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Designing the Beekeepers' Clothes with the ability to Repel Insects

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Abstract

In this research, insect repellent fabric (bee) was produced and with this fabric the beekeepers' clothes were designed. Therefore, a fabric has been designed and produced so that the bee does not come in connect with the beekeeper from a distance so that it cannot bite. In the theoretical section of this article, initially, types of fabrics were examined. After selecting the type of fabric that should have the cooling property, the different types of beekeepers' clothes were studied. In this regard, research and study has been done on the repellents that can be used in this article. Then, the process of practical work and production of repellent fabrics was done and the repellent fabrics were produced by using diethyltoluamide in combination with the fabric. Finally, with the findings obtained regarding the efficiency and use of the relevant clothing, the initial plans related to them were performed, and after the approval of the final designs, the Marulus program was used to implement them. Also, the design execution was analyzed.

Keywords: Beekeepers' Clothes; Fabric Design; Insect Repellent

1. Introduction

Honey bee is one of the beneficial insects for humans, which belongs to the double wing category. The honey bee came into existence on earth long before man. Bees were there since 150 million years ago and were busy breeding. However, the difference is that it did not have a social life and like todays many non-honey bees, it had a solitary life and each bee had its own beehive and lived in it. A hive is a place where bees are born, work, raise their siblings, and store their

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necessary food. Bees have different breeds and with complex body structure (Michener, 2000; Danforth, 2006; www.daneshnameh.roshd.com).

1.1. Appearance of Honey Bees

The honey bees are approximately 15 mm in size and usually light brown in color. Bees are usually oval shaped creatures in golden yellow color with brown stripes. Although, the body color of bees varies from species to species, some bees have black bodies, but all bees have dark to light spectrum. These dark and light bands target the bee existence: unlike other species that hide when detected by hunters, those with light-colored bodies and the ability to bite act as a warning to the hunters (www.ahoota .com).

1.2. Honey Bee Body Structure

Head: located in the front part of the body and includes the following organs: two compound eyes, three simple eyes, two antennas, and a mouth with proboscis. The size of the eyes is a means by which the beekeeper can easily distinguish the male bee from the worker bee. Because the male honey bee eyes are larger and meet each other from the back of the head, but it does not meet for the worker and the queen bee. The antenna's does the job of touch and smell. Bee with the help of proboscis collects the nectar from the flowers and sends it into the honey making bee hive through the mouth (www.ahoota.com).

Chest: It is made of three chitin rings and the underneath members are attached to it: four wings or feathers, two of which are the forewings and the other two are the hind wings. Among the six legs, the hind pair has porous called baskets, that the bee fills it with flower pollen and carries it to the hive. These baskets are larger in workers than in males (www.ahoota.com).

Abdomen: Located at the end of the body, it consists of six hind chitin rings and six abdominal pieces. At the end of the abdomen, the anus is seen for fecal excretion. Through this anus can remove its sting to bite. The male honey bees cannot bite, because they do not have sting at all (www.ahoota.com; Cardinal, 2011; Engel, 2001).

2. Types of Beekeeper's Clothes

1. Finished space beekeeping clothes: The finished space beekeeping clothes and in terms of quality are sewn in three categories. In the first grade, it is made of multi-layered net at the waist for proper air ventilation and prevents perspiration. The finished beekeeping clothes include beekeeping clothes connected to the head hat and trousers which is one piece suit and sewn in the model finished space beekeeping clothes (www.roodinshop.com).

2. Two-piece beekeeping dress was the shirt attached to the hat: This dress is suitable for those who use a separate beekeeping hat (www.makikala.com).

3. Two-piece beekeeping clothes without hat: This model of clothes is in two pieces (shirt and pant). Some people feel more comfortable with this model of clothes (www: roodinco.com/).

4. Super complete beekeeping clothes: These clothes are made by extra-ordinary technology. They are made of a high-tech three-dimensional polyester mesh fabric that keeps the person cool and comfortable during the day. The thickness of the fabric is five millimeters, which is deeper than the length of a bee sting.

5. Beekeeping jacket: This jacket has also used high technology for production and the honey bee and its sting cannot pass through it in anyways.

6. Luxury beekeeping clothes: The complete luxury clothes are the most popular and favorite clothes among commercial enthusiasts and beekeepers. With too many pockets, other accessories can be included and can protect from head to toe when used with accessories.

7. Light weight luxury beekeeping clothes: This innovative fabric is covered with rain-resistant Teflon and has a very soft covering. It has lost about half its weight and is cooler and is worn by beekeepers who work in hot climates.

8. Beekeeping vest: This vest has a half-zipper near the neck, which does not mean that it separates completely. The trunk is a stretchable net that is light and breathable.

9. Beekeeping shirt and pant suit: The pant is luxury with waterproof patches on the knees and ankle zippers.

10. Children's beekeeping clothes: Children's bee clothes have everything that is necessary for the children to move around the apiary.

3. Insect Repellents

Insect repellents are substances which only irritate the skin while protecting the body. Some may be used against insect bites and can have systemic effects. Some reports have stated that this substance causes serious illness and possibility of death, because insects act as carriers of disease. Mosquito bites are a common problem around the world, and in some area, mosquitoes are carriers of serious diseases such as malaria, West Nile virus, dengue fever, and Congenial fever (www.dermnetnz.org).

Lyme disease is spread through the bites of infected mites on the skin. Currently, the insect repellents come under two categories: chemical repellents and natural plant repellents substances. The most well-known chemical repellents are DEET. Other chemical repellents include MGK-326/IR3535 and MGK264. The last chemical substance that is effective on DEET is the pepcaridin. The natural plant repellents are popularly processed for their low toxicity but have not been as effective as DEET to date. This substance includes Bistonella, soybean oil, and eucalyptus products (www.dermnetnz.com; Johansson, 1982; Alcock, 1999).

4. Material and Goods Used

In this article, has used the cotton fabric with the specifications listed in Table 1. Also, the substance “Diethyl toluamide” with the chemical formula CH3C6H4CON (C2H5)2 was used.

Table 1 Specifications of the fabric used

Weave type	Cloth quality	Weight (g/m2)	Density warp(1/cm)	Density weft (1/cm)
Tafte	100% cotton	115	24	13

5. Practical Work Process

To prepare, the cloth was kept in a laboratory beaker and pour on it distilled water until the volume reaches 100 ml. Then 3 gm of diethyltoluamide was added to it and place beaker for 20 minutes on a heater (at 50^0C) and subjected to ultrasonic radiation. Then the cloth was washed with distilled water and dried in an oven.

6. Cloth Design

In the following designs, two-piece cloths are considered which is easy for the person to use. With respect to the special design, repellent fabrics have been used in the areas marked in yellow color to prevent the honey bee from approaching the person. The sections with repellent properties on the fabric provide us possibility to use it in an easier way. In the sections of the wrist and the wrist of the pants, has been incorporated with elastic so that the honey bee cannot approach the person. In these designs the loose parts of the clothes have been reduced so that the person is at ease to performance the activity.

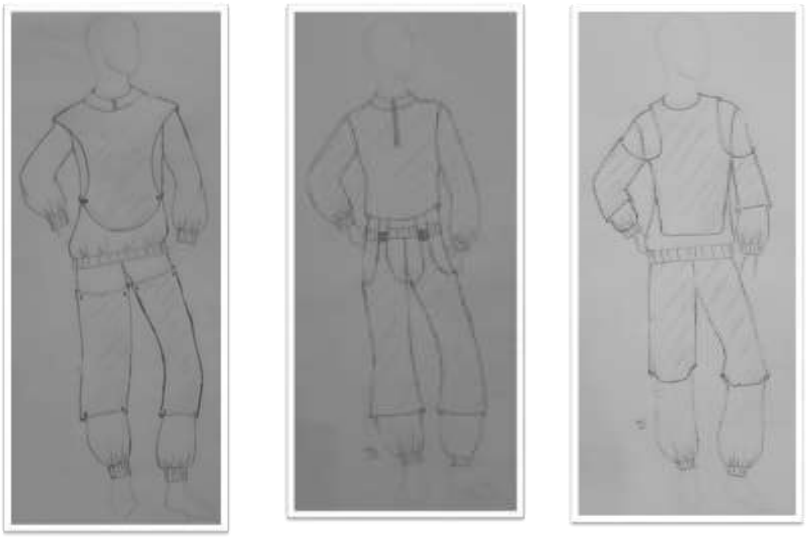

Fig 1 Linear sketch of clothing design

Fig 2 Final design of a beekeeper suit

7. Conclusion

In this article, due to the movement and security problems that exist for beekeepers, steps were taken to design clothes for this group. The designed cloths in this article were examined from two

aspects. Therefore, the fabrics used were completed with diethyl toluamide, which is an insect repellent, and secondly, due to the repellent properties of the fabric, clothes were designed for this profession. Clothes are presented that were not loose as earlier ones, so the beekeepers were comfortable of work with more security. Finally, the clothes design was presented which is proportional to beekeeping environment, based on color and form principles.

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