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# ECONOMIC ASPECTS OF THE COLONY COLLAPSE DISORDER (CCD) IN BULGARIA

**G. Aleksiev***

Department of Management, Trakia University, Stara Zagora, Bulgaria

**ABSTRACT**

The apiculture is an important part of the agricultural sector, not only for the production of healthy foods and supplements, but also for the part that bees play in the plants pollination. In this context the loss of bee colonies reflects on the economic results in the apicultural sector, as well as on the production potential of the agricultural sector, as a whole.

The purpose of the study is to evaluate the economic consequence of the loss of bee colonies in different agricultural regions of the country and analyze the impact of the factors – size of the apiculture production units and the professional experience of the bee-keeper.

To reach its goal the study moves through three phases. In phase one an evaluation is made on the overall condition of the sector and the loss of bee colonies in different regions of the country. Inquiry between producers with different number of bee colonies is held in phase two, and the data is used to evaluate the impact of the size of the producer and professional training of the bee-keeper. The focus of attention in phase three is on the economic consequence of the loss of bee colonies and its impact on the development of the sector after the accession of the country to the European Union. In the study data from centralized and decentralized sources have been used, as well as own information, inquired by conducting interviews with specialist and people engaged in the sector.

**Key words:** apiculture, colony collapse disorder, income

## INTRODUCTION

The loss of apicultural families is viewed as problematic mainly due to the important role that bees play in the agriculture, on one hand as providers of healthy food, and on the other as the main pollination agent. The complete or partial decay of the number of apiculture colonies in any given region will result in a decline of the agricultural production. A study of the factors leading to a complete loss of the bee-colonies is necessary for insuring the sustainable development of the sector in Bulgaria. The importance of the apiculture for a future sustainable increase of the production in the agricultural sector if the country is undeniable and there for the future sustainment and preferably increase of the number of active bee colonies must be secured.

Since the beginning of the 21st century the loss of apicultural families due to "unknown" factors is continuously growing. This issue is investigated by many researchers who propose many different answers and suggestions for its resolution. Thou the problem is identified and well described the factors that determine it are still argued upon. Most researchers believe that the extensive use of insecticides and pesticides as well as the electro-magnetic contamination of the environment are arguably the most important ones. The number of apicultural colonies lost in Bulgaria due to "unknown" reasons is growing in later years and even more so after the

***Correspondence to**:*Georgi Aleksiev, Department of Management, Trakia University, Stara Zagora, Bulgariae-mail: georgi.alexiev@gmail.com*

accession of the country to the European Union. This progression must be investigated and its factors uncovered in order for the study to propose a sustainable solutions for the future of the sector.

The study is implemented from March to June 2013, as a part of a larger project focused on the problems regarding the decay of some parts of the apicultural sector and tasked with offering institutional, economic and if possible – technical solutions for its sustainable development. The focus of the study is on the period after the accession of the country to the European Union, as that is a point linked to a significant change in the production techniques, the overall production, yield and structure of the sector.

The goal of the study is to evaluate the impact of the process of losing apiculture colonies on the overall production in the sector as well as the economical consequences for the producers. The study goes through four phases. In the first one a summary of the data on the issue is analyzed. During the second phase the losses of colonies in Bulgaria are studied on a regional base, and in-depth interviews with producers are held in phase 3. In the final phase some conclusions are drawn towards the sustainable resolution of the issue.

The main sources of information used are: Ministry of Agriculture and Foods, National Statistical Institute, Eurostat and FAO centralized databases. The particular study of the factors responsible for the loss of apicultural colonies in the country was held among 72 producers evenly spread through the six regions of the country (North-Western, North-Central, North-Eastern, South-Western, South-Central and South-Eastern) and the four groups based on the size of the production (up to 10 colonies, 10 to 50 colonies, 50 to 150 colonies, over 150 colonies). The study was held between April and June 2013 and covers a period yet uncovered by official data.

**Colony Collapse Disorder (CCD) and other causes for loss of apicultural colonies**

The Colony Collapse Disorder (CCD) is a term crafted in 2006 to cover the unaccounted for disappearance of worker bees in hives all over the word, since the problem arose severely in North America and was not confined to Europe and Asia. Such accounts of loss of colonies date back to the domestication of the bees, but the drastic rise of the number of cases cannot go unnoticed. The increased use of neonicotinoid pesticides traces the rise of apicultural losses as latest study on the subject are proving, as the chemicals impact the worker bees in several ways – through pollens, dust and nectar. The result is a failure of the affected specimens to return to the hive without immediate lethality, which is the primary symptom of the disorder. As a result of those studies and a peer review by the European Food Safety Authority a position was taken that neonicotinoid pesticides pose a threat to the apicultural sector and therefore there use must be regulated. CCD is a consequence of many factors and there combinations. An argument was made about the link between the Varroa mites, Nosema Apis parasites and some localized diseases that weaken the colony, conditioning it for the Disorder. Other environmental factors ware also argued to affect the bee colonies in this way, such as electro-magnetic waves, pollution, environment-change related stress and so on, although no relation was scientifically proven.

The economic significance of CCD is based on the declining quality of pollination in agricultural areas most affected by the disorder, as well as on the reduction of the production in the apiculture. Considering those facts, with a goal to stop the declining in the number of bee colonies in Europe, the European Commission passed legislation in April 2013 that banned the use of many neonicotinoid pesticides.

**Dimension of the Colony Collapse Disorder (CCD) in Bulgaria**

In recent years worldwide CCD is accounted for a loss of around 20% of the apicultural families. In Bulgaria a full measurement of the scale of the problem is yet to be conducted. In official documents (Agro-Statistics, Agricultural Bulletins and etc.) CCD is not proposed as a viable option for the loss of an apicultural colony. In order to assess the scale of the issue and the factors that determine it a thorough investigation must be conducted. This study does not profess a full examination of the problem, but an appraisal of the economic consequences of CCD on the apicultural sector in Bulgaria.

Due to the significant difference in the topography, climate, population and agricultural development of Bulgarian regions they are separated so individual analysis can be made. The period studied covers the years after the accession of the country to the EU, and the data in **Table 1** is shown as an average of the values for those years. In Bulgaria for the studied period an overall of 12% of the bee colonies ware lost due to various reasons, which is well below the European countries average. The most significant factor that accounts for 53% of all losses is marked as "unknown" or "other" and therefore a more in-depth study of that group is required.

***Table 1.*** *The loss of apiculture colonies in Bulgaria (2007 – 2011)*

| Regions | Apicultural colonies | Total colonies lost | Due to poisoning | Due to disease | Due to starvation | Due to unknown reasons |
|---|---|---|---|---|---|---|
| North-Western | 104915,6 | 14606,6 | 1171,2 | 2656,2 | 3708,2 | 7071,2 |
| North-Central | 131513 | 11753,2 | 1603 | 1410,4 | 2825,4 | 5914,4 |
| North-Eastern | 133275,2 | 14635,8 | 2473,6 | 2404 | 3333,8 | 6424,4 |
| South-Western | 51461,6 | 11475,6 | 2817,8 | 1668,4 | 1543,2 | 5446,4 |
| South-Central | 96075,2 | 12559,4 | 1038 | 1507,8 | 1991,8 | 8021,6 |
| South-Eastern | 114221,6 | 12143,4 | 776,4 | 1583 | 1958,8 | 7825,2 |
| Bulgaria | 631462,2 | 77174 | 9880 | 11229,8 | 15361,2 | 40703,2 |

Source: Calculated on database of "Agro-statistics" Department at MAF

In the North-Western region of Bulgaria a high number of bee colonies are lost but due to the large production base in that part of the country, the losses are under 14%, which is close to the period's average. In later years there is a significant decline in the number of producing colonies and a consistent increase of the lost apicultural families that outlines an alarming trend that can lead to a serious decay of the base for production in the region. A similar tendency can be noted in the North-Central region of the country, where the rising number of lost colonies is faced by a gradual decline in the number of bee hives. This trend is still weak but can also prove problematic for the sector in the future. The situation is very different in the North-Eastern part of the country that shows an alarming trend of doubling the number of lost apicultural families in the last two years of the studied period, while the number of bee hives in the region remains on the same levels. The North-Eastern part of Bulgaria is traditionally one of the strongpoints of the apicultural sector in the country and its decay can have a large impact on the overall production as well as on the agriculture as a hole, since that region is also one of the most heavily used by the sector.

In the South-Western part of the country the apiculture was always underdeveloped since that is mainly industrial and heavily populated region. During the studied period a quick degradation of the sector is underway and in 2011 an alarming 63% of the bee colonies ware lost manly due to poisoning. The apiculture in this region is mainly a source for additional income and does not have professional characteristics and therefor the relatively large amount of the losses will prove to be economically insignificant to the sector. In the South-Central region the constant increase of the number of lost bee hives coincides with a persisting decay of the base for production in this part of the country. By the end of the studied period a little under 22% of the colonies are lost, even if the average for the region is 13%. In the South-eastern part of the country a gradual decrease of the number of bee colonies supports the increase of the losses, although the period's average is equal to the country's – 12%.

In all regions of the country a decline of the number of the apicultural colonies and an increase in the number of lost hives was noted. The preliminary data for 2012 shows that a gradual recovery of the sector is underway, but

that can only be proven by official data, whenever it is made available.

The poisonings of the colonies account for 13% of all lost hives. The lower than the European average use of pesticides and especially neonicotinoids, accounts for the smaller number of losses, due to this factor. The number of apicultural families lost to disease in later years has spiked, mainly because of the transformation of the production practices undergoing in the sector, in order to answer the stricter requirements regarding the safety and quality of the foods on the EU market. The producers have not yet adapted to the new technics and medicines and therefor lose more colonies to disease than usual. The institutional support towards the integration of the new production techniques and supplies has proven to have positive effect on the sector.

The loss of apicultural families to starvation is characteristic for the northern parts of the country, due to the harshest climatic conditions and the lower quality of the products used during the winter hibernation of the colonies. The rapid transformation of the agricultural sector in the northern regions towards the production of just technical cultures and grains leads to a lowering of the quality of the honey and using that honey in the same quantities during the winter hibernation leads to starvation of some colonies. This factor for losing the apicultural families has a weaker impact in the southern regions due to better soothing climatic conditions that increase the survivability of the colonies.

The Colony Collapse Disorder is not regarded as a disease, but as an overall loss of the bee population of the hive and therefor the cases of CCD are mostly accounted in the "Due to unknown reasons" factors. The number of colonies lost for no identifiable reason is fluctuating throughout the studied period and a trend cannot be drawn. Nevertheless a rapid increase in the number of cases in this category in the last year of the period requires an in-depth investigation, which can only be completed through a survey among producers in all regions of the country.

An inquiry with produces was held as a part of the study during the months of April and May 2013. Overall 72 respondents took part, evenly distributed among all six regions of the country and the four groups based on number of colonies in production. The data is not representative but allows for some conclusion to be drawn regarding the factors for losing the apicultural families.

***Table 2.*** *Average result of the inquiry among producers on the question "How many bee hives have you lost each year – form 2007 to 2012?"*

| | under 10 | 10 to 50 | 50 to 150 | over 150 |
|---|---|---|---|---|
| North-Western | 4,33 | 21 | 34 | 32 |
| North-Central | 2,33 | 10 | 29 | 30 |
| North-Eastern | 4 | 19 | 31 | 45 |
| South-Western | 5,33 | 23 | 38 | 44 |
| South-Central | 4,33 | 17 | 31 | 39 |
| South-Eastern | 3,67 | 12 | 27 | 31 |

Source: Calculated from the results of an own inquiry.

The results of the study show that producers with less apicultural colonies suffer from relatively heavier losses due to a number of reasons. Mostly because for them the apiculture is a hobby and a source of quality food for the household and they tend to pay less attention to the symptoms shown by the bees, and take longer to find and implement the right solutions in the appropriate time and with the necessary skill. This group of producers recovers their losses slower than the others, but is more viable and has stated that a heavy loss (of over 50% of the colonies) won't drive them out of the sector.

The group of producers with 10 to 50 colonies also suffers of heavy relative losses in some of the periods with bad climatic conditions. They are producing mainly for the household but

market some of the products, mostly to cover for the cost of medicine and inventory. This group recovers quicker than the smaller one due to internal transfers of queen bees and in some cases better relations with other producers in the region. When asked if a heavy loss of colonies (over 50%) will drive them out of the sector, most replayed that they will probably pass the production to younger members of the family, but will continue to produce with a joined effort.

The group with 50 to 150 bee colonies suffers from lower relative losses than the first two, mainly due to the professional character of the productions. The extensive knowledge and expertise in this group with mostly around 80-90 colonies, allows for faster reactions to any deviation of the normal condition of the hives. Those bigger producers invest relatively more than the smaller ones mainly in the medicines and inventory. This group is heavily market orientated and they sell a fraction of their products directly to the consumer, thus securing higher profit margin per colony. The larger producers take longer to recover if they suffer from heavy losses of apicultural families, because they will have to buy new queens from a certified supplier which will take time. When asked how will they act if they lose over 50% of their colonies, this larger producers state that the recovery may take them a long time and probably they won't be profitable in that give year, but they will not leave the sector.

The group with over 150 colonies shares many characteristics with the one that has 50 to 150. The main difference is that due to the large amount of the production those producers don't usually sell a very small amount directly to the consumer, and mostly supply the processing plants, which offer lower prices, and thus the profit margin per colony is smaller.

When asked about the Colony Collapse Disorder and the losses they have suffered from it, the larger producers (with over 80 colonies) state that they haven't encounter heavy losses from it and rarely have they found a hive empty. Most of them are concerned with a potential over extensive use of pesticides by the agricultural producers in the region, and agree that the communication between the two groups must be improved. The smaller producers, especially the ones with fewer than 20 colonies are prone to render some of their losses due to CCD. Most of the accounts of the disorder are made in the southern regions of the country, where loses from other sources are mainly lower which helps to maintain a low level of production decay.

## CONCLUSION

The manifestations of the Colony Collapse Disorder in Bulgaria are scattered and too few to make an impact on the economic results in the sector. The other mentioned factors for loss of apicultural families have a stronger role for the recent drop of the number of bee colonies in country. The sector is fragmented with many small producers that are not market oriented and thus cannot face the challenges of the open EU market and its requirements. As stated in the inquiry most producers with fewer than 50 colonies are retired and would like to pass the endeavor along to younger family members. In most cases this is impossible due to the migration of young people to the cities. The main reason for the decline of the number of apiculture colonies in the country is the abandonment of the production by the older bee-keepers which in some cases sell the inventory to the larger producers. This leads to a consolidation and concentration of the production in the sector in order to increase its competitiveness on the open EU market.

Institutional support is required towards a building of an informational backchannel between apicultural producers and the agricultural producers in the sector in order to lower the losses by poisoning on one side and ensure a qualitative pollination process on the other. The National program for apiculture is now in its second planning period and is showing improvement in its support for the sector, an increase of the ease of access to its measures would greatly improve the effectiveness and competitiveness of the smaller producers. Institutional support is needed towards the better education of the producers in order for them to improve on the definitions of the factors leading to the loss of bee colonies and there after the methods to counteract them.