# A New Andean Species and a New Combination in Oreobolopsis (Cyperaceae) 

Sandra Dhooge and Paul Goetghebeur<br>Ghent University, Department of Biology, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium. Sandra.Dhooge@rug.ac.be; Paul.Goetghebeur@rug.ac.be


#### Abstract

Oreobolopsis inversa, a new species of Cyperaceae from the Andes occurring in Ecuador and Peru, is fully described and illustrated. It differs from Oreobolopsis tepalifera Koyama \& Guaglianone by its stiff erect leaves and tepals shorter than the achene. The habit of the new species is very similar to Trichophorum rigidum (Steudel) Goetghebeur, Muasya \& Simpson, but there are some remarkable differences in floral morphology between the two. In addition, the combination $O_{r}$ eobolopsis clementis (M. E. Jones) Dhooge \& Goetghebeur is made.

Key words: Andes, Cyperaceae, Oreobolopsis, Trichophorum.


The genus Oreobolopsis was described by Koyama and Guaglianone (1987) based on a single species, Oreobolopsis tepalifera. The well-developed, membranous tepals are the most conspicuous aspect of the genus. During our study of a number of scirpoid specimens from the Americas, the presence of two additional species became evident, one new taxon from the Andes, and another from California, U.S.A., which was initially described as Scirpus clementis M. E. Jones and recently transferred to Trichophorum Persoon by Smith (1995).

Oreobolopsis inversa Dhooge \& Goetghebeur, sp. nov. TYPE: Ecuador. Azuay: Parque Nacional de Las Cajas, along road Soldados-Angas, ca. 13 km from Soldados, $79^{\circ} 17^{\prime} \mathrm{W}, 02^{\circ} 53^{\prime} \mathrm{S}$, alt. 3900-4000 m, 2 May 1992, S. Laegaard 102684 (holotype, GENT; isotypes, AAU, QCA, QCNE). Figure 1.

Herba perennis rigida. Folia erecta. Spicula solitaria terminalis. Glumae inferiores vacuae 3. Glumae floriferae $3-4$. Flos bisexualis tepalis $3+3$, squamiformibus, persistentibus, achenio brevioribus. Achenium brunneum, obovatum, trigonum.

Perennial, rhizomatous herb, forming dense tussocks (Fig. 1A). Roots up to 1 mm wide, brownish. Culm (4-)11-25 cm long, 0.5-0.9 mm wide, erect, terete with 8 to 10 ribs, rounded-trigonous below the inflorescence, scabrous distally. Leaves stiff and
erect, shorter than longest culms; sheaths brown; blades (2-) $5-11 \mathrm{~cm}$ long, $0.5-0.7 \mathrm{~mm}$ wide, green, acute, margins scabrous, upper part asymmetrical (surface of adaxial side is reduced to rib toward leaf tip). Ligule membranous, brown. Inflorescence of a single pseudolateral spikelet, $4-6 \times 2-3 \mathrm{~mm}$ (Fig. 1B). Involucral bracts 2; lower bract pseudoterminal, 13-19 mm long, scabrous, with an awn $10-18 \mathrm{~mm}$ long; the upper bract $4-6 \mathrm{~mm}$ long, glumiform, scabrous, with an awn $1-3 \mathrm{~mm}$ long. Glumes spirally arranged, brown, elliptical, glabrous; lower glumes 3-3.5 mm long, empty, obtuse; fruit-bearing glumes 3 or 4, 3-4 mm long, obtuse, sometimes bifid at tip. Flowers bisexual. Tepals 3 +3 , scale-like, shorter than achene (Fig. 1C); outer whorl of tepals $1-1.4 \times 0.5-0.9 \mathrm{~mm}$, pale, obtuse or bifid; inner whorl of tepals $0.5-1 \times 0.2-0.5 \mathrm{~mm}$, irregularly lobed, pale, often with a central, reddish, acute tip. Stamens 3; anthers about 1 mm long, opening with 2 longitudinal slits, red-tinged; filaments pale brown. Ovary 3 -carpellate; stigma branches 3, papillose. Achene $1.5-1.7 \times 1-1.3$ mm , obovate, trigonous, brown, glabrous (Fig. 1D).

Paratypes. ECUADOR. Azuay: paramos, in vicinity of Toreador, between Molleturo and Quinoas, alt. 38103930 m, 15 June 1943, J. A. Steyermark 53173 (NY); paramo de Soldadas-Angas, at highest point of road, $79^{\circ} 17^{\prime}$ W, $02^{\circ} 52^{\prime}$ S, alt. $3950-4050 \mathrm{~m}$, 14 Feb. 1988, S. Laegaard 70109 (AAU, GENT, NY); paramo de Soldados, SW of Cuenca, $79^{\circ} 17^{\prime}$ W, $2^{\circ} 53^{\prime} \mathrm{S}$, alt. $3700-3800 \mathrm{~m}, 24$ Oct. 1984, S. Laegaard 53241 (AAU, GENT, NY); paramo de Soldadas, $79^{\circ} 18^{\prime} \mathrm{W}, 02^{\circ} 53^{\prime} \mathrm{S}$, alt. $3700-4000 \mathrm{~m}, 28$ Aug. 1985, S. Laegaard 55106 (AAU, GENT, NY); near pass in Parque Nacional las Cajas, W of Cuenca, $79^{\circ} 14^{\prime} \mathrm{W}, 02^{\circ} 40^{\prime} \mathrm{S}$, alt. $4150 \mathrm{~m}, 22$ Oct. 1984, S. Laegaard 53190 (AAU, GENT, NY). Bolívar: 6 km on road Sali-nas-los Arenales, grass paramo and open rocks, $79^{\circ} 0^{\prime} \mathrm{W}$, $1^{\circ} 22^{\prime} \mathrm{S}$, alt. $4000 \mathrm{~m}, 2$ Oct. 1985, S. Laegaard 55331 (AAU, GENT, NY). PERU. Ancash: Yungay, Huascarán National Park, $77^{\circ} 34^{\prime} \mathrm{W}, 8^{\circ} 59^{\prime} \mathrm{S}$, alt. $4000-4300 \mathrm{~m}, 12$ Jan. 1985, D. N. Smith et al. 9124 (U); Huaylas, Huascarán National Park, $77^{\circ} 46^{\prime}$ W, $8^{\circ} 53^{\prime} \mathrm{S}$, alt. $3960-4400 \mathrm{~m}$, D. N. Smith et al. 9987 (U).

Anatomical Observations (Terminology According to Metcalfe, 1971)

The transverse section of the lamina is thickly crescentiform, except at the apex where ellipsoidal.



Figure 2. Anatomical section through the lamina (A) and culm (B) of Oreobolopsis inversa (Laegaard 53190). (Drawn by S. Dhooge.)

The lamina margins are continuously scabrous. Epidermis: Contrary to many Cyperaceae, the size of the epidermal cells on both surfaces is more or less alike. The outer periclinal wall of epidermal cells is strongly thickened. Stomata only abaxial. Mesophyll: a homogeneous tissue of parenchymatous cells. In the leaf center, lysigenous air cavities
are present. At the periphery, the mesophyll is interrupted by strands of sclerenchyma opposite the vascular bundles. Adaxially, the sclerenchyma comprises only a few $(2-3)$ columns resting against the epidermis. Abaxially, the sclerenchyma connects the epidermis with the largest vascular bundles, forming abaxial girders (Fig. 2A). Adaxial

Table 1. Main differences between Oreobolopsis inversa and Trichophorum rigidum.

|  | Oreobolopsis inversa | Trichophorum rigidum |
| :--- | :--- | :--- |
| Perianth segments | + | - |
| Fruit length $(\mathrm{mm})$ | $1.5-1.7$ | $1.8-2$ |
| Fruit width $(\mathrm{mm})$ | 1.2 | 1 |
| Fruit color | chestnut | dark brown-black |
| RHS colour chart | grayed orange group 165 A | brown group 200 A |
| Ligule form | straight | arched |

caps often are associated with the vascular bundles. Vascular bundles (5 or 6 ) are surrounded by a bundle sheath consisting of two layers: an inner sheath composed of cells with U-shaped thickenings and an outer sheath of thin-walled cells. Bundle sheaths surrounding minor vascular bundles are more clearly marked than those surrounding the major vascular bundles. The vascular bundles are collateral and of two different shapes: the minor vascular bundles are circular; the major ones are elliptical. Xylem consists of xylem vessels and xylem parenchyma, phloem of sieve cells and phloem parenchyma.

The transverse section of the culm is circular, with or without a wavy outline, to rounded triangular under the inflorescence. Epidermis: Cells with a strongly thickened outer periclinal wall. The parenchyma of the culm is homogeneous but the central tissue is broken down and looks like a threedimensional meshwork ("net" type, Metcalfe, 1971: 28). Vascular bundles (11 to 18) are in the periphery of the culm (Fig. 2B), supported by a sclerenchyma girder (at the phloem side, toward the epidermis) and a sclerenchyma cap at the xylem side. The minor vascular bundles are only provided with 2 caps. In the lower half of the culm, small air cavities appear between the vascular bundles. Bundle sheath: see description under lamina. The vascular bundles are collateral with endarch xylem and exarch phloem.

## The Affinity of Oreobolopsis inversa and Trichophorum rigidum

Koyama (in Koyama \& Guaglianone, 1987: 84) reported the presence of scale-like perianth segments in the bisexual flowers of certain specimens identified by him as "Scirpus rigidus." This species, invariably without perianth segments, was recently transferred to Trichophorum, as Trichophorum rigidum (Steudel) Goetghebeur, Muasya \& D. A. Simpson (Muasya et al., 2000).

A number of specimens, earlier included under Scirpus rigidus, are here described as Oreobolopsis inversa based on the presence of perianth segments.

The epithet alludes to its opposite characters (tepals shorter than the achene and the larger size of the plant) compared with the first described species, Oreobolopsis tepalifera. Specimens of $O$. inversa are contrasted with specimens of Trichophorum rigidum (without perianth segments), because in gross morphology they look very much alike. The fruit and the ligule, however, are conspicuously different in shape (Table 1). Future DNA studies could be used to support or refute our morphological interpretation.

## A Californian Species of Oreobolopsis

Mention should also be made of a small scirpoid species occurring in California (U.S.A.), Scirpus clementis M. E. Jones. This species recently was transferred to Trichophorum by S. G. Smith (1995: 102). However, this species is distinct from a typical Trichophorum due to the presence of scale-like perianth segments, which is the most striking feature of Oreobolopsis.

Oreobolus R. Brown looks superficially like Oreobolopsis because it also has scale-like perianth segments. The structure of the 1-flowered spikelet and the distichous leaves, however, make Oreobolus clearly distinct from Oreobolopsis. In addition, the embryos are different: Oreobolus has a caricoid embryo with a clear basal root cap, while the embryo of Oreobolopsis (inclusive of $O$. clementis) has a subbasal root cap (Van der Veken, 1964). Therefore, we assume that Oreobolopsis is the most appropriate generic name for Scirpus clementis.

Oreobolopsis clementis (M. E. Jones) Dhooge \& Goetghebeur, comb. nov. Basionym: Scirpus clementis M. E. Jones, Contr. W. Bot. 14: 21. 1912. Trichophorum clementis (M. E. Jones) S. G. Smith, Novon 5: 102. 1995. TYPE: U.S.A. California: Rae Lake, King's River, alpine, 20 July 1910, Mrs Clements s.n. (lectotype, designated by Smith (1995), POM; isolectotypes, DS, POM).

Scirpus yosemitanus F. J. Smiley, Univ. Calif. Publ. Bot. 9:
108. 1921. TYPE: U.S.A. California: Yosemite National Park, Tuolumne Meadows, Soda Springs, 8 Aug. 1898, J. W. Congdon s.n. (holotype, GH).

## Key to the Andean Scirpoid Genera

1a. Inflorescence a dense head of several spikelets, hypogynous bristles well developed . . Phylloscirpus
1b. Inflorescence of 1 terminal spikelet . . . . . . . 2
2a. Hypogynous scales absent . . . . . . . . . . 3
3a. Leaves ligulate . . . . . . . . . Trichophorum
3b. Leaves eligulate . . . . Scirpus boliviensis
(generic allocation under study)
2b. Hypogynous scales present . . . . . . . . . . 4
4a. Spikelet 1 -flowered, leaves distichous
. . . . . . . . . . . . . . . . . . . . . Oreobolus
4b. Spikelet 3- or 4-flowered, leaves tristi-
chous . . . . . . . . . . . . . . Oreobolopsis

## Key to the Species of Oreobolopsis

1a. Slender, rigid plants, longer culms $10-25 \mathrm{~cm}$ tall
lb. Plants $<9 \mathrm{~cm}$ tall.
2a. Leaves acute; achene $>1.5 \mathrm{~mm}$ long, surface smooth . . . . . . . . . . . . . O. O. tepalifera
2b. Leaves muticous; achene $\leq 1.5 \mathrm{~mm}$ long, surface reticulate . . . . . . . . . . O. clementis

Acknowledgments. We express our gratitude to the curators of the Herbarium Jutlandicum of Aarhus University (AAU), the herbarium of Utrecht University (U), and The New York Botanical Garden (NY) for kindly providing specimens. We thank Marcel Verhaegen (BR) for the SEM images and Peter Chaerle (GENT) for his assistance with the photography.

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Dhooge, S and Goetghebeur, Paul. 2002. "A new Andean species and a new combination in Oreobolopsis (Cyperaceae)." Novon a journal of botanical nomenclature from the Missouri Botanical Garden 12, 338-342.

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