SCIENTIFIC VETERINARY INSTITUTE „NOVI SAD“

INSTITUTE OF VETERINARY MEDICINE OF SERBIA

„One Health – New Challenges“

First International Symposium of Veterinary Medicine

(ISVM2015)

PROCEEDINGS



Hotel "Premier Aqua" - Vrdnik
May 21 – 23, 2015

Publisher

Scientific Veterinary Institute „Novi Sad“, Novi Sad, Serbia

For the Publisher

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Editor in Chief

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Printed by

Multidizajn, Novi Sad

250 copies

Novi Sad, 2015

ISBN: 978-86-82871-36-1

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THE UNUSUAL COLONY LOSSES IN VOJVODINA PROVINCE

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Abstract

The apiculture has been in decline in Serbia as well as in Europe and the USA over recent decades, as is shown by the decreasing numbers of managed honey bee (*Apis mellifera*) colonies. Over the past 10 years, beekeepers have been reporting unusual weakening of bee numbers and colony losses. According to the European Food and Safety Authority (EFSA) no single cause of declining bee numbers has been identified.
During a two-year study (December, 2012 – December, 2014) 210 bee hives were examined from 63 apiaries in Vojvodina province. All samples were examined in laboratories of Scientific Veterinary Institute „Novi Sad". Examination included detection of *Varroa destructor, Aethina tumida, Tropilaelaps spp, Nosema spp, Paenibacillus larvae. Nosema spp.* were detected in 42.48% of the samples, *Varroa destructor* in 21.43%, *Paenibacillus larvae* in 2 examined samples. There were no evidence of *Aethina tumida* and *Tropilaelaps spp* from examined samples from Vojvodina province. According to the results of our study, major detected problems at Vojvodina's apiaries are still *Nosema spp.* and *Varroa destructor*. Our further study will try to determinate others possible causes of colony losses in this part of Serbia.

Key words: apiculture, colony losses, Vojvodina, *Varroa destructor, Nosema spp*

Introduction

The importance of bees and beekeeping is demonstrated directly through the production of honey and other food and feed supplies (EFSA, 2014). Furthermore, honey bees *Apis mellifera* are critically important in sustaining biodiversity by providing essential pollination for a wide range of plants (Bradbear, 2009) as the most economically valuable pollinators of crop monocultures worldwide. FAO (The Food and Agriculture Organization of the United Nations) estimates that of the 100 crop species that provide 90% of food worldwide, 71 are pollinated by bees (EFSA, 2014). According to FAO and the European Union the value of that indirectly importance of bees is 20-30 times higher than value of honey production (Petrović et al, 2013). Also, 35% of the human diet is thought to benefit from pollination (Stindl and Stindl, 2010).

The apiculture has been in decline in Serbia as well as in Europe and the USA over recent decades, as is shown by the decreasing numbers of managed honey bee (*Apis mellifera*) colonies (Van Engelsdorp et al, 2009; VanEngelsdorp and Meixner, 2010; Vejsnaes et al, 2010; Neumann and Carreck, 2010; Nazzi et al, 2012; Meixner et al, 2014). Over the past 10 years, beekeepers have been reporting unusual decreasing of bee numbers and colony losses. Mortality is the highest at the end of winter and beginning of spring (UNEP, 2010; Genersch and Aubert, 2010).

Group of authors Potts et al. (2010) compiled data from 18 European countries to assess trends in the number of honey bee colonies and beekeepers between 1965 and 2005. They found consistent declines in honey bee colony numbers in central European countries, but some increases in Mediterranean countries. Furthermore, beekeeper numbers have declined in all European countries

examined. In Canada, the average level of winter loss of honey bee colonies over the winter of 2013/14 was 25.0% (CAPA, 2014). According to the annual survey conducted by the Bee Informed Partnership and the U.S. Department of Agriculture (USDA) the total loss of honey bee colonies over the winter 2013/14 was 23.2 %, which is slightly less than in previous years when bee losses over the winter had an average of 29.6 % (USDA, 2014). Beekeepers from apiaries in Chile in early spring 2010 reported the massive death of bees (Rodriguez et al, 2012). The total colony losses that occurred in South Africa in 2010-2011 were 46.2 % (Pirk et al., 2014). The average percentage of winter losses in Germany was from 3.8% (2004/05) to 15.2% (2005/06), but regionally higher losses were reported (Genersch et al, 2010). The recorded losses in the Republic of Serbia in the last decade varied from 30 to 70% (Plavša et al, 2013). The decreasing numbers of managed honey bee colonies in some parts of the world is caused by different pathogens, improper pesticide and herbicide use, weather conditions, beekeeping technology, antimicrobial resistance due to uncontrolled use of antibiotics, malnutrition, the environment, the failure by public administrations to control cross-border trade in breeding stock, socio-economic factors, ageing of the beekeeper population and lower market prices for their products and services (van Engelsdorp and Meixner, 2010; CAPA, 2014; Rose et al, 2014; OIE, 2014; Chen et al, 2014). According to the European Food and Safety Authority (EFSA) no single cause of declining bee numbers has been identified. Many studies have indicated that the losses were usually the result of a combination of different causes (Riviere et al, 2013; Chen et al, 2014). Honey bees succumb to a variety of pathogens such as *Nosema spp, Ascarapis woodi, Paenibacillus larvae, Melissococcus plutonius, Aethina tumida, Tropilaelaps spp, Varroa spp* and viruses (Genersch et al, 2010; Antúnez et al, 2012). Ability of honey bees to resist those infections is compromised if they are malnourished or exposed to pesticides (Antunez et al, 2015). COLOSS (Prevention of Honeybee Colony Losses) and the US Department of Agriculture's Area wide and Managed Pollinator CAP (Coordinated Agricultural Project) made the first step in understanding and mitigating honey bees losses and objectively discriminated among types of colony mortality occurring worldwide. This will enable a more informed and appropriate allocation of research efforts into CCD and other causes of mortality in general (Williams et al, 2010).

Vojvodina province has excellent natural conditions for beekeeping. However, unusual colony losses that the beekeepers have encountered represent an important problem whose etiology hasn't been sufficiently examined.

The aim of the present study was examination of the presence of different honey bees pathogens as potential causes of unusual colony losses in Vojvodina province.

Material and methods

During a two-year study (December, 2012 – December, 2014) 210 bee hives were examined. The samples of bees which were used as material for this study have been collected in 63 apiaries in the area of Vojvodina province, Republic of Serbia. All apiaries were clinically examined in detail, whereupon the brood sample size 10 x 10 cm (Regulations about establishment of Programme of animal health protection measures, 2009) were taken, together with approximately 100 adults bees from the back frames, approximately 200–250 bees removed from unsealed brood combs and finally,samples from bottom board were taken for laboratory analysis.

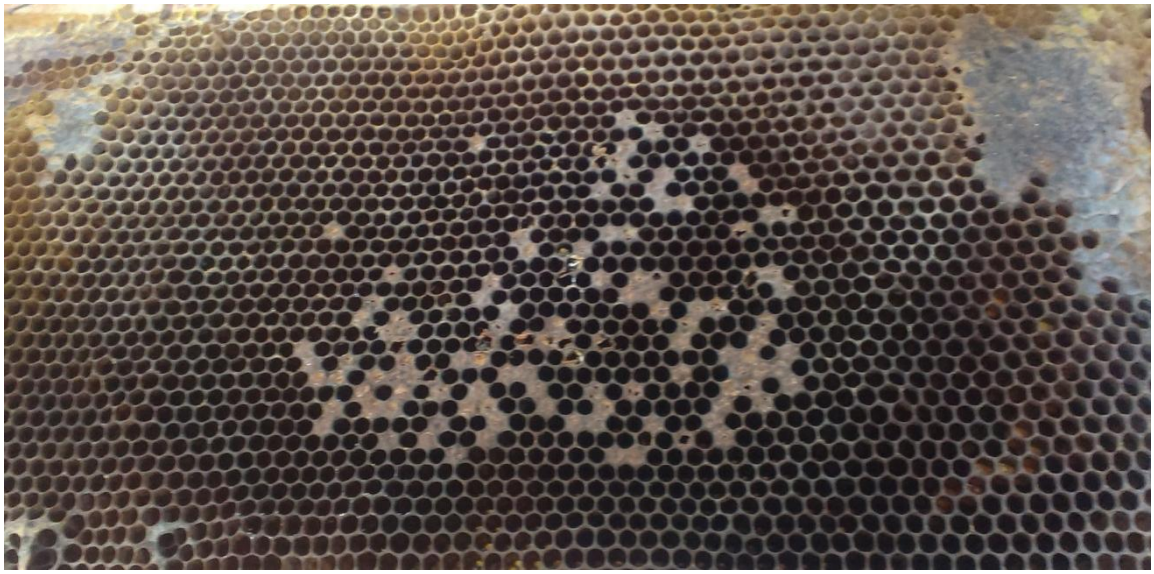
All samples were examined in laboratories of Scientific Veterinary Institute „Novi Sad“. Examination included detection of *Varroa destructor, Aethina tumida, Tropilaelaps spp, Nosema spp, Paenibacillus larvae.*

Detections of *Varroa destructor, Aethina tumida,* and *Tropilaelaps spp* were done in according to OIE Terrestrial Manual 2008 (OIE, 2008). Microscopic method of counting *Nosema* spores using hemacytometer was done on the basis of the instructions *Testing for Nosema Spores using*

Hemacytometer, Instructional Poster # 167 (Reuter et al, 2010). Diagnosis of American foulbrood (AFB) was based on the presence of clinical signs and identification of the pathogenic agent- *Paenibacillus larvae* in according to OIE Terrestrial Manual 2008 (OIE, 2008; OIE, 2014).

Results

Varroa destructor was present in 21.43% of the samples, while the microscopy analysis of macerated bee abdomens showed the presence of the spores Nosema *spp*. in 42.48% of the samples. During clinical trial a characteristic AFB image was identified (Picture1), whereupon the brood samples size 10 x 10 cm were taken to identification of *Paenibacillus larvae.* Microbiological characterization confirmed the presence of *Paenibacillus larvae* in both samples, one of them being from the area of Novi Sad, and the other from Sremska Mitrovica. All colonies of the whole two apiaries were eliminated and all beekeeping material was destroyed. Also, in areas of those two apiaries all bee colonies were checked for visual symptoms of AFB. There were no evidence of *Aethina tumida* and *Tropilaelaps spp* from examined samples from Vojvodina province.



Picture 1. Clinical AFB image in samples taken from/in the area of Novi Sad

Discussion and Conclusion

The ANSES laboratory in France designated by the European Commission as the EU Reference Laboratory and OIE Reference Laboratory for bee diseases has implemented an active epidemiological surveillance programme on honey bee colony mortality in 17 EU Member States during 2012 and 2013. Results of that surveillance programme confirmed that the major honey bee diseases are varroosis, American foulbrood, European foulbrood, nosemosis and chronic paralysis (Chauzat et al, 2014). The main focus of most recent studies about colony mortality has been on the pathogens (Meixner et al, 2014).

The most serious of all pathogens is the parasitic mite, *Varroa destructor*, which contributes significant losses to honeybee (Dietemann et al. 2012; Martin et al. 2012).

Many studies have confirmed substantial contribution of *Varroa destructor* to honey bee losses across the Northern hemisphere (Dietemann et al, 2012).This ubiquitous parasite act as a vector for viruses by facilitating their transfer between hosts (Nazzi et al, 2012; Chen et al, 2014). Also, the

mites have been reported to activate inapparent virus infections in honey bees probably by down regulation of honey bee immune genes (Meixner et al, 2014).

Nosema spp has been reported to cause collapse of colonies in both spring and winter (Meixner et al, 2014). *Nosema ceranae* as the new parasite has rapidly spread all over the world and the transfer of this parasite is nearly impossible to avoid (Ritter, 2014). It was present in European *Apis mellifera* from 1998 and perhaps from the mid-1990s in the USA and possibly elsewhere (Paxton, 2010).
American foulbrood is considered one of the most contagious and destructive infectious diseases affecting the larval and pupal stages of honey bees that have been spread nearly all over the world (Ritter, 2014; OIE, 2014).

During the US national survey of honey-bee pests and diseases, *Varroa* mites were detected in approximately 90% of all sampled apiaries in the period from 2010 to 2012. In the same survey, Nosema spores were found in 47 to 57 %.

The German bee monitoring project has shown the prevalence of *Nosema* infection 31% in 2005 and less than 14% in 2007. That project also demonstrated a statistically highly significant difference between the *Varroa* infestation rate of surviving colonies and of colonies which collapsed over winter (Genersch et al, 2010).

The results show that in our region there is still no evidence of *Aethina tumida* and *Tropilaelaps*, although they do represent a threat. *Aethina tumida* was detected for the first time in Reggio Calabria, South West Italy on 5th September 2014. Until March 2015, more than a thousand apiaries have been inspected in Calabria and Sicily. *Aethina tumida* has been confirmed in 61 apiaries in Calabria region and in one apiary in Sicily. Because of that, in those regions approximately 3,500 honeybee colonies have been destroyed (Chauzat et al, 2015).

During 2006 and 2007 in Spain 73 % of the samples had viral presence, but most (80%) had one virus and only 20% had two different viruses which was lower than expected (Antunez et al, 2012).

According to the results of our study, major detected problems at Vojvodina's apiaries are still *Nosema spp.* and *Varroa destructor*. Our further study will try to determinate other possible causes of colony losses in this part of Serbia. In the preserved samples of the adult bees, as well as in the ones of Varroa mites, the analysis on the most important viruses that affect honeybees such as Black Queen Cell Virus (BQCV), Deformed Wing Virus (DWV), Sacbrood Virus (SBV), Chronic Bee Paralysis Virus (CBPV), Acute Bee Paralysis Virus (ABPV), Kashmir Bee Virus (KBV), and Israeli Acute Paralysis Virus (IAPV) will primarily be done (Antunez et al, 2012).

By regularly controlling the bees we get the real insight into this problem of unusual colony losses, and based on this insight we can aim at the" source of the problem" and by doing so, preserve the health of bees. A preserving the health of bees is an integral part of good environmental management, food security, enhanced global agriculture and global economy.

Acknowledgments

This study was supported by Project TR 31084 of Ministry of Education, Science and Technological Development, Republic of Serbia.

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