

# Abamectin: Ant Toxin or Antifeedant?

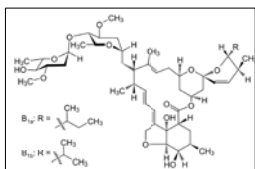
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## Introduction

- Abamectin is a mixture of two avermectins (~80% avermectin B1a and ~20% avermectin B1b).



- Abamectin was first isolated and characterized in 1979.<sup>1</sup> It is produced by the soil bacterium *S. treptomycetes avermitilis* and has insecticidal and anthelmintic properties. Previous studies have classified as an insecticide when sprayed onto various ant species.<sup>2,3</sup>
- One means of ant control is use a bait – food that is attractive to ants, but which also contains a toxin. The theory is that ants will consume it, carry it to the next and use it to feed larvae thus poisoning and liking them.
- An “old” version of RAID Ant Bait contained chlorpyrifos as the toxin. Recently, Johnson Co. came up with a new and “improved” version called Raid Ant Bait III, which contains naturally occurring abamectin as the toxin.
- The main components of commercial Raid Ant Bait III are peanut butter and abamectin. Abamectin when sprayed on ants is a well know insecticide; however, it has somewhat dubious reputation as an effective ant bait.<sup>4</sup> RAID Ant Bait III has received numerous complaints and poor reviews over its “improved” abamectin –containing product. A simple search for the product’s reviews shows that Ant Bait III fails to attract ants to the trap.



Figure 1. Customer ratings of RAID Ant Bait III on Amazon.

- We chose to use Borax as a comparison to abamectin because it has previously been proven to demonstrate properties of a toxin.<sup>5</sup> The ants we observed were tentatively identified as red imported fire ants (*Solenopsis invicta*), longhorn crazy ant (*Paratrechina longicornis*), and ghost ants (*Tapinoma melanocephalum*).

## Objective

The study was designed to test whether abamectin is ant toxin or an antifeedant and to compare it to other well known ant toxins such as borax and boric acid.



## Method

- Ants, depending on a species, feed on simple carbohydrates (monosaccharides and disaccharides), or fats. We prepared samples of various food spiked with Borax, Boric Acid, or abamectin and a control of plain peanut butter or white chocolate. We avoided dark chocolate as theobromine may be an antifeedant.



Some of the samples used in this study listed in Table 1.

Table 1. Composition of representative samples used in this study.

ID #	Ingredients	Peanut Butter (g)	Sugar (g)	Antifeedant/Toxin	Antifeedant/Toxin % by weight
PB1	PB/sugar/Abamectin & Olive oil	23.88	1.269	1 mL of (0.0506g + 10 ml oil)	0.02%
PB2	PB/sugar/Borax	23.7003	1.248	1.1295g	0.04%
PB3	PB/sugar	23.7533	1.251	0	0

## Results

After presenting red imported fire ants (*Solenopsis invicta*) with commercial RAID Ant Bait III and our prepared mixtures of abamectin and peanut butter on aluminum foil, the majority of ants appeared to withdraw or ignore the samples for the first 20 minutes of observation. The few ants that approached the bait appeared to test it with their antennae, but quickly recoiled. Only after all the other nearby food sources were exhausted did they begin to try the abamectin samples. When presented with samples containing peanut butter with added Borax, Boric Acid, and a control of plain peanut butter, the ants readily swarmed and gorged on all the samples without hesitance.



Figure 2. Fire ants consumed sample of peanut butter with added borax (left) while ignoring peanut butter with added abamectin (right).



Figure 3. Some fire ants consumed abamectin-containing sample hours later.

- Longhorn crazy ants (*Paratrechina longicornis*) exhibited behavior similar to the fire ants (*Solenopsis invicta*).
- Ghost ants (*Tapinoma melanocephalum*) appeared to completely ignore samples of peanut butter with added abamectin.

## Discussion

- A toxin is a substance that is harmful when consumed, on contact with, or absorption by body tissues.
- An antifeedant is a substance that is recognized by an organism as undesired for consumption.
- In the papers referenced, abamectin was used for pest control by spraying it on ants, in which they cannot avoid exposure. However in this experiment, the ants were given the choice to consume it. Since it was apparent that ants avoided consuming samples with abamectin, it suggested the ants recognized it as an antifeedant. Thus, properties of abamectin are more consistent with those of an absolute antifeedant upon immediate exposure and a relative antifeedant after some time compared to those of a toxin.

## Conclusion

Based on the results obtained so far, it appears that an abamectin-containing bait is not an effective means of ant control.

## Acknowledgments

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## References

- Burg, R.W.; Miller, B.M.; Baker, E.E.; Birnbaum, J.; Currie, S.A.; Hartman, R.; Kong, Y.L.; Monaghan, R.L.; Olson, G.; Putter, J.; Tunac, J.B.; Wallick, H.; Stapley, E.O.; Oiwa, R.; Omura, S. *Antimicrobial Agents and Chemotherapy* 1979, 15, 361–367.
- Albers-Schoenberg, G.; Arison, B.H.; Chabala, J.C.; Douglas, A.W.; Eskola, P.; Fisher, M.H.; Lusi, A.; Mrozik, H.; Smith, J.L.; Tolman, R. L. J. *Am. Chem. Soc.* 1981, 103, 4216-422.
- Fisher, M.H *Recent Advances in avermectin research.* ACS Symposium Series 1993 524(Pest Control with Enhanced Environmental Safety), 169-82.
- Reviews of customers posted on amazon.com (accessed on March 26, 2012).
- Niyaz, N.M.; Tisdell, F.E.; Watson, G.B.; Renga, J.M.; Lo, W.C.; Yap, M.C.H. Preparation of insecticidal pyridine compounds as pesticides. *From PCT Int. Appl.* 2010.