A Critical Point in Beekeeping: Beekeepers' Health

Erkan TOPAL[1], Mirela STRANT[2], Cristina Bianca POCOL[3], Mustafa KÖSOĞLU[1]

[1]*Apicultural Department, Aegean Agricultural Research Institute, Menemen-Izmir/TURKEY*
[2]*CasaBio cu Sănătate S.R.L., Cluj-Napoca, Romania*
[3]*Department of Animal Production and Food Safety. University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca.*
[*]*corresponding author: cristina.pocol@usamvcluj.ro*

Bulletin UASVM Food Science and Technology 76(1)/2019
ISSN-L 2344-2344; Print ISSN 2344-2344; Electronic ISSN 2344-5300
DOI: 10.15835/buasvmcn-fst: 2018.0021

Abstract

Beekeeping activity implies a series of intensive processes and a variety of risks. After examining studies on beekeeping activity, it became obvious that beekeeping risk factors and beekeeping health studies are quite limited throughout world. This study aimed to reveal the possible effects of this activity on beekeepers health and to bring recommendations to be applied during practice. The beekeeper is often exposed to adverse effects such as mechanical and physical difficulties, environmental and climatic conditions: high temperature, time related stress, colonies transfer stress, insomnia, bee venom and smoke exposure during production activities. Any disadvantages that might occur in an environmentally friendly production context can be attributed to possible disruptions, injuries, psychological disorders and/or occupational accidents. The difficulties of living away from home and an irregular diet are constantly placing beekeeper's health under pressure. The difficult process of bringing bee products to the table, influences on beekeeper's health. In this production process, the beekeeper must make proof of his own health as well. Despite the reduction of labour force and risks through modern tools and equipment support in the developed countries, there are multiple risks in every stage of honey production, which is dependent on natural conditions. The results of the present research should bring awareness on the subject of beekeepers health and establish grounds about occupational health and safety in beekeeping activities.

Keywords: beekeeper, environment, lifestyle, occupational health, risk factors

Introduction

Beekeeping activity is increasingly dependent on flora, but it is a production model different from the general agricultural one. A study made in Romania found that current beekeeping difficulties were constituted by factors that did not affect beginners; while the desire to pursue a passion and to be autonomous was the basis for starting beekeeping (Popa et al., 2011). There are risks in every stage of beekeeping activity. The importance of occupational health and safety is due to the increase in work accidents in recent years. The concept of "occupational health and safety", expresses the work carried out in a multidisciplinary way in the awareness of the need to protect employees, in order to ensure production continuity and increase productivity, thus presenting a risk that can adversely affect employees' health in the work environment. This goes along with industrial and technological developments. It was considered necessary to determine risk sources in the beekeeping-working environment and to assess risks in terms of health and safety, to determine and implement prevention and protection measures in order to inform beekeeping employees (Berk et al., 2011).

Particularly, the danger comes from doing business in an objectionable manner or from an inappropriate business environment. Depending on the nature of the activities in a workplace, there can be many and various kinds of dangers. The risk is the possibility of a certain and undesired

(dangerous) event occurring within a certain period of time. Risk refers to the probability of a loss related to a hazard (Nettleingham and White, 2008; Ceylan and Başhelvacı, 2011).

The agricultural sector employs more than one-third of the world's total working population. In some countries, agriculture constitutes the largest employment rate that employs the entire family, including young children. As a result of labour associated with farms, agricultural workers and their families face numerous risks throughout the day (Perry, 2017). For example, Turkey's weather in 2013 in the GAP region and the 'Occupational Risk List in Agriculture' were used on a study in which overall environmental risks were examined. This report showed that about 60% of workers were not able to access safe drinking water during field work, paired with no hand-washing system and soap, 85% did not have accessible toilets, and 2% of them worked at sunrise hours. Also, 91% stated that there was no first aid available. When the risks associated with transport and machinery were examined, about 80% said they did not wear safety belts, and one out of four said that the maintenance and control of the tractors were not regular. Moreover, 72% of the workers reported that they did not wear a pantsuit when applying pesticides, 2% of them did not wear a mask, and 28% of them reported smoking during the application. In terms of child labour, 27% of the participants reported children were employed in agriculture, and 14% reported that children under 14 years old used tractors. 66% of the participants reported that working in agriculture was stressful (Şimşek et al., 2014; Kara and Şimşek, 2014).

Agriculture is one of the most dangerous businesses in terms of illness and premature deaths, and beekeepers face some of this health and safety risks (Stanhope et al., 2017). In order to ensure that everyone involved in the beekeeping activity can work safely, the risks and hazards need to be identifiable and manageable. The state controls laws and regulations to protect the health and safety of working people in order to minimize both hazards and risks. The reasons for the low level of education of the employees are the inadequacy of the control on their health and the fact that the employees are not informed about occupational health and safety issues (Soysal and Gürcan, 2005; Donham and Thelin, 2006; Tunca and Çimrin, 2012; Topal et al., 2016).

The basic characteristics of beekeeping activities that distinguish health and safety practices from other types of work can be: problems in meeting basic needs such as cleanliness and living in the same place, joint living and working of all family members, drinking water, electricity access; unhealthy living conditions created for short periods due to migratory beekeeping, the necessity of the majority of tasks to be done in open areas. The absence of occupational health and safety standards and regulations in agriculture or the difficulties in their implementation, are in addition to the fact that many of them are not covered by occupational health and safety services. Due to the fact that production is seasonal and certain jobs are carried out shortly after each other (Pyykkönen and Aherin, 2012), there are unregistered difficulties in adjusting working hours and qualified staff problems.

When we look at the risks in beekeeping, there are many other factors, which are more dangerous to occupational health than bee stings, although bee stings are a serious problem for those who have allergies (Nettleingham and White, 2008; Stanhope et al., 2017). The advantages of beekeeping are bigger compared with the problems related to beekeeping. More research is needed to study the systematic development and management of beekeeping (İsmail, 2016; Stanhope et al., 2017).

Materials and Methods

This review aimed to present the current knowledge about the main aspects related to beekeepers' health: nutrition, education and risks factors in production activity (physical, mechanical, environmental). A literature search was performed to identify studies about occupational health and safety, beekeepers' nutrition, their bee products consumption behaviour, challenges and opportunities facing beekeepers on production process, optimal conditions for beekeepers. Quantitative and qualitative studies were identified in three major bibliometric databases: Google Scholar, Web of Science and Scopus. Articles were selected for relevance to the research topic (beekeepers' health). Other texts and papers from books and encyclopaedia were rigorously read and

critically analysed. A number of 45 bibliographic sources were finally used for obtaining a narrative review about health related aspects of beekeeping activity.

Results

Health and the Beekeeper's Health

The issue of health has been on the public agenda in recent years mainly due to consumer' s claims. Production models, of course, should offer products that do not threat human health. But it is also necessary to take precautionary measures to ensure the health of the employees engaged in the production of the product before reaching the consumer. Sustainability of production and consumption are considered both as very important issues. With the increasing consciousness in our society, occupational health and safety has gained importance, as a consequence of recent accidents in big companies (Hofmann et al., 2017; Stanhope et al., 2017).

It is considered that external injuries (trauma, sunburn, insects' bites) and internal diseases (muscular and skeletal problems, arthritis, osteoarthritis, vertebral hernia, disc herniation, circulatory disorders, varicose veins, allergies) are the most frequent beekeepers health problems. Excessive or inadequate weight, excessive or inadequate diet, excessive or incomplete physical effort (movement), bad positions, accidents, weather conditions are causes of imbalance in bone and muscle systems. The causes of skin, conjunctiva and adipose tissue problems are: diet, fluid consumption, environment, sun exposure (insufficient or excessive), excessive or inadequate movement and stress. The balance of lymphatic and immune system can be affected by the quality of the food, wind, air and substances that reach the body as treatment, allergens, exposure to oncogenic or toxic substances (Strant and Grosu, 2016; Stanhope et al., 2017).

A study determined a relationship between telomere length and beekeeping. It seems that telomeres of the beekeepers are longer as compared to non-beekeepers based on statistical significance analysis. Again, since telomere length reflects biological life span, beekeepers might have a longer life compared to non-beekeepers. The length of the telomeres in beekeepers DNA, is related to the length of the period they have consumed bee products. Frequent consumption of daily bee products is associated with longer length of the telomeres (Nasir et al., 2015).

As a result of research conducted to prevent the causes of work accidents, it was determined that the three most important factors were the inadequacy of practices due to the lack of experience, irregularity of workplace and carelessness (Aybek et al., 2003).

Agriculture will continue to maintain its importance in terms of meeting the food requirements of the world, providing input to the industrial sector, trade and for creating employment opportunities. Agricultural activities are a high-risk business. Especially when the beekeeping activity is thought to have been carried out, its risk factors are even higher than the other agricultural activities (Menemencioğlu, 2012).

Beekeper's Nutrition

By spending long time away from home, beekeepers faces difficulties in terms of having a proper and regular nutrition. They do not feed properly and regularly, due to an irregular schedule of meals and workload, as well as the lack of ways to preserving food. The use of bee products in their daily diet, especially when it comes to migrating beekeeping, provides many benefits to nutrition, health and longevity (Crane, 1999; Nazik et al., 2018). These benefits are accessible and inexpensive (beekeepers are "self-sufficient").

Honey, fresh pollen and bee products such as bee bread or royal jelly can be used as food (for example, at breakfast) or as food supplements, considering their high nutritional value. On the other hand, if the beekeeper uses bee products immediately after harvesting, it becomes completely fresh and nutritious. Because of its carbohydrate content, which are rapidly absorbed in the blood stream, honey is a fast source of energy. In addition, honey represents a source of minerals, vitamins, enzymes, antioxidants and lactobacillus that provide good energy and immunity for the beekeeper. As a practical conclusion, every beekeeper should use 50-80 grams of honey daily – in meals, or directly from combs, alternatively as a drink dissolved with water and lemon juice (this beverage replacing water and some minerals lost during work) (Strant, 2018).

Fresh pollen and bee bread are a rich source of proteins and essential fatty acids, while glucides, minerals, vitamins, antioxidants, fiber, lactobacilli and other components provide the nutrients to

the body. They also have a great therapeutic and preventive health value. The use of fresh pollen or beebread daily, can actually supply the nutritional and energetic needs of the body. Depending on the purpose of use, the daily maximum dose should range between 20g and 40g of fresh pollen, respectively and 10-20 g of beebread (Asafova et al., 2001; Mateescu, 2011; Varadi et al., 2017; Strant, 2018).

Royal jelly can be also useful due to its bio stimulant effect given by its special nutrients. Royal jelly is considered a micro-food with important effects in the body, helping to maintain health and stamina of the beekeeper. Adding 5-10 grams of fresh royal jelly to the daily diet during intensive working period will improve body condition, stamina and immunity (Strant and Varadi, 2016; Strant, 2017a). Even this dose seems to be high comparing with other scientist recommendations - 0,75 grams/day (Bogdanov, 2006), there are recent evidences from the literature showing that higher doses are successfully used without side effects (Çavuşoğlu et al., 2009; Münstedt et al. 2009).

Considering the health effects of bee products, their consumption by beekeepers is very important, under condition of a proper production and storage.

Possible Risks in Production Activities

A. Physical Challenges

The beekeeping activity implies the exposure to many positive and negative effects. The number of colonies of the beekeeper determines the workload. The higher the number of colonies is, the higher the workload is, which means that the beekeeper is influenced longer by the weather conditions (Mujuni et al., 2012; Zheng et al., 2018). For example, wearing a protection suit during hot and sunny weather can lead to heatstroke as the water loss increases.

Excessive heat is an environmental and occupational hazard. The risk of heat-related death increases with natural aging, but people with specific social or physical vulnerability are also at risk (Kovats and Hajat, 2008). Research on the impacts of climate change and trends has mostly focused on thermal stress, extreme weather events and infectious diseases, future estimates of regional food yields and hunger prevalence. A wider approach has resulted in wider health risks due to social, demographic and economic disruptions of climate change (McMichael et al., 2006).

There is something wrong with encouraging non-use of gloves among beekeepers. The person who does not wear gloves can be seen as a more skilled beekeeper. On the other hand, it is forgotten that wearing gloves gives us good health and good results. A study conducted in Germany investigated bee sting risk factors among beekeepers and determined the level of allergy; the annual average number of bee stings in beekeepers was determined as 57.8. In general, 46 (4.4%) of beekeepers reactions to bee venom were systemic reactions, 797 beekeepers (75.6%) had mild local reactions and 196 beekeepers (18.6%) were not reactive. Various risk factors were also confirmed in the study. According to their significance, the upper respiratory tract symptom, the presence of other allergies, the time spent in beekeeping and the bee stings in the spring have been found to increase allergic reactions when working with beehives. According to this survey, psychological condition of the beekeeper was found to be related with appearance of allergic reactions (Münstedt et al., 2008). Exposure to bee venom and allergens is declining over the years, results suggesting that practice of beekeeping induce a relatively high incidence of allergic reactions but with a trend to the spontaneous improvement of symptoms and a low incidence of severe reactions (Pastorello et al., 1987). According to the study revealing this situation, protective factors against bee venom have been determined to be 0.32 in beekeeping activity of over 20 years and for people over 50 years age, compared with 4.33 for beekeepers with less than 10 years of beekeeping (Becerril-Angeles et al., 2012). The atopy, which is high in systemic and large local reactions after bee stings among beekeepers, is associated with systemic reactions. The presence of nose or eye symptoms may increase when working in hives and the risk of significant systemic reactions is less when the activity has been developed for less than 15 years (Annila et al., 1996).

Turkish beekeepers have also been reported to have a low incidence of systemic reactions and a high frequency of bee incidence. It has been stated that the presence of an atopic disease and the risk of a systemic reaction will increase the risk of two or more concurrent diseases tenfold (Celikel et al., 2006).

On the other hand, there are other health complications, the risk of being bitten by other insects, sometimes being life-threatening. The most common in Europe are spiders and ticks, which can cause long-term complications. Lyme borreliosis is known to be associated with several outdoor professions and activities. A study made in 2012 in Austria, Germany, Luxemburg and Switzerland, by distributing questionnaires (based on various earlier investigations) to 732 beekeepers showed that for 31.1% of the responders, Lyme borreliosis had been diagnosed. Only a minority of responders (11.4%) used protection against tick bites. As a conclusion of the study, beekeepers should be considered as a high-risk group for Lyme borreliosis when compared to the general population and even forest workers (Münstedt and Thienel, 2012).

In warm climate countries such as Turkey, beekeepers can confront with scorpion's bites that can also be life threatening. Education must be encouraged to increase the use of protective equipment in order to decrease the incidence of Lyme borreliosis and other problems caused by various insects. Beekeepers should be also educated in first aid measures, especially when they confront with poisonous insects and they are far away from hospitals (Strant and Topal, 2017).

Beekeepers and their family members exposed to propolis also represent a risk group for allergies. Sensitivity in these groups ranges from 0.76% to 4.04%. According to the results of the research done in Poland, out of 558 beekeepers, 17 (3.05%) were found to develop allergic reactions to propolis. Comparing with general healthy population, where propolis allergy ranges from 0.64% to 1.3%, beekeepers appear to be more sensitive to propolis (due to the long contact with propolis). However, at the same time, they are not more affected with propolis allergy comparing with patients cured earlier because of allergic dermatoses (1.2%-6.7%) (Basista and Filipek, 2012; Basista-Sołtys, 2013). Another study returned 1051 questionnaires, of which 37 beekeepers (3.6%) were allergic cases and 10 of them accepted allergic reactions before the study. Propolis contact allergy is associated with significant lung diseases and other allergic reactions. Few of the propolis-affected beekeepers chose to protect themselves (Münstedt et al., 2007).

Another issue for beekeepers might be smoke exposure. It is well known that exposure to smoke is one of the main cause of chronic bronchitis and chronic obstructive pulmonary disease (COPD) in non-smokers in rural villages. Beekeepers use the smoke for the purpose of calming bees and reducing stings. An investigation has been made to study factors for obstructive airway diseases among beekeepers. At all types of respiratory symptoms such as coughing, sputum and breathing difficulty, the results of the pulmonary function tests were not significantly different in beekeepers compared to control subjects for each smoking and non-smoking group ($P > 0.05$). However, both beekeepers and control subjects showed decreased lung function and increased respiratory symptoms in cigarette smokers when compared to non-smokers ($P < 0.05$). It was suggested that less intense and short working periods in addition to outdoor exposure to biomass smoke in beekeepers might be a factor of lower risk for chronic bronchitis (Polatlı et al., 2002). On the other hand, education about the consequences of cigarette smoking would probably have a great effect on health status of beekeepers as well.

In Germany, beekeeping is used to encourage the use of royal jelly, honey, pollen and propolis – as apitherapy - because of their healing properties. The effects of bee products consumption on the physical health of the beekeepers were determined by questionnaire. When they have been asked if pollen and propolis were used, results showed that propolis was used for cold, burns, sore throat, gum disorders, prostate disorders and generally for prophylactic action (Hellner et al., 2008).

As a result, due to unconscious and inadequate use of drugs used to fight diseases and harmful substances used in their hive, beekeepers have reduced their immunity and harmed their own health. It must become a necessity to be attentive with chemical applications. Colony transplants, as a result of migratory beekeeping, lead sometimes to undesired situations. Excessive fatigue caused by the number of colonies and the insufficient number of workers is accompanied by a lack of attention, resulting in accidents. Some of the beekeepers that worked at night reported to have suffered of insomnia and attention deficit. Due to uncoordinated and unplanned migration, it is possible that bees and beekeepers confront with

various stressful situations that disrupt their plans (Gaga and Esaulov, 2016).

B. Mechanical difficulties

Optimization of working conditions is very important. Particularly, the tools and equipment for work must be ergonomic and functional. Ergonomic work helps the worker to reduce physical stress in the body and eliminate skeletal-muscle disorders. In terms of beekeeping, especially the type of hives and their height, ergonomic work is very important for a healthy performing of the activity. For this reason, the ergonomic efficiency of the beehives is essential and necessary for improving harvest conditions and reducing the stress load on the beekeeper while ensuring a high quality of the bee products (Günbey, 2007).

Bending over beehives during work has a negative impact on the skeletal system. Farmers and beekeepers are particularly at risk for work-related musculoskeletal disorders (Osborne et al., 2012; Maina et al., 2016) and work is underway to identify these risks (Colombini et al., 2012). In the study of the effect of the height ergonomics of the honey harvest, it was shown that the most effective task of the harvest was the cutting of honey combs, which required more flexion of the waist, wrist, neck and twisted posture (Aiyeloja et al., 2015). This result is the most important factor affecting the degree of bending of body parts. The study has been suggested for ergonomic beekeeping with an average height of 80-84 cm compared to average human height.

C. Environmental Challenges

The beekeepers are mostly challenged and exposed to environmental factors. Variable environmental conditions become a stress source for the beekeeper. The fact that agricultural production is flora-orientated is a proof of the difference when compared to other production models (Crane, 1990).

In Europe, beekeepers are migrating 2 times per year, while in Turkey beekeepers might do it 4-5 times per year. Beekeeping is carried out after a migration model and the beekeeper may be forced to spend 5-6 months apart from their family. In some cases, this place is close to home, but most of the time it is far away (Günbey, 2007). The beekeeper, who has spent his life in the barracks where bees are also found, faces many difficulties. Water supply, electricity, food preservation and social life are very difficult to get being away from normal conditions (Zheng et al., 2018). Cold weather also stresses the beekeeper. When faced with an urgent health problem, it is necessary for them to make their first intervention and to have a first aid kit.

Bekret et al., (2015) also stated that the nectar and pollen resources from the Kayseri region that could benefit to breed young bees, particularly in early spring, were scarce. In recent years, local beekeepers have reported that periods of flowering and nectar secretion have changed as an effect of global warming, honey yield has fallen and complaints have been made. These changes in the flora force the beekeeper to be helpless, either to feed or to move their bees to another region.

Other issues related to beekeepers' health

The level of education is very important for a right and quick decision during beekeeping activity. Generally, the level of education of beekeepers is low throughout in some countries (Soysal and Gürcan, 2005). As educational level and awareness increase, the view and decision making of risk factors are changing (Westaby and Lee, 2003). As the level of education increases, the attention to health is also increasing. Income level and access to facilities are directly linked. If the economic income of the beekeeper is good, it reflects in the use of new tools and equipments and raises the quality of life in the vicinity (Günbey, 2007).

Conclusion

The main finding of this review was that beekeeping is an intensive activity model. In this process, beekeepers health faces certain risks. In the process of decision-making, healthcare and risk factors should also be evaluated. It should not be forgotten that beekeepers will be able to earn money from their own products, as well to protect themselves from health costs by using their own bee products for prevention. Since it is easier to prevent diseases with proper nutrition and lifestyle, it is necessary to nurture oneself regularly, with high quality food and at the right time.

In cases where the number of hives has to be increased, additional workforce needs to be used. Over time, without intense competition, the intense work should be reduced and then adjusted so that the workload is not compromised. It is

especially necessary to use the machines when transporting the hives. Increasing the amount of workforce when needed, as well as reducing stress factors, are very important to protect the beekeepers' health.

According to the results of previous studies and to authors' inferences, the conditions for optimum beekeeping can be listed below:

1. Each beekeeper should be able to easily lift an average load of 30 kg.
2. The place where the bees are located should be clean, sunny, with access to drinking water within 200 m, nectar resources within 2 km and away from other bees (looting, disease).
3. Proper colony management (spring, winter care, harvesting period) and additional feeding should be done if needed.
4. Bees must be protected against diseases and pests.
5. If the beekeeper is working as an amateur, he should work with bees as much as he can handle, and if he is a professional, he should work as much as he can afford. It should not be forgotten that there is no chance to compete with producers with low production inputs.
6. Beekeepers shall use bees from their region.
7. Work with the correct beekeeping tools and equipment, beekeeping mechanization should be utilized.
8. Beekeepers should be knowledgeable about technical beekeeping.
9. Beekeepers must have knowledge of the flora and should be able to follow the flora.
10. Beekeepers should be constantly aware about the weather forecast, considering meteorological conditions can change fast (Nettleingham and White, 2008; Peterson, 2017).

The limitations of this review are related to the lack of statistical data and indicators about the main subjects presented by authors: beekeepers' health, mechanical difficulties, environmental problems. Due to the lack of literature studies on this topic, the review is based mostly on qualitative rather than quantitative data and on authors' inferences and experiences. Further studies on beekeepers are needed in order to demonstrate the influence of their work upon their health.

References

1. Aiyeloja A A, Adedeji G A, Emerhi E A, (2015). Impacts of beehive stand's heights and hive's types on the ergonomics of honey harvesting in Port Harcourt, Nigeria. New York science Journal, 8(4), 23-27.
2. Annila I T, Karjalainen E S, Annila P A, Kuusisto P A, (1996). Bee and wasp sting reactions in current beekeepers. Annals of Allergy, Asthma & Immunology, 77(5), 423-427.
3. Asafova N, Orlov B, Kozin R, (2001). Physiologically active bee products. YA Nikolaev Nijnij Novgorod, 360.
4. Aybek A, Güvercin Ö, Hurşitoğlu Ç, (2003). Teknik personelin iş kazalarının nedenleri ve önlenmesine yönelik görüşlerinin belirlenmesi üzerine bir araştırma. KSÜ Fen ve Mühendislik Dergisi, 6(2), 91-100.
5. Basista-Sołtys K,(2013). Allergy to propolis in beekeepers-a literature review. Occupational Medicine & Health Affairs, 1(105), 1-3.
6. Basista K M, Filipek B, (2012). Allergy to propolis in Polish beekeepers. Advances in Dermatology & Allergology/ Postepy Dermatologii i Alergologii, 29(6), 440-445.
7. Becerril-Ángeles M, Núñez-Velázquez M, (2013). Risk factors for allergy to honey-bee venom in Mexican beekeepers. Revista Alergia Mexico, 60(3), 100-104.
8. Bekret A, Çankaya S, Silici S, (2015). The Effects of Mixture of Plant Extracts and Oils are Added to Syrup on Honey Bee Colony Development and Honey Yield. Turkish Journal of Agriculture-Food Science and Technology, 3(6), 365-370.
9. Berk M, Önal B, Güven R, (2011). Çalışma ve sosyal güvenlik bakanlığı iş sağlığı ve güvenliği genel müdürlüğü (İSGGM): Meslek hastalıkları kitabı. Ankara: Matsa Basımevi.
10. Bogdanov S, (2006). Contaminants of bee products. Apidologie, 37(1), 1-18.
11. Çavuşoğlu K, Yapar K, Yalçin E, (2009). Royal jelly (honey bee) is a potential antioxidant against cadmium-induced genotoxicity and oxidative stress in albino mice. Journal of medicinal food, 12(6), 1286-1292.
12. Ceylan H, Başhelvacı V S, (2011). Risk değerlendirme tablosu yöntemi ile risk analizi: Bir uygulama. International Journal of Engineering Research and Development, 3(2), 25-33.
13. Celikel S, Karakaya G, Yurtsever N, Sorkun K, Kalyoncu A F, (2006). Bee and bee products allergy in Turkish beekeepers: determination of risk factors for systemic reactions. Allergologia et immunopathologia, 34(5), 180-184.
14. Colombini D, Occhipinti E, Peluso R, Montomoli L, (2012). Hazard identification and pre-map with a simple specific tool: synthesis of application experience in handicrafts in various productive sectors. Work-Journal of Prevention Assessment and Rehabilitation, 41, 3956.
15. Crane E, (1990). Bees and beekeeping: science, practice and world resources. Heinemann Newnes.
16. Crane E, (1999). The world history of beekeeping and honey hunting. Duckworth. London, UK, 35-103.
17. Donham K J, Thelin A, (2006). Agricultural Medicine: Occupational and Environmental Health for Rural Health Practitioners. Ames, IA: Blackwell Press; 2006: 341–345.

18. Gaga V A, Esaulov V N, (2016). Innovative Technologies And Modern Facilities In Beekeeping. IOP Conference Series: Materials Science and Engineering, 142 (1), 1-11.
19. Günbey V S, (2007). Van ili gezginci arıcılık hareketlerinin belirlenmesi. Yüksek lisans tezi, Yüzüncü Yıl Üniversitesi Fen Bilimleri Enstitüsü (Basılmamış), Van. Hellner M, Winter D, von Georgi R, Münstedt K, (2008).
20. Apitherapy: usage and experience in german beekeepers. Evidence-Based Complementary and Alternative Medicine, 5(4), 475-479.
21. Hofmann D A, Burke M J, Zohar D, (2017). 100 years of occupational safety research: From basic protections and work analysis to a multilevel view of workplace safety and risk. Journal of Applied Psychology, 102(3), 375.
22. Kara B, Şimşek Z, (2014). Güneydoğu Anadolu Bölgesi'nde Pestisit Satış Yerlerinde Risk Değerlendirmesi. VII. Uluslararası İş Sağlığı ve Güvenliği Konferansı. 5-7 Mayıs 2014-İstanbul.
23. Kovats R S, Hajat S, (2008). Heat stress and public health: a critical review. Annu. Rev. Public Health, 29, 41-55.
24. Ismail W I W, (2016). A review on beekeeping in Malaysia: History, importance and future directions. Journal of Sustainability Science and Management, 11(2), 70-80.
25. Nettleingham J, White B, (2008). Beekeeping Certificate III, Participants Learning Guide, RTE3713A Carry out workplace OHS procedures. Australian Honey Bee Industry Council: 4-18, Available at: https://honeybee.org.au/pdf/BSBCMN304A.pdf. Accessed: 07.05.2018.
26. McMichael A J, Woodruff R E, Hales S, (2006). Climate change and human health: present and future risks Lancet 367 (9513): 859–869.
27. Maina G, Rossi F, Baracco A, (2016). How to assess the biomechanical risk levels in beekeeping. Journal of agromedicine, 21(2), 209-214.
28. Mateescu C, (2011). Apiterapia sau Cum să folosim produsele stupului pentru sănătate. ISBN 978-973-9250-90-0. Bucureşti.
29. Menemencioğlu K, (2012). Tarım ve orman işçiliğinde çalışma yeri koşulları ve karşılaşılan sorunlar. Türk Bilimsel Derlemeler Dergisi, (2), 72-76.
30. Mujuni A, Natukunda K, Kugonza D R, (2012). Factors affecting the adoption of beekeeping and associated technologies in Bushenyi District, Western Uganda. Livestock Research for Rural Development (24), 133.
31. Münstedt K, Bargello M, Hauenschild A, (2009). Royal jelly reduces the serum glucose levels in healthy subjects. Journal of Medicinal food, 12(5), 1170-1172.
32. Münstedt K, Hellner M, Winter D, Von Georgi R, (2008). Allergy to bee venom in beekeepers in Germany. Journal of Investigational Allergology and Clinical Immunology, 18(2), 100.
33. Münstedt K, Hellner M, Hackethal A, Winter D, Von Georgi R, (2007). Contact allergy to propolis in beekeepers. Allergologia et immunopathologia, 35(3), 95-100.
34. Münstedt K, Thienel J, (2012). Beekeepers in central Europe are at high risk for contracting Lyme borreliosis. Journal of Apicultural Research, 51(4), 291-297.
35. Nasir N F M, Kannan T P, Sulaiman S A, Shamsuddin S, Azlina A, Stangaciu S, (2015). The relationship between telomere length and beekeeping among Malaysians. Age, 37(3), 58.
36. Nazik H, Turhan M, Koca T T, Mülayim M K, Öztürk P, Nazik S, (2018). Arıcılarda Arı Ürünlerine Maruziyet ile Allerji, İnflamasyon ve Enfeksiyon İlişkili Durumların Araştırılması. Kahramanmaraş Sütçü İmam *Üniversitesi* Tıp Fakültesi Dergisi, 13(2), 34-37.
37. Osborne A, Blake C, Fullen B M, Meredith D, Phelan J, McNamara J, Cunningha C, (2012). Prevalence of musculoskeletal disorders among farmers: a systematic review. American journal of industrial medicine, 55(2), 143-158.
38. Pastorello E A, Incorvaia C, Sarassi A, Qualizza R, Bigi A, Farioli L, (1988). Epidemiological and clinical study on bee venom allergy among beekeepers. Bollettino dell'Istituto sieroterapico milanese, 67(5-6), 386-392.
39. Perry J M, (2017). Agricultural Health and Safety. International Encyclopedia of Public Health (Second Edition), 38–44.
40. Peterson M M, (2017). The Basics of Beekeeping. Available at: https://www.scottishbeekeepers.org.uk/images/education/studynotes/MagnusNotesComplete.pdf. Accessed: 07.01.2018.
41. Polatlı M, Sönmez H M, Cildag O, (2002). Respiratory symptoms and pulmonary function tests in beekeepers exposed to biomass smoke inhalation. Journal of apicultural research, 41(1-2), 51-57.
42. Popa A A, Mărghitaş L A, Pocol C B, (2011). Factors that influence entrepreneurship in the beekeeping sector in the North-West Region of Romania.Analele Universităţii din Oradea, Fascicula: Ecotoxicologie, Zootehnie şi Tehnologii de Industrie Alimentară, 10(A), 287-295.
43. Pyykkönen M, Aherin B, (2012). Occupational Health and Safety in Agriculture. Sustainable Agriculture, 391.
44. Stanhope J, Carver S, Weinstein P, (2017). Health outcomes of beekeeping: a systematic review. Journal of Apicultural Research, 56(2), 100-111.
45. Strant M, Grosu R, (2016). Natural remedies for the most common diseases of beekepers.Training notes. Cluj-Napoca.
46. Strant M, Varadi A, (2016). Royal jelly, studies, clinical cases. Api-therapy Symposium and work-shop, Cluj-Napoca, Romania,18-19 February.
47. Strant M, Topal E, (2017). Possible Risk and Hazard Factors for Beekeeper Health. 45th APIMONDIA International Apicultural Congress. 29 September-4 October 2017 İstanbul, Turkey.
48. Strant M, (2017a). A Treasure in Apiterapy ''Royal Jelly''- Myths and Realities. II. Marmaris Apitherapy and Apicultural Products Symposium 14-15 October, Marmaris, 41-42.
49. Strant M, (2017b). Personal experience and practices for royal jelly, Cluj-Napoca.
50. Strant M, (2018). Personal experience and practices for pollen, bee bread and honey, Cluj-Napoca.

51. Soysal M A, Gürcan E K, (2005). Tekirdağ İli Arı yetiştiriciliği Üzerine Bir araştırma. Tekirdağ Ziraat Fakültesi Dergisi. 2(2):161-165.
52. Şimşek Z, Kayı, İ, Keklik Z, Demir C, (2014). GAP Bölgesi'nde Tarımda Hastalık ve Erken Ölümlerle İlişkili Risk Değerlendirmesi. VII. Uluslararası İş Sağlığı ve Güvenliği Konferansı. 5-7 Mayıs 2014-İstanbul.
53. Topal E, Atayoğlu T A, Kösoğlu M, Atayoğlu G A, (2016). Arıcılıkta İş Sağlığı ve Güvenliği Risk Faktörleri. 8.Uluslararası İş Sağlığı ve Güvenliği Konferansı. S:458. 8-11 Mayıs. Haliç Kongre Merkezi. İstanbul.
54. Tunca R İ, Çimrin T, (2012). Kırşehir İlinde Bal Arısı Yetiştiricilik Aktiviteleri Üzerine Anket Çalışması. Iğdır Univ. J. Inst. Sci. & Tech. 2(2), 99-108.
55. Varadi A, Starnt M, Margaoan R, (2017). Daily Api Diet Benefits. Why is Good to Introduce Bee Products in Your Daily diet? II. Marmaris Apitherapy and Apicultural Products Symposium 14-15 October. Marmaris, 59-67.
56. Westaby J D, Lee B C, (2003). Antecedents of injury among youth in agricultural settings: A longitudinal examination of safety consciousness, dangerous risk taking, and safety knowledge. Journal of safety research, 34(3), 227-240.
57. Zheng H, Cao L, Huang S, Neumann P, Hu F, (2018). Current Status of the Beekeeping Industry in China. In Asian Beekeeping in the 21st Century (pp. 129-158). Springer, Singapore