STUDIES ON MONSTEREAE (ARACEAE) OF BORNEO I: TWO NOVEL *ANADENDRUM* FROM SARAWAK

by
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Abstract

Two new *Anadendrum* from Sarawak, *A. calcicola* and *A. muluensis*, are described and illustrated. By the leaf lamina abaxially glaucous they are most similar to *A. affine* (Sumatera). *Anadendrum calcicola* differs from *A. affine* in the bimodal gorgonoid synflorescence, and the stamen filaments not extending at male anthesis. *Anadendrum muluensis* also shares the character of the anthers not exserted at male anthesis, but differs from both *A. affine* and *A. calcicola* by flowering on the tips of elongated shoots, and by the consistently cordate lamina bases.

Keywords: Araceae, *Anadendrum*

Anadendrum is a small genus of hemiepiphytes restricted to the Sunda Shelf, the Philippines, Thailand, and Indochina as far north as southwestern China (Yunnan). Currently there are 14 published names at all ranks, but there exists considerable difficulty in regard the application of these names to plants in the field. The problems are compounded by the inadequate nature, and condition, of most historical types, the fact that many names are based upon mixed-taxon syntypes, a long tradition of misapplication of names in literature, and in herbaria, and not least, based on fieldwork in Peninsular Malaysia, Thailand and Sarawak, upon the fact that the majority of plants encountered in the field appear to be undescribed. While a start has been made to understand Thai species (Boyce, in press), much remains to be done in Sunda and elsewhere.

While undertaking fieldwork in Sarawak as part of the Araceae of Sarawak subprogramme of CATE (see Haigh *et al.*, 2008) two distinctive *Anadendrum* with leaf laminae conspicuously abaxially

glaucous, adaxially matte olive green (in striking contrast to all other Sarawak species in which leaf laminae are adaxially glossy medium to dark green, while abaxially paler and slightly shiny), and with the petiolar sheath extending to the base of the apical pulvinus, were encountered, both usually, but not exclusively, in association with limestone.

Anadendrum Schott, Bonplandia 5: 45 (1857); Mayo, Bogner & Boyce, Genera of Araceae 113, Map. 11, Pl. 11 (1997).

Small climbing hemiepiphytes. Leaves opposite on climbing shoots, usually congested-distichous on flowering shoots; *petiole* pulvinate apically and basally, sheathed to the apical pulvinus in most species, sheath persistent or marcescent; *lamina* obliquely ovato-oblong, entire; primary lateral veins pinnate, running into marginal vein, higher order venation reticulate. *Inflorescences* 1 – 7 in each floral sympodium; *peduncle* relatively long. Spathe oblongo-ovate, boat-shaped, inflating-gaping at female anthesis, thence opening and remaining erect or reflexing during male anthesis, greenish white to yellowish, rarely internally purple-stained, or bright green, rostrate apically and much overtopping the spadix, caducous after anthesis, rarely marcescent. *Spadix* stipitate, cylindric. *Flowers* bisexual, perigoniate; *perigone* membranaceous, cup-like, tepals truncate, equalling or shorter than gynoecium; *stamens* 4, free, filaments relatively short, broad, spathulate, sometimes extending during male anthesis to raise the anthers above the gynoecium; connective slender, thecae linear-elliptic, dehiscing by longitudinal slit. *Pollen* inaperturate, subspheroidal, small (mean 22 μm.), exine psilate or subretipilate, pilae spinulose tipped and solitary, or united into groups of 2 – 4 or more. *Gynoecium* with ovary obconic or obpyramidal, subquadrangular, 1-locular, ovule 1, anatropous, funicle short, placenta basal, stylar region as broad as ovary, stigma transversely oblong. *Fruits* a berry, distinctly truncate apically, subglobose, ripening from green through medium yellow to scarlet or orange red. *Seed* rounded, subglobose, testa smooth, glossy, embryo large, endosperm absent.

Anadendrum calcicola **Boyce & Wong,** ***sp. nov.*** Ab alli

Anadendrii Borneensibus combination foliis subtus glaucis, laminis adultis basaliter cuneatis, et inflorescentis plures in synflorescentiis gorgonoidiis bimodulis dispositis differt. *Anadendrum affinis* (Sumatera) accedit, petioli vagina long persistens et staminis non-exserta distinguitur.

— Typus: Malaysia, Sarawak, Kuching, Bau, Gua Angin, 01° 24' 54.8"; 110° 08' 08.2", 45 m asl, 9 May 2009, *P.C. Boyce & Wong Sin Yeng AR-2450* (SAR, holo). Plate II.

Climbing hemiepiphyte to 3 metres. *Stems* terete, ca 1 cm dia. on flowering shoots; climbing shoots to ca 3 mm dia., matte pale green. *Leaves* on flowering shoots scattered to ca 3 – 5 cm distant; *petiole* 5 – 33 cm long, pulvinate basally and apically, *apical pulvinus* ca 1 – 2 cm long; *petiolar sheath* reaching to the base of the pulvinus, conspicuous, long-persistent, wings up to 1.2 cm wide, lowest part of sheath membranous-cartilaginous, upper part somewhat leathery, the extreme margin marcescent; *lamina* very narrowly lanceolate to oblong lanceolate, slightly oblique, flowering plants with lamina 8 – 34 × 3 – 13 cm, juveniles often with the lamina very narrow compared with the length, in extreme cases almost linear; lamina adaxially dull, matte olive green; abaxially glaucous-grey, particularly on juvenile plants, base cuneate to very weakly cordate (the latter only in juvenile shoots), apex acute with a conspicuous tubular mucro ca 3 – 4 mm long; primary lateral veins (PLV) up to 11 per side, but much fewer on smaller leaves, impressed adaxially, conspicuously raised abaxially; interprimary veins (IPV) ca half as prominent as PLV and ± regularly interspersed with them; both PLV & IPV arising from the mid-rib at ca 60°; 2-order veins forming a conspicuous loose reticulum, and often markedly darker than the lamina. *Inflorescences* ca 7 together in a bimodular gorgonoid synflorescence, each module subtended by up to 6 lanceolate-oblong prophylls and cataphylls, each inflorescence subtended by a leathery convolute prophyll to 7 × 2 cm; *inflorescences* up to 12 together, sequentially produced, with the oldest in juvenile fruit before the newest has passed through anthesis, and the whole synflorescences often then displaced by a continuation

module of the primary axis; *peduncle* extending during development, up to 17 cm long, ca 3 mm wide during anthesis, laterally somewhat compressed, pale green, occasionally slightly glaucous. *Spadix* stipitate; *stipe* to 1.5 cm long, 3 mm wide, very slightly longitudinally angled; *fertile portion of spadix* cylindrical, obliquely inserted on stipe, 3 – 3.5 × ca 0.7 cm, pale yellow at anthesis, becoming darker yellow, and thence green as fruit begin to develop. *Spathe* inflating-gaping at female anthesis, 8 × 1 cm, pale green, then at onset of male anthesis swiftly opening, lanceolate, and conspicuously beaked, 10 × 3 cm, pale yellowish white, the interior waxy, exterior pale glaucous green, spathe late in anthesis reflexing and blackening before circumscissile at spathe/spadix insertion, and falling; *Flowers* 4 × 6 mm; *perigone* much shorter than gynoecium, translucent very pale green; *gynoecium* pale creamy yellow, stigma ca 1 mm, linear, transverse, gynoecium later medium yellow, later still green, with stigmatic remains blackening; *stamens* with filaments not extending during male anthesis, anthers dehiscing while still concealed between adjacent flowers. *Infructescence* up to 10 together, spreading to erect; *spadix* dark green; *fruits* ripening dark green through yellow to scarlet.

Distribution: To date endemic to Sarawak, but there widespread and with collections from very close to the Brunei and Kalimantan border such that it is almost certainly distributed throughout N. Borneo as far north as Brunei.

Habitat: Climbing hemiepiphyte in perhumid dense forest, often on, but not restricted to, limestone, 35 – 450 m alt.

Notes: A highly distinctive species by virtue of the large (for the genus) leaves with the laminae abaxially glaucous, and the numerous inflorescences produced in a strongly bimodular gorgonoid synflorescence. *Anadendrum calcicola* is similar in overall appearance to *A. affine* Schott (Sumatera) but readily distinguished by the persistent petiolar sheath, and the anthers not exserting at anthesis. Juvenile plants are remarkable by the long, narrow, occasionally almost linear, leaf lamina.

Other specimens seen Sarawak, Kuching Division: Bau, Jambusan, Kampung Seromah, 2 April 2004, *P.C. Boyce & Jeland ak Kisai AR-111* (SAR) SAR is Sarawak Forestry Department Herbarium; Bau, Kampung Segong, Ulu Sungai Adis, 2 June 2004, *P.C. Boyce & Jipom ak Tisai AR-425* (SAR); Bau, Jambusan, 8 Dec. 2004, *P.C. Boyce & M.Gibernau AR-844* (SAR); Bau, Kampung Bogag, Gunung Tibugai, 01° 21' 31.1"; 110° 03' 48.7", 12 Jan 2005, *P.C. Boyce, R. Kneer & Jeland ak Kisai AR-963* (SAR); Krokong, Kampung Tringgus, Sungai Bong, 01° 15' 22.8"; 110° 05' 53.9", 4 March 2005, *P.C. Boyce, Jeland ak Kisai & Jipom ak Tisai AR-1018* (SAR); Bau, Kampung Segong, 01° 32' 00.9"; 110° 08' 58.8", 10 Aug. 2005, *P.C. Boyce et al. AR-1325* (SAR); Bau, Kampung Segong, Sori, Sungai Adis, 01° 32' 22.8"; 110° 08' 48.5", 16 Sept. 2005, *P.C. Boyce et al. AR-1360* (SAR); Bau, Gunung Juita, 01° 23' 48.7"; 110° 08' 07.2", 28 Oct. 2005, *P.C. Boyce et al. AR-1496* (SAR); Kuching, Siburan, Kampung Giam, Air Terjun Giam, 01° 19' 11.2"; 110° 16' 11.4", 7 Feb. 2006, *P.C. Boyce, Jeland ak Kisai & Wong Sin Yeng AR-1692* (SAR); Bau, Kampung Grogo, Sungai Tubih, 7 March 2006, *P.C. Boyce & Jeland ak Tisai AR-1715* (SAR); Kuching, Siburan, Kampung Giam, Air Terjun Giam, 01° 19' 11.2"; 110° 16' 11.4", 7 Feb 2006, *P.C. Boyce & Jeland ak Kisai AR-2166* (SAR). Samarahan Division: Serian, Gunung Ampungan, 01° 09' 08.2"; 110° 37' 21.2", 21 Nov. 2003, *P.C. Boyce & Jeland ak Kisai AR-170* (SAR); Serian, Pichin, Gunung Kedadum, Sugun Kerang, 13 Nov. 2004, *P.C. Boyce & Simon Kutuh ak Paru AR-749* (SAR); Serian, Pichin, Sungai Bombo, 5 Dec. 2004, *P.C. Boyce & Simon Kutuh ak Paru AR-856* (SAR); Serian, Pichin, Labu, Sungai Tiyab, 26 July 2005, *P.C. Boyce & Simon Kutuh ak Paru AR-1295* (SAR); Serian, Mongkos, Kampung Batuh, Gunung Selabur, 00° 57' 26.2"; 110° 30' 15.8", 15 March 2006, *P.C. Boyce et al. AR-1731* (SAR). Sarikei Division: Pakan, Berasok, 01° 54' 30.8"; 111° 38' 59.1" 6 Dec 2005, *P.C. Boyce et al. AR-1560* (SAR); Sarikei, Ulu Sarikei, 01° 55' 05.4"; 111° 29' 35.8", 7 Dec 2005, *P.C. Boyce et al. AR-1581* (SAR). Kapit Division: Kapit, Nanga Gaat, Rejang Wood Concession, km 65 road to Camp Gahada, 01° 42' 01.1"; 113° 31' 14.8", 12 May 2004, *P.C. Boyce, Jeland ak Kisai & Jipom ak Tisai AR-368* (SAR); Kapit, Taman Rekreasi Sebabai, 01° 56' 45.6"; 112° 54' 16.8",

13 Dec. 2004, *P.C. Boyce, Jeland ak Kisai & M. Gibernau AR-872* (SAR); Belaga, Belaga road, Sungai Unan, 02° 55' 40.0"; 113° 44' 15.4", 12 Oct. 2005, *P.C. Boyce, Jeland ak Kisai & Jipom ak Tisai AR-1469* (SAR). Bintulu Division: Tatau, Bukit Sarang, Grand Perfect field station, path to Gua Lubang Batu Rusa L-45, 12 July 2006, *Skornickova 114 sub. AR-2015* (SAR). Miri Division: Niah Suai, Niah National Park, Madu Trail, 03° 48' 57.9"; 113° 46' 18.3", 13 July 2006, *P.C. Boyce et al. AR-1882* (SAR); Marudi, Long Lama, Mulu N.P., Trail to Gunung Mulu Summit, 04° 02' 18.7"; 114° 49' 44.2", 29 Sept. 2007, *P.C. Boyce et al. AR-1957* (SAR); Marudi, Long Lama, Mulu N.P., Nightwalk Trail, 04° 02' 42.2"; 114° 48' 55.5", 3 Oct. 2007, *P.C. Boyce et al. AR-1999* (SAR). Limbang Division: Nanga Medamit, Mulu N.P., Sungai Empangau, tributary from Sungai Mendalam, 04° 13' 41.6"; 114° 52' 50.5", 30 Sept. 2007, *P.C. Boyce et al. AR-2249* (SAR).

Anadendrum muluensis **Boyce & Wong, *sp. nov.*** *Anandrum muluensis* differt ab speciebus ceteris laminis foliorum adaxiali glaucis, basalis cordatis, caulis florenti foliis non distichus congestis et staminis non-exserta. *Anandrum cordatum* accedit sed ab eo foliis subtus glaucis atque in synflorescentiis florenti ad apicem surculorum non-specialis differens. — Typus: Malaysia, Sarawak, Miri, Marudi, Long Lama, Mulu N.P., Trail to Deer Cave, 04° 02' 23.8"; 114° 48' 54.6", 60 m asl, 27 Sept. 2007, *P.C. Boyce, et al. AR-1929* (SAR, holo). Plate III.

Climbing hemiepiphyte to two metres but usually much less. *Stems* weakly compressed, ca 5 mm flowering shoots, climbing shoots to ca – 3 mm dia. glaucous medium green; *Leaves* scattered to ca 3 – 5 cm distant; *petiole* 2 – 9 cm long, canaliculate, pulvinate apically and basally, *apical pulvinus* ca 1.5 cm long, strongly D-shaped in cross section, the angles sharply defined; *petiolar sheath* extending to the base of the apical pulvinus, conspicuous, pale green, turning yellow, then soon-marcescent, wings up to 3 mm wide.; *lamina* broadly oblongo lanceolate to broadly cordate, 3 – 12 × 3.5 – 6 cm, slightly oblique, base sub-truncate (and then very slightly cordate at petiole insertion) to cordate, apex acute with a conspicuous tubular mucro ca 1 mm long; adaxially dull, matte olive green; abaxially glaucous-grey,

particularly on juvenile plants; primary lateral veins up to 6 per side, but half this number on smaller leaves, slightly impressed adaxially, raised abaxially; interprimary veins ca half as prominent as PLV and ± regularly interspersed with them; both PLV & IPV arising from the mid-rib at ca 60°; 2-order veins forming a barely visible reticulum. *Inflorescences* ca 3 together in a loose bimodular synflorescence on primary shoots; first two inflorescences each subtended by a leaf, terminal inflorescence subtended by a leathery convolute prophyll to 2 × 0.04 cm; inflorescences sequentially produced, with the oldest in juvenile fruit before the terminal has reached anthesis, the whole synflorescence always displaced by a continuation module of the primary axis; *peduncle* extending during development, up to 5 cm long, ca 2.5 mm wide at anthesis, laterally somewhat compressed, medium green, conspicuously pulvinate at insertion of spadix and, on pendent shoots, this pulvinus twisting to present spathe and spadix upright. *Spadix* stipitate; *stipe* to 1 cm long, 2 mm wide, terete; *fertile portion of spadix* cylindrical, obliquely inserted on stipe, 3 × ca 0.7 cm, pale yellow at anthesis, becoming darker yellow and thence deep green as fruit begin to develop. *Spathe* gaping at female anthesis, 5 × 1 cm, pale green; opening at onset of male anthesis, oblong triangular, 5 × 3 cm deeply concave with the terminal third (corresponding to the part exceeding the spadix) constricted into a conspicuous beak, narrower than the lower 2/3, spathe pale yellowish white, the interior waxy, remaining upright throughout anthesis, circumscissile at spathe/spadix insertion during late male anthesis, and thence caducous. *Flowers* 4 × 2.5 mm; *perigone* much shorter than gynoecium, translucent very pale green; *gynoecium* cream; *stigma* transverse, pale yellow, gynoecium later darkening and then turning green with stigmatic remains blackening; *stamens* with filaments not extending during male anthesis; anthers dehiscing concealed between the flowers. *Infructescence* several together, spreading to erect; *spadix* dark green; *fruits* ripening dark green through yellow to bright scarlet.

Distribution: Sarawak, known only from the type collection.

Habitat: Climbing hemiepiphyte in perhumid dense forest on limestone, 60 m alt.

Notes: *Anadendrum muluensis* is unusual in the genus in flowering on undifferentiated shoots (as compared with most species where flowering occurs on shoots with fans comprised of congested-distichous leaves). The leaf laminae cordate basally and glaucous abaxially, and stamens non-exserted during anthesis readily differentiates *A. muluensis* from all other Sarawak species.

In leaf form, and in carrying inflorescences on shoots with scattered leaves, *A. muluensis* approaches *A. cordatum* Schott (Sumatera), and *A. montanum* var. *cordatum* Ridl. (Peninsular Malaysia), from both it differs by the leaves glaucous abaxially and the anthers not exserting during anthesis.

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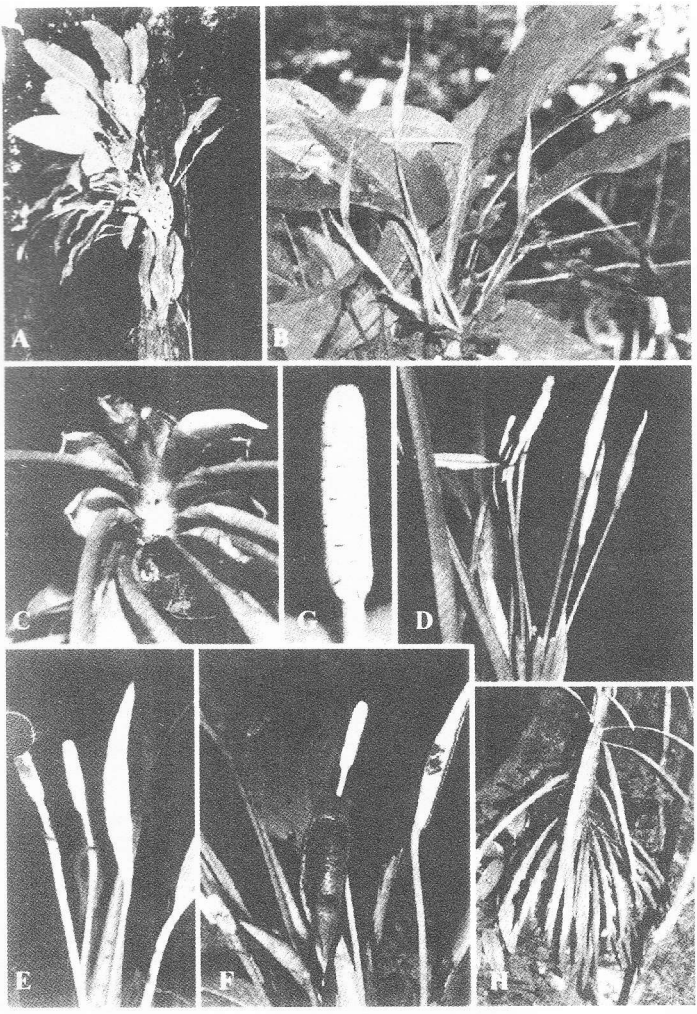

Plate II: ***Anadendrum calcicola*** **Boyce, Ipor & Wong. A.** Plant in habitat showing the abaxially glaucous leaf laminae. **B.** Flowering shoot. **C.** Detail of the bimodular gorgonoid synflorescence. **D.** Flowering shoot, lateral view. Note the younger inflorescences towards the 'front' with older inflorescences (these at onset of male anthesis) behind, and the conspicuous, persistent petiolar sheath. **E.** Inflorescence at female anthesis. Note the spathe has inflated and is gaping as compared with the younger inflorescences in Plate 1D. **F.** Inflorescence at late male anthesis. Note the spathe has reflexed and turned black. **G.** Detail of spadix at male anthesis. The dehisced anthers are clearly visible down between the individual flowers. **H.** Juvenile plant showing the characteristic long, narrow leaves. **A-G:** *AR-2450*; **H:** *AR-963*. Images ©Peter C. Boyce.

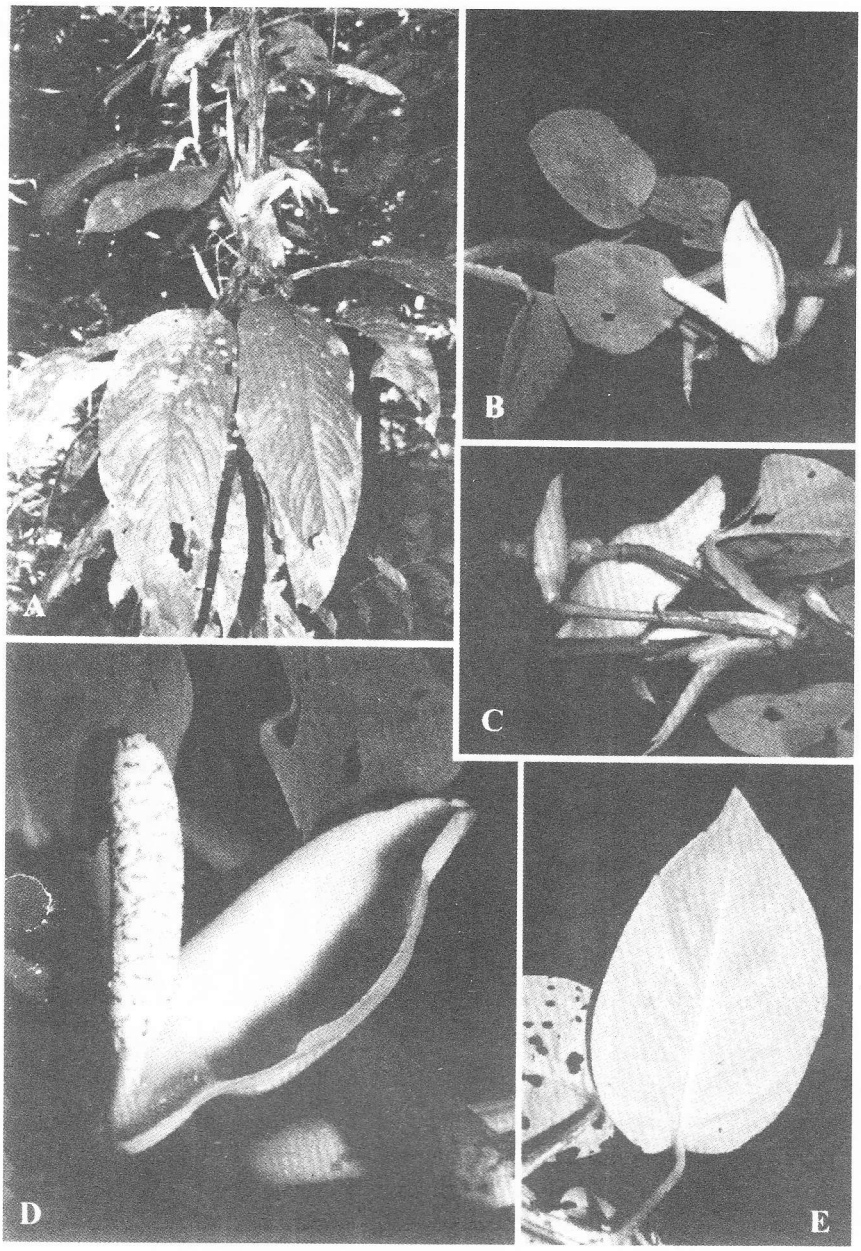

Plate III: ***Anadendrum muluensis*** **Boyce & Wong. A**. Plant in habitat. **B**. Flowering shoot. Note that there is no congested fan of leaves. **C**. Synflorescence, ventral view. **D**. Inflorescence at male anthesis. **E**. Leaf lamina, abaxial view to show glaucous surface. **A-E**: *AR-1929*. Images ©Peter C. Boyce.