

A REVIEW OF THE MALESIAN SPECIES OF GERANIUM L. (GERANIACEAE)

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SUMMARY

In the Flora Malesiana area 15 species of *Geranium* can be recognized: the Asian *G. nepalense* in N. Sumatra, the Australian *G. homeanum* in E. Java and Timor, and 13 endemics, occurring in Java (1), S.W. Celebes (1), and New Guinea (11). Of these latter 10 are newly described here.

INTRODUCTION

The last revision of *Geranium* for the Flora Malesiana area was given by Carolin (1964; 1965). He recognized only three taxa: *G. homeanum* Turcz., *G. potentilloides* DC. var. *potentilloides*, and *G. monticola* Ridl. For his work only very little material was then available, so his caution in the recognition of more taxa, which later might prove to be mere extremes of a range of variation, is very laudable.

During two expeditions to Papua New Guinea*) the senior author had the opportunity to see and collect several forms of *Geranium* in the field, from which it became clear that these could not very well be fitted into Carolin's concepts. Some collections were shown to the latter during a visit to Leiden and he then agreed that undescribed taxa were concerned. A tentative survey of the material in Leiden, undertaken a few years later, showed that not only these, but many more forms could be discerned in New Guinea. Accumulation of additional collections proved them to be quite constant.

The junior author during an advanced course in Angiosperm taxonomy undertook to study the extra-New Guinea material for Malesia, which resulted in the distinction of four species, all different from the New Guinea ones.

The evaluation of the taxonomic status of these taxa has posed a bit of a problem, which we have not been able to solve entirely to our satisfaction. A recent revision of the European species (Tokarsky, 1972) showed that these can not only be recognized by their leaves and flowers, but especially by the differ-

*) Suckling Expedition, 1972, with grants from The Netherlands Foundation for the Advancement of Tropical Research (WOTRO, grant no. W 85—61), the Royal Dutch Academy of Sciences and its Melchior Treub Fund, the Rumphius Fund of the Gresshoff Foundation of the Royal Institute for the Tropics, the Company for Scientific Research in the Tropics (Treub Maatschappij), and the B.P. Bishop Museum, Honolulu; Star Mts. Expedition, 1975, with a grant from WOTRO (W 85—99); both joint ventures of the Rijksherbarium and the Division of Botany, Lae.

ences in their fruits and seeds. In the latter characters the taxa in Malesia are virtually identical, only *G. homeanum* has slightly more distinct and irregular alveolae on the seed coat. Solely on these criteria one would be inclined to give only an infra-specific status to the taxa. On the other hand the related taxa from Asia, Australia, and New Zealand, similar in these features, have been accorded specific rank (Carolin, 1965; Schönbeck-Temesy, 1970). This, together with field observations made by several collectors, has induced us to regard the taxa as species. Some support for this decision is, moreover, given by the only two chromosome counts available for the area: $2n=36$ for *G. niuginiense* Veldk. and $2n=56$ for *G. hyperacrium* Veldk. (Borgmann, 1964, sub *G. potentilloides* DC.). Apparently this is the first record of $2n=36$ for *Geranium*, while $2n=18$ has been recorded for *G. columbinum* Linné (Fedorov, 1969, and subsequent reports in Taxon). From Borgmann's remarks it would seem that this count is trustworthy. A common number is $2n=28$, which has also been reported for *G. nepalense* Sweet in India, while $2n=56$ is also not rare.

A useful character for the distinction of the species is provided by the depth of the incision of the leaves. Rather vague terms as 'partite' or '-fid' seemed insufficient, therefore decimals have been given, also. These can be computed by measuring the length of the middle segment from the tip of the terminal gland to the insertion of the petiole (a), and from there the distance to the sinus between the middle segment and its neighbour (b). The measure of incision is then $(1-b/a)$. Sepals have always been measured inclusive the terminal mucro, which latter appeared to be too variable for use. The sepals may enlarge considerably in fruit.

ACKNOWLEDGEMENTS

The Directors and Keepers of the following Herbaria are thanked for making their collections available for study: LAE and U (visited by JFV), A, B, BM, BR, G, K, PUR, and, of course, L.

LITERATURE

- BORGSMANN, E. 1964. Anteil der Polyploidien in der Flora des Bismarck-gebirges von Ostneuguinea. Zeitschr. Bot. 52: 118—172.
 CAROLIN, R. C. 1964. Geraniaceae. Flora Malesiana I, 6: 445—449. Groningen.
 ——. 1965. The genus *Geranium* in the South Western Pacific area. Proc. Linn. Soc. N. S. W. 89: 326—361.
 FEDOROV, A. (Edit.) 1969. Chromosome numbers of flowering plants: 331—332. Leningrad.
 SCHÖNBECK-TEMESY, E. 1970. Geraniaceae. Flora Iranica 69: 1—67. Graz.
 TOKARSKI, M. 1972. Morphological and taxonomical analysis of fruits and seeds of the European and Caucasian species of the genus *Geranium* L. Mon. Bot. 36: 5—115.

KEY TO THE SPECIES

- 1a. Leaves (sub)compound, middle 'leaflet' free for at least 0.9th of its length 2
 b. Leaves palmatifid to -partite, middle segment free for at most 0.9th of its length, usually much less 3
 2a. 'Leaflets' repeatedly 2—3-partite with \pm linear-lanceolate overlapping seg-

- ments; the middle 0.2—0.3 mm wide at base. *Suckling* 9. **G. leptodactylon**
- b. 'Leaflets' 3-lobed to -fid, segments broader, not overlapping, the middle 0.3—1 mm wide at base. *Star Mts., Saruwaket, Owen Stanleys.*
- 13. G. subcompositum**
- 3a. Lower surface of the leaves very densely grey to silvery hairy to silvery brown when dried, this indument obscuring the nervation. *Carstensz to Star Mts* **10. G. monticola**
- b. Lower surface of the leaves variously strigose, the indument not obscuring the nervation, often making it more prominent, instead. 4
- 4a. Middle segments entire, the laterals sometimes with a lobe, rarely the middle segments of some leaves 2- or 3-lobed, leaves then glabrous on the upper surface, 5-partite, and petals pink 5
- b. Middle segments lobed, in some upper or reduced leaves occasionally entire and rarely also glabrous on the upper surface, then 5—7-fid or petals purple 7
- 5a. Upper surface of the leaves strigose-setose. Peduncle at anthesis already 18—23 mm long. *Saruwaket* **6. G. editum**
- b. Upper surface of the leaves glabrous. Peduncle in fruit 0—11 mm long . 6
- 6a. Leaves 7-fid, middle segment free for 0.5—0.6th of its length, 0.8—2 mm wide at the base of its free part. *Giluwe, Wilhelm, Bangeta* **7. G. hyperacriion**
- b. Leaves 5-partite, middle segment free for 0.8—0.9th of its length, 0.5—0.7 mm wide at the base of its free part. *Wilhelmina* **15. G. wilhelminae**
- 7a. Upper surface of the leaves glabrous or sparsely and patchily long-strigose 8
- b. Upper surface of the leaves evenly strigulose to strigose 10
- 8a. Petals 9—16 mm long, purple (always?), 1.7—2.1 times as long as the 5.5—7.6 mm long sepals. *Carstensz, Star Mts., Piora* **12. G. papuanum**
- b. Petals 4.5—6 mm long, white to pink, 1.2—1.4 times as long as the 3.5—4.8 mm long sepals 9
- 9a. Upper surface of the leaves patchily long-strigose. *Wilhelmina*.
- 8. G. lacustre**
- b. Upper surface of the leaves glabrous or with some long hairs near the margin. *Wharton Range* **14. G. whartonianum**
- 10a. Blades fairly large, generally more than 15 by 25 mm 11
- b. Blades fairly small, usually less than 15 by 25 mm 12
- 11a. Inflorescences strictly 1-flowered. Peduncle 25—41 mm long. Sepals 5—6 mm long, in fruit 7.5—9 mm. Petals 5.5—7.5 mm long. *Java: Merbabu to Tengger* **2. G. ardjunense**
- b. Inflorescences usually 2-flowered. Pedicels 9—16 mm long. Sepals 3.5—5 mm long, in fruit 3.8—7.5 mm. Petals 3.5—6 mm long. *Java: Tengger; Timor* **3. G. homeanum**
- 12a. Middle segment pinnately lobed. Peduncle in fruit 55—150 mm long. *Sumatra: Pupandji* **1. G. nepalense**
- b. Middle segment 3-lobed, its outer lobes rarely with a lateral tooth. Peduncle in fruit 0—45 mm long 13
- 13a. Leaf blades 7-fid to -partite. Peduncle in fruit 0—3 mm long. *Star Mts., Kinkain, Wilhelm., Saruwaket* **5. G. balgooyi**
- b. Leaf blades 5-partite. Peduncle in fruit 6—45 mm long 14

- 14a. Inflorescences 1- or 2-flowered. Peduncle in fruit 6—20 mm long, pedicel then 4—15 mm. Petals red-purple. *Celebes: Bonthain*. **4. *G. frigidurbis***
 b. Inflorescences strictly 1-flowered. Peduncle in fruit 19—45 mm long, pedicel then 16—31 mm. Petals white to pinkish. *Sugarloaf, Giluwe, Saruwaket, to Dayman* **11. *G. niuginiense***

1. *Geranium nepalense* Sweet

- G. nepalense* Sweet, *Geran.* 1 (1820) t. 12; Don, *Prodr. Fl. Nepal* (1825) 208; Thwaites, *Enum.* (1858) 64; Edgew. & Hook. *f.*, *Fl. Br. Ind.* 1 (1872) 430; Trimen, *Handb. Fl. Ceylon* 1 (1893) 195; Knuth in *Engl.*, *Pfl. R.* 85 (1912) 192; Fyson, *Fl. Nilgiri & Pulney* 1 (1915) 52; Hara, *Fl. E. Himal.* (1966) 637, 661, pl. 33c; Fedorov, *Chrom. Nos. Fl. Pl.* (1969) 332; Schönbeck-Temesy, *Fl. Iran.* 69 (1970) 23; Anon., *Icon. Corm. Sin.* 2 (1972) 529, t. 2788; Sarkar et al., *Taxon* 23 (1974) 810. — *Type*: *W. Anderson s.n.* (CGE?, *n.v.*, extant?), Nepal, cult. in Chelsea.
- G. radicans* DC., *Prodr.* 1 (1824) 639. — *Type*: *Wallich 8560-A* (G-DC; iso in K; *n.v.*; IDC-microfiche seen), Nepal.
- G. affine* W. & A., *Prodr.* (1834) 133, *nom. ill., non Ledeb.*, 1831; Wight, *Icon. Pl. Ind. Or.* 1 (1838) 153, t. 59. — *G. armottianum* Steud., *Nomencl.*, ed. 2, 1 (1840) 677. — *Syn types*: *Wight Cat.* 438, 439 (K, *n.v.*), probably from the Nilgiris and Ceylon.
- G. ardjunense* auct., *non* Zoll. & Mor.: Steen., *Bull. Jard. Bot. Btzg.* III, 13 (1934) 210, *p.p.* — *G. potentilloides* DC. var. *ardjunense* auct., *non* Carolin: Carolin, *Fl. Mal.* 1, 6 (1964) 447, *p.p.*; *Proc. Linn. Soc. N. S. W.* 89 (1965) 341, *p.p.*

Leaves 5-partite, 11—14(—18) by 20—25(—29) mm, the middle segment pinnately lobed, free for 0.85—0.9th of its length, 1.25—2.25 mm wide at the base of its free part, diamond-shaped in outline, lobes with a rounded apiculate apex, lateral and marginal nerves distinct, upper surface sparsely to moderately strigose between the nerves, lower surface strigose, especially on the nerves. *Inflorescences* 1- or 2-flowered, peduncle in fruit 55—150 mm long, pedicels then 20—30 mm. *Petals* c. 5.2 mm long, pale lilac with 3 purple nerves and dark lilac venation, subequal to the 5—5.5 mm long sepals. *Sepals* in fruit c. 6 mm long.

Distribution. Himalayas from Afghanistan to W. China; Nilgiris; Ceylon; Malesia: Sumatra (Atjeh, Laut Pupandji, *v. Steenis 6400*).

Ecology. Herbaceous vegetation around lake at 1900 m in Atjeh.

Chromosome number. $n=14$ (Sarkar et al., 1974), $2n=28$ (Hara, 1966; Fedorov, 1969) (Counts based on Indian material).

Notes. The above description is based on the Sumatran collection, only. It no doubt represents *G. nepalense s.l.*, a very variable taxon, of which the present delimitation may well encompass several distinct taxa. Schönbeck-Temesy, for instance, stated that *G. affine* W. & A. from the Nilgiris and Ceylon is distinct, but did not elaborate this point. It was beyond the scope of this study to disentangle the taxonomic knots present in *G. nepalense*.

The occurrence of this Asian species in North Sumatra, and then in one locality so far known only, is very interesting. There are a few analogous distributions, e.g. *Swertia bimaculata* (*Gentianaceae*), also only known from Laut Pupandji, *Wahlenbergia erecta* (*Campanulaceae*), *Mosla dianthera* and *Nosema cochinchinensis* (*Libiatae*) in Toba-Batak, *Viola biflora* (*Violaceae*), *Utricularia salwinensis* (*Lentibulariaceae*) from the G. Leusir-complex. *Hedyotis verticillaris* (*Rubiaceae*) mentioned by Taylor (*Fl. Mal.* 1, 8, 1977: 277) seems not to fit in this list, as it is not a temperate species, moreover the Sumatran plants are

possibly a distinct taxon. Vicarious (infra-)specific temperate taxa occurring in continental Asia and North Sumatra are further found in *Parnassia* (*Saxifragaceae*) and *Pirola* (*Pirolaceae*), also in the *G. Leusir*-complex.

2. *Geranium ardjunense* Zoll. & Mor.

G. ardjunense Zoll. & Mor., Nat. & Geneesk. Arch. Ned. Ind. 2 (1845) 585; Miq., Fl. Ind. Bat. 1, 2 (1859) 685; Back., Schoolfl. Java (1911) 169; Knuth in Engl., Pfl. R. 85 (1912) 150; Steen., Bull. Jard. Bot. Btzg. III, 13 (1934) 210, p.p. — *G. potentilloides* DC. var. *ardjunense* Carolin, Fl. Mal. I, 6 (1964) 447, p.p.; Proc. Linn. Soc. N. S. W. 89 (1965) 341, p.p.; Steen., Mt. Fl. Java (1972) pl. 20: f. 6. — Type: Zollinger 2246 (G; iso in B†, BO, P; n.v.), Java (Ardjuno).
G. nepalense auct., non Sweet: Koord., Exk. Fl. Java 2 (1912) 411, p.p.

Leaves 5(—7)-partite, (9—)15—20(—25) by (14—)25—35(—40) mm, the middle segment 3-lobed, sometimes somewhat irregularly so, free for 0.8—0.9th of its length, 1.25—3.5 mm wide at the base of its free part, obovate in outline, apex acutish, sometimes 3-lobed, minutely apiculate, lateral and marginal nerves distinct, upper surface evenly, usually rather densely strigose, lower surface appressedly strigose, especially on the nerves. *Inflorescences* 1-flowered. Peduncle in fruit (0—)17—53 mm long, pedicel then (17—)25—41 mm. *Petals* pink with fine darker lines, white at base, 5.5—7.5 mm long, 1—1.4 times as long as the 5—6 mm long sepals. *Sepals* in fruit 7.5—9 mm long.

Distribution. Java (Merbabu, *Coert 119*, *Kooper 1731 m*; Lawu, *Coert 363*, *994*, *Dorgelo 442*, *464*; Arjuno, *Backer 37198*, *Skottsberg & Backer 37199*; Welirang, v. *Steenis 7055*; Kawi, *Docters v. Leeuwen-Rijnvaan 12330*; Jang, v. *Steenis 10921*; Tengger).

Ecology. In shrubberies, between rocks, and in Casuarinaforest; alt. 2600—3200 m.

Note. The floral biology described by Docters v. Leeuwen for '*G. nepalense*' may pertain to this species (see sub *G. homeanum*).

3. *Geranium homeanum* Turcz.

G. homeanum Turcz., Bull. Soc. Imp. Nat. Mosc. 36 (1863) 591; Carolin, Fl. Mal. I, 6 (1964) 448; Proc. Linn. Soc. N. S. W. 89 (1965) 346, f. 6, f. 7, pl. vi: 5, pl. vii: 4; Contr. N. S. W. Nat. Herb., Fl. Ser. 102 (1967) 6; Back. & Bakh. f., Fl. Java 3 (1968) 644; Steen., Mt. Fl. Java (1972) pl. 20: f. 7. — Type: *Home 86* (KIW, photo in K, SYD; n.v.), New Zealand (Perakiteri).
G. parviflorum Willd., Enum. Hort. Berol. (1809) 716, nom. ill., non Curt., 1798, nec. Andr., 1805. — *G. potentilloides* DC. var. *parviflorum* Hook f., Fl. Tasm. 1 (1860) 57. — Syn types: *Hb. Willdenow 12572-1*, -2 (B, n.v.; IDC-microfiche 7440).
G. dissectum Linné var. *glabratum* Hook. f., Handb. N. Z. Fl. (1864) 36; Knuth in Engl., Pfl. R. 85 (1912) 52. — *G. glabratum* Small, N. Am. Fl. 25 (1907) 10, pro comb. (?); Abrams, Ill. Fl. Pac. St. 3 (1951) 4. — Lectotype: *Edgersley* in *Hb. Hook.* (K, n.v.; Carolin, 1965, lect.), N. Zealand.
G. nepalense Sweet fa. *javanicum* Back., Schoolfl. Java (1911) 168 ('*javanica*'). — Type: *Backer 8403* (BO, n.v.; iso in L, U), Java (Tengger).
G. affine auct., non W. & A.: Britten in Forb., Wand. (1885) 501.
G. ardjunense auct., non Zoll. & Mor.: Steen., Bull. Jard. Bot. Btzg. III, 13 (1934) 210, p.p.; Lam, Blumea 5 (1945) 580, p.p. — *G. potentilloides* DC. var. *ardjunense* auct., non Carolin: Carolin, Fl. Mal. I, 6 (1964) 447, p.p.; Proc. Linn. Soc. N. S. W. 89 (1965) 341, p.p.
G. nepalense auct., non Sweet: Koord., Exk. Fl. Java 2 (1912) 411, p.p.; Docters v. Leeuwen, Verh. Kon. Akad. Wet. II, 31 (1933) 255; Steen., Bull. Jard. Bot. Btzg. III, 13 (1934) 210, p.p.; Back. & Bakh. f., Fl. Java 1 (1964) 243.

Leaves 5—7-partite, (12—)20—30(—40) by (20—)25—50(—60) mm, the middle segment 3-lobed, lobes usually again with lateral lobules, free for (0.65—)0.75—0.85th part of its length, 1.8—7 mm wide at the base of its free part, obovate in outline, apex rounded to acuminate, apiculate, lateral and marginal nerves distinct, upper surface evenly moderately appressedly strigose, lower surface especially so on the nerves. *Inflorescences* 1- or 2-flowered. Peduncle in fruit 10—44(—67) mm long, pedicels then 9—16(—28) mm. *Petals* white (to pale red purple?), 3.5—6 mm long, 1—1.3 times as long as the 3.5—5 mm long sepals. *Sepals* in fruit 3.8—7.5 mm long.

Distribution. Malesia: Java (Tengger, *Arens 84*, *Backer 8403*, *36699*, *Buijsman 8—11—1908*, *28—1—1909*, *197*), Timor (*Mutis*, *Schmutz 2338a*, *de Voogd 2272*; *Samoro*, *Forbes 3818*; *Tatamailau*, *Cinatti 275*, v. *Steenis 18362*, *18378*, *18444*); Australia: S.E. Queensland, N. S. Wales, Tasmania, N. Zealand (N. Island); introduced in California?

Ecology. Roadsides, grassy slopes, light *Casuarina*-forest; alt. 1300—2700 m.

Notes. The specimens from Timor are slightly different from those of Java (but certainly do not belong to *G. ardjunense*). The leaves are smaller: 12—33 by 19—47 mm, vs. 20—30 by 24—50 mm, middle segment 1.8—4.5 mm wide at the base of its free part, vs. 3.5—7 mm. Peduncle in fruit longer, to 67 mm, vs. 44 mm, pedicels then 12—28 mm long, vs. 9—16 mm. Flowers distinctly larger: sepals 4.5—5 mm long, in fruit 6.3—7.5 mm, petals 5—6 mm, vs. resp. 3.5—4 mm, 3.8—4.8 mm, and 3.5—4 mm. Except for the distinctly larger flowers there seem to be no other significant differences, e.g. in shape, incision, or pubescence of the leaves, and no distinct taxa are recognized here.

Carolin referred the Timorese specimens to *G. ardjunense*; because of the resultant even greater disjunction in distribution he did not rule out the possibility of introduction of the species in Java. The present pattern is reminiscent of that of *Rumex brownii* (*Polygonaceae*), which occurs in the same localities (and also in New Guinea).

The species is said to have been introduced in California, but has not been taken up by Munz (*Calif. Fl. & Suppl.*, 1968). Small and Abrams mention the petals as purple, nearly all other references to these, as well as the flowers seen, indicate that they are pale pink to almost white. Only Backer annotated a specimen as 'pale red purple', which was taken over by the Fl. Java. See the beautiful plate in the Mt. Fl. Java, of which the accurateness of the colours may well be trusted. It would therefore seem that another species occurs in California, probably *G. solanderi* Carolin (as *G. pilosum* Forst f. in Munz).

The collection by De Voogd from the Mutis is exceptional for having multicellular gland-tipped hairs among the indument of the axes and petioles. Such hairs occur in many species of *Geranium* and are often of taxonomic significance, but we have seen them only in one other specimen from Malesia (*G. frigidurbis*). The indument is also much denser and the leaves are less incised (middle segment free for 0.65—0.75th of its length). As the collection is very fragmentary and is otherwise apparently identical with others from Timor, inclusive the other one mentioned above from the Mutis, no special status can be awarded to it at present.

Docters v. Leeuwen studied the floral biology of what he claimed to be this species (as *G. nepalense*) on the Lawu. Although he indicated to have known this species and *G. ardjunense* well enough, no records of *G. homeanum* are known from that mountain, but instead several of *G. ardjunense* (q.v.), to which his observations may

well refer. Whatever it may be, he recorded that on the first day of flowering the anthers open at 9 o'clock a.m.; one or two lean against the thick stigmas, whereby selfing may occur. Insects were never observed. On the second day the flowers are more open, while the anthers are empty; the thick stigmas are in the same condition as the previous day.

4. *Geranium frigidurbis* Moerman, sp. nov.

G. ardjunense auct., non Zoll. & Mor.: Lam, *Blumea* 5 (1945) 579. — *G. potentilloides* DC. var. *ardjunense* auct., non Carolin: Carolin, *Fl. Mal.* 1, 6 (1964) 447, p.p.; *Proc. Linn. Soc. N. S. W.* 89 (1965) 341, p.p. *G. nepalense* auct., non Sweet: Steen., *Bull. Jard. Bot. Btzg.* III, 13 (1934) 210, p.p.

Folia 5-partita, 6.5—10 mm longa, 12—22 mm lata, lobo medio 3-lobato, pro parte 0.75—0.85 longitudinis libero, pagina superiore strigosa, inferiore praecipue in nervos. *Inflorescentia* floribus solitariis aut binis gaudet. *Petala* atro-purpurea. *Pedunculus* fructifer 6—20 mm, *pedicellus* 4—15 mm longus. — *T y p u s*: *Bünnemeijer 11906* (L; iso in BO, n.v.), Celebes (Bonthain).

Leaves 5(—7)-partite, 6.5—10(—21) by 12—22(—39) mm, the middle segment 3-lobed, free for 0.75—0.85th part of its length, 1.2—2.5(—4.5) mm wide at the base of its free part, obovate to obtriangular in outline, apex roundedly acuminate, apiculate, lateral and marginal nerves distinct, upper surface evenly moderately strigose, lower surface especially so on the nerves. *Inflorescences* 1- or 2-flowered. *Peduncle* in fruit 6—20 mm long, *pedicels* then 4—15 mm. *Petals* red-purple, 5—5.5 mm long, 1.1—1.4 times as long as the 4—5 mm long sepals. *Sepals* in fruit 5.5—7 mm long.

D i s t r i b u t i o n. Celebes (Bonthain, *Bünnemeijer 11906*, *Monod de Froideville 229*).

E c o l o g y. Subalpine herb field on volcanic rock; alt. 2500—2800 m.

N o t e s. The type specimen has a few septate glandular hairs on some petioles, but these are absent in the collection by Monod. Other collections from the Bonthain, cited by Carolin (*Bünnemeijer 12319*, 12388), are not present in L.

The epithet of this new species is in honour of Mr. Ch. Monod de Froideville, who collected this species together with many other interesting ones on the Bonthain (see also Lam, 1945).

5. *Geranium balgooyi* Veldk., sp. nov.

G. monticola auct., non Ridl.: Johns & Stevens, *Bot. Bull.*, *Lae* 6 (1971) 27, p.p.

Folia 7-frissa ad -partita, 5—10.5 mm longa, 8.2—20 mm lata, lobo medio 3-lobato, lobulis lateralibus lateraliter dente unico raro provisus, pro parte 0.55—0.75 longitudinis libero, pagina superiore strigulosa, inferiore inter nervis strigosis glabra ad strigulosa. *Pedunculus* fructifer 0—3 mm longus. — *T y p u s*: v. *Balgooy 924* (L; iso in LAE), Nova Guinea (Mt. Wilhelm).

Leaves (5—)7-fid to -partite, 5—10.5(—13) by 8.2—20(—25) mm, middle segment 3-lobed, its outer lobes rarely with a lateral tooth, the central exceptionally also (Star Mts.), free for 0.55—0.75th of its length, 1.5—3.5(—4.5) mm wide at the base of its free part, spatulate in outline, apex rounded, mucronulate, lateral nerves occasionally present, marginals distinct, upper surface evenly strigose, lower surface glabrous to strigulose between the strigose nerves. *Inflorescences* 1-flowered. *Peduncle* in fruit 0—3 mm long, the pedicel then 4—52 mm. *Petals* pinkish white,

3.6—5 mm long, 1.2—1.5 times as long as the 2.7—5 mm long sepals. *Sepals* in fruit 4.5—6 mm long.

Distribution. New Guinea (Star Mts., LAE 67411 Barker & Umba; Kinkain, Vink 16168, 16235; Wilhelm, ANU 5214 Walker p.p., 7045 McVean & Wade, 11356 Hnatiuk p.p., v. Balgooy 187 p.p., 818, 924; Saruwaket, LAE 68448 Croft & Lelean).

Ecology. Very wet peaty soil between grass tussocks, *Astelia papuana*, *Trochocarpa decockii*, epiphytic on *Cyathea*; alt. 3100—4000 m.

Notes. The specimens from the Kinkain are conspicuous for their more compact habit with short branches, leaves that are underneath glabrous between the nerves and bright purple, the absence of peduncles, and the stout pedicels.

This species has been named for Dr. Max van Balgooy in recognition for this excellent collections from Mt. Wilhelm and his achievements in the phytogeography of the Pacific.

6. *Geranium editum* Veldk., sp. nov.

G. monticola auct., non Ridl.: Hartley, Lloydia 36 (1973) 258, p.p.

Folia 7-partita, lobo medio integro, pro parte 0.7—0.85 longitudinis libero, pagina superiore strigososetosa, inferiore in nervos strigosa. Pedunculus anthesi 18—23 mm longus. — **T y p u s:** Hartley 11102, p.p. (L, mixtum cum *G. niuginiense*, in LAE non est), Nova Guinea (Saruwaket).

Leaves (5—7)-partite, 2.4—4 by 6.5—10 mm, the middle segment entire, free for 0.7—0.85th of its length, 0.6—0.8 mm wide at the base of its free part, obovate-oblong, apex rounded, obscurely mucronate, marginal and lateral nerves present or not, upper surface evenly moderately strigose-setose, lower surface strigose on the veins. *Inflorescences* 1-flowered. Peduncle (in flower !) 18—23 mm long, pedicel then c. 5 mm. *Petals* white, c. 4.8 mm long, c. 1.6 times as long as the c. 3 mm long sepals. No fruits seen.

Distribution. New Guinea (Saruwaket, Hartley 11102, p.p.)

Ecology. Fire induced alpine meadow; alt. 3050 m.

Phytochemistry. Hartley noted the absence of alkaloids in this and/or *G. niuginiense*, with which the gathering in L is mixed; the duplicate in LAE consists entirely of the latter.

7. *Geranium hyperacrion* Veld., sp. nov.

G. monticola auct., non Ridl.: Carolin, Proc. Linn. Soc. N. S. W. 89 (1965) 342, p.p.; Johns & Stevens, Bot. Bull., Lae 6 (1971) 27, p.p.

G. potentilloides auct., non DC.: Borgmann, Zeitschr. Bot. 52 (1964) 143, 149, p.p., f. 12; Johns & Stevens, Bot. Bull., Lae 6 (1971) 27, p.p. — *G. potentilloides* DC. var. *potentilloides* auct.: Carolin, Fl. Mal. I, 6 (1964) 447, f. 1 b—d.

Folia 7-fida, lobo medio integro, pro parte 0.45—0.6 longitudinis libero, basi partis liberae 0.8—2 mm lato, pagina superiore glabra, inferiore subglabra vel in nervos strigosa. Pedunculus fructifer 2.5—11 mm longus. — **T y p u s:** NGF 16010 v. Royen (L; iso in LAE), Nova Guinea (Mt. Wilhelm).

Leaves 7-fid, 2.5—6.5 by 5—15 mm, the middle segment entire, free for 0.45—

0.6th of its length, 0.8—2 mm wide at the base of its free part, elliptic to obovate with nearly parallel margins, apex obtuse, slightly mucronate, lateral and marginal nerves usually absent, upper surface glabrous, the lower subglabrous to strigose on the nerves. *Inflorescences* 1-flowered. Peduncle in fruit 2.5—11 mm long, the pedicel then 3—7(—10) mm. *Petals* pink, 5.5—7.2 mm long, 1.3—1.7 times as long as the 3.5—5.5 mm long sepals. *Sepals* in fruit 5—6.5 mm long.

Distribution. New Guinea (Gifuwe, *Coode & Wardle 3703*, *Schodde 1946*; Wilhelm, *ANU 5214 Walker*, p.p., 7175 *McVean & Wade*, 11356 *Hnatiuk*, p.p., v. *Balgooy 187*, p.p., 235, *Borgmann 92*, *NGF 16010* v. *Royen*; Bangeta, *NGF 20002* v. *Royen*).

Ecology. Peaty tussock-grassland on poor well-drained soil, between the tussocks of *Astelia papuana*, *Trochocarpa decockii*, with mosses and small herbs, e.g. *Viola kjellbergii*, *Pilea* cf. *johniana*; alt. 3550—4325 m.

Chromosome number. $2n = 56$ (Borgmann, 1964).

8. *Geranium lacustre* Veldk., sp. nov.

G. monticola auct., non Ridl.: Carolin, Proc. Linn. Soc. N. S. W. 89 (1965) 342, p.p.
Geranium sp.: Steen., Bull. Jard. Bot. Btzg. III, 13 (1934) 210, p.p.

Folia 7-fissa, lobo medio libero pro parte 0.55—0.7 longitudinis, pagina superiore irregulariter sparsiter strigosa, inferiore strigosa praecipue in nervos. *Petala* c. 5 mm longa, *sepalis* c. 3.5 mm longis c. 1.4-plo longiora. — **T y p u s:** *Versteeg 2494* (L; iso in BO, n.v.), Nova Guinea (Mt. Wilhelmina).

Leaves 7-fid, 2.5—3.5 by 4.5—8 mm, the middle segment usually 2—3-lobed, free for 0.55—0.7th of its length, 0.8—1.25 mm wide at the base of its free part, obovate in outline, apex rounded, mucronulate, lateral and marginal nerves little developed, upper surface irregularly sparsely strigose, the lower strigose mainly on the nerves. *Inflorescences* 1-flowered. Peduncle in fruit c. 4 mm long, the pedicel then c. 5 mm. *Petals* c. 5 mm long, the colour not recorded, probably whitish, c. 1.4 times as long as the c. 3.5 mm long sepals. *Sepals* in fruit c. 4 mm long.

Distribution. New Guinea (Wilhelmina, *Versteeg 2494*).

Ecology. Grassfields near the lake (Meer-bivak); alt. 3600 m.

Note. This collection no doubt represents dwarf forms most similar to *G. papuanum*, from which it differs by the much smaller flowers and the more compound leaves.

9. *Geranium leptodactylon* Veldk., sp. nov.

Folia composita, foliolis repete 2—3-partito, lobis \pm lineari-lanceolatis, imbricatis, foliolo medio basi 0.2—0.3 mm lato. — **T y p u s:** *Veldkamp & Stevens 5783* (L; iso in LAE), Nova Guinea (Mt. Suckling).

Leaves finely 5—7-subcompound, 3—8 by 6—16 mm, 'leaflets' pseudo-stalked, repeatedly 2—3-partite with \pm linear-lanceolate overlapping lobes, not in one plane, middle 'leaflet' 0.2—0.3 mm wide at base, apex acute, indistinctly mucronulate, nerves invisible, appressed strigose all over. *Inflorescences* 1-flowered. Peduncle in fruit 7—15 mm long, pedicel then 6—13 mm. *Petals* white to pinkish, c.

5.5 mm long, c. 1.4 times as long as the 3.2—4 mm long sepals. *Sepals* in fruit 5—6 mm long.

Distribution. New Guinea (Suckling, *LAE 54264 Stevens & Veldkamp, 54431 id., Veldkamp & Stevens 5754, 5783*).

Ecology. In the shade of higher plants, e.g. *Styphelia suaveolens*, also in open sandy flats with *Danthonia oreoboloides*, in sub-alpine grasslands; alt. 3250—3500 m.

Note. Most similar to *G. subcompositum*, which also occurs in the Suckling-complex, but at much lower altitudes and which appeared quite different in the field. It cannot be ruled out that *G. leptodactylon* is a dwarfed form of it due to the exceptional soil conditions of the Suckling, but at present the specimens seem aberrant enough to be placed separately. In the field the plants were usually sterile and by the finely divided leaves resembled an Umbellifer more than a Geranium.

10. *Geranium monticola* Ridl.

G. monticola Ridl., Trans. Linn. Soc., London, Bot. II, 9 (1916) 23; Steen., Bull. Jard. Bot. Btzg. III, 13 (1934) 210; Carolin, Fl. Mal. I, 6 (1964) 446, p.p.; Proc. Linn. Soc. N. S. W. 89 (1965) 342, p.p. — **Type:** *Kloss s.n.* ('camp xiii') (BM), New Guinea (Carstensz).

G. potentilloides DC. var. *alpestre auct., non* Hope: Hope et al., The equatorial glaciers of New Guinea (1976) 161, p.p.

Leaves 5—7-partite, (2—)4—9.5 by (4—)7—18 mm, middle segment usually 3-lobed, rarely entire, free for 0.7—0.85th of its length, 1—1.5 mm wide at the base of its free part, obtuse, or elliptic when entire, apex rounded, mucronulate, upper surface appressedly strigose, or sparsely erecto-patently hairy, or glabrous, lower surface very densely grey or silvery hairy (occasionally brown when dried), the indument obscuring the nervation. **Inflorescences** 1-flowered. Peduncle in fruit 0—31 mm long, the pedicel then 5—30 mm. **Petals** pink, rarely white, 5.5—7 mm long, 1.2—1.6 times as long as the 4—6 mm long sepals. **Sepals** in fruit 5—6 mm long.

Distribution. New Guinea (Carstensz, *ANU 16048 Hope, Kloss s.n., Wissel 11, 46, 50, 82, 91, 103*; Wilhelmina, *Brass & Meijer-Drees 9868, 10185*; Star Mts., *LAE 67412 Barker & Umba, 68070 Croft & Hope, Veldkamp 6472, 6499*; Bangeta, *NGF 20046 v. Royen*).

Ecology. Sandy banks of streams in subalpine grassland, open, irregularly overgrown, rocky soil with outcrops of limestone; alt. 3100—4400(—4600 ?) m.

Notes. Depending on the short or long indument of the upper surface of the leaves two groups might be discerned on the Carstensz, but at present there is insufficient material for a dependable decision, the Kloss- and Wissel-collections being too fragmentary. Some plants collected by the latter (*11, 46*) have very small, (sub-)entire middle segments, sparsely long-hairy to glabrous on the upper surface, but specimens with 'normal' leaves are mixed in the gathering. Because of the often hap-hazard way in which Geraniums have been collected it can therefore not be ascertained whether only one or more populations are involved.

The species is cushion-forming, developing straggling branches, a feature usually lost in the collecting, as the cushions are torn apart to make 'better' specimens.

11. *Geranium niuginiense* Veldk., sp. nov.

G. monticola auct., non Ridl.: Hartley, *Lloydia* 36 (1973) 258, p.p.

G. potentilloides auct. non DC.: Borgmann, *Zeitschr. Bot.* 52 (1964) 143, 149, p.p.; Johns & Stevens, *Bot. Bull., Lae* 6 (1971) 27, p.p. — *G. potentilloides* DC. var. *potentilloides* auct.: Carolin, *Fl. Mal.* 1, 6 (1964) 447, f. 1-a, -e, -f; *Proc. Linn. Soc. N. S. W.* 89 (1965) 340, p.p.

Folia 5-partita, 4—13 mm longa, 7—24 mm lata, lobo medio 3-lobato, lobulis lateralibus lateraliter dente unico raro provisus, pro parte 0.7—0.9 longitudinis libero, pagina superiore strigosa, inferiore inter nervos strigosos plerumque strigulosa. *Inflorescentia* flore solitario gaudet. *Petala* alba ad subrosea. *Pedunculus* fructifer 19—45 mm, pedicellus 16—31 mm longus. — *T y p u s* : v. *Balgooy* 296 (L; iso in LAE), Nova Guinea (Mt. Wilhelm).

Leaves 5-partite, 4—13(—17.5) by 7—24(—33) mm, the middle segment 3-lobed, its outer lobes rarely with a lateral tooth, free for (0.6—)0.7—0.9th of its length, (0.4—)0.8—3(—4) mm wide at the base of its free part, obtuse to obtusish, rarely acutish, mucronulate, lateral and marginal nerves absent to distinct, upper surface evenly strigose, lower usually strigulose between the strigose nerves. *Inflorescences* 1-flowered. *Peduncle* in fruit (9—) 19—45(—56) mm long, *pedicel* then (9—) 16—31(—53) mm. *Petals* white to pinkish, 5—8 mm long, 1.1—1.7 times as long as the 3—7 mm long sepals. *Sepals* in fruit 4.5—8 mm long.

D i s t r i b u t i o n. New Guinea (Sugarloaf, *Hoogland & Schodde* 7215; Giluwe, *Schodde* 1961; Wilhelm, *ANU* 7379 *Wade*, 15009 *Hnatiuk*, v. *Balgooy* 296, 320, 828, *Borgmann* 66, *Brass* 30183, *Hoogland & Pullen* 5708, *NGF* 15187 v. *Royen*, 15196 *id.*; *Piora*, *NGF* 16598 *Henty & Carlquist*; Saruwaket, *Clemens* 5872, p.p.; *Hartley* 11102, p.p.; *Strong*, *Coode & Stevens* 3847; *Suckling*, *LAE* 54421 *Stevens & Veldkamp*, *Veldkamp & Stevens* 5724, 5753; *Dayman*, *Brass* 22643, *Cruttwell* 1030, 1070, 1290, 1324).

E c o l o g y. In subalpine forests, on mossy dead tree- and *Cyathea*-trunks, in long-grass communities, in *Astelia papuana* bogs, on humus-rich soil with small herbs, e.g. *Oxalis magellanica*, *Trigonotis abata*; alt. 2050—3950 m.

C h r o m o s o m e n u m b e r. $2n = 36$ (Borgmann, 1964).

P h y t o c h e m i s t r y. Hartley (1973) noted the absence of alkaloids. His collection in L is a mixture of this species and *G. editum*, however.

N o t e. A very variable species with the widest distribution of the New Guinea taxa. Local forms are perhaps discernable, but the differences are so slight that no special status seems warranted. The specimens from the Owen Stanleys differ from those of the Wilhelm by somewhat more deeply divided leaves and larger flowers.

V e r n a c u l a r n a m e s. *ogogum* (Karel, Hagen), *sik'wi* (Mendi).

12. *Geranium papuanum* Ridl.

G. papuanum Ridl., *Trans. Linn. Soc., London, Bot.* II, 9 (1916) 22. *T y p e* : *Kloss s.n.* ('camp x-xi') (BM), New Guinea (Carstensz).

G. papuanum Ridl. var. *alpestre* Ridl., *Trans. Linn. Soc., London, Bot.* II, 9 (1916) 23. — *G. potentilloides* DC. var. *alpestre* Ridl. ex Hope in Hope et al., *The equatorial glaciers of New Guinea* (1976) 161, p.p., *comb. inval.* (ICBN § 33, no basion.). — *Type* : *Kloss s.n.* ('camp xiii-xi') (BM; iso in K).

G. monticola auct., non Ridl.: Carolin, *Fl. Mal.* 1, 6 (1964) 446, p.p.; *Proc. Linn. Soc. N. S. W.* 89 (1965) 342, p.p.

Leaves 5-fid, 3.5—10 by 8—20 mm, the middle segment 3-lobed, rarely entire,

free for 0.5—0.75th of its length, 1.2—3.2 mm wide at the base of its free part, obdeltoide to obcordate in outline, obovate when entire, middle lobule often distinctly shorter than the laterals, mucronulate, lateral and marginal nerves distinct, upper surface sparsely setose to subglabrous, lower setose on the nerves only. *Inflorescences* 1-flowered. Peduncle in fruit 9—45 mm long, pedicel then 10—71 mm. *Petals* vivid red purple (always ?), 9—16 mm long, 1.7—2.1 times as long as the 5.5—7.5 mm long sepals. *Sepals* in fruit 7—9.5 mm long.

Distribution. New Guinea (Carstenz, *Kloss s.n.*, camp x-xi, xiii-xi, xi-xiii; Star Mts., *Craig 55*, *LAE 66990 Barker*, *67346 Barker & Umba*, *67347 id.*, *68109 Croft & Hope*, *Veldkamp 6236*; Piora, *Hayes 490*, *LAE 68217 Croft & Akakavara*).

Ecology. Sheltered hollows, in the Star Mts. generally in ashes among stumps of *Cyathea*, *Deschampsia*, *Rubus lorentzianus*, *Plagiogyria papuana*, etc.; alt. 2500—3500 m.

Notes. Conspicuous among all other *Geraniums* from New Guinea by the exceptionally large bright purple petals. Ridley recorded pale pink for the Carstenz, but did not state the source of this information; it is not on the Kloss labels. The material disagrees in some other aspects with his description: no basal parts are present; the petioles are 7—17 mm long and shortly strigose, the blades are up to 10 by 18 mm; the peduncles 15—35 mm, the pedicels 18—28 mm, together 32—63 mm, the 'bracts', i.e. the bracteoles, are 2—3 mm, and the petals 9—15 by 6 mm. The Giullianetti collection mentioned is a mixture of *G. subcompositum* and *G. whartonianum*.

LAE 67346 from the Star Mts. is tentatively included here. It was growing among the 'normal form (*LAE 67347*) without any intermediaries'. The leaves are more deeply incised (0.85—0.9th), the middle segment is narrower at its base (0.7—1 mm), the petals are paler purple and are probably smaller, as the sepals are *c.* 4.6 mm long in flower and *c.* 5.3 mm in fruit. The specimens key out to *G. whartonianum*, but seem better placed here.

Vernacular name. *maunz-habi'inz* (Tairora, Piora).

13. *Geranium subcompositum* Veldk., sp. nov.

G. dissectum auct., non Linné: Hemsley, Kew Bull. (1899) 98, *p.p.*; Steen., Bull. Jard. Bot. Btzg. III, 13 (1934) 210, *p.p.*

G. papuanum auct., non Ridl.: Ridl., Trans. Linn. Soc., London, Bot. II, 9 (1916) 23, *p.p.*

G. monticola auct., non Ridl.: Carolin, Fl. Mal. I, 6 (1964) 446, *p.p.*; Coode & Stevens, Proc. P. N. G. Sc. Soc. 23 (1972) 24, *p.p.*

Folia subcomposita, foliolis 3-fissis, lobulis non imbricatis, foliolo medio basi 0.3—1 mm lato. — **Types:** *LAE 61481 Croft & Lelean* (L; iso in LAE; BRI, CANB, *n.v.*), Nova Guinea (Mt. Albert Edward) (Distributed as *Veronica archboldii*!).

Leaves 5(—7)-subcompound, 5.5—19 by 8—20(—28) mm, the middle 'leaflet' 3(—5)-fid, free for more than 0.9th of its length, 0.3—0.8(—1.5) mm wide at base, obovate to obcuneate in outline, apex acutish-rounded, mucronulate, lateral nerves absent, marginals absent to distinct, even the midrib sometimes inconspicuous, rather densely strigulose all over, on the lower surface especially on the nerves, sometimes ± glabrous in between. *Inflorescences* 1-flowered. Peduncle in fruit 8—

35(—67) mm, pedicel then 5—25(—34) mm long. *Petals* white to pink, 4.8—6.5 mm, 1.4—1.5(—1.9) times as long as the 3.3—4.5(—7.5) mm long sepals. *Sepals* in fruit 5—6(—8.6) mm long.

Distribution. New Guinea (Star Mts., *Veldkamp 6368*; Saruwaket, *Clemens 5871 ? p.p.*, *5872 p.p.*; Strong, *NGF 46213 Coode & Stevens, p.p.*; Wharton Range (? Scratchley), *Giullianetti & English s.n., p.p.*; Albert Edward, *Craven 2793*, *Gillison 461*, *LAE 60516 Croft & Lelean, 61481 id.*; Suckling, *Veldkamp & Stevens 5581, 5991*).

Ecology. Banks of rivers in subalpine tall-grassland, forest margins, cushion bogs, moist places in tussock grassland; alt. 1700—3800 m.

Notes. A remarkable species because of its disjunct area and great altitudinal range. Only after some hesitation the specimens from the Suckling, found at 1700 and 2065 m, have been included. The first locality was a riverbank in a rather narrow gorge, through which apparently cold air drained, the second a frost pocket where —5.6°C was measured one night! The flowers were exceptionally large and more or less violet-shaped: the lower 3 petals being directed downward, the upper 2 up- and sideward. The leaves have a slightly more distinct nervation. The species was not observed at higher altitudes (unless *G. leptodactylon* is a modification of it, which seems hard to believe). These differences in size may be due to the lower altitude.

Although the Star Mts. collection is from such a distant locality it is identical with the others.

The synonymy of this species and of the next is the same, as it is based on two collections only, which are a mixture of both species: *Giullianetti & English* and *NGF 46213*. The first is mistakenly labeled 'Oriomo River, opposite Daru, 29 May 1896. About 25 miles from the mouth. Fearly (*sic*) common at the place where this specimen was collected. Good water, plenty of game and fairly good number of friendly natives near the place. A. Giullianetti.' No *Geraniums* occur at sealevel in New Guinea.

The holotypes of *G. clemensiae* Knuth and *G. sarawaketense* Knuth, *Clemens 5872* and *5871* respectively, formerly in B, have been lost. All likely herbaria (see also the acknowledgments above) have been searched for duplicates, but these appeared to be present in A only. The majority of the specimens on these sheets belong to the present species. The descriptions given by Knuth disagree so much with the material, however, that they fit no known New Guinea species. It can not be ruled out that the Clemens collections were mixed and that the original specimens in B represented different taxa than those still available in A as *Clemens 5872* contains also a small piece of *G. niuginiense*.

G. clemensiae is compared by Knuth with *G. kilimandscharicum* Engl. which seems well-depicted in Engler's *Pflanzenreich* IV, 129 (1912) 158, fig. 20. This plate does not resemble *G. subcompositum* very much and actually of all New Guinea species is most like *G. balgooyi*. The description of *G. clemensiae*, on the other hand, is most reminiscent of *G. hyperacrion*, from which it differs apparently by being completely glabrous, the leaf blades being 5-partite, divided to 4/5th (= 0.8), and by the petals twice as long as the sepals. Because of all these discrepancies it is hazardous to guess what exactly Knuth had before him, and it seems better to regard *G. clemensiae* as a dubious name.

G. sarawaketense is compared with *G. ardjunense* and the latter does resemble *G. subcompositum* superficially. The latter species, however, differs too much from the

description of the first one to merely regard this description as containing a few errors or referring to an exceptional state of *G. subcompositum*. For one thing, Knuth repeatedly stated that his specimens were glabrous in all vegetative parts, and 'glabriusculus' or 'subglabra' for the peduncles, pedicels, sepals, style, rostrum, and fruit valves, a situation not known from any New Guinea species; secondly, he described the leaf blades as 2—3 cm in diameter, and (5—7)-partite, incised to 5/6th (=0.83) only. In general the description seems to fit *G. niuginiense* best, but again differs from that species by the absence of an indument, the (5—)7-partite leaf blades with their deeply incised lobes ($\frac{1}{2}$ — $\frac{2}{3}$), enough to make it impossible to place the name *G. sarawaketense* with certainty. We therefore prefer to regard it of dubious application as well.

14. *Geranium whartonianum* Veldk., sp. nov.

For synonymy see the preceding species.

Folia 5—7-fissa, lobo medio 3-lobato, pro parte 0.55—0.75 longitudinis libero, pagina superiore glabra vel pilis longis ad marginem irregulariter dispositis, inferiore in nervos longe strigoso-setosa. *Petala* alba ad subrosea, 4.5—6 mm longa, sepalis 3.5—4.8 mm longis 1.2—1.4-plo longiora. — *T y p u s*: LAE 61390 Croft et al. (L; iso in LAE; BRI, n.v.), Nova Guinea (Mt. Albert Edward).

Leaves 5—7-fid, 4.4—10 by 7—21 mm, middle segment (2—)3(—4)-lobed, rarely subentire, free for 0.55—0.75th of its length, 1—3 mm wide at the base of its free part, obtuse to obtriangular in outline, apex rounded to obtuse, mucronulate, lateral nerves rarely present, marginals distinct, upper surface glabrous or with some hairs in patches near the margin, lower surface usually long strigose-setose on the nerves, shortly strigulose to glabrous in between. *Inflorescences* 1-flowered. Peduncle in fruit 14—47 mm long, pedicel then 14—26 mm. *Petals* white to pale pink, 4.5—6 mm long, 1.2—1.4 times as long as the 3.5—4.8 mm long sepals. *Sepals* in fruit 4.8—5.5 mm long.

Distribution. New Guinea (Strong, NGF 46213 Coode & Stevens, p.p.; Albert Edward, Craven 2798, LAE 61390 Craven et al.; Murray Pass, Brass 4637, NGF 20459 v. Royen; Wharton Range (= ? Scratchley), Giullianetti & English s.n., p.p.).

Ecology. Moist areas in subalpine tussock grasslands, remnants of subalpine forest, epiphytic on *Cyathea*; alt. 2840—3800 m.

Note. A collection from the Star Mts. (LAE 67346) keys out to this species, but is included in *G. papuanum*, q.v.

15. *Geranium wilhelminae* Veldk., sp. nov.

G. monticola auct., non Ridl.: Carolin, Proc. Linn. Soc. N. S. W. 89 (1965) 342, p.p.

Folia 5-partita, lobo medio integro ad 3-lobato, pro parte 0.8—0.9 longitudinis libero, basi partis liberae 0.5—0.7 mm lato, pagina superiore glabra, inferiore in nervos tantum strigosa. Pedunculus fructifer 0—10 mm longus. — *T y p u s*: Brass 9207 (L; iso in LAE; A, BO, n.v.) Nova Guinea (Wilhelmina).

Leaves 5-partite, 5—7 by 9—12 mm, middle segment entire to 3-lobed, free for 0.8—0.9th of its length, 0.5—0.7 mm wide at the base of its free part, elliptic to obovate with convex margins when entire, rather broadly obtuse when lobed,

apex rounded, mucronulate, lateral nerves absent, marginals distinct, upper surface glabrous, lower strigose on the nerves only. *Inflorescences* 1-flowered. Peduncle in fruit 0—10 mm long, pedicel then 7—11 mm. *Petals* pink, 5—6 mm long, 1.4—1.5 times as long as the 3.5—4 mm long sepals. *Sepals* in fruit 4.5—5.5 mm long.

Distribution. New Guinea (Wilhelmina, Brass 9207, Brass & Meijer-Drees 9813, 10186).

Ecology. Open boggy ground and steep banks of grassland streams; alt. 3225—3800 m.

DUBIOUS OR EXCLUDED NAMES

1. *Geranium clemensiae* Knuth, Fedde's Repert. 45 (1938) 61. — **Type:** *Clemens 5872 p.p.* (B†). See sub no. 13. *G. subcompositum*.
2. *Geranium pilosum* Forst. f., Prodr. (1786) 91; F. v. M., J. Bot. 31 (1893) 324, based on a McGregor collection from the 'summit of the Owen Stanley Range'. The specimen in MEL is equated with *G. potentilloides* DC. var. *potentilloides* by Carolin (1964: 446). *G. pilosum* does not occur in New Guinea, the specimen(s) may belong to *G. niuginiense*, *G. subcompositum*, or *G. whartonianum*.
3. *Geranium sarawaketense* Knuth, Fedde's Repert. 45 (1938) 61. — **Type:** *Clemens 5871 ?p.p.* (B). See sub no. 13 *G. subcompositum*.

IDENTIFICATION LIST

ANU 5214 (Walker): 5/7; 7045 (McVean & Wade): 5; 7175 (id.): 7; 7379 (Wade): 11; 11356 (Hnatiuk): 5/7; 15009 (id.): 11; 16048 (Hope): 10; Arens 84: 3.
 Backer 8403: 3; 36699: 3; v. Balgooy 187: 5/7; 235: 7; 296: 11; 320: 11; 818: 5; 828: 11; 924: 5; Borgmann 66: 11; 92: 7; Brass 4637: 14; 9207: 15; 22643: 11; 30183: 11; Brass & Meijer-Drees 9813: 15; 9868: 10; 10185: 10; 10186: 15; Bünnemeijer 11906: 4; Buysman 197: 3.
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