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RESEARCH ARTICLE

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Passiflora kapiriensis (*Passifloraceae*), a new species from French Guiana

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Key words

Amazonia
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passion fruit

Abstract *Passiflora kapiriensis* is a new Guianese species in the series *Laurifoliae* of subgenus *Passiflora*, found near Saint-Georges-de-l'Oyapock. The filaments of the fourth corona row are 1 cm long and oriented to the androgynophore, which is reminiscent of *P. acuminata*, *P. cerasina*, *P. fissurosa*, *P. killipiana* and *P. nitida*. It differs from these close relatives by the combination of subequal first and second rows of filaments, a very short hypanthium, very long petioles, with medial nectary glands, and much larger leaves.

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INTRODUCTION

Passiflora is divided into five subgenera (MacDougal & Feuillet 2004, Krosnick et al. 2009). Within subgenus *Passiflora*, supersection *Laurifolia* (Cervi) Feuillet & J.M.MacDougal series *Laurifoliae* Killip ex Cervi is entirely neotropical and composed of lianas that have laurel-shaped leaves with biglandular petioles, setaceous to linear early deciduous stipules, as well as three verticillate wide bracts with entire or glandular-serrulate margins. The flowers are commonly large and showy, fragrant with a short hypanthium. Petals and sepals are generally white or densely spotted with purple. The coronal filaments, usually comprises two outer series of long filaments and a variable number of inner reduced series. The two long series are subequal or the outer series is about half as long. *Passiflora acuminata* DC., *P. cerasina* Annonay & Feuillet, *P. fissurosa* M.A.D.Souza, *P. killipiana* Cuatrec. and *P. nitida* Kunth have an additional inner series of filaments, about 1 cm long, converging towards the androgynophore. The yellow fruits (berries) are generally large, with thick mesocarp and appreciable quantity of sweet and aromatic translucent pulp, produced by the arils that surround each seed. For this reason, *P. nitida* is commonly cultivated in northern South America and Central America. *Passiflora laurifolia* L. is cultivated in the Caribbean, however it is not commercially cultivated in French Guiana. Another species in this series, *P. popenovii* Killip, is highly prized in the Andes of Southern Colombia and Southern Ecuador (Yockteng et al. 2011).

As stated by Killip (1938), series *Laurifoliae* is an "exceedingly difficult" group. This author distinguished two main subgroups, one "with the outermost series of corona filaments much shorter than the next series", "the other with the outermost filaments equalling or exceeding those of the next series". Other diagnostic traits highlighted by Killip (1938) are ovary pubescence and the position of nectaries on the petiole: near the apex, close to the middle, or below the middle. Since Killip's monograph, reporting 13 species, series *Laurifoliae* has been augmented with eight more species, presenting new combinations for these criteria, as well as particular traits related to the presence of phellem or indumenta (Killip 1960, Feuillet 2004, De Souza & Hopkins 2011), shape and colour of stipules (Feuillet 1986) or bracts (Feuillet & Annonay 1997).

Series *Laurifoliae* is particularly well represented in French Guiana with seven known species (*P. acuminata*, *P. cerasina*, *P. crenata* Feuillet & Cremers, *P. gabrielliana* Vanderpl., *P. laurifolia*, *P. nitida* and *P. rufostipulata* Feuillet). They appear to occupy similar forest habitats, often close to small streams and temporarily flooded areas. This capacity to withstand excessive soil water is an interesting rare trait in *Passiflora*, with potential interest for the main commercial species, which are sensitive to root diseases (Yockteng et al. 2011).

From March to May 2007, a botanical expedition was carried out in French Guiana to characterize this remarkable diversity in series *Laurifoliae*, using a comprehensive list of 162 quantitative and qualitative descriptors. Although morphological analyses have not been completed yet, we could verify that the diagnostic traits mentioned by Killip (1938) do not vary at the infraspecific level. Three populations presented particular vegetative features, as compared to the other species of the complex. Two additional expeditions allowed for collection of fertile material and the description of this new species, under the name of *Passiflora kapiriensis* Rome & Coppens. As its flowers have the additional inner series of filaments present in *P. acuminata*, *P. cerasina*, *P. fissurosa*, *P. killipiana* and *P. nitida*, we have compared it to these five species.

Passiflora kapiriensis Rome & Coppens, *sp. nov*. — Fig.1, 2, Map 1

Passiflora kapiriensis Rome & Coppens differs from other species in series *Laurifoliae* by its unusually long petioles and wide leaves. It is unique in presenting a combination of medial petiole nectaries, an inner series of 1 cm long filaments, and subequal external series of filaments. Thus, it can be distinguished from *P. acuminata*, *P. fissurosa*, *P. killipiana* and *P. nitida*, by its two glands at the middle of the petiole (vs at apex), and from *P. cerasina* by its two subequal external series of corona filaments (vs shorter outermost series). — Type: *Rome 48* (holotype CAY; isotype LYJB, P), French Guiana, on the road between Regina and Saint-Georges-de-l'Oyapock, 56 m, N4°4'25.32" W52°2'33.72", 10 Apr. 2008.

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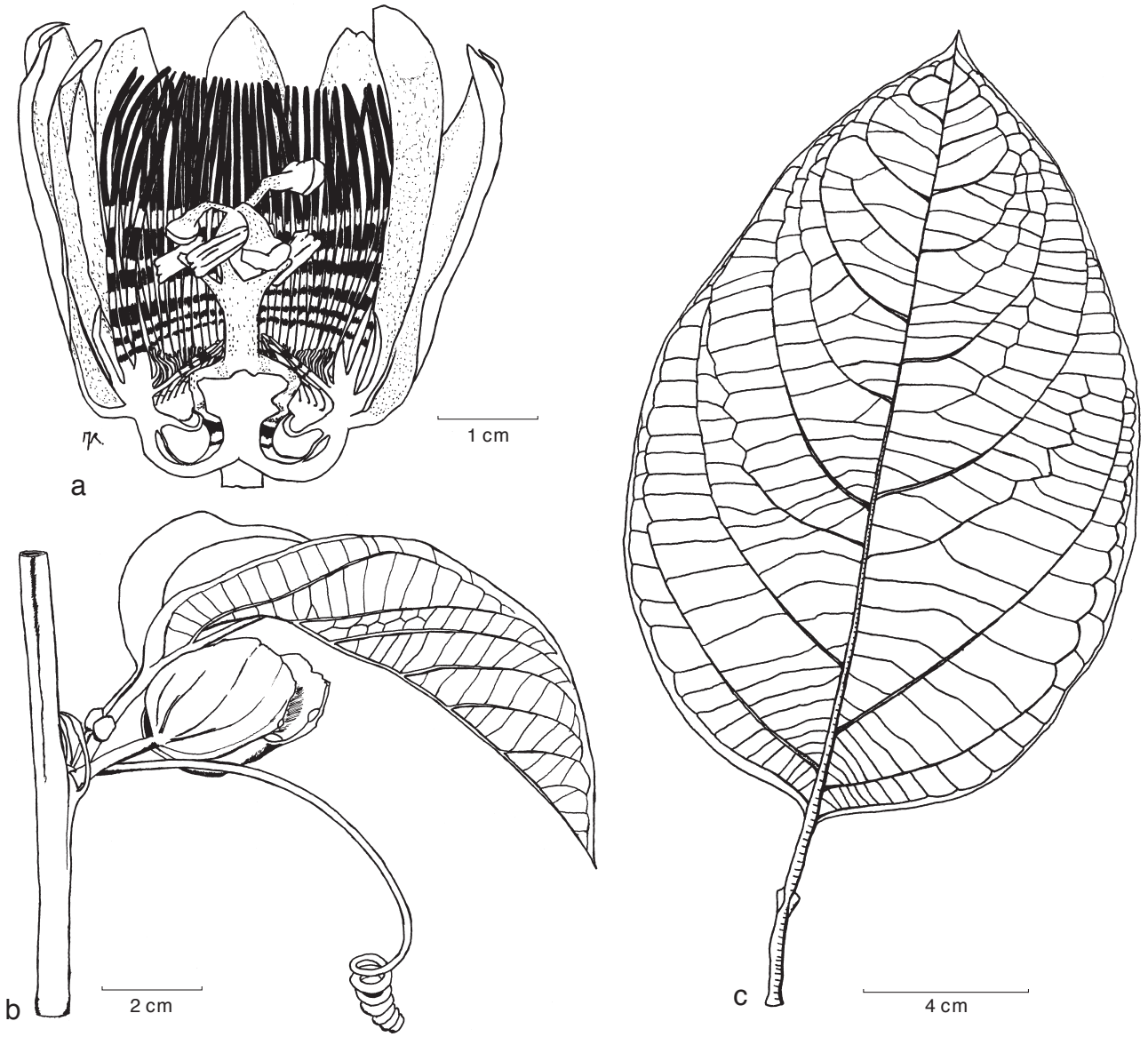


Fig. 1 *Passiflora kapiriensis* Rome & Coppens. a. Flower cross section; b. stem, leaf, with petiolar nectaries, stipules, tendril and young bud; c. leaf. — Drawing from the holotype (*Rome 48*, CAY).

Etymology. The specific epithet of the new species refers to the type locality, situated near Kapiri Creek where the species forms a large population.

Woody liana. *Stem* terete, glabrous, and green; internodes 19–60 cm. *Tendrils* glabrous. *Stipules* setaceous to linear, generally aristate, green to yellow green, glandular (1–4 nectaries), very slightly pubescent at apex, 8–18 × 0.6–1.9 mm (including an arista 1–4 mm), early deciduous. *Petiole* 3–8 cm long, green to dark green, slightly canaliculate adaxially, glabrous, bearing two conspicuous oval sessile glands (about 2 mm long), at the middle (1–4 cm from petiole base). *Leaves* simple, unlobed, 12–23 × 8–22 cm, glabrous throughout, green to dark green, adaxial surface lustrous, rounded to cordate at base, acute at apex, mucronate and generally acuminate; margins entire to glandular-serrulate (0–35 minute nectaries along margins). *Inflorescence* axillary, sessile, solitary. *Peduncles* terete, green, glabrous, wide (2.5–5 mm diam), 3–4 cm long; pedicel 3.5–4.5 mm long. *Bracts* persistent (until fruit maturity), slightly pubescent on both sides, yellow green dotted with dark purple, concave, 4–4.5 × 2 cm, with 2–4 marginal sessile nectaries in distal half. *Flowers* pendulous, 2.5 cm long (from the base of nectary chamber to the ovary apex), sometimes presented in clusters on pseudoracemes (small branches with short internodes, small leaves, and flowers at each node). *Nectary chamber* glabrous, green outside and white inside, 17.5–19 mm in outer diam, about 5 mm in depth. *Hypanthium* glabrous, green outside and white inside, about 2 mm long and 18 mm diam at the base of sepals. *Sepals* glabrous, oblate, 4–4.3 × 1.7–2 cm, adaxial surface dark purple, abaxial surface green with dark purple dots, slightly keel-shaped in distal half with a short awn (3–6 mm long) below apex. *Petals* glabrous, oblate, 3.9–4.4 × 0.8–1.1 cm, white, with dark purple dots. *Corona filaments* in four series, banded white and dark purple; two major outer series, slightly curved, subequal: outer series 41–49 mm, second series 40–48 mm; third series 1–2 mm, curved filiform capitulate; fourth inner series 8–10 mm long, straight, oriented towards the androgynophore, covering the entrance to the hypanthium. *Staminal filaments* 8–10 mm long, white greenish finely speckled with dark purple. *Ovary* tomentose, light yellow, 8–10 mm long; three styles, white, finely speckled with dark purple, 11–13 mm long, stigmas light yellow. *Androgynophore* glabrous, greenish white, finely speckled with dark purple, 15–16 mm long with a trochlea about 10 mm wide. *Operculum* membranaceous, 5–6 mm long, recurved, shortly fimbriated at the margin. *Fruit* obovoid, round in transversal section, lightly pubescent, 6–10 cm long, about 6–10 cm diam; pericarp 1.5–2.2 cm thick; immature fruits green with fine white

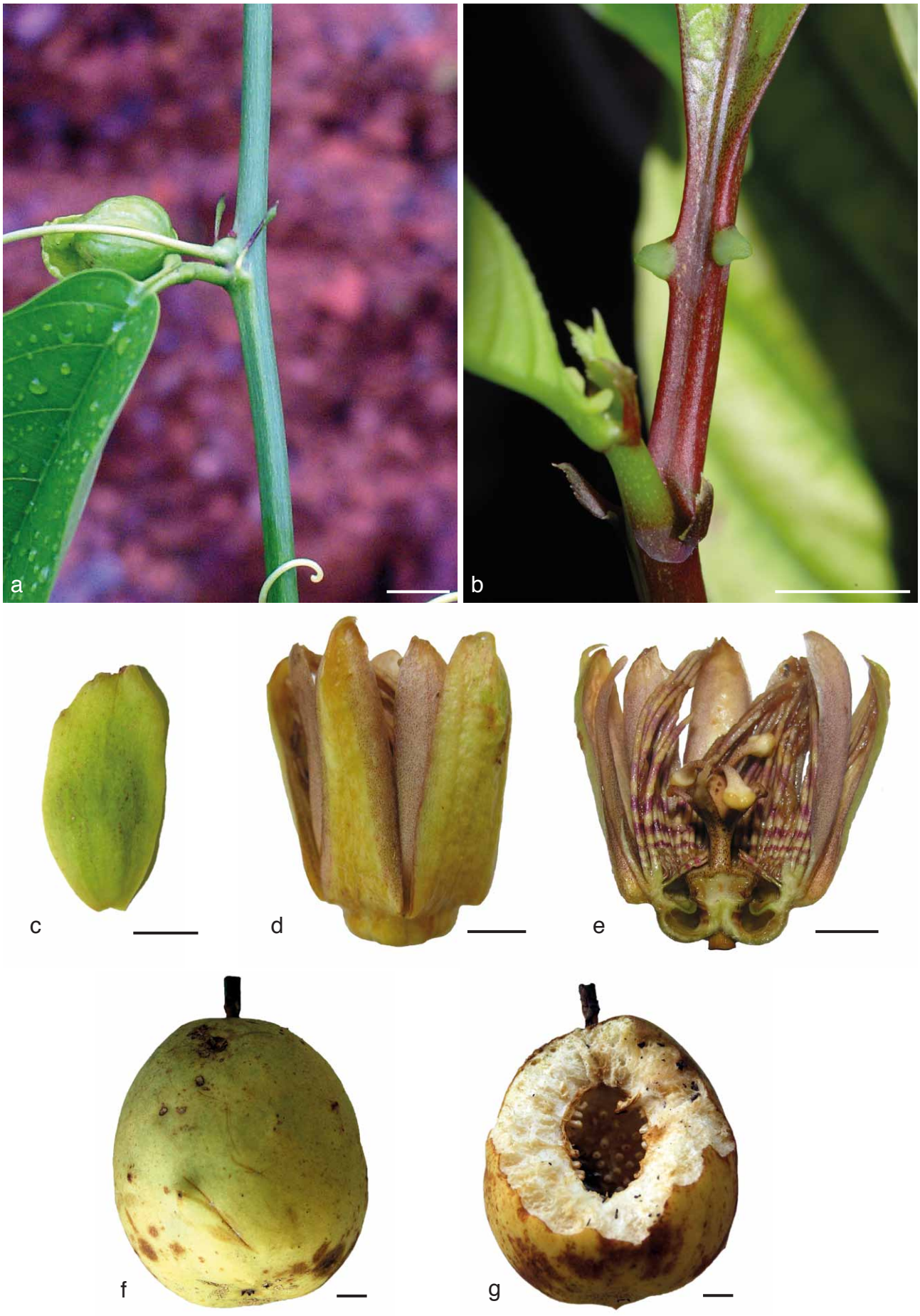


Fig. 2 *Passiflora kapiriensis* Rome & Coppens. a. Setaceous stipules with nectaries, petiolar glands and young bud (mature plant); b. conical petiolar gland and foliaceous stipules (young seedling); c. bract; d. sepals and petals (outer view); e. flower section (same as Fig. 1a); f, g. fruits, showing mesocarp. — Scale bars: 1 cm. — Photos by Maxime Rome, from the holotype (*Rome 48*, CAY) or by David Scherberich, from the holotype offspring (photo b).

Table 1 Comparison of *Passiflora kapiriensis*, *P. acuminata*, *P. cerasina*, *P. fissurosa*, *P. killipiana* and *P. nitida*, based on the descriptions of Killip (1938, 1960), Feuillet & Annonay (1997) and De Souza & Hopkins (2011), as well as cited specimens.

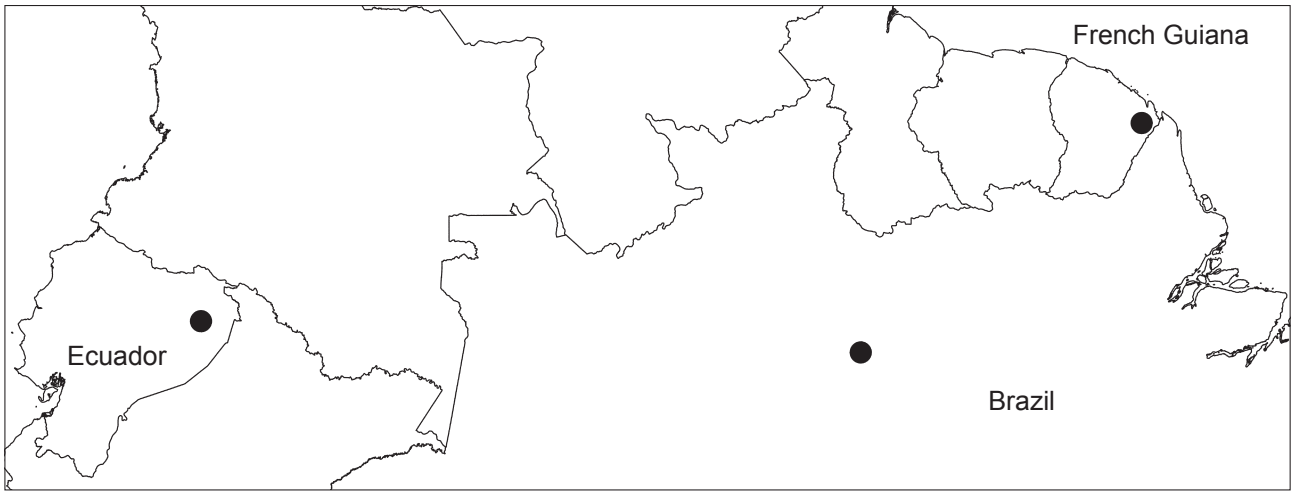
Characters	*P. kapiriensis*	*P. acuminata*	*P. cerasina*	*P. fissurosa*	*P. killipiana*	*P. nitida*
Stipules	linear, generally aristate, 8–18 mm, slightly pubescent	narrowly linear, falcate, c. 4 mm, glabrous	Linear, 3–5 mm, glabrous	Setaceous-subulate, 5 mm, glabrous	linear-subulate, 10–13 × 1 mm, ferruginous-hirtellous	linear-subulate, 5–6 mm, glabrous
Petiole	3–7 cm, biglandular at middle	c. 1 cm, biglandular at apex	2–2.2 cm, biglandular at middle	1.2–2.5 cm, biglandular at apex	7–11 mm, ferrugineo-tomentellous, biglandular below apex	up to 3 cm, biglandular at apex
Leaves	12–23 × 8–22 cm, entire to serrulate, rounded to cordate at base	7–14 × 2–5 cm, lanceolate or oblong-lanceolate, rounded or acutish at base	13–15 × 8–9 cm, entire, rounded to cuneate at base, apex acuminate	9–12 × 5–6 cm, ovate to elliptic, rounded or subcordate at base, apex acuminate	9–16 × 4–8 cm, ovate-oblong, rounded or obtuse at base, acuminate at apex, minutely and distantly crenulate, hirtellous on the nerves above	9–17 × 6–12 cm, ovate-oblong, ovate-elliptic or broadly ovate, acute or acuminate at apex, subentire to serrulate
Bracts	oblate, concave, 3.9–4.4 × 2.2 cm, slightly pubescent on both sides, yellow green with dark purple dots	oblong, 2.5–4 × 1–1.5 cm, obtuse at apex, narrowed at base, entire, green	ovate, 4.2–4.8 × 2.2–2.9 cm, pubescent, cherry-red in flower	ovate to elliptic, rounded or obtuse at base, 2.3–2.6 cm × 0.9–1.5 cm, glabrous, green outside, pinkish inside	thick, obovate-oblong, cuneate at base, deeply toothed on upper half, densely ferruginous-pubescent, 4.5–5.5 × 2–3 cm	oblong-ovate, c. 3.5 × 2.5 cm, rounded at apex and base
Corolla internal colour	densely spotted with purple	white	densely spotted with red	densely spotted with red	deep red	white
External corona filaments	two subequal rows	two subequal rows	two rows; outermost row shorter	two subequal rows	one row	two subequal rows

dots; mature fruits light orange with a sweet translucent pulp. *Seeds* obovoid, flat, retuse apex, about 1 cm long.

Phenology — The Guianese populations of *P. kapiriensis* have been observed in March 2007, April 2007, mid-November 2008 and in early December 2008, without any flowers. Many immature fruits were observed in populations in early February 2012. We suppose that this species blooms principally in late December or early January. The holotype has been found in bloom in May 2007 but with two flowers only, indicating that this flowering was secondary. Nine-month seedlings, grown at the Jardin Botanique de Lyon, show green petiolar glands, about 1 mm long, conical and slightly curved. Their stipules are foliaceous, with many minute nectary glands, instead of setaceous (Fig. 2b).

Distribution & Habitat — In French Guiana, *P. kapiriensis* is currently known only from the Kapiri Creek and from the road between Régina and Saint-Georges-de-l'Oyapock, in tropical forest, at altitudes of 40–60 m. The type locality is Régina County. Two additional herbarium specimens, *Villa 855* (QCA), found in Yasuní Park (Ecuadorian Amazonia) and *Melo 610* (INPA), found in Presidente Figueiredo (Amazonas, Brazil) present the same particular combination of traits: long petioles (c. 7 cm) with medial to submedial glands, red-to-purplish flowers with two equal outer series of filaments, a third series with very short, comma-like filaments, and a fourth inner series oriented towards the androgynophore. Thus, all indicates that they belong to *P. kapiriensis*, which implies a surprisingly wide distribution for a rare species. On the other hand, several other species of series *Laurifoliae* appear both rare and widely distributed: *P. phellos* Feuillet, dispersed in Amazonia, from Venezuela to the lower Amazon in Brazil; *P. killipiana* (three stations in Amazonian regions of Colombia and Peru, at distances comprised between 300 and 900 km); *P. gleasoni* Killip has been reported in Guyana, Venezuela and Peru. Furthermore, the rarity of these species may be only apparent; first because the Amazonian region has been poorly collected as compared to other regions (compare for example the inventory of Andean and Amazonian *Passifloraceae* of Colombia in Ocampo et al. 2007); second, because more recently and/or less often collected *Laurifoliae* species are poorly known and easily confused with or assimilated to 'older' and more common species (e.g., *Villa 855* and *Melo 610* were identified as *P.* cf. *riparia* and *P. nitida*, respectively). The online availability of many scanned specimens with approximate identification facilitates the comparison of specimens collected in different countries, which could lead us to revise supposed endemisms among *Laurifoliae*, particularly in the relatively small French Guiana.

Comparison with related species — In series *Laurifoliae*, *Passiflora kapiriensis* differs from the other species by its slightly pubescent stipules, its much larger leaves and petioles. It shares a particular floral morphology with *P. acuminata*, *P. cerasina*, *P. fissurosa*, *P. killipiana* and *P. nitida*. Indeed, these species also present a particular development of the innermost series of filaments, contributing to close the nectary chamber. In addition, it shares an extremely short hypanthium with at least *P. acuminata* and *P. fissurosa*. *Passiflora acuminata*, *P. fissurosa* and *P. nitida* differ from *P. kapiriensis* by their glabrous and shorter stipules and by their glands borne at the petiole apex. Additional differences concern the white corollas of *P. acuminata* and *P. nitida*, and the suberous stems of *P. fissurosa*. *Passiflora killipiana* can be distinguished from *P. kapiriensis* by its glands situated at the apex of the petiole and its rufo-tomentose peduncles and bracts, whereas *P. cerasina* mostly differs by its unequal two outermost series of filaments and its typical cherry-red bracts at anthesis (Table 1).



Map 1 Geographical distribution of *Passiflora kapiriensis* populations observed in French Guiana and two herbarium specimens with the same combination of traits characteristic of the species, in Ecuador and Brazil.

Herbarium specimens examined.

Passiflora acuminata (herbarium specimens): Brazil, Pará, Porto Trombetas, 26 Apr. 1987, *Knowles s.n.* (INPA); Belem, 25 Nov. 1942, *Archer 7864* (K); Amazonas, Estrada Manaus, Caracarai, trecho perdido, 10 Mar. 1978, *Silva 4557* (NY); *De Candolle s.n.* (type P).

Passiflora cerasina (observations on living materials): French Guiana, Plateau des Cascades, 5 Apr. 2008, *Rome 26* (LYJB); road of St-Georges, 10 Apr. 2008, *Rome 46* (LYJB), 19 May 2008, *Rome 126* (LYJB), *Rome 127* (LYJB), *Rome 128* (LYJB), 20 May 2008, *Rome 140* (LYJB), *Rome 141* (LYJB); Citron Path, *Rome 155* (LYJB), *Rome 160* (LYJB), *Rome 161* (LYJB); Montagne de Kaw, 23 Apr. 2008, *Rome 98* (LYJB), 24 Nov. 2009, *Rome 200* (LYJB); Path Kapiri, 25 Nov. 2009, *Rome 222* (LYJB), *Rome 223* (LYJB), *Rome 224* (LYJB), *Rome 227* (LYJB), *Rome 237* (LYJB).

Passiflora cerasina (herbarium specimens): French Guiana, Mont Grand Matoury, Ile de Cayenne, 5 Apr. 1995, *Cremers 13889* (Cay).

Passiflora kapiriensis (observations on living material): French Guiana, road of St-Georges, 19 May 2008, *Rome 48* (holotype CAY; isotypes P, LYJB), 19 May 2008, *Rome 131* (L), *Rome 133* (K), *Rome 134* (MO); Kapiri Creek, 25 Nov. 2009, *Rome 214* (NY), *Rome 215* (LYJB), *Rome 216* (LYJB), *Rome 217* (LYJB), *Rome 218* (LYJB), *Rome 219* (LYJB), *Rome 221* (LYJB), *Rome 225* (LYJB), *Rome 228* (LYJB), 3 Feb. 2013, *Rome 410* (LYJB), *Rome 411* (LYJB); path of Rivière Mataroni, 25 Nov. 2009, *Rome 235* (LYJB), *Rome 236* (LYJB).

Passiflora kapiriensis (herbarium specimens): Brazil, Amazonas, Presidente Figueiredo, 24 Nov. 2008, *Melo 610* (INPA). – Ecuador, Yasuní National Park, 6 Feb. 2001, *Villa 855* (QCA).

Passiflora killipiana (herbarium specimens): Colombia, Rio Caquetá, vicinity of la Pedrera, Apr. 1944, *Schultes 5875* (K); Caquetá, Araracuara, 20 Feb. 1991, *Dulmen 128* (L). – Peru, Amazonas, Rio Santiago, 24 Nov. 1979, *Huashikat 1399* (MO).

Passiflora nitida (observations on living materials): French Guiana, road of St-Georges, *Rome 130* (LYJB), *Rome 139* (LYJB); road of Tonnegrande, 12 Apr. 2008, *Rome 49* (LYJB); road of Cacao, *Rome 67* (LYJB), *Rome 207* (LYJB); Eskol village, 31 Mar. 2008, *Rome 17* (LYJB); road of Apatou, *Rome 234* (LYJB).

Passiflora nitida (herbarium specimens): Brazil, Roraima, Rorainopolis, Rio Xixuau, 3 Feb. 2011, *Marinho 194* (INPA); Amazonas, Rio Cuieras, Lake Jaradá, 5 Aug. 1991, *Mori 21923* (NY); Amazonas, District Agropecuario, 27 Aug. 1991, *Oliveira 184* (INPA); Rondônia, Porto Velho, 13 Feb. 2012, *Peirera-Silva 16087* (CEN); Acre, Municipality of Sena Madureira, 3 Oct. 1968, *Prance 7779* (NY). – British Guyana, Rupununi, Kuyuwini River, 9 Feb. 1991, *Jansen-Jacobs 2482* (U); Potaro-Siparuni Region, Pakaraima Mountains, 24 Oct. 1994, *Muchnick 286* (US). – Colombia, Vaupés, Municipality of Mitú, 22 Mar. 2003, *Betancur 10030* (COL); Vaupés, Raudal Jirijirimo, Pacoa, 22 Mar. 2008, *Betancur 13611* (COL); Guaviare, Municipality San José del Guaviare, 25 Aug. 1995, *Cárdenas 6535* (COAH). – French Guiana, Crique Petit Laussat, Bassin de la Mana, 9 Feb. 1990, *Cremers 11336* (CAY). – S. Loc., *Bonpland s.n.*, type.

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