Die Öko-Lebensmittelhersteller

[*Association of Ecological Food Producers*]

AöL Member Information

Version of 7/12/2020

DEET and Icaridin residues

AöL information on Deet and Icaridin residues

in organic food

1. Problem/Initial situation

According to information from laboratories and the Chemical and Veterinary Investigation Office (CVUA) Stuttgart [1], the repellents **DEET (diethyltoluamide) and Icaridin**, such as, e.g., in insect repellents, are detected as residues in plant-based food, such as wild mushrooms, in fruit, flower, and herbal infusions, in green and black tea, as well as in berries and leafy vegetables. In that, the raw goods can come from all origins.

Both substances are biocides, which are recorded in a whitelist and approved throughout the EU. Approval of these preparations is undertaken in the member states or throughout the EU.

The repellents are normally applied onto the skin. They may also be sprayed onto grading tables, which are used for plant-based raw materials. DEET and Icaridin are effective against mosquitos, mites, fleas, bugs, blackflies, and ticks. Their use is recommended by the WHO for protection against diseases transmitted by insects (e.g., malaria, yellow fever, dengue fever).

DEET was patented by the US army in the mid-1940s. Icaridin has only been on the market for a few years and has a comparable effectiveness. As biocidal agents, they do not fall into the scope of EU law for pesticides. According to national law in Germany, for pesticides, which are not plant protection products in terms of the Plant Protection Act, a general maximum content of 0.01 mg/kg is specified for all food [2]. This value was explicitly deleted for DEET and Icaridin with the 23rd Regulation on the Amendment of the Maximum Residue Levels (RHmV) by the BMEL (*Federal Ministry of Food and Agriculture*) coming into force with effect from 25/7/2020, since the scientific risk assessment does no

longer support this value [3]. At EU level, legally non-binding reference values ("intra union levels") were agreed at the level of the Standing Committee in September 2018 [4].

2. Toxicology

In repellents, the content of biocidal active agents is present between 20 % and 50 %. They are directly applied onto the skin. The active agent DEET is absorbed well via the skin. For Icaridin, the resorption rate is lower, however, Icaridin is considered more skin friendly. The active agents have been tested and approved according to the EU Biocide Regulation. According to the CVUA Stuttgart [1], there are indications that the mode of action is not only based on olfactory deterrence, but also, similar to insecticides, invokes an inhibition of the enzyme cholinesterase. Thus, there is an effect enhancement by DEET in combination with the use of insecticides. For Icaridin, there are indications that amphibians can be damaged, if small amounts enter surface waters [7].

According to the CVUA, content amounts of the two substances in food, which correspond to trace quantities, are toxicologically not of great relevance. In a 2009 statement of the Federal Institute for Risk Assessment (BFR) [5], a detection of DEET in chanterelles of 1 mg/kg was assessed as not harmful to health. In the derivation of a toxicological dose for DEET, the BfR arrives at the conclusion that intake quantities up to 0.75 mg/kg/day "are considered not harmful to health".

3. Entry pathways

Unintentional transfers: the repellents are normally applied onto the skin. If, following application onto the skin, the active agents are then not rinsed from the hands, then these are transferred onto the harvested goods. Their use is recommended by the WHO for protection against diseases transmitted by insects (e.g., malaria, yellow fever, dengue fever). In order to avoid transfers into the food, the harvest workers should be able to wash their hands following application onto the skin. Furthermore, the agents should not get into direct contact with the harvested goods, e.g., upon spraying them onto the skin. By wearing gloves, a transfer via the hands can likewise be avoided.

4. Analytical aspects

DEET and Icaridin can be routinely analysed in food in residue laboratories equipped for that. Detection takes place within the scope of the common multi-methods (e.g., QuEChERS) by means of LC-MS/MS. The determination limits for both substances should be 0.01 mg/kg.

5. Legal aspects

Both substances are biocides, which are approved throughout the EU and are recorded in whitelists. The approval of preparations is undertaken in the member states or

throughout the EU. As biocidal active agents, these do not fall into the scope of the EU Law for Pesticides (Regulation (EC) No. 365/2005). According to EU organic law, DEET and Icaridin preparations may also be used in ecological production for deterrence of insects. However, according to national law in Germany, for pesticides, which are not plant protection products in terms of the Plant Protection Act, a general maximum content of 0.01 mg/kg is specified for all food [2]. This value was explicitly deleted for DEET and Icaridin with the 23rd Regulation on the Amendment of the Maximum Residue Levels (RHmV) by the BMEL coming into force with effect from 25/7/2020 [3]. At the EU level, legally non-binding reference values were agreed at the level of the Standing Committee in September 2018 [4].

Table: Reference values for trade throughout the EU (SCoPAFF 17/9/2018) [3]

Food	DEET (mg/kg)	Icaridin (mg/kg)
Pine kernels	0.5	-
Berries and small fruit, except for table grapes	0.1	-
Wild mushrooms	1.0	0.05
Herbal infusions from flowers and leaves	0.3	0.5
Spices	0.5	-

Due to the deletion of the maximum value of 0.01 mg/kg of food, now the above-stated reference values apply to the trade throughout the EU, which must not be exceeded for organic food either. The two substances may also be used according to the rules of the EU Ecological Regulation, since they only serve as health protection of the people working on the respective plots. Furthermore, residues of the substances in food are classified as toxicologically not of great relevance. In terms of preventive consumer protection, a respective value of 0.1 mg/kg could be taken as a basis, as it was specified by Bio Suisse for cocoa in the decision grid for the evaluation of residues and contaminants in “Bud” products 2019 [6].

6. Recommendation/Conclusion

Until the 23rd Regulation on the Amendment of the Maximum Residue Levels coming into force on 25/7/2020, the general maximum level for the two active agents was 0.01 mg/kg in food in Germany; this was deleted by the amendment without substitution. The repellents are normally used by harvest workers for protecting their health. Even though these substances are toxicologically classified as harmless, they are undesired in food and should, as far as possible, be avoided or reduced. A suitable measure for that is, e.g., if the harvest workers can wash their hands following application onto the skin and use of the agents takes place far enough away from the harvested goods. As an alternative, the harvest workers can also use plant-based repellents on the basis of essential oils, however, their effectiveness is significantly lower than that of DEET and Icaridin. Wearing gloves is likewise recommended. Since the maximum residue level has now been deleted in Germany, organic food can be marketed as such in the trade up to the above reference values

throughout the EU – as far as they exist for specific products. If no product-specific reference value has been recorded, a detected repellent concentration is not provided with a limit value. For reasons of preventive consumer protection, the marketing partners could also agree on lower values with the value-added chain, as they were, e.g., specified by Bio Suisse for cocoa.

7. Literature and references

[1] CVUA Stuttgart 2019; A report from our daily laboratory routine – Insect repellent as contamination in food – Occurrence and legal evaluation

[2] Regulation about maximum levels of residues of plant protection products and pesticides, … (Maximum Residue Level Regulation, RHmV) of 1 September 1994 (§1 Section 4)

[3] Twenty-third Regulation on the Amendment of the RHmV in the Federal Law Gazette, published; coming into force on 25/7/2020

[4] Summary Report of the Standing Committee on Plants, Animals, Food and Feed held in Brussels on 17 September 2018

[5] Statement No. 034/2009 of the BfR of 31 August 2009

[6] Decision grid for evaluation of residues and contaminants in "Bud" products of July 2019

[7] Corbel V., Evidence for inhibition of cholinesterases in insects and mammalian nervous systems by the insect repellent deet. BMC Biology 7, Article Number 47 (2009)

AöL information

The Association of Ecological Food Producers is an alliance of more than 120 companies of the food industry. Its European members generate an organic turnover of more than 4 billion Euros. Its work is focusing on the political representation of interests as well as promoting exchange and cooperation of the members among one another.

This information was compiled with the participation of the Scientific Committee of AöL.

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