other invertebrates are an important part of the tropical ecosystem and must be considered in conservation and management planning (Alonso 2010). As E.O. Wilson (2006) has so aptly stated, "People need insects to survive, but insects do not need us. If all humankind were to disappear tomorrow, it is unlikely that a single insect species would go extinct, except three forms of human body and head lice…But if insects were to vanish, the terrestrial environment would soon collapse into chaos."

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Appendix. A preliminary list of ant species of the Werehpai area, SW Suriname.

Ant morphospecies	ALL Transect near Werehpai caves	Hand collecting
Acanthognathus lentis	X	
Acanthognathus 01		X
Apterostigma 01	X	
Atta 01 (*sexdens*?)		X
Attini 01	X	
Attini 02	X	
Attini 03	X	
Attini 04	X	
Attini 05	X	
Azteca 01	X	
Azteca 02		X
Basicerotini 01	X	
Basicerotini 02	X	
Basicerotini 03	X	
Camponotus 01		X
Camponotus 02		X
Camponotus 03		X
Camponotus 04		X
Carebara nevermanni	X	
Cephalotes 01		X
Cephalotes atratus		X
Crematogaster 01	X	
Crematogaster 02	X	
Crematogaster 03	X	
Crematogaster 04		X
Crematogaster 05		X
Crematogaster 06		X
Crematogaster 07		X
Cyphomyrmex laevigata	X	
Cyphomyrmex 01		X
Daceton armigerum		X
Discothyrea horni	X	
Dolichoderus 01		X
Eciton burchelli		X
Eciton 01		X
Gigantiops destructor		X
Gnamptogenys minuta	X	
Gnamptogenys 01		X
Hypoponera 01	X	
Hypoponera 02	X	
Hypoponera 03	X	
Hypoponera 04	X	
Hypoponera 05		X
Lachnomyrmex 01	X	X
Myrmicocrypta guianensis	X	
Nesomyrmex 01 (*spinodis*?)		X
Nyleanderia 01	X	
Nyleanderia 02	X	
Nyleanderia 03		X
Octostruma balzani		X
Octostruma 01	X	
Octostruma 02	X	
Octostruma 03	X	
Odontomachus 01	X	
Odontomachus 02	X	
Odontomachus 03		X
Odontomachus 04	X	
Odontomachus 05	X	
Pachycondyla 01	X	
Pachycondyla 02	X	
Pachycondyla 03	X	
Pachycondyla 04		X
Pachycondyla 05		X
Pachycondyla 06		X
Paraponera clavata		X
Pheidole 01	X	
Pheidole 02	X	
Pheidole 03	X	
Pheidole 04	X	
Pheidole 05	X	
Pheidole 06	X	
Pheidole 07	X	
Pheidole 08	X	
Pheidole 09	X	
Pheidole 10	X	
Pheidole 11	X	
Pheidole 13	X	
Pheidole 14	X	
Pheidole 15		X
Pheidole 16		X
Pheidole 17		X
Pheidole 18		X
Pheidole 19		X
Pheidole 20		X

table continued on next page

Ant morphospecies	ALL Transect near Werehpai caves	Hand collecting
Pseudomyrmex 01		X
Pseudomyrmex 02		X
Pseudomyrmex 03		X
Pyramica denticulata	X	
Pyramica subdentata	X	
Pyramica alberti	X	
Pyramica glenognatha	X	
Pyramica 01		
Solenopsis 01	X	
Solenopsis 02	X	
Solenopsis 03	X	
Solenopsis 04	X	
Solenopsis 05	X	
Solenopsis 06		X
Solenopsis 07		X
Strumigenys elongata		X
Strumigenys 01	X	
Strumigenys 02	X	
Trachymyrmex ruthae (species group)	X	
Wasmannia auropunctata	X	X
Total number of species (105)	**62**	**44**