Resistance of Varroa destructor to most commonly used synthetic acaricides

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Abstract

This review presents different aspects of Varroa destructor resistance to most commonly used contact acaricides. It is concerned with (1) – genetic background of the mechanism of this resistance, (2) – phenomenon of cross-resistance, (3) spread of discussed resistance throughout Europe and North America, (4) – methods of combating varroa resistance. The authors conclude that a rapid and sensitive DNA based test, enabling early detection of varroa resistance to pyrethroids and other contact acaricides is urgently needed.

Key words: Varroa destructor, contact acaricides, resistance, cross-resistance

The emergence of Varroa destructor as a parasite of the Western honeybee (Apis mellifera L) having transferred from the Eastern honeybee (Apis cerana F.) in forms of Russian-Korean and Japan-Thailand haplotypes (Anderson and Trueman 2000) has had a disastrous impact on honey bee population and beekeeping in a number of countries (Ritter 1981, Watkins 1997, Vetharaniam and Barlow 2006). This transfer first occurred in Far-Eastern Russia where in the 1960s the earliest evidences of colony losses in A. mellifera due to varroa infestations were recorded (Smirnov 1978). Since that time it has been found that the parasite is damaging immature and adult A. mellifera bees by feeding on their proteins in haemolymph (Gliński and Jarosz 1984, Żółtowska et al. 2005a) lowering their body sugars (Żółtowska et al. 2005, 2007) and contributing to oxidative stress (Lipiński et al. 2005b) due to inoculation of it’s digestive proteins, toxin and bee pathogens. This is usually associated with increased incidences of honey bee viruses (Ball 1994) and reduced individual body weight and life span (De Jong et al. 1982), which greatly weaken or kill the bees (Elzen et al. 2000). As a result of this, if an infested colony is not treated, it will die within a few years (Trouiller 1998). According to De Jong et al. (1982) mortality from V. destructor can reach even 100% within 2 years if mite control is not implemented.

Many control measures have been developed for varroa (Fries 1993, De Jong 1997, Thomas 1997) in a situation where it is extremely difficult to find efficient treatments due to constraints related to varroa biology, the mutual parasite-host relationship and the animal development cycle in honey bee colonies (Faucon and Fleche 1988). Most of these measures are based on the use of synthetic acaricides (pesticides) called also miticides or varroacides (De Jong 1997, Thompson et al. 2003). This is because non-chemical control methods are in general very labour intensive and often achieve a low efficacy (Ritter 1981).

The commonly used varroacides belong to three different chemical groups: (1) pyrethroids (fluvalinate, flumethrine, acrinathrine), (2) – formamidine (amitraz), (3) organophosphate (cound-