

# A brief taxonomic history of neotropical mistletoe genera, with a key to the genera

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Abstract A brief chronological account is provided of the discovery and recognition of the genera of the New World mistletoes, with a key to the genera.

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When European botanists were first faced with mistletoes of the New World they interpreted them, not surprisingly, within the framework of the mistletoes they knew from their own continent. The new discoveries were thus initially placed in either Loranthus Jacq. or Viscum L. It was to be a long time before it was realized that neither of these genera occur in the New World, and that a fresh look was needed; even Bentham (1880), for example, continued to place all Loranthaceae (in the modern sense) in Loranthus, with the singular exception of the extraordinary Australian genus *Nuytsia* R.Br.

The first New World mistletoe recognized (and illustrated) as a new species seems to have been *Tristerix corymbosus* (L.) Kuijt, under the designation Periclymenum foliis acutis floribus profunde dissectis .... (Feuillée 1714; see Kuijt 1988b: 20-21). Linnaeus later (1753) renamed this plant Lonicera corymbosa L., from which the present, acceptable binomial is derived.

The primarily northern hemisphere genus Arceuthobium M. Bieb. was the earliest American genus to receive a separate name (as Razoumofskya Hoffmann, 1808, later named Arceuthobium M.Bieb. (Marschall von Bieberstein 1819), even though it was not then recognized that the genus also occurred in the New World – especially that most diversity in the genus existed there; the earliest known New World species was at first placed in Viscum (V. vaginatum Willd., Willdenow 1806).

No exclusively American genus was recognized until 1830 (Martius 1830), and the rapid subsequent developments can at least in part be credited to the Brazilian travels of this author (1817–1820) and the collections he brought back to Germany. The generic names published by him in that year (Phthirusa Mart., Psittacanthus Mart., Struthanthus Mart. and Tristerix Mart.) remain accepted today. Tristerix included some Old World species. Even before Martius had broken through this mental logiam, other generic names that survive today had begun to appear (Gaiadendron G.Don and Notanthera (DC.) G.Don, Don 1834; Antidaphne Poepp. & Endl., Poeppig & Endlicher 1838; Dendropemon (Blume) Rchb., Reichenbach 1841; Eubrachion Hook.f. and Lepidoceras Hook.f. (Hooker 1846); Passovia H.Karst., Karsten 1846; and *Phoradendron* Nutt., Nuttall 1848). Passovia was published in a fashion that today would be unacceptable. The curious genus Misodendrum Banks ex DC. was first described as part of Loranthaceae (De Candolle 1830)

earlier recognized as representing a distinct American family (Agard 1858).

and later placed in Santalaceae by Bentham (1880), but was

No additional American genera appeared in print until 1868, when Eichler published his monumental account of Brazilian mistletoes, an account that also contained much information concerning other neotropical countries. It is difficult not to have the greatest admiration for Eichler's contribution, especially since it was the only contribution to mistletoe taxonomy he published; a century and a half later, it is still necessary to consult its contents in our work. Eichler was a disciple of Martius and, having full access to Martius' collections, he brilliantly consolidated the latter's generic concepts. However, he went considerably further than his mentor by producing the genera Ixidium Eichler, Oryctanthus Eichler and Dendrophthora Eichler, Ixidium presently being placed under synonymy in Antidaphne (Kuijt 1988a). The latter genus was known to him but, in an inconspicuous footnote on p. 96 (not 98, as stated erroneously in Kuijt 1988a), its treatment was referred to Santalaceae where the genus was subsequently overlooked. His judgment (even though he placed the other Brazilian Eremolepidaceae in subfamily Visceae) is intriguing in the light of modern molecular studies indicating close affinities of *Eremolepidaceae* with, or even incorporation within, Santalaceae (Nickrent et al. 2010). Eichler also introduced Psittacanthus subg. Aetanthus Eichler, recognized as a distinct genus since Engler (1889).

Eichler nevertheless made two serious errors that have bedevilled mistletoe systematics subsequently. The first of these was the erection of his new genus Phrygilanthus Eichler that was said to have species both in the New and the Old World. After a century of confusion, this situation was fortunately clarified by Barlow & Wiens (1973), where Eichler's neotropical species are referred to Desmaria, Gaiadendron, Notanthera, Tripodanthus and Tristerix. Eichler's remaining Phrygilanthus species - all Australian – are presently placed in Muellerina (Barlow 1997), rendering the generic name superfluous. The second, more inconspicuous error has persisted until our day, and requires a brief, separate discussion.

Phthirusa in the sense of Martius consisted of a single, relatively rare species, Phthirusa clandestina (Mart.) Mart. from Atlantic Brazil. It has sessile flowers without inflorescences and other features that later suggested even to Bentham (1880) affinities to his Mexican Loranthus inconspicuus Benth. Eichler fundamentally altered the circumscription of Phthirusa by including (or

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newly describing) many species with inflorescences and other features that clash with *P. clandestina*. The weight of Eichler's authority was such that his arrangement was not questioned until Kuijt (2011), where I returned to Martius' original conception, relegating other species to *Passovia*, the only other generic name available. Six other species were at that time recruited from *Ixocactus* Rizzini into *Phthirusa*, including the above "*Loranthus inconspicuus*".

Following Eichler's publication, no new neotropical Loranthaceous genera were published until 1895. It was then that the French botanist Van Tieghem produced a sudden burst of generic names that, with a couple of exceptions, can now be seen as a mostly meaningless proliferations of the taxonomic literature. The most striking instance was when he introduced, usually with very scant information (and, as always, without any illustrations), a large number of new genera within what are now considered Aetanthus, Psittacanthus and Struthanthus, as well as some beyond these genera (Van Tieghem 1895a, b). This nomenclatural grapeshot did, however, produce some small genera that remain currently recognized (Desmaria Tiegh., Ligaria Tiegh., Oryctina Tiegh. and Tripodanthus Tiegh.) as well as two others that he based on a single species each but that have more recently been enlarged significantly (Cladocolea Tiegh. and Peristethium Tiegh.; Kuijt 1975, 2012). In the second edition of Die Natürlichen Pflanzenfamilien (Engler & Krause 1935) and earlier in Engler (1897), Van Tieghem's genera were taken seriously but simply reduced to subgeneric rank without any analytical comments (Desmaria and Peristethium remaining at the generic level). Across the Channel, the Eurocentric view of Loranthaceae persisted (Bentham1880), the worldwide genus Loranthus having become progressively more complex and unwieldy.

Since Van Tieghem's time, a few more, very small genera were published intermittently for the New World. Psathyranthus Ule (Ule 1906 – 1907) later turned out to be one of several unusual Amazonian species of Psittacanthus (Kuijt 1983, 2009). Ixocactus (Rizzini 1952) can now be seen to be part of an enlarged Phthirusa in Martius' sense (Kuijt 2011), while Furarium Rizz. (Rizzini 1956) is – perhaps questionably – placed in *Passovia*. Panamanthus Kuijt (Kuijt 1991) and Pusillanthus Kuijt (Kuijt 2008) are monotypic genera that will probably continue to be accepted, as will Maracanthus Kuijt (Kuijt 1976). However, the genus Passovia as now circumscribed is known to have a baffling amount of anther diversity that cannot preclude further segregates (Kuijt 2011). Elsewhere, a single and extremely rare Mexican species of Cladocolea, C. biflora Kuijt, has such an extraordinary floral structure that it might be a fair candidate for generic segregation if more adequate material were available (Kuijt 1980).

With regard to the neotropical genera beyond Loranthaceae, little needs to be reported: generic synonyms are listed for Eremolepidaceae in Kuijt (1988a), for Viscaceae in Kuijt (1961, Dendrophthora) and Kuijt (2003, Phoradendron), for Arceuthobium in Hawksworth & Wiens (1996) and for Misodendraceae in Orfila (1978). However, some comments on the admittedly difficult distinction between Dendrophthora and Phoradendron seem appropriate (see the discussion in Kuijt 2003: 34), as it has been argued that both genera are paraphyletic (Nickrent et al. 2010). Fortunately, no one has seriously proposed to unite these two very large genera (together having more than 350 species), of which only a minute fraction of each has been included in the molecular work on which these conclusions are based. In at least one case (Ashworth 2000a, b, Nickrent et al. 2010), an important argument turned out to reflect a gap in knowledge. Dendrophthora guatemalensis Standl., when investigated by Ashworth (2000a) showed clearly that it has a genetic makeup linked to Phoradendron. At that time the male flowers of the species were

not yet known. When they were later found and analysed, it was discovered that the anthers are bilocular; the species had thus been misplaced in *Dendrophthora* to begin with, and this argument for paraphyly of the genus automatically became moot. The species is now known as *Phoradendron naviculare* Kuijt (Kuijt 2003). Nevertheless, it appears that *Dendrophthora* occupies a nested position in *Phoradendron*, but taking the uncertainties linked to limited sampling and difficult identifications in this group into account, I do not consider this necessarily requiring nomenclatural action yet.

A revised classification of the Order Santalales has recently restructured the relationships of the mistletoe families among each other and with other parasitic or autotrophic members of the order (Nickrent et al. 2010). The newly proposed or reintroduced taxa for the Loranthaceae of the New World include tribe Psittacantheae Horan subtribe Psittacanthinae Engl. (all small-flowered genera, including Tripodanthus, as well as Aetanthus and Psittacanthus), subtribe Notantherinae Nickrent & Vidal-Russ. (Desmaria & Notanthera) and subtribe Ligarinae Nickrent & Vidal-Russ. (Ligaria & Tristerix).

Finally, it should be mentioned that APG III (2009) placed *Viscaceae* in *Santalaceae*, a move now followed in some publications but not by Nickrent et al. 2010 or myself.

## Estimated species numbers in neotropical genera

Aetanthus	12 or 13	Notanthera	1
Antidaphne	9	Oryctanthus	15
Arceuthobium	18	Oryctina	6
Cladocolea	28	Panamanthus	1
Dendropemon	32+	Passovia	22+
Dendrophthora	115	Peristethium	16
Desmaria	1	Phoradendron	240
Eubrachion	2	Phthirusa	7
Gaiadendron	2	Psittacanthus	118
Lepidoceras	2	Pusillanthus	1
Ligaria	2	Struthanthus	45
Maracanthus	3	Tripodanthus	3
Misodendrum	8	Tristerix	13

Total number of accepted neotropical genera: 26; number of species: c. 720.

N.B. *Viscum album* is established in the Santa Rosa, California, area, but is not here taken into account (Scharpf & Hawksworth 1976).

Note. It has frequently been stated that *Loranthaceae* consists primarily of large-flowered, ornithophilous species. This is emphatically not true in the New World, where this group has about 132 species, the small-flowered assemblage 170 species (both counts exclude *Gaiadendron*, *Notanthera* and *Tripodanthus*).

### **KEY TO THE NEW WORLD GENERA OF MISTLETOES**

N.B. It should be noted that the recent classification proposed by Nickrent et al. (2010) places *Eremolepidaceae* as a separate clade in *Santalaceae*. Wherever placed, it remains a heterogeneous group, morphologically as well as palynologically and karyologically, with a disjointed geographic distribution.

2.	Ovary crowned with calyculus in at least the female flower;	15.	Anthers elongate, versatile, filaments slender (very rarely
	flowers 2 mm to 30 cm long, at least the longer ones brightly coloured, including white ( <i>Loranthaceae</i> )	10	absent); plants dioecious
2.	Calyculus lacking; flowers 3 mm or less long, greenish or greenish yellow ( <i>Eremolepidaceae</i> and <i>Viscaceae</i> ) 21		Inflorescence bearing bracteated monads, or inflorescences absent
3.	Epicortical roots on host branches generating leafy shoots;		Floral bracts and bracteoles foliaceous; primary hausto-
3.	endemic to southern Chile		rium lacking; shrubs or small trees, terrestrial or on tree branches
	shoots, or epicortical roots absent, plants sometimes ( <i>Gaiadendron</i> ) terrestrial shrubs; not present in Chile except		Floral bracts and bracteoles not foliaceous (except for
	<i>Ligaria</i>		the bracts of some <i>Tristerix</i> ); primary haustorium present; branch-parasitic on shrubs or trees
4.	Petals bright yellow, nearly 40 cm long, turning orange in age; short-shoots present, bearing the flowers at the tip;	18.	Seeds with endosperm; epicortical roots from base of plants and/or from the stem (not known for <i>T. belmirensis</i> Roldán
4	deciduous		& Kuijt); inflorescence triadic
	plants evergreen Notanthera	18.	Seeds lacking endosperm; epicortical roots mostly lacking; inflorescence triadic or dyadic
5.	Petals mostly > 12 mm long, mostly brightly coloured, including yellow or white	19.	Anthers needle-like, as thin as the filament, basifixed, with
5.	Petals < 12 mm long, often greenish white or reddish, not bright yellow 6		acicular tip; inflorescence dyadic; flowers mostly pendent; higher Andes
6.	Flowers sessile in leaf axils, tetramerous; inflorescences	19.	Anthers not needle-like, thicker than the filament, mostly
	lacking		dorsifixed, lacking acicular tip (exception: <i>P. hamulifer</i> Kuijt); inflorescence triadic or dyadic, flowers pendent or
	Flowers in axillary and/or in terminal inflorescences; 4–6 petals		not; lower and middle elevations, NW Mexico to Bolivia and Argentina
7.	Inflorescences mostly determinate, subtended by chartaceous, partly caducous leaf scales Peristethium	20.	Inflorescence a raceme; cotyledons cryptocotylar, fused
7.	Inflorescences determinate or indeterminate, lacking basal		apically; leaves with apical sclerotic nail only in <i>T. choda-tianus</i> (Patsch.) Kuijt
8	caducous leaf scales	20.	Inflorescence lacking, flowers individually attached, axillary in position, pedicellates estudence distinct, eventu-
	Inflorescences triadic or dyadic only (1 or 2 exceptions,		lary in position, pedicellate; cotyledons distinct, eventually spreading; leaves with apical sclerotic nail except in
0	Mexico & Bolivia)		L. teretiflora Kuijt Ligaria
9.	Monads ebracteolate; inflorescences mostly determinate		Plants with decussate phyllotaxy throughout 23 Adult plants with alternate phyllotaxy 22
9.	Monads bracteolate, the bracteoles separate or fused with the bract; inflorescence mostly indeterminate 10		Leaves of adult plants squamate and/or peltate; juvenile plants with decussate phyllotaxy; epicortical roots lacking;
10.	Bracteoles and bracts fused into a cupule; monads pedicel-		usually on Myrtaceae Eubrachion
10.	late or sessile	22.	Plants with expanded foliage, leaves mostly petiolate; both juvenile and adult plants with alternate phyllotaxy; epicorti-
11.	Staminodia and fertile stamens alternating; anthers basifixed or nearly so; Caribbean only Dendropemon		cal roots present at least in some species; hosts various
11.	All stamens fertile; anthers dorsifixed, versatile; Chiriquí	23.	Male flowers pedicellate, the inflorescence a raceme;
12.	only		stamens free, filaments present although short; fruit short-pedicellate; Central Andean Peru and Chile S of 35°S
	pressions on each face; leaf mesophyll with stellate fiber		Lepidoceras
12.	bundles	23.	Male flowers sessile, rarely in 1-flowered units, not in a raceme; anther sessile on perianth member; fruit mostly
	lacking circular depressions; leaf mesophyll lacking stellate		sessile; N of 35°S
13	fiber bundles	24.	Plants squamate, dioecious; flowers 1 per axil, sometimes whorled, not sunken in the stem; fruits explosive (exception:
	and evident connectival prominence; Northern Venezuela,		A. verticilliflorum Engelm.); female flower with 2 minute
13.	Colombia and Costa Rica (Osa Peninsula) <i>Maracanthus</i> Bracteoles extremely small, neither naviculate nor strap-		perianth members; on <i>Pinaceae</i> only, Canada to Meso- america, including Hispaniola <i>Arceuthobium</i>
	like; anthers sessile, minute; Eastern Brazil (one species	24.	Plants squamate or foliaceous, dioecious or monoecious;
14	in Guyana)		inflorescence squamate, spike-like, flowers partly sunken in its axis, 1-many above each axil, in various serial pat-
17.	ous, usually bisexual; tomentose when young; epicortical		terns; fruits not explosive; female flowers with $3-4$ perianth
14	roots present or not		members; USA to Bolivia and Paraguay-Uruguay, including the Caribbean
	faces glabrous or partly furfuraceous (tomentose in one	25.	Anthers unilocular; flowers uni-, (bi-) or triseriate, some-
	Bolivian species of <i>Struthanthus</i> ); epicortical roots mostly present		times with 1 flower per bract; Veracruz to Brazil and Bo-
15.	Anthers basifixed or nearly so, filaments often stout or	25.	livia
	laterally excavated; flowers bisexual or plants dioecious		seriate, or with 1 flower above each bract); USA to Bolivia
	assovia		and Argentina Phoradendron

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