

Loranthaceae. (Engler (†) and Krause.)

**Trib. II. 2. Viscoideae- Phoradendreae.**

Viscoideae-Phoradendreae Engl. In E. P. III. 1. (1889) 190, Nachr. I. (1897) 137.

Flowers single or in groups in the axils of persistent hypsophylls [Hochblättern] or extra-axillary positioned at the internodes. Stamens of the ♂ flower epitepalous; anthers 2-locular or 1-locular. Placenta central. Embryo sacs U-shaped.

Subtrib. II 2a. **Viscoideae-Phoradendreae- Korthalsellinae.**

Viscoideae-Phoradendreae-Korthalsellinae Engl., In E. P. Nachr. I (1897) 137 (*Bifariées* van Tiegh in Bull. Soc. Bot. France XLIII. [1896] 162).

Inflorescence serial at the nodes.

30. **Korthalsella** van Tiegh. In Bull. Soc. Bot. France XLIII. (1896) 86, 163.

Flowers unisexual, monoecious. Tepals 3. ♂ Flowers narrowed at the base, with triangular, valvate tepals; Stamens 3, more rarely 4, with very short filaments and 3, more rarely 4, anthers connected to a hemispherical body; each anther with 2 locules, which open on the inside with a slot. ♀ Flowers oviform; Tepals 3, in a short tube surrounding the receptacle, with small, triangular, free tips; Stamens absent. Ovary, inferior with a jug-shaped placental swelling [mamelon], on which the embryo sacs grow in a U-shape into the wall of the ovary; Stigma sessile, quite large. False-fruit ovoid to pyriform, tri-lobed, often crowned by the remains of the perigone. Embryo partly emergent. – Parasitic, often very small shrubs with stalked or flattened branches; foliage leaves missing or tiny, scale leaves alternate. Flowers very small, in the axils of the leaves, amongst unicellular, usually red-brown hairs, always without prophylls, in 3 or 5 longitudinal rows, sometimes only one ♂ flower in the middle row.

Important literature: Hayata in Bot. Magaz. Tokyo XXX. (1916) 69. – H. Lecomte, Les *Korthalsella* van Tiegh., in Bull. Mus. d'Hist. Nat. d. Paris XXII. (1916) 124-128; Le genre *Korthalsella* et la tribu des Bifariées de van Tieghem, in Bull. Mus. d'Hist. Nat. Paris XXII. (1916) 260-267. – E. D. Merrill, *Korthalsella*, *Bijaria* and *Pseudixus*, in Bot. Magaz. Tokyo XXX. (1916) 66--68. – Ridley, Fl. Malay Penins. III. (1924) 163. – Cheeseman, Man. New Zealand Fl. (1925) 394-396. – B. H. Danser in Bull. Jard. Bot. Buitenzorg 3. ser, XI. (1931) 452-454; in Recueil Trav. bot. Neerland. XXXI. 3/4. (1934) 758. – R. M. Laing and E. W. Blackwell, Pl. New Zealand, 3. ed. (1927) 137.

The genus is named after the Dutch botanist Peter Wilhelm Korthals.

Peter Wilhelm Korthals, born 1 Sept. 1807 in Amsterdam, died 8 February 1892 in Haarlem, botanist and philosopher, since 1830 a member of Naturk. Commission for India, traveled to Java (1831-32), Sumatra (1833 and subsequent years), Borneo (1836), returned to Holland in

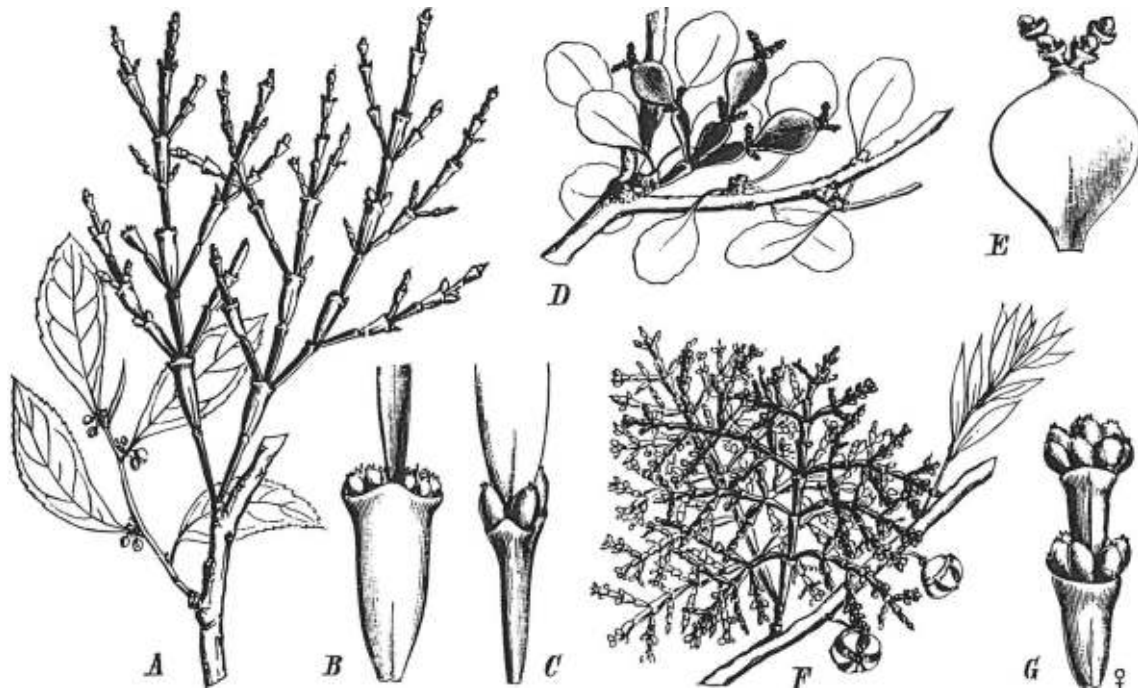
1837, retired in 1843; especially known for his treatise in *Verhandelingen over de Natuurlijke Geschiedenis of the Nederlandsche Overzeesche Bezittingen, Botanie* [Negotiations on the Natural History of the Dutch Overseas Possessions, Botany] (1839-42). After a friendly message from Mr C. A. Backer, we would like to thank him for the information.

18-20 or so closely related and only imperfectly known species, in the north from the Himalaya to Japan, in the south from Madagascar and the Comoros over the islands of the Indian Ocean to Tahiti, some on New Zealand and the Hawaii islands.

Sect. I. *Eukorthalsella* Engl. In E. P. Nachr. I. (1897) 138. – Internodes at least at the apex cylindrical. Bracts decussate. Flowers in the axils of all bracts. – *K. Remyana* van Tiegh. In the Hawaiian Islands; *K. aoraiensis* (Nadeaud) Engl., In Tahiti; *K. salicornioides* (A. Cunn.) Van Tiegh. (Fig. 99 F-G), on New Zealand and the Isle of Pine, north to New Caledonia, as parasites observed on *Leptospermum*, *Gaultheria*, *Dracophyllum*, and others.

Sect. II. *Bifaria* (van Tiegh.) Engl. in E. P. Nachtr. I. (1897) 138 (*Bifaria* van Tiegh. in Bull. Soc. Bot. France XLIII. [1896] 164; *Pseudixus* Hayata, Icon. pl. Formos. V. [1915] 187 et in Bot. Magaz. Tokyo XXIX. [1915] 31). – Internodes cylindrical or flat. Bracts in a plane. Flowers in the axils of all bracts. – Most common *K. Opuntia* (Thunb.) Merr. <sup>1</sup>) (= *Viscum Opuntia* Thunb; *Viscum moniliforme* Wight et Am. ; *V. Japonicum* Thunb.; *Pseudixus japonicus* Hayata) (Fig. 99 A-C), smaller, about 10 cm high subshrub with flat internodes, from the Himalaya to Japan; Malayan area, south to the Philippines; *K. fasciculata* (van Tiegh.) H. Lecomte, in China, in southern Shansi and Szechuan; *K. cylindrica* (van Tiegh.) Engl. and *K. complanata* (van Tiegh.) Engl., in the Hawaiian Islands; *K. platycaulis* (van Tiegh.) H. Lecomte, in Tahiti; *K. vitiensis* (van Tiegh.) Engl., in the Fiji Islands; *K. disticha* (Endl.) Engl., on Norfolk Island; *K. dichotoma* (van Tiegh.) Eng. and others on New Caledonia; *K. Humboldtii* (van Tiegh.) Engl., on the Comoros; *K. taenioides* (Comm.) Eng, on Reunion; *K. Richardii* (van Tiegh.) Engl., to Bourbon, others very close to Mauritius and Madagascar.

Sect. III. *Heterixia* (van Tiegh.) Engl. in E. P. Nachtr. I. (1897) 138 (*Heterixia* van Tiegh. in Bull. Soc. Bot. France XLIII. [1896] 177). – Internodes flat. Lower leaf pairs in one plane, without flowers; upper leaf pairs decussate, with flowers in the axils. – *K. geminata* (Korth.) Engl., with very flat, elongated-inverted ovoid internodes, on Borneo; *K. Lindsayi* (Oliv.) Engl., with broadly inverted ovoid to nearly spatula-shaped internodes (Fig. 99 DE), on New Zealand, as a parasite, observed on *Myrtus*, *Metrosideros*, *Melicope*, *Sophora*, *Myrsine*, *Coprosma* and others; *K. clavata* (Kirk) Cheeseman, closely related to the preceding one, and perhaps only a variety, but smaller and more dainty, also on New Zealand, observed on *Aristotelia*, *Discaria* and *Coprosma*.



99. A–C *Korthalsella Opuntia* (Thunb.) Merr. A branch on *Eurya japonica* Thunb.; B branch with ♀ flowers; C branch with false fruits, both enlarged – D–E *Korthalsella Lindsayi* (Oliv.) Engl. D branch on *Melicope simplex* A. Cunn. ; E Internodes with two flowering branches. F–G *Korthalsella salicornioides* (A. Cunn.) Van Tiegh. F branch on *Lepiospermum scoparium* Forst.; G Twigs with ♀ flowers. – From E. P. 1. Ed. III. 1, 194, Fig. 133.

Danser in Recueil Trav. bot. Neerland. XXXI. 3/4. (1934) 758 reported for *Korthalsella*: *K. Dacrydii* (Ridley) Danser (*Arceuthobium Dacrydii*); the species known so far from the Malay Peninsula was also identified for Java (Sect. *Eukorthalsella*).

#### Subtrib. II. 2b. **Viscoideae Phoradendreae-Phoradendrinae.**

Viscoideae-Phoradendreae-Phoradendrinae Engl. in E. P. Nachtr. I. (1897) 137 (Phoradendrees van Tiegh. in Bull. Soc. Bot. France XLIII. [1896] 179). – Inflorescence serial at the internodes.

31. **Dendrophthora** Eichl. in Fl. brasil. 2. (1868) 102, p. 31 (*Arceuthobium* Griseb. West Ind. Isl. [1860] 314). – Flowers unisexual, usually dioecious, rarely monoecious, 3-, rarely 4- or 2-merous. Tepals completely connate with short, free lobes. Stamens up to the middle of the perigone, with only the anthers free; Anthers 1-locular, opening through a single transverse slit. Disk fleshy. ♀ flowers with an inferior, oviform ovary; Style short, thick, almost conical, with a blunt stigma. False fruit berry-like, globular or ovoid, crowned by the remains of the perigone. – Parasitic shrubs with terete, clavate or compressed branches, mostly without foliage leaves, rarely with a prophyllar sheath. Flowers in simple or compound spikes; the flowers on the limbs usually on each side in a row, rarely the ♂ in 2 × 3 rows, the ♀ often single.

Important literature: Eichler in Fl. brasil. V. 2. (1868) 102-105, t. 31. – Van Tieghem in Bull. Soc. Bot. France XLIII. (1896) 180-184. – I. Urban, Über die Loranthaceengattung

*Dendrophthora* Eichl., in Ber. Deutsch. Bot. Ges. XIV. (1896) 284-294 und in Engl. Bot. Jahrb. XXIV. (1898) 52-70; Symbol. Antill. VIII. (1920) 189. – H. H. York, The origin and development of the embryosac and embryo of *Dendrophthora opuntioides* and *D. gracilis*, in Bot. Gaz. LVI. (1913) 89, 200, t.5-6. – I. Urban in Arkiv för Bot. XXA. Nr. 15. (1926) 26; XXIIIA. Nr. 5. (1930) 63.

About 30 species in the West Indies, several in South America from Bolivia and Peru to Costa Rica, 1 in North Brazil (*D. Poeppigii* van Tiegh.), 1 in Mexico (*D. pedicellata* van Tiegh.).

δένδρον (tree), φθορά (to spoil or ruin).

Sect. I. *Eudendrophthora* Engl. In E. P. Nachr. I. (1897) 138. - Branches stalked, rarely square or compressed. Scale leaves or deciduous leaves decussate.

§ 1. *Medianae* Engl. & Krause. – Leaf pairs all decussate; the lowest pair of each branch formed as a scale leaf or foliage leaf, placed on the axil of the median subtending bract. Almost all species are covered with foliage leaves. – *D. constricta* (Griseb.) Eichl., with 1 or 2 pairs of scale leaves, of which the lowest stands entirely basally, close to the minute tooth, in Cuba; *D. confertiflora* Krug et Urb., as before, but the scale pairs at the lowest internodes fairly evenly distributed, leaves ovate to spatulate, also in Cuba; *D. cubensis* Eichl., with 1, more rarely 2, pairs of scales and obovate leaves, likewise in Cuba; *D. buxifolia* (Lam.) Eichl., with broad, obovate to nearly circular leaves, on Santo Domingo and Cuba; *D. grandifolia* Eichl., with relatively large, broadly obovate leaves, in Cuba; *D. chrysostachya* (Presl.) Urb., in Peru; *D. subtrinervis* Urb., in Bolivia; *D. elliptica* (Gardn.) Krug et Urb., in Venezuela, Brazil and Dominica; *D. costaricensis* Urb., with a pair of scales above the base, in Costa Rica; *D. Lindeniana* van Tiegh., in Colombia and Venezuela; *D. macrostachya* (Jacq.) Eichl., with a scale pair and deciduous foliage, as well as several-membered spikes, on Martinique; *D. Eichleriana* Urb., with few foliage leaves, in Venezuela; *D. biserrula* Eichl., with one-branched spikes, from Guatemala to Colombia, and *D. epiviscum* (Griseb.) Eichl., to Cuba, both species without leaves, only with scale leaves, the latter observed as parasites on other Loranthaceae (*Phoradendron rubrum*, *Dendrophthora buxifolia*).

§ 2. *Transversales* Engl. & Krause. – Leaf pairs decussate, but the lowest of each branch transverse in the axil of the subtending bract, thus with the basal scales distichous. The species provided with foliage leaves belonging here are: *D. sessilifolia* (Griseb.) Krug et Urb., with 1-2 scale pairs above the base, in Cuba; *D. crassuloides* (Presl) Urb. in Peru; *D. portulacoides* (Presl) Urb. in Ecuador; *D. clavata* (Benth.) Urb., without scale pairs, from Venezuela to Colombia and Ecuador to Bolivia. Those provided with a only few foliage leaves are: *D. Wrightii* Eichl. and *D. serpyllifolia* (Griseb.) Krug et Urb., in which one to several pairs of scales precede the leaves, both in East Cuba; *D. flagelliformis* (Lam.) Krug et Urb., without pairs of scales among the foliage leaves, Haiti, Santo Domingo, Puerto Rico. Completely without foliage leaves are: *D. cupulata* (DC.) Eichl., on Santo Domingo; *D. Mancinellae* (Wright) Eichl., in Cuba; *D. Bonaniae* (Wright) Eichl., in western Cuba; *D. domingensis* (Spreng.) Eichl., with cup-shaped basal scales, on Santo Domingo and Cuba; *D. cupressoides* (Macf.) Eichl., as well as the former with terete branches, on Santo Domingo and Jamaica; *D. pendula* Krug et Urb., in Cuba.

Sect. II. *Distichella* (van Tiegh.) Engl. in E. P. Nachtr. I. (1897) 139 (*Distichella* van Tiegh. in Bull. Soc. Bot., France, XLIII, 1896). – Leaf pairs in one plane. – *D. gracilis* (Griseb.) Eichl. and *D. Danceri* Krug et Urb. on Jamaica; *D. opuntioides* (L.) Eichl., in Jamaica and Santo Domingo, with phyllodial branch members.

Fawcett and Rendle (Fl. Jamaica III, 1. [1914] 100) distinguish *D. monstrosa* Fawc. et Rendle (*D. opuntioides* Eichl.) and *D. opuntioides* (L.) Fawcett et Rendle (non Eichl.), for which *D. Danceri* Krug et Urb. is reckoned to be a synonym.

Note: For the earlier division in van Tieghem (Bull. Soc. Bot., France, XLIII, 1896) of Sect. I *Eudendrophthora* into § 1 *Hexasira*, § 2 *Disira*, § 3 *Diantha*, we would like to replace it with the above outline, in which we essentially follow 1. Urban (l. c.).

32. **Phoradendron** Nutt. in Journ. Acad. Philadelphia, 2. ser. I. part II (Aug. 1848) 185; E. P. III. 1. (1889) 196; Nachtr. I. (1897) 139 (*Baratostachys* Korth. in Verh. batav. Gen. XVII. [1839] 236 [Sectio *Visci*]; Uphof, Pflanzengattungen [1910] 173 [genus]; *Castrea* A. St. Hilaire, Morph. [1840] 451; *Spiciviscum* Engolm. ex A. Gray in Mem. Amer. Acad. new ser. IV. [1849] 58; *Allobium* Miers in Ann. and Magaz. Nat. Hist. 2. ser. VIII. [1851] 178; *Phoradendron* Urban in Engler's Bot. Jahrb. XXIII. Beibl. 57. [1897] 1). – Flowers mostly 3-, rarely 4-, 2- or 5-merous, unisexual, monoecious or rarely dioecious. Tepals broadly triangular to ovate, thick, fleshy, persistent, stamens in the ♂ flowers united with the tepals at the base, missing in the ♀ flowers; filaments free only a very little, gradually broadened into the connective, with oviform or elliptical, terminally one locular thecae opening at the tip by a pore or a slit; pollen elliptical or almost spherical, with 3 furrows or pores and a thin exine. Pistillode in the ♂ missing, covered by the lobed disk, in the ♀ flowers obovoid and sunken, 1-locular; style short with a scarcely broader stigma. Sometimes asexual flowers have an undeveloped ovary and stamens without anthers. False fruits small, spherical or elliptical, with a strongly sticky middle layer and membranous to fibrous inner layer, which is tapered upwards and at the base connected with the outer layer. Fruit laterally compressed, elliptical, pointed at the tip, with fleshy endosperm and small embryo situated in its apex. Cotyledons small, lanceolate, on very short hypocotyls. – Shrubs or sub-shrubs, perching on laurels, rarely conifers, with round or quadrangular or compressed internodes, usually opposite, more rarely in three-membered whorls, perennial, palmately veined, rarely pinnately veined, leathery, foliage leaves petiolate or at base narrow stalk-like, rarely with small scale-like leaves. Prophyllar pairs are usually formed only at the base of the branches with the exception of the lower two-toothed sheath. Flowers in axillary or rarely terminal, storied-like articulated spikes, in every part between two sheaths, in two or more rows of the spike axis, embedded in pits, small, greenish to yellowish; ♂ abscising.

Important special literature: Eichler in Fl. brasil, V. 2. (1868) 97-129, t.31, I, 32-43. – Van Tieghem in Bull. Soc. Bot. France XLIII. (1896) 183. – I. Urban, Additamenta ad cognitionem florum Indiae occidentalis Part. IV. *Phoradendron*, in Engl. Bot. Jahrb. XXIV. (1897) 32-52; *Phoradendron* und *Phoradendron*, in Fedde, Repert. spec. nov. XVII. (1921) 251-253. – H. York, The anatomy and some of the biological aspects of the american mistletoe, *Phoradendron flavescens* (Pursh) Nutt., in Bull. of the Univ. of Texas, No. 120. (1909) 1-31, pJ. I-XIII. – W. J. Bray, The mistletoe pest in the South-West, in Bull. 166, Bur. Pl. Industr., U. St. Dept. Agric. (1910) 1-39, pl. 2, fig.7. – W. Trelease, *Phoradendron*, in Bot. Gaz. LIV. (1912) 439 and in

Proceed. Nat. Acad. Sci. I. (1915) 30-35; The genus *Phoradendron*, a monographic revision, in Univ. of Illinois Bull. XIII. No. 45, Urbana (1916) 1-224, pl. 1-245; Additions, in Bull. Torrey Bot. Club. LIV. (1927) 471-477, in Repert. XXVI. (1929) 343. – G. Hedgcock, Notes on some diseases of trees in our national forests, in Phytopathology V. (1915) 175-181. – J. A. Rarris, Secondary parasitism in *Phoradendron*, in Bot. Gaz. LXVI. (1918) 275-276. – E. S. Tucker, Studies of insects associated with the american mistletoe, *Phoradendron flavescens*, in Transact. Kansas Acad. Science XXX. (1922) 388-392. – J. Harris, G. Harrison and T. A. Pascoe, Osmotic concentration and water relations in the mistletoes with special reference to the occurrence of *Phoradendron californicum* on *Covillea tridentata*, in Ecology XI. (1930) 687-702, 2 Textfig. – I. Urban in Arkiv för Bot. XXIII A. Nr.5. (1930) 62. – G. H. Billings, Development of the embryo-sac in *Phoradendron*, in Annals of Bot. XLVII. (1933) 261-278.

"From φωρ a thief, and δένδρου a tree, in allusion to their parasitic habit". *Ph. californicum* was the first to be described, and in addition are placed several *Viscum* species, first among which was called *Viscum flavescens*.

W. Trelease distinguished 277 species and tribes in his monograph; in the meantime a few others have been described, so that the total number of species is probably nearly 300. Only a few species have the capacity to attack several host plants; most of them appear to be dependent on certain wild trees, and have, partly in connection with them, a very limited range of distribution. In North America the genus extends to Washington, southern Colorado, the mouth of the Ohio River and New Jersey, in South America to the mouth of the La Plata. One species inhabits Guadalupe and two the Galapagos Islands. Of the two large subgenera, into which *Phoradendron* falls, the approximately 66 species and tribes of *Boreales* inhabit North America to Mexico, while the *Equatoriales*, to which all the other species belong, are found in tropical South and Central America up to Mexico and the West Indies. According to W. Trelease the genus is divided in the following manner:

Subgenus. I. *Boreales* Trelease, The genus *Phoradendron* (1916) 19. – Branches at the base without scales, never dichotomous, scarcely ever sharply two-edged. Spikes axillary, never terminal. Flowers dioecious, male and female spikes often very dissimilar. – In continental North America, especially in the Mexican highlands, in the southern and southwestern United States; Only 2 species in Central America.

A. branches never winged. Receptacular cup not lacerate.

Section I. Pauciflorae Trelease l. c. 20. – Spikes short, 1-4 jointed. ♀ Flowers to 2 in each spike segment. Mainly on conifers.

§ 1. *Aphyllae* Trelease l. c. 20. – Foliage leaves represented by thin scales, which do not disarticulate from the stem. – *Ph. juniperinum* Engelm., in the southern Rocky Mountains from Colorado to Sonora, on *Juniperus*; *Ph. Libocedri* (Engelm.) Howell, from Oregon to Baja California, on *Libocedrus*; *Ph. ligatum* Trelease, in the western Sierra Madre, on *Juniperus*; *Ph. californicum* Nutt., in the Sonora region, from Sierra Nevada in California to southern California and Sonora, mainly on legumes (*Acacia*, *Prosopis*, *Parkinsonia* and others), never on conifers.

§ 2. *Bolleanae* Trelease l. c. 24. – Foliage leaves sessile, elongated to spatulate; only with a kind of fleshy scale leaves, which are articulated with the stem. – 8 species of California to Guadalupe Island and Chihuahua; *Ph. minutifolium* Urb., with fleshy scale leaves, in the eastern Sierra Madre, on *Juniperus*; *Ph. Bolleanum* (Seemann) Eichl., in Chihuahua and the western

Sierra Madre, with some spatulate leaves, likewise mostly on *Juniperus*; *Ph. densum* Torr., from Oregon to Sonora, with oblanceolate leaves; *Ph. pauciflorum* Torr., in California, with oblanceolate-elliptic leaves, on *Abies* and *Cupressus*.



Fig. 100. *Phoradendron rubrum* (L.) Griseb. A branch with inflorescences; B branch with flowers; C longitudinal section through a bit of the same, at the same time through a ♀ and a ♂ flower; D a leaf of the perianth with a stamen standing in front; E Branch with false-fruits (pseudocarps); F Longitudinal section through a pseudocarp (cal outer layer of the receptaculum, vi viscin layer, fr pericarp); G Fruit. B-G magnified. – From Engler & Prantl first edition.

Section II. *Pluriseriales* Trelease l. c. 29. – Spike 2-6 jointed. Flowers to 6 or more at each node. – In northern Mexico and the neighboring areas of continental America.

8. Leaves never long, usually small; limbs not flattened.

§ 3. *Flavescentes* Trelease l. c. 29. – Leaves moderately large, fairly wide. Internodes neither sharp-edged nor strongly compressed. – 17 species in the southwestern United States and adjacent Mexico. –  $\alpha$  ♂ spikes thin; the almost glabrous, little-flowered segments 2-7 mm long. False berries fairly large, glabrous. – In the Atlantic States: *Ph. flavescens* (Pursh) Nutt., with short (2-4 cm) fruiting spikes and oblanceolate to obovate leaves, in the Atlantic States from New Jersey to Florida (*Acer*, *Platanus*, *Quercus*, *Ulmus*, etc.), sometimes occurring in southwestern Texas, and then a dangerous pest (see also Hedgcock in *Phytopathology*, V. [1915] 178).

*Ph. macrotomum* Trelease, with 6--7 cm long fruits, on *Quercus*, *Prunus*, *Nyssa* and others, in Florida. – β. ♂ spikes are usually stiffer and longer; the many-flowered segments 6-15 mm long. – 8 species in the southwestern United States and Mexico, including: *Ph. macrophyllum* (Engelm.) Cockerel, on various deciduous trees (*Alnus*, *Celtis*, *Juglans*, *Platanus*, *Populus*, *Salix*), in Arizona; *Ph. coloradense* Trelease, on *Prosopis*, in California. – γ. ♂ spikes short; the few-flowered, short woolly hairy segments barely 5 mm long. False fruit a bit woolly. – 3 species, *Ph. tomentosum* (DC.) Oliv. and *Ph. puberulum* Trelease, in Mexico, as well as *Ph. villosum* Nutt., with oblanceolate to obovate leaves, in California and Oregon, mostly on oaks, but also on other trees, often covering their crown completely. – δ. False berries small (3 mm), soft-haired above. – 3 species, in the southwestern states of North America, mainly in Arizona, southern California and Sonora; *Ph. coryae* Trelease, in Arizona and southern California, on oaks.

§ 4. *Brachystachyae* Trelease l. c. 45. – Leaves fairly narrow, never greatly elongated or broad. Internodes neither edged nor compressed. – 15 species in Mexico and southern California, including *Ph. brachystachyum* (DC.) Nutt., in Mexico, *Ph. tumidum* Trelease and *Ph. diguetii* van Tiegh., both in Mexico.

§ 5. *Ferrugineae* Trelease l. c. 51. – Leaves wide, thick, densely rust-colored hairy. Internodes neither edged nor compressed. – 1 species, *Ph. Robinsonii* Urb., in Mexico in the Sierra Madre on *Celtis*.

b. Leaves long and usually quite wide.

§ 6. *Velutinae* Trelease l. c. 51. – Leaves fairly large, thin, lanceolate, with distinct nerves. Internodes not flattened, yellowish-woolly hairy. – 1 species, *Ph. vVelutinum* (DC.) Nutt., in the Mexican highlands and in the Central American Cordillera, on *Cornus*, *Crataegus* and others.

§ 7. *Longifoliae* Trelease l. c. 52. – leaves large, thick. Internodes at the nodes clearly compressed. – 3 species in Mexico and Guatemala, *Ph. scaberrimum* Trelease and *Ph. longifolium* Eichl., in Mexico, *Ph. uspantanum* Trelease, in Guatemala.

B. Twigs broadly winged. Receptaculum is often split into sepals-like sections.

Section III. *Calyculatae* Trelease l. c. 54. – Twigs broadly winged, receptaculum often split. ♀ flowers numerous. Spikes fairly long, 3-5 jointed; each spike segment with numerous flowers in approximately 12 rows.

§ 8. *Alatae* Trelease l. c. 54. – Internodes decussate, strongly flattened, with nerved wings. Leaves falcate-lanceolate. – 1 species, *Ph. falcatum* (Hook.) Eichl. 1868 (*Ph. calyculatum* Trelease), on oaks, in eastern Mexico. – *Viscum falcatum* Hook. Icon. (1841) t. 368.

Subgenus. II. *Equatoriales* Trelease l. c. 55. – Scale leaves at least at the base of internodes of each branch. Spike axillary and terminal. Flowers monoecious and dioecious, mostly ♂ and ♀ flowers in the same spike. – In South America, mainly in Brazil, south to Argentina, north to the West Indies and to the northern Bahamas.

Sect. IV. *Interruptae* Trelease l. c. 55. – Scale leaves only at the basal node of each branch.

Subsection 1. *Foliosae* Trelease l. c. 55. – With foliage leaves. All species glabrous except the South American *Anomalae*.

α. *Basinerviae* Trelease l. c. 55. – Leaves with basal nerves.

§ 9. *Annulatae* Trelease l. c. 58. – Leaves long or narrow, fairly thick. Flowers mostly in 4 rows. – 4 species, in southern Mexico and Central America; *Ph. annulatum* Oliv., in Guatemala and Costa Rica; *Ph. carneum* Urb., in Mexico.

§ 10. *Pringleae* Trelease l. c. 60. – Leaves linear-lanceolate, quite thick. Flowers in 4 + 2 rows. – 2 species, *Ph. Pringlei* Trelease and *Ph. Forestierae* Rob. et Greenm., in southern Mexico.



- § 11. *Nervosae* Trelease l. c. 61. – Leaves fairly broad and fleshy. Flowers mostly in 4 + 2 rows. – 5 species, in Mexico, including *Ph. pachyarthron* Eichl. and *Ph. nervosum* Oliv.
- § 12. *Lanceolatae* Trelease l. c. 64. – Leaves narrowly lanceolate, quite fleshy. Flowers in 4 + 2 rows. – 2 species, *Ph. lanceolatum* Engelm. and *Ph. schiedeanum* DC. (*Viscum falcatum* Cham, et Schlecht. 1830, non Hook, 1841, *Ph. falcatum* [Ch. et Schl.] Trel.), in Mexico.
- § 13. *Angustifoliae* Trelease l. c. 65. – Leaves narrow, rather thin. Flowers in 4 + 2 rows. – 5 species in the Andes; *Ph. Angustifolium* (HBK) Eichl., in Peru and Bolivia, *Ph. parietarioides* Trelease, in Ecuador.
- § 14. *Corynarthrae* Trelease l. c. 66. – Leaves long or narrow, thin. Flowers in 4 or 4 + 2 rows, – 3 species in Central America, including *Ph. corynarthron* Eichl., in Panama.
- § 15. *Andinae* Trelease l. c. 67. – Leaves broad or large, thin. Flowers in 4 + 2 rows. – 8 species in the Andes and Venezuela; *Ph. trianae* Eichl., in Colombia, *Ph. semiteres* Trelease, in Bolivia, *Ph. tubulosum* Urb., in Venezuela.
- § 16. *Amplectentes* Trelease l. c. 70. – Leaves of medium size, quite thin. Flowers mostly in 6 rows. – 12 species, most in South America from Guiana to Paraguay, only one, *Ph. tetrapterum* Krug et Urb., in the Antilles, Haiti, Jamaica, Puerto Rico and Martinique; *Ph. tovarense* Urb., in Venezuela; *Ph. amplectens* Trelease, in Ecuador.
- § 17. *Brevifoliae* Trelease l. c. 75. – Leaves small, thick, barely veined. Flowers in 4 or 4 + 2 rows. – 4 species in southern Mexico and Central America; *Ph. brevifolium* Oliv., in Mexico; *Ph. vulcanicum* Trelease, on Leguminosae, in Guatemala.
- § 18. *Robustissimae* Trelease l. c. 77. – Leaves fairly large and broad, thick. Flowers in 4, 4 + 2 or 6 rows. – 3 species in the montane region in Mexico and Central America; *Ph. robustissimum* Eichl., in Costa Rica.
- § 19. *Coriaceae* Trelease l. c. 79. – Leaves quite small, coarse. Flowers in 4, 4 + 2 and 6 rows. – 8 species in South America, Brazil and Colombia; *Ph. coriaceum* Mart. ex Eichl., in Minas Gerais; *Ph. exiguum* Trelease, in Colombia.
- § 20. *Rigidae* Trelease l. c. 83. – Leaves moderately large, thick. Flowers in 2, 4 or 6 rows. – 5 species in Venezuela and Guiana; including *Ph. ovalifolium* Urb. and *Ph. rigidum* Urb., in Venezuela, *Ph. Jenmanii* Trelease, in British Guiana.
- § 21. *Polygynae* Trelease l. c. 85. – Leaves moderately large, broad, thick. Flowers in 4 + 2 or 6 rows. – 3 species, *Ph. polygynum* (Karst.) Eichl., in Venezuela; *Ph. Briquetianum* Trelease, in Colombia. – *Spiciviscum polygynum* Karsten, Fl. Columb. I. (1859) 73 part 36.
- § 22. *Obliquae* Trelease l. c. 86. – Leaves large, dimidiately elliptical to lanceolate, thick, fleshy. Flowers in 4 + 2 or 6 rows. – 2 species, *Ph. obliquum* (Presl) Eichl., in Peru and Ecuador; *Ph. guascanum* Trelease, in Colombia.
- § 23. *Dimidiatae* Trelease l. c. 87. – Leaves quite large, dimidiately lance-elliptical, drying rather thin. Flowers in 4 + 2 or 6 rows. – 3 species in eastern South America; *Ph. dimidiatum* (Miq.) Eichl., in Surinam, on *Citrus* species; *Ph. bathyoryctum* Eichl., in Brazil by Piauí and Ceará to Minas Gerais, as well as in Bolivia, on *Ficus*.
- § 24. *Nitentes* Trelease l. c. 89. – Leaves moderately large, elliptical to narrowly lanceolate, drying glossy. Flowers in 4 + 2 rows. – 5 species in Brazil; *Ph. craspedophyllum* Eichl., in S. Paulo; *Ph. pellucidulum* Eichl., in Rio Negro.
- § 25. *Longibaccaae* Trelease l. c. 91. – Leaves moderately large, broad and short. Flowers in 4 or 4 + 2 rows. False fruit long. – 4 species, from Guiana to Paraguay; *Ph. acinacifolium* Mart. ex Eichl., in Brazil and Paraguay, on Lauraceae and composites.

§ 26. *Vernicosae* Trelease l. c. 93. – Leaves moderately large, lanceolate to obovate, rather thin. Flowers mostly in 2 rows. – 4 species in Mexico and Central America; *Ph. vernicosum* Greenman, in Mexico and Yukatan; *Ph. cheirocarpum* Trelease, in Guatemala.

§ 27. *Campbelliae* Trelease l. c. 95. – Leaves moderately large, lanceolate, herbaceous. Flowers in 2 or 4 rows. – 3 species, in Jamaica; *Ph. Fici* Urb., on *Ficus*; *Ph. grisebachianum* Eichl., on *Coccoloba*, *Ficus* and *Nectandra*.

§ 28. *Chrysocarpae* Trelease l. c. 97. – Leaves moderately large, lanceolate or elliptic to roundish-obovate. Flowers in 2, 4 or 4 + 2 rows. – 9 species in the West Indies; *Ph. chrysocarpum* Krug et Urb., in Puerto Rico, St. Thomas, St. Croix, Martinique, St. Vincent, with golden yellow fruits; *Ph. Hartii* Krug et Urb., in Trinidad; *Ph. Wattii* Krug et Urb., in Jamaica; see Fawcett and Rendle, Fl. Jamaica III. 1. (1914) 94 fig. 29.

§ 29. *Domingenses* Trelease l. c. 102. – Leaves moderately large, lanceolate to spatulate, thin. Flowers in decussed pairs. – 1 species, *Ph. domingense* (Desv.) Trelease, in the West Indies.

§ 30. *Rubrae* Trelease l. c. 102. – Leaves small, usually spatulate, rather thin. Flowers mostly in 4 + 2 rows. False fruits usually red. – 10 species, from Mexico and the West Indies to northern South America; *Ph. trinervium* (Lam.) Griseb. <sup>2</sup>), in the Bahama Islands, the Greater and Lesser Antilles; *Ph. rubrum* (L.) Griseb., in the Bahamas and Cuba; *Ph. sanciae-mariae* Trelease, in Colombia.

§ 31. *Quadrangulares* Trelease l. c. 108. – Leaves quite small, narrow, thin. Branches usually 4-edged. Flowers mostly in 4 or 4 + 2 rows. – 17 species in the West Indies, Central and South America; *Ph. quadrangulare* (HBK) Krug et Urb., in Colombia and Ecuador; *Ph. antillarum* Trelease, on the Greater and Lesser Antilles; *Ph. affine* (Pohl ex DC.) Nutt., in Brazil.

§ 32. *Emarginatae* Trelease l. c. 115. – Leaves usually small, thin. Flowers in 2, 4 or 4 + 2 rows. – 13 species, most in South America, 1, *Ph. yucatanum* Trelease, in Yucatan; 1, *Ph. mucronatum* (DC.) Krug et Urb., in the West Indies; *Ph. obovatifolium* Morong, in Paraguay; *Ph. emarginatum* Eichl., in Brazil and Bolivia.

§ 33. *Argentinae* Trelease l. c. 120. – Leaves small, quite leathery. Flowers in 4 or 4 + 2 rows. – 3 species, in Peru, Bolivia, Paraguay and Argentina; *Ph. argentinum* Urb., in Argentina; *Ph. Meliae* Trelease, in Bolivia, Paraguay and Argentina; *Ph. Ernstianum* Patschovsky, in Peru.

§ 34. *Ligae* Trelease l. c. 122. – Leaves small to medium, fairly thick. Flowers usually in 4 + 2 rows. – 4 species, *Ph. liga* (Gilliam ex Hook. Et Arn.) Eichl., in andean Argentina, Bolivia and Paraguay, *Ph. pruinosum* Urb. and *Ph. Hieronymi* Trelease, only in andean Argentina.

§ 35. *Ensifoliae* Trelease l. c. 124 – Leaves long, very narrow, fairly rough. Flowers mostly in 6 rows. – 3 species in southern Brazil; e.g. *Ph. lanceolato-ellipticum* (Pohl ex DC.) Trelease.

§ 36. *Turbinispicae* Trelease l. c. 125. – Leaves moderately large, lanceolate. Flowers in 4 + 2 rows. – 1 species, *Ph. macrarthrum* Eichl., in Brazil, in the state of Goiás.

§ 37. *Falciferae* Trelease l. c. 126. – Leaves narrow-oblongate, curved. Flowers in 4 + 2 rows. – 1 species, *Ph. falcifrons* (Hook. et Arn.) Eichl., in Uruguay and Matto Grosso.

§ 38. *Anomalae* Trelease l. c. 127. – Leaves small, lanceolate, thick, felty hairy. Flowers in 4 + 2 rows. – 2 species, *Ph. tucumanense* Urb., in Argentina, in the Sierra de Tucumán, as well as in Bolivia; *Ph. Kuntzei* Urb., in Bolivia.

β. *Penninerviae* Trelease l. c. 128. – Leaves with pinnate from midrib, never with several nerves on the base of the leaf.

§ 39. *Eggersiae* Trelease l. c. 128. – Leaves large, fairly thick, broadly elliptical to ovate. Flowers in 4 + 2 rows. – 1 species, *Ph. Eggersii* Urb., in the Andes of Ecuador.

§ 40. *Northropiae* Trelease l. c. 129. – Leaves fairly large and thick, obovoid to spatulate, with very indistinct nervature. Flowers in 4 + 2 rows. – 1 species, *Ph. Northropiae* Urb., in the Bahamas.

§ 41. *Undulatae* Trelease l. c. 129. – Leaves fairly large, thick, lanceolate. Flowers in 4 + 2 rows. – 3 types from the West Indies to Brazil; *Ph. undulatum* (Pohl ex DC.) Eichl., in Brazil and Bolivia; *Ph. Herminieri* Trelease, on Dominica and Guadeloupe.

§ 42. *Peruviana* Trelease l. c. 131. – Leaves fairly large, lanceolate, or ovate-lanceolate, quite thick. Flowers in 4 + 2 or 6 + 2 rows. – 6 species in the Andes of Colombia, Peru, Bolivia and Northern Argentina, as well as in Paraguay; *Ph. peruvianum* Eichl. and *Ph. Englerianum* Patsch., in Peru; *Ph. Mandonii* Eichl., in Bolivia.

§ 43. *Rugulosae* Trelease l. c. 134. – Leaves moderately large, fleshy, elliptical. Flowers in 4 or 4 + 2 rows. – 1 species, *Ph. Warmingii* Eichl., In southern Brazil, Rio de Janeiro and Minas Gerais.

§ 44. *Heydeanae* Trelease l. c. 135. – Leaves large, rather thin, ovate-lanceolate. Flowers in 4 + 2 rows. – 1 species, *Ph. Heydeanum* Trelease, in Guatemala and Costa Rica.

§ 45. *Hexastichae* Trelease l. c. 135. – Leaves moderately large, fairly thick, elliptical to ovoid or lanceolate. Flowers mostly in 6 rows. – 3 species, *Ph. hexastichum* (DC) Griseb., In the West Indies; *Ph. Oliverianum* Trelease, in eastern Mexico.

§ 46. *Pteroneurae* Trelease l. c. 136. – Leaves usually large, more or less leathery. Flowers in 4-6 rows. – 7 species in West India and South America; *Ph. racemosum* (Aubl.) Northrop, in the Bahamas, the great Antilles, in Guiana and Venezuela; *Ph. pteroneuron* Eichl., in Brazil from Pernambuco to Rio de Janeiro; *Ph. bolivianum* Trelease, in Bolivia.

Subsection 2. *Squamosae* Trelease l. c. 140. – With scale leaves, not disarticulating.

§ 47. *Fragile* Trelease l. c. 140. – Leaves scale-like. Internodes thick, round. Flowers in 4 + 2 rows. – 1 species, *Ph. fragile* Urb., with fleshy internodes, in southern Brazil, Rio de Janeiro, S. Paulo and Goiás, mostly on Melastomataceae.

§ 48. *Tunaeformis* Trelease l. c. 141. – Leaves scale-like. Internode very thin, flat. Flowers in 4 + 2 rows. – 2 species, *Ph. tunaeforme* (DC) Eichl., in southern Brazil, from Piauí to S. Paulo and Minas Gerais; *Ph. canzacotoi* Trel., Ecuador.

Section V. *Paradoxae* Trelease l. c. 142. – Scale leaves at alternate nodes or (in one species) at all nodes. Branches normally percurrent. Glabrous and with foliage leaves.

§ 49. *Fendlerianae* Trelease l. c. 142. – Leaves moderately large, rather thick. Flowers in 6 rows. – 2 species, *Ph. Fendlerianum* Eichl. and *Ph. paradoxum* Urb., both in Venezuela.

Section VI. *Continuae* Trelease l. c. 143. – Scale leaves at all nodes, even if the stem is percurrent. Glabrous and with foliage leaves.

Subsection 3. *Percurrentes* Trelease l. c. 143. – Branches always or predominantly percurrent.

§ 50. *Crassifoliae* Trelease l. c. 144. – Leaves large, ovate, thick. Flowers in 4 + 2 or 6 rows. – 3 species, *Ph. crassifolium* (Pohl ex DC.) Eichl, from southern Brazil to Costa Rica; *Ph. martinicense* (DC.) Trelease, in the West Indies; *Ph. tenuifolium* Urb. et Ekm., Haiti.

§ 51. *Piperoides* Trelease l. c. 145. – Leaves moderately large, broad-lanceolate to ovate, thick. Flowers in 4, 4 + 2 or 6 rows. – 1 species, *Ph. piperoides* (HBK) Trelease, from northern Argentine to Mexico and the West Indies.

§ 52. *Gardnerianae* Trelease l. c. 148. – Leaves quite small. Flowers in 4 or 4 + 2 rows. – 7 species in South America; *Ph. Gardnerianum* Urb., in Piauí; *Ph. surinamense* Pulle, in Surinam.

§ 53. *Flaventes* Trelease l. c. 151. – Leaves fairly large, lanceolate, or ovate. Flowers mostly in 6 rows. – 10 species, 8 in Central and South America, 2 in the West Indies; *Ph. chrysocladon* A. Gray, in Rio de Janeiro and Bahia; *Ph. quinquenervium* Krause, in Costa Rica; *Ph. flavens* (Swartz) Griseb., in Jamaica.

Subsection 4. *Dichotomae* Trelease l. c. 156. – Branches normally dichotomously branched at each node.

§ 54. *Huallagenses* Trelease l. c. 156. – Leaves moderately large, ovate-lanceolate. Flowers in 2 or 4 rows. – 2 species, *Ph. huallagense* Ule, in eastern Peru, and *Ph. laxiflorum* Ule, in the upper Amazon region.

§ 55. *Cymosae* Trelease l. c. 157. – Leaves large, rather thin. Flowers mostly in 6 rows. – 8 species, in South America, the West Indies and the Galapagos; *Ph. dichotomum* (Bert. ex Spreng.) Krug et Urb., in the Greater Antilles; *Ph. galapageium* (Hook. f.) Robinson, on the Galapagos.

### Subtrib. II. 2c. **Viscoideae Phoradendreae-Ginalloinae.**

Viscoideae-Phoradendreae-Ginalloinae Engl. in E. P. Nachr. I (1897) 137 (*Ginalloées* van Tiegh., Bull. Soc. Bot. France XLIII. [1896] 161).

Inflorescence a spike with sessile, androgynous triads.

33. **Ginalloa** Korth. in Verh. batav. Gen. XVII. (1839) 260. - Flowers very small, unisexual, monoecious, 3-, rarely 4 merous. ♂ flowers with free tepals; Stamens only a little free; filaments very short; anthers almost sessile, small, with two laterally opening thecae; disk small. ♀ flowers 3, rarely 4-merous, fused below into a tube, above ending in a short, roundish perigone lobe; style short with a capitate stigma. False fruit berry-like, ovoid, crowned on the margin by the perigone. Seed with endosperm. - Dainty, glabrous shrubs with dichotomous or trichotomous branches and opposite, often narrow, leathery, parallel-nerved or arch-nerved leaves and axillary or terminal spikes, in which the scale-leaved, opposite branching prophylls are united in pairs into a sheath. Flowers usually to 3 in sessile triads, usually with the middle one ♂ and on each side a ♀ flower.

The genus is named after the Malay name of the plants; cf. Filet, Plantk. Woordenboek (1888) 105.

Important literature Hooker f., Fl. Brit. Ind. V. (1886) 228. – Van Tieghem in Bull. Soc. Bot. France XLII. (1895) 646; XLIII. (1896) 162. – H. Lecomte, Fl. Indo-Chine V. (1915) 206. – Merrill, Enum. Philipp. Fl. Pl. II. (1923) 112. – Ridley, Fl. Malay Penins. III. (1924) 163. – Danser in Bull. Jard. Bot. Buitenzorg 3. ser. XI. (1931) 448; in Recueil Trav. bot. Néerland. XXXI. (1934) 757.

7-8 species in the Malay region, from Burma, Indochina and Siam over to Borneo, Java, the Sunda Islands to the Philippines. Most common *G. Arnottiana* Korth. (Including *G. Cumingiana* [Presl] F. Villar, *G. Zollingeri* van Tiegh, *G. Beccariana* van Tiegh.), with terete internodes and ovate to elliptical leaves, from Borneo, Celebes, Lesser Sunda Islands, the Philippines and Moluccas; *G. linearis* Dans. (*G. tenuitolia* van Tiegh.), with terete internodes and narrow, linear leaves, on Borneo; *G. spathulifolia* (Thwaites) Oliv., with narrow spatulate leaves, on Ceylon; *G. andamanica* with obovate leaves and fleshy spike axes, on the Andamans; *G. appanata* Dans., With flat internodes and lanceolate leaves, on Borneo.

### Trib. 11. 3. **Viscoideae Arceuthobieae.**

Arceuthobieae Engl. in E. P. Nachr. I. (1897) 137 (*Arceuthobies* van Tiegh in Bull. Soc. Bot. France XLII. [1895] 631).

Embryo sacs remain enclosed in the placenta and ascending in it. Anthers with only one compartment.

34. **Arceuthobium** Marsch.-Bieb. Fl. taur.-caucas. Suppl. (1819) 629 (*Razoumovskia* Hoffm. Hort. Mosq. [1808] p. 1, f. 1, ex Marsch.-Bieb.-taur.-caucas Suppl. [1819] 629, *Razoumofskia* auct., *Razoumofskya* auct.). - Flowers unisexual, dioecious. Flowers with 2-5-merous limbs; Anthers sessile, scutiform [shield-shaped], with an annular locule opening with a transverse slit. ♀ flowers with a 2-, rarely 3-parted perigone; tepals fused at the base; style short, conical with an obtuse, indistinct 2-lobed stigma; receptacle oviform; ovary with a convex placenta in which two embryos are directed obliquely upwards from the periphery. False-fruit berry-like, oviform, crowned by the perigone, with a broad base, sitting on an anteriorly enlarged pedicle, at maturity (in the second autumn), through a gap running around the base, and elastically ejecting the oblong-oviform fruits [error: seed] (see note). Embryo with ample endosperm. - Small, parasitic on conifers, richly branched, sub-shrubs provided with cortical strands, whose branches are provided only with small, scalelike, pairwise at the base thick connate prophylls and bear in the axils of the prophylls single flowers without bracteoles or simple triads.

Important Literature: H. Graf zu Solms-Laubach, Über den Bau und die Entwicklung parasitischer Phanerogamen, *Viscum Oxycedri*, in Pringsheims Bot. Jahrb. VI. (1867-68) 615-638, 1 Taf. – G. Engelmann, *Arceuthobium*, in Watson, Botany of California II. (1880) (ins Deutsche übersetzt von C. v. Tubeuf in Beitr. z. Kenntnis d. Baumkrankheiten [1883]). Hooker f., Fl. Brit. Ind. V. (1886) 227. – H. Johnson, *Arceuthobium Oxycedri*, in Ann. of Bot. II. (1888) 138. – C. von Tubeuf, *Arceuthobium Douglasii* und *americanum* auf *Pseudotsuga Douglasii* und *Pinus Murrayana*, in Beitr. z. Kenntnis d. Baumkrankheiten (1888), I Taf.; Überblick über die Arten der Gattung *Arceuthobium* (*Razoumowskia*) mit besonderer Berücksichtigung ihrer Biologie und praktischen Bedeutung, in Naturwiss. Zeitschr. f. Forst- u. Landwirtschaft XVII. (1919) 167-273, 50 Textfig.; dort auch ausführliches Literaturverzeichnis. – W. Skrobischewsky, Morphologische und embryologische Untersuchung der Schmarotzerpflanze *Arceuthobium Oxycedri*. Riga, 1890. – G. J. Peirce, On the structure of the haustoria of some phanerogamic parasites, in Ann. of Bot. VII. (1893) 291; The dissemination and germination of *Arceuthobium occidentale* Engelm., in Ann. of Bot. XIX. (1905) 99, 2 Fig. – Van Tieghem, Sur le genre *Arceuthobium* considéré comme type d'une tribu distincte dans la famille des Loranthacées, in Bull. Soc. Bot. France XLII. (1895) 625-631. – Mac Dougal, Seed dissemination and distribution of *Razoumofskya robusta*, in Minnesota Bot. Stud. 2. ser. H. (1899) 169. – Hermann von Schrenk, Notes on *Arceuthobium pusillum*, in Rhodora H. (1900) 2. – N. L. Fernald, *Arceuthobium* in St. John and St. Lawrence Valleys, in Rhodora H. (1900) 10. – J. G. Jack, *Arceuthobium pusillum* in Massachusetts, in Rhodora H. (1900) 6. – C. O. A. Rosendahl, A new species of *Razoumofskya*, in Minnesota Bot. Stud. 3. ser. H. (1903) 271. – E. Heinricher, Notiz über die Keimung unserer europäischen Zwergmistel, *Arceuthobium*, in Naturwiss. Zeitschr. f. Forst- u. Landwirtsch. XI. (1913) 173; Ein Hexenbesen auf *Juniperus communis*, verursacht durch *Arceuthobium Oxycedri*, ebenda XII. (1914) 36; Beiträge zur Biologie der Zwergmistel, besonders zur Kenntnis des anatomischen Baus und der Mechanik ihrer explosiven Beeren, in Sitzungaber. Akad. Wissensch. Wien, math.-nat. Kl. 1. Abt. CXXIV. (1915) 181-230; Die

Keimung und Entwicklungsgeschichte der Wacholdermistel, auf Grund durchgeführter Kulturen geschildert, eben da CXXIV. (1915) 319-352, 5 Textfig., 2 Taf.; Über Bau und Biologie der Blüten von *Arceuthobium Oxycedri*, ebenda CXXIV. (1915) 481-504, 1 Textfig., 2 Taf.; Über besondere Keimungsbedingungen, welche die Samen der Zwergmistel beanspruchen, im Centralbl. f. Bakteriologie, 2. Abtlg. XLII. (1915) 706; Aufzucht der Zwergmistel, *Arceuthobium Oxycedri*, im Freilande des Innsbrucker Botanischen Gartens, in Ber. Deutsch. Bot. Ges. XXXIV. (1916) 673-676; Berichtigende Mitteilung über die Keimungsbedingungen der Samen von *Arceuthobium Oxycedri*, in Ber. Deutsch. Bot. Ges. XXXV. (1917) 204-212; Die Bedingungen, unter denen durch den Parasitismus der Zwergmistel, *Arceuthobium Oxycedri*, auf *Juniperus Hexenbesen* entstehen können, in Zeitsehr. f. Pflanzenkrankh. XXVIII. (1918) 193-200, 3 Taf.; *Arceuthobium Oxycedri* (DC.) M. Bieb. auf *Cupressus*, in Ber. Deutsch. Bot. Ges. XXXVIII. (1920) 220-223; Zur Biologie der Blüte von *Arceuthobium*, in Naturwiss. Zeitsehr. f. Forst- u. Landwirtschaft. XVIII. (1920) 101-107; Das Absorptionssystem von *Arceuthobium Oxycedri* (DC.) M. Bieb., in Ber. Deutsch. Bot. Ges. XXXIX. (1921) Generalversammlungsheft 20-25; Das Absorptionssystem der Wacholdermistel, *Arceuthobium Oxycedri* (DC.) M. Bieb. mit Berücksichtigung seiner Entwicklung und Leistung, in Sitzungsber. Akad. Wissensch. Wien, math.-nat. Kl. 1. Abt. CXXXII (1923) 143-194; Über *Arceuthobium Oxycedri* (DC.) M. Bieb. auf *Chamaecyparis sphaeroidea* Spach pendula hort. und einen Hexenbesen, der durch den Einfluß des *Arceuthobiums* auf dieser Cupressinee entstand, in Planta X. (1930) 374-380, 3 Textfig. – W. L. Jepson, *Arceuthobium*, in Flora of California IV. (1914) 372. – Hedgcock and Hunt, Notes on *Razoumofskya campylopoda*, in Phytopathology VII. (1917) 315-316. – J. R. Weir, New hosts for *Razoumofskya americana* and *R. occidentalis abietina*, in Phytopathology VII. (1917) 140; New hosts for *Razoumofskya laricis*, in Phytopathology VIII. (1918) 62-63; Experimental investigations on the genus *Razoumofskya*, in Bot. Gaz. LXVI. (1918) 1-131, 19 Textfig. – W. B. Turrill, *Arceuthobium Oxycedri* and its distribution, in Kew Bull. (1920) 264-268; On the flora of the nearer east, in Kew Bull. (1926) 375-380. – C. F. Korstian and W. H. Long, The western yellow pine mistletoe, *Razoumofskya cryptopoda* (Engelm.) Cov.; effect on growth and suggestions for control, in U. S. Dept. Agric. Bull. Nr. 1112. (1922) 35 S., 5 Taf. – H. Heil, Die Bedeutung des Haustoriums von *Arceuthobium*, in Zentralbl. f. Bakteriologie 2. Abt. IL. (1923) 26-55, 21 Fig. – H. A. Pisek, Antherenentwicklung und meiotische Teilung bei der Wacholdermistel, *Arceuthobium Oxycedri* (DC.) M. B., in Sitzungsher. Akad. Wissensch. Wien, math.-nat. Kl. 1. Abt. CXXXII. (1924) 1-15. – Ridley, *Arceuthobium*; in Fl. Malay Penins. III. (1924) 163. – E. S. Dowding, The vegetation of Alberta. The sandhill areas of Central Alberta with particular reference to the ecology of *Arceuthobium americanum* Nutt., in Journ. of Ecology XVII. (1929) 82-106, 3 Textfig., 6 Taf., 2 Karten. – D. Thoday and E. T. Johnson, On *Arceuthobium pusillum* Peck, in Ann. of Bot. XLIV. (1930) 393-413, 813-824, 20 Textfig., 1 Taf. – B. H. Danser, *Arceuthobium*, in Bull. Jard. Bot. Buitenzorg 3. ser, XI. (1931) 454-456, 1 Textfig.

Χοχευθος (juniper), βίος; (life); the type species, *A. oxycedri*, lives on *Juniperus*.

The name *Arceuthobium* Marsch. Bieb. (1819) is on the list of nomina conservanda opposite *Razoumowskia* Hoffm. (1808); Briquet, Regl. International Nomen. bot. ed. 2 (1912) 85.

About 12-15 species on the northern hemisphere, most in America, a few in Europe and Asia, 1 in tropical Africa, only 1 in tropical Asia south of the equator.

A. ♂ Flowers on the ends of short branches with few leaf pairs: *A. Oxycedri* (DC.) Marsch. Bieb. <sup>3)</sup>, on *Juniperus Oxycedrus* L., *J. drupacea* Labill. and *J. Sabina* L. (juniper mistletoe), from the Mediterranean region<sup>4</sup> to the western Himalayas, but the distribution does not coincide

completely with that of the host plants, since, for example, in contrast to those on Crete, the Peloponnese and the Cycladen are missing; *A. minutissimum* Hook. with very small stems, branching from the bark of the host, and tiny flowers, which protrude above the bark, probably the smallest dicotyledonous plant, in the Himalayas, in Kumaon about 3000 m above sea level, on *Pinus excelsa* Wall.; *A. pusillum* Peck, in northeastern North America, on *Pinus nigra* (Michx.) Link, *P. canadensis* (L.) Britton, *P. rubra* (Lamb.) Link, *Larix laricina* C. Koch et al. See, in particular, the details of various researchers in Rhodora II (1900) 1-11.

B. Flowers on the ends of longer branches: *A. americanum* Nutt., ♂ Plant 6-9 cm long, ♀ with 5 mm long fruits, in North America from Wyoming to Oregon and southward to Colorado and California, on *Pinus contorta* Dougl. and *P. Murrayana* Grev. et Balf.

C. ♂ Flowers axillary, formed into simple or composite spikes: *A. Douglasii* Engelm., Greenish-yellow, with accessory branches behind the primary and with short ♂ floral spikes, from New Mexico to Arizona, on *Pseudotsuga taxifolia* (Lamb.) Britton, as well as in northern Arizona on *Picea Engelmannii* (Parr.) Engelm., occasionally in great numbers on the mentioned trees, and large witches' brooms on them; *A. divaricatum* Engelm., brownish green, with more spreading branches and 3-7-flowered spikes, from New Mexico to Arizona and Utah, on *Pinus monophylla* Torr. et al., *P. cembroides* Zucc. and *P. edulis* Engelm.; *A. occidentale* Engelm., larger than the other species, with 9-17-flowered spikes, in the coastal mountains and the Sierra Nevada of California, north to British Columbia, on *Pinus ponderosa* Dougl.; *A. vaginatum* (H. B. K.) Eichl., similar to the previous one, in Mexico; is related to *A. bicarinatum* Urban (Symb. Antill. VIII. [1920] 185) on S. Domingo (on *Pinus occidentalis*); *A. robustum* Engelm., with shorter spikes, in the Rocky Mountains and in Arizona; *A. Abietis religiosae* Heil, in Mexico at Popocatepetl, on *Abies religiosa* Lindl., remarkable for the fact that the richly branched cortical strands, when they penetrate, first dissolve the walls of the parenchyma cells, and later also the first included stone cells; the sinkers penetrate as far as the cambium ring, and stimulate the formation of wound parenchyma; the sinker tracheids are connected with the tracheids and ray initial cells of the host; *A. Dacrydii* Ridl. <sup>5)</sup>, about 8-9 cm high, on the Malay Peninsula and on Java, observed on *Podocarpus imbricatus* Blume, as well as on *Dacrydium*; *A. Juniperi procerae* Chiov., light green, hardly a decimeter high, in tropical Africa, on the *Erythraea*, as well as in East Africa, Kenya and Mt. Aberdare, on *Juniperus procera* Hochst. in some places; these and the preceding species are the only representatives of the genus which also occur south of the equator.

Note on the explosive pseudo-berries of *Arceuthobium* (see above in the literature of H. Johnson, Mac Dougal, Peirce, and Heinricher). – The data on the flowering season and the fruit ripening of *Arceuthobium* are very different; Heinricher has determined for *A. Oxycedri* that the beginning of the flowering season is in late September, a highpoint in mid-October, and maturity in mid-December. The anatomical structure of the pseudo-berry and the fruits is described in great detail by the investigator, but can not be reproduced here in detail. Of interest is the proof of a slightly corky collenchyma, which is of greater importance in the mechanism of the pseudo-berry. In the pseudo-berry provision is often made for water storage. The "endocarp" consists of a multilayered layer of cells with thicker, through mucilagination, prone walls, which are slightly separated from each other by pressure and the actual superimposed viscin layer. Heinricher argues that the viscin strands are not to be seen as a particular cell layer, but are merely hairy excrescences of the lower endocarp cells. The separating meristem between the pseudo-berry and the pedicel corresponds to a ring layer and reaches under the collenchyma up to the viscin layer.

The mechanics of the explosive berry are according to Heinrich: the viscin layer provides the tension and at the same time a suitable lubricant, so that the projectile, the actual fruit [error: seed], emerges without friction resistance. Another important structural part is the stretchiness and elasticity of the wall, and is evidently shown by the peculiar collenchyma. The considerable dilation, which is experienced in the length and transverse direction, first leads to the breaking of the separating layer, but at the same time also causes the suddenly permitted compensation of the tension. This balancing also constitutes the actual driving force which causes the expulsion of the fruit [error: seed].

Among the pseudo-berries of *A. Oxycedri* examined, Heinricher also found a parthenocarpic one, which looked normal on the outside, but did not contain any fruit [error: seed], embryo or nutrient tissue.

#### Trib. II. 4. **Viscoideae-Visceae.**

Viscoideae-Visceae Engl. In E. P. III. 1. (1889) 190 et Nachtr. I. (1897) 139 (Viscées van Tiegh. in Bull. Soc. Bot. France XLIII. [1896] 185).

Placenta basal. Anthers with more than 4 or with numerous compartments.

35. *Notothixos* Oliv. In Journ. Linn. Soc. VII (1864) 103 (*Viscum* Sect., *Lysianthera* F. v. Muell, Fragm. II. [1860] 109). – Flowers unisexual, monoecious. ♂ flowers with 4, rarely 5-cleft perigone; anthers almost sessile, wide, multilocular, each locule opening by a pore. ♀ flowers with mostly 4-lobed perigone, fleshy disk and an almost sessile, capitate stigma. Pseudo-berry oviform, crowned by the perigone limb, with endosperm. – Parasitic shrubs, the younger parts short gray-felty or yellow-wooly, with opposite, leathery, flat leaves, and very small flowers, which are either in small, terminal heads, or terminal stems in 1-3 heads, or even terminal spikes or racemes.

Important literature: Bentham, Fl. austral. III. (1866) 396-397. – Hooker f., Fl. Brit. Ind. V. (1886) 227. – Van Tieghem in Bull. Soc. Bot. France XLIII. (1896) 186-187. – K. Krause in Englers Bot. Jahrb. LVII. (1922) 492-494, 1 Textfig. – Ridley, Fl. Malay Penins. III. (1924) 165. – Danser in Bull. Jard. Bot. Buitenzorg 3. ser. XI. (1931) 456-459; in Recueil des Trav. bot. Néerland. XXXI. (1934) 758 (*N. Curranii* Merrill und *N. sulphureus* Merrill auch auf Borneo).

νοτόθειν (from the south), ἰξός (mistletoe).

About 10 species of Ceylon over the Malay Peninsula, Java, the Philippines to New Guinea and East Australia; No species especially frequent.

Section I. *Eunotothixos* van Tiegh. In Bull. Soc. Bot. France XLIII. (1896) 187. – Flowers in terminal racemes composed of triads. *N. cornifolius* Oliv., almost completely glabrous, leaves obovate to cuneate, in Queensland and New South Wales; *N. subaureus* (F. Muell.) Oliv., densely golden-yellow hairy, leaves ovate, in Queensland and New South Wales; *N. liophyllus* K. Schum., golden-yellow hairy, leaves ovate, in New Guinea, the Moluccas, the Philippines, in New Pomerania and Queensland; *N. Schlechteri* Krause, light-brown hairy, leaves ovate to elliptical, on New Guinea.



Section II. *Ixostachys* van Tiegh. In Bull. Soc. Bot. France XLIII. (1896) 187. – Flowers in terminal spikes composed of triads. - *N. floccosus* (Thwaites) Oliv., On Ceylon; *N. spicatus* Krause, in northeastern New Guinea and on Java.

Section III. *Peneixos* van Tiegh. in Bull. Soc. Bot. France XLIII. (1896) 187. – Flowers in simple, terminal triads. *N. malayanus* Oliv., rather strong, yellow-wooly shrub with roundish-obovate leaves, on the Malay Peninsula, on Penang; *N. incanus* (Hook.) Oliv., gray-felty shrub with cuneate-spatulate leaves, in Queensland.

36. **Viscum** L. [Tourn. ex L. Gen. Ed. 1. (1737) 284] Spec. pl. ed. (1753) 1023; Gen. pl. ed. 5. (1754) 448. – Flowers unisexual, monoecious or dioecious. ♂ flowers with a very short, not hollow basal part and usually 4, more rarely 3 or 6 sections fused with the anthers; Anthers sessile, broadly ovoid or more elongated, on the inside with more than four or numerous, irregular, compartments inwardly opening by pores. ♀ Flowers with mostly 4-merous limbs, thick, cushion-shaped stigma, with short, conical style or without such. False fruit berry-like, crowned by the perigone lobes, or without these, with a thick viscin layer; 1-3 terete embryos, enclosed by ample endosperm. – Parasitic shrubs with cortical strands and opposite, repeatedly bifurcated branches. Leaves thick, leathery, rarely scaly or completely absent. Inflorescences composed of simple cymes, which are 3-flowered or only 1-flowered as a result of reduction of the lateral flowers. Flowers small, not showy, greenish, yellow or whitish. Pseudo-berries red, orange, yellow or white.

Important literature: Malpighi, Opera omnia. Anatomia plantarum II. Tract. de plantis quae in aliis vegetant, Londini (1686) 49, t. 26. – Duhamel, Diverses observations sur le gui, in Hist. de l'acad. d. scienc. (1740) 483-510, t.22-24. – Gaspard, Mémoire physiologique sur le gui, in Magendie, Journ. de physiol. VII. (1827) 227. – De Candolle, Prodr. IV. (1830) 277. – Zuccarini, Einiges über Geschichte und Vorkommen von *Viscum* und *Loranthus*, in Flora XVI. 1. (1833) 145. – Decaisne, Sur le pollen et l'ovule du gui, in Ann. scienc. nato 2. sér. XIII. (1840) 291. – Unger, Beiträge zur Kenntnis der parasitischen Pflanzen, in Annal. d. Wien. Mus. d. Naturgesch. 11. (1840) 32, t.2. – Treviranus, Bau und Entwicklung der Samen der Mistel, in Abhandl. d. math. physik. Kl. d. Bayr. Akad. VII. (1853) 167-169. – Gümbel, Zur Entwicklungsgeschichte von *Viscum album*, in Flora XXXIX. (1856) 433, t. 6. – Hofmeister, Neue Beiträge zur Kenntnis der Embryobildung, in Abhandl. kgl. sächs. Ges. d. Wissensch. VI. (1859) 540-542. O. Harley, On the parasitism of the mistletoe, in Transact. Linn. 800. XXIV. (1863) 175. – Bentham, Fl. austral. 111. (1866) 395. – Van Tieghem, Anatomie des Heur et du fruit du gui, in Ann. scienc. nato 5. sér. XII. (1869) 136. – M. Treub, Observ. sur les Loranth., *Viscum articulatum*, in Ann. Jard. bot. Buitenzorg 111. (1883) 1-12. – W. Skrobischewsky, Ueber den Ursprung des Fadenapparates bei *Viscum album*, in Bot. Centralbl. XVIII. (1884) 106. Marktanner-Turneretscher, Zur Kenntnis des anatomischen Baues unserer Loranthaceen, in Sitzungsber. d. Kais. Akad. d. Wissensch. Wien, math. naturw. Kl. 1. Abt., XCI. 1. Abt. (1885) 430. – L. Jost, Zur Kenntnis der Blütenentwicklung der Mistel, in Bot. Zeitung XLVI. (1888) 357. – Hooker f. Fl. Brit. Ind. V. (1886) 223. – M. Kronfeld, Zur Biologie der Mistel, in Biol. Centralblatt VII. (1887) 449-464. – S. Schönland, Contributions to the morphology of the mistletoe, *Viscum album*, in Ann. of Bot. IV. (1888) 283-296, t. 17. – C. A. M. Lindemann, Einige Notizen über *Viscum album*, in Bot. Centralblatt XLIV. (1890) 241-244. – E. Loew, über die Metamorphose vegetativer Sproßanlagen in Blüten bei *Viscum album*, in Bot. Zeitg. XLVIII. (1890) 565-573. – R. Keller, Die Conüerenmistel, in Bot. Centralblatt XLIV. (1890) 48. – Ch. Guérin, Expériences

sur la germination et l'implantation du gui, Avril 1890; Note sur quelques particularités de l'histoire naturelle du gui, in Bull. de 10. Soc. Linnéenne de Normandie 4. sér. VI. (1892) 183-229. – Van Tieghem, in Bull. Soc. Bot. France XLIII. (1896) 187-194. – J. Wiesner, über die Ruheperiode und über einige Keimungsbedingungen der Samen von *Viscum album*, in Ber. Deutsch. Bot. Ges. XV. (1897) 503-516. – Männel, über die Anheftungsweise der Mistel an ihre Nährpflanze, in Forstl.-naturwiss. Zeitschr. (1897) 62-65. – F. Kuhla, Die Plasmaverbindungen bei *Viscum album*, in Bot. Zeitg. LVIII. (1900) 27-58, 1 Taf. – C. von Tubeuf, Beiträge zur Biologie der Mistelkeimlinge, in Naturwiss. Zeitschr. f. Land. u. Forstwirtschaft. V. (1907) 342; Gärtherische Kultur der Mistel, in Mitteil. Deutsch. Dendrolog. Ges. XXVI. (1917) 188-196, 8 Taf.; über die Begrenzung der Mistelrassen und die Disposition ihrer Wirtspflanzen, in Zeitschr. f. Pflanzenkrankheiten XXVII. (1917) 241-257, 10 Tal.; Misteldrossel, in Naturwiss. Zeitschr. f. Forst. u. Landwirtschaft. XVI. (1918) 289-309; Einbruch der Kiefernmistel nach Bayern von Süden, in Naturwiss. Zeitschr. f. Forst- u. Landwirtschaft. XVIII. (1920) 230-232; Monographie der Mistel, Berlin u. München (1923) XII u. 823 pp., 181 Textfig., 35 Tal., 5 Karten; Die Mistel, *Viscum album*, auf dem Ölbaume, in Zeitschr. f. Pflanzenkrankh. XXXVIII. (1928) 139-140; Die Mistel auf der Ulme, in Zeitschr. f. Pflanzenkrankh. XL. (1930) 7-11, 2 Textfig. – A. Engler u. K. Krause, über die Lebensweise von *Viscum minimum* Harvey, in Ber. Deutsch. Bot. Ges. XXVIa. (1908) 524-530. – E. Heinricher, Beiträge zur Kenntnis der Mistel, in Naturwiss. Zeitschr. f. Forst- u. Landwirtschaft. V. (1907) 357; über Versuche, die Mistel, *Viscum album*, auf monocotylen und auf sukkulenten Gewächshauspflanzen zu ziehen, in Sitzungsber. Akad. Wissensch. Wien, math. naturw. Kl. 1. Abt. CXXI. (1912) 541-572, 12 Textfig., 1 Taf.; Samenreife und Samenruhe der Mistel und die Umstände, welche die Keimung beeinflussen, ebenda CXXI. (1912) 573-613, 1 Textfig.; Bei der Kultur von Misteln beobachtete Korrelationserscheinungen und die das Wachstum der Mistel begleitenden Krümmungsbewegungen, ebenda CXXII. (1913) 1259-1280, 2 Taf.; über den Mangel einer durch innere Bedingungen bewirkten Ruheperiode bei den Samen der Mistel, *Viscum album* L., ebenda CXXV. (1916) 183-188, 1 Taf.; Der Kampf zwischen Mistel und Birnbaum. Immune, unecht immune und nicht immune Birnrassen. Immunwerden früher für das Mistelgift sehr empfindlicher Bäume nach dem überstehen einer ersten Infektion, in Denkschr. kais. Akad. Wissensch. Wien XCIII. (1916) 501-534, 4 Taf.; über die geotropischen Reaktionen unserer Mistel, in Ber. Deutsch. Bot. Ges. XXXIV. (1916) 818-828, 8 Textfig., 1 Taf.; Warum die Samen anderer Pflanzen auf Mistelschleim nicht oder nur schlecht keimen, in Anzeiger kais. Akad. Wissensch. Wien, math. naturw. Kl. LIV. (1917) 236-238; über tödende Wirkung des Mistelschleimes auf das Zellgewebe von Blättern und Sprossen, ebenda LIV. (1917) 238-239; Die Krümmungsbewegungen des Hypokotyls von *Viscum album*, ihre zeitliche Folge, insbesondere der Nachweis seiner negativ geotropischen Reaktion. Beziehungen zwischen Lichtgenuß und Keimung sowie Erhaltung des Keimvermögens der Mistelsamen, in Jahrb. f. wissensch. Bot. LVII. (1916) 321-362, 4 Textfig., 3 Taf.; Ist die Mistel wirklich nur Insektenblütler?, in Flora N. F. XIII. (1919) 155-167, 1 Tal.; Ein Versuch, Samen, allenfalls Pflanzen, aus der Kreuzung einer Laubholzmistel mit der Tannenmistel zu gewinnen, in Ber. Deutsch. Bot. Ges. XXXVII. (1919) 392-398; Wie erfolgt die Bestäubung der Mistel, scheiden ihre Blüten wirklich Nektar ab?, in Biolog. Centralbl. XL. (1920) 514-527, 1 Textfig.; Zur Kenntnis der Verhältnisse zwischen Mistel und Birnbäumen, in Zeitschr. f. Pflanzenkrankh. XXX. (1920) 41-51, 1 Textfig., Mistelträger im Botanischen Garten zu Innsbruck, in Ber. Deutsch. Bot. Ges. XXXIX. (1921) 291-295, Über die Blüten und die Bestäubung bei *Viscum cruciatum* Sieb., ebenda XL. (1922) 168-173, 2 Textfig., Kreuzungsversuche zwischen *Viscum*

*album* L. und *Viscum cruciatum* Sieb., ebenda XL. (1922) 174-177, Hygronastische Öffnungs- und Schließbewegungen bei den männlichen Blüten der Mistel, ebenda XLIII. (1925) 366 bis 372, Bastardierung zwischen *Viscum album* und *V. cruciatum*, ebenda XLIV. (1926) 301-307, 1 Textfig., Allmähliches Immunwerden gegen Mistelbefall, in *Planta* VII. (1929) 165-173, 2 Textfig.; Über chlorophyllfreie Austriebe der Mistel, verursacht durch den gleichzeitigen Mangel von Licht und Nährsalzen, in *Ber. Deutsch. Bot. Ges.* XLVII. (1930) 628-628, 1 Textfig. – C. Baenitz, Allgem. über *Viscum album* L. und neue Nährpflanzen desselben für Schlesien und Ostpreußen, in *Allg. Bot. Zeitschr.* XVII. 19B (1912) 83. – Ascherson u. Graebner, *Synops. mitteleurop. Fl.* IV. (1912) 669-676. – Hub. Winkler, Versuche über die Ernährung der Mistel, in *Naturwiss. Zeitschr. f. Forst- u. Landwirtschaft.* XI. (1913) 13-17. T. A. Sprague, *Viscum*, in *Fl. trop. Afr.* VI. (1913) 393-411. – H. Lecomte, *Viscum*, in *Fl. Indo-Chine* V. (1915) 208; Apropos d'un *Viscum* de Nossi-Bé à fleurs d'abord encapuchonnées, in *Bull. Mus. Hist. Nat. Paris* XXII. (1916) 268-271, Un organe de protection de la fleur chez certaines espèces du genre *Viscum*, in *Bull. Mus. Hist. Nat. Paris* XXXII. (1926) 384 bis 386; Le genre *Viscum* a Madagascar, in *Notulae system. Herb. du Museum de Paris* IV. (1927) 65-83, 12 Fig. – J. M. Roper, Mistletoe on the oak, *Quercus intermedia* Boenn., in Somerset, in *Journ. of Bot.* LIV. (1916) 88. – D. E. Horne, Notes on mistletoe, in *Journ. of Bot.* LIV. (1916) 292-295, Fertilization of mistletoe, in *Journ. of Bot.* LVI. (1918) 331-332; Pollination of *Viscum album*, in *Journ. of Bot.* LXI. (1923) 262. – F. Moewes, Die Mistel, in *Naturdenkmäler* II, H. 16/17. (1918) 245-338 (zusammenfassende Übersicht alles für die Allgemeinheit Wissenswertes über die Mistel in sehr ansprechender Darstellung). – F. Schumacher, Die Insekten der Mistel und verwandter Loranthaceen, in *Naturwiss. Zeitschr. f. Forst- u. Landwirtschaft.* XVI. (1918) 195-238. Bellegarde, Zum plötzlichen Vorkommen der Mistel, in *Mitteil. Deutsch. Dendrol. Ges.* XXIX. (1920) 331. – L. A. Boodle, Mistletoe on lime-trees, in *Kew Bull.* (1921) 212-215. – H. Melchior, Über den anatomischen Bau der Saugorgane von *Viscum album* L., in *Beitr. z. allgem. Bot.* II. (1921) 55-88, 15 Textfig. – P. N. Schürhoff, Die Befruchtung von *Viscum album*, in *Ber. Deutsch. Bot. Ges.* XL. (1922) 314-316, 6 Textfig. – A. Pisek, Chromosomenverhältnisse, Reduktionsteilung und Revision der Keimentwicklung der Mistel, *Viscum album*, in *Jahrb. f. wiss. Bot.* LXII. (1923) 1-19, 6 Textfig. – Merrill, *Viscum*, in *Enum. Philipp. Plants* II. (1923) 113. – A. Letacq, Le gui, sa biologie, ses usages, sa destruction, in *Revue Bot. appl. et Agric. colon.* III. (1923) 377. – B. Löffler, Beiträge zur Entwicklungsgeschichte der weiblichen Blüte, der Beere und des ersten Saugorgans der Mistel, *Viscum album* L., in *Tharandt. Forstl. Jahrb.* LXXIV. (1923) 2. Heft, 14 pp. – Ridley, *Viscum*, in *Fl. Malay Penins.* 111. (1924) 164. – P. Bugnon, Dichotomie foliaire chez le gui, *Viscum album* L., in *Compt. Rend. Acad. Scienc. Paris* CLXXVIII. (1924) 1305 bis 1307, 11 Textfig. – G. Roth, Über die Verbreitung der Mistel in Ungarn, in *Erdészeti Kisértetek* XXVIII. (1926) 43-63, 87-90, 1 Karte. – A. Boros, Ergänzende Angaben zur heimatlichen Verbreitung der Mistel, in *Erdészeti Kisértetek* XXVIII. (1926) 64-66. – H. Karmazynska, *Viscum* en Pologne, in *Ann. Soc. Dendrol. Pologne* II. (1928) 2-33, 6 Textfig., 1 Taf. – M. Voronine, Sur un point septentrional de la distribution géographique de *Viscum album* au gouvernement Smolensk, 52° lat., in *Bull. Jard. Bot. Princip. U.R.S.S.* XXVII. (1928) 234. – M. Zaborski, Sur l'autoparasitisme foliaire chez *Viscum cruciatum*, in *Bull. Sec. Science Nat. Maroc* IX. (1929) 96-98. C. van Steenis, Een nieuwe waardplant van *Viscum articulatum*, in *Trop. Natuur* XIX. (1930) 103. – A. Lange, Misteltenen i Danmark, in *Bot. Tidsskr. København* XLI. (1930) 189-200, 1 Textfig. – B. H. Danser, *Viscum*, in *Bull. Jard. Bot. Buitenzorg* 3. sér. XI. (1931) 459-470, 1 Textfig. – Fr. Pohl, Zur Ökologie der Blüten von *Viscum album* L., in *Beih. z. Bot. Centralbl.* 1. Abt. XLVII. (1931) 378-396, 8 Textfig. – J. A. Müller, Zur Kenntnis

der Inhaltsstoffe der nordischen Mistel, *Viscum album* L., in Archiv d. Pharmacie CCLXX. (1932) 449-476. – C. Nicholson, The mistletoe and its hosts, in Garden. Chron. XCI. (1932) 259.

About 65 species, most of them in tropical and subtropical Africa, some in tropical Asia as far as northern Australia, but here they are already decreasing towards the east; few species in temperate Europe and Asia; completely missing in America.

*Viscum* is the Latin name <sup>6)</sup> for mistletoe or bird glue. – *Stelin* ("Eubaeis ex Plinio") Bubani, Fl. Pyrenaea I. (1897) 128 = *Viscum*, on the grounds that the name *Viscum* refers to our genus *Loranthus* in Theophrastus and Pliny; *Stelin album* Bubani; see. H. Harms in the Writings of Ascherson (1904) 320.

Section 1. *Euviscum* Engl. in E. P. III. 1. (1889) 193 emend. Engl. in E. P. Nachtr. I. (1897) 140. – Forked branching exclusively present or predominant. Branches at the base with 2 prophylls and at the end with 1 pair of opposite foliage leaves, with terminal and axillary floral triads between the branch forks (only rarely 5-flowered groups) or solitary flowers. Flowers dioecious.

Subsection 1. *Triflorae* Engl in E. P. I. (1897) 140 (*Euviscum* van Tiegh in Bull. Soc. Bot. France XLIII [1896] 189; Sect *Visci*). – Flowers in terminal and axillary cymes (triads). – Best known *V. album* L. (mistletoe [English], gui [French]; because of the numerous other names in the various dialects of Germany, as well as for other foreign names, see Tubeuf's monograph, p 86 and 87); up to 1 m or more in diameter, bush with leathery, persistent, elongated, cuneate at the base leaves, branches like the green leaves, yellowish green, in the south in February or March, in the north flowers opening in April (the ♂ flowers larger than the ♀) and spherical, pea-sized, white pseudo-berries, on branches (and on trunks) (about 60) of various trees in Europe and extratropical Asia, especially the poplar, willow, pear and apple trees, birch, linden, mountain ash, firs, maples, walnut trees, etc.; relatively rarely parasitic on oaks, according Willkomm also observed on vines and *Loranthus* (further details on the host plants of different races see below). Cortical strands are deployed under the host branches that on their underside the so-called sinkers develop (see above, p. 109).

Since fertile buds are formed on the ramifications that grow under the bark, which break through the bark, grow into bushes, and develop especially vigorously upon removal of the mother stock, a tree infested by the mistletoe can not be freed from it. In addition, a part of the dormant berries, which are mature in December but can only be germinated in May, remain attached to the bark of the tree, so as to give rise to the development of new bushes (see above under Germination p. 108). After germination, following on the hypocotyl are two cotyledons and two foliage leaves, from whose axes branches emerge, which, like the following, bear only one pair of leaflets and 1 pair of foliage leaves, in the axil of the latter, in turn, shoots of higher order. After several generations of shoots have been developed, the youngest stand above the foliage leaves of the two hypsophylls and the inflorescence is formed. Depending on the host trees, the leaves vary, particularly in breadth; especially narrow-leaved forms are found on the pine. Also the form of the fruit is soon more triangular, sometimes more elliptical, the color of the berries more or less yellowish-green; the latter is observed, especially in mistletoe, which occurs on *Pinus silvestris* in southern and central Europe, and which therefore was also distinguished as a species of its own (*V. laxum* Boiss and Reut.).

Schönland described several peculiar deviations with 3-membered and 4-membered shoots in Annals of Bot. II. (1888) 283.

The distribution of *Viscum album* extends in Europe from Portugal to Athos and from Sicily to Oslo (Kristiania) in Norway. In the north-east the mistletoe is still present at Memel, but is still missing eastwards in Courland, Livonia, Estonia and Finland. The information for Moscow, the Volga, and the Southern Ural, and, in any case, Central Russia, are incorrect according to Tubuf (ibid., P. 136). The north-eastern border runs from Tilsit at about 52° 36' north through the governorate of Vilna, via Bobruisk, Rogachev, Starodub to Kharkov. To the south-west of this frontier, the mistletoe appears quite everywhere, and quite often, as far as the northern boundary of the treeless steppe. In Poland it is also widespread and sometimes covers entire parts of the forest. In the south of the Russian steppe area, it occurs in the Crimea as well as in the Caucasus (up to about 1600 m above sea level), in the Talysch near Lenkoran and Astara, in Kleinasien, North Persia, Afghanistan, further from Kashmir to Nepal in the Himalayas 1000-2300 m), Tibet, at the upper reaches of Hoang-ho in China, southern Amur and Japan. However, the East Asian plant, which is usually listed as a *Viscum album* in Japanese literature, differs from the European and Central Asian by light yellow or sallow yellow berries, and may perhaps be separated as a special variety. It is found throughout Japan from Jezo (on *Pirus alnifolia*, oaks and other trees) to Nagasaki, also in Manchuria, southern Amur, and on the central and lower Ussuri, especially *Populus tremula*, *P. euaoeolens*, *Pirus baccata*, *Betula*, *Ulmus* and *Tilia*, it is still to be found in northern China as far as the borders of Korea. The data on the occurrence of *Viscum album* in western North Africa are questioned by Tubeuf, assuming confusion with witches' bees.

In adaptation to the various host plants *Viscum album* has developed three breeds or varieties which, according to Tubuf, differ in the following manner:

a. Hardwood mistletoe; pale berries transparent white, rarely somewhat yellowish. Shape of the pseudo-berry changing. Fruit ovate or triangular, with flat margins; The plate-like shape depends in particular on the number of the enclosed seedlings (2, 1, 3, 4). Leaves vary in form, size and longevity according to the nutritional condition of the host plant as well as according to climatic and light conditions, usually broader than in the first mistletoe. The races pass from one hardwood host to the other, and thrive on species of the following genera (in rare ones designated \*): *Populus*, *Salix*, *Juglans*, *Carya*, *Alnus*, *Betula*, *Corylus*, *Carpinus*, *Ostrya*, *Castanea*, *Quercus* (Not on *Fagus*), *Ulmus* \*, *Amelanchier*, *Crataegus*, *Cotoneaster*, *Rosa*, *Pirus*, *Sorbus*, *Mespilus*, *Prunus avium* and *P. cerasus*, *Robinia*, *Gleditschia*, *Caragana*, *Cladrastis*, *Cytisus*, *Spartium*, *Acer*, *Pavia*, *Aesculus*, *Tilia*, *Hibiscus*, *Nerium*, *Fraxinus* \*, *Syringa*, finally on *Viscum* itself as well as on *Loranthus*.

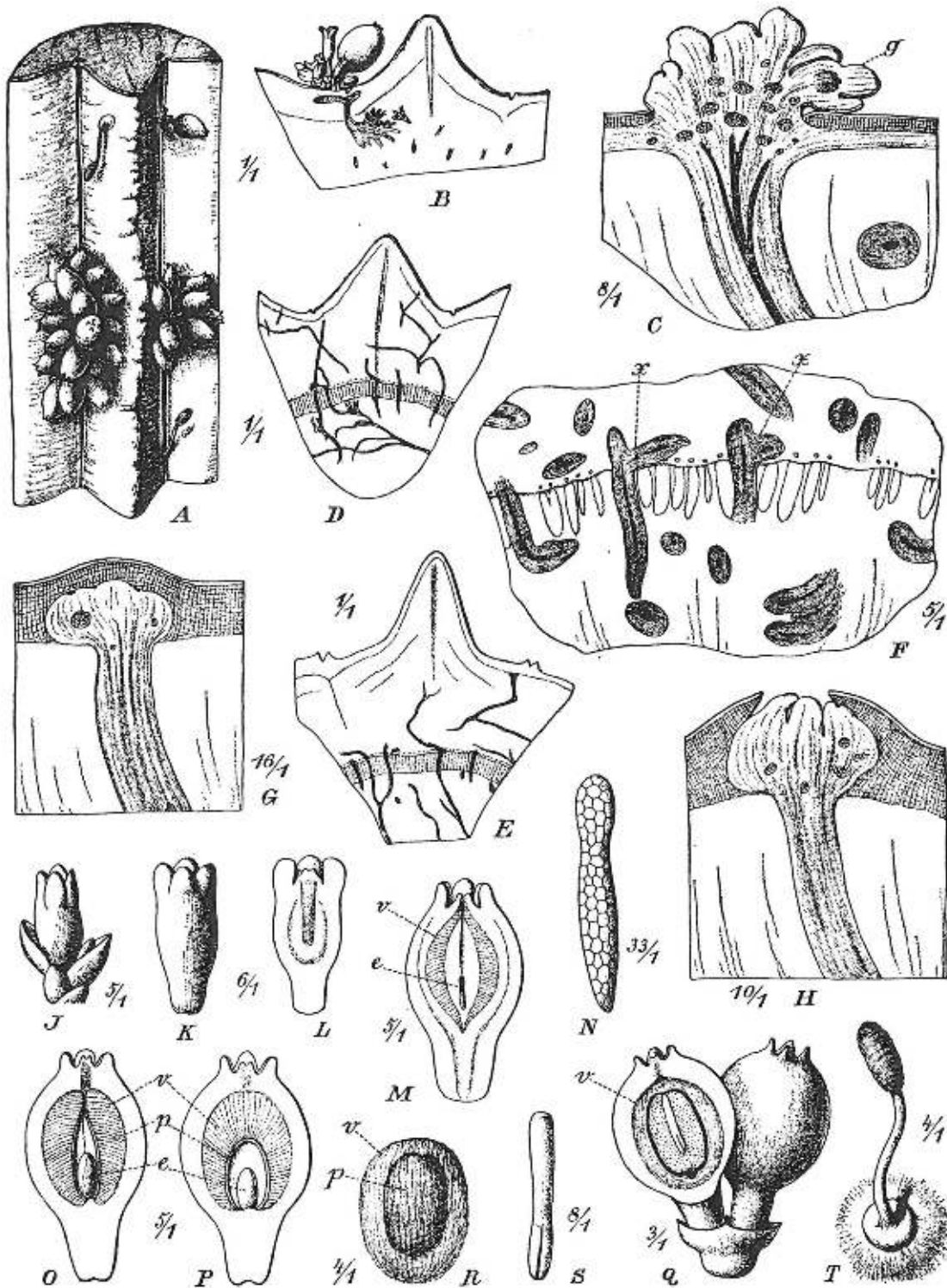


Fig. 101. A piece of the *Euphorbia polygona* Harv. with *Viscum minimum* Harv., above and below a germinating seedling; B cross section of the E. with a shoot of the *Viscum*, with a large widening haustorial strand [endophyte] and several small pieces of haustorial strands; C section through a shoot which has grown out from the inside and through the tracheid bundle of the haustorial strand, under the cork layer of the E. lateral branches, outside a bud O, in the swollen

part of the shoot groups of stone cells, to the right of the haustorial strand another cross-section; D, E pieces of the E. in the cross-section with numerous haustorial branches extending in all directions and branching out, the latter also penetrating the vascular cylinder and penetrating into the ray, the lighter parts being vascular bundles of the E.; F part of the bundle ring of E. shows how the strands penetrate through the medullary rays at x branches of the strands in the neighborhood of the cambium; G penetration of a haustorial strand at the end into the cork layer of the E.; H a similar strand, bursting the cork layer and forming buds; J sprigs with a ♀ flower; K young ♀ flower, L same in longitudinal section; M young "fruit" with embryo (e) and viscin layer (v); N young embryo; O, P longitudinal sections of a young "fruit", v the viscin layer belonging to the flower axis, p the actual fruiting wall, e the embryo; Q two mature "fruits", one of which is in longitudinal section, with endosperm; R viscin layer with the enclosed fruit; S finished embryo; T seedling with holdfast. – After Engler and Krause.

b. Fir mistletoe; Pseudo-berries mostly larger than those of the pine-mistletoe, but as with it usually longer than broad. Fruit ovate to ovoid with strongly arched lateral wings, similar to that of the pine-mistletoe, but larger; as in the case of the pine-mistletoe, often with 1, more rarely with two embryos. In nature, on *Abies* species, therefore absent in the regions north of the fir; Also on *Larix leptolepis*, also on *Acer dasycarpum* and *A. rubrum*.

c. pine mistletoe; Pseudo-berry often yellowish (but also pure white), somewhat smaller than in the fir mistletoe. But, as in this case, is longer than broad, oval or oviform, with strongly arched lateral surfaces. Leaves narrower than in the fir and hardwood mistletoe. Mostly on *Pinus silvestris* and *P. nigra*, under favorable conditions also on *P. montana*, more rarely on the spruce, *Picea excelea*. By artificial infection the race could also be drawn on *Pinus resinosa*, *P. Banksiana*, *P. montana*, *P. nigra*, *P. cembra*, *Cedrus atlantica*, *Larix leptolepis*, and even twice on *Salix caprea*; Otherwise, hardwood infections have always failed.

Most recently, a remedy prepared from the berries mistletoe drop "Evisco" is recommended against arteriosclerosis.

Subsection 2. *Uniflorae* Engl., In E. P. Nachr. I. (1897) 140 (*Aspidixia* sect., *Euaspidixia* van Tiegh., In Bull. Soc. Bot., France, XLIII [1896], 192). – Flowers single. – *V. minimum* Harv. <sup>7)</sup>, small, only a few centimeters high, on succulent, cactus-like euphorbias, in the Cape (Fig. *V. bivalve* (van Tiegh.) Engl., Also in the Cape; *V. myriophlebium* Bak. on Madagascar.

Sect. *Botryoviscum* Engl. In E. P. Nachr. I. (1897) 140. – Forked branching not predominant. Flowers in triads or individually. Leaves deciduous or scaly.

Subsection 1. *Ploionixia* (*Ploionuxia*) Korth. in Verh. batav. Gen. XVII. (1839) 254. – Flowers in triads, more rarely single. Leaves all deciduous or only some foliage leaves on the lower part of the plant,

Important literature: Sprague in Fl. trop. Afr. VI. 1. (1913) 394-404.

§ 1. *Isanthemum* van Tiegh. In Bull. Soc. Bot. France XLIII. (1896) 190. – Flowers of the triads or single flowers monoecious. – A. Flowers in triads or sometimes also pentads: *V. triflorum* DC. On Reunion and Mauritius; *V. nervosum* Hochst., with short-petioled, ovoid, 3-5-nerved leaves and 1-2 short-peduncled floral triads in the axils of the leaves, from Abyssinia, through East and Central Africa to the Congo region; *V. congolense* De Wild. (*V. Staudtii* Engl.), *V. Zenkeri* Engl. and *V. grandifolium* Engl. In Cameroon, the former also in the Congo region; *V. Fischeri* Engl., on various host plants, also on *Loranthus*, but never on *Juniperus procera*, in East Africa; *V. orbiculatum* Wight and *V. verruculosum* Wight in East India; *V. cuneifolium*

Bak., *V. vacciniifolium* Bak., *V. rhytidocarpum* Bak. Among others, in Madagascar. - B. With single flowers: *V. ramosissimum* Wall., with very long and thin branches, few stems, inverted, ovoid or linear-elongated leaves or completely without such, with small, sessile flowers and almost globular false-fruits, on *Rhododendron*. Among others, in the Hindus and Ceylon; *V. Grandidieri* van Tiegh., only with foliage leaves, in Madagascar.

§ 2. *Mesandrum* van Tiegh. In Bull. Soc. Bot. France XLIII. (1896) 190. - Flowers of the triads unequal, in the center a ♂ flower. - *V. capitellatum* Smith, low, with short, terete branches, short-stemmed, obovoid or almost circular, three-nerved leaves and stalked inflorescences, often parasitic on other Loranthaceae, in India and Ceylon; *V. tuberculatum* A. Rich., with a tiny false-fruit, on *Gymnosporia senegalensis*, *Rhus glaucescens*, *Terminalia Brownei*, *Ehretia silvatica*, *Tarchonanthus*, and others, from Eritrea and Abyssinia through East and Central Africa to Angola and Rhodesia; *V. rotundifolium* Thunb., with broadly ovate or almost roundish, sessile, gray-green leaves, and small, sessile ♂ or pedicellate ♀ floral triads, in Cape and South West Africa; *V. pauciflorum* Thunb., with larger, thicker and more elongated leaves, on *Euclea* and *Rhus*, in the Cape; *V. tricostatum* E. Mey., with oblong-ovoid or oblong-lanceolate, gray-green leaves, in the Cape. Herero and Namaqualand; *V. obovatum* Harv., with obovoid leaves, in Natal.

§ 3. *Mesogynum* van Tiegh. In Bull. Soc. Bot. France XLIII. (1896) 190. - Flowers of the triads unequal, in the center a ♀ flower. - *V. orientale* Willd., daintier, rather polymorphic shrub with stems, obovate to lanceolate, obtuse leaves, monoecious, pedicellate or sessile flower buds, and initially warty, ultimately smooth globular to broadly ellipsoidal false-fruits, from India over to the Malaysian peninsula, Java, Sumatra, Borneo, Celebes, Philippines, Sunda Islands to New Guinea and Northern Australia; *V. monoicum* Roxb., with acute leaves and oblong false-fruits, of similar distribution as the preceding species; *V. multinerve* Hayata, on Formosa; *V. Wrayi* Gamble, with obovate to spatulate leaves and spherical, smooth false-fruits, even when young, on the Malay Peninsula and Borneo.

Subsekt. 2. *Aspidixia* (*Aspiduxia*) Korth. In Verh. batav. Gen. XVII. (1839) 258 (*Aspidixia* van Tiegh, Bull. Soc., Bot., France, XLIII, 1896, 191, pr. p.; *Aspidixia* sect. *Dipleura* van Tiegh, l. c. 192, *Aspidixia* sect. *Monopleura* van Tiegh, l. c. 193). - Flowers mostly single, rarely in triads.

Leaves all scaly. - A. Branches cylindrical: *V. Schimperi* Engl. In Abyssinia and Eritrea; *V. Hildebrandti*, Engl., *V. tenue* Eng. and *V. verrucosum* Harv., in East Africa; *V. robustum* Eckl. & Zeyh., with terete, sulfur-yellow branches and small flowers standing mostly pairwise, in Cape and Namaqualand; *V. capense* Thunb., with thinner branches and usually flowers standing singly, on *Acacia*, *Rhus* and others, in the Damara and Namaqualand, as well as in the Cape. see. Marloth, Fl. South Africa I. (1913) 167 Pl. 39A (on *Zizyphus mucronata*); *V. Crassulae* Eckl. & Zeyh., with short internodes and almost circular, very thick and fleshy little leaves, as well as elongated, red false-fruits, on succulent euphorbias and shrubby *Crassula* species, also in the Cape; *V. Menyharti* Engl. & Schinz, in the lower Zambezi country and in Rhodesia. - B. Branches quadrangular: *V. angulatum* Heyne, with thin, long branches and very small flowers, singly or in triads sitting in the leaf axils, in the Indian subcontinent. - C. Twigs hexagonal: *V. trachycarpum* Bak., on Madagascar. - D. Lower branches cylindrical, upper flat: *V. semiplanum* van Tiegh., in Eritrea; several species described by Hayata in Formosa. - E. branches flat, the flat internodes decussate: *V. articulatum* Burm. <sup>8)</sup> (= *V. moniliforme* Blume), with widened internodes contracted at the nodes, very small smooth flowers arranged in axillary triads,



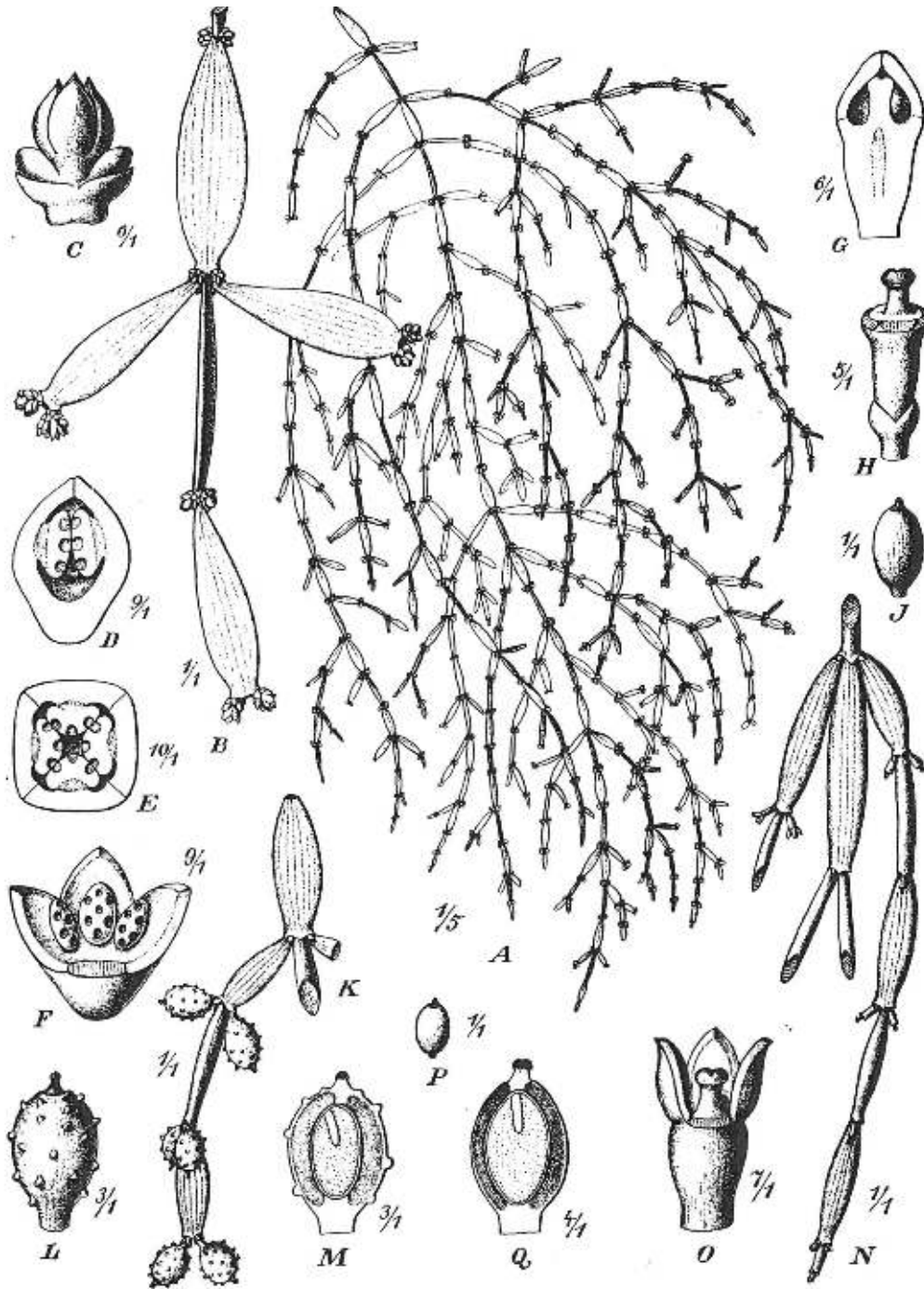


Fig. 102. AJ *Viscum Engleri* Van Tiegh. (*V. elegans* Engl.). A piece of a hanging branch,  $\frac{1}{5}$  nat. size.; B Branch, nat. size.; C Triad of ♂ flowers; D Longitudinal section through a ♂ flower and the anthers; E cross-section through the same; F ♂ flower after removal of a tepal; G ♀ flower in longitudinal section; H ♀ Flower after removal of the tepals; J false-fruit ("berry"). – K-M *Viscum shirensense* Sprague. K. Piece of a branch of the ♀ plant; L mature false-fruit; M longitudinal section of the same. – N-Q *Viscum anceps* E. Mey. N piece of a branch of the ♀ plant; O ♀ flower after removal of a tepal; P false-fruit, Q the same in longitudinal section. – From Engler, Pflanzenwelt Afrikas III. 1, 108 Fig. 71.

globular, yellow to white false-fruits, in subtropical Himalayas, in Khasia, lower India, on the Malay Peninsula, Sumatra, Borneo, Java, Celebes, the Moluccas, Timor and in tropical Australia; *V. anceps* E. Mey., closely related to the preceding species, but differing by warty false-fruits, in South Africa and on Madagascar; *V. Engleri* van Tiegh. (= *V. elegans* Engl.) (Fig. 102A-J), up to two meters in length, from the trees, especially from *Albizzia fastigiata* and *Acacia* species, forming drooping bushes, in East Africa, from Uzambara to Uhehe; *V. shirensis* Sprague (102 K-M), in northern Nyassaland.

Important Literature: Sprague in Fl. trop. Afr. VI. 1. (1913) 394-395, 404-411; in Fl. capens. V. 2. (1915) 121; Lecomte, Loranth., in Catal. Pl. Madagascar (1932) 9.

Addendum: In the important literature, p. 99, we must also mention the following: G. Cufodontis in Archivio Bot. X. (1934) estr. 40 (Arten von Costarica), - G.O.A. Malme in Arkiv för Bot. XXVI. A. Nr. 9 (1935) 5, 25 (Verbreitung der Arten in Süd- und Mittelbrasilien). (Distribution of Species in Southern and Central Brazil).

### Genera of Uncertain Position.

*Hemitria* Rafinesque in Ann. gén. sc. phys. VI. (1820) 79. – *H. uniflora* Raf. – unknown home; according to index Kewensis.

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### Footnotes

1. On the occurrence of the species of *Altingia* in Java, cf. W. Docters van Leeuwen in Trop. Natuur XXI. (1932) 53, XXII. (1933) 112.
2. For this species cf. Fawcett and Rendle, Fl. Jamaica III. 1. (1914) 96, under *Ph. verticillatum* comb. nov. (*Viscum verticillatum* L., 1763, excl. Syn. Sloane), with var. *domingense* (Desv.) comb. nov. (= *Ph. domingense* [Desv.] Trelease).
3. See also Ascherson & Graebner, Synops. mitteleurop. Fl. IV. (1912) 668.
4. On the isolated occurrence in the Azores (Pico, 800-1300 m) see Guppy, Plants, seeds and currents in the West Indies and Azores (1917) 426; On the occurrence in the West, Himalaya (Lahaul) Brandis, Indian trees (1921) 553.
5. *Arceuthobium Dacrydii* Ridl. = *Korthalsella Dacrydii* (Ridl.) Danser. - See van Steenis in Trop. Natuur XX. (1931) 168.
6. Plinius (Hist. nat. XVI, 93, ed. Tauchnitz, III. [1830] 113): Visci tria genera. Namque in abiet ac larice stelin dicit Euboea nasci, hyphear Arcadia. *Viscum* autem in quercu, robore, pruno silvestri, terebintho, nec aliis arboribus adnasci, plerique. Copiosissimum in quercu, quod dryos hyphear vocant. - στελής of Theophrastus is interpreted as *Loranthus europaeus*; K. Sprengel, Theophrasts Naturgesch. Gewächse II. (1822) 117.
7. See Marloth, Fl. S. Afr. 1. (1913) 167 pl. 88 B.
8. Seedlings of *V. articulatum*: Docters van Leeuwen in Trop. Natuur XX. (1931) 116, Figs. 10, 11.