UTILIZATION OF EDIBLE HONEYBEE DRIED BROOD IN FOOD TECHNOLOGY

By

ENAS OSMAN METAWEA NOUR EL-DEEN

B.Sc. Agric. Sci. (Food Technology), Fac. Agric., Cairo Univ., 2004
M.Sc. Agric. Sci. (Economic Entomology), Fac. Agric., Cairo Univ., 2009

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APPROVAL SHEET

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Title of Thesis: Honeybee(*Apis mellefera* L.) brood as a new food Protein Resource.
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Department: Economic Entomology and Pesticides
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ABSTRACT

The activity of honeybee colonies in brood rearing was expressed through th measuring and removing the amounts of brood reared in one and two brood combs.
the areas (in^2.) of honeybee brood, sealed and unsealed worker and drone brood), that reare and harvested from one and two brood combs at 14 day intervals during the period fron Febrauary,1 to November,22 of year 2011. The total amounts of harvested brood areas fron one brood comb were 3325.6 in^2. / Colony / year. However these areas reached 6533.3 in^2. colony / year when two brood combs were yielded. This means that about twice brood area could be obtained with removing two brood combs per colony. the weight of fresh broo amounts either of one or two brood combs was gradually increase and follows the broo areas harvested with the progression of active season. So, the highest yield of fresh broo meat for the two treatments was observed at July, 5 recorded 1013.5 gr/colony and 2106.9 g. / colony for one and two brood combs, respectively. The total yield of fresh brood meat o one brood comb was ranged from to with a mean valued 16630.6 g./colony/year and it wa ranged from to with a mean value of 31664.4 g./colony/year for two brood combs. The fres brood meat yielded during and summer seasons were approximately similar in the case o removing one brood comb where it recorded 6655.4 g. /colony and 6689.4 g./colony for th previous seasons, respectively. However, those amounts were relatively higher during sprin seasons,(13045.5 g./colony), than summer season, (11730.7 g./colony). The lowest crop o fresh brood meat was obtained during autumn season where they weighed 3285. g./colony/year and 6888.2 g./colony for the one and two harvested brood combs respectively. The attained amounts of dry brood meat, when one and two brood combs wer harvested, had the same trend of fresh brood meat and gradually increased from th beginning of active season until reached its climax at July,5. The mean amounts of dry broo meat at that date were 253.4 g. /colony and 509.8 g./colony. The total net protein tha contained and produced from dry brood meat of one brood comb was 1968.3 g./colony (314.87 g. nitrogen) and was 3848.1 g./colony, (615.55 g. nitrogen) in the case of harvestin two brood combs.

The effect of adding different rates of honeybee brood on the apparent viscosity o cake dough was studied at different time of mixing. The results show that as increasing tim of mixing, the apparent viscosity of cake dough increased.

Keywords: Honeybee brood , drying brood, chemical composition, harvested

DEDICATION

Thanks for my great God for guiding me through my thesis which supported me for experience and acknowledgement, through which a number of people provided me with helpful. I feel totally indepted to my small and big family especially my husband mohammad, who put up with the hard work and continuous support and give me lovely emotional support needed for the study, my father, my mother ,my aunty Tota and all my uncles for all the support they lovely offered along the period of my post graduation

All love for my sons Anas and Malek

I wish to dedicate my PhD to the memory of my late unckle, Dr Mohamad Motawea.

He was more of a family leader, a man respected by everyone and conferred love and kindness down on all the family, old and young.

He was supportive and encouraging in every possible way. He helped me admire science and encouraged me to follow my ambition until I accomplished my PhD study.

From all the world, I truly wished to have him share this moment, yet I am all hopes all my efforts would be his reward, in shaa Allah.

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CONTENTS

INTRODUCTION

To alleviate the world protein deficiency and maintain the ever increasing human populations, attention has been directed over the past several decades to the development of new protein sources such as fish protein concentrate, (Pariser, *et al.,* 1978 and Sikka *et al.,* 1979), single call protein, (Ferriante & Fiechter, 1983), and soybean protein, (Mendez, *et al.,* 2002 and Bhatia & Greer, 2008). However, there is still an estimated one billion people suffering from protein deficiency, (FAO \ WHO, 2007).

Increase in world population will require the production of vast amount of foods in the latter half of the twenty – first century. However it will be difficult to increase productivity to a level that satisfies food demand, mainly because of limited availability of new farm land. This will lead to shortages of food, especially animal protein. When total food resources are insufficient, it is unwise to feed livestock with gain and other foodstuff, which can be consumed directly by humans. Therefore, it becomes necessary to look for new sources of animal protein such as insects, which are rich in nutrients. (Mitsuhashi, 2010)

Insects account for the greatest species diversity and the largest numbers of all of the worlds Funna (Sirimungkararat, *et al*. 2010).

Insects make up about two-third of the food of our common land birds and two – fifths of the food of adult fresh water fish. Turkeys, hogs and other domestic animals are often fattened on insects, (Metcalf & Flint, 1962). Mass rearing of insects has been practiced for years.

Bees are grown in large quantities for distribution as colonies to honey producers, (Kok *et al.,* 1991)

Insects are eaten in many parts of the world. Archaeological evidence suggests that entomophagy has been practiced since humans first appeared, (Chung, 2010).

Nutritive values of insects vary depending upon species, habitats, and the growth stage of insects and methods of cooking. Characteristics of consumers such as gender and food habits contribute to their preferences, (Yhoung- aree, 2010). Many publications state that edible insects are rich in protein, fat and calories, as well as being good sources of minerals such as iron, calcium and vitamins A, B1, B2 and D, (Ramos Elordury *et al.,* 1997)

Historically, humans have consumed insects for thousands of years, in some cases as emergency foods, in other circumstances as a staple and in still other instances as delicacies, (Durst and Shono, 2010). Johnson, (2010), mentioned that the eating of insects appears to be culturally universal, only varying with location, insect populations and ethnic group. He, also, believed that harvesting and eating wild honey led to the collecting and consumption of bee brood, (egg, larvae and pupae) as a source of protein. This behavior could have led to sampling other insect larvae, pupae and, perhaps later, adults that were encountered. So, these were presumably adopted, over time, as normal, ritual or emergency food resources.

Many people in the world suffering from poor nutrition due to a protein deficit. However, various of interesting researchers desire to remedy the problems associated with protein deficient diets through the

utilization of edible insects which represent rich sources of protein for improvement of human diets, (Chung *et al.*, 2002; DeFoliart, 2003 and Ramos - Elorduy, 2005 & 2006).

The hymenopterous insects, (ants, bees and wasps) lead the second rank by about 21% of the total insect orders that reported to be used as edible human food, (Ramos- Elorduy, 2005) . It is known that the food products from bees are derived from wild, semi-domesticated and fully domesticated species. In addition to the obvious attraction of sweet honey, insect larvae and pupae (bee brood) contained within the hive are eaten in Asia, Africa and the Americas, (DeFoliart, 1995). There are remarkable large scale consumption of brood of honeybees (*Apis* spp.) as reported by (Gullan & Cranston, 2005) and so many other insects (Chen, *et al.*, 1998).

Bee brood has excellent nutrition properties. It is rich in protein than beef and it has no crunchy cuticle like most insects eaten for food. It is also, contains a high quality protein, fat, carbohydrate and many vitamins, (Hocking & Matsumura, 1960; Ryan *et al.*, 1983; Bailey, 1989; Abd Al Fattah *et al.*, 2009 and Nour El- Din, 2009). In some Asian countries, workers and drones pupae are prepared for human consumption by pickling or boiling in canned form. If it used in drying form, they may be ground to powder which may be used to enrich other poor meals, (Narumi, 2004). Besides, it is found in some European or American specialty stores and can be considered a value added product, (Schmidt & Buchmann, 1992).

Therefore, the aims of this work could be determined in the following points:

1. Evaluate the brood productivity as fresh, dry and protein quantity throughout the active season and effect of this production on the harvested honey.

2. Analyze and recognize of chemical composition of workers and drones honeybee brood, (larvae and pupae).

3. Comparison between the chemical contents of the harvested brood during spring and summer season.

4. Effect of long-term storage of the dried honeybee brood on its quality.

5. Effect of introducing various levels of the dried brood to cake dough on its rheological properties and mixing parameters.

6. The nutrition value of the dried honeybee brood compared with standard protein on the experimental animals, (in vivo).

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