

CENTROLEPIDACEAE (Ding Hou, Leyden)

Plants small, annual or perennial, densely tufted, often of moss-like habit, some species forming cushions. *Leaves* radical or densely distichous on short, branched stems, narrowly linear, canaliculate, provided with a broadly membranous, sometimes apically auricled, mostly 1-nerved sheath. *Scape* simple, accrescent, the base surrounded with 1 to 3 sheath-like, hyaline, reduced leaves. *Inflorescences* terminal, head- or spikelet-like, 2-3-bracteate (in some extra-Mal. genera ∞ -bracteate); bracts distichous, each enclosing 1 to 11 flowers. *Flowers* hermaphrodite or unisexual, usually subtended by 1 to 3 hyaline glumes; sometimes a few barren and reduced. *Perianth* none. *Stamens* 1 to 2; filament(s) filiform; anther(s) dorsifixed, versatile, oblong or linear, 1- to 2-celled, introrse, lengthwise dehiscent. *Carpels* 1 to many, superior, connate or free, collateral or superposed in 1 or 2 rows; styles free or connate at the base; stigmas linear and simple. *Ovule* solitary and pendulous from the apex in each carpel, orthotropous. *Fruiting carpels* resembling enlarged carpels, in the case of 2 collateral carpels resembling an ovary (fruit); pericarp membranous; carpels or cells dehiscent lengthwise with a lateral (outward) slit or more rarely with 2 loculicidal valves. *Seed* minute, ovoid or ellipsoid, areolate, with farinaceous albumen.

Distribution. Genera 5, with about 30 *spp.*, chiefly distributed in Australia and New Zealand, a few in *Malaysia* (2 genera with 4 species), southeastern Asia and South America. Fig. 2.

Ecology. Partly eurytherm, partly microtherm plants, in *Malaysia* one species (expected) in the lowlands, the other three representatives only in the subalpine to alpine zone between 2100 and 4000 m, on rocks, in bogs, on heaths, and other non-forested country, mostly gregarious.

Notes. The family *Centrolepidaceae* is a typical element of the Australasian region, centering in South Australia and Tasmania, with one genus shared by Papua, Tasmania, New Zealand, and Fuegia (*Gaimardia*). Most genera consist only of one or a few species; the largest genus *Centrolepis* extends from New Zealand to Tonkin and Hainan.

The 'radiating' of several Australasian-Subantarctic genera through *Malaysia* to the SE. parts of the Asiatic continent, where they are then represented by one or a few stray species, and these mostly in the mountains, as shown by *Centrolepis*, occurs in several other genera, viz *Corybas*, *Dacrydium*, *Drosera* subg. *Ergaleium* & *Polypeltes*, *Halorrhagis*, *Lagenophora*, *Leptocarpus*, *Microtis*, *Myoporum*, *Nertera*, *Pratia*, *Styliidium*, and others.

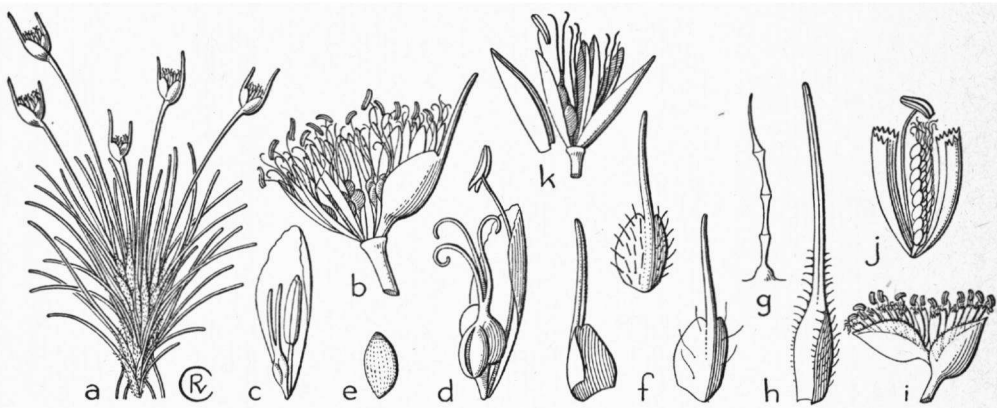


Fig. 1. *Centrolepis* species in *Malaysia*.—*C. fascicularis* LABILL. a. Habit, nat. size, b. head with outer bract removed, $\times 3$, c. young flower, $\times 7$, d. deflorate flower, $\times 7$, e. seed, $\times 10$, f. three outer bracts, showing the variation in hairiness in one collection, g. single hair, $\times 25$, h. leaf, $\times 2$.—*C. banksii* (R.Br.) R. & S. i. Head, $\times 3$, j. flower, $\times 7$.—*C. philippinensis* MERR. k. Head with outer bract removed, $\times 3$ (a-h VAN STEENIS 9072, i-j BALANSA 177, k MERRILL 6160).

The taxonomic relations of the *Centrolepidaceae* are generally accepted with the *Restionaceae* and *Eriocaulonaceae*, from both of which they differ by the absence of a perianth. HUTCHINSON *l.c.* inserts them in his *Juncuales* with *Thurniaceae*, *Juncaceae*, and *Restionaceae*. This is also corroborated by the structure of the pollen, according to ERDTMAN (Pollen Morph. 1952, 105), who finds similarity with *Restionaceae*.

The morphology of the inflorescence is a particularly interesting one, specially that of the gynaecium which has in the *Centrolepis* species with many carpels a unique structure of superposed ovaries (fig. 1j). Taking into consideration the remarkably reduced inflorescence, one wonders whether what is accepted generally as a 'flower' is not really itself a reduced spikelet of naked ♂ and ♀ flowers, the 2 rows of carpels imitating the 2 rows of flowers within each bract, and repeating a similar 'contraction'. This would then account for the superposed position of the carpels.

HIERONYMUS accepted the flowers contained in each bract to represent a cincinnus, accepting a cymose inflorescences type, but BENTHAM assumed a secund (*i.e.* racemose) type of inflorescence.

There is a remarkable tendency in *Centrolepis* to unite the carpels and to reduce their numbers and also to reduce the number of flowers in each bract. Accepting this tendency, the *Centrolepis* species with many flowers in each bract and many carpels in each flower would morphologically represent the most primitive condition, and *Gaimardia* the most reduced, derived state.

Within the general scheme there seems to be variability in the inflorescences of a single plant. The number of what is here called 'glumes' (by others 'scales') may vary behind (below) each flower (1-3), and there may be one before (above) the flower. The outermost flower may be ♀ by absence of the stamen, or ♂ by absence of the carpels, or it may be barren and represented by a glume only. This variation contributes to the fact that the distinction of the genera is less satisfactory than desirable for which I refer to the discussion under *Gaimardia*. *cf.* fig. 6.

Sincere thanks are due to Dr TURRILL for entrusting me with the Papuan material which he had formerly under study and to Mr J. H. KERN for assistance in drawing the diagrams.

KEY TO THE GENERA

1. Stamen 1. Carpels 2 to 20, free or united and superposed in 1-2 rows. Bracts 2. Annual or perennial. 1. *Centrolepis*
1. Stamens 2. Carpels 2, connate and collateral. Bracts (2)-3. Perennial 2. *Gaimardia*

1. CENTROLEPIS

LABILL. Nov. Holl. Pl. 1 (1804) 7, t. 1; BENTH. Fl. Austr. 7 (1878) 202.—*Devauxia* R.BR. Prod. (1810) 253.—*Alepyrum* R.BR. *l.c.*—*Alepyrum* HIERON. Abh. Naturf. Ges. Halle 12 (1873) 217, *non* R.BR.—*Pseudalepyrum* DANDY, J. Bot. 70 (1932) 32.—Fig. 1-5.

Plants annual or perennial. *Leaves* radical or distichous, eligular. *Inflorescences* a head consisting of 2 opposite, inequilateral, 1-11-flowered bracts. *Flowers* hermaphrodite, sessile, if several, alternate and inserted in 1 or 2 rows, flowering in a centrifugal sequence; each flower consisting of 1-3 glumes, 1 stamen and 2-20 carpels. *Glumes* 1 to 3, hyaline, unequal in length, erose at the apex, monostichous and dorsal, very rarely opposite (ventral and dorsal). *Stamens* 1, dorsal (in the median) between the carpels and the glumes; anther 1-celled, dorsifixed near the base. *Carpels* 2 to 20 to a carpophore, sac-like, superposed in 1 or 2 rows, free or connate, the pairs transversal; style one to each carpel, terminal, free or united at the base, twisted or curled at the tips, adaxial, apical part papillose, stigmatic. *Fruiting carpels* dehiscent with a lengthwise, lateral (outward) slit.

Distr. About 20 *spp.* chiefly distributed in Australia, Tasmania, and New Zealand, through *Malaysia* (New Guinea, Celebes, the Philippines, N. Borneo, and N. Sumatra) to SE. Asia (NE. Siam, Viet Nam, and Hainan).—Fig. 2.

Ecol. Lowland up to c. 4000 m, in marshy places, humid sandy grounds, open heaths, and on rocks, in *Malaysia* exclusively above 2100 m.

I have examined and photographed the two mountain species in North Sumatra and Central Celebes in the field and have observed that both start as small pin-cushions which may occur scattered, but in other cases fuse together in a cushion or turf, which may be later invaded by seedlings of other plants (fig. 3-4). Isolated tufts will grow and increase in size but in reaching a diameter over c. 10-20 cm, the central part of the cushion will decay (or mummify) into a bare hole, thus bringing about the remarkable

ring-shaped cushion of which a specimen is shown in fig. 5. I have observed the same phenomenon in several other high mountain plants in Malaysia, notably *Oreobolus* and *Monostachya*, with which *Centrolepis* is often associated in Malaysia. It occurs also in other caespitose plants in Europe and is obviously due to the polarity of the stems causing centrifugal growth with natural decay of the older, central (distal) parts. This puts the cause of the formation of the rings on the same level with those popularly known as 'fairy circles' in toadstools, rather than assuming that the central part of the plant decays because in this portion either necessary trace minerals are exhausted or the decayed matter contains self-poisoning substances. Field experiments should be made to ascertain the non-poisonous nature of the bare central part in the rings.—VAN STEENIS.

Notes. In 1810 R. BROWN (Prod. p. 253) established the genus *Alepyrum* with three species and stated that it differed from *Devauxia* (= *Centrolepis*) only by absence of a glume and a uniflorous spathe (here called bract). He already expressed doubt whether it deserved generic status ("an ideo separatae?"). HOOKER f. in 1853 (Fl. Nov. Zel. 1, p. 268) and 1857 (Fl. Tasm. 2, p. 77-78) described four more species in *Alepyrum*.

In 1873 HIERONYMUS, in his monograph of *Centrolepidaceae* (Abh. Naturf. Ges. Halle 12, p. 209, 217), reduced the three original species of *Alepyrum* to *Centrolepis* retaining in *Alepyrum* only *A. pallidum* HOOK. f., which had originally been described as *Gaimardia pallida* HOOK. f. (Fl. Antarct. 1847, 86); the other *Alepyrums* described by HOOKER f. were referred to other genera, two of them to *Centrolepis* and one to *Aphelia*.

In the 2nd edition of the 'Pflanzenfamilien' (vol. 15a, 1930, 27-33) GILG-BENEDICT, following HIERONYMUS, chiefly used vegetative characters to separate *Centrolepis* LABILL. from *Alepyrum* (non R.BR.) HIERON. and *Gaimardia* GAUD.: *Centrolepis* was defined as annual, *Alepyrum* and *Gaimardia* as perennial.

HIERONYMUS's use of the name *Alepyrum* for a monotypic genus based on HOOKER's *A. pallidum* is illegitimate and DANDY (J. Bot. 70, 1932, 330-331) proposed a new name, *Pseudalepyrum*, for *Alepyrum sensu* HIERONYMUS, including 4 species and 2 varieties.

In his 'The Families of Flowering Plants' (vol. 2, 1934, 187-190) HUTCHINSON essentially followed the classification of HIERONYMUS and GILG-BENEDICT, but did not mention *Pseudalepyrum* DANDY.

The floral characters of *Alepyrum pallidum* HOOK. f., the type of *Pseudalepyrum* DANDY, leave no doubt, however, of its congenericity with *Centrolepis* and CHEESEMAN has rightly transferred it to the latter genus (Man. New Zeal. Fl. 1906, 757). It is one of the perennial species.

I have further checked the types of original descriptions and drawings of all other species assigned to *Pseudalepyrum* and have found that they all clearly belong to *Centrolepis*.

No subdivision has been proposed for *Centrolepis*. The species have mostly been claimed to be annual, an opinion still maintained by GILG-BENEDICT (l.c. 31 in clav.) and by HUTCHINSON (Fam. Fl. Pl. 2, 1934, 187), but it appears that whereas *C. banksii* is doubtless annual and unbranched, the two other species recorded here from Malaysia are distinctly perennial, strongly branched cushion plants (fig. 3-5).

The morphological resemblance of the species, both in vegetative and floral structure, is so obvious that this single vegetative character does not deserve generic evaluation. It is recommended to a future monographer of the genus to examine whether it might conveniently serve for a natural subdivision of the genus.

KEY TO THE SPECIES

1. Leaves radical. Glumes usually 2 in each flower, opposite. Carpels 10-20, distinct, superposed in two rows. Styles free, unequal in length. Annual 1. *C. banksii*
1. Leaves distichous on a short but distinct and usually branched stem. Glumes usually 1, rarely 2 or 3 in each flower, on one side. Carpels 2 or 3, united, superposed in one row. Styles united at the base, equal in length. Perennial.
 2. Inner bract short-stalked, outer one with a distinct awn 2-5 mm long 2. *C. fascicularis*
 2. Inner bract sessile, outer one obtuse or rarely with an obscure awn up to 1½ mm long. 3. *C. philippinensis*

1. *Centrolepis banksii* (R.BR.) R. & S. Syst. 1 (1817) 44; BENTH. Fl. Austr. 7 (1878) 207.—*Devauxia banksii* R.BR. Prod. 1 (1810) 253.—*C. hainanensis* MERR. & METCALF, Lingn. Sc. J. 16 (1937) 185, fig. 3.—*C. miborooides* GAGNEP. Not. Syst. 6 (1938) 177.—*C. asiatica* MERR. ex GAGNEP. Fl. Gén. I.-C. 6 (1942) 1229, t. 116 (10-15), nom. illeg.—Fig. 1i-j.

Annual, unbranched, 3-8 cm tall. Leaves 15-25 mm, tip acute; sheath 4 mm long, glabrous, ciliate. Scapes 2-7 cm. Bracts each obtuse, ciliate, and 6-11-flowered; outer bract ovate, 3-4 mm long, sessile, inner bract suborbicular, 2½-3 mm long, short-stalked. Glumes 2, opposite, oblong or

linear, 2-3 mm long. Filament 3 mm. Carpels 10-20, distinct, adnate laterally to a carpophore; styles free, unequal in length, 1-3 mm, the lower most one the longest.

Distr. Viet Nam (Balansa 177), Hainan (S.K. LAU 3348), and Australia (Northern Territory: R.L. SPECHT 411, 466; Queensland). Fig. 2.

Ecol. Lowland, in marshy ground, sandy meadows, and rice-fields after harvest.

Notes. This species has not yet been found in Malaysia but according to its geographical distribution and ecology it might well be found there locally. A similar disjunct (equiform) area is known of e.g. *Philydrum lanuginosum* B. & S. (cf. vol. 4,

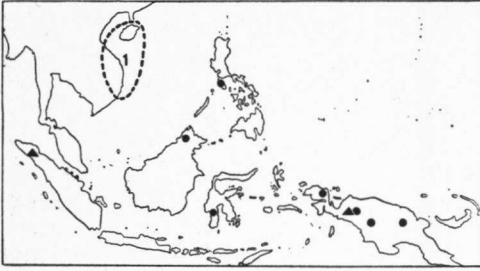


Fig. 2. Distribution of the genus *Centrolepis* in Malaysia. *C. banksii* (R. BR.) R. & S. (interrupted line in SE. Asia, also in Australia), *C. philippinensis* MERR. (dots), *C. fascicularis* LABILL. (triangles, also in Australia).

p. 5) and I can find no structural differences between this species and *C. strigosa* R. & S. l.c. p. 43, the only difference being the hispid indument of the bracts in the latter. This character has been found to vary in single collections of *C. fascicularis* and is obviously of minor value.

2. *Centrolepis fascicularis* LABILL. Nov. Holl. Pl. 1 (1804) 7, t. 1; BENTH. Fl. Austr. 7 (1878) 207.—Fig. 1a-h, 3-4, 7.

Perennial, forming pin-cushions, cushion-rings, or caespitose plants; branchlets rooting. Leaves 15-25 mm, tip acute to obtuse; sheath 4-5 mm long, slightly auriculate, ciliate, hispid on the outer surface. Scapes 4-8 mm. Bracts each 2-8-flowered, densely hispid to glabrous on the outer surfaces, ciliate, with a distinct awn 2-5 mm long; outer bract sessile, 3-4 mm long, inner bract short-stalked, 3-4 mm long. Glumes usually 1, rarely 2 or 3, on one side of the flower, obovate or oblong, 2-3 mm long. Filament 3-4 mm. Carpels 2 or 3, united; styles united at the base, c. 2½ mm.

Distr. Australia (Queensland and New South Wales: BOORMAN 203, JOHNSON & CONSTABLE 26366), in Malaysia: N. SUMATRA (Gajo Lands: Mt Ngo Lembuh: VAN STEENIS 9072 and Mt Losir: VAN STEENIS 8577) and W. New Guinea (Wissel Lakes: EYMA 4778; Mt Wilhelmina: BRASS & MEIJER DREES 9760, Lake Habbema, BRASS 9173). Fig. 2.

Ecol. Swampy ground, wet quartzite rocks, and in sandy and peaty open heaths, 1900-3460 m.

Notes. In Australian and New Guinean specimens the bracts are densely hispid, whereas those in Sumatran specimens vary from slightly hispid to entirely glabrous.

A related species *C. cambodiana* HANCE is found in the hills of Cambodia, Laos, and NE. Siam; it differs by 5-7 carpels, hairy leaves, and larger size of the plants.

3. *Centrolepis philippinensis* MERR. Philip. J. Sc. 2 (1907) Bot. 264; TURRILL, J. Linn. Soc. Bot. 42 (1914) 172; MERR. En. Philip. 1 (1923) 191; STEEN. Bull. Jard. Bot. Btzig III, 13 (1934) 182.—*C. novoguineensis* GIBBS, Arfak (1917) 99; HATUSIMA, Bot.



Fig. 3. *Centrolepis fascicularis* LABILL. on summit of Mt Losir, Gajo Lands (N. Sumatra), c. 3440 m. Tuft on stony ridge, pierced by stems of *Scirpus subcapitatus* THW. and with some seedlings of other herbs, above a creeping stem of *Lycopodium*, right a white patch of a lichen.

Mag. Tokyo 56 (1942) 422.—*C. kinabaluensis* GIBBS, op. cit. 99, footnote; MERR. En. Born. (1921) 109; STEEN. Bull. Jard. Bot. Btzig III, 13 (1934) 181.—Fig. 1k, 5.

Perennial. Pin-cushions or cushion-rings c. 3 cm



Fig. 4. *Centrolepis fascicularis* LABILL. near summit of Mt Kemiri, Gajo Lands (N. Sumatra), c. 3200 m. Solid tufted mat in moist place with juvenile rosettes of *Primula prolifera* between *Cyperaceae* behind.

high, with rooting branchlets. *Leaves* 7–15 mm long, obtuse; sheath 3–6 mm long, glabrous or nearly so, with a few hairs on the outer surfaces. *Scapes* 10–18 mm. *Bracts* 2, similar in shape, 3½–5 mm long, each 1–2-, rarely 3–4-flowered, sessile, ovate, obtuse, rarely with an obscure awn up to 1½ mm long, usually glabrous, rarely with a few hairs on the outer surfaces. *Glumes* 1, rarely 2 or 3, on one side of the flower, 2–3 mm long. *Filament* 2–4 mm long. *Carpels* usually 2, rarely 3 or 4, united; styles united at the base, 2–3 mm.

Distr. Malaysia: Borneo (Mt Kinabalu: GIBBS

4207, CLEMENS 10625, 27776 = 28940, 32415, 51404), Philippines (Mindoro, Mt Halcon: MERRILL 6160), Celebes (Latimodjong Range, Mt Rante Mario: EYMA 763, 764), New Guinea (Mt Arfak: GIBBS 5566, KANEHIRA & HATUSIMA 13645, GJELLERUP 1171; Mt Doorman: LAM 1713a, 1745; Mt Goliath: DE KOCK 27; Mt Wilhelm, HOOGLAND & PULLEN 5755). Fig. 2.

Ecol. Marshy grounds on sand, open clay slope, cracks in granite, 2100–4000 m. Often associated with other cushion or pin-cushion plants of *Oreobolus* and *Monostachya* (fig. 5).

2. GAIMARDIA

GAUD. Ann. Sc. Nat. Paris 5 (1825) 100; in Freyc. Voy. Bot. (1826) 418.

Plants perennial, densely tufted and forming cushions. *Stems* branched. *Leaves* glabrous, slightly ligular. *Inflorescences* spikelet-like, (2-)3-bracteate. Fertile *flowers* 1–2, hermaphrodite, with or without a hyaline dorsal glume, a third one represented by barren glumes or absent. *Stamens* 2, alternating with the carpels; anther versatile, 1-celled. *Carpels* 2, collaterally connate, transverse or median; styles 2,



Fig. 5. *Centrolepis philippinensis* MERR. near summit of Mt Rante Mario, Latimodjong Range (SW. peninsula of Celebes), c. 3300 m. Ring-shaped tuft (c. 15–20 cm diam.) and solid young tuft (right, dark coloured) of *Centrolepis*, left solid young tuft of *Oreobolus* (dark coloured), behind two solid pale-coloured tufts of *Monostachya oreboloides*.

united at the base, twisted or curled at the tips, adaxial apical part papillose-stigmatic. *Fruiting carpels* dehiscent along the outer side of each carpel or ovary or loculicidally dehiscent with two valves.

Distr. Two or 3 species distributed in antarctic South America, New Zealand, and Tasmania, in *Malaysia* only once found in New Guinea.

Ecol. Distinctly microtherm, in the tropics in marshy or boggy places on the high mountains.

Notes. *Gaimardia* shows a striking similarity with the perennial species of *Centrolepis*.

If only the type species, *G. australis* GAUD. is considered the floral differences are obvious *viz* in *Gaimardia* 3 bracts, solitary flowers (only the terminal one fertile), the pair of carpels in the median line, 2 anthers in the transverse line (fig. 6g), carpels connate and collateral forming a true ovary, dehiscent with 2 valves.

These characters do not all hold for *G. setacea*, however, in which the (1–)2 basal flowers are fertile and the upper one is generally reduced or barren, the 2 carpels arranged in the transverse line, and the 2 stamens nearly in the median line (the anterior one slightly obliquely inserted) (fig. 6b–f).

Moreover, as alluded to under *Centrolepis*, individual variations occur in a single specimen: in *G. australis* the reduced lowest flower may be absent or represented by 1 or by 2 glumes, in the Papuan material the lowest flower may have a dorsal glume or not. Slight variations occur also in the New Zealand material of *G. setacea*; see the diagrams fig. 6b–f. Besides the Papuan plant does not well show 2 fruit valves but the carpels dehisce with a lateral (outward) slit as in *Centrolepis*.

The Papuan plant thus breaks down several differential characters, which possibly indicates its ancient affinity.

The only generic differences now left between *Gaimardia* and *Centrolepis* have been mentioned in the key to the genera and consist principally in the occurrence in *Gaimardia* of 2–3 bracts, 2 stamens in each flower and 2 connate, collateral carpels forming an ovary. Whether this is sufficient for a distinct generic status must be left to a future monographer of the family.

A third species, *G. fitzgeraldi* F.v.M. & RODWAY (in Rodway, Fl. Tasm. 1903, 233, pl.) has been described from Tasmania. The type specimen is neither at Kew nor in the University Herbarium at

Hobart. I have seen a sheet at Kew, without collector's name and field note, which has been authenticated by RODWAY. I have also received fragments collected in Tasmania and kindly sent by Miss W. M. CURTIS, which agree with the description. *G. fitzgeraldi* is very similar to *G. setacea* in floral parts, but differs from the latter vegetatively in that the setae are longer and twisted at the tip; besides the leaf sheath is densely woolly.

A fourth species has been described by PAX from Bolivia, viz *G. boliviana* PAX (in Fedde, Rep. 5, 1908, 225), based on BUCHTIEN 836. The type of it could not be located, but from the Hamburg Herbarium I obtained a later specimen from the same locality of the same collector BUCHTIEN 9359 (also represented at Kew & Stockholm) which proved to represent the juncaceous *Distichia muscoides* NEES & MEYEN! According to Dr ASPLUND (Stockholm) there is no doubt whatsoever that the type also represents this juncaceous plant, which agrees with the inadequate original description by PAX. Dr ASPLUND told us that there are many errors in PAX's paper and that all species and genera described by him there were assigned to either wrong genera and families respectively, except for the two *Acalyphas* (*sic*).

KEY TO THE SPECIES

1. Inflorescence with (1-)2(-3) flowers in spaced bracts. Apex of the leaves acicular. Carpels transverse; dorsal stamen in the median line, anterior stamen inserted obliquely. Axis flattened. Spikelet caducous above the lowest glume. Fruit opening with 2 lateral slits. Fig. 6a-f . . . 1. *G. setacea*
1. Inflorescence with a single terminal flower above 2 barren ones. Apex of the leaves blunt. Carpels in the median line; stamens transversely inserted. Axis \pm terete, faintly angular. Spikelet persistent. Fruit 2-valved. Fig. 6g. Fuegia and New Zealand *G. australis* GAUD.

1. *Gaimardia setacea* HOOK. f. Fl. Nov. Zel. 1 (1853) 267; Handb. N.Z. Fl. (1867) 295; CHEESEM. Man. N.Z. Fl. (1906) 758.—*G. sp.*, cf. TURRILL ex GIBBS, J. Ecol. 8 (1921) 104.—Fig. 6.

Plant 6-8 cm tall. Leaves 10-18 mm long, the apex acicular and transparent about $1\frac{1}{2}$ -1 mm long; sheath glabrous 4-7 mm long; ligule obtuse c. 1 mm long. Scape 1-2 $\frac{1}{2}$ cm. Bracts convolute, appressed, each enclosing one flower, sometimes the upper one empty or with an imperfect flower. Lower glume 3 mm long, second glume c. 2 $\frac{1}{2}$ -3 mm, third glume c. 1 mm, internodes of the rhachis 1 $\frac{1}{2}$ -2 mm. Fruiting carpels 2 or 1 by abortion, longitudinally dehiscent along the outside of the carpel.

Distr. New Zealand (Port Preservation, LYALL *s.n.*, K, authenticated sheet; Wellington, W. R. B. OLIVER *s.n.*, K), Tasmania (Mt Field National Park, Miss W. M. CURTIS *s.n.*, Hobart, L), in *Malaysia*: Mt Wichmann, S of Mt Wilhelmna, PULLE 1035).

Ecol. In boggy places forming large green cushions, 3000 m, fl. Febr. 1913.

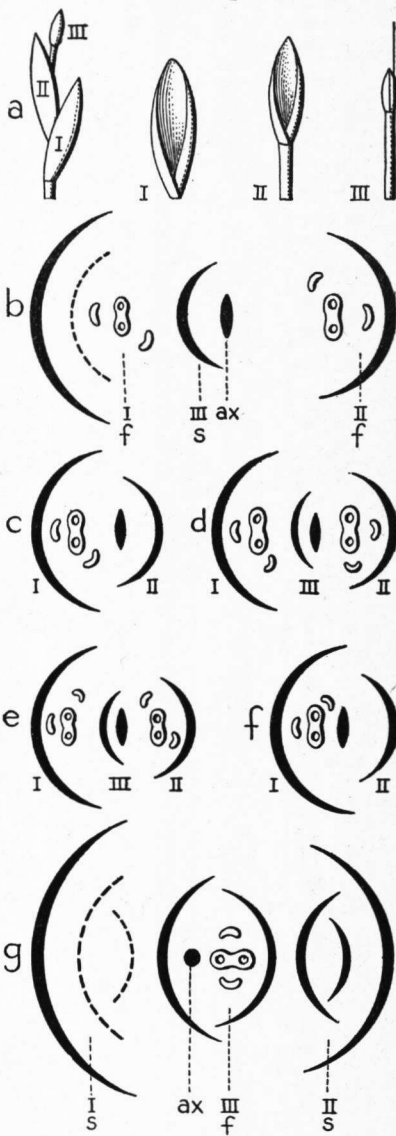


Fig. 6. Diagrams of *Gaimardia* species.—a-f. *G. setacea* HOOK. f.—g. *G. australis* GAUD.—In all diagrams i, ii, and iii indicate first, second, and third glume respectively: f = fertile, s = sterile; ax means axis (black); a flower consists of a 2-celled ovary and 2 stamens; glumes which may be either present or absent drawn in dotted lines (a-b PULLE 1035 from Papua, c-d two different heads of LYALL *s.n.*, type (?) from New Zealand, e-f two different heads from OLIVER *s.n.* from New Zealand, g. VERVOORT 363 from Chile).

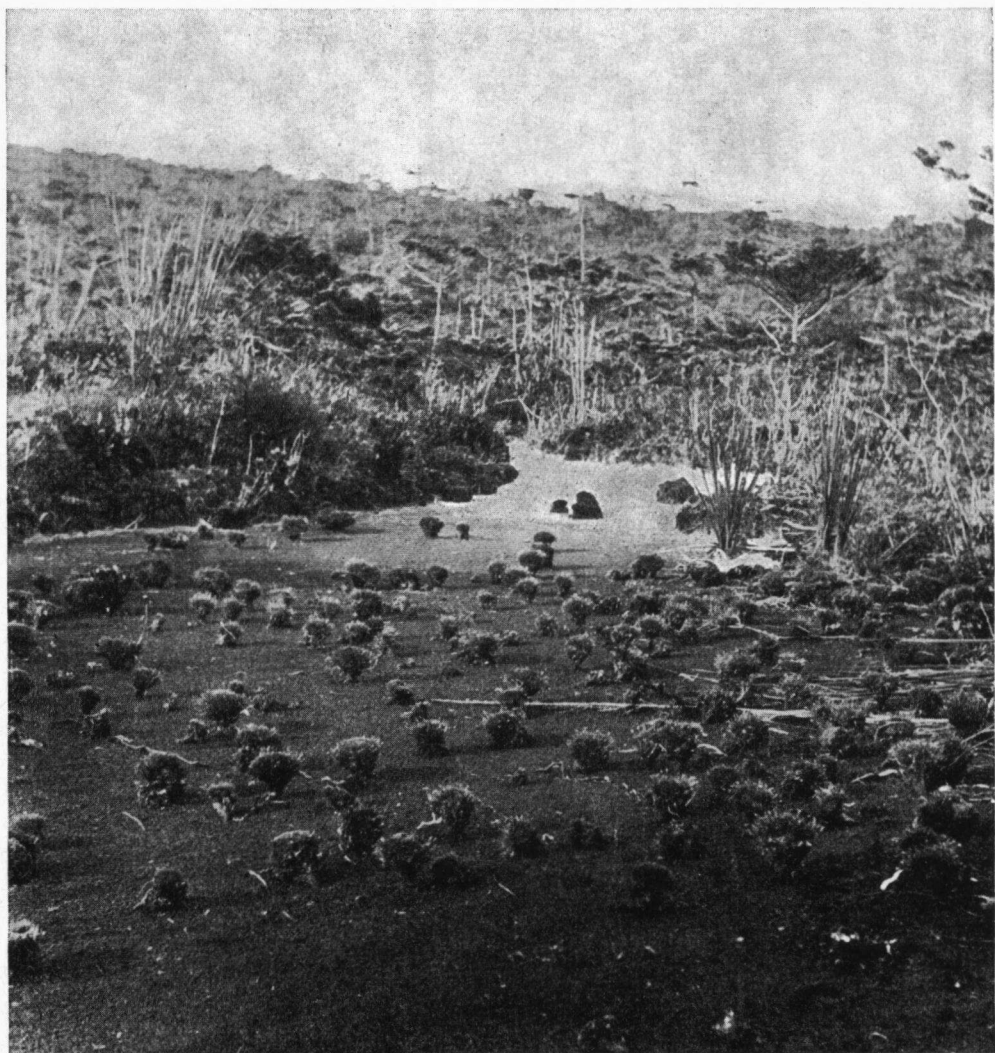


Fig. 7. *Centrolepis fascicularis* LABILL. on podsolized white quartzsand covered by a thin layer of brown mud with small grains on the surface, near Egogitugapa, above Kugapa, near Lake Paniai (Wisselmeren area, New Guinea), c. 1900 m. Obviously the toadstool-like tufts, c. 10 cm high, have originated from cushions by surface erosion through which the tuft became stalked; EYMA records cushions and fairy rings from the same locality. On the 'padang soil' associates were *Xyris*, *Burmannia*, *Gahnia*, *Lycopodium*, *Styphelia*, *Vaccinium*, *Rhododendron*, *Sphagnum*, and lichens; the surrounding low forest consists of *Libocedrus* and another conifer, in which large *Myrmecodia*. Photogr. EYMA n. 1095, March 29, 1939 (Herb. EYMA 4778).