

The Effectiveness of Carrot Seed Oil and Citronella as Repellants of Bean Beetles, *Callosobruchus maculatus*



Gabriel Onor¹ and Illya Tietzel²

¹) Benjamin Franklin High School, New Orleans, ²) Southern University at New Orleans, New Orleans -USA

Introduction

The bean beetle, *Callosobruchus maculatus*, is an agricultural pest destroying cowpeas in West Africa [1,2] and Brazil [3]. *Callosobruchus maculatus* has a life cycle (Fig.1) involving larval growth in the bean and is widely distributed making it a global pest (Fig.2). In order to protect crops insect repellants are used (Fig.3 a,b). Natural substances from citronella and other plants (Tawatsin et al. 2001, Muller GC et al. 2009) were successful insect repellants (Fig.3 c). Repellants had desired effects also on beetles (Ukeh DA, et al. 2010, Ukeh DA, et al. 2009). Furthermore, repellants worked also in the case of *Callosobruchus maculatus* [4,5] Stevens CV, et al. 2005; Tripathi AK, et al. 2000).

Hypothesis

Citronella was found to be an effective repellent for insects and even beetles. Thus it is hypothesized that Citronella most likely repel *Callosobruchus maculatus* (Fig.4). Furthermore, citronella appeared to be harmless to human beings. Another plant substance commercially available and harmless for humans is carrot seed oil. Maxia A., et al. (2009) reported that carrot seed oil had beneficial anti-fungal activities. We wondered whether carrot seed oil also had repellent functions.

Material & Methods

To test the hypothesis, bean beetles from Carolina Biologicals were placed in containers with cow peas without any repellent (negative control) or with alternatively either citronella or carrot seed oil for several days (Fig.5,6). Over the time course of the experiment numbers of bean beetles were counted that were close to the beans, that were repelled from the beans with hypothetical repellent, found alive, dead or missing.

Results

No beetle was found inside cup of beans under citronella treatment and higher numbers of dead beetles were observed in comparison to controls or carrot seed. (Fig.7,8,9). Carrot seed oil treated containers had beetles in cowpeas, more than the control (Fig.10).

Conclusion & Future Research

Citronella functioned as repellent and insecticide as hypothesized. Carrot seed oil worked as an attractant. Future research can explore the feasibility to use carrot seed as a decoy to lure bean beetles away from threatened beans. A combination of push-pull with citronella should be considered.

References

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Acknowledgments

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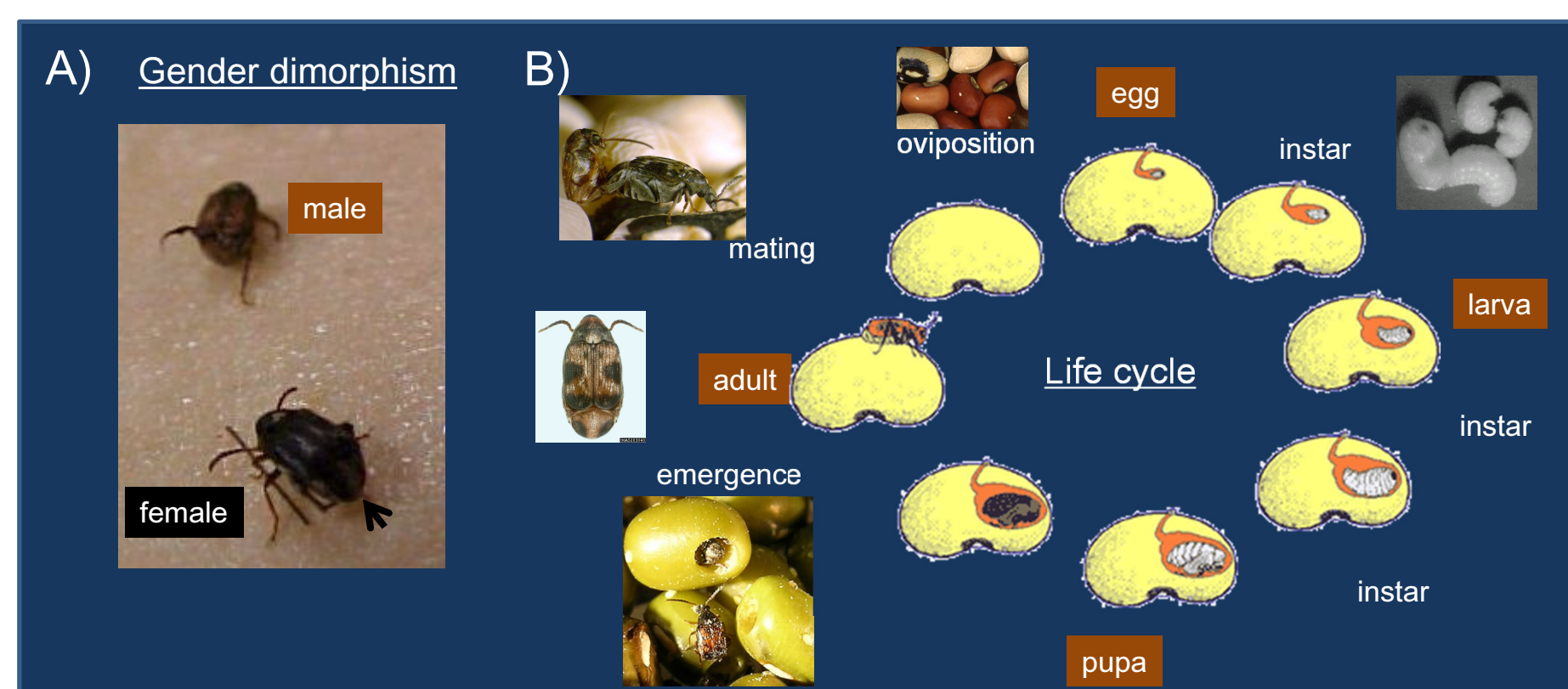


Fig.1 Bean Beetle *Callosobruchus maculatus*. The life cycle includes larval development inside beans such as cowpeas explaining the common names of “bean beetle” or “cowpea weevil”.

Photos: (1) Tietzel (2) Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org (3) http://www.dpi.qd.gov.au/26_6016.htm (4) <http://tomdoran.net/cowpea/english/background.htm>

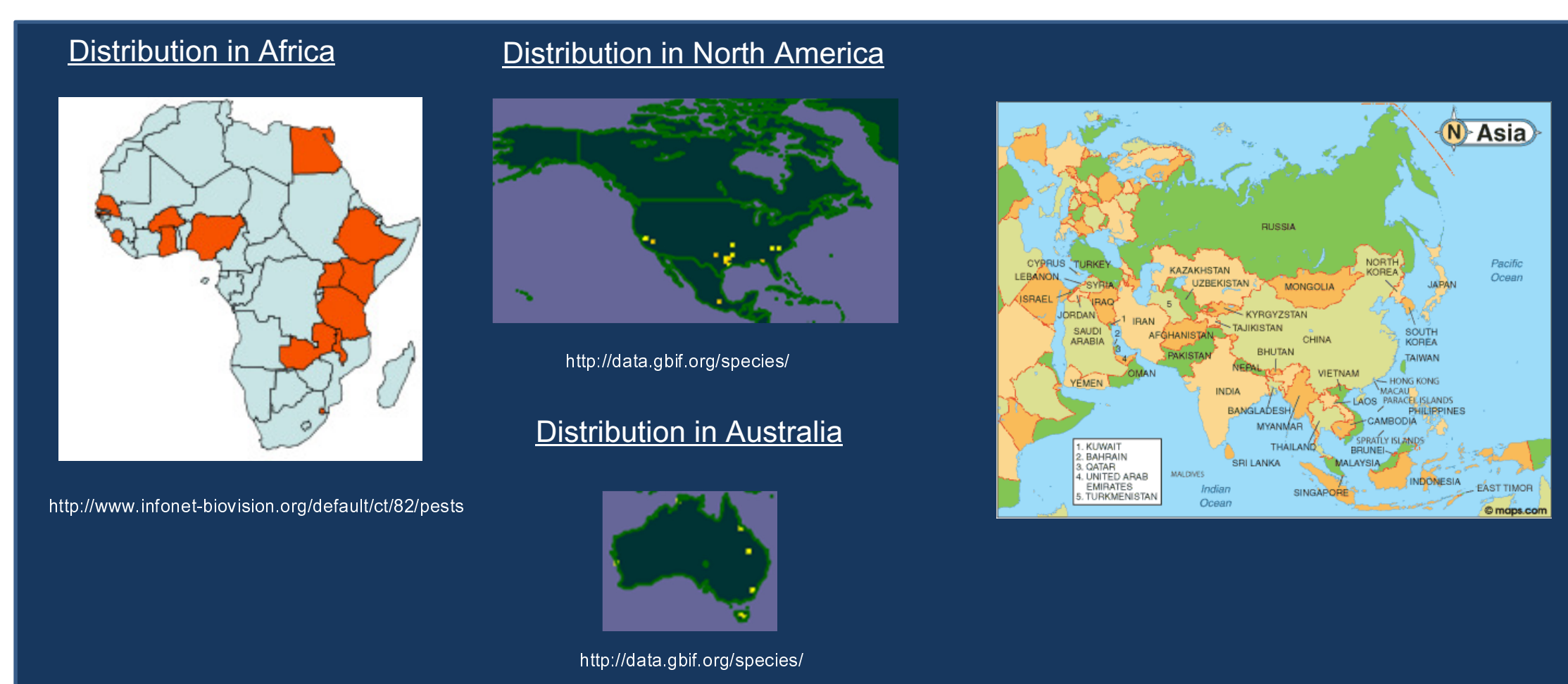


Fig.2 Distribution of *Callosobruchus maculatus*. *Callosobruchus* is an agricultural pest in Africa, North America, Brazil, Phillipines, Australia and Asia.



Fig.3 Protection of crop by use of repellants.

A) Repellents effective against pest to protect crops. B) Compounds from plants protect produce from pests. C) Plant extract citronella as insect repellent and insecticide effective against beetles such as weevils.

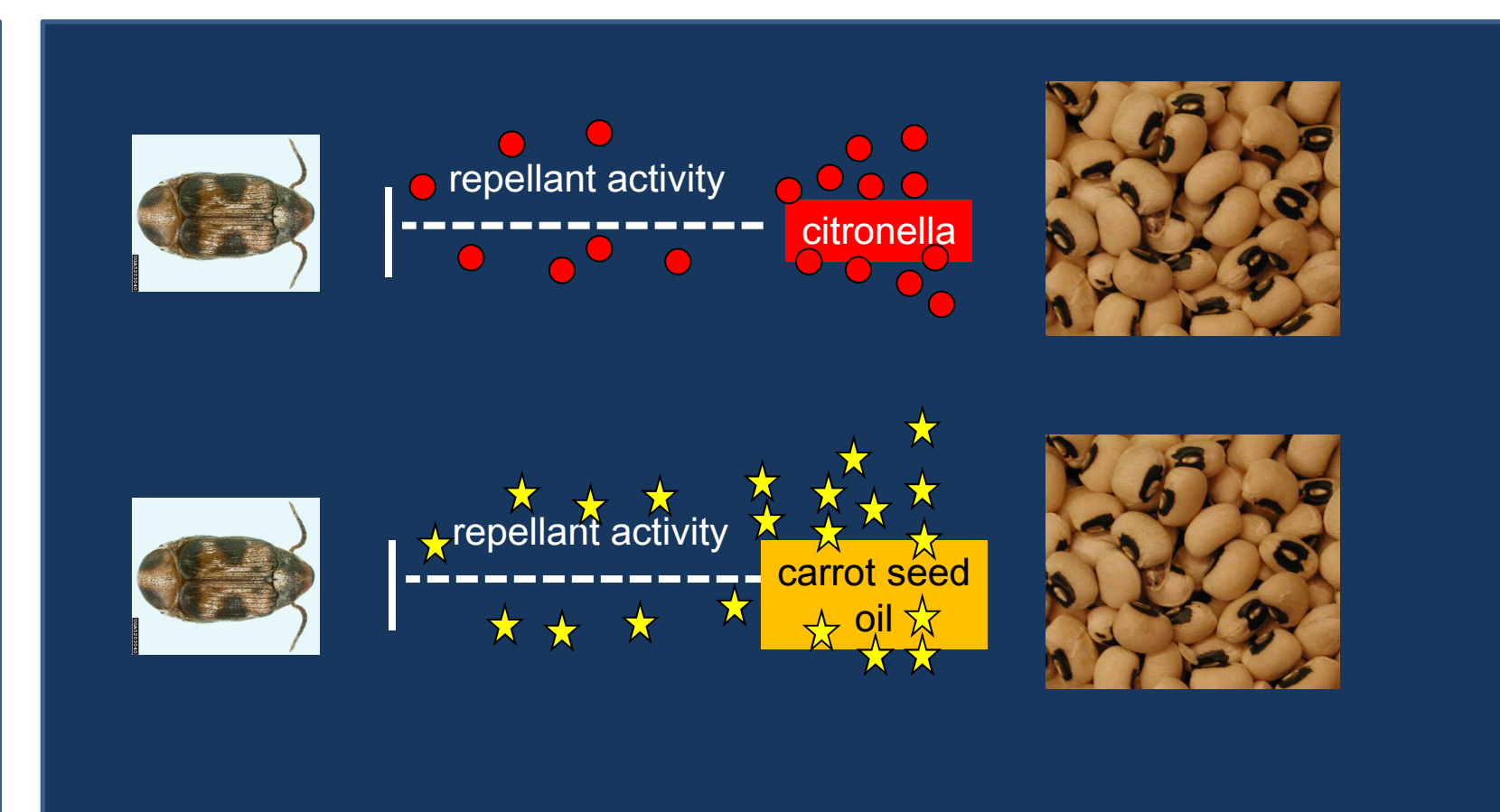


Fig.4 Hypothetical bean beetle repellants. Citronella and carrot seed oil is hypothesized to be repellent against *Callosobruchus maculatus*, thus protecting cow peas.

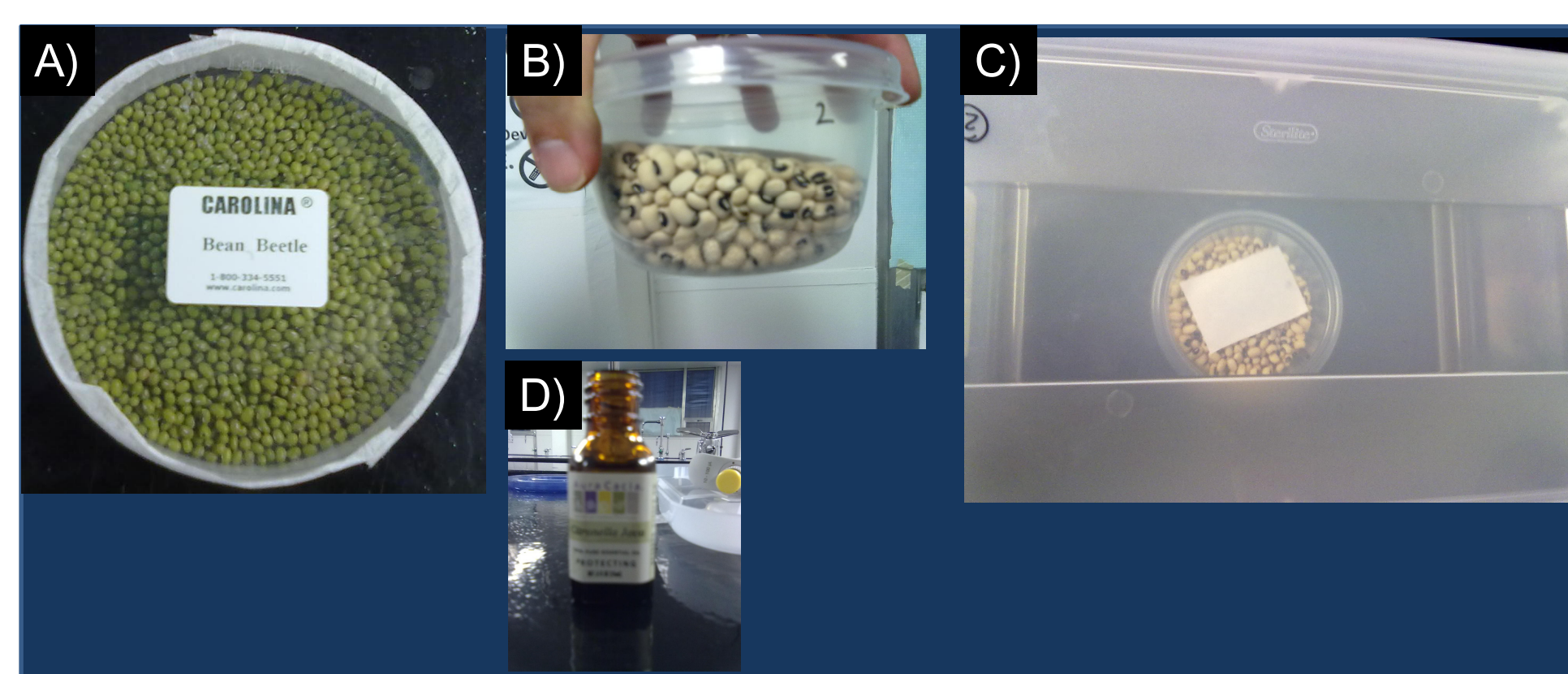


Fig.5 Material.

A) Bean beetles from Carolina Biologicals were used. B) 250 mL Cowpeas from Rouses supermarket were placed into 414 mL ziploc plastic containers. C) 2.5 x 4 cm of bibulous paper was placed on cowpeas for dispersal of repellants. 14L plastic containers from Big Lots Inc. served as incubation chambers. D) Citronella, carrot seed oils were from Whole Foods.

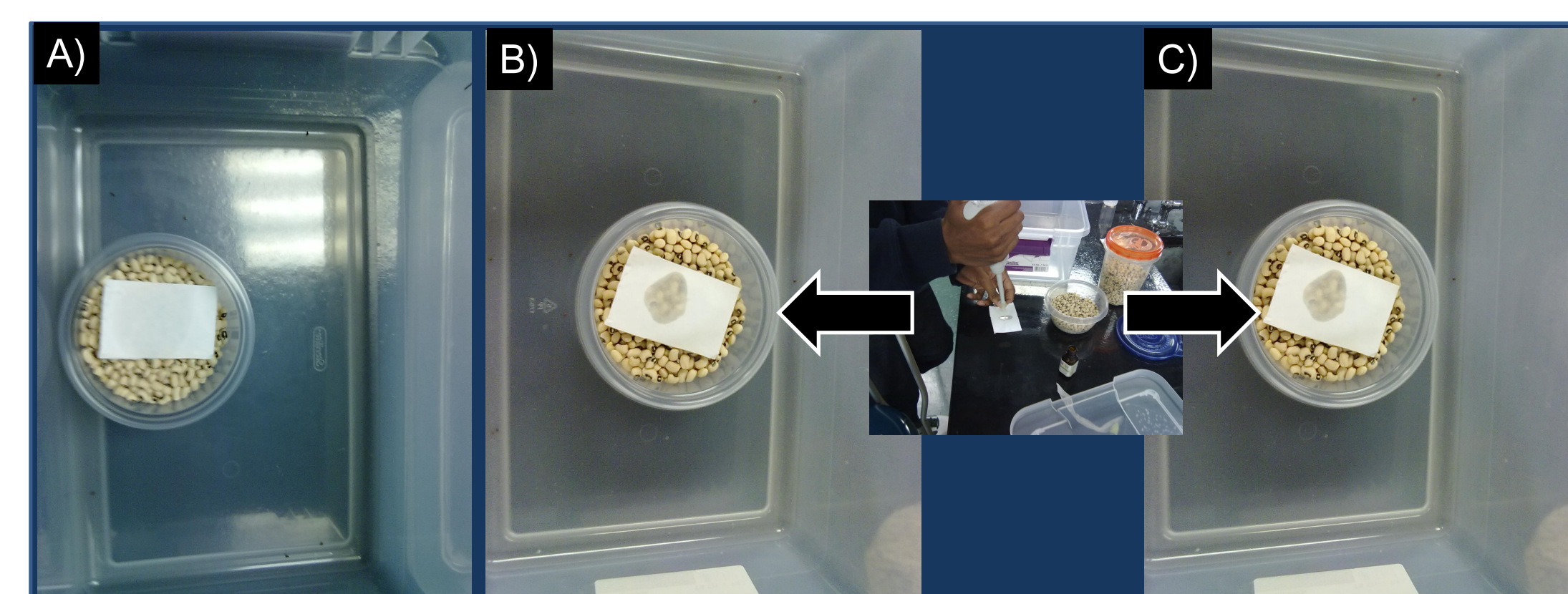


Fig.6 Experimental set up.

8 beetles each were placed in incubation chambers containing cow peas without any olfactory compound (A) as negative control, or alternatively with 50 uL citronella (B) or carrot seed oil (C).

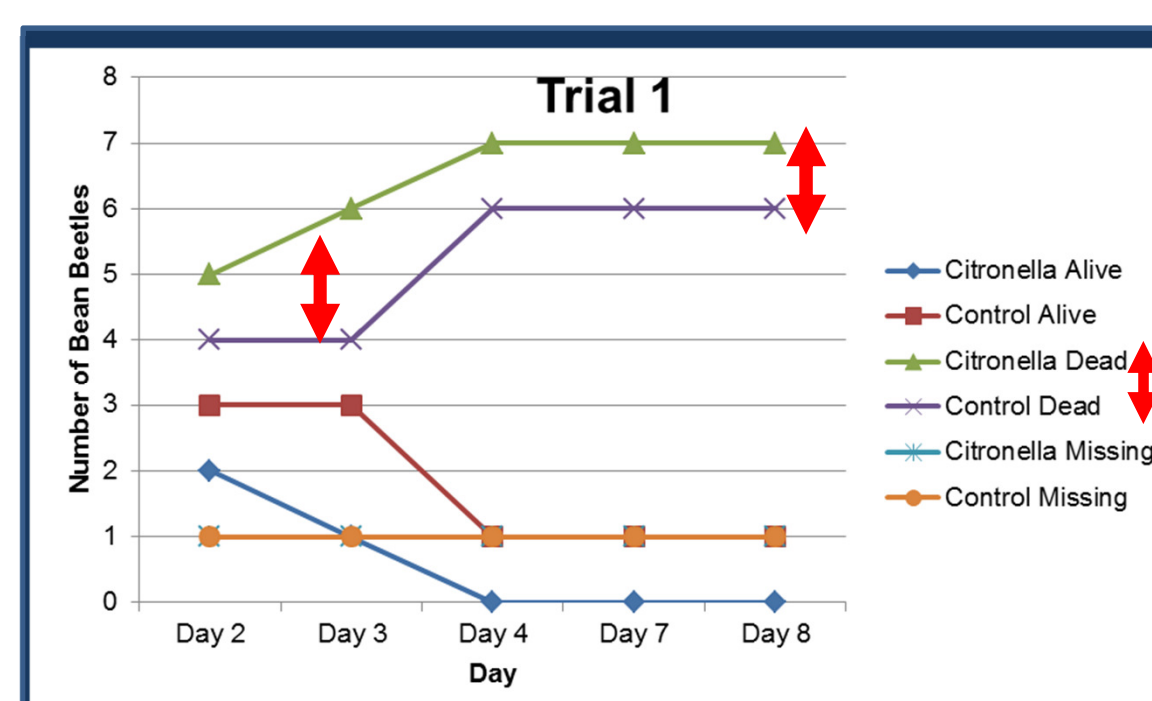


Fig.7 Bean Beetles Alive, Dead, and Missing in Trial 1. Higher number of dead beetles with citronella.

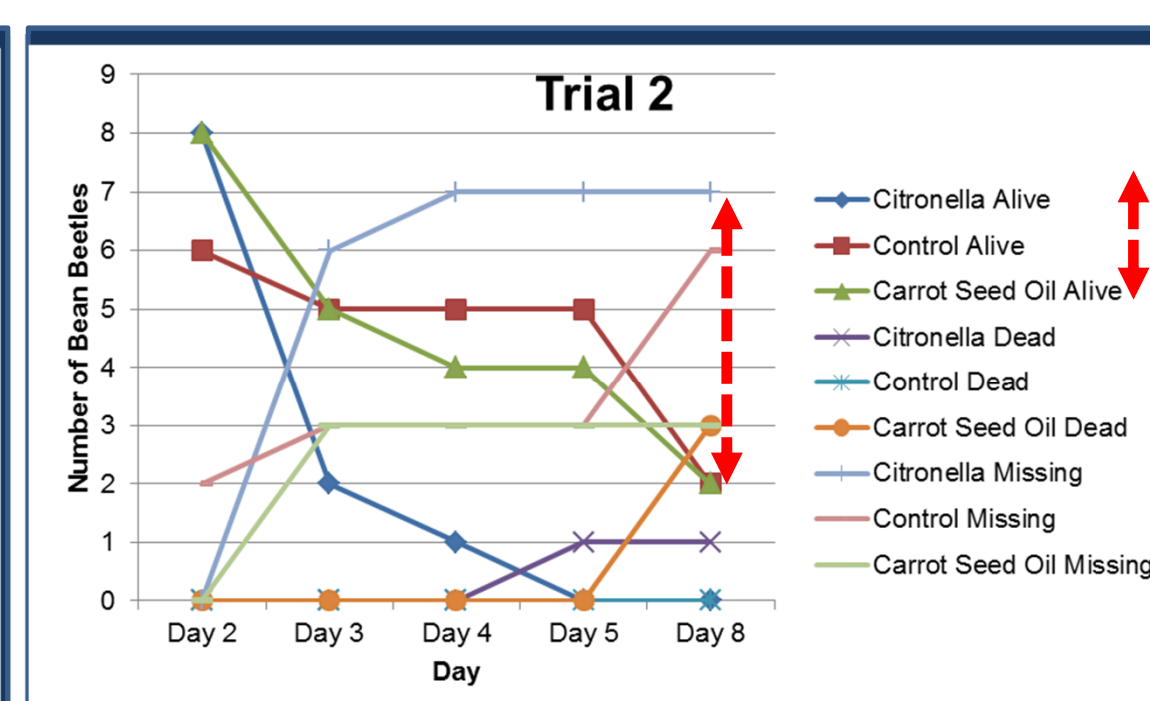


Fig.8 Bean Beetles Alive, Dead, and Missing in Trial 2. Insecticidal effects of citronella.

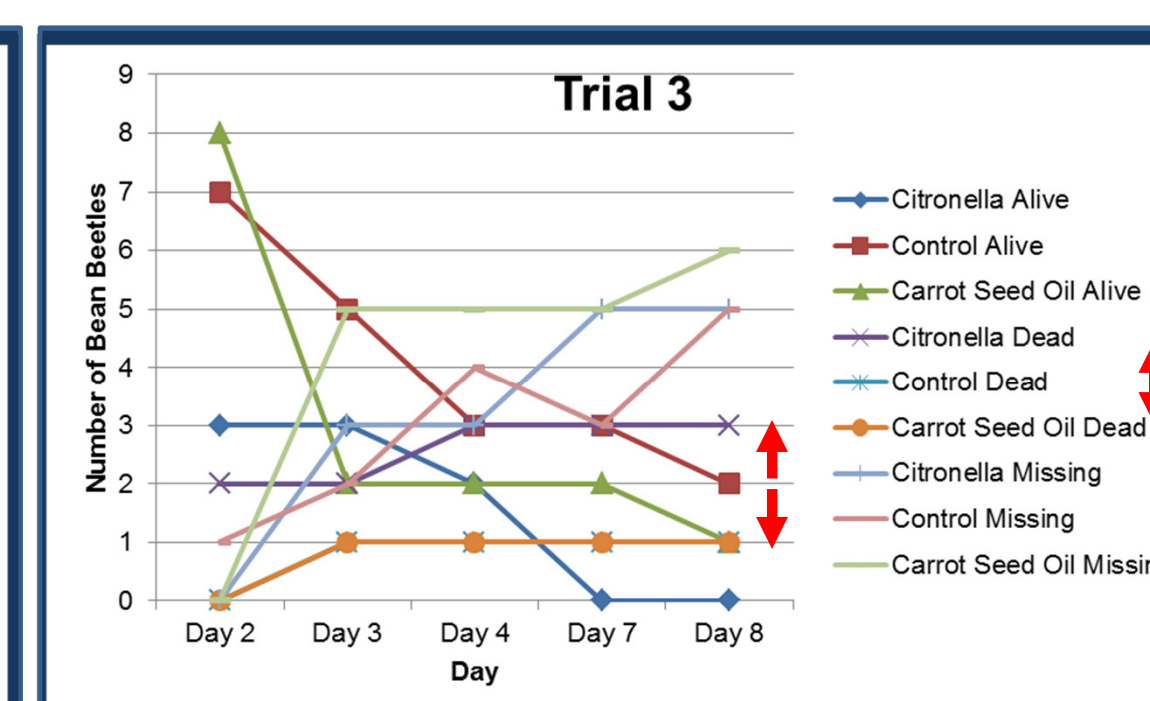


Fig.9. Bean Beetles Alive, Dead, and Missing in Trial 3. Insecticidal effects of carrot seed oil are minor in comparison to citronella.

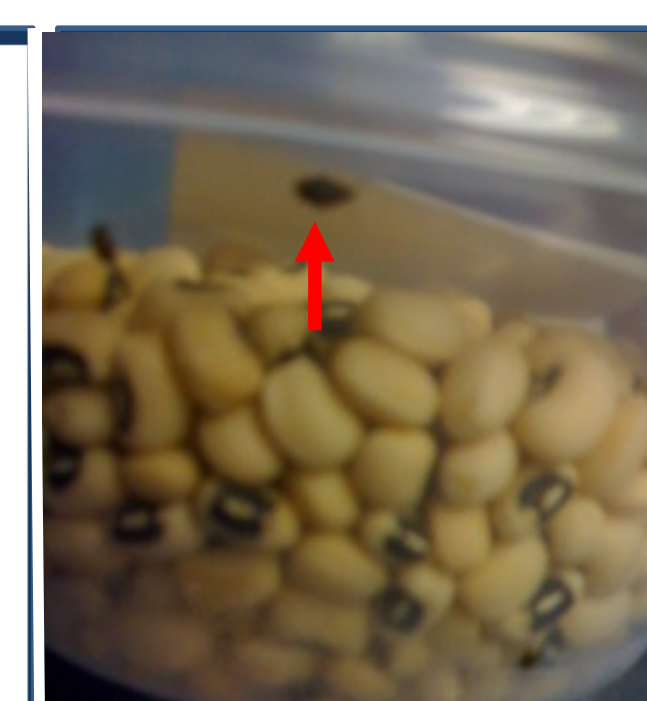


Fig.10. Bean Beetles attracted to carrot seed oil.