

Anisadenia pubescens (Linaceae), a new generic record for Vietnam

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Summary: *Anisadenia pubescens* is reported from Cao Bang province in Northern Vietnam, representing the first record of this species and the genus *Anisadenia* in Vietnam. This record enlargens the number of genera of the family Linaceae known from this country to five. A key to the Vietnamese genera of Linaceae is provided. Patterns of distribution of both *Anisadenia* species are discussed. Two floral morphs are described in *A. pubescens* that differ by the length of stamens.

Keywords: biodiversity, flora, floral dimorphism, Indochina, key, Phia Oac-Phia Den National Park, Southeast Asia, Vietnam

Linaceae, as currently circumscribed (including Hugoniaceae), is a family of moderate size and an almost worldwide distribution (VAN HOOREN & NOOTEBOOM 1984; STEVENS 2001). It comprises about 250–300 species (STEVENS 2001; LIU & ZHOU 2008; DRESSLER et al. 2014). Thirteen genera are accepted in the most recent account of Linaceae (DRESSLER et al. 2014); meanwhile, the generic delimitation of this family is still being evaluated, and a number of changes are expected (see STEVENS 2001). The principal species diversity of Linaceae is confined to the genus *Linum* L., which is estimated to comprise ca. 180 species. Given that *Linum* is remarkable for its extra-tropical (mostly temperate and subtropical) distribution, the family Linaceae is rather poorly represented in the tropical regions (e.g. VAN HOOREN & NOOTEBOOM 1988; LARSEN 1997a, b; KRESS et al. 2003).

Four native genera of Linaceae were reported from Vietnam to date. Three of them, namely, *Hugonia* L., *Indorouchera* Hallier f. and *Tirpitzia* Hallier f., are listed in the main accounts of the Vietnamese flora (TARDIEU-BLOT 1945; NGUYEN KHAC KHOI 2003a, b; PHAM HOANG HO 2003). Additionally, the presence of *Reinwardtia* Dumort. in this country was indicated by LIU & ZHOU (2008). Although LARSEN (1997b) treated *Tirpitzia sinensis* (Hemsl.) Hallier f. as a synonym of *Reinwardtia indica* Dumort. (indicated by him as occurring in Vietnam), it was apparently made by a mistake, which is evident from a later work by SUKSATHAN & LARSEN (2006). Summarizing information from these sources, one can estimate that the family Linaceae is represented in Vietnam by about six species; taxonomic delimitation of *Indorouchera* and *Tirpitzia* is uncertain and needs further clarification.

Here we report a discovery of *Anisadenia pubescens* Griff. in Cao Bang province of Vietnam, which appears to be the first record of the genus *Anisadenia* Wall. ex Meisn. from Eastern Indochina. We provide illustrations of our finding and an updated key to the genera of Linaceae in Vietnam. The key also covers the territory of Cambodia and Laos, from where only scarce data on the presence of Linaceae are available to date (e.g. LARSEN 1997b; LIU & ZHOU 2008), but more records are expected based on the diversity of the family in the surrounding areas.

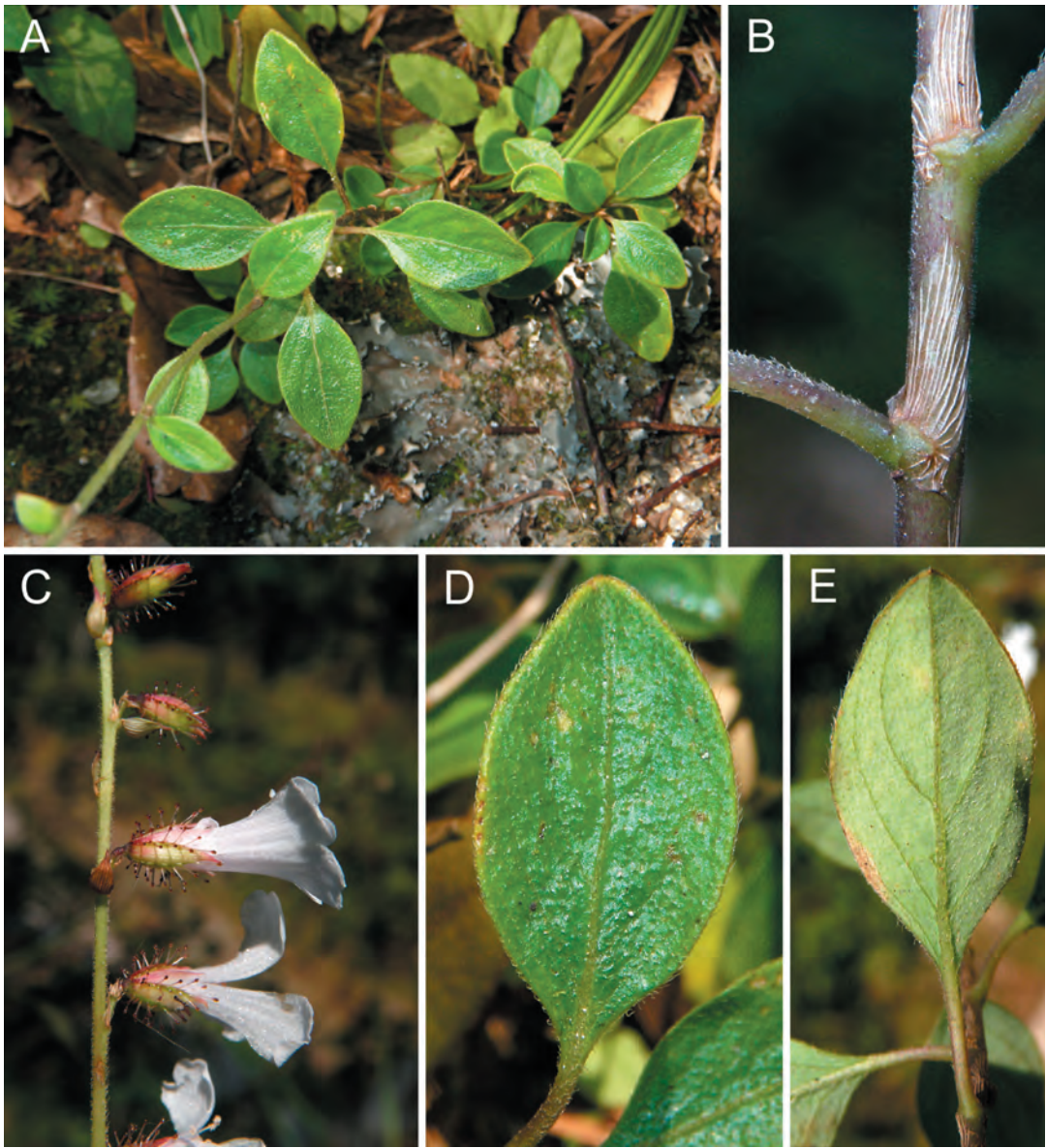


Figure 1. *Anisadenia pubescens*: A – leafy shoots; B – stem with stipules at petiole bases; C – inflorescence; D – leaf, adaxial view; E – leaf, abaxial view. *Nuraliev 2245*. Photos by M. Nuraliev.

***Anisadenia pubescens* Griff. (Figs 1, 2)**

Studied specimen. Vietnam: Cao Bang province, Nguyen Binh district, Phia Oac-Phia Den National Park, 11 km WSW of Nguyen Binh town, near road to Phia Oac summit, roadside, 22°36'25"N 105°52'10"E, 1600 m, 04 October 2018, *M.S. Nuraliev 2245* [MW: MW0756074].

Notes on morphology. The family Linaceae is remarkable for comprising a number of taxa with stylar polymorphism of diverse morphological nature, often accompanied by dimorphism of stamens between the floral morphs (i.e. heterostyly) and sometimes also within them (DULBERGER 1973; McDILL et al. 2009). Neither heterostyly nor any other kind of floral polymorphism has hitherto been reported for *Anisadenia* (McDILL et al. 2009; DRESSLER et al. 2014). During

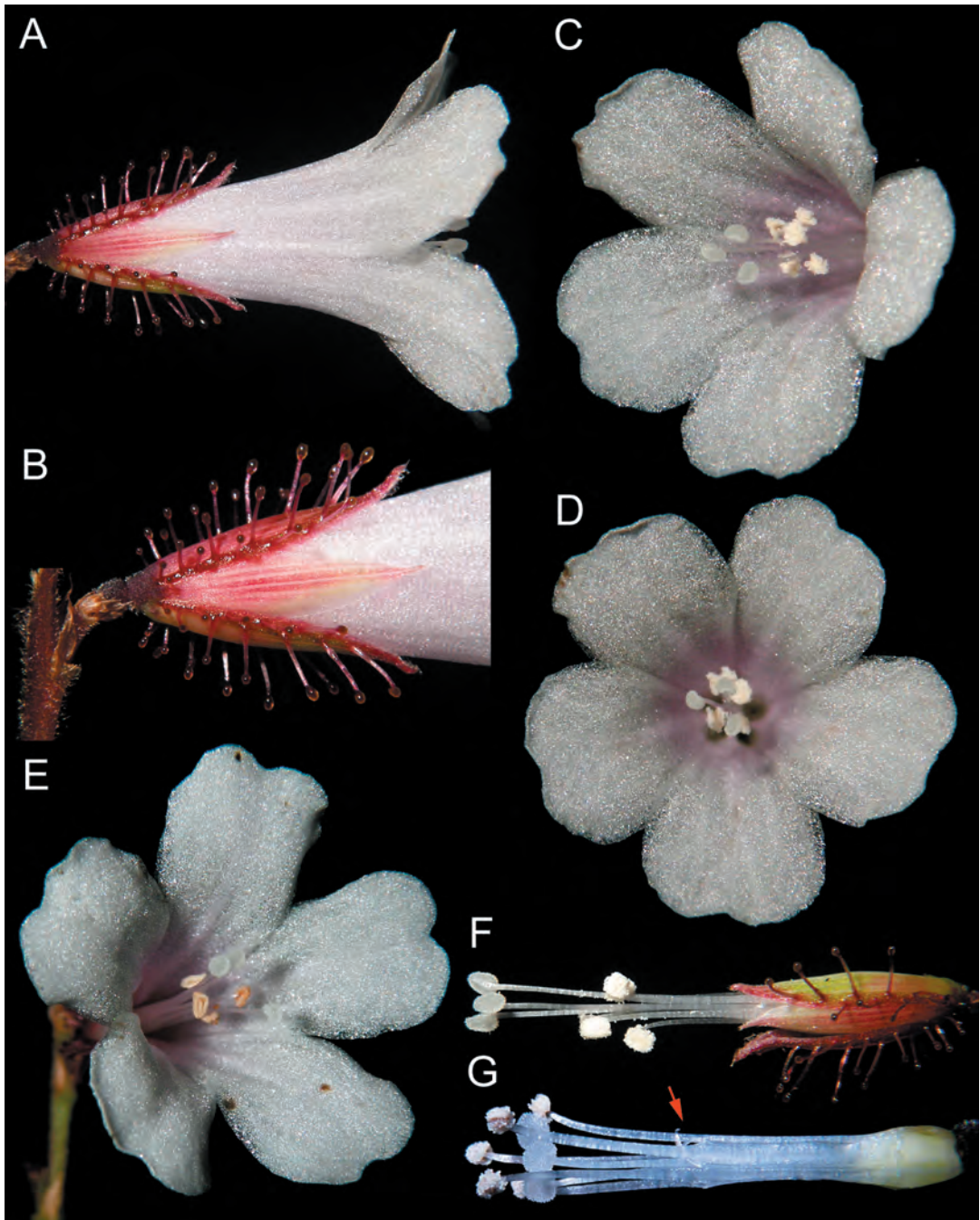


Figure 2. *Anisadenia pubescens*: A – flower, side view; B – calyx, side view; C, D – flower with short stamens, oblique and top view; E – flower with long stamens, oblique view; F – flower with short stamens (petals removed), side view; G – flower with long stamens (perianth removed), side view; note the staminodes (arrow). *Nuraliev 2245*. Photos by M. Nuraliev.

field investigation of the Vietnamese population of *A. pubescens*, we have recorded flowers of two morphs, the first one characterized by short stamens (shorter than styles; Fig. 2C, D, F) and the second one by long stamens (nearly as long as styles; Fig. 2E, G). The styles were apparently monomorphic, though it remains to be verified by measurements of appropriate material. These

preliminary data indicate the need of a comprehensive study of the reproductive system of *Anisadenia*.

Notes on distribution. The genus *Anisadenia* comprising two species (the second one being *A. saxatilis* Wall. ex Meisn.) was believed to be distributed predominantly in the Himalayan region, found in Nepal, Bhutan, Tibet (= Xizang, China), Northeastern India, Northern Myanmar and extending eastwards to Northern Thailand and the Chinese province of Yunnan (GRIERSON & LONG 1987; LARSEN 1997b; KRESS et al. 2003; LIU & ZHOU 2008; SRIVASTAVA et al. 2010). The areas of distribution of the two *Anisadenia* species are generally similar, but *A. pubescens* found in Vietnam seems to be a more rare species; for example, it is not known from Thailand and was reported from Myanmar and Nepal only in the 2000s. As it is evident from the recent studies and our investigation, the distribution range of *Anisadenia* is still underestimated.

The population of *A. pubescens* in Cao Bang province of Vietnam reported here occupies open places along the roadside on the slope of Phia Oac mountain. This habitat is disturbed to a considerable extent and covered by secondary vegetation, which indicates the possibility of a recent introduction of *A. pubescens* into Vietnam. On the other hand, the roadsides and especially roadcut surfaces along the way to Phia Oac summit are inhabited by a remarkable diversity of indigenous floristic elements (pers. obs.). The most prominent examples here are two species of Gesneriaceae, namely, *Oreocharis caobangensis* T.V. Do, Y.G. Wei & F. Wen endemic to Phia Oac-Phia Den National Park described in 2017 (TRUONG VAN DO et al. 2017) that is abundant at roadcut surfaces, and *Loxostigma fimbrisepalum* K.Y. Pan recently reported as a new record for Vietnam (DO THI XUYEN & VU XUAN PHUONG 2011). However, we have also observed both of these species in less disturbed habitats under the forest shadow, which was not the case for *Anisadenia pubescens*.

In a recent investigation (YANG et al. 2014), *Anisadenia pubescens* was listed among the species more vulnerable to disturbance from off-road travel in comparison with other species of plants and fungi treated as protected in Yunnan province of China. This evidence supports the idea of indigenous nature of the Vietnamese population. Clearly, more studies are needed to elucidate the history of distribution of *Anisadenia* in Vietnam.

Key to the genera of Linaceae in Vietnam

Partly based on: VAN HOOREN & NOOTEBOOM (1984, 1988), LARSEN (1997a, b), SUKSATHAN & LARSEN (2006), LIU & ZHOU (2008), DRESSLER et al. (2014).

Information on species diversity in Vietnam is given in brackets after each genus.

- 1 Woody lianas, often with curved climbing hooks (some species may remain shrubs without support; trees in South America); stamens twice as many as petals; fruit a drupe, rarely splitting into mericarps (subfam. Hugonioideae) 2
- Erect herbs, shrubs or small trees; stamens as many as petals, often the same number of staminodes present (absent only outside Vietnam); fruit usually a capsule, more rarely indehiscent or splitting into mericarps (subfam. Linoideae) 3
- 2 Indumentum present, at least on calyx; stylodia 5(6); ovary 5(6)-locular; drupe with 2–4(5) developed seeds *Hugonia* (2 spp.)

- All parts glabrous; stylodia 3–5; ovary 3–5-locular; drupe usually with one developed seed *Indorouchera* (probably 1 sp.)
- 3 Perennial herbs (sometimes basally woody); outer sepals with conspicuous long-stalked glands; corolla white to mauve or pink *Anisadenia* (*A. pubescens*)
- Shrubs or small trees; sepals without stalked glands; corolla white or yellow (also pink outside Vietnam) 4
- 4 Corolla white (also pink outside Vietnam); ovary 2-, 4- or 5-locular, false septae absent (or incomplete); stylodia 2, 4 or 5; capsule splitting into 2, 4 or 5 two-seeded valves *Tirpitzia* (1–2 spp.)
- Corolla yellow; ovary 3–4-locular, each locule with false septum; stylodia 3–4; capsule splitting into 6–8 one-seeded valves / mericarps *Reinwardtia* (*R. indica*)

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Artikel/Article: [Anisadenia pubescens \(Linaceae\), a new generic record for Vietnam 189-194](#)