



---

## **Risk Assessment of Genetically Modified Carnation SHD-27531-4**

**Åshild Andreassen<sup>1\*</sup>, Ville Erling Sipinen<sup>2</sup>, Merethe Aasmo Finne<sup>2</sup>,  
Per Brandtzaeg<sup>3</sup>, Knut Helkås Dahl<sup>2</sup>, Knut Tomas Dalen<sup>4</sup>, Olavi Junntila<sup>2</sup>,  
Richard Meadow<sup>5</sup>, Inger Elisabeth Måren<sup>6</sup>, Kåre M. Nielsen<sup>7</sup>, Monica Sanden<sup>8</sup>,  
Rose Vikse<sup>1</sup> and Hilde-Gunn Opsahl-Sorteberg<sup>5</sup>**

<sup>1</sup>Norwegian Scientific Committee for Food Safety (VKM), Norwegian Institute of Public Health (FHI),  
Norway.

<sup>2</sup>Norwegian Scientific Committee for Food Safety (VKM), Norway.

<sup>3</sup>Norwegian Scientific Committee for Food Safety (VKM), Oslo University Hospital, Norway.

<sup>4</sup>Norwegian Scientific Committee for Food Safety (VKM), University of Oslo, Norway.

<sup>5</sup>Norwegian Scientific Committee for Food Safety (VKM), Norwegian University of Life Sciences,  
Norway.

<sup>6</sup>Norwegian Scientific Committee for Food Safety (VKM), University of Bergen, Norway.

<sup>7</sup>Norwegian Scientific Committee for Food Safety (VKM), Oslo and Akershus University College of  
Applied Sciences, Norway.

<sup>8</sup>Norwegian Scientific Committee for Food Safety (VKM), Institute of Marine Research, Norway.

### **Authors' contributions**

*This work was carried out in collaboration among all authors. The opinion has been assessed and approved by the Panel on Genetically Modified Organisms of VKM. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/EJNFS/2021/v13i430410

**Grey Literature**

**Received 05 May 2021**

**Accepted 10 July 2021**

**Published 30 July 2021**

---

### **ABSTRACT**

Carnation SHD-27531-4 is a genetically modified variety of *Dianthus caryophyllus* L. used as a decorative plant species. The red-purple colour of the flowers results from expression of the two newly introduced genes *df*r and *f* 3'5'h, encoding the enzymes dihydroflavonol 4reductase (DFR) and flavonoid 3',5'-hydroxylase (F3'5'H). The two enzymes enable the production of the pigments delphinidin and cyanidin (anthocyanidins) in the flower petals. Anthocyanidins and their sugar derivatives, anthocyanins, make up a large group of natural colours and are accepted food additives (E 163). The colours of most flowers, berries and fruits consist of a combination of anthocyanidins and anthocyanins.

Carnation line SHD-27531-4 also contains a mutated herbicide tolerance gene from *Nicotiana tabacum*, coding for an acetolactate synthase (ALS) variant protein, used to facilitate the selection of GM plantlets during the genetic transformation process. Southern blot analysis and sequencing indicate only a single copy of the intended T-DNA insert in the SHD-27531-4 genome. Flanking sequences show no disruption of endogenous genes. In silico analyses show no significant homologies between the DFR, F3'5'H and ALS proteins and known toxins and IgE-bound allergens. No observed changes in the introduced trait, i.e. the particular flower colour, indicative of instability, have been reported during several generations of vegetatively propagated plants.

Considering that carnation SHD-27531-4 is not intended for cultivation or use as food or feed, the VKM GMO Panel considers the comparative analysis of the anthocyanidins delphinidin, cyanidin, petunidin and pelargonidin in the flower petals sufficient for the risk assessment. The reported morphological differences between SHD-27531-4 and the parent cultivar do not raise safety concerns.

Based on current knowledge and the scope of the application, the VKM GMO Panel concludes that the DFR, F3'5'H and ALS proteins and anthocyanidin pigments are unlikely to increase a potential health risk related to an accidental intake or other exposure routes to carnation SHD-27531-4 compared to the conventional counterpart or other non-GM carnations.

Likewise, the VKM GMO Panel concludes that carnation SHD-27531-4, based on current knowledge and the intended use as cut ornamental flowers, does not represent an environmental risk in Norway.

**Keywords:** *GMO; carnation (Dianthus caryophyllus L.); SHD-27531-4; anthocyanidin; anthocyanin; petal colour; dfr; f3'5'h; als; SuRB; health safety; environmental risk assessment; Directive 2001/18/EC; VKM; risk assessment; Norwegian Scientific Committee for Food Safety; Norwegian Environment Agency.*

Available: <https://vkm.no/download/18.a665c1015c865cc85bc055e/1498558917054/265035f321.pdf>

**ISBN:** 978-82-8259-224-6

#### **NOTE:**

This work was carried out in collaboration between all authors. The opinion has been assessed and approved by the Panel on Genetically Modified Organisms of VKM. All authors read and approved the final manuscript.

**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 on legal competence apply for all work prepared by VKM.

**Suggested citation:** VKM (2016) risk assessment of genetically modified carnation SHD27531-4. Opinion of the Panel on Genetically Modified Organisms of the Norwegian Scientific Committee for Food Safety, Oslo, Norway.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

© 2021 Andreassen et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.