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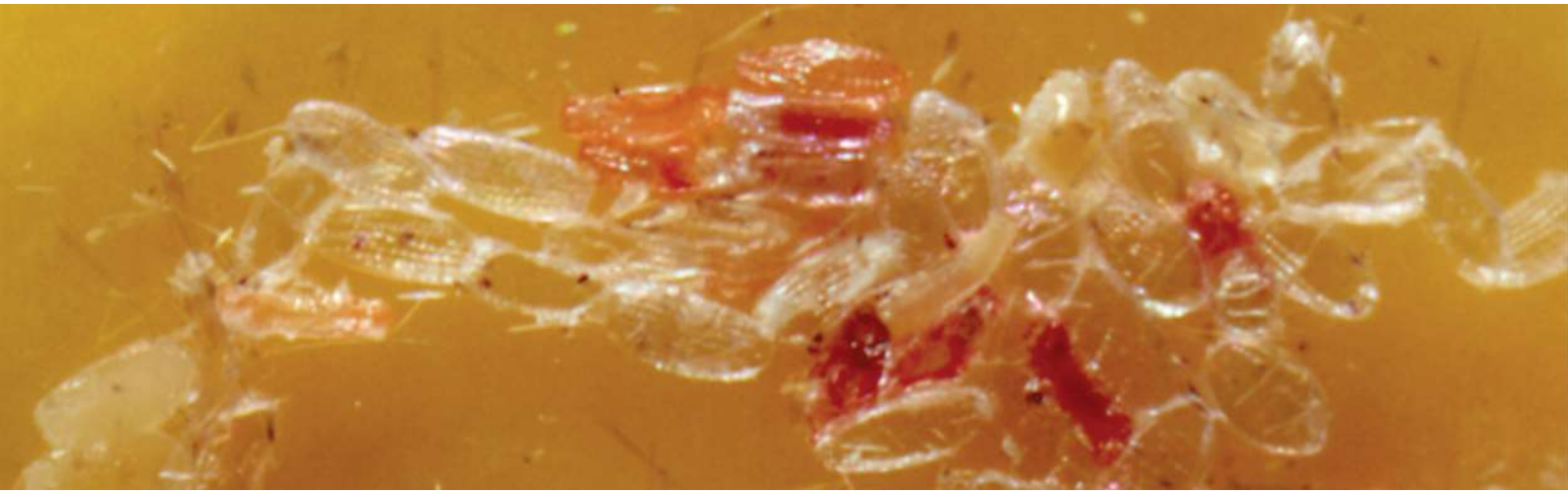

Assessment of possible human health hazards of frozen *Sitotroga cerealella* eggs in the plant protection products CHRYSObio and CHRYSOcontrol

Johan A. Stenberg, Daniel Flø, Kjetil K. Melby, Selamawit Tekle, Beatrix Alsanius, Jorunn Børve, Paal Krokene, Christer Magnusson, Mogens Nicolaisen, Line Nybakken, May-Guri Sæthre, Iben M. Thomsen, Sandra A. I. Wright

Scientific Opinion of the Panel on Plant Health of the Norwegian Scientific Committee for Food and Environment

The Norwegian Scientific Committee for Food and Environment (VKM) assessed the potential human health hazards of frozen eggs of the grain moth *Sitotroga cerealella* in the plant protection products CHRYSObio and CHRYSOcontrol. VKM found no evidence supporting that frozen eggs of *S. cerealella* are harmful to humans as carriers of pathogens or as allergens.

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Preparation of the opinion

The Norwegian Scientific Committee for Food and Environment (Vitenskapskomiteen for mat og miljø, VKM) appointed a project group to draft the opinion. The project group consisted of two VKM members and two project managers from the VKM secretariat. A referee commented on and reviewed the draft opinion. The Committee, by the Panel on Plant Health, assessed and approved the final opinion.

Authors of the opinion

The authors have contributed to the opinion in a way that fulfils the authorship principles of VKM (VKM, 2023). The principles reflect the collaborative nature of the work, and the authors have contributed as members of the project group and/or the VKM Panel on Plant Health.

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Acknowledgement

VKM would like to thank the referee Torgeir Storaas, Haukeland University Hospital, for reviewing and commenting on the manuscript. VKM emphasises that the referee is not responsible for the content of the final opinion. In accordance with VKM's routines for approval of risk assessments (VKM, 2024), VKM received the referee comments before evaluation and approval by the Panel on Plant Health, and before the opinion was finalised for publication.

Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third-party interests. The Civil Services Act instructions regarding conflicts of interest apply to all work prepared by VKM.

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Summary

The plant protection products CHRYSObio and CHRYSOcontrol contain frozen eggs of the pantry moth *Sitotroga cerealella*. The eggs serve as food for larvae of *Chrysoperla carnea* (green lacewing), the biocontrol agent in the products. The Norwegian Food Safety Authority asked the Norwegian Scientific Committee for Food and Environment (VKM) to prepare an assessment of potential hazards to human health from using these products.

Insect eggs, whether frozen or not, may carry pathogens that might be harmful to humans. Freezing may kill some of these pathogens, but some hardy pathogens can survive low temperatures. Some people are allergic to insect proteins. Freezing does not eliminate allergenic proteins. However, VKM have not found literature supporting that *S. cerealella* eggs are harmful to humans, neither as carriers of human pathogens nor as allergens.

Key words: Feed organisms, Frozen eggs, Norwegian Food Safety Authority, Norwegian Scientific Committee for Food and Environment, *Sitotroga cerealella*

Sammendrag på norsk

Plantevernmidlene CHRYSObio og CHRYSOcontrol inneholder frosne egg av maismøllen *Sitotroga cerealella*. Eggene brukes som fôr til larver av *Chrysoperla carnea* (nordvintergulløye), nytteorganismen som inngår i produktene. Mattilsynet har bedt VKM vurdere mulige farer for menneskers helse ved bruk av disse produktene.

Insektegg, også frosne, kan bære med seg patogener som kan være skadelige for mennesker. Frysing kan drepe noen av disse patogenene, men noen hardføre patogener kan overleve lave temperaturer. Noen mennesker er allergiske mot insektproteiner og frysing eliminerer ikke slike proteiner. VKM har, imidlertid, ikke funnet litteratur som tilsier at *S. cerealella*-egg er skadelige for mennesker, hverken som bærere av patogener eller som årsak til allergier.

Nøkkelord: Fôrorganismer, frosne egg, Mattilsynet, *Sitotroga cerealella*, Vitenskapskomiteen for mat og miljø

Background and terms of reference as provided by the Norwegian Food Safety Authority

The Norwegian Food Safety Authority hereby ask for an assessment of eggs of *Sitotroga cerealella* used as a food source to *Chrysoperla carnea* in the products CHRYSObio and CHRYSOcontrol. The eggs have been frozen before they are transferred to the product containers.

Background

Eggs of *Sitotroga cerealella* are part of the products CHRYSObio and CHRYSOcontrol. They are meant to be used as food source to larvae of *Chrysoperla carnea*. The eggs have been frozen before they are transferred to the product containers.

The organism *Chrysoperla carnea* has earlier been evaluated by VKM. *Sitotroga cerealella* has not been evaluated, and since the products only contain eggs that have been frozen, we order a simplified risk assessment.

Description of the assessment

With the view on the eggs of *Sitotroga cerealella*, which have been frozen, we order an assessment of the following:

- The human health risk by using the plant protection products CHRYSObio and CHRYSOcontrol

1 Introduction

1.1 Purpose and scope

This assessment presents a scientific opinion prepared by the Panel on Plant Health, in response to a request from the Norwegian Food Safety Authority. The opinion is an assessment of human health hazards associated with frozen eggs of *S. cerealella*, commonly known as the pantry moth or Angoumois grain moth.

1.2 Products and constituent organisms

The products CHRYSObio and CHRYSOcontrol contain live larvae of the biocontrol organism *Chrysoperla carnea* (green lacewing) and frozen eggs of *S. cerealella* (pantry moth). The eggs are used as a feed source for the lacewing larvae. *Chrysoperla carnea* has previously been evaluated by VKM (2014) and will not be further considered in this report.

Sitotroga cerealella is known as a cosmopolitan and uniform pest species with no known subspecies (Bushra and Aslam, 2014). The health hazard assessment given in this report is based on the very reasonable assumption that the frozen *S. cerealella* eggs in the products are dead and will not hatch.

The products do not contain other known organisms, although microbial contamination remains a possibility.

2 Data and literature search

Literature searches were performed on January 28, 2025, in ISI Web of Science and Scopus, using the search term "*Sitotroga cerealella*". After removing duplicates, the searches resulted in a total of 558 records. Literature searches were also carried out using earlier scientific names of the moth, but these searches resulted in no additional records. In addition, a search was performed in PubMed using "*Sitotroga cerealella*" together with the terms "clinical presentation" and "human". Screening and quality assessment of publications were done independently in Rayyan (Rayyan | Home) by each member of the project group. Publications on research conducted under environmental conditions not relevant to Norway, and publications that did not address the question in the terms of references were excluded. Snowballing, *i.e.* checking articles that were referred to in papers found in the main literature searches, was also performed.

3 Hazard assessment

Although *S. cerealella* is mainly known as a pest of stored cereal grains (Bushra and Aslam, 2014), it is also used for other purposes and has thus repeatedly been reared under controlled laboratory conditions (e.g., Salim et al., 2023). For example, it has been explored as an edible insect used as an ingredient in biscuits (Mohsen et al., 2024). Furthermore, compounds such as chitin derived from *S. cerealella* can be used in human medical products (Palomares-Pérez et al., 2021).

Insect eggs, whether frozen or not, may carry pathogens that might be harmful to humans. Freezing may kill some of these pathogens, but hardy pathogens can survive low temperatures. However, we have not found any reports identifying *S. cerealella* as a carrier of human pathogens.

Some people are allergic to insect proteins. If eggs from e.g. cockroaches, pantry pests or mites are accidentally ingested or inhaled, they may trigger allergic reactions in sensitive individuals. Chitin may also induce allergic reactions in sensitive humans (Reese et al., 2007). *Sitotroga cerealella* adults are also known to produce amylase, adenosine triphosphatase (ATPase) and lactase (Hashem et al., 2014), which might induce allergic reactions in sensitive humans (Ganseman et al., 2022). A case report on allergy to amylase has been presented, but the frequency of this condition remains unknown (Ganseman et al., 2022). *Sitotroga cerealella* larvae also produce lactate dehydrogenase (LDH), acetylcholinesterase and acid phosphatase, which are known to cause various negative effects to human health (Hashem et al., 2014). Freezing does not eliminate allergenic proteins. However, we have not found any reports of *S. cerealella* eggs causing allergies in humans.

4 Uncertainties

Sitotroga cerealella is rarely studied as an allergen, likely due to its lower allergenic potency or less frequent human exposure. Sensitization to *S. cerealella* eggs is likely rare in the general population, but this remains uncertain.

5 Conclusions (with answers to the terms of reference)

5.1 Assessment of hazard to human health

There is no evidence in available literature that frozen S. cerealella eggs are harmful to humans as carriers of pathogens or allergens.

6 Data gaps

There are no studies that provide specific prevalence rates for allergies to *S. cerealella* in human populations.

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