Cardosoa, a new genus of the subtribe Anisopappinae (Athroismeae, Asteraceae)

by

Santiago Ortiz

Laboratorio de Botánica, Facultade de Farmacia, Universidade de Santiago, 15782 Santiago de Compostela, Galicia, Spain

santiago.ortiz@usc.es

Abstract


The new genus Cardosoa of the subtribe Anisopappinae (Athroismeae, Asteraceae) is described for the species Anisopappus athanasioides from the Angola Plateau. The diagnostic morphological characteristics of the new genus are discussed, and contrasted to those in Anisopappus its putative sister genus. The main distinguishing features of Cardosoa in Athroismeae are its inflorescence morphology, the bilabiate marginal florets, and shallowly zygomorphic disc florets.

Keywords: Asteridae, Compositae, Tropical Africa, Angola, Huambo, systematics, taxonomy, morphology.

Resumen


Se describe el nuevo género Cardosoa de la subtribu Anisopappinae (Athroismeae, Asteraceae) para la especie Anisopappus athanasioides del planalto de Angola. Se discuten los caracteres morfológicos más distintivos del nuevo género, especialmente frente a Anisopappus. Los caracteres morfológicos de mayor valor diagnóstico son el tipo de inflorescencia y la presencia en Cardosoa de flores marginales bilabiadas y flores del disco zigomórficas en mayor o menor medida.

Palabras clave: Asteridae, Compositae, África tropical, Angola, Huambo, sistemática, taxonomía, morfología.

Introduction

In 1995 Ortiz & Paiva described the species Anisopappus athanasioides (Asteraceae) from somewhat immature material collected by H. Cardoso in Chianga (Huambo), on the Angola Plateau. Eldenäs & Anderberg (1996: 174) considered the specimen from which it was described to be “significantly different from all other species of Anisopappus”. We subsequently found more complete material of this taxon and discovered that, besides its distinct capitula and inflorescence, it has bilabiate (i.e. with one adaxial and three abaxial lobes) marginal florets when mature, very different to those of Anisopappus Hook & Arn., which always are true ray florets. In view of these and other very marked morphological differences with respect to Anisopappus and other related members of the Asteraceae, we describe a new genus for this species.

Material and methods

Morphological characters were studied in herbarium specimens of the 18 species of Anisopappus (including A. athanasioides) from BM, COI, K, LISC, LISE, LISU, LUA, LUAI, P and PRE.

Macromorphological characters were studied with the aid of a light microscope. For microscopic examination of floral parts, these were first boiled in water with a surfactant, and subsequently mounted in Hoyer’s solution (Anderson, 1954). Cypsela sections were cut by hand with razor blades. Micromorphological and anatomical characters were studied with a compound light microscope.

For examination of corolla and cypsela features, florets were mounted on aluminium stubs and coated with a c. 30-nm gold layer for study with a LEO 435VP scanning electron microscope (SEM) operating at 15 kV.
Description

**Cardosoa** S. Ortiz & Paiva, *gen. nov.*


*A genere Anisopappus differt capitulis racemosis, florum marginalibus capituli uniuscusique bilabiatis - limbo quidem abaxiali 1.5-2 mm longo nervisque lobulorum usque ad basin divisis - floribus centralibus plus minusve zygomorphis ob lobulorum corollinorum inaequalem satis incisionem.*

Subshrubs. Stems terete, without resin canals, herbaceous parts with multiseptate hairs. Leaves alternate, simple, entire, linear, with revolute margins, with short petioles or petioles wanting. Capitula cyathiform, arranged in racemiform cymes (Fig. 1a); phyllaries in 3-4 rows, acute, with non-scarious margins. Receptacles flat, paleate; paleae folded, acute, with glandulose apices. Marginal florets female, sometimes with staminal tails; endothecial tissue polarized; cells of oxalate crystals, with obtuse sweeping-hairs not accompanied by sclerenchymatous cells accompanying the submarginal narrow vascular strands. Stamen filaments without oxalate crystals; anthers shortly calcarate, with short, unbranched tails; endothecial tissue polarized; cells of filament collar wider than long. Style without star-shaped oxalate crystals, with obtuse sweeping-hairs not reaching the style branch bifurcation; style branches with obtuse, rounded apices, stigmatic areas in two apically confluent lines, style branch veins narrow. Cypselae (immature) cylindric to slightly obconic (Figs. 1b, 1c), ribbed, hairy, without conspicuous sclerenchymatous tissue, with small oxalate crystals of diverse shape (as “crystal sand”) in the epidermis, without secretory ducts; carpodipodium absent. Pappus of inconspicuous short scales (Fig. 1b, c; line drawing in Ortiz & Paiva, 1995; Fig. 1).

**Other representative specimen examined**

ANGOLA. Huambo: Chiangia, ca. 1700 m, 7-V-1967, M. Silva 2070 (LISC); 10 km from Cachungo on the right side of the road Cachungo-Bailundo, 1.5 km from the river Ko, ca. 1700 m, 23-VI-2001, S. Ortiz 847, J.A.R. Paiva, J. Rodríguez-Oubiña, R. Carballo, M. Serrano & M. Soares (SANT).

The generic name honors Helder Cardoso, the first collector of this plant, and João Cardoso, who has accompanied us and provided invaluable help during our collecting trips in Angola.

**Discussion**

As a result of a molecular phylogenetic analysis using the cpDNA marker *ndhF*, Eldenäs & al. (1999) suggested that *Anisopappus* should be assigned to Heliantheae s.l. instead of Inuleae as proposed by several authors in the last decade (Anderberg, 1991; Anderberg, 1994; Eldenäs & Anderberg, 1996; Ortiz & al., 1996; Eldenäs & al., 1998). In that analysis *Anisopappus* forms a trichotomy with the *Athroisma-Blepharispermum* group and with the remaining genera of Heliantheae s.l. Panero & Funk (2002), on the basis of a phylogenetic analysis of the entire Asteraceae family using a large number of chloroplast DNA markers, suggested that the group *Athroisma-Blepharispermum*, already found by Kim & Jansen (1995) in their analysis of the Asteraceae using the marker *ndhF*, should be considered a tribe, which they denominate Athroismeae (including the genera *Athroisma* DC., *Blepharispermum* Wight ex DC., and *Leucolelephas* Arn.), phylogenetically situated between a) a clade including the tribes Inuleae and Plucheeae - the latter currently included in Inuleae by its author (Anderberg & Eldenäs, 2007; Anderberg, 2009) - and b) a large monophyletic group including the rest of subfamily Asteroideae (Heliantheae s.l.). A similar position for this tribe is also supported by the phylogenetic analyses of Panero & Funk (2008). These authors had already noted the possibility of including *Anisopappus* in this tribe. Also recently Panero (2005) described the new subtribe Anisopappinae, with the sole genus *Anisopappus*, within the tribe Athroismeae. In 2007 Panero also included in Anisopappinae the genus *Weltwitschiella* O. Hoffm. although more recently Anderberg (2009) removed this genus from the Athroismeae based on his preliminary molecular phylogenetic analyses which nested it within the tribe Astereae as was confirmed by Brouillet & al. (2009). *Cardosoa* is very probably a member of that subtribe taking into account its morphological affinities to *Anisopappus* and we are currently carrying out a molecular phylogenetic analyses using the markers ITS and 1 *ndhF* to check the relationships of *Cardosoa*.

Differences in inflorescence morphology can be readily used to separate *Cardosoa* from its putative sister taxon *Anisopappus*. *Cardosoa* has racemiform cymes (Fig. 1a) whereas the genus *Anisopappus*, has corymbose or subcorymbose cymes (Fig. 1d), sometimes with capitula on long peduncles that appear...
Fig. 1. Inflorescence (S. Ortiz 847, J.A.R. Paiva, J. Rodríguez-Oubiña, R. Carballal, M. Serrano & M. Soares, SANT) and SEM micrographs of florets (M. Silva 2070, USC) of Cardosoa athanasioides and inflorescence of Anisopappus fruticosus S. Ortiz & Paiva (S. Ortiz 885, J.A.R. Paiva, J. Rodríguez-Oubiña, R. Carballal, M. Serrano & M. Soares, SANT): a, inflorescence of C. athanasioides; b, marginal bilabiate floret of C. athanasioides; c, disc floret of C. athanasioides, note the different depths of the lobe sinuses; d, inflorescence of A. fruticosus.
solitary [A. chinensis Hook. & Arn., A. grangeoides (Vatke & Höpfner ex Klatt) Merxm., A. marianus Lawalrée, etc.].

The involucre of Cardosoa is cyathiform (Fig. 1a), whereas in Anisopappus it is campanulate to hemispheric (Fig. 1d). Only A. smutsii Hutch. and A. pseudopinnatifidus S. Ortiz & Paiva have an involucre similar to that of Cardosoa.

The marginal florets of Cardosoa are bilabiate (one adaxial and three abaxial lobes) (Fig. 1b) or very rarely pseudobilabiate (one adaxial and four abaxial lobes), whereas the marginal florets of Anisopappus are always true ray florets (Fig. 1d). In addition, the marginal florets of Anisopappus are much larger than those of Cardosoa (abaxial limb 4-13 mm long in Anisopappus versus 1.5-2 mm long in Cardosoa), though in some species (such as A. pinnatifidus (Klatt) O. Hoffm., A. pseudopinnatifidus and A. chinensis subsp. scrobpulariifolius (Baker) S. Ortiz, Paiva & Rodr. Oubiña) the ray florets may be absent. Cardosoa also differs from Anisopappus in the nerves of the apical lobes of the abaxial lip, which remain separate to the base of the limb (Fig. 2a), whereas in Anisopappus these nerves normally join close to the sinuses (Fig. 2b).

The disc florets of Cardosoa are zygomorphic, with the depth of the sinuses varying among lobes (Figs. 1c, 2c); in Anisopappus, by contrast, the disc florets are actinomorphic. In Cardosoa, the lobes are conspicuously more acuminate, with the nerve clearly extending to the apices (Fig. 2a); we have not observed this character in any of the species of Anisopappus.

The anthers of Cardosoa have a conspicuously apiculate apical appendage whereas in Anisopappus the apical appendage is acute, not apiculate.

The cypselae are not fully mature in the Cardosoa material available, but appear to differ markedly from those of Anisopappus, to judge from the number of nerves and incipient ribs: in Cardosoa the number of nerves per cypsela seems always to be less than or equal to 5, and the number of ribs less than 10, whereas in Anisopappus the number of nerves is characteristically 5-10(20?), and the number of ribs 10-20. The single exception to this is A. latifolius (S. Moore) B.L. Burtt, a distinctive species found to be sister to the other species of Anisopappus in the morphological cladistic analyses of Eldenás & Anderberg (1996).

**KEY TO THE GENERA OF ANISOPAPPINAE**

(sensu Panero, 2007)

1. Capitula disciform; receptacle epleate; marginal florets generally tetramerous; pappus a crown of scales fused at the base..................... **Welwitschiella**

1. Capitula radiate or rarely discoid; receptacle paleate, rarely epleate; marginal florets generally pentamerous; pappus of small ± free scales or absent .... 2

2. Capitula arranged in racemiform cymes; marginal florets bilabiate (rarely pseudobilabiate), with an abaxial limb 1.5-2 mm long and the nerves of the apical lobes separated to the base of the limb; disc florets more or less zygomorphic, sinuses depth varying among the lobes; apical appendage of the anther conspicuously apiculate; cypselae with up to 5 nerves and 10 ribs........................................... **Cardosoa**

2. Capitula arranged on more or less lax corymb; marginal florets true ray florets (rarely absent), with abaxial limb 4-12 mm long and nerves of the apical lobes joining close to the sinuses; disc florets totally actinomorphic; apical appendage of the anther not apiculate; cypselae with 5-10(20?) nerves and 10-20 ribs........................................... **Anisopappus**

**Acknowledgements**

Our thanks go to Manuel Latíz for the Latin diagnosis, to Ramiro Barreiro for SEM micrographs, to G. Norman for the En-
glish translation, to João Cardoso for his invaluable help during the collecting trips in Angola, and to the keepers of the herbaria mentioned for the loan of studied material.

References