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Effect of Polythene and Lime applied to Top Bars Hive on Colonization, Weight Gain and Pest Infestation

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ABSTRACT

A preliminary study was carried out to investigate the impact of polythene and lime onbees wax baited top bars hives on colonization, hive weight and pest infestation in Ogbomoso (longitude $4^0 30^1$E and latitude $10^0 5^1$N), Nigeria. All hives were baited with bees wax at the rate of 25 g per hive. The experimental treatments were lime (L), Polythene (P), Polythene and Lime (PL) and baiting alone which was the control. The results of the experiment show that none of the treatments prevented hive colonization by bees. Although treatment effect was not significant ($p>0.05$), the first treatment to be colonized was polythene (P) where hive was colonized 17 days after installation. For lime (L) treatment, Polythene and lime (PL) and control (wax alone) colonization periods were 48, 60 and 74.5 days respectively. Pests encountered were Crematogester species F. (Hymenoptera: Formicidae) and Belonogaster juneus F. (Hymenoleptera: Vespide) in polythene (P) and Polythene and lime (PL) respectively. Hive treated with polythene had greater weight towards the end of the experimental period whereas hive treated with lime had comparatively early colonization suggesting that lime could be a synergist to wax in baiting of hives.

Key words: Topbar hives, lime, polythene, colonization period, apicultural pest

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INTRODUCTION

Beekeeping can be a complementary medium-scale agricultural enterprise among resource-poor arable farmers in the tropics. The apicultural resources are naturally available and intending farmers can learn the skill with a minimum leve of inconviniences or costs. The products can also be sold at the market outlets available to the farmers within their immediate reach. Despite its prospects, a number of fundamental problems such as late colonization [1], pest infestation [2-3], vandalization and buglary cases [2, 4] affect the tropical potentials of beekeeping. Beside late colonization of hives, absconding is another problem of beekeeping in the south western Nigeria.

The cause can be biological, induced by pest like wax moths (*Galleria mellonela* and *Achria grisella*) and ants (*Formes* spp, *Oecophylla longinoda)* or climate (adverse weather conditions). Pest infestation is a serious post colonization problem because it causes great economic losses. Besides, when pests infest a hive, it opens the gate for future possible problem of pest complexes.

Although several hive types and designs had been experimented [2, 4-8], hive treatment for colony management seems not to have received much attention. Many farmers in developing countries that are resource-poor perceive pest infestations as a major concern since proper management skills are either unaffordable or unavailable. Therefore, there is a need to research into the possibilities of incorporating hive treatment strategies into usual apicultural practices. Such incorporations should be economical and eco-friendly. To that end, polythene which has natural insect proof potential and lime, a biological and biodegradable material, were experimented.

This preliminary investigation was designed with the following objective: to evaluate the effects of polythene and lime applied on top bars hive on hive colonization, hive weight gain and pest infestation.

MATERIALS AND METHODS

Experimental Site

The apiary was located in a sprawling agrarian village called Idi-Oro along Iwofin Road which was about 15 km from the Campus of ladoke Akintola University of Technology, Ogbomoso, Nigeria. It was about 4 m to the stream.

Hive Construction and Baiting

The Kenya top bars hives used for the experiment were constructed using Gregory models [7]. Each hive had 15 top bars of 3 cm width and 44 cm long. Each hive was baited with 20 g bee wax and installed on 9-inch building blocks in January 2009. Corrugated roofing sheets were used as roofing material to prevent adverse weather conditions. A total of 12 hives were baited. The baited hives were placed under cashew (*Anacardium occidentalis*) trees and the site was surrounded by mango (*Manigfera indica* and locust beans (*Parkia biglobosa*) trees.

Experimental Treatment

After baiting, the twelve hives were divided into four groups (representing treatments) of three replicates per treatment. The first treatment was installed with a sheet of polythene (0.03 mm thickness) on the top of the hives before the placement of roofing material. This was designated as polythene alone (P). The second treatment was without polythene but smeared with 60 ml of lime juice with the aid of carmel brush. The lime juice was applied on the crevices of the hives that could serve as an access route for pests. This was designated as lime alone (L). The third treatment was a combination of polythene and application of lime juice and was designated polythene and lime (PL). A control was included which was a baited hive without polythene or lime and was designated bating alone (control). Each hive was placed at a distance of 20 m from another with all hives randomly distributed within an area of about half an acre. For all treatments with lime juice, there were repetitions of lime juice application for ten times at bi-weekly interval from installation date.

Data Collection

Data were collected on colonization date, pest infestation hive weight gain, and bees' population. Colonization date was recorded as number of days that the bees colonized post installation of hives. Pest infestation was determined by daily inspection of the hives. Infestation date was recorded and pest encountered were collected and preserved. Identification was done at the Insect Collection Museum of the Crop Protection and Environmental Biology Department, University of Ibadan, Ibadan, Nigeria. Hive weight was determined immediately after baiting before installation and was taken on bi-weekly interval. Hive weight gain was calculated as the difference between the previous weight and weight at bi-weekly interval. A top loading weighing machine (Camry®) was used for hive weight determination. Number of bees at the flight entrance was recorded on inspection of colonized hives at bi-weekly interval. The number of bees at flight entrance (BNFE) was determined by visual count and an estimate of the bees' population was determined by ERLS [9] formula thus,

$$\text{Bees Population} = \text{BNFE} \times \frac{80}{100} \times 1000$$

where BNFE = Bees number at flight entrance with assumption that every bee at flight entrance represents 1000 bees in the colony and worker were 80% of total colony population.

Experimental Design and Statistical Analysis

The experimental design was completely randomized design. Data was subjected to analysis of variance (ANOVA) and mean seperation was done using Turkey Honestly significantly difference with the aid of SPSS Software Version 15 [10].

RESULT

Effect of lime and polythene treatment of hive colonization period

The result of the experiment shows that none of the treatments prevented hive colonization of bees. Of the four treatments, only polythene treatment had 1/3 of the hive colonized. For other treatments, 2 out of 3 replicates were colonized. The first treatment to colonize was polythene (P) in which case hive was colonized 17 days post installation. The mean colonization days after hive treatment for lime (L) treatment, Polythene and lime (PL) and control (baiting alone) were 48, 60 and 74.5 days respectively (Figure 1).

Effect of lime and polythene treatment of hive on hive weight

At 2 weeks after colonization, the highest hive weight was observed in the control. However from 4th – 20th week, highest hive weight was observed in hive treated with polythene and lime (PL) and from 15th – 20th week, lowest hive weight was observed in the control (Figure 2).

Effect of lime and polythene treatment of hive on bee population

There was no regular pattern for bee population across the period of study. At 2 week after colonization, polythene and lime (PL) and lime (L) had high population of bees than the control. Consequently, at 14th – 20th week after colonization polythene and lime (PL) had greater population than other 2 treatments (Figure 3).

Pests associated with different treatment and record of absconding

One polythene treated replicate absconded within the first 5 weeks post colonization. The reason for the absconding could not be ascertained but, *Crematogaster* sp (Hymenoptera: Formicidae) was earlier seen on the top bars at 2-4 weeks after colonization. There was absconding also in one replicate of polythene and lime (PL) after 6 weeks post colonization. Before the absconding of the colony, *Belonogaster juneus* F. (Hymenoptera: Vespidea) was found around the flight

entrance of the hive. There was no record of wax moth (*Galleria melonella)* and hive beetle (*Aethina tumida)* in all the treatments.

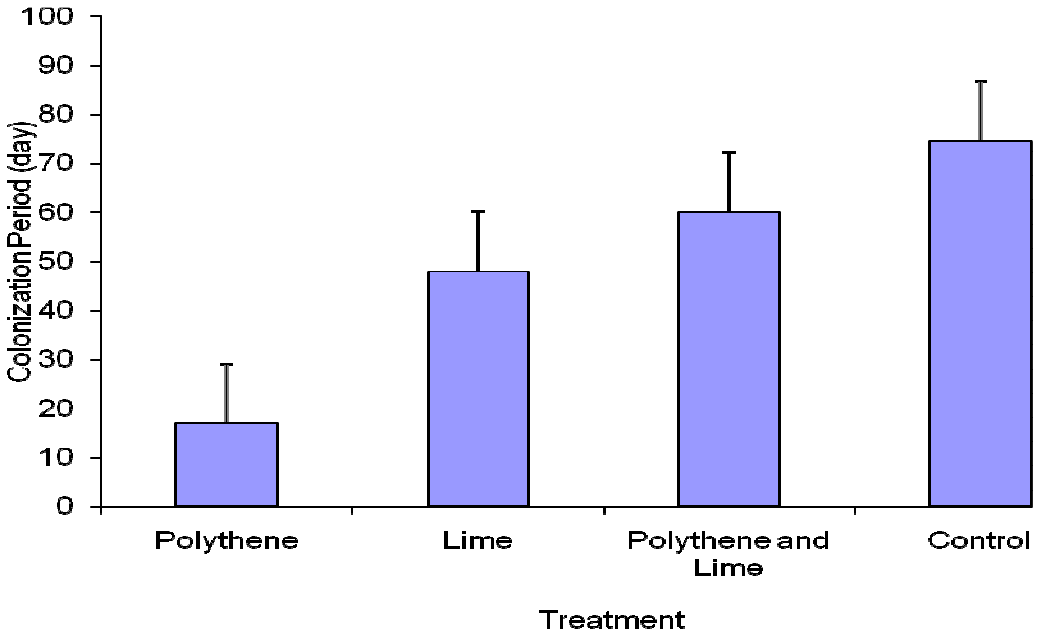

Figure 1: Effect of lime and polytene treated hive on colonization period

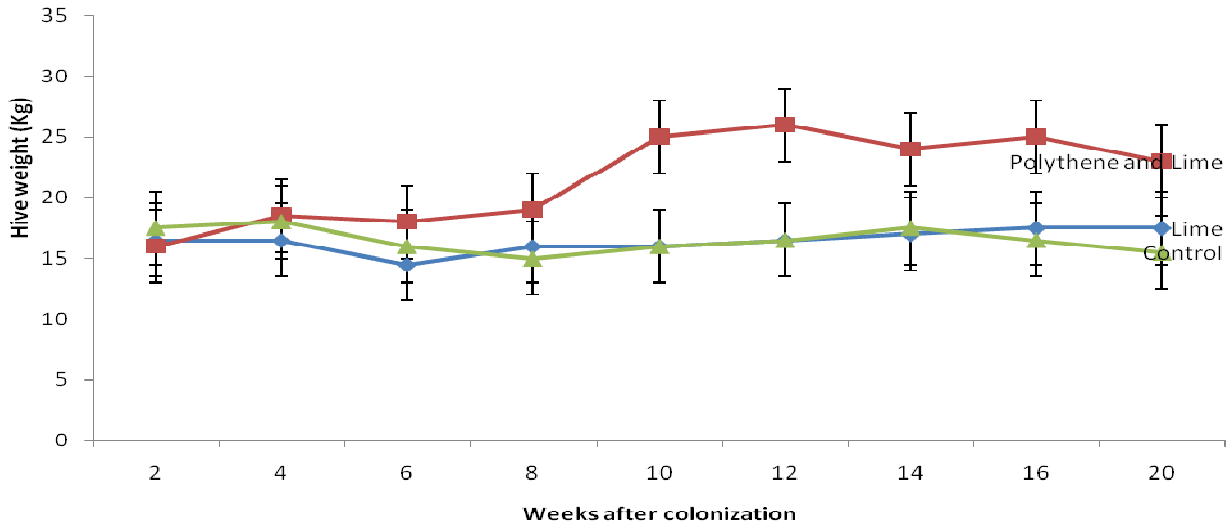

Figure 2: Effect of lime and polythene treated hive on hive weight

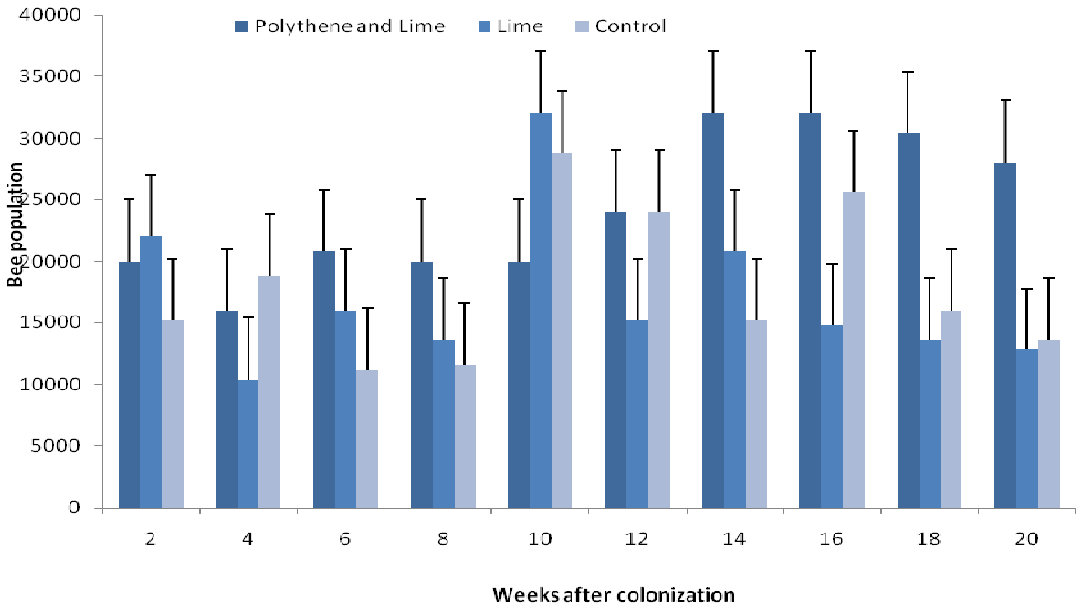

Figure 3: Effect of lime and polythene treated hive on bee population

DISCUSSION

Recently, efforts have been geared towards design of hive type towards cost reduction and convinient colony management [2, 11]. This experiment was a preliminary investigation on the impact of special treatment of hive on colonization period and management of pests of honey bees. Since none of the treatment prevented colonization, the potential of utilizing lime and polythene in apiculture is established. Application of lime seems to be a good synergist for efficacy of wax to attract bee colonies into the hive.

Pest infestation is a major menace of apiculture in the tropics [2, 4]. Several authors have examined different control strategies for different pests. El-sinary and Rizk [12] investigated the efficacy of entomopathogenic fungus, *Beauveria bassiana* (Bals.) and gamma irridiation as integrated pest management of greater wax moth. Loucif-Ayad *et al* [13] reported the use of various acaricides in controlling *Varroa destrutor* (Aceri, Varroidae.)

Some *Citrus* species have been studied for their pesticidal activities against post harvest insect pests [14, 15]. Since lemon is a natural product that easily biodegradable, the risk or contamination of honey produced by the bees is eliminated. Whether *Citrus* species is pesticidal to major apicultural pests like wax moth, hive beetle and ants is not certain, since the pests were not encountered in the course of the research.

This study establishes the potential of lime and polythene in management of bees' colony. However, further works are required to establish the best method for applying them for maximum result. The use of polythene appears to be of positive effect on bee population and hive weight. Hive weight gain could have been due to high bee population. The impermeability of polythene which reduced adverse environmental ondition could be the reason for higher hive weight recorded in hive treated with it.

Factors responsible for absconding could be biological due to pest infestation or climatic due to adverse environmental factors [2, 5, 6]. Since the pests encountered in the absconded hives were noticed prior to absconding, there is the need for further study to establish the pestiforous status of the pests in causing absconding.

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