

MONITORING REPORT FOR GMO USES OTHER THAN CULTIVATION

CNL1302
FLO-40685-2
Florigene®Moonvista™

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1. General information

1.1 Crop/traits

Carnation (*Dianthus caryophyllus*) with modified flower colour, variety Florigene®Moonvista™.

1.2 Decision authorisation number pursuant to Directive 2001/18/EC and number and date of consent pursuant to Directive 2001/18/EC

Florigene®Moonvista™

Decision authorisation number; C/NL/13/02

Number of consent; C/NL/13/02/00 bes.1

Date of consent; September 5, 2019

1.3 Decision authorisation number and date of authorisation pursuant to Regulation (EC) No. 1829/2003

Not applicable.

1.4 Unique identifier

FLO-40685-2

1.5 Report period from

July 1, 2021 to June 30, 2022

1.6 Other monitoring reports have been submitted in respect of cultivation

YES NO

2. Executive summary

Approximately 21 tonnes (1.2 million flowers) of Florigene® Moonvista™ were imported into the EU from July 1, 2021 to June 30, 2022, through a single importer in the Netherlands. Flowers were imported from Colombia (32%) and Ecuador (68%).

Results of general monitoring for the occurrence of genetically modified carnation in the EU were;

- The importer and a breeder reported that they were not aware of any illegal growing. Neither they nor consumers have reported any adverse effects of handling the flowers.
- No reports were provided via the Florigene website. Florigene/Suntory received one question from EU-based public, distributors, or retailers in the period. This query related to business opportunities in Australia.
- Information on survey work was provided by three botanical experts, covering work in 10 European countries. There was no evidence of the establishment of any carnation populations in the wild, or of hybridisation between carnation and wild *Dianthus* species.
- 33 responses were received from 153 emails sent to botanical gardens and previously contacted entities. None of the respondents reported collecting or observing carnation populations established outside of cultivation. Wild type *Dianthus caryophyllus* records were noted.
- A review of literature related to *Dianthus* was carried out. No escape populations of cultivated carnation or hybrids with other *Dianthus* species in wild populations were identified.
- Botanical and floral databases were searched for records of carnation and *Dianthus caryophyllus* made since the last monitoring report. New records of *Dianthus caryophyllus* L. were found from Germany, Norway, France, Portugal and Switzerland. Photographs of the observations (where available) and follow up communication indicated observations to be 5-petal wild *Dianthus caryophyllus* or non-transgenic varieties of carnation.

The overall results are consistent with previous monitoring reports and indicate carnation is not established in nature in Europe. The monitoring this year supports previous observations that wild type *Dianthus caryophyllus* is rare and is most commonly found in France.

3. Uses of GMOs other than cultivation

3.1 Commodity imports into the community

3.1.1 Commodity crop (GM and non-GM) imports into the community by country of origin

GM product

GM product was imported from Colombia and Ecuador. Table 1 provides information on the imports of all transgenic carnation varieties imported into the EU in this reporting period. Information on the specific variety covered by this report is highlighted in red font.

Table 1. Tonnes of GM carnation imported into the EU from July 1 2021 to June 30 2022

GM carnation variety	Quantity (tonnes)	
	Imported from Ecuador	Imported from Colombia
Florigene®Moonaqua™	31	13
Florigene®Moonlite™	24	11
Florigene®Moontea™	0	12
Florigene®Moonberry™	0	3
Florigene®Moonvelvet™	0	3
Florigene®Moonvista™	13	8
All GM carnation varieties	68	50

GM and non-GM product

When the EUROSTAT database was accessed in late July information on import of carnation flowers was only shown to the end of April 2022. In order to estimate the percentage of imports which are GM we have therefore chosen to use data for the 12-month period from May 2021 to April 2022. Table 2 shows the data for imports of the GM carnation varieties over this period. Table 3 shows the combined total of GM and non-GM carnation flower imports¹ over the same period.

Table 2. Tonnes of GM carnation imported into the EU from May 2021 to April 2022.

GM carnation variety	Quantity (tonnes)	
	Imported from Ecuador	Imported from Colombia
Florigene®Moonaqua™	33	11
Florigene®Moonlite™	25	11
Florigene®Moontea™	0	11
Florigene®Moonberry™	0	3
Florigene®Moonvelvet™	0	3
Florigene®Moonvista™	14	7
All GM carnation varieties	72	46

Table 3. Estimated import of carnation flowers (total of GM plus non-GMO) into the EU, May 2021 to April 2022.

Country of origin	Quantity (tonnes)*	
	NL imports	EU27 total imports
Ecuador	309	356
Colombia	11,761	14,232
Other countries	17,538	20,353
Total ²	29,608	34,941

* From EUROSTAT (code 06031200; fresh cut carnations, DS-016890 trade since 1988 by CN8).

¹ <http://epp.eurostat.ec.europa.eu/newxtweb/setupdimselection.do>

² Reporter; EU27_2020_EXTRA

Percentage of import which is GM

Table 4 shows the percentage of carnation flower import into the EU which is GM.

Table 4. Percentage of carnation flower import into the EU which were GM flowers. Data is calculated from tables 2 and 3.

GM carnation variety	Percentage of carnation imports		
	From Ecuador#	From Colombia##	From all extra-EU countries*
Florigene®Moonaqua™	9.19%	0.08%	0.13%
Florigene®Moonlite™	7.11%	0.08%	0.10%
Florigene®Moontea™	0.00%	0.08%	0.03%
Florigene®Moonberry™	0.00%	0.02%	0.01%
Florigene®Moonvelvet™	0.00%	0.02%	0.01%
Florigene®Moonvista™	3.91%	0.05%	0.06%
All varieties	20.21%	0.33%	0.34%

GM imports into the EU27 from Ecuador as a percentage of total GM plus non-GM product imported from Ecuador

GM imports into the EU27 from Colombia as a percentage of total GM plus non-GM product imported from Colombia

*GM imports into the EU27 from all extra-EU countries (including Ecuador plus Colombia) as a percentage of total GM plus non-GM product

3.1.2 Commodity crop (GM and non-GM) imports into the community by country of destination

All imports of the GM product were into the Netherlands. Table 5 shows the percentage of carnation flower imports into the Netherlands which were GM.

Table 5. Percentage of carnation flower import into the Netherlands which were GM flowers. Data calculated from tables 2 and 3.

GM carnation variety	Percentage of carnation imports		
	From Ecuador#	From Colombia##	From all extra-EU countries*
Florigene®Moonaqua™	10.59%	0.10%	0.04%
Florigene®Moonlite™	8.19%	0.10%	0.04%
Florigene®Moontea™	0.00%	0.09%	0.04%
Florigene®Moonberry™	0.00%	0.03%	0.01%
Florigene®Moonvelvet™	0.00%	0.02%	0.01%
Florigene®Moonvista™	4.51%	0.06%	0.02%
All varieties	23.28%	0.40%	0.16%

GM imports into NL from Ecuador as a percentage of total GM plus non-GM product imported from Ecuador

GM imports into NL from Colombia as a percentage of total GM plus non-GM product imported from Colombia

*GM imports into NL from all extra-EU countries (including Ecuador and Colombia) as a percentage of total GM plus non-GM product

3.1.3 Analysis of data provided in 3.1.1 and 3.1.2

Approximately 21 tonnes of the GM event Florigene®Moonvista™ were imported in the monitoring period (July 2021 to June 2022). Imports were predominantly (68%) from Ecuador (table 2). The transgenic carnation event represents approximately 0.05% of total

imports of carnation into the EU from Colombia and 3.9% of total imports of carnation into the EU from Ecuador (table 4). As the Netherlands dominates the import of extra-EU27 imports of carnation, similar percentages were recorded for import into the Netherlands alone. The transgenic carnation event represents approximately 0.06% of total imports of carnation into the Netherlands from Colombia and 4.5% of total imports of carnation into the Netherlands from Ecuador (table 5).

3.2 General surveillance

3.2.1 Description of general surveillance

The general surveillance plan consisted of;

1. Importer questionnaire.
2. Survey reports. Florigene contacted a breeder and engaged the services of botanists to alert us to any wild carnation populations or unusual *Dianthus* hybrids. This year we have received information from three experts and the breeder.
3. Mail out. An email survey was carried out, in multiple languages. 153 contacts were made in 2022, in accordance with the revision of the mail out strategy proposed last year.
 - Contact was made with 128 entities that have never responded by letter. The enquiry was not accompanied by a brochure or pamphlet.
 - Contact was made with 25 entities who have responded regularly advising them that a) though a mail out will no longer be made the general monitoring will continue b) provide contact details for them to voluntarily advise of any observations of escape carnation populations in future years.
4. Literature review (attachment 5) and database review (attachment 6).

The same general monitoring plan was applied to all the transgenic carnation varieties which are imported into the EU. Accordingly, the information provided in attachments 1 to 6 is similar in the monitoring reports for each transgenic carnation event imported into the EU.

3.2.2 Details of industry, environmental, food and/or feed related surveillance networks used during general surveillance

Attachment 1. Breeders and experts contacted in 2022.

Attachment 2. Institutions contacted in 2022.

Attachment 6. Databases reviewed in 2022.

3.2.3 Details of information and/or training provided to importers, handlers, processors etc.

No training was provided.

3.2.4 Results of general surveillance

Importer questionnaire

See attachment 3. The importer reported that they were not aware of any illegal growing and that neither they nor their consumers have reported any adverse effects of handling the flowers.

Website feedback

Three queries were made to the Florigene website during the year. Two were from outside Europe and one was seeking industry leads in Australia.

Survey reports

Florigene received survey reports from three expert botanists. The results, summarised in attachment 4, reported no evidence of escape populations of transgenic carnation and no evidence of putative hybrids.

Mail out

The results of the 128 emails to entities that have never responded by letter were;

- 17 emails were returned as undeliverable. Access to contact information was via web search and we assume these email addresses were not updated by webmasters.
- 16 responses were received (14.4% response rate). The response rate was lower than the 40 – 50% normal response rate to emails, but acceptable given the entities had not responded to multiple letter requests in the past. The majority of responses were unable to assist or confirmed no records of *D. caryophyllus* or carnation. No entity had any record of carnation naturalisation. Two institutions had recent records of wild type *Dianthus caryophyllus* (all collected in France). One herbarium had a wild type specimen from 1550.

Replies were received from 16 of the other 25 entities contacted (64% response rate). All but one of the responses was to indicate no records or no change since the last monitoring report. The single other response was a new herbarium record of carnation, which based on colour and record details was a non-transgenic variety in cultivation.

In summary, the responses to the mail out did not provide evidence of “escape” or naturalised populations of carnation.

Literature review

Attachment 5 summarises the output from the literature review. A summation is provided in section to 3.2.6.

Database review

Attachment 6 lists the details of the 73 databases examined. No databases identified transgenic carnation, or hybrids between transgenic carnation and wild *Dianthus* populations. Sixteen databases (listed in table 1 of attachment 6) provided records of *Dianthus caryophyllus* (or synonyms) in Europe that were made since the last monitoring report. Where photographs were available, or collectors were able to be contacted it was established the records were of wild type *D. caryophyllus* or non-transgenic carnation in or adjacent to cultivation (refer table 1, attachment 6).

3.2.5 Additional information

No adverse or unanticipated effects associated with production or sale of flowers of the transgenic event have been observed or reported. Additional information relevant to the transgenic event is summarised below.

Production sites

In May 2022 the transgenic carnation production area in Colombia was surveyed for the possible presence of escaped populations of cultivated transgenic carnation. No carnation plants were found outside of cultivation.

Phenotypic stability

Off-type percentage in the event was measured in Colombia in May 2022. The flower colour modification phenotype remains stable with an observed off-type (to pink flowers) of 0.19%. Off-type flowers are not exported to the EU from either Ecuador or Colombia.

3.2.6 Review of peer-reviewed publications – Attachment 5

Attachment 5 provides details of the methodology and outcome of the literature review. Papers cited numerically in this section are listed in the reference list in attachment 5 and cross referenced by those numbers.

Evidence for escape of carnation from cultivation

None of the literature identified cultivated carnation, escape populations of cultivated carnation or hybrids with other *Dianthus* species in wild populations.

Vegetation survey data

Of the 255 papers read, 125 were vegetation surveys, local floras or plant checklists. No *Dianthus* species were identified in 58 of those papers. In the other 67 papers [1 – 67] one or more *Dianthus* species were found but not *Dianthus caryophyllus*. A total of 150 records of 69 different *Dianthus* species were noted in the 67 papers with *D.armeria* *D. deltoides*, and *D. carthusianorum* the three most widely reported species (table 6).

Table 6. The number of citations noted in references 1 – 67 (attachment 5) in which one or more *Dianthus* species were recorded

GM carnation variety	Number of citations
<i>Dianthus armeria</i> L.	14
<i>Dianthus deltoides</i> L.	13
<i>Dianthus carthusianorum</i> L.	9
<i>Dianthus sylvestris</i> Wulfen	8
<i>Dianthus superbus</i> L.	7
<i>Dianthus barbatus</i> L.	6
<i>Dianthus hyssopifolius</i> L.	5
<i>Dianthus pinifolius</i> Sm. subsp. <i>pinifolius</i>	4
<i>Dianthus petraeus</i> Waldst. & Kit.	4
<i>Dianthus longicaulis</i> Ten.	4

Wild *Dianthus* species whose synonym names are subspecies of *D. caryophyllus*³ were noted in Italy and France. *These species were D. longicaulis* [16, 22, 33, 61], *D.saxicola* [43], *D. siculus* [27] and *D. tarentinus* [63]. Cultivated *Dianthus* species other than carnation (for example sweet william, *D. barbatus*) were recorded in surveys in Romania [50], the UK [58] and Germany [89].

In a review of plant distribution in European Alps and the Caucasus [80], wild *D.caryophyllus* was stated to occur in the Alps only.

Dianthus taxonomy

Papers discussing the genetic relatedness, ploidy, taxonomy and lectotypification of *Dianthus* species related to and synonymous with *Dianthus caryophyllus* have been published in this reporting period [70, 75, 76, 77, 78, 91, 92]. Several of the authors had been contacted in earlier mail outs as part of this monitoring process. These papers show that the wild *Dianthus* species with synonyms to wild *Dianthus caryophyllus* are now well characterised and are not likely to be confused with *D. caryophyllus* in the literature, let alone be confused with cultivated carnation. For this reason, the synonyms to *D. caryophyllus* will be removed from literature review and database review in future monitoring reports.

Published literature on the transgenic event

No literature relating to the transgenic events was identified.

³ Bacchetta, G., Brullo, S., Casti, M., & Pietro Giusso del Galdo, G. (2010). Taxonomic revision of the *Dianthus sylvestris* group (Caryophyllaceae) in central–southern Italy, Sicily and Sardinia. *Nordic Journal of Botany*, 28(2), 137-173.

Carnation molecular biology

Evidence for a role of transcription factor expression in interruption of anthocyanin biosynthesis in carnation has been published [73, 93]. Transcription factor mediated variation to the anthocyanin pathway is one possible cause of the variation in flower colour sometimes observed in transgenic carnation. A second carnation genome sequence has been generated for carnation using the non-transgenic variety “scarlet queen” [93]. The nucleotide sequences have been made available⁴ and data includes mapping of certain loci to the anthocyanin biosynthesis pathway in carnation [93].

Other information

other relevant papers were;

- A phylogenetic analysis [85] carried out on flavonoid 3'5' hydroxylase – the colour modification gene in the transgenic carnation.
- Photo-luminescence (dye treated flowers) carnation has been described [86]. Potentially these are new, non-transgenic, carnation varieties.
- *Dianthus caryophyllus* was shown to be sensitive to cadmium and not suitable for reclamation vegetation [83].
- A review of edible flower use in Europe includes non-transgenic cultivated carnation [68]
- A review on the health benefits of delphinidin (the novel anthocyanin in the transgenic carnation flowers) has been published [81].
- Further evaluation and characterisation of the delphinidin-enhanced transgenic crimson tomato and indigo tomato has been made [69,71].
- Wild *D.pavonius* and *D.carthusianorum* genotypes from mountain areas have been identified as potential nursery species [72].
- *Dianthus campestris* has been identified as an indicator species for soil type [74].
- Additional evidence has been provided for enthno-medical use of carnation to treat health problems [84].
- More background information on pollination biology, ecology and climate adaptation in *Dianthus* species other than *Dianthus caryophyllus* has been published [24, 70, 82, 87, 88].
- Methods for conservation of rare *Dianthus* species has been described [11,13, 79].
- The persistence of cultivated *Dianthus* species other than carnation in abandoned rural areas has been presented [21, 39, 40, 90].

3.3 Case-specific monitoring

3.3.1 Description and results of case-specific monitoring (if applicable)

Not applicable.

Processing (if applicable)

EU member state	Point of entry/point of cultivation	Point of processing	Distance from point of entry/site of cultivation	Transport used
Not applicable				

⁴ https://www.ncbi.nlm.nih.gov/assembly/GCA_023091065.1
https://www.ncbi.nlm.nih.gov/genome/?linkname=pubmed_genome&from_uid=35247284

3.3.2 Monitoring and reporting of adverse effects resulting from accidental spillage (if applicable)

Not applicable.

3.4 Concluding remarks

There was no evidence of the establishment of the transgenic carnation event in the wild, or of introgression with wild *Dianthus* species. There has been no evidence of unexpected adverse effects on human health or the environment.

The general monitoring of the literature and databases again generated more relevant records than the mail out, which will be discontinued from 2023, as proposed and adopted in November 2021⁵.

4. Summary of results and conclusions

Results

1. The importer reported that they were not aware of any illegal growing and that neither their staff nor consumers have reported any adverse effects of handling the flowers.
2. Reports from surveys carried out by three experts failed to identify Florigene® Moonvista™ in the wild and no evidence of hybridisation to this variety.
3. A final mail out was carried out. None of the responses received identified any plants which could have been Florigene® Moonvista™.
4. A review of recent peer-reviewed literature failed to identify any variety of cultivated carnation outside of cultivation in Europe.
5. Sixteen databases (listed in table 1 of attachment 6) provided records of *Dianthus caryophyllus* (or synonyms) in Europe that were made since the last monitoring report. Where photographs were available, or collectors were able to be contacted it was established the records were of wild type *D. caryophyllus* or non-transgenic carnation in or adjacent to cultivation.

Conclusions

There was no evidence of the establishment of carnation of any variety in the wild, or of introgression. The data collected was consistent with the distribution in nature in Europe of wild-type unimproved *Dianthus caryophyllus* only, primarily in France.

5. Adaptation of the monitoring plan and associated methodology for future years

The literature and database review will be continued. Publicly available flora databases and research vegetation databases are the most relevant source of information and efforts will continue to be made to ensure all relevant European databases have been identified, expanding the current list of databases. Larger “citizen scientist” on-line depositories of observations, particularly *i-naturalist*, are a very useful resource. Though the mail out part of the monitoring plan has been discontinued, there are a number of European herbaria that have not yet been contacted. Next year we plan to contact these as part of the literature review, using the contact information in the *Index Herbariorum* database.⁶

The synonym names for *Dianthus caryophyllus* will not be included as search words in future literature and database reviews. We have not found any instances where these species have

⁵https://webgate.ec.europa.eu/fip/GMO_Registers/GMO_Part_C.php

⁶ <http://sweetgum.nybg.org/science/ih/>

been used as the Latin name for carnation and have only found examples of wild type *Dianthus* when records of such synonyms have been found in databases. In the scientific literature *Dianthus* species are carefully defined and carnation is universally known as *Dianthus caryophyllus*.

We will continue to carry out the literature and database reviews with sufficient time to contact authors and collectors if necessary.

We will continue to work with experts in the Balkans and continue to try and find botanical experts based in Italy and France.

Dated..... August 3, 2022

Attachment 1. Breeders and experts contacted

Breeders	
Selecta Klemm GmbH and Co.	Hanfäcker 10 70378 Stuttgart, Germany
Botanists	
Ss. Cyril and Methodius University in Skopje	Department of Botany and Dendrology Faculty of Forestry in Skopje MK-1000 Skopje Republic of North Macedonia
Slovak University of Agriculture in Nitra	Department of Botany Tr. A. Hlinku 2, 949 76 Nitra Slovakia
University of Zagreb	Department of Biology Rooseveltovo trg 6 10000 Zagreb Croatia

Attachment 2. Mail out summary 2022

A list of institutions contacted in 2022 is shown below.

Organisation	City	Country
University of Vienna	Vienna	Austria
Alpengarten Villacher Alpe	Villach	Austria
Sarajevo Botanical Garden	Sarajevo	Bosnia And Herzegovina
The Institute of Introduction and Plant Resources "K.Malkov"	Sadovo	Bulgaria
National Museum of Natural History	Sofia	Bulgaria
Faculty of Agronomy	Plovdiv	Bulgaria
School Botanic Garden 'Ostrog'	Kastel Luksic	Croatia
The Agricultural Research Institute	Nicosia	Cyprus
Botanická zahrada PřF Masarykovy univerzity v Brně	Brno	Czech Republic
Botanická Zahrada PřF UP	Olomouc	Czech Republic
Dept of Biology	Ostrva	Czech Republic
Botanická Zahrada hl.m. Prahy	Prague	Czech Republic
Klub Skalničkářů Prague	Prague	Czech Republic
Botanická Zahrada Petra Albrechta	Prostejov	Czech Republic
Botanická Zahrada při SZeŠ Rakovník	Rakovnik	Czech Republic
Vedoucí Botanické Zahrady Botanická Zahrada	Prague	Czech Republic
Botanická Zahrada Při Voš a SzeŠ v Táboře	Tabor	Czech Republic
Talinn Botanic garden	Talinn	Estonia
Botanical garden, University of Tartu	Tartu	Estonia
Institut National d'Horticulture Herhier	Angers	France
Floralpina	Arras	France
Jardin botanique de Marnay sur Seine	Aube	France
Museum Requien	Avignon	France
Centre Régional de Phytosociologie Herhier	Bailleul	France

Association Jardin Botanique Du Val D'yser	Bambecqu	France
Jardin Botanique de la Ville et de l'Universite de Besancon	Besancon	France
Natural History Museum	Bordeaux	France
Jardin Botanique de la Ville de Caen	Caen	France
Les Jardins D'eau	Carsac - Aillac	France
Jardin Botanique De La Villa	Chemin	France
Jardin Botanique des Olfacties	Coëx	France
Parc Botanique de Cornouaille	Combrit	France
Jardin des Paradis	Cordes Sur Ciel	France
Museum Jardin des Sciences de l'Arquebuse	Dijon	France
Muséum National d'Histoire Naturelle Herbarier	Dinard	France
Les jardiniers du Dimanche	Genay	France
Univ. Grenoble Alpes	Grenoble	France
Église de Saint-Xist et Jardin Botanique	Le Clapier	France
Jardin Botanique de la Faculte des Sciences Pharmaceutiques, Universté de Lille	Lille	France
Conservatoire Ethnologique de Haute-Provence	Mane	France
Jardins Botanique E.-M.-Heckel	Marseille	France
Les Jardiniers de Maubeuge et de la Vallée de la Sambre	Maubeuge	France
Parc Zoologique et Botanique de la Ville de Mulhouse	Mulhouse	France
Le Parc Botanique de Neuvic	Neuvic-Sur-L'isle	France
Parc Botanique du Château d'Ouge	Ouge	France
Parc et Roseraie du Château de Rambures	Rambures	France
Jardin Botanique de l'Universite de Rennes	Renens	France
Jardin Botanique de la Ville de Rennes (Jardin Botanique "Le Thabor")	Rennes	France
Jardin Botanique des Pyrenees-Occidentales	Saint-Jammes	France
Jardin Botanique Paul Jovet	Saint-Jean De Luz	France
Université de Lyon I (Claude Bernard)	Villeurbanne	France
Jardin botanique de la Presle	Nanteuil La Floret	France
Freien Universität Berlin	Berlin	Germany

Botanical garden of the Humboldt-Universität zu Berlin	Berlin	Germany
Technische Universität	Dresden	Germany
Botanischer Garten der Universität Karlsruhe (TH)	Karlsruhe	Germany
Botanischer Garten der Stadt	Langensalza	Germany
Botanischer Garten der Universität Leipzig	Leipzig	Germany
Botanischer Garten München-Nymphenburg	Munich	Germany
Botanischer Garten der Universität Osnabrück	Osnabrück	Germany
Botanischer Garten der Universität Halle	Wittenberg	Germany
Botanischer Garten der Stadt Wuppertal	Wuppertal	Germany
Gibraltar Botanic Gardens	Gibraltar	Gibraltar
Natural History Museum of Crete, University of Crete	Heraklion	Greece
Botanic Garden of Stavroupoli	Thessaloniki	Greece
Hungarian Academy of Sciences - Botanic Garden	Vacratot	Hungary
University of Debrecen	Debrecen	Hungary
University of West Hungary, Botanic Garden	Sopron	Hungary
Museo Regionale di Scienze Naturali della Valle d'Aosta Erbario	Alba	Italy
Università di Ancona	Ancona	Italy
Giardino Botanico Gole del Sagittario	Anversa Degli Abruzzi	Italy
Istituto Ortobotanico	Bari	Italy
Università di Camerino	Barisciano	Italy
Orto Botanico de Bergamo	Bergamo	Italy
University of Bologna	Bologna	Italy
The Reiza Alpine Botanical Gardens Bormio	Bormio	Italy
Museo Civico di Scienze Naturali	Brescia	Italy
Università di Camerino	Camerino	Italy
Giardino Botanico di Valbonella Via della Foresta	Corniolo	Italy
Orto Botanico dell'Università di Genova	Genova	Italy
Giardino Botanico alpino "Castel Savoia"	Gressoney-Saint-Jean	Italy
Università degli Studi di Torino	Grugliasco	Italy


University of Molise	Isernia	Italy
Universita' degli Studi di L'Aquila	L'Aquila	Italy
Museo di storia naturale del Mediterraneo	Livorno	Italy
Comune di Lucca	Lucca	Italy
Università Degli Studi di Napoli Federico II	Napoli	Italy
Orto Botanico dell'Università di Palermo	Palermo	Italy
Università degli Studi di Parma	Parma	Italy
Università di Perugia	Perugia	Italy
Università degli Studi di Napoli	Portici	Italy
Università di Sassari	Sassari	Italy
Giardino dei semplici Facoltà di Farmacia Dipartimento di Scienze del Farmaco	Scalo	Italy
Giardino Esperia Club Alpino Italiano Localita' Passo Del Lupo	Sestola	Italy
Museo di Storia Naturale	Torino	Italy
Museo Tridentino di Scienze Naturali	Trento	Italy
University of Trieste	Trieste	Italy
University of Latvia	Riga	Latvia
Institute of Botany	Vilnius	Lithuania
Arboretum Radigojno	Kolasin	Montenegro
Botanic Garden Groningen 'Domies Toen'	Groningen	The Netherlands
Botanic Garden	Kerkrade	The Netherlands
The Botanical Garden	Oslo	Norway
Jardim Botanico da Ajuda, Lisboa	Lisbon	Portugal
Jardim Botânico da Universidade de Lisboa	Lisbon	Portugal
Jardim Botânico da Universidade de Trás-os-Montes e Alto Douro, Vila Real	Vila Real	Portugal
Gradina Botanica a Universitatii din Craiova	Craiova	Romania
Gradina botanica a Complexului Muzeal de Stiintele Naturii din Galati	Galati	Romania
Gradina Botanica Targu Mures	Tirgu-Mures	Romania
Comenius University Faculty of Pharmacy, Garden of Medicinal Plants	Bratislava	Slovakia
Agricultural University of Nitra Botanic Garden	Nitra	Slovakia

Maribor University Botanic Garden	Hoče	Slovenia
University of Ljubljana	Ljubljana	Slovenia
Botanical Garden TAL 2000	Pragerskem	Slovenia
Botanical Garden Sežana	Sezana	Slovenia
Universidad de Castilla	Albacete	Spain
Jardín Botánico Atlántico	Gijón	Spain
Arboretum i Jardí Botànic de Lleida Dr. Pius Font i Quer	Lleida	Spain
Institut d'Estudis Ilerdencs	Lleida	Spain
Escuela Técnica Superior de Ingenieros Agrónomo	Madrid	Spain
Universidad de Murcia	Murcia	Spain
University of Navarra	Pamplona	Spain
Universidad de Salamanca	Salamanca	Spain
Universidad de Sevilla Herbario	Sevilla	Spain
Universidad Politécnica Herbario	Valencia	Spain
Isole de Brissago Botanic Garden	Brissago	Switzerland
Jardin Botanique de l'Université de Fribourg	Fribourg	Switzerland
Botanischer Garten Sankt Gallen	Gallen	Switzerland
Actuakky garden of the ville Neuchâtel	Neuchâtel	Switzerland
Alpine Garden Society	Pershire	United Kingdom

Attachment 3. Importer questionnaire response

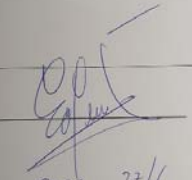
December 2021

Questionnaire			
Questionnaire	Number 2021.2		
<p>As part of the conditions for marketing approval of Florigene varieties in the EU, Florigene are required to monitor for any unexpected effects that may be associated with the import and consumption of our flowers. Your help in completing this questionnaire is very much appreciated. If you tick YES to any question a representative of Florigene will contact you as soon as possible for more details, including variety and circumstances.</p> <p>Your feedback can be returned to us electronically to schudler@florigene.com.au</p>			
Your name	ED GROOT		
Your company	FRESH CHAIN BV, NETHERLANDS		
PART ONE			
(Please tick appropriate box)			
Are you aware of any reports of illegal growing of Florigene varieties?	Florigene®Moonlight™	Yes	No
	Florigene®Moonberry™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvelvet™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonitea™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvista™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonlight™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Has any of your staff or repackers reported any adverse or unexpected response to handling Florigene flowers?	Florigene®Moonlight™	Yes	No
	Florigene®Moonberry™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvelvet™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonitea™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvista™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonlight™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Have any of your customers reported to you any adverse or unexpected effects of handling Florigene flowers?	Florigene®Moonlight™	Yes	No
	Florigene®Moonberry™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvelvet™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonitea™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvista™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonlight™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
If there any comments you wish to make on PART 1, please make them here;			
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PLEASE TURN TO PAGE 2			

PART TWO	
Please provide an estimation of the number of staff who have handled the flowers during import or re-packing in the period July 2021 – Dec 2021	2
Please provide an estimation of the number of customers you have supplied the flowers to in the in the period July 2021 – Dec 2021	9
If there any other comments you wish to make, please make them here;	
<div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
Signature	
Date	17-12-2021

June 2022

Questionnaire			
Questionnaire	Number 2022.1		
<p>As part of the conditions for marketing approval of Florigene varieties in the EU, Florigene are required to monitor for any unexpected effects that may be associated with the import and consumption of our flowers. Your help in completing this questionnaire is very much appreciated. If you tick YES to any question a representative of Florigene will contact you as soon as possible for more details, including variety and circumstances.</p> <p>Your feedback can be returned to us electronically to schudler@florigene.com.au</p>			
Your name	ED GROOT		
Your company	FRESH CHAIN BV, NETHERLANDS		
PART ONE			
(Please tick appropriate box)			
Are you aware of any reports of illegal growing of Florigene varieties?	Florigene®Moonlight™	Yes	No
	Florigene®Moonberry™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvelvet™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonitea™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvista™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonlight™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Has any of your staff or repackers reported any adverse or unexpected response to handling Florigene flowers?	Florigene®Moonlight™	Yes	No
	Florigene®Moonberry™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvelvet™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonitea™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvista™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonlight™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Have any of your customers reported to you any adverse or unexpected effects of handling Florigene flowers?	Florigene®Moonlight™	Yes	No
	Florigene®Moonberry™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvelvet™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonitea™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonvista™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Florigene®Moonlight™	<input checked="" type="checkbox"/>	<input type="checkbox"/>
If there any comments you wish to make on PART 1, please make them here;			
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>			
PLEASE TURN TO PAGE 2			

PART TWO	
Please provide an estimation of the number of staff who have handled the flowers during import or re-packing in the period July 2021 – Dec 2021	2
Please provide an estimation of the number of customers you have supplied the flowers to in the in the period July 2021 – Dec 2021	9
If there any other comments you wish to make, please make them here;	
<div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
Signature	
Date	2022, 27/6

Attachment 4. Summary of survey data

Florigene received reports from three experts, covering work in seven Balkan countries, Austria, Greece and Italy. None of the experts found any indication of hybrids with transgenic carnations, populations of carnation or populations of wild *Dianthus caryophyllus*. Restrictions to movement imposed by the Covid-19 pandemic remained in place for some of this period (until the end of June 2022 in some places).

Slovakia

One expert provided data for Slovakia. Dates and locations of sampling are listed in table 1, with *Dianthus* species identified. Five *Dianthus* species were recorded, but not *Dianthus caryophyllus*.

Month	Location	Species
August 2021	Slovakia, Štiavnické vrchy Mts., Banská Belá village, meadows at site "Pod Kramiarom" near train lines, 48°29'11.4"N 18°56'58.5"E	<i>Dianthus carthusianorum</i> L.
September 2021	Slovakia, Štiavnické vrchy Mts., Banský Studenec village, meadows west from the Kolbašský tajch pool, 48°27'08.0"N 18°58'24.5"E	<i>Dianthus carthusianorum</i> L.
September 2021	Kremnické vrchy, Veľká Stráž hill, rocky cliffs upper the R1 highway, 48°33'34.9"N 19°05'33.3"E	<i>Dianthus carthusianorum</i> L.
June 2022	Slovakia, Štiavnické Vrchy Mts., Vyhne village, dry grasslands near Kamenné more Nature Monument, 48°30'35.9"N 18°47'38.6"E	<i>Dianthus carthusianorum</i> L. <i>Dianthus deltoides</i> L.
June 2022	Hungary, Tihany, Porta Pacis, 46°54'51.5"N 17°53'21.8"E	<i>Dianthus carthusianorum</i> L.
June 2022	Slovakia, Biele Karpaty Mts., Bohunice village, Babiná hill, dry grasslands, 49°02'07.0"N 18°10'38.9"E	<i>Dianthus carthusianorum</i> L.
June 2022	Slovakia, Podunajská nížina Lowland, Nesvady, calvary hill in the village, 47°55'38.5"N 18°07'28.4"E	<i>Dianthus serotinus</i> W. & K.
July 2022	Slovakia, Borská nížina Lowland, Borský Mikuláš village, abandoned Jewish cemetery W from the village, 48°37'42.7"N 17°11'22.9"E	<i>Dianthus serotinus</i> W. & K.
July 2022	Slovakia, Myjavská pahorkatina Hills, Myjava, Holičov vrch Hill, dry grasslands, 48°44'03.6"N 17°33'17.7"E	<i>Dianthus carthusianorum</i> L.
July 2022	Slovakia, Myjavská pahorkatina Hills, Myjava, ruderalized grassland near re-cultivated waste deposit, 48°44'20.4"N 17°33'06.8"E	<i>Dianthus armeria</i> L.
July 2022	Slovakia, Malé Karpaty Mts., Plavecké Podhradie village, ruin of the Plavecký Hrad castle, 48°29'37.1"N 17°16'07.2"E	<i>Dianthus praecox</i> subsp. <i>lumnitzeri</i>
July 2022	Slovakia, Myjavská pahorkatina Hills, Podbranč - Podzámok, ruin of the Branč castle, dry grasslands, 48°43'59.6"N 17°28'06.9"E	<i>Dianthus carthusianorum</i> L.
July 2022	Slovakia, Malé Karpaty Mts., Brezová pod	<i>Dianthus armeria</i> L.

	Bradlom, Mníchova úboč Nature Reserve, dry grasslands, 48°38'56.7"N 17°29'57.7"E	<i>Dianthus carthusianorum</i> L.
July 2022	Slovakia, Malé Karpaty Mts., Brezová pod Bradlom, Kysel'ová Nature Reserve, dry grasslands, 48°38'39.8"N 17°30'01.0"E	<i>Dianthus carthusianorum</i> L.

Republic of North Macedonia

One expert provided data for North Macedonia. Dates and locations of surveys are listed in table 2.

Table 2. Details of field work in Republic of North Macedonia

Month	Location	Species
Sep 2021	Skopska Crna Gora mountains	No <i>Dianthus</i> species identified
June 2022	Jakupica mountain range (Skopje region)	<i>Dianthus kapinaensis</i> and <i>Dianthus deltooides</i> subsp. <i>degenii</i> were identified
June 2022	Demir Kapija region	No <i>Dianthus</i> species identified
Informal	Urban and peri-urban sites in the city of Skopje	No <i>Dianthus</i> species identified

Six populations of *Dianthus* species were also identified in North Macedonia, by a third expert. The represented species were *Dianthus integer*, *D. deltooides* and *D. sylvestris*.

Italy

Table 3 lists the *Dianthus* species identified in Italy. The records of *D. caryophyllus* were wild type.

Month	Location	Species
June 2021	Pesaro E Urbino, Marche	Complex <i>Dianthus caryophyllus</i>
June 2021	Province of Ascoli Piceno	<i>Dianthus ciliatus</i>
June 2021	Province of L'Aquila	<i>Dianthus sylvestris</i>
June 2021	Province of Pesaro and Urbino	<i>Dianthus ciliatus</i> , Complex <i>Dianthus caryophyllus</i>
June 2021	Province of Teramo	<i>Dianthus deltooides</i> , <i>Dianthus sylvestris</i>
July 2021	Altipiani di Arcinazzo, Metropolitan City of Rome	<i>Dianthus sylvestris</i>
July 2021	Province of Avellino	<i>Dianthus sylvestris</i>
July 2021	Province of Campobasso	<i>Dianthus ciliatus</i>
July 2021	Province of Chieti	<i>Dianthus ciliatus</i> , <i>Dianthus sylvestris</i>
July 2021	Province of Foggia	<i>Dianthus sylvestris</i> , <i>Dianthus tarentinus</i>
July 2021	Province of Frosinone	<i>Dianthus sylvestris</i>
July 2021	Province of L'Aquila	<i>Dianthus deltooides</i>
July 2021	Province of Salerno	<i>Dianthus sylvestris</i>

Other countries

Table 4 lists the *Dianthus* records provided by the third expert for the other countries where records were made. Record dates are from August 2021 to July 2022.

Country	Number of records	Species identified
Albania	7	<i>Dianthus ciliates</i> , <i>D.deltoides</i> , <i>D.sylvestris</i>
Austria	7	<i>Dianthus alpinus</i> , <i>D. carthusianorum</i> , <i>D. superbus</i> , <i>D.barbatus</i> , <i>D.sylvestris</i>
Bosnia - Herzegovina	6	<i>Dianthus ciliates</i> , <i>D. integer</i> , <i>D.sylvestris</i>
Bulgaria	8	<i>Dianthus petraeus</i> , <i>D. microlepis</i>
Croatia	27	<i>Dianthus ciliates</i> , <i>D.deltoides</i> , <i>D.sylvestris</i> , <i>D. carthusianorum</i> , <i>D. armeria</i> , <i>D. hyssopifolius</i> , <i>D. petraeus</i> , <i>D.barbatus</i> , <i>D.sylvestris</i>
Greece	13	<i>Dianthus caucaseus</i> , <i>D. integer</i> , <i>D. orientalis</i> ,
Montenegro	5	<i>D. ciliates</i> , <i>D.sylvestris</i>

Attachment 5. Literature review methodology

Source databases and journals

Literature searches were carried out using the following databases.

- AGRICOLA Article citation (NAL)
- Proquest -biological sciences
- Science Direct (Elsevier)
- Google Scholar

All papers published since January 2021 in these five journals were also reviewed;

- Preslia
- Journal of vegetation science
- Vegetation classification and survey
- PhytoKeys
- *Hladnikia*

Search terms

Search terms used were carnation, carnation biology, *Dianthus*, *Dianthus* biology, *Dianthus* fertilization, *Dianthus* gene, *Dianthus* genome, *Dianthus* medicinal, Europe flora, Europe plant survey, Europe plant checklist, Europe botany survey, *Dianthus caryophyllus*, vegetation survey, Europe vegetation, *Dianthus arrosti*, *Dianthus caryophyllus* var. *coronarius*, *Dianthus gasparrinii* Guss., *Dianthus godronianus* Jord, *Dianthus longicaulis* Ten., *Dianthus saxicola*, *Dianthus siculus*, *Dianthus sylvestris* subsp. *longibracteatus*, *Dianthus sylvestris* subsp. *boissieri*, *Dianthus tarentinus*, *Dianthus virgatus*.

Search terms were each used exactly as listed in normal font, with use of suitable filters to remove papers published before the beginning of 2021. The primary focus of the literature review was seeking information on carnation and *Dianthus* populations outside of cultivation.

Citation search

48 key citations from literature reviews from previous monitoring reports were searched in google scholar for citing literature, which was then screened.

Literature review short list

The initial review identified hundreds of abstracts. Papers not considered for further review covered the chemistry of secondary products, essential oil preparation and analysis, non-European studies, horticultural studies relating to carnation production and breeding, physiological and biochemical studies relating to post-harvest care in carnation, herbicide resistance and plant pathology studies. Abstracts concerning the coral species *Dianthus* or clove oil use were ignored.

Following the initial cull, 256 papers were read, including any supplementary information files provided with the papers. No naturalised populations of cultivated carnation were identified in any of the papers.

93 papers with relevance to carnation or *Dianthus caryophyllus* distribution, identification of other *Dianthus* species, potential weediness, possible biosafety implications, taxonomy and/or genetic modification are cited in the reference list below. The reference list excludes 58 papers (out of the 256 read) which provided data from vegetation surveys but where no *Dianthus* species were identified.

Reference list

Vegetation surveys and checklists in which *Dianthus* species were found

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Attachment 6. Database information

Search terms

Databases previously identified were re-examined for any new entries listing *Dianthus caryophyllus* or *Dianthus godronianus* since the last monitoring report. In the event neither of these species were found, the databases were checked for the following species;

- *Dianthus arrostii* C.Presl
- *Dianthus caryophyllus* var. coronarius L.
- *Dianthus gasparrinii* Guss.
- *Dianthus longicaulis* Ten.
- *Dianthus saxicola* Jord
- *Dianthus sículus* C.Presl
- *Dianthus sylvestris* subsp. *longibracteatus* (Maire) Greuter and Burdet
- *Dianthus sylvestris* subsp. *boissieri* (Willk.) Dobignard
- *Dianthus tarentinus* Lacaita
- *Dianthus virgatus* Pasq.

Results

Results of the database survey are summarized in tables 1 and 2 of this attachment, Each table has the following information:

Site no.	Internal number allocated to each website for cross reference.
URL	Address of the website
Site name	Title of the website, database, flora or checklist according to the website
Site geographical coverage	Area and/or country covered by website
Site description	Brief description of the information provided at the website
Access date	Date the website was reviewed for this report
Search outcome	Table 1 - Websites in which observations of carnation or <i>Dianthus caryophyllus</i> are described. For existing websites, the observations described have been made since the 2021 monitoring report was compiled. Websites reviewed for the first time are noted.
	Table 2 - Websites in which no observations of carnation or <i>Dianthus caryophyllus</i> are described. For websites we have previously reviewed and no observations of carnation or <i>Dianthus caryophyllus</i> have been made since the last monitoring report, we have noted the search outcome as <i>No new information</i> . For websites we have reviewed for the first time, this fact is noted and a brief description is provided of the coverage of the <i>Dianthus</i> genus provided at the website.

Table 1. Websites in which observations of carnation or *Dianthus caryophyllus* were described.

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
1	www.gbif.org	Global biodiversity information Network	Worldwide	Searchable collation of multiple datasets.	10 July 2022	Two Europe observations of <i>Dianthus caryophyllus</i> both in 2022 and both from Norway ⁷ .
2	https://www.inaturalist.org/observations	i-naturalist	Worldwide	Searchable dataset with access to record photos and IDs.	11 July 2022	432 records for <i>Dianthus caryophyllus</i> , including synonyms, since July 2021. All wild type apart from 6 cultivated, non-transgenic, carnation.
3	https://www-mittelmeerflora-de	Mediterranean and Alpine flora	Europe	Checklist with superb photographs.	12 July 2022	Newly identified database. <i>D.caryophyllus</i> is illustrated with images of cultivated carnation or other wild type <i>Dianthus</i> species. 113 <i>Dianthus</i> species are listed.
4	https://hirc.botanic.hr/fcd/	Flora Croatica database	Croatia	Searchable dataset of herbaria, bibliographies and images.	12 July 2022	<i>Dianthus caryophyllus</i> ssp. <i>godronianus</i> is listed with an image of a five-petal flower.
5	http://www.cbn-alpin-icno.fr/Phototheque/categories	National Alpine botanical conservatory	Alps and foothills, France	Searchable datasets of herbaria sheets and photographic images, with collector ID.	11 July 2022	Newly identified website. Images of <i>Dianthus gordorianus</i> are of five petal wild type.
6	http://www.tela-botanica.org with links to http://siflore.fcbn.fr	Tela botanica	France and Corsica	Searchable datasets and bibliography with access to record photos and IDs.	10 July 2022	Two observations of <i>D.caryophyllus</i> and two of <i>D. godronianus</i> . Three are five petal wild type.
7	https://nature.silene.eu	Silene nature	Provence-Alpes-Côte d'Azur, France	Searchable datasets and bibliography with access photos and distribution. There are no means to access the record IDs.	13 July 2022	New additions are of <i>Dianthus</i> species synonymous to <i>D. caryophyllus</i> , Photos are of five petal wild type.
8	http://www.naturedugard.org	Observatoire du patrimoine naturel du Gard	Languedoc-Roussillon, France	Searchable dataset with access to record photo gallery and record IDs.	10 July 2022	Five observations of <i>D.caryophyllus</i> . Sites were Saint-Martin-de-Valgalmgues, Mons, Canaules-et-Argentières, Gailhan and Saint-Dionizy.

⁷ Refer site no. 14

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
9	https://www.cbnbrest.fr/observatoire-plantes/cartes-de-repartition/ecalluna	Conservatoire botanique national de Brest (CBN).	Nouvelle-Aquitaine Basse-Normandie, Bretagne and Pays, France	Searchable distribution dataset with access to record locations.	10 July 2022	Two records of <i>D. caryophyllus</i> in 2021.
10	https://www.flora-germanica.de	Flora of Germany	Germany	Searchable flora with photographs and distribution.	11 July 2022	Newly identified website. 15 <i>Dianthus</i> species are described including <i>D. caryophyllus</i> . Carnation examples are clearly in cultivation.
11	https://nabu-naturgucker.de/natur .	Naturgucker citizen science project (“Enjoy nature”)	Germany	Searchable dataset with access to photo gallery and record IDs.	10 July 2022	Three observations of <i>D. caryophyllus</i> since June 2021. One record wild type <i>Dianthus</i> .
12	http://dryades.units.it/Roma	Flora of city of Rome	Udine, Italy	Species list with links to further information.	12 July 2022	<i>D. virgineus</i> is listed, Images are all five petal flowers.
13	http://urdis.unicam.it/crfa/	Centro Ricerche Floristiche dell’Appennino (CRFA)	Central Apennines, Italy	List of plant species with distribution details.	11 July 2022	Newly identified website. <i>Dianthus longicaulis</i> Ten is listed with 15 other <i>Dianthus</i> species, none of which are endemic.
14	www.artsdatabanken.no	Norwegian biodiversity information centre	Norway	Searchable datasets with access to record photos and IDs.	10 July 2022	Two <i>D. caryophyllus</i> records added in 2022. Both show five petal <i>Dianthus</i> plants.
15	http://azoresbiportal.uac.pt/azores-species	Azorean biodiversity portal	Azores, Portugal	Species list with links to records and distribution maps.	11 July 2022	A <i>D. caryophyllus</i> record from June 2021 is a five petal <i>Dianthus</i> species.
16	www.infoflora.ch	National database of the flora of Switzerland	Switzerland	Searchable atlas with access to record dates.	11 July 2022	Two observations of <i>Dianthus caryophyllus</i> after 2021.

Table 2. Websites in which no observations of carnation or *Dianthus caryophyllus* were described.

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
17	http://plants.jstor.org	JSTOR global plants	Worldwide	Herbarium specimens sortable by date and species.	12 July 2022	No new information.
18	https://www.synbiosys.alterra.nl/evc	European vegetation survey	Europe	Searchable link of diagnostic species in EuroVeg database.	11 July 2022	No new information.
19	http://www.nobanis.org/search.asp	European network on invasive alien species	Europe	Searchable database of invasive species definitions by country..	11 July 2022	No new information.
20	https://easin.jrc.ec.europa.eu	European alien species information network	Europe	Checklist with descriptions and maps. Linked to GBIF and <i>inaturalist</i> .	13 July 2022	No new information.
21	http://herbarium.univie.ac.at/database/search.php	Herbarium WU	Austria	Database of herbarium specimens.	12 July 2022	No new information.
22	http://flora.nhm-wien.ac.at/Seiten-Allgemein/Pflanzengattungen.html	Botanik im Bild	Austria	A collection of photographs of the wild plants of Austria.	11 July 2022	Newly identified database. 17 <i>Dianthus</i> species are shown, but not <i>D.caryophyllus</i> .
23	http://waarnemingen.be	Belgian branch of the observation.org portal	Belgium	Searchable dataset with access to record photos and IDs.	10 July 2022	No new information.
24	http://www.plantcol.be/search-plants.php	Belgian living plants collection	Belgium	Searchable dataset of living plant collections in nine botanical institutions in Belgium.	11 July 2022	No new information.
25	https://alienplantsbelgium.my-species.info/	Manual of the alien plants of Belgium	Belgium	Searchable dataset with maps and record IDs.	12 July 2022	No new information.
26	http://www.prirodoslovni.com/inventarna/en/search.php#	Natural history museum Rijeka	Croatia	Searchable dataset of herbarium images.	13 July 2022	No new information.
27	http://www.flora-of-cyprus.eu	Flora of Cyprus	Cyprus	Checklist with photographs.	12 July 2022	No new information.
28	http://www.biolib.cz/en/main	BioLib biological library	Czech Republic	Checklist and linked datasets with photographs.	12 July 2022	No new information.

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
29	http://www.florius.cz	Catalogue Florius	Czech Republic	Checklist and linked Europe-wide collection with collector ID.	12 July 2022	No new information.
30	https://pladias.cz/en/	Database of the Czech flora and vegetation	Czech Republic	Searchable database of plant species with distribution. record IDs and some photographs. Links to Flora of Czech Republic.	13 July 2022	No new information.
31	https://otluuk.github.io/atlas/	Estonian atlas of vascular plants	Estonia	Searchable database of plant species and their distribution with record IDs and some photographs.	12 July 2022	No new information.
32	https://elurikkus.ee	Estonia biodiversity database	Estonia	Searchable database with photographs.	12 July 2022	No new information.
33	https://kasviatlas.fi/	Database of the Finnish museum of natural history	Finland	Searchable database of plant species and their distribution.	11 July 2022	No new information.
34	http://www.sivim.info/sivi/	On-line database of Iberian and Micronesian vegetation	France, Portugal and Spain	Searchable database of plant species and their distribution with record IDs and some photographs.	12 July 2022	No new information.
35	https://inpn.mnhn.fr/accueil/a-propos-inpn	National inventory of natural heritage (INPN)	France and French territories	Dataset compilation providing atlas searchable by species.	10 July 2022	No new information.
36	http://cbnmc.fr/cartoweb3/Chloris/atlas_auv/menu_auv.php	Atlas of flora d' Auvergne	Allier, Puy-de-Dôme, Cantal and Haute-Loire, France	On line atlas with distribution maps. Searchable for species only.	10 July 2022	No new information.
37	http://azunpeche.free.fr/flore.htm	Flora of the Pyrenees	Val d' Azun, France	Checklist with photographs.	12 July 2022	Newly identified website. 3 <i>Dianthus</i> species are listed but not <i>D. caryophyllus</i> or synonyms.
38	http://www.florealpes.com	FloreAlpes	Hautes-Alpes, Corsica, Pyrenees, Provence, France	Searchable flora with photos and distribution maps.	11 July 2022	No new information.

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
39	http://biodiversity-georgia.net/	Georgian biodiversity database	Georgia	Searchable database with observations linked to GBIF ⁸ .	11 July 2022	Newly identified website. 21 <i>Dianthus</i> species are listed but not <i>D. caryophyllus</i> or synonyms.
40	http://daten.bayernflora.de/de/info_pflanzen	Botanical information node Bavaria	Bavaria, Germany	Checklist with distribution maps.	13 July 2022	No new information.
41	http://www.floraweb.de	Floraweb – German wild plants	Germany	Floral descriptions and distribution maps.	11 July 2022	No new information.
42	http://filotis.itia.ntua.gr/home	FILOTIS - database for the natural environment of Greece	Greece	Searchable dataset with access to distribution maps and record IDs.	12 July 2022	No new information.
43	http://portal.cybertaxonomy.org/flora-greece/intro	Flora of Greece	Greece	Checklist with images of some species.	13 July 2022	No new information.
44	https://maps.biodiversityireland.ie	National biodiversity data centre of Ireland	Republic of Ireland	Searchable collation of datasets with maps and botanical information. Collector ID accessible.	13 July 2022	No new information.
45	http://www.wildflowersofireland.net/	Wild flowers of Ireland	Republic of Ireland	Photographic flora.	11 July 2022	Newly identified website. No <i>Dianthus</i> species in the species list.
46	http://dryades.units.it/trieste	Flora of city of Trieste	Trieste, Italy	Species list with links to further information.	11 July 2022	No new information.
47	http://dryades.units.it/casentinesi/	Flora of National Parks Casentinesi forests, Monte Falterona and Campagna	Casentinesi forests, Monte Falterona and Campagna, Italy	Species list with links to further information.	11 July 2022	No new information.
48	http://dryades.units.it/prealpi giulie	Flora of Julian pre-Alps natural park	Julian Pre-Alps Natural Park, Italy	Species list with links to further information.	11 July 2022	No new information.
49	http://dryades.units.it/dolomiti friulane	Flora of Friulian Dolomites natural park	Friulian Dolomites Natural Park, Italy	Species list with links to further information.	11 July 2022	No new information.
50	http://dryades.units.it/udine	Flora of city of Udine	Udine, Italy	Species list with links to further information.	11 July 2022	No new information.

⁸ Site no. 1. Refer row 1

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
51	http://dryades.units.it/euganei	Flora of Euganean Hills	Euganean Hills, Italy	Species list with links to further information.	11 July 2022	No new information.
52	http://dryades.units.it/valerio	Flora of Monte Valerio	Monte Valerio, Trieste, Italy	Species list with links to further information.	11 July 2022	No new information.
53	http://www.anarchive.it	Flora of Italy	Italy	Searchable botanical data archive, with maps and sample dates.	11 July 2022	No new information.
54	https://www.actaplantarum.org/flora/flora	Flora of Italy	Italy	Searchable collation of datasets of herbaria specimens, photographs, maps and botanical information. Collector ID accessible.	11 July 2022	Newly identified website. <i>D. caryophyllus</i> is not listed and all <i>Dianthus</i> sp. in the gallery are five petal wild type.
55	http://www.floramaritime.it	Floral catalogue of maritime Alps	Italy and France	Searchable photographs catalogue.	12 July 2022	No new information.
56	https://cambriasalvatore.wixsite.com/flora-della-sicilia	Flora of Sicily	Sicily, Italy	On line plant species list.	11 July 2022	Newly identified website. <i>D. caryophyllus</i> is not listed and all <i>Dianthus</i> in gallery are five petal wild type, including synonyms species <i>D. arrostii</i> and <i>D. siculus</i> .
57	http://www.maltawildplants.com/wildplants	Malta wild plants	Malta	Plant list with linked distribution information.	11 July 2022	No new information.
58	http://waarneming.nl	Dutch citizen science-based nature observations	The Netherlands	Searchable dataset with access to photo gallery and record IDs.	11 July 2022	No new information.
59	http://www.verspreidingsatlas.nl/planten	FLORON – wild flora of the Netherlands	The Netherlands	Searchable dataset with access to distribution and photo gallery.	11 July 2022	No new information.
60	http://www.iop.krakow.pl/ias/en	Alien species in Poland	Poland	Searchable dataset with species description.	12 July 2022	No new information.
61	http://www.florasilvestre.es/mediterranea	Mediterranean and Micronesian wild flora	Portugal, Spain, France, Balearic Islands	Checklist with photographs.	12 July 2022	Newly identified website. 23 <i>Dianthus</i> species listed but not <i>D. caryophyllus</i> . <i>D.arrostii</i> is only synonym.

Site no.	URL	Site name	Site geographical coverage	Site description	Access date	Search outcome
62	http://www.flora-on.pt/	Flora of Portugal	Portugal	Checklist with photographs.	12 July 2022	Newly identified website. Nine <i>Dianthus</i> species listed but not <i>D. caryophyllus</i> or synonyms.
63	http://dryades.units.it/triglav_ita	Flora of Triglav National Park	Triglav National Park, Slovenia	Species list with links to further information.	11 July 2022	No new information.
64	http://www.floraiberica.es	Flora Iberica	Spain	Species list with links to further information.	11 July 2022	No new information. Flora does not currently include <i>D. caryophyllus</i> or synonyms.
65	http://biodiver.bio.ub.es/biocat/	Biodiversity databank of Catalonia	Catalonia, Spain	Searchable dataset with species description, maps and underlying citations.	12 July 2022	No new information.
66	http://www.anthos.es , Anthos	Spanish plants information system	Spain	Species list with links to further information.	11 July 2022	No new information. Flora does not currently include <i>D. caryophyllus</i> or synonyms.
67	http://flora-aragon.blogspot.fr/	Flora of Aragon	Spain	Check list with photographs.	12 July 2022	Newly identified website. Four <i>Dianthus</i> species listed but not <i>D. caryophyllus</i> or synonyms.
68	http://www.almerinatura.com/joyas/	Flora of Almeria	Spain	Check list with photographs.	12 July 2022	Newly identified website. The only <i>Dianthus</i> species listed is <i>D. charmed</i> .
69	https://www.floravascular.com	Flora of Western Andalucía	Spain	Check list with photographs and maps (some species).	12 July 2022	Newly identified website. Fifteen <i>Dianthus</i> species listed but not <i>D. caryophyllus</i> or synonyms.
70	RJB colecciones www.csic.es	Herbarium of royal botanic garden Madrid	Spain	Species list and images searchable by date.	13 July 2022	No new information.
71	https://www.artportalen.se	Species observation system	Sweden	Searchable dataset with access to record IDs.	10 July 2022	No new information.
72	https://www.wsl.ch/land/products/webflora/floramodul1-en.html	Swiss web flora	Switzerland	Checklist with distribution maps.	12 July 2022	No new information.
73	http://www.bsbimaps.org.uk/atlas	Botanical society of British Isles – flora of British Isles	United Kingdom	Atlas searchable by species.	11 July 2022	No new information.