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## RESEARCH ARTICLE

## IMMORTALS TO MORTALS - HOME REMEDIES FOR CONTROL OF INDOOR PESTS AND THEIR EFFICACY

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### Abstract

Animal associations such as parasitism, symbiosis, mutualism, antagonism and prey-predator relationship play an important role in ecological balance. Indoor pests play a key role as decomposers, and live in close contact with humans. House hold pests are the carriers of many pathogenic bacteria both externally, internally and also in their droppings. The pests are known to cause diseases, allergies and respiratory problems to humans. This menace of pests should be addressed through control measures at regular intervals. Generally chemical treatments like aerosols, coils are used for control of pests, which are expensive, may cause side effects to the human populations. Simple house hold remedies can be cost effective control measures with less toxicity to humans at source and result in 100% control. During the study three such methods were selected, experimented and compared for their cost effectiveness and duration of pest free environment with almost zero side effects.

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### Introduction

Pests play a prominent role in anthropogenic populations as decomposers and also as sources for the spread of diseases and allergens. Animal populations are interdependent in the nature. Anthropocentric environmental changes are of great importance as different populations of micro, meso and macro levels get affected structurally, functionally, numerically and can cause imbalance. Cockroaches are insects with omnivorous habits, live in close contact with human beings and work as degraders which cause health problems. These indoor pests belong to kingdom : *Animalia*, Phylum : *Arthropod*, Class: *Insect*, Order : *Blatteria*, Family : *Blattidae*, Genus: *Periplaneta* Species: *Periplaneta americana*. The life cycle of roaches is short and hemimetabolus (eggs → nymph → adult) and without larval stage.

Gram positive and gram negative bacteria found to be carried on the external body parts and internal digestive tracts of the cockroach (Sisai Mapuchane et.al. 2006). Their feeding mechanisms and filthy breeding habits make them the ideal agents for harboring and transmitting pathogenic bacteria.

Studies have been carried out on the pathogenic bacteria of cockroaches (*Staphylococcus aureus*, *E.coli*, *Streptococcus* spp., *Enterobacter* spp and *Pseudomonas* spp.) their antibiotic sensitivity and the infections caused by them which are easily treatable (Lamiaa Bouamama et. al 2010). Control of these arthropod vectors would allow a reduction of the transmission of these pathogenic bacteria.

A primary prevention of the roaches is better than usage of antibiotics and other anti-allergens. Control methods include usage of aerosols (sprays), baits, IGR- Insect growth regulators, gels (Muller and Kohler, 2003) and biological methods by using *Metarhizium anisopliae* and *Beauveria bassiana* (Ramirez et.al., 2008) The cost effective control measures can be developed using simple house hold materials with less toxicity to humans at source and 100% control. During the study three such methods were selected, experimented and compared for their cost effectiveness and duration of roaches' free environment with almost zero side effects.

### Materials and methods:

Cockroaches were collected from grocery shop in a sterile collecting jar. Two to three cockroaches were

transferred to a sterile assay tube and 5 ml of normal sterile saline was added to it. It was shaken very gently to collect the external flora. Roaches were dissected in sterile conditions and digestive tract was collected in three parts foregut, midgut and hind gut in a sterile test tubes containing sterile saline. The samples homogenate was prepared and centrifuged at 100 rpm for 10 minutes. The supernatant of the interior parts homogenate and the saline used for washing cockroaches were considered as sample to study the internal and external bacterial populations. The saline dilutions were made up to  $10^3$  dilutions and considered for plating on nutrient agar plates. Colonies were isolated and the characteristics were studied using selective media and biochemical tests as suggested by Bergey's manual.(2001)

Three mixtures (three chemical combinations and one biomaterial combination) were considered for the control of pests. The different controls were made in a base containing

Wheat flour (150g), sugar (30g), and oil( as required to make pellet) as components

Control 1; pellets made up of boric acid

Control 2: pellets made up of Baking soda,

Control 3: pellets made up of rind of bottle gourd, Cucumber, garlic and sugar

Control 4: baking soda and boric acid in different combinations (50:50; 25:75; 75:25) (weighing around 320g each component or mixture)

Pellets in a range of 0.5 to 10 gm weight were prepared from each of the compounds and used in triplets to check their effects *in vitro* and *in vivo* conditions.

Commercially available cockroach controls (stick bait - Rekha, gel - used by pest control), and the digestive system of cockroaches after the treatment were checked to identify and assess the concentration/ presence of Boron by Curcumin reagent test by colorimetry ([www.odp.tamu.edu/US](http://www.odp.tamu.edu/US)). The home remedial combinations were prepared as pellets with concentrations of 0.5, 1, 2, 4 and 8 g. All the tests were conducted in triplicates irrespective of the control, concentrations, exposure conditions and boric acid estimations for statistical authenticity. The average values of each test along with the standard error were estimated and considered for comparisons.

## RESULTS:

During the study, external and internal flora of roaches was found to be almost similar and comprised *E.coli*, *S.aureus*, *Pseudomonas* spp., and *Klebsiella* spp. Home remedial measures were tested in the form of boric acid pellets of different concentrations between 0.5 gm to 10gms in the open and *in vitro* conditions. The results indicated that the

time taken to kill the cockroaches using this control was less in open conditions than the closed conditions. More number of organisms was killed in the open conditions (close to sewage outlets / dark and wet corners in the kitchen) (Fig.1). There was no re-infestation of cockroaches for a period of > 6 months after the treatment of open areas with boric acid pellets. The study indicated a remarkable relation between the death time, size and weight of cockroach and the pellet composition. The average weight of the cockroach should be considered for control studies as procuring same sized organisms in normal conditions, their availability and preserving them was difficult.

Statistical analysis of correlation between the weight, length, of the organism with respect to the effect of pellet concentration and death time was studied. The results indicated negative correlation between death time and pellet concentration ( $r = -0.9$ ), and positive correlation between weight/length ratio and pellet size of the control ( $r = 0.7$ ). Control 1 boric had more impact as pesticide as the death time (Time taken to kill) showed an inverse relation to weight of the organism. The dead insects were characterized with slightly bulged stomachs and presence of boron was noticed in their guts (7.5mcg/g wt of organism) indicating that the boric acid break open the digestive walls resulting death with this treatment.

The presence and concentration of Boron was checked in the control 1 and other commercially used baits, gels and pest control gels using curcumin method. The boron concentration varied in the commercial bait (2.75mcg/g), pest control gel (395mcg/g) and home remedial combination (625 mcg/g). The Boron concentration was 7.5 mcg/g of the gut material of cockroach after the home remedial treatment by using control 1.

A comparative *in vitro* conditions study was conducted with baking soda (control 2), biocomplex (control 3) and a combination of baking soda and boric powder (control 4) as other house hold remedies.

Control 2 containing baking powder had remarkable impact on the number of cockroach populations with respect to the death time. The death time of the organisms with respect to the concentrations showed remarkable variations. Increased concentrations of pellets controlled the organisms with reduced the death time (Fig. 3). Control 2 showed impact on death time of the organism (hrs) with respect to pellet weight and the ratio of weight and length. Higher level of bulging than control 1 and, the reinfestation time was less than the control 1.

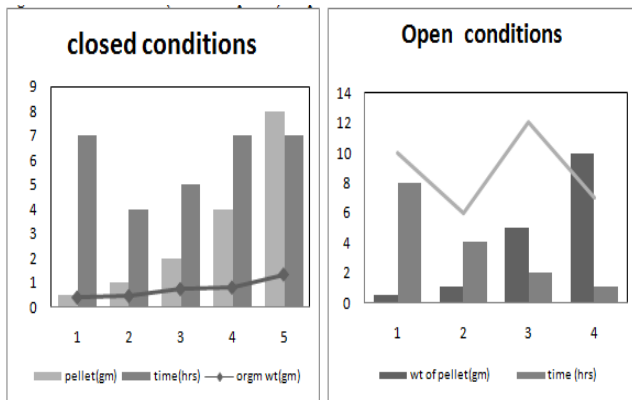
Control 3: The cockroaches were alive for > 24 hrs and repulsed to the bio control in vitro conditions as well as open conditions irrespective of the pellet wt(g) without an impact on their death.

Control 4: Boric acid (BA) and baking powder (BS) were mixed in the combinations of 30BA+10BS; 20BA+20BS; 10BA+30BS and prepared as pellets (0.5,2,4,6,8 g) with the same binding material. The death time reduced with the increasing pellet size, Among the three combinations 30BA+ 10BS was effective in killing cockroaches on an average death time of 5hrs. (Fig. 2.) This combination was promising among the rest of the two as the reinfestation time for the cockroaches was above 3 months. The death time reduced with increase in the pellet weight.

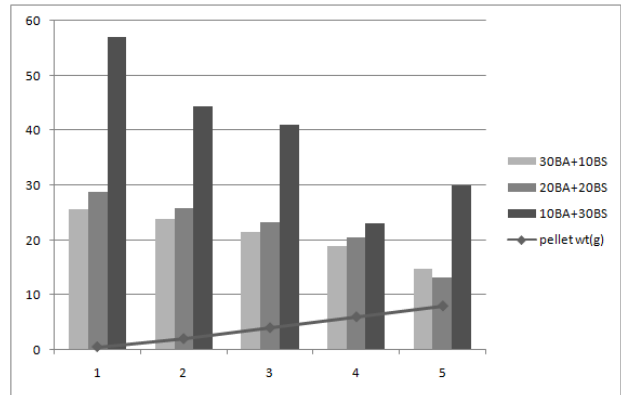
On an average pellet weight (4g) of these chemical controls was considered with respect to the death time (hrs) to assess their efficacies in the pest control (Fig.3). Control 2 comprising baking soda found to be effective in controlling the pests followed by boric acid (control1) and control 4a (30BA+10BS).

Insufficient data is available on boron toxicity on humans. The Tolerable Intake (TI) of boron was set at 0.4 mg/kg body weight per day. Among the four controls control 1( Boric acid) found to be effective control with longer effect (>a period of 6 months approx.) and less reinfestation turns. The toxic level of boron over human is 5g-20gm if consumed directly as per EPA 2005 (USA). It is a safe roach controller with 100% results are shown by the mixture and no side effects to human population . Baking soda mixture was effective but the stability of the product reduces with the time.

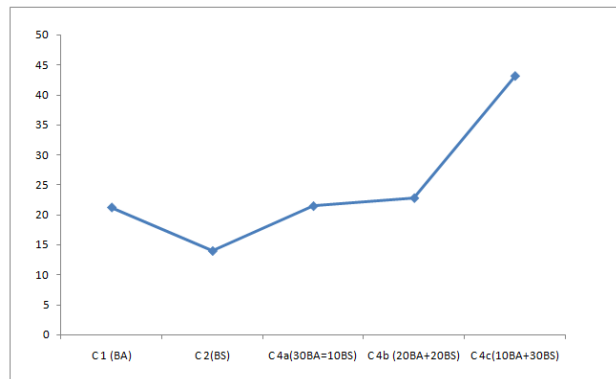
**Fig.1: Effect of Control 1 (Boric acid pellets) in open and closed conditions**



**Fig.2 : Efficacy of Boric acid (BA) and Baking soda (BS) combinations**



**Fig.3: Chemical controls and their efficacy with respect to the death time (hrs)**



**Conclusion**

The presence of more number of common pests such as cockroach is a safety concern as they are considered as carriers of food borne pathogens and food spoilage organisms. Cockroaches trapped from different sites (toilets, parlours, kitchens and bedrooms) in houses with pit latrines and water system, the bacterial, fungal and parasitic isolates were identical irrespective of the site (Tatfeng et.al.,2005). These included: *E.coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *P. mirabilis*, *Citrobacter freundii*, *Enterobacter cloacae*, *Salmonella* sp, *Pseudomonas aeruginosa*, *Serratia marcescens*, *S. aureus*, *S. feacalis*, *S. epidermidis*, *Aeromonas* sp, *Candida* sp, *Rhizopus* sp, *Aspergillus* sp, *Mucor* sp, cysts of *E. hystolitica*, oocysts of *Isospora belli*, cysts of *Balantidium coli*, ova of *Ascaris lumbricoides*, *Anchylostoma deodunale*, *Enterobius vermicularis*, ova *Trichuris trichura*, larva of *Strongyloides stercoralis* (Tatfeng et.al.,2005). The cockroaches in the house holds play potential role as transmitters of bacterial species isolated such as *S. aureus*, *Enterococcus species*,

*Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*, *Serratia marcescens*, and *Proteus* species with antibiotic resistant (Pai et.al.,2005).

Many reviews on pest control methods mentioned about the different components as cockroach controls (Ogg et.al,2006) The development of house hold control of these pests can be possible by preparing a pellet of boric acid/ Baking soda / 30Boric acid+10 Baking soda combinations found to be effective. Of these the first combination gives long lasting control, reduced reinfestation times and effective for prolonged period. The second combination of Baking soda gives immediate result but effective for short duration followed by the third combination. Since these combinations made at household materials, impact on human system is less, and cheap which can be advised to have immediate control on the pests.

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#### **REFERENCES:**

1. Hernandez - Ramirez.. G, Sanchez - Arroyo, H and Alatorre - Rosa, R (2008). Pathogenecity of *Metarhizium abisopliae* and *Beauveria bassiana* to the American cockroach (Dictyoptera: Blattidae) .Proceedings of the Sixth International Conference on Urban Pests William H Robinson and Dániel Bajomi editors), Printed by OOK-Press Kft.,Hungary2 pgs.
2. Lamiaa Bouamama, Antonio Sorlozano, Amin Laglaoui, Mariam Lebbadi, Ahmed Aarab, and Jose Gutierrez. (2010).Antibiotic resistance patterns of bacterial strains isolated

from *Periplaneta americana* and *Musca domestica* .J Ininiwas Sfect Dev Ctries 4(4):194-201.

3. Miller, D.M and Koehler,P.G.(2003) Least Toxic Methods of Cockroach Control1. ENY-258, one of a series of the Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food andAgricultural Sciences, University of Florida. <http://edis.ifas.ufl.edu>.
4. Barb Ogg, Clyde Ogg, and Dennis Ferraro 2006.cockroach control manual. *University of Nebraska–Lincoln Extension*. 72 pgs
5. Pai, H.H. , Chen, W.C., Peng, C.F. (2005) Isolation of bacteria with antibiotic resistance from household cockroaches (*Periplaneta americana* and *Blattella germanica*) *Acta Tropica*, 93 (3): 259-265
6. Sisai Mpuchane, Ignatius M. Matsheka, Berhanu A. Gashe, Joseph Allotey, Gervus Murindamombe and Neema Mrema.2006. Microbiological studies of cockroaches from three localities in Gaborone, Botswana. *African Journal of food agriculture nutrition and development*.6(2) :1-17.
7. Tاتفeng, Y.M, Usuanlele, M.U, Orukpe, A, Digban, A.K, Okodua,M,Oviasogie,F, Turay, A.A. 2005. Mechanical transmission of pathogenic organisms: The role of cockroaches. *Journal of Vector Borne Diseases* 42(4) : 129-134
8. David R. Boone, George M. Garrity. *Bergey's Manual of Systematic Bacteriology:V 2001 2<sup>nd</sup> edn*. Published by Springer–Verlag, New York.
9. Estimation of Boron concentrations using Curcumin reagent.([www.odp.tamu.edu/US](http://www.odp.tamu.edu/US)), Toxicological review of Boron and compounds, 2004 (CAS No. 7440-42-8) EPA 635/04/052, U.S. Environmental Protection Agency Washington, DC

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