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Studies of *Parnassia* (Parnassiaceae) in the Sino-Himalayan Region. Notes on *Parnassia pusilla* Wall. ex Arn. and *P. chinensis* Franch. in Nepal

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Abstract In *Parnassia pusilla* Wall. ex Arn. and *P. chinensis* Franch., variations of floral characters are examined based on our recent collections from Nepal. In Nepal *P. pusilla* and *P. chinensis* are clearly distinguished by the shape of the petals. A variety of *Parnassia chinensis* is newly described.

Key words: *Parnassia*, Nepal, Himalaya, Sino-Himalayan region

Introduction

The genus *Parnassia* is diversified in the Sino-Himalayan floristic region. Since Drude (1875) the genus has been studied by several taxonomists. Hara (1979) recognized six species from Nepal, two of which, *P. pusilla* Wall. ex Arn. and *P. chinensis* Franch., occur in the alpine zone and are similar to each other in their short stems, small flowers, white petals distinctly larger than the sepals and trilobed staminodes. *Parnassia pusilla* ranges from the Himalaya to southern Tibet, while *P. chinensis* is known from the Himalaya, southern Tibet, northern Burma and southwestern China. In his monograph of section Nectarotrilobus, Nekrassova (1927) wrote that "petala elongato-ovata, integerrima..." in *P. pusilla* and "petala spathulata, late flabellata, basi fimbriata..." in *P. chinensis*. Later Pan (1985) distinguished *P. chinensis* from *P. pusilla* by its petals, which are dentate apically or ciliate below the middle; those of *P. pusilla* are entire or finely dentate at the apex. Grierson (1987) considered the petals of *P. chinensis* to be "ciliate or dentate near base" and those of *P. pusilla* to be "entire below middle." Ku (1995) described the petals of *P. chinensis* as having "the apical part entire, undulate or irregularly dentate, 1/4 of the basal part (except the claw) densely long fimbriate," and those of *P. pusilla* as "the basal part short fimbriate except the claw, and the apical part dentate or undulate." Although the shape and size and the marginal processes of the petals have been regarded as important characters

to distinguish the species of *Parnassia*, they seem to be rather variable, as mentioned above.

During our taxonomic studies relating to the Flora of Nepal, we observed recent collections of these two species mainly from the Jaljale Himal (Ohba & Akiyama, 1992) and from the Hinku and Hunku valleys (Ohba & Ikeda, 2000) in eastern Nepal and from Ganesh Himal (Ohba & Ikeda, 1999) in central Nepal.

Observations

Parnassia pusilla [Figs. 1 and 2]

Figure 1 shows the five calyx lobes, five petals and two staminodes of a single flower of *Parnassia pusilla* collected in Ganesh Himal. The calyx lobes are 3–3.7 mm long, 1.3–2.2 mm wide, ovate, rounded at the apex, entire to finely erose on the margins, and with or without a small projection near the base. The petals are 5.8–6.3 mm long, 2.5–3 mm wide, narrowly obovate, erose on the margins throughout or in part and without hairs at the base. The staminodes are ca. 1.6 mm long and trilobed; three

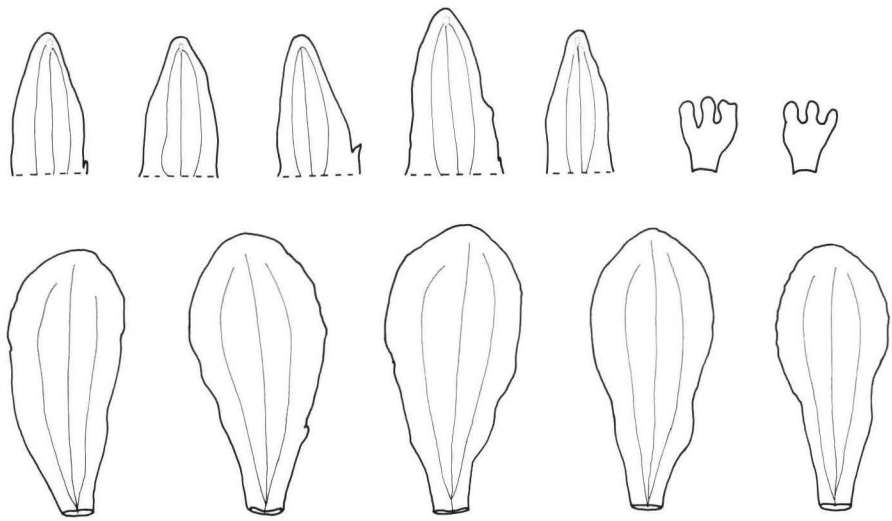
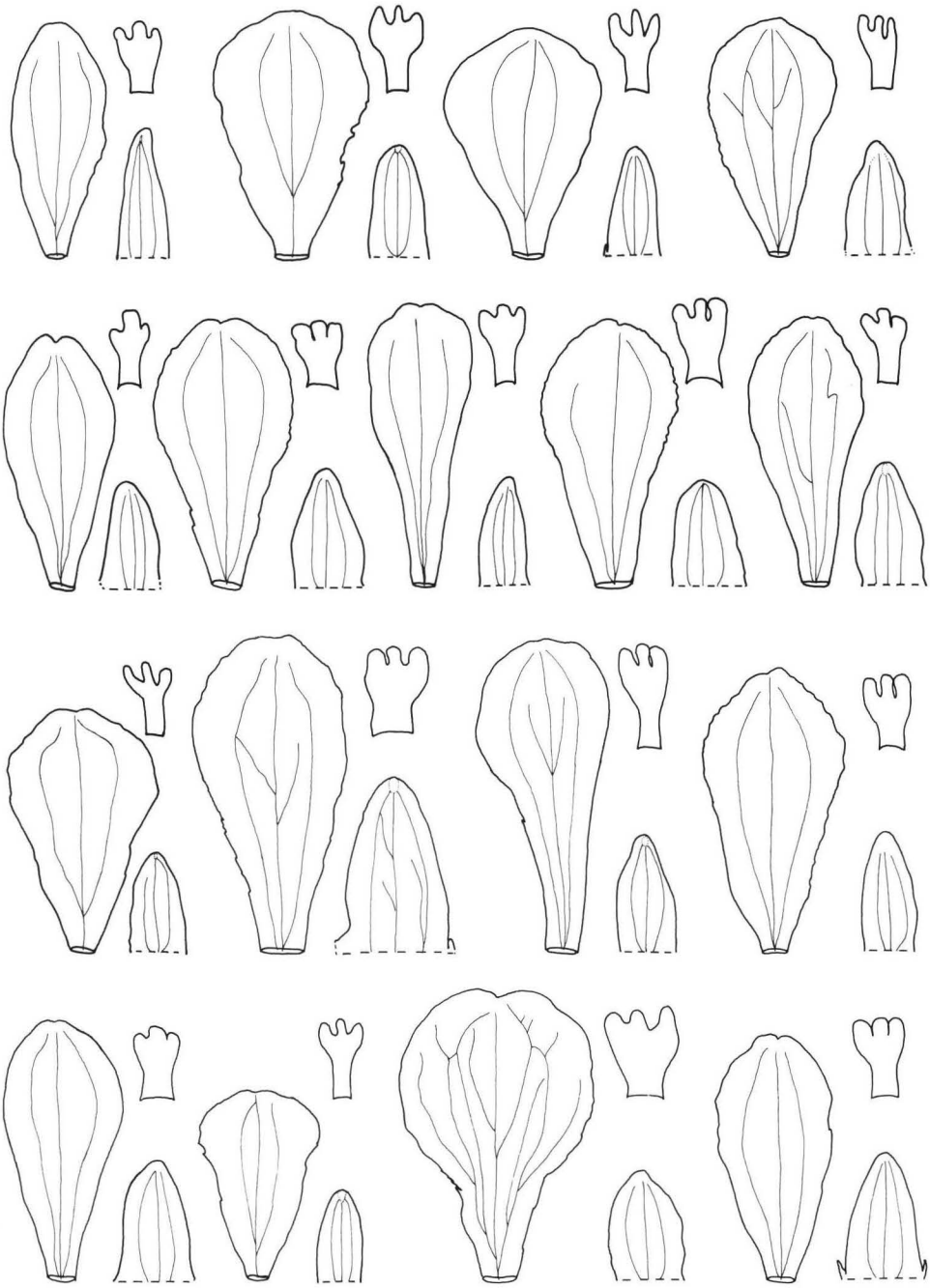


Fig. 1. Calyx lobes, petals and staminodes from a flower of *Parnassia pusilla* (Miyamoto *et al.* 9420044). All×6.

Fig. 2. Calyx lobes, petals and staminodes of *Parnassia pusilla*. Top (left to right): Miyamoto *et al.* 9440024, Ohba *et al.* 9110172, Ohba *et al.* 9153220, Miyamoto *et al.* 9580206. Second row (left to right): Miyamoto *et al.* 9584210, Miyamoto *et al.* 9592183, Miyamoto *et al.* 9592570, Miyamoto *et al.* 9596424, Wakabayashi *et al.* 9710158. Third row (left to right): Wakabayashi *et al.* 9710187, Wakabayashi *et al.* 9710299, Wakabayashi *et al.* 9710420, Wakabayashi *et al.* 9720172. Bottom (left to right): Wakabayashi *et al.* 9720247, Wakabayashi *et al.* 9720308, Wakabayashi *et al.* 9720313, Wakabayashi *et al.* 9730214. All × 6.



lobes are nearly the same in size. Figure 2 (left at top) shows a calyx lobe, a petal and a staminode of a flower of another specimen collected in Ganesh Himal. The variation in shape and size of the calyx lobes, petals and staminodes is narrow within and among individuals in Ganesh Himal.

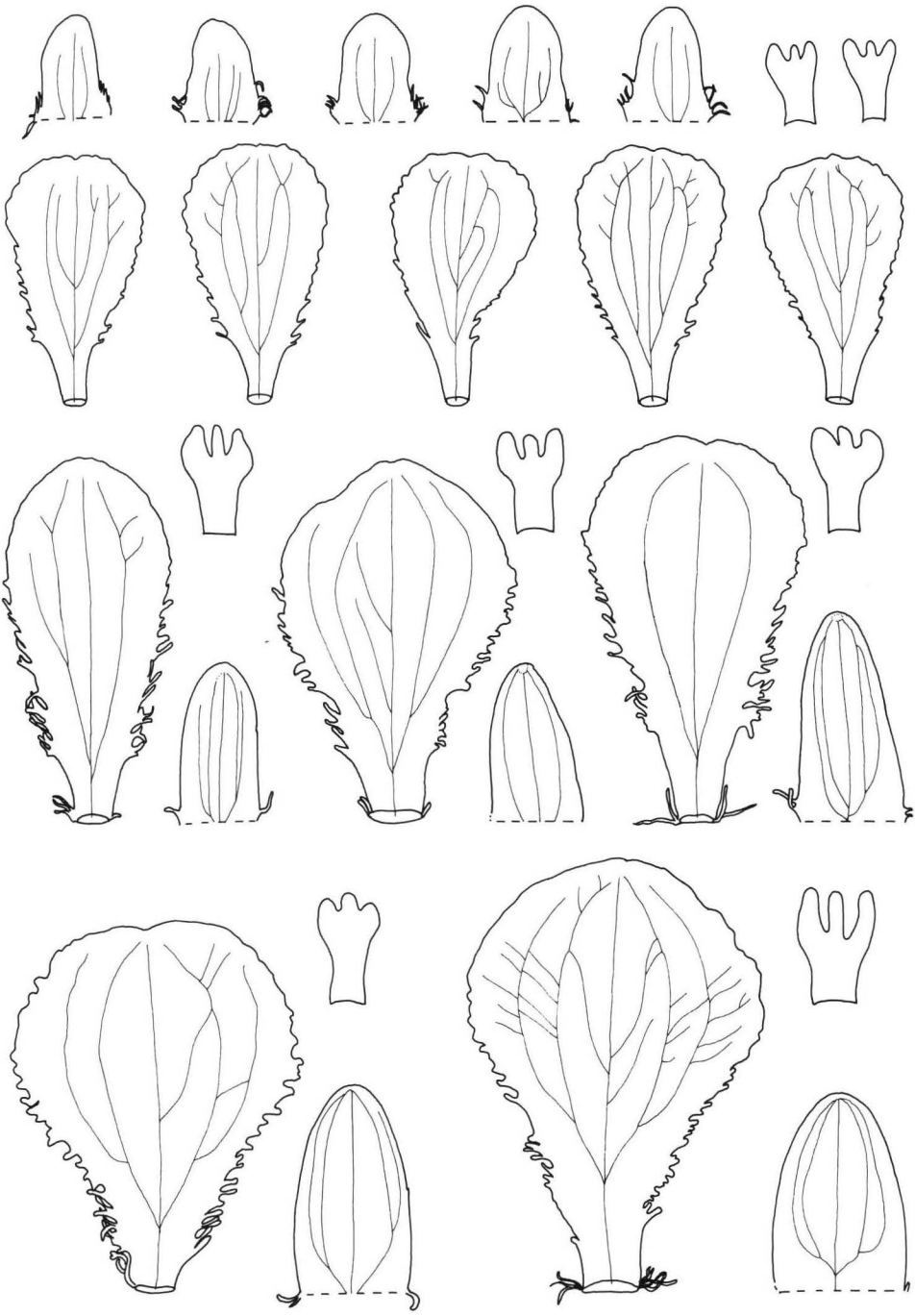
Figure 2 shows variation in 17 sepals, petals and staminodes of *P. pusilla* collected in Ganesh Himal, Jaljale Himal and the Hinku and Hunku valleys. The calyx lobes are 2–3 (–4) mm long, 1–1.6 (–2.4) mm wide, oblong to ovate, rounded at the apex, glabrous, and usually without hairs or small projection at the base, although rarely one hair or small projection is present. The petals are 5.4–6.6 mm long, 2.4–4.3 mm wide, narrowly obovate to obovate, obtuse or slightly retuse at the apex, attenuate at the base, and erose on the margins throughout or partly without hairs at the base. The range of variation is greater than in the individual plasticity shown in Fig. 1 and also among the specimens collected in Ganesh Himal. Although some plants from Jaljale Himal (nos. 9110172 and 9153220) and from the Hinku and Hunku valleys (no. 9720313) have wider petals, the margins are always finely erose and not fimbriate. In these, the staminodes are always trilobed; the three lobes are nearly equal in some flowers but in others the middle lobe is larger or smaller than the lateral ones. No local differences were found among plants from Ganesh Himal, Jaljale Himal and the Hinku and Hunku valleys.

Parnassia chinensis [Fig. 3]

Figure 3 (upper row) shows the five calyx lobes, five petals and two staminodes of a single flower of *P. chinensis* collected in Ganesh Himal. The calyx lobes are ca. 2.5 mm long and 1.6–1.8 mm wide, oblong, rounded at the apex, and with a few hairs on the basal margins and between the calyx lobes. The petals are ca. 5.8 mm long, ca. 3.3 mm wide, obovate, obtuse to slightly retuse at the apex, attenuate at the base, and slightly fimbriate on the margins except at the apex and base and without hairs at the base. The staminodes are ca. 1.7 mm long, trilobed and with the middle lobe smaller. The variation in shape and size of the calyx lobes, petals and staminodes is narrow both within and among individuals.

Figure 3 (middle and lower rows) shows the five calyx lobes, five petals and five staminodes a flower of *P. chinensis* collected in Jaljale Himal. The calyx lobes are 3.7–5 mm long, 1.6–3 mm wide, oblong to ovate or elliptic, rounded at the apex, glabrous, and usually with one to a few hairs between the calyx lobes or on the basal margins. The petals are obovate, 8.3–10 mm long, 3.6–6 mm wide, obtuse or slightly retuse at the apex, attenuate at the base, and distinctly fimbriate except at the apex and base, and usually with a few hairs at the base. The staminodes are always trilobed

Fig. 3. Calyx lobes, petals and staminodes of *Parnassia chinensis*. Upper: From a flower (Miyamoto *et al.* 9420220). Middle (left to right): Ohba *et al.* 9110116, Ohba *et al.* 9110199, Ohba *et al.* 9120178. Lower (left to right): Ohba *et al.* 9120215, Ohba *et al.* 9153264. All×6.



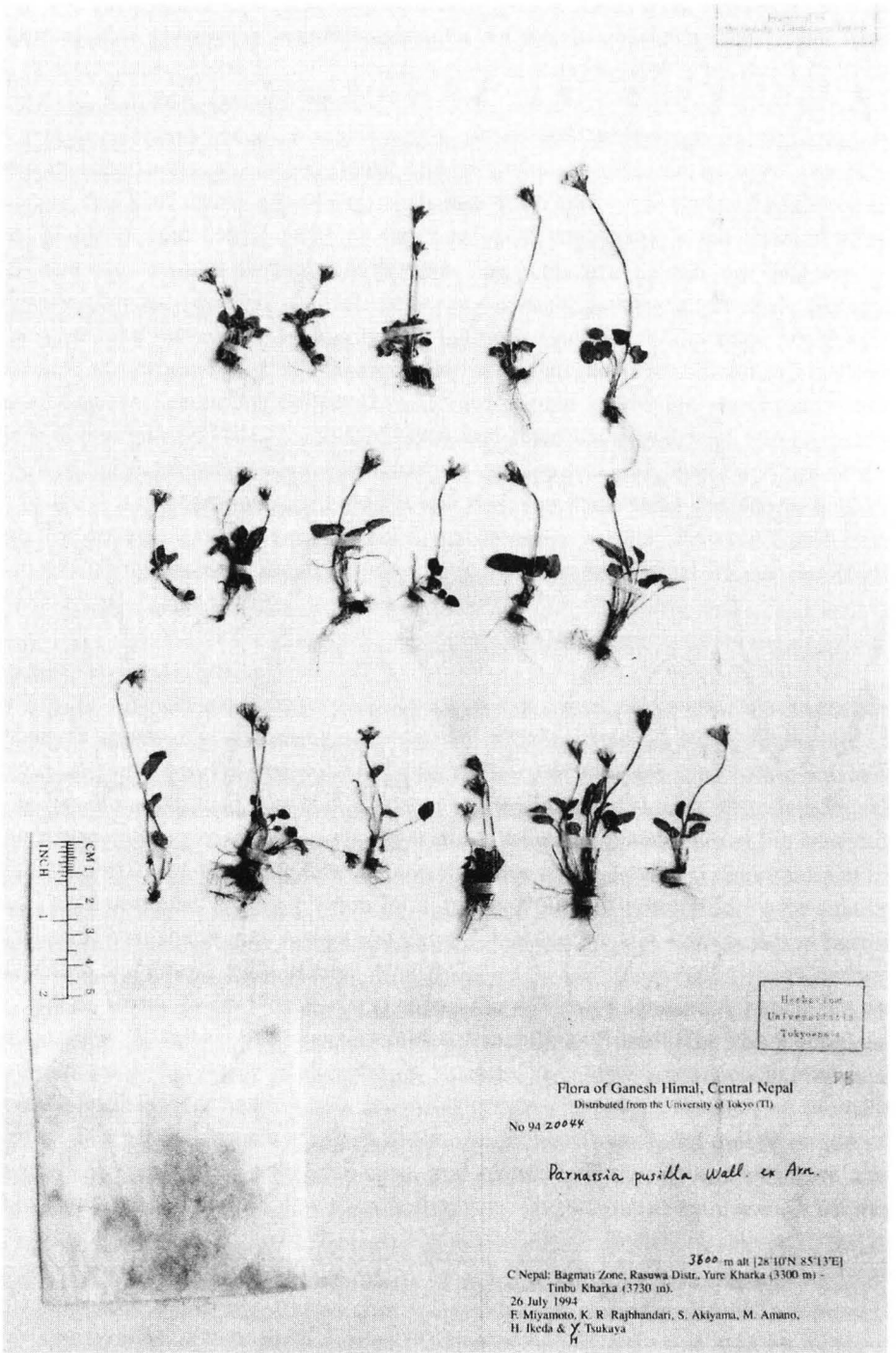


Fig. 4. *Parnassia pusilla* (Miyamoto *et al.* 9420044).

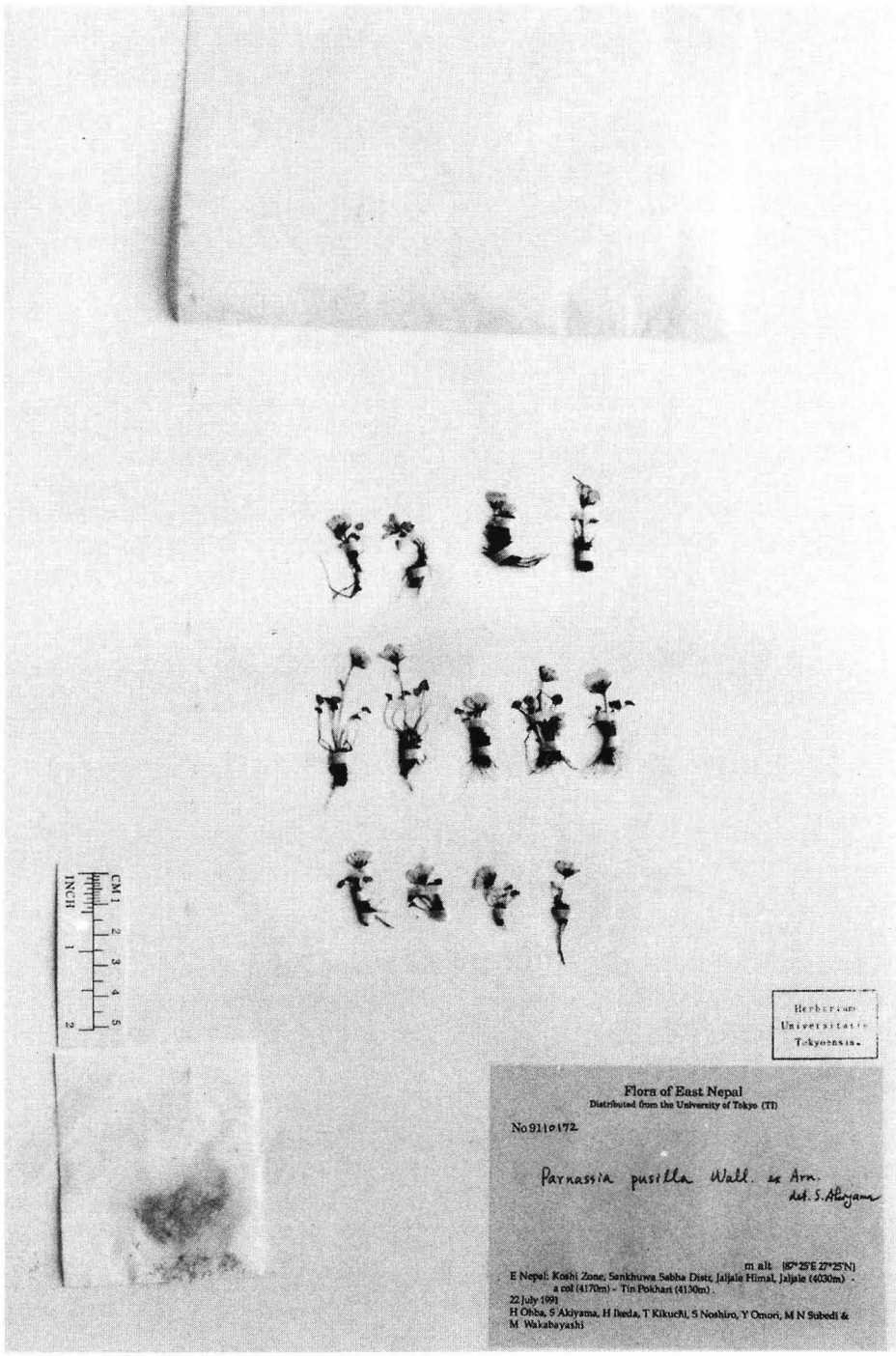


Fig. 5. *Parnassia pusilla* (Ohba *et al.* 9110172).

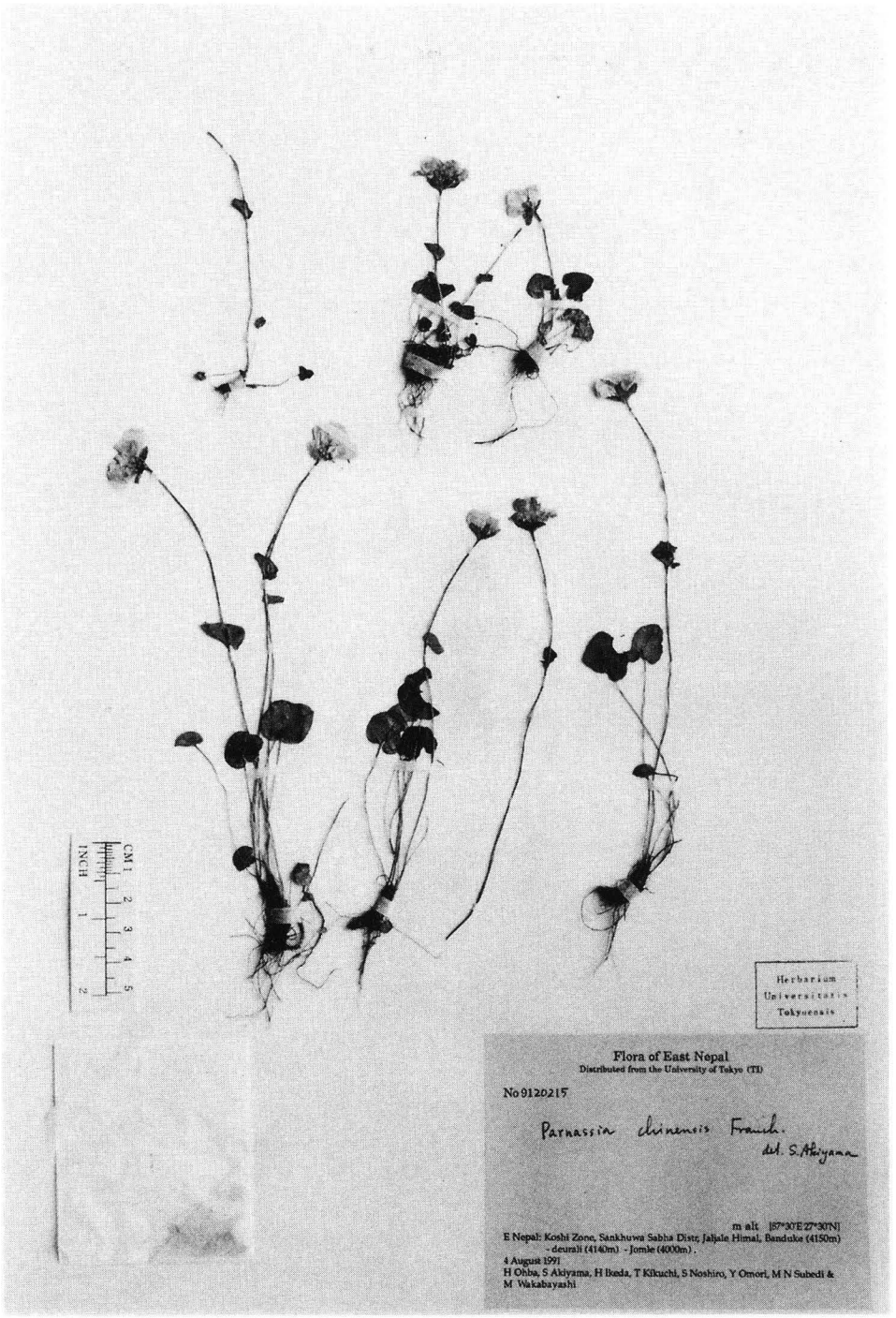


Fig. 6. *Parnassia chinensis* (Ohba *et al.* 9120215).

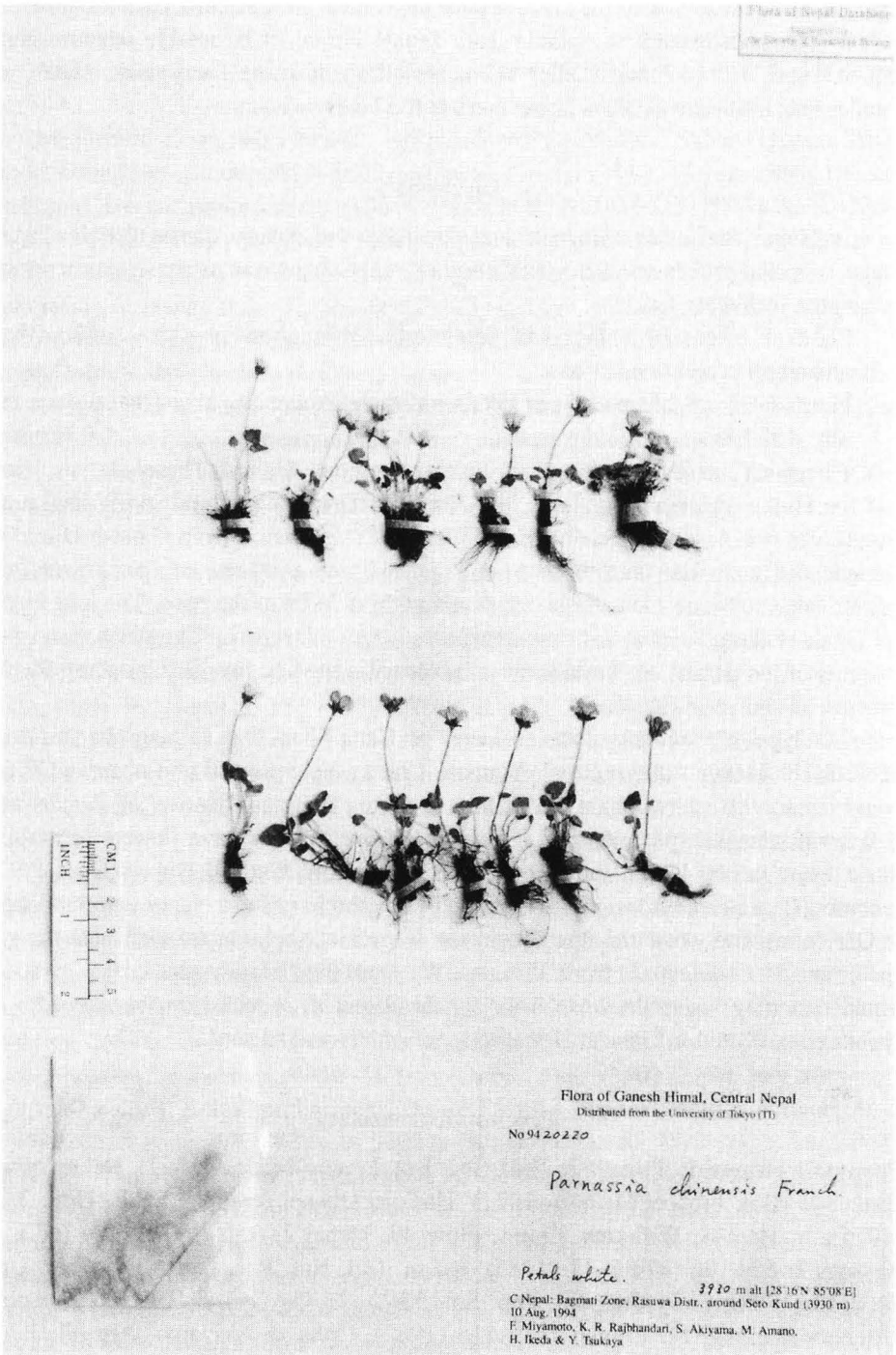


Fig. 7. *Parnassia chinensis* var. *ganeshii* (Ohba *et al.* 9420220, holotype).

with the three lobes nearly the same size or the middle lobe smaller than the others.

In comparison with the plants from Jaljale Himal, it is notable that the plants from Ganesh Himal have smaller stems, smaller and more hairy calyx lobes, and smaller less fimbriate petals with no hairs at the base.

Discussion

In Nepal *Parnassia chinensis* and *P. pusilla* are clearly distinguishable by the shape, size and processes of the petals and by other characters as shown in the figures and by the following key.

A. Plants 1–10 cm tall; margin of petals erose throughout or partly without hairs and small projections at base ..... *P. pusilla*

A. Plants 5–20 cm tall; margin of petals fimbriate except apical and basal parts usually with hairs ..... *P. chinensis*

Parnassia pusilla was found in the three regions, Ganesh Himal, Jaljale Himal and the Hinku and Hunku valleys, but *P. chinensis* was not found in the Hinku and Hunku valleys. As discussed above, the plants of *P. chinensis* from Ganesh Himal are conspicuously smaller than those from Jaljale Himal, and have smaller flowers with hairier calyx lobes and less fimbriate petals without hairs at the base. The less fimbriate petals without hairs at the base approach those of *P. pusilla*. The dissection of the margins of the petals, i.e. fimbriate versus erose, is the key for distinguishing the two species, as shown in Figs. 1–3.

The type of *P. chinensis* was collected on Cang Shan, Dali [Tsang-chan au-desus de Tali, alt. 3800 à 4000 mètres], Yunnan, China. We collected and observed *P. chinensis* in southwestern China and Tibet. In China the classification of *Parnassia* is also controversial. Specimens of *P. chinensis* from Yunnan have flowers resembling those from Jaljale Himal, but larger than those from Ganesh Himal. Hara (1975) recorded *P. chinensis* from Topke Gola and Kipuphu in eastern Nepal and Sandakphu in Darjeeling and wrote that the specimens from Sandakphu agree well with the type specimen of *P. chinensis* from Yunnan. We examined Hara's specimens in TI and found that they resemble those from Jaljale Himal. In conclusion, we consider the specimen collected in Ganesh Himal to represent a local variety.

Taxonomic treatment

Parnassia chinensis Franch. in Bull. Soc. Bot. France **44**: 252 (1897). Nekrassova in Bull. Soc. Bot. France **74**: 650 (1927). Hara in Ohashi (compl.) Fl. E. Him. **3**: 48 (1975); in Hara & Williams, Enum. Flow. Pl. Nepal **2**: 156 (1979). Wu (ed.), Fl. Xizang. **2**: 523, fig. 170 7–11 (1985). Ku in Bull. Bot. Res. North-East. For. Univ. **7**(1): 33 (1987); in Fl. Reipubl. Pop. Sin. **35**(1): 26, fig. 1 4–6 (1995). Grierson in Grierson & Long, Fl. Bhutan **1**(3): 516 (1987). Ohba & Akiyama, Alp. Fl. Jaljale

Him.: 29 (1992); Contr. Fl. Ganish Himal.: 30 (1999).

var. **chinensis** [Figs. 3 (middle and lower) and 5]

Parnassia mysorensis auct. non Heyne: Hara in Kihara (ed.), F. & Fl. Nepal Him.: 143 (1955); in Hara (compl.), Fl. E. Him.: 115 (1966); **2**: t. 9a (1971).

Specimens examined. **Nepal**. Koshi Zone, Sankhuwa Sabha Distr., Milke Danda, Chhippon–Gidde, 2980–3500 m (Ohba *et al.* 9110116, 19 July 1991, TI); Jaljale Himal, around Banduke, ca. 4150 m (Ohba *et al.* 9110199, 9120178 & 9153264, 25 July–3 Aug. 1991, TI); Jaljale Himal, Banduke–Jomle, 4150–4000 m (Ohba *et al.* 9120215, 4 Aug. 1991, TI). **Darjeeling** (**Singalila**). Sandakphu, 3600 m (Hara s.n., 16 Sept. 1964, TI; Kanai *et al.* 721351 & 723123, 1 Aug. 1972, TI); 3900 m (Hara *et al.* 69676, 14 July 1969, TI). Tonglu (Kurosawa s.n., 12 July 1969, TI).

var. **ganeshii** S. Akiyama & H. Ohba, var. nov. [Figs. 3 (upper) and 7]

A typo differt petalis toto minoribus, ca. 5.8 mm longis, ca. 3.3 mm latis, margine sparse fimbriusculis et calycis lobis margine basi multo ciliatis differt.

Type: **Nepal**. Bagmati Zone, Rasuwa Distr., around Seto Kund, 3930 m (Miyamoto *et al.* 9420220, 10 Aug. 1994, TI -holo, KATH and TNS-iso).

Parnassia pusilla Wall. [Numer. List: 34, no. 1245 (1829), nom. nud.] ex Arn. in Comp. Bot. Mag. **2**: 81 (1837). Hooker & Thomson in J. Linn. Soc. Bot. **2**: 81 (1857). C. B. Clarke in Fl. Brit. India **2**: 403 (1878). Baehni in Candollea **16**: 219 (1958). Hara in Ohashi (compl.), Fl. E. Him. **3**: 48 (1975) in Hara & Williams, Enum. Flow. Pl. Nepal **2**: 156 (1979). Wu (ed.), Fl. Xizang. **2**: 521, fig. 169 10–14 (1985). Ku in Bull. Bot. Res. North-East. For. Univ. **7**(1): 38 (1987); in Fl. Reipubl. Pop. Sin. **35**(1): 35 (1995). Grierson in Grierson & Long, Fl. Bhutan **1**(3): 516 (1987). Ohba & Akiyama, Alp. Fl. Jaljale Him.: 30 (1992); Contr. Fl. Ganish Him.: 30 (1999). [Figs. 1, 2, 4 and 5]

Specimens examined. **Nepal**. Koshi Zone, Sankhuwa Sabha Distr., Topke Gola, 3600 m (Kanai *et al.* 723253, 19 June 1972, TI); Thudam–Lama Chungbu, 3500 m (Kanai *et al.* 720679, 23 June 1972, TI); 4000 m (Shakaya 1690, 23 June 1972, TI); Lama Chungbu–Thudam, 4400–3400 m (Kanai *et al.* 723254, 24 June 1972, TI); Phujeng La–Topke Gola, 3800 m (Kanai *et al.* 720820, 27 June 1972, TI); Jaljale Himal, Khokling–Jaljale, 3420–4030 m (Ohba *et al.* 9153220, 21 July 1991, TI); Jaljale Himal, Jaljale–Tin Pokhari, 4030–4170 m (Ohba *et al.* 9110172, 22 July 1991, TI). Sagarmatha Zone, Solukhumbu Distr., Saure Kharka–Tangna, 4000 m (Miyamoto *et al.* 9580206, 5 Aug. 1995, TI, TNS); 3700 m (Miyamoto *et al.* 9592183, 5 Aug. 1995, TI); Kahre–Tangna, 4360 m (Miyamoto *et al.* 9584210, 20 Aug. 1995, TI); Tangna–Samakang Kharka, 3925 m (Miyamoto *et al.* 9596424, 23 Aug. 1995, TI, TNS); Jumbesi–Kensa, 3300 m (Miyamoto *et al.* 9592570, 2 Sept. 1995, TI); around Khola Kharka, 4100 m (Wakabayashi *et al.* 9710158, 7 Aug. 1997, TI); Khola Kharka–Rangdu Kharka, 3900 m (Wakabayashi *et al.* 9710187, 8 Aug. 1997, TI); Rangdu Kharka–Horsola Kharka, 3620 m (Wakabayashi *et al.* 9720172, 10 Aug. 1997, TI);

Horsola Kharka–Tangnag, 3750 m (Wakabayashi *et al.* 9730214, 11 Aug. 1997, TI); around Tangnag, 4300 m (Wakabayashi *et al.* 9710299, 20 Aug. 1997, TI); Tangnag–Mosom Kharka, 4040 m (Wakabayashi *et al.* 9720247, 21 Aug. 1997, TI); Thuli Kharka–Kurki, 3920 m (Wakabayashi *et al.* 9720313, 28 Aug. 1997, TI); 4100 m (Wakabayashi *et al.* 9720308, 28 Aug. 1997, TI); Junbesi–Sete, 3350 m (Wakabayashi *et al.* 9710420, 1 Sept. 1997, TI). Bagmati Zone, Rasuwa Distr., Yure Kharka–Tinbu Kharka, 3600 m (Miyamoto *et al.* 9420044, 26 July 1994, TI); 3650 m (Miyamoto *et al.* 9440024, 26 July 1994, TI, TNS); Singum Gompa–Gosainkund, 3200–4200 m (Kanai *et al.* 721855 & 723255, 23 Aug. 1972, TI); Gosainkund–Gopte, 3500–4400 m (Kanai *et al.* 723256, 25 Aug. 1972, TI); Thale Patil–Mangen, 3100–3400 m (Kanai *et al.* 723257, 27 Aug. 1972, TI); Chilime Khola, Oo Kharka–Mul Kharka, 3400–3800 m (Kanai & Shakya s.n., 1 July 1970, TI); Mul Kharka, 3800–4100 m (Kanai & Shakya s.n., 2 July 1970, TI).

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