COMMISSIE
COGEM
GENETISCHE
MODIFICATIE

To the State Secretary of
Infrastructure and the Environment
Mr. J.J. Atsma
P.O. Box 30945
2500 GX The Hague
The Netherlands

DATE May 14th, 2012
REFERENCE CGM/120514-01
SUBJECT Accompanying letter with research report 'The possible role of honey bees in the spread of pollen from field trials'

Dear Mr. Atsma,

The judgment of the European Court of Justice about the presence of pollen from genetically modified (GM) plants in honey has placed this topic high on the European political agenda.

Honey is produced by bees from the nectar of flowers and always contains small amounts of pollen. Further to a German court case concerning the presence in honey of small amounts of pollen originating from genetically modified MON810 maize, the European Court of Justice was asked whether a specific admittance is required for the presence of GM pollen in honey. The Court concluded on the basis of the European Directive relating to honey (2000/110/EC), among other things, that pollen should be considered a component of honey.[1] This means that GM pollen in honey falls under the labelling requirement. In the past the European Commission has always taken the position that honey should be considered a food of animal origin. Such foods only have to be labelled if the animal itself has been genetically modified.[1]

The judgment has important consequences for the import of honey from countries where GM crops that are not admitted to Europe are cultivated and for field trials in the European Union when these lead to the presence of GM pollen in honey. The use of GM pollen as a component in food is also not included in some older European permits and therefore the trading of honey containing such GM pollen is not permitted at the moment. This is the case, for example, with pollen from the GM maize line MON810, the only GM crop currently under cultivation in the EU. Monsanto has recently submitted an application for the use of pollen from MON810 as or in food to be admitted to the EU.[2]

[1] European Court (2011). Judgment of the Court (Grand Chamber) of 6 September 2011 (reference for a preliminary ruling from the Bayerische Verwaltungsgerichtshof – Germany) – Karl Heinz Bablok and Others v. Freistaat Bayern. Case C-442/09. Official Journal of the European Union C311/7-8

[2] EFSA (2012) Application for authorisation of genetically modified pollen MON 810 as or in food submitted under Regulation (EC) No. 1829/2003 by Monsanto (EFSA-GMO-NL-2012-107). Register of questions EFSA-Q-2012-00408

In view of the recent developments surrounding bees and GM crops COGEM had a study conducted to look at the various aspects involved. The study was not specifically concerned with the relationship between bees and GM crops, but collected background information which is relevant to this topic, such as the distances covered by bees while foraging, the transport of pollen by bees, the amount of pollen found in honey and the origin of the pollen found in Dutch honey samples. This study was carried out by Ameco Environmental Services (S.J. van Keulen MSc and drs. H.A.W. Kleinjans) and bees@wur (Dr. T. Blacquière, Dr. ir. C.J.H. Booij et al.).

I would hereby like to present you with the research report 'The possible role of honey bees in the spread of pollen from field trials'.

The most important results of the study are briefly set out below, followed by COGEM's conclusions.

1. Results of the study

Foraging distance depends largely on the location of food sources and their attractiveness

From a literature survey it appears that the distance covered by bees when foraging depends on the location of flowering plants which could serve as a food source relative to the hive. A bee is dedicated to a specific task and gathers pollen, nectar or water. Distances of around 0.5 to 1 kilometre are covered during most foraging flights. However, when there is little food available in the vicinity and attractive food sources are present further away, bees can cover greater distances to gather this food. These distances depend on the food to be gathered and, according to the research report, can amount to as much as 2.5 km for water, 10 km for pollen and 14 km for nectar.

Transport of pollen declines exponentially with increasing distance

During the collection of pollen and nectar, pollen ends up in the fur of the bee. This pollen can be transferred to another bee in the hive. The pollen on the bee fur can lead to cross-pollination the next time a flower is visited. The distance over which pollen is transported depends on the complex foraging behaviour of bees. This behaviour depends on the time of year, the state of the bee colony, the distribution of food sources and individual differences between bees in their level of activity. The amount of pollen transported declines exponentially with the distance. Although bees can cover great distances, bee colonies are often placed close to food sources which, according to the researchers, means that most of the pollination will take place within a couple of hundred metres or even less from the bee hive.

Three routes for contamination of honey with pollen

Another aspect of the study concerned the presence of pollen in honey. The report describes three routes by which pollen can end up in honey.

Firstly, during the conversion of nectar into honey, pollen can end up in the nectar because of the pollen which is present in the air of the bee hive and was brought into the bee hive in the fur of the foraging bees. The researchers consider this to be the principal route.

Secondly, pollen can end up in the honey when the beekeeper harvests the honey. Particularly when the honey is harvested by pressing the honeycombs, a lot of pollen can end up in the honey. This method is hardly used anymore. It continues to be used only in rural beekeeping in for example Africa. The method most commonly used for harvesting honey is

by centrifugation of the honeycombs, which results in much less pollen ending up in the honey than when the honeycombs are pressed.

A third possible route whereby pollen can end up in the honey is when the nectar gathered by the bees already contains pollen. The nectar collected by the bee ends up in the honey stomach. During transport the nectar in the honey stomach is filtered and the pollen grains end up in the ventriculus. The speed at which this takes place depends on the size of the pollen grains. Large grains of pollen are removed more quickly from the honey stomach than smaller grains. After about ten minutes all the pollen grains will have been filtered out of the nectar. The contribution from this route depends on how long the transport of the nectar to the hive takes.

Honey contains only a very small amount of pollen

The researchers examined five Dutch honey samples to determine the quantity of pollen grains present. These honey samples turned out to contain between approx. 300 to 28,000 pollen grains per gram of honey. The researchers considered that this is in reasonable agreement with data from the literature where it appears that most types of honey contain between roughly 2,000 and 10,000 pollen grains per gram honey. From the data available the researchers calculated that one gram of honey could contain between 43 and 670 micrograms ($\mu g = 10^{-6}$ g) of pollen, depending on the type of honey.

Dutch honey almost always contains pollen from Rosaceae and Brassicaceae

In addition, roughly 190 honey samples were examined to determine which plant families the pollen in honey comes from. These honey samples were harvested from sites across the Netherlands in the spring, summer or autumn of 2008. Pollen from both insect-pollinated and wind-pollinated plant species was found in the honey. The report looked at the results in detail for apple (Rosaceae), potato (Solanaceae), maize, sugar beet (Chenopodiaceae) and oilseed rape (Brassicaceae) because there are genetically modified variants of these crops currently undergoing field trials or they could take place in the future.

Pollen from Rosaceae and Brassicaceae was found in almost all the honey samples. Higher percentages of these pollen types were found in spring honey. There were slightly fewer samples with high percentages of these pollen types in honey harvested in the summer and autumn. This agrees with the general picture that honey harvested in these seasons comes from several plant species.

Presence of pollen in honey from sugar beet and potato unlikely

In a few cases a small percentage of pollen was found in the honey samples from the family which the sugar beet belongs to, Chenopodiaceae. Although it cannot be ruled out that pollen from sugar beet was present in the samples, it is unlikely because honey bees do not forage on sugar beets. Sugar beets are harvested before they flower. The exceptional sugar beet plant which does bloom during cultivation will not generally be visited by bees because bees prefer to visit areas with many flowering plants.

In the Dutch honey samples a small percentage of pollen was regularly found from the family which the potato belongs to, Solanaceae. Potato plants produce little pollen and no nectar. Bees are almost never observed on potato flowers. In theory pollen from potato could end up in honey when bees collect honeydew from potato plants infested with aphids. Such pollen is not found in floral honey however.

Maize pollen hardly found in Dutch honey

Maize plants produce no nectar. Although it is known that bees collect pollen from maize, maize pollen was found in only two of the honey samples investigated. This represents roughly 1% of the honey samples. The percentage of maize pollen in these samples was 1.5% and 4.2% of the total number of pollen grains, respectively. The researchers noted that it was reported in a French and a US study that bees collect large quantities of maize pollen. There are no Dutch data available on the collection of maize pollen. The researchers indicated that a small percentage of maize pollen was found in about 10% of the German and French honey samples. In the case of the German honey samples, 0.2% of the pollen present had come from maize.

According to the researchers, the small percentage of maize pollen found in Dutch honey could be explained by the fact that in the Netherlands there is not much nectar produced by other flowering plants during the flowering period of maize (July/early August), and very little honey is produced as a result. Honey is therefore almost never harvested during this period.

Most of the honey is imported

In their report the researchers also considered honey production in the Netherlands. Most of the Dutch honey is sold locally by hobby beekeepers. In 2009 the annual production of honey in the Netherlands was 1422 tonnes. This represents about 8% of Dutch honey consumption. The remaining 92% is imported from countries like China and Argentina, the world's biggest honey producers.

2. Assessment by COGEM

Cross-pollination mainly takes place over shorter distances

The report considered the distances covered by bees when foraging. A distance of approx. 0.5 to 1 kilometre is covered during most foraging flights. Cross-pollination generally takes place over very short distances because bees go from flower to flower and prefer to fly as little as possible while doing this. When there is little food available close by and attractive food sources are present further away, bees can cover greater distances to gather this food.

In the risk assessment of GM crops it is considered whether cross-pollination with other plants is possible and whether this could lead to any risks. Information about the distances in which cross-pollination can still take place is obtained from experimental data or information from the field. The data in the present report about the foraging distances and foraging behaviour of bees are consistent with the data in previous COGEM reports in which the possibility of cross-pollination was assessed.

Chance of contamination of honey with GM pollen from field trials is crop-dependent

The research report further considered a number of crops which are being tested as GM crops in field trials or where it is expected that this may take place in the future. According to the research report potato and sugar beet are not attractive to bees, as a result there is little chance that pollen from field trials with GM potato or GM sugar beet will end up in honey. Maize pollen was encountered in an occasional Dutch honey sample.

In view of the small chance of maize pollen being present in honey, together with the small number of field trials being conducted in the Netherlands with GM maize, COGEM's

conclusion is that the chance of pollen from a field trial with GM maize ending up in Dutch honey is extremely small.

The chance of GM pollen from a field trial ending up in honey varies per crop. Crops other than those referred to here will therefore have to be considered on a case-by-case basis during the permit application procedure, to assess whether GM pollen could end up in honey and whether there are any risks or other adverse consequences associated with the presence of GM pollen in honey.

Food and feed safety and risks of cross-pollination as part of the risk assessment

Food and feed safety and any risks further to cross-pollination always form part of the risk assessment of a GM crop. Applications for market admittance are almost always for food crops in which food and feed safety are comprehensively assessed. This is carried out at European level by the European Food Safety Authority (EFSA) and in the Netherlands an assessment is also conducted by the Netherlands Institute of Food Safety (RIKILT). In applications for field trials in the Netherlands, as well as market admittance of non-food crops (such as ornamental plants) the risks of incidental consumption, e.g. due to the presence of pollen in honey, would be assessed by COGEM.

Consumption of honey leads to small intake of pollen and a slight possibility of exposure to a transgenic protein

If GM pollen is present in honey it will also contain a very small quantity of transgenic protein. In the study the researchers calculated that one gram of honey contains between around 43 and 670 µg of pollen. The average honey consumption in the Netherlands is roughly one gram of honey per day.[3] Only one GM crop is currently being cultivated in Europe (MON810). The pollen from this maize line contains a maximum of approx. 0.097 µg transgenic Cry1Ab protein per gram.[4] If all the pollen present in the honey (670 µg/g) were to come from MON810 maize, the average consumer of honey would have a daily intake of around 0.065 nanograms (ng = 10^{-9} gram) of transgenic protein.

There are consumers who consume greater quantities of honey. Most of them consume about 10 grams of honey a day on average, while some consume 50 or more grams. With such a high honey consumption of 50 grams per day, in the worst case a person would be exposed to around 3.2 ng Cry1Ab protein per day.

The scenarios outlined above are extreme, such that all the honey consumed contains a large quantity of pollen, only pollen from a single crop is present and all this pollen is GM. The study showed that honey always contains pollen from various plant species. The percentage of maize pollen that was found in honey was a maximum of 4.2% of the total number of pollen grains. Based on the example given above, this percentage would result in a consumption of roughly 0.13 ng Cry1Ab protein.

From the above it may be concluded that the Dutch consumer has an extremely small intake of pollen through honey and, in the event that GM pollen is present, even with a high honey consumption of 50 grams a day, only a minute quantity of transgenic protein would be ingested.

---

[3] Van Rossum CTM *et al.* (2011). Dutch National Food Consumption Survey 2007-2010: Diet of children and adults aged 7 to 69 years. RIVM: Bilthoven.

[4] EFSA (2011). Scientific Opinion. Statement on the safety of MON810 maize pollen occurring in or as food. EFSA Journal 9(11):2434.

Presence of transgenic protein in honey will generally pose no risk

In the case of the MON810 GM maize line cultivated in Europe, the amount of transgenic protein which may be found in honey will be approximately 0.065 ng Cry1Ab protein/g honey (see above). The feed and food safety of this maize line have been assessed and there are no indications that MON810 or the Cry1Ab protein produced by MON810 is toxic to humans or animals. No signs of toxic effects were observed when the Cry1Ab protein was administered to mice (single dose of 4 mg/g body weight).[5]

To put into perspective the amount of transgenic protein (which is non-toxic to humans and animals) that may be found in honey, it is worth taking a general look at the quantity of naturally occurring toxic substances in honey. Pyrrolizidine alkaloids (PAs) from plants may be found in honey. A large number of PAs are carcinogenic. PA were detected in 28% of the honey samples analysed by the Netherlands Food and Consumer Product Safety Authority (VWA), in which the quantities found ranged from 1 to 365 ng PA per gram honey, with an average of 6.8 ng per gram honey. The VWA concluded that the presence of PA creates a very small additional risk of cancer in consumers who regularly consume honey from various origins.[6]

The Cry1Ab protein content that may be present in honey due to GM pollen from MON810, is roughly 100x less than the average amount of PA in honey considered to be acceptable by the VWA.

Presence of pollen from GM crops is a legal problem when use of pollen is not included in the permit

The research showed that only a small proportion of the honey consumed in the Netherlands, i.e. around 8%, is from the Netherlands. The remaining honey is imported from China, Argentina and elsewhere. GM crops are cultivated in some of these countries. A large proportion of these crops have been assessed for food and feed safety and may be imported into Europe such that the permit also covers the presence of pollen in honey. However, some GM crops may be grown which are not (or not yet) admitted to Europe. In a number of older permits for GM crops the use of pollen in food is not included in the European permit and therefore has not been specifically assessed. The food and feed safety of these GM crops have been assessed for other plant parts. The food safety of GM pollen has thus also been assessed, albeit indirectly. The presence of pollen from these GM crops in honey will therefore not pose a risk to food safety. Because the use of pollen in food is not included in the permit however, the trading of honey containing such GM pollen is not permitted. COGEM notes that this situation creates a legal problem.

In the period between September and December 2011, the German authorities checked for the presence of GM pollen in 368 honey samples.[7,8] Pollen from GM crops was present in 29

[5] EFSA (2009). Scientific Opinion. Applications for renewal of authorisation for the continued marketing of 1) existing food and food ingredients produced from GM insect resistant maize MON810; 2) feed consisting of and/or containing maize MON810, including the use of seed for cultivation; and of 3) food and feed additives, and feed materials produced from maize MON810, all under Regulation (EC) No 1829/2003 from Monsanto. The EFSA Journal 1149: 1-85

[6] VWA (2007). Advies Pyrollizidine alkaloïden in honing. VWA/2007/47531 (in Dutch)

[7] Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (2011). Current state of Honey analysis in Germany. Presentation at the International workshop on the consequences of the ECJ judgment on GM pollen in honey for GM crop releases and cultivation in Germany and the EU

honey samples (8%). In the majority of cases the GM pollen was pollen from admitted GM crops. Ten of the honey samples however contained pollen from GM crops which are admitted to Europe but for which the specific application of GM pollen in food is not covered by the permit. This study confirmed that honey can contain GM pollen.

Labelling of the presence of GM pollen in honey and its importance in terms of consumer freedom of choice

As previously mentioned, an assessment of the risks due to the presence of GM pollen in honey forms part of the permit procedure. This sufficiently covers the detection of any risks. The discussion about the presence of GM pollen in honey is not new. This topic was already discussed in the Standing Committee on the Food Chain and Animal Health in 2002. Further to the detection of pollen from GM oilseed rape in honey, the Committee stated at the time that it was not necessary to take the honey concerned off the market. They reached this conclusion due to the extremely small amounts of GM pollen and because the presence of this pollen appears to pose no safety concern.[9] In the discussion concerning the presence of GM pollen in honey, apart from the possible risks and the legal problem relating to older permits for GM crops, there is also the matter of consumers' and producers' freedom of choice. Apart from the safety aspects, consumers and producers may have objections to GMOs on the basis of moral, religious or ideological beliefs. In 2010 COGEM published a topic report about GMOs and freedom of choice[10] in which it was concluded that freedom of choice in relation to GMOs remains as important as ever in Europe.

Freedom of choice is one of the basic tenets of European policy and that is why there is a labelling requirement in Europe for foods containing GMOs (or GMO constituents). This labelling requirement applies both to foodstuffs produced in Europe as well as imported foodstuffs. The precise details for the labelling of honey containing GM pollen are currently under discussion in Europe. The dilemma here is as follows. The labelling of all honey with GM pollen will be difficult and costly to implement and could lead to trade issues in the import of honey, on the one hand. While setting a threshold value for GM pollen in honey could put consumer freedom of choice at stake, on the other.

COGEM notes that - given that honey is perceived as a 'natural product' – freedom of choice is an area of concern in this discussion. COGEM also concludes however that labelling is not the only requirement for freedom of choice. Information, education and confidence also play an important part in enabling consumers and producers to make informed choices. It is therefore important that consumers and producers are clearly informed whether, why and when the presence of GM pollen in honey will be labelled.

3. Conclusions

To summarize, COGEM has reached the following conclusions:

- Honey contains extremely small quantities of pollen, i.e. around 43 to 670 µg per gram honey. As a result the possible exposure to transgenic protein through the consumption of

[8] Bundesamt für Verbraucherschutz und Lebensmittelsicherheit – A. Krüger (2012). Personal communication. Update on the current state of honey analysis in Germany

[9] Standing Committee on the food chain and animal health. Section on general food law. Summary record of meeting held on June 13th, 2002

[10] COGEM (2010): Geboeid door keuzevrijheid; een verkenning van de ontwikkeling en rol van keuzevrijheid rondom ggo's in Europa (CGM/101230-01 (in Dutch)

honey is exceptionally small and the presence of GM pollen in general will not constitute a food safety risk.

- Any risks due to the presence of GM pollen in honey will be sufficiently covered by the risk assessment carried out in the context of an application for market admittance.
- In permit applications for field trials the risks of incidental consumption of the GM crop are evaluated. Any risks due to the consumption of GM pollen in honey will thus be adequately assessed.
- The presence of pollen in honey is not included in some older permits for GM crops, as a result of which trading honey with such GM pollen is not permitted. The trading of GM pollen from field trials is also not permitted. Because in older permits the use of these GM crops for other applications in Europe is included and the food safety of these GM crops has been assessed for these applications, this creates a legal problem in this case which could further lead to trade issues.
- Because the consumer is exposed to only a minute amount of transgenic protein through honey and the assessment of any risks due to the presence of GM pollen forms part of the permit procedure(s), the presence of GM pollen in honey is primarily a problem of co-existence or freedom of choice.

The conclusion of the European Court that pollen should be considered an ingredient of honey is based on the European Directive relating to honey (2001/110/EU), among other things. This Directive therefore has an unexpected consequence in the area of genetic modification. COGEM would like to convey the importance of the rapid development of European policy in the area of GM pollen and honey, in which amendment of the Directive relating to honey (2001/110/EC) or amendment of the Regulation on GM food and feed (1829/2003/EC) may offer a possible solution to the issues outlined in this letter.

Yours sincerely,

Prof. dr. ir. Bastiaan C.J. Zoeteman

COGEM Chairman

c.c. drs. H.P. de Wijs
Dr. I. van der Leij