Evaluation of Canadian Bee Mortalities that Coincided with Corn Planting in Spring 2012

Canada

In the spring and summer of 2012, Health Canada's Pest Management Regulatory Agency (PMRA) received a significant number of honey bee mortality reports from the provinces of Alberta, Manitoba, Saskatchewan, Nova Scotia, Quebec and Ontario. A portion of these mortalities were determined to be associated with spray drift, however, an unusually high number of reports of honey bee mortalities were received from beekeepers in corn growing regions of Ontario and Quebec. The majority of reports were from southern Ontario, involving over 40 beekeepers and 240 different bee yard locations. Additionally, one report was received from Quebec involving eight bee yards. Timing and location of these honey bee mortalities appeared to coincide with planting corn seed treated with insecticides. An evaluation was undertaken to assess whether pesticides may have contributed to the mortalities and whether regulatory action was required. This evaluation focussed only on pollinator mortalities that coincided with planting treated corn.

To evaluate the role that pesticides may have played in the Ontario bee losses, Health Canada, supported by the Ontario Ministry of Environment (MOE) and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), collected samples for pesticide residue analysis, as well as information on the effects observed, bee health, and agricultural activities in the vicinity of affected bee yards.

Affected Ontario beekeepers reported varying levels of mortalities and other symptoms consistent with pesticide exposure (twitching, unable to fly, extended proboscis). It was commonly reported that the bees were foraging at the time of the incidents and that the strongest colonies were the most affected, having the largest number of dead and dying bees, which were often observed to have pollen on their legs.

Many of the beekeepers monitored their affected hives through the season and reported ongoing effects, including lack of recovery and colony build up and lack of honey production. Effects on queens were also reported, including queen mortality, high supersedure (replacement of the queen), and poor egg laying resulting in spotty brood. Additionally, some beekeepers noted drone mortality and brood removal from the colonies. Some beekeepers reported colony recovery after varying time periods (days to weeks).

Prior to the mortality there were indications that the bees were healthy. Most of the beekeepers reported overwinter losses below 15%, the level generally considered to be acceptable and sustainable by most apiculturists. The 2012 province-wide overwinter loss reported by OMAFRA was 12%. This is the lowest Ontario overwintering loss in the last 6 years (range 20% to 43%, as reported by OMAFRA). Canada-wide, the overwintering loss in 2012 was 15%, also the lowest in the past 6 years.

Weather conditions in the areas where beekeepers were affected were unusual in spring 2012, particularly in Ontario. It was warmer and drier than normal as well being windy in April. OMAFRA reports indicate corn planting began two to three weeks ahead of schedule in Ontario, which coincided with the first honey bee mortalities. The unusual weather conditions may have been a contributing factor to the high number of mortality incidents. Corn planting was early, the bees overwintered well and began to increase hive populations early, and in many cases the bees were out foraging. As well, dry windy conditions could have facilitated exposure to bees if dust travelled further afield than would normally be the case.

In almost all cases, there was evidence of corn planting near affected beeyards. Some affected beekeepers observed corn planting near their affected hives. Information collected from growers confirmed large areas of corn planted near these yards, and that negative pressure (vacuum) planters and talc seed flow lubricants were used. Information from OMAFRA and Agricorp confirmed a correlation between the bee mortalities and location of corn growers in Ontario. The reported honey bee mortality in Quebec was also located in a corn growing region.

Residue analysis was conducted to determine whether bees were exposed to the insecticides used on treated corn seeds. Samples of affected bees, from many incident locations, were analyzed for pesticide residues by the PMRA Laboratory Services or Ministère de l'Agriculture, Pêcheries et Alimentation Québec. Clothianidin was detected in approximately 70% of the samples analyzed in Ontario and clothianidin and thiamethoxam were detected in the samples analyzed from Quebec. On a bee yard basis, these residues were detected in approximately 80% of the bee yards where dead bee samples were collected and analysed. Samples of unaffected bees were also analysed and clothianidin was only detected in one sample at very low levels. Corn seed in Ontario and Quebec is treated in approximately equal quantities with either clothianidin or thiamethoxam. Since thiamethoxam is converted to clothianidin, the detection of clothiainidin in dead bees could indicate exposure to either clothianidin or thiamethoxam.

Additional pesticides were detected in some affected honey bee samples, including acetamiprid, coumaphos, fluvalinate, permethrin, phosmet and thiabendazole. However, these pesticides were detected only in a small number of samples or in localized areas, whereas clothianidin was detected across all areas of reported honey bee mortalities. Acetamiprid, fluvalinate and permethrin were also detected in unaffected honey bee samples. With the exception of phosmet, which is toxic to honey bees and was detected at high levels in samples collected close to apple orchards where phosmet is commonly used, it was considered unlikely that these pesticides contributed significantly to the honey bee mortalities.

The information evaluated suggests that planting of corn seeds treated with the nitro guanidine insecticides clothianidin and/or thiamethoxam contributed to the majority of the bee mortalities that occurred in corn growing regions of Ontario and Quebec in Spring 2012. The likely route of exposure was insecticide contaminated dust generated during the planting of treated corn seed. The unusual weather conditions in the spring of 2012 were likely also a contributing factor.

Measures have been implemented to reduce honey bee exposure to dust generated during planting of treated corn seed, including communication of best practices to reduce the exposure of honey bees, labelling of treated seed, a treated seed dust standard, and development of technical solutions to reduce dust, including developments in the areas of seed coating quality, seed flow lubricants, planting equipment, and disposal of treated seed bags. Please refer to "Pollinator Protection: Reducing Risk from Treated Seed" (http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_fact-fiche/pollinator-protection-pollinisateurs/index-eng.php) for details.

Additionally, the nitro-guanidine neonicotinoids have been placed under re-evaluation (REV2012-02, http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2012-02/index-eng.php) and further regulatory action will be taken if required.