

First record of *Neea madeirana* (Nyctaginaceae: Pisonieae) from the Peruvian Amazon

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ABSTRACT

Neea is one of the largest genera of Nyctaginaceae and comprises approximately 80 species distributed in the Neotropical region. Here, we report for the first time the occurrence of *Neea madeirana* in Peru, almost 50 years after it was first collected in this country, but was misidentified as *Guapira noxia*. We also insert *N. madeirana* in the identification key for Peruvian species of *Neea* and update the distribution map of *N. madeirana*. Given that we have not located any posterior specimen of *G. noxia* in Peruvian collections, and the original specimens cited as *G. noxia* correspond to *N. madeirana*, we suggest the exclusion of *G. noxia* from the Peruvian flora checklist.

KEYWORDS: Caryophyllales, Loreto, new record, Pisonieae, taxonomy

Primeiro registro de *Neea madeirana* (Nyctaginaceae: Pisonieae) da Amazônia peruana

RESUMO

Neea é um dos maiores gêneros de Nyctaginaceae e compreende aproximadamente 80 espécies distribuídas na região neotropical. Aqui, relatamos, pela primeira vez, a ocorrência de *Neea madeirana* no Peru, quase 50 anos depois de ter sido coletada pela primeira vez neste país, mas foi erroneamente identificada como *Guapira noxia*. Também inserimos *N. madeirana* na chave de identificação para espécies peruanas de *Neea* e atualizamos o mapa de distribuição de *N. madeirana*. Dado que não localizamos nenhum espécime posterior de *G. noxia* nas coleções peruanas, e os espécimes originais citados como *G. noxia* correspondem a *N. madeirana*, sugerimos a exclusão de *G. noxia* da flora peruana.

PALAVRAS-CHAVE: Caryophyllales, Loreto, novo registro, Pisonieae, taxonomia

Neea Ruiz & Pav. is one of the largest genera in the family Nyctaginaceae, comprising approximately 80 species distributed in the Neotropical region (Furlan and Giulietti 2014), and is most diverse in the Amazonas and Orinoco river basins and the Guayana Shield region (Steyermark and Aymard 2003; Costa et al. 2021). The genus is found in eleven neotropical countries, of which Brazil (ca. 23 spp.), Venezuela (ca. 25), and Peru (ca. 20) (Grandtner and Chevrette 2014) have the most species.

In the Peruvian Amazon, *Neea* is represented by 13 species that occur in different habitats, such as tropical lowland and montane forests (Vásquez et al. 2018). In the state of Loreto, there are records of eight species that occur in upland primary forests (Vásquez 1997; Vásquez et al. 2018). However, cataloguing the diversity of *Neea* is still a work in progress,

and many specimens in collections remain potentially unidentified or misidentified (Costa et al. 2023). While reviewing the Herbario Amazonense (AMAZ) collection, we found specimens identified as *Guapira noxia* (Netto) Lundell collected in Loreto, Peru. However, *G. noxia* is typical of the Cerrado savanna in Brazil. Therefore, we reexamined these specimens and redescribe them here as *Neea madeirana* Standl., which is herewith reported for the first time for Peru.

We analyzed specimens at herbaria AMAZ and HH, and online images of specimens at F, MO and U (acronyms follow Thiers 2022), all misidentified as *G. noxia*. In addition, between July and November 2020, we conducted expeditions in the Napo River basin in the Peruvian Amazon. The material from Peru was morphologically compared with the *N. madeirana* holotype and its respective synonyms, according

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to Furlan and Giulietti (2014) (*Neea krukovii* Standl. and *Neea aeruginosa* Standl.), available at BM, F, K, NY, and RB. The material was measured using a digital caliper, following the terminology of Radford et al. (1974), Furlan and Giulietti (2014), and Ellis et al. (2009) for leaf architecture. The description of *Neea huachamacarae* Steyerl., followed Steyerl. and Aymard (2003).

Quantitative morphological characters were presented as mean, standard deviation and the range (maximum and minimum), according to Vasconcelos et al. (2020). To prepare an updated distribution map for *N. madeirana*, geographical coordinates of records throughout its distribution range were obtained from herbarium specimen labels available online on SpeciesLink (2021) and Reflora (2021). The map was made with the package *Maps* (Becker and Wilks 2013) in the program R (R Core Team 2020). We determined the conservation status of the species using IUCN criteria (IUCN 2021) with the *ConR* package (Dauby et al. 2017) estimating the area of occupancy (AOO), extent of occurrence (EOO), and number of subpopulations.

***Neea madeirana* Standl.**

(Figures 1 and 2)

Description – *Trees*, 10–30 m tall. Trunk 25 cm DBH. *Leaves* subopposite; petioles 1.3–(2.3 ± 0.9)–4.9 cm long, tomentose; blades 5.4–(14 ± 5.7)–23.6 × 3.2–(7.2 ± 3)–13.4 cm, elliptic or ovate, surface smooth, adaxially and abaxially pubescent to tomentose, trichomes reddish; apex attenuate or acute; base acute or asymmetric; margin entire. Midrib pinnate, adaxially impressed or prominent, abaxially prominent; secondary venation brochidodromous, with 6–(10.2 ± 2.7)–15 pairs, adaxially impressed, abaxially prominent, tertiary veins alternate percurrent. *Inflorescences* 1–3, 1.6–(3.1 ± 1.3)–3.9 cm long, in terminal to cauliflorous cymes, with dense trichomes, tomentose or ferruginous-puberulous, reddish; primary branches 1.4–(2.4 ± 0.8)–3.4 cm long, opposite to alternate, branched into 3–5 secondary axes, these subopposite, with dense reddish trichomes and groups of flowers congested at the apical portion. *Bracts* not observed. *Bracteoles* deltoid, with reddish trichomes covering the surface. *Staminate buds* not observed. *Staminate flowers* 4–(5.4 ± 0.6)–6.5 × 2–(2.4 ± 0.2)–2.5 mm, urceolate, 5-lobed, lobes close, deltoid, densely pubescent. *Pistillate flowers* 2.2–(2.6 ± 0.2)–2.5 × 1.5–(1.5 ± 0.1)–1.7 mm, tubular, 5-lobed, lobes close, deltoid, densely pubescent; ovary 0.7–(0.9 ± 0.2)–1 mm long, elliptic to ovoid; style 0.7–(0.9 ± 0.3)–1.4 mm long; stigma entire; staminodes 4–6, ca. 1–(1.3 ± 0.2)–1.5 mm long. *Infructescences* 7.3–(8.6 ± 0.9)–9.3 cm long, puberulent. *Anthocarps* 1.5–(1.8 ± 0.3)–2.2 cm, elliptic; apical cupule apiculate or commonly absent.

Material examined - PERU. Loreto: Maynas: Santa María de Nanay, Río Nanay, halfway between Santa María de Nanay and Iquitos, 3°50'S, 73°30'W, c.a. 140 m, 23 February 1981 (fr.), A.H. Gentry et al. 31563 (AMAZ! [12787], F!, MO!, U!);

ibid: Santa María de Nanay, 3°52'52.00"S, 73°29'31.00"O, c.a. 90m, 1 October 1981 (bud), J.J. Pipoly et al. 12666 (MO! [738340]); Requena: Jenaro Herrera, km 2.8 de la carretera Jenaro Herrera-Angamos, arboreto de terraza alta del CIJH, 04°50'S, 73°45'W, 10 January 1983 (fl.), D. Angulo 7/153 (HH! [2603]); Maynas: Puerto Almendras: Río Nanay, 03°45'S, 73°25'W, 122m, 25 October 1984 (fl.), R. Vásquez et al. 5849 (AMAZ! [21143], MO!); Requena: Jenaro Herrera, 04°50'S, 73°45'W, 122m, 13 September 1987 (fl.), R. Vásquez et al. 9538 (AMAZ! [113], MO!); Río Apayacu, Terra firme forest on low rolling hills in the upper watershed of the Apayacu River. Soils well-drained 38% sand and 16% clay, 3° 07'00»S, 72°42'45»W, 16-23 August 2003 (sterile), N. Pitman et al. 9744 (AMAZ! [34404]); Santa Clotilde, Río Napo, bosque sobre arcilla, 1° 0'18.19"S 74°49'7.08"O, c.a. 160 m, 22 November 2020 (fr.), R. Soplin et al. 37-A-5 (AMAZ! [97584]). **BOLIVIA.** Pando: W bank of rio Madeira, 2 km above Abuná, 10°24'57.36"S 65°29'14.87"O, 25 July 1968 (fr.), G.T. Prance et al. 6492 (INPA!, NY). **BRAZIL.** Acre: Mâncio Lima:

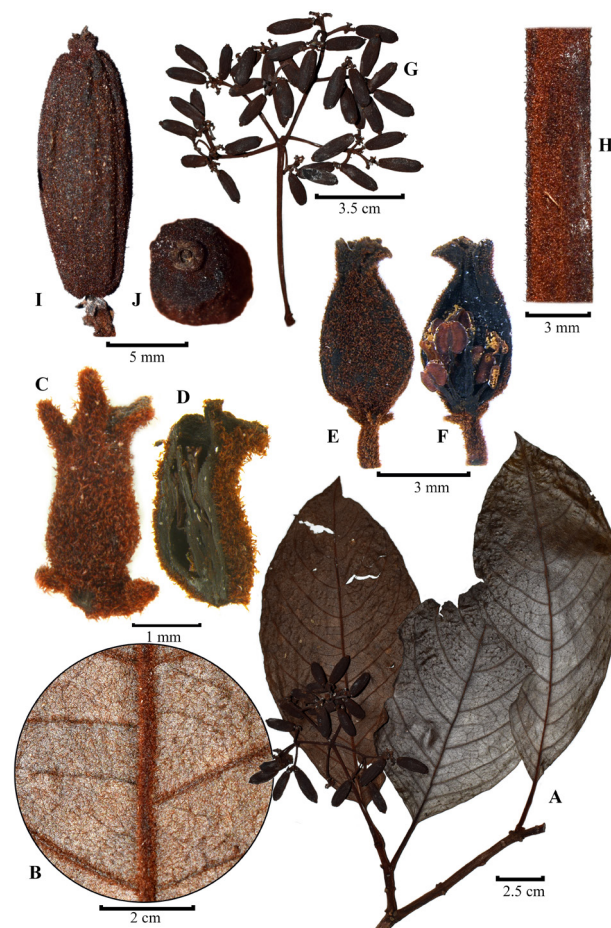


Figure 1. *Neea madeirana*. A – fertile branch; B – detail of veins on abaxial surface; C–D – pistillate flower; E–F – staminate flower; G – infructescence; H – detail of infructescence axis; I – anthocarp; J – cupule of anthocarp. (A–B, G–J from R. Soplin 37-A-5; C–D from N. T. Silva 5401) Credit: Francisco Farroñay.

Ramal do Banho a 5 Km da Sede do Município, 7°54'0.00"S, 73°28'12.00"O, 8 November 1991 (fr.), *C.A. Cid Ferreira et al. 10629* (INPA!, NY, UFAC!); Amazonas: Manaus: Reserva Florestal Adolfo Ducke, 2°52'48.00"S, 59°58'12.00"O, 8 October 2015 (sterile), *G.P. Viana s.n.* (INPA!, FUEL!); *ibid.*: 2°52'48.00"S, 59°58'12.00"O, 31 October 1994 (buds), *A. Vicentini & C.F. Silva 754* (IAN!, FUEL!, NY!); Presidente Figueiredo: Rebio Uatumã, grade do PPBio, 0°59'60.00"S 59° 0'0.00"O, 25 September 2007 (fl.), *J.G de Carvalho-Sobrinho 1683* (INPA!, FUEL!); São Gabriel da Cachoeira: Camanaús, Alto Rio Negro, abaixo de Camanaus. Caatinga com piassabal, 0° 7'12.00"S, 67°34'48.00"O, 15 October 1932 (bud), *W.A. Ducke 25641* (RB); Pará: Almeirim: Área Cova da Onça, 2°18'55.33"S, 59°41'7.70"O, 15 August 1979 (fl.), *N.T. Silva 5401* (INPA!); Rondônia: Manicoré: RADAM/ BRASIL SB-20-XD, Sub-base do Projeto RADAM/ BRASIL SB-20-XD-Pro.02, 5°49'60.00"S 61°16'60.00"O, 19 August 1976 (fl.), *C.D.A. Mota s.n.* (INPA!); Mato Grosso: Reserva Cirecatina, Próximo Alcaítitu - Reserva Ciracatinga Sopezal, 12°41'60.00"S 58° 5'60.00"O, 24 August 1995 (fl.), *R. Godinho 2* (INPA!)

Distribution and habitat - It is known to occur in *terra firme* forests in Brazil, in the states of Amapá, Amazonas, Mato Grosso, Maranhão, Pará, and Rondônia (Furlan and Giulietti 2014; Costa et al. 2020), and in Bolivia, in the state of Pando. Here we expand the known distribution to Peru, Loreto state, where it occurs in upland primary forests with well-drained, sandy and clayey soils (Figure 2).

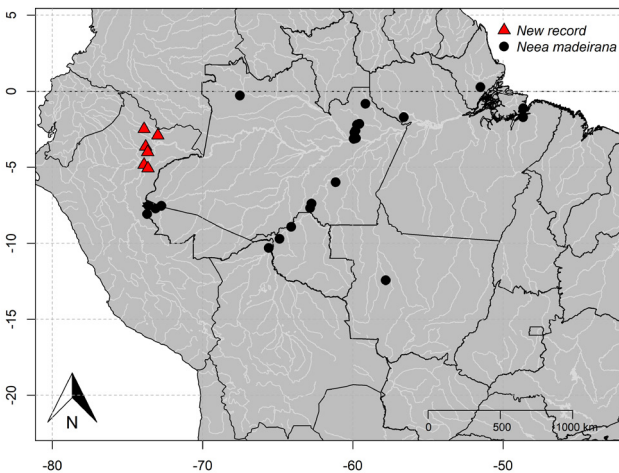


Figure 2. Updated distribution map of *Neea madeirana*.

Conservation status - Based on the updated distribution (Brazil, Bolivia, and Peru), EOO is 4,478,116 km² and AOO is 144 km², with 38 subpopulations (radius 5 km). According to IUCN criteria, *Neea madeirana* is categorized as of Least Concern (LC).

Diagnosis - *Neea madeirana* is characterized by Furlan and Giulietti (2014) by the reddish trichomes covering the midrib

on both leaf surfaces (Figure 1a,b) and reproductive structures (e.g., inflorescence, bracts, bracteoles, and flowers) (Figure 1a-h), inflorescence and infructescence with opposite, alternate or subverticillate primary axes (Figure 1a-g), urceolate, tomentose staminate flowers with long, truncated lobes (Figure 1e,f), and tubular, tomentose pistillate flowers with long, linear lobes (Figure 1c,d). Relative to the diagnosis by Furlan and Giulietti (2014) for *Neea madeirana* from Brazil, the most relevant differences we observed to the specimens from Peru were that the indument of the staminate perianth is densely pubescent (vs. puberulous or glabrescent) and the cupule of the anthocarps are apiculate (vs. immerse) (see Figure 1).

The misidentification of *Neea madeirana* as *Guapira noxia* was probably due to the vegetative similarity between them, as both have leaves with a tomentose adaxial surface with reddish trichomes. However, *N. madeirana* can be differentiated from *G. noxia* by the shape of the tertiary veins (alternate-percurrent vs. ramified), the shape of the staminate flowers (urceolate vs. campanulate), the position of the stamens in the perianth (included vs. exerted), and the shape of the pistillate flower lobes (deltoid vs. papillated) (see Furlan and Giulietti 2014). Also, *G. noxia* in Brazil has a greater affinity for savanna environments, while *N. madeirana* occurs predominantly in Amazonian rainforests (*terra firme* forests and dry forests on slopes) (see Furlan and Giulietti 2014).

We recommend removing *G. noxia* from the Peruvian flora list, as the specimens cited in the Peruvian tree checklist by Vásquez et al. (2018) (collection *Gentry 31563*) are *Neea madeirana* as reported in this study.

Updated key to the species of *Neea* in Peru (modified from Costa et al. 2020)

- 1. Leaves alternate *N. virens* Poepp. ex Heimerl
- 1. Leaves opposite, subopposite, or verticillate 2
- 2. Leaves equal or more than 30 cm long 3
- 3. Peduncle flexible, less than 3 cm thick *N. laxa* Poepp. & Endl.
- 3. Peduncle inflexible, more than 3 cm thick 4
- 4. Bracts deltoid, ca. 1.5 mm long *N. floribunda* Poepp. & Endl.
- 4. Bracts linear or lanceolate, more than 2 mm long 5
- 5. Pistillate flowers glabrous *N. mapirensis* Standl.
- 5. Pistillate flowers pubescent ... *N. verticillata* Ruiz & Pav.
- 2. Leaves less than 30 cm long 6
- 6. Intersecondary veins less than 1 cm from major secondary veins *N. ovalifolia* Spruce ex. J.A. Schmidt
- 6. Intersecondary veins more than 1 cm from major secondary veins 7
- 7. Leaves pubescent 8

8. Intercostal tertiary veins ramified
..... *N. parviflora* Poepp. & Endl.
8. Intercostal tertiary veins opposite percurrent
..... *N. madeirana* Standl.
7. Leaves glabrous 9
9. Staminate flowers tubular, with minute trichomes at the
base *N. oppositifolia* Ruiz & Pav.
9. Staminate flowers subpandurate-tubular or cylindric-
campanulate, glabrous 10
10. Staminate flowers 4–5.5 mm long
..... *N. macrophylla* Poepp. & Endl.
10. Staminate flowers 7.5–8 mm long
..... *N. huachamacaruae* Steyermark.

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DATA AVAILABILITY

The data that support the findings of this study are not publicly available.



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