

Polyscias fruticosa L. in Cuba. Use Value

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Abstract

Context: The presence of previously unrecorded plant species in Cuba, from genus *Polyscias* (Araliaceae), in gardens in the city of Holguín, created the need to conduct a research study to determine their identity, origin, and properties.

Aims: To unveil the nomenclature, taxonomy, and taxon description, and to provide an illustration of the plant, and comment on the main qualities that determine its usefulness, which goes beyond the ornamental value.

Methods: Botanical methods like collection and herborization, matching to specimens from scientific collections, and comparison of descriptors and keys in specialized catalogs, including the description, and scientific illustration.

Results: The presence of *Polyscias fruticosa* L. was confirmed in Cuba. The nomenclature of the plant was determined, and an analytical key was created for contrasting to other members within the genus, which have already been recorded in Cuba. Aspects related to the usefulness for gardening and medicine, based on the presence of triterpenes, glycosides, steroids, saponins, and polyacetylene are commented.

Conclusions: *Polyscias fruticosa* L. should be included in the catalogs and scientific journals of Cuban flora. The studies of economic botany in Cuba must focus more on the plant's usefulness for gardening and traditional medicine.

Key words: Araliaceae, Cuban flora, Cuban economic flora, ornamental plants, medicinal plants.

Introduction

Fans of ornamental plants sought the help of botanical teachers at the University of Holguín to gather information in relation to the identity of a plant species cultivated in their gardens.

A first approximation led to two preliminary hypotheses: One related to a plant that frequently appears in the gardens of multiple urban and rural areas across the country, the other is *Polyscias fruticosa* L. Harms (Araliaceae).

However, this species is not recorded in the preliminary inventory of Cuban plants (Greuter & Rankin, 2017). This seeming contradiction demanded specialized analysis, which brought about an initial consultation of a research protocol.

The aim of this paper is to reveal the results of studies done to reveal the identity of the species, to determine the presence and record in the country, to provide a description of the plant, and an analytical key for contrasting to similar taxons, and to compile related elements in terms of use, and the main properties.

Materials and Methods

This research was conducted within the frame of the tasks of business project: *Sanitation and Protection of Ecosystems Associated to Communities Affected by Climate Change*, managed by the Department of Biology-Geography at the Faculty of Natural and Agricultural Sciences, University of Holguín, and the Provincial Botanical Garden.

The reflections associated to the phytochemistry and usefulness of the taxon also contributed to this project. *Plant Biotechnology: Support to local development, based on the teaching-research-production link of Biology and Agronomy Degrees, in the University of Holguín, and the Center for Biopreparations (CENBIO), from MINSAP.*

The species was screened on gardens of Holguín, Camagüey, Mayari, Moa, Puerto Padre, and Potrerillo (rural area in the municipality of Rafael Freyre). Digital images were made, and the morphology of vegetative and reproductive plant structures were evaluated. The owners were interviewed about the common names and phenology of the plant. A representative sample was herborized, and introduced to HIPC, the Herbarium of the City of Camagüey (acronyms from Thiers, 2016).

The species was identified by comparing with descriptors, keys, and images from different works, including: Lowry & Plunkett (2010). Besides, digitalized samples of HAC were consulted.

The terminology established by Font Quer (1975) was used for description. The search for possible documentary evidence of its presence in Cuba included bibliographic review, and a review of material deposited in herbariums: HAC, HAJB, HIPC and ULV.

Results and discussion

The application of previously described research methods permitted to corroborate the preliminary taxonomy determination of the plant studied: *Polyscias fruticosa* L. Harms (Araliaceae). Although genus *Polyscias* is not a novelty in the Cuban flora (Greuter & Rankin, 2017), it had not been described in detail so far, within the national scientific literature.

Polyscias J. R. Forst. & G. Forst., Char. Gen. Pl. 63. 1775.

The genus comprises poorly ramified evergreen trees and shrubs. Leaves: alternate, mostly imparipinnate (bipinnate or tripinnate), seldom simple leaves; generally long and amplexicaule petiole; entire or divided, dissect in some cultivars, opposing folioles; stipules inconspicuous attached to the base of petiole. Terminal panicles: formed by small umbels or capitella. Flowers: bisexual or unisexual; articulated pedicels under the calyx, occasionally having a verticil with secondary-calyx like bracts. Calyx: gamosepaloid, ring-like, dented or undulate. Corolla: dialipetalous, having 4-5 petals; valvate petals. Androecium: having 4-5 stamens (same number of petals); beige stamens; short filaments (approx. 2.5 mm); ovate anthers. Gynoecium: having inferior ovary, 2-13-loculate, each locule having a

seminal rudiment; as many styles as loculi, often attached on the base; elongated, base-broadened stigma. Fruit: globose drupe, fleshy, with persistent calyx and styles; 2-8 pyrenes. Seed: abundant endosperm and a very small embryo.

The name comes from Greek *poly* (numerous), and *skias* (umbrella), alluding to several umbrellas that make the inflorescence (Sánchez 2007).

It comprises about 1000 species distributed in the tropics of Europe, Australia, and the Pacific islands; particularly abundant in Madagascar, Mascarenas Islands, New Guinea, and New Caledonia (Sánchez 2007). In Cuba, Greuter & Rankin (2017), species have been recorded: *Polyscias balfouriana* (André) L. H. Bailey y *Polyscias guilfoylei* (W. Bull), though every species recorded in the country through history was not included, which has been explained in this paper.

Polyscias fruticosa (L.) Harms Nat. Pflanzenfam. 3(8): 45. 1894 ≡ *Panax fruticosus* L. Sp. Pl. (ed. 2): 1513. 1763. ≡ *Nothopanax fruticosus* (L.) Miq. in Bonplandia 4: 139. 1865. Lectotype (Grushvitzky & al. in Novosti Sist. Vyssh. Rast.22: 182. 1985): [specimen] Herb. Linn. No. 1237.5 (LINN [photo!]).

Description.

Glabrous, 3-4 m high shrub. Leaves: 7-16 cm petiole; 20-29x 18-25cm 3-4-pinnate limb, opposing 7-15 pinnas; pinnules having 2-3 pairs per pinna, opposing below, alternate in the end; 4-6 folioles per pinna (only one in the apical, pinnati-divided), lanceolate, 0.3-3x4.5-5 cm, longly acuminate in the apex, cuneate in the base, irregularly dented or lacinate on the edges. Pannicles: 10-30 cm, having numerous ramifications in the verticil; 12-20 flower terminal umbels. Flowers: hermaphrodite or functionally male, 2-4 mm pedicels, somewhat shorter than the male flowers. Calyx: ring-like, sinuous, hyaline. Corolla: having 5 greenish petals; 2-4x2-3mm acute, deciduous ovate petals. Androecium: having 5 stamens; beige filaments; ovate, yellow-white or beige anthers. Gynoecium: hermaphrodite flowers, having a 2-3 carpellary ovary; initially concrescent styles, forming a spike, separated or twisted in the fruit; atrophied in functionally male flowers. Fruit: drupe compressed on the side, 3-4 mm diameter, black on ripening; 2 flat pyrenes. Seed: compressed, having smooth endosperm.

This species is believed to have originated from a cultivar obtained many years ago in the east of Malasya, and the west Pacific regions (Varadharajan & Rajalingam, 2011), from where it was transported to several parts of the world (Sánchez, 2007). Cultivation extended across the tropic of the old world, and it is frequently observed in Vietnam

(Hong, Hai & Tien, 2016), China, Fiji Islands, Ghana, and other tropical countries (Minh, 2020), India (Bernard, Pakianathan, Venkataswamy & Divakar, 1998). Later, it was brought to the Americas, including the Antilles: La Española, Haiti, Puerto Rico, and Virgin Islands (Acevedo & Strong, 2012), *Polyscias fruticosa* was recorded in Cuba by Gómez de la Maza (1897); Gómez de la Maza & Roig (1914), and Esquivel, Knüpfner & Hammer (1992). In turn, Roig (1965) listed this name in the index of his work, but offered no information about it. Other important catalogs on the national flora do not report its existence (De la Sagra, 1845, 1850; Grisebach, 1860, 1864, and 1866; Sauvalle, 1873; Gómez de la Maza, 1889; Agete, 1939; Seifriz, 1943; Lioger, & Sauget, 1953; Anonymous, 1958; Bolfo & Estévez, 1990; Herrera, 1993; Oviedo, 1994; Acevedo & Strong, 2012; Greuter & Rankin, 2017).

It may have been introduced in Cuba on several occasions. In the late nineteenth century, it was already known in Cuba (Gómez de la Maza, 1897), meanwhile Esquivel et al. (1992) claimed that it was part of a group of species brought on Atkin Gardens. Today, this species is cultivated in all the provinces.

Specimens observed: Province of Pinar del Río, Candelaria, Soroa, Pilila Garden (22.79343, - 83.00922), cultivated plant 12-04-1949, *Acuña 15781* (HAC). Province of Habana, vicinity of Santiago de las Vegas (22.96882, - 82.38755), cultivated plant, 29-07-1904, *Van Herman 1267* (HAC). Province of Havana, Santiago de las Vegas Experimental Agronomic Station (22.96882, - 82.38755), cultivated plant, 1-4-1925, *Roig 3544* (HAC). Province of Holguín, Holguín City, Lening neighborhood (20.886379, - 76.270089), cultivated plant in gardens, 11-I-2020, *A. Hernández, I., C. Pupo & I. E. Méndez, HPC-12517* (HIPC).

Field observations. Cuba. Province of Holguín. Municipality of Holguín. Holguín City, Lenin neighborhood (20.886379, - 76.270089); “Hilda Torrez” neighborhood, gardens of “Celia Sánchez” University Venue (20.87066 - 76.24597); “Alcides Pino” neighborhood, road to Gibara (20.90236 - 76.25800). Municipality of Rafael Freyre. Cochico, Road to Guardalavaca Beach (21.03548 - 75.99533). Municipality of Moa, Rolo Monterrey neighborhood (20.64670 - 74.92708). Province of Las Tunas. Municipality of Puerto Padre, Road to Delicias (21.19746 - 76.60189). Province of Granma. Municipality of Cauto Cristo, near the bridge on Río Cauto (20.55636 - 76.47414).

Common names: ‘aralia javanesa’ (Gómez de la Maza & Roig, 1914). The following names were given by the locals: ‘aralia’ (municipality of Rafael Freyre and Lenin neighborhood, Holguín), ‘aralia rizada’ (municipality of Rafael Freyre), ‘aralia de

cerca’ (Hilda Torres neighborhood, Holguín), ‘aralia de hojas finas’ (San Andrés settlement, Holguín).

Along with *Polyscias fruticosa* other three known species cultivated in Cuba are observed, which may be contrasted using the following analytical key:

1 Leaves of up to 40 cm long, having the last divisions rounded in the apex. *P. balfouriana*.

1* Leaves of up to 55 cm long, having the last divisions obtuse-acuminate in the apex. 2

2 Pinnate leaves, having the last divisions obtuse to broadly acuminate in the apex.

2* 2-3 pinnate leaves, having the last divisions acuminate at length in the apex. *P. fruticosa*.

This species (Fig.1) is widely used in different parts of the world with ornamental and medicinal purposes. In relation to the first notorious aspect, the compound leaf is appealing, largely acuminate folioles in the apex, having a regularly dented or lacinate margin, in intense dark green color (when growing in the shade or under less light), or green with yellowish shades (growing in the sun). In Cuba, it is often used to form hedges.

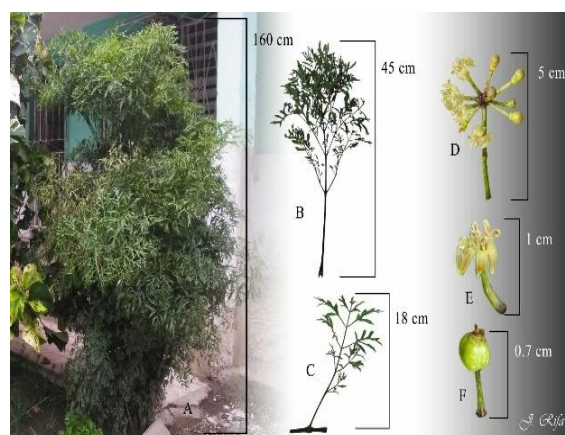


Fig. 1. *Polyscias fruticosa* (L.) Harms (Araliaceae). Photos by Julio C. Rifa Tellez and Isidro E. Méndez Santos. Photo composition: Julio C. Rifa Tellez. A-Full plant. B-Leaf. C-Base pinna. E-terminal umbel. D-flower. F-Fruit.

The people who cultivate the plant were interviewed for this research study; they assured that it grows better in the full sun light (the color of leaves occasionally turns green-yellow), though it can be grown in pots, indoors, with high levels of light. The most suitable substrate is made of two parts of peat and two parts of soil, with plenty of moisture. Periodical addition of materials that increase soil fertility is recommended. It can take pruning, though it must be thoroughly planned due to slow growing.

From a medicinal perspective, *Polyscias fruticosa* has a long list of known properties, as an analgesic (Hong et al., 2016); anti-asthma (Minh, 2020); antibacterial (Bernard et al., 1998); antidiabetic, and to prevent associated complications (renal failure and retinopathy), an effect which is increased using *Morus alba* L. (Hong et al., 2016; Le, Lay & Le, 2019); antidysentery (Minh, 2020); anti-inflammatories (Koffuor et al., 2014; Hong et al. (2016); anti-ischemic (Hong et al. (2016); anti-neuralgic (Minh, 2020); antipyretic (Hong et al. (2016); anti-rheumatic (Minh, 2020); diuretic (Varadharajan & Rajalingam, 2011; Minh, 2020); stimulating (Pérez de Alejo, Larionova, Rodríguez & Miranda, 1999), and as a fever reducer (Minh, 2020). It has also been known that it can raise animal resistance to fatigue (Pérez de Alejo, et al., 1999). The leaf extract can be used as a nanoparticle stabilizer (Yulizar & Ayun, 2016).

The above-mentioned properties are given by the chemical composition of the plant, which contains: Alkaloids (Yulizar & Ayun, 2016); steroids (Yulizar & Ayun, 2016; Minh et al., 2019); phenols (Minh, 2020); flavonoids (Yulizar & Ayun, 2016; Minh, 2020); polysaccharides (Minh et al., 2019); saponins (Yulizar & Ayun, 2016; Minh, 2020; Minh, et al., 2019); triterpenes (Minh et al., 2019; Minh, 2020), sesquiterpenes (Minh et al., 2019), and volatile oils, (Joseph, Lassak & Apichart, 1990).

The utilization of the medicinal properties in Cuba is limited. The species is not recorded as such in Roig (1974), Fuentes & Expósito (1994), Rankin (1992), García, Morón & Larrea (2010). A reference to the plant with these properties was only found in Pérez de Alejo et al. (1999), who praised its action as a stimulant, due to the presence of saponoside and triterpenic fragments, which can be used in combination with the gingerols contained in *Zingiber officinale* Roscoe.

Conclusions

-The presence of *Polyscias fruticosa* L. Harms (Araliaceae) in Cuba was confirmed.

-There is sufficient evidence to assure that the species has been cultivated in the country for over 120 years, and it exists in all the provinces.

Polyscias fruticosa (L.) Harms has demonstrated its usefulness with ornamental and medicinal purposes. It is especially promising in pharmacology due to the proven existence of multiple substances.

Author contribution

Alejandro Miguel Hernández Peña: research planning, bibliographic review, creation of the

analytical key, analysis of results, manuscript redaction, final review.

Liris Ania Hernández Pérez: research planning, bibliographic review, search and location of specimens, manuscript redaction, final review.

Conflicts of interest

Not declared.

Recommendations

-To include *Polyscias fruticosa* L. Harms in the list of species that are part of the Cuban economic flora, and pay the required attention as a promising species for gardening and pharmacognosy.

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