adansonia

2020 • 42 • 17

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Maxime ROME &
Geo COPPENS d'EECKENBRUGGE

art. 42 (17) — Published on 23 November 2020
www.adansonia.com

PUBLICATIONS SCIENTIFIQUES

MUSÉUM NAL HIST NATURELLE

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Adansonia *is a fast track journal published by the Museum Science Press, Paris*

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CP 41 – 57 rue Cuvier F-75231 Paris cedex 05 (France)
Tél.: 33 (0)1 40 79 48 05 / Fax: 33 (0)1 40 79 38 40
diff.pub@mnhn.fr / http://sciencepress.mnhn.fr

ISSN (imprimé / *print*): 1280-8571/ ISSN (électronique / *electronic*): 1639-4798

New insights into the distribution and variation of *Passiflora cerasina* Annonay & Feuillet

Maxime ROME
Université Grenoble Alpes, CNRS, SAJF, F-38000 Grenoble (France)
maxime.rome@univ-grenoble-alpes.fr (corresponding author)

Geo COPPENS d'EECKENBRUGGE
CIRAD, UMR AGAP, Avenue Agropolis, F-34398 Montpellier, France
and AGAP, Université Montpellier, CIRAD, INRA,
Montpellier SupAgro, F-34398 Montpellier (France)

Submitted on 8 January 2020 | accepted on 25 May 2020 | published on 23 November 2020

Rome M. & Coppens d'Eeckenbrugge G. 2020. — New insights into the distribution and variation of *Passiflora cerasina* Annonay & Feuillet. *Adansonia*, sér. 3, 42 (17): 273-278. https://doi.org/10.5252/adansonia2020v42a17. http://adansonia.com/42/17

KEY WORDS
Passifloraceae, subgenus *Passiflora*, series *Laurifoliae*, French Guiana, Suriname, neotypification.

ABSTRACT
Until recently, *Passiflora cerasina* was known only from two herbarium specimens. Three botanical expeditions in French Guiana, in 2008, 2009, and 2017, have greatly improved our knowledge on its geographical distribution and morphological variation. A key to the Guianese species of series *Laurifoliae* is given. As the holotype mentioned in the original description is missing, we propose a neotype collected from the *locus classicus*.

MOTS CLÉS
Passifloraceae, sous-genre *Passiflora*, série *Laurifoliae*, Guyane française, Suriname, néotypification.

RÉSUMÉ
Nouveaux éléments sur la distribution et la diversité de Passiflora cerasina *Annonay & Feuillet.*
Jusque récemment, *Passiflora cerasina* n'était connue que par deux spécimens d'herbier. Trois expéditions botaniques en Guyane française, en 2008, 2009 et 2017, ont considérablement amélioré nos connaissances sur sa répartition géographique et sa diversité morphologique. Une clé des espèces guyanaises de la série *Laurifoliae* est donnée. La description originale étant basée sur un holotype manquant, nous proposons un néotype collecté sur le *locus classicus*.

INTRODUCTION

Passiflora L. is the most important genus of the family Passifloraceae (Juss. ex Roussel), native to tropical America, South-East Asia and Oceania. Mainly distributed in the Neotropics, from coastal regions up to elevations about 4300 m, its 576 species have adapted to highly diverse environments and forged many strong interactions with animals (herbivory, mutualisms of pollination and protection), giving rise to a formidable species diversity through a particularly complex evolution and phylogeography (Rome & Coppens d'Eeckenbrugge 2018).

Five subgenera are currently recognized in the genus *Passiflora L.*: *Passiflora, Astrophea* (DC.) Masters, *Decaloba* (DC.) Rchb., *Deidamioides* (Harms) Killip and *Tetrapathea* (DC.) P.S. Green. Supersection *Laurifolia* (Cervi) Feuillet & MacDougal is part of subgenus *Passiflora*. It includes the morphologically very homogenous series *Laurifoliae* Killip ex Cervi, with a very difficult taxonomy. It is composed of 20 species (Rome & Coppens d'Eeckenbrugge 2019) of glabrous to pubescent plants, with stems that are terete to angular, and sometimes corky on old parts; leaves are entire, oblong-lanceolate, not peltate, with entire to glandular-serrulate margins and biglandular petioles; stipules are setaceous or linear, early deciduous. Their three bracts, free at base, with entire or serrulate-glandular margins, are more than 1 cm long. Their flowers are pendent, usually large and showy, often fragrant with a short hypanthium, two campanulate series of long external filaments, and a variable number of series of reduced internal filaments (Rome & Coppens d'Eeckenbrugge 2017). They are valued for their soft and sweet pulp and some species are cultivated, including *P. laurifolia* L.

The series *Laurifoliae* is very well represented in French Guiana with seven known species: *P. kapiriensis* Rome & Coppens, *P. nitida* Kunth, *P. acuminata* DC., *P. gabrielleana* Vanderplank, *P. rufostipulata* Feuillet, *P. riparia* Martius ex Masters, and *P. cerasina* Annonay & Feuillet. The latter, described from French Guiana, was distinguished from the others by the cherry red color of its bracts, sepals, petals, endocarp and ovules, thence the epithet "cerasina" given by Annonay & Feuillet (1997). According to these authors, *P. cerasina* was then known only from the Kaw mountain in French Guiana and the Brownsberg mountain in Suriname, and the holotype (*Annonay 1*), collected on the Kaw mountain, was deposited at the US Herbarium. In fact, it is not present in the collections of this institution (I. Lin, Smithsonian institution, personal communication).

Three expeditions in French Guiana in 2008, 2009 and 2017, have improved our knowledge of *P. cerasina*. Here, we revise its description and its geographical distribution in French Guiana. Following the articles 9.8 & 9.16 of the International code of nomenclature (Turland *et al.* 2018), we propose a neotype to replace the missing holotype.

MATERIAL AND METHODS

Vines like passionflowers are more visible and accessible in secondary and disturbed forests. For this study, we followed all Guianese roads that were transitable by car. Only "Camp Citron" and "La Montagne d'Or" were surveyed with other means (planes, quads).

During the three botanical expeditions in French Guiana (March to June 2008, November to December 2009, and February to March 2017), we examined 39 living specimens and two herbarium specimens of *P. cerasina* (*Vreden 13727* and *Cremers 13889*). Two plants were in fruit, 28 in vegetative state, and 9 were flowering. Only 30 plants were collected and placed into herbaria. Each plant was characterized morphologically using the same descriptor list as Ocampo Pérez & Coppens d'Eeckenbrugge (2017), with adaptations for members of series *Laurifoliae*, and georeferenced.

RESULTS AND DISCUSSION

Here we present an improved and completed description.

Family PASSIFLORACEAE (Juss. ex Roussel)
Genus *Passiflora* L.

Passiflora cerasina Annonay & Feuillet
(Figs 1; 2)

SIDA Contributions to Botany 17 (3): 551-554, f. 1 (1997). — Type: French Guiana, Montagne de Kaw, road of Kaw, Pk 6, *locus classicus*, 5.III.2017, *Rome 587* (neo-, P[P00936446, P00936447], here designated).

EXAMINED SPECIMENS. — ***P. cerasina*** (examined on fresh specimens). **French Guiana**. After Iracoubo, Pk 161.5, 13.III.2017, *Rome 581* (P00936451). — Path of gîte Moutouchi, Plateaux des Mines, 14.III.2017, *Rome 583* (P00936454), *Rome 584* (P00936452), *Rome 585* (P00936448, P00936449, P00936450). — Path of Kapiri Creek, 11.XII.2009, *Rome 222* (LYJB), *Rome 223* (LYJB), *Rome 224* (LYJB), *Rome 227* (LYJB), *Rome 238* (LYJB); 8.III.2017, *Rome 576* (P). — Road of Kaw, 23.IV.2008, *Rome 98* (LYJB); 11.XII.2009, *Rome 200* (LYJB); 5.III.2017, *Rome 573* (P00936458); 28.II.2017, *Rome 555* (P00936459, P00936460, P00936461). — Road of Roura wastewater treatment plant, 2.III.2017, *Rome 560* (P00936462). — Road of Port Larivot, 7.III.2017, *Rome 572* (P00936463, P00936464). — Road between Mana and Saint Laurent, 14.III.2017, *Rome 586* (P00936453). — Road of Saint Georges, 19.V.2008, *Rome 126* (LYJB), *Rome 127* (LYJB), *Rome 128* (LYJB), *Rome 140* (LYJB), *Rome 141* (LYJB). — Path between Camp Citron and Paul Isnard, 3.VI.2008, *Rome 153* (LYJB), *Rome 155* (LYJB), *Rome 160* (LYJB), *Rome 161* (LYJB). — Crossroad of Bœuf Mort, 3.VI.2008, *Rome 164* (LYJB). — Mounts Dékou Dékou, Montagne d'Or, 3.VI.2008, *Rome 168* (LYJB). — Path of Délice, 3.VI.2008, *Rome 173* (LYJB), *Rome 176* (LYJB). — Path of Plateau des Cascades, 5.IV.2008, *Rome 26* (LYJB).

P. cerasina (examined on herbarium specimens). **French Guiana**. Mount Grand Matoury, île de Cayenne, 5.IV.1995, *Cremers 13889* (P05619264). — **Suriname**. Mount Brownsberg, 12.VII.1974, *Vreden 13727* (BBS).

***Passiflora* sp. Guyana**. Cuyuni-Mazaruni, 2-5 km NW of northern prov. Roraima, 24.II.1989, *Hahn 5496* (US). — **Venezuela**. Amazonas; Carinagua, Caño Carinagua, 5-6 km E of Pto. Ayacucho, 19.XI.1977, *Morillo 6818* (US).

Fig. 1. — *Passiflora cerasina* Annonay & Feuillet: **A**, young stems with yellow greenish leaves, cherry red tendrils and stipules; **B**, Mature leaf with two nectaries at the middle of petiole; **C**, **D**, Flowers from the Kaw mountain (same population as holotype and neotype); **E**, transversal section of the flower, showing the fourth inner series closing the nectary chamber; **F**, Flower from the Kapiri Creek (Saint Georges), an example of variation in the color of bracts and perianth; **G**, **H**, Fruits from the Plateau des Mines, near Saint Laurent du Maroni. Scale bars: 1 cm.

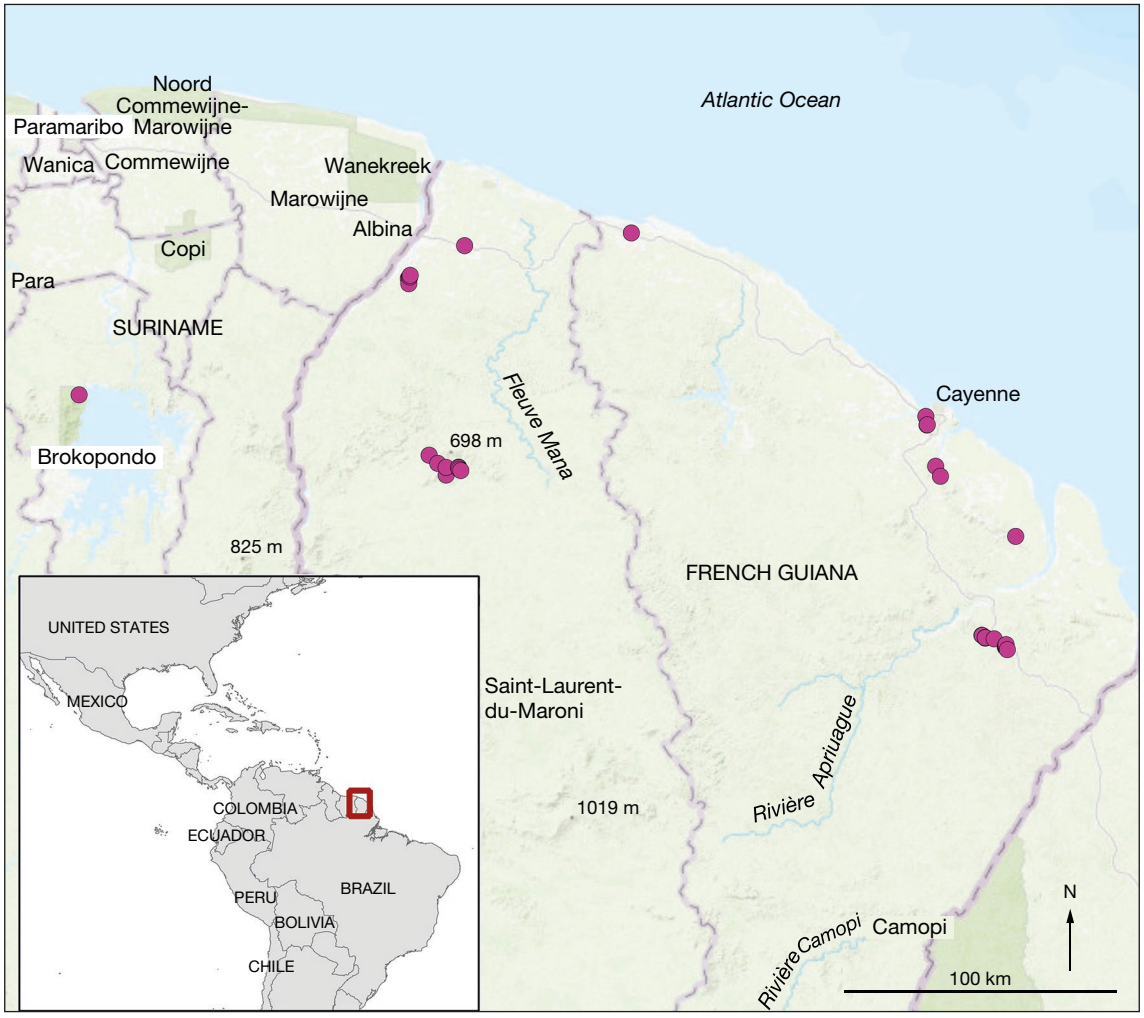

Fig. 2. — Geographic distribution of *P. cerasina* Annonay & Feuillet from field collections and herbarium specimens.

Description

Woody liana with a pubescence on young vegetative parts (stems, petioles and tendrils). Stems rounded, glabrous and green. Tendrils conical, glabrous, moderately (<80%) to strongly tinged with cherry red. Stipules setaceous to linear, greenish yellow to brown red, glandular (0-1 gland), glabrous, 6.2-9.1 × 0.3-0.7 mm, soon deciduous. Petiole 13-23 mm, greenish yellow to green, slightly canaliculate on the upper part, glabrous, with two sessile and ovate glands to 5-11 mm from the petiole base. Leaves unlobed, 9.2-15 × 5.1-8.5 cm, glabrous throughout, green to dark green (young leaves yellow), upper surface lustrous, rounded to cordate at base, obtuse (>90°) to acute (between 45 and 90°) at apex, mucronate and acuminate; margin entire to serrulate-glandular with the presence of 0-10 minute marginal nectaries. Peduncle terete, slightly to strongly tinged with red, glabrous, 1.3-2.5 mm in diameter, 26-48 mm long; pedicel 4.4-7.7 mm long. Bracts persistent (until complete ripeness of fruit), slightly pubescent on both sides, green to dark red, concave, 46-56 mm long, 30-54 mm wide, with 3-9 sessile nectaries around the upper half. Flowers fragrant (lily fragrance), axillary, pendulous, 24-29 mm long (from the nectary chamber to the ovary apex), solitary or clustered in pseudoracemes. Hypanthium slightly pubescent, purplish white to purple outside and white inside, 6.7-9.3 mm (including the nectary chamber, 5-6.3 mm long), with a diameter of 17-23 mm at the sepal base. Sepals slightly pubescent, oblong, 43-53 mm long, 13-19 mm wide, adaxial and abaxial faces highly variable in coloration, from white with pinkish or red dots to uniformly red, slightly keel-shaped in distal half with a short to medium awn (3-7.2 mm long). Petals glabrous, oblong, 42-51 mm long, 7-12 mm wide, same coloration patterns as sepals. Corona filaments in 4-5 series, banded with white and red to dark violet; two major outer series unequal; outermost series 23.6-28.9 mm long, second series 41-55.6 mm long; third series 4.6-6.4 mm long, comma-shaped, at base of the second series; the fourth and innermost series 8.5-9.5 mm long, with filaments more or less merged at base, almost perpendicular to other series, closing the hypanthium entrance; between the third and fourth series, an atrophied series is sometimes visible. Oper-

culum membranous, reddish, 3.6-5.2 mm long, recurved, thinly fimbriate at margin. Androgynophore glabrous, nearly white to densely dotted with red, 8.7-16 mm long with an enlarged, red-dotted base, with two bulges 8.9-12.8 mm in diameter. Limen atrophied or even reduced to the basal bulge. Staminal filaments 10.9-13.9 mm long, greenish white with red dots. Ovary ovoid, pubescent, light yellow, 7.1-9.6 mm long; three pubescent styles, white with red dots, 14-19.1 mm long, stigmas light yellow. Fruit oblong, pubescent, 61-84 mm long, 43-58 mm in diameter, rounded-triangular in transversal section, pericarp about 0.7-1.2 cm thick; unripe fruit green with minute white dots; ripe fruit light yellow, slightly dotted, with a sweet translucent pulp. Seeds obovoid, flat, heart shaped, coarsely reticulate, *c.* 6 × 5 mm, nearly flat, 1.5 mm thick at the middle, canaliculate at margin, each half crenate at margin, brown.

Contrary to the original description, the species appears to be pubescent on the young parts of the plant (stems, stipules, petioles), as well as on the bracts, hypanthium, ovary and styles. The morphological characterization of the new materials extends the variability in the size of vegetative and floral organs. Furthermore, the cherry red coloration of the bracts, petals, sepals, endocarp and ovules, appears to be much more variable than mentioned in the original description. Thus, the bracts can be entirely green, while the petals and sepals can vary from white with pink dots to uniformly dark red . Finally, we have not observed any red [or purple] coloration on the endocarp and the ovules.

The *locus classicus* population of *P. cerasina* still exists on Kaw mountain, with several individuals easily observable from the roadside. Only two other collection sites had been sampled for herbaria, in Grand Matoury near Cayenne and the Brownsberg mountain in Suriname. In our survey, we have observed that *P. cerasina* is common on the road between Regina and Saint Georges and on the Dékou Dékou mountains. We could also find it in the Mirande Reserve, on the road of Port Larivot, near Iracoubo, as well as on the Plateau des Mines and between Mana and Saint Laurent du Maroni. The herbarium specimens *Morillo 6818* and *Hahn 5496*, respectively collected in the Venezuelan Amazon (Puerto Ayacucho) and in Guyana (Cuyuni-Mazaruni), conserved at the US Herbarium and identified as *Passiflora* cf. *cerasina* by Christian Feuillet are sterile specimens and cannot be considered as reliable new localities, because of the very difficult identification on dry vegetative organs.

The species has been seen in flower only between February 28 and March 14, 2017, in fruit around April 10, 2008. It was flowering on July 12, 1974, when collected on the Brownsberg mountain in Suriname.

To help identify species from series *Laurifoliae* in French Guiana and Suriname, we present a determination key. It first separates the species on the most available and discriminant vegetative criterion (the position of the nectar-bearing glands on the petiole).

Identification key of Guianese species of series *Laurifoliae* Killip ex Cervi

1. Plants with two glands at the middle of petiole or below (on mature leaves) 2
— Plants with two glands at the apex of petiole or just below the apex (on mature leaves) 4

2. Flowers with two equal outer series of filaments ..... *P. kapiriensis* Rome & Coppens
— Flowers with two unequal outer series (the outermost can even be completely atrophied) 3

3. Flowers with a fourth inner series of filaments almost perpendicular to the androgynophore, closing the nectary chamber ..... *P. cerasina* Annonay & Feuillet
— Flowers without this fourth series ..... *P. riparia* Martius ex Masters

4. Flowers with two unequal outer series 5
— Flowers with equal outer series 7

5. Bracts purple pinkish ..... *P. gabrielleana* Vanderpl.
— Bracts green 6

6. Stipules orange ..... *P. rufostipulata* Feuillet
— Stipules green ..... *P. laurifolia* L. (mainly cultivated)

7. Ovary pubescent, hypanthium absent (nectary chamber directly connected to sepals), corona filaments very slender ..... *P. acuminata* DC.
— Ovary glabrous, hypanthium present, corona filaments thicker ..... *P. nitida* Kunth.

In the absence of the *P. cerasina* holotype, *Annonay 1*, at the National Herbarium of the United States (US), we propose *Rome 587*, collected on the *locus classicus*, as a neotype for the species, in accordance with articles 9.8 & 9.16 of the International code of nomenclature (Turland *et al.* 2018).

CONCLUSION

Our study extends the variability of the morphological characters of *P. cerasina* and adds new characters, absent from the original description: pubescence on young parts and styles, variability of bract and perianth color. Our extensive survey along the roads of French Guiana has improved our knowledge of the species distribution. Despite the new localities, the species remains rare as compared to *Passiflora gabrielleana* from the same group. Finally, with an edible fruit larger than the traditional kouzou (*Passiflora nitida*) cultivated in French Guiana, *Passiflora cerasina* is a good candidate for domestication tests.

Acknowledgements
The first author thanks Frédéric Danet (Herbarium of Botanical Garden of Lyon), Véronique Andro and Marc Jeanson (National Museum of Natural History of Paris) for our exchanges and the conservation of his herbarium specimens, Julien Renaud (LECA) for his help in Geographical Information System, and J. J. de Granville, Michel Boudrie, Eddy Poirier for their help on the field in French Guiana. The MNHN gives access to the collections in the framework of the RECOLNAT national Research Infrastructure.

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Submitted on 8 January 2020;
accepted on 25 May 2020;
published on 23 November 2020.