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# Ants and Spices: The Potential of Spices to Repel Pest Ants (Formicidae)

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**Title:**

# Ants and Spices: The Potential of Spices to Repel Pest Ants (Formicidae)

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**Abstract:**

We examined the spices nutmeg, cinnamon, Ngo Hiang Spice Mix (anise, galangale, cinnamon and star anise) and turmeric for repellent activity against foraging ants. Control baits consisting of a cracker substrate topped with granulated sugar were presented next to treatment baits (cracker, granulated sugar and spice spread over the sugar) to ants in natural habitats. After an hour, the numbers of ants recruiting to the control and treatment baits were recorded. Jenny Vu first tested nutmeg and then cinnamon; Hritam Mitra tested turmeric; Joe Steven Hardy tested Ngo Hiang Spice Mix and Nirupama Chauhan tested turmeric. Data were analyzed with the sign test. Nutmeg was ineffective in repelling ants, but cinnamon, Ngo Hiang Spice Mix and turmeric all showed promise as ant repellents.

Keywords: Formicidae, ant repellent, bioassay

## 1. Introduction:

Pest ants can enter houses and cause problems for homeowners (Klotz et al. 1997). Insecticides are commonly used to control ants, but many insecticides have harmful effects on other species and the environment (Klotz et al. 1997). Several spices including black pepper (Ashouri and Shavesteh 2010), chili pepper (Ashouri and Shavesteh 2010, Mutalib et al. 2017), cinnamon (Mutalib et al. 2017), cloves (Ibrahim and Alahmadi 2015), cumin (El-Lakwah et al. 2000), ginger (Abidi and Butt 2015), mustard (Singh 2011) and turmeric (Wagan et al. 2016) have been shown to repel or kill insects. In this project we studied the effects of nutmeg, cinnamon, Ngo Hiang Spice Mix (anise, galangale, cinnamon, and star anise) and tumeric as repellents for ants.

## 2. Materials and Methods:

Each of us first chose five locations in nature and baited for ants with a control bait consisting of a cracker substrate topped with granulated sugar. The location where the bait had the most ant visitors was chosen for the experiment. Then we prepared treatment baits similar to the control except that the spice was added to the bait. Treatment baits were placed approximately 2.5cm from the control bait at five stations 1 m apart along a transect. After 30 minutes – 1 hour, numbers of ants on treatment and control baits (both on top of the bait and underneath the bait) were recorded. If the spice showed promise as a repellent, then 10 more stations of treatment and control baits were placed 1 m apart and the numbers of ants recruited to the baits were recorded.

*Jenny Vu*
To begin, baits with Ritz crackers as a substrate were topped with the bait material, granulated sugar. The first trial consisted of five replicates of nutmeg treatment baits. The second trial consisted of 10 replicates of cinnamon treatment baits.

*Hritam Mitra*
I used a cracker substrate with granulated sugar as a control bait and added turmeric for the treatment bait. I placed 10 control and treatment bait pairs along a transect and counted the ants on the baits after an hour.

*Joe Steven Hardy*
I baited for ants with a control bait consisting of expired coconut biscuits as a substrate topped with the bait material of granulated sugar. This control bait was placed in eight separate locations. If ants visited the bait, I prepared a treatment bait similar to the control except that the Ngo Hiang spice mix (anise, galangale, cinnamon and star anise) was added to the bait. Then I placed both a control bait and a treatment bait 4 cm apart at eight different locations.

*Nirupama Chauhan*
My control bait consisted of a cracker topped with granulated sugar and my treatment bait also had turmeric spice on it. I placed 10 replicates of control and treatment baits 1 m apart along a transect and recorded the numbers of ants on the baits after an hour.

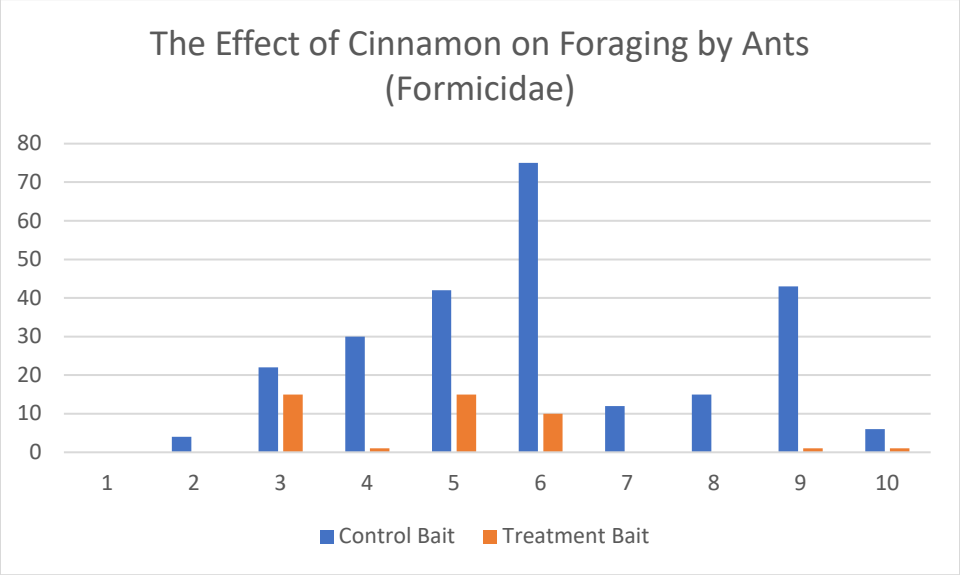
## 3. Results:

*Jenny Vu*
The following numbers of ants on control and treatment baits are as shown below in Table 1. The results were then statistically analyzed using the sign test. It was found that the ants did prefer the control bait over the treatment bait. The probability P-value was $P = 0.002$, indicating statistical significance.

Table 1. Number of ants on control and treatment baits when testing the spice Cinnamon.

| Control Bait | Treatment Bait | Description of Ants |
|---|---|---|
| 0 | 0 | N/A |
| 4 | 0 | Large, black |
| 22 | 15 | Large, black |
| 30 | 1 | Very small, black |
| 42 | 15 | Large, black |
| 75 | 10 | Very small, black |
| 12 | 0 | Very small, black |
| 15 | 0 | Large, black |
| 43 | 1 | Large, black |

| | | |
|---|---|---|
| 6 | 1 | Large, black |




After a preliminary set of 5 trials, mixed results indicated that nutmeg did not show promise as an ant repellent (Table 2).

Table 2. Number of ants on control and treatment baits when testing the spice Nutmeg.

| Control Bait | Treatment Bait | Description of Ants |
|---|---|---|
| 4 | N/A | Small reddish-black |
| 59 | 68 | Small reddish-black |
| 0 | 0 | Small reddish-black |
| 33 | 42 | Small reddish-black |
| 34 | 47 | Small reddish-black |

*Hritam Mitra*

There were more ants on the control baits than on the treatment baits with turmeric, but the difference was not significant (Table 4). However, the results were close to significance and turmeric has potential to be repellent to ants. Most of the ants attracted to both the control and treatment baits were tiny red ants.

Table 4. Numbers of ants on control baits and treatment baits with turmeric. A sign test revealed the difference was not significant (Number of differences = 10, Least common sign = 2; Probability P-value = 0.055).

| Meter number | Control bait ants | Treatment bait ants | Sign |
|---|---|---|---|
| 0 | 4 | 2 | + |

| | | | |
|---|---|---|---|
| 1 | 1 | 22 | - |
| 2 | 16 | 3 | + |
| 3 | 23 | 3 | + |
| 4 | 158 | 12 | + |
| 5 | 31 | 38 | - |
| 6 | 6 | 0 | + |
| 7 | 48 | 16 | + |
| 8 | 8 | 0 | + |
| 9 | 232 | 33 | + |

*Joe Steven Hardy*

I found the following numbers of ants on control and treatment baits with Ngo Hiang spice as shown below in Table 3. The sign test showed there were significantly more ants on the tops of the control baits than on the tops of the treatment baits (Number of differences 19; Number of least common sign 4; Probability P-value = 0.01).

Table 3. Number of ants on control and treatment baits when testing the Ngo Hiang spice mix. The sign test analyzed only the ants on the tops since those ants encountered the spice on treatment baits.

| # Bait | Control Bait | | Treatment Bait | | Sign Test on top |
|---|---|---|---|---|---|
| | Top | Bottom | Top | Bottom | |
| 1 | 2 | 32 | 0 | 63 | + |
| 2 | 25 | 6 | 0 | 0 | + |
| 3 | 17 | 0 | 4 | 0 | + |
| 4 | 3 | 8 | 0 | 0 | + |
| 5 | 73 | 7 | 5 | 0 | + |
| 6 | 2 | 1 | 2 | 0 | 0 |
| 7 | 5 | 0 | 3 | 3 | + |
| 8 | 10 | 0 | 6 | 4 | + |
| 9 | 7 | 3 | 0 | 3 | + |
| 10 | 1 | 2 | 0 | 18 | + |
| 11 | 0 | 2 | 1 | 2 | - |
| 12 | 2 | 3 | 13 | 0 | - |
| 13 | 4 | 3 | 2 | 0 | + |
| 14 | 3 | 0 | 12 | 0 | - |
| 15 | 3 | 0 | 5 | 1 | - |
| 16 | 2 | 0 | 0 | 1 | + |
| 17 | 5 | 2 | 4 | 3 | + |
| 18 | 4 | 3 | 3 | 0 | + |
| 19 | 5 | 72 | 0 | 11 | + |
| 20 | 6 | 23 | 4 | 3 | + |

*Nirupama Chauhan*
More ants recruited to control baits than to the treatment baits (Table 5), although the difference was not significant. Tumeric does show promise as an ant repellent.

Table 5. Ants recruiting to control and treatment baits with turmeric spice. The Sign test was used to analyze the results (Number of differences = 10, Least common sign = 3, Probability P - value= 0.172.

| Meter number | Control bait ants | Treatment bait ants | Sign |
|---|---|---|---|
| 0 | 6 | 2 | + |
| 1 | 4 | 0 | + |
| 2 | 0 | 1 | - |
| 3 | 9 | 2 | + |
| 4 | 3 | 0 | + |
| 5 | 7 | 4 | + |
| 6 | 16 | 3 | + |
| 7 | 16 | 9 | + |
| 8 | 2 | 13 | - |
| 9 | 4 | 8 | - |

## 4. Discussion:

The research conducted by Jenny Vu indicates that cinnamon spice might be a good repellent for ants. In a study conducted by Mutalib et al. (2017), researchers found that the spices black pepper, chili pepper, and cinnamon extracts had a repelling effect on the odorous house ant, *Tapinoma sessile*. Using this information, cinnamon was determined to be a viable candidate for further research. After two rounds of testing 10 pairs of the control and treatment bait, the data indicate that cinnamon, *Cinnamomum zeylanicum,* would likely function as an effective ant repellent. Joe Steven Hardy's research indicates that Ngo Hiang spice mix is a good repellent for ants. This spice mix contains cinnamon which might be responsible for the repellent effect. However, the other spices such as anise, star anise, and galangale should be investigated individually to determine if they are also repellent. Hritam Mitra's research on turmeric had similar results to Nirupama's experiment with the same spice. More ants were attracted to the control baits than the treatment baits with turmeric but the results were not statistically significant. Wagan et al. (2016) found that the essential oil of turmeric was repellent to the ant *Monomorium pharaonis*, so further research into this spice would be valuable.

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