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Trichanthera gigantea (Homb. & Bonpl.) Nees, (Acanthaceae) in Cuba

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Abstract

Context: This research is part of the efforts made to establish a new taxonomic approach of family Acanthaceae, and to have an update on the taxa introduced in Cuba. It will also include a verification of its permanence in the land, probable naturalization, and (if it occurs) its later behavior.
Aim: To elucidate the current introduction and status of the cultivation or establishment of *Trichanthera gigantea* (Humb. & Bonpl.) Nees. (Acanthaceae) in Cuba.
Methods: Botanical methods were used, such as collection studies, comparison of descriptors, and the keys found in specialized catalogs, along with the description and scientific illustration. The local population was surveyed to check how this species can be useful.
Results: This study confirmed the presence of *T. gigantea* in Cuba, with a detailed analysis of the nomenclature. The taxon was described and illustrated, and the corresponding analytical key was established to contrast it from akin specimens reported in Cuba. Aspects related to its usefulness as a forage-producing plant were tackled as well.
Conclusions: *T. gigantea* should be included in the catalogs and specialized journals on the Cuban flora. The demonstrated usefulness of the plant to produce forage will have to be considered as part of the economic botany, as it will certainly become a factor for the spreading of the plant throughout Cuba.

Keywords: *Acanthoideae, Ruelliinae, Cuban flora, forage producing plants, nacedera.*

Introduction

In the early stages of research programs to establish a new taxonomic treatment of family Acanthaceae in the Cuban flora, one of the most significant tasks was the review of newly introduced taxa in the country, to check their permanence as cultivated plants, probable naturalization, and (if that was the case) later behavior.

Among the species that needs elucidation is the one commonly known in Latin America as “nacedero”. On one hand, there are records of the existence and exploitation of this plant in Cuba (Suárez & Milera, 1996; Cancio et al., 2006; Espinosa et al., 2013); and, on the other, it does not appear in the lists of taxa observed in Cuba (Esquivel et al., 1992; Greuter & Rankin, 2017.

This paper aims to elucidate the current introduction and status of the cultivation or establishment of *Trichanthera gigantea* (Humb. & Bonpl.). Nees. (Acanthaceae) in Cuba.

Materials and Methods

The research study was conducted as part of project: Taxonomic and phytogeographic studies of Cuban flora families” (PNCBN10), from the National Basic and Natural Science Program (PNCBN10).

The *in-situ* study included the collection of specimens from herbariums, along with digital images and the morphological evaluation of vegetative and reproductive structures of the plant. The measurements were performed using a measure tape and gauge caliper.

Upon the confirmation of Acanthaceae specimens in the province of Camaguey, whose identity required elucidation, the specimens were identified through comparison descriptors and keys, such as Leonard (1930 and 1951), Gómez et al. (2002), Villanueva-Espinoza & Condo (2019). Digital images in herbariums were consulted as well. COL, F, MO, NY, P, US y WAG (according to Thiers, 2021), whose access was possible through the following sites: EOL, GBIF, JSTOR and Tropics. BHL information was consulted as well. The Font Quer (2001) terminology was used for the description.

The local population was surveyed to corroborate their knowledge of the species, their possible common names used today, and the propagation material. The herborized samples were added to the Julián Acuña Galé Herbarium, at the University of Camaguey (HIPC, according to Thiers, 2021).

The query for documentary evidence of the presence of the plant in Cuba included a bibliographic review, and a review of the materials deposited in the herbariums: HAC, HAJB, HIPC and ULV (according to Thiers, 2021).

Special scientific collections were visited (in botanical gardens, agricultural research facilities, and medicinal plants), and several specialists were interviewed. A similar procedure was performed with the private farmers growing forage species.

Results and Discussion

The initially collected specimens were identified as *Trichanthera gigantea* (Humb. & Bonpl.) Nees. (Acanthaceae), with references made in different regions of the Cuba. The first conclusion stated that it was a much better represented species in Cuba than it had been reported in the scientific literature related to the Cuban flora. Then it was necessary to evaluate whether the species deserved to be treated like the widely-spread taxa reported in Cuba.

According to Scotland & Vollesen (2000) and Tripp et al. (2013), genus *Trichanthera* belongs to subtribe Ruelliinae (globose and open-reticulate, occasionally spinulate pollen, clavate, 3-to several times apertured, mostly porate or seldom colpate); tribe Ruelliae (filament-curtain corolla and contortus pre-foliation to the left; filiform and unequal stigma lobules; with frequent hygroscopic trichomes in the seeds), and subfamily Acanthoideae (1-theca anthers and colpate pollen).

According to this, there are eight genera of Ruelliinae reported in Cuba (*Bravaisa, Dyschoriste, Eranthemum, Hygrophila, Ruellia, Sanchezia, Strobilanthes* and *Trichanthera*), which may be contrasted using the following analytical key:

1+ Small shrubs or trees. Rounded or obtuse calyx segments at the limb.....2
1- Grass (more or less sub-frutescence) or shrubs. Subulated or lanceotale calyx segments, usually acute or acuminate at the limb.....3
2+ Edged techas with asingle projection, subulated at the base, 0.1- mm. Glabrous capsule when ripe. Sessile flowers on an up to 2 mm pedicel. q mm long stigma.....*Bravaisia*
2- Non-edged techas, rounded at the base. Pubescent capsule when ripe, 2-11 mm flower pedicel. Elongated stigma of 4.0-4.5 mm.....*Trichanthera*
3+ Fertile stamens 4.....4
3- Fertile stamens 2, at times 2 staminodiae.....7
4+ Single or fassciculate flowers.....*Hygrophylia*
4- Flowers mostly on a spike, bunch, tops, or pannicles, at times axilliary.....5
5+ Creeping weeds, rooted at the knots. Single, axilliary, or fasciculate flowers.....*Dyschoriste*
5- Shrubs or grass, erected or decumbent. Tops, heads, pannicles or spikes.....6
6+ 2-20-seed capsules.....*Ruella*
6- 2-4-seed capsules.....*Strobilanthes*
7+ Yellow corolla, sub-cylindrical .....*Sanchezia*
7- Blue corolla, limbed.....*Eranthemum*

Since genus *Trichanthera and species T. gigantea* are not recorded in the scientific reports of the Cuban flora, reference data will be compiled, namely nomenclature, phenotypical characterization, ethnobotanical distribution, and behavior in the country:

Trichanthera Kunth Nov. Gen. Sp. (page ed.) 2: 197. 1818.

Type: *Ruellia gigantea* Bonpl. = *Trichanthera gigantea* (Bonpl.) Nees.

Shrubs or trees. *Branches:* squared, with numerous cystolites. *Leaves*: single, opposite, petiolate, with numerous cystolites; ovate-oblong, sub-coriaceous, glabrous laminas, with a whole or undulated margin. *Inflorescence*: panicles or terminal corymbs, dense, with various closely-arranged flowers; small triangular bracteate. Regular flowers. *Calyx*: 5-parted, lacinate. *Corolla*: red-yellowish, gamopetalous, 5-lobulate, tomentose, with a filament curtain, and contortus pre-foliation to the left in the bud. *Androecium*: 4 exerted, didynamous stamens with ciliated anthers, and rounded basal lobes. *Gynoecium*: ovoid ovary, filiform style, exerted; subulate stigma. *Fruit*: sub compressed capsule, 2-loculate, with 4 seeds (two per loculi). *Seeds*: lenticulate, glabrous.

Neotropical genus, made of two species. It is distributed from Central America to Bolivia (Villanueva-Esinoza & Condo, 2019).

It is only represented by one species in Cuba:

Trichanthera gigantea (Bonpl.) Nees Prodr. 11: 218. 1847 ≡ *Ruellia gigantea* Bonpl. Pl. Aequinoct. 2: 75–77, t. 102. 1809. Type (detailed herein): [illustration] Rivera del Magdalena, Colombia (Table 102, in Humboldt & Bonpland, 1809); isotypes: Bonplant 1545 (P #0719181 [photo!], P #0719182 [photo!]). Figure 1

Shrubs or up to 5m high trees with adventitious roots, round top. *Branches*: squared and young, round angles, diminute brown-tomentose, with prominent lenticels. *Leaves*: decussate; 1-5 cm tomentose petioles; ovate to oblong leaf laminas, of up to 26 x 14 cm, acuminate in the apex and rounded on the base, glabrous or pubescent in the veins. *Panicles*: terminal, 5-15 x 4-5 cm, brown tomentose, bracteate making 3 mm triangles. *Flowers*: regular. *Calix*: 1-1.2 cm brown tomentose, 7-10 x 5 mm segments, round at the apex. *Corolla*: 3-4 cm, red and glabrous to the edges, yellowish and silky-tomentose to the center, red and glabrous inside; 1-1,5 cm tube, limb up to 1 cm, oblong to long ovate lobules, 3-5 mm wide. *Stamen*: 2-4 cm from the spot where its insertion in the corolla tube ends. Ovary*: tomentose*, 4-5 cm style, exerted. *Capsule*: 2-4 seminate, 1,5-2 cm, obtuse at the apex, silky pubescent, closely-arranged hairs; 3 mm retinaculum, curved, truncate and erose on the top. *Seeds*: 3-4 mm lenticular, glabrous.

The reports in Cuba confirm the occurrence of blossoming between December and February. It has never been reported to bear fruit. Generally, a large number of seeds are not viable (McDade, 1983), so it is propagated by stakes (Milera et al., 1996; Rosales & Ríos, 1999).

It is native to Central and South America. Guatemala, Costa Rica, Panama, Colombia, Venezuela, Guyana, Ecuador, Surinam Brazil, Perú, and Bolivia (Leonar, 1930, 1951; Gómez et al., 2002; Villanueva-Espinoza & Condo, 2019). It was introduced in other areas. No evidence has been provided of its existence in the Caribbean (Acevedo & Strong, (2012), except in Cuba, according to this report.

Few references of its presence in Cuba were found. It is not recorded in the most relevant sources related to the national flora (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; Betancourt, 2000; Greuter & Rankin, 2017). Neither it is included in the collections of the National Botanical Garden (The University of Havana, 1993-94), or at HAC, HAJB, HIPC, and ULV.



Fig. 1. *Trichanthera gigantea* (Bonpl.) Nees. A. Plant. B. Branch fragment. C. Leaf, face. D. Leaf, back. E. Inflorescence. F. Flower, outer lateral view. G. Flower, inner cross section view. H. flower peduncle. I. Calyx, outer view. J. Corolla, inner view, cross section K. Stamin. L. Gynoecium with fragments of the calyx. M. Fruits. N. Seed. A – L, photos and composition by Julio C. Rifa Tellez. M and N, sketches by Humboldt et al. (1809), b. 102.

The above indicates a relatively recent introduction. Data from the technical sciences (Milera et al., 1996; Suárez & Milera, 1996; Cancio et al., 2006), confirm its presence in Cuba since 1990. In the 2010s, it was still thought to be found only in research institutions and small seed bank areas (Espinosa et al., 2013; Rodríguez et al., 2016).

The objective of its introduction in Cuba was associated with the fact that it is a promising species in terms of animal nutrition, though no information was found linking a particular person or moment. Probably, it was introduced on more than one occasion with the same purpose. Accordingly, the documentary evidence of its presence in Cuba may have been related to the Research Institute for Pastures and Forages (Havana), the Animal Sciences Institute (Mayabeque), the Indio Hatuey Experimental Station of Pastures and Forages (Matanzas), the Cienfuegos Botanical Garden (Cienfuegos), the Experimental Station of Pastures (Sancti Spiritus), and the University of Granma (Granma).

Specimens spotted: CUBA. Camagüey, Camagüey City, The Botanical Park of Camagüey (21.35324 – 77.875602). Cultivated plant, 18-XII-2021, *J. Rifa and R. Morales HPC-12689* (HIPC). Camagüey,

Camagüey City, Reparto Lenin (21.409213 -77.873646), cultivated plant, 4-III-2021, *R. Morales HPC-12690* (HIPC).

This species has also been recorded in Mayabeque (Rodríguez et al., 2016), Matanzas (Suárez & Milera, 1996), Sancti Spíritus (Cancio et al., 2006) and Granma (Espinosa et al., 2013).

However, the information search led to the conclusion that the plant is being cultivated outside these institutions. In the city of Camaguey, it is present in the Lenin, Jayama, and Floiran Quiros neighborhoods, as well as in the Farmers' Market. In the province, it has been spotted in the municipality of Jimaguayu.

In Cuba, is mainly known as *nacedero* (Suárez & Milera, 1996; Cancio et al., 2006; Espinosa et al., 2013). In Bolivia, it is known by the name *cenicero*; in Brazil, as *beque* and *pau santo*; in Colombia, as *aro*, *aro blanco*, *cajeto*, *fune*, *madre de agua*, *quiebrabarringo*, *yatago*, (Leonard, 1951); in Costa Rica and Panama, as *palo de agua*; in Guatemala, as *tuno*; and in Venezuela, as *naranjillo* (Leonard, 1930; Gómez et al., 2002).

No references were found in relation to a possible invasive character of the plant in areas where it has not been introduced, or that it has been naturalized in Cuba. However, being a relatively new, exotic species in Cuba, its future behavior will have to be evaluated periodically.

T. gigantea is used to make hedges, protect areas from streams, provide shade in coffee and cocoa plantations, with medicinal purposes, as a forage producer, and somehow for its wood (Gómez et al., 2002).

In health, it can be used for the treatment of chicken pox, rheumatism, liver and kidney conditions, to control blood pressure, intestinal parasites, and herpes. It is also thought to have galactogenous properties, such as in fevers, farrowing disorders in pigs, and hernias in horses (Gómez et al., 2002).

Its most frequent use is as a forage-producing plant for cattle, sheep and goats, swine, rabbits, and birds (Suárez & Milera, 1996; Rosales, 1996; Hess & Domínguez, 1998; Rosales & Ríos, 1999; Gómez et al., 2002; Quirama et al., 2002; Cancio et al., 2006; Ruiz-Fonseca & Jiménez-Campos, 2010; Posso et al., 2011; Vargas-Sánchez & Estrada-Álvarez, 2011; Brenes-Soto, 2015; Rojas-Cordero et al., 2021). Its leaves are said to have an excellent chemical composition, especially for its content of proteins, phosphorous, and calcium, which make this plant ideal for mammal nutrition during their lactation, and for laying birds.

Its yields are variable, depending on the soil types and other factors (Ruiz-Fonseca & Jiménez-Campos, 2010), though are normally high, especially under drought conditions, when the production of other species is limited (Suarez & Milera, 1996). The plant adapts well to frequent cutting of the aerial parts.

The presence of tripertenes, steroids, flavonoids, phenols, and/or tannins, saponins, and bitter and/or astringent principles has been detected in the plant. Besides, no alkaloids, chinones, reductor sugars, amino acids, lactones, cardiotonic glycosides, and essential oils have been found (Cancio et al., 2006).

Several studies have contributed to higher efficiency in the selection of more productive genotypes, multiplication, planting, and management (Milera et al., 1996; Ruiz-Fonseca & Jiménez-Campos, 2010; Posso et al., 2011; Espinosa et al., 2013).

Conclusions

Despite the time elapsed since the introduction of *T. gigantea* (Acanthaceae) in Cuba, it may not be over 50 years; its cultivation spreads gradually, so it is no longer limited to research or productive facilities. Therefore, it must be considered as part of the economic flora of the Republic of Cuba, and treated the same way as other widespread species.

Author contribution statement

Isidro E. Méndez Santos: General research conception, content review, specimen collection and identification, design of the analytical key, analysis of typification, and redaction of the manuscript.

Rayner Morales Pérez: Plant location, field data, collections, herborization, redactions of parts of the manuscript and review of the original version.

Julio C. Rifa Tellez: Collections, specimen herborization and identification, photo composition, redaction of the manuscript and review of the original version.

Conflict of interest statement

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