German Federal Institute for Risk Assessment

Selected Questions & Answers on Grayanotoxins in Honey

Updated FAQ from the German Federal Institute for Risk Assessment (BfR) from 3 May 2023

Grayanotoxins are plant toxins that occur in some rhododendron species, among others. The substances can also be found in honey if bees have processed the nectar of these plants. This is mainly known to occur in the Turkish Black Sea region. Due to occasional cases in which honey containing grayanotoxin caused symptoms of poisoning, the German Federal Institute for Risk Assessment (BfR) has answered the following questions on the subject.

What are grayanotoxins?

Grayanotoxins are plant toxins that occur in the pollen, flowers, leaves and nectar of various genera of the *Ericaceae* family. Examples of grayanotoxin-producing plants are found in various rhododendron species. More than 180 different grayanotoxins occur naturally. Grayanotoxins have different toxic potencies, with grayanotoxin I and grayanotoxin III being assigned the highest potency based on experimental data.

Which foods can contain grayanotoxins?

Grayanotoxins in the pollen and nectar of grayanotoxin-producing plants can be transferred to honey. Accordingly, honey may contain grayanotoxins if it is obtained in regions where grayanotoxin-containing rhododendron species are widespread. These include *R. luteum* and *R. ponticum*, which are mainly found on the Turkish Black Sea coast but also in mountainous regions in Spain and Portugal, as well as *R. ferrugineum*, which is found in the Alpine region. However, only some of the more than 180 different naturally occurring grayanotoxins are actually found in honey. Honey containing grayanotoxins is also known as “Pontic honey”, “mad honey” or “bitter honey” due to its bitter, pungent taste.

How high can the level of grayanotoxins be?

Analyses of rhododendron honeys from Italy in 2017-2019 showed that 30% of the samples contained measurable levels of grayanotoxins up to 0.10 milligrams per kilogram (mg/kg). Between 2012 and 2017, 127 honeys from the Black Sea region were analyzed for grayanotoxins in Turkey, and grayanotoxin levels of up to 74 mg/kg were detected in 98 samples. An analysis of 49 honeys from the German retail trade carried out in 2015, did not reveal any grayanotoxins. The honeys tested here came from various EU and non-EU countries.

Which acute toxic effects can be caused by grayanotoxins?

Grayanotoxins ingested through food can lead to acute symptoms of poisoning. The acute symptoms affect the muscles as well as the cardiovascular system, with a slowed heartbeat and a drop in blood pressure being the most common. Other symptoms such as dizziness, paralysis, nausea, vomiting, increased salivation, sweating or diarrhoea may also occur. Symptoms appear within minutes and up to five hours after consumption of the food, usually patients recover within a few days. The severity of the symptoms depends on the amount of honey consumed. The results of a study indicate that people with cardiovascular disease who take antihypertensive drugs appear to be more susceptible to the toxic effects of grayanotoxins.

At what quantity can honey containing grayanotoxins cause symptoms of poisoning?

Scientific literature shows that no exact amount can be stated, from which grayanotoxin-containing honey leads to poisoning. The data on this in the literature are between 5 and 180 grams. The reason is that the honeys are very different in their composition and the content of grayanotoxins also varies. In the worst case, even a teaspoon of honey containing grayanotoxins could lead to symptoms of poisoning. The BfR currently has only a few analytical data on levels of grayanotoxins in honey from the Black Sea region that are causally linked to symptoms of poisoning.

Are there any known cases of poisoning by grayanotoxins in Germany?

According to information from the BfR, there have been at least five cases of poisoning in Germany since 2010 after the consumption of honey containing grayanotoxins. In 2012, a 56-year-old man showed severe symptoms of poisoning such as slowed heartbeat, drop in blood pressure, circulatory weakness and abdominal pain, after eating two tablespoons of honey from the Black Sea region, from which, however, the man fully recovered. In 2019, a 40-year-old man also developed severe symptoms with clouding of consciousness and slowed heartbeat after eating honey from the Black Sea region. All cases of poisoning known to the BfR involved honey that was either not commercially available in Germany or whose origin is unclear.

What are the possible health effects of long-term (chronic) exposure to grayanotoxins?

In an animal study with male mice, genotoxic effects occurred after the ingestion of honey containing grayanotoxins, which were expressed, for example, in chromosomal changes. Due to the lack of data on the mode of action of the genotoxicity and the lack of data on long-term intake of honey containing grayanotoxins, it is currently not possible to derive a safe intake level.

How can consumers protect themselves from poisoning by grayanotoxins?

The BfR recommends that rhododendron honeys, especially from the Black Sea region, should not be consumed because they may contain harmful levels of grayanotoxins. However, the German Honey Ordinance does not provide for any binding labelling for the region of origin or the type of honey, but only for the country of origin – or, in the case of mixed honey, for the countries of origin. For honey originating in several countries, the indication “mixture of honey from EC countries / non-EC countries” or “mixture of honey from EC countries and non-EC countries” may also be used. Systematic data from official food monitoring on honeys in Germany that contain grayanotoxins are currently not available.