The following paper is the result of a study done at the Institute For Tropical Ecology and Conservation (ITEC) in Central American Panama. This paper is only the preliminary report leading toward a more in-depth project for the future. The report obviously justifies a further look into the idea that ants are capable of gliding behavior, at least among those species studied thus far. The report is offered here with permission from the student.

Home Tree Preference as Observed in the Gliding Ant Species *Camponotus sericeiventris*

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Gliding behavior in ants was originally observed by Stephen P. Yanoviak in 1995, in the ant species *Cephalotes atratus* (Yanoviak 2005). It is believed that the chance of ants being dislodged from their branch or falling from the canopy and getting lost on the ground is high (Yanoviak 2005). In order to reduce the chance of falling, many ant species have developed ways of "sticking" to the branches more effectively, such as modified pretarsal structures with special adhesive properties (Yanoviak 2005). It would seem that some ants also exhibit gliding behavior as a way of preventing falling to the forest floor.

Previous experiments with gliding in *Cephalotes atratus* have determined that when dropped from the lower crown branches of their resident tree, 85% of the ants landed on the trunk, which exceeds the expected horizontal drift of parachuting insects exhibiting undirected drift during freefall (Yanoviak et al. 2005). Experiments have also determined that glide success is not related to specific characteristics of their home tree, nor does the location within the tree with respect to the trunk from which the ant is dropped (Yanoviak 2005). It was determined that ants locate the tree by visual means and that the ants will glide to any light coloured column (Yanoviak 2005). It is believed that the shape and orientation of the ants' appendages play an important role in gliding ability (Yanoviak 2005) but this has yet to be firmly established.

The genus *Camponotus* is known to contain both gliding and non-gliding species (Yanoviak

2005). Preliminary trials have determined that *Camponotus sericeiventris* will glide when dropped. The species displays a division of size and labour among 3 worker castes, wherein the mandibular glands and the maxillary glands are disproportionately large in the major caste (Busher et al. 1985). Behavioral differences have been observed between the castes and initial drop tests revealed that the individuals with the significantly larger heads did not glide when dropped from the tree.

As of yet, no studies have been published regarding preference of gliding ants to return to their original tree when given a choice between their original tree and another. The experiment was designed to determine if ants of the species *Camponotus sericeiventris* show a preference to return to their original tree when dropped from a point equidistant between their original tree and another tree not occupied by the ant colony. I hypothesized that ants which are removed from a branch in the canopy will glide more often to their original tree from which they were removed than to another available tree when dropped from a point equidistant from each. A null hypothesis would suggest that the ants will show no preference for their original tree over another available tree.

The study was conducted in a section of primary forest on the island of Isla Colon in Bocas del Toro province in Panama. The site consists of 3 trees. Tree A is the tree from which the ants were collected. It has a circumference of 288cm. Tree B has a circumference of 334cm and is joined with Tree A until approximately 20 feet above the ground, at which point the two trunks diverge. The majority of ants were observed on Tree A, and they had access to Tree B at the joined trunk 20 feet above the ground, at a point approximately 70 feet above the ground and via a constructed platform 85 feet above the ground. Ants were observed in both trees during the study. Tree C is located at a distance of 177cm from the base of Trees A and B, and has a circumference of 119cm. Tree C is of a lighter colour than Trees A and B. No ants were observed on Tree C over the course of the study.

44 individuals of the species *Camponotus sericeiventris* were caught from a branch approximately 70 feet above the ground in Tree A. Initial drop tests suggested that the larger *Camponotus sericeiventris* did not glide, whereas the smaller ones did. Therefore, the drop tests were performed on the smaller ants of the species.

Ants were then dropped one at a time from approximately 70 feet in the air, from a spot equidistant from Trees A, B and C. Ants were observed during descent until they reached either a tree or the ground. As per Yanoviak et al. (2005) ants were examined for the presence of all appendages before dropping, and were dropped in still air based on lack of leaf motion in surrounding vegetation.

The drop test was repeated for a control group of 50 ants found on the ground a significant distance from the original tree. Ants were collected from this second site and dropped from the same location and height as the original ants. It is assumed that this group can act as a control because none of the trees available within gliding range are within the territory of this colony. The trees were then measured for circumference and distance from one another.

In total, 44 ants were collected from Tree A and dropped from a point approximately 70 feet above the ground from a point equidistant between trees A, B and C. Of those, 6 ants were either killed in the process of dropping, influenced by a sudden strong breeze or lost visually on the way down. The remaining 38 drops were viable. Of those, 21 ants glided to, and landed on the trunk of Tree A. 5 ants glided to, and landed on Tree B, and 4 landed on Tree C. 8 ants landed on the ground, either by falling or gliding.

Based on these results and running a randomization test, the probability of an ant landing 30 times on a tree out of 38 drops by chance is 0.002. The probability of an ant landing 21 times on Tree A vs. 9 times on Trees B and C by chance is 0.04, and the probability of an ant landing 21 times on Tree A and 5 times on Tree B by chance is 0.002. The ants tended to land in the lower 30 feet of the trees when they did glide to the tree. The randomization test on the control group suggested that the results are not significant and the ants did not glide preferentially to Tree A out of the three tree options.

50 ants were dropped as part of the control group. Of those, 15 glided to Tree A, 11 glided to Tree B and 16 glided to Tree C. 8 ants fell to the ground.

The original hypothesis suggested that when removed from a specific tree, ants of the species *Camponotus sericeiventris* would show a preference to return to that same original tree when dropped from a point equidistant between the original tree and another. The results of this experiment support this hypothesis.

Given the choice of 3 trees, the ants removed from the canopy showed a strong preference for their original tree. By contrast, the ants removed from the ground site a distance away showed no preference for any of the 3 trees. If the ants were simply gliding to the largest available column, it would be expected that they would show a preference in landing on Tree B which had the largest diameter. If the ants showed a preference for lighter coloured columns, as suggested by Yanoviak (2005), then the ants should have preferentially glided to Tree C. However, the ants removed from Tree A showed a preference in returning to that same tree, suggesting that the ants may have a method of knowing or recognizing their home tree from others in the area. Studies on tandem running in Temnothorax albipennis have suggested that these ants are capable of teaching and learning (Franks and Richardson 2006). Franks and Richardson found as well that the lead ant and the following ant both modified their behavior in response to the other (2006). Experiments with the workers of the species *Formica pallidefulva* have shown that the ants are able to learn a 6 point maze at a rate of only 2-3 times slower than laboratory rats, and are able to remember their way through the maze up to 4 days later (Jander 1957). Further studies with *Formica rufa* showed that the ants were able to learn the position of 4 separate landmarks and use them for orientation up to a week later (Jander 1957). Given the capabilities of learning demonstrated by various ant species, it is therefore possible that ants are able to learn and process information about their environment, allowing the ant to recognize its original tree when falling to the forest floor and modify its direction in order to land on its home tree. Studies have shown that gliding ants locate a tree by visual means (Yanoviak 2005), and it is possible that the ants are able to visually recognize their home tree or visually locate the tree by referencing its location in the forest by some other means, such as the sun. Research with the species Solenopsis saevissima has suggested that when foraging the ants will orient themselves with reference to a constant angle to the principle light source available, either the sun or the moon (Marak and Wolken 1965).

Further studies on the methods of environmental recognition in ants would be useful in expanding our understanding of how ants process information about their territory and therefore how they are able to recognize their original tree in order to return to it. As well, it would be useful to see if other ant species that display gliding behavior also show a strong preference to return to their home tree.

References:

Busher, C. E., P. Calabi and J.F.A. Traniello 1985. Polymorphism and Division of Labor in the Neotropical Ant Camponotus-Sericeiventris Hymenoptera Formicidae. Annals of the Entomological Society of America 78(2):221-228

Franks, Nigel R. and Tom Richardson 2006. Teaching in Tandem-Running Ants. Nature 439 (7073):153

Jander 1957. Die Optische Richtungsorientierung der Roten Waldameise (Formica rufa L). in The Insect Societies. Edward O. Wilson. President and Fellows of Harvard College. USA.

Marak, G.E. and J.J. Wolken 1965. An Action Spectrum for the Fire Ant (Solenopsis saevissima). Nature, London. 205:1328-1329.

Wilson, Edward O. 1971. The Insect Societies. President and Fellows of Harvard College. USA.

Yanoviak, Stephen P. 2005. Gliding Ants in Tropical Forests. What's Up Vol II(2):1-3

Yanoviak, Stephen P., Robert Dudley and Michael Kaspari 2005. Directed Aerial Descent in Canopy Ants. Nature 433 (7026):524-626