Ormocarpopsis Anosyana Thulin & Razafim. (Fabaceae), a New Species from Southern Madagascar and Its Phylogenetic Position

Authors: Thulin, Mats, and Razafimandimbison, Sylvain G.

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Ormocarpopsis anosyana Thulin & Razafim. (Fabaceae), a new species from southern Madagascar and its phylogenetic position

Mats Thulin & Sylvain G. Razafimandimbison

Abstract

THULIN, M. & S.G. RAZAFIMANDIMBISON (2016). Ormocarpopsis anosyana Thulin & Razafim. (Fabaceae), a new species from southern Madagascar and its phylogenetic position. *Candollea* 71: 281-286. In English, English and French abstracts. DOI: http://dx.doi.org/10.15553/c2016v712a13

Ormocarpopsis anosyana Thulin & Razafim. *(Fabaceae)*, a new species from the Anosy Region of south-eastern Madagascar, is described and illustrated. According to phylogenetic analyses based on nuclear ribosomal ITS sequences, the new species is, with strong support, sister to *Ormocarpopsis mandrarensis* Dumaz-le-Grand, another species confined to south-eastern Madagascar. *Ormocarpopsis anosyana* differs markedly from *Ormocarpopsis mandrarensis* by its generally smaller leaflets with the secondary and tertiary venation drying more or less blackish beneath, by its shorter hypanthium, by its smaller calyx with the lowest tooth about as long as the others, by its wing-petals that are much longer than the keel, by its glabrous ovary, and by its slightly articulated fruits. *Ormocarpopsis anosyana* is known only from two collections from a single patch of spiny dry forest east of Imonty. It is assigned a preliminary conservation status as "Endangered".

Résumé

THULIN, M. & S.G. RAZAFIMANDIMBISON (2016). Ormocarpopsis anosyana Thulin & Razafim. (Fabaceae), une nouvelle espèce du sud de Madagascar et sa position phylogénétique. *Candollea* 71: 281-286. En anglais, résumés anglais et français. DOI: http://dx.doi.org/10.15553/c2016v712a13

Ormocarpopsis anosyana Thulin & Razafim. *(Fabaceae)*, une nouvelle espèce de la Région Anosy au sud-est de Madagascar, est décrite et illustrée. D'après des analyses phylogénétiques basées sur des séquences nucléaires ribosomiques d'ITS, la nouvelle espèce est l'espèce sœur d'*Ormocarpopsis mandrarensis* Dumaz-le-Grand, une autre espèce confinée au sud-est de Madagascar. *Ormocarpopsis anosyana* diffère nettement d'*Ormocarpopsis mandrarensis* par ses folioles généralement plus petites avec des nervures secondaires et tertiaires plus ou moins noirâtres en dessous après séchage, par son hypanthium plus court, par son plus petit calice avec la dent inférieure à peu près aussi longue que les autres, par ses ailes beaucoup plus longs que la carène, par son ovaire glabre, et par ses fruits légèrement articulés. *Ormocarpopsis anosyana* est connue uniquement de deux collections d'un fragment de forêt sèche à épineux à l'est d'Imonty. Il lui a été assigné le statut de conservation préliminaire «En Danger».

Keywords

FABACEAE – *Ormocarpopsis* – Madagascar – Anosy – Taxonomy – Phylogeny

Addresses of the authors:

MT: Systematic Biology, Department of Organismal Biology, EBC, Uppsala University, Norbyvägen 18D, SE-752 36 Uppsala, Sweden. E-mail: **mats.thulin@ebc.uu.se**

SGR: Department of Botany, Swedish Museum of Natural History, SE-104 05 Stockholm, Sweden.

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Introduction

Ormocarpopsis R. Vig., as currently circumscribed, is a genus of seven species in the tribe *Aeschynomeneae (Fabaceae),* all shrubs or small trees endemic to Madagascar (Thulin et al., 2013). With the inclusion of *Ormocarpopsis nitida* (Du Puy & Labat) Thulin & Lavin (= *Peltiera nitida* Du Puy & Labat), based on molecular as well as morphological data, the morphological variation in the genus was expanded to include also a species with articulated fruits.

Ormocarpopsis differs apomorphically from its sister genus *Ormocarpum* P. Beauv. (Thulin & Lavin, 2001 ; Thulin et al., 2013) : "by its leaflets with the midrib or part of the lower surface drying brown or black due to the accumulation of tannins, by its pods with inconspicuous venation on the valves (valves not prominently longitudinally striate), and by its ellipsoid-spherical (not lenticular) seeds" (Thulin et al., 2013).

During routine naming of Malagasy legumes sent for identification from MO to one of us (MT), two collections of *Ormocarpopsis* were encountered that could not be matched with any of the previously known species. One of the collections was in flower, the other in fruit, and both originate from the same patch of spiny dry forest in the Anosy Region of south-eastern Madagascar. The aims of the present paper are to describe this new species and to use nuclear ribosomal ITS sequences to infer its phylogenetic position within the genus. The morphology of the new species is discussed, differences from the sister species *O. mandrarensis* and other species in the genus are provided, as well as field photographs and a preliminary IUCN conservation assessment following IUCN Red List Categories and Criteria (IUCN, 2012).

Material and methods

Samples from the two collections of the new species were analyzed along with samples from all seven, previously known, species of *Ormocarpopsis,* including the type, *O. aspera* R. Vig. Also included in the analyses were three species of *Ormocarpum*: the two Malagasy endemics *O. drakei* R. Vig. and *O. bernierianum* (Baill.) Du Puy & Labat, and the type of *Ormocarpum*, *O. verrucosum* P. Beauv. from continental Africa. The type of *Zygocarpum* Thulin & Lavin, *Z. coeruleum* (Balf. f.) Thulin & Lavin, was used as outgroup, based on Thulin & Lavin (2001) and Thulin et al. (2013).

ITS sequences of the two collections of the new species were produced according to the procedures described by Delgado-Salinas et al. (1999). ITS sequences for all the other species included in the analysis were obtained from GenBank. Voucher information and GenBank accession numbers for all sequences are provided in Table 1.

The two new sequences were assembled using Staden package v.2.0b9 (Staden, 1996), and subsequently aligned with the previously published sequences using MUSCLE v.3.8.31 (Edgar, 2004). Manual adjustments were made following the similarity criterion (Simmons, 2004) using Se-Al v.2.0 (Rambaut, 1996). Gaps were treated as missing data. We tested the fit of models of nucleotide sequence evolution to our ITS dataset using the Perl script MrAIC v.1.4.5 (Nylander, 2004) based on the software PhylML v.3.1 (Guidon et al., 2010). The corrected Akaike information criterion (AICs, Akaike, 1998) was utilized to select the optimal evolutionary model. The GTR + I + G model (Tavare, 1986) was preferred for the ITS dataset.

A maximum likelihood (ML) analysis was performed using RAxML v.7.2.8 (Stamatakis, 2014) with 1000 rapid bootstrap analyses (using a parsimony tree as a starting tree) followed by the search for the best-scoring ML tree in one single run. A Bayesian analysis was performed using MrBayes v.3.2.3 (Ronquist et al., 2012). Two parallel runs were set, each with four chains and using GTR + I + G as substitution model. The analysis was run for five million generations with a sampling frequency of 1000 generations. Convergence of the two runs was checked using AWTY (Nylander et al., 2008), and was considered to be higher when effective sample size (ESS) values, monitored with Tracer v.1.6 (Rambaut & Drummond, 2003), were higher than 200. We removed the initial 2000 trees as burn-in, and summarized the remaining trees in a majority rule consensus tree.

Results and discussion

The topology of the ITS trees generated from the ML and Bayesian analyses is identical (Fig. 1), and it is also consistent with that of Fig. 1 in Thulin & Lavin (2001). The present analysis clearly shows that the new species is nested within the strongly supported (bootstrap support, BS = 99%, Bayesian posterior probability, BPP = 1.0) *Ormocarpopsis* clade and that it is, with strong support (BS = 100%; BPP = 1.0), sister to *O. mandrarensis* Dumaz-le-Grand. *Ormocarpopsis mandrarensis* is, like the new species, restricted to south-eastern Madagascar, where it grows in xerophytic shrubland and open woodland at elevations between 300 and 1500 m (Du Puy & Labat, 2002), i.e. somewhat higher than the new species that is known from, respectively, 160 m and 224 m elevation. The only other species of *Ormocarpopsis* that is known from south-eastern Madagascar is the widespread *O. aspera* R. Vig.

Taxonomic treatment

Ormocarpopsis anosyana Thulin & Razafim., **spec. nova** (Fig. 2).

Typus: Madagascar. Prov. Toliara: Anosy Region, Ambatoabo, Ankoba, 2 km E of Imonty, 24°47'54"S, 46°40'24"E, 160 m, 16.III.2010, fl., *Ratovoson 1559* (holo-: UPS!; iso-: K!, MO-6038420!, P, TAN).

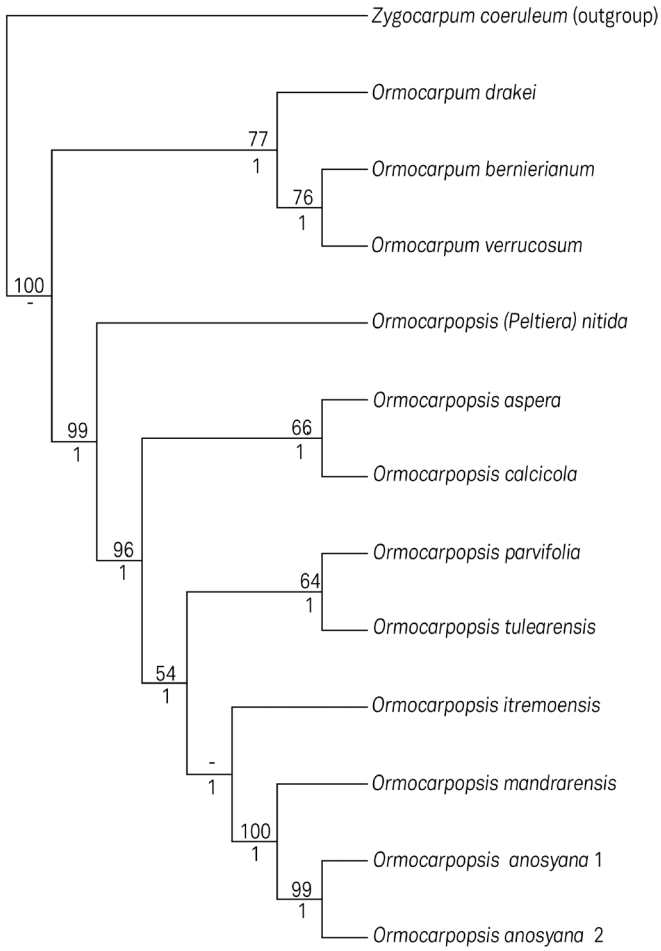

Fig. 1. – Best tree from the RAxML analysis of *Ormocarpopsis* R. Vig. and allied genera based on ITS data. Bootstrap support values are shown above and Bayesian posterior probabilities below the branches.

Ormocarpopsis anosyana Thulin & Razafim. differs from O. mandrarensis Dumaz-le Grand by its generally smaller leaflets (5–15 × 4–10 mm vs 10–35 × 5–18 mm) with secondary and tertiary venation, but not midrib, drying more or less blackish beneath (not with midrib drying dark brown or blackish beneath for a half to two-thirds of its length), by its 1–2 mm (not 3–4 mm) long hypanthium, by its c. 4 mm long calyx with the lowest tooth about as long as the others (not with calyx 5–7 mm long and with lowest tooth clearly longer than the others), by its corolla with wings much longer than the keel (not with wings about as long as or slightly longer than the keel), by its glabrous ovary (ovary not with glandular pubescent stipe and margins), and by its articulated fruits slightly constricted between the segments (not with unarticulated fruits).

Shrub, 3-4 m tall, DBH 3 cm; twigs glabrous to sparsely pubescent when young, greyish or purplish brown. *Leaves* alternate on long shoots or clustered on short shoots covered by closely spaced and overlapping stipules, pinnate, with alternate leaflets; stipules narrowly triangular, acute, c. 3 mm long; petiole up to 8 mm long, sparsely pubescent with appressed hairs; rhachis up to 25 mm long, sparsely pubescent with appressed hairs; leaflets 6-8, broadly elliptic to obovate, 5-15 × 4-10 mm, cuneate to rounded at the base, obtuse to truncate or emarginate and shortly mucronate at the apex, glabrous to sparsely pubescent with appressed hairs on both sides, midrib prominent beneath and not drying black, secondary and tertiary venation forming a fine reticulum beneath that is drying more or less blackish; petiolules 1-1.5 mm long, glabrous to pubescent. *Flowers* 17-18 mm long, solitary from tips of short shoots; bracts 1-2 mm long, ciliolate; pedicels 4-11 mm long, glabrous or sparsely pubescent with appressed hairs; bracteoles inserted at top of pedicel, opposite, narrowly elliptic, 2-2.5 mm long, ciliolate. *Calyx* c. 4 mm long, glabrous except for sparsely ciliolate teeth; hypanthium 1-2 mm long, reddish; teeth subacute, the lowest tooth about as long as the others. *Corolla* yellow; standard erect or curved backwards, subcircular, the limb c. 13-14 × 12-13 mm, notched at the apex, with 2 callous protuberances at the base inside, the claw c. 3 mm long; wings narrowly and asymmetrically obovate, the limb c. 16 × 6 mm, rounded at the apex, oblique and auriculate at the base, the lower margin rounded, with crescent-shaped folds between the veins near the base, with a claw c. 2.5 mm long; keel-limb semicircular, c. 7 × 4 mm, with claws c. 3 mm long. *Stamens* 10, fused into 2 lateral groups of 5 situated on either side of the ovary, 12-15 mm long; anthers c. 0.8 mm long. *Ovary* with a 3-6 mm long stipe, linear, glabrous, with 4-9 ovules; style 6-8 mm long; stigma minute, capitate. *Fruits* articulated, with 1-3 segments developing and only slightly constricted between the segments; fertile segments ellipsoid, thinly coriaceous, reticulately veined, c. 12-15 × 10-12 × 8-10 mm, with thin endocarp, 1-seeded, apparently indehiscent. *Seeds* subglobose, 10-11 × c. 9 mm, with a minute excentric hilum.

Etymology. – The epithet of the new species is derived from Anosy, the name of the region to which it is apparently confined.

Distribution and ecology. – *Ormocarpopsis anosyana* is known only from a single patch of spiny dry forest with the genus *Alluaudia* (Drake) Drake east of Imonty in south-eastern Madagascar at an elevation of 160-224 m.

Phenology. – The single flowering and fruiting collections known were made in March and February, respectively.

Notes. – As is clear from the diagnosis above, *Ormocarpopsis anosyana* differs markedly from its sister species *O. mandrarensis*, but it also differs markedly from all other species of the genus. The secondary and tertiary venation of the leaflets drying blackish beneath is a character that is not matched in any of the other species. The articulated pods, slightly constricted between

Fig. 2. – *Ormocarpopsis anosyana* Thulin & Razafim. **A.** Front view of flower; **B.** Flowering branch; **C.** Fruiting branch, showing fruit with a single seed developed.
[Photos: **A-B**: F. Ratovoson; **C:** R. Randrianaivo]

the segments, are also unique in the genus. In the not closely related *Ormocarpopsis nitida* the articulated fruits are strongly constricted between the seeds, whereas all the other species have unarticulated fruits. Also, wing-petals that are much longer than the keel are not found in any of the other species.

Conservation status. – *Ormocarpopsis anosyana* is only known from two collections from a single patch of forest situated in the corridor between the parcels I and II of the Andohahela National Park and currently managed by the WWF Madagascar (F. Ratovoson, pers. comm.). The area holds a mosaic of vegetation types reflecting recent land use practices such as: residual mature forest patches, farmland, and abandoned slash-and-burn fields (de Wilde et al., 2012). The two collections were made only c. 2 km apart and the occurrence can be regarded as a single location. Similar types of dry forest occur in the adjacent parcel II of this national park and the species should be searched for also there. With only a single location with only two known individuals the species is clearly threatened. *Ormocarpopsis anosyana* is therefore assigned a preliminary conservation status as "Endangered" [EN C2a(ii)] following the IUCN Red List Categories and Criteria (IUCN, 2012).

Table 1. – Species included in the phylogenetic analysis with voucher information and GenBank accession numbers (new sequences in bold).

Taxon	Voucher	Herbarium	ITS
Ormocarpopsis anosyana Thulin & Razafim. 1	*Ratovoson 1559*	UPS	**KK686109**
Ormocarpopsis anosyana Thulin & Razafim. 2	*Randrianaivo et al. 1768*	UPS	**KK686110**
Ormocarpopsis aspera R. Vig.	*Peltier 4416*	MO	AF068148
Ormocarpopsis calcicola R. Vig.	*Service Forestier 24240*	K	AF068145
Ormocarpopsis itremoensis Du Puy & Labat	*Labat 2363*	K	AF068149
Ormocarpopsis mandrarensis Dumaz-le-Grand	*Phillipson 2924*	K	AF068147
Ormocarpopsis nitida (Du Puy & Labat) Thulin & Lavin	*Labat et al. 3577*	P	GU951673
Ormocarpopsis parvifolia Dumaz-le-Grand	*Du Puy et al. M132*	K	AF068144
Ormocarpopsis tulearensis Du Puy & Labat	*Keraudren 1369*	K	AF068146
Ormocarpum bernierianum (Baill.) Du Puy & Labat	*Labat et al. 2882*	P	AF189035
Ormocarpum drakei R. Vig.	*Rakotozafy 986*	P	AF189039
Ormocarpum verrucosum P. Beauv.	*Jungner* s.n.	UPS	AF189050
Zygocarpum coeruleum (Balf. f.) Thulin & Lavin	*Thulin & Gifri 8781*	UPS	AF189037

Paratypus. – **Madagascar. Prov. Toliara :** Anosy Region, Ambatoabo, Ankoba forest, 24°48'23"S 46°41'13"E, 224 m, 28.II.2009, fr., *Randrianaivo et al. 1768* (MO-6420454, P, TAN, UPS).

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