

## Geographical Distribution and Variation of *Bistorta tenuicaulis* and Its New Variety from Japan, with Special Reference to Gynodioecy of *B. tenuicaulis* and *B. abukumensis* (Polygonaceae)

Koji YONEKURA and Hiroyoshi OHASHI

Biological Institute, Graduate School of Science, Tohoku University, Sendai, 980-0845 JAPAN

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Geographical distribution and morphological variation of *Bistorta tenuicaulis* (Bisset & S. Moore) Nakai are examined. Two types of plants are recognized in the species by the differences in rhizomes, radical leaves, inflorescences, pedicels and sex expression patterns. Plants from the Japan Sea side regions of central to western Honshu are recognized as a new variety, var. *chionophila* Yonekura & H. Ohashi. Gynodioecy of *B. tenuicaulis* is reported for the first time and compared with that of *B. abukumensis*.

*Bistorta tenuicaulis* (Bisset & S. Moore) Nakai is a perennial herb growing by streams under deciduous forests in the temperate regions of Japan. This species has a well branched prostrate rhizome and flowers blooming before full unfolding of leaves in spring, while most of other *Bistorta* species grow in open places in the alpine or the arctic regions in northern hemisphere and have short simple rhizomes and flowers bloom after the unfolding of leaves. *Bistorta abukumensis* Yonekura, Iketsu & H. Ohashi in Abukuma Mountains, northeastern Honshu, has similar characters and thought to be related to *B. tenuicaulis* (Yonekura et al. 1995).

Rhizomes in *B. tenuicaulis* are moniliform (Fig. 1, a-c) or elongated (Fig. 1, d), and the apices of rhizomes become thickened in every year. The elongated one consists of thickened parts, which are composed of nodes and shortened internodes, and slender parts, which are composed of one or few nodes and elongated internodes. When the rhizome branches, the first year's branch often abnormally elongated.

Variation ranges of length of the slender parts and length/thickness ratio of the thickened parts are shown in Fig. 2. Two groups of plants can be recognized in *B. tenuicaulis*, which are here arbitrarily designated Group A and Group B respectively. The Group A is characterized in having moniliform rhizomes which usually have short slender parts and spherical thickened parts (Fig. 1, a-c), while the Group B is characterized by elongated rhizomes with long slender parts and fusiform thickened parts (Fig. 1, d). Such differences in the shape of rhizomes never changed after cultivation of the plants for several years under uniform condition in the experimental garden of Tohoku University, Sendai. The Group A is distributed in the regions of the Pacific Ocean side of Honshu, Shikoku and Kyushu, while the Group B is distributed in the Japan Sea side regions from central to western Honshu (Fig. 3). Among the Group A plants from western Japan (Kyushu, Shikoku and westernmost Honshu) tend to have elongated slender parts (Fig. 1, c). These plants, however, are difficult to recog-

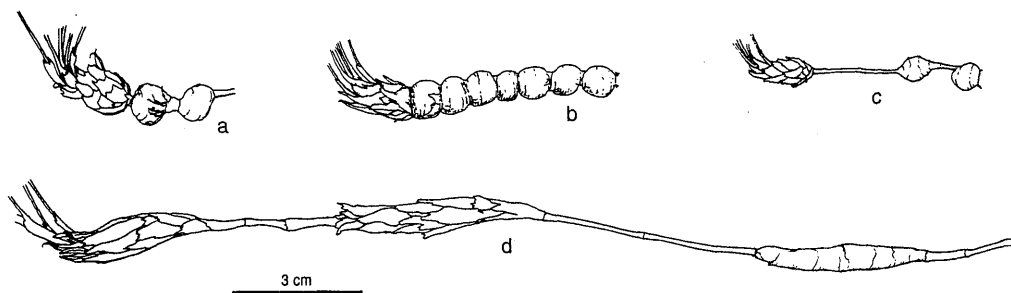


Fig. 1. Representative forms of rhizomes in *Bistorta tenuicaulis* showing the last three year's growth in a, c, and d, and the last eight year's growth in b. a-c. Group A. d. Group B. Voucher specimens: a. Ohba & Akiyama 1153 (TI). b. Sakai 840502 (TUS). c. Miake s. n. (TUS). d. Tateishi & Hoshi 13718 (TUS).

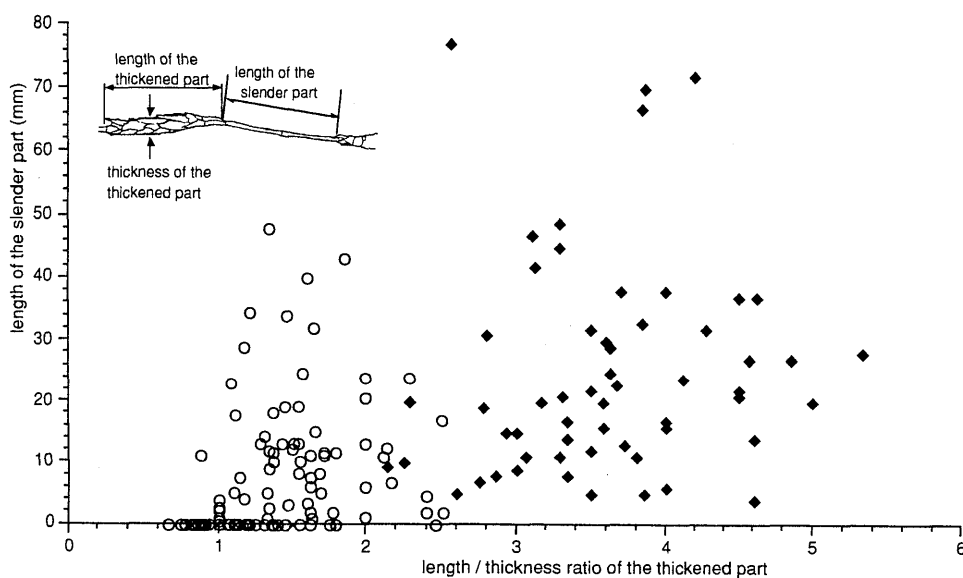


Fig. 2. Scatter diagram showing the variation of length/thickness ratio of thickened parts vs. length of slender parts of rhizomes in *Bistorta tenuicaulis*. ○: Group A. ◆: Group B. The first year's branches are excluded from measurements. Voucher specimens: Group A: Enomoto s. n. (TI), Hara s. n. (TI), Iketsu 1416 (TUS), Kanai s. n., (TUS), Kanai 4874 (TI), Kanai 6429 (TUSG), Makino s. n. (TI), Miake s. n. (TUS), G. Murata et al. 93 (TI, TUSG), J. Murata 3687 (TI), J. Murata et al. 11037 (TI), Nakajima s. n. (TI), Ohba & Akiyama 1153 (TI), Sakai 840502 (TUS), Sohma & Ohashi s. n. (TUS), Yamanaka s. n. (TUS), Yamazaki s. n. and 7101 (TI), Yonekura 94522 (TUS). Group B: Kurosaki 10662 and 15147 (TUS), G. Murata 1023 (TUSG), G. Murata 7043 (TI), G. Murata & Fukuoka 308 (TI), Tateishi & Hoshi 13718 and 13850 (TUS), Tsugaru et al. 13120 (TUS), Yonekura 94604, 94624, 94626, 94640, 94698, 94720 and 94739 (TUS).

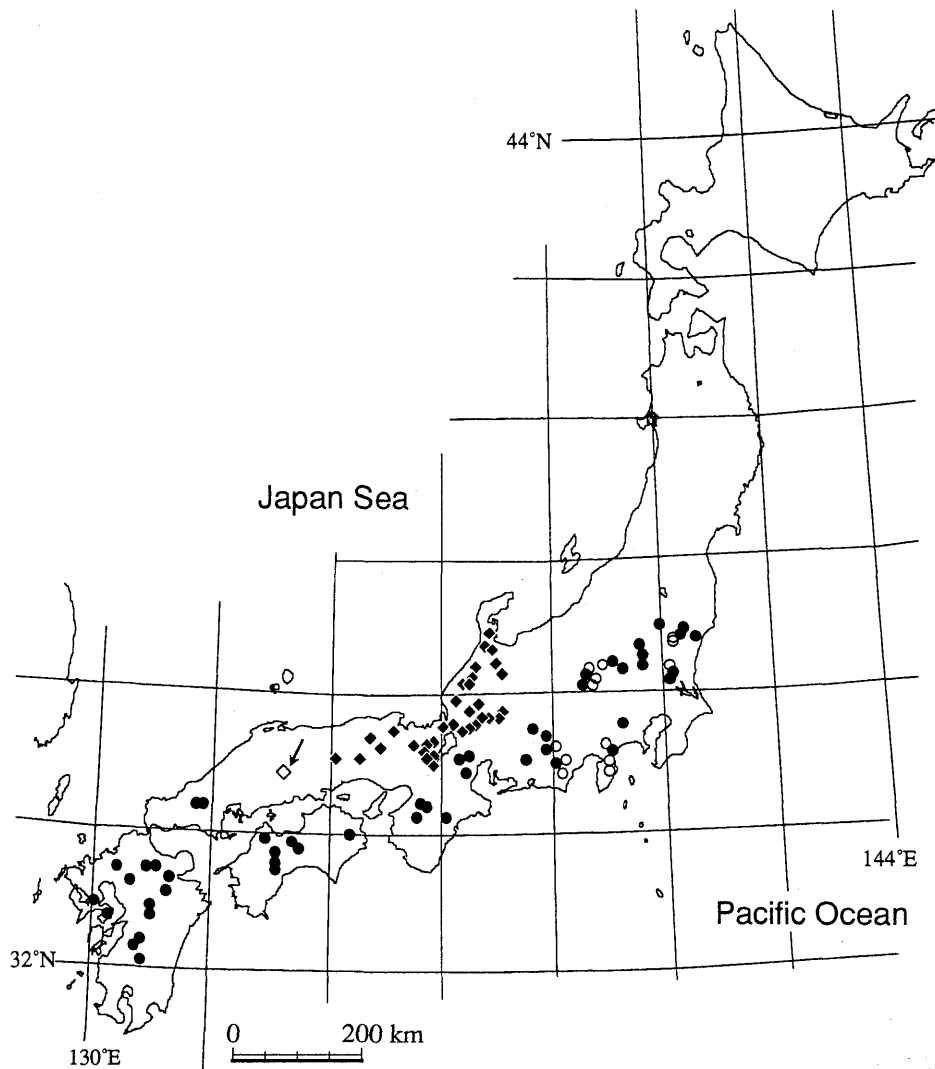


Fig. 3. Distribution of *Bistorta tenuicaulis* in Japan. Circle: Group A. Diamond: Group B. Localities indicated by solid symbols are based on the specimens listed in Appendix; open symbols are after Inami (1985, indicated by arrow), Ogura et al. (1989), Sugimoto (1984), and Tobe et al. (1987).

nize as a distinct group from other plants having moniliform rhizomes (Fig. 1; a, b), because plants with such rhizomes as shown in Fig. 1, c are sometimes observed among the population in eastern Japan (e.g. Iketsu 1416 (TUS) from Ibaraki Prefecture). Plants of the Group B tend to produce large populations by developing and extending their rhizomes in

forest floors by a stream, while those of the Group A usually occur sporadically in natural habitats and hardly make such a large population.

Geographical variation in shape and size of radical leaves at flowering time in *B. tenuicaulis* is shown in Fig. 4. The Group A has usually oblong to elliptic leaves with acute or obtuse

tip and cuneate base at flowering time, while the Group B has ovate radical leaves with more or less acuminate tip and truncate base. Leaves of the Group A unfolding in summer are much larger than those of flowering time and become similar to leaves of the Group B in shape, while in the Group B the shape of leaves at flowering time are not so different from those in summer. Plants of the Group B from the Ryohaku and Ibuki mountain ranges in Ishikawa, Fukui, Gifu and Shiga Prefectures

(20, 21, 23 and 24 in Fig. 4) have larger leaves than those from other regions, but plants with intermediate size of leaves between such large leaved plants and small leaved Group A (1–17 in Fig. 4) frequently occur in Kyoto, Ishikawa, Fukui, Gifu and Toyama Prefectures (19 and 22 in Fig. 4).

Geographical variation in pedicel length of *B. tenuicaulis* is shown in Fig. 5. The pedicels were measured in the longest three to five ones in every inflorescence, but the lowest flower is

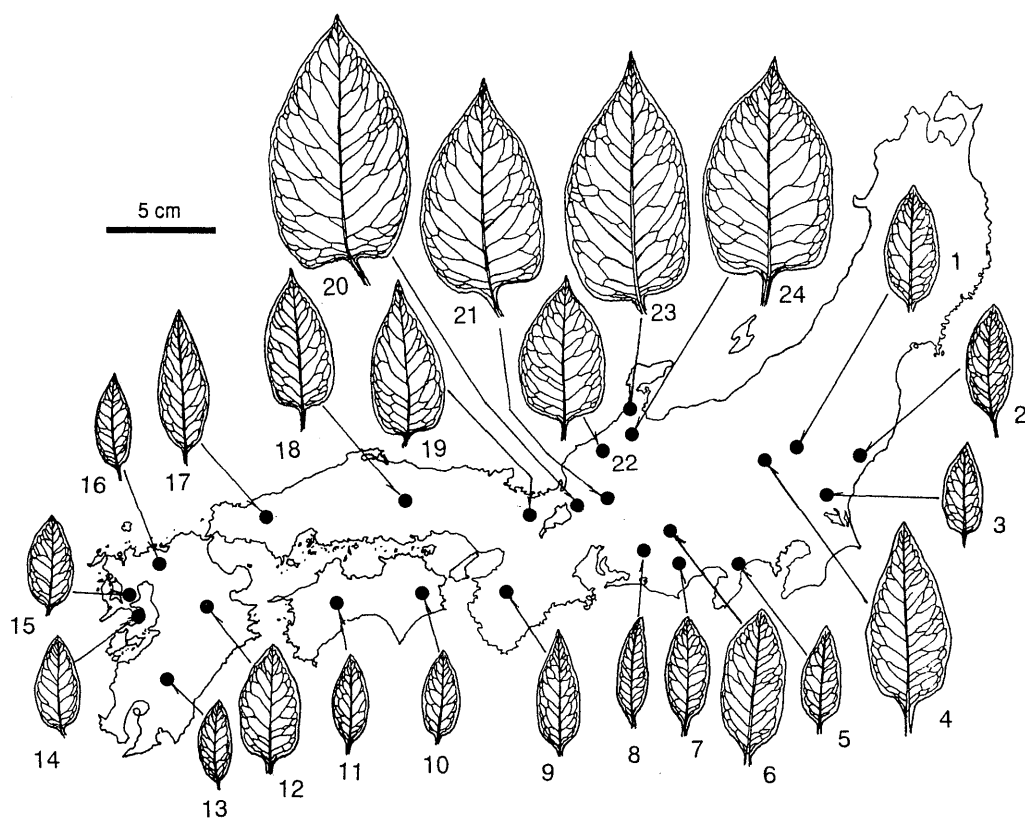


Fig. 4. Geographical variation in shape and size of radical leaf at flowering time of *Bistorta tenuicaulis* in Japan. 1–17. Group A; 18–24. Group B. Voucher specimens: 1. Ohba & Akiyama 1153 (TI). 2. Iketsu 1416 (TUS). 3. Okawa s. n. (TNS). 4. Sakai 840502 (TUS). 5. Yamazaki 682 (TI). 6. Kanai 795752 (TNS). 7. G. Murata et al. 93 (TNS). 8. Torii s. n. (KYO). 9. Nakajima s. n. (TI). 10. Koyama 968 (TNS). 11. Makino s. n. (MAK). 12. Yamazaki 7101 (TI). 13. Mayebara s. n. (TNS). 14. Tashiro s. n. (TNS). 15. Nitta 63 (KYO). 16. Baba 79 (KYO). 17. Miyake 17059 (TNS). 18. Takayama s. n. (TNS). 19. G. Murata s. n. (MAK). 20. G. Murata 70177 (KYO). 21. Takahashi 3570 (KYO). 22. Tsugaru et al. 13120 (TNS). 23. Kurosaki 10662 (KYO). 24. Kurosaki 13160 (KYO).

excluded, because length of the lowest pedicels varies in growing condition. Plants from the Ryohaku and Ibuki mountain ranges (17–23 in Fig. 5) tend to have longer pedicels than those from other regions, although such variation seems clinal as in the case of size of leaves. Larger plants of the Group B having longer pedicels are more or less similar to *B. abukumensis*, but it is easily distinguishable from the latter in leaves, inflorescences and flowers (Yonekura et al. 1995).

In some populations of the Group B female (male-sterile) plants are observed with hermaphrodite plants (19, 20 and 25 in Fig. 5), while in the Group A such plant have never been found. Female plants of the Group B have flowers with smaller reddish sterile anthers and short filaments as those of *B. abukumensis*. In *B. abukumensis* female flowers have shorter pedicels and narrower corollas than hermaphrodite ones (Yonekura et al. 1995). In *B. tenuicaulis*, however, both female and hermaphrodite flowers are hardly distinguishable from each other in such characters. Both hermaphrodite and female individuals occur in most of the populations of *B. abukumensis*, but such gynodioecious populations are rare in the Group B and the most populations consist of only hermaphrodite ones. Even in gynodioecious populations of the Group B ratio of female plants in each population is less than 10%, while in *B. abukumensis* it is more than 30%.

The Group B is generally different from the Group A as discussed above. We conclude that both groups should be recognized as distinct at the varietal rank.

The type of *Polygonum tenuicaule* Bisset & S. Moore was collected in Nikko, the Pacific Ocean side in eastern Honshu, and its original description well fits for the plants of what we call the Group A in the present paper. *Polygonum tenuicaule* var. *nanum* Matsum. & Nakai was described from Mt. Hakusan on the

Japan Sea side regions of central Honshu, but we failed to find any type materials of this variety in major herbaria in Japan. Its original description is disaccordant with the plants from the vicinities of Mt. Hakusan, and the illustration of this variety by Nakai (plate 2B in Nakai (1909)) is different from the Group B in the forms of rhizomes and the shapes of leaves and inflorescences. This variety is presumed to be based on a dwarf form of the typical *B. tenuicaulis*. In fact, such a form is frequently observed in western Japan (especially Shikoku and Kyushu), but never occur in the Japan Sea side regions of central Honshu. We regard this variety as merely a dwarf form of *B. tenuicaulis* var. *tenuicaulis*. Accordingly, the Group B should be given a new name of the varietal rank. We name it var. *chionophila*, which is derived from their habitat (snowy region in Japan).

#### Key to varieties of *Bistorta tenuicaulis*

1. Blades of radical leaves at flowering time ovate-oblong or elliptic, obtuse or acute at apex, attenuate or cuneate at base. Rhizomes shortly creeping, thickened parts spheroidal. Plants hermaphrodite. Inflorescences 0.8–2 cm long, pedicels 1.5–3 mm long ..... var. *tenuicaulis*
1. Blades of radical leaves at flowering time ovate to triangular ovate, acuminate to acute at apex, truncate at base. Rhizomes long-creeping, thickened parts fusiform. Plants gynodioecious, while female plants very rare. Inflorescences 1.5–5 cm long, pedicels 2–4.5 mm long ..... var. *chionophila*

***Bistorta tenuicaulis*** (Bisset & S. Moore) Nakai in Rigakkai **24**: 295 (1926); Hara in J. Jap. Bot. **9**: 253 (1934); Nemoto, Fl. Jap. Suppl. 167 (1936); Nakai in J. Jap. Bot. **14**: 739 (1938), excl. specim. ex Isl. Cheju; in J. Jap. Bot. **18**: 288 (1942), excl. syn. *Polygonum marrettii* H. Lév.; Kitagawa in Satake et al.,

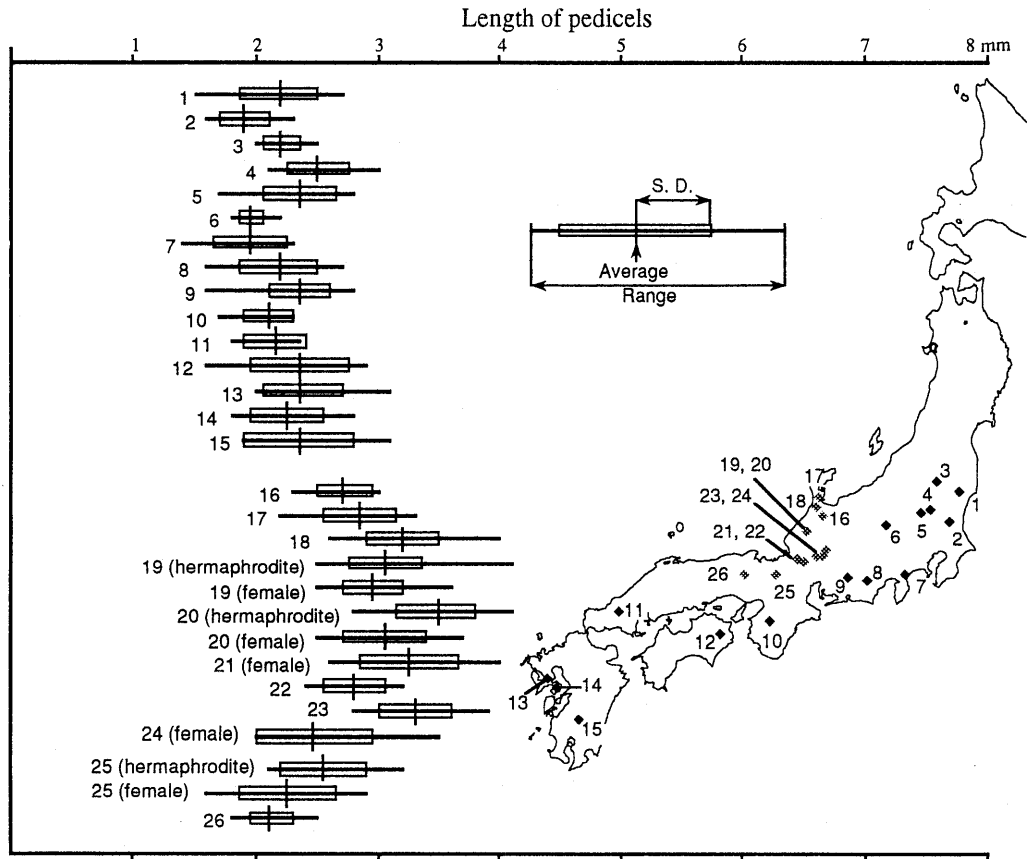


Fig. 5. Geographical variation in pedicel length in *Bistorta tenuicaulis*. 1–15. Group A. 16–26. Group B. Voucher Specimens: 1. Iketsu 1416 (TUS). 2. Okawa s. n. (TNS). 3. Hara s. n. (TI). 4. Kobayashi s. n. (MAK) and Ogawa s. n. (TNS). 5. Ohba & Akiyama 1153 (TI). 6. Kanai 6429 (TI, TUSG). 7. Kanai 4874 (TI), J. Murata 228 (TI), Sawada s. n. (TI, TUS) and Yamazaki 682 (TI). 8. G. Murata et al. 93 (KYO, TUSG). 9. G. Murata s. n. (TNS), Torii s. n. (KYO) and Torii 11709 (TNS). 10. Nakajima s. n. (TI). 11. Miake s. n. (TUS). 12. Koyama 968 (KYO, TNS). 13. Nitta 63 (KYO) and Yonekura 94522 (TUS). 14. Greatrex s. n. (TI), Matsumura & Koidzumi s. n. (TI) and Tashiro s. n. (TNS). 15. Mayebara s. n. (TNS). 16. Kurosaki s. n. (MAK, TI) and Kurosaki 13160 (KYO). 17. Fukuoka 3506 (KYO) and Satomi 10111 (MAK). 18. Fukuoka 3424 (KYO), Kurosaki 10662 (TNS, TUS) and Yonekura 94604 (TUS). 19. Masamune 1952 (MAK), Takeuchi 41 (KYO), Tsugaru et al. 7873 (KYO) and Yonekura 94624, 94626 (TUS). 20. Tsugaru et al. (KYO, TNS, TUS) and Yonekura 94640 (TUS). 21. Tateishi & Hoshi 13718, 13850 (TUS). 22. G. Murata & Fukuoka 308 (KYO, TI). 23. G. Murata & Togashi 204 (KYO). 24. Takahashi 5372 (KYO). 25. Yonekura 94738, 94739 (TUS). 26. Kurosaki 15147 (KYO, TUS).

Wild Fl. Jap. **2**: 18, excl. pl. 16-2 of 1st–3rd printings (1982); Ono et al., Rev. Makino's New Ill. Fl. Jap, 79, t. 313 (1989); Yonekura & Ohashi in J. Jpn. Bot. **72**: 302 (1997).

*Polygonum tenuicaule* Bisset & S. Moore in S. Moore, J. Bot. **16**: 135 (1878); Nakai in Bot. Mag. Tokyo **23**: 413 (1909); Ohwi in Fl. Jap. 465 (1953); Kitamura & Murata, Col. Ill.

Herb. Pl. Jap. Choripet. 303, pl. 64–574 (1961).

*Bistorta tenuicaulis* (Bisset & S. Moore) Petrov in Bull. Jard. Bot. Princ. URSS **27**: 226 (1928), comb. superfl.; Nakai in J. Jap. Bot. **14**: 739 (1938), pro syn.

**Type:** JAPAN, Tochigi Pref., Nikko (leg. Bisset) – Holotype probably in E, isotype in LE (fide Petrov 1928), non vidi.

var. **tenuicaulis**.

*Polygonum tenuicaule* var. *nanum* Matsum. & Nakai in Bot. Mag. Tokyo **22**: 153 (1908); Nakai in Bot. Mag. Tokyo **23**: 413, pl. 2-B (1909); Makino & Nemoto, Fl. Jap. 1044 (1925), Fl. Jap. ed. 2, 264 (1931). – *Bistorta tenuicaulis* Nakai var. *nana* (Matsum. & Nakai) Nakai in Rigakkai **24**: 295 (1926); Nemoto, Fl. Jap. Suppl. 167 (1936), **syn. nov.**

**Type:** JAPAN, Ishikawa Pref. (Prov. Kaga), Mt. Hakusan (collector and date unknown from the original description). No type materials are found.

Distr. Japan; Honshu (Pacific Ocean side regions from Fukushima Pref. to Wakayama Pref., and Yamaguchi Pref.), Shikoku and Kyushu.

*Bistorta tenuicaulis* is reported from Isl. Cheju of Korea (Nakai 1939, 1942, Chung 1957, T.B. Lee 1980, W.T. Lee 1996a, 1996b), but all specimens in TI cited by Nakai (1939) as *B. tenuicaulis* and one of isosyntypes of *Polygonum marrettii* H. Lév. (Taquet 1297, TI) which was synonymized to *B. tenuicaulis* by Nakai (1941) belong to *B. suffulta* (Maxim.) H. Gross. Moreover, the illustrations of ‘*B. tenuicaulis*’ in Chung 1957 (Fig. 293) and W.T. Lee 1996b (pl. 73–437) are not *B. tenuicaulis* but *B. suffulta*. *Bistorta suffulta* in early spring are often misidentified as *B. tenuicaulis*, but they are easily distinguishable from each other by the number and size of cauline leaves in each stem (more than 3 and developed in the former, while less than 2 and small in the latter), the number of flowers in each node of inflorescence (2 in the former,

one flower blooms after the other fructifies, while 1 in the latter), etc. The previous reports of *B. tenuicaulis* from Isl. Cheju appear to be misidentifications.

var. **chionophila** Yonekura & H. Ohashi, var. nov. (Fig. 6)

A typo rhizoma longe repenti nodulis incrassis fusiformibus, laminis foliorum radicalibus sub anthesi ovatis vel trianglari-ovatis apice acuminatis basi truncatis vel leviter cordatis differt. A *Bistorta abukumensi* foliis radicalibus sub anthesi laminis basi distincte in petiorum decurrentibus subtus glabris, floribus anguste campanulatis teparis vix patentibus distinguitur.

A perennial gynodioecious herb, although female individuals much rare. Rhizomes elongated, nodose, slender parts usually 5–15 cm long, thickened parts fusiform, sometimes branching at nodes in thickened parts. Radical leaves at flowering time usually 3–5, 8–32 cm long (including petioles), blades ovate to triangular-ovate, 4–13 cm long, 3–7 cm wide, acute to acuminate, truncate or slightly cordate at base, glabrous on both side; petioles 4–20 cm long, winged. Stems bear from axiles of leaves of last year, 5–18 cm tall, (1–)2(–3)-leaved, withering after anthesis. Cauline leaves broadly ovate, 0.8–2.7 cm long (excl. petioles), 0.5–2 cm wide, obtuse to acute at apex; lower ones petiolate, upper ones shortly petiolate or sessile, rarely amplexicaul. Ochreae 2–5 mm long, brownish, membranaceous, glabrous. Inflorescences at the apex of stems, (1.5–)2–5(–6) cm long, 8–12 mm thick, each node bears one flower. Bracts narrowly triangular, 1.5–2 mm long, brownish. Pedicels 2–4.5 mm long, nearly equal to the bracts in length. Perianthes campanulate, 2.6–3.4 mm long. Tepals 5, ovate, 2.2–2.7 mm long, 1–1.2 mm wide, white or slightly pinkish at apex, trifid-veined. Stamens 8. Styles 3, filiform, 2–2.5 mm long. Ovaries elliptic, triangular, reddish, stigmas capitate. In hermaphrodite flowers stamens



Fig. 6. *Bistorta tenuicaulis* (Bisset & S. Moore) Nakai var. *chionophila* Yonekura & H. Ohashi. a, b. Habit. c. A hermaphrodite flower. d. The same, cut, spread out and a pistil removed. e. A female flower. f. The same, cut, spread out and a pistil removed. g. A pistil. h. A fruit of female flower with persistent calyx and stamens. Scale bar = 7 cm (a, b); 1 cm (c-f, h); 5 mm (g). Voucher specimens: a, b. Tateishi & Hoshi 13718 (TUS, Holotype). c-i. Yonekura 94624 (TUS).



2.7–3.5 mm long, anthers dark purplish, exerted from perianth. In female flowers stamens 1.6–2.5 mm long, anthers reddish, smaller, sterile, included in perianth. Achenes brown, broadly elliptic, triangular, 2.7–3 mm long, without beak.

Nom. Jap. Oo-harutoranoo (オオハルト  
ヲノオ) (nov.)

**Type:** JAPAN; Shiga Pref., Ika-gun, Yogo-machi, Obara, alt. 230–450 m (Y. Tateishi & H. Hoshi 13718, 4 May 1988, Holotype in TUS).

Other specimens are in appendix.

Distr. Japan; Japan Sea side regions of central to western Honshu (from Toyama Pref. to Hiroshima Pref.).

A plant in the drawing of *B. tenuicaulis* by Inami (1985) from Hiroshima Pref., western Honshu (indicated by an arrow in Fig. 3) has an elongated rhizome with fusiform nodules. Accordingly, this plant is identified as var. *chionophila*.

We wish to express our sincere thanks to curators of FU, KANA, KYO, MAK, TI, TNS and TUSG for their permission to examine their specimens.

#### Appendix

Representative specimens examined. Asterisks indicate specimens in which female plants are included.

*Bistorta tenuicaulis* var. *tenuicaulis*.

**JAPAN; Fukushima Pref.**, Higashishirakawa-gun, Tanagura-machi, Oome, along upper stream of Kuji-gawa River, above Oiwadaira, alt. 330–340m (K. Yonekura 95444, TUS); Yamatsuri-machi, Mt. Yamizo-san, Shidadani (K. Sohma & H. Ohashi s. n., 5 May 1964, TI, TUS); **Ibaraki Pref.**, Takahagi-shi, Shimokimoda, about 2 km south of Yanagisawa, bank of upper stream of Ohkitagawa River, alt. ca. 610m (J. Iketsu 1416, TUS); Makabe-gun, Mt. Kaba-san (C. Okawa s. n., 27 Apr. 1980, TNS); Tsukuba-shi, Mt. Tsukuba-san (S. Okuyama 20759, TNS); **Tochigi Pref.**, Kuroiso-shi, Nasu, Itamuro (H. Hara s. n., 26 Apr. 1984, TI); Kanuma-shi, Mt. Ozaku-san (S. Kobayashi s. n., 18 Apr. 1979, MAK); Tochigi-shi (Shimotsuga-gun, Terao-mura), Izuru-san (S. Sugaya s. n., 26 Apr. 1935, TI); Nikko-shi, prope Jakko-no-taki Waterfall (H. Ohba & S. Akiyama 1153, TI); Nikko-shi, en route to Aioi-no-taki Waterfall (M. Ono s. n. 29 Apr. 1961, MAK); **Gunma Pref.**, Kiryu-shi, Mt. Narukami-yama (West side), alt. 600–979m (J. Murata, K. Inoue & T. Kubo 11037, KYO, TI, TUS); Seta-gun, Kurohone-

mura, foot of Mt. Akagi-san, near Ninotorii (H. Sakai 840502, TUS); Seta-gun, Fujimi-cho, Mt. Akagi-san, Minowa (Y. Shiobara s. n., 28 Apr. 1929, TNS); **Tokyo Pref.**, Hachioji-shi (Minamitamaga-gun), Takao-san (T. Makino s. n., 1925, MAK); **Kanagawa Pref.**, Ashigarashimo-gun, Hakone-machi, Ninooka, alt. 800m, cult. in Tokyo (T. Yamazaki 682, KYO, MAK, TI); Hakone-machi, near Motohakone, alt. 700m (J. Murata 228, TI); Ashigarashimo-gun, Yugawara-machi, Mt. Nango-yama (K. Someno s. n., 17 Apr. 1958, TNS); **Nagano Pref.**, Kitasaku-gun, Karuizawa-machi, Kyu-karuizawa, alt. 1000m (H. Kanai 6429, TI, TUSG); Saku-shi, South of Karuizawa, Shoya-kosen (H. Kanai s. n., 23 May 1965, KYO, TI TUS); Kiso-gun, Yamaguchi-mura, Hara, alt. 500m (H. Kanai 795752, TNS); Shimoina-gun, Hiraoka-mura, Mt. Kumabuse (K. Asano s. n., 5 Jun. 1965, TI); Shimoina-gun, Yasuoka-mura, Kinno (K. Katsumata s. n., 24 Apr. 1936, TI); **Shizuoka Pref.**, Syuchi-gun, Haruno-cho, Mt. Iwatake, alt. 900m (G. Murata, M. Hotta, H. Takahashi & F. Konta 93, KYO, MAK, TNS, TUSG); **Aichi Pref.**, Kitashidara-gun, Shidara-cho, Mt. Dando-yama, Sumikawa (K. Torii 11709, TNS); Mt. Dando-yama, Uradani (K. Torii s. n., 4 May 1953, KYO); **Mie Pref.**, Inabe-gun, Fujiwara-cho, Mt. Fujiwara-dake, alt. 700m (G. Murata 20587, KYO); Suzuka-shi, Mt. Nonobori-yama (S. Matsuyama s. n., 28 Apr. 1927, KYO); **Shiga Pref.**, Echi-gun, Aito-cho (Higashiogura-mura), Ibarakawa (G. Murata 8583, KYO); **Nara Pref.**, Yoshino-gun, Mt. Odaigahara (N. Satomi 892, MAK); Gose-shi, Mt. Kongo-san, The Summit – Nagara, alt. 900m (G. Murata s. n., 3 May 1962, KYO); **Wakayama Pref.**, Ito-gun, Koya-cho, Koyasan (K. Numajiri s. n., 16 May 1921, KYO; T. Nakajima s. n., 6 Jun. 1921, TI); **Osaka Pref.**, Minamikawachi-gun, Chihayaakasaka-mura, Mt. Kongo-san (K. Tanino s. n., late Jun. 1907, TNS); **Shimane Pref.**, Kanoashi-gun, Kakinoki-mura, Chujo (I. Iwamoto 43, MAK); **Yamaguchi Pref.**, Abugun, Ato-cho, Tokusa (N. Miake s. n., 20 Apr. 1968, TUS; N. Miake 6027, KYO, TNS); Ato-cho, Nomichiyama (S. Miyake 17059; TNS); **Tokushima Pref.**, Myozai-gun, Kamiyama-cho (Jinryo-mura), Mt. Shibakoshi-yama (T. Inobe s. n., 3 May 1931, KYO); Kamiyama-cho, Mt. Asahinomaru (H. Koyama 968, KYO, TNS); **Kochi Pref.**, Agawa-gun, Agawa-mura, Nanokawa (T. Makino s. n., 4 Apr. 1890, MAK); Takaoka-gun, Niyodo-mura (Befu-mura), Mt. Torigata-yama (T. Makino s. n., 22 May 1889, MAK); Nagaoka-gun, Mt. Kuishi-yama (T. Makino s. n., 6 May 1893, MAK); Nagaoka-gun, Tachikawa-mura (T. Makino s. n., May 1893, MAK); **Ehime Pref.**, Uماغun, Doi-cho & Iyomishima-shi, Mt. Akaboshi (M. Yamanaka s. n., 17 Apr. 1956, TUS); Hojo-shi (Onsen-gun), Mt. Takanawa (K. Okudaira s. n., 7 Apr. 1907, MAK); Kamiukena-gun, Omogo-mura, foot of Mt. Ishizuchi-san (K. Kasai s. n., 21 Apr. 1911, MAK); **Fukuoka Pref.**, Buzen-shi, Mt. Inugatake (M. Togashi s. n., 28 Jun. 1947, TI); Tagawa-gun, Soeta-machi, Mt. Hiko-san, Hoheiden – Onisugi, alt. 740m (S. Fujii 19, KYO); Fukuoka-shi, Sawara-ku, Mt. Sefuri-san (Seburi-yama), alt. 1000m (J. Murata 3687, TI); Maebaru-shi, Mt. Rai-zan (M. Takenouchi 12699, FU); Yame-gun, Kuroki-cho, Mt. Gozen-dake (Z. Tashiro s. n., 16 Aug. 1911, KYO); **Saga Pref.**, Kanzaki-gun, Sefuri-mura, Mt. Sefuri-san (Y. Baba 79, KYO); Fujitsu-gun, Tara-cho, Mt. Tara-dake – Mt. Kyogadake, alt. ca. 740m (K. Yonekura 95131, TUS); **Nagasaki Pref.**, Ohmura-shi, Kuroki-cho, Kuroki – Mt. Tara-dake (A. Nitta 63, KYO);

Kuroki-cho, Mt. Tara-dake, Hatchodani – Kinsenji, alt. 640–660m (K. Yonekura 94151, TUS); Minamitakaki-gun, Obama-cho, Mt. Unzen-dake (Z. Tashiro s. n., 28 Apr. 1907, KYO, TNS); **Kumamoto Pref.**, Kikuchi-shi, Fukaba (Y. Hamada s. n., 27 Mar. 1969, TNS-254062; H. Kozuma s. n., 30 Apr. 1916, TNS); Aso-gun, Kugino-mura, alt. 700m (Y. Shimada s. n., 11 Sep. 1955, TNS); Yatsushiro-gun, Izumi-mura, entrance of Gokanoshō, Sasagoe (Z. Tashiro s. n., 15 Aug. 1915, KYO); Izumi-mura, Momigi – Shiibaru, alt. 600–700m (M. Hotta 12102, KYO); Izumi-mura, Matashidani (N. Naruhashi 3072, KYO); Kuma-gun, Itsuki-mura, NE. Side of Mt. Nokeeboshiyama, Takano – Hotokeishi, alt. 600–1100m (N. Kurosaki 6626, KYO); Kuma-gun, Ue-mura (K. Mayebara s. n., 2 Apr. 1921, KYO); *ibid.*, Mt. Shiraga-dake (K. Mayebara s. n., 16 Apr. 1916, TNS); **Oita Pref.**, Shimoge-gun, Yabakei-cho, Mt. Kyoyomi-dake (I. Enomoto s. n., 16 Mar. 1968, TI); Usa-gun, Ajimu-cho, Mt. Tateishi (collector unknown, 28 Apr. 1911, MAK); Kusu-gun, Kokonoe-cho, Mt. Kuju, Yoshibu (T. Yamazaki s. n., 18 Oct., 1955, TI); Naoiri-gun, Kuju-cho, Kuji-zan, Bogatsuru, alt. 1200m (T. Yamazaki 7101, TI); **Miyazaki Pref.**, Nishiusuki-gun, Mt. Shiraiwa-yama, alt. 900m (S. Hirata 21, TI); Ebino-shi (Nishimorokata-gun, Ue-mura), upper reach of Sendai River (Z. Tashiro s. n., 16 Apr. 1916, KYO, MAK).

*Bistorta tenuicaulis* var. *chionophila*.

**JAPAN; Toyama Pref.**, Higashitonami-gun, Inami-machi, Zuisenji – Tochibara Pass, alt. 200–600m (N. Kurosaki 13160, KYO); Inami-machi, Nishiootani (N. Kurosaki s. n., Apr. 1968, KYO, MAK, TI); Oyabe-shi, Sugahara (K. Yonekura & M. Mikage 95565, TUS); **Ishikawa Pref.**, Kashima-gun, Kashima-cho (Koshiji-cho), Mt. Sekido-zan (N. Fukuoka 3506, KYO; G. Masamune 9595, KANA; N. Satomi s. n., 14 Apr. 1957, MAK, TNS); Hakui-gun, Oshimizu-machi, Azuma, W. Foot of Mt. Hodatsu-zan, alt. 100–150m (N. Kurosaki 10662, KANA, TNS, TUS); Oshimizu-machi, Kon'ya-machi, W. foot of Mt. Hodatsu-zan, along a branch stream of Maeda-gawa River, alt. ca. 190m (K. Yonekura 94604, TUS); Mt. Hodatsuzan, Noda Route, alt. 400m (S. Yamadori 2735, KANA); Kahoku-gun, Tsubata-cho (Hakui-shi), Mt. Hodatsu, Uri (N. Fukuoka 3424, KYO); Kanazawa-shi, Tubono-cho, along Fushimi-gawa River, alt. ca. 300m (G. Murata, H. Nishimura, I. Kozima & Y. Naito 41205, KYO); Kanazawa-shi, Kurokabe (N. Satomi s. n., 24 Apr. 1977, KANA); Ishikawa-gun, Kawachimura, Shimofukuoka – Gozu (Y. Sugie 6081, KYO); Ishikawa-gun, Torigoe-mura, vicinity of Mitsuse, alt. ca. 250m (S. Tsugaru 6950, KYO); Torigoe-mura, Hidaritsubute (Y. Sugie 1503, KYO); Ishikawa-gun, Tatsunokuchi-cho, Otani (K. Ide s. n., 21 Apr. 1981, KANA); Komatsu-shi, Maruyama-machi, alt. ca. 360m (S. Tsugaru, M. Takeuchi & T. Takeuchi 13120, KYO\*, TNS, TUS); *ibid.*, Maruyama – Gohyaku Pass, along a branch stream of Dainichi-gawa River, alt. ca. 370m (K. Yonekura 94640, TUS\*); Komatsu-shi, Ikenojo-machi, alt. ca. 100m (K. Deguchi, S. Tsugaru & M. Takeuchi 7053, KYO, TNS); Komatsu-shi, Nishinomata-machi, near Torigoe, alt. ca. 140m (K. Deguchi, S. Tsugaru & M. Takeuchi 7165, KYO, TNS); Komatsu-shi, Akase-machi, Akase – Akase-jinja Shrine (Isoda & Kutomi s. n., 17 Apr. 1975, KANA); Komatsu-shi (Nomi-gun), Osugidani (G. Masamune s. n., 18 May 1952, KANA, MAK; M. & T. Takeuchi 41, KYO, TNS); *ibid.*, en route to

Ushigakubi Pass., along a branch stream of Osugidani-gawa River, alt. 180–185 m (K. Yonekura 94624, 94626, TUS\*); Nomi-gun, Yamanaka-cho, Yamanaka Spa (N. Satomi 24921, KANA); **Fukui Pref.**, Takefu-shi, Mt. Okamoto-yama (S. Mimura s. n., 8 Apr. 1960, KANA); Ono-gun, Kamianamamura (Kamiuma-mura) (Y. Hori s. n., 1 May 1955, TNS); Oonoshi, Nukumi Pass., Mt. Nogohakusan, alt. ca. 1050m (M. Ito, H. Nagamasu & A. Soejima 7060, KYO); Wakasa, Shiratani-yama (Z. Tashiro s. n., 2 May 1937, TNS); **Gifu Pref.**, Yoshiki-gun, Miyakawa-mura, Mannami (M. Ihara s. n., 2 Jun. 1957, KANA, TNS; N. Satomi 7562, MAK); Miyakawa-mura, Utsubo – Ioridani (N. Yonezawa 139, KANA); Ibi-gun, Fujihashi-mura, Nishiyokoyama, alt. 200–300m (N. Kurosaki 12496, KANA, KYO); Ibi-gun, Tokuyama-mura, 2 km south of Hongo, alt. 300–500m (H. Takahashi 2275, KYO); Motosu-gun, Neomura, N. side of Mt. Youkin-zan (H. Takahashi 3840, KYO); Yamagata-gun, Miyama-cho, Iodo – Nakagoshi, along Kanzakigawa River, alt. 400–500m (H. Takahashi 3570, KYO); Miyama-cho, Mt. Funabuse – Kanzaki (H. Takahashi 5372, KYO\*); Miyama-cho, Natsuzakadani (H. Hara & S. Kurosawa s. n., 6 May 1961, TI); Mugi-gun, Horado-mura, Mt. Koga-san, Koga shrine – the Summit, alt. 700m (H. Takahashi, M. Yamanaka & S. Sawada 5252, KYO); Gujou-gun, Hachiman-machi, Ichijima, Mt. Kyouzuka, Ohora-dani, alt. ca. 400m (K. Kosuge 1564, KYO); Hachiman-machi, vicinity of Kaizasa, alt. 500m (H. Takahashi 9711, KANA); Hachiman-machi, Akuta (H. Kaneko 5245, KANA); Gujou-gun, Minami-mura, Fukuno – Kamagataki, alt. 150–300m (N. Kurosaki 12544, KANA, KYO); **Shiga Pref.**, Ika-gun, Yogo-machi, Obara, along Takatoki-gawa River, Suganami – Obara, alt. 220m (Y. Takeishi & H. Hoshi 13850, TUS\*); Higashiasai-gun, Asai-cho, Mt. Kanakuso, alt. ca. 600m (G. Murata & N. Fukuoka 308, KYO, TI); Asai-cho, South of Mt. Kanakuso, Takayama – Torigoe Pass, alt. 300–600m (Y. Inamasu & N. Fukuoka 49, KANA, KYO); Sakata-gun, Ibuki-cho, Kotsuhara, alt. ca. 800m (G. Murata 70177, KYO); Takashima-gun, Kutsuki-mura, Oisugi, alt. 600m (S. Kitamura & G. Murata 1023, KANA, KYO, TNS, TUSG); Otsu-shi, Mt. Hiei-zan (G. Koidzumi s. n., 28 Apr. 1921, KYO; C. Hashimoto 10772, TI); **Kyoto Pref.**, Kyoto-shi, Sakyo-ku, Mt. Hiei-zan, Yokokatayama – Yokawatyudo, alt. 690m (H. Terao 78, KYO); Sakyo-ku, Ohara, Kochi-dani, Kochidaira – Mt. Amagadake (M. Hotta s. n., 3 May 1953, KYO); Sakyo-ku, Ohara, near Kodeishi (Y. Hajime s. n., 13 Apr. 1932, TNS); Sakyo-ku, Kurama, Kibuneyama (Y. Araki s. n., 24 Apr. 1932, KYO); Sakyo-ku, near Hanase Pass, alt. 600–700m (S. Tsugaru 2864, TNS); Sakyo-ku, Hanaseyamasu-cho, along stream of Yamasu-gawa, alt. ca. 410m (K. Yonekura 94738, 94739, TUS\*); Sakyo-ku, Hanaseharachi-cho, along Teradani-gawa River, South of Daihi-zan, alt. ca. 450m (K. Yonekura 94712, TUS); Hanaseharachi-cho, Daihizan, Kuwadani (G. Murata s. n., 5–6 May 1956, KYO, MAK); Sakyo-ku (Kitakuwada-gun, Kuroda-mura), Hirogawara (G. Murata 7043, KYO, TI); Kitakuwada-gun, Keihoku-cho, Foot of Mt. Sajikigatake (Sajikiyama), Yamakawa (I. Sono s. n., 26 Apr. 1908, TNS); Keihoku-cho (Kuroda-mura), Haiya (G. Nakai 3709, KYO); Kitakuwada-gun, Miyama-cho (Sazari-mura), along Yura-gawa River (C. Kataoka s. n., 2 May 1954, TNS); Miyama-cho, Ashiu, Jizou-touge – Chojidani, alt. 620–680m (S. Fujii 2697, KYO); Miyama-cho, Ashiu Experimental Forest of Kyoto Uni-

versity, alt. 400m (Y. Inamasu s. n., 12 May 1963, KYO); *ibid.*, alt. 685–765m (T. Kurihara s. n., 19 May 1994, KANA); Funai-gun, Wachi-cho, Mt. Choro-ga-take (Y. Araki s. n., 6 May 1934, KYO); H. Imai s. n., 26 Apr. 1981, KYO); Kasa-gun, Ooe-cho, Mt. Ooe-yama, Senjogahara, alt. 500m (N. Fukuoka 8653, KYO); **Hyogo Pref.**, Hikami-gun, Aogaki-cho, Mt. Awagayama (S. Hosomi 5553, KYO); Yabu-gun, Yoka-cho, Tsubairo, alt. 100–300m (N. Kurosaki 15147, KANA, KYO\*, TUS\*); Shiso-gun, Yamasaki-cho, Iwagami National Forest (M. Hashimoto 9564, KYO); **Okayama Pref.**, Katsuta-gun, Nagi-cho, Mt. Naginosen (K. Takayama s. n., 29 Apr. 1961, TNS).

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米倉浩司, 大橋広好: タデ科ハルトラノオの新変種オオハルトラノオとハルトラノオ群における雌性両全性異株の報告

ハルトラノオ *Bistorta tenuicaulis* (Bisset & S. Moore) Nakai は福島県南部以南の本州, 四国, 九州の温帯の主に沢沿いの林床に生育する多年生草本であり, 春に開花し結実した後大型の葉を展開する林床植物としての生活型をもち, また匍匐性の根茎がある。これらの点において, ハルトラノオは筆者らが1995年に記載した宮城, 福島両県産のアブクマトラノオ *B. abukumensis* Yonekura, Iketsu & H. Ohashi と共に, 陽地性で短い根茎を持ち葉の展開後に開花する種が多いイブキトラノオ属中では特異な植物である。なお, ハルトラノオは韓国の済州島からも報告されているが, 同島産の標本を見た限りでは全てクリンユキフデ *B. suffulta* (Maxim.) H. Gross であった。

本州の太平洋側(福島県～和歌山県)と山口県, 四国および九州に生育する個体は根茎がつまって数珠状になることが多く, 肥厚部は球形である。一方, 本州中部から中国地方東部の日本海側に産する個体の根茎は長く伸長し, 根茎の肥厚部は間隔を置いて生じ紡錘形で, アブクマトラノオの根茎に似ている。この特徴は東北大学の実験園で両方

の型を数年間比較栽培した後も変わらず, 安定した形質であると考えられる。また花期に楕円形で基部が楔形の根出葉を有する太平洋側の植物に比べると, 本州の日本海側の植物は植物体が全体的に大型であり, 花期の根出葉が卵形で先端がより鋭く尖り, 基部が切形である点も異なっている。特に石川県から滋賀県北部にかけての地域に産する植物は大型である。さらに, 性表現の点でも差異が認められ, 本州の日本海側の地域の一部の個体群では雌性個体と考えられる雄性不稔の花をつける個体が両性花のみをつける個体と混生しているのに対し, 他の地域では両性花をつける個体のみが見られる。雄性不稔個体はアブクマトラノオでは多く観察されたが, ハルトラノオではまれであった。以上の点から, 日本海側地域に産する植物は地理的に分化した1変種と考えられるので, *var. chionophila* Yonekura & H. Ohashi と命名して記載した。和名は全体大型であることからオオハルトラノオとし, 変種形容語は多雪地帯に生ずることからとった。

(東北大学大学院理学研究科生物学教室)