

CHOROLOGICAL ADDITIONS AND DISTRIBUTION OF THE NATIVE ORCHIDS OF GRAN CANARIA

ÁGUEDO MARRERO¹, MARIJKE CLAESSENS², DANIEL GONZÁLEZ³, CONCHI SANTIAGO⁴ AND JEAN CLAESSENS⁵

¹ Jardín Botánico Canario Viera y Clavijo, Unidad Asociada al CSIC, c/ Camino del Palmeral nº 15, 35017, Las Palmas de Gran Canaria, Islas Canarias, agmarrero@grancanaria.com

² Moorveldsberg 33, 6243 AW Geulle, The Netherlands

³ Avenida Matías Vega, nº 9, 35350, Artenara, Gran Canaria (Islas Canarias). kore_art@hotmail.com

⁴ C/ Concejal García Feo, nº 14, Las Palmas de Gran Canaria

⁵ Naturalis Biodiversity Center, Leiden, The Netherlands

Recibido: mayo 2019

Keywords: Endemics, Orchidaceae, flora of Gran Canaria, chorology, distribution maps

Palabras claves: Endemismos, Orchidaceae, flora de Gran Canaria, corología, mapas de distribución

SUMMARY

During three weeks of field work in 2017, two of the authors (M. C. & J. C.) searched for potential orchid sites in Gran Canaria, resulting in a large number of unknown orchid sites. These data were supplemented with samples from the LPA Herbarium and unpublished data provided by two other authors (A. M. and D. G.). Finally chorological data were complemented with field campaigns during the season 2018-2019 (A.M. and C.S.). Orchids are limited almost exclusively to the Northeastern slopes and peaks of the island; the mountain region of Tenteniguada and Vega de San Mateo, Barranco de la Virgen in Valleseco, environments of Los Tiles, in Moya and the pine trees of Tamadaba and Tirma proved to be sites rich in species and in numbers of plants. Data are presented on chorological maps of *Habenaria tridactylites* (which has been located in 90 UTM-km grids), *Orchis patens* subsp. *canariensis* (located in 40 UTM-km grids), *Gennaria diphylla* (in 21 UTM-km grids), *Neotinea maculata* (in 24 UTM-km grids) and *Ophrys bombyliflora* (located in 10 UTM-km grids), as well as maps of densities of these species. Also the presence of *Serapias parviflora* and *Himantoglossum metlesicsianum* on the island is commented.

RESUMEN

El trabajo de campo durante tres semanas de 2017 de dos de los autores (M.C. & J. C.), en posibles sitios de crecimiento de orquídeas en Gran Canaria, reveló la existencia de núcleos poblacionales nuevos. Estos datos se complementaron con los del Herbario LPA y los datos inéditos aportados por otros dos autores (A. M. y D.G.). Finalmente los datos corológicos se complementan con las campañas de campo durante la temporada 2018-2019 (A.M. y C.S.). Las orquídeas se limitan casi exclusivamente a la vertiente noreste y cumbres de la isla, donde la región montana de Tenteniguada y Vega de San Mateo, Barranco de la Virgen

en Valleseco, los entornos de Los Tiles, en Moya, y los pinares de Tamadaba y Tirma resultaron ser sitios ricos tanto en especies como en número de plantas. Los datos se presentan en mapas corológicos de *Habenaria tridactylites* (la cual ha sido localizada en 90 cuadrículas UTM-km), *Orchis patens* subsp. *canariensis* (localizada en 40 cuadrículas UTM-km), *Gennaria diphylla* (en 21 cuadrículas UTM-km), *Neotinea maculata* (en 24 cuadrículas UTM-km) y *Ophrys bombyliflora* (localizada en 10 cuadrículas UTM-km), a los que se añaden mapas de clases de densidades de estas especies. Igualmente se comenta la presencia de *Serapias parviflora* e *Himantoglossum metlesicsianum* en la isla.

INTRODUCTION

Gran Canaria is part of the Canary Islands, located between 27° 38' and 29° 25' N and between 13° 20' and 18° 09' W. The Canary Islands have a volcanic origin, have never been connected to the African continent, and were colonized by plants via long-distance dispersal (SHMIDA & WERGER 1992).

Gran Canaria is the third largest island of the archipelago, and it was formed about 14.6 million years ago (CARRACEDO & PÉREZ-TORRADO 2013). It is an almost circular island, with the Pozo de las Nieves, located at its centre, as its highest elevation (1950 m). The south-eastern coast exhibits sedimentary landscapes, hills and ravines gradually sloping down towards the sea, whereas at the northwest coast steep slopes and cliffs dominate. Two large ravines, Agaete-Guayedra and Tirajana-Juan Grande, divided the island into two geologic, geomorphologic and bioclimatic sectors: Alisiocanaria and Xerocanaria (PÉREZ-CHACÓN *et al.* 1995; DEL ARCO *et al.*, 2002). This division is determined by the influence of the trade winds from the northeast, which together with the radial network of steep ravines and the altitude of the island range generate a variety of micro-climates and multiple ecosystems, from the hyperarid desert, the inframediterranean bioclimatic belt to the wet meso-supramediterranean bioclimatic belt (see RIVAS-MARTÍNEZ *et al.* 2002, DEL ARCO & GONZÁLEZ 2003).

The Canary Islands accommodate a very high number of endemic species. About 100 species are endemics restricted to Gran Canaria; 130 Canarian endemic species are shared with any of the other islands (MARRERO & PÉREZ DE PAZ, 1993; GARCÍA GALLO *et al.*, 2003). About 40% of the presently emerged surface of this island is part of the "Gran Canaria Biosphere Reserve", and includes several protected natural areas. Gran Canaria is the most densely populated island of the archipelago, so that agriculture, urbanisation and tourism have greatly influenced the present flora. According to different estimates, only 1% of the original laurel forests, the Laurisilva, is left (KUNKEL 1993, SUÁREZ 1994). Yet, many plant species found refuge in the numerous ravines with their unique and varying biotopes.

The flora of Gran Canaria has been well documented (LID 1967, SUNDING 1972, BRAMWELL & BRAMWELL 1990, 2001, KUNKEL 1992, HOHENESTER & WELSS, 1993, GARCÍA GALLO *et al.*, 2003; NARANJO *et al.* 2004), but the chorological information presented is always generic (sometimes only at the level of island) and very sparse or limited. An overview of chorological data on the orchids of Gran Canaria has never been published before.

Orchids are rare on the Canary Islands, due to their isolated nature and the extreme growing conditions. On Gran Canaria seven orchid species are found: *Habenaria tridactylites* Lindl., *Orchis patens* Desf. subsp. *canariensis* (Lindl.) Asch. & Graebn., *Gennaria diphylla* (Link) Parl., *Neotinea maculata* (Desf.) Stearn, *Ophrys bombyliflora* Link, *Serapias parviflora* Parl. and *Himantoglossum metlesicsianum* (W.P.Teschner) P.Delforge. Of these, *H. tridactylites*, *O. patens* subsp. *canariensis* and *H.*

metlesicsianum are exclusive Canarian endemics. In 2017, two of the authors (Marijke and Jean Claessens), visited the island of Gran Canaria; during this stay, especial attention was paid to the orchid flora of the island. A comparison with the data provided on the 2017 website of the CANARY BOTANICAL GARDEN, VIERA Y CLAVIJO - UNIDAD ASOCIADA AL CSIC (2017) revealed that many of their observations were not yet mapped on the distribution maps.

This led to contact with A. Marrero, curator of the Herbarium LPA of that Canary Botanical Garden, who not only brought the data available in the LPA, but he furnished many other new details of his field work for many years, that made it possible to write a chorological update of the orchids of Gran Canaria. These data are added observations of another author (D. González) and finally the chorology of the species, especially *Habenaria* and *Neotinea*, is complemented after additional sampling in the season 2018 / 2019 (A. Marrero & C. Santiago).

MATERIALS AND METHODS

The field observations were performed using sampling campaigns in possible areas of localization of species taking into account previous information on them. In each population are scoring GeoReference data (UTM-km grids), altitude (m a.s.l.), ecology and habitat and number of reproductive individuals. Some observations were made through binoculars. When it was deemed suitable, samples of plant were prepared for Herbarium. To this material were added the data available from the Herbarium LPA (A. Marrero), and the data of field notebooks unpublished of this author. Additional data were gathered by using the GBIF database (GBIF.ORG 2017) as well as data provided by various workers. The populations of orchids initially observed by M. Claessens and J. Claessens in 2017 were stored the program Obsmapp; data were uploaded to the website observation.org. These data were then transferred on distribution maps. Distribution maps were made on the Grafcan Cartographic through the web portal IDECanarias visor 4.5. For the most frequent species (*H. tridactylites*, *O. patens* subsp. *canariensis*, *G. diphylla*, *N. maculata* and *Ophrys bombyliflora*), maps were drawn showing population densities, using counts or estimates of populations and represented in kinds of number of individuals.

Plant communities, according to phytosociological nomenclature and the bioclimatic belts are based on RIVAS MARTÍNEZ *et al.* (2001, 2002), DEL ARCO *et al.* (2002), DEL ARCO & GONZÁLEZ (2003) and DEL ARCO & RODRÍGUEZ DELGADO (2003).

RESULTS AND DISCUSSION

Orchids are mainly found in the North-eastern part of the island, the region influenced by the trade winds. Many orchids were found in the Tenteniguada region, reflecting both the high potential of this region, and the fact that it was the subject of many field trips. Another hotspot for orchids is the Parque Natural de Tamadaba, which is likely to host more populations. The landscape of Gran Canaria, with a multitude of barrancos (ravines) with an almost impenetrable vegetation makes orchid prospecting difficult. Orchid biotopes are rather rare in the North, due to the urbanisation and the extensive agricultural use: almost every plowable piece of land is terraced and is or was laboured. Nowadays, many terraces are no longer farmed and are overgrown with a

dense vegetation, leaving no open space for the orchids. Some alien species plantations of eucalyptus, chestnuts, elms, poplars, etc. have influenced negatively in natural communities, native species and also in orchids (LIANG & ZONG-QIANG 2009, TERERAI *et al.* 2013).

***Habenaria tridactylites* Lindl., Gen. Sp. Orch. 4: 318 (1835)**

Habenaria tridactylites is an endemic species of the Canary Islands and it grows on all islands except Fuerteventura (ACEBES *et al.* 2010). The plant has two large, ovate, green, slightly shiny basal leaves, is 15 to 30 cm high, stem is leafless and carries a loosely-flowered inflorescence. The 5 to 30 flowers are pale green to yellow-green. Median sepal and petals form a loose hood, the lateral sepals are spreading. The lip is deeply three-lobed; the specific name *tridactylites* refers to the long, narrow lobes reminding of three fingers. It has a long, slender spur in which copious nectar is secreted. This species is pollinated by various Lepidoptera from Noctuidae, Geometridae, Crambidae, Pyralidae and Tortricidae (CLAESSENS & KLEYNEN 2016, CLAESSENS *et al.* in press.). *H. tridactylites* is a very early flowering species, which can flower from mid-November until January. (Figure 1).

The species extends throughout the Northeast sector of the island, appearing in coastal communities of the arid and desert inframediterranean bioclimatic belt, in communities of *Astydamia* and *Euphorbia aphylla* Brouss. ex Willd. (*Kleinio-Euphorbietea canariensis*, *Astydamio-Euphorbietum aphyllae*), up to the mountain areas in the communities of *Chamaecytiso-Pinetum canariensis*, *Pinetum canariensis* and especially the subassociation *ericetosum arboreae*, the mountain areas of damp pine forest, the lower mesomediterranean subhumid bioclimate belt (RIVAS MARTÍNEZ 1995, RIVAS MARTÍNEZ *et al.*, 2002; DEL ARCO & al. 2002; DEL ARCO & RODRÍGUEZ DELGADO, 2003). It is best adapted to thermophilous forests, being one of the more common orchids that can be found in its thickets (*Rhamno-Oleetea cerasiformis*), in many cases associated to *Davallia* and *Polypodium* communities, in crevices of Roque Nublo Brechia rocky outcrops. It can be found in the same biotopes as *G. diphylla* as well as in the Fayal-Brezal (*Myrico fayae-Ericion arboreae*). *H. tridactylites* grows on cliffs and cliff ledges; a secondary biotope are broad piled stone walls, preferably overgrown with the fern *Polypodium macaronesicum* A. E. Bobrov, *Davallia canariensis* (L.) Sm. or other humidity retaining plants (Figure 2). There are still many suitable growing sites, and the orchid is less demanding than e.g. *O. patens* subsp. *canariensis*. Especially its ability to colonise secondary biotopes makes its chances of survival better than the specialist orchids like *Ophrys bombyliflora*. *H. tridactylites* is the most common orchid of Gran Canaria, we mapped 182 sites, corresponding to 90 UTM-km grids (+ 9 UTM-km grids from GBIF unconfirmed). (Figure 2).

Exsiccata and observed locations: *Habenaria tridactylites* Lidl., Hs (Ci), Islas Canarias, Gran Canaria, **Agüimes:** Guayadeque, Pino Calzado, Degollada La Rispa, 1200 m a.s.l., UTM: 28R DR 50 89, A. Marrero, 30-04-1985, (!); **Valsequillo de Gran Canaria:** Tenteniguada, Los Roques 1160 m a.s.l., UTM: 28R DR 47 94, J. Claessens, 02-02-2017, 06-02-2017, (!); Tenteniguada, Roque Redondo, NW-N-NE, 1120-1125 m a.s.l., UTM: 28R DR 48 94, J. Claessens, 08-02-2017, (!); Tenteniguada, Lomo de la Majada 1100 m a.s.l., UTM: 28R DR 48 96, J. Claessens, 09-02-2017, (!); Tenteniguada, Casas Blancas, above the road 915 m a.s.l., UTM: 28R DR 48 96, J.



Figure 1- *Habenaria tridactylites*. A) Las Palmas de Gran Canaria, Jardín Botánico Canario Viera y Calvijo, 20-03-2018; B) Santa Brígida, Lomo del Bermejil, 20-1-2017; C) Teror, Caldera de Pino Santo, 13-2-2009, fotos Á. Marrero.

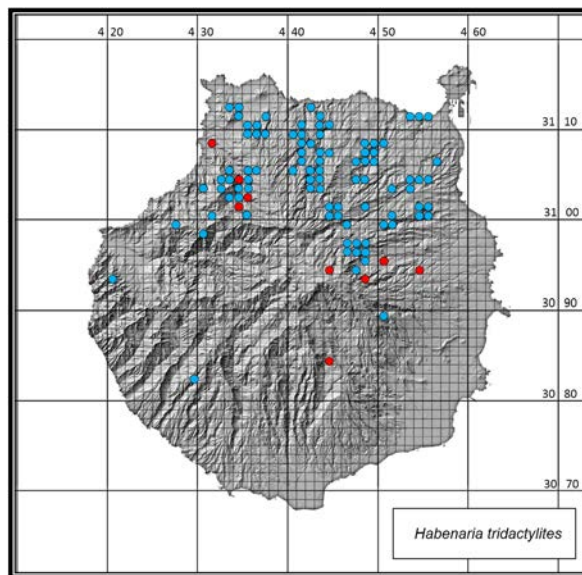


Figure 2- Map of Gran Canaria, distribution of *Habenaria tridactylites*. Here and in successive figures, blue dots: new contributions or previous appointments confirmed; red dots: unconfirmed previous appointments.

Claessens, 14-02-2017, (!); **Vega de San Mateo**: La Lechucilla, below the Risco Campanario 1075 m a.s.l., UTM: 28R DR 46 96, J. Claessens, 11-02-2017, (!); El Calero, Lomo de Cuevas Nuevas 1115 m a.s.l., UTM: 28R DR 46 96, J. Claessens, 11-02-2017, (!); Montañón, Cruz de La Misión 1055 m a.s.l., UTM: 28R DR 48 97, J. Claessens, 13-02-2017, (!); trail to Cruz de La Misión, Montañón, NE 1000-1045 m a.s.l., UTM: 28R DR 48 97, J. Claessens, 13-02-2017, (!); trail to Cruz de La Misión 1000 m a.s.l., UTM: 28R DR 47 97, J. Claessens, 13-02-2017, (!); El Calero, on the road to Tenteniguada 1055 m a.s.l., UTM: 28R DS 46 97, D. González, no date, (!); Presa de Ariñez, GC-42 road, 900-910 m a.s.l., UTM: 28R DS 45 00, Á. Marrero & C. Santiago 03/01/2019, (!); Utiaca-San Mateo, GC-42 road, 790-800 m a.s.l., UTM: 28R DS 46 99, Á. Marrero & C. Santiago 03/01/2019, (!); **Santa Brígida**: Caldera de Bandama, W and SW slopes 250-300 m a.s.l., UTM: 28R DS 55 00, J. Claessens, 21-01-2017, (!); Llanos de María Rivera, El Roque, 485 m a.s.l., UTM: 28R DS 51 03, Á. Marrero & C. Santiago 03/01/2019, (!); Lomo Cruz del Gamonal, 700-725 m a.s.l., UTM: 28R DS 50 99, Á. Marrero & C. Santiago 03/01/2019, LPA: 36273; Lomo Cruz del Gamonal, 750-760, m a.s.l., UTM: 28R DS 51 99, Á. Marrero & C. Santiago 03/01/2019, (!); Cruz del Gamonal-Tres Piedras, 710-725 m a.s.l., UTM: 28R DS 51 99, Á. Marrero & C. Santiago 03/01/2019, LPA: 36276; Tres Piedras, below to observatorio 650-670 m a.s.l., UTM: 28R DS 51 00, Á. Marrero & C. Santiago 03/01/2019, LPA: 36277-36278; **Santa Brígida/Teror**: Pinar de Ojeda-Caldera de Pino Santo, 815 m a.s.l., UTM: 28R DS 48 01, Á. Marrero & C. Santiago 03/01/2019, LPA: 36268; **Las Palmas de Gran Canaria**: Bandama 400 m a.s.l. between rocks G. Kunkel nº 7713, 27-11-1965, LPA: 3527-3528; Pico de Bandama 400-500 m a.s.l., UTM: 28R DS 54 01, Á. Marrero, 03-05-1995, (!); road to Bandama, El Cabezo, 400-430 m a.s.l., UTM: 28R DS 54 02, Á. Marrero, 03-05-1995, (!); Barranco de Guiniguada 120-130 m a.s.l., UTM: 28R DS 56 06, Á. Marrero, 30-01-2000, (!); Tafira Alta 350 m a.s.l., G. Kunkel 01-01-1972, LPA: 15233; Tafira Baja, Montaña del Socorro 370 m a.s.l., hillsides of volcanic slag, with *Olea cerasiformis* and *Pistacia lentiscus*, UTM: 28R DS 55 04, Á. Marrero, 18-03-2018, LPA: 35223-35224; Jardín Botánico Canario Viera y Clavijo, track to Arco de Piedra 290-320 m a.s.l., UTM: 28R DS 54 04, Á. Marrero 13 and 16-02-2009, LPA: 26842-26852, 26862, *Ibidem*, 313 m a.s.l., UTM: 28R DS 54 04, Á. Marrero 12-01-2006, LPA: 32014; *Ibidem*, Plaza de Viera-Dragos Gemelos, 295 m a.s.l., UTM: 28R DS 54 04, Á. Marrero 18-02-2009, LPA: 26905-26906; *Ibidem*, natural rockery of Alpendre 245 m a.s.l. UTM: 28R DS 54 04, Á. Marrero 19-03-2009, LPA: 32212-32213; on the terrace above the new waterfall 300 m a.s.l., UTM: 28R DS 54 04, Á. Marrero 07-03-2009, LPA: 26964, 26982-26983; *Ibidem*, path of the labiadas 285 m a.s.l., UTM: 28R DS 54 04, J. Claessens, 31-01-2017, (!); *Ibidem*, path to the dragos 290 m a.s.l., UTM: 28R DS 54 04, J. Claessens, 31-01-2017, (!); Barranco de Tenoya, at the height of the real irrigation channel, 210-215 m a.s.l., UTM: 28R DS 50 08, B. Navarro, *et al.*, 15-01-2004, LPA: 20048; El Zardo-Siete Puertas, 400-450 m a.s.l., UTM: 28R DS 53 04, Á. Marrero & C. Santiago 03/01/2019, LPA: 36264-36265; Volcán de la Angostura, 345 m a.s.l., UTM: 28R DS 53 03, Á. Marrero & C. Santiago 03/01/2019, (!); road to Bandama, El Cabezo 415 m a.s.l. UTM: 28R DS 54 02, Á. Marrero 06-02-2012, LPA: 30554-30555; El Rincón 90 m a.s.l., UTM: 28R DS 55 11, Á. Marrero, 16-02-2005, (!); El Ricón, below the Llano de Burgos 140 m a.s.l., UTM: 28R DS 54 11, Á. Marrero 16-02-2005, LPA: 35286-35287; *Ibidem*, below and to the West of the Lomo del Bicho, 100 m a.s.l., UTM: 28R DS 53 11, Á. Marrero 12-02-2005, LPA: 35259; **Valleseco**: Barranco de la Virgen, El Molino Chico 750-760 m a.s.l., UTM: 28R DS 42 03, Á. Marrero, 02-01-2019, (!); *Ibidem*, Piedra Caballera, 740 m a.s.l., UTM: 28R DS 42 03, Á. Marrero, 02-01-2019, (!); *Ibidem*, Casa La Palma 570 m a.s.l., UTM: 28R DS 43 05, Á. Marrero, 02-01-2019, (!); *Ibidem*, to La Mina, the Heredad de Aguas irrigation channel, 830 m a.s.l., UTM: 28R DS 42 04, Á. Marrero, 17-02-2008, (!); *Ibidem*, La Gallega, near the Morro, the Heredad de Aguas irrigation channel, 860-865 m a.s.l., UTM: 28R DS 42 03, Á. Marrero, 22-02-2009 and 24-02-2018 (!); road to Valsendero, El Cardoso 975 m a.s.l., UTM: 28R DS 42 03, Á. Marrero, 01-01-2019, (!); Las Troyanas, 930-950 m a.s.l., UTM: 28R DS 43 03, Á. Marrero, 01-01-2019, (!); Molinete, Lomo Mocán 695 m s.m., UTM: 28R DS 43 05, Á. Marrero & C. Santiago, 03/02/2019, (!); Madrelagua, to Montaña Valerio 1030 m a.s.l., UTM: 28R DS 44 01, J. Claessens, 28-01-2017, (!); **Teror**: above San Isidro 965-970 m a.s.l., UTM: 28R DS 44 00, J. Claessens, 25-01-2017 and 28-01-2017, (!); road Cruce Ariñez-San Isidro, GC-42, 925-930 m a.s.l., UTM: 28R DS 45 00, Á. Marrero & C. Santiago 03/01/2019, LPA: 36269-36270; San Isidro, Los Peñascos, 930 m a.s.l., UTM: 28R

DS 45 00, Á. Marrero & C. Santiago 03/01/2019, (!); Ojero, Lomontero, GC-42 road, 840-850 m a.s.l., UTM: 28R DS 45 01, Á. Marrero & C. Santiago 03/01/2019, (!); San Isidro-Ojero, 885 m a.s.l., UTM: 28R DS 45 00, Á. Marrero & C. Santiago 03/01/2019, (!); Lomo La Peña, 525-550 m a.s.l., UTM: 28R DS 47 06, Á. Marrero 19-01-2019, LPA: 36429-36430; La Peña, above houses, 510-520 m a.s.l., UTM: 28R DS 48 06, Á. Marrero 19-01-2019, (!); Barranco del Pino 390-400 m a.s.l., UTM: 28R DS 49 06, Á. Marrero 19-01-2019, (!); between Barranco del Pino and Lomo La Palma, 390-400 m a.s.l., UTM: 28R DS 49 07, Á. Marrero 19-01-2019, (!); Lomo La Palma, 360-370 m a.s.l., UTM: 28R DS 49 07, Á. Marrero 19-01-2019, LPA: 36431; El Hornillo 510-540 m a.s.l., UTM: 28R DS 47 04, Á. Marrero 19-01-2019, (!); Mujica, Barranco de la Culata 460-480 m a.s.l., UTM: 28R DS 48 04, Á. Marrero 19-01-2019, (!); Mirafior, Las Pozas 480-500 m a.s.l., UTM: 28R DS 48 04, Á. Marrero 19-01-2019, (!); **Firgas**: Barranco de Azuaje, above the Balneario 250-340 m a.s.l., UTM: 28R DS 43 09, 43 08, Á. Marrero, 13-02-2018, (!); Los Chorros, Las Huertecillas, 625 m s.m., UTM: 28R DS 44 07, Á. Marrero, 26-04-2015, (!); Casas de Matos, road to Las Madres 525 m a.s.l., UTM: 28R DS 44 07, J. Claessens, 24-01-2017, (!); **Arucas**: Riquiáñez, path of the Picacho, N of Radionaval Station 545-550 m a.s.l., UTM: 28R DS 48 07, J. Claessens, 18-01-2017, (!); Riquiáñez, path of the Picacho above Santa Flora 490 m a.s.l., UTM: 28R DS 48 08, J. Claessens, 22-01-2017, (!); Riquiáñez, path of the Picacho above Santa Flora 415-435 m a.s.l., UTM: 28R DS 48 08, J. Claessens, 22-01-2017, (!); Lomo Riquiáñez, high ramp 500-505 m a.s.l., UTM: 28R DS 48 07, J. Claessens, 29-01-2017, (!); Lomo Riquiáñez, La Bicornina 450-470 m a.s.l., UTM: 28R DS 49 08, Á. Marrero, 17-02-2015, (!); **Moya**: Los Tilos trail above the road 510-515 m a.s.l., UTM: 28R DS 41 07, J. Claessens, 26-01-2017, (!); *Ibidem*, D. González, no date, (!); El Lance, cliff below the village 325-340 m a.s.l., UTM: 28R DS 43 10, Á. Marrero, 06-01-2019, (!); *Ibidem*, 330-350, UTM: 28R DS 44 10, Á. Marrero, 06-01-2019, (!); Cabo Verde below El Frontón 225 m a.s.l., exp: North, UTM: 28R DS 422 122, Á. Marrero & C. Santiago 12/01/2019, LPA: 36279; escarpment below Los Toscales 360 m a.s.l., exp: North, UTM: 28R DS 431 114, Á. Marrero & C. Santiago 12/01/2019, (!); Doramas, cliffs North of Montaña Dorama 455 m a.s.l., exp: North, UTM: 28R DS 435 079, Á. Marrero & C. Santiago 12/01/2019, LPA: 36280-36281; road Moya-Los Tilos, GC-700 Km 8,3, 490-500 m a.s.l., exp: NW, UTM: 28R DS 42 08, Á. Marrero & C. Santiago 12/01/2019, (!); Barranco del Laurel, below Hoya de la Fuente 600 m a.s.l., exp: NE, UTM: 28R DS 41 06, Á. Marrero & C. Santiago 12/01/2019, (!); Barranco del Laurel, in front of the Hermitage 750 m a.s.l., exp: SE, UTM: 28R DS 40 05, Á. Marrero & C. Santiago 12/01/2019, (!); **Santa María de Guía**: El Palmital, Los Desaguaderos 385 m a.s.l., UTM: 28R DS 41 09, Á. Marrero 30-12-2012, LPA: 30223-30224.; road to El Palmital, Los Desaguaderos-Barranco de Moya 330 m a.s.l., UTM: 28R DS 41 10, Á. Marrero 30-12-2012, (!); Montaña de Guía, 410 m a.s.l., UTM: 28R DS 37 11, Á. Marrero, 13-12-2014, (!); El Brezal del Palmital 535 m a.s.l., UTM: 28R DS 40 09, D. González, no date, (!); Confluence Los Propios - Los Tilos ravine, left margin 460-470 m a.s.l., exp: SE, UTM: 28R DS 41 08, Á. Marrero & C. Santiago 12/01/2019, (!); **Gáldar**: Montaña Amagro, Barranco del Roque 271 m a.s.l., UTM: 28R DS 34 11, R. Barendse & J. Willemsen, 08-03-2012, (!); Montaña de Amagro 200-250 m a.s.l., UTM: 28R DS 34 12, Á. Marrero, 09-04-2005, (!); *Ibidem*, Barranquillo de la Sabina 250 m a.s.l., cliff, UTM: 28R DS 33 12, Á. Marrero, 11-05-2005, (!); El Agazal 340-380 m a.s.l., UTM: 28R DS 35 09, Á. Marrero 19-01-2019, (!); *Ibidem*, 350-400 m a.s.l., UTM: 28R DS 35 10, Á. Marrero 19-01-2019, LPA: 36432; Los Silos, GC-220 road to Hoya Pineda 450-480 m a.s.l., UTM: 28R DS 36 10, Á. Marrero 19-01-2019, (!); Barranco de La Furnia-Anzó, GC-220 road to Hoya Pineda 420-460 m a.s.l., UTM: 28R DS 36 09, Á. Marrero 19-01-2019, (!); Hoya Pineda, cross the village access 550-560 m a.s.l., UTM: 28R DS 37 09, Á. Marrero 19-01-2019, (!); Caideros de San José, Barranco del Caidero 960 m a.s.l., UTM: 28R DS 36 05, Á. Marrero 19-01-2019, (!); Fagagesto, road to El Hornillo, El Viñátigo 950 m a.s.l. exp: norte UTM: 28R DS 35 03, Á. Marrero & C. Santiago 12/01/2019, (!); Fagagesto to El Hornillo road, Cueva Oscura 895 m a.s.l., exp: North, UTM: 28R DS 35 03, Á. Marrero & C. Santiago 12/01/2019, (!); **Agate**: Los Berrazales 450 m a.s.l., [UTM: 28R DS 35 05], G. Kunkel 7659, 18-11-1965, LPA: 3525-3526.; Tamadaba, Risco de Faneque, Morro de las Lechugas and headwaters of the Barranco de La Palma 990-1000 m a.s.l., UTM: 28R DS 30 03 Á. Marrero 24-02-2018, (!); *Ibidem*, Cortijo de Sansó, headwaters of the Barranco del Chorro 1070 m a.s.l., UTM: 28R DS 33 04, Á. Marrero 16-02-2012, LPA: 35306; *Ibidem*, 960 m a.s.l., UTM: 28R DS 33 04, Á. Marrero 31-01-2009, (!); *Ibidem*, La Gambuesa 860

m a.s.l., UTM: 28R DS 33 05, Á. Marrero 31-01-2009, (!); road the El Hornillo to Fagagesto, 900-920 m a.s.l., 28R DS 34 03, Á. Marrero, 06-03-2018, (!); Los Pérez to Fagagesto road, above El Hornillo 900-950 m a.s.l., exp: NO, UTM: 28R DS 34 03, Á. Marrero & C. Santiago 12/01/2019, (!); Presa de Los Pérez, El Taginastal, dam high cliffs 870-900 m a.s.l., exp: NW, UTM: 28R DS 34 02, Á. Marrero & C. Santiago 12/01/2019, (!); El Valle above the Balneario 450-470 m a.s.l., UTM: 28R DS 35 05, J. Claessens, 23-01-2017; El Valle above the Balneario 590 m a.s.l., UTM: 28R DS 35 04, J. Claessens, 29-01-2017, (!); El Valle, above the Balneario 535 m a.s.l., UTM: 28R DS 35 05, J. Claessens, 29-01-2017, (!); El Valle, on the way to El Sao, slopes of wild olive tree forest (acebuchales) 480-515 m a.s.l., UTM: 28R DS 35 04, J. Claessens, 29-01-2017, (!); Lomo Caraballo, UTM: 28R DS 32 04, D. González, no date, (!); Tamadaba, UTM: 28R DS 32 03, D. González, no date, (!); **Artenara**: Presa de Lugarejos, 880 m a.s.l., exp: NO, UTM: 28R DS 33 02, Á. Marrero & C. Santiago 12/01/2019, (!); Barranco de Coruña 1035 m a.s.l., UTM: 28R DS 35 00, D. González, no date, (!); Barranco Hondo 940-970 m a.s.l., UTM: 28R DS 34 02, D. González, no date, (!); Montaña Altavista or Azaenegue 1175 m a.s.l., UTM: 28R DS 30 98, D. González, no date, (!); Tirma 855 m a.s.l., UTM: 28R DS 31 00, D. González, no date, (!); Tirma 815-875 m a.s.l., UTM: 28R DS 27 99, D. González, no date, (!); **La Aldea de San Nicolás**: Montaña de Los Cedros 745-845 m a.s.l., UTM: 28R DS 20 93, D. González, no date, (!); **Mogán**: Hoya de Los Laerones 700-725 m a.s.l., UTM: 28R DR 29 82 (with *Dracaena tamaranae*), Á. Marrero, 08-10-1996 y 19-08-1997, (!).

***Orchis patens* Desf., Fl. Atl. 2: 318 (1799)**
subsp. *canariensis* (Lindl.) Asch. & Graebn. Syn. Mitteleur. Fl. 3: 697
(1907).

Basion.: *Orchis canariensis* Lindley, *Gen. sp. orchid.* 4: 263-264 (1835)

Orchis patens subsp. *canariensis* is an endemic of the Canary Islands and can be found on all islands except Fuerteventura and Lanzarote (ACEBES *et al.* 2010). KREUTZ 2004, BERNARDOS *et al.* 2006, ACEBES *et al.* 2010 and IPNI (International Plant Names Index) cite it at specific level as *O. canariensis* Lindl.). It has a rosette with three to five unspotted leaves and one or two sheathing leaves. It can be 15 to 40 cm high and has a short, dense-flowered inflorescence with 5-20 pale purple to pink flowers. Median sepal and petals form a loose hood; the lateral sepals are spreading, generally directed upwards. The lip is three-lobed, flat, more or less horizontal to pending, pinkish-white to pink with red spots and stripes. The spur is shorter than the ovary, horizontal or upward pointing and contains no nectar. All *Orchis* species are deceit-flowers, meaning that they do not provide any nectar to a visiting insect (CLAESSENS & KLEYNEN 2011, 2016). They attract inexperienced young bees, which still have to learn which flowers are rewarding and which are not. Pollinators are *Bombus canariensis* Pérez, *Anthophora alluaudi* Pérez and *Megachile canescens* Brullé (PAULUS 1999). It flowers from February to April. (Figure 3).

Orchis patens subsp. *patens* is a taxon of the mountains of Algeria and Tunisia, also occurring in Italy (Liguria) (BERNARDOS *et al.* 2006, ORSENIGO *et al.* 2016), and closely related to *Orchis spitzelii* subsp. *cazorlensis* (Lacaita) D. Rivera & López Velez of the mountain ranges in the Centre and East of the Iberian Peninsula and Balearic Islands (AEDO, 2005a). In Gran Canaria the subsp. *canariensis* grows preferably on steep cliffs or in pine forests in moist, slightly acid, eroded lava soils, often accompanied by *Aeonium simsii* (Sweet) W. T. Stearn, *Aeonium undulatum* Webb & Berthel. and



Figure 3- *Orchis patens* subsp. *canariensis*. A) Gáldar: Barranco del Culatón (above to Barranco Hondo), 30-03-2018, Á. Marrero; B) Artenara, Tirma, Montaña de Altavista, Paso del Palo, detail of inflorescence, 01-03-2002, J. Enrique Arnold; C) Vega de San Mateo, 14-2-2017, J. Claessens.

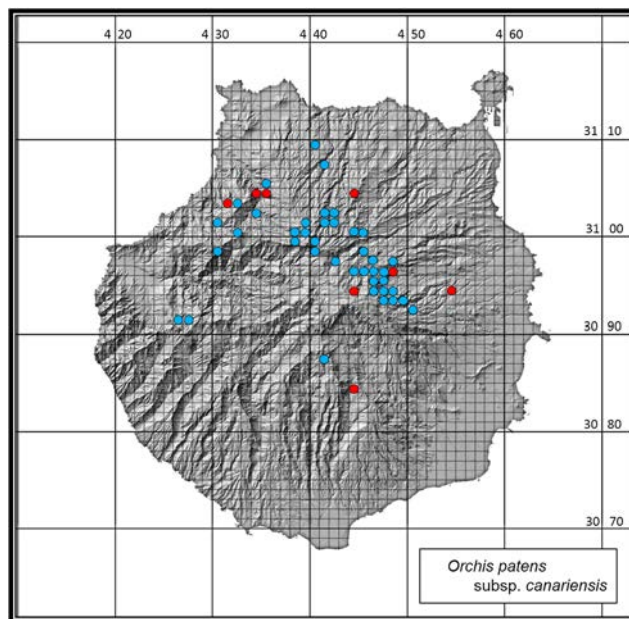


Figure 4- Map of Gran Canaria, distribution of *Orchis patens* subsp. *canariensis*.

Greenovia aurea C.Sm. ex Hornem. (*Greenovio-Aeonietea*, *Greenovion aureae* communities). It grows in the zones influenced by the trade winds, between 800 and 1500 (1600) m a.s.l.

The species is distributed in the North and East of the island but has a more restricted distribution than *H. tridactylites*. It is more restricted to the mountains areas in the *Pruno-Lauretea novocanariensis* and *Chamaecytiso-Pinetea canariensis* communities. Within this bioclimatic belt it prefers rocks or steep, rocky roadsides where it shares habitats with rupicolous communities of succulents, mainly in the communities of *Greenovio-Aeonietum caespitosi*. We found some nice growing places along the main road, where the steep rocks provide suitable growing conditions. Moreover, those places cannot be reached by the cattle which graze in the mountain meadows of the region. *Orchis patens* subsp. *canariensis* was found in 77 sites, corresponding to 40 UTM-km grids (+ 8 UTM-km grids from GBIF unconfirmed). (Figure 4).

Exsiccata and observed locations: *Orchis patens* subsp. *canariensis*, Hs (Ci), Gran Canaria, **Valsequillo de Gran Canaria:** Los Marteles, Paso de la Caldera 1520 m a.s.l., UTM: 28R DR 47 93, J. Claessens, 03-02-2017, (!); Tenteniguada, El Rincón, Los Barrancos 1055-1103 m a.s.l., UTM: 28R DR 47 94, J. Claessens, 01-02-2017, 02-02-2017, (!); *Ibidem*, trail to Los Roques 1165-1172 m a.s.l., UTM: 28R DR 47 94, J. Claessens, 02-02-2017, (!); *Ibidem*, Barranco del Corte, Risco Carnero 1345 m a.s.l., UTM: 28R DR 46 95, J. Claessens, 04-02-2017, (!); *Ibidem*, Los Alfaques 1095 m a.s.l., UTM: 28R DR 48 94, J. Claessens, 06-02-2017, (!); *Ibidem*, top of Los Roques 1305 m a.s.l., UTM: 28R DR 47 94, J. Claessens, 06-02-2017, (!); *Ibidem*, Los Barrancos 1200 m a.s.l., UTM: 28R DR 46 94, J. Claessens, 06-02-2017, (!); *Ibidem*, Los Barrancos, Lomito del Tafetal 1200 m a.s.l., UTM: 28R DR 47 94, J. Claessens, 06-02-2017, (!); *Ibidem*, El Majaleta 1050 m a.s.l., UTM: 28R DR 47 94, Á. Marrero & C. Santiago 03-03-2019, LPA: 36757; *Ibidem*, Roque Redondo, NW-N-NE 1120-1125 m a.s.l., UTM: 28R DR 48 94, J. Claessens, 08-02-2017, (!); *Ibidem*, Roque Redondo, E 1140 m a.s.l., UTM: 28R DR 48 93, J. Claessens, 08-02-2017, (!); *Ibidem*, Barranco La Umbria 1110 m a.s.l., UTM: 28R DR 48 93, J. Claessens, 08-02-2017, (!); Cañada los Hidalgos, Los Manantiales 1075 m a.s.l., UTM: 28R DR 47 96, J. Claessens, 09-02-2017, (!); road to Fuente La Mimbre, Los Manantiales 1190m a.s.l., UTM: 28R DR 47 95, J. Claessens, 09-02-2017, (!); Tenteniguada, Lomo de la Majada 1080 m a.s.l., UTM: 28R DR 47 96, J. Claessens, 09-02-2017 !; road Tenteniguada to San Mateo, km 5.2, 970 m a.s.l., UTM: 28R DR 47 96, J. Claessens, 09-02-2017, (!); **Telde:** Cazadores, ~ 1200-1250 m a.s.l., 28R DR 49 92, J. Rodrigo 03-04-1982, LPA: 8771; Cazadores, La Solana 1220 m a.s.l., UTM: 28R DR 50 92, J. Claessens, 03-02-2017, (!); **Vega de San Mateo:** Presa Ariñez, GC-42 road, 930 m a.s.l., UTM: 28R DS 45 00, Á. Marrero 03/01/2019, (!); Lagunetas 1150 m a.s.l., in wet rocks, [UTM: 28R DR 42 97], G. Kunkel 8275, 31-01-1966, LPA: 4149; Barranco de Antona 800 m a.s.l. [UTM: 28R DR 45 98], V. Montelongo 03-03-1987, LPA: 15071; Barranco de Maizep, Cueva Grande, 1230 m a.s.l., UTM: 28R DR 44 96, Á. Marrero, 28-04-2001, (!); La Lechucilla, Risco Campanario, SW 1280 m a.s.l., UTM: 28R DR 46 96, J. Claessens, 11-02-2017, (!); El Calero, Lomo de Cuevas Nuevas 1110 m a.s.l., UTM: 28R DR 46 96, J. Claessens, 11-02-2017, (!); The Lechucilla ravine, cuesta Los Viñáticos to Camaretas 1195-1250 m a.s.l., UTM: 28R DR 45 96, J. Claessens, 12-02-2017, (!); trail to Cruz de La Misión, Montañón, N-NE 1020-1045-1060 m a.s.l., UTM: 28R DR 48 97, J. Claessens, 13-02-2017, (!); El Calero 1055 m a.s.l., UTM: 28R DR 46 97, D. González, no date, (!); **Valleseco:** Barranco La Virgen 1000 m a.s.l., hillside shaded and Rocky, [UTM: 28R DS 41 02], with violet flower, G. Kunkel 8289, 31-01-1966, LPA: 4157; *Ibidem*, La Peña 860 m a.s.l. UTM: 28R DS 42 04, Á. Marrero 30-03-2008, (!); Valsendero, El Llanete 920 m a.s.l., UTM: 28R DS 42 01, Á. Marrero & C. Santiago 18-05-2019, (!); *Ibidem*, laderas altas del Llanete, 1100 m a.s.l., UTM: 28R DS 42 01, Á. Marrero & C. Santiago 18-05-2019, (!); *Ibidem*, UTM: 28R DS 42 02, Á. Marrero & C. Santiago 18-05-2019, (!); Barranco del Andén 1115 m a.s.l., UTM: 28R DS 42 01, Á. Marrero & C. Santiago 18-05-2019, (!); **Teror:** San Isidro, cuesta de La Parra 955 m a.s.l., UTM: 28R DS 44 00, J. Claessens, 13-02-2017, (!); **Moya:** Los Tiles de Moya, 510 m a.s.l., UTM: 28R DS 41 07, D. González, no date, (!); Montañón Negro, pared 1550 m a.s.l., UTM:

28R DS 39 01, D. González, (!); Caldera de Lo Pinos de Gáldar, 1400-1550 m a.s.l., UTM: 28R DS 39 01, Á. Marrero & C. Santiago 05-03-2019, LPA: 36995-36996; **Santa María de Guía**: Brezal del Palmital, 535 m a.s.l., UTM: 28R DS 40 09, D. González, no date, (!); **Gáldar**: Barranco del Culatón (above to Barranco Hondo) 1450-1500 m a.s.l., UTM : 28R DS 38 00, 39 00, Á. Marrero 30-03-2018, (!); **Agæete**: El Valle, above the Baleario 570 m a.s.l., UTM: 28R DS 35 05, J. Claessens, 29-01-2017, (!); Tamadaba 1300 m a.s.l., [UTM: 28R DS 32 03], G. Kunkel 8954 26-03-1966, LPA: 4544; *Ibidem*, to the E of the camp, channel 1170-1175 m a.s.l., UTM: 28R DS 32 03, J. Claessens, 05-02-2017, (!); Tamadaba, Barranco Oscuro, canal-side 1165 m a.s.l., UTM: 28R DS 32 03, D. González, 1974, (!); Montaña Ganoba or Tamadaba, above the forest House 1280 m a.s.l., UTM: 28R DS 32 03, D. González, no date, (!); **Artenara**: Tirma, Montaña de Altavista, Paso del Palo, 1250-1300 m a.s.l., UTM: 28R DR 30 98, Á. Marrero, 01-03-2002, LPA: 35283-35285 ; Tirma pathway 1090 m a.s.l., UTM : 28R DS 32 00, Á. Marrero 17-03-2018, (!); Tirma, Montaña Azaenague o Altavista, Hoya del Laurel 1275 m a.s.l., UTM: 28R DR 30 98, D. González, no date, (!); Barranco Hondo, NW of Risco Caído 945 m a.s.l., UTM: 28R DS 34 02, D. González, no date, (!); Barranco del Caballero, road to Pinos de Gáldar 1430 m a.s.l., UTM: 28R DR 38 99, D. González, no date, (!); Los Morrillos, West of Tamadaba, 915 m a.s.l., UTM: 28R DS 30 01, D. González, no date, (!); road to Pinos de Gáldar 1435 m a.s.l., UTM: 28R DR 38 99, R. Barendse & J. Willemsen, 11-03-2012, 12-03-2012, (!); **La Aldea de San Nicolás**: Reserva Integral de Inagua, Cortijo de Inagua, the forest track water tank 1124 m a.s.l., UTM: 28R DR 27 91, M. Martínez Pérez 23-03-2010, LPA: 29594; Inagua, Montaña La Escalera 1125 m a.s.l., UTM: 28R DR 26 91, D. González, no date, (!); **San Bartolomé de Tirajana**: Pilacones, to the left of the Pico San Antonio, [UTM: 28R DR 41 87], B. Navarro y Á. Marrero 12-03-2002, LPA: 20029.

***Gennaria diphylla* (Link) Parl., *Fl. Ital.* 3: 405 (1858)**

Basion.: *Satyrium diphyllum* Link, J. Bot. Göttingen, 2:2 (1799)

Gennaria diphylla grows on all islands except on Fuerteventura (MARRERO *et al.*, 1995; ACEBES *et al.* 2010). The plant is 10-30 cm high. Characteristic for this orchid are the two green, heart-shaped, sheathing leaves placed at different heights on opposite sides of the stem. This species generally grows in large groups. The inflorescence is up to 10 cm long, one-sided and entirely yellowish-green with up to 40 small flowers. Sepals and petals form a bell-shaped tube with their tips curving outwards. The lip is three-lobed, somewhat longer than the sepals and petals, ending in a short rounded, sack-shaped spur containing nectar. The anthers open wide, enabling the pollinaria to fall onto the stigma (CLAESSENS & KLEYNEN 2011, 2016). Although there is a high degree of autogamy, allogamous pollination is possible (FERNANDES *et al.* 2003). On Tenerife we observed various small Lepidoptera as pollinators (CLAESSENS & KLEYNEN 2016, CLAESSENS *et al.* in press.). It flowers from the end of January until April. (Figure 5).

The species grows in thermo-sclerophilous thickets of holm oaks, cork oaks and pine forests of the Mediterranean Region, North Africa, Canary Islands and Madeira (AEDO, 2005b), especially in communities of the *Quercus rotundifoliae-Oleion sylvestris* (RIVAS MARTÍNEZ *et al.*, 2002). In the Canary Islands it can be found in the thermophilous forest ("bosque termófilo" of *Rhamno-Oleetea cerasiformis*), as well as in pine forests (*Cisto-pinion canariensis*), especially in the Laurel forests and *Erica arborea* bushes ("Monteverde", *Pruno-Lauretalia novocanariensis* and *Andryalo-Ericetalia*).

It has been observed that it develops well, in dense populations, under the *Eucalyptus* plantations.

This species was found in 29 sites, corresponding to 21 UTM-km grids (+ 1 UTM-km grids from GBIF unconfirmed). (Figure 6).

Exsiccata and observed locations: *Gennaria diphylla*, Hs (Ci), Gran Canaria, **Agüimes:** Guayadeque, Degollada La Rispa, 1200 m a.s.l., UTM: 28R DR 50 89 (with *Helianthemum tholiforme*), Á. Marrero, 30-04-1985, (!); **Vega de San Mateo:** Barranco de Antona 800 m, [UTM: 28R DR 45 98] D. Bramwell 03-03-1987, LPA: 15074; **Valleseco:** Barranco del Andén 1115 m a.s.l., UTM: 28R DS 42 01, Á. Marrero & C. Santiago 18-05-2019, (!); Barranco de la Virgen, La Peña, the Heredad de Aguas irrigation channel 835 m a.s.l., UTM: 28R DS 42 04, Á. Marrero, 17-02-2008, (!); *Ibidem*, Cañada Grande 820-830 m a.s.l., UTM: 28R DS 42 04, Á. Marrero & C. Santiago 02-03-2019, LPA: 36775-36776; *Ibidem*, La Gallega, the Heredad de Aguas irrigation channel, 830-900 m a.s.l., UTM: 28R DS 42 03, Á. Marrero, 30-03-2008, LPA: 35298; *Ibidem*, to La Mina, the Heredad de Aguas irrigation channel, 830 m a.s.l., UTM: 28R DS 42 04, Á. Marrero, 17-02-2008, (!); El Molinete, Lomo Mocán 695 m a.s.l., UTM: 28R DS 43 05, Á. Marrero & C. Santiago, 03/02/2019, LPA: 36523-36524; *Ibidem*, 750 m a.s.l., UTM: 28R DS 43 05, Á. Marrero & C. Santiago, 03/02/2019, LPA: 36517-36518; **Teror:** zona alta de San Isidro 960 m a.s.l., UTM: 28R DS 44 00, J. Claessens, 25-01-2017, (!); Aríñez, Cruz del Herrero 1050 m a.s.l., UTM: 28R DS 44 00, J. Claessens, 28-01-2017, (!); San Isidro, Los Peñascos 930 m a.s.l., UTM: 28R DS 45 00, Á. Marrero, 02-02-2019, (!); Finca de Osorio, 675-700 m a.s.l., UTM: 28R DS 45 05, Á. Marrero, 03-04-2011, (!); *Ibidem*, 675 m s.m., UTM: 28R DS 46 05, nemoral en retazos de laurisilva con otras especies exóticas, Á. Marrero & C. Santiago 27/01/2019, LPA: 36562; **Moya:** Lomo de San Fernando, towards Corvos 725-745 m a.s.l., UTM: 28R DS 41 06, J. Claessens, 19-01-2017, (!); *Ibidem*, 730 m a.s.l., UTM: 28R DS 42 06, J. Claessens, 19-01-2017 !; Corvos, 800 m a.s.l., UTM: 28R DS 41 05, Á. Marrero & C. Santiago, 05-03-2019, (!); **Agæte:** Tamadaba, to the E of the camp, on the channel 1118 m a.s.l., UTM: 28R DS 32 03, J. Claessens, 05-02-2017, (!); Tamadaba, Barranco Oscuro, canal towards Sansó 1165 m a.s.l., UTM: 28R DS 32 03, D. González, no date, (!); Tamadaba, Cortijo de Samsó, Montaña de las Presas 1025 m a.s.l., UTM: 28R DS 32 05, D. González, no date, (!); Tamadaba-Finca de Sansó, above the Barranco del Chorro 1070 m a.s.l., UTM: 28R DS 33 04, Á. Marrero 16-02-2012, LPA: 30599, 35307; *Ibidem*, under the dam of Los Rajones 1115-1130 m a.s.l., UTM: 28R DS 32 04, Á. Marrero 16-02-2012, LPA: 35308; *Ibidem*, Peñón del Cura 1170-1190 m a.s.l., UTM: 28R DS 32 03, Á. Marrero 16-02-2012, LPA: 35309; *Ibidem*, Risco de Faneque, headwaters of the Barranco de La Palma 990-1000 m a.s.l., UTM: 28R DS 30 03, Á. Marrero, 24-02-2018, LPA: 35187-35188.

***Neotinea maculata* (Desf.) Stearn, *Ann. Mus. Goulandris* 2: 79 (1974)**

Basion.: *Satyrium maculatum* Desfontaines, *Fl. atlant.*, 2(9): 319-320 (1799)
= *Neotinea intacta* (Link) Rchb.f. s. aut.

Neotinea maculata is a small, inconspicuous plant, growing on all islands except Lanzarote and Fuerteventura (ACEBES *et al.* 2010). It was cited for the first time in Gran Canaria (SUNDING, 1968), as *Neotinea intacta* (Link) Rchb.f., “cliffs on the northwest side of Tamadaba, near the upper part of Bco. Guayedra, 1180 m”. It is 8-30 cm high, has two to three spotted or unspotted rosette leaves and some smaller, sheathing stem leaves. The inflorescence is cylindrical, 2-10 cm long with numerous quite small, white, greenish-white or pink flowers. Sepals and petals form a helmet, leaving only little space between the helmet and the lip. The lip is three-lobed with a long, strap-shaped median lobe that is bifid at the apex. The side lobes are small and linear. The short spur is conical, downward curving, containing no nectar. This species is generally autogamous (CLAESSENS & KLEYNEN 2011, 2016). The anther opens wide and the very loosely cohering pollinia easily fall apart. The massulae constituting the pollinium then fall onto



Figure 5- *Gennaria diphylla*. A) Agaete, Tamadaba, 12-2-2012; B) flowers showing the characteristic bell-shaped perianth, Valleseco, El Molinete, 12-2-2019; C) Valleseco, Lomo Mocán, 12-2-2019. Fotos Á. Marrero.

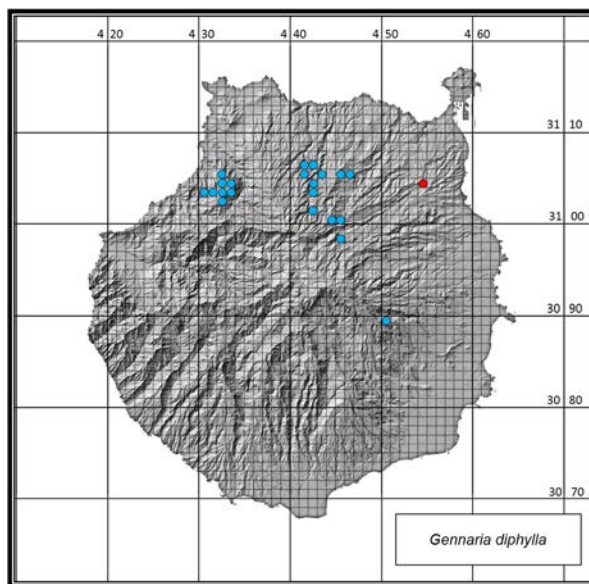


Figure 6- Map of Gran Canaria, distribution of *Gennaria diphylla*.

the underlying stigma. There are only very rare reports of visiting/pollinating insects, mostly Coleoptera (WILCOX 2014). It flowers from April until May. (Figure 7).

Neotinea maculata grows in the clearings of forests in the Mediterranean Region, southern Europe, NW Africa, W of Palestine and Anatolia, Canary Islands, Madeira and the Azores (LÓPEZ, 2005). In the Mediterranean it grows especially in the oak forests belonging to the *Quercetea ilicis* community (RIVAS MARTÍNEZ *et al.*, 2002), in Thermomediterranean humid or lower Mesomediterranean subhumid bioclimate belts. In Gran Canaria, like in Tenerife, it is mainly associated with humid pine forests (*Pinus canariensis* woods) of the mountain areas (*Cisto-Pinion canariensis*, *Micromeris pineolentis-Pinetun canariensis*). As these forests in Gran Canaria are well protected, this orchid is not threatened.

Neotinea maculata has been observed in 27 locations, corresponding to 24 UTM-km grids (+ 1 UTM-km grids from GBIF unconfirmed). (Figure 8).

Exsiccata and observed locations: *Neotinea maculata*, Hs (Ci), Gran Canaria, **Valsequillo:** Caldera de los Marteles, slopes towards the north, 1530 m a.s.l., UTM: 28R DR 47 92, Á. Marrero, 04-04-2009, (!); Tenteniguada, Roque Grande, 1490-1510 m a.s.l., UTM: 28R DR 47 93, Á. Marrero, 04-04-2009, (!); Roque Saucillo, under the pine forest of reforestation, 1600-1650 m a.s.l., UTM: 28R DR 46 94, Á. Marrero, 06-03-2018, (!); Cuevas Blancas, under the pine forest of reforestation, 1690-1700 m a.s.l., UTM: 28R DR 46 93, Á. Marrero, 06-03-2018, (!); **Vega de San Mateo:** Cruz del Saucillo, under the pine forest of reforestation, 1635 m a.s.l., UTM: 28R DR 46 94, Á. Marrero, 06-03-2018, (!); *Ibidem*, 1650 m a.s.l., UTM: 28R DR 45 94, Á. Marrero, 06-03-2018, (!); La Portillada, under the pine forest, 1850 m a.s.l., UTM: 28R DR 44 94, Á. Marrero, R. López & C. Santiago, 27-04-2019, LPA: 36999; Los Picachos, Casa Forestal-CECOPIN, under the pine forest, 1685 m a.s.l., UTM:28R DR 42 95, Á. Marrero, R. López & C. Santiago, 27-04-2019, LPA: 37000; **Valleseco:** Montañón Negro, basaltic lava flows on the northern slope, 1440-1450 m a.s.l., UTM: 28R DS 40 01, Á. Marrero, 19-05-1999, (!); Los Moriscos 1685 m a.s.l., UTM: 28R DR 39 99, N. Budding, 15-04-2015, (!); **Moya:** Caldera de Los Pinos de Gáldar, 1550-1560 m a.s.l., UTM: 28R DS 39 01, Á. Marrero & C. Santiago 05-03-2019, LPA: 36997-36998; **Gáldar:** Hoya de Los Pinos, 1550-1560 m a.s.l., UTM: 28R DS 39 01, Á. Marrero & C. Santiago 05-03-2019, (!); **Agate:** Tamadaba, Cortijo Sansó, Lomo Caballo 1140 m a.s.l., UTM: 28R DS 32 04, J. Claessens, 05-02-2017, (!); Tamadaba, , to the E of the camp, channel 1170 m a.s.l., UTM: 28R DS 32 03, J. Claessens, 05-02-2017, (!); Tamadaba, Cortijo de Sansó, Degollada del Humo 1220 m a.s.l., UTM: 28R DS 33 03, E. Sloopweg, 03-03-2013, (!); Tamadaba, way down to Risco de Faneque 1050-1060 m a.s.l., UTM: 28R DS 30 03, Á. Marrero 14-04-1985, LPA: 35270; **Artenara:** Tirma, Montaña de Altavista, Paso del Palo, 1250-1300 m a.s.l., UTM: 28R DR 30 98, Á. Marrero, 01-03-2002, (!); Altavista-Tirma way, Hoya de los Pinos Dulces 1250 m a.s.l., UTM: 28R DS 32 00, 32 99, Á. Marrero, 04-04-2002, LPA: 35281-35282; Tirma, Lomo de la Yegua, 1070-1080 m a.s.l., UTM: 28R DS 31 00, Á. Marrero, 08-04-2018, (!); Barranco del Caballero, road to Pinos de Gáldar 1435 m a.s.l., UTM: 28R DR 38 99, R. Barendse & J. Willemsen, 12-03-2012, (!); way Cruz de María to Altavista 1190 m a.s.l., UTM: 28R DR 31 99, G. van Noord, 06-01-2012, (!); **Tejeda:** Reserva Integral de Inagua, Degollada del Agujero, 1209 m a.s.l., UTM: 28R DR 29 91, M. Martínez Pérez 26-03-2010, LPA: 29587; Degollada de Cruz de la Piedra, on the way to the Pico de Las Nieves 1795 m a.s.l., UTM: 28R DR 42 92, Á. Marrero, 06-12-2018 (!); **La Aldea de San Nicolás:** andenes de Inagua, 1230 m a.s.l., UTM: 28R DR 26 91 (with *Helianthemum bystropogophyllum*), Á. Marrero, 12-05-1995 and 30-04-1996, (!)

***Ophrys bombyliflora* Link in Schrader, *Jour. Bot.* 1799 (2): 325 (1800)**

Ophrys bombyliflora Link subsp. *canariensis* G. Kunkel, *Kanar. Ins. Pflanz.*, 1980: 158, *nom. nud.*



Figure 7- *Neotinea maculata*. A) Valsequillo, Los Marteles, 09-04-2009, Á. Marrero; B) Valsequillo, Tentenguada, 16-03-2002, J. Enrique Arnold; C) rosettes, Moya, Caldera de los Pinos de Gáldar, 5-4-2019, Á. Marrero.

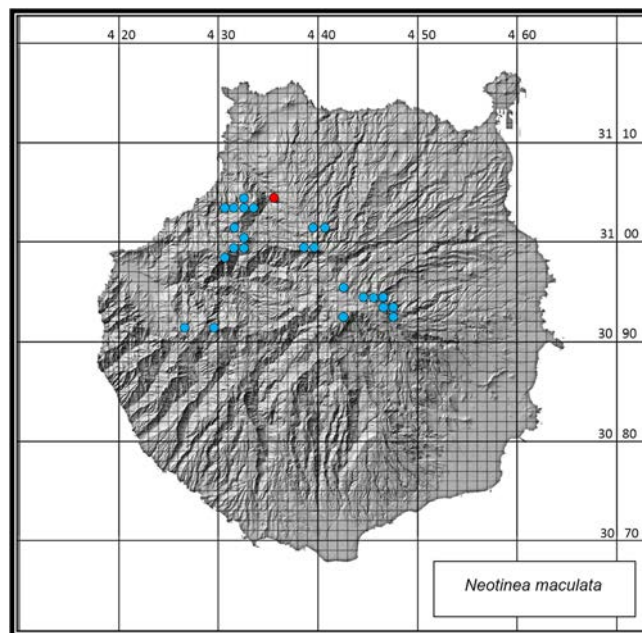


Figure 8- Map of Gran Canaria, distribution of *Neotinea maculata*.

This is the only *Ophrys* species of the Canary Islands. There are indications that it formerly grew on Tenerife (REICHENBACH 1851, PITARD & PROUST 1908, KELLER *et al.* 1928, NELSON 1962), but nowadays it is only known from Gran Canaria. The rosette has four to six broadly lanceolate leaves. The plants are usually small, 5-20 cm, but can grow up to 35 cm. The lax inflorescence can have up to five small flowers. The relatively large, oval sepals are green, the small triangular green petals are sometimes tinged with bronze. The lip is three-lobed, globose, brown with a dark purple or blue centre. The side lobes are hairy, contrasting with the smooth lip. *Ophrys bombyliflora* is an orchid that has no nectar, but relies on sexual deceit for attracting pollinators. It is pollinated by males of various *Eucera* species (PAULUS 1999, CLAESSENS & KLEYNEN 2011, 2016). It can also reproduce vegetatively by means of root-tubers. It flowers from March until April. (Figure 9).

The species grows in grassland, scrub and open forest of the Mediterranean and the Canary Islands, South of the Iberian Peninsula and Balearic Islands (ALDASORO & SÁEZ, 2005). In the Mediterranean it grows especially in herbaceous communities of perennials *Lygeo-Stipetea*, *Thero-Brachypodium retusi*, associated with the holm oak forests (RIVAS MARTÍNEZ *et al.*, 2002). *Ophrys bombyliflora* is a rare orchid of Gran Canaria and is restricted to the Northeastern quadrant of the island. In contrast to the previous species it does not grow in a specific bioclimatic belt, appearing in grasslands at altitudes from 400-500 m in the San Lorenzo region and up to 1000 - 1070 m in the Tenteniguada region. This species seems to be extremely endangered on Gran Canaria. It was observed in 21 sites, corresponding to 13 UTM-km grids (+ 3 UTM-km grids from GBIF unconfirmed). (Figure 10).

Exsiccata and observed locations: *Ophrys bombyliflora*, Hs (Ci), Gran Canaria, **Valsequillo:** Tenteniguada, towards the Barranco de Coruña 1050 m a.s.l., UTM: 28R DR 47 94, Á. Marrero 16-03-2002, LPA: 35276; *Ibidem*, El Majaleta 1050 m a.s.l., UTM: 28R DR 47 94, Á. Marrero & C. Santiago 03-03-2019, (!); Tenteniguada, El Rincón 1020-1070 m a.s.l., UTM: 28R DR 48 94, Á. Marrero 12-03-2005, LPA: 35289; Pine forest above Barranco de los Mocanes, 1030 m a.s.l., UTM: 28R DR 50 94, 08-11-2015, C. Ríos !; Tenteniguada, way to Roque Grande 1080 m a.s.l., UTM: 28R DR 47 94, N. Budding, 13-04-2014, 41742 !; **Santa Brígida - Telde:** Barranco Las Goteras 400 m a.s.l., [UTM: 28R DR 53 99], G. Kunkel 8516, 12-02-1966, LPA: 4328; **Vega de San Mateo:** Barranco de Antona 900 m, [UTM: 28R DR 45 98], V. Montelongo 03-03-1987, LPA: 15070; La Lechucilla, Risco Campanario, SW 1295 m a.s.l., UTM: 28R DR 46 96, J. Claessens, 11-02-2017, (!); El Calero, towards Cuevas Nuevas 1055 m a.s.l., UTM: 28R DR 46 97, D. González, 2015, (!); **Las Palmas de Gran Canaria:** Monte Lentiscal 500 m a.s.l., [UTM: 28R DS 52 01], G. Kunkel 8344, 03-02-1966, LPA: 4198; San Lorenzo, road to La Milagrosa, 450-500 m a.s.l., UTM: 28R DS 50 04, Á. Marrero, 12-03-2005, LPA: 35288; **Teror:** Finca del Mayorazgo de Osorio 670-700 m a.s.l., UTM: 28R DS 46 05, Á. Marrero 04-02-2006 and 03-04-2011, LPA: 31806; San Isidro, Los Peñascos 930 m a.s.l., UTM: 28R DS 45 00, Á. Marrero 31-03-1985, LPA: 35271.

Note: *Ophrys tenthredinifera* Willd., is cited for the Canary Islands without concrete location (Aldasoro & Sáez, 2005), but is probably a confusion (?).

***Serapias parviflora* Parl. Gior. Sci. Sic. 59: 66 (1837)**

= *Serapias occulta* J. Gay ex Cavalier, *Deux Nouv. Esp.*: s.p. (1848).

= *Serapias parviflora* subsp. *occultata* (J.Gay ex Cavalier) Maire & Weiller, *Fl. Afrique N.* 6: 318 (1959).



Figure 9- *Ophrys bombyliflora*. A) Teror, Osorio, 3-04-2011, Á. Marrero; B y C) Valsequillo, Tenteniguada, 16-03-2002, J. Enrique Arnold.

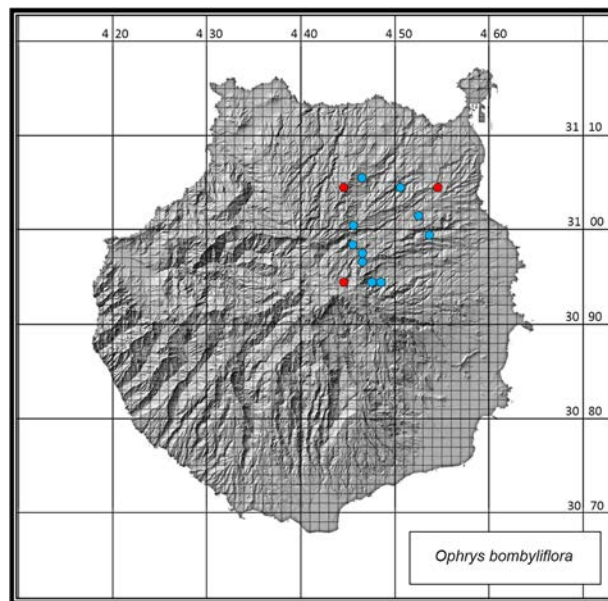


Figure 10- Map of Gran Canaria, distribution of *Ophrys bombyliflora*.

Serapias parviflora is a slender orchid, 10-40 cm high. It has five to seven narrow, lanceolate, keeled leaves. It grows on all islands except Lanzarote and Fuerteventura. The leaves are green and often have a red spotted base. The inflorescence is lax, with 3-9 small, red-brown flowers that sit close to the stem. The perianth segments form a closed, tubular helmet, silver-grey with reddish stripes on the outside. The lip is brown to red-brown and bipartite; the basal part of the lip is hidden in the tubular helmet. It has two deep dark lateral lobes. The apical part of the lip bends backwards to lie along the ovary. It is covered with reddish hairs at the entrance of the helmet. *Serapias parviflora* is an autogamous species; the column stands upright and massulae of the pollinia fall down onto the underlying stigma. (Figure 11).

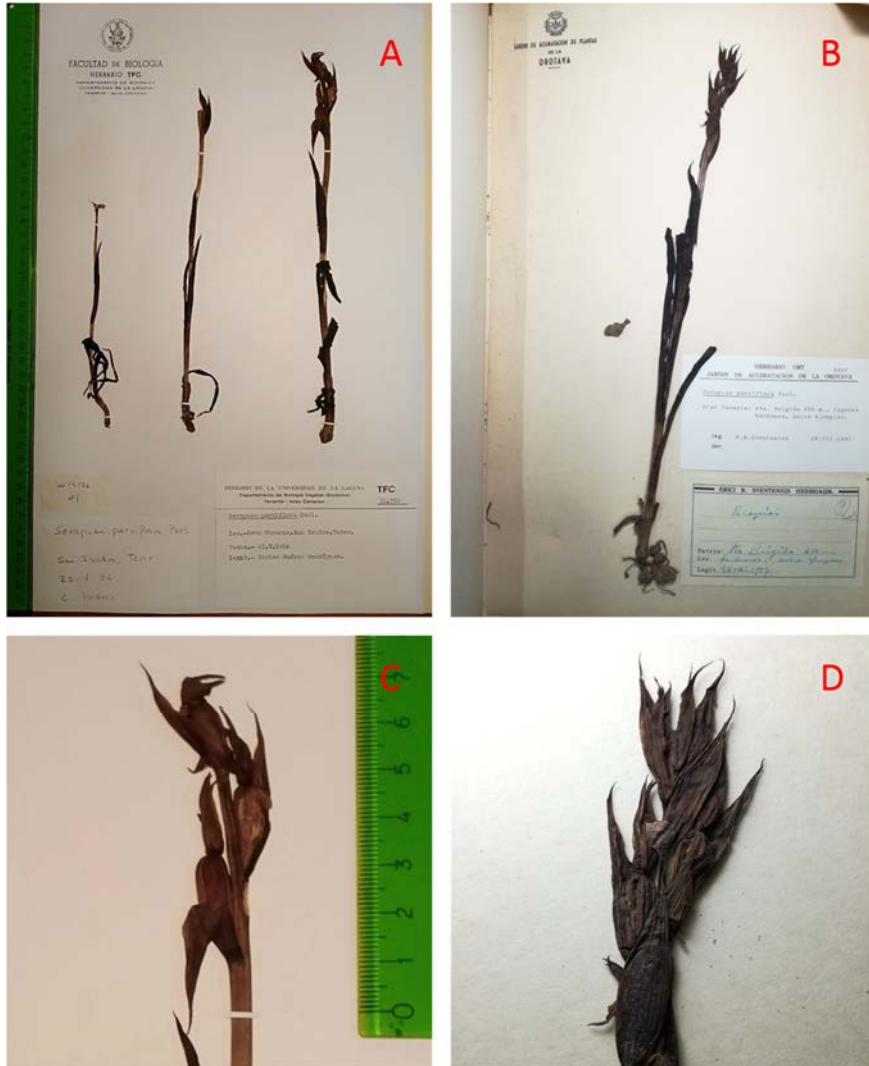


Figure 11- *Serapias parviflora*. A y C) Teror, San Isidro, 22-05-1986, C. Suárez, in TFC 31752; B y D) Santa Brígida, 26-03-1947 E.R. Sventenius in ORT: 8407.

This species grows in grasslands and open bushes and forests, from Britain to Cyprus and the Aegean Islands, Iberian Peninsula and Balearic Islands (SÁEZ *et al.*, 2005). In the Mediterranean and North African Rif West it grows especially in perennial grasslands communities of *Stipo-Agrostietea*, *Agrostietalia castellanæ* (RIVAS MARTÍNEZ *et al.*, 2002). In Gran Canaria old references mention it for Tafira, 400 m “in herbidis” (BORNMÜLLER, 1904) and Santa Brígida, 650 m (Sventenius in ORT), places where it has not been found again. SUÁREZ (1994) observed it in San Isidro, Teror (material is deposited in the herbarium TFC). Currently this species is extremely rare on the island and it would be interesting to revisit the old references.

The description of *Serapias mascaensis* (= *Serapias parviflora* Parl. subsp. *mascaensis* (H.Kretzschmar, G.Kretzschmar & Kreutz) Kreutz) as endemic to Tenerife (KRETSCHMAR & KREUTZ, 1993, KREUTZ 2004, ACEBES *et al.* 2010), taxa considered in "The Plant List" as synonyms of *S. parviflora* (GOVAERTS, 2003, 2011), and the scarce data of *S. parviflora* for Canary Islands (but cited for all the Islands except La Gomera and Fuerteventura, according to ACEBES *et al.* 2010), advised to consider a revision of these taxa in the Canary Islands.

Exsiccata: *Serapias parviflora*, Hs (Ci), Gran Canaria, **Santa Brígida**: 650 m, E.R. Sventenius, 26-03-1947, ORT: 8407, (!); **Teror**: San Isidro, C. Suárez, 22/05/1986, TFC: 31752, (!).

***Himantoglossum metlesicsianum* (W. P. Tschner) P. Delforge, *Naturalistes Belges* 80(3): 401 (1999)**

Basion.: *Barlia metlesicsiana* Tschner, *Orchidee*, 33(3): 117 (1982).



Figure 12- *Himantoglossum metlesicsianum*. A-C) Agaete, Tamadaba-Faneque surroundings, D. González, 06-03-2019 C) plant grazed probably by rabbits.

Himantoglossum metlesicsianum is an endemic of the Canary Islands. It was initially found only on Tenerife, where it grows in reasonable numbers (STIERLI 2011, KROPF *et al.* 2012, CLAESSENS 2014, 2015). In 2013 it was also reported for La Palma (ACEVEDO RODRÍGUEZ & MESA COELLO 2013) and in 2014 reported for Gran Canaria by one of us (D. González, <https://artenaraesnaturaleza.blogspot.com/2014/02/>), recorded by BELLO HERNÁNDEZ & BARONE (2015), without a mention of a site.

The species was formerly described as *Barlia metlesicsiana*. It is a tall plant, 35-70 cm high with several basal leaves. It has 3-8 glossy, yellow-green leaves spreading along the thick stem. The inflorescence is 8-17 cm long and dense-flowered, carrying 20 to 40 flowers. The flowers are large, sepals and petals form a loose helmet which is red brown to red-violet on the outside, punctate on the inside. The lip is spreading, three-lobed, almost as long as it is large, white with violet markings without a green tinge, red-violet at the margins. The spur is conical, downward pointing, without nectar. It is pollinated by queen bumblebees of *Bombus canariensis* and possibly by *Bombus* (*Megabombus*) *hortorum* L. (TESCHNER 1993, CLAESSENS 2014). (Figure 12).

The only locality of this orchid lies in a quite inaccessible territory in the west of the island in the zone influenced by the trade winds. The population consists of only few plants, with a maximum of three flowering plants and six seedlings.

Location noted: Artenara, Tamadaba-Faneque surroundings, UTM: 28R DS 29 04, D. González, 02-2014 & 06-03-2019, (!).

CONCLUDING REMARKS

Orchids are almost exclusively distributed on the Northern part of the island of Gran Canaria. This distribution pattern reflects the adequate growing conditions to the zones influenced by the trade winds, contrasting with the dry and arid, unsuitable conditions to the leeward zones, where the orchids only appear in certain favourable niches. Trade wind influenced areas and mountains of Gran Canaria coincide with the areas of most intense agricultural use or areas of grazing over the centuries. As a consequence, orchid species were restricted to small areas or steep and inaccessible sites, as happened with many other species of the native or endemic flora. Abandonment of farming activities, together with the reforestation programs is allowing the recovery of the natural vegetation. The orchids still have areas of discontinuous distribution, but the perspectives have improved, thanks to these protective measures, although the intensive grazing reduces the number and surface of appropriate biotopes.

From the point of view of the habitat, many species show trends linked to specific environmental needs. In general, *H. tridactylites* is the species with the largest area of occupation within the island with a preference for the thermophilous forest or open spaces of the *Erica arborea* bushes ("Monteverde"). *Orchis patens* subsp. *canariensis* prefers the cliffs and cornices of the high zone of the Monteverde and the damp pinewood; *Gennaria diphylla*, sometimes accompanying *Habernaria tridactylites*, prefers the undergrowth of the Monteverde or the more humid pine forest areas. *N. maculata* is more restricted to the montane pine forest. *Ophrys bombyliflora* and *S. parviflora* appear in more or less open grasslands of trade wind influenced zones but do not present preferences for specific local environments. *Himantoglossum*

metlesicsianum, only very recently found for the first time in Gran Canaria, seems to prefer pine forests of moist environments.

Population density

For the most frequent species (*H. tridactylites*, *O. patens* subsp. *canariensis*, *G. diphylla* and *N. maculata*), we also made a map showing the size of the populations visited. For this we only used the data that contained the exact or estimated number of orchids flowering on the site. This enables to show the main distribution areas of the orchids.

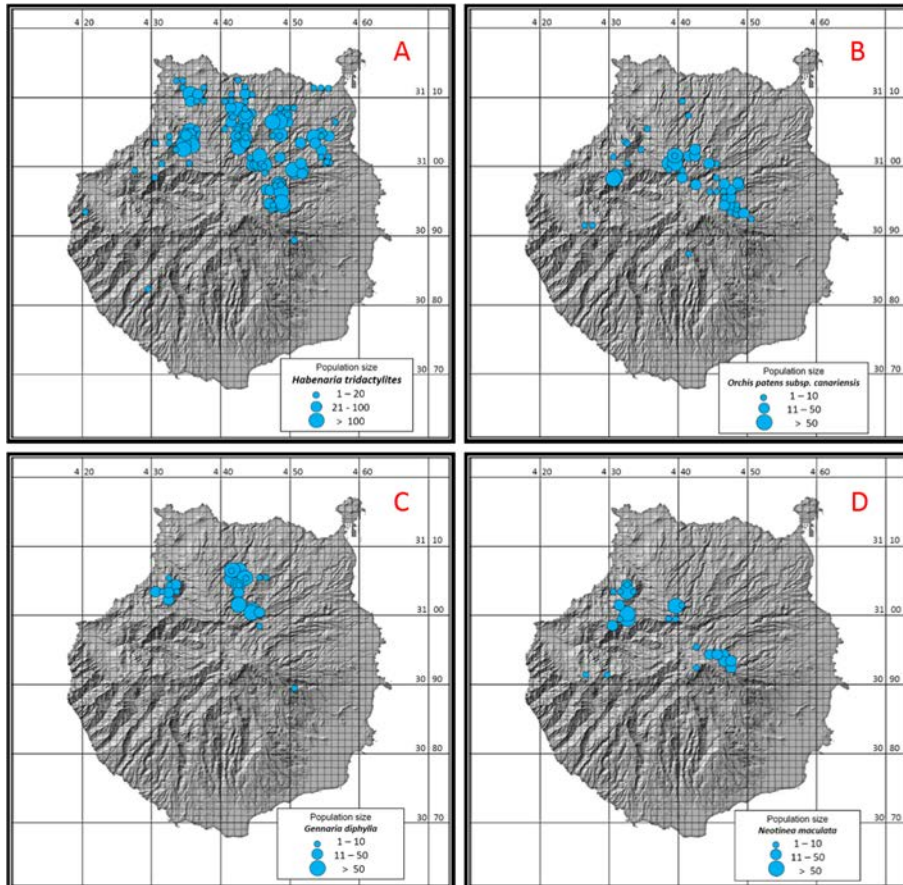


Figure 13.- Maps of population density of: A) *Habenaria tridactylites*, B) *Orchis patens* subsp. *canariensis*, C) *Gennaria diphylla*, and D) *Neotinea maculata*.

The current distribution of *H. tridactylites* appears fragmented, presenting areas of greater density in the thermo-sclerophilous forest, in Monte Lentiscal, the lower zone to El Brezal, Moya and at both ends of the mountain area, that is in the region around Tenteniguada and Vega de San Mateo with another center near Tamadaba (Figure 13-A). Our observations show that *O. patens* subsp. *canariensis* is concentrated around the summits of Tenteniguada, where we found various sites with the highest number of

plants observed, with other important centres in higher areas of Tejeda, Artenara and the Altavista-Tirma pinewood (Figure 13-B). *Gennaria diphylla*, whose distribution is more restricted to the Monteverde, shows centers of remarkable density on the northern slope in the surroundings of the Barranco de La Virgen, Valleseco, Moya-Fontanales, and towards the Tamadaba pine forest (Figure 13-C). *N. maculata* presents two main centers of concentration: the environments of the Caldera de Los Marteles, Cuevas Blancas and the height of Tenteniguada on its eastern edge, and the Tamadaba-Tirma surroundings to the West (Figure 13-D).

Generally, we can say that the surroundings and summits of Tenteniguada and the Tamadaba-Tirma pinewoods are the principal areas for orchids, showing the highest number of individuals and of growing sites. We hope that this survey can contribute to the protection of orchid sites in Gran Canaria and to the further study of this interesting and endangered plant family.

JC and MC initiated the study, collected field data (29% of the UTM-km grids) and wrote the initial manuscript. AM contributed specimen data, field data (57% of the UTM-km grids), revised the manuscript, adding the exsiccata and distribution data, comments ecological and bioclimatic data and prepared the maps of distribution. CS along with AM contributed data from field (20% of the UTM-km grids). DR collected field data (13% of the UTM-km grids).

ACKNOWLEDGEMENTS

We want to thank Marilu Cabrera Valenciano, Fernando González Sánchez, Antonio Martín Guadalupe, Rubén Barone Tosco, Rutger Barendse, Jeroen Willemsen, Erik Sloomweg, Gertjan van Noord, Noortje Budding, R. López González & C. Ríos Jordana for support and for providing data on the distribution of the orchids; José Enrique Arnold allowed us the use of photos of various species. We thank J.R. Acebes-Ginovés (TFC) and J.A. Reyes-Betancort (ORT) for providing data and photos of the *Serapias parviflora* voucher. Juli Caujapé revised the English version. The basic cartography has been obtained from Grafcan, IDE Canarias.

REFERENCES

- ACEVEDO RODRÍGUEZ, A. & R. MESA COELLO, 2013.- Adiciones corológicas de *Himantoglossum metlesicsianum* (W. Teschner) P. Delforge (Orchidaceae): primera cita para la isla de la Palma (Islas canarias). *Bot. Macaronésica* 28: 123-128.
- ACEBES, J.R., M.C. LEÓN, M.L. RODRÍGUEZ, M. DEL ARCO, A. GARCÍA, P.L. PÉREZ DE PAZ, O. RODRÍGUEZ, V.E. MARTÍN & W. WILDPRET, 2010.- Pteridophyta, Spermatophyta. En: Arechavaleta, M., S. Rodríguez, N. Zurita & A. García (coord.). *Lista de especies silvestres de Canarias. Hongos, plantas y animales terrestres. 2009*: 119-172. Gobierno de Canarias.
- AEDO, C. 2005a.- *Orchis*. In Castroviejo, S., Aedo, C., Laínz, M., Muñoz Garmendia, F., Nieto Feliner, G., Paiva, J. & Benedí, C. (eds.). *Flora iberica XXI, Smilacaceae-Orchidaceae*: 114-146. Real Jardín Botánico, CSIC, Madrid.
- AEDO, C. 2005b.- *Gennaria* Parl. In Castroviejo, S., Aedo, C., Laínz, M., Muñoz Garmendia, F., Nieto Feliner, G., Paiva, J. & Benedí, C. (eds.). *Flora iberica XXI, Smilacaceae-Orchidaceae*: 75-77. Real Jardín Botánico, CSIC, Madrid.
- ALDASORO J.J. & L. SÁEZ, 2005.- *Ophrys* L. [nom. cons.]. In Castroviejo, S., Aedo, C., Laínz, M., Muñoz Garmendia, F., Nieto Feliner, G., Paiva, J. & Benedí, C. (eds.). *Flora iberica XXI, Smilacaceae-Orchidaceae*: 165-195. Real Jardín Botánico, CSIC, Madrid.

- BERNARDOS B., M. GARCÍA-BARRIUSO, M.C. LEÓN-ARENCEBIA, A. REYES-BETANCORT, R. GONZÁLEZ-GONZÁLEZ, M. PADRÓN & F. AMICH 2006.- A cytotoxic study of three endemic orchids of the Canary Islands. *Ann. Bot. Fennici* 43: 161–166.
- BORNMÜLLER, J. 1904.- Die nachfolgende Arbeit: Ergebnisse zweier botanischer reisen nach Madeira und den Canarischen Inseln. *Botanische Jahrbücher*: 387-492.
- BRAMWELL, D. & Z. BRAMWELL, 1990.- *Flores silvestres de las Islas Canarias*. Madrid, Editorial Rueda, 376 pp.
- BRAMWELL, Z. & D. BRAMWELL, 2001.- *Flores silvestres de las Islas Canarias*, 4ª eds. Madrid, Editorial Rueda, 437 pp.
- CARRACEDO, J. C. & F. J. PÉREZ-TORRADO, 2013.- Geological and Geodynamic context of the Teide Volcanic complex. *Teide Volcano*, Springer: 23-36.
- CLAESSENS, J., 2014.- Ein Vorkommen von *Himantoglossum metlesicsianum* im Norden Teneriffas. *Ber. Arbeitskrs. Heim. Orchid* 31(1): 213-218.
- CLAESSENS, J., 2015.- *Himantoglossum metlesicsianum* in Northern Tenerife: An Endangered Orchid. *Journal of the Hardy Orchid Society* 12(1): 23-29.
- CLAESSENS, J. & J. KLEYNEN, 2011.- *The flower of the European orchid - Form and function*. In Geulle, Jean Claessens & Jacques Kleynen, 440 pp.
- CLAESSENS, J. & J. KLEYNEN, 2016.- *Orchidées d'Europe, fleur et pollinisation*. Mèze, Biotope Éditions, 448 pp.
- CLAESSENS, J., J. J. BACALLADO, D. BOGARIN, L. DEDROOG, R. HEIJUNGS, R. LANGELAAN, E. VAN NIEUKERKEN, K. VAN DEN BERG, & B. GRAVENDEEL, (in press.).- Pollination of *Habenaria tridactylites* on the Canary Islands. unpublished.
- DEL ARCO, M. & O. RODRÍGUEZ DELGADO, 2003.- Las comunidades vegetales de Gran Canaria. In Rodríguez Delgado (Ed. Coord.) *Apuntes sobre la flora y vegetación de Gran Canaria*: 71-134. Las Palmas de Gran Canaria. Cabildo de Gran Canaria.
- DEL ARCO, M. & R. GONZÁLEZ, 2003.- El Bioclima de Gran Canaria. In Rodríguez Delgado (Ed. Coord.) *Apuntes sobre la flora y vegetación de Gran Canaria*: 33-39. Las Palmas de Gran Canaria. Cabildo de Gran Canaria.
- DEL ARCO, M., M. SALAS, J.R. ACEBES, M.C. MARRERO, J.A. REYES-BETANCORT & P.L. PÉREZ DE PAZ, 2002.- Bioclimatology and climatophilous vegetation of Gran Canaria (Canary Islands). *Annales Botanici Fennici*, 39: 15-41.
- FERNANDES, F.M., M.A.A. PINHEIRO CARVALHO & A.F. AGUIAR, 2003.- Pollination of Madeiran indigenous orchids. In M.A. Pinheiro Carvalho, G.M. Pereira da Costa & S. Hughes (eds.), *Proceedings of the II Symposium Island Ecosystems*, pp. 25-36. Centro de Estudos da Macaronesia, Universidade da Madeira.
- GARCÍA-GALLO A., J.R. ACEBES-GINOVÉS, V.E. MARTÍN-OSORIO & W. WILDPRET, 2003.- La flora vascular de Gran Canaria. In Rodríguez Delgado (Ed. Coord.) *Apuntes sobre la flora y vegetación de Gran Canaria*: 41-70. Las Palmas de Gran Canaria. Cabildo de Gran Canaria.
- GBIF.org, 2017.- GBIF Home page. Retrieved 13nd November, 2017, from <http://gbif.org>.
- GOVAERTS, R. 2003.- *World Checklist of Monocotyledons Database in ACCESS*: 1-71827. The Board of Trustees of the Royal Botanic Gardens, Kew.
- GOVAERTS, R. 2011.- *World checklist of selected plant families published update*. Facilitated by the Trustees of the Royal Botanic Gardens, Kew.
- HERNÁNDEZ BELLO, S. & R. BARONE, 2015.- Aportación a la iconografía científica de *Himantoglossum metlesicsianum* (W. P. Teschner) P. Delforge (Orchidaceae), endemismo canario en peligro. *Vieraea* 43: 335-337.
- HOHENESTER, A. & W. WELSS, 1993.- *Exkursionsflora für die Kanarischen Inseln: mit Ausblicken auf ganz Makaronesien*. Stuttgart, Ulmer, 374 pp.
- JARDÍN BOTÁNICO CANARIO VIERA Y CLAVIJO, 2017.- *Flora de Gran Canaria*. Retrieved 8-12-2017, from <http://www.jardincanario.org/web/viera-y-clavijo>.
- KELLER, G., R. SCHLECHTER & R. VON SOÓ, 1928.- *Monographie und Iconographie der Orchideen Europas und des Mittelmeergebietes*, Verlag des Repertoriums, 472 pp.
- KROFF, M., E. SOMMERKAMP & K. BERNHARDT, 2012.- Population dynamics of *Barlia metlesicsiana* (Orchidaceae) endemic to Tenerife (Canary Islands). *Bocconea* 24: 271-276.
- KRETZSCHMAR, G & G. KREUTZ, 1993.- Beitrag zur Orchideenflora von Teneriffa. *Ber. Arbeitskreis Heim. Orchid.* 10 (1): 26-44.
- KREUTZ, 2004.- *Kompendium der Europäischen Orchideen / Catalogue of European Orchids*. Kreutz Publishers, Landgraaf, Netherlands, 240 pp.
- KUNKEL, G. 1992.- Las Monocotiledóneas. En G. Kunkel (Coord.), *Flora y Vegetación del Archipiélago Canario. Tratado florístico de Canarias, 1ª parte*: 229-288, Edirca, Las Palmas de Gran Canaria.
- KUNKEL, G. 1993.- *Die Kanarischen Inseln und ihre Pflanzenwelt*. Stuttgart, G. Fischer, 239 pp.
- LIANG, P. & X. ZONG-QIANG, 2009.- Effects of introducing *Eucalyptus* on indigenous biodiversity. *Yingyong Shengtai Xuebao* 20(7): 1765-1774.

- LID, J. 1967.- *Contributions to the flora of the Canary Islands*. Oslo, Norske Videnskaps Akademi, 212 pp.
- LÓPEZ, N. 2005.- *Neotinea* Rchb. fil. In Castroviejo, S., Aedo, C., Lainz, M., Muñoz Garmendia, F., Nieto Feliner, G., Paiva, J. & Benedí, C. (eds.). *Flora iberica XX, Smilacaceae-Orchidaceae* I: 111-114. Real Jardín Botánico, CSIC, Madrid.
- MARRERO Á., M. GONZÁLEZ MARTÍN, M^a J. BETANCORT-VILLALVA, A. CARRASCO & A. PERDOMO, 1995a.- Adiciones y comentarios sobre la flora vascular de Lanzarote. *Bot. Macaronésica*, 22: 91-110.
- MARRERO Á., F. GONZÁLEZ-ARTELES & M. GONZÁLEZ-MARTÍN, 1995b.- Corología de varias especies raras de las bandas del sur de Gran Canaria, Islas Canarias. *Bot. Macaronésica* 22: 49-63.
- MARRERO, A. & P.L. PÉREZ DE PAZ, 1993.- Flora terrestre de Canarias y su biodiversidad. In P.L. Pérez de Paz (Edit.), *Master de Gestión Ambiental. Ecosistemas insulares canarios, usos y aprovechamientos del territorio*: 177- 189. ULL, ULPGC, Gesplan, F.S. Europeo, Viceconsejería de Medio Ambiente, Consejería de Trabajo y Función Pública. Santa Cruz de Tenerife.
- NARANJO, J., B. NAVARRO, J. NAVARRO & D. BRAMWELL, 2004.- Atlas de la flora de Gran Canaria. *Bot. Macaronésica* 25: 189-196.
- NELSON, E. 1962.- *Gestaltwandel und Artbildung erörtert am Beispiel der Orchidaceen Europas und der Mittelmeerländer, insbesondere der Gattung Ophrys*, E. Nelson mit Unterstützung des Schweizerischen Nationalfonds zur Förderung der wissenschaftlichen Forschung.
- ORSENIKO, S., G. BACCHETTA, J. CALEVO, M. CASTELLO, D. COGONI, M. GENNAI, W. LICHT, C. MONTAGNANI, E. V PERRINO, AND S. M PINNA, 2016.- Global and regional IUCN red list assessments: 1. *Italian Botanist* 1:61-85.
- PAULUS, H.F. 1999.- Bestäubungsbiologische Untersuchungen an *Ophrys bombyliflora*, *Orchis canariensis* und *Habenaria tridactylites* (Orchidaceae) in Gran Canaria (Spanien). *Ber. Arbeitskr. Heim. Orchid.* 16(1): 4-22.
- PÉREZ-CHACÓN, E., SUÁREZ, C., RIOS, C. AND SÁNCHEZ, J. 1995.- Mapa de Ambientes, Sistemas y Unidades. In J. Sánchez (dir.), *Cartografía del medio Natural de la isla de Gran Canaria. Memoria*: 21-60. Cabildo Insular de Gran Canaria, Universidad de Valencia, Universidad de Las Palmas de Gran Canaria.
- REICHENBACH, H. G. 1851.- Orchideae in Flora germanica recensitae: additis orchideis Europae reliquae, reliqui Rossicii Imperii, Algerii: ergo, tentamen orchidographiae europaeae, *Hofmeister*, 240 pp.
- RIVAS-MARTÍNEZ, S. 1995.- Clasificación bioclimática de la Tierra. *Folia Botánica Matritensis* 16, 29 pp.
- RIVAS-MARTÍNEZ, S., F. FERNÁNDEZ-GONZÁLEZ, J. LOIDI, M. LOUSA & A. PENAS, 2001.- Syntaxonomical checklist of vascular plant communities of Spain and Portugal to Association level. *Itinera Geobotánica* 14: 5-341.
- RIVAS-MARTÍNEZ, S., T.E. DÍAZ, F. FERNÁNDEZ-GONZÁLEZ, J. IZCO, J. LOIDI, M. LOUSA & A. PENAS, 2002.- Vascular plant communities of Spain and Portugal. Addenda to the syntaxonomical checklist of 2001. *Itinera Geobotánica* 15(2): 433-922.
- RODRIGO J.D. & V. MONTELONGO, 1995.- Distribución de especies significativas para la comprensión de las formaciones boscosas en Gran Canaria (Islas Canarias). *Bot. Macaronésica* 12-13: 3-16.
- SÁEZ L., M.P. QUIJADA, M.L. ALARCÓN & J.J. ALDASORO, 2005.- *Serapias* L. [nom. cons.]. In Castroviejo, S., Aedo, C., Lainz, M., Muñoz Garmendia, F., Nieto Feliner, G., Paiva, J. & Benedí, C. (eds.). *Flora iberica XXI, Smilacaceae-Orchidaceae*: 156-165. Real Jardín Botánico, CSIC, Madrid.
- SHMIDA, A. & M. WERGER, 1992.- Growth form diversity on the Canary Islands. *Vegetatio* 102(2): 183-199.
- STIERLI, J. 2011.- Die *Barlia metlesicsiana* Teschner auf Teneriffa. *AGEO-Mitteilungen* (2): 22-33.
- SUÁREZ, C. 1994.- *Estudio de los relictos actuales del monte verde en Gran Canaria*. Ed. Cabildo Insular de Gran Canaria, Consejería de Política Territorial del Gobierno de Canarias, Las Palmas de Gran Canaria, 617 pp.
- SUNDING, P. 1968.- Additions to the Flora of Gran Canaria. *Cuadernos de Botánica* III: 3-10.
- SUNDING, P. 1972.- *Vegetation of Gran Canaria*. Oslo, 186 pp.
- TERERAI, F., M. GAERTNER, S. JACOBS & D. RICHARDSON, 2013.- Eucalyptus invasions in riparian forests: Effects on native vegetation community diversity, stand structure and composition. *Forest ecology and Management* 297: 84–93.
- TESCHNER, W. 1993.- Der Bestäuber von *Barlia metlesicsiana*. *Ber. Arbeitskr. Heim. Orch* 10(1): 45-49.
- WILCOX, Y. 2014.- Spermophagus sericeus pollinisateur de *Neotinea maculata*. *SFO-Poitou-Charentes et Vendée*: 35-43.