

# *Anemopaegma kawense* (Bignoniaceae), a new species from the Kaw Mountain (French Guiana), with notes on related species and a key to the genus in the Guianas

Olivier Lachenaud<sup>1,2,\*</sup>, Fabiana Firetti<sup>3</sup> & Lúcia G. Lohmann<sup>3</sup>

<sup>1</sup>Meise Botanic Garden, Meise, Belgium

<sup>2</sup>Herbarium et Bibliothèque de Botanique africaine, Université Libre de Bruxelles, Brussels, Belgium

<sup>3</sup>Departamento de Botânica, Instituto de Biociências, Universidade de São Paulo, São Paulo, SP, Brazil

\*Corresponding author: [olivier.lachenaud@meisebotanicgarden.be](mailto:olivier.lachenaud@meisebotanicgarden.be)

**Background and aims** – The genus *Anemopaegma* (Bignoniaceae) includes around 47 species and has its centre of diversity in Brazil. Here, we describe and illustrate a new species from French Guiana, *Anemopaegma kawense*, and compare it to the two most similar species, *A. foetidum* and *A. granvillei*. We further assess the conservation status of all three species.

**Material and methods** – Morphological descriptions are based on herbarium specimens deposited at BM, BR, CAY, INPA, K, MO, P, SPF, and U, and, in the case of the newly described species, also on field observations. The conservation status assessments follow the IUCN Red List criteria.

**Key results** – *Anemopaegma kawense* differs from both *A. foetidum* and *A. granvillei* by its densely villose twigs, longitudinally plicate leaflets with secondary veins not or hardly prominent below, and tertiary veins impressed below. It is further separated from *A. foetidum* by the leaflets that are villose below and the calyx that is entirely pubescent outside. On the other hand, *A. kawense* differs from *A. granvillei* by the densely lepidote outer surface of the corolla, shorter petiolules, leaflets with midrib impressed above, shorter bracts and bracteoles, inflorescence peduncle exceeding the rachis, and pedicels densely puberulous, not lepidote or only sparsely so at the apex. This species is endemic to the Kaw Mountain in north-eastern French Guiana, where it grows in low stunted forest on laterite; it is assessed as Endangered according to the IUCN criteria. New descriptions are provided for *A. granvillei*, which is newly reported from Suriname, and for *A. foetidum*, which is newly reported from French Guiana; these two species are assessed as Endangered and Least Concern, respectively. Lectotypes are designated for *A. maguirei*, which is here synonymised with *A. foetidum*, and for *A. umbellatum*, another synonym of that species. A key to the 12 species of *Anemopaegma* occurring in the Guianas is presented.

**Keywords** – *Anemopaegma*; Bignoniaceae; Bignoniaceae; French Guiana; Guiana Shield; Kaw Mountain; new species; rainforest; Suriname; taxonomy.

## INTRODUCTION

French Guiana covers 83,846 km<sup>2</sup>, of which more than 95% consists of lowland equatorial rainforest. Despite its small size, the country includes a very rich flora, with over 5,400 species of vascular plants (Funk et al. 2007). Its flora has been relatively well-studied by various botanists, and

a comprehensive guide of the vascular plants of central French Guiana is available (Mori et al. 2002). Despite that, collecting efforts have been unequal across the country, and new species are still being discovered on a regular basis (e.g. Granville 2007; Judziewicz & Sepsenwol 2007; Vlasáková & Gustafsson 2011; Delprete 2014, 2015; Delprete & Lachenaud 2018). Granville et al. (1993)

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recorded 162 species of vascular plants endemic to French Guiana. Although some of these species were subsequently collected in neighbouring countries (e.g. Brazil, Suriname, and Guyana), a number of new endemic species, and even two new genera (Feuillet & Skog 2002; Chiron et al. 2015) have since been described.

The north-eastern part of French Guiana is particularly rich in endemic species (Granville et al. 1993; Rignon & Rignon 2003). This area includes a series of low hills, among which is the Kaw Mountain, a lateritic ridge that is approximately 40 km long and 330 m in elevation and runs more or less in parallel to the coast, east of the town of Roura. The Kaw Mountain receives the highest rainfall in French Guiana with > 4,000 mm per year. It is a well-known biological hotspot (Granville 1986), part of which is preserved within two natural reserves: (i) the Réserve Naturelle des Marais de Kaw-Roura, covering 94,700 ha of forest and wetlands and managed by the Parc Naturel Régional de Guyane, and (ii) the Réserve Naturelle Trésor, covering 2,464 ha of forest with some savannas included, managed by the Office National des Forêts. The highest portions of the mountain are not protected.

The Kaw Mountain harbours a variety of forest habitats, including a very specialized forest on lateritic crust on the summit that consists of low stunted trees (5–15 m tall) forming a rather open canopy, and a very dense undergrowth with many lianas and bromeliads. This habitat is particularly interesting botanically but there is apparently no detailed study of its floristic composition. The dominant tree species are *Manilkara bidentata* (A.DC.) A.Chev. (Sapotaceae), *Micrandra brownbergensis* Lanj. (Euphorbiaceae), and *Zygia tetragona* Barneby & J.W.Grimes (Leguminosae-Mimosoideae). Forests growing on lateritic crusts are scattered in many areas of French Guiana but vary in composition from one site to another; those on the Kaw Mountain appear to be significantly different from the rest, possibly due to the high rainfall.

Fieldwork on the Kaw Mountain has resulted in several interesting discoveries, including a new species of *Anemopaegma* Mart. ex Meisn. (Bignoniaceae) described here. Bignoniaceae includes around 82 genera and 840 species worldwide (Lohmann & Ulloa Ulloa 2020), most of which are found in tropical America. The family is well-represented in French Guiana, where 86 species are currently recognized (Lohmann & Ulloa Ulloa 2020). Eight major clades are recognized within the Bignoniaceae (Olmstead et al. 2009), among which the tribe Bignonieae is the largest, including 20 genera and 393 species (Lohmann & Taylor 2014; Fonseca & Lohmann 2019).

The tribe Bignonieae is exclusively Neotropical and is characterized by a climbing habit, a wood anatomy composed of 4–32-phloem wedges, and leaf tendrils (Lohmann 2006). *Anemopaegma* includes 47 species, representing the third largest genus in the tribe (Lohmann & Taylor 2014; Firetti-Leggieri et al. 2015; Lohmann et al. 2018). The genus is easily recognized by the 2–3-foliolate leaves, cylindrical stems, racemose inflorescences, yellow flowers (except *A. ionanthum* A.H.Gentry with violet flowers), and dorsally compressed stipitate fruits (Lohmann & Taylor 2014).

*Anemopaegma* is supported as monophyletic and is sister to *Pyrostegia* C.Presl by molecular phylogenetic data (Lohmann 2006). A synopsis of the entire tribe Bignonieae includes an account of the genus as a whole (Lohmann & Taylor 2014). A detailed taxonomic revision is currently being prepared (Firetti & Lohmann in prep.). *Anemopaegma* is centred in Brazil, where 36 species (13 endemic) occur (Lohmann 2010; Firetti-Leggieri et al. 2015; Lohmann et al. 2018). In the most recent species list available for the region, eight species are documented for French Guiana and 11 for the Guianas (Lohmann & Ulloa Ulloa 2020).

The new species *Anemopaegma kawense* O.Lachenaud & Firetti-Legg. is here described and illustrated, as well as compared to its most similar relatives, *A. foetidum* Bureau & K.Schum. and *A. granvillei* A.H.Gentry. The occurrence of *A. foetidum* in French Guiana is documented for the first time. New collections of *A. granvillei* extend its range to Suriname, allowing for a critical re-evaluation of its morphology. As such, updated descriptions are also presented for *A. foetidum* and *A. granvillei*. The conservation status of all three species is assessed.

## MATERIAL AND METHODS

Morphological descriptions are based on the study of herbarium material deposited at BM, BR, CAY, INPA, K, MO, P, SPF, and U, and field studies conducted by the first author between 2014 and 2019 in French Guiana. Descriptions and measurements were made following the terminology of Lohmann & Taylor (2014). The conservation status of the new species was assessed according to IUCN Red List Categories and Criteria v.3.1 (IUCN 2012; IUCN Standards and Petitions Committee 2019). The extent of occurrence and the area of occupancy were estimated with GeoCAT (<http://geocat.kew.org/>), using a grid size of 2 × 2 km.

## TAXONOMIC TREATMENT

*Anemopaegma kawense* O.Lachenaud & Firetti-Legg., **sp. nov.** (figs 1, 2) – Type: FRENCH GUIANA • Route de Kaw, juste après la scierie; 295 m a.s.l.; 12 Dec. 2015; fl., fr.; *O. Lachenaud 2134*; holotype: CAY; isotypes: BR[BR0000027750056V, BR0000027750070V], MO, SPF.

**Diagnosis** – *Anemopaegma kawense* resembles *A. foetidum* and *A. granvillei* in its contracted and few-flowered inflorescences, truncate calyx, minute prophylls of the axillary buds, and leaflets with pinnate venation and weakly ascending secondary veins. It differs from both species by its densely villose twigs, longitudinally plicate leaflets with secondary veins not or hardly prominent on the lower surface, and tertiary veins impressed on the lower surface (vs twigs glabrous or minutely puberulous, leaflets flat with secondary and tertiary veins prominent below). It is further separated from *A. foetidum* by the villose lower surface of leaflets (vs glabrous) and the calyx which is entirely pubescent outside (vs glabrous towards the apex, except for the ciliate margin). It additionally differs from *A. granvillei* by the following characters: corolla densely lepidote outside (vs glabrous), petiolules 1–4 mm long (vs 5–10 mm long), leaflet midrib

impressed above (vs prominent), tendrils with trifid apices (vs simple), bracts and bracteoles ca 1 mm long (vs 2–3.5 mm long), inflorescence peduncle exceeding the rachis (vs shorter than rachis), and pedicels densely puberulous, not or sparsely lepidote at apex (vs glabrous to sparsely puberulous and densely lepidote).

**Description** – Woody liana; stems cylindrical to irregularly striate, densely villose, with simple, non-glandular, multicellular patent trichomes 1–1.5 mm long, intermingled with shorter trichomes of similar morphology, interpeltolar glandular fields absent; prophylls of the axillary buds minute, narrowly triangular to subulate,  $1.5\text{--}2 \times 0.5\text{--}0.8$  mm. Leaves 3-foliolate, or 2-foliolate with the central leaflet replaced by a tendril, 4–6 cm long, shortly trifid at apex; petioles 0.2–1 cm long, terete, densely villose; petiolules 1–4 mm long, villose; leaflets elliptic,  $4\text{--}9.5 \times 2\text{--}4.8$  cm, round at base, acuminate and mucronulate at apex, coriaceous and plicate longitudinally, smooth (not rugulose) when dry, with peltate glandular trichomes distributed on both surfaces, shiny medium green and glabrous to minutely pubescent above, dull pale green and densely villose below, with simple, non-glandular, multicellular trichomes 0.3–0.7 mm long, and a few glandular cupular/patelliform trichomes towards the base; venation pinnate, midrib slightly impressed above, strongly prominent below; secondary veins 6–9 on each side of midrib, rather faint, slightly impressed above and flat or nearly so below, weakly ascending and arching at 1.5–3 mm from the margin; tertiary veins lax and inconspicuous, slightly impressed below. Inflorescence axillary, a congested raceme, 1–3-flowered; peduncle 0.3–0.6 cm long, with short densely arranged non-glandular trichomes; rachis extremely reduced; bracts and bracteoles lanceolate, ca 1 mm, with non-glandular trichomes. Flowers pedicellate; pedicel 5–7.5 mm long, densely puberulous, trichomes eglandular or peltate-glandular, sparsely distributed towards the apex. Calyx green, campanulate, 4–7 mm long  $\times$  4.5–6 mm wide, truncate, puberulous with cupular/patelliform glandular trichomes in the middle–upper portion. Corolla pale yellow, zygomorphic, infundibuliform; tube 4–6.2 cm long, campanulate, widening around the basal  $1/4^{\text{th}}$  or  $1/3^{\text{rd}}$ , 0.4–0.7 mm wide at base, 1.6–2.2 cm wide at mouth, outside glabrous at the base and lepidote with peltate glandular trichomes densely distributed through the medium and distal portions, inside glabrous except for a broad ring of capitate glandular trichomes at the insertion of stamens; lobes round, usually slightly notched at apex,  $1\text{--}1.5 \times 1.1\text{--}2.1$  cm, glabrous outside except from cupular/patelliform glandular trichomes at the base, lepidote inside. Stamens didynamous, included, filaments glabrous, 2.4–2.5 cm long in longer stamens, ca 1.5 cm long in shorter stamens, anthers glabrous, thecae  $3.5\text{--}4.5 \times 1\text{--}1.5$  mm, diverging at  $180^\circ$ ; staminode linear, 6.5–8 mm long. Ovary ellipsoid, ca 3 mm long, non-stipitate, lepidote, with peltate glandular trichomes. Style included, ca 33 mm long, glabrous, style lobes ca 3.5 mm long. Nectar disk hemispherical, ca 1.5 mm, glabrous. Fruit capsular, 2-valved, coriaceous, green when young, brown and dry when mature, ellipsoid and compressed,  $6.8\text{--}12 \times 4\text{--}5.5$  cm, glabrous except for sparse cupular/patelliform glandular trichomes, apex abruptly and narrowly acuminate,

base with a distinct stipe 0.5–1 cm long. Seeds numerous, whitish, flat, and winged,  $2.4\text{--}2.8 \times 3.5\text{--}4$  cm.

**Distribution and ecology** – This species is endemic to the Kaw Mountain in north-eastern French Guiana (fig. 3). It grows in low stunted forest on lateritic crust, 150–300 m in elevation, and is locally frequent in this habitat, which covers only small areas on the ridge of the mountain.

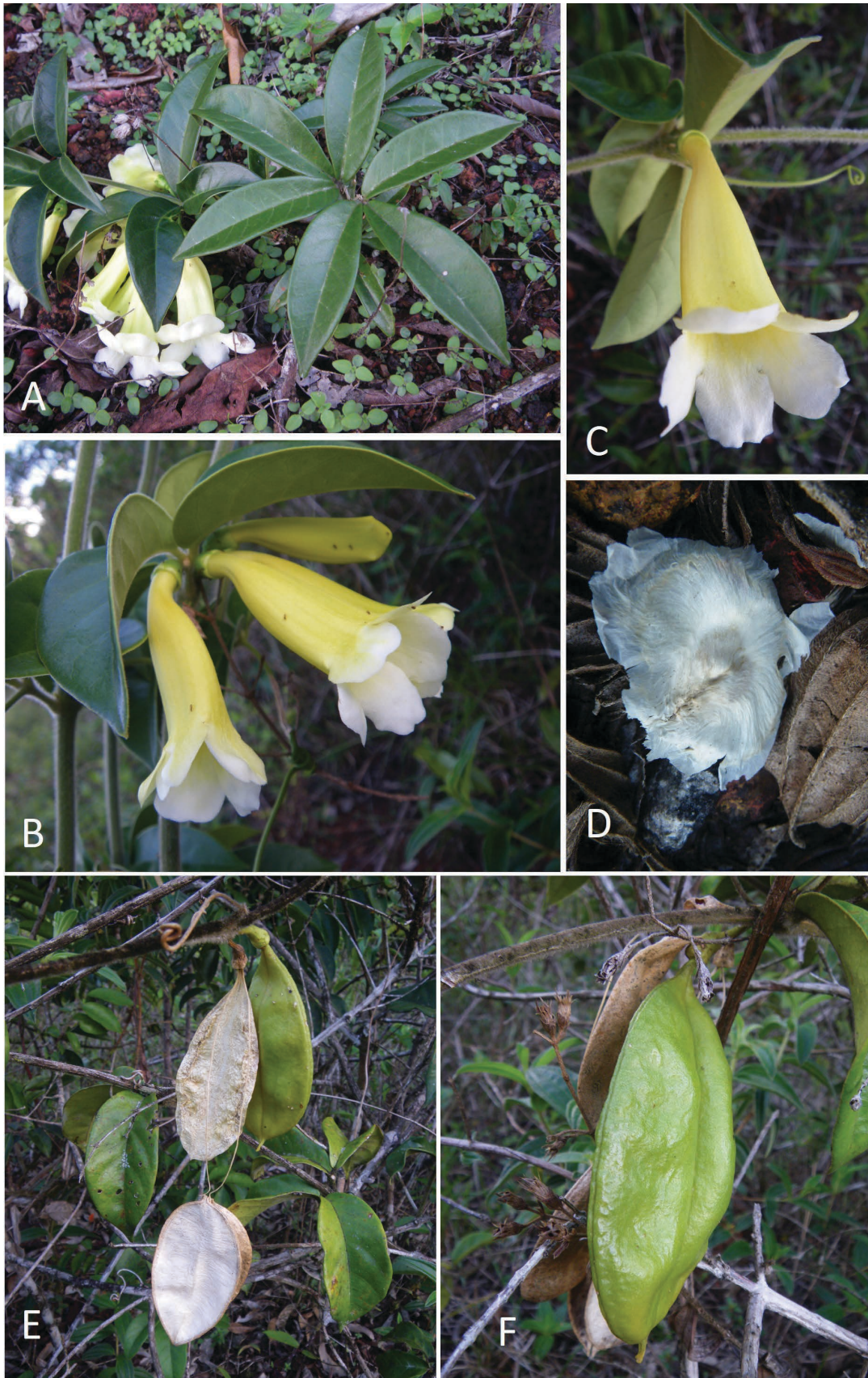
**Phenology** – Both flowers and fruits were seen from December to February (first rainy season) and in August (beginning of main dry season).

**Etymology** – The species is named for the Kaw Mountain, where it is endemic.

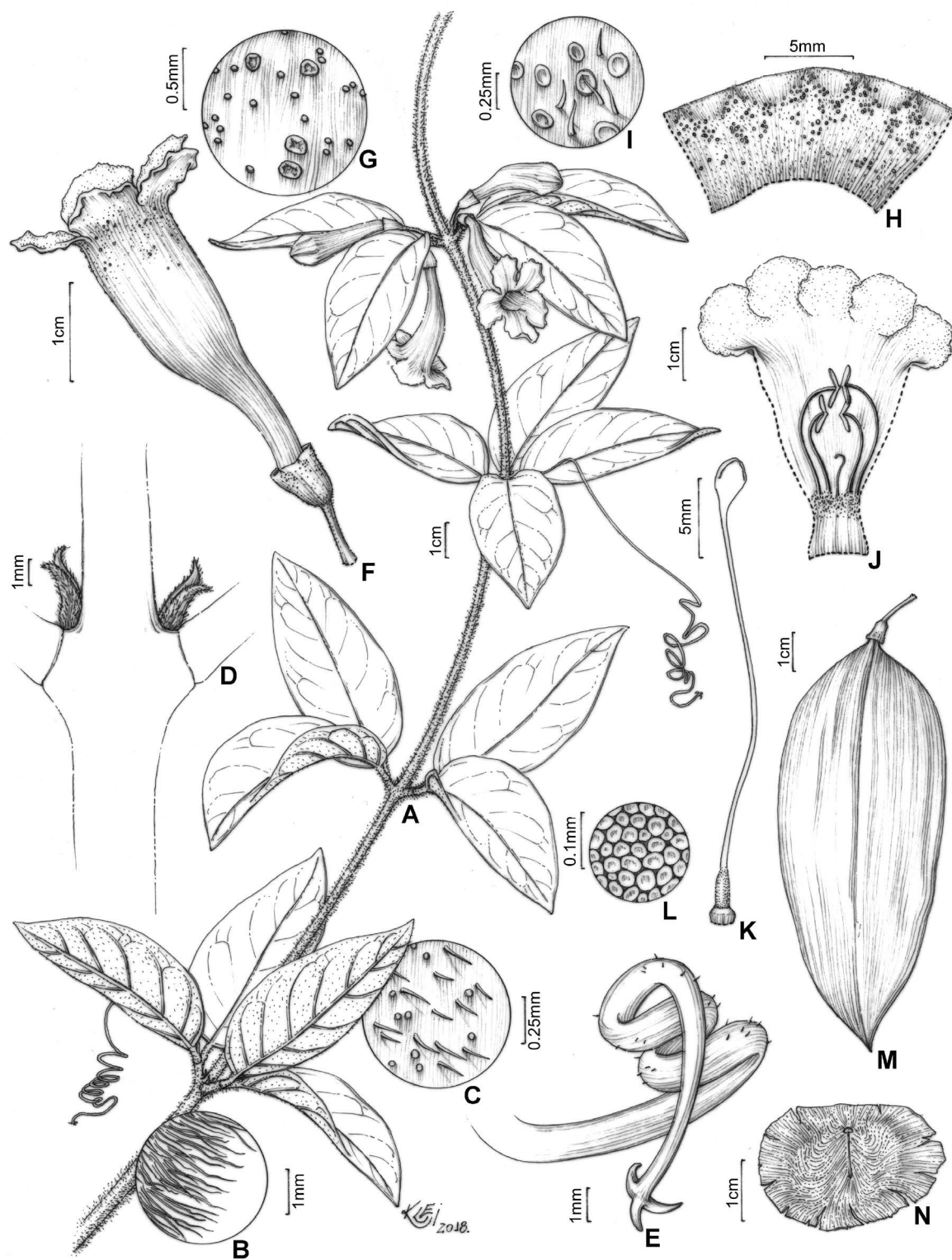
**IUCN conservation assessment (provisional)** – Endangered: EN B1ab(iii)+2ab(iii). *Anemopaegma kawense* is endemic to the ridge of the Kaw Mountain in French Guiana, where it grows in low stunted rainforest on lateritic crust. Its extent of occurrence (EOO) is estimated to be 44 km<sup>2</sup>, which falls within the limit for Critically Endangered under criterion B1. Its area of occupancy (AOO) is estimated to be 24 km<sup>2</sup>, within the limit for Endangered status under criterion B2; however, because its habitat only occurs as small isolated patches, the actual AOO must be  $< 5$  km<sup>2</sup>. The species is known from four collections and five additional field observations, representing nine occurrences. None of the sites where the species was found are under protection. Though it may eventually be found in two nearby protected areas, the Réserve Naturelle Trésor and Réserve Naturelle des Marais de Kaw-Roura, suitable habitat mostly lies outside these reserves. Ongoing forest exploitation in part of the species' range is unlikely to represent a major threat, since the plant occurs in areas of low forest with few exploitable trees. However, the area where it is found harbours important bauxite and gold deposits; mining projects were abandoned in 2008, but may resurface in the future, representing a major threat to this species. Another potential threat comes from touristic development and related infrastructure. In view of all these factors, a decline in habitat extent and quality is projected. The eight occurrences represent four locations in the sense of IUCN, and the species qualifies for Endangered status under the conditions B1ab(iii)+2ab(iii). *Anemopaegma kawense* is recommended for inclusion on the list of protected plants of French Guiana, and special measures should be taken to protect its habitat, which harbours several other threatened species.

**Additional specimens examined** – FRENCH GUIANA • Route de Kaw, près de la scierie Zwaelen; 25 Feb. 2009; fl., fr.; *Billiet & Jadin 8354*; BR, CAY • Montagne de Kaw, Amazon Lodge; 281 m; 23 Aug. 2017; st.; *Lachenaud 2640*; BR, CAY, SPF • Montagne de Kaw, piste de Fourgassié, peu après le croisement de la route de Kaw; 3 Jan. 2019; st.; *Lachenaud 2696*; BR, CAY.

**Notes** – This species is most similar to *A. foetidum*, which is almost identical in flower and fruit morphology but quite different vegetatively; it also resembles *A. granvillei*. Differences among these three species are summarized in the diagnosis and in table 1. The plicate character of the leaflets in *A. kawense* is obvious in the field and conspicuous even in dried specimens; the central leaflet is usually absent, but, when present, shows a petiolule similar in length to those



**Figure 1** – *Anemopaegma kawense*. A. Habit. B. Flowers. C. Flower, side view, and leaves seen from below. D. Seed. E. Fruiting branch with one immature and one dehiscent fruit. F. Immature fruit. From Lachenaud *et al.* 2134. Photographs by Olivier Lachenaud.



**Figure 2** – *Anemopaegma kawense*. **A**. Flowering stem. **B**. Detail of stem indumentum. **C**. Detail of indumentum on lower surface of leaflet. **D**. Prophylls of the axillary buds. **E**. Tendril. **F**. Flower. **G**. Detail of base of corolla lobes, outside. **H**. Calyx, seen from outside. **I**. Detail of calyx indumentum. **J**. Dissected corolla, with stamens and staminode. **K**. Style, ovary, and disk. **L**. Detail of ovary (outer surface). **M**. Fruit. **N**. Seed. From Lachenaud et al. 2134. Drawn by Klei Sousa.

of the lateral leaflets (and not distinctly longer as in *A. foetidum*). Both *A. foetidum* and *A. granvillei* also occur in French Guiana but not within the range of *A. kawense* (fig. 3). The strong foetid smell reported for the flowers of *A. foetidum* has not been noted in *A. kawense* (whose flowers are inodorous, at least between 9 a.m. and 6 p.m.) but since flowers of this group are believed to be bat-pollinated, it is possible that the smell might only be perceptible during the night.

***Anemopaegma granvillei*** A.H.Gentry (Gentry 1978: 311) – Type: FRENCH GUIANA • Rivière “Petite Ouaiqui”, végétation ripicole vers l’embouchure de la crique Carbet Brûlé; 27 Jul. 1973; fl.; *J.J. de Granville 1935*; holotype: P[P00077208]; isotypes: MO[MO-2665614], P[P00077209, P00608056].

**Description** – Woody liana; stems cylindrical to slightly 4-angled, shortly and sparsely pubescent with simple, non-glandular, multicellular patent trichomes 0.1–0.5 mm long, becoming glabrescent, interpetiolar glandular fields absent; prophylls of the axillary buds narrowly elliptic, 2–4 × 1–1.5 mm, caducous or marcescent. Leaves 2-foliolate, with the central leaflet modified into a tendril 3–9 cm long, with simple apex; petiole 1–3.5 cm long, terete, minutely puberulous, the upper side with uncinat trichomes ca 0.2 mm long; petiolules 5–10 mm long, shortly and densely puberulous; leaflets 5.3–15 × 2.7–6 cm, elliptic, obtuse or rounded at base, acuminate at apex, coriaceous and flat, shiny especially above and smooth (not rugulose) when dry, with peltate glandular trichomes sparsely distributed on both surfaces, glabrous above except for short eglandular trichomes covering the venation, glabrous to shortly and sparsely pubescent below, with simple, non-glandular, multicellular erect trichomes ca 0.2 mm long, with a few cupular/patelliform glandular trichomes towards the base; venation pinnate; midrib slightly prominent above and strongly so below; secondary veins 5–9 on each side of midrib, rather conspicuous, slightly prominent on both sides, weakly ascending and arching 2–5 mm from margin; tertiary veins laxly reticulate and slightly prominent below. Inflorescence axillary, a congested raceme, 2–10-flowered; peduncle absent or 0.1–0.4 mm, pubescent, with simple, eglandular, multicellular patent trichomes ca 0.3 mm long; rachis 0.5–3 mm long, with similar indumentum; bracts and bracteoles linear to lanceolate, 2–3.5 × 0.3–1 mm, with sparse eglandular trichomes. Flowers pedicellate; pedicel 3–5 mm long, glabrous to sparsely pubescent with indumentum similar to the inflorescence axis, and peltate glandular trichomes densely distributed, especially towards the apex. Calyx green, campanulate, 7–10 × 6–9 mm, truncate, minutely ciliate on the margin, otherwise sparsely and shortly pubescent to glabrous, with a few cupular/patelliform glandular trichomes. Corolla yellow to greenish-yellow, zygomorphic, infundibuliform; tube 3.3–4.7 cm long, campanulate, widening around the basal 1/3<sup>rd</sup>, ca 0.4 mm wide at base, 1.4–1.5 cm wide at mouth, glabrous and eglandular outside, glabrous inside except for a ca 3 mm wide ring of capitate glandular trichomes at the insertion of the stamens; lobes suborbicular to elliptic, rounded at apex, 0.7–1.1 × 0.7–1 cm, glabrous and eglandular outside, shortly ciliate on the margin, densely lepidote inside, with

peltate glandular trichomes. Stamens didynamous, included, filaments glabrous, ca 2 cm long in longer stamens, ca 1.5 cm long in shorter stamens, anthers glabrous, thecae 3–3.5 × 1.5–2 mm, diverging at 180°; staminode linear, ca 5 mm long. Ovary ellipsoid, ca 2.5 mm long, non-stipitate, lepidote with dense peltate glandular trichomes. Style included, ca 40 mm long, glabrous, style lobes ca 3 mm long. Nectar disk hemispherical, ca 1.5 mm, glabrous. Fruits and seeds not seen.

**Distribution and ecology** – This species is restricted to eastern Suriname and western French Guiana (fig. 3), where it grows in riparian forest. It has mostly been collected along the Maroni River and its tributaries, but there is one record further west along the Saramacca River. From the small number of collections, it appears to be rare.

**Phenology** – Flowers have been collected from late November to February, corresponding to the first rainy season, and in July, at the end of the second rainy season.

**IUCN conservation assessment (provisional)** – Endangered: B2ab(iii). *Anemopaegma granvillei* occurs in riparian forest in French Guiana and Suriname. Its extent of occurrence (EOO) is estimated as 6,951 km<sup>2</sup>, and its area of occupancy (AOO) as 16 km<sup>2</sup>. These values fall within the limit for Vulnerable status under criterion B1 and Endangered status under criterion B2, respectively. The species is known from nine collections, representing four occurrences, one of which occurs in a protected area (the Parc Amazonien de Guyane in French Guiana). The subpopulation in Suriname occurs close to a mining area, and those along the Maroni River in French Guiana are potentially threatened by illegal gold mining, so a decline in the extent and quality of habitat may be inferred. The four occurrences represent four locations, and the species qualifies for Endangered status according to the conditions B2ab(iii). Considering the low collection density in its range, the species may be more widespread than records suggest, in which case this assessment will have to be revised.

**Vernacular name and local uses** – This plant is called “kalaman” by the Wayana (*Cremers 5116*, *Veth 252*), who reportedly smoke its leaves in cigarettes, and use it to relieve a sore throat by cutting the stems and have the water running down the throat (*Veth 252*). Since the same name and uses are reported for *Bignonia sordida* (Bureau & K.Schum.) L.G.Lohmann (*Veth 249*) and the unrelated *Maripa scandens* Aubl. (Convolvulaceae; *Veth 227*), its uses should be verified.

**Additional specimens examined** – FRENCH GUIANA • En amont de Touinké sur l’Itany; 25 Nov. 1977; fl.; *Cremers 5116*; CAY[CAY085748, CAY085749] • Maroni; 1877; fl.; *Mélinon 414*; P[P03586951] • 1864; fl.; *Mélinon s.n.*; P[P0358637, P0358638] • Haut-Maroni; Nov. 1977; *Moretti 826*; CAY[CAY085747] • Marouini (Malani); 3°15’N, 54°05’W; 134 m; 24 Jan. 1992; fl.; *Veth 252*; U[U0144053].

SURINAME • Oever Saramaca tussen Doorsnee en Peprekampoe; 1 Feb. 1951; fl.; *J. & P.A. Florschütz 1116*; U[U0160811] • 1843; fl.; *Hostmann 1115*; P[P03586930] • Marowijne River; Aug. 1965; fl.; *Hugh-Jones 40A*; K.

**Notes** – This species was so far only known from the type collection. The holotype, originally deposited at CAY (Gentry 1978: 311), was subsequently transferred to P (*Cremers 2001*:

294). However, several other specimens from French Guiana and Suriname have been found, the latter representing a new country record. Most of these collections, some of which date back to the 19<sup>th</sup> century, were hitherto misidentified either as *A. chrysoleucum* (Kunth) Sandwith or *A. paraense* Bureau & K.Schum. These two species are morphologically similar to *A. granvillei*, especially in the glabrous outer surface of the corolla, truncate calyx, and slightly prominent midrib of the leaflets but differ by their larger and foliaceous prophylls of the axillary buds (vs minute prophylls in *A. granvillei*). While *A. paraense* is widespread in both French Guiana and Suriname, *A. chrysoleucum* seems to be absent from both countries. Previous records (Funk et al. 2007) probably refer to misidentified collections of either *A. granvillei* or *A. paraense*.

*Anemopaegma granvillei* may also be confused with *A. kawense* and *A. foetidum*, from which it differs by the characters listed in table 1. While Gentry (1978) considered the puberulous indumentum of the leaflet abaxial side as an important diagnostic character of *A. granvillei*, in some specimens, the leaflets may be glabrous (*Hugh-Jones 40A, Mélinon 414, Mélinon s.n.*).

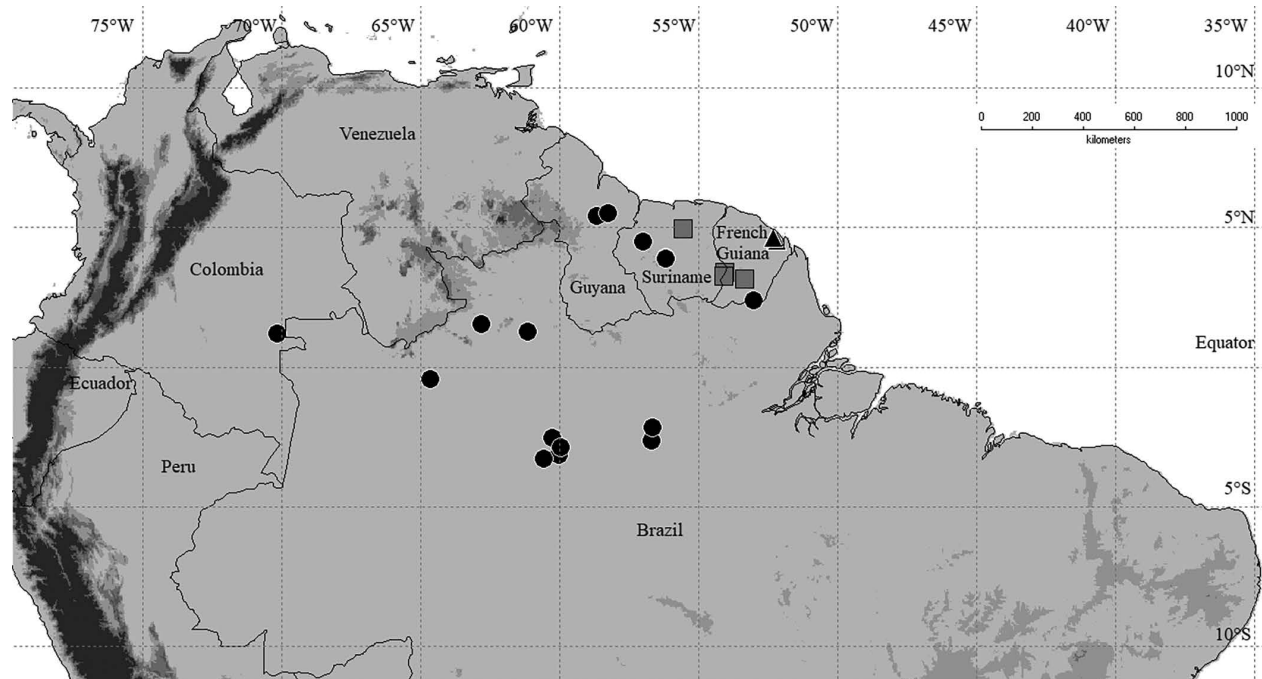
Fruits of *A. granvillei* are unknown. Even though the labels of the collections *Veth 252* and *Mélinon 414* mention fruits, the former specimen lacks fruits, while the latter reports fruits in spirit that could not be located at P (Thierry Deroin pers. comm.).

*Anemopaegma foetidum* Bureau & K.Schum. (Bureau & Schumann 1896: 143) – Type: BRAZIL • Amazonas, Manaus; 20 Apr. 1882; fl.; *Schwacke 3620*; holotype: B†, photos at F[F0BN18454] and K.

*Anemopaegma umbellatum* A.Sampaio (Sampaio 1936: 82) – Type: BRAZIL • Amazonas, Parintins; 23 Aug. 1932; fl.; *Ducke s.n. (RB 24090)*; lectotype: RB[RB00536866], **designated here**; isolectotypes: K[K000449408], MO[MO-081079], R[R000028621], R000028621a], RB[RB00537277].

*Anemopaegma maguirei* Sandwith, **syn. nov.** (Sandwith in Maguire 1948: 664) – Type: SURINAME • Tafelberg; 17 Aug. 1944; fl.; *Maguire 24403*; lectotype: K[K000449409], **designated here**; isolectotype: NY[NY00313070], U[U0005290].

**Description** – Woody liana, 1–2 m high; stems cylindrical, striate, puberulous with patent trichomes < 0.2 mm long to almost glabrous, interpetiolar glandular fields absent; prophylls of the axillary buds minute (not foliaceous), elliptic, 3.5–8 × 0.3–1.7 mm, puberulous, with cupular/patelliform glandular trichomes. Leaves 2–3-foliolate with the central leaflet often replaced by a tendril 5.5–8 cm long, simple or trifid at apex; petiole (0.5–)1.2–2.2 cm long, terete, striate, puberulous on above; petiolule of the lateral leaflets 1–5 mm long, of the terminal leaflet 3–12 mm long, semi-circular, puberulous; leaflets 3.8–12 × 1.4–4.3 cm, elliptic or the central one obovate, obtuse to rounded at base, acuminate at apex, coriaceous and ± flat, shiny especially above and smooth (not rugulose) when dry, above with minute eglandular trichomes over the midrib, provided on both surfaces with peltate glandular trichomes (denser below) and sparse cupular/patelliform glandular trichomes; venation pinnate; midrib flat or slightly impressed above, prominent below; secondary veins (5–)6–10 on each side of the midrib, flat or slightly impressed above, slightly prominent below, weakly ascending and arching 1–1.5 mm from margin; tertiary veins reticulate and rather prominent on the lower surface.



**Figure 3** – Distribution map of *Anemopaegma foetidum* (circles), *A. granvillei* (squares), and *A. kawense* (triangles). Map created with DIVA-GIS v.7.5.0.0 (Hijmans 2012).

**Table 1** – Differences between *Anemopaegma granvillei*, *A. kawense*, and *A. foetidum*. Diagnostic traits are indicated in bold.

	<i>A. granvillei</i>	<i>A. kawense</i>	<i>A. foetidum</i>
<b>Twigs</b>	shortly pubescent (hairs 0.1–0.5 mm long) to glabrescent	<b>densely villose (hairs 1–1.5 mm long)</b>	shortly puberulous (hairs < 0.2 mm long) to glabrescent
<b>Tendrils</b>	simple	trifid at apex	trifid or simple at apex
<b>Petioles</b>	1–3.5 cm long, minutely puberulous	0.2–1 cm long, <b>villose</b>	(0.5–)1.2–2.2 cm long, minutely puberulous (on upper side at least)
<b>Petiolules</b>	5–10 mm long in all leaflets	1–2 mm long in all leaflets	(0–)1–5 mm long in lateral leaflets, 3–12 mm in central one (if present)
<b>Leaflets</b>	± flat	<b>plicate longitudinally (V-shaped in section)</b>	± flat
<b>Midrib of leaflets</b>	<b>prominent above</b>	impressed above	flat or impressed above
<b>Secondary veins of leaflets</b>	prominent below	<b>flat or almost so below</b>	prominent below
<b>Tertiary veins of leaflets</b>	prominent below	<b>slightly impressed below</b>	prominent below
<b>Lower side of leaflets</b>	glabrous to (usually) shortly pubescent	villose	glabrous
<b>Bracts and bracteoles</b>	<b>2–3.5 mm long</b>	ca 1 mm long	1–1.5 mm long
<b>Inflorescence</b>	<b>peduncle &lt; rachis</b>	peduncle > rachis	peduncle ≥ rachis
<b>Pedicels</b>	<b>glabrous or sparsely puberulous, densely lepidote</b>	densely puberulous, eglandular or sparsely lepidote at apex	densely puberulous, eglandular or sparsely lepidote at apex
<b>Calyx size</b>	7–10 mm long × 6–9 mm wide	4–7 mm long × 4.5–6 mm wide	4–9 mm long × 4–9 mm wide
<b>Calyx indumentum</b>	sparsely pubescent to glabrous	entirely pubescent	glabrous near the apex (except ciliate margin)
<b>Corolla tube (outside)</b>	<b>glabrous, eglandular</b>	densely lepidote (except at base)	densely lepidote (except at base)
<b>Ecology</b>	riparian forest	low forest on lateritic crust	forest on drained soils (including xerophytic formations on granitic outcrops)

**Inflorescence** axillary, a congested raceme, 2–6-flowered; peduncle 0.8–1 cm and rachis 0.4–0.7 cm long, both with short densely arranged non-glandular trichomes; bracts and bracteoles subulate, 1–1.5 mm, with eglandular trichomes. **Flowers** pedicellate; pedicel 4–5.5 mm long, puberulous and sometimes sparsely lepidote at apex. **Calyx** green, campanulate, 5–9 × 4–9 mm, truncate, minutely ciliate on the margin, otherwise puberulous at base and glabrous at apex, with groups of cupular/patelliform glandular trichomes in the middle and upper portions. **Corolla** pale yellow to white, the lobes sometimes pink, zygomorphic, infundibuliform, tube 3.7–5.5 cm long, campanulate, widening around the lower 1/5<sup>th</sup> to 1/3<sup>rd</sup>, 0.2–0.5 cm wide at base, 1.2–1.8 cm wide at mouth, outside glabrous at the base and lepidote with peltate glandular trichomes densely distributed through the medium and apical portions, cupular/patelliform glandular trichomes present towards the apex or absent, inside glabrous except for a broad ring of capitate glandular trichomes at the insertion of the stamens; lobes round, 0.5–1.3 × 0.5–1.2 cm, ciliate on the margin, outside lepidote with peltate glandular trichomes (often glabrescent towards the margin) and sparse cupular/patelliform glandular trichomes towards the base, densely lepidote inside with peltate glandular trichomes. **Stamens** didynamous, included, filaments glabrous, 1.6–1.8 cm long in longer stamens, 1.3–1.5 cm long in shorter stamens, anthers glabrous, thecae 0.35–0.5 cm, forming an

acute angle; staminode linear, 0.4–0.5 cm long, glabrous. **Ovary** ellipsoid, 0.4 × 0.1 cm, non-stipitate, lepidote with peltate glandular trichomes. **Style** included, 2.3–4 cm long, glabrous, style lobes 2–2.5 mm long, glabrous. **Nectar disk** annular, 1.2–2.5 mm long, glabrous. **Fruit** capsular, 2-valved, coriaceous, green when young, brown and dry when mature, ellipsoid and compressed, 6.5–14.5 × 3.5–5.5 cm, glabrous. **Seeds** numerous, whitish, flat and winged, 2.2–2.5 × 3–3.8 cm; embryo cordiform, 1–1.1 × 1.4–1.5 cm.

**Distribution and ecology** – This species occurs in northern Brazil (Amazonas, Roraima, and Pará), south-eastern Colombia, north-central Guyana, central Suriname, and the extreme south of French Guiana (fig. 3). It occurs in forest on drained soils, occasionally on white sands or in low xerophytic forests on inselbergs, up to 300 m in elevation.

**Phenology** – Flowers have been collected in all months except March, August, and November; fruits were collected from September to December.

**IUCN conservation assessment (provisional)** – Least Concern: LC. *Anemopaegma foetidum* occurs in forests growing on drained soils, sometimes on inselbergs, in northern Amazonia and the Guianas. Its extent of occurrence (EOO) is estimated as 1,029,954 km<sup>2</sup>, well above the limit for Vulnerable status under criterion B1, and its area of occupancy (AOO) as 64 km<sup>2</sup>, within the limit for Endangered



**Key to species of *Anemopaegma* from the Guianas**  
(abbreviations: GU = Guyana, SU = Suriname, FG = French Guiana)

1. Leaflets with main venation palmate or subpalmate; tertiary veins densely reticulate and conspicuous below ..... **2**
- 1'. Leaflets with main venation pinnate (tending to subpalmate in *A. longidens*); tertiary veins lax and faint below ..... **3**
2. Stems and petioles densely villose, with spreading hairs; leaflets not bullate; calyx lobes 1–3 mm long [GU] ..... ***A. jucundum* Bureau & K.Schum.**
- 2'. Stems and petioles puberulous, with short crisped hairs; leaflets bullate; calyx lobes 0.5–1 mm long [GU SU FG] ..... ***A. oligoneuron* (Sprague & Sandwith) A.H.Gentry**
3. Stems with interpetiolar glandular fields; corolla glabrous outside except for large cupular/patelliform trichomes at the base of the lobes; calyx lobes (1–)3–5 mm long [FG] ..... ***A. longidens* DC.**
- 3'. Stems without interpetiolar glandular fields; corolla not as above, outside either densely lepidote or completely eglandular; calyx lobes < 1 mm long ..... **4**
4. Leaflet midrib slightly prominent above; corolla glabrous outside; fruits (unknown in *A. granvillei*) coriaceous but not woody, seeds not winged ..... **5**
- 4'. Leaflet midrib impressed or flat above; corolla lepidote or pubescent outside; fruits (unknown in *A. ionanthum*) either woody or coriaceous, if the latter then seeds winged ..... **7**
5. Prophylls of the axillary buds small, 2–4 × 1–1.5 mm, narrowly elliptic, caducous [SU FG] ..... ***A. granvillei* A.H.Gentry**
- 5'. Prophylls of the axillary buds large, 7–20 mm, foliaceous, persistent ..... **6**
6. Leaflets not bullate above, 2.5–6.4 cm wide; corolla tube 5.5–7 cm long [GU] ..... ***A. chrysoleucum* (Kunth) Sandwith**
- 6'. Leaflets bullate above, 5–16 cm wide; corolla tube 2.5–4.5 cm long [GU SU FG] ..... ***A. paraense* Bureau & K.Schum.**
7. Stems densely villose, hairs 1–1.5 mm long; secondary veins of leaflets rather faint, flat or nearly so on the lower surface; petioles 0.2–1 cm long [FG] ..... ***A. kawense* O.Lachenaud & Firetti-Legg.**
- 7'. Stems glabrous or puberulous, hairs if present < 0.2 mm long; secondary veins of leaflets conspicuous and raised on the lower surface; petioles usually > 1 cm long (rarely shorter in *A. foetidum*) ..... **8**
8. Leaflets dull above, with surface minutely rugulose when dry; fruits (unknown in *A. ionanthum*) woody, the seeds winged or not; corolla with glandular trichomes, often mixed with eglandular ones outside ..... **9**
- 8'. Leaflets shiny above, with surface smooth when dry; fruits coriaceous but not woody, the seeds always winged; corolla with glandular trichomes only ..... **11**
9. Bark of twigs exfoliating; tendrils trifid; corolla with glandular trichomes outside; seeds winged [GU SU FG] ..... ***A. parkeri* Sprague**
- 9'. Bark of twigs not exfoliating; tendrils mostly simple (rarely trifid in *A. ionanthum*); corolla with both glandular and eglandular trichomes outside; seeds (unknown in *A. ionanthum*) not winged ..... **10**
10. Stems not lenticellate; leaflets 5.5–13.5 × 2.5–9 cm, rounded at base; calyx sparsely puberulous; corolla with purple lobes, the tube cream or yellow [GU FG] ..... ***A. ionanthum* A.H.Gentry**
- 10'. Stems lenticellate; leaflets 14–22 × 8–12.5 cm, cordate at base; calyx densely pubescent; corolla entirely yellow [GU FG] ..... ***A. robustum* Bureau & K.Schum**
11. Prophylls of the axillary buds not foliaceous; leaflets with (5–)6–10 pairs of weakly ascending secondary veins; corolla lepidote outside and with cupular/patelliform trichomes around the base of the lobes [GU SU FG] ..... ***A. foetidum* Bureau & K.Schum.**
- 11'. Prophylls of the axillary buds foliaceous (but early caducous); leaflets with 4–5 pairs of strongly ascending secondary veins; corolla lepidote outside without cupular/patelliform trichomes [GU] ..... ***A. karstenii* Bureau & K.Schum.**

status under criterion B2. The species is known from 32 collections, representing 16 occurrences, three of which occur in protected areas (Parc Amazonien de Guyane in French Guiana, and Parque Nacional do Viruá and Reserva Florestal Ducke in Brazil). Deforestation for agriculture represents a threat to the species in parts of its range in the Brazilian Amazon. Some historical occurrences around Manaus have probably been lost because of urban expansion. As a result, a decline in area of occupancy, habitat extent and quality, number of subpopulations, and number of individuals may be inferred. The 16 occurrences represent 14 locations in the sense of the IUCN, which is above the limit for Vulnerable status under subcriterion B2ab. Consequently, the species is assessed as Least Concern. In addition, considering the low collection density in most of its range, it is likely to be more widespread than the records suggest.

**Additional specimens examined** – FRENCH GUIANA • Mont Saint-Marcel, zone sud-est du massif; 2°23'00"N, 53°00'20"W; 19 Jul. 2002; fl.; *Granville et al. 15331*; CAY, P.

SURINAME • Bakhuis Mts, concession BMS; 4°30'N, 57°01'W; 5 Apr. 2006; fl.; *Bordenave et al. 8373*; CAY • Along creek running perpendicular to Lisa's creek; 26 Jun. 1998; fl.; *Lohmann 176*; BBS, MO • Between north ridge and Lisa creek; 28 Jun. 1998; fl.; *Lohmann 186*; BBS, L, MO, SPF, US.

GUYANA • East of Ituni, 35 miles S of Mackenzie; 17 Jan. 1955; fl.; *Cowan 39224*; K • Mabura Hill; 21 Apr. 1989; *Hahn 5817*; MO, US.

BRAZIL – Amazonas • Manaus, Br-18 km 8; 22 Apr. 1955; fl.; *J. Chagas 987*; K • Manaus, km 9 da Br-17; 24 Jun. 1955; fl.; *J. Chagas 1248*; K • Manaus, Igarapé de Santa Maria; 24 Feb. 1956; fl.; *J. Chagas & D.F. Coêlho 3505*; K • Manaus, Paredão; 23 Apr. 1956; st.; *D.F. Coêlho & F. Mello s.n.*; INPA • Praia Dorada, Rio Negro near Manaus; 24 May 1980; fl.; *Davidson 9966*; MO • Manaus, margem do Igarapé do Passarinho; 17 Nov. 1955; fr.; *Dionisio 2917*; K • Km 130, Manaus–Caracará Road (BR 174); 1 Dec. 1974; st.; *Gentry 12977*; MO, WAG • Bank of Rio Taramã at Praia Dourado; 14 Dec. 1974; fl., fr.; *Gentry 13285*; MO • Manaus, Paredão; 23 Apr. 1956; fl.; *Luiz & Francisco 3764*; K • Est Exp Silv Trop INPA/SUFRAMA, km 45 da BR L74; 7 Jun. 1981; fl.; *Mantovani & da Rocha 12793*; MO • Manacapuru, Propriedade do Sr. Pedro Brussio Barbosa, Sistema Agroflorestal; 3°17'08"S, 60°33'10"W; 29 Apr. 1997; st.; *D. Mitja 4234*; INPA • Tapuruquara, Margem do Rio Negro; 21 Oct. 1971; fl.; *Prance et al. 15766*; INPA, MO • 2 km from Rio Cuieras at 2 km below mouth of Rio Brancinho; 15 Sep. 1973; fl., fr.; *Prance 17996*; MO, U • Manaus, Manaus–Itacoatiara, km 29; 19 Oct. 1960; fr.; *W.A. Rodrigues & J. Chagas 1860*; GH, IAN, INPA, MO • Manaus, Igarapé do Buaio; 1 Nov. 1965; fr.; *W.A. Rodrigues & J. Chagas 2065*; INPA • Manaus, Igarapé do Passarinho; 9 Dec. 1961; fl.; *W.A. Rodrigues & D.F. Coêlho 2453*; INPA • Tapuruquara, Margem do rio; 30 Apr. 1973; fl.; *M.F. Silva et al. 1177*; INPA • Reserva Florestal Ducke; 2°53'S, 59°58'W; 14 Jun. 1996; fb.; *M.A.D. de Souza et al. 252*; K • Reserva Florestal Ducke; 21 Apr. 1997; fl.; *M.A.D. de Souza et al. 678*; K. – Pará • Campos ao E. de Faro; 23 May 1911; fl.; *Ducke s.n.*;

MG. – **Roraima** • Caracará, Parque Nacional do Viruá, ao longo da estrada de terra conhecida como “Estrada Perdida”, Campina amazônica; 16 Sep. 2010; st.; *A. Nogueira & L.H. Fonseca 339*; SPF.

COLOMBIA – **Vaupés** • Mitú and vicinity, along Rio Vaupés at Circasia; 14 Sep. 1976; fl.; *Zarucchi 2059*; INPA.

**Notes** – This species is morphologically similar to *A. kawense* (see table 1 for differences) and to *A. karstenii* Bureau & K.Schum. For differences with the latter, see the key. Photographs of *A. foetidum* (flowers and leaves) are found in Ribeiro et al. (1999: 609, 621). Several collectors note that the flowers have a strong foetid smell – hence the species epithet. As noted in the description, the corolla is variable in colour: it may be yellow or white, sometimes with pink lobes. In other species of the genus, the corolla is uniformly yellow or cream, the only exception is *A. ionanthum* with purple lobes.

The type of *A. foetidum* deposited at B was destroyed. However, according to Sandwith (1958: 427), there is a specimen in GOET with the same locality and date, labelled “Manãos, 20.iv.1882, ex *Herb. Schwacke* no. III.258” which is likely a duplicate. This collection would make a convenient lectotype but we refrain from designating it as such, having not seen the specimen itself.

The type of *A. maguirei* was identified by Gentry in 1990 as *A. foetidum*, although this synonymy has not been published. Sandwith (1958), in his original description of *A. maguirei*, does not specify whether the holotype is deposited at K or NY, although he wrote on the NY sheet: “The Kew specimen, with calyces, was used for my description, and I have made it the type.” Therefore, preserving the intention of the original author, the K sheet is here selected as lectotype.

The original description of *A. umbellatum* mentions the type as being deposited at RB; this herbarium holds two sheets of *Ducke s.n. (RB 24090)* of which the most complete, with barcode RB00536866, is here selected as lectotype.

The collection from French Guiana, near the border with Brazil, cited in the additional specimens examined, is a new country record. The species was not reported from French Guiana in an earlier account of tribe Bignoniaceae (Lohmann & Taylor 2014), nor in species lists for the region (Funk et al. 2007; Lohmann & Ulloa Ulloa 2020).

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