

A Craze for Carrion and Compost: Investigating the Early Decomposition of Various Organic Matter at Finca Las Piedras

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Abstract

This study explores the diversity of insects that uses various organic matter in decomposition through time-lapse recorded in the leaf litter at Finca Las Piedras, biological station in Southeastern Peru.

Introduction

Despite the appearance of a lush and abundantly rich environment, the wildlife that call the Amazon Rainforest home are constantly competing for resources. Whether that may be the various scarab beetle of the family Scarabaeidae scouring the forest floor for any suitable slice of decaying hardwood or the antbirds that seek out army ants to snag any escaping insects from the fray, animals and plants are working tirelessly day and night to get their fill. Out of all the nutritious matter in the dense foliage, however, are some aspects that are much more prized than others. When an animal meets its unfortunate end, the carcass spends little time alone before being swarmed by various hungry scavengers. Even the fecal matter of a passing monkey or the droppings of a macaw high up in the canopy are quickly consumed and returned to the cycle of nutrition. Sweet fruits and any other usual meal found on the dinner table is a delicacy to the native Peruvian wildlife and is immediately flocked upon as well.

Methods

Three days over the span of three weeks were chosen to conduct the experiments, with a

separate medium being used on each day. At a location between the Lindero and Castana trail, two instances of the organic matter were placed at the same time, with one being filmed through timelapse. At 15- or 30-minute intervals, depending on the extent of the changes, any notable observations on the matter itself or participating organisms were described. Such would occur for 3-4 hours, with one or two later observations recorded after a significant amount of time such as 6 or 24 hours. In order to produce a smell that was capable of attracting a significant amount of attention, the food matter was left out in the sun for at least one full day. This fermentation process created a strong odor, compelling a great variety of organisms to venture towards the target sites.

On Day 1, two instances of feces were produced on the Cortahojas trail mouth, intersecting with the Lindero trail and monitored during sunny and hot weather for approximately 215 minutes. (Fig. 1).

Day 2 consisted of two separate chicken entities placed on the Morfo trail near the intersection with the Castana trail. Rather than producing identical pieces, one instance was of fermented chicken, and the other, raw. (Fig.2).



Figure 1. Cortahojas trail (in red).

Various fruit items such as papaya, pineapple and watermelon were chosen as Day 3's organic matter. Mixes of the three were placed along the Cortahojas trail near the intersection with the Castana trail. (Fig. 3).

Results

On Day 1, two feces were produced at an approximate 5-meter distance from each other. One labelled Feces A was placed within a light gap, while the second labelled Feces B was located in more dense foliage with heavy ant traffic. Right off the start, dung beetle scarabs and a variety of flies hurried towards the freshly laid and odorful product.

The scarab beetles quickly buried themselves into the fecal matter and scooped out sizable balls to roll away as the flies began inspecting. Active competition engaged between the two parties as the dung scarabs hurried to retreat with their prize before being bullied off by the larger and more aggressive flies.

At the 15-minute mark, most of the beetles had already departed as larger insects such as wasps and cockroaches paid a visit.

Each feces held around a dozen members of Diptera and such activity attracted the attention of several onlookers. A lichen spider hiding under a fallen log managed to successfully hunt one of the larger flies, snatching the insect out of mid air. After another 15 minutes, ants had begun to send investigators to begin picking at the feces. By the 45 minute mark, a surge of ants, especially on Feces B had sent many of the flies fleeing, along with many of the spiders as well. As the first hour passed, Feces B had been completely overrun by ants, possibly due to its close proximity to an ant highway. However, a number of grasshoppers and cockroaches were spotted awaiting their turn on nearby leaves or branches, awaiting their turn.

Throughout the next hour, few insects besides the ants were able to touch the feces. Some brave monkey grasshoppers (Eumastacidae) made their attempt to take a meal but were quickly driven away. The only individual able to contend was a leafwing butterfly, using its long proboscis to reach between the smaller insects. Beginning the third hour displayed feigning interests from the



Figure 2. Morpho trail (in red).

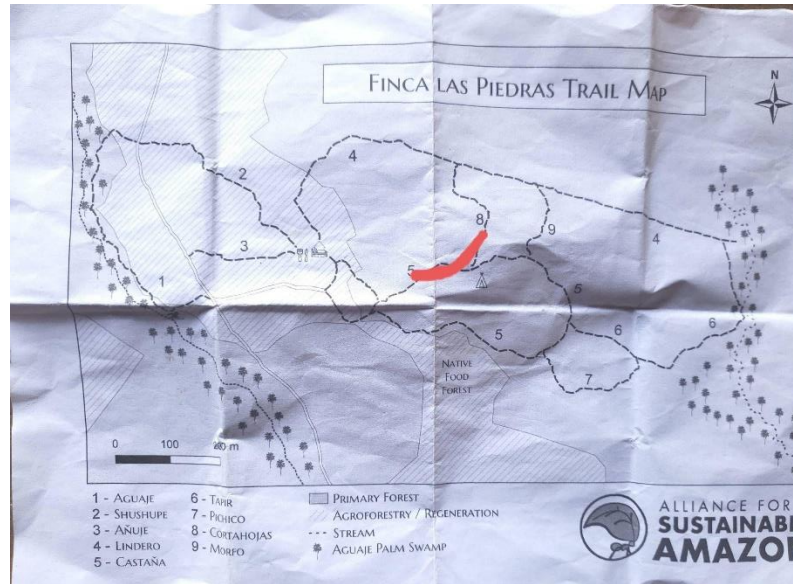


Figure 3. Castaña trail (in red).

ants, with forces beginning to draw away, especially from Feces A. This allowed room for several small flies to return, along with a few monkey grasshoppers and cockroaches.

After returning at a 5-hour interval, Feces A saw dramatic changes. Rather than being swarmed by ants, monkey grasshoppers had completely covered the matter. At the 24-hour interval, grasshopper frass had almost surpassed the amount of human feces. Feces B remained rather the same after 5 hours, still retaining interest of the ants. However, 24 hours yielded a shift in power amongst ants, as a larger species (possibly an army ant species) had overridden the smaller variant to take control.

On the Morfo trail, one instance of raw(unfermented) chicken and another of rotten(fermented) chicken was placed slightly off trail in rather open areas to allow for more comfortable studying. Once again, flies were the first to arrive, but only on the rotten entity. A cockroach seemed to stumble upon the raw chicken and enjoyed the meal. At half an hour, the various flies had already begun to see

competition, as several were driven away by a combination of wasps, stingless bees and cockroaches. A few dung beetles also showed up but were driven to the perimeter without getting any bites. The raw chicken, however, drew the attention of a few ants.

At the hour mark, each group of insects on the rotten chicken had claimed a certain section. Stingless bees, monkey grasshoppers and ants all had a third to claim. The greater presence of stingless bees even led to direct predation on them by wasps. The fresh chicken had also witnessed various separations. Turtle ants and two smaller species each took a body part for their own.

Throughout the next two hours, the clans shoved each other around for control of space. For a period of time, the stingless bees had driven many of the ants and grasshoppers out of the area on the rotten chicken. The larger turtle ants in particular began increasing their grasp on the fresh chicken. A few larger cockroaches and butterflies were able to make some room for themselves as well, kicking or flapping at their neighbors to demand space.

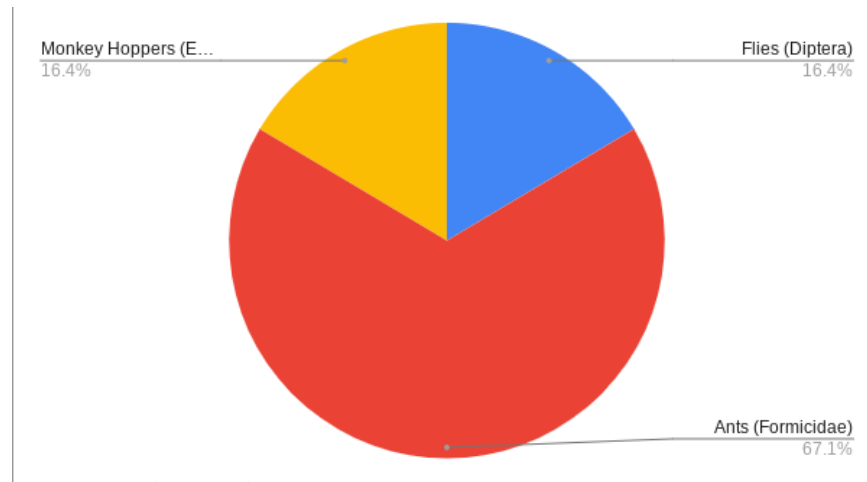


Figure 4. Feces possession by insect type.

Returning after a few more hours, the fresh chicken was now completely dominated by the large turtle ants. Each square inch part of the chicken possessed at least five of the insects, each chewing down at the parts. The rotten chicken however had seen a yellow species of stingless bee overrun the previous occupants. Although smaller, they took room from the ants and monkey grasshoppers while completely removing the original larger and black stingless bees (possibly vulture bees). Several of the vulture bees had even fallen victim to the swarm of other winged insects.

Day 3 consisted of mixes including papaya, pineapple and watermelon rinds. Both instances were left to rot for a day and a half. When placed out in semi-open areas, a few flies were the first to appear. Visits from a longhorn beetle and the occasional butterfly all started to point out towards a peculiar trend. Unlike the previous two experiments, none of the insects were keen on staying amongst the fruit for an extended amount of time. Even the various flies present quickly departed after inspecting the matter. However, it became apparent that the lack of individuals provided room for more diversity. At the half an hour mark, cockroaches, rove beetles and a few individual

ants made their way over. Even a small spider waited for any unsuspecting insect atop a slice of papaya and quickly departed after seeing little action.

Interestingly enough, despite the various different types of invertebrates present that were not spotted with the feces or chicken, activity across the fruit yielded little activity, especially long-term attention. Such continued for the next two hours. A return trip the next day saw the fruit barely touched and practically deserted.

Discussion

Which resource appeared to be the most valuable?

Throughout all the scrambles to collect as much fecal matter or chicken as possible, many of the insects risked their lives and several fell victim to other predators. Grazing upon such material must be extremely compelling in the eyes of the little arthropods.

Many of the participating animals viewed the organic components as absolutely crucial, but the question on whether any particular piece of the puzzle stood out was the topic of debate.

Rather than an element that possesses any real physical properties like that of a decapitated chicken head or the corn pellets from a portion of feces, the most contentious of all the resources was space itself. Prior to gouging into the stenchful material, each individual either large or small required an area of comfort. Adaptations run wild throughout the Amazon Rainforest, especially when looking at all of the well-equipped invertebrates. Even the most miniscule ant may possess an array of spines along its dorsal side and each grasshopper and cockroach comes packed with a powerful kick. Coming a bit too close to any individual of a different species may result in unnecessary and possibly dangerous conflict.

Retaining a decent radius of space around oneself was also a constant trend for many of the animals drawn towards the organic matter. While ants had sheer numbers to form a coat around whatever they chose, larger and more independent insects resorted to several distinct techniques. The monkey grasshoppers of Eumastacidae often pointed their heads towards the center of the feces or chicken, using their powerful hind legs to kick at any unsuspecting ants or stingless bees hoping to

gain more territory. The large and robust cockroaches maintained a similar kicking strategy but had the armor to bypass most competition. Butterflies on the other hand, with their more delicate structures, were forced to be more creative with their strategies. Some larger individuals could flap their wings in an aggressive manner to dissuade any neighbours and those with a longer proboscis could reach in from outside the boundaries while still obtaining some nutrients.

Which parties appeared the most dominant and why?

During each observation period, it became apparent that for the most part, a single type of insect would be the reigning party over the other species present. Controlling the overall space and maintaining the majority of territory, those with the most plentiful numbers and highest possessions of areas could dictate the overall direction of the process. For example, once the ants obtained control over a chunk of Feces, they only spun their forces along the most nutritious areas or those most convenient. However, the monkey grasshoppers were quick to stake their claim in

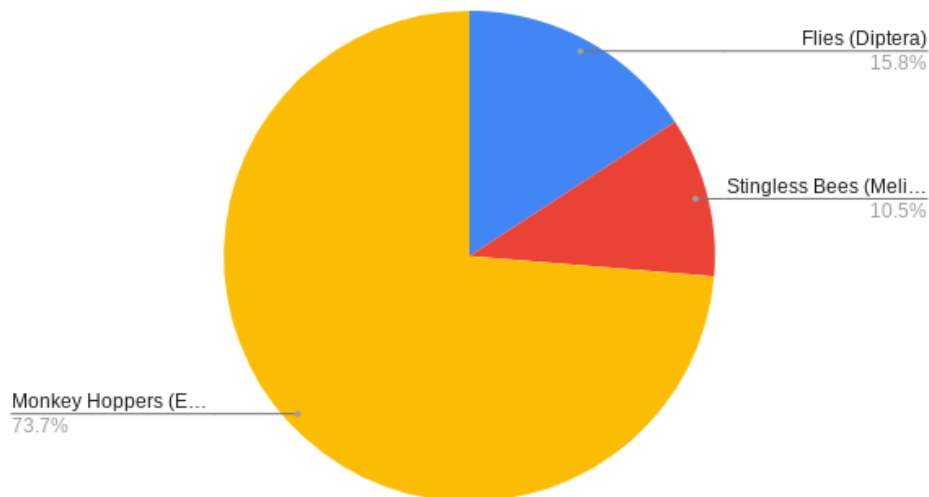


Figure 5. Chicken possession by insect type.

a different manner. When a gap was noticed, they would quickly pounce near the center and push others out with their hind legs' kicks.

Using the timelapse recording of Feces A, the footage was analyzed over the first three hours and given time values for each insect type during which they were the most dominant over the matter. Dominance was defined by whether such species had taken over a grand majority of the fecal product. Initially for the first 16.4% of the time, flies were the controlling party. As soon as the feces was produced, they used their heightened sense of smell and quick flight to begin feeding and laying eggs. However, since they did not possess any combative measures, ants quickly drove them away once numbers amassed. Using their collaborative strategies, the colony quickly surpassed the flies and retained a majority stake until sufficient nutrients were taken and interest feigned. This immediate gap was taken advantage of by the monkey grasshoppers. Every instance of space resulted in a larger insect hopping in from the surrounding foliage and trying its luck at making some room. Although the first few attempts were unsuccessful, they eventually managed to exceed the territorial space of the ants, giving them control for the last 16.4% of the time.

The rotten chicken filmed used the same manner of measurement as well. Similarly, the flies were the first to arrive and held possession for the preliminary 15.8% of time. Shortly after, a type of stingless bee known as the vulture bees flew in and took their claim. Quickly, their numbers amassed and began endlessly chewing into the carrion. Arriving much quicker this time, the monkey grasshoppers realized their weaker opposition and used their haste to remove most of the

competition. This resulted in possession for the larger insects for 73.7% of the initial three hours. Stingless bees were a surprising late arrival. Although the vulture bees had maintained a small chunk of territory for the grand majority of their time present, a more aggressive stingless variant also entered the picture nearing the end, giving this group of insects 10.5% of the possession time.

Conclusion

Traveling throughout the deciduous or coniferous forests of Northern America, larger piles of dung from mammals such as mooses or bears aren't the rarest site. Even a decomposing bird or rodent is a sight most hikers see at least once. However, such elements are quick to be recycled back into the forest within the Finca Las Piedras area and vanish before the eyes of many catches even a glimpse. The creatures which emerge during the presence of carrion and compost rival those you see on any traversing of the trails, especially in diversity and density. Such events are microcosms of the ecosystem as a whole, bringing together animals across the food chain to participate in direct and indirect competition on a completely different scale to behold. They captivate the imagination and allow one to experience the delicate balances between each organism and the resources around them.