



## ***Zamia incognita* (Zamiaceae): the exciting discovery of a new gymnosperm from Colombia**

ANDERS J. LINDSTRÖM<sup>1</sup> & ÁLVARO IDÁRRAGA<sup>2</sup>

<sup>1</sup>Nong Nooch Tropical Botanical Garden, 34/1 Sukhumvit Highway, Najomtien, Sattahip, Chonburi 20250 Thailand

<sup>2</sup>Universidad de Antioquia, Herbario Universidad de Antioquia (HUA), Medellín, Colombia

### **Abstract**

Colombia is home to the majority of known South American species of *Zamia* (*Zamiaceae*). Although *Zamia* is now the only recognised genus of extant Cycadales in South America, it shows some complex ecological adaptations that have resulted in several evolutionarily divergent sections within the genus. The recent publication of Flora de Colombia listed 16 species, of which seven are endemic and five were newly described in the very same treatment. Although this treatment was current at the time of publication, recent collections and additional material of little-known species have made an update and further clarification necessary. A new species, *Zamia incognita* is described here and its relationships are discussed.

**Key words:** Colombia, cycads, gymnosperms, *Zamia*

### **Introduction**

The classification of *Zamia* Linnaeus (1763: 1659), a genus of about 57 species of mainly South and Central American cycads, is still incomplete with new species still to be discovered and described. The relationships are not very well-studied and there are few classifications at the subgeneric level (Schuster, 1932). Most species have been described individually by various authors and not as part of a larger taxonomic treatment or revision. Because of the inaccessibility of many habitats, there are very few specimens of South American species. This has resulted in a limited understanding of the geographical distribution and morphological variability of these species. Several of the *Zamia* species named during the 19<sup>th</sup> century were described from cultivated material, often from only a single sterile plant. Some of the descriptions and illustrations are inadequate for specific determination, and typification is often unresolved or confusing, making the correct application of names difficult. Recent nomenclatural and taxonomical clarifications (Lindström, 2009) have increased our basic knowledge of South American *Zamia*, and have resulted in a more appropriate synonymy and resurrection of existing names for known species.

In this article we present a new species that was previously overlooked and could not be matched with any of the existing species.

### **Material and Methods**

Field work in Panama, Colombia, Ecuador, Peru, Bolivia and Brazil was carried out annually since 1998 by the first author. Herbarium vouchers, including types and additional specimens, were studied from AMAZ, BM, COAH, COL, CUUC, FTG, HUA, INPA, JAUM, K, L, MEDEL, MG, MO, P, QCA, QCNE, RB, RPSC, SEL, STO and USM. Living specimens were studied in cultivation at the Jardín Botánico de Medellín in Colombia and the Nong Nooch Tropical Botanical Garden in Thailand.

## Taxonomy

*Zamia incognita* A.Lindstr. & Idárraga, *sp. nov.* (Figs. 1–2).

*Ad Zamia cupatiensiae similis. Pinnae latis, obovatis, lucidis, foliae longioris, megastrobilae brevioris, obovatis per pedunculae ignotis differt.*

**Type:**—COLOMBIA: Antioquia: elev. 478 m, 28 January 2008, A., Idárraga, J.A. Lindström & M.C. López-Gallego 3460 (holotype: HUA; isotype JAUM).

Similar to *Zamia cupatiensis* Ducke (1922: 20), but distinguished by the broad, obovate, glossy leaflets, longer leaves and short, distinctly obovate megastrobilus with indistinct peduncle.

Stem tuberous, hypogeous to epigeous, 22 cm long, irregularly shaped, 15 cm at widest, 15–19 cm in circumference, not uncommon with dichotomously branching apex; cataphylls 2.5–6 cm long, soft, narrowly triangular, stipulate, shedding tomentum. Leaves 2–3 (rarely 4), 93–153 cm tall, erect to arcuate, basally keeled, apically flat, emerging green or pink; petiole (29.5–)33–86 (rarely 92–116) cm long, with few to numerous prickles on the lower part; rachis 11–42 (rarely to 123–152) cm, few prickles to unarmed; pinnae 13–32 per leaf, opposite basally and apically, alternate medially, obovate to lanceolate, coriaceous, glossy green, (22–) 30–40 × (4.1)–4.7–7 cm, serrate in distal 25–75%, margin revolute, 4–7 mm wide (rarely larger) at point of attachment, spaced 4–9 cm apart, apex acuminate (sometimes emarginate). Macrostrobilus 7.5 × 2.7 cm; sporophylls 20 × 11–12 mm, in 15 rows and 8 columns; bullae 4–5 mm wide, 3–4 mm tall, 4–6 sporangia on each side of abaxial surface, distinctly separated; apex 3–10 mm tall; peduncle 3–6 cm long. Megastrobilus solitary or paired, barrel shaped, often appearing sessile, 7–11 cm tall, 7 cm wide, distinctly brown tomentose; sporophylls 20–30 mm long, 35–45 mm wide, in 6–7 rows; bullae flat, hexagonal, with large terminal facet 16 mm wide, 10 mm tall; apex 2.5–3.7 cm tall, blunt to mucronate (seems to vary with maturity of strobili); peduncle 3.5–7.6 cm long, brown tomentose; seeds 20 mm long, 15–19 mm in diameter, globose; immature sarcotesta cream to light pink-coloured (mature seeds not seen).

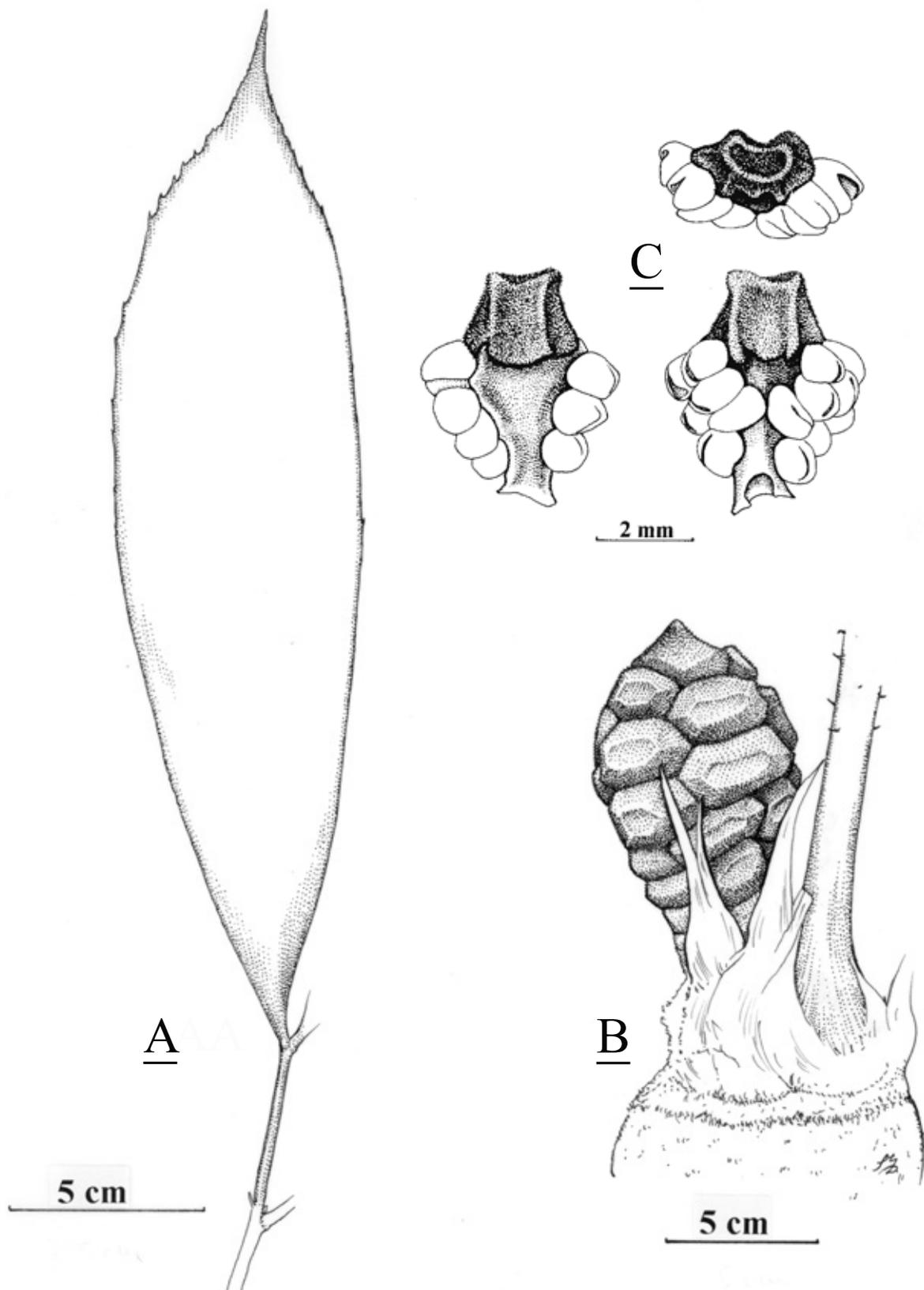
**Phenology:**—Mature plants have been collected with newly emergent cones in November and January.

**Habitat:**—Well-drained hills often near ridges surrounded by moist tropical forest, in shaded, rather open understory. Average canopy at 20 m with emergents up to 25 m. ELEVATION ranging from 200–500 m. Associated flora includes *Astrocaryum malybo*, *Bactris pilosa*, *Oeonocarpus bataua* (Arecaceae), *Cochlospermum orinocense* (Bixaceae), *Aegiphila laeta* (Lamiaceae), *Gustavia hexapetala*, *G. nana* (Lecythidaceae), *Clathrotropis brunnea*, *Ormosia* sp., *Schizolobium parahyba*, *Swartzia oraria*, (Leguminosae), *Bunchosia pseudonitida* (Malpighiaceae), *Brosimum guianense*, *Helianthostylis sprucei*, *Naucleopsis glabra* (Moraceae), *Virola sebifera* (Myristicaceae), *Heisteria acuminata* (Olacaceae), *Pouteria* sp. (Sapotaceae). The soil consists of 46% sand, 15% lime, 39% clay, 1.9% organic matter with the following micronutrients: P = 2.5 ppm, Al = 6.05 mg/100 gr, Ca = 7.1 mg/100 gr, Mg = 4.8 mg/100gr, K = 0.235 mg/100 gr. The pH was found to be acidic. Some populations exist in soil overlaying limestone outcrops.

**Distribution:**—Widespread along the valley of the Río Magdalena in Colombia.

**Etymology:**—From the Latin *incognitus*, meaning ‘unknown’, which was chosen because this species remained unknown until now.

**Additional material studied (paratypes):**—COLOMBIA: Santander: *Haught 1447* (BM), *1578*, *2101* (COL, F, GH, P, US). Upper Magdalena Valley, *von Eggers 14034* (K); Antioquia: 200 m, *Cogollo & Bernal 11669* (JAUM); *Cogollo et al. 1, 2, 3, 4* (JAUM); 245 m, *Cardona et al. 1081* (HUA, MO); 200 m, *Pérez-Zabala & Idárraga 900* (MEDEL); *Idárraga, Lindström & Lopez-Gallego 3454, 3455* (HUA); 478 m, *Idárraga, Lindström & López-Gallego 3461, 3462* (HUA); 200 m, *Idárraga et al. 1076* (HUA); 470 m, *Tuberquia et al. 2676* (HUA); 500 m, *Roldan et al. 2924* (HUA); 340–380 m, *Callejas et al. 5250* (HUA, NY).



**FIGURE 1.** Illustration of *Zamia incognita* (drawn from *Idárraga et al. 3460* by Stig Dalström). **A.** mature pinnae. **B.** macrostrobilus **C.** microstrobili.

**Conservation status:**—Several populations are known, both historically and still extant. Most populations are not included in any protected areas and are usually on private land. Deforestation and habitat

alteration is the main threat. Plants often grow in dense populations, although several populations have been severely disturbed and have consequently been reduced to scattered individuals (López-Gallego & Idárraga, 2001). The species should be classified as ‘vulnerable’ according to the most recent IUCN Red List categories and criteria (IUCN, 2001). The complete proposed Red List assessment is VU A1c,b(i,iv)+2a,b(i,ii,iii,iv).



**FIGURE 2.** Mature leaf (Idárraga *et al.* 3460) illustrating typical pinna shape and spacing.

**Observations:**—Herbarium vouchers, some even with fertile material, have been collected as early as 1889, but it seems that nobody realised the distinctness of the species. Various *Zamia* taxa have been recently described, but the taxonomical and genetical relationships between them are practically unknown. We found several specimens not assignable to any known species. Stevenson (2001) placed many of these in already described species, such as *Z. poeppigiana* Mart. & Eichler in Eichler (1863: 414), *Z. melanorrhachis* Stevenson (2001: 55) and *Z. muricata* Willdenow (1806: 847). *Zamia incognita* is a species with a subterranean stem that matures at a small size. It does not appear to be related to *Z. poeppigiana*, which, as currently circumscribed (Lindström, 2009), does not grow within the political borders of Colombia. The distance from the most northerly known population of the species in Peru (San Martín, Tarapoto), is too long and *Z. poeppigiana* is most likely endemic to that country. Even at the seedling stage these species can be easily told apart, as *Z. poeppigiana* always has narrow, lanceolate pinnae, while *Z. incognita* always has broad, obovate pinnae. As for *Z. melanorrhachis*, this species seems to be restricted to northern Colombia, as previously considered specimens from central and southern Colombia have been re-identified and are now considered to belong to other species. Finally, *Z. muricata* is known only from the extreme northeast of Colombia but is more widespread in northern Venezuela, where the type was collected.

*Zamia cupatiensis* has previously (Stevenson, 2001) been considered a synonym of *Z. ulei* (Dammer, 1907: 117), but study of recently collected material shows that the strobili of both sexes are very distinct. *Zamia cupatiensis* share the subterranean stem habit and the glossy pinnae, it differs however in the distinctly pedunculate female strobili and the distinctly flattened and broad lamina of the microsporangia.

For this study on *Zamia*, we studied the morphological variation within each species analysing as many specimens as possible to be able to present a better understanding of the species in question. By introducing modern molecular techniques, the relationships and groupings of species within the genus *Zamia* will undoubtedly carry us into the next level of understanding in the evolution of this interesting group of gymnosperms.



**FIGURE 3.** Cross-section of immature macrostrobilus of *Zamia incognita* (Idárraga 3454).

## Acknowledgements

We thank the keepers of the herbaria visited for their utmost help and kindness in facilitating this study, and the librarians at The Natural History Museum, London and The Royal Botanic Gardens, Kew for their assistance in obtaining the necessary literature. Dr Dennis W. Stevenson has provided valuable comments during our discussions. Our utmost gratitude goes to Mr Kampon Tansacha, owner and director of Nong Nooch Tropical Botanical Garden, Thailand, for his full financial support for travel and research. We also thank Mr Stig Dalstrom, Marie Selby Botanical Garden, USA, for his excellent line drawings. Dr Cristina López-Gallego for being our most enjoyable travelling companion, friend and colleague. We also thank Dr Alvaro Cogollo for his interesting discussions, and we thank the two anonymous reviewers for their valuable comments.

## References

- Dammer, U. (1907) Cycadaceae. In: Ule, E. (ed.) II. Beiträge zur Flora der Hylaea nach den Sammlungen von Ule's Amazonas-Expedition. *Verhandlungen des Botanischen Vereins für die Provinz Brandenburg und die Angrenzenden Länder* 48: 117–118.
- Ducke, A. (1922) Plantes nouvelles ou peu connues de la region amazonienne (II<sup>e</sup> partie). *Archivos do Jardim Botânico*

*do Rio de Janeiro* 3: 3–269.

Eichler, A.G. (1863) Cycadeae et Coniferae. In: Martius, M. (ed.) *Flora Brasiliensis* 4(1): 409–452.

IUCN (2001) *IUCN Categories & Criteria, ver. 3.1*. IUCN Species Survival Commission, Gland, Switzerland. [http://www.iucnredlist.org/static/categories\\_criteria\\_3\\_1](http://www.iucnredlist.org/static/categories_criteria_3_1). Accessed July 2009.

Lindström, A.J. (2009) Typification of some species names in *Zamia* L. (*Zamiaceae*), with an assessment of the status of *Chigua* D.Stev. *Taxon* 58: 265–270.

Linnaeus, C. (1763) *Species Plantarum*, ed 2, vol. 2. Laurentius Salvius, Stockholm.

López-Gallego, M.C. & Idárraga A. (2001) Estado de Conservación de las especies de *Zamiaceae* del departamento de Antioquia (Colombia). *Actualidades Biológicas* 23: 23–31.

Schuster, J. (1932) Cycadaceae. In: Engler, A. (ed.) *Das Pflanzenreich* 4, vol. 99. Wilhelm Engelmann, Berlin.

Stevenson, D.W. (2001) Cycadales. *Flora de Colombia*, vol. 21. Universidad Nacional de Colombia, Bogotá.

Willdenow, C.L. (1806) *Caroli a Linné Species Plantarum exhibentes plantas rite cognitatas ad genera relatas cum differentiis specificis, nominibus trivialibus, synonymis selectislocis natalibus, secundum systema sexuale digestas, editio quarta* 4(2). G.C. Nauk, Berlin.