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First Record of the Cultivation of *Gypsophila elegans* M. Bieb (Caryophyllaceae) in Cuba

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Abstract

Context: The presence of plants from the family Caryophyllaceae in a private garden located in the municipality of Ciego de Ávila, which do not correspond to any of the species from this family recorded in the preliminary inventory of Cuban vascular plants, prompted the need to effectively document their presence in the country.
Aims: To reveal the identity of the taxon, describe its main phenotypic attributes, and design an analytical key to differentiate it from related taxa; to clarify its presence in the country and compile information regarding its principal properties and current uses.
Methods: Botanical research methods were employed, including work with collections, comparison with descriptions and keys found in specialized catalogs, as well as scientific description and illustration. Inquiries were conducted with local residents to uncover aspects related to the ethnobotany of the species.
Results: *Gypsophila elegans* was recorded for the first time in Cuba, thereby adding a new genus to the country’s exotic flora. Additionally, a key is presented to identify the genera of Caryophyllaceae represented in the national territory. It is the only species of this family in the national territory that exhibits both stipules and connate sepals forming an obconic or bell-shaped calyx. It has only been observed in cultivation, but it should be considered as having the potential to naturalize and even become invasive, given its behavior in other regions of the world.
Conclusions: Due to its stable cultivation in at least one region of the country, its promising ornamental value and commercial potential as a cut flower, as well as its saponin content, *Gypsophila elegans* should be considered part of Cuba’s current economic flora.

Keywords: *Ciego de Ávila, ethnobotany, exotic flora, ornamental plant, saponins.*

Introduction

As part of the ongoing exchanges between researchers from the Bioplants Center (affiliated with the University of Ciego de Ávila “Máximo Gómez Báez”) and producers in the province of Ciego de Ávila, the ornamental cultivation of a taxon with potential for cut flower commercialization was confirmed. During the assessment of its actual economic exploitation potential for such purposes, the identity of the taxon emerged as a knowledge gap that constrained the subsequent analyses to be conducted.

A preliminary systematic determination, carried out by specialists from the Julián Acuña Galé Herbarium at the University of Camagüey “Ignacio Agramonte Loynaz,” revealed the

possibility that the specimen belonged to an exotic species of the family Caryophyllaceae not previously recorded in the country (sensu Greuter & Rankin, 2022; Vega-Catalá & García-Beltrán, 2024). To verify this, a more detailed investigation was required from both taxonomic and phytogeographic perspectives, for which the collaboration of Duilio Iamonico (Sapienza Università di Roma, Italy), a renowned specialist in this plant group, was requested.

This article aims to reveal the identity of the taxon, describe its main phenotypic attributes, and design an analytical key to differentiate it from related taxa; to clarify its presence in the country and compile information regarding its principal properties and current uses.

Materials and methods

The *in situ* study included the collection of herbarium specimens and digitized images, as well as the gathering of seeds to promote future cultivation. Inquiries were also conducted with the family that owns the land where the plant grows, in order to understand their motivations for cultivating the species, the original source of the propagation material, and the common names they use to refer to it.

The herbarium specimen was incorporated into the Julián Acuña Galé Herbarium at the University of Camagüey (HIPC, acronym according to Thiers, 2024). The identification was carried out through comparison with descriptors and keys found in Li et al. (2022); El Mokni & Iamonico (2023); and POWO (2024). Additionally, digitized specimens from the following herbaria were consulted: BM, E, K, LE, LINN and SAV, whose access was provided by the following sites: JSTOR and Tropics. Bibliographic sources available in BHL were also consulted. The description followed the terminology of Font Quer (2001).

The seeds were transferred to the Bioplants Center at the University of Ciego de Ávila "Máximo Gómez Báez" with the aim of inducing germination and more precisely evaluating the morphology of vegetative and reproductive structures in cultivated plants. They were sown in a polystyrene tray with 56 cells (each with a volume of 30 cm^3) in April 2024. The wells were filled with a substrate mixture composed of Typical Red Ferralitic Soil with worm humus. Two seeds were placed in each well. Approximately 20 days after emergence, the seedlings were transferred to nylon bags measuring about 35 cm in height and 17 cm in diameter. The substrate used in the seedling phase was maintained. The process continued in the climate-controlled greenhouse of the Bioplants Center. Irrigation was performed once a day. The average maximum and minimum ambient temperatures from May 1st to July 20th were taken into account.

In July, when the plants showed increased flowering, morphological characterization was conducted. For this, 10 stems were randomly selected, and their length (cm) was measured from the base. Twenty mid-aged leaves were selected, and their length (cm) and width (mm) were measured. Width measurement was done in the center of the leaf. The number of veins in each leaf was counted. Twenty flowers were randomly selected. Their diameter was measured, and the number of stamens and styles was counted. The pedicels were also measured (mm). The measurements were taken by comparison with a graduated ruler. In each case, the maximum and minimum values were identified, and the average value was determined.

The search for documentary evidence related to the presence of the taxon in Cuba included a bibliographic review and an examination of materials deposited in herbaria. HAC, HAJB, HIPC, and ULV (according to Thiers, 2024).

Results and discussion

The specimens found in Ciego de Ávila were identified as: *Gypsophila elegans* M. Bieb. (Caryophyllaceae). This species represents the first record of its genus in Cuban territory, bringing the total number of genera from this family present in the country to five.

It is therefore necessary, prior to assessing the specific situation of the species in the country, to establish an analytical key to differentiate the genera of Caryophyllaceae represented in Cuba and to present a general characterization of *Gypsophila* Medik., given that none exists in the scientific literature concerning Cuba's flora.

Analytical key for identifying the genera of Caryophyllaceae represented in Cuba

1+ Stipules present …… 2

1- Stipules absent …… 3

2+ Stipules in groups of 2-14 or more units per node, filiform, scarious ……..... *Stipulicida*

2- Stipules in groups of 2-4 per node, subulate to filiform (in this case, not scarious) …….. *Drimaria*

3+ Sepals connate, forming an obconical or bell-shaped cup …… *Gypsophila*

3- Sepals free or connate only at the base …….. 4

4+ Petals entire or slightly emarginate; stems with hairs covering the entire surface or arranged in several longitudinal lines …… *Arenaria*

4- Petals cleft or divided; stems with hairs in a single longitudinal line …… *Stellaria*

Gypsophila L. Sp. Pl. 1: 406. 1753.

Type: *G. repens* L. (Britton et Brown, Ill. Fl. N.U.S. ed. 2. 2: 71. 1913).

Annual or perennial herbs *Roots* taprooted, sometimes adventitious in decumbent stems or elongated rhizomes. *Stems* erect or spreading, becoming decumbent or prostrate, branched, terete. *Leaves* opposite, sessile; blade linear to oblong or ovate, 1 or 3-5-nerved; apex rounded or obtuse to acuminate; base slightly connate; stipules absent. *Inflorescences* cymose or thyrsoid (dichasial), multi-flowered, scattered; bracts in pairs, the proximal ones foliaceous, the distal ones smaller, herbaceous with scarious margins; bracteoles absent; pedicels erect in fruit. *Flowers* pentamerous, hypogynous, small. *Calyx* gamosepalous, campanulate to obconic-tubular; sepals connate proximally, 5-nerved, with commissural spaces membranous and devoid of nerves. *Corolla* white, pink, or pink-purple; petals free, entire or superficially emarginate to bifid, claw slightly differentiated, auricles and coronal appendages absent. *Androecium* with 10 stamens; nectaries at the base of the filaments; stamens 10; filaments free almost to the base; staminodes absent. *Gynoecium* with superior ovary, 1-locular; styles 2(-3), clavate, glabrous; stigmas 2(-3), subterminal, papillate. *Fruit* a unilocular capsule, globose to ovoid-oblong, dehiscent by 4(-6) valves slightly curved distally; carpophore absent. *Seeds* 4-36, brown to black, reniform to subprismatic, laterally compressed, tuberculate, without marginal wing or appendages; hilum marginal; peripheral, curved embryo.

Includes around 150 native species from the Mediterranean region, Eurasia, southern Australia, and New Zealand (El Mokni & Iamonico, 2023; POWO, 2024). Exotic in the Americas, recorded in countries such as Argentina (Iamonico, 2022), North America (Rabeler & Hartman, 2005), Central America (Guatemala), and the Caribbean (Dominican Republic) (Iamonico, 2021, 2023 & POWO, 2024).

In Cuba, only one species is currently recorded:

Gypsophila elegans M. Bieb., Fl. Taur.-Caucas. 1: 319. 1808. Neotype (Iamonico, Phytotaxa 446: 298, 2020): [specimen] Caucasus, Terek ad Kafbek, s.d., Ex herbarium *Bieberstein w/n.* (LE #01042983 [photo!]). Fig. 1.

Annual herb, glabrous. *Root* primary vertical, 4 cm long, from which numerous secondary roots emerge. *Stems* erect, glabrous, (10-)25-43(-60) cm tall, simple or slightly branched (mostly near the inflorescence). *Leaves* linear-lanceolate to narrowly oblong, 9-13 × 14-18 mm, with 2-4 nerves; apex obtuse to acute; base connate in lower leaves, rounded in those near the inflorescences. *Cymes* corymbiform, loose. *Flowers* 13-15 mm in diameter; pedicels (10-)22-30(-35) mm, glabrous. *Calyx* (2.5-)3-3.7(-5) mm, divided up to 2/5-1/2 of its length, lobes obtuse or mucronate. *Corolla* with petals white or rarely pink, 6-8(15) mm, emarginate. *Androecium* with 9-11 stamens. *Gynoecium* with 2 styles *Capsules* globose. *Seeds* 1-1.2 × 0.8-1 mm, subreniform, black, rough, with obtuse and slightly prominent tubercles.

Some details differentiate the specimens of *G. elegans* cultivated at the Bioplants Center from the descriptions of natural populations, primarily the number of petals (6-8 vs. 5; see, for example, López, 1990; El Mokni & Iamonico, 2023. This phenomenon may be due, among other factors, to changes in the environmental conditions in which these plants developed. Primarily, the composition of the mixed substrate where they were planted, as well as the irrigation system. The average maximum ambient temperature was 32 ± 1.5°C and the minimum was 25 ± 1.9°C. However, the optimal temperature range for its development is recommended to be between 15-17°C, tolerating maximum temperatures of 20-25°C during the day and minimums of 10-15°C at night (InfoAgro, 2024). It is also important to consider that several cultivars of *Gypsophila* species are artificially selected by humans, some with supernumerary petals (for example, *G. paniculata* L. var. *adenopoda* Borbás ex Hallier (Poornima et al., 2021; INaturalistMX, 2024) 'Million Stars', with double flowers). Of *G. elegans* M. Bieb, there is a cultivar ('Covent Garden') with supernumerary petals (7 on average, sensu Schmakov, 2021). Additional studies

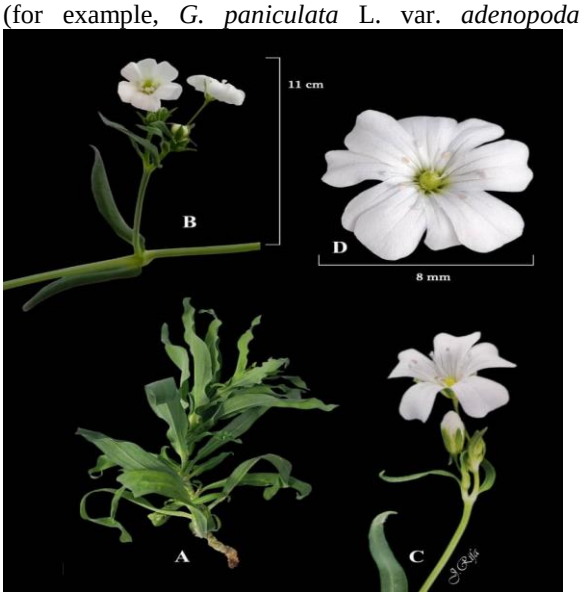

Fig. 1. *Gypsophila elegans* M. Bieb. (Caryophyllaceae). A. Main branch. B. Branching of the apex. C. Flower

will be needed to accurately determine the variant introduced in Cuba.

In Ciego de Ávila, flowering was observed during the rainy months, specifically from July to September. No fruit was observed. Propagation, according to InfoAgro (2024), should be carried out using terminal cuttings of 7.5-10 cm, taken from the mother plant, with at least three pairs of leaves. However, its propagation can also be achieved through seeds in favorable climates (EcuRed, 2024). In general, a significant portion of the seeds are not viable (authors' observation). Nevertheless, the observed and studied specimens were propagated by seeds.

G. elegans is native to a region spanning Ukraine to Iran, from where it has been introduced to all continents except Australia (El Mokni & Iamonico, 2023; POWO, 2024). In the Caribbean, it has been reported only for the Dominican Republic, where it has grown spontaneously (POWO, 2024). In Cuba, its cultivation has only been recorded in Ciego de Ávila province, specifically in the town of Modesto Reyes. The family cultivating it claims that the seeds originate from Mexico, though this information could not be verified.

It does not appear recorded in the most important sources referring to the flora of the country (De la Sagra, 1831, 1850; Grisebach, 1860, 1864, and 1866; Layunta, 1861; Sauvalle, 1873; Gómez de la Maza, 1889 and 1897; Gómez de la Maza & Roig, 1914; Seifriz, 1943; Alain, 1957 and 1969; Anonymous, 1958; Roig, 1965 and 1974; Boldo & Estévez, 1990; Esquivel et al., 1992; Herrera, 1993; Oviedo, 1994; Greuter & Rankin, 2022). It is also not included in the collections of the National Botanical Garden (National Botanical Garden, University of Havana, 1993-94), nor were herbarium specimens found in HAC, HAJB, HIPC, and ULV.

All this suggests that its introduction into the country likely occurred relatively recently. It appears to have been intentionally introduced for ornamental cultivation, but no evidence was found to identify a specific responsible party or exact time of introduction.

Observed specimens: CUBA. Ciego de Ávila. Cultivation areas of the Bioplants Center, University of Ciego de Ávila (21.884422, -76.690288), cultivated plant, VI-2024, L. Hernández CB-0021 (HIPC).

No generalized common names were recorded in Cuba. Internationally, it is known as: "common illusion," "gypsophila," and "papabel" (Picturethis, 2024; Coproa, 2024).

No references were found indicating that *G. elegans* has successfully naturalized in Cuba. Nevertheless, it is important to monitor its future behavior, as it is recorded as invasive in 17 countries or islands, including the United States and Canada (GBIF, 2024).

The genus *Gypsophila* holds an important place in the floriculture industry. Its species are used in various countries worldwide as ornamental plants in gardens, as well as fillers in decorative bouquets (Li et al., 2020; Ustuner et al., 2022; El Mokni & Iamonico, 2023). Additionally, some species have commercial importance as a source of saponins, primarily extracted from their roots (Altay et al., 2019; Elateeq et al., 2022; Ustuner et al., 2022). Among the species with the highest production of saponins, *G. paniculata* L. and *G. elegans* stand out (Casierra-Posada & Peña, 2010).

Conclusions

G. elegans M. Bieb. has been recorded for the first time in Cuba. (Caryophyllaceae), which also adds a new genus to the exotic flora present in the country. It was found under cultivation conditions in Ciego de Ávila province, with no evidence of the pathway by which it was introduced. Although it does not appear to have been naturalized, given its behavior in other regions of the world, it should be considered potentially invasive. Its evident aesthetic attributes and proven saponin content allow it to be considered part of the economic flora represented in the national territory.

Author contribution statement

Leslie Hernández-Fernández: General conception of the research, sample collection and processing, specimen identification, overall text drafting.

Osbel Mosqueda Frometa: Cultivation location, sample collection and processing, seed contribution, crop planting, monitoring of crop development, obtaining general specimen characteristics, review of the original text version.

Yanier Acosta: Sample collection and processing. Monitoring of crop development, obtaining general specimen characteristics, review of the original text version.

Isidro E. Méndez: Preparation of the analytical key, drafting of parts of the text, review of the original and final versions of the text.

Duilio Iamonico: Confirmation of specimen identification, nomenclatural refinements, drafting of text sections, review of the original and final versions of the text.

Conflict of interest statement

Not declared.

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