

NECKERA INOPINATA (NECKERACEAE, BRYOPHYTA), A NEW SPECIES FROM HUNAN AND ZHEJIANG, CHINA

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Abstract. *Neckera inopinata* Enroth (Neckeraceae) is described as a new species from Hunan Province and Zhejiang Province, China. It can be distinguished by the following suite of characters: plants of relatively small stature; leaves variably undulate, shortly decurrent, ovate-lingulate to ovate; costa reaching to midleaf or above; leaf margins very sharply serrulate; and upper laminal cells solid-walled. An identification key to the species of *Neckera s.l.* in China is provided.

Key words: moss flora of China, new species, taxonomy, morphology

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INTRODUCTION

As a result of recent phylogenetic analyses based on several genomic regions (Olsson *et al.* 2009a, b, 2010, 2011), the taxonomy and systematics of the moss family Neckeraceae have undergone profound modifications at all taxonomic levels. The family circumscription and generic content have changed, and some of the traditional genera have been split into smaller genera. One of those traditional (and heterogeneous) groupings is *Neckera* Hedw., which was divided into three genera by Olsson *et al.* (2011). The work on *Neckera* will continue with more comprehensive sampling of taxa, and therefore I employ the traditional generic concept here, pending further molecular work.

Ji and Enroth (2010) provided a list of the 25 species of *Neckera* then known from China. Of those species, *N. crenulata* Harv. is now placed in *Taiwanobryum*, *N. neckeroides* (Broth.) Enroth & B. C. Tan (Enroth & Tan 1994) belongs in *Homaliodendron* (Olsson *et al.* 2010), *N. crispa* Hedw. belongs in the recently established *Exsertotheca*, *N. complanata* (Hedw.) Huebener belongs in another recently described genus, *Alleniella*, and *N. goughiana* Mitt. and *N. yezoana* Besch. are now placed in *Forsstroemia* (Olsson *et al.*

2011). Those changes were not included in the most recently published treatment of the Chinese *Neckera* by Wu (2011), who recognized a total of 17 species, neglecting some recently described ones (Ji & Miao 2009; Enroth & Ji 2010), as well as some that were recently reported for the first time for China (Ji & Enroth 2010). Wu (2011) did not treat *N. complanata* at all, although it has been reported from Shaanxi Province and Shanxi Province (cf. Redfearn *et al.* 1996).

Given the recent systematic and nomenclatural changes, and the as-yet unclear morphological circumscriptions of several of the ‘*Neckera*-like’ genera, I have constructed an identification key to the species of *Neckera s.l.* in China; it includes species currently placed in *Alleniella*, *Forsstroemia*, *Homaliodendron* and *Taiwanobryum*. The current names are given in parentheses in the key.

Although the generic position of some of the Chinese species now placed in *Neckera* may change, they are relatively well understood morphologically, as are those of Japan (Noguchi 1989). This allows me to describe a new species here, based on two specimens, one from Zhejiang and the other from Hunan.

TAXONOMY

Neckera inopinata Enroth & M. Ji, *sp. nov.*

Figs 1 & 2

HOLOTYPE: CHINA. HUNAN PROV., Wulingyuan World Heritage Area, Zhangjiajie, Pipajie, 29°19'N, 110°24'E. Subtropical (warm temperate) zone, on roadside, in bushes, alt. 687 m, on *Liquidambar formosana*, 15 Sept. 1999, P. Rao 58379 (H). PARATYPE: CHINA. Zhejiang Prov., Tian Mu Shan Mts. ('Ten Mu Shan') W of Hangzhou, alt. 1000 m, in *Cryptomeria* forest, 17 Sept. 1960, T. Simon 39 (EGR!).

ETYMOLOGY: The epithet *inopinata* (Latin) means unexpected.

Plants gregarious, somewhat sordid green and slightly glossy, with creeping, small-leaved stolons, and to ca 3 cm tall. Fronds irregularly pinnately branched. Rhizoids produced on stolons and also on fronds at places in contact with substrate, in tufts situated just below leaf insertions, brownish orange, sparsely branched, smooth. Stems in cross-section elliptic, with 3 or 4 layers (including epidermal cells) of thick-walled outer cortical cells which grade to thinner-walled and larger inner cortical cells; medullary cells much larger and thinner-walled; central strand none. Stem leaves somewhat complanate-spreading to patent and not complanate, sometimes homolalous, especially near shoot tips, shortly decurrent, to ca 3 mm long and 1.2 mm wide, symmetric to slightly asymmetric, ovate-lingulate to ovate, lower ones hardly undulate, upper ones mostly distinctly undulate; leaf apices acute. Branch leaves otherwise similar but smaller, to ca 2 mm long and 0.8 mm wide, on branch tips and very young branches often characteristically falcate. Leaf margins plane, entire or nearly so only at base, becoming finely serrulate above leaf base and gradually more so towards midleaf; leaf apices regularly and sharply serrulate. Costa single, mostly reaching to midleaf or sometimes to 2/3 of leaf length. Leaf cells smooth, fairly thick-walled; laminal cells in wider apices mostly rhombic, 15–20 × 6–10 μm, in narrower leaf apices fusiform, 20–30 × 6–10 μm, their walls solid or with few pores; median laminal cells fusiform, 25–50

× 6–8 μm, walls solid or faintly porose; basal laminal cells linear or elongate-rectangular, some slightly vermicular, 30–60 × 5–10 μm, cells solid or especially towards the leaf insertion somewhat porose; cells along both leaf margins in 1–2(–3) rows distinctly shorter than corresponding laminal cells; alar cells relatively distinct and numerous, quadrate to rectangular. Branch primordia covered by broad embryonic leaves; pseudoparaphyllia absent or few per branch primordium, leaf-like, to ca 0.5 mm long and 0.1 mm wide. Presumably dioicous (male gametoeceia not observed). Post-fertilization perichaetial leaves sheathing, oblong-acute to oblanceolate-acute, to ca 3.5 mm long; costa single, of variable length but reaching up to 2/3 of leaf length; perichaetial paraphyses numerous, hyaline, filiform, unbranched. Sporophytes immature; seta short, capsules immersed, erect, apparently obloid; operculum conic-rostrate, slightly oblique; calyptra 1.1 mm long, cucullate, bearing numerous paraphyses and an archegonium at tip.

In addition to *N. inopinata* there are several other species of *Neckera s.l.* (as treated by Wu 2011) in China with a single costa reaching to or above the midleaf. Of those, *N. crenulata*, *N. yunnanensis* Enroth, *N. perpinnata* Cardot & Thér., *N. polyclada* Müll. Hal., *N. undulatifolia* (Tixier) Enroth and *N. serrulatifolia* Enroth are robust plants, at first glance quite different from *N. inopinata*. The rest of the species with long costae are more or less of the same size as *N. inopinata*. Among those species, *N. neckerooides* is distinct in having large, composite teeth at the leaf apices, while *N. humilis* Mitt. and *N. setschwana* Broth. consistently have numerous paraphyllia (although called 'pseudoparaphyllia' by Wu 2011) on the stems and branches. Those three, as well as *N. konoii* Broth. and *N. coreana* Cardot (which was excluded from the Chinese flora by Wu 2011) also differ from *N. inopinata* in having very thick and distinctly porose walls in the laminal (including the apical) cells. The identification key below should aid in identification of the Chinese collections of *Neckera s.l.*

Both specimens of *N. inopinata* were growing epiphytically. The Hunan specimen was found on

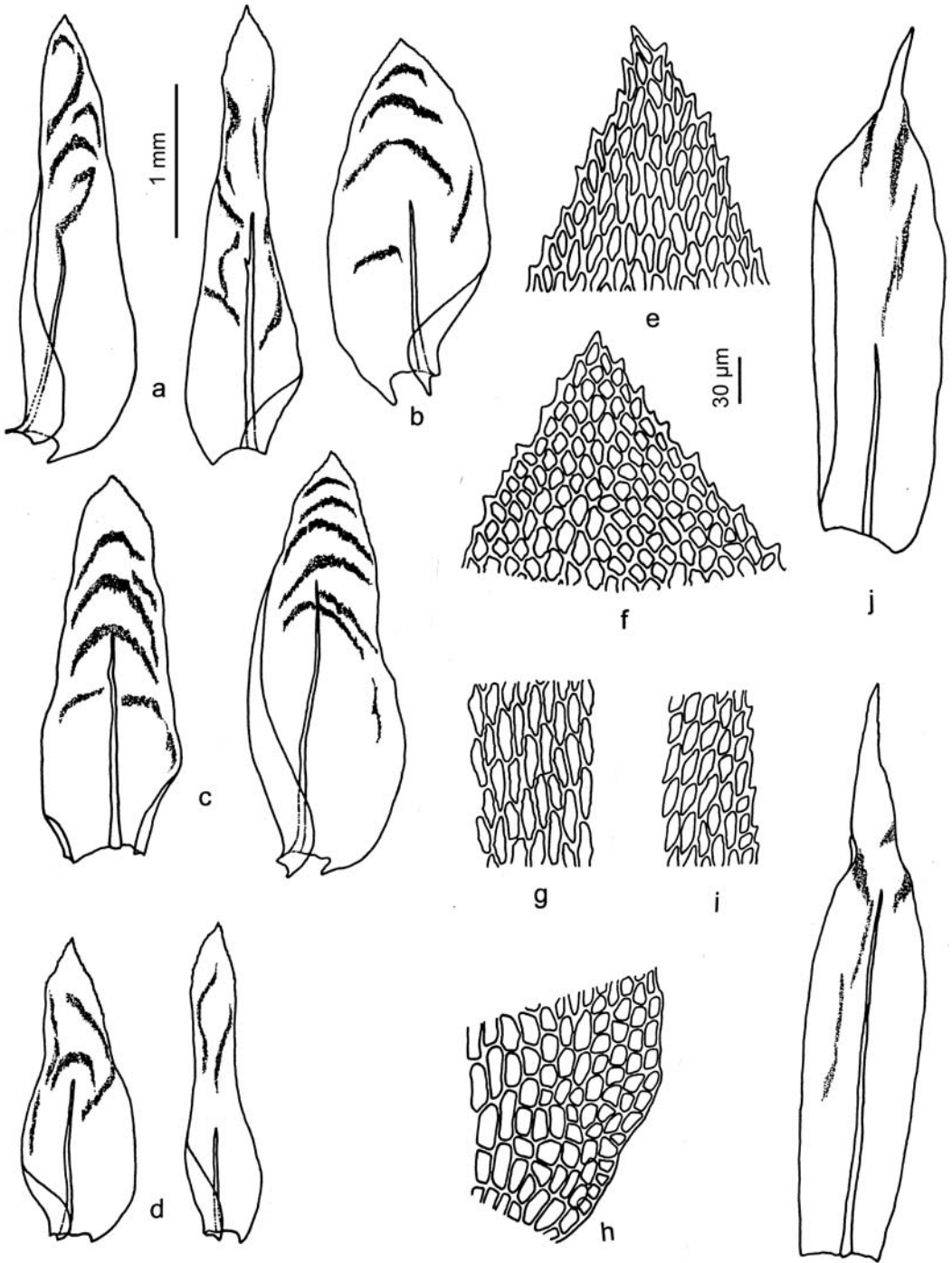


Fig. 1. *Neckera inopinata* Enroth & M. Ji, *sp. nov.* a–c – stem leaves, d – branch leaves, e & f – leaf apices, g – median laminal cells, h – alar region, i – margin at midleaf, j – two post-fertilization perichaetial leaves (drawn by M. Ji from the holotype). Scale bars: a, b, c, d & j – 1 mm; e, f, g, i & h – 30 µm.

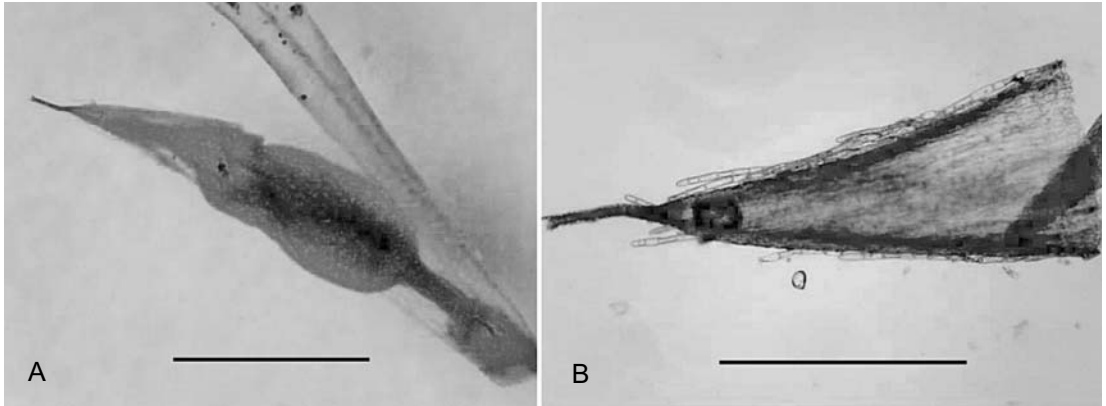


Fig. 2. *Neckera inopinata* Enroth & M. Ji, *sp. nov.* A – immature sporophyte, with calyptra still attached, B – calyptra (from the holotype). Scale bars: A = 1 mm, B = 0.5 mm.

the trunk of *Liquidambar formosana* and the Zhejiang specimen apparently on the trunk of *Cryptomeria japonica*. Although there is no substrate information in the latter specimen, some of its stolons are attached to small pieces of bark.

KEY TO THE CHINESE SPECIES OF *NECKERA* S.L.

1. Upper laminal cells distinctly porose 2
- 1* Upper laminal cells solid or faintly porose 14
 2. Paraphyllia present 3
 - 2* Paraphyllia absent 6
3. Costa reaching to midleaf or above 4
- 3* Costa vanishing below midleaf 5
 4. Leaves nearly symmetric, apex obtuse-mucronate; costa commonly reaching at least to 3/4 of leaf length *N. polyclada*
 - 4* Leaves distinctly asymmetric, apex acute; costa reaching to ca 2/3 of leaf length *N. setschwanica*
5. Costa absent or hardly distinguishable; endostome absent *N. xizangensis*
- 5* Costa reaching to 1/4 (–1/3) of leaf length; endostome present *N. denigricans*
6. Leaves from ovate base long-ligulate, nearly symmetric *N. undulatifolia*
- 6* Leaves ovate or ovate-ligulate to ovate-lanceolate, nearly symmetric or asymmetric 7
7. At least some apical teeth of stem leaves bi- or multicellular 8
- 7* Apical teeth of leaves indistinct or, if distinct, unicellular 10
8. Some branch tips naked due to caducous leaves; stem leaves to ca 4 mm long *N. serrulatifolia*
- 8* Branch leaves not caducous; stem leaves to ca 3 mm long 9
9. Fronds (incl. stipe) to ca 5 cm long, irregularly pinnately branched; leaves not undulate; apical teeth of stem leaves mostly multicellular *N. neckeroides* (*Homaliodendron neckeroides*)
- 9* Fronds (incl. stipe) to ca 10 cm long, densely pinnately branched; leaves undulate above; apical teeth of stem leaves mostly bicellular *N. yunnanensis*
10. Median laminal cells ca 30 µm long *N. perpinnata*
- 10* Median laminal cells (35–)40–60(–70) µm long 11
11. Leaf apices obtuse to rounded, sometimes mucronate; capsule long-exserted (seta 5–7 mm long) *N. crenulata* (*Taiwanobryum crenulatum*)
- 11* Leaf apices (broadly) acute; capsule immersed or long-exserted 12
 12. Most branch tips long-attenuate, nearly flagelliform; seta ca 5 mm long, capsule long-exserted *N. konoii*
 - 12* Branch tips obtuse or truncate; seta less than 1 mm long, capsules immersed 13
13. Stem leaves to 3 mm long, distinctly concave, apices broadly acute; median laminal cells 35–45 µm long; inner post-fertilization perichaetial leaves to 3 mm long, capsules not deeply immersed (tip often visible between perichaetial leaves) *N. humilis*
- 13* Stem leaves to 3.8 mm long, not concave, apices

- acute; median laminal cells 40–60(–70) µm long; inner post-fertilization perichaetial leaves to 3.8 mm long, capsules deeply immersed *N. yezoana*
- 14. Leaves not undulate 15
- 14*. Leaves distinctly undulate 20
- 15. Costa reaching to *ca* half of leaf length 16
- 15*. Costa nearly absent or reaching to *ca* 1/3 of leaf length at most 17
- 16. Plants strongly glossy; leaves not homomallous when dry; leaf margins faintly serrulate above, entire or faintly crenulate at midleaf *N. pusilla*
- 16*. Plants only slightly glossy; distal stem and branch leaves usually homomallous when dry; leaf margins distinctly serrulate from tips *ca* to midleaf *N. goughiana* (*Forsstroemia goughiana*)
- 17. Fronds (incl. stipe) to 1 cm long; stem leaves 0.9–1.2 mm long; costa absent or reaching to *ca* 1/10 of leaf length *N. enrothiana*
- 17*. Fronds (incl. stipe) to 5 cm long or more; stem leaves to 2.0–2.5 mm long; costa reaching to 1/5 of leaf length or more 18
- 18. Stem leaves to 2.5 mm long; costa often reaching to 1/3 of leaf length; seta less than 0.5 mm long *N. borealis*
- 18*. Stem leaves to *ca* 2 mm long or less; costa virtually absent or reaching to *ca* 1/5 of leaf length at most; seta 1.5–10.0 mm long 19
- 19. Flagelliform branches common; stem leaves to 1.5 mm long, often distinctly apiculate or mucronate; seta to 10 mm long, capsules long-exserted *N. complanata* (*Alleniella complanata*)
- 19*. Flagelliform branches uncommon; stem leaves to *ca* 2 mm long, not apiculate or mucronate; seta 1.5 mm long, capsules immersed *N. laevidens*
- 20. Leaves symmetric or slightly asymmetric; costa reaching to 1/2–2/3 of leaf length *N. inopinata*
- 20*. Leaves distinctly asymmetric; costa short, sometimes double, only rarely reaching to 1/2 of leaf length 21
- 21. Leaves with long and wide decurrences; costa sometimes reaching to 1/2 of leaf length *N. decurrens*
- 21*. Leaves not decurrent or with short, narrow decurrences; costa very short or occasionally reaching to *ca* 1/3 of leaf length 22
- 22. Plants slender and soft; branches often arcuate; stem leaves to 1.5 mm long; seta 3–4 mm long *N. flexiramea*

- 22*. Plants relatively robust, not soft; branches not arcuate; stem leaves to 2.8–3.3 mm long; seta less than 1 mm long 23
- 23. Leaves not decurrent; pseudoparaphyllia to 0.7–1.0 mm long; endostome absent *N. bhutanensis*
- 23*. Leaves shortly decurrent; pseudoparaphyllia less than 0.4 mm long; endostome present *N. pennata*

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