CODEX ALIMENTARIUS COMMISSION E

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JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON CONTAMINANTS IN FOODS

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DISCUSSION PAPER ON MANAGEMENT PRACTICES TO REDUCE EXPOSURE OF FOOD-PRODUCING ANIMALS (LIVESTOCK AND BEES) TO PYRROLIZIDINE ALKALOIDS; AND TO REDUCE PRESENCE OF PYRROLIZIDINE ALKALOIDS IN COMMODITIES (RAW AND PROCESSED)

Codex members and Observers are invited to consider the conclusions and recommendations in paragraphs 9-10 in order to assist the Committee on how to proceed further with management practices to reduce the presence of pyrrolizidine alkaloids in commodities and to reduce exposure of food-producing animals to PA containing plants.

Background

1. A first discussion paper on Pyrrolizidine Alkaloids (PAs) in Food and Feed and Consequences for Human Health (CX/CF 11/5/14) was prepared by an electronic working group, led by the Netherlands, for discussion at the 5th session of the Committee on Contaminants in Foods.[1]

2. For the 6th session of the CCCF, a discussion paper on Management Practices for the Prevention and Reduction of Contamination of Food and Feed with PAs (CX/CF 12/6/12) was prepared by an electronic working group, led by the Netherlands. This discussion paper updated the first discussion paper with respect to existing management practices and evaluated the possibility to develop a code of practice.

3. At the 6th session, it was reported that there were a number of data gaps and uncertainties regarding the risk of PAs to humans, including:

- the relative toxicity of different PAs;
- the major PA contributors in the human diet in different geographical areas;
- the extent to which animal consumption of PAs contributes to human health effects;
- the overall risk to humans from PAs;
- and the efficacy of different management practices.

However, due to the potential health-threatening effects that can be caused by ingestion of these toxins in feed or food, the Working Group concluded that it is desirable to reduce exposure of both human and animals to PAs as much as possible. The Working Group therefore recommended development of a code of practice (COP) for the prevention and reduction of contamination of food and feed with PA, in particular with regard to weed control as there was useful information available in this regard.[2]

4. However, on the topics of “Management practices to reduce exposure of food-producing animals to PA-containing plants – livestock and bees” and “Management practices to reduce presence of PAs in commodities – raw and processed”, the Committee noted that a number of data gaps had been identified and quite a lot of uncertainties existed and that it was premature to include in the COP; that more data collection was necessary and that a discussion paper could be prepared on this matter.

5. The Committee agreed to re-establish the electronic Working Group on PAs, led by the Netherlands, working in English only and open to all Codex members and observers, to prepare a discussion paper for consideration by the next session on the topics “Management practices to reduce exposure of food-producing animals to PA-containing plants – livestock and bees” and “Management practices to reduce presence of PAs in commodities – raw and processed” to explore their possible inclusion in the proposed Code of Practice.

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1 REP11/CF, paras. 80-83.
2 REP12/CF, para. 107-115.

6. The electronic working group (eWG) was established and members included: Australia, Austria, Brazil, China, Colombia, European Union, FoodDrinkEurope, Germany, International Special Dietary Foods Industries, Japan, Malaysia, New Zealand, Nigeria, United Kingdom, and Vanuatu. Comments were received from Australia, Austria, Brazil, FoodDrinkEurope, Germany, Japan, New Zealand and United Kingdom.

7. A discussion paper was prepared based on Appendix I (Management practices) of the preceding discussion paper (CX/CF 12/6/12) on the topics "Management practices to reduce exposure of food-producing animals to PA-containing plants – livestock and bees" and "Management practices to reduce presence of PAs in commodities – raw and processed". The aim was to investigate if there was sufficient new information to possible include in a Code of Practice.

Information available for possible inclusion in Code of Practice

8. The retrieved information is included in Appendix I to this document. Some information was found on practices to reduce exposure of food-producing animals to PA-containing plants (livestock and bees), and a new source of exposure to PAs was identified. For management practices to reduce the presence of PAs in commodities (raw and processed), only new information was received on the removal of pollen grains from commercial mixtures of bee pollen, and one study was identified addressing blended honeys. Consequently, information on existing practices for managing exposure of livestock and bees to PA-containing plants and the possible subsequent transfer of PAs to food is still limited. The same applies to the exact effectiveness of the found practices for the reduction of PAs in feed and food once contaminated.

Conclusions and recommendations

9. Since the information on existing practices for managing exposure of livestock and bees to PA-containing plants and the possible subsequent carry-over of PAs to food is still limited, the eWG concludes that the information currently available is not sufficient for inclusion in a Code of Practice.

10. As such, the eWG recommends that:

- the topics "Management practices to reduce exposure of food-producing animals to PA-containing plants (livestock and bees)" and "Management practices to reduce presence of PAs in commodities (raw and processed)" should in principle be included in a Code of Practice to prevent and reduce PA contamination of food and feed, but that there is currently too little information available on existing practices and their efficacy to fully realize this.
- the CCCF discusses whether this information could be gathered during the preparation of a following discussion paper, possibly in two years' time.

APPENDIX I

Discussion paper on Management practices to reduce exposure of food-producing animals to Pyrrolizidine Alkaloid (PA) containing plants and to reduce presence of PAs in commodities

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1. Introduction

1. Pyrrolizidine alkaloids (PAs) are natural toxins occurring in a wide variety of plants. PAs are probably the most widely distributed natural toxins that can affect wildlife, livestock and humans (WHO, 1988; FAO, 2010). Currently, there is insufficient information on the levels of PAs in different foods to estimate human dietary exposure and its significance to human health. Nevertheless, it is desirable to reduce exposure of both humans and (food-producing) animals to PAs as much as possible due to the potential health-threatening effects that can be caused by ingestion of these toxins in feed or food. Therefore, management or mitigation practices aimed at preventing or reducing the occurrence of PAs in feed and food are needed.

2. This Appendix will present new information, if available, on management practices as compared to the previous discussion paper on Management practices for PAs prepared for the 6th session of the CCCF (CX/CF 12/6/12). Management practices other than weed control were investigated; practices to reduce the presence of PAs in raw and processed commodities, practices to reduce exposure of food-producing animals (including livestock and bees) to PA-containing plants, and practices to reduce PA contamination by further processing of commodities.

2. Practices to reduce exposure of food-producing animals to PA-containing plants

2.1 Livestock

3. There is some evidence to suggest that wilted and dried PA-containing plants such as ragwort (*Senecio Jacobaea*) are much more palatable to some animals because the bitter taste associated with the plant reduces over time. Therefore, dried or dying PA-containing plants should not be left lying around after mowing in pastures where livestock is present.

2.2 Bees

4. Honey bees may operate in a radius of several km around their hives, covering an area of many km2. It has been shown that honey bees may even forage up to 12 km or more from the hive (Ratnieks, 2000). However, honey bees will mainly remain close by the hive when searching for nectar and only travel far when nothing is present in the direct neighbourhood (Blacquière, 2012, personal communication; Kleinjans, Blacquière et al., 2012).

5. What is more, some PA-containing plants are important food sources for honeybees. Removing these plants without replacement may lead to decreased honey production. A better option might be to introduce so-called mitigation plants; alternative plants flowering at the same time and of higher quality for the honeybees than the PA-containing plant. This could have a positive effect on the PA-concentration in honey (FoodDrinkEurope, 2011, comment in eWG). However, in case attractive PA-containing plants, such as *Echium vulgare*, *Borago officinalis* and *Eupatorium cannabinum*, are in the neighbourhood of the beehive, these plants will likely be foraged on. Introducing mitigation plants will thus probably not prevent foraging on these attractive PA-containing plants. Especially in the case of *Echium*, mitigation plants will not be sufficient as it flowers for a long time and is widely present in many areas (Blacquière, 2012, personal communication).

6. It may be different for PA-containing plants that are not attractive to honey bees, such as plants belonging to Senecio. In that case, honeybees will preferably visit the mitigation plants. On the other hand, when nectar from other plants is limited, honeybees may even forage on non-attractive PA-containing plants, when these are largely available.

7. To gain insight into how PAs are transmitted among bees, Reinhard et al. (2009) tested for horizontal PA transfer (trophallaxis). In a study under laboratory conditions, up to 15% of an ingested PA diet was exchanged from bee to bee, disclosing a possible route for incorporation into the honey comb. Therefore, a small proportion of the total PAs found in honey may arise through this route.

8. There are some techniques to estimate the distance honeybees from a beehive travel to forage on plants, for example by using energetic models, pollen analysis or by observation of bee dances (Kleinjans, Blacquière et al., 2012). This may provide insight in the plants that are visited by the honeybees, which may help in aiming mitigation measures.

9. Knowledge and education about which PA-containing plants are favoured by honeybees, their presence in nature, their flowering period, and the way their pollen look like will help beekeepers to estimate the possibility that PAs will be present in their honey. In the UK for example, beekeepers make use of factsheets describing the different PA-containing plants and include pictures of their pollen (Dübecke et al.; UK Foods Standard Agency, 2012, personal communication). In the Netherlands and Germany, it is recognized that honey produced during spring is generally free of PAs, because no attractive PA-containing plants flower during that period. Honey that is produced during or shortly after the flowering periods of (attractive) PA-containing plants may contain high amounts of PAs (Beuerle et al., 2011).

3. Practices to reduce presence of PAs in raw commodities

10. New information was identified on the topics filtering/sieving of bee pollen and blending of honey, no other new information was found.

3.1 Filtering/sieving of pollen

11. Commercial mixtures of bee pollen often contain high amounts of PAs typical for plants of the genus *Echium*. These pollen grains are relatively easy to identify visually, as they are of dark purple colour. Technically it should be possible to sort out these dark purple pollen grains, e.g. by the combination of high speed cameras and pressurized air pulses, which would blow out pollen grains passing by on a conveyor belt. This technique is already used for other foodstuffs. This measure would substantially reduce the PA-content of such pollen mixtures. However, as PAs are also contributed by other plants, some PAs might still remain in the product (FoodDrinkEurope, 2013, personal communication).

3.2 Blending of honey

12. Griffin et al. (2013) studied the presence of PAs in commercial honey. Of the 50 retail samples, eight samples tested positive for one or two PAs, predominantly lycopsamine and echimidine. From the eight positive samples six originated from outside the EU and two were blends of EU and non-EU honeys. Positive samples from outside the EU ranging from 190 to 4078 µg/kg, while blends from both EU and non-EU honeys had relatively lower PA concentrations of 182 to 634 µg/kg.

4. Practices to reduce PA contamination by further processing of commodities

13. No new information on this topic was found.

5. Other interesting new information

5.1 Recent case study

14. It is interesting to note that three complementary articles were published describing and analysing the outbreak of veno-occlusive liver disease (VOD) in one village in Ethiopia in 2005 (Bane et al., 2012; Debella et al., 2012; Schneider et al., 2012). More than 100 people were reported to be affected with VOD of which 45 persons died. Epidemiological investigations revealed that the affected villagers shared similar geodemographic characteristics and eating habits with the neighbouring villages except in their drinking water source which was from unprotected wells. In environmental samples PAs were found belonging to the Ageratum plant species growing in the drinking water well used by the villagers. Trace PAs were detected from the suspected water sample and pyrroles were detected in the extracts of liver specimens of mice following feeding trials with water from the contaminated well. Based on this outbreak, drinking of contaminated water may form an additional source of PA poisoning in humans and should be kept in mind in relation with management measures.

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