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Notes on Polygonaceae in Japan and Its Adjacent Regions (I)

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Taxonomic and floristic notes are provided about recent floristic account of Japanese Polygonaceae (Yonekura 2006), along with further additions and corrections. 1. Yonekura and Ohashi (1997)'s classification system of Polygonaceae is modified based on molecular phylogeny. 2. Additional comments are made about a few cultivated or naturalized genera of Rumiceae not treated in Yonekura (2006). 3–7. Floristic and taxonomic comments are made about *Rumex acetosella* (3), *R. alpestris* (4), *R. nepalensis* (5), *R. madaio*, *R. longifolius*, *R. gmelinii* and *R. aquaticus* (6) and *R. dentatus* (7) in Japan and its adjacent regions. Lectotype of *R. madaio* is designated.

Key words: flora, Japanese Polygonaceae, classification system, Rumiceae, *Rumex.*

Polygonaceous plants have not been revised throughout East Asia since Steward (1930) and Rechinger (1949). These studies, especially the former, are rather preliminary being based on limited herbarium materials. After these publications East Asian Polygonaceae have mostly been treated in regional floristic studies, but delimitations of genera and species are highly diverse among these regional floras. In a few groups worldwide or international monographs were made (e. g., Park 1988) but their results are still not widely accepted. Recently I published a monographic account of Japanese Polygonaceae (Yonekura 2006) in which several new opinions were proposed. Here I will describe these opinions in detail, together with further additions and corrections to Yonekura (2006).

1. Infrafamilial classification and generic delimitation of Polygonaceae

Based on a recent molecular phylogeny using *rbcL* (Lamb Frye and Kron 2003), Polygonaceae is divided into two clades. One consists of tribes Polygoneae, Persicarieae and Rumiceae in the sense of Ronse de Craene and Akeroyd (1988), and another consists of tribes Coccolobeae, Triplareae and Eriogoneae (Fig. 1). Eriogoneae has been regarded as representing its own subfamily Eriogonoideae and all the rest of Polygonaceae have been included in the subfamily Polygonoideae (Haraldson 1978, Ronse de Craene and Akeroyd 1988, Brandbyge 1993), but monophyly of the Polygonoideae was not supported by Lamb Frye and Kron (2003). Plants belonging to the latter clade are predominantly woody and confined almost exclusively to the New World, but apomorphic characters shared in the clade are not known so far.

Polygonum s. l. as circumscribed by Meisner (1826, 1856) has been considered as heterogeneous and variously subdivided as summarized by Yonekura and Ohashi (1997). Among many classification systems subdividing *Polygonum* s. l. the systems

proposed by Haraldson (1978) and by Ronse de Craene and Akeroyd (1988) have been frequently used in recent floras. Both Haraldson (1978) and Ronse de Craene and Akeroyd (1988) disintegrated *Polygonum* s. l. into several genera and placed them into two or three different tribes together with many genera traditionally considered as distinct from *Polygonum* s. l. The systems proposed by Haraldson (1978) and by Ronse de Craene and Akeroyd (1988) were different from each other mainly in the following three aspects:

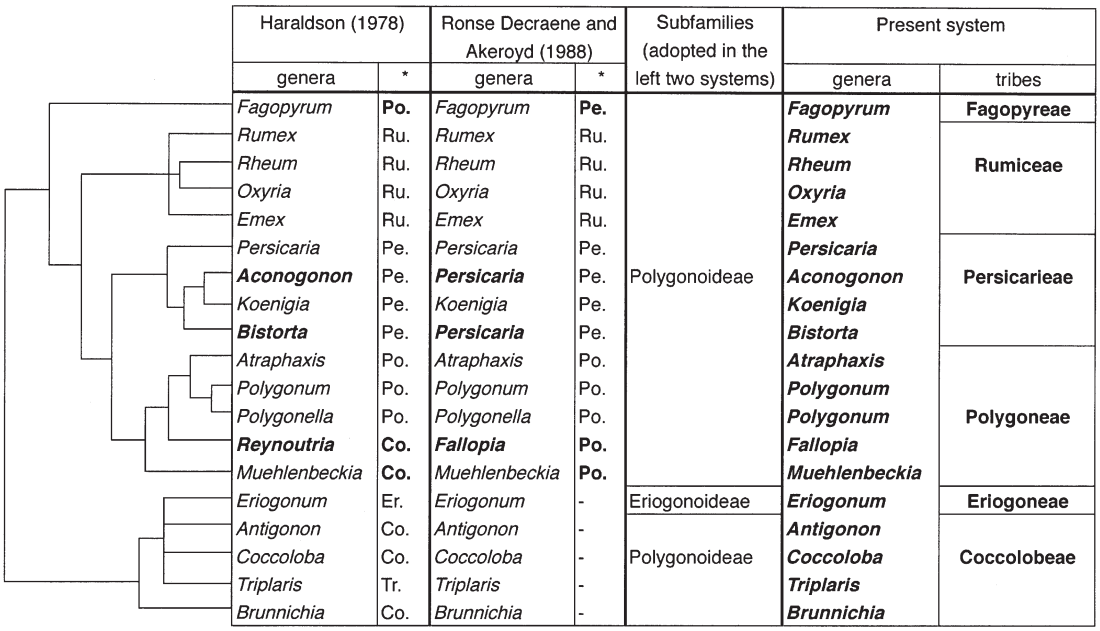
(1). Circumscription of *Persicaria* and its related genera: Ronse de Craene and Akeroyd (1988) united *Persicaria*, *Bistorta* and *Aconogonon* into one genus *Persicaria*, which were recognized as distinct genera by Haraldson (1978).

(2). Circumscription and placement of *Fallopia* and its related genera: Haraldson (1978) placed *Fallopia* and *Reynoutria* within Coccolobeae, but Ronse de Craene and Akeroyd (1988) united them as a single genus *Fallopia* and placed this within Polygoneae.

(3). Placement of *Fagopyrum*: Haraldson (1978) placed *Fagopyrum* within Polygoneae but Ronse de Craene and Akeroyd (1988) placed it within Persicarieae.

I formerly proposed a classification system for East Asian Polygonoideae (Yonekura and Ohashi 1997) combining the two systems, i. e. adopting Haraldson's view for (1), and Ronse de Craene and Akeroyd's view for (2) and (3). Lamb Frye and Kron (2003) supported Haraldson's view for (1), as *Persicaria* in the sense of Ronse de Craene and Akeroyd (1988) was proved paraphyletic, and supported Ronse de Craene and Akeroyd's view for (2) on the generic placement of *Fallopia*, as they showed close relationship between *Polygonum* s. str. and *Fallopia*. Unfortunately Lamb Frye and Kron (2003) did not provide an answer about the problem of circumscription of *Fallopia* because they did not include *Fallopia* s. str. in their analysis. For placement of *Fagopyrum* (3), Lamb Frye and Kron (2003) supported neither Haraldson (1978) nor Ronse Decraene and Akeroyd (1988) as they revealed *Fagopyrum* as a sister of the rest of the clade consisting of Polygoneae, Persicarieae and Rumiceae. Lamb Frye and Kron (2003) implied that many changes in the classification of the genus *Polygonum* s. l. were necessary, but their results seem accordant with the extant systems as far as the generic circumscription. Here I keep the classification system of Yonekura and Ohashi (1997) for *Polygonum* s. l. except the placement of *Fagopyrum*, representing its own tribe to be newly described. *Fagopyrum* has such characters as stalked floral nectaries, tricolporate pollen grains with peculiar sculpture (Hong 1988, Hong and Choi 1998, Zhou et al. 2003), plicate cotyledons and unique basic chromosome number $x = 8$, some of which are considered as apomorphic. These characters, along with the phylogenetic position distant from any other genera of *Polygonum* s. l., suggests *Fagopyrum* as a distinct tribe of its own. The newly described tribe Fagopyreae Yonek. is to be monotypic as I circumscribe *Fagopyrum* broadly including *Pteroxygonum* Dammer & Diels (China), *Eskemukerjea* Malick & Sengupta (Nepal) and *Harpagocarpus* Hutch. & Dandy (E. Africa) following Hong (1988) and Brandbyge (1993).

In conclusion, I adopt the following classification system for native, naturalized and cultivated species of Polygonaceae in Japan. Among the tribes accepted here Coccolobeae is still paraphyletic (Fig. 1) but I tentatively retain it as a tribe following the recently published North American Flora. Genera written in bold font are native to Japan; those written in italic font are only naturalized or cultivated. Genera with asterisk are not treated in



Haraldson (1978)		Ronse Decraene and Akeroyd (1988)		Subfamilies (adopted in the left two systems)	Present system	
genera	*	genera	*		genera	tribes
Fagopyrum	**Po.**	*Fagopyrum*	**Pe.**		***Fagopyrum***	**Fagopyreae**
Rumex	Ru.	*Rumex*	Ru.		***Rumex***	**Rumiceae**
Rheum	Ru.	*Rheum*	Ru.		***Rheum***	
Oxyria	Ru.	*Oxyria*	Ru.		***Oxyria***	
Emex	Ru.	*Emex*	Ru.		***Emex***	
Persicaria	Pe.	*Persicaria*	Pe.		***Persicaria***	**Persicarieae**
Aconogonon	Pe.	***Persicaria***	Pe.	Polygonoideae	***Aconogonon***	
Koenigia	Pe.	*Koenigia*	Pe.		***Koenigia***	
Bistorta	Pe.	***Persicaria***	Pe.		***Bistorta***	
Atraphaxis	Po.	*Atraphaxis*	Po.		***Atraphaxis***	**Polygoneae**
Polygonum	Po.	*Polygonum*	Po.		***Polygonum***	
Polygonella	Po.	*Polygonella*	Po.		***Polygonum***	
Reynoutria	**Co.**	***Fallopia***	**Po.**		***Fallopia***	
Muehlenbeckia	**Co.**	*Muehlenbeckia*	**Po.**		***Muehlenbeckia***	
Eriogonum	Er.	*Eriogonum*	-	Eriogonoideae	***Eriogonum***	**Eriogoneae**
Antigonon	Co.	*Antigonon*	-		***Antigonon***	**Coccolobeae**
Coccoloba	Co.	*Coccoloba*	-	Polygonoideae	***Coccoloba***	
Triplaris	Tr.	*Triplaris*	-		***Triplaris***	
Brunnichia	Co.	*Brunnichia*	-		***Brunnichia***	

-: Genera not treated in Ronse de Craene and Akeroyd (1988).

*: Tribes. Po: Polygoneae. Pe.: Persicarieae. Ru: Rumiceae. Co.: Coccolobeae. Er.: Eriogoneae. Tr.: Triplareae.

Fig. 1. Simplified phylogenetic relationship among selected genera of Polygonaceae after Lamb Frye and Kron (2003) and their position in the systems proposed by Haraldson (1978), Ronse de Craene and Akeroyd (1988) and the present author adopted in Yonekura (2006). Differences between systems of Haraldson (1978) and Ronse de Craene and Akeroyd (1988) are indicated in bold.

Yonekura (2006).

Tribe Rumiceae
Rumex L.
Oxyria Hill
Rheum L.*
Emex Campd.*

Tribe Fagopyreae Yonek. (in K. Iwats. & al., Fl. Japan **2a**: 132, in nota, 2006).
Fagopyrum Mill.

Tribe Polygoneae
Polygonum L.
Fallopia Adans. (including *Reynoutria* Houtt.)
Muehlenbeckia Meisn. (including *Homalocladium* L. H. Bailey)

Tribe Persicarieae
Bistorta (L.) Scop.
Aconogonon Rchb.
*Koenigi*a L.*
Persicaria Mill.

Tribe Coccolobeae
Antigonon Endl.
Coccoloba L.

2. Classification of Rumiceae, with comments on a few cultivated or naturalized genera not treated in Yonekura (2006)

The tribe Rumiceae is subdivided into three well-defined genera in East Asia: *Rumex*, *Oxyria* and *Rheum*, the former two are native to Japan. *Rumex* in East Asia is subdivided into three subgenera, Rumex, Acetosa and Acetosella (Rechinger 1949). These subgenera have often been treated as distinct genera (Tzvelev 1989) due to differ-

ences of sex expressions and basic chromosome numbers. These genera are, however, undoubtedly more closely related to each other than any other genera in Rumiceae, and a few intermediates among the subgenera are recorded outside Asia. I follow traditional opinion treating them as subgenera of *Rumex* (Rechinger 1949, Li et al. 1998, 2003, Mosyakin 2005).

Yonekura (2006) recorded 18 species (10 native, 8 naturalized) and 13 hybrids of *Rumex* and one native species of *Oxyria* in Japanese Rumiceae. A few species of *Rheum* e. g., *R. rhabarbarum* L., *R. palmatum* L. and *R. coreanum* Nakai, are often cultivated as vegetables or medicinal herbs in cooler regions of Japan but not naturalized. Meisner (1865) mentioned fragmental specimens of *Rheum* from the Siebold herbarium in L from Japan but not enumerated due to the incomplete materials. Yamaguchi et al. (2003) listed a Siebold specimen (L-908.175-223) as *Rheum tataricum* L. f. and two specimens (bearing same number L-908.175-243) as *Rheum* sp., which probably correspond to the specimens mentioned by Meisner. I examined them in Leiden in March 2006 and found they were not *Rheum* at all; the former was a large leaf of Asteraceae and the latter were leaves of *Cardiocrinum cordatum* (Liliaceae)! As cultivation of *Rheum* in lowland Japan is difficult due to the hot summers, *Rheum* was less popular in Siebold's time in Japan. Instead, native species of *Rumex* with thick yellow rhizomes, e. g., *R. madaio*, have been cultivated as a substitute to *Rheum* until recently.

A Mediterranean species of *Emex*, *E. spinosa* (L.) Campd. is occasionally naturalized in Japan (Hisauchi 1961) but has not been established.

3. *Rumex acetosella* (*Rumex* subgen. Acetosella) in Japan

Rumex acetosella L. (*Acetosella vulgaris* Fourr.), a cosmopolitan weed probably native of Europe, is variable not only morphologically but also cytologically and has been variously divided into several infraspecific taxa or into different species. Recent studies on European plants showed it to be divided into four subspecies based on number of lateral lobes of radical leaves and angiocarpy of inner tepals (Nijs 1984, Akeroyd 1991). Japanese plants are generally uniform in shape of leaves with one pair of lateral lobes developed on each radical leaf. Tepals of nearly all the fruiting specimens from Japan, including old collections made in the late 19th century are angiocarpous, i.e. inner tepals fused with each other tightly enclosing achenes. These specimens are therefore referable to the subspecies *pyrenaicus* (Pourr. ex Lapeyr.) Akeroyd. Tzvelev (1989) recognized the same taxon under the name *Acetosella angiocarpa* (Murb.) Á. Löve from Sakhalin, the Kuril Islands and Kamtchatka but not from the other regions of Far Eastern Russia. *Rumex acetosella* subsp. *pyrenaicus* from these regions might have spread from Japan after becoming established there in early 20th century. On the other hand, *R. acetosella* subsp. *acetosella*, different from subsp. *pyrenaicus* in the free inner tepals rather loosely enclosing achenes, is common in the Asian Continent but very rare in Japan, known only from one specimen, cited below, so far. Several specimens from Hokkaido show intermediacy between these subspecies in having inner tepals that are connate below the middle, and free toward the apex but easily detachable from the achenes.

The North American *Rumex hastatulus* Baldwin ex Ell. (Sketch Bot. S. Carolina **1**: 416 (1817) – Mosyakin, Fl. N. Amer. **5**: 502 (2005)) is recorded as naturalized in Okinawa Pref. (Urasoe City, Isl. Okinawa) (Hatusima and Amano 1994) although I have not confirmed it. It is apparently similar to *R.*

acetosella in the gross morphology and the leaf shape but entirely different in its annual or short-lived perennial habit without subterranean rhizomes and the accrescent inner tepals forming orbicular winged valves. It belongs to subgenus Acetosa, not Acetosella.

Rumex acetosella L., Sp. Pl. **1**: 337 (1753).

subsp. **acetosella**; Yonek. in K. Iwats. et al., Fl. Japan **2a**: 124 (2006).

Japanese name: Hina-suiba ヒナスイバ (Yonekura 2006)

Distribution in Japan: Honshu (Miyagi Pref.). Casually naturalized.

Specimen examined. **JAPAN**: Honshu, Miyagi Pref., Shiroishi City, Ohota, Shiroishi-Kosan KK (Yoshida s. n., 10 Jul. 1978, TUS).

subsp. **pyrenaicus** (Pourr. ex Lapeyr.) Akeroyd in M. E. Newton (ed.) in Bot. J. Linn. Soc. **106**: 99 (1991), "*pyrenaica*"; in Fl. Europ. ed. 2, **1**: 101 (1993); Yonek. in K. Iwats. & al., Fl. Jap. **2a**: 124 (2006).

Rumex pyrenaicus Pourr. ex Lapeyr., Suppl. Hist. Pl. Pyrénées 49 (1818).

Rumex angiocarpus auct. non Murb.: Rech. f. in Candollea **12**: 16 (1949).

Acetosella angiocarpa auct. non (Murb.) Á. Löve: Tzvelev in Kharkev., Pl. Vasc. Orient. Extr. Soviet. **4**: 45 (1989).

Rumex acetosella auct. non L.: Franch. & Sav., Enum. Pl. Jap. 1: 393 (1875) – Yatabe & Matsum., Nippon Shokubutsu-Mei **1**: 168 (1884) – Nakai in Bot. Mag. Tokyo **23**: 458 (1909) – Matsum., Index Pl. Jap. **2**(2): 65 (1912) – Takeda in J. Linn. Soc. Bot. **42**: 484 (1914) – Miyabe & T. Miyake, Fl. Saghal. 398 (1915) – Makino & Nemoto, Fl. Jap. 1046 (1925) – Hultén, Fl. Kamtch. **2**: 44 (1928) – Miyabe & Kudo, Fl. Hokkaido & Saghal. **4**: 498 (1934) – Rech.f. in Candollea **12**: 16 (1949), p. p.–Hisauti, Kika-Shokubutsu 94 (1950) – Ohwi, Fl. Jap. 459 (1953); ed. Engl. 403 (1965) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 294 (1961) – T. S. Liu & al., Fl. Taiwan **2**: 288 (1976) – Osada, Col. Ill. Naturalized Pl. Jap. 353, t. 57 (1976) – Kitag. in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 15 (1982) – Ohwi & Kitag., New Fl. Jap. 610 (1983) – Yonek. in T. Shimizu, Naturalized Pl. Jap. 48 (2003).

Japanese name: Hime-suiba ヒメスイバ

Distribution in Japan: S. Kuriles, Hokkaido, Honshu, Shikoku, Kyushu, Ryukyus and Volcano Islands (Isl. Iwo-jima).

4. Correct name of Japanese plants hitherto called *Rumex montanus* or *R. arifolius* (subgen. Acetosa)

Japanese alpine plants of *Rumex* subgen. Acetosa have been referred to European *Rumex alpestris* Jacq. (*R. arifolius* All., *R. montanus* Desf.) after Nakai (1911). The latter species described from the European Alps is taxonomically and nomenclaturally problematic, often subdivided into several species or contrarily regarded as comprising one or few infraspecific taxa of widespread *R. acetosa*. The Japanese plants differ from typical *R. alpestris* (subsp. *alpestris*) in the shape of leaf blades and inflorescences and match well with *R. alpestris* subsp. *lapponicus* (Hiitonen) Jalas widely distributed in Scandinavia, throughout Arctic Russia and Arctic and montane regions of North America (Tolmatchev 1966, Tzvelev 1989, Nilsson 2000, Mosyakin 2005). The taxon was originally described as a subspecies of *R. acetosa* due to the close morphological affinity with the latter, and later has been regarded as a distinct species or a subspecies of *R. alpestris*. Mosyakin (2005) retained it as a distinct species *R. lapponicus* (Hiitonen) Czernov not only because the morphological distinctness but also because the nomenclatural validity of *R. alpestris* Jacq. was dubious. Borodina (1979) regarded *R. alpestris* and *R. acetosa* as distinct from each other, regarding *R. lapponicus* as a

subspecies of *R. acetosa*. Nilsson (2000) considered both *R. lapponicus* and *R. alpestris* as subspecies of *R. acetosa* based on the existence of a few intermediates in Europe. I use the name *R. alpestris* subsp. *lapponicus* (Hiitonen) Jalas for the alpine plants distinct from lowland *R. acetosa* because both seem distinct morphologically and ecologically from each other at least in Japan. For nomenclatural stability the application of the name *R. alpestris* should be fixed by lectotypification.

Rumex alpestris subsp. *lapponicus* is rather common in alpine regions in Hokkaido and central Honshu in Japan but absent from most mountains of N. Honshu. It is also common in the Kuril Islands, Kamtchatka and Arctic Russia but absent in Ussuri, Amur, Sakhalin, Korea and China, except two scattered records from Sakhalin and the northern Sikhote-Alin Range (Tzvelev 1989). This taxon probably migrated into Japan through Kamtchatka and the Kuril Islands from Arctic Russia.

Rumex alpestris Jacq., Enum. Stirp. Vindob. 62 (1762) – Czerep., Addit. Corr. Fl. URSS: 643 (1973).

subsp. **lapponicus** (Hiitonen) Jalas in Ann. Bot. Fenn. **14**: 191 (1977) – Jalas & Suominen, Atl. Fl. Europ. **2**(4): 42 (1988) – Akeroyd, Fl. Europ. ed. 2, **1**: 102, in nota (1993).

Rumex acetosa L. subsp. *lapponicus* Hiitonen, Suomen Kasvio 300 (1933) – Rech. f., Fl. Europ. **1**: 81, in nota (1964) – Tolmachev, Fl. Arct. URSS **5**: 150 (1966) – Hultén, Circumpolar Pl. **2**: 298 (1971) – Borodina in Novit. Syst. Pl. Vasc. **15**: 105 (1979) – Nilsson in Fl. Nordica **1**: 295 (2000).

Rumex lapponicus (Hiitonen) Czernov in Gorodokov & Pojarkova, Fl. Murmansk. Obl. **3**: 154, t. 31, f. 3 (1956) – Vorosch., Opred. Rast. Soviet. Dal'n. Vost. 206 (1982) – Mosyakin, Fl. N. Amer. **5**: 503 (2005).

Acetosa lapponica (Hiitonen) Holub in Folia Geobot. Phytotax. (Praha) **11**(1): 80 (1976) – Tzvelev in Kharkev., Pl. Vasc. Orient. Extr. Soviet. **4**: 50 (1989).

Rumex arifolius auct. non All.: Miyabe & Kudo, Fl. Hokkaido & Saghal. **4**: 500 (1934) – H. Hara in J. Fac. Sci. Univ. Tokyo ser. 3, **6**(2): 38 (1952) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 295 (1961) – Ohwi & Kitag., New Fl. Jap. 611 (1983).

Rumex montanus auct. non Desf. ex Meisn.: Nakai in Bot. Mag. Tokyo **25**: 151 (1911) – Makino & Nemoto, Fl. Jap. 1048 (1925) – Rech.f. in Candollea **12**: 28 (1949) – Ohwi, Fl. Jap. 459 (1953); ed. Engl. 403 (1965) – Vorosch., Fl. Soviet. Dal'n. Vost. 160 (1966) – Kitag. in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 15 (1982) – T. Shimizu, New Alp. Fl. Jap. Col. **2**: 103, t. 101, f. 312 (1983).

Japanese name: Takane-suiba タカネスイバ, Ôba-suiba (Nakai 1911).

Distribution in Japan: S. Kuriles, Hokkaido and N. to C. Honshu (absent in northernmost part of Honshu).

5. The relationship between *Rumex andreaeanus* and *R. nepalensis*

Rumex andreaeanus Makino in Japan was synonymized into *R. nepalensis* by Kitamura (1956) based on the similarity of gross morphology and hooked spines on margin of valves (accrescent inner tepals in fruit), but later Kitamura (1975) regarded the former as a variety of the latter based on the differences of valves as keyed out below (see also Fig. 2, a–b). Considering the widely disjunct distribution between Japan and southwestern China, the nearest locality for *R. nepalensis*, *R. andreaeanus* is best treated as a subspecies of *R. nepalensis*, rather than a variety. *Rumex nepalensis* subsp. *andreaeanus* is distinguished from subsp. *nepalensis* as follows:

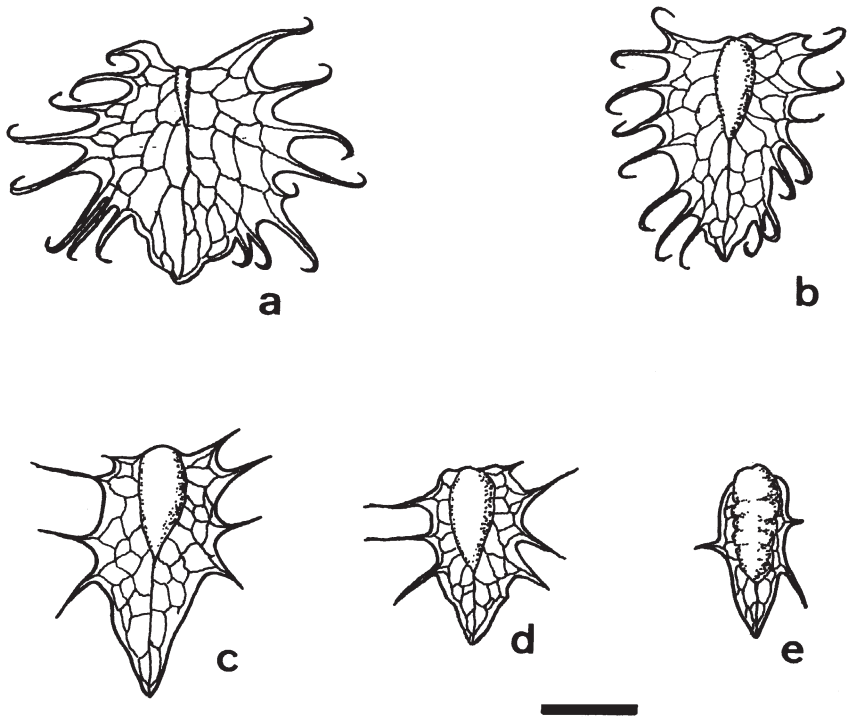


Fig. 2. Valves (= inner perianthes at fruiting stage) of *Rumex*. a: *Rumex nepalensis* subsp. *andreaeanus* (Himi 961527-13, TUS). b: *R. nepalensis* subsp. *nepalensis* (Mikage & al. 9684087 (TUS) from Nepal). c, d: *R. dentatus* subsp. *klotzschianus* (c: Yonekura 98600 (TUS) from Saga Pref., Kyushu. d: Yonekura 97257 (TUS) from Nagasaki Pref., Kyushu). e: *R. dentatus* subsp. *nigricans* (Yonekura 98467, TUS). Scale bar = 2 mm.

1. Valves (excluding spines) nearly as long as wide, tubercles ill developed, linear, up to 1.5 × 0.4 mm (endemic to Japan) ....subsp. *andreaeanus* (Fig. 2, a)
1. Valves (excluding spines) distinctly longer than wide, tubercles well developed on one valve, prominent, to 2.5 × 1.5 mm (E. Africa, W. to SE. Asia, SW. China) .... subsp. *nepalensis* (Fig. 2, b)

A few specimens of *Rumex nepalensis* from Tibetan Plateau (e. g., Nepal, Dolpa Distr., Tsarka, 4150 m, Namikawa 460, 11 Aug. 1958, KYO) approach subsp. *andreaeanus* in valve morphology.

Rumex nepalensis subsp. *andreaeanus* is known from two isolated localities in western Honshu in Japan: around the Kyoto Basin and western part of Okayama Prefecture (Fig. 3). In both localities it is restricted to moist places along a few village-side streams. Such habitats were formerly threatened by reclamation and water pollution. Hybridizations between naturalized *Rumex obtusifolius* also frequently occur in habitats in Kyoto Pref. This taxon is considered critically endangered (Environment Agency of Japan 2000).

Rumex nepalensis Spreng., Syst. Veg. **2**: 159 (1825) – Meisn. in DC., Prodr. **14**: 55 (1856) – F. B. Forbes & Hemsl. in J. Linn. Soc., Bot. **26**: 357 (1891) – Rech. f. in Beih. Bot. Centralbl. **49**(2): 69 (1932); in

Candollea **12**: 112 (1949) – H. Hara, Fl. E. Himal. 75 (1966) – A. J. Li, Fl. Reipubl. Popularis Sin. **25**(1): 160, t. 40, f. 1–3 (1998) – A. J. Li & al. in C.Y. Wu & Raven, Fl. China **5**: 339 (2003).

subsp. **andreaeanus** (Makino) Yonek. in K. Iwats. & al., Fl. Jap. **2a**: 125, in adnot. (2006).

Rumex andreaeanus Makino in Bot. Mag. Tokyo **20**: 7 (1906) – Nakai in Bot. Mag. Tokyo **23**: 455 (1909) – Matsum., Index Pl. Jap. **2**(2): 65 (1912), "*andraeanus*" – Makino & Nemoto, Fl. Jap. 1046 (1925) – Ohwi, Fl. Jap. 460 (1953). Type: **JAPAN**: Kyoto Pref., Kyoto-shi, Kibune T. Makino s. n., Sep. 1905, TI–n. v.).

Rumex daiwoo Makino var. *andreaeanus* (Makino) Makino in J. Jpn. Bot. **20**: 295 (1944), "*andreaeanum*".

Rumex nepalensis Spreng. var. *andreaeanus* (Makino) Kitam. in Acta Phytotax. Geobot. **26**: 141 (1975), "*andreanus*" – H. Hara in J. Jpn. Bot. **58**: 375 (1983).

Rumex nepalensis auct. non Spreng.: Kitam. in Acta Phytotax. Geobot. **16**(6): 194 (1956) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 295, f. 133. 1 (1962) – Ohwi, Fl. Jap. ed. Engl. 404 (1965) – Kitag. in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 16 (1982) – Ohwi & Kitag., New Fl. Jap. 611 (1983).

Japanese name: Kibune-daiô キブネダイオウ

Distribution: Honshu (Kyoto and Okayama Prefs.; Fig. 3). Endemic to Japan.

Representative specimens examined. **JAPAN**: **HONSHU**. Kyoto Pref., Kyoto-shi, Sakyo-ku, Kibune (Koidzumi s. n., 2 Sep. 1922, KYO; Makino s. n., 1933, MAK 18767, KYO); Kuramakibune-cho; transplanted and cult. at Toyama University (Himi 960527-13, 30 Jun. 1996, TUS); by Kibune-gawa River (Asato s. n., 1908, MAK 18754; Oka 53425, 2 Jun. 1997, TUS); in river near Kibune-jinja Shrine (G. Nakai 2400, 2 Jun. 1946, KYO); Kibune, Asodani (Araki 138 & 138-b, 2 Jul. 1933, KYO); between Kumogahata and Kibune, alt. 300 m (Murata 12547, 7 Jun. 1957, KYO); Kumogahata (Kinashi s. n., 26 May 1921, KYO; Kinashi s. n., 13 Jun. 1922, KYO, TI); Yase (Koidzumi s. n., not dated, KYO); Ohara (Koidzumi s. n., 8 Jun. 1922, KYO); Momoi, N. of Oohara (Murata 8834, 12 Jun. 1955, KYO); Ohara, Kodeishi, 260 m alt. (Tsugaru & Takahashi 26290, 26291, 28 May 1998, KYO, TUS); Kodeishi–Iwaodani, 280 m alt. (Murata & Takahashi 26089, 26 Apr. 1998, KYO); Hieizan (Makino s.n., in 1932, MAK 18762); Takanogawa, Yasemichi (Fushimi s. n., May 1921, KYO); Hanase-mura, Onodani (Nakai 2478, 12 Jun. 1946, KYO); Ukyo-ku, Kiyotaki (Murata 72824, 6 Jun. 2000, KYO); Kiyotaki–Takao, 100 m (Tsugaru & Takahashi 26449, 12 Jun. 1998, KYO); Ochiai–Kiyotaki (Tsugaru & Takahashi 26437, 12 Jun. 1998, KYO, TUS); Kitakuwada-gun, Kuroda-mura, Sasari Pass (Okamoto s. n., 13 Jul. 1934, KYO); Okayama Pref., Kawakami-gun, Bitchu-cho, Iwayadani (Okubo s. n., 10 Jun. 1984, KYO); Bitchu-cho, Kamifuse, Iwayadani, riverside (Enomoto s. n., 24 Jun. 1984, KYO); Bitchu-cho, Fuse (Furuse s. n., 5 Jun. 1983, TI).

6. Notes on Japanese species of *Rumex* subgen. Rumex without tubercles and spines on valves

Four species of *Rumex* subgen. Rumex (*Rumex aquaticus*, *R. longifolius*, *R. gmelinii* and *R. madaio*) have been recorded from Japan as having valves without tubercles (often with a very small tubercle on one valve) and marginal spines (Ohwi 1953, 1965, Kitamura and Murata 1961, Kitagawa 1982, Ohwi and Kitagawa 1983). They are distinguished by the shape of leaf blades and valves but some of the distinctions are obscure in immature specimens. Among the four species listed above, the occurrence of *R. aquaticus* in Japan is quite dubious. *Rumex aquaticus* was first recorded from Japan by Makino (1896) and repeatedly reported by various authors as occurring in Japan (Nakai 1928, Miyabe and Kudo 1934, Rechinger 1949), but all of them are based on misidentified specimens as far as I can determine. For example, Faurie 5837 (KYO) cited by Rechinger (1949) as *R. aquaticus* is *R. longifolius*, and Ono 11 (TI), the possible voucher specimen of Nakai (1928)'s report, is *R. madaio*. *Rumex aquaticus* has been often considered as naturalized in Japan (Kitamura and Murata 1961, Osada 1972)

but there is no evidence of it. Tzvelev (1989) reported *R. aquaticus* from S. Sakhalin and the S. Kuriles but their records seem to be based on inadequate specimens, as I have not seen specimens of true *R. aquaticus* from these regions in herbaria SAPS and VLA. Records of *R. aquaticus* from Korea (Lee 1996) proved to be based on misidentified specimens of *R. gmelinii* in TI. The unquestionable record of *R. aquaticus* nearest to Japan is from the Kamtchatka Peninsula (specimens examined: Kharkevich & Buch s. n., 9 Aug. 1975, SAPT, TNS 685479, VLA).

Rumex madaio is an endemic species of Japan, sporadically distributed in warmer regions (Fig. 3). It had been often cultivated in the past as a substitute for *Rheum* for medicinal use of its rhizome, and locally called "Madaio" (true rhubarb). Siebold (1830) first recorded it as *Lapathum daiwoo* (nom. nud.) and later Makino (1896) described it as a new species *Rumex madaio*. Makino (1901), Nakai (1909) and Rechinger (1949) used the name *R. daiwoo* (Siebold) Makino adopting the earlier epithet used by Siebold (1830), but it is illegitimate as Makino (1901) cited *R. madaio* Makino as a synonym. Makino (1896) did not cite any specimens, so I designated the lectotype among specimens extant at that time and cited in the descriptions of *R. daiwoo* (Makino 1901).

Rumex madaio has habit so similar to *R. nepalensis* subsp. *andreaeanus* that Makino (1944) considered the latter to be a variety of the former "*R. daiwoo* var. *andreaeanum*". They are distinguishable only by presence of hooked spines on valve margins in the latter. Despite the morphological similarity I prefer them as distinct species from each other as they have different chromosome number ($2n = 120$ in *R. nepalensis* subsp. *andreaeanus*, $2n = 100$ in *R. madaio*) (Himi et al. 1999) and no intermediates have been found so far. On the other hand, *R. madaio* is often confused with *R. longifolius* in the northern part of Honshu. As far as I examined the northernmost record of *R. madaio* is from Miyagi Prefecture, and I have not seen specimens from the Japan Sea side regions of northern Honshu. Reports of *R. madaio* in Northern Honshu are mostly referred to *R. longifolius*. Tzvelev (1987, 1989) reported *R. madaio* from S. Kuriles (Yurii Isl. in the Habomai Islands) with some hesitation. I examined its voucher specimen in VLA and found it to be *R. gmelinii* with wider valves than usual.

Rumex longifolius is widely distributed in Hokkaido and Honshu, more northerly than *R. madaio* (Fig. 4). The blades of lower leaves in Japanese plants are 3–4 times longer than wide, slightly wider than typical European *R. longifolius* where they are 3.5–6 times longer than wide (Nilsson 2000). Japanese plants have $2n = 80$ chromosome number (Himi 1999), which is different from that reported for European plants ($2n = 60$, rarely 40). Japanese plants might represent an infraspecific taxon of *R. longifolius*, but here I pend the recognition due to difficulty of morphological distinction from the European plants. Wider-leaved plants of *R. longifolius* are often misidentified as *R. aquaticus* in Japan, but are considered as falling within the variation range of *R. longifolius*.

Rumex gmelinii is known from several localities of Hokkaido and is considered critically endangered (Environment Agency of Japan 2000). During the course of this study I found specimens collected from Togakushi and the Iizuna Heights of the northern part of Nagano Prefecture primarily identified as *R. aquaticus*. They were in fact identical with *R. gmelinii*. This is the first record of *R. gmelinii* from Honshu.

The three species recognized in Japan are distinguished as follows:

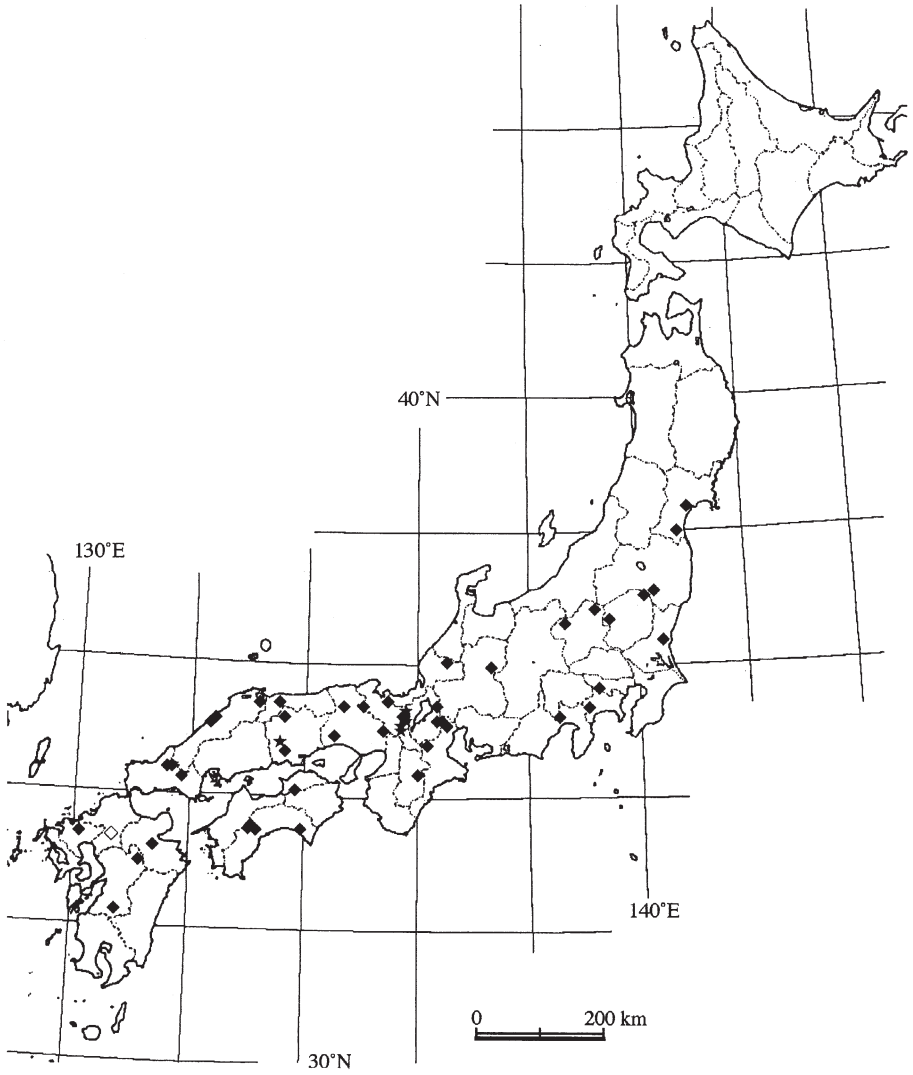


Fig. 3. Distribution of *Rumex nepalensis* subsp. *andreaeanus* (stars) and *R. madaio* (diamonds).

1. Infructescence branches widely interrupted; valves wider than long, margins distinctly dentate when mature ..... *R. madaio*
1. Infructescence branches usually continuous except in lower part; valves longer than or as long as wide, margins entire or shallowly dentate

2. Leaf blades narrowly oblong-ovate or oblong; lower inflorescence branches erect, much longer than internodes of stem just above the branch ..... *R. longifolius*

2. Leaf blades widely ovate or triangular-ovate; lower inflorescence branches ascending or divergent, as long as or slightly longer than internodes of stem just above the branch ..... *R. gmelinii*

Rumex madaio Makino in Bot. Mag. Tokyo **10**: 107 (1896), cum diagn. Jap. – Ohwi, Fl. Jap. 460 (1953); ed. Engl. 404

(1965) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 298, f. 133. 2 (1962) – Kitag. in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 16 (1982) – Ohwi & Kitag., New Fl. Jap. 611 (1983) – Yonek. in K. Iwats. & al., Fl. Japan **2a**: 128 (2006). Lectotype (designated here): **JAPAN**: Shikoku, Kochi Pref. (Prov. Tosa), Agawa-gun, Kitagawa-mura (S. Watanabe s. n., 9 Jun. 1888, MAK 19083 !; photo in TUS).

Rumex aquaticus L. var. *japonicus* Meisn. in Miq. in Ann. Mus. Bot. Lugd.-Bat. **2**: 55 (1865) – Franch. & Sav., Enum. Pl. Jap. **1**: 392 (1875) – Makino in Bot. Mag. Tokyo **3**: 5 (1889). Type: **JAPAN**: without precise locality (Siebold s. n., L-908.177-819 ! – holotype).

Rumex daiwoo Makino in Bot. Mag. Tokyo **15**: 124 (1901), '(Siebold) Makino', nom. superfl.; Nakai in Bot. Mag. Tokyo **23**: 454 (1909) – Matsum., Index Pl. Jap. **2** (2): 65 (1912) – Rech. f. in Candollea **12**: 65 (1949).

Rumex aquaticus auct. non L.: Nakai in Bot. Mag. Tokyo **42**: 18 (1928).

[*Lapathum daiwoo* Siebold, Syn. Pl. Oecon.: 19 (1830), nom. nud.]

Japanese name: Ma-daiô マダイオウ

Distribution: Honshu (southward from Miyagi Pref.), Shikoku and Kyushu (Fig. 3). Endemic to Japan.

Representative specimens examined. **JAPAN**: **HONSHU**. Miyagi Pref., Sendai, Atagoyama (Ono 11a & 11b, Aug. 1929, TI); Kakuda-shi, Takakura, alt. ca. 110 m (Mori 11706-b, 1 Jul. 2005, TUS); Fukushima Pref., Shirakawa-shi, Sekibe (Suzuki 15215, 27 Jun. 1984, TUS); Ibaraki Pref., Mito-shi (collector unknown, 21 Jun. 1930, MAK 19072; Ando 64, Jul. 1911, TI)l; Tochigi Pref., Nasu, Sandogoya (Kitamura s. n., 18, Aug. 1965, KYO); Nikko-shi, Akanumagahara (Makino s. n., Aug. 1905, MAK 19086, KYO); Nikko, Chuzenji (Makino s. n., 1900, MAK 19087); Gunma Pref., Tone-gun, Oze (Makino s. n., Jul. 1930, MAK 19073); Agatsuma-gun, Kuni-mura, Kozame (Masuda 627, 20 Aug. 1961, TNS 379585); Tano-gun, Manba, Mt. Onariboko-yama (Yamazaki s. n., 12 Jul. 1953, TI); Tokyo Pref., Hachioji-shi, Kobotoke (Makino s. n., Jun. 1932, MAK-19078); Bunkyo-ku, Koishikawa Bot. Gard., cult. (Makino s. n., Jun. 1900, MAK-19079); Kanagawa Pref., Yamakita (Makino s. n., in 1932, MAK 19077); Shizuoka Pref., Koizumi-mura (Muramatu s. n., 1926, TI); Gifu Pref., Ono-gun, Kuguno-cho, Kuchiuto, 900 m (Nagase 901105, 7 Jul. 1990, KYO); Hida (Makino s. n., 1939, MAK 19089); Fukui Pref., Katsuyama-shi, Obara–Mt. Onagayama (S. Watanabe s. n., 18 Jun. 1967, KYO); Shiga Pref., Sakata, Oonitoge (Hashimoto s. n., 21 Jun. 31, KYO); Inukami-gun, Otaki-mura, Ojigahata; transplanted and cult. in Ohtsu (Hashimoto 11995, 25 Jun. 1944, KYO, TNS 73283); Mie Pref., Inabe-gun, Toyashiro-mura, Kawahara, below Mt. Fujiwara-dake (Ichiki s. n., 15 Jul. 1940, KYO); Fujiwara-cho, Mt. Fujiwara-dake, Sakamoto, Shohoji (Koidzumi s. n., 13 Jun. 1922, KYO); Ayama-gun, Nunobiki-mura, Bano (Kurokawa 27, 7 Jun. 1933, KYO); Kyoto Pref., Yamashiro, Kuta-mura (G. Nakai 2451, 12 Jun. 1946, KYO); Kitakuwada-gun, Kuroda-mura, Miya (Koidzumi s. n., 29 Jun. 1940, KYO); Ayabe-shi, Mutsuyori-cho, Kmatake, 200 m alt. (Murata 70957, 4 Jun. 1994, KYO); Fukuchiyama-shi, Kannamiyama (Araki s. n., 17 Jul. 1932, KYO); Nara Pref., Omineyama and Kashiwagi (Koidzumi s. n., 13 Jul. 1922, KYO); Osaka Pref., Toyono-gun, Higashinose-mura, 350 m (Murata 19286, 7 Jun. 1964, KYO); Hyogo Pref., Tajima, Mt. Myoken (Araki s. n., 12 Jul. 1931, KYO); Ako-gun, Wakasano-mura (Muroi s. n., 27 Jun. 1933, KYO); Tottori Pref., Mt. Daisen (Koidzumi s. n., 3 Jul. 1924, KYO); Shimane Pref., Nogi-gun, Ijiri-mura (Moriyama 80, 2 Jun. 1939, KYO); Nima-gun, Okuni-mura (Kishino s. n., 5 Jul. 1933, KYO); Nima-gun, Ida-mura, Fukuda (Kishino s. n., 16 Jun. 1933, KYO); Okayama Pref., Maniwa-gun, Katsuyama-cho, Kanbanotaki Waterfall (Tashiro s. n., 24 Jun. 1930, KYO); Asaguchi-gun, Nagao (Morikawa 35, 5 Jun. 1914); Yamaguchi Pref., Tsuno-gun, Kano-cho, Kanoue, Itane (Minami 31699, 2 Jul. 1982, TNS 427867); Abu-gun, Ato-cho, Tokusa (Miake s. n., 9 Jun. 1968, TUS); Ato-cho, Kane; transplanted and cult. in Hagi (Nikai s. n., 10 Jun. 1922, TNS 48809). Shikoku, Tokushima Pref., Miyoshi-gun, Ikeda-cho, Unpenji (Takato 1607, 18 Jun. 1990, KYO); Kochi Pref., Aki-shi, Ananai (Makino s. n., 2 Jun. 1892, MAK 19082); Takaoka-gun, Sakawa-mura (Makino s. n., in 1892, MAK 19090); Agawa-gun, Kitagawa-mura (T. Watanabe s. n., 9 Jun. 1888, MAK 19083-lectotype); Nanokawa-mura (T. Watanabe s. n., 18 May 1889, MAK 19084). **KYUSHU**. Fukuoka Pref., Prov. Chikugo (Nabeshima s. n., date unknown, KYO); Saga Pref., Higashimatsuura-gun, Hamatama-cho, Torinosu (Baba 16, 7 Jun. 1969, TNS 253179); Oita Pref., Oita-gun, Yunohira (Tashiro s. n., 26 Jun. 1922, KYO); Kumamoto Pref., Sakanashi (Tashiro s. n., 1

Jun. 1924, KYO); Yanase-mura (K. Mayebara s. n., 3 May 1928, KYO); Aida (Mayebara 263, 6 Jun. 1926, TI).

Rumex longifolius DC. in Lam. & DC., Fl. Franç. ed. 3, **5** (Suppl. 6): 368 (1815) – Meisn. in DC., Prodr. **14**: 44 (1856) – Rech. f. in Candollea **12**: 49 (1949) – Ohwi, Fl. Jap. 460 (1953); ed. Engl. 404 (1965) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 15 (1962) – Vorosch., Fl. Soviet. Dal'n. Vost. 160 (1966); Opred. Rast. Soviet. Dal'n. Vost. 210 (1982) – Kitag., Neo-Lineam. Fl. Mansh. 246 (1979); in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 15 (1982) – Ohwi & Kitag., New Fl. Jap. 611 (1981) – Tzvelev in Kharkev., Pl. Vasc. Or. Extr. Soviet. **4**: 35 (1989) – W. T. Lee, Lineam. Fl. Kor. **1**: 241 (1996) – A. J. Li, Fl. Reipubl. Popularis Sin. **25**(1): 152 (1998) – A. J. Li & al. in C. Y. Wu & Raven, Fl. China **5**: 336 (2003) – Yonek. in K. Iwats. & al., Fl. Jap. **2a**: 128 (2006).

Rumex domesticus Hartm., Handb. Scand. Fl.: 148 (1820) – Makino in Bot. Mag. Tokyo **15**: 126 (1901) – Kom., Fl. Mansh. **2**: 116 (1903) – Nakai in Bot. Mag. Tokyo **23**: 454 (1909) – Matsum., Index Pl. Jap. **2** (2): 65 (1912) – Makino & Nemoto, Fl. Jap. 1047 (1925).

Rumex aquaticus L. var. *japonicus* Franch. & Sav., Enum. Pl. Jap. **2**: 470 (1878), non Meisn. (1865).

Rumex aquaticus auct. non L.: Makino in Bot. Mag. Tokyo **10**: 108 (1896) – Miyabe & Kudo, Fl. Hokkaido & Saghal. **4**: 493 (1934), p. p. – Rech. f. in Candollea **12**: 54 (1949) – Ohwi, Fl. Jap. 459 (1953), p. p.; ed. Engl. 404 (1965) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 298 (1962) – Kitag. in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 15 (1982) – Ohwi & Kitag., New Fl. Jap. 611 (1983), p. p.

Japanese name: No-daiô. ノダイオウ

Distribution in Japan: S. Kuriles, Hokkaido and Honshu (eastward from Okayama Pref.; Fig. 4).

Representative specimens examined. **JAPAN**: **S. Kuriles**. Isl. Shikotan, Kagenoma (Ohwi 1180, 31 Aug. 1931, KYO, TNS 219613). **HOKKAIDO**. Nemuro Division, Kanebuchi Farm (Tatewaki 32843, 21 Aug. 1941, SAPS); Kushiro Division, Kushiro-cho, Hosooka, SW side of Takkobu-numa pond (Takahashi 10430, 12 Jul. 1990, SAPT); Akkeshi-gun, Akkeshi-cho, on soil at the edge of meadow, 80 m (Takita 1726, 11 Sep. 1983, KYO); by the Lake Kussharo, Nibushi (Okamoto 1243, 6 Sep. 1954, KYO); Tokachi Division, Kamiashoro (Okamoto s. n., 7 Aug. 1959, KYO); Obihiro-shi, Aikoku, swampy place (G. Murata 22030, 8 Aug. 1970, KYO); Hidaka Division, Saruru (Tokubuchi s. n., 12 Aug. 1892, TI); near Fuyushima (Hara 3454, 8 Aug. 1933, TI); Soya Division, Isl. Rishiri, Oshidomari (Satake & Ito s. n., 2 Aug. 1957, TNS 273249); Ishikari Division, Horomui (Miyabe s. n., 13 Jul. 1885, SAPS; Odagiri s. n., 20 Jun. 1893, SAPS); Chitose-shi, in the Chitose River, the down stream of the Hatchery, Daiichi-usakumai-bashi (Takahashi 16501, 2 Aug. 1993, SAPT); Iburi Division, Shiraoi-cho, Yokosuto (Takahashi 95–29, 17 Aug. 1995, SAPT); Noboribetsu Spa (Saida s. n., 29 Jul. 1906, TNS 5298); Hiyama Division, Kumaishi-cho, Ainumanai-rindo (Oita & al. 99–3263, 8 Jul. 1999, SAPT); Nishi-gun, Otobe-cho, Sibino-misaki cape, alt. 0–60 m, seashore (Takahashi & Takita 25427, 30 Jul. 1998, SAPT); Oshima Division, Narukagawa, near Nanae (Greatrex 23/18, 19 Jul. 1918, SAPS); Onuma (Yamazaki s. n., 10 Jul. 1956, TI). **HONSHU**. Aomori Pref., Aomori-shi, Komagome, Tashirotai, Tashiro Stock-farm, alt. 570–580 m (Yonekura 4767, 9 Sep. 1999, TUS); Akita Pref., Noshiro-shi, Asanai, near Samukawa, alt. 30 m (Nemoto 4046, 22 Jun. 1988, TUS); Iwate Pref., Iwate-gun, Yonai-mura, Kamiyonai (G. Koidzumi s. n., 25 Aug. 1941, KYO); Shimohei-gun, Kawai-mura, Kuzakai (Yamamoto s. n., 29 Jul. 1971, TNS 344114); Miyako-shi, Ishihama, alt. 0–10 m (Tohda & al. 1150, 9 Jul. 1986, SAPT, TUS); Miyagi Pref., Tome-gun, Hasama-cho, Nishiomote, alt. 5–7 m (Ohashi & Ueno 68070, 7 Jun. 2004, TUS); Sendai-shi, Aoba-ku, Okura, Aoshita (A. Kimura s. n., 30 Jun. 1946, TUS); Igu-gun, Marumori-machi, Ohuchi, Myohkohzawa, alt. 80 m (Mori 6285, 22 Jun. 1989, TUS); Yamagata Pref., Mogami-gun, Semi (Okuyama 6696, Aug. 1936, TNS 112723); Kitamurayama-gun, Numazawa (Okuyama 6581, 28 Jun. 1946, TNS-94600); Komatsu (Kato 5347, 7 Jul. 1934, KYO); Fukushima Pref., Onuma-gun, Mishima-machi, Takahata (Suzuki s. n., 9 Jul. 1954, TUS); Mt. Azuma-yama (Koidzumi s. n., Aug. 1911, TI); Higashishirakawa-gun, Kaneyama, Inugami (Suzuki s. n., 25 Jun. 1953, SAPT, TNS, TUS);

Tochigi Pref., Nasu, Hojo (Kitamura s. n., 13 Jun. 1962, KYO); Nasu, Konasawagawa (Kitamura s. n., 25 Jul. 1967, KYO); Gunma Pref., Nozori-ike (Hisauchi & Hara s. n., 27 Jul. 1952, TI, TNS 117082); Saitama Pref., Tajimagahara (Okuyama 18634, 23 Jun. 1957, TNS 281058–9); Tokyo Metropolis., Shimura (Hisauchi s. n., 10 Jul. 1929, TUS); Ukimagahara (Nakai s. n., Jun. 1912, TI); Niigata Pref., Koshi-gun, Suyoshi-mura (Iwano 1599, 25 Jun. 1944, TUS); Toyama Pref., Higashitonami-gun, Toga-mura, Abetto (Himi 970711A–1, 11 Jul. 1997, TUS); Nagano Pref., Kitasaku-gun, Kitaazumi-gun, Hakuba-mura, Shinjo, Sano, alt. 750–800 m (Mimoro & Tsugaru 1143, 27 Jul. 1973, KYO, TNS); Minamiazumi-gun, Azumi-mura, Kamikochi (A. Kimura s. n., 22 Aug. 1929, TUS); Mt. Asama (Makino s. n., Jul. 1939, MAK 19064, KYO; Faurie 5837, Jul. 1904, KYO); Mt. Kirigamine (Okamoto s.n., 1 Aug. 1935, KYO); Kiso-gun, Fukushima-cho, Chigono, alt. 900 m (G. Murata 30139, 13 Jul. 1976, KYO); Ishikawa Pref., Mt. Ioo, Yokotani–Tori (Fukuoka 3962, 11 Jun. 1961, KYO); Fukui Pref., foot of Mt. Kyogadake (Tashiro s. n., 8 Jul. 1934, KYO); Oono City, SW of Sannomine in Mts. Hakusan, en route from Hatogayu to Karikomiike (Fukuoka & Inamasu 469, 16 Jul. 1963, KYO); Gifu Pref., Yoshiki-gun, Kamitakara-mura, Imami, alt. 800 m (G. Murata & al. 453, 3 Oct. 1968, KYO, TNS 210185); Ono-gun, Kuguno-cho, Onishi, Ohoradani (Nagase 901136, 9 Jul. 1990, KYO–fl.); Shiga Pref., Mt. Ibuki (Tashiro s. n., 1 Sep. 1924, KYO); Higashiazai-gun, Biwa-cho, Ohama, alt. 80–90 m (Kobayashi 32976, 31 May 1999, TNS 700657); Ika-gun, Niu-mura, Okukawanami (Hashimoto 645, 18 Aug. 1932, KYO); Takashima-gun, Shin'asahi-cho, N. of Fukamizo and Harie, alt. 85 m (Fujii 5697, 16 Jun. 1997, TNS 678563); Nara Pref., Yoshino-gun, Tenkawa-mura, Kawai to Gyojagaeri, 800 m (G. Murata & T. Shimizu 13, 15 Jul. 1954, KYO); Hyogo Pref., Mikata-gun, Muraoka-cho, Osasa, 35º24'N, 134º33'E, alt. 800–900 m (Kobayashi 29210, 16 Jul. 1998, TNS 641115); Shiso-gun, Chigusa-mura, E. of Mt. Okinosen, 1000 m alt. (Fukuoka & Inamasu 799, 28 Jul. 1963, KYO); Okayama Pref., Tomata-gun, Aba-son, Okoge (Ookubo 319, 19 Jun. 1989, KYO).

Rumex gmelinii Turcz. [Cat. Pl. Baical: 16 (1838), nom. nud.] ex Ledeb., Fl. Ross. **3** (2): 508 (1850), "*gmelini*" – Turcz., in Bull. Soc. Nat. Moscou **25**(4): 444 (1852) – Meisn. in DC., Prodr. **14**: 43 (1856) – F. Schmidt, Reis. Amurl. u. Sachal. 167 (1868) – Miyabe & T. Miyake, Fl. Saghal. 397 (1915) – Nakai in Bot. Mag. Tokyo **33**: 47 (1919) – Koidz. in Bot. Mag. Tokyo **33**: 222 (1919) – T. Mori, Enum. Pl. Cor. 136 (1922) – Makino & Nemoto, Fl. Jap. 1047 (1925) – Ohwi in Acta Phytotax. Geobot. **1**: 126 (1932); Fl. Jap. 460 (1953), "*gmelini*"; ed. Engl. 404 (1965) – Miyabe & Kudo, Fl. Hokkaido & Saghal. **4**: 494 (1934), "*gmelini*" – Losinsk., Fl. URSS **5**: 457 (1936) – Rech. f. in Candollea **12**: 63 (1949) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 297 (1962) – Vorosch., Fl. Soviet. Dal'n. Vost. 160 (1966); Opred. Rast. Soviet. Dal'n. Vost. 208 (1982) – Kitag., Neo-Lineam. Fl. Mansh. 245 (1979); in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 15 (1982), "*gmelini*" – Ohwi & Kitag., New Fl. Jap. 611 (1983) – Tzvelev in Novit. Syst. Pl. Vasc. **24**: 73 (1987); in Kharkev., Pl. Vasc. Or. Extr. Soviet. **4**: 39 (1989) – W. T. Lee, Lineam. Fl. Kor. **1**: 241 (1996), "*gmelini*" – A. J. Li, Fl. Reipubl. Popularis Sin. **25**(1): 155 (1998) – A. J. Li & al. in C. Y. Wu & Raven, Fl. China **5**: 337 (2003) – Yonek. in K. Iwats. & al., Fl. Jap. **2a**: 129 (2006).

Rumex aquaticus auct. non L.: Ohwi in Acta Phytotax. Geobot. **1**: 128 (1932) – Miyabe & Kudo, Fl. Hokkaido & Saghal. **4**: 493 (1934), p. p. – Ohwi, Fl. Jap.: 459 (1953), p. p.; ed. Engl. 404 (1965), p. p.

Japanese name: Karafuto-no-daiô カラフトノダイオウ, Karafuto-daiô, Maruba-gishigishi.

Distribution in Japan: S. Kuriles, Hokkaido and C. Honshu (Togakushi and Iizuna Heights in Nagano Pref.) (Fig. 4).

Specimens examined. **JAPAN: S. KURILES**. Isl. Shikotan, Notoro (Ohwi 801, 11 Aug. 1931, KYO); Isl. Kunashiri, Furukamappu Lake (Matsumura s. n., 22 Jul. 1930, KYO); Isl. Etorofu, Posoru (Saito s. n., 14 Aug. 1928, TI); Porosu–Sokiya (Saito s. n., 7 Aug. 1928, TI). **HOKKAIDO**. Soya Division, Soya-gun, Sarufutsu village, Daiichi Pond (Fujita 9800672, 27 Jul. 1998, SAPT); Kamikawa Division, Nakagawa-gun, Mt. Hako-dake (Teshio side), alt. 1000 m (Yamamoto 6677, 6668, 7879, 30 Jul. 1936, SAPS); Mt. Daisetsu (Nakai s. n., Aug. 1928, TI); Daisetsu

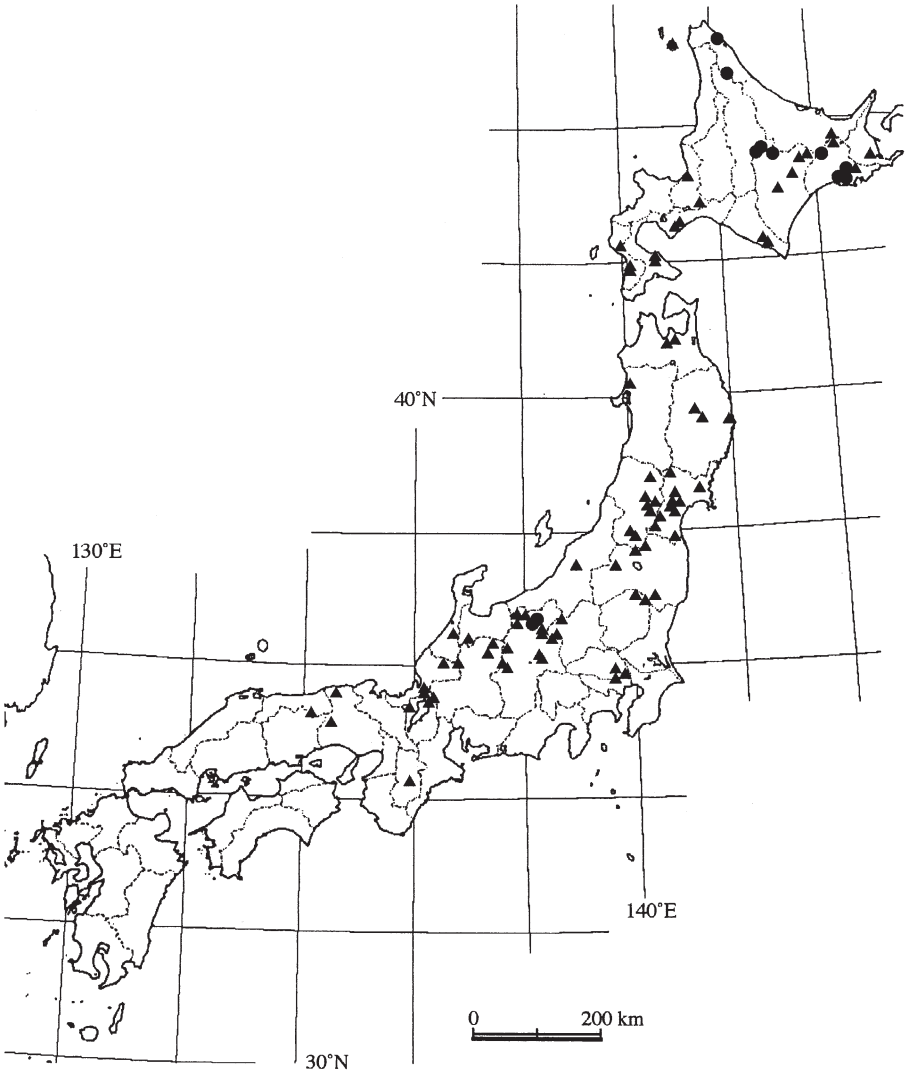


Fig. 4. Distribution of *Rumex longifolius* (triangles) and *R. gmelinii* (circles) in Japan.

Mts. Takanegahara (Nakajyo s. n., 20 Aug. 1962, SAPS; H. Koidzumi 52241, 27–28 Aug. 1925, TNS-909042; Kimura s. n., 13 Jul. 1928, TUS); Hiragatake-daiichi-shitsugen (H. Koidzumi 14937, 8 Aug.1927, TNS 909099); Mt. Chubetsu (Takeda & Hayashi s. n., 16 Aug. 1929, SAPS); Kushiro Division, Tsurui-mura, Kushiro-mire, Akanuma (Fujita 9700529, 27 Aug. 1997, SAPT); Shibecha (Faurie 5338, 27 Jun. 1890, KYO); Shibecha-cho, foot of Mt. Meakan, Pirikaneppu (Tatewaki 5270, 15 Sep. 1925, SAPS). **HONSHU**. Nagano Pref., Togakushiyama (Muramatu s. n., 7 Aug. 1925, TI); Kamiminochi-gun, Togakushi-mura, Huruike, on wet grassy slope, 1100 m alt. (Ito 2122, 3 Sep. 1978, TNS 484117); Togakushi-mura, Ohashi, 1150 m (Fujiwara s. n., 6 Jun. 1997, TUS); Shinano-machi, Furuike, 1190 m (Fujiwara s. n., 9 Sep. 1997, TUS).

7. Identity of *Rumex nipponicus*, with reference to a subspecies of *R. dentatus* newly recorded from the Ryukyus and Taiwan

Rumex nipponicus Franch. & Sav., described from the coast of Kamakura in Kanagawa Prefecture, is widely distributed in lowland fields westward from the Kanto

District of Honshu, Shikoku and Kyushu in Japan. It has also been collected from some islands in the Ryukyus, but is considered introduced from mainland Japan (Hatusima and Amano 1994). It was once a common weed of cultivated fields especially in western Japan but is now becoming rare due to urbanization and changes of landscape (Environment Agency of Japan 2000). *Rumex nipponicus* is often confused with *R. obtusifolius* with similar shape of valves. Nakai (1909) treated the former as a variety of the latter. For example, the photograph of "*R. nipponicus*" in Kitagawa (1982; pl. 14, no. 1) is *R. obtusifolius*. Indeed, *R. nipponicus* is entirely different from *R. obtusifolius* in its biennial habit (vs. perennial in *R. obtusifolius*), glaucous-green leaves never tinged red (vs. bright green leaves usually red-tinged along costa) and valves with evenly well-developed white tubercles (vs. only one valve in each flower with well developed usually reddish-tinged tubercle). Tzvelev (1987, 1989) recorded *R. nipponicus* from S. Kuriles (Kunaschir Isl.) but the record seems dubious, as the description provided by Tzvelev (1989) disagrees with Japanese plants.

Rechinger (1932) considered *Rumex nipponicus* as identical with Himalayan *R. klotzschianus* Meisn., reducing the latter into a subspecies of *R. dentatus* L. described from Egypt. Later Rechinger (1949) changed his interpretation and regarded *R. nipponicus* as a subspecies of *R. dentatus* distinct from subsp. *klotzschianus*. He distinguished *R. dentatus* subsp. *nipponicus* in Japan, Korea and China (including Taiwan) from subsp. *klotzschianus* in China, the Himalayas and Afghanistan by length of the valves (4–5 mm vs. 3–4 mm) and relative length of spines on the valves to width of valve itself (spines longer than width of valves vs. shorter). The size of valves of Japanese *R. nipponicus*, however, ranges continuously 3.6–4.5(–5 mm) (Fig. 2, c-d). The relative length of spines to width of valves is also variable and is not to be used as reliable distinguishing character. The valve characters of *R. dentatus* are also continuously variable in China, where the two subspecies are widely overlapping according to Rechinger (1949). No infraspecific taxa for *R. dentatus* L. has been recognized in Chinese floras (Li et al. 1998, 2003). I also recognize *R. dentatus* indigenous to East Asia, including *R. nipponicus* as one entity. Compared to East Asian plants, Egyptian specimens of *R. dentatus* have larger valves (4.5–)5–6 mm in length with usually 2 pairs of marginal spines, which are 2–3 mm long. In conclusion, East Asian representative of *R. dentatus* is best treated as a subspecies, subsp. *klotzschianus* Rech. f. as Rechinger (1932) did.

In 1998, I collected plants similar to *Rumex dentatus* subsp. *klotzschianus* on sandy seasides of Isl. Ishigaki and Isl. Iriomote in Yaeyama Islands. These plants are different from *R. dentatus* subsp. *klotzschianus* by valve characters as keyed below (also see Fig. 2, e). Hatusima and Amano (1994) did not record *R. dentatus* (as *R. nipponicus*) from Yaeyama Islands. The plants seem casually naturalized, as I could not find them when I revisited the same islands in 2002 and 2004. A specimen apparently identical with the plants was collected from a beach of Taiwan in 1992 and identified as *R. maritimus.* But this specimne is different from *R. maritimus* in characters of inflorescences and valves. These are identical with *R. dentatus* subsp. *nigricans* (Hook. f.) Rech. f. distributed in the Lower Gangetic Plain in India and Bangladesh (Rechinger 1949). It is the first record of *R. dentatus* subsp. *nigricans* from East Asia, but it may not be considered as the natural extension of the distribution; the introduction into Taiwan might be artificial. The plants in Yaeyama Islands might come from Taiwan through sea current by dispersal of achenes. The large

spongy tubercles of valves allow long-distance dispersal of subsp. *nigricans*.

Key to the subspecies of *Rumex dentatus* in East Asia:

1. Valves 3.5–4.5(–5) mm long, 2–2.5 mm wide excluding spines, marginal limb conspicuous, with (2 or) 3 or 4 spines 1–2.5 mm long; tubercle 1.7–2.4 mm long, smooth or weakly wrinkled (Fig. 2, c–d) ....subsp. *klotzschianus*

1. Valves 3–3.6 mm long, 1.6–1.9 mm wide excluding spines, marginal limb often inconspicuous, with 1 or 2 spines up to 1 mm long or rarely entire; tubercle 2.5–2.8 mm long, prominently wrinkled (Fig. 2, e) ....subsp. *nigricans*

Rumex dentatus L., Mant. Pl. Alt.: 226 (1771) – Hook. f., Fl. Brit. Ind. **5**: 59 (1886) – F. B. Forbes & Hemsl. in J. Linn. Soc., Bot. **26**: 356 (1891) – Sam. in Hand.-Mazz., Symb. Sin. **7**: 168 (1929) – A. J. Li, Fl. Reipubl. Popularis Sin. **25**(1): 161, t. 39, f. 1-2 (1998) – A. J. Li & al. in C. Y. Wu & Raven, Fl. China **5**: 339 (2003).

subsp. **klotzschianus** (Meisn.) Rech. f. in Beih. Bot. Centralbl. **49**(2): 19 (1932); in Candollea **12**: 119 (1949) – Yonek. in K. Iwats. & al., Fl. Jap. **2a**: 129 (2006).

Rumex klotzschianus Meisn. in DC., Prodr. **14**(1): 57 (1856).

Rumex nipponicus Franch. & Sav., Enum. Pl. Jap. **2**: 471 (1878) – Makino in Bot. Mag. Tokyo **5**: 166 (1891) – Matsum., Index Pl. Jap. **2**(2): 66 (1912) – Makino & Nemoto, Fl. Jap. 1048 (1925) – Ohwi, Fl. Jap. 461 (1953); ed. Engl. 405 (1965) – Hatus., Fl. Ryukyus 249 (1971) – T. S. Liu & al., Fl. Taiwan **2**: 292 (1976) – Kitag. in Satake & al., Wild Flow. Jap. Herb. Pl. **2**: 16 (1982), excl. t. 14, f. 1 – Ohwi & Kitag., New Fl. Jap. 613 (1983) – W. T. Lee, Lineam. Fl. Kor. **1**: 242 (1996) – H.Y. Liu, Fl. Taiwan ed. 2, 2: 315 (1996). Type: **JAPAN**: Kanagawa Pref., in arenosis maritimis ad Kamakoura, prope Yokoska (Savatier 1012, P–n. v.).

Rumex obtusifolius L. var. *nipponicus* (Franch. & Sav.) Nakai in Bot. Mag. Tokyo **23**: 457 (1909).

Rumex dentatus L. subsp. *nipponicus* (Franch. & Sav.) Rech. f. in Candollea **12**: 118 (1949) – Kitam. & Murata, Col. Ill. Herb. Pl. Jap. **2**: 296 (1961).

Rumex maritimus auct. non L.: C. C. Hsu, Ill. Common Pl. Taiwan **1**: 49, f. 15, photo 2 (1971).

Rumex dentatus auct. non L.: Matsum., Index Pl. Jap. **2**(2): 65 (1912) – Makino & Nemoto, Fl. Jap. 1047 (1925) – A. J. Li, Fl. Reipubl. Popularis Sin. **25**(1): 161 (1998) – A. J. Li & al. in C. Y. Wu & Raven, Fl. China **5**: 339 (2003).

Japanese name: Ko-gishigishi コギシギシ

Distribution in Japan: Honshu (westward from Kanto Dist.; southward from Niigata Pref.), Shikoku, Kyushu. Introduced to the Ryukyus (Amami-oshima, Okinawa Islands and Minami-Daito-jima).

subsp. **nigricans** (Hook. f.) Rech. f. in Beih. Bot. Centralbl. **49**(2): 20 (1932); in Candollea **12**: 120 (1949) – Yonek. in K. Iwats. & al., Fl. Jap. **2a**: 129 (2006).

Rumex nigricans Hook. f. in Fl. Brit. India **5**: 59 (1886).

Japanese name: Hama-ko-gishigishi ハマコギシギシ (Yonekura 2006).

Distribution in Japan: The Ryukyus (Ishigaki-jima and Iriomote-jima). New to the Ryukyus and Taiwan.

Specimens examined. **JAPAN**: Okinawa Pref., Isl. Ishigaki, Ishigaki-shi, Maezato, seashore SW. of Ishigaki Airport (Yonekura 98467, 23 Apr. 1998, TUS); Isl. Iriomote, sandy coast around Nishigeda Bridge (Yonekura 98389, 21 Apr. 1998, TUS). **TAIWAN**: Kaohsiung City, Chungchou, beach (S. F. Huang 4639, 31 Mar. 1992, TUS).

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米倉浩司：**日本とその周辺のタデ科植物に関する新知見（I）**

東アジア産のタデ科植物は，Steward (1930) と Rechinger (1949) による全面的な検討以来包括的な研究がなされておらず，各地域ごとに出版されている植物誌の間で分類群の範囲付けや名前に差異が著しい．日本国内においてすら，九州以北と琉球のタデ科植物は別々に扱われていることが多く，全てを一覧できる著作は戦後刊行されていないのが現状である．筆者は2006年に出版された Flora of Japan **2a** (Yonekura 2006) の中でタデ科を担当し，日本全域のタデ科植物を包括的に再検討したが，紙面の都合のため十分な説明を行い得なかった．この一連の論文では，Yonekura (2006) の中で発表された新見解に関する詳細な説明を中心として，さらに若干の追加や変更を行うことにしている．今回は，Yonekura (2006) で採用したタデ科の分類体系と，ギシギシ属 *Rumex* の若干の種に関する説明を行い，また Yonekura (2006) には含めなかったギシギシ連のダイオウ属 *Rheum* (日本には野生はなく栽培のみ) とイヌスイバ属 *Emex* (日本には開港地に稀に帰化する) について補足した．

1．2003年に*rbcL*遺伝子によるタデ科の分子系統樹（Lamb Frye and Kron 2003）が発表され，この中でしばしば広義のタデ属 *Polygonum* s. l. に含められるソバ属 *Fagopyrum* が広義のタデ属からは系統的に大きく異なったものであることが明らかになった．広義のタデ属は近年は複数の属に分割されることが多く，筆者もこの立場で分類体系を提案したことがある（Yonekura and Ohashi 1997）．Lamb Frye and Kron (2003) による系統樹は Yonekura and Ohashi (1997) の属の範囲付けと矛盾しなかったので Yonekura (2006) で採用したが，上記のソバ属の系統的位置を重視して単型のソバ連 Fagopyreae Yonek. を新たに設立する変更を行っ

た．

2．漢方薬に用いられるダイオウ属植物は日本には野生がなく，夏の暑さを嫌うため冷涼な地域で栽培されることがあるに過ぎない．シーボルトが江戸時代に日本で採集しダイオウ属の1種とみなした葉だけの標本がオランダ国立標本館ライデン分館に保管されているが，資料が断片的なためこれまできちんと検討されなかった．筆者がこの標本を検討したところ，意外にもこれらはダイオウ属はおろかタデ科ですらなく，1枚はキク科と思われ，2枚はウバユリ（ユリ科）であった．

3．ヨーロッパ原産で現在日本全土に普通の雑草となっているヒメスイバ *Rumex acetosella* L. は，原産地では変異に富み，4亜種に分けられている．日本に帰化している型はほとんど全て subsp. *pyrenaicus* (Pourr. ex Lapeyr.) Akeroyd に当たり，同じ型は南サハリンや千島からも報告されている (Tzvelev 1989)．一方，これとは雌花の果期の内花被片の性質が異なることによって区別される subsp. *acetosa* は，アジア大陸では普通の型だが，日本では宮城県で最近採集された1枚の標本以外には知られていない．この型に対してヒナスイバの和名を新称する．ヒナスイバは今後日本の他の地域でも見つかる可能性がある．なお，沖縄から記録されているハネミヒメスイバ *R. hastatulus* Baldw. ex Ell. は，ヒメスイバに似ているが内花被片が果期に大型となるだけでなく根茎を欠く点で大きく異なり，むしろスイバ *R. acetosa* L. に近い．これに関して，『日本の帰化植物』(清水建美編：平凡社；米倉 2003)のハネミヒメスイバの著者名と記述に誤りがあった．

4．タカネスイバ，5．キブネダイオウの学名に関して議論を行った．

6．ギシギシ属ギシギシ亜属の中で，果期の内花被片に瘤体も刺もない種には日本からはヌマダイオウ *Rumex aquaticus* L.，ノダイオウ *R. longifolius* DC.，マダイオウ *R. madaio* Makino およびカラフトノダイオウ *R. gmelinii* Turcz. ex Ledeb. の4種が知られているが，その区別点は微妙で特に未熟な標本では区別が困難である．ヌマダイオウは，しばしば日本や朝鮮半島から報告されているが，その証拠標本はいずれも他の3種のいずれかの誤同定と考えられ，日本における生育は疑わしい．また，カラフトノダイオウは，従来日本では北海道にのみ自生が知られていたが，長野県北部の戸隠および飯綱高原にも生育することが明らかとなった．長野県のものは従来ヌマダイオウまたはマダイオウと同定されていた．

7．コギシギシ *Rumex nipponicus* Franch. & Sav. は，日本の文献では従来独立種とされることが多かったが，アフガニスタンからヒマラヤを経て中国にまで分布する *R. dentatus* L. subsp. *klotzchianus* (Meisn.) Rech. f. と全く区別できない．中国の植物誌では *R. dentatus* L. は広義に扱われており亜種は認められていないが，*R. dentatus* L. の基準産地であるエジプトの標本を見た限りでは東アジアのものとは異なっているので，独立の亜種として認めてよいものと考えられる．

1998年に沖縄県の石垣島と西表島の海岸でコギシギシに似た植物を採集したが，この植物はコギシギシよりも果期の内花被片の幅が狭く縁の刺の発達も悪い反面，瘤体がよく発達している点で異なっている．同様の植物が台湾の海岸からも1992年に採集されている．この植物は，インドとバングラデシュのガンジス川下流域に分布する *Rumex dentatus* subsp. *nigricans* (Hook. f.) Rchb. f. と同定される．本亜種は東アジアからは初めての報告であるが，本来の自生というよりも，最初台湾に帰化し，その後に果実が海流によって八重山諸島の海岸に漂着して発生したものではないかと憶測される．海岸に生育していたことから，ハマコギシギシの和名を新称する．筆者が2002年と2004年に八重山諸島を再訪した際にはハマコギシギシを発見できなかったので，本植物の出現は一時的なものでその後定着することはなかったものと考えられる．

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