**Chusquea nedjaquithii** (Poaceae: Bambusoideae, Bambuseae, Chusqueinae), a new endemic species from Oaxaca, Mexico

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**Abstract**

*Chusquea* is the most diverse among woody bamboo genera, with 174 described species. Not surprisingly, *Chusquea* is the most diverse bamboo genus in Mexico, and with the description of *C. nedjaquithii* the number of species will increase to 20, representing almost 45% of the total Mexican woody bamboo diversity. Based on fieldwork in the Mexican state of Oaxaca and revision of herbarium specimens we describe and illustrate *C. nedjaquithii*, a species endemic to the Sierra Madre del Sur in Oaxaca, Mexico. *Chusquea nedjaquithii* is similar to *C. liebmannii* but differs in having culms with deciduous hairs, an oblate central bud and fewer subsidiary buds, strongly geniculate branches in one row forming an incomplete verticil, oblique foliage leaf blade bases, and longer inner ligules in the foliage leaves. A key to the Mexican *Chusquea* species based on vegetative characters is provided.

**Keywords**: endemic, Neotropical cloud forest, Sierra Madre del Sur, woody bamboo

**Resumen**

El género *Chusquea* es el más diverso entre los géneros de bambúes leñosos. En México no es la excepción, con la descripción de *C. nedjaquithii*, se incrementa el número de especies a 20, representando casi el 45% de la diversidad total de bambúes leñosos en México. Basados en trabajo de campo en el estado de Oaxaca y revisión de especímenes de herbarios, describimos e ilustramos *C. nedjaquithii* endémica de la Sierra Madre del Sur en Oaxaca, México. *Chusquea nedjaquithii* es similar a *C. liebmannii*, pero difiere en tener culmos con pelos hirsutos y deciduos, yema central oblada y menos yemas subsidiarias, ramas fuertemente geniculadas formando un verticilo incompleto en una única fila, hojas del follaje con bases oblicuas y ligula interna más larga. Se presenta una clave de las especies Mexicanas de *Chusquea* basada en caracteres morfológicos vegetativos.

**Palabras clave**: especie endémica, Bosques nublados Neotropicales, Sierra Madre del Sur, bambúes leñosos

**Introduction**

*Chusquea* Kunth (1822: 151) is the most diverse woody bamboo genus, with 174 described species (Fisher et al. 2009, 2014; Bamboo Phylogeny Group 2012; Costa Mota et al. 2014a,b; Guerreiro & Rúgulo de Agrasar 2014). *Chusquea* species are found in a wide range of habitats, from Andean montane forests, páramos, subpáramos, campos de altitud, Atlantic forests, Southern beech forests to Neotropical cloud forests, tropical dry forests, pine-oak and fir-pine forests in South America, Mexico, Central America and the West Indies (Clark 1989; Judziewicz et al. 1999; Fisher et al. 2009; Ruiz-Sanchez & Clark 2013; Ruiz-Sanchez et al. 2014). Species of *Chusquea* range from sea level to 4,300 m in elevation, giving this genus the broadest altitudinal range of any bamboo. *Chusquea* species tend to form a visible and sometimes dominant component of the vegetation (Clark 1989; Judziewicz et al. 1999; Fisher et al. 2009).

Recent molecular phylogenetic studies indicate that *Chusquea* is a monophyletic lineage, recognized as the

Mexico is home to 46 species of woody bamboos. Two genera (Chusquea with 19 species and Olatea (McClure & E.W. Sm) Calderon & Soderstrom (1980: 21) with eight species) account for more than 62% of the diversity (Rui-Sanchez 2012, 2013; Ruiz-Sanchez et al 2011b, 2014; Ruiz-Sanchez & Clark 2013; Londoño & Ruiz-Sanchez, 2014). Of the 19 Mexican Chusquea species, 15 grow in Neotropical cloud forest and 10 are endemic to Mexico. With our description of the new endemic species the number of Mexican Chusquea species will increase to 20, with 11 of these endemic to Mexico.

Following fieldwork in the summer of 2013 in the Sierra Madre del Sur in the Mexican state of Oaxaca and a review of herbarium specimens we noted one entity that did not match any known Mexican Chusquea species morphologically, although it shared similarities with C. liebmannii Fournier (1886: 587). We conducted a morphological analysis comparing our collected specimens with the species cited above and concluded that it represented an undescribed species, which we here describe as C. nedjaquithii. Chusquea nedjaquithii is classified in Chusquea subg. Chusquea sect. Verticillatae Clark (1989: 74) because it has 13 to 17 subsidiary smaller buds in two patches (one subtending the central bud) arranged in an incomplete verticil. A morphological key to the Mexican Chusquea species based on vegetative characters is presented.

Key to the species of Chusquea present in Mexico based on vegetative characters

1. Internodes hollow .................................................................................................................................2
2. Internodes solid, sometimes becoming fistulose with age .................................................................3
3. Internodes thin-walled; subsidiary buds/branches at mid-culm nodes numerous, verticillate, subequal; foliage leaf blades abaxially glabrous .......................................................................................................................... C. perotensis Clark, Cortes & Chazaro (1997: 225) 4. Internodes thick-walled; subsidiary buds/branches at mid-culm nodes 5–16, constellate, of two sizes; foliage leaf blades abaxially ciliate at the blade base. ................................................................................................. C. matlatzinca Ruiz-Sanchez & Clark (2013: 3)
3. Subsidiary buds/branches at mid-culm nodes numerous, verticillate or nearly so ......................................4
4. Subsidiary buds/branches at mid-culm nodes few to numerous, constellate or linear but never encircling the node ........................................8
5. Central bud circular or oblate; apex of culm leaf sheath short and more or less broad .....................................5
6. Central bud triangular; apex of culm leaf sheath narrow and elongate .........................................................6
7. Culms 3–5 cm in basal diameter, 10–20 m tall, erect to scandent at the tips; root thorns encircling the lower and middle nodes of culm and major branches, some root thorns usually present on upper nodes of culms and major branches ................................................................. C. pittieri Hackel (1903: 153)
8. Culms to 2.5 cm in basal diameter, to 15 m tall, arching and clambering, not erect; root thorns usually absent, rarely a few present at mid-culm nodes ..................................................................................................................7
9. Subsidiary branches 60–100 or more per node, 0.3–0.5 mm in diameter, exserted more or less horizontally; foliage leaf blades 0.3–1.2 cm wide, L/W = 5.8–10, the base attenuate, the apex apiculate..............C. coronalis Soderstrom & Calderon (1978: 158)
10. Subsidiary branches 20–50 per node, 0.6–0.9(–1) mm in diameter, exserted more or less vertically; foliage leaf blades 0.3–0.7 cm wide, L/W = 8–16.5(–23), the base attenuate to rounded-attenuate, the apex apiculate to subulate ................................................................. C. circinata Soderstrom & Calderon (1978: 156)
11. Branching extravaginal, never extravaginal or intravaginal; plants scrambling and hanging from vegetation .................................................. C. glauca Clark (1989: 95)
12. Branching extravaginal or both extravaginal and intravaginal, never intravaginal; plants erect to arching and clambering
10. Foliage leaf blades 10–11.7 cm long, 0.8–1.2 cm wide; culms 0.05–0.15 cm in diameter, 0.2–1 m tall; endemic to Volcan Acatlán, Veracruz, Mexico.......................................................... C. enigmatica Ruiz-Sanchez, Mejia-Saulés & Clark (2014: 20)

10. Foliage leaf blades 12.5–24.5 cm long, 2.1–4 cm wide; culms 1–2 cm in diameter, 2–8 m tall; Chiapas, Mexico to Honduras.......................................................... C. lanceolata Hitchcock ex Morton (1935: 145)

11. Branching intravaginal; subsidiary buds both flanking and subtending the central bud, forming a line extending up to half the circumference of the node; foliage leaf blades abaxially tessellate .................................................. C. bilimekii Fournier (1886: 132)

11. Branching extravaginal or extravaginal; subsidiary buds strictly constellate, subtending or curving around the central bud; foliage leaf blades abaxially usually not tessellate .......................................................... C. cortesii Ruiz-Sanchez & Clark (2014: 20)

12. Branching extravaginal, culm leaves often deciduous as branches develop; foliage leaf blades usually with an abaxial tuft of hairs at the base (sometimes lacking in C. sulcata) ......................................................................................................... C. simpliciflora Munro (1868: 54)

12. Branching intravaginal, culm leaves usually persistent; foliage leaf blades abaxially glabrous, pilose or with scattered hairs but lacking a defined tuft of hairs at the base ............................................................................................................. C. sulcata Swallen (1940: 209)

13. Central bud circular; internodes 27–50 cm long ................................................................. C. galeottiana Munro (1868: 59)

13. Central bud triangular; internodes 10–22 cm long .......................................................................................................................... C. repens Muero (1868: 65)

14. Foliage leaf blades 0.7–1.5 cm wide, L:W = 5–8.5; culms climbing and hanging; tropical or montane forest ................................................................. C. simplexta Munro (1868: 74)

14. Foliage leaf blades 0.3–0.9 cm wide, L:W = 8–30; culms erect and arching only at the apices to arching; montane or pine-oak forests ................................................................. C. circinata Munro (1868: 20)

15. Culm leaf sheaths narrowed and elongate toward the apex, bottle-shaped; foliage leaf blade L:W = 8–16.5(–23); culms arching; supranodal ridge a line, not prominent; sometimes a patch of subsidiary buds or branches present on the opposite side of the node from the main bud/branch complement ......................................................................................................... C. circinata

15. Culm leaf sheaths more or less triangular with rounded shoulders; foliage leaf blade L:W = (15–)17–30; culms erect, arching at the apices; supranodal ridge prominent; buds/branches strictly constellate ......................................................................................................... C. sulcata Swallen (1940: 209)


16. Culms arching and scandent or trailing and clambering; foliage leaf blades green, abaxially not tessellate ......................................................................................................... C. aperta Clark (1987: 74)

17. Subsidiary branches 80–100 per node; culms 2–6 cm in basal diameter, erect at the base and then arching to scandent; foliage leaf blades L:W = 16–33 ................................................................. C. longifolia Swallen (1940: 30)

17. Subsidiary branches 5–30 per node; culms 0.2–1 cm in basal diameter; arching to scandent or trailing and clambering; foliage leaf blades L:W = 6–20 ......................................................................................................... C. longifolia Swallen (1940: 30)

18. Foliage leaf blades abaxially glabrous ...................................................................................... C. simpliciflora Munro (1868: 54)

18. Foliage leaf blades abaxially pilose (completely or only toward the base) .......................................................... C. repens Muero (1868: 65)

19. Central bud circular; subsidiary branches 6–14 per node, usually rebranching; foliage leaf blades narrowly ovate ................................................................. C. muelleri Munro (1868: 65)

19. Central bud triangular; subsidiary branches 10–25 per node, usually not rebranching; foliage leaf blades linear lanceolate ................................................................. C. repens Clark & Londoño (1991: 327)

20. Subsidiary branches 5–10 per node; foliage leaf blades 1.1–1.8 cm wide ............................ C. cortesii Ruiz-Sanchez & Clark (2013: 7)

20. Subsidiary branches 10–30 per node; foliage leaf blades 0.3–1.1 cm wide ................................................................. C. repens

21. Culms 0.2–0.3 cm in basal diameter, trailing and clambering; Chiapas and Oaxaca ................................................................. C. repens

21. Culms 0.5–1 cm in basal diameter, arching and scandent; Guerrero, Michoacan, Chiapas ................................................................................................. C. nelsonii Lamson-Scribner & Smith (1897: 16)

Chusquea nedjaquithii Ruiz-Sanchez, Mejia-Saulés, & L. G. Clark sp. nov., Figs. 1–2.

TYPE:—MEXICO. Oaxaca: Candelaria Loxicha, Portillo del Rayo, Finca El Encanto, 15°58’41"N, 96°31’43"W, 1600 m, 1 June 2013, E. Ruiz-Sanchez & L. Cervantes 445 (holotype: XAL!; isotypes: IEB!, ISC, MEXU!).

Chusquea nedjaquithii is similar to C. liebmannii but differs in having culms with deciduous hairs, an obl ate central bud, fewer subsidiary branches (13–17) but these larger in diameter, strongly geniculate subsidiary buds and branches in one row in an incomplete verticil, oblique foliage leaf blade bases, and longer (5–10 mm) inner ligules of the foliage leaves.

HABITAT AND DISTRIBUTION:—This species is only known from one population in the Sierra Madre del Sur in the state of Oaxaca. Chusquea nedjaquithii inhabits Neotropical cloud forest in the ecotone with tropical dry forest. This species grows sympatrically with undescribed Chusquea species. In the same locality, Brailovsky (1987) described a new tribe, genus and species of a hemipteran insect, Barreratalpa Brailovsky (1987: 157). This insect was discovered feeding on cultivated Asiatic bamboos, but is also known to associate with Chusquea, so it likely occurs on C. nedjaquithii.

FIGURE 2. Chusquea nedjaquithii. A. Nodal region, showing oblate central bud, subsidiary branches and intravaginal branch pattern. B. Nodal region, showing subsidiary branches in development. C. Lateral view of the nodal region, showing incompletely verticillate subsidiary branches in development and part of the culm leaf. D. Central branch in development. E. Apical culm region, showing hirsute indument and branches in development. F. Foliage leaf complements. Photos by E. Ruiz-Sanchez.
Comparison:—Morphologically *Chusquea nedjaquithii* is most similar to *C. liebmannii*. The differences between *C. nedjaquithii* and *C. liebmannii* are the following: main culms with deciduous hairs, becoming strigose, central bud oblate, subsidiary branches 13–17 arranged in a single row in two patches (forming an incomplete verticil) and strongly geniculate, foliage leaf blades oblique at the base and with an inner ligule 5–10 mm long in *C. nedjaquithii*, vs. culms glabrous, central bud circular, subsidiary branches > 100 in 2 to 3 rows forming a complete verticil and not geniculate, foliage leaf blades attenuate at the base and with an inner ligule 0.5–1 mm long in *C. liebmannii*.

Etymology:—This species honors Mr. Ned Jaquith (1939–2013), a long-time bamboo grower and nurseryman who gave unstintingly of his knowledge and enthusiasm for bamboo species. We recognize Ned’s extensive contributions to the bamboo community by dedicating this species to his memory.

Phenology:—Flowers of this species have never been collected. However, E. Ruiz-Sanchez observed some dead individuals in the population that could have flowered and died one or two years prior to the type collection.

Additional specimen examined:—MEXICO. Oaxaca: Candelaria Loxicha, Portillo del Rayo, Finca El Encanto, 15°58’41”N, 96°31’43”W, 1600 m, 22 Nov. 2012, L. Cervantes 08BA (XAL).

Discussion

With the description of *C. nedjaquithii* the number of native Mexican bamboos will increase to 47 described species representing all three Neotropical woody bamboo subtribes (Arthrostyliidinae, Chusqueinae and Guaduinae). Of those 47 Mexican bamboo species, almost half (20) belong to *Chusquea* (Ruiz-Sanchez & Clark 2013; Ruiz-Sanchez et al. 2014). Guaduinae are represented by three genera, *Guadua* Kunth (1822: 150), *Olmeca* Soderstr. (1982: 161) and *Otatea*, and 20 described species (Ruiz-Sanchez et al. 2011a, b; Ruiz-Sanchez 2012, 2013; Londoño and Ruiz-Sanchez 2014) and the rest (seven) species are Arthrostyliidinae (Cortés-Rodríguez 2000). According to the most recent taxonomic classification of the Bambusoideae (Bamboo Phylogeny Group 2012) the Neotropical woody bamboos comprise 405 described species, of which the Mexican bamboo species account for 12%.

The Mexican *Chusquea* species inhabit mainly tropical dry forests, pine-oak and pine-fir forests and Neotropical cloud forest. The latter represents the main habitat for *Chusquea* in Mexico as 17 of the 20 species inhabit this type of forest (Ruiz-Sanchez et al., 2014).

Sosa et al. (2013) published a study using two chloroplast genes (*matK* and *rbcL*) and one spacer (*psbl-psbK*) sequenced from 36 native Mexican bamboo species, to test if those markers could be used to discriminate (barcode) bamboo species. Only *matK* in combination with *psbl-psbK* could distinguish between taxa and only at the generic level. We therefore encourage the use of morphology to identify woody bamboos at the species level.

*Chusquea nedjaquithii* is known from a single locality in the Sierra Madre del Sur in the state of Oaxaca. We therefore propose the inclusion of this species in the IUCN red list under the “endangered” category of protection.

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