The puzzle of honey bee losses: a brief review

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Abstract

The impact of pesticides on honey bees is an issue that has been studied for many years and is now being reconsidered because controversy still exists with the relationship of insecticides and Colony Collapse Disorder (CCD). It is insufficient to explain CCD with only bee pathology studies. Research must be conducted on a wider series of causes: i) in open field and agroecosystems, to understand the fate of pesticide blends, ii) in the hives, to determine ways to enhance honey bee defence to diseases and parasites. References regarding imidacloprid and CCD in the maize agroecosystems are critically reviewed. Pesticides and the techniques to rationally use them (in particular following the integrated pest management guidelines) represent one of the several puzzles regarding the mystery of CCD or honey bee vanishing. An appendix, i.e., a rejected letter to Science and relevant reply, is also reported.

Key words: pesticides, side-effects, sub-lethal, maize sowing, imidacloprid, honey bee.

Introduction

For many years a group of entomologists at Bologna University and the National Institute of Apiculture (now CRA-API) worked on honey bees and studied the possibility of adopting Apis mellifera L. as a bioindicator of environmental pollution in Italy (Celli et al., 1985; Celli and Porrini, 1988; Porrini et al., 2002; Celli and Macagnani, 2003). In agroecosystems, new and old active ingredients applied for pest control can kill many beneficial insects and the residues of such active ingredients can be found both in the bodies of dead adult honey bees, and in hive products (Porrini et al., 2003).

Pesticides are applied in different environmental conditions, with different application technologies and concentrations. Moreover, pesticide use is regulated by laws specific to individual countries, the type of crop, period of year, and agroecosystem. Combined with other stress factors, agrochemicals are suspected to contribute to the recent honey bee ‘mystery’ known as ‘honey bee vanishing’ or Colony Collapse Disorder (CCD), as mainly indicated in North America.

Many hypotheses are available on the problem of declining bee populations and the related economic damage for beekeepers and agriculture. We believe that the problem is made worse by some in the media who sensationalize and report unsupported data and opinion. Such sensationalizing and the use of unsupported data are, unfortunately, not restricted to the media and can be made by scientists who report data that are not sufficiently verified, come from suspected sources, and/or fail to cite the relevant research. We feel that the latter is of special concern because in some published manuscripts neither the author(s), reviewer(s), and editor(s) were acquainted with competing literature.

The recent concern over honey bee losses is a poorly understood phenomenon. As recently as March 15, 2010 in The Washington Post, Jeffery S. Pettis (research leader for the USDA-ARS Honey Bee Laboratory in Beltsville) said: “I am very concerned about on what we have seen in California and other parts” of the United States. It is evident that as we enter the spring season, CCD is still an unsolved problem. Unfortunately, CCD in several Italian localities continues and remains a very important global issue. The debates between beekeepers, farmers, pesticide producers, environmentalists, and researchers are ongoing.

Despite the fact that CCD is unanimously considered by scientists to depend on several causes, two camps are now in conflict. One the one side are the environmentalists/beekeepers and on the other pesticide companies and the scientists sponsored by them. It is impossible to ‘demonstrate scientifically’ the direct influence that the pesticide corporations, seed companies, and some farm lobbies, have on research teams that conduct research on honey bees – especially that related to CCD. There are several international and national projects investigating CCD, examples include COLOSS and APENET, respectively. Globally many other projects are being carried out, while some of these are sponsored by public funding, others are supported by the pesticide corporations. In the latter case, are the scientific results and hypothesis influenced?

The International Commission for Plant Bee Relationships (ICP-BR) - Bee Protection Group since 1980 has investigated on the hazards of pesticides to honey bees. The data on honey bees have stimulated the research to obtain information on other pollinators. We believe that gathering such data may be important for the enhancement of regulatory risk assessments designed at reducing the impact of pesticides on bees (Lewis et al., 2007).

The purpose of this brief review is to comment, and stimulate discussion, on recent papers published by Nguyen et al. (2009), Chauzat et al. (2009), and Ratnieks and Carreck (2010). In response to the paper of Nguyen et al. (2009) we have submitted a critical manuscript to the Journal of Apicultural Research but, six months after the submission it was rejected by the senior editor Prof. Norman L. Carreck. Another submission of a short letter to Science was rejected too. We believe strongly that the proper use and evaluation of pesticides is one of the most important issues facing scientists, environmentalists, and farmers today. Therefore, we decided to publish here some opinions regarding pesticide
treatments that can seriously affect honey bee health, particularly in maize. At the end of this paper (appendix) we attach the letter sent by the first author to the journal Science and the reply relevant to the rejection is presented to our readers.

In Italy, the suspension of sowing dressed maize seeds provoked many reactions in the popular press and other media. We believe that papers published in scientific journals influence politicians and legislators preparing rules regarding prohibition and limitation of pesticide use. Scientific papers that indicate no hazard of pesticides and refuse to discuss data offering contrary opinions on the effect of pesticides on honey bees and other beneficial insects may cause an underestimation of the real damages that agrochemicals inflict on ecosystems.

### Possible impact on honey bees of sowing dressed maize seeds

In a recently published article, Nguyen et al. (2009), the last two lines of the abstract, report: “Our results support the hypothesis that imidacloprid seed-treated maize has no negative impact on honey bees”. Verbatim this statement is strong but based on a weak hypothesis, because it only concerns the Belgian conditions. Furthermore, should the readers of Nguyen et al. (2009) not study the text thoroughly; they might misunderstand the real hazard of this agronomic practice. Other studies have scientifically demonstrated the negative impact of imidacloprid-coated maize seeds on honey bees. Some of these results, not cited by Nguyen et al. (2009), were published in the Bulletin of Insectology 2003 (available online for free) in the “Proceedings 8th International Symposium of the ICP-BR Bee Protection Group – Hazards of Pesticides to Bees – Bologna, September 4-6, 2002”. A discussion of these controversial data was published too.

With regard to all the papers presented during the Symposium, Nguyen et al. (2009) only reported the reference of Maus et al. (2003) (i.e. Bayer researchers). The main conclusion of Maus et al. (2003) was: “crops grown from seeds dressed with imidacloprid do not pose any significant risks to honeybees under field conditions”. On the contrary, the paper of Greatti et al. (2003) and Greatti et al. (2006) (data related to northeastern Italy) indicated that, during maize sowing, pesticide dust is dispersed from the sowing machine, drifts to the wild vegetation and negatively impacts foraging bees. Based on the highly systemic properties of imidacloprid, the Belgian colleagues (Nguyen et al., 2009) investigated in open fields on correlation between bee poisoning and the presence of dressed-seed maize areas. The experiments were designed to detect a possible summer intoxication caused by pollen collections from maize fields sown during the spring. The aim of the Nguyen et al. (2009) paper was to study imidacloprid’s side-effects on honey bees later in the maize growing season. However, it was already suspected that sub- and subsequently sub-lethal effects might be observed on honey bees after the overwintering period, when foragers collect pollen, nectar, honey dew, water, etc. on wild vegetation at the border of maize fields. The poisoning, for instance, could be related not only to ingestion of insecticide-contaminated pollen produced by treated plants but also to the pesticide drift observed during the sowing of coated maize seeds.

In agreement with these findings are the latest observations made during the spring of 2008 in southern Germany (van Engelsdorp and Meixner, 2010). The weather conditions during, and just after, sowing and the type of drilling machine (i.e. pneumatic or not) are also important and must be considered in any pesticide evaluation. Laboratory data also suggest the possibility of honey bee poisoning due to the toxic guttation drops from maize plant grown up from imidacloprid-coated seeds (Girolami et al., 2009). In Mediterranean areas, maize sowing starts earlier than in northern Europe, with periods of scattered rain and wind. These environmental factors must also be considered in any proper evaluation of pesticides. Thus, the reported differences in side-effects on coated seed on honey bees might very well depend upon circumstances (figure 1) (Porrini et al., 2009).

Regarding sub-lethal effects, the paper of Nguyen et al. (2009) was probably submitted for publication before the paper of Yang et al. (2008), so the Belgian authors could not cite the latter study. Nevertheless, other data on the effects of low doses of imidacloprid on honey bees can easily be found in the literature. Kirchner (1999), for example, found that a dose above 20 ppb, “causes not only a reduction in the foraging activity of treated bees, but also induces trembling dances that discourage other worker bees from foraging. The waggle dance that communicates foraging direction becomes less precise”. However, the data of Schmuck et al. (2001) - Bayer researchers - indicate no damage at a feeding dose concentrations of 20 ppb. The papers of: Suchail et al. (2001a; 2001b), Pham-Delegue et al. (2002), Medrzycki et al. (2003), Bortolotti et al. (2003), Decourt et al. (2004a), Bonmatin et al. (2005b) all demonstrated several negative side-effects of imidacloprid and also found residues in maize pollen that can be collected by foraging bees late in the season (Bonmatin et al., 2005a). Concentrations as low as 6 ppb of imidacloprid and 2 ppb of fipronil have caused observed sub-

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**Figure 1.** Main mortality factors affecting honey bees in northern Italy.
lethal effects (Colin et al., 2004). Recently, Yang et al. (2008) clearly confirmed – again – these previous data. Particularly in open fields abnormal foraging behaviour of honey bees was observed. The effect on foragers indicated that: “...the normal foraging interval of honey bee workers was within 300 seconds. However, these honey bee workers delayed their return visit for > 300 seconds when they were treated orally with sugar water containing imidacloprid. This time delay in their return visit is concentration-dependent and the lowest effective concentration was found to be 50 µg/liter”.

Pesticide exposure and diseases affecting bees

In general the research on sub-lethal effects of pesticides is a complicated topic particularly in social insects (Desneux et al., 2007).

Past examples of low levels of insecticides that are responsible for decreasing the number of honey bee colonies available for pollination and reducing the honey bees’ effectiveness as pollinators are reported. Sub-lethal doses of deltamethrin disrupt the homing flight of honey bees (Vandame et al., 1995). Parathion disrupts the communication dance of foragers (Schricker and Stephen, 1970). Furthermore, sub-lethal exposure to permethrin retards learning as measured by the classical conditioning of proboscis extension response (PER) (Mamood and Waller, 1990; Taylor et al., 1987; Decourtsey and Pham-Delegue, 2002). Insecticides considered harmless to bees actually interfere with associative learning (Abramson et al., 1999; Abramson et al., 2004; Decourtsey et al., 2004b).

The concern about the chronic exposure to sub-lethal doses of insecticides (fipronil, acetamiprid and thiamethoxam) on honey bees was recently discussed by Aliouane et al. (2009).

Fungicides are usually considered safe for honey bees and beneficial insects. However, captain and the propiconazole (ergosterol biosynthesis inhibitor - EBI) can affect Osmia lignaria Say and A. mellifera (Ladurner et al., 2005). Propiconazole and myclobutanil can be synergists for the insecticide cyhalotrin inducing negative side-effects on bees (Pilling and Jepson, 1993). Pesticide residues in hives positioned in apple orchards can affect honey bees (Snodiš Škerl et al., 2009). In Slovenia these latter authors indicate: “...insecticide residues remain in pollen loads when using doses appropriate for crop protection purposes, and regularly contaminate the grass and underground in orchards”. Muffin et al. (2010) indicates that: “frequent coincidence in pollen of high levels of the non-systemic fungicide chlorothalonil with lower levels of systemic pesticides including fungicides is another probable synergistic combination that needs further exploration concerning bee decline”.

The effect of pesticides may be studied not only on adults but also with the larvae. In bumble bees Mommaerts et al. (2006) found that although no lethal effect could be detected on adults, the use of insecticides (IGR) has strong effects on colony growth and larval development. Pesticides considered harmless to Osmia cornuta (Latreille) adults can manifest a toxic impact on larvae (Tesoriero et al., 2003). Studies on honey bee larvae are reported by Davis et al. (1988), Desneux et al. (2007) and the in vitro rearing of artificial feeding to test side-effects of pesticides on different stages of larval is described by Aupinel et al. (2005).

Sub-lethal effects were also reported in causing stress and may lower resistance to pathogens such as Nosema sp. (Alaux et al., 2010). Diana Cox-Forster in Stokstad (2007) “suggests that the discovery of so many kinds of pathogens in the collapsed colonies indicates that the bees in them, for whatever reason, have suppressed immune systems”. Although many papers regarding bee diseases and parasite attacks are recently published, some references are much older e.g., 1906 Isle of Wight disease! See: Bowen-Walker and Gunn, 2001; Amdan et al., 2004; Yang and Cox-Foster, 2007; Neumann and Carreck, 2010.

The recent supplemental issue of the Journal of Invertebrate Pathology emphasized pathogens and parasites that cause honey bee decline. Sponsored by 5 corporations, the Sponsorship Statement suggests the possibility that pesticides have negative side-effects on bees and states verbatim: “Unfortunately, honeybees, like all organisms are subject to diseases caused by pathogens, among those being various viruses, bacteria, and fungi. In addition, the use of chemical insecticides, especially when used improperly, can take a heavy toll on bee populations”. But can we be sure that even in the case of proper agrochemical use, no honey bee damage occurs? The paragraph about the ‘Non-disease factors influencing managed honey bee populations’ in the van Engelsdorp and Meixner (2010) historical review, indicate the presence of dangerous pesticide residues. Further, pesticide impacts differ between Germany and the United States. In all the other papers published in this supplemental issue, the focus seems to shift away from the effect of pesticides to other mortality factors. As but one example, consider Ratnieks and Carreck (2010) who stated: “consensus seems to be that pests and pathogens are the single most important cause of bee colony losses”.

In general it is possible to demonstrate the causes by symptoms (i.e. some typical honey bee adult dead or appearance of colony mortality in the hive), but in the case of CCD event is not. The hypothesis that CCD is linked to diseases and parasites is supported by the data. Other data, however, indicate that among these many factors, the relationship between agrochemicals, particularly imidacloprid applications and honey bee mortality, is scientifically sound and well demonstrated in particular areas. Since the late 1990s, for example, many peer reviewed journals have published papers on toxicity and poisoning of honey bees, wild bees and other pollinators (Tasei, 2002). Bumble bees are also affected by imidacloprid (Tasei et al., 2000; Bortolotti et al., 2002) and at more than one month after the treatment in greenhouses, pesticide residues may still be dangerous to these pollinators (Sterk and Benuzzi, 2004). Finally, imidacloprid metabolites are very toxic to arthropods and may be hazardous to other organisms. The study of imidacloprid metabolites is a particular important and seldom studied research area that can provide important new data (Suchail et al., 2001b).
Is it possible to mitigate pesticide side-effects on the honey bee? Is the farm economy damaged by a reduced use of pesticides?

In the case of pesticide-coated maize seeds, we suggest to follow the Integrated Pest Management (IPM) techniques. Instead of merely preventing possible attack by pest insects, farmers must know when, and if, the pesticide seed dressing is really necessary. In this particular agroecosystem (maize is not a typical cash crop), we strongly believe that the available data suggests that the negative side-effects of pesticide-coated maize seeds are so dangerous to honey bees, other beneficial insects and to the environment, that it should not be used.

As a consequence of only relying upon insecticides, crop pests may actually increase. For instance, the European corn borer, Ostrinia nubilalis (Hubner) (Lepidoptera Crambidae), damage to maize appears to be favoured due to the reduction of predators following the use of imidacloprid seed treatment (Albajes et al., 2003). Few data in the literature demonstrate the necessity of adopting insecticide-coated maize seeds to obtain an increase yield. In Spain, no benefit was observed (Albajes et al., 2003). Similar data regarding northeastern Italy are also available. Monitoring by direct sampling or pheromone traps to forecast possible heavy damages by click beetles and other ground insect pests, is the typical way to rationally deal with good agronomical practices (Furlan, 2005). As an example, IPM can be adopted to reduce damage made by the new established pests in northern Italy, including the western corn rootworm, Diabrotica virgifera virgifera LeConte (Coleoptera Chrysomelidae). This pest is already resistant to several pesticides. Crop rotation together with monitoring using pheromone traps will be the best way to mitigate the insecticide resistance and rootworm invasion (Furlan et al., 2006).

In crops other than maize, pesticide treatments must be regulated following IPM guidelines such as not allowing pesticide use during the blossom period. Farmers must be made aware that many active ingredients with long persistence can be hazardous to honey bees and beneficial insects. They must also be made aware that pesticide residues on honey bees can be easily detected as demonstrated by the huge research program carried out in the United States (Mullin et al., 2010).

Despite many references and data reported in the literature, the French authors Chauzat et al. (2009) state: “To our knowledge, this study is the first attempt to quantify the effects of pesticide residues on honey bee colony health under field conditions”. Nevertheless, the problem was studied by many authors even before 2009 (as example: Atkins et al., 1981; Anderson and Glowa, 1984; Anderson and Wojtas, 1986; Sanford, 1993, Koch and Weisser, 1997; Schmidt et al., 2003; Bonmatin et al., 2005b) and it is important to stress that abnormal bee mortality is one of the symptoms of colony health’s impairment. In Italy too, the effects of pesticides in open fields were examined (Celli and Gattavecchia, 1984; Celli et al., 1985; Celli and Porrini, 1988; Giordani et al., 1979; Porrini et al., 2002; Grettii et al., 2003). The statement of Chauzat et al. (2009) that: “no statistical relationship was found between colony mortality and pesticide residues”, appears very optimistic and differs in respect to previous French opinion and the latest findings by Bonmatin et al. (2005b), Rortais et al. (2005) and Halm et al. (2006) that indicate concentrations of imidacloprid found in the field are large enough to damage honey bees.

In the case of the insecticide use in the maize agroecosystem, any pesticide-coated seed application in our opinion represents a non-sustainable practice. It is evident that farmers, beekeepers and society in general can obtain economic and environmental advantages by adopting IPM. No references about this aspect are reported in the Nguyen et al. (2009) paper. In some situations (particularly in Italy) since 2008 (the seasons 2009 and 2010 this practice was suspended by law) the choice to use pesticide-coated maize seeds, or not to use such seeds, was not an easy decision for the farmers to make because usually only pesticide-coated seeds were sold by seed companies. As reported before, this agro-nomical practice (i.e. sowing of insecticide-dressed maize seeds) is not cost effective for farmers and, at least in Italy, could provide hazard to honey bees and other beneficial insects. Recently, for example, some still unpublished field and laboratory trials indicated that the neonicotinoids have sub-lethal side-effects on the two-spot ladybird Adalia bipunctata (L.) (Lanzoni et al., in press). In laboratory experiments, Papachristos and Milonas (2008) have demonstrated a detrimental effect at sub-lethal doses of two soil applied insecticides (imidacloprid and carbofuran) on development, survival and fecundity on the ladybird Hippodamia undecimnotata (Schneider).

Generally speaking there is no doubt that imidacloprid and other pesticides are dangerous at very low doses to beneficial insects. Oldroyd (2007) reports: “when insecticides are used, honey bee losses are common, and where bees are required for pollination, careful management is required to minimize bee losses” and further: “Insecticides must be applied in a manner that is non-hazardous to bees and other beneficial organisms”. But as with all risk assessment, it is difficult to foresee all possible consequences of wide-spread usage of particular compounds. Perhaps some new insecticide-related phenomenon is now manifesting as CCD”. Since 1988, Haynes (1988) indicates the importance of sub-lethal effects of neurotoxic insecticides on insect behaviour and reports: “The assumption that a colony of honeybees is healthy simply because no increase in mortality is noted immediately after exposure to an insecticide may not be valid”. Thompson (2003) stressed the importance of considering the wide variety of sub-lethal effects of pesticides on bee behaviour, ranging “from effects on odour discrimination to loss of foraging bees from disruption of their homing behaviour. Many of the reported effects occurred at levels at or below those estimated as likely occur, in the short term, following field application”.

The case of Italian maize sowing with imidacloprid coated seed can be one of the several that may occur in the field. The fact that in some apiaries, following this kind of treatment, bees are healthy as immediately detected, is not an indication of harmless effects on honey bees, as reported by Haynes (1988) and Medrzycki et al. (2009). The
concern about these agronomical practices discussed in the papers published by Italian researchers was important to forbid the use of coated maize seeds. The results of the Italian studies clearly suggest that one neglected area of cooperation between scientists and the agro industry is in the design of more efficient sowing machinery and a better preparation for seed insecticide coating that will reduce drift and hazards for beneficial insect (Maini, 2008). These findings may be useful to enhance bee protection if this method of pesticide application is again legalized.

Conclusion

The European Environmental Agency (EEA) discusses 12 lessons and the last is: “avoid paralysis by analysis” (Harremoës et al., 2001). We believe that this fits the case of pesticide hazards to honey bees (Maxim and van der Sluijs, 2007). In fact, if scientists use more refined analytical detection tools (i.e. reducing LOD - level of detection) the problems remain with a classical 'uncertainty' and no decisions are made by decision-makers. The previous paper of Chauzat et al. (2009), just for imidacloprid in the pollen load, indicated a LOD of 0.2 ppb but in Mullin et al. (2010) the LOD is 2 ppb. Comparisons are not always easy to do between different laboratories and analytical methodologies (Suchail et al., 2001a).

In field experiments, honey bees may show different ranges of susceptibility with high variability and controversial data are difficult to be statistically analysed. Stress, due to mixtures of pesticides or other toxic ingredients collected by honey bees in polluted areas, may induce diseases as shown in recent studies reported by Alaux et al. (2010). Recently, another possible stress factor induced by pesticides has been discovered. During the early spring, colonies may have difficulties in maintaining an optimum hive temperature (Medrzycki et al., 2010) causing the rearing of low-fitness honey bees.

Another important issue is the use, in the hive, of the miticides to control the Varroa destructor (Anderson et Trueman). These miticides could be applied by beekeepers incorrectly affecting honey bee health (Lodesani et al., 1992; Tremolada et al., 2004).

The agrochemical industry stakeholders may contest this situation clearing the pesticide treatments in open fields for protection of honey bees to reduce mortality or CCD. So usually these long debates impact regulatory policy.

Goulson et al. (2008) reviewed the literature on the effects of sub-lethal pesticides on beneficial insects and reported data that support Mineau et al. (2008). In fact, the latter authors state: “Mounting evidence suggests that pollinators worldwide are experiencing dramatic population declines, and exposure to pesticides is one of the factors that can account for this”. So we need to suggest that farmers adopt a safer use of pesticides. Mineau et al. (2008) also report: “… application rates and oral or contact toxicity (but the latter especially) can be used to predict the likelihood that honey bee mortality will occur. Model predictions also suggest that some insecticides carry an extreme risk for bees, despite the lack of documented incidents”.

The criticisms discussed in this brief review must be considered as constructive. We hope to clarify (particularly in Italian agroecosystems) that weather conditions, kind of machinery used, timing of sowing and the active ingredient must be taken into account in order to reduce not only the damages caused by pests but also the hazard to honey bees and other beneficial insect populations. The wild bee populations also must be studied to predict any decline due to pesticide exposure and other factors. In Italy, for example, a survey was administered to locate various species and populations of wild bees. Results indicate a lower number of species than those listed in the Italian Checklist. As reported by Quaranta et al. (2004): “The specimens account for a total of 355 species (38% of the species listed in the Checklist of the Italian Fauna). The 74.6% (total No. 265) of these was found in the agroecosystems, and the 81.4% (total No. 289) in the seminatural landscapes”. Recently, Manino et al. (2010) indicate a possible decrease or shrinking in the Bombus sp. in the Susa Valley (Italy). Once again Mullin et al. (2010) reported: “The widespread occurrence of multiple residues, some at toxic levels for single compounds, and the lack of any scientific literature on the biological consequences of combinations of pesticides, argues strongly for urgent changes in regulatory policies regarding pesticide registration and monitoring procedures as they relate to pollinator safety. This further calls for emergency funding to address the myriad holes in our scientific understanding of pesticide consequences for pollinators”. The abstract of Mullin et al. (2010) concludes: “While exposure to many of these neurotoxicants elicits acute and sublethal reductions in honey bee fitness, the effects of these materials in combinations and their direct association with CCD or declining bee health remains to be determined”, so with this sentence are we continuing to follow the paralysis by analysis? As the last sarcastic EEA lesson points out.

We are conscious that the CCD puzzle will be very difficult to unravel. We strongly believe that the data show that pesticide involvement is a large piece. It is for posterity to judge and fit into place the last piece; to understand what happened to the honey bees during the last years of the second millennium and the first years of the third millennium.

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Europe aim at protecting bees by limiting the use of insecticides harmful to pollinating insects. Farmers and bee-articles have also confirmed the neonicotinoid side effects on bees (which demonstrate the sub-lethal effects of imidacloprid on bees (imidacloprid. The authors of the perspective (1) have neglected to cite other articles published in the same issue, (toring, and these IPM principles are being neglected in the case of sowing of seed coated with neonicotinoid imida-

According to F.L.W. Ratnieks and N.L. Carreck (“Clarity on Honey bee collapse?” 8 January 2010, p.152) (1) the “consensus seems to be that pests and pathogens are the single most important cause of bee colony losses”. Actually, many other scientists are concerned about the inappropriate or even misuse of insecticides. So, not only the beekeepers are seriously affected by bee colony losses, but also farmers, seed companies and pesticide producers. The fact that they state the main cause of bee losses are “diseases” may give the false impression that insecticides can be sprayed without the attention that is needed. For example, Integrated Pest Management strategies rely on pest monitoring, and these IPM principles are being neglected in the case of sowing of seed coated with neonicotinoid imidacloprid for a simple reason: the insecticide has been applied even if the pest infestation is not present. According to (2) cited by (1) imidacloprid “seems unlikely responsible for the French bee deaths”. This appears to be a biased opinion and a conflict of interest in light of the fact that the author of (2) is a researcher employed by the producer of imidacloprid. The authors of the perspective (1) have neglected to cite other articles published in the same issue, which demonstrate the sub-lethal effects of imidacloprid on bees (3). Why were these results ignored? More recent articles have also confirmed the neonicotinoid side effects on bees (4). Regulatory guidelines in both the USA and in Europe aim at protecting bees by limiting the use of insecticides harmful to pollinating insects. Farmers and beekeepers should work together to find solutions which result in effective pest control while protecting bee health.

Needless to say, healthy bees are less susceptible to diseases (5) and vice versa.

References


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