



Darwiniana, nueva serie

ISSN: 0011-6793

ISSN: 1850-1702

Instituto de Botánica Darwinion & Museo Botánico de Córdoba

Fonseca-Cortés, Andrés; Peña-Torres, Jairo A.
FIRST RECORD OF THE GENUS CRYPTOTAENIA (APIACEAE, OENANTHEAE) IN COLOMBIA
Darwiniana, nueva serie, vol. 9, no. 1, 2021, pp. 63-71
Instituto de Botánica Darwinion & Museo Botánico de Córdoba

DOI: <https://doi.org/10.14522/darwiniana.2021.91.942>

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FIRST RECORD OF THE GENUS *CRYPTOTAENIA* (APIACEAE, OENANTHEAE) IN COLOMBIA

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Abstract. Fonseca-Cortés, A. & J. A. Peña-Torres. 2021. First record of the genus *Cryptotaenia* (Apiaceae, Oenantheae) in Colombia. *Darwiniana*, nueva serie 9(1): 63-71.

Cryptotaenia japonica Hassk., a native species of Eastern Asia, is reported for the first time for the flora of Colombia. This taxon is easily recognized by its ternate leaves, rhombic leaflets, leaf margins irregularly serrate, cymose inflorescences, irregular rays and pedicels, white petals, cylindrical stylopodium, erect stiles, and oblong fruits with five ribs. To date, this species has been recorded only in one locality in Cundinamarca department. A neotypification of *C. japonica* is proposed and keys for the genera of the tribe Oenantheae present in Colombia, and the species of *Cryptotaenia* s. str., are presented. Additionally, we report for the first time the family Empididae (Diptera) as floral visitor of this species.

Keywords. Cundinamarca flora; exotic flora; Umbelliferae.

Resumen. Fonseca-Cortés, A. & J. A. Peña-Torres. 2021. Primer registro del género *Cryptotaenia* (Apiaceae, Oenantheae) en Colombia. *Darwiniana*, nueva serie 9(1): 63-71.

Se registra por primera vez para Colombia a *Cryptotaenia japonica* Hassk., una especie nativa del este de Asia. Este taxón es fácilmente reconocible por sus hojas ternadas, folíolos rómbicos de márgenes irregularmente aserrados, inflorescencias cimosas de radios y pedicelos desiguales, pétalos blancos, estilopodios cilíndricos, estilos erectos y frutos oblongos con cinco costillas. Al presente, esta especie solo se ha registrado en una localidad en el departamento de Cundinamarca. Se propone una neotipificación de *C. japonica* y se presenta una clave para reconocer los géneros de la tribu Oenantheae presentes en Colombia y una para las especies de *Cryptotaenia* s. str. Adicionalmente, se reporta por primera vez a la familia Empididae (Diptera) como visitante floral de esta especie.

Palabras claves. Flora de Cundinamarca; flora exótica; Umbelliferae.

INTRODUCTION

Cryptotaenia DC. (Apiaceae) is a polyphyletic genus with four species in tribe Oenantheae and three in tribe Pimpinelleae (Spalik & Downie, 2007). The species in Oenantheae form a clade that has been denominated “*Cryptotaenia* s. str.” (Spalik & Downie 2007). This group exhibits a Holarctic distribution pattern, with its members

present in regions that were important glacial refuges: *Cryptotaenia canadensis* (L.) DC. is endemic to North America, *Cryptotaenia flahaultii* Koso-Pol. to the Caucasus Mountains (Georgia); *Cryptotaenia japonica* Hassk. to East Asia (China, Japan, South Korea, and Taiwan), and *Cryptotaenia thomasii* D.C. to Italy (Spalik & Downie 2007).

Two species of *Cryptotaenia* have been used for their culinary or medicinal properties.

In Canada, *C. canadensis* is known as “honestwort” and it is used in salads, soups or as a condiment (CBA, 2001). In Japan, China, Indonesia and Taiwan, *C. japonica* is known as “mitsuba” and is cultivated as a condiment (CBA, 2001), in China, it is used as tonic to strengthen the body (Wu et al., 2014), and in Japan it is used as a garnish in soups, main course, or as an ingredient of sushi (Sanderson & Renfrew, 2005). Recently, Lu et al. (2018) reported that *C. japonica* is a good source of antioxidant, antibacterial, and anti-inflammatory compounds for applications in the food and pharmaceutical industries.

In Colombia, Apiaceae are represented by 28 genera and 64 species (Bernal, 2016), grouped in subfamilies Azorelloideae, Apioideae, Mackinlayoideae, and Saniculoideae. Subfamily Apioideae is the richest with 46 species. Tribe Oenantheae, in subfamily Apioideae, is represented in the country only by the genus *Lilaeopsis* Greene with two species, *Lilaeopsis macloviana* (Gand.) A.W. Hill and *Lilaeopsis schaffneriana* (Schltdl.) J.M. Coult. & Rose (Bernal, 2016). Eleven species of Apiaceae reported in Colombia are exotic, and three have been reported as invasive in other countries, *Conium maculatum* L. (CABI, 2020a), *Daucus carota* L. (CABI, 2020b) and *Foeniculum vulgare* Mill. (CABI, 2020c).

Herein, *Cryptotaenia japonica* is reported for the first time for Colombia. With this new record we contribute to the knowledge of the Colombian flora and, in particular, to the knowledge of exotic species, which can become invasive and often cause major phytosanitary, ecosystem, and socioeconomic problems.

MATERIALS AND METHODS

To determine the generic identity of the species, we consulted the pertinent literature on the taxonomy of Apiaceae (Posadas & Martín, 1990; Zehui & Watson, 2005; Plunkett et al., 2018) and the species of this family reported for Colombia (Bernal, 2016). For the circumscription of *Cryptotaenia*, we followed Spalik & Downie (2007). For the elaboration of the description, we measured the organs with a digital caliper with an accuracy of 0.01 mm. The herbarium vouchers were deposited in COL and UDBC (herbarium acronyms follow Thiers, 2021) and the floral visitors in the Entomological Collection of the Instituto de Ciencias Naturales (ICN-MHN-En) of the Universidad Nacional de Colombia. For the elaboration of the keys, we saw the protologues and the types deposited in JSTOR PLANTS website (<http://plants.jstor.org>) of the Colombian species of *Lilaeopsis* and of the species of *Cryptotaenia* s. str. Additionally, we saw the virtual collections from COL, L, MW, NS, P, US and VO.

RESULTS AND DISCUSSION

Cryptotaenia japonica Hassk., Retzia, 1: 113. 1856.

Cryptotaenia canadensis var. *japonica* (Hassk.) Makino, Botanical Magazine, Tokyo 22(263): 175. 1908. *Cryptotaenia canadensis* subsp. *japonica* (Hassk.) Hand.-Mazz., Symbolae Sinicae 7(3): 713. 1933. **Neotype** (designated here): Japan, Ooizumi-machi, Nerima-ku, Tokyo Pref., 1926, *T. Makino* 72334 (L-200586). Figs. 1, 2 and 3.



Fig. 1. Habitats of *Cryptotaenia japonica*. **A**, disturbed, shady environments. **B**, rocky soils. Photographs: Andrés Fonseca-Cortés & Jairo A. Peña-Torres. Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/942/1209>

Myrrhis canadensis R.S. in sched. (L. 0327079)

Sanicula japonica Tib in sched. (L. 0327081)

Herbs, glabrous, poorly branched, 20-40 cm tall. Roots tuberculate at the base, up to 40 cm long. Stems terete striated, fistulous. Petioles 5-15 cm long, sheaths 3-4 × 0.1-0.5 cm, oblong with 8-9 parallel veins. Leaves ternate, with reduced rachises, pinnate venation, with 4-6 secondary veins dichotomously branched at the apices; cuneate bases; tips acuminate; rhombic leaflets with irregularly serrated margins, lateral leaflets with asymmetric bases; terminal and lateral leaflets 4.8-5.2 × 4-4.5 cm. Inflorescence 12-16 cm long, terminal, cymose, peduncle 1-5 cm long; bract 0.4-0.5 cm long, subulate; rays 0.4-1 cm long, two or three; bracteoles 0.1-0.3 cm long, four, whorled, subulate. Flowers 0.2-0.3 mm long, 3-11 per ray, pedicels up to 1 mm long;

sepals 5, up to 1 mm long, triangular; petals 5, up to 1.5 mm long, elliptical, white, cucullated before anthesis, fully unfolded after anthesis; stamens 5, up to 1.2 mm long, inserted, ovary 2-carpellar, cylindrical; stylopodium up to 0.05 mm long, cylindrical; styles up to 0.05 mm long, erect; stigma inconspicuous. Capsules oblong, with five longitudinal ribs. Seeds 4-5 × 1-1.2 mm two, oblong, 120-180 seeds per plant.

Etymology. *Cryptotaenia* comes from the Greek words κρυπτός 'occult' and ταινία 'band' and probably refers to the oil tubes hidden in the fruits. The specific epithet 'japonica' refers to the place where the author saw this species for the first time.

Distribution and habitat. In Colombia, this species is only known from one locality in the municipality of Tena, Cundinamarca (Fig. 4).

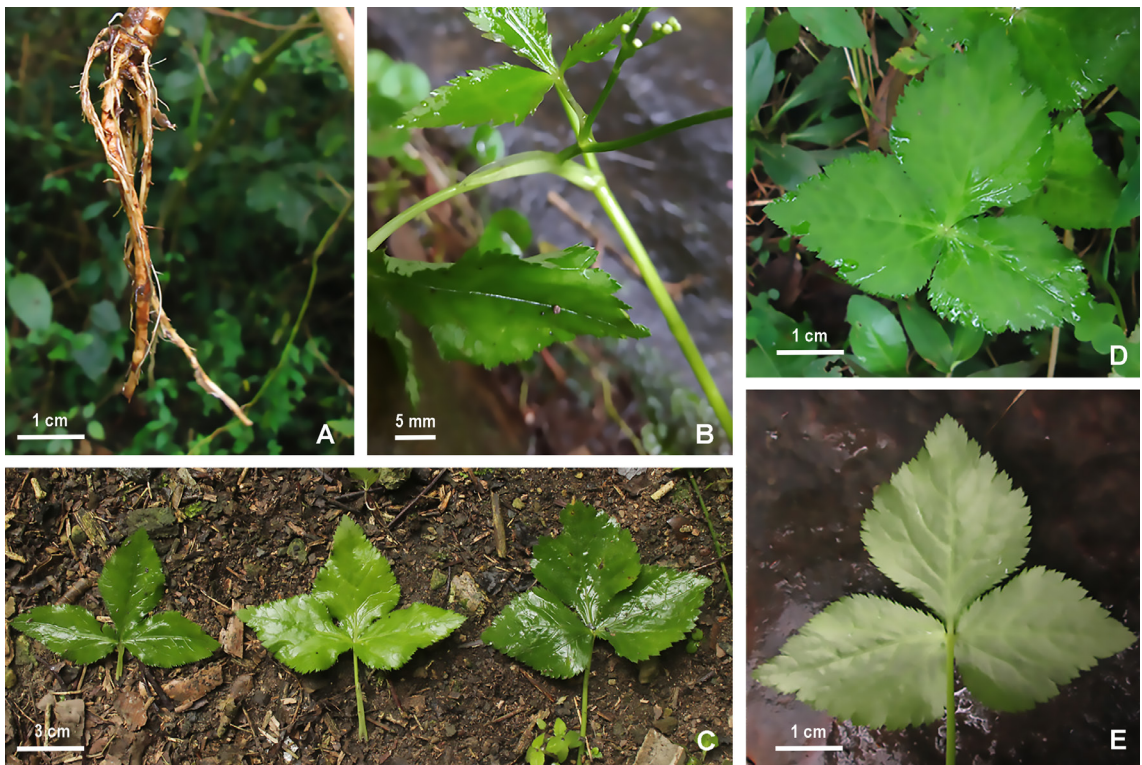


Fig. 2. *Cryptotaenia japonica*. **A**, root. **B**, sheath. **C**, variation in size of leaves from apex to base. **D**, **E**, upper and lower face of the leaves. Photographs: Andrés Fonseca-Cortés & Jairo A. Peña-Torres. Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/942/1209>

It is found in shady and humid areas, with slopes of 30-45°, on stony and clay-loam soils. The forests of these areas present a fragmentation due to the establishment of pastures for cattle and agricultural production systems of coffee and banana.

The forest patches where *C. japonica* is found are dominated by trees of *Heliocarpus*

americanus L., *Ficus tonduzii* Standl., and *Cinchona pubescens* Vahl, shrubs of *Palicourea demissa* Standl., *Miconia theizans* (Bonpl.) Cogn., and *Urera baccifera* (L.) Gaudich. ex Wedd. and herbs of *Hydrocotyle humboldtii* A. Rich., *Sanicula liberta* Cham. & Schtdl, and *Spigelia hamelioides* Kunth.



Fig. 3. *Cryptotaenia japonica*. **A**, inflorescence. **B**, infructescence. **C**, **D**, flowers. **E**, fruits. **F**, seeds. Photographs: Jairo A. Peña-Torres & Andrés Fonseca-Cortés. Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/942/1209>

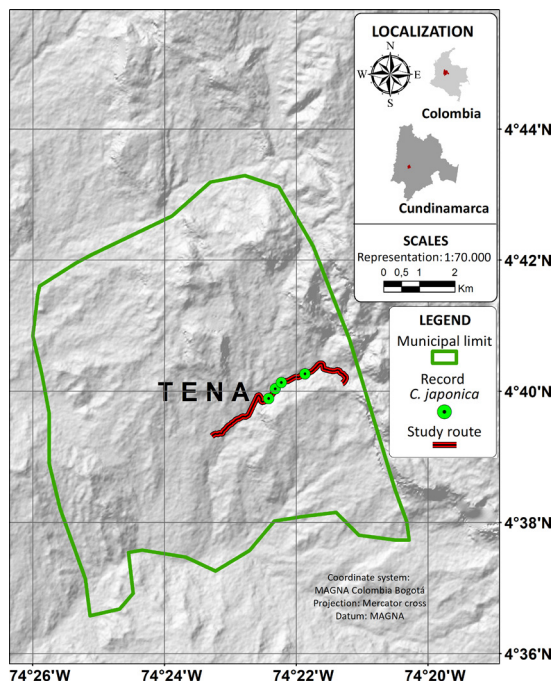


Fig. 4. Distribution of *Cryptotaenia japonica* in Colombia. Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/942/1209>

Examined material

COLOMBIA. **Cundinamarca.** Puerto Araújo, sendero de Mutis de Puerto Araújo a Tena. 4°40'6.87" N 74°22'15.58" W. 1500-1700 m a.s.l., 5-XII-2020, *A. Fonseca-Cortés et al.* 1253 (COL, UDBC).

COMMENTS

Hasskarl (1855) described *C. japonica* and cited "habit. japoniam". However, he did not mention any type, collector or collection number. According to Tropicos (2021), the type of *Cryptotaenia japonica* is cited as "China, Guizhou, Guiding, damp places in forests, *Handel-Mazzetti 10619* (PT?)". PT is not recorded in Index Herbariorum (Thiers, 2021). We saw *Handel-Mazzetti 10619* at C and GZU, this specimen was collected in 1917, 62 years after the original description of this species. Additionally, this specimen has no annotation about a posterior neotypification. "*Handel-Mazzetti 10619*" was cited in the floristic work

of the plants of the southwest China (Handel-Mazzetti, 1933), where the author also cited another collection *Handel-Mazzetti 10575*, both of which in the context of the floristic work, should not be interpreted as the types. In other works, *C. japonica* is cited (Maximowicz, 1886; Ito & Matsumura, 1899; Yabe, 1902; Makino, 1908; Makino, 1926, Yamazaki, 2001; Zehui & Watson, 2005), but the authors did not make any attempt, purposely or not, to typify the species. After a search in L, where Hasskarl deposited his types, we could not find original material of *C. japonica*. Therefore, we designate a neotype to serve as a nomenclatural type as long as the original material is missing, following Article 9.8 (Turland et al., 2018). This specimen (L-200586) was collected in the same country of the original material locality.

Cryptotaenia canadensis has been reported in Loreto, Peru, at 1600 meters above sea level, in humid and shady conditions (Brako & Zarucchi, 1993). This species is very similar to *C. japonica*, to the point of being treated as synonym of *C. canadensis* by Forbes & Hemsley (1888), Makino (1908), Handel-Mazzetti, (1933) and Brako & Zarucchi, (1993). Zehui & Watson (2005) cite "It is here treated as a species... closely resembling, but distinct from, the North American *Cryptotaenia canadensis* (Linnaeus) de Candolle". Spalik & Downie (2007) comment "These species of *Cryptotaenia* differ only slightly in leaf shape and size and inflorescence structure". However, none of them comment any character that allows to distinguish *C. japonica* from *C. canadensis*. After the analysis of the types and the collections deposited in the herbaria studied, we only could see the differences cited in the table 1 and illustrated in the Fig. 5. We strongly recommend carrying out morphometrical and palynological studies for finding out more characters that allow better distinguishing these two species.

We recorded two combinations in the exsiccata of *C. japonica* deposited at L, *Myrrhis canadensis* R.S. (L-0327079) and *Sanicula japonica* Tib (L-0327081). After a search in IPNI and Tropicos, we could not find publications that cites these two names. Therefore, these are unpublished combinations not cited in previous works.

The origin of *C. japonica* in Colombia is probably related to the soil contamination with diaspores of this species. It is common to see cultivated ornamental plants thriving along the study route, such as *Hedychium coronarium* J. Koenig, *Monstera deliciosa* Liebm. and *Tradescantia zebrina* Bosse, among others, it is possible that the original soil with which these

species were planted carried seeds of *C. japonica*, which germinated and established when they found suitable conditions of light, humidity, and temperature. It is unlikely that this species was dispersed by birds, due to the seeds has no hooks or structures that allow it to stick to the feathers of the birds and there are no reports of bird consumption of the seeds.

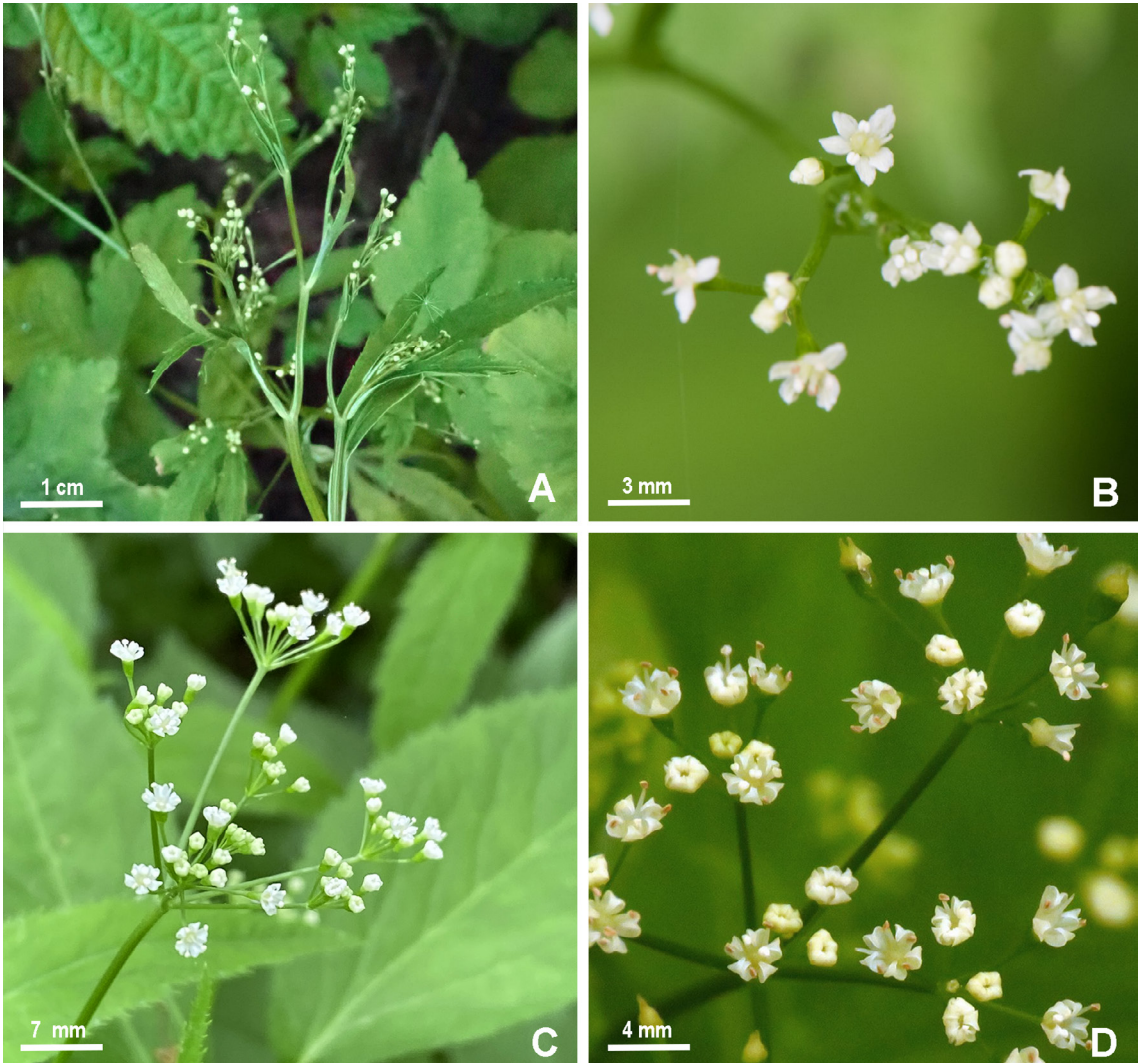


Fig. 5. Morphological differences between *Cryptotaenia japonica* and *Cryptotaenia canadensis*. **A**, cymose inflorescences with unequal rays of a *C. japonica* from Taiwan (Kuan-Chieh Hung; CC BY-NC 4.0). **B**, flowers with fully extended petals and inserted stamens in a *C. japonica* from Taiwan (Cheng-Tao Lin; CC BY 4.0). **C**, umbellate inflorescence with equal rays of *C. canadensis* from Canada (draleah; CC BY-NC 4.0). **D**, *C. canadensis* flowers with cucullated petals and exserted stamens of a *C. canadensis* from United States (A. R.; CC BY-NC-SA 4.0). Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/942/1209>

Cryptotaenia japonica is a perennial herb, with strong and long roots that allow it to grow between rocks; we observed no trace of herbivory, as no organ damage was visible in any of the plants. Each individual can produce between 120 and 180 flowers which more of the 80% become in fruits, the seeds seem to have high viability, because we saw patches dominated only by this species and we counted more than 130 individuals of different ages in a 50 m² sampling area. Given the mentioned life history traits, *C. japonica* can become a common or even an invasive species at the edges of secondary forests.

It is not known if the secondary metabolites produced by this species have any negative effect on the germination of native species, these aspects should be studied to evaluate in detail the invasiveness of this species in Colombia and in other countries in South America.

Kato et al. (1990) report two Syrphidae (Diptera) visiting flowers of *C. japonica* in the primary forest of Hayas de Ashu, Kyoto. We recorded one floral visitor (Fig. 6), a Empididae (Diptera), which consumes the nectar of the flowers, this is the first record of this family on *C. japonica*.

Table 1. Main characters and distribution of the species of *Cryptotaenia* s. str.

Characters	<i>C. canadensis</i>	<i>C. flahaultii</i>	<i>C. japonica</i>	<i>C. thomasi</i>
Roots	Tuberculate in the base	Multituberculate	Tuberculate in the base	unknown
# of cuspid in the terminal leaflet	1	3	1	3
Ovary	Oblong	Globose	Oblong	Globose
Stylopodium	> 0.2 mm	< 0.3 mm	> 0.2 mm	< 0.3 mm
Stigmas in the fruit	Erect	Reflexed	Erect	Reflexed
Inflorescence	Umbellate	Umbellate	Cymose	Umbellate
Rays of the inflorescence	Alternate	Opposite	Alternate	Opposite
Length of the rays	Equal	Equal	Unequal	Equal
Petals in anthesis	Cucullated	Cucullated	Extended	Extended
Stamens	Exserted	Inserted	Inserted	Exserted
Natural distribution	North America	Georgia	East Asia	Italy

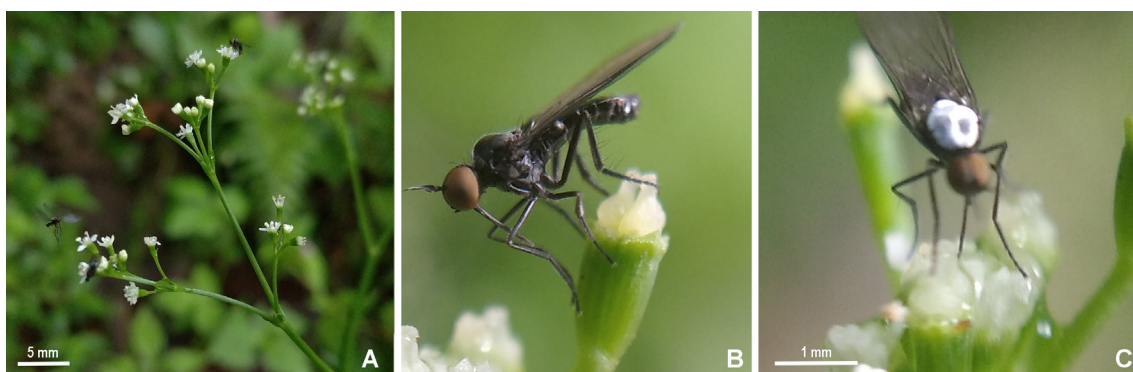


Fig. 6. Floral visitor Empididae (Diptera) of *Cryptotaenia japonica*. **A**, individuals visiting the inflorescence. **B**, side view. **C**, individual feeding nectar. Photographs: Jairo A. Peña-Torres & Andrés Fonseca-Cortés. Color version at <http://www.ojs.darwin.edu.ar/index.php/darwiniana/article/view/942/1209>

Key to the genera of tribe Oenantheae in Colombia

1. Aquatic plants, rhizomatous stems, simple, linear, hollow, transversely septate leaves, simple umbels *Lilaeopsis*
 1. Terrestrial plants, erect stems, ternate, rhombic leaves, compound umbels and cymes *Cryptotaenia*

Key to the species of *Cryptotaenia* s. str.

1. Leaflets with cuneate bases, inflorescences with opposite rays, globose ovary, reflexed styles 2
 1. Leaflets with attenuated bases, inflorescences with alternate rays, cylindrical ovary, erect styles 3
 2(1). Vigorous herbs, terminal leaflets with three cuspid of similar length, apex of the terminal leaflets with many slightly pronounced teeth *C. flahaultii*
 2. Weak herbs, terminal leaflets with the terminal cuspid longer than the other two, apex of the terminal leaflets with few teeth *C. thomasii*
 3(1). Inflorescences umbellate, congested, rays of the same length, petals cucullated in anthesis, exerted stamens
 *C. canadensis*
 3. Inflorescences cymose, pauciflorous, rays of different lengths, petals fully extended in anthesis, inserted stamens
 *C. japonica*

ACKNOWLEDGMENTS

The authors are grateful to Gustavo Romero-González (AMES), Gerardo Aymard-Corredor (PORT) and Orlando Rivera Díaz (COL) for the corrections to the initial manuscript, to Jim Solomon (MO) for the digitization of *C. canadensis* sheet present at MO from Perú, to Roxali Bijmoer (L) for the search for the type specimen of *C. japonica* at herbarium L, to the curators of A, B, BM, BP, C, E, EGR, FH, FL, G, GB, GOET, H, GZU, K, M, MO, NY, P, W, WU for searching the Handel-Mazetti specimens of *Cryptotaenia*. To Kuan-Chieh Hung, Cheng-Tao Lin, Draleah and A. R. for sharing and allowing the use of your photos under the creative commons license.

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