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Ants and Spices: Multiple Bioassays Investigating Turmeric (*Curcuma longa*) and Chili Powder as Repellents for Ants (Formicidae)

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Title:

Ants and Spices: Multiple Bioassays Investigating Turmeric (*Curcuma longa*) and Chili Powder as Repellents for Ants (Formicidae)

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Abstract:

Spices offer an environmentally friendly method of controlling ants (Formicidae) in homes. In this study, I used three bioassays to examine the effect of Turmeric (*Curcuma longa*) and one bioassay to examine the effect of Chili Powder as repellents for ants. Tests were conducted near active ants outdoors. All bioassays examined paired control and treatment baits along a transect, and control baits consisted of a small sheet of corrugated cardboard (a sterile yet easy to manipulate substrate) with granulated sugar on top. In the first bioassay, treatment baits were similar to controls but with Turmeric covering the sugar. In the second and third bioassays, treatment baits had a ring of Turmeric surrounding the sugar on the substrate. In all Turmeric-focused bioassays, a Sign Test demonstrated that Turmeric holds significant possibility as a repellent for ants but needs further study. Finally, the fourth bioassay was conducted as the first, but with Chili Powder in place of the Turmeric and showed no statistical differences between the control and treatment groups.

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), and mustard (Singh 2011) have been shown to repel or kill insects. In this project, I studied the spices Turmeric (Wagan et al. 2016) and Chili Powder as a repellent for ants.

2. Materials and Methods:

I baited for ants with a control bait consisting of cardboard or a cracker as a substrate topped with the bait material granulated sugar. This control bait was placed in 10 locations. If ants visited the bait, I prepared a treatment bait similar to the control except that a spice was added to the bait. Then, I placed both a control bait and a treatment bait 2 inches apart at 10 different locations. On the first iteration of 10, to create the treatment bait, I first placed ½ tablespoon of bait on the center of a ~4 x 4 square of brown cardboard, and then placed ½ tablespoon of Turmeric on top (see table 1). For the second and third iterations, I created a ring of Turmeric

around the bait (see tables 2 and 3). Finally, for the fourth iteration, I completed the steps described for the first iteration, but with Chili Powder in place of Turmeric.

3. Results:

In the first iteration, I found the following numbers of ants on control and treatment (Tumeric) baits as shown below in Table 1. I analyzed the results statistically using the Sign Test and found that the ants did not prefer the control bait over the treatment bait. The probability value was P = 0.14

For the second iteration (rings), I found the following numbers of ants on control and treatment (Tumeric) baits as shown below in Table 2. I analyzed the results statistically using the Sign Test and found that the ants did prefer the control bait over the treatment bait. The probability was P-value = 0.003

For the third iteration (rings), I found the following numbers of ants on control and treatment (Tumeric) baits as shown below in Table 3. I analyzed the results statistically using the Sign Test and found that the ants did not prefer the control bait over the treatment bait. The probability was P-value = 0.31

For the fourth iteration, I found the following numbers of ants on control and treatment (Chili Powder) baits as shown below in Table 4. I analyzed the results statistically using the Sign Test and found that the ants did not prefer the control bait over the treatment bait. The probability was P-value = 0.63

Table 1: Number of ants on control and treatment baits when testing the spice Turmeric on top of bait.

Control Bait	Treatment Bait
1	0
1	0
5	2
1	0
1	0
0	1
0	0
0	0
0	1
1	0

Table 2: Number of ants on control and treatment baits when testing the spice Turmeric in a ring around the bait.

Control Bait	Treatment Bait
3	0
2	0
1	0
1	0
1	0
1	0
1	0
1	0
0	0
0	0

Table 3: Number of ants on control and treatment baits when testing the spice Turmeric in a ring around the bait.

Control Bait	Treatment Bait
2	0
3	2
1	3
1	1
2	2
3	1

Table 4: Number of ants on control and treatment baits when testing the spice Chili Powder on top of the bait.

Control Bait	Treatment Bait
14	2
1	2
1	2

0	0
1	0
0	1
1	0
0	1
2	0
0	0

4. Discussion:

This study indicates that Turmeric spice has much potential as a good repellent for ants but will need a further study and a larger experiment to fully analyze. In direct observation, the ants would not cross the Turmeric, and would not recruit other ants to the substrates with Turmeric. This study also indicates that Chili Powder did not have an effect on the ants. Furthermore, when using the ring experiment style, the experiments were more likely to be statistically significant.

References:

Abidi, R. & S. Butt. 2015. Repellent activity of cardamom, ginger and nutmeg against certain insect pests. International Journal of Zoology and Research 5(6): 1-6.

Ashouri, S. and N. Shayesteh. 2010. Insecticidal activities of two powdered spices, black pepper and red pepper on adults of *Rhyzopertha dominica* (F.) and *Sitophilus granarius* (L.). Munis Entomology & Zoology, 5 (2): 600-607.

El-Lakwah, F.A., Mohamed, R.A., & El-Aziz, A.E. 2000. Toxicity and joint action of cumin seeds extract with certain controlled atmospheres against stored-product insects.

Ibrahim, R.A. & S.S. Alahmadi. 2015. Effect of *Syzygium aromaticum* cloves on larvae of the rhinoceros beetle, *Oryctes agamemnon* (Coleoptera: Scarabaeidae). African Entomology 23(2): 458-466.

Klotz, J.H., Greenberg, L., Shorey, H.H., & D.F. Williams. 1997. Alternative control strategies for ants around homes. J. Agric. Entomol. 14(3):249-257.

Mutalib, N.A., Azis, T.M.F., Sarina Mohamad, Azizan, N.I., Sidek, H.J., Roziana, M. H. and Z. Razali. 2017. The repellent and lethal effects of black pepper (*Piper nigrum*), chilli pepper (*Capsicum annuum*) and cinnamon (*Cinnamomum zeylanicum*) extracts towards the odorous house ant (*Tapinoma sessile*). Journal of Engineering and Applied Sciences 12(8): 2710-2714.

Singh, R. 2011. Evaluation of some plant products for their oviposition deterrent properties against the *Callosobruchus maculatus* (F.) on Chik pea seeds. Journal of Agricultural Technology 7(5): 1363-1367.

Wagan, T., Chakira, H., He, Y., Zhao, J., Long, M. and Hua, H. 2016. Repellency of two essential oils to *Monomorium pharaonis* (Hymenoptera: Formicidae). Florida Entomologist 99(4): 608-615.