

MONITORING REPORT FOR GMO USES OTHER THAN CULTIVATION

CNL0902

IFD-26407-2

Florigene®Moonvelvet™



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1. General information

1.1 Crop/traits

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

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

Florigene®Moonvelvet™

Decision authorisation number; C/NL/09/02

Number of consent; C/NL/09/02/00 ab.1

Date of consent; July 20, 2015

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

Not applicable.

1.4 Unique identifier

IFD-26407-2

1.5 Report period from

July 1, 2019 to June 30, 2020

1.6 Other monitoring reports have been submitted in respect of:

Cultivation YES NO

2. Executive summary

Approximately 2 tonnes (0.2 million flowers) of Florigene® Moonvelvet™ were imported into the EU from July 1, 2019 to June 30, 2020, through a single importer in the Netherlands. Flowers were imported from Colombia.

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

- The importer reported that they were not aware of any illegal growing and that neither they nor consumers have reported any adverse effects of handling the flowers.
- Florigene/Suntory received two questions from EU-based public, distributors and retailers in the period. One was from Italy, enquiring whether it was possible to buy plants and one was from the Netherlands asking for information on fungicide usage at the production sites.
- Information on survey work was provided by three botanical experts from work in Greece, Slovakia and North Macedonia. There was no evidence of the establishment of transgenic carnation in the wild, or of hybridisation with wild *Dianthus* species. One expert found what could be a carnation plant established outside of cultivation. The plant appeared to be white-flowered cultivar, and so not a transgenic variety.
- 60 responses were received from 213 letters and emails sent to European botanical and plant conservation groups, botanical gardens, amateur botanists and University departments. None of the respondents reported collecting either carnation or *Dianthus caryophyllus* since the last monitoring report. A single new herbarium record was provided (of a florist purchased carnation) and a record of *Dianthus caryophyllus* in the database of spontaneously occurred plants in the city Brno (Czech Republic) from 2012.
- A broad outreach was made through the newsletter of the Telabotanica network (<http://www.tela-botanica.org/site:accueil>) in France, seeking reports from amateur botanists of any naturalised carnations or wild *Dianthus* in the past 12 months. 43 respondents made contact all of whom reported wild type *Dianthus* observations with twenty respondents provided photographic evidence. No carnations were observed.
- A review of recent literature related to *Dianthus* was carried out. There were no reports indicating evidence of the establishment of carnation in the wild, presence of wild-type *Dianthus caryophyllus* outside of cultivation or of hybridisation between carnation and any wild *Dianthus* species outside of breeding programs.
- Botanical and floral databases were searched for records of *Dianthus caryophyllus* made since the last monitoring report. Four new records of *Dianthus caryophyllus* L. were identified from Belgium, two from Germany, one from Sweden, and 11 from France. Photographs of the observations (where available) indicate the collections to be of 5-petal wild *Dianthus caryophyllus*, not carnation.

Though a carnation plant was found by one of the expert botanists the find was probably from a garden escape and an individual specimen. The overall results are therefore consistent with previous monitoring reports showing carnation is not present in nature in Europe. The monitoring this year also supports previous observations that

wild type *Dianthus caryophyllus* is rare and largely confined to southern regions of 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. Table 1 provides information on the imports of all transgenic carnation varieties imported into the EU during the reporting period.

This information is provided to show information on the specific variety covered by this report and the total of all GM carnation varieties.

Table 1. Tonnes of GM carnation imported into the EU from July 2019 to June 2020.

GM carnation variety	Quantity (tonnes)	
	Imported from Ecuador	Imported from Colombia
Florigene®Moonaqua™	34	6
Florigene®Moonlite™	28	2
Florigene®Moontea™	0	7
Florigene®Moonberry™	0	3
Florigene®Moonvelvet™	0	2
Florigene®Moonvista™	5	5
All GM carnation varieties	67	25

GM and non-GM product

At the time of accessing the EUROSTAT database to assess import of all carnation flowers into the EU (database accessed July 12, 2020) information was only available till the end of April 2020 for imports from Colombia and Ecuador and to the end of March 2020 for imports from the bulk of other countries. In order to estimate the percentage of imports which are GM we have therefore chosen to use the import data for the 12-month period from April 2019 to March 2020. 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 imports from EUROSTAT¹.

Table 2. Tonnes of GM carnation imported into the EU from April 2019 to March 2020.

GM carnation variety	Quantity (tonnes)	
	Imported from Ecuador	Imported from Colombia
Florigene®Moonaqua™	35	6
Florigene®Moonlite™	29	1
Florigene®Moontea™	0	7
Florigene®Moonberry™	0	3
Florigene®Moonvelvet™	0	3
Florigene®Moonvista™	4	4
All GM carnation varieties	68	24

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

Table 3. Estimated import of carnation (total of GM plus non-GMO) into the EU, April 2019 – March 2020.

Country of origin	Quantity (tonnes)*	
	NL imports	EU27 total imports
Ecuador	235	292
Colombia	8,981	11,705
Other countries	11,077	14,234
Total ²	20,293	26,231

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

Percentage of import which is GM

Table 4 shows the percentage of carnation flower import into the EU which is GM. Data from tables 2 and 3 was used to make this estimation.

Table 4. Percentage of carnation flower import into the EU 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®Moonacqua™	11.85%	0.05%	0.16%
Florigene®Moonlite™	9.84%	0.01%	0.11%
Florigene®Moontea™	0.00%	0.06%	0.03%
Florigene®Moonberry™	0.00%	0.03%	0.01%
Florigene®Moonvelvet™	0.00%	0.02%	0.01%
Florigene®Moonvista™	1.30%	0.04%	0.03%
All varieties	22.99%	0.20%	0.34%

GM imports into the E27 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

² Reporter; EU27_2020_EXTRA

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™	14.72%	0.07%	0.20%
Florigene®Moonlite™	12.23%	0.01%	0.14%
Florigene®Moontea™	0.00%	0.08%	0.03%
Florigene®Moonberry™	0.00%	0.03%	0.01%
Florigene®Moonvelvet™	0.00%	0.03%	0.01%
Florigene®Moonvista™	1.62%	0.05%	0.04%
All varieties	28.57%	0.26%	0.45%

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 2 tonnes of the GM event Florigene®Moonvelvet™ were imported in the monitoring period (July 2019 to June 2020). The origin of the flowers was Colombia (table 2). The transgenic carnation event represents approximately 0.02% of total imports of carnation into the EU from Colombia (table 4). As the Netherlands dominates the import of extra-EU27 imports of carnation (table 3), a similar percentage was recorded for import into the Netherlands alone. The transgenic carnation event represents approximately 0.03% of total imports of carnation into the Netherlands from Colombia (table 5).

3.2 General surveillance

3.2.1 Description of general surveillance

The general surveillance plan consisted of;

1. Importer questionnaire.
2. A broad outreach was made through the newsletter of the Telabotanica network in France.
3. Survey reports. Florigene engaged the services of breeders and botanists with interests in *Dianthus* biology to alert us to any wild populations or unusual *Dianthus* hybrids that might find during their routine survey work. This year we have received information from three experts.
4. Institutional mail out. A mail and email survey were carried out, in multiple languages. 213 contacts were made in 2020, compared to 245 in 2019. Where communication was established by email last year this was continued as the means of communication. Most emails and letters were accompanied by a brochure illustrating the six transgenic varieties available in the EU (attachment 8). The breakdown of

responses in 2020 is described in attachment 5. This year we added European alpine and rock garden societies to the mail out.

5. Literature and database review (attachments 6 and 7).

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 8 is the same 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 2020.

Attachment 2. Institutions contacted in 2020.

Attachment 7. Floral databases reviewed.

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

Two queries were made to the Florigene website during the year. One was a request for information on use of fungicides during production and one was from Italy enquiring about possible purchases of plants.

Telabotanica network

See attachment 5. 43 respondents made contact, all of whom reported wild type *Dianthus* observations. One respondent showed an interest in the genetic modification aspects of the product.

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. Wild *Dianthus caryophyllus* populations were not found. For the first time since we began monitoring in 2007 one expert found what could be a carnation plant established outside of cultivation. The plant appears to be white-flowered cultivar, and so not a transgenic variety.

Mail out

Overall response rate was 28.2%, which was comparable to rates in 2019 (26.5%), 2018 (29.2%) and 2017 (25.1%) (Figure 1). The response rate to emails was higher than to postal enquiries.

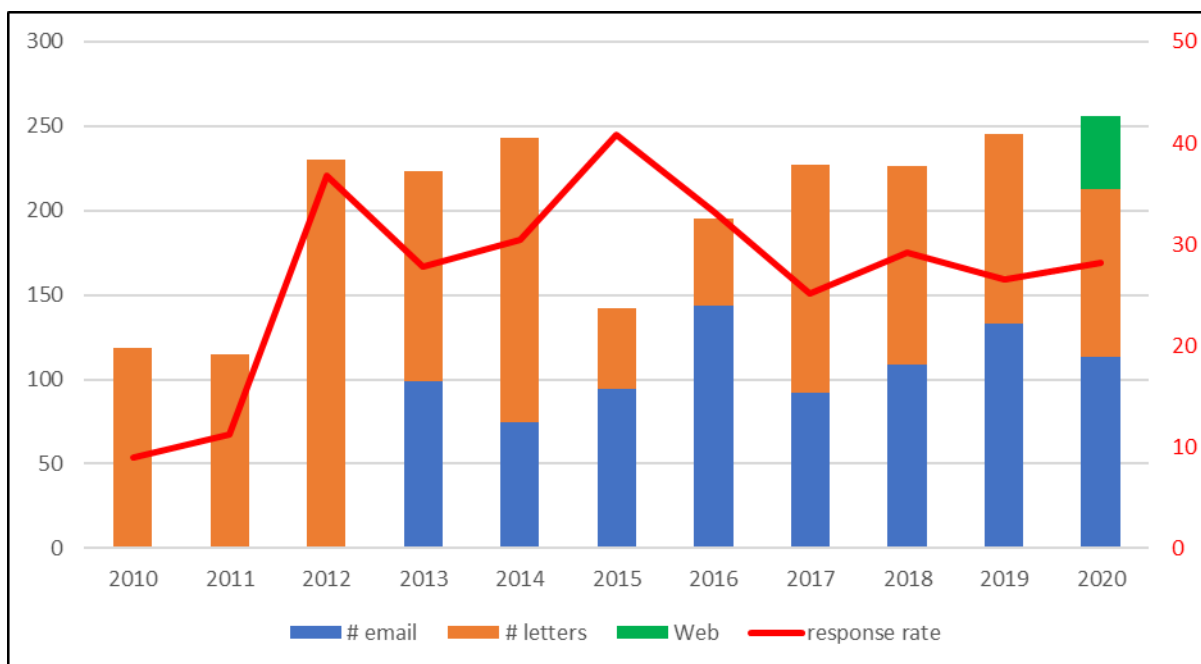


Figure 1. Number of postal and email enquiries each year since 2010 and overall response rate. Response rate is calculated from email and letter response only. The web responses, shown as the green block, are responses to the request for observations from the Telabotanica network.

Details of the information obtained from the mail out is provided in attachment 5. No respondents reported populations of carnation.

Literature review

Attachment 6 summarises the output from a literature review (also refer section 3.2.6).

Database review

Attachment 7 lists the databases examined. No databases identified transgenic carnation, or hybrids between transgenic carnation and wild *Dianthus* populations. The databases provided 18 records of *Dianthus caryophyllus* in Europe made since the last monitoring report. Where photographs were available, these reports were seen to be for 5 petal wild type *Dianthus* species.

3.2.5 Additional information

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

Testing of carnation varieties for illegal propagation

Our experience has been that images of transgenic carnation flowers are often used by other companies and individuals, without permission or accreditation, in advertising and promotional material. This strategy has also been used by seed suppliers (advertising “purple carnation seed”) and in 2019 we noted an Italian company advertising seed of purple carnation using images of Florigene flowers. Seed was ordered in August 2019 and was sent from a supplier in China. PCR analysis of seedlings was carried out using primers from four transgenic carnation varieties (Florigene®Moonaqua™, Florigene®Moonlite™, Florigene®Moonvista™, Florigene®Moonshade™). PCR results were negative for all seedlings.

Production sites

In October 2019, January 2020 and May 2020 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

Flower colour in the variety Florigene®Moonvelvet™ is very stable. This variety is only produced at one location, in Colombia. The post-harvest facility records off-types and in the monitoring period (week 27 2019 to week 26 2020) 35 off-types (these are discarded in post-harvest) were measured out of 1,049,750 flowers produced. This rate is very low (0.003%) and is consistent with the fact no off-types were found during 13 field surveys of flowers in production (as opposed to in post-harvest) from February 2015.

Australia

The Australian government regulatory body, the Office of the Gene Technology Regulator, has made a determination to include dealings with GM carnation variety Florigene®Moonvelvet™ on the GMO Register, effective 17 July 2020³.

3.2.6 Review of peer-reviewed publications – Attachment 6⁴

During this reporting period publications have appeared in the scientific literature which contain some information on *Dianthus* biology, ecology and distribution. None of these publications, which are listed and summarised in attachment 6, have identified cultivated carnation, or hybrids with other *Dianthus* species, in wild populations. We could not find any descriptions of wild populations of *Dianthus caryophyllus* or its synonymous species though reference to the species was made in a checklist for Catalonia (Aymerich and Sáez, 2019), in an index seminum for Siena botanical garden (Castagnini et al., 2020) and in a private botanical garden inventory (Gallegos Villegas, 2019). The bulk of papers listed in attachment 6 have added to our baseline information on distribution of other *Dianthus* species.

The literature review came across several papers that used vegetation survey techniques in urban situations in which we might expect cultivated carnation to have an opportunity to establish were it to have a weediness propensity. These study sites included urban areas of Italy (Giannantonio et al., 2019; Buldrini et al., 2020) cemeteries (Nowińska et al., 2020), tram tracks (Rendeková et al., 2020) and hedgerows (Vanneste et al., 2020). *Dianthus armeria* L. subsp. *armeria* was the only *Dianthus* species found in these reports. The same species was found in the open spaces of Milan airport (Martignoni et al., 2019).

As we have found in previous years, the literature review identified papers showing the beneficial effects to health of carnation extracts (Assem et al., 2019; Kamil et al., 2020). New literature was found on the mechanism of flower colour off-type production in carnation (Morimoto et al., 2019, 2020) as well as a review including reference to transgenic carnation varieties (Boutigny et al., 2020). Matveeva and Otten (2019) showed non-transgenic carnation contains intact opine and cucumopine synthase (*cus*)-like genes, presumably naturally acquired from *Agrobacterium*.

3.3 Case-specific monitoring

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

Not applicable.

³ Determination on a proposal to include dealings with cut flowers of genetically modified carnations on the GMO Register – REG-002 <http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/reg002>

⁴ Cited references are listed in attachment 6.

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				

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, or of any 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.

4. Summary of results and conclusionsResults

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® Moonvelvet™ in the wild and no evidence of hybridisation to this variety.
3. An extensive mail out was carried out and contact made with French botanists through the Telabotanica network and we were not made aware of any specimens from the wild which could have been Florigene® Moonvelvet™.
4. A review of recent peer-reviewed literature failed to identify *Dianthus caryophyllus* or cultivated carnation outside of cultivation in Europe.
5. A review of floral databases identified 18 collections made in the last 12 months of *Dianthus caryophyllus* in the wild. Available photographs show the collections are single flower, 5 petal, *Dianthus caryophyllus* and not carnation.

Conclusions

There was no evidence of the establishment of transgenic carnation in the wild, or of introgression. The data collected is consistent with the occurrence in nature in Europe of wild-type unimproved *Dianthus caryophyllus* being rare with most records continue to occur in France.

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

The literature and database review will be continued. Databases are the most relevant source of observation information and efforts will continue to be made to ensure all relevant European databases have been identified. The mail out will be continued.

- Next year, the database review will be made in early June to allow time to contact the recorders of any new observations. The database will be expanded to include taxonomic synonyms for *Dianthus caryophyllus*. This was only done for the literature review this year.

- Next year, the literature review will be carried out in early June to allow time to contact authors of new literature.
- *Dianthus godronianus* will be added to the search terms in literature and database review.

We will continue to work with experts in the Balkans and desist survey work in Greece. Though we could not find suitable expert(s) based in Italy and France the broadcast to the website TelaBotanica was successful and we will expand this to similar societies next year. We will continue to try and find a botanical expert based in Italy and are targeting Northern Italy.

Dated.....**July 31, 2020**

Attachment 1. Breeders and experts contacted

Breeders	
Azienda Agricola Moraglia	Italy
Santa Maria	Italy
Selecta Klemm GmbH and Co.	Stuttgart, Germany
Botanists	
Ss. Cyril and Methodius University in Skopje	Republic of Macedonia
Slovak University of Agriculture in Nitra	Slovakia
Cephalonia Botanica	Greece

Attachment 2. Mail out summary 2020

A list of institutions contacted in 2020 is shown below. For reasons of privacy details are not provided of individuals such as amateur collectors and botanists. This list also excludes contacts from the individuals who responded to the newsletter published in the Telabotanica website (refer appendix 5).

ORANIZATION	CITY	COUNTRY
Austrian Vegetation Database (V.I.N.C.A.)	Vienna	AUSTRIA
Federal Ministry of Agriculture, Forestry, Environment and Water Management, Plant Protection	Vienna	AUSTRIA
Institute of Integrative Nature Conservation Research, University Of Applied Life Sciences	Vienna	AUSTRIA
Arge Vegetationsökologie und Landschaftsplanung Technisches Büro	Vienna	AUSTRIA
Meise Botanical Garden	Meise	BELGIUM
Department of Botany, Plovdiv University	Plovdiv	BULGARIA
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy Of Sciences	Sofia	BULGARIA
Školski Botanički vrt Oš Ostrog	Kastel Luksic	CROATIA
Učka Nature Park Public Institution	Lovran	CROATIA
Biokovski Botanički vrt 'Kotišina	Makarska	CROATIA
Faculty of Geotechnical Engineering, University of Zagreb	Zagreb	CROATIA
Botanická Zahrada Přf Masarykovy Univerzity v Brně	Brno	CZECH REPUBLIC
Institute of Botany, Czech Academy of Sciences	Brno	CZECH REPUBLIC
Department of Botany and Zoology, Masaryk University	Brno	CZECH REPUBLIC
Botanická Zahrada Léčivých Rostlin Farmaceutické Fakulty	Hradec Kralove	CZECH REPUBLIC
Department of Forest Ecology, Czech University of Life Sciences	Kamýcká	CZECH REPUBLIC
Botanická Zahrada SOŠ	Malesice	CZECH REPUBLIC
European Weed Research Society	National Rep.	CZECH REPUBLIC
Botanická Zahrada, Ostravská Univerzita v Ostravě	Ostrva	CZECH REPUBLIC
Klub Skalničkářů Prague	Prague	CZECH REPUBLIC
Faculty of Medicine, Charles University	Prague	CZECH REPUBLIC
Botanická Zahrada Hl.M. Prahy	Prague	CZECH REPUBLIC
Zoologická a Botanická Zahrada Plzeň	Plzen	CZECH REPUBLIC

Botanická Zahrada Petra Albrechta	Prostejov	CZECH REPUBLIC
Botanický Ústav AV	Pruhonice	CZECH REPUBLIC
Institute of Botany, Academy of Sciences of The Czech Republic	Průhonice	CZECH REPUBLIC
Botanická Zahrada Při Szeš Rakovník	Rakovnik	CZECH REPUBLIC
Vedoucí Botanické Zahrady Botanická Zahrad	Suchdol	CZECH REPUBLIC
Botanická Zahrada Při VOŠ a Szeš v Táboře	Tabor	CZECH REPUBLIC
Botanical Museum and Library	Copenhagen	DENMARK
Den Alpine Have	Ringkøbning	DENMARK
Department of Biological and Environmental Science, University of Jyvaskyla	Jyvaskyla	FINLAND
European Weed Research Society	National Rep.	FINLAND
La Bambouseraie (Maurice Negre Parc Exotique de Prafrance)	Anduze	FRANCE
Les Jardins de Valloires	Argoules	FRANCE
Les Jardiniers de Compagnie	Asnières-Sur-Seine	FRANCE
Association Jardin Botanique du Val D'yser	Bambecqu	FRANCE
Jardin Botanique de la Ville Et de l'Universite, Universite de Franche-Comte	Besancon	FRANCE
Société Linnéenne de Bordeaux	Bordeaux	FRANCE
Jardin Botanique de L'hopital D'instruction des Armées Clermont-Tonnerre	Brest	FRANCE
Parc de la Teyssonnière	Buellas	FRANCE
Jardin Botanique de la Ville de Caen	Caen	FRANCE
Les Jardins D'eau	Carsac - Aillac	FRANCE
Conservatoire Botanique National du Massif-Central	Chavaniac-Lafayette	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
Le Jardin Botanique a Durban-Corbières	Durban-Corbières	FRANCE
Association Jardiniers de l'Eure	Gauville-La-Campagne	FRANCE
Les Jardiniers du Dimanche	Genay	FRANCE
The Martels Garden	Giroussens	FRANCE
Univ. Grenoble Alpes	Grenoble	FRANCE

Muséum d'Histoire Naturelle de Grenoble	Grenoble	FRANCE
Conservatoire Botanique National Méditerranéen	Hyères	FRANCE
Le Jardin Alpin du Mont Cenis	Lanslebourg Mont Cenis	FRANCE
Église De Saint-Xist et Jardin Botanique	Le Clapier	FRANCE
Jardin Botanique de Haute-Bretagne	Le Chatellier	FRANCE
Jardin Botanique de la Faculte des Sciences Pharmaceutiques, Universté de Lille	Lille	FRANCE
Jardin des Plantes	Lille	FRANCE
Jardin Botanique Alpin " Daniella "	Limoges	FRANCE
Jardin Botanique de l'Ecole Veterinaire d'Alfort	Maisons-Alfort	FRANCE
Association des Jardiniers de Marcq-En-Barœul	Marcq-En-Barœul	FRANCE
Jardins Botanique E.-M.-Heckel	Marseille	FRANCE
Jardin Botanique de Marnay Sur Seine	Marnay-Sur-Seine	FRANCE
Les Jardiniers de Maubeuge et de La Vallée de la Sambre	Maubeuge	FRANCE
Jardin Botanique Pyrénéen	Melles	FRANCE
Conservatoire Botanique National Méditerranéen de Porquerolles	Montferrier-Sur-Lez	FRANCE
Jardin Botanique de la Presle	Montigny-Les-Metz	FRANCE
Parc Zoologique et Botanique de la Ville De Mulhouse	Mulhouse	FRANCE
European Weed Research Society	National Rep.	FRANCE
Le Parc Botanique de Neuvic	Neuvic-Sur-L'isle	FRANCE
Parc Botanique du Château d'Ouge	Ouge	FRANCE
Société des Amateurs de Jardins Alpins	Paris	FRANCE
Jardin Botanique Universitaire de Poitiers	Poitiers	FRANCE
Parc Et Roseraie du Château de Rambures	Rambures	FRANCE
Jardin Exotique and Botanique de Roscoff	Roscoff	FRANCE
Jardin des Plantes	Rouen	FRANCE
Jardin Botanique des Pyrenees-Occidentales	Saint-Jammes	FRANCE
Jardin Botanique Paul Jovet	Saint-Jean De Luz	FRANCE
Conservatoire Botanique Pierre Fabre	Soual	FRANCE
Institut de Botanique	Strasbourg	FRANCE
Jardin Botanique de Talence	Talence	FRANCE

Jardin Botanique et Arboretum Henri Gaussen	Toulouse	FRANCE
Le Jardin Botanique de Tourcoing Mairie de Tourcoing	Tourcoing	FRANCE
Association des Jardiniers de France	Valenciennes	FRANCE
Ökologisch-Botanischer Garten der Universität Bayreuth	Bayreuth	GERMANY
Institute of Biology, Martin Luther University Halle Wittenberg	Halle	GERMANY
Univ. of Regensburg	Regensburg	GERMANY
Botanischer Garten der Universität Kiel	Kiel	GERMANY
Faculty Of Geography and Geosciences, University Of Trier	Trier	GERMANY
Julia and Alexander N. Diomedes Botanic Garden	Athens	GREECE
MTA Centre for Ecological Research, Institute of Ecology and Botany	Alkotmány	HUNGARY
Szent Istvan University, Institute of Nature Conservation And Landscape Management	Godolló	HUNGARY
MTA Centre for Ecological Research, Institute Of Ecology and Botany	Vácrátót	HUNGARY
Giardino Aplino "Antonio Segni"	Agordino	ITALY
Giardino Botanico Gole Del Sagittario	Anversa Degli Abruzzi	ITALY
Institute of Bioscience and Bioresources, CNR	Bari	ITALY
Civic Orto Botanico "L. Rota"	Bergamo	ITALY
The Reiza Alpine Botanical Gardens Bormio	Bormio	ITALY
Centro Conservazione Biodiversità (CCB), Università Degli Studi Di Cagliari	Cagliari	ITALY
Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania	Caserta	ITALY
Il Giardino Delle Erbe "Augusto Rinaldi Ceroni"	Casola Valsenio	ITALY
University of Catania	Catania	ITALY
Giardino Alpino "Paradisia"	Cogne	ITALY
Giardino Botanico Di Valbonella	Corniolo	ITALY
Giardino Botanico Di Saussurea	Courmayeur	ITALY
Natural History Museum, Section of Botany, University of Florence.	Florence	ITALY
Department Of Biology, Laboratory of Plant Biology, University of Florence.	Florence	ITALY
Orto Botanico Dell'università di Genova	Genova	ITALY
Giardino Botanico Alpino "Castel Savoia"	Gressoney-Saint-Jean	ITALY
University of L'Aquila	L'Aquila	ITALY

Giardino Botanico Della Majella	Lama Dei Peligni	ITALY
Chanousia Alpine Botanical Garden	La Thuile	ITALY
Intragnola Gardens	Laveno-Mombello	ITALY
Museo di Storia Naturale del Mediterraneo	Livorno	ITALY
European Weed Research Society	National Rep.	ITALY
Orto Botanico Dell'università di Pavia	Pavia	ITALY
Centro Visita di Pescasseroli	Pescasseroli	ITALY
Giardino Botanico Alpino "Giangio Lorenzoni"	Puos D`Alpago	ITALY
Giardino Botanico "Loreto Grande"	Villavallelonga	ITALY
Department of Science, Roma Tre University, Rome, Italy	Rome	ITALY
Cooperativa Sociale Prassi E Ricerca Onlus	Rome	ITALY
CAT Grano	Rome	ITALY
Civico Orto Botanico "Ulisse Aldrovandi"	San Giovanni in Persiceto	ITALY
Dipartimento Di Chimica E Farmacia, University Of Sassari	Sassari	ITALY
Istituto Regionale per la Floricoltura	San Remo	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
Giardino Botanico Dell'isola Madre	Stresa	ITALY
Giardino Botanico Alpino "Giangio Lorenzoni" Al Pian di Cansiglio	Tambre d'Alpago	ITALY
Orto Botanico Conservativo Carlo Spegazzini	Treviso	ITALY
Giardino Fenologico "Alessandro Marcello"	Treviso	ITALY
Orto Botanico Dell'università di Trieste	Trieste	ITALY
Giardino Botanico "Carsiana"	Trieste	ITALY
Department of Life Sciences, University Of Trieste	Trieste	ITALY
Giardino Aplino "Antonio Segni"	Veneto	ITALY
Giardino Botanico Alpino "San Marco"	Vicenza	ITALY
European Weed Research Society	National Rep.	NETHERLANDS
Utrecht University Botanic Gardens	Utrecht	NETHERLANDS
NIBIO - Norwegian Institute of Bioeconomy Research, Trondheim, Norway	Trondheim	NORWAY

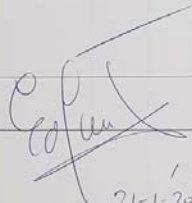
The Botanical Garden in Lodz	Lodz	POLAND
University of Łódź	Lodz	POLAND
European Weed Research Society	National Rep.	POLAND
Instituti Fibrarum Naturalium et Plantarum Medicinalium	Plewiska	POLAND
Department of Plant Ecology and Environmental Conservation, University of Warsaw	Warsaw	POLAND
Botanical Garden, University of Wrocław	Wrocław	POLAND
Centre For Applied Ecology, University Of Lisbon	Lisbon	PORTUGAL
University of Porto	Porto	PORTUGAL
Macedonian Academy of Sciences and Arts, Skopje	Skopje	REPUBLIC OF NORTH MACEDONIA
Gradina Botanica A Universitatii din Bucuresti	Bucarest	ROMANIA
Department Of Molecular Biology And Biotechnology, Babeş-Bolyai University	Cluj-Napoca	ROMANIA
Gradina Botanica din Tulcea	Tulcea	ROMANIA
Faculty of Natural Science, Chechen State Pedagogical University	Grozny	RUSSIA
Faculty Of Biology , Chechen State University	Grozny	RUSSIA
Immanuel Kant State University Botanical Garden	Kaliningrad	RUSSIA
Department Of Natural Sciences, Karachay-Circassian State University	Karachaevsk	RUSSIA
Central Siberian Botanical Garden	Novosibirsk	RUSSIA
Botanical Garden 'Jeremovac'	Belgrade	SERBIA
Department of Botany, University of Belgrade	Belgrade-Zemun	SERBIA
Institute For Biological Research, National Institute of Republic of Serbia	Belgrade	SERBIA
Dept of Environment and Sustainable Development Singidunum University	Belgrade	SERBIA
European Weed Research Society	National Rep.	SERBIA
Slovak Academy of Sciences	Banská Bystrica	SLOVAKIA
Slovenia Rock Garden Society	Bratislava	SLOVAKIA
Slovakian Rock Garden Society	Nitra	SLOVAKIA
Biotechnical Faculty of The University in Ljubljana	Ljubljana	SLOVENIA
Institute of Biology, Research Center of The Slovenian Academy of Sciences And Arts	Ljubljana	SLOVENIA
Botanical Garden Tal 2000	Pragerskem	SLOVENIA

Atropa	Pragsko	SLOVENIA
Botanical Garden Sežana	Sezana	SLOVENIA
Scientific Research Centre of The Slovenian Academy of Sciences and Arts, Institute of Biology	Tolmin	SLOVENIA
Department of Biology, Healthcare and the Environment	Barcelona	SPAIN
Institut Botànic De Barcelona (IBB, CSIC-ICUB)	Barcelona	SPAIN
Departamento de Biología Vegetal y Ecología Universidad de Sevilla	Seville	SPAIN
Fundació Jardí Botànic de Sóller Herbario	Sóller, Balearic Islands	SPAIN
Göteborgs Botaniska Trädgård	Gothenburg	SWEDEN
Schynige Platte Botanical Alpine Garden Association	Bern	SWITZERLAND
Swiss Federal Research Institute WSL, Biodiversity and Conservation Biology	Birmensdorf	SWITZERLAND.
Botanischer Garten Im Eichholz, Grueningen	Grueningen	SWITZERLAND
Dep. Of Environmental Systems Science, ETH	Zurich	SWITZERLAND
Oles Honchar Dnipro National University	Dnipro	UKRAINE
M.G. Kholodny Institute of Botany of the National Academy of Sciences of Ukraine	Kyiv	UKRAINE
Botanical Society of Britain and Ireland	East Sutherland, Scotland	UNITED KINGDOM
Rock Garden Society	Glasgow, Scotland	UNITED KINGDOM
Botanical Society of Britain and Ireland	Kent, England	UNITED KINGDOM
Botanical Society of Britain and Ireland	Midlothian, Scotland	UNITED KINGDOM
Alpine Garden Society	Pershore, England	UNITED KINGDOM

Attachment 3. Importer questionnaire response


January 2020

Questionnaire																						
Questionnaire Number 2019																						
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Your company																						
PART ONE																						
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Please provide an estimation of the number of staff who have handled the flowers during import or re-packing in the period July 2019 – Dec 2019	2
Please provide an estimation of the number of customers you have supplied the flowers to in the in the period July 2019 – Dec 2019	12
If there any other comments you wish to make, please make them here;	
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Signature	
Date	21-1-20

June 2020

Questionnaire																						
Questionnaire Number 2020.1																						
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Signature	
Date	24/6/20

Attachment 4. Summary of survey data provided by experts

Florigene received reports from three experts, covering work in Greece, Slovakia and North Macedonia. None of the experts found any indication of hybrids with transgenic carnations, populations of transgenic carnation or populations of wild *Dianthus caryophyllus*. Two experts commented that restrictions to movement imposed by the Covid-19 pandemic had restricted the amount of field work possible since March 2020.

North Macedonia

Dates and locations of surveys are listed in table 1. For the first time since we began monitoring in 2007 the expert found what could be a carnation plant established outside of cultivation. The plant is shown in Figure 1 and appears to be white-flowered cultivar, and so not a transgenic variety.



Figure 1. *Dianthus* sp. Identified in North Macedonia

Table 1. Details of field work in North Macedonia

Month	Location	Species
September 2019	Sini Viroi. Belchishko Blato (Belchishta Wetland), Ohrid region.	No <i>Dianthus</i> species identified
October 2019	Bistra Mt. (Medenica peak; Kjurkov dol). Mavrovo National Park.	Possible occurrence of <i>Dianthus integer</i> subsp. <i>minutiflorus</i> (Halácsy) Bornm. ex Strid
June 2020	Kozle (Vodno Mt. foothill). Vodno Mt. (Skopje region).	A cultivar of <i>Dianthus</i> sp. growing beside a woodland strawberry, <i>Fragaria vesca</i> L. Highly probable to have originated from neighbouring private yards.
Informal	Urban and peri-urban sites in the city of Skopje (municipalities and bordering mountains)	No <i>Dianthus</i> species identified

Greece

A survey was carried out in June and July 2020 on four Ionian islands in Greece;

- South Leucada (Iefkada).
- Central Leucada.
- North and North-West Cephalonia (Kefalonia).
- North and south Zante.
- Serifos.

Small populations of *Dianthus fruticosus* subsp. *occidentalis* were found on limestone rock habitats on all four islands. A single 10 plant population of *Dianthus viscidus* was found in central Leucada.

Slovakia

Dates and locations of sampling are listed in table 2 below, together with *Dianthus* species identified. Five *Dianthus* species were recorded, but not *Dianthus caryophyllus*.

Table 2. Details of *Dianthus* species identified in field work in Slovakia.

Month	Location	Species
August 2019	Vinné, road edge near the entrance gate to Military training area Valaškovce, 48°49'37.3"N 21°58'53.1"E	<i>Dianthus armeria</i> L.
August 2019	Červenica, meadows NE from the village near the road no. 3440, 48°53'39.3"N 21°27'24.2"E	<i>Dianthus carthusianorum</i> L.
June 2020	Plavé Vozokany, abandoned vineyards N from the village, 48°06'09.2"N 18°27'32.7"E	<i>Dianthus armeria</i> L.
June 2020	Chľaba, dry rocky grasslands on andesite, 47°49'59.6"N 18°48'54.1"E	<i>Dianthus pontederæ</i> A. Kern
June 2020	Valaská Belá, Gápel hamlet, meadow, 48°54'59.1"N 18°30'27.3"E	<i>Dianthus deltoides</i> L.
June 2020	Velčice, Kľačany hamlet, meadow near the Čerešňový potok stream, 48°27'20.0"N 18°17'02.3"E	<i>Dianthus deltoides</i> L.
June 2020	Modrany, abandoned vineyards near Suchý vrch hill, 47°49'43.4"N 18°21'56.0"E	<i>Dianthus carthusianorum</i> L.
July 2020	Tlmače, foothill of Plešovica hill, forest edge, 48°17'17.8"N 18°29'55.9"E	<i>Dianthus armeria</i> L.
July 2020	Velčice, Srázky site 500 m W from the village, 48°24'49.8"N 18°17'29.7"E	<i>Dianthus armeria</i> L.
July 2020	Kružlová, hill with T-34 tanks, WW II memorial near road no. 3539, 49°21'42.7"N 21°35'38.7"E	<i>Dianthus deltoides</i> L.
July 2020	Kapušany pri Prešove, Kapušiansky hrad castle, 49°03'16.8"N 21°19'12.9"E	<i>Dianthus carthusianorum</i> L.
July 2020	Rohožník, afforested sandy dunes in W edge of the village, 48°27'40.9"N 17°09'22.0"E	<i>Dianthus serotinus</i> W. et K.

Attachment 5. Summary of response to mail out

Tela-botanica (<http://www.tela-botanica.org/site:accueil>)

This year broad outreach was made through the newsletter of the Telabotanica network in France, seeking reports of any naturalised carnations or wild *Dianthus caryophyllus* in the past 12 months. The network has more than 53,000 members and close to 1 million records in the database. A copy of the posting outlining the request for information, which was made on June 22 2020, is shown below.

A la recherche de *Dianthus caryophyllus*

Steve Chandler lance un appel à tous ceux qui ont croisé *Dianthus caryophyllus* en dehors de cultures ou de jardins ces dernières années. Signalez lui vos observations.



Dianthus caryophyllus L. par Michel Pansiot CC BY-SA

C'est un fait encore peu connu, mais depuis plus de 10 ans, des variétés génétiquement modifiées d'œillet (également appelés transgéniques) sont vendues sous forme de fleurs coupées en Europe. Les œillets ont été modifiés avec un gène de pétunia de sorte que les fleurs sont d'une couleur violette ou mauve – couleurs que l'on ne trouve pas naturellement chez l'œillet. La commercialisation des fleurs génétiquement modifiées en Europe a été autorisée par les autorités compétentes et, dans le cadre de cet accord, des recherches sur le long terme ont été menées pour comprendre si les variétés cultivées d'œillets pouvaient s'établir à l'état sauvage en Europe. L'œillet a une longue histoire de culture et l'espèce sauvage dont il est originaire, *Dianthus caryophyllus*, est indigène des pays méditerranéens, y compris la France. *Dianthus caryophyllus* est relativement rare mais a été relevée ces dernières années par les membres de Tela Botanica. En revanche, l'œillet cultivé, qui a des fleurs doubles et beaucoup plus de pétales que les cinq de *Dianthus caryophyllus* est largement cultivé en Espagne, en Italie, aux Pays-Bas et dans d'autres pays européens. Des centaines de millions de fleurs d'œillet cultivées localement et importées sont utilisées à travers l'Europe chaque année pour la décoration de la maison et d'événements. Depuis plus de dix ans, je communique avec des botanistes, des jardins botaniques, des herbiers et des universités chaque année à la recherche de donnée d'observation de *Dianthus caryophyllus* à l'état sauvage en Europe. Ces informations ont été très utiles, me permettant de cartographier la distribution de l'œillet sauvage, *Dianthus caryophyllus*. Faire une carte de distribution est l'objectif principal de ma recherche, mais comme l'œillet sauvage est rare, je ne peux faire une telle carte qu'avec la coopération des botanistes professionnels et amateurs qui partagent généreusement leurs données, y compris les photographies. Ainsi, si vous avez vu *Dianthus caryophyllus*, qui fleurit en Juin ou Juillet, dans vos excursions ou voyages ces dernières années, n'hésitez pas à me contacter ! Je serais également très intéressé d'entendre tous ceux qui pensent avoir vu l'œillet cultivé en dehors du cadre du jardin. Je n'ai encore jamais trouvé d'observation de l'œillet dans la nature et quelle que soit la couleur des fleurs, je serais heureux d'entendre parler de vous si vous avez fait une telle observation. Identifier la présence de l'œillet de culture dans la nature fait également partie de mes recherches, dans le but d'étudier les risques qu'il devienne invasif. Dans ce cadre, je serais très intéressé de **prendre contact avec tous les botanistes et les observateurs qui peuvent avoir vu des populations d'œillets en dehors de cultures ou de jardins** – quelle que soit la couleur des fleurs. Je serais très heureux d'échanger avec vous !

Steve Chandler

As of July 29, 43 respondents had made contact regarding the above posting, all of whom reported wild type *Dianthus* observations. Twenty respondents provided photographic evidence. 39 respondents provided geographical information and figure 1 plots the distribution of these observations. The majority of reports were from the South of France, consistent with the historical records in the Telabotanica network, also shown in figure 1.

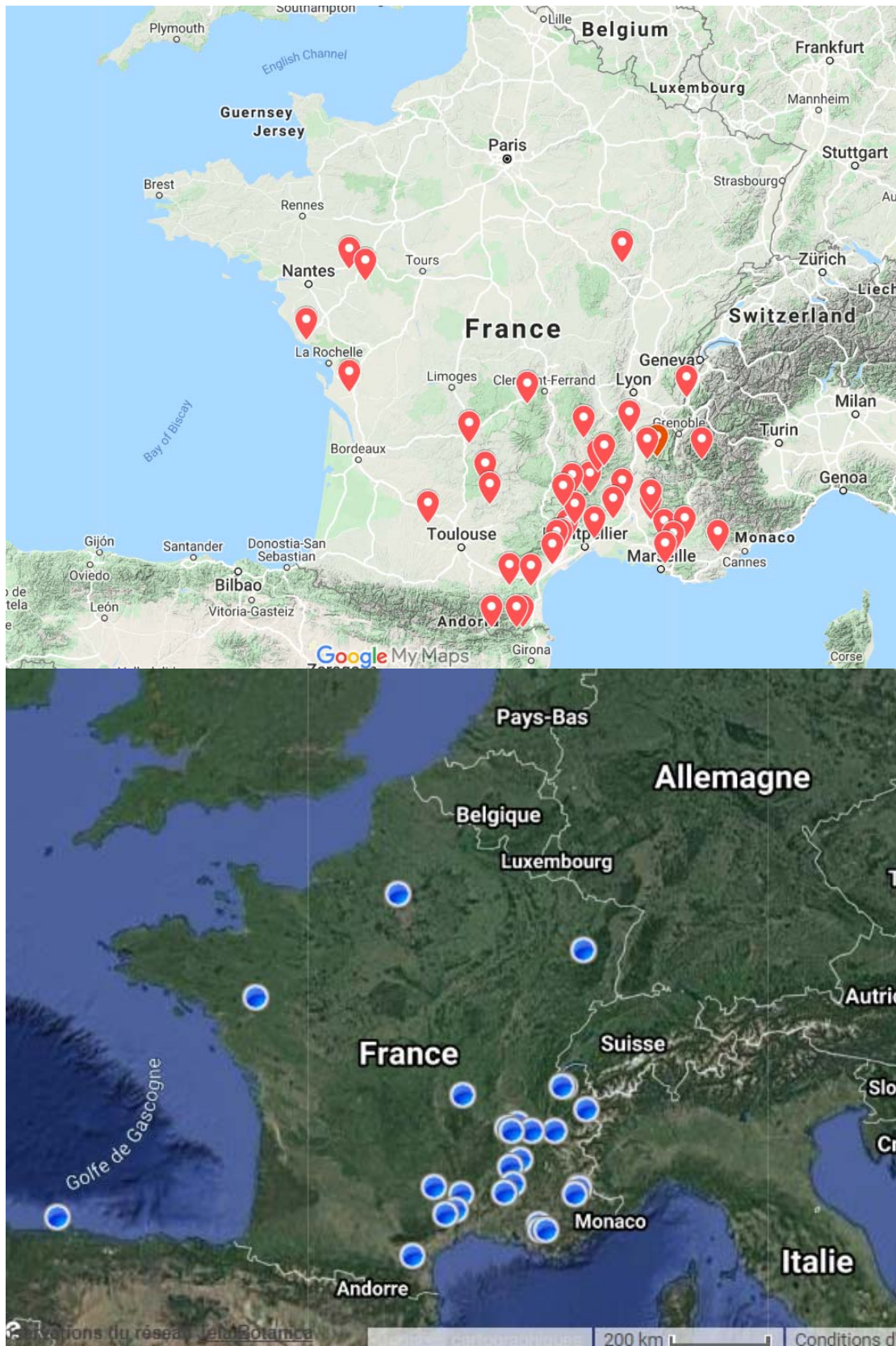


Figure 1. Comparison of geographical distribution of observations reported in response to the newsletter article in Telabotanica (upper panel) to distribution of *Dianthus caryophyllus* reported in the Telabotanica website⁵ (lower panel).

⁵ Observations du carnet en ligne (<https://www.tela-botanica.org/bdtfx-nn-22083-repartition>)

Enquiry letters and emails

Emails were personalised to individuals and were written in English unless they were directed to new correspondents or old contacts who preferred to communicate in their own language. Communication to new contacts was made in the language of their country using on-line translation services. An electronic copy of a brochure describing transgenic carnation varieties (attachment 8) was included with new email and postal communications.

Frequency of response to enquiry letters and emails

Table 1 provides a breakdown of response rate. The data was collated approximately 6 weeks after the letters and emails were sent out. As table 1 shows, overall response rate was 28.2%, which is comparable to rates in 2019⁶ (26.5%), 2018 (29.2%) and 2017 (25.1%). The response rate to emails was, consistent with all previous surveys, significantly higher than that to postal enquiries. Except one, all responses to postal enquiries were delivered via email.

Table 1. Summary of 2020 response to mail out

	Post		Email	
	Sent	Responses	Sent	Responses
Total	100	9 (9.0%)	113	51 (45.1%)
Grand total (post and email)	213	60 (28.2%)		

Nature of response to enquiry letters and emails

Some information was provided that added to our baseline knowledge of *Dianthus* or specifically referred to *Dianthus caryophyllus* or carnation.

1. We were told of a June 2019 addition of *Dianthus caryophyllus* to a herbarium in Spain. We were advised that this herbarium voucher was a cultivated specimen from a yellow or red variety⁷, purchased from a local florist.
2. We were advised of the widespread use of carnation flowers in folk botany in the Catalonian festival call *La Patum*⁸.
3. We were told that *Dianthus godronianus* Jord. in France is very close to *D. caryophyllus* and can be distinguished by thinner stems and no scent. Synonyms of this species are *D. caryophyllus* ssp. *godronianus* and *D. caryophyllus* ssp. *longicaulis*.
4. Taxonomic or distribution information on *Dianthus* species other than *Dianthus caryophyllus* was provided for the Friuli Venezia Giulia, Italy⁹
5. We were told the only non-native *Dianthus* species occurring in the wild in Hungary is *D. barbatus*.
6. Amongst the 60,000 records in the database of spontaneously occurred plants in the city Brno (CZ)¹⁰ there is a single record for *Dianthus caryophyllus*, from 2012.

⁶ Three late responses were received to the 2019 mail out and are excluded from this report and estimation of response rate for 2019.

⁷ Barceló, M. C., Butí, E., Gras, A., Orriols, M., & Vallès, J. (2019). Ethnobotany in a “Masterpiece of the Oral and Intangible Heritage of Humanity”: Plants in “la Patum” Festivity (Berga, Catalonia, Iberian Peninsula) 1. *Economic Botany*, 73(4), 522-529.

⁸ (https://en.wikipedia.org/wiki/Patum_de_Berga).

⁹ Ten *Dianthus* other than *D. caryophyllus*. Poldini, L. (1991). Atlante corologico delle piante vascolari nel Friuli-Venezia Giulia: inventario floristico regionale. Regione autonoma Friuli-Venezia Giulia-Direzione regionale delle foreste e dei parchi: Università degli studi di Trieste.

7. We were directed to an older taxonomic paper we had not seen before¹¹ in which *Dianthus caryophyllus* subsp. *godronianus*, a synonym for *Dianthus caryophyllus*, was reclassified.

Aside from the responses outlined immediately above the nature of other responses was;

- To state that no new observations of *Dianthus* carnation, or transgenic carnation had been made in the past 12 months.
- Directions to old herbarium records of *Dianthus caryophyllus* (pre-2000).
- To provide new records of *Dianthus* species other than *Dianthus caryophyllus*.
- To provide statements on absence of *Dianthus caryophyllus* in floras.
- Provide opinions on lack of invasiveness of *Dianthus caryophyllus*.
- To provide new sources of website data. Website leads were incorporated within the search outlined in attachment 7.
- To state they were unable to provide assistance.
- One email and two letters were returned as undeliverable.

¹⁰ The vraticka database, the Department of Botany and Zoology, Faculty of Science, Masaryk University (<http://www.sci.muni.cz/botany/vraticka/www>).

¹¹ João Do Amaral Franco. (1988). Notulae taxinomicae, chorologicae, nomenclaturales, bibliographicae, aut philologicae in opus "flora Iberica" intendentes. *Anales del Jardín Botánico de Madrid*, 45, 359 - 375.

Attachment 6. Peer-reviewed articles

Databases

Literature searches were carried out using the following databases.

- AGRICOLA Article citation (NAL)
- Proquest -biological sciences
- Science Direct (Elsevier)
- SCOPUS (Elsevier)
- Web of science (ISI)
- Google Scholar

Search terms

Search terms used in previous monitoring reports were again used. These 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.

As indicated in the 2019 - 2020 monitoring report, synonyms of *Dianthus caryophyllus* (the synonyms listed are to sub species of *Dianthus caryophyllus*) were also added as search terms. These were;

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

Search terms were each used exactly as listed in normal font, with use of the filter of “since 2019”. The primary focus of the literature review was seeking information on carnation and *Dianthus* populations outside of cultivation.

Cross citation

38 key citations from literature reviews from previous monitoring reports were searched in google scholar and Web of science for citing literature, which was then checked.

Literature review outcome

The preliminary database review identified hundreds of abstracts. Certain fields were not considered for further review as the publications were unrelated to the purpose of monitoring. Such examples include 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 and plant pathology studies. Hits on the coral species *Dianthus* and on clove oil use were also eliminated.

Following the initial cull, 171 papers were read in full. Those with relevance to carnation or *Dianthus caryophyllus* distribution, potential weediness, possible

biosafety implications and/or genetic modification are listed and briefly summarized below.

Ademović, E., Zekić, D. Ž., Jašarević, E., and Boškailo, A. (2019). Natural Potential of Vascular Flora and Part of Faune Mountain Prenj-Rujiste and Bijele Vode. In: *Book Of Proceedings Sixth international scientific conference "June 5th - World environment day" Bihać, June 2018. ISSN 2566-4530.p 272 - 288.*

One *Dianthus* species, *Dianthus petraeus* Waldst. et Kit, was found in the survey area in Bosnia -Herzegovina.

Adolphi, K. (2019): Anmerkungen zur Bekämpfung "invasiver" Arten. In: *Erforschung und Erhaltung der Phytodiversität: Festschrift zum 70. Geburtstag für Prof. Dr. Dietmar Brandes 13, S. 83–92.*

Dianthus barbatus was one of the species to establish in the Römerich quarry near Linz am Rhein, Germany.

Alexandrova, A., Dimitrov, M., Vassilev, K., Sopotlieva, D., Pedashenko, H., and Tashev, A. (2020). Forest vegetation diversity of Slivenska Mountain (eastern Stara planina, Bulgaria). *Hacquetia*, 19, 233–258

Two *Dianthus* species were found in the survey area; *Dianthus moesiacus* and *Dianthus giganteus*.

Amidžić, L., Djordjević-Milošević, S., Vujčić-Trkulja, M., Cvetković, D., Djordjević, S., and Prodanović, D. (2020). Vegetation overview of meadows and pastures of north-west Šar-Planina Mountain (Serbia). *Vegetos*, 33, 239 – 246.

Five *Dianthus* species are found in the national park; *Dianthus superbus* L., *Dianthus scardicus* Wettst., *Dianthus tristis* Velen., *Dianthus integer* Vis. and *Dianthus deltoides* L.

Assem, F. M., El-Sayed, H. S., Matter, M. A., Hanafy, M. S., and Amer, A. M. (2019). Effects of carnation essential oil extracted from carnation calli on extending shelf life of yoghurt. *Plant Tissue Culture and Biotechnology*, 29, 1-14.

The study showed that eugenol, extractable from carnation flowers also, extends the shelf life of yoghurt by up to 15 days. The treatment had no effect on the palatability of the yoghurt or content of *Lactobacillus*.

Aymerich, P., and Sáez, L. (2019). Checklist of the vascular alien flora of Catalonia (northeastern Iberian Peninsula, Spain). *Mediterranean Botany*, 40, 215-242.

Dianthus caryophyllus L. subsp. *caryophyllus* is the only *Dianthus* species listed. The species is recorded as a rare Mediterranean casual.

Ballelli, S., Pennesi, R., Campetella, G., Cervellini, M., Chelli, S., Cianfaglione, K., ... and Canullo, R. (2020). An updated checklist of the vascular flora of Montagna di Torricchio State Nature Reserve (Marche, Italy). *Italian Botanist*, 9, 87 – 100.

Dianthus carthusianorum L. subsp. *carthusianorum*, is the only *Dianthus* species found in the study area. This was a new record for Marche.

Baranovski, B. A., Karmyzova, L. A., Roshchyna, N. O., Ivanko, I. A., and Karas, O. G. (2020). Ecological-climatic characteristics of the flora of a floodplain landscape in South-eastern Europe. *Biosystems Diversity*, 28, 98-112.

The survey was the Klokov floodplain of the Samara river in Ukraine. The floodplain has a high plant species diversity, but the only *Dianthus* species identified was *Dianthus platyodon*.

Barceló, M. C., Butí, E., Gras, A., Orriols, M., and Vallès, J. (2019). Ethnobotany in a “Masterpiece of the Oral and Intangible Heritage of Humanity”: Plants in “la Patum” Festivity (Berga, Catalonia, Iberian Peninsula) 1. *Economic Botany*, 73, 522-529.

A description of the use of carnation flowers in a Catalan festival *La Patum*.

Barina, Z., Somogyi, G., and Pifkó, D. (2020). Typification of names in the *Dianthus plumarius* group in the Carpatho-Pannonian region. *Taxon*, 69, 161-169.

A taxonomic review of no relevance to *Dianthus caryophyllus* or its synonyms but providing information to baseline knowledge.

Barošová, I., Šantrůčková, M., Matiska, P., and Baroš, A. (2020). Ornamental perennials in small rural settlements: a case study from the Czech Republic. *Horticultural Science*, 47, 130-138.

The *Dianthus* genus (species not defined) represented approximately 1.5% of the overall taxa cultivated in the area. The study area was Čertovo Břemeno, Moravský Kras and České Středohoří, Czech Republic.

Bergmeier, E., Sakellarakis, F. N., Strid, A., and Swinkels, C. (2020). New additions to the flora of Prespa, Greece. *Phytologia Balcanica: International Journal of Balkan Flora and Vegetation*, 26, 103-130.

Four *Dianthus* species were found in the study area in north west Greece overlapping Albanian border. *Dianthus caryophyllus* or its synonyms were not found.

Boutigny, A. L., Dohin, N., Pornin, D., and Rolland, M. (2020). Overview and detectability of the genetic modifications in ornamental plants. *Horticulture Research*, 7, 1-12.

A review of genetically modified ornamentals (including carnation) within the context of unintentional release, particularly in Europe.

Bruns, E. L., Miller, I., Hood, M. E., Carasso, V., and Antonovics, J. (2019). The role of infectious disease in the evolution of females: Evidence from anther-smut disease on a gynodioecious alpine carnation. *Evolution*, 73, 497-510.

Within a heavily diseased population of *Dianthus pavonius*, females consistently had lower levels of *Microbotryum* spores. The finding has no relevance to cultivated carnation.

Brzeg, A., Szwed, W., and Wojterska, M. (2019). Flora of vascular plants of the Seili island and its surroundings (SW Finland). *Biodiversity Research and Conservation*, 53, 33-65.

Dianthus deltoides was identified in the SW Finnish archipelago.

Bubanja, N., Šinžar-Sekulić, J., and Stevanović, V. (2019). Contribution to the flora of Velika plaža and its vicinity in Ulcinj (Montenegro). *Biologia Serbica*, 41, 13-44.

Dianthus armeria was the only *Dianthus* species found in the study area, which includes the island of Ada Bojana in Ulcinj.

Buldrini, F., Gentilini, M., Bruni, C., Santini, C., Alessandrini, A., and Bosi, G. (2020). Flora vascolare spontanea della città di Modena: analisi del centro storico In; Natural History Sciences. - ISSN 2385-0922. 7, 3-56.

The urban flora of the whole central area of the city of Modena was surveyed – apparently a first for an Italian city. *Dianthus armeria* subsp. *armeria* (a protected species in Italy) was the only *Dianthus* species found.

Bunce, R. G. H., Pungar, D., Villoslada, M., Raet, J., Kaart, T., and Sepp, K. (2020). A survey of habitats on agricultural land in Estonia: I Construction and validation of the database using the botanical field data. *Global Ecology and Conservation*, <https://doi.org/10.1016/j.gecco.2020.e01007>

No *Dianthus* species were identified.

Cano, E., Musarella, C. M., Cano-Ortiz, A., Piñar Fuentes, J. C., Rodríguez Torres, A., Del Río González, S., ... and Spampinato, G. (2019). Geobotanical study of the microforests of *Juniperus oxycedrus* subsp. *badia* in the central and southern Iberian Peninsula. *Sustainability*, 11, 1111. 10.3390/su11041111
Dianthus crassipes and *Dianthus lusitanus* were the only two *Dianthus* species found in 134 microforest sites sampled across Spain and Portugal.

Castagnini, P., Donati, A. and Castagnini, P. (2020). Delectus Sporarumet Semium Qua Hortus Botanicus Universitatis Siena.

Dianthus longicaulis Ten. [syn. *Dianthus sylvestris* Wulfen in Jacq. ssp. *longicaulis* (Ten.) Greuter and Burdet] is the only *Dianthus* species held by the Siena botanical gardens.

Cattaneo, C., and Grano, M. (2019). Checklist updating and analysis of the flora of Symi island and of the nearby island of Seskli (Dodecanese, Greece). *Bocconea*, 28, 425-463.

Four *Dianthus* species were found in the survey area: *Dianthus fruticosus* subsp. *rhodius*. *Dianthus elegans*, *Dianthus strictus* Banks and *Dianthus tripunctatus*.

Ciaschetti, G., Di Musciano, M., Pirone, G., Di Cecco, V., Pace, L., and Frattaroli, A. R. (2020). A new pioneer association of detrital substrata of the hilly and low-mountain belts in Central Apennines (Italy). *Plant Sociology*, 57, 75 - 84.

Dianthus ciliatus Guss. ssp. *ciliatus* and *Dianthus* gr. *sylvestris* were identified in a vegetation survey carried inside or just outside the "Gran Sasso and Laga Mountains" National Park, Molise" National Park and "Sirente-Velino" Regional Park (Abruzzo, Lazio).

Ćuk, M. (2019). Status I Vremenska Dinamika Flore I Vegetacije Deliblatske Peščare. (Status and time dynamics of flora and vegetation of Deliblato sands). Ph. D thesis, Univerzitet U Novom Sadu, Novi Sad, Siberia.

A vegetation survey of the Deliblato sands, an arid desert like 300 km² habitat in central Europe. Seven *Dianthus* species were identified but not *Dianthus caryophyllus* or its synonyms.

Dakskobler, I. (2019). Successional stages in the development of forest vegetation in cirques of two valleys in the Julian Alps (NW Slovenia). *Folia biologica et geologica*, 60, 101-127.

Dianthus sternbergii was the only *Dianthus* species identified in a survey of Zadnjica and Kot near the Slovenian border with Austria.

Dewanti, M., Rostini, N., & Karmana, M. H (2019). Phenotypic performance of six interspecific carnation genotypes obtained from hybridization of *Dianthus caryophyllus* “Liberty” x *Dianthus chinensis* “SK 11-1” IOP Conf. Ser.: Earth Environ. Sci. 308 012063

A rare published example of interspecific hybridisation between carnation and *Dianthus chinensis*. Carnation was used as the female parent.

Di Martino, L., Di Cecco, V., Di Cecco, M., Di Santo, M., Ciaschetti, G., and Marcantonio, G. (2020). Use of native plants for ornamental purposes to conserve plant biodiversity: case of study of Majella National Park. *Journal for Nature Conservation*, 125839. <https://doi.org/10.1016/j.jnc.2020.125839>

Four rare and endemic *Dianthus* species (not *Dianthus caryophyllus* or its synonyms) are offered for sale to visitors to the park.

Dimitrov, D., and Vutov, V. (2019). Floristic and habitat diversity of the Trigrad Gorge protected area (Central Rhodopes Mts.), Bulgaria. *Ecologia Balkanica*, 11, 145 – 154.

Five endemic *Dianthus* species were found in the surveyed area but no carnation of *Dianthus caryophyllus*.

Drava, G., Iobbi, V., Govaerts, R., Minganti, V., Copetta, A., Ruffoni, B., and Bisio, A. (2020). Trace elements in edible flowers from Italy: Further insights into health benefits and risks to consumers. *Molecules*, 25, 2891. doi:10.3390/molecules25122891

Dianthus chinensis was included in an analysis of microelements in species that might be used as edible flowers. It was concluded the concentrations found do not pose a risk to human health.

Dudek, T., Wolański, P., and Rogut, K. (2020). The Content of Macro-and Micro Minerals in the Sward of Different Types of Semi-Natural Meadows of Temperate Climate in SE Poland. *Agronomy*, 10, 273. <https://doi.org/10.3390/agronomy10020273>

Two *Dianthus* species (*Dianthus carthusianorum* and *Dianthus deltoides* L.) were found in the highland meadows of the central Beskid foothills and the Carpathian foothills, SE Poland.

Gallegos Villegas, F. J. (2019). Caracterización ecológica de la flora y fauna del Jardín Botánico" La Almunya del Sur". Ms.C, University of Almeria, June 2019.

There are five *Dianthus* species under cultivation in the private botanical garden, including *Dianthus caryophyllus*.

Gianniantonio, D., Emilio, D. G., Filippo, S., Roberta, C., Giuseppe, V., and Letizia, G. M. (2019). The urban vascular flora of Palermo (Sicily, Italy). *Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology*, 1-8. DOI: 10.1080/11263504.2019.1651787

No *Dianthus* or carnation were found in the survey.

Glinska, S. O., Shtokalo, S. S., Lyko, D. V., Stepaniuk, Y. V., and Savchuk, L. K. (2020). Ecological-coenotic features of rare flora species of pine-oak stands of Volyn Polissya. *Ukrainian Journal of Ecology*, 10, 55 – 61.

The rare species *Dianthus pseudosquarrosus* (Novak) Klok. was the only *Dianthus* species found in Lopatyn, Ozersk, and Zviriv nature conservation departments of Kivertsi national natural park in Ukraine.

Höcker, R., and Gregor, T. (2019). Der Dolomitsand-Schwingel (*Festuca pulveridolomiana* spec. nov.), eine übersehene *Festuca* der Nördlichen Frankenalb. *Kochia*, 12, 1-18.

Dianthus carthusianorum was the only *Dianthus* species found in surveys near Nuremberg, Germany.

Hofmann, M. M., and Renner, S. S. (2020). One-year-old flower strips already support a quarter of a city's bee species. *Journal of Hymenoptera Research*, 75, 87-95.

Dianthus superbus L. *Dianthus carthusianorum* L. and *Dianthus deltoides* L. are included in flower strips that were demonstrated to attract bees in an urban environment.

Hülber, K., Kuttner, M., Moser, D., Rabitsch, W., Schindler, S., Wessely, J., ... and Dullinger, S. (2020). Habitat availability disproportionally amplifies climate change risks for lowland compared to alpine species. *Global Ecology and Conservation*, e01113. <https://doi.org/10.1016/j.gecco.2020.e01113>

Dianthus alpinus was studied as an alpine species marker for habitat definition.

Jakovljević, K., Tomović, G., Djordjević, V., Niketić, M., and Stevanović, V. (2020). Steppe flora in Serbia—distribution, ecology, centres of diversity and conservation status. *Folia Geobotanica*, 55, 1-14.

Dianthus was found to be the genus that contributes most species to the steppe habitat flora in Western Serbia. 9 *Dianthus* species were described, several of which are protected and highly endangered. No carnation or *Dianthus caryophyllus* was found.

Jovanović, M., Buzurović, U., Ivančević, B., Paunović, A., and Niketić, M. (2019). Distribution of selected vascular plants, fungi, amphibians and reptiles in Serbia: Data from biological collections of the Natural History Museum in Belgrade implemented in current national conservation projects. *Bulletin of the Natural History Museum*, 12, 37-84.

Dianthus superbus L. subsp. *superbus* and *Dianthus monadelphus* Vent. subsp. *pallens* (Sm.) Greuter and Burdet. are 2 of the 990 records described.

Kaiser, T. and Müller, K. (2019): Flora der historischen Parkanlagen Celles unter besonderer Berücksichtigung von *Tulipa sylvestris* L. In: Erforschung und Erhaltung der Phytodiversität: Festschrift zum 70. Geburtstag für Prof. Dr. Dietmar Brandes 13, S. 69–82.

An inventory of the 31 wild flowers in the historical gardens of Celle, Germany includes *Dianthus deltoides*.

Kamil, S. S., Hussein, H. J., and Al-Marzoqi, A. L. I. H. (2020). Evolution of antibacterial efficacy of *Dianthus caryophyllus* L. extracts against some hospitals pathogenic bacteria. *International Journal of Pharmaceutical Research*, 12, 1274 – 1279.

Extracts from carnation flower buds were shown to have antibacterial effect against certain pathogenic bacterium. The colour of the carnation flowers was not defined.

Krasniqi, E., Berisha, N., Millaku, F., and Rexhepi, F. (2019). Contribution to the knowledge on the flora of Mt Golesh, central Kosovo. *Natura Croatica: Periodicum Musei Historiae Naturalis Croatici*, 28, 425-442.

Dianthus carthusianorum was found as a grassland species.

Kun, R., Bartha, S., Malatinszky, Á., Molnár, Z., Lengyel, A., and Babai, D. (2019). “Everyone does it a bit differently!”: Evidence for a positive relationship between micro-scale land-use diversity and plant diversity in hay meadows. *Agriculture, Ecosystems and Environment*, 283, 106556. <https://doi.org/10.1016/j.agee.2019.05.015>

Dianthus compactus, the only *Dianthus* species found, is nominated as a frequently occurring species in a survey of Lunca de Jos (Gyimesközéplök), Eastern Carpathians, Romania.

Kunev, G., and Tzonev, R. (2019). New data on the ecological peculiarities and the distribution in Bulgaria of the vulnerable habitat F3. 1d Balkan-Anatolian submontane genistoid scrub from the European Red List of Habitats. *Hacquetia*, 18, 271-287.

Seven *Dianthus* species are listed in the checklist, but not *Dianthus caryophyllus* or its synonyms.

Kuzyarin, O. T., Hrytsyna, M. R., Senchyna, B. V., and Lubynets, I. P. (2019). The vegetation of “Bila Skelya” tract (Yavoriv national nature park, Lviv region). *Studia biologica*, 13, 67 – 78.

Dianthus carthusianorum was the only *Dianthus* species found in the study area, located in Ukraine.

Lausen, E. D., Emilsson, T., and Jensen, M. B. (2020). Water use and drought responses of eight native herbaceous perennials for living wall systems. *Urban Forestry & Urban Greening*, 126772. <https://doi.org/10.1016/j.ufug.2020.126772>.

Dianthus deltoides is a *Dianthus* species native to Denmark but in experimental green wall trials was found to be sensitive to dry conditions and possibly unsuitable.

Löffler, F., Poniatowski, D., and Fartmann, T. (2020). Extinction debt across three taxa in well-connected calcareous grasslands. *Biological Conservation*, 246, 108588. <https://doi.org/10.1016/j.biocon.2020.108588>

Dianthus carthusianorum is listed as the only *Dianthus* species in a list of important grassland species.

López-Jurado, J., Balao, F., and Mateos-Naranjo, E. (2020). Polyploidy-mediated divergent light-harvesting and photoprotection strategies under temperature stress in a Mediterranean carnation complex. *Environmental and Experimental Botany*, 171, 103956. <https://doi.org/10.1016/j.envexpbot.2019.103956>

Characterisation of *Dianthus broteri*.

Lozano Terrazas, J. L. (2019). Catálogo florístico del término municipal de Cedrillas (Teruel). *Flora Montiberica* 75: 126-133

Four *Dianthus* species were found in a survey of the Gúdar Mountains of the Iberian Range, Spain. Species were *Dianthus brachyanthus* Boiss., *D. carthusianorum* L., *D. hispanicus* Asso and *D. turolensis* Pau.

Lukash, O., and Danko, H. (2020). The vegetation of sands in the Chernihiv city (Ukraine). *Studia Quaternaria*, 37, 31-44.

Dianthus borbasii was the only *Dianthus* species found in the study area.

Martignoni, M., Banfi, E., and Galasso, G. (2019). Vascular flora of Milan Malpensa airport (Lombardy, Italy). Part I: checklist. *Natural History Sciences*, 6, 3 – 10.

Dianthus armeria L. subsp. *armeria* was the only *Dianthus* species amongst 395 taxa identified within the airport green spaces.

Mârza, M., Novac, G., Mamai, I., Buracinschi, N., Bulicanu, D., And Mîrza, E. (2019). Comparative analysis of the Butesti-Cobani flora (Republic of Moldova) and the Stanca-Stefanesti flora (Romania). *Studia Universitatis Moldaviae-Științe Reale și ale Naturii*, 6, 51 – 58.

In a survey of the Butești-Cubani localities of Romania and Moldova *Dianthus rehmanii* Blocki., *Dianthus andrzejowscianus* (Zapal.) Kuicz., *Dianthus capitatus* Balb ex DC., and *Dianthus gutatus* were identified.

Matveeva, T. V., and Otten, L. (2019). Widespread occurrence of natural genetic transformation of plants by *Agrobacterium*. *Plant Molecular Biology*, 101, 415-437.

In a search for T-DNA-like genes in the sequenced genomes of a number of plants, carnation was shown to carry contain intact opine genes and an intact cucumopine synthase (*cus*)-like gene. As an unrelated aside, the authors noted carnation plants with blue flowers are a well-known example of a man-made GMO ornamental plant.

Morimoto, H., Narumi-Kawasaki, T., Takamura, T., and Fukai, S. (2019). Analysis of Flower Color Variation in Carnation (*Dianthus caryophyllus* L.) Cultivars Derived from Continuous Bud Mutations. *The Horticulture Journal*, 88, 116 – 128. <https://doi.org/10.2503/hortj.UTD-007>

A study showing pigment variation due to differential gene expression. This has relevance as a possible explanation of some off types in transgenic carnation.

Morimoto, H., Narumi-Kawasaki, T., Takamura, T., and Fukai, S. (2020). Flower color mutation caused by spontaneous cell layer displacement in carnation (*Dianthus caryophyllus*). *Plant Science*, 110598. <https://doi.org/10.1016/j.plantsci.2020.110598>

Explanation of flower colour off-types arising from periclinal chimeras in carnation. Some transgenic carnation varieties are likely to be periclinal chimeras.

Nāburga, I., and Evarts-Bunders, P. (2019). Status of some escaped ornament perennials in the flora of Latvia. *Botanica*, 25, 131-144.

Examples of ornamental species that have escaped from cultivation in Latvia. No *Dianthus* species are named.

Nowińska, R., Czarna, A., and Kozłowska, M. (2020). Cemetery types and the biodiversity of vascular plants—A case study from south-eastern Poland. *Urban Forestry and Urban Greening*, 49, 126599.

<https://doi.org/10.1016/j.ufug.2020.126599>

No *Dianthus* species is listed.

Papaporfyriou, P. K., Sarrou, E., Avramidou, E., and Abraham, E. M. (2020). Abundance and Phenotypic Diversity of the Medicinal *Sideritis Scardica* Griseb. in Relation to Floristic Composition of Its Habitat in Northern Greece. *Sustainability*, 12, 2542. <https://doi.org/10.3390/su12062542>

In a search of *Sideritis scardica* habitats, *Dianthus petraeus* ssp. *orbelicus*, *Dianthus gracilis* ssp. *gracilis* and *Dianthus petraeus* ssp. *orbelicus* were found in mountainous areas of Northern Greece (prefecture of North-Central and North-Eastern Macedonia, Greece).

Pricop, E., Filip, P. N., and Negrea, B. M. (2019). Floristic study of a protected wetland from Borsaros-Sancraieni, Harghita County, Romania. *Advances in Agriculture and Botany*, 11, 97-108.

Dianthus superbis L., was identified in a survey of the Borsaros-Sancraieni swamp reserve, Harghita county, Romania.

Rakonjac, L., and Marković, M. (2019). Dry pastures and Karst the third year after wildfire on the Vidlič Mountain. *Pirotski zbornik*, 44, 235-250.

Dianthus petraeus Waldst. and Kit. was the only *Dianthus* species identified on the mountain.

Rendeková, A., Mičieta, K., Randáková, Z., Ballová, D., Eliašová, M., and Miškovic, J. (2020). Flora of the tram tracks of Bratislava. *Urban Ecosystems*, 23, 875–891.

No *Dianthus* or carnation were found in the survey.

Roleček, J., Dřevojan, P., Hájková, P., and Hájek, M. (2019). Report of new maxima of fine-scale vascular plant species richness recorded in East-Central European semi-dry grasslands. *Tuexenia*, 39, 423-431.

Species of the *Dianthus carthusianorum* aggregate (*D. borbassii*, *D. carthusiano-rum*, *D. collinus*, *D. giganteiformis*, *D. giganteus*, *D. membranaceus*, *D. pontederiae*, *D. rogowiczii*) were identified in the Chernivtsi region (Ukraine) and the Cluj region (Romania).

Rozman, A., Dakskobler, I., and Šilc, U. (2020). Phytosociological analysis of basophilic Scots pine forests in the Southeastern Alps. *Hacquetia*, 19, 23-80.

Four *Dianthus* species were identified in more than 300 sites in Slovenia but not *Dianthus caryophyllus* or its synonyms.

Sarbu, A., Janauer, G. A., Exler, N., Sarbu, I., and Anastasiu, P. (2020). The potential sensitivity to climate change of selected endangered and important Natura 2000 Habitats and plants from Bucegi Natural Park, Romania. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 48, 456-479.

Three *Dianthus* species (*Dianthus carthusianorum*, *Dianthus glacialis* and *Dianthus spiculifolius* Schur) were identified in the Romanian Carpathians.

Schaminée, J. H., Chytrý, M., Hájek, M., Hennekens, S. M., Janssen, J. A., Jiroušek, M., ... and Tichý, L. (2019). Updated crosswalks of the revised EUNIS Habitat Classification with the European Vegetation Classification and the European Red List Habitats for EUNIS coastal habitats and wetlands.

An exhaustive list of habitats across Europe lists 52 *Dianthus* species, some present in up to four different habitats. *Dianthus caryophyllus* or its synonyms is not listed.

Seleck, M., Mathelart, C., Gauquie, B., Taymans, J., Sneessens, A., Calozet, M., and Mahy, G. (2019). *Synthèse des inventaires biologiques des 24 carrières du Life in Quarries*. Life In Quarries. LIFE14 NAT/BE/000364 - Action A.3, April 2019.

Dianthus deltoides and *D. armeria* were the only two *Dianthus* species found in a survey of 24 quarries across the Wallonia region of Belgium.

Serra, L. (2019). Addicions i correccions a la flora del Parc Natural de la Serra de Mariola (Est de la península Ibèrica). *Butlletí de la Institució Catalana d'Història Natural*, 83, 177-194.

Dianthus turoloensis Pau was the only *Dianthus* species found in the survey area.

Shtogrin, M., Onuk, L., Shtogun, A., and Bobrik, I. (2019). Steppe ecosystem of the national nature park "Kremenets mountains", saving and reproducing. *Scientific Issue Ternopil Volodymyr Hnatiuk National Pedagogical University. Series: Biology*, 75, 94-99.

Dianthus arenarius subsp. *pseudoserotinus* (Blocki) Tutin was the only *Dianthus* species found in a national nature park in Ukraine.

Stinca, A., Chianese, G., D'Auria, G., Fascetti, S., Ravo, M., Romano, V. A., ... and Bonari, G. (2019). Contribution to the floristic knowledge of eastern Irpinia and Vulture-Melfese area (Campania and Basilicata, southern Italy). *Italian Botanist*, 8, 1-16.

Dianthus vulturius Guss. and Ten. subsp. *vulturius* and *Dianthus carthusianorum* L. subsp. *tenorei* (Lacaita) Pignatti were found in the Campania-Basilicata border region.

Stoyanov, P. S., Dimitrova-Dyulgerova, I. Z., Radoukova, T. I., and Mladenov, R. D. (2019). Floristic Diversity of Certain Wetlands in Southern Bulgaria. *Ecologia Balkanica*, 11, 141 – 153.

D. armeria L. and *D. campestris* M. Bieb. Were found in rice fields.

Strumia, S., Buonanno, M., Aronne, G., Santo, A., and Santangelo, A. (2020). Monitoring of plant species and communities on coastal cliffs: Is the use of unmanned aerial vehicles suitable?. *Diversity*, 12, 149. doi:10.3390/d12040149

Dianthus rupicola Biv. subsp. *rupicola* was included as a target cliff species for evaluation of drone technology for vegetation survey.

Taisumov, M. A., Umarov, M. U., Astamirova, M. A., Abumuslimov, A. A., Baibatyrova, E. R., Abdurzakova, A. S., ... and Israilova, S. A. (2019). Floristic research of the biological reserve “Bragunsky”. *KnE Life Sciences*, 4, 1149-1156 <https://doi.org/10.18502/kls.v4i14.571>.

Two rare *Dianthus* species - lanceolate carnation (*Dianthus pallens*) and variable carnation (*Dianthus polymorphus*)-were the only two *Dianthus* species found in the study area.

Terzi, M., Bogdanović, S., D’Amico, F. S., and Jasprica, N. (2020). Rare plant communities of the Vis Archipelago (Croatia). *Botany Letters*, 167, 241-254. *Dianthus sylvestris* Welfen subsp. *longicaulis* (Ten.) and *Dianthus longicaulis* were identified on the island of Vis, Croatia.

Tomaselli, M., Carbognani, M., Foggi, B., Petraglia, A., Rossi, G., Lombardi, L., and Gennai, M. (2019). The primary grasslands of the northern Apennine summits (N-Italy): a phytosociological and ecological survey. *Tuexenia*, 39, 181-213.

Dianthus deltoides and *Dianthus sylvestris* were nominated as diagnostic of the region and two other rare *Dianthus* species were also identified (*Dianthus hyssopifolius* and *Dianthus seguieri*).

Towpasz, K. (2019). Vascular plants of Pilzno surroundings (South-Eastern Poland). *Annales Universitatis Paedagogicae Cracoviensis Studia Naturae*, 4, 31-64. [10.24917/25438832.4.2](https://doi.org/10.24917/25438832.4.2)

Dianthus deltoides L. was the only *Dianthus* species found, located on sandy grasslands.

Tzonev, R. T., Baleva, R. G., and Purvanov, I. P. (2019). Flora, vegetation and habitats of Kayluka Protected Area. *Annual of Sofia University, Faculty of Biology* 103, 69 – 89.

Dianthus armeria and *Dianthus petraeus* ssp. *noeanus* (Boiss.) were found in the survey area, located in the river Danube plain, Bulgaria.

Vanneste, T., Govaert, S., De Kesel, W., Van Den Berge, S., Vangansbeke, P., Meeussen, C., ... and Graae, B. J. (2020). Plant diversity in hedgerows and road verges across Europe. *J Appl Ecol*. 57,1244–1257. <https://doi.org/10.1111/1365-2664.13620>

No *Dianthus* or carnation were found in the survey.

Viciani, D., Vidali, M., Gigante, D., Bolpagni, R., Villani, M., Acosta, A. T. R., ... and Assini, S. (2020). A first checklist of the alien-dominated vegetation in Italy. *Plant Sociology*, 57, 29–54 DOI [10.3897/pls2020571/04](https://doi.org/10.3897/pls2020571/04)

No *Dianthus* or carnation were found in the survey.

Vitasović-Kosić, I., Vukojević, M., and Bogdanović, S. (2020). First inventory of vascular flora of Matokit mountain (Biokovo massif, Croatia). *Šumarski list*, 144, 257-268.

Three *Dianthus* species were identified in the survey; *Dianthus ciliatus* Guss. ssp. *dalmaticus* (Čelak.) Hayek, *Dianthus sylvestris* Wulfen in Jacq. and *Dianthus sylvestris* Wulfen in Jacq. ssp. *tergestinus* (Rchb.)

Wang, J., Liu, S., Ma, H., Tao, Y., Feng, S., Gong, S., ... and Zhou, A. (2020). Reliable and efficient *Agrobacterium tumefaciens*-mediated genetic transformation of *Dianthus spiculifolius*. *Horticultural Plant Journal*. 6, 199 – 204.

A transformation protocol for an alpine pink ornamental species.

Wang, Q., Dan, N., Zhang, X., Lin, S., Bao, M., and Fu, X. (2020). Identification, characterization and functional analysis of C-class genes associated with double flower trait in carnation (*Dianthus caryophyllus* L.). *Plants*, 9, 87. <https://doi.org/10.3390/plants9010087>

A paper which focuses on candidate genes that may have a role in control of petal number in carnation.

Yamalov, S. M., Lebedeva, M. V., Golovanov, Y. M., and Petrova, M. V. (2019). Rare and protection needed species of petrophytic steppes of the Southern and Middle Urals. *Samara Journal of Science*, 8, 107-115.

The research area covers the south and central Ural Mountains of the Russian federation and includes in a list of rare species that should be targeted for protection *Dianthus versicolor*, *Dianthus acicularis*, *Dianthus uralensis* and *Dianthus leptopetalus*.

Attachment 7. Database information

7.1. Databases previously examined

Databases previously identified were re-examined for any new entries (since last monitoring report) listing *Dianthus caryophyllus*. Species which have synonyms to subspecies of *Dianthus caryophyllus* were excluded from this summation.

7.1.1 Records of *Dianthus caryophyllus*

- **www.gbif.org** (accessed July 16 2020)

Global Biodiversity Information Network. The whole dataset was reviewed, including all associated datasets. There were 11 entries from Europe since the last review listing *Dianthus caryophyllus*. No photographs were provided. All are cross referenced in two databases described later in this section; the Norwegian Species Observation service and the living plants collection of Meise botanic garden, Belgium.

- **http://waarnemingen.be** (accessed July 16, 2020)

Database of plants of Belgium. There have been four observations of *Dianthus caryophyllus* since the last monitoring report; one in 2019 and three in 2020. Available photographs show five-petal, wild type flowers (see below) of *Dianthus* species.



Photographs downloaded from <https://waarnemingen.be/observation/194092706/> (top left), <https://waarnemingen.be/observation/185716388/> (top right) and <https://waarnemingen.be/observation/178180872/> (bottom).

- <http://www.tela-botanica.org> (accessed July 16, 2020)

The French botany network. Four new records of *Dianthus caryophyllus* L. have been posted on the carnet de ligne since the last monitoring report. The dates and locations of the new records were;

Date	Location
9 July 2019	Grignan
15 July 2019	Chantemerle-Les-Bles
3 September 2019	Bau du Régage
24 June 2020	Crepol

Images, shown below, were available for two collections and both show wild type form flowers or cultivated pinks.



Images from <http://www.tela-botanica.org>.

- <http://www.naturedugard.org> (accessed July 16, 2020)

The database has seven new entries for records of *Dianthus caryophyllus* in France. Unfortunately, no photographs are provided. We assume from the representative photographs provided next to the distribution map these are wild type.

Date	Location
23 June 2019	Saint Jeean de Marejeole – et-Auegan
30 Aug 2019	Saint Jean de Valeriscle
12 Sep 2019	Pognadoresse
26 Sep 2019	Sauveterre
6 Oct 2019	Saint Nazaire-de-Gardies
27 Apr 2020	Gajan
17 June 2020	Saint Victor la Coste

- <http://www.naturgucker.de> (accessed July 16, 2020)

The database had two new entries for *Dianthus caryophyllus* since the last monitoring report, both from Baden-Württemberg. The observer was contacted for more information.

- <https://www.artportalen.se/ViewSighting/SearchSighting> (accessed July 17, 2020)

Database of the Swedish Species Information Centre. A single new, unvalidated record for *Dianthus caryophyllus* was lodged in August 2019. No photograph was provided.

7.1.2 Databases with no new records of *Dianthus caryophyllus*

- <http://www.artsdatabanken.no> (accessed July 16 2020)

Norwegian Species Observation service/ Norwegian Biodiversity Information Centre. There have been no new records since the last monitoring report.

- <http://www.plantcol.be/search-plants.php> (accessed July 16 2020)

A database of the living plant collections in nine botanical institutions in Belgium. Accessions of *Dianthus caryophyllus* are listed but there are no new records since 2018.

- <http://www.cbnbrest.fr/eCalluna/index.php> (accessed July 16 2020)

Floristic database of the vascular flora of the Basse-Normandie, Bretagne and Pays de la Loire regions of France. There have been no new records since the last monitoring report.

- <http://www.bsbimaps.org.uk/atlas> (accessed July 16 2020)

Botanical records for the British Isles. The atlas of records for *Dianthus caryophyllus* indicates no new records for 2020.

- <http://inpn.mnhn.fr/espece> (accessed July 16, 2020)

Database of French government (natural heritage service). No new entries listing *Dianthus caryophyllus*.

- <http://www.florealpes.com> (accessed July 16 2020)

Vegetation database of Hautes-Alpes, Corsica, Pyrenees and Provence. No new entries for *Dianthus caryophyllus*.

- <http://www.isatis31.botagora.fr> (accessed July 16, 2020)

A database of the flora of the department of Haute Garonne, France. No new entries listing *Dianthus caryophyllus*.

- http://www.floraiberica.es/PHP/cientificos_.php?gen=Dianthus (accessed July 17 2020)

Flora Iberica (Spain) website. No new entries listing *Dianthus caryophyllus*.

- <http://www.anthos.es>, Anthos. (accessed July 16, 2020)

Spanish plants information system. No entries listing *Dianthus caryophyllus*.

- <http://www.herbmedit.org/Home.html> (accessed July 16, 2020)

This URL leads now leads to the publications page and will be removed from future database searches.

- <http://waarneming.nl/> (accessed July 16, 2020)

A website of the biodiversity of the Netherlands. No new entries listing *Dianthus caryophyllus*.

- <http://www.anarchive.it> (accessed July 16, 2020)

Database lists hundreds of sample of *Dianthus caryophyllus* as species and five sub-species. No sample is younger than 2010.

- <http://herbarivirtual.uib.es/cas-med/genere/2523.html> (accessed July 16, 2020)

A database of the vascular plants in the western Mediterranean basin. Eleven *Dianthus* species are listed in the database, but not *Dianthus caryophyllus*.

- <http://www.sivim.info/sivi> (accessed July 16 2020)

A database of the vegetation of Spain and France. No new entries listing *Dianthus caryophyllus*. The most recent of the 53 observations for the species is from 1982.

- <http://biodiver.bio.ub.es/biocat> (accessed July 16 2020)

A flora and vegetation database of Catalonia. Three entries list *Dianthus caryophyllus*. Details of the observations show all records bar one to be pre 2010. A single 2017 record refers to a cultivated specimen in a garden. No records since then.

- <http://www.luomus.fi/kasviatlas/taxa.php> (accessed July 16, 2020)

Database of the Finnish museum of natural history. Data has not been updated since 2018.

- <http://www.greekmountainflora.info> (accessed July 16 2020)

Dataset of the flora of the Greek mountain region. No entries listing *Dianthus caryophyllus*.

- data.mnhn.lu (accessed July 16 2020)

Database of the natural history museum, Luxembourg. No new entries listing *Dianthus caryophyllus* (one entry from 1942).

- <http://filotis.itia.ntua.gr/home/> (accessed July 16 2020)

Database for the natural environment of Greece. The Filotis database lists 45 *Dianthus* species but not *Dianthus caryophyllus*.

- <http://flore.silene.eu> (accessed July 16 2020)

Website is functioning but links to floras are broken. The website will be removed from future monitoring reports.

- <http://www.flora-of-cyprus.eu> (accessed July 16 2020)

Flora of Cyprus. The website lists three *Dianthus* species but not *Dianthus caryophyllus*.

- <http://www.nobanis.org/search.asp> (accessed July 16 2020)

European invasive plant database. No change in status for *Dianthus caryophyllus*, which is listed as non-invasive for Denmark and Norway and no status for other European countries.

- <http://www.verspreidingsatlas.nl/planten> (accessed July 16, 2020)

Database of flora of the Netherlands. Lists 11 *Dianthus* species, but not *Dianthus caryophyllus* species or subspecies.

- <http://bit.ly/Raasay> (accessed July 16, 2020)

A database of plants of Skye, Ramsay and the small Isles, Scotland. Flora no longer updated. The website will be removed from future monitoring reports.

- <http://www.biolib.cz/en/main/> (accessed July 16, 2020)

A Czech Republic based library of biological observations with a focus on the Czech Republic area but also multiple checklists consolidating other databases. The database has not been updated for *Dianthus caryophyllus* since last reviewed.

- <http://www.wsl.ch/land/products/webflora/floramodul1-en.html> (accessed July 16, 2020)

A web-based flora of Switzerland. Nine *Dianthus* species are listed but not *Dianthus caryophyllus*.

- <http://www.floramaritime.it> (accessed July 16, 2020)

A botanical database of the plants of the Maritime Alps region of Italy. 14 *Dianthus* species are listed but not *Dianthus caryophyllus*.

- <http://www.floraofromania.transsilvanica.net> (accessed July 16, 2020)

This website is not accessible and will be removed from future monitoring reports.

- <http://www.floraweb.de/> (accessed July 16, 2020)

A database of vegetation of Germany. *Dianthus caryophyllus* is listed but no records of recent collections.

- <http://www.maltawildplants.com/wildplants> (accessed July 16, 2020)

A database of the wild plants of Malta. No *Dianthus* species are listed.

- <http://herbarium.univie.ac.at/database/search.php> (accessed July 16, 2020)

A database of herbarium specimens held within Austria. The database has 10 *Dianthus caryophyllus* specimens from Europe, the most recent of which is 2006 (no change from last year).

- <http://alienplantsbelgium.be> (accessed July 16, 2020)

Manual of the alien plants of Belgium. *Dianthus caryophyllus* is listed along with five other *Dianthus* species. No information has been added since last year's review.

- <http://www.iop.krakow.pl/ias/en> (accessed July 16, 2020)

A data base of alien species in Poland. Three *Dianthus* species, *D. barbatus*, *D. campestris* and *D. serbanii* are listed.

- <http://hirc.botanic.hr/fcd/Search.aspx> (accessed July 16, 2020)

Floral database of Croatia. 21 *Dianthus* species are listed including *Dianthus caryophyllus*. No details of collection dates are provided for this species and no photographs aside from an herbarium specimen of a red-flowered cultivated carnation.

- www.infoflora.ch (accessed July 16, 2020)

The national database of the flora of Switzerland. 16 *Dianthus* species are listed, including *Dianthus caryophyllus*. The 27 sites identified in the distribution map are all defined as naturalised and rare. No information is provided on sample collection date but does indicate observation year. No observations have been made since the three noted in the database review in the 2018 monitoring report.

- <http://www.flora-mv.de/index> (accessed July 16, 2020)

A floristic database of the Mecklenburg-Vorpommern region of Germany. 6 *Dianthus* species are listed, excluding *Dianthus caryophyllus*. Registration is required.

- <http://www.florius.cz> (accessed July 16, 2020)

Catalogues of the Union of Botanical Gardens, Czech republic. No records of *Dianthus caryophyllus*. One new *Dianthus* entry in the past 12 months (*D. japonicus*).

- <http://www.cbnsa.fr> (accessed July 16, 2020)

Website of the National botanical conservatory South Atlantic, France. The most recent observation of *Dianthus caryophyllus* is from April 2017.

- <http://www.ofsa.fr> (accessed July 16, 2020)

Flora of the region of New Aquitaine, France. The most recent observation is from April 2017.

- <http://azoresbioportal.uac.pt/azores-species/> (accessed July 16, 2020)

Database of the flora of the Azores, Portugal. No *Dianthus* species are listed.

- <http://plants.jstor.org/> (accessed July 16, 2020)

A database of herbarium specimens sortable by date and species. The most recent *Dianthus caryophyllus* species is from 2002 and is of a wild type, not carnation. No additions since last review.

- <http://gartenbank.cos.uni-heidelberg.de/public/gb> (accessed July 16, 2020)

Databank of the plant collections of the botanical garden of the Ruprecht-Karls-Universität, Heidelberg, Germany. The website lists nine *Dianthus* species, not including *Dianthus caryophyllus*.

- <http://flora-on.pt/> (accessed July 16, 2020)

On-line flora of Portugal. Eight *Dianthus* species are listed (excluding sub species) but the list does not include *Dianthus caryophyllus*. Particularly fine photographs.

- <https://www.cbnaipin.fr/Atlas/AtlasFlore/CartesEspèces/MenuAtlas.htm> (accessed July 16, 2020)

An atlas of the flora of the French alps and foothills contained within the Alpine National Botanical Conservatory (CBNA) website. The atlas has distribution maps of 15 *Dianthus* species, including *D. caryophyllus*. The distribution map on the website indicates all observations are before 1990.

- <http://www.atlasflorapyrenaea.org/> (accessed July 16, 2020)

An atlas of the flora of the Pyrenees. Domain has expired and website not accessible.

- <http://dryades.units.it/trieste/> (accessed July 16 2020)

A database of the city of Trieste, Italy. Two *Dianthus* species, but not *D. caryophyllus*.

- <http://dryades.units.it/casentinesi/> (accessed July 16, 2020)

Portal to the flora of the National Park of the Casentinesi forests, Monte Falterona and Campigna. Six *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://dryades.units.it/prealpijulie/> (accessed July 16, 2020)

Portal to the flora of the Julian Pre-Alps Natural Park. Five *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://dryades.units.it/dolomitifriulane/> (accessed July 16, 2020)

Portal on the flora of the Friulian Dolomites Natural Park. Four *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://www.priodoslovni.com/inventarna/en/> (accessed July 16, 2020)

The online collections database of Natural History Museum Rijeka, Croatia. Specimens from 17 *Dianthus* species are listed, but not *D. caryophyllus*. Generic collections of *Dianthus* are herbarium specimens dated before 2007.

- <http://www.species.be/nl/home.php> (accessed July 16, 2020)

A Belgium species list. Five *Dianthus* species are listed, but not *D. caryophyllus*.

- https://www.pifh.fr/donnees/recherche_par_plante (accessed July 16, 2020)

A floral database of the région Auvergne- Rhône Alpes, France. The site still does not provide photographs or collection dates but does list 27 *Dianthus* species and hybrids, including *Dianthus caryophyllus*.

- http://dryades.units.it/triglav_ita/ (accessed July 16, 2020)

Portal on the flora of the Triglav National Park (Slovenia). Five *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://dryades.units.it/udine/> (accessed July 16, 2020)

Portal on the flora of the City of Udine. Three *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://dryades.units.it/euganei/> (accessed July 16, 2020)

Information system on the vascular flora of the Euganean Hills. Four *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://dryades.units.it/valerio/> (accessed July 16, 2020)

Information system on the vascular flora of Monte Valerio (Trieste). Two *Dianthus* species are listed, but not *D. caryophyllus*.

- <http://siflore.fcbn.fr> (accessed July 17, 2020)

Database within the National Botanical Conservatories of France www.fcbn.fr. *Dianthus caryophyllus* observations are listed since 2000 but there are no new records since the database was accessed last year. The most recent observation is from 2014.

7.2. New databases

Three new sites were brought to our attention, all of which have search functions and will be added to future monitoring reports;

- http://cbnmc.fr/cartoweb3/Chloris/atlas_auv/menu_auv.php (accessed July 16)

A database of the flora d'Auvergne, south-central France. The database covers the departments of Allier, Puy-de-Dôme, Cantal and Haute-Loire. *Dianthus caryophyllus* and 9 sub-species of *D. caryophyllus* are listed. There are nine records of *Dianthus caryophyllus* from post 1990 but no mechanism to contact collectors.

- <https://obv-na.fr/consulter/carte> (accessed July 16)

A database of the flora of the Nouvelle-Aquitaine région, France. There are nine records of *Dianthus caryophyllus* since 2000, the most recent one from 2017. Collectors names are provided but no photographs of any record.

- http://daten.bayernflora.de/de/info_pflanzen (accessed July 16)

The *Botanischer Informationsknoten Bayern* (Flora of Bavaria, Germany). A comprehensive database with 13 *Dianthus* species, sub-species and hybrids. There are three records of *Dianthus caryophyllus* in Bavaria.

Attachment 8. Brochure

TRANSGENIC CARNATION VARIETIES

<http://www.florigene.com/product/regulatory.html>

Florigene® Moonaqua™ (standard carnation)	
VBN product code	106726
Flower colour (RHS code)	84B



Florigene® Moonlite™ (standard carnation)	
VBN product code	102111
Flower colour (RHS code)	77C



TRANSGENIC CARNATION VARIETIES

<http://www.florigene.com/product/regulatory.html>

Florigene® Moontea™ (standard carnation)	
VBN product code	120344
Flower colour (RHS code)	N79C



Florigene® Moonvista™ (standard carnation)	
VBN product code	124042
Flower colour (RHS code)	77A



TRANSGENIC CARNATION VARIETIES

<http://www.florigene.com/product/regulatory.html>

Florigene® Moonberry™ (spray carnation)	
VBN product code	117528
Flower colour (RHS code)	N82C



Florigene® Moonvelvet™ (spray carnation)	
VBN product code	117529
Flower colour (RHS code)	77A

