CONSPECTUS GENTIANACEARUM JAPONICARUM

A general view of the Gentianaceae indigenous to Japan

By

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(With 4 Plates, 3 Tables & 62 Text-figures)

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I. Introduction

The present work is a conspectus or general view of the Gentianaceae, s. str. with special reference to the species growing in Japanese territory.

Although described in detail in works published by our great forerunners, such as KUSNEZOW (1896–1904, on *Gentiana*, esp. Eugentiana), WHELDON and SALMON (1925, on *Erythraea*), ST. JOHN (1941, on *Swertia*), SATAKE (1944, on *Swertia*; 1951, on *Tripterospermum*), MA (1951, on *Gentiana* s.l., esp. *Gentianopsis*), GILLETT (1957, on *Gentiana* s.l., esp. *Gentianella*), etc., dealing either locally or world-widely with the species of the above genera, a brief review of the history of the taxonomic treatment of the family up to date may assist in an understanding of the status of the Gentianaceae to-day.

TOURNEFORT (Institutiones rei herbariae (ed. 1) 1700) commenced the use of the genus name '*Gentiana*', a Dioscoridean name commemorating GENTIUS, King of Illyria, for the plant group now recognised as *Gentiana*, s.l. LINNAEUS took up that name in his 'Species plantarum (ed. 1) 1753', and established the taxonomic status of the genus; under *Gentiana*, LINNAEUS enumerated 23 species, dividing those into three subgroups as follows:

*Corollis quinquefidis subcampaniformibus (*G. lutea*, *G. purpurea*, *G. punctata*, *G. asclepiadea*, *G. pneumonanthe*, *G. saponaria*, *G. villosa* and *G. acaulis*).

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**Corollis quinquefidis infundibuliformibus (*G. verna*, *G. bavarica*, *G. nivalis*, †*G. aquatica*[1], *G. utriculosa*, *G. centaurium*, †*G. spicata*, *G. quinquefolia* and *G. amarella*).

***Corollis non quinquefidis (*G. campestris*, *G. ciliata*, *G. cruciata*, *G. sessilis*, *G. filiformis* and *G. perfoliata*).

He established the genus *Swertia* along with *Gentiana* in the same literature; under *Swertia* are enumerated five species, i.e., †*S. perennis*, *S. difformis*, *S. rotata*, †*S. corniculata* and *S. dichotoma*.

In his 'Elementa botanica 1790', NECKER established *Gentiana*, *Pneumonanthe*, *Anthopogon*, *Spirogyne*, *Thyrophora*, etc. as species, which correspond to 'genus' in modern nomenclature, but, his conception of species being quite ambiguous, almost all Neckerian species were rejected as *nomina invalida* by the current code of nomenclature.

MOENCH published the genus *Gentianella* in 1794, basing it on *Gentianella tetrandra* (nom. ill. = *G. campestris*). In 1796, SCHMIDT divided the contents of the Linnean *Gentiana* and *Swertia* into six smaller genera, *Pneumonanthe*, *Hippion*, *Chironia*, *Gentiana*, *Swertia* and *Chlora*, while BORCKHAUSEN, in that year, divided the Linnean genera into thirteen smaller ones, viz. *Swertia*, *Halenia*, *Asterias*, *Coilantha*, *Dasystephana*, *Ciminalis*, *Ericoila*, *Eurythalia*, *Gentiana*, *Gentianella*, *Chlora*, *Centaurium* and *Erythraea*. FROELICH's monograph of *Gentiana* appeared also in the same year; he established 4 subgroups, *Coelanthae, **Calathianae, ***Endotrichae and ****Crossopetalae which have been assumed to be sections by many later authors; he enumerated 47 species. BUNGE published 'Conspectus generis *Gentianae* imprimis specierum rossicarum' in 1829 and described 80 species. In 1830, BRAUN established the genus *Lomatogonium* in a short paper entitled '*Lomatogonium*: ein neues Genus für *Gentiana carinthiaca* FROEHL.'. This new genus was taken up by REICHENBACH in 1831.

In 1836, GRISEBACH published his preliminary work on the Gentianaceae of the world, in which the treatment of the family was fixed, and he executed similarly his later two works, 'Genera et species Gentianearum 1839' and 'Gentianeae' in DE CANDOLLE's 'Prodromus **9**. 1845', epoch-making works in respect to the taxonomy of the Gentianaceae. In 1859, MAXIMOWICZ published the genus *Pterygocalyx* in his 'Primitiae florae amurensis'. TURCZANINOW, in his 'Monographische Beschreibung der Enzianen', reviewed *Gentiana* monographically in 1860. HUXLEY suggested, in 1888, a rearrangement of the genus *Gentiana*, s. l. in relation to pollination mechanism. His Mesomelitae includes the plants with glanduliferous ovaries; his Perimelitae those having epipetalous

1) The mark (†) denotes the species also occurring within our boundaries.

glands, namely the former corresponds to KUSNEZOW's Eugentiana, while the latter to his Gentianella. In 1892, MURBECK published a small monograph of the European species of the Endotrichae group of *Gentiana*.

In 1894, KUSNEZOW divided the Linnean *Gentiana* into two subgenera, Eugentiana and Gentianella. He contributed much to the taxonomy of Eugentiana but little to that of Gentianella. His monograph was written in Russian, and was later (during 1896–1904) translated into German.

GILG renewed the system of the Gentianaceae as a whole in ENGLER and PRANTL: Die natürlichen Pflanzenfamilien **4** (2). 1895, as follows[2]:

Subfamily **I. Gentianoideae**
Tribe 1. Gentianeae
Subtribe a. Exacinae
Subtribe b. Erythraeinae
Subtribe c. Chironiinae
Subtribe d. Gentianinae
Subtribe e. Tachiinae
Tribe 2. Rusbyantheae
Tribe 3. Helieae
Tribe 4. Voyrieae
Tribe 5. Leiphaimeae
Subfamily **II. Menyanthoideae**

By the above work, the system of the Gentianaceae was almost fixed and established.

WETTSTEIN, in 1896, published 'Die europäischen Arten der Gattung *Gentiana* aus der Sektion Endotricha Froel. und ihr entwicklungsgeschichtlicher Zusammenhang', in which he reported that seasonal dimorphism (i.e. 'Saison-Dimorphismus' in his term) had been observed among the members of the section. In the same year, he separated the group of *Gentiana tenella* and *G. nana* from the section Amarella (sect. Gentianella of the genus *Gentianella*), establishing a new section, Comastoma. SCHOCH's synopsis of the genus *Chironia* appeared in 1903. In 1923, SCHUSTLER, in a short paper entitled 'Some remarks to the system of Gentianae', re-raised *Gentianella* to the status of a genus, stating that the only common characteristic for *Gentiana* and *Gentianella* is the joined corolla-lobes, but he credited the name to BORCKHAUSEN rather than to MOENCH. WHELDON and SALMON's work on the genus *Erythraea* appeared in 1925. ALLEN, in 1933, published a monograph of the genus *Halenia* of N. America.

2) The genus *Gentiana* of subtr. d. Gentianinae was worked out by KUSNEZOW.

H. SMITH made HEMSLEY's section Megacodon of *Gentiana* an independent genus in 1936, and MARQUAND (1931 and 1937) united *Crawfurdia*, lowering its rank to a section, to *Gentiana*.

In 1941, ST. JOHN revised *Swertia* of the Americas, uniting *Frasera* to *Swertia*, while SATAKE (1944 and 1947) reduced *Lomatogonium* to *Swertia* as a subgenus.

MA, in 1951, separated *Gentianopsis* from *Gentianella* as a distinct genus, but discussed no synonymy. In 1952, GROSSHEIM returned *Ophelia* which had been reduced to *Swertia* as a section or a subgenus to the rank of genus.

From the cytotaxonomical point of view, Á. and D. LÖVE divided the Linnean *Gentiana* into a few smaller genera in 1956; they restored the genera *Hippion* (for sect. Cyclostigma) and *Anthopogon* (for sect. Crossopetalum and identical with MA's *Gentianopsis*); at the same time they transferred the section Comastoma from *Gentianella* to *Lomatogonium*, emphasising that the chromosome number of both *Lomatogonium* and the Comastoma group of *Gentianella* is n=5.

In 1957, GILLETT revised the genus *Gentianella* of N. America monographically, and divided it into three subgenera, viz., Gentianella, Comastoma and Eublephis, while TOYOKUNI, in that year, recognised three relative subgenera under *Gentiana*, s.l., i.e., Gentiana (Eugentiana of KUSNEZOW), Gentianella and Gentianopsis. SHINNERS published a synopsis of the genus *Eustoma* also in the same year. SATAKE made a synopsis of *Gentianella* of Japan in 1959, adopting the system proposed by GILLETT (1957). PRITCHARD (1959–1961) introduced some statistical methods into the taxonomy of *Gentianella*. In 1961, Á. and D. LÖVE restored *Ericoila* for a part of *Gentiana*, s.l., while TOYOKUNI separated *Comastoma* from *Gentianella* as a good genus in the same year.

Along with other families of the Spermatophyta, Japanese species of the Gentianaceae had been collected and taxonomically studied by foreign botanists before the end of the last century; these botanists are THUNBERG, ZOLLINGER, FRANCHET and SAVATIER, SIEBOLD and ZUCCARINI, MAXIMOWICZ, KUSNEZOW, LÉVEILLÉ, etc. After those days Japanese botanists gradually took the place of preceding ones, and since then the Japanese members of the Gentianaceae have been studied chiefly by MAKINO, HAYATA, NAKAI, TAKEDA, KOIDZUMI, HONDA, MASAMUNE, HARA, SATAKE, OHWI and the present writer.

Each species has been tested in detail, but so far as the author is aware no monographic work has been published except LÉVEILLÉ's (1906, on *Gentiana*) and SATAKE's (1944 and 1947, on *Swertia* s.l.; 1951, on *Tripterospermum*; 1959, on *Gentianella*). Meeting this need the author has ventured to undertake the present work.

Desiring to know delicate differences and variation patterns in polymorphic collective species, the author visited, as far as possible, the very place where each species is growing. Along with field observations, he visited the main herbaria of Japan from 1953 to 1961, and under the kind permission of their directors and curators he was able to carry out careful observations and comparisons of gentianaceous specimens.

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II. General characters of the family

The family Gentianaceae defined here is that in the strict sense, not including the Menyanthoideae.

Habit. Height of plant in the smallest species is 1 cm or less compared with the tallest more than 1 m; habitat of some is wet or swampy places, but some others prefer dry conditions; plants have simple stems or ramose ones,

TABLE 1. Nature of roots in Japanese species of the Gentianaceae. According to the increase in number of the sign (+), root becomes larger in diameter.

Genus	Section	Name of species	Root		Thickness	Rhizome or caudex
			perenn.	annual or bienn.		
Centaurium	Spicaria	*C. spicatum*	−	+	+	−
Halenia	—	*H. corniculata*	−	+	++	+
Ophelia	Stellera	*O. tetrapetala*	−	+	+	−
	Japonicae	*O. diluta*	−	+	+	−
		O. pseudo-chinensis	−	+	+	−
		O. japonica	−	+	+	−
	Swertopsis	*O. umbellata*	−	+	++	−
	Bimaculatae	*O. bimaculata*	−	+	++	+
	Rosulatae	*O. tashiroi*	−	+	+	−
Swertia	—	*S. perennis*	+	−	+	−
Lomatogonium	—	*L. carinthiacum*	−	+	+	−
Comastoma	—	*C. pulmonarium*	−	+	+	−
Gentianella	Gentianella	*G. auriculata*	−	+	+	−
		G. yuparensis	−	+	+	−
Gentianopsis	—	*G. contorta*	−	+	+	−
		G. yabei	−	+	+	−
Pterygocalyx	—	*P. volubilis*	+	−	+	+
Gentiana	Chondrophylla	*G. aquatica*	−	+	+	−
		G. laeviuscula	−	+	+	−
		G. thunbergii	−	+	+	−
		G. yakumontana	−	+	+	−
		G. squarrosa	−	+	+	−
		G. zollingeri	−	+	+	−
		G. nipponica	+	−	+	−
		G. jamesii	+	−	+	−
	Frigida	*G. glauca*	+	−	++	+
		G. algida	+	−	+++	+
	Kudoa	*G. yakushimensis*	+	−	++++	+
	Pneumonanthe	*G. triflora*	+	−	+++	++
		G. makinoi	+	−	+++	+
		G. scabra	+	−	+++	++
		G. sikokiana	+	−	++	+
Tripterospermum	—	*T. japonicum*	+	−	+	+

and the ramification varies in each group; branches and branchlets are produced from the very base in some, but are produced in the middle to upper portions of the main stem in some others—such ramified stems are rather common characteristics for annual or biennial species, and furthermore, in some species of the genus *Gentianella*, there is often found seasonal dimorphism. The stems are extremely thin and slender except in a few species which have very thick ones.

Root. Perennial species usually produce rhizomes or caudices with such exceptions as *Gentiana nipponica*, *G. jamesii*, etc., which, in spite of their being perennial, do not produce them; annual or biennial ones are almost devoid of them. Rhizome-producing species are those belonging to the sections Pneumonanthe and Frigida of the genus *Gentiana*, while caudices are found to exist in the members of the section Kudoa of the same genus (Table 1).

General speaking, annual roots in the Gentianaceae have biennial nature as well, because later-germed seeds of a certain annual species spend the rest of the year to the next without fading away, so that many of so-called annual species have both natures, annual and biennial.

Stem. As the author has already touched upon in the explanation of habit, various types of ramification of stems are met with in the present family. However, the basic types are usually as follows (Fig. 1).

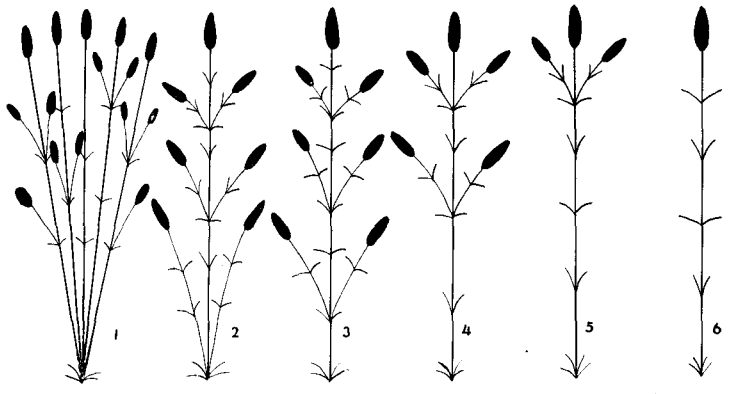

Fig. 1. Ramification of stems in the Gentianaceae: 1. Fasciculate type (typus fasciculatus), 2. Basiramiferous type (typus basiramifer), 3. Inferior-ramiferous type (typus inferioriramifer), 4. Middle-ramiferous type (typus medioramifer), 5. Superior-ramiferous type (typus superioriramifer), and 6. Simple type (typus simplex).

In *Centaurium* all 6 types are found, but the fasciculate one is rare. In *Halenia* and *Ophelia* the first half of these 6 types are common, but rarely the simple type is also found. In *Swertia*, however, types 1–4 never occur;

the superior-ramiferous type, too, is rare. In the genera *Lomatogonium*, *Comastoma*, *Gentianella* and *Gentianopsis*, all but type 1 are common. In the genera *Pterygocalyx* and *Tripterospermum*, the stems are coiling belonging to none of these categories. In *Gentiana*, the ramification is somewhat diverse. All the Japanese members of the section Pneumonanthe have in almost all cases simple stems, but those growing in wet places, e. g., marsh, etc. sometimes have fasciculate stems. The Japanese species of sect. Frigida, namely *G. algida* and *G. glauca*, hardly ramify in stems, but are somewhat fasciculate from their rhizomes. In the next section, Chondrophylla, all members sometimes ramify in the middle to upper part of stems, forming types 4 to 6.

Leaves. 1. Radical or basal leaves: The types of radical leaves in the family are (1) Rosulate type, (2) Several-fasciculate type, (3) Opposite type, (4) Scarious type and (5) Leafless type. The first type is seen in *Halenia*, *Ophelia*, *Lomatogonium*, *Comastoma*, *Gentianella*, *Gentianopsis* and almost all the species of *Gentiana* sect. Chondrophylla subsect. Annuae. The second type is common in *Gentiana* sect. Frigida, and the third in *Halenia*, *Ophelia*, *Swertia*, *Lomatogonium*, *Gentianella*, *Gentianopsis* and *Gentiana* sect. Chondrophylla. The members of *Halenia*, *Ophelia* sect. Stellera and sect. Japonicae, *Lomatogonium*, *Comastoma*, *Gentianella* and *Gentianopsis* are usually of the third type, but are sometimes of the second type as well, because they vary a good deal according to the oecological conditions of their habitats. The fourth and the fifth types are seen in *Ophelia* sect. Bimaculatae and *Gentiana* sect. Pneumonanthe. Such classification of types is of course tentative, and the demarcations between them are often vague.

2. Cauline leaves: Opposite leaves are most common throughout the family, and a pair of leaves is arranged crosswise on a stem, i. e., its phyllotaxis is 1/2. Such type is seen in the following genera and species: *Halenia*, *Ophelia* sect. Stellera and sect. Japonicae, *Lomatogonium*, *Comastoma*, *Gentianella*, *Gentianopsis yabei*, *Gentiana* (excl. sect. Kudoa), etc. In *Gentianopsis contorta*, however, a pair of leaves on a stem is arranged not crosswise but 1/3 in phyllotaxis, namely, a next upper pair of leaves is in relation to the first pair at a degree of 60°. On the other hand, in *Gentiana yakushimensis*, the leaves are no longer opposite, but are 4-leaved verticillate, sometimes turning to be 3-leaved verticillate in accordance with the external conditions. In *Swertia perennis*, alternate leaves are occasionally seen along with opposite ones.

Almost all the Japanese species of the Gentianaceae have sessile leaves, their forms being linear, linear-spathulate, lanceolate, oblanceolate, oblong-lanceolate, oblong-elliptical, elliptical, ovate, etc.; their colours are almost always light green-yellow or yellowish green in many of the Japanese species, but in

such species as *Gentiana scabra*, they are diamine-green and in *Gentiana glauca* yellowish dusky green.

The leaf-apices are acute, acutiuscule, obtusiuscule, obtuse or rotundate, and the bases attenuate, acute, acutiuscule, obtusiuscule, obtuse, rotundate, cuneate or subcordate as well as somewhat vaginous and embracing the stems. The leaf-margins are usually scabrous but hardly serrate or laciniate. Many of *Gentiana* have leaves with scabrous margins which are often rolled as though they were quite entire.

In accordance with the writer's observation on some species of *Gentianella* and *Gentiana*, the stomata are extensively distributed on the under surface, except on veins, but are deficient on the upper, with such exceptions as *Gentianella yuparensis* and *Gentiana glauca* (Table 2).

TABLE 2. Relative distribution of stomata on the two sides of leaves in some species.

Name of plant	Upper surface	Under surface
Gentianella yuparensis	+	+++
subsp. *takedai*	+	+++
Gentiana nipponica	−	+++
G. jamesii	−	+++
G. glauca	++	+++
G. algida f. *igarashii*	−	+++
G. triflora var. *japonica* f. *montana*	−	+++

The number of vascular bundles in leaves varies 1–7, rarely 9.

Flower. Eleven essential types of flowers are encountered in the Gentianaceae of Japan: (1) Centaurioid type, (2) Halenioid type, (3) Ophelioid type, (4) Swertioid type, (5) Lomatogonioid type, (6) Comastomoid type, (7) Gentianelloid type, (8) Gentianopsioid type, (9) Pterygocalycioid type, (10) Gentianoid type, and (11) Tripterospermoid type. These types correspond to the 11 genera and are briefly characterised as follows:

(1) Centaurioid type: tetramerous or pentamerous, corolla with no appendages, namely neither with glanduliferous ovary nor with epipetalous grands, ovary unilocular or semibilocular, sepals without intracalycine membranes.

(2) Halenioid type: tetramerous, each corolla-lobe with a calcar but without any glands, ovary unilocular, sepals without intracalycine membranes.

(3) Ophelioid type: tetramerous or pentamerous, each corolla-lobe with one fovea or two foveae which are sometimes surrounded by linear hairs, ovary

unilocular, sepals without intracalycine membranes. This type includes further a few different floral types.

(4) Swertioid type: pentamerous, rarely tetramerous, each corolla-lobe with two foveae near its base which are surrounded by somewhat long hairs, ovary unilocular, sepals without intracalycine membranes.

(5) Lomatogonioid type: pentamerous or tetramerous, each corolla-lobe with two foveae, over which fimbriated scales occur, stigma decurrent, ovary unilocular, sepals without intracalycine membranes.

(6) Comastomoid type: pentamerous or tetramerous, each corolla-lobe with two epipetalous glands near its base, with fimbriated scales which are distant from the glands, stigma not decurrent, ovary unilocular, sepals without intracalycine membranes.

(7) Gentianelloid type: tetramerous or pentamerous, each corolla-lobe with only one epipetalous gland near its base, fimbriated scales bearing vascular bundles present at the corolla-orifice, ovary unilocular, sepals without intracalycine membranes.

(8) Gentianopsioid type: tetramerous, corolla-lobes without any appendages, but often fimbriated at margins, each lobe with only one gland near its base, ovary unilocular, sepals with membranes.

(9) Pterygocalycioid type: almost tetramerous, corolla-lobes without any appendages and any epipetalous glands, ovary unilocular, sepals without membranes.

(10) Gentianoid type: tetramerous to octomerous, corolla plicate, ovary glanduliferous at the base, sepals with intracalycine membranes.

(11) Tripterospermoid type: pentamerous, corolla plicate, ovary not glanduliferous, sepals without intracalycine membranes.

The flowers of the family are terminal or axillary, and are arranged as though they were umbellate; some bracteate (e.g., *Gentiana* sect. Pneumonanthe, but some ebracteate (e.g., *Comastoma*, *Gentianella*, etc.); some have peduncles (e.g., *Comastoma*, *Lomatogonium*, etc.), but some do not possess them (e.g., *Centaurium*); some are large (e.g., *Gentiana* sect. Pneumonanthe), but some are small (e.g., *Centaurium*).

The form of the corolla is hypocraterimorphous, cylindrical-campanulate, infundibuliform or campanulate, and the colour is blue, bluish, bluish-purple, purple, violaceous, white, yellowish-white, yellow, green or red, but green and red flowered species have not been found in Japan.

Stamens are alternate with the corolla-lobes, and are adnated to the inside of corolla-tube by the lower or middle part of filaments; filaments are complanate, linear, subulate or filiform, and are yellowish-green or yellowish-white in colour;

anthers are rather small, almost oblong in outline, and are yellow or dark-umber in colour; pollens are 3-colporate with striate or reticulate surface, and are 20–60 μ in diameter; pistil is one for one flower and is fusiform or clavate in shape; stigmata are two and usually well-developed, sometimes recurved, rarely not biparted and decurrent (in *Lomatogonium*), style none or very short, ovary stipitate or sessile, and unilocular, rarely semibilocular (in *Centaurium*).

Calyces are also various in shape changing from cylindrical to hypocraterimorphic; sepals ovate, elliptic, deltoid, lanceolate or linear-lanceolate in outline, sometimes scabrous at margins, and sometimes connected with intracalycine membranes (in *Gentiana*) or with thin hyaline membranes (in *Gentianopsis*).

Fruits and seeds. All the fruits of the family, except for the genus *Tripterospermum* (baccate), are capsular. The capsules are usually fusiform or oblong in shape, and are stipitate or sessile. At maturity, they often exceed corollas in length in some species. The capsules vertically split into two at last, becoming beneficial for dispersion of seeds. The bacca is long-ovoid.

In the present family, several seed forms are met with: oblong and attenuate to both ends, depressed-lenticular, oblong or almost globose; the form is not always constant even within the same genus.

In the genera *Gentianella*, *Comastoma* and *Lomatogonium*, for instance, the seeds are globose, 1 mm in diameter or less, and smooth, while in the genus *Gentiana*, s. str., there are three major categories of seed type as follows:

(1) Seed small, but the integument elongates to both ends, oblong-fusiform in outline, seemingly like sawdust, 1.5–2 mm long (e. g., *Gentiana scabra*, *G. makinoi*, *G. triflora*, etc.).

(2) Seed below 1 mm long, covered firmly with integument, not attenuate to the two ends (e. g., *Gentiana nipponica*, *G. jamesii*, *G. zollingeri*, *G. squarrosa*, *G. aquatica*, etc.).

(3) Seed ca. 1 mm long, the integument partially alate (e. g., *Gentiana algida*, *G. glauca*, etc.).

In spite of such diversity in outline, the patterns and structure of the surface of seeds are more or less constant in each group, and appear to be of importance from the phylogenetic point of view. The most primitive type of seeds in the Gentianaceae may be ovoid, globose or fusiform with smooth or almost smooth surface; such type is found in *Halenia*, *Ophelia*, (sects. Stellera and Japonicae), *Lomatogonium*, *Comastoma*, *Gentianella* and *Gentiana* (sect. Chondrophylla). The seeds of *Ophelia* (sects. Swertopsis, Bimaculatae and Rosulatae), *Gentianopsis* and *Gentiana* (a part of sect. Pneumonanthe) are of a more advanced type, and have processes, spines or hairs, while the most advanced type of seeds with wings is encountered in *Swertia*, *Pterygocalyx*, *Gentiana*

TABLE 3. A list of chromosome numbers in species of the Gentianaceae which have hitherto been investigated. Only the species marked with asterisks are growing in Japan; the genera not occurring in Japan are omitted from this list. The number after investigators indicates the publication year of the data.

Name of species	Somatic number	Investigator & publication year	Distribution
Lomatogonium (basic number: x=5)			
L. rotatum	10	D. LÖVE 1953	Circumpolar
Comastoma (basic number: x=5)			
C. tenellum	10	FAVARGER 1949	North Reg.
Gentianella (basic number: x=6)			
G. amarella	36	D. LÖVE 1953	W. Europe–Siberia
G. aurea	36	D. LÖVE 1953	Arctic
G. austriaca	36	FAVARGER 1952	Europe
G. campestris	36	FAVARGER 1949	Europe
G. clusii	36	FAVARGER 1949	Europe
	36	SKALINSKA 1950	
Gentianopsis (basic number: x=11, 13)			
G. ciliata	44	FAVARGER 1949	Europe
G. detonsa	44	D. LÖVE 1953	N. Europe–Arc. Russia
G. cruciata	52	FAVARGER 1949	Europe & N. Asia
G. phlogifolia	52	RORK 1949	E. Europe, Asia
Gentiana (basic number: x=5, 6, 7; x_2=11, 13)			
G. nivalis	14	FAVARGER 1949	Europe
G. utriculosa	22	FAVARGER 1952	Europe
G. brachyphylla	24	MATTICK 1950	Europe
G. frigida	24	SKALINSKA 1951	Europe
**G. algida*	66	SOKOLOVSKAJA & STRELKOVA 1938	N. Asia–N. America
G. altaica	26	SOKOLOVSKAJA & STRELKOVA 1938	Siberia
G. andrewsii	26	RORK 1949	N. America
G. septemfida	26	SOKOLOVSKAJA & STRELKOVA 1938	Asia Minor–Persia
**G. makinoi*	26	SAKAI 1934	Japan
G. pneumonanthe	26	SCHEERER 1939	Europe, N. Asia
**G. triflora*	26	HIROSE 1958	N. Asia
**G. scabra*	26	SUZUKA 1950	N. E. Asia
G. bavarica	28	MATTICK 1950	C. Europe
G. verna	26	SKALINKSA 1950	Europe, Asia
	28	FAVARGER 1949	
G. acaulis	36	RORK 1949	Europe

G. alpina	36	FAVARGER 1949	Europe
G. insubrica	36	FAVARGER 1952	Europe
G. kochiana	36	FAVARGER 1949	C. Europe
G. praecox	36	SKALINSKA 1951	Europe
G. prostrata	36	FAVARGER 1952	N. Temp.
G. quinqueflora	36	RORK 1949	E. N. America
G. saxosa	36	FAVARGER 1952	New Zealand
G. tenuifolia	36	FAVARGER 1952	New Zealand
G. lutea	40	FAVARGER 1949	M. Europe, Asia Minor
G. punctata	40	FAVARGER 1952	Europe
	40	SKALINSKA 1951	
G. purpurea	40	FAVARGER 1949	Europe
G. macrophylla	42	RORK 1949	Siberia, China & Korea
G. asclepiadea	44	FAVARGER 1949	Europe
	44	SKALINSKA 1951	
G. straminea	52	RORK 1949	W. China
G. crinita	78	RORK 1949	E. N. America
G. procera	78	RORK 1949	E. N. America
Centaurium (basic number : x=7)			
C. vulgare	c. 38	WULFF 1937	Europe
	c. 56	WARBURG 1939	
C. minus	42	RORK 1949	N. America
C. pulchellum	42	RORK 1949	Europe & Temp. Asia
Ophelia (basic number : x=12)			
**O. bimaculata*	24	SUZUKA 1950	Himalayas-Japan
Swertia (basic number : x=7, 9, 12)			
**S. perennis*	18	SAKAI 1935	N. Temp.
	18	SAKAI 1940	
	24	WOYCICKI 1937	
	28	FAVARGER 1952	
Halenia (basic number : x=11)			
H. elliptica	22	FAVARGER 1952	Asiat. Russia to Himalayas

(sect. Frigida and a part of sect. Pneumonanthe) and *Tripterospermum*.

SCHUSTLER (1923) regarded winged seeds as primitive ones, but the present writer holds the opposite opinion.

Chromosome number. Chromosome numbers which have hitherto been counted have little importance in the systematics of the Gentianaceae for the time being, because less than one-twentieth of the members of the family have been subjected to cytological observation.

According to D. LÖVE (1953) and DARLINGTON and WYLIE (1955), the basic

numbers of chromosomes of the Gentianaceae are x=5, 6, 7, 9, 11 and 13. The basic numbers 11 and 13, in accordance with the view proposed by D. LÖVE (1953), seem to have arisen by simple combination and alloploidy from x=5+6=11 and x=6+7=13, respectively. All the chromosome numbers of the genera of the Gentianaceae indigenous to Japan counted by different workers are listed (Table 3).

Distribution. As regards the distribution, the following 10 species are endemic in Japan: *Ophelia umbellata*, *O. tashiroi*, *Gentianella yuparensis*, *Gentianopsis yabei*, *Gentiana laeviuscula*, *G. yakumontana*, *G. nipponica*, *G. yakushimensis*, *G. makinoi* and *G. sikokiana*. Among them, some have very restricted areas in distribution, e.g., *Gentianopsis yabei* (central Honshû; alp.), *Gentiana laeviuscula* (c. Honshu; alp.), *G. yakumontana* (Isl. Yaku), *G. yakushimensis* (Isl. Yaku; alp.), etc., but some are distributed more widely, e.g., *Gentiana nipponica* (from Hokkaidô southwards to central Honshû), *G. makinoi* (northern to central Honshû), etc.

Those distributed not only in Japan but in foreign lands are 23; so far as the distributional areas in Japan are concerned, they are divided into several types as follows:

(1) Hokkaidô—Kyûshû. *Ophelia japonica*, *O. bimaculata*, *Gentiana thunbergii* and *G. zollingeri*.

(2) Hokkaidô—Honshû—Shikoku. *Pterygocalyx volubilis*.

(3) Hokkaidô—c. Honshû. *Halenia corniculata*, *Ophelia tetrapetala*, *Swertia perennis*, *Gentiana algida* and *G. triflora*.

(4) Honshû—Kyûshû. *Ophelia diluta*, *O. pseudochinensis*, *Gentiana squarrosa* and *G. scabra*.

(5) Hokkaidô. *Gentianella auriculata*, *Gentiana glauca* and *G. jamesii*.

(6) C. Honshû. *Lomatogonium carinthiacum*, *Comastoma pulmonarium*, *Gentianopsis contorta* and *Gentiana aquatica*.

(7) Kyûshû (incl. Yaku Isl.). *Centaurium spicatum*.

III. Taxonomic treatment of the family

GENTIANACEAE A. L. DE JUSSIEU, Gen. Pl. 141. 1789, ut *Gentianae*.–BULLOCK in Taxon **8**: 173. 1959. (nom. conserv.)

A *Menyanthaceis* foliis oppositis vix alternatis, lobis corollae non valvatis dignoscendae.

Herbae annuae v. biennes v. perennes, herbaceae interdum lignescentes, parvae v. magnae, graciles robustaeve. Radices rhizomatae aut erhizomatae, longae sive breves, in speciebus perennibus plerumque crassae sed in annuis biennibusque iis vulgo tenues. Caules humiles sive alti, simplices vel ramosi.

Folia radicalia rosulata v. opposita v. pauperia v. emarcida, foliis caulinis oppositis seu verticillatis, sessilibus vel petiolatis, plerumque integris, sed non semper toto integris magis plerumque minute scabriusculis, interdum scabris aut minute undulatis, lanceolatis v. oblongolanceolatis v. oblongoëllipticis v. ellipticis v. ovatis, rare linearilanceolatis v. linearibus, uni- v. tri- v. quinque- v. septemnervigeris, stipulis deficientibus. Flores vulgo hermaphroditi, 4–8-meri, sessiles aut pedunculati, erecti vel ascendentes, inflorescentiis cymosis seu solitariis et saepe plus minusve racemiformibus, calycibus cylindricis v. cylindricocampaniformibus v. campanulatis v. hypocraterimorphis, quattuor—octofidis aut -partitis, sepalis parvis sive plus minusve magnis, aequantibus seu inaequantibus, margine interdum scabris, corollis cylindricis—campanulatis—hypocraterimorphis—rotatis, interdum leviter zygomorphis, lobis in gemmis saepe dextrorsum contortis, rare plus minusve imbricatis, staminibus plerumque intus corollis affixis, pistillo uno, ovario superiore et uniloculare, vulgo 1-cellulato cum placentis duabus parietalibus, interdum 2-cellulato, rarissime cum disco basali glanduloso. Fructus plerumque capsulae septicidales 2-valvatae rare baccae, seminibus numerosis, parvis, utrinque attenuatis et scabinate depressolenticularibus v. oblongis et interdum alatis supra laevibus v. oblongis et supra minute protuberantibus v. globosis et laevibus.

Typus: *Gentiana* LINNAEUS

Clavis subtribuum generumque

1. Stylus filiformis vel gracilis, antheris post anthesin spiralibus, ovario uniloculare, capsulis interdum bilocularibus . . . . subtrib. Erythraeinae GILG . . . . . *Centaurium*
1. Stylus vulgo brevis, plus minusve crassus, antheris post anthesin non spiralibus, ovario capsulisque distincte unilocularibus . . . . . subtrib. Gentianinae GILG 2
2. Corolla calcaribus ornata . . . . . *Halenia*
2. Corolla eis non ornata 3
3. Corolla plicis non ornata sed saepe glandulis aut foveis instructa . . . 4
3. Corolla plicis ornata, pistillo basi saepe glandulifero 10
4. Corollae profunde 4–5-partitae, foveis solitariis vel duabus et saepe setis fimbrillisve circumdatis plerumque instructae 5
4. Corollae 4–5-fidae sive -lobatae, vulgo glandulis epipetalis solitariis rare duabus ornatae 6
5. Radix annua sive biennis, foliis radicalibus sub anthesi emarcidis vel rosulatis, sessilibus vel brevipetiolatis, seminibus laevibus v. processibus ornatis nec alatis . . . . . *Ophelia*

5. Radix perennis, foliis radicalibus longe petiolatis, seminibus secus margines alatis . . . . . *Swertia*
6. Corolla glandulis duabus epipetalis et squamis fimbriatis bifissis ornata fimbrillis linearibus nec filiformibus 7
6. Corolla vulgo glandulis solitariis epipetalis ornata et interdum squamis fimbriatis instructa, fimbrillis filiformibus 8
7. Glandulae epipetalae magnae, squamis fimbriatis bifissis circumdatae, fimbrillis brevibus, linearibus, paucis (4–8), stigmate secus suturam pistilli basipetaliter decurrente . . . . . *Lomatogonium*
7. Glandulae epipetalae parvae; squamae fimbriatae bifissae a glandulis distantiores, fimbrillis linearibus, pluribus (10–13), stigmate bipartito et non decurrente . . . . . *Comastoma*
8. Flores tetrameri v. quinarii, corollis in faucibus vulgo squamis fimbriatis ornatis, seminibus globosis aut ovoideis, laevibus . . . . . *Gentianella*
8. Flores plerumque tetrameri, corollis squamis non ornatis, seminibus pilosis vel alatis 9
9. Caulis erectus vel ascendens, corollis glandulis epipetalis ornatis, seminibus pilosis . . . . . *Gentianopsis*
9. Caulis tenuis volubilisque, corollis glandulis non ornatis, seminibus alatis . . . . . *Pterygocalyx*
10. Caulis erectus vel ascendens rare repens, pistillo basi glandulifero, fructu capsulare . . . . . *Gentiana*
10. Caulis tenuior et volubilis, pistillo basi eglandulifero, fructu baccato . . . . . *Tripterospermum*

Genus 1. **Centaurium** HILL

Centaurium HILL, Brit. Herb. 62. 1756, emend. ADANSON, Fam. Pl. **2** (1): 502. 1763, ut *Centaurion*.–GILIBERT, Fl. Lith. **1**: 35. 1781.–HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1968. 1927.–HARA, Enum. Spermat. Jap. **1**: 130. 1949.–GROSSHEIM in Fl. URSS **18**: 527. 1952.–OHWI, Fl. Jap. (ed. 1), 947. 1953. (nom. conserv.)

Syn.—

Erithrea NECKER, El. Bot. **2**: 10. 1790.

Erythraea [RENEALMI, Sp. Hist. Pl. 77, pars syn. **1**: 283. 1611.] BORCKHAUSEN in ROEMER, Arch. Bot. **1**: 28. 1796.–GRISEBACH in DE CANDOLLE, Prodr. **9**: 57. 1845.–GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 73. 1895.–WHELDON et SALMON in Jour. Bot. **63**: 345. 1925.–LING, Fl. Ill. N. Chine **2**: 2. 1933.

Herbae annuae v. biennes v. perennes. Radices vulgo breves. Folia opposita, sessilia et saepe amplexicaulia. Flores 5(vel 4)-meri, dilute rubri v. fulvi v. albi, in cymatibus densis laxisve rare in pseudoracemis dipositi, calycibus

vulgo cylindricocampaniformibus aut campanulatis, apicibus 5–4-partitis v. -fidis, lobis saepe carinatis, corollis hypocraterimorphis v. campanulatohypocraterimorphis v. campanulatis 5–4-lobatis aut -fidis, lobis contortis, sub anthesi vulgo patentibus, staminibus intus corollis affixis, filamentis brevibus, filiformibus, antheris post anthesin saepe spiralibus, ovariis solitariis et unilocularibus, stylis grcilibus et filiformibus, stigmatibus globosis seu lamellatis. Capsulae vulgo septicidae, demum in segmenta duo dehiscentes, seminibus numerosis, parvis.

Nomen genericum est ductum secundum DIOSCORIDEM (Mat. Med. **3**: 7) ex caentaurio parvo, i.e. *κενταύριον το μικρόν* (kentaúrion to mikrón).

Typus: *Centaurium umbellatum* GILIBERT

The generic name *Erythraea* had often been used rather than *Centaurium* before the adoption of the latter as *nomen conservandum*.

The genus *Centaurium* was established by HILL in 1756, stating 'But, though it agrees with gentian in the structure of the flower, it differs sufficiently in its whole form and substance'. In 1839, GRISEBACH divided the genus *Erythraea* into four sections, Eu-erythraea, Trichostylus, Spicaria and Xanthaea. However, no alteration of these sections was made in his later work appeared in DE CANDOLLE's Prodromus, vol. **9**. 1845, and these divisions of the genus were also followed by GILG in 1895. In his enumeration of the Russian species of the genus *Centaurium*, GROSSHEIM adopted in 1952 two of the above four sections under *Centaurium*, without proposing any new combinations. However, when citing these sections, Eu-erythraea (nom. ill. = Centaurium) and Spicaria under *Centaurium*, the combinations must be credited to GROSSHEIM rather than to GRISEBACH, because the latter author established them under *Erythraea*. To the latter of the above two sections, i.e., *Centaurium* sect. Spicaria (GRISEBACH) GROSSHEIM in Fl. URSS **18**: 535. 1952, the only centaury within our limits belongs.

The present genus includes about 40 species distributed in the temperate and subtropical regions of the Northern Hemisphere.

Centaurium spicatum FRITSCH var. **japonicum** TOYOKUNI

[Figs. 2 & 4]

Centaurium spicatum [var. spicatum] (LINNAEUS) FRITSCH in Mitteil. Naturw. Ver. Wien **5**: 97. 1907.–HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1968. 1927, in nota sub genere *Centaurii*.–HARA in Jour. Jap. Bot. **13**: 25. 1937.–MASAMUNE in Sci. Rep. Kanazawa Univ. **3**: 321. 1955, quoad syn. nonnul.

Syn.—

Gentiana spicata LINNAEUS, Sp. Pl. (ed. 1) **1**: 230. 1753.

var. **japonicum** (MAXIMOWICZ) TOYOKUNI, comb. et stat. nov.

Syn.—

Erythraea japonica MAXIMOWICZ in Bull. Acad. St.-Pétersb. **31**: 67. 1886.-TASHIRO in Bot. Mag. Tokyo **3**: 167. 1889. *Centaurium japonicum* (MAXIMOWICZ) DRUCE in Rep. Bot. Exch. Cl. Brit. Isl. **4**: 613. 1917.-HARA in Jour. Jap. Bot. **13**: 25. 1937.; Enum. Spermat. Jap. **1**: 130. 1949.-HONDA, Nom. Pl. Jap. (ed. 1), 279. 1939.; ibid. (ed. em.), 205. 1957.-OHWI, Fl. Jap. (ed. 1), 948. 1953.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 214, pl. 65, n. 528. 1957.

'*Erythraea australis* R. BROWN' sensu HAYATA, Mater. Fl. Formosa, 200. 1911.-MATSUMURA, Ind. Pl. Jap. **2** (2): 499. 1912.

'*Erythraea spicata* PERSOON' sensu SAKAGUCHI, Gen. Ind. Fl. Okin. 22. 1924.-MAKINO et NEMOTO, Fl. Jap. (ed. 2), 945. 1931.-MASAMUNE, Fl. & Geobot. Yakus. 372. 1934.-NEMOTO, Fl. Jap. Suppl. 597. 1936.

'*Centaurium spicatum* FRITSCH' sensu MASAMUNE in Sci. Rep. Kanazawa Univ. **3**: 321. 1955, excl. syn. nonnul.

Herba annua, pulveroviridis, glabra. Radix pauciramosa, tenuis, cremeobrunnea, usque 10 cm longa. Caulis simplex vel in inferioribus caulis partibus ramosissimus rare a basi ramosus, omnibus partibus foliatus, longitudinaliter et semialatim quadriangulatus, erectus, 8–40 cm altus. Folia radicalia abbreviata, parva, late oblonga vel elliptica, 10–15 mm longa. Folia caulina iis radicalibus conformia sed majora, elliptica vel ellipticoövata, 1.5–2.5 cm longa, 7–15 mm lata, trinervia, apicibus rotundatis, basibus rotundatis, foliis caulinis superioribus minoribus, oblongis aut lanceolatoöblongis, 5–8 mm longis, 1.5–4 mm latis, utrinque obtusis vel rotundatis. Flores in axillis partium superiorum caulis ramorumque plerumque solitarii, sessiles, calycibus 6–8mm longis, angustocampanulatis, profunde quattuor—quinquepartitis, sepalis acicularilinearibus, in apices angustatis, apice acutis, quain tubi 3–6-plo longioribus, corollis anguste campanulatis, 8–18 mm longis, partibus supremis tuborum leviter constrictis, tubis calycibus subaequilongis vel brevioribus rare paulum longioribus, lobis oblongis vel angustoöblongis, quam tubi ca. 1/2-plo longioribus, staminibus tubis corollae aequilongis, filamentis anguste linearibus, antheris ca. 0.5 mm longis, ellipticis, pistillo uno, oblongofusiformi, ovario sessile unilocularique, stylo gracili, brevissimo, stigmate bipartito. Capsulae cylindricoöblongae, calyces paulo sed corollas haud superantes.

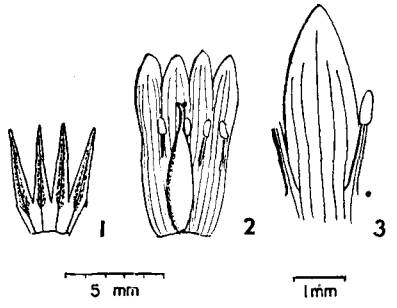

Fig. 2. *Centaurium spicatum* var. *japonicum*:
1. Open calyx, 2. Open corolla, and 3. Corolla-lobe.

Nom. Jap. Shima-semburi, Hôrai-semburi.

Specim. exam.

Kyûshû. Prov. Ohsumi: Takara-jima, insl. Tokara (maio, 1953. M. HORI-KYO[3]). Amami-ôshima (junio, 1894. T. ITÔ-TNS). Yaku-shima (aug. 1923. Z. TASHIRO-KYO; julio, 1927. G. MASAMUNE-TI; aug. 1928. Idem-TI).

Area geogr. Japonia austr. et insulae Ryûkyûenses et Formosa.

Typus: *Liukiu*: insulis Ō-sima et Okinawa, in maritimis (A. Tashiro)' (in LE).

The present variety *japonicum* is distributed on small islands of southernmost Japan; no allied centaury has hitherto been reported in our boundaries. Some authors regard the present plant as a good species, while a few regard it as identical with *Centaurium spicatum* var. *spicatum* which has a wider range in dirtribution.

The writer, however, regards this as a variety of *C. spicatum*, because the style of pistil is shorter and the corolla-orifice is narrower in our plant as compared with those in *C. spicatum* var. *spicatum*.

Genus 2. **Halenia** BORCKHAUSEN

Halenia BORCKHAUSEN in ROEMER, Arch. Bot. **1**: 25. 1796.–GRISEBACH in DE CANDOLLE, Prodr. **9**: 128. 1845.–CLARKE in Jour. Linn. Soc. **14**: 448. 1875.–GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 89. 1895.–LING, Fl. Ill. N. Chine **2**: 4. 1933.–HARA, Enum. Spermat. Jap. **1**: 137. 1949.–GROSSHEIM in Fl. URSS **18**: 638. 1952.–OHWI, Fl. Jap. (ed. 1), 957. 1953.–POPOV, Fl. Sr. Sib. **2**: 597. 1959.–RICKETT et STAFLEU in Taxon **9**: 80. 1960. (nom. conserv.)

Syn.—

Swertia LINNAEUS, Sp. Pl. (ed. 1) **1**: 226. 1753, pro min. parte.; Gen. Pl. (ed. 5), 107. 1754, pro min. parte.

Tetragonanthus S. G. GMELIN, Fl. Sib. **4**: 113. 1769, pro syn.

Herba annua v. biennis v. perennis. Radix saepe crassa, iterum atque iterum ramosa. Caulis erectus, simplex vel ramosus, longitudinaliter striatus. Folia radicalia sub anthesi rosulata, foliis caulinis oppositis. Flores terminales in cymatibus sive axillares in paniculis racemosis dispositi, vulgo tetrameri rare quinarii, calycibus campanulatis, profunde 4-(rarissime 5-)partitis, sepalis oblongo-lanceolatis—longilanceolatis, corollis campanulatis rare subrotatis, 4- rare 5-fidis, marcescentibus, lobo calcari uno ornato, staminibus 4 rare 5, cum lobis corollae alternatis, intus corollis affixis, filamentis linearibus, antheris ovalibus—oblongis, ovario uno et uniloculari, stylo brevissimo sive nullo. Capsula septicida, ellip-

3) Herbarium abbreviations used here are those adopted in 'Index Herbariorum (ed. 4) 1959'; the specimens to which no abbreviations are attached are conserved either in the Herbarium of the Faculty of Science, Hokkaidô University (SAP) or in the author's private herbarium.

soidea, demum in segmenta duo dehiscens, seminibus numerosis, globosis v. ovatoövoideis v. depressoglobosis, laevibus.

In memoriam J. P. HALENI qui plantas kamtschaticas anno 1750 studit, hoc nomen genericum a BORCKHAUSENIO anno 1796 est introductum.

Typus: *Halenia corniculata* CORNAZ (=*H. sibirica* BORCKHAUSEN=)

The anchor-shaped flowers characteristic to this genus are no doubt striking features among this family. The genus name *Tetragonanthus* GMELIN was published as a synonym, whereas *Halenia* is a carefully designed genus name selected as *nomen conservandum*.

About 40 species have been reported from the world, and only one species in Japan.

Halenia corniculata CORNAZ

[Figs. 3 & 4, Plate I (2)]

Halenia corniculata (LINNAEUS) CORNAZ in Bull. Soc. Sci. Nat. Neuchâtel **25**: 171. 1897.–TAKEDA in Bot. & Zool. **3**: 2214, f. 81. 1935.–HARA in Bot. Mag. Tokyo **51**: 18. 1937.; in Jour. Jap. Bot. **13**: 389. 1937.; Enum. Spermat. Jap. **1**: 137. 1949.–GROSSHEIM in Fl. URSS **18**: 638. 1952.–OHWI, Fl. Jap. (ed. 1), 957. 1953.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 217, pl. 66, n. 534. 1957.

Syn.—

Swertia corniculata LINNAEUS, Sp. Pl. (ed. 1) **1**: 227. 1753, excl. pl. ex Canada. *Tetragonanthus corniculatus* (LINNAEUS) O. KUNTZE, Rev. Gen. Pl. **2**: 431. 1891. *Halenia corniculata* (LINNAEUS) DRUCE in Rep. Bot. Exch. Cl. Brit. Isl. **3**(5): 419. 1914.—HULTÉN, Fl. Kamtchat. **4**: 69. 1930.–POPOV, Fl. Sr. Sib. **2**: 597. 1959.

Halenia sibirica BORCKHAUSEN in ROEMER, Arch. Bot. **1**: 25. 1796.–FR. SCHMIDT, Reis. Amurl. u. Sachal. 160. 1868.–GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 90. 1895.–MATSUMURA, Ind. Pl. Jap. **2**(2): 502. 1912.–KUDO, Fl. Param. 151. 1922.

H. japonica GANDOGER in Bull. Soc. Bot. France **65**: 61. 1918.

H. deltoidea GANDOGER, l.c. 1918.

Herbae biennes, glaberrimae. Radices subcrassae, usque 8 mm in diametro, ad 13 cm longae, simplices vel aliquot ramosae, ramis tenuibus gracilibusque, saepe radiculis densis ornatis, atrobrunneis sive atrocastaneis. Caulis simplex vel in partibus inferioribus—superioribus ramosus rare a basi intense ramosus, longitudinaliter subangulatus striatusque, intense viridis. Folia radicalia sub anthesi plerumque rosulata rare subrosulatim abbreviata vel opposita, oblanceolatospathulata, 1–3.5 cm longa, 3–8 mm lata, apice acuminata, basi petiolatim angustata, saepe petiolata, petiolis brevibus, foliis caulinis lanceolatis—oblongoövatis—ellipticoövatis, 2–6 cm longis, 0.7–2.5 cm latis, tri—quinquenerviis, breviter petiolatis vel sessilibus, apicibus acutis, basibus in petiolos

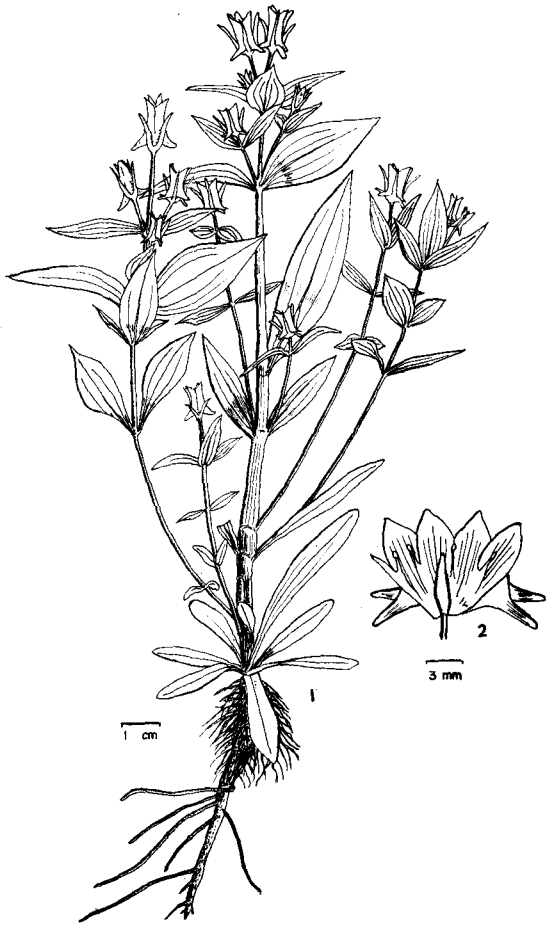

Fig. 3. *Halenia corniculata*:
1. Habit, and 2. Open corolla with pistil.

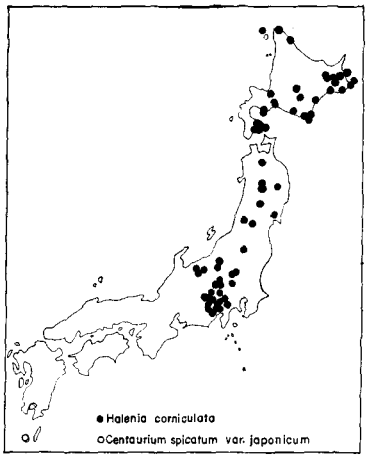

Fig. 4. Distribution of *Halenia corniculata* (black dots) and *Centaurium spicatum* var. *japonicum* (circle).

cuneatim angustatis, marginibus integris. Flores tetrameri, in caulis ramorumque apicibus solitarii—nonnuli, pedunculati, pedunculis usque 3.5 cm longis, calycibus anguste campanulatis, viridibus, profundissime quattuorpartitis, sepalis linearioblanceolatis, apicibus acutis vel acutiusculis, marginibus scabris, 5–10 mm longis, corollis dilute flavis, profunde quattuorpartitis, 0.6–1.2 cm longis, lobis ellipticoövatis, prope bases calcaribus ornatis, calcari uno pro lobo uno, staminibus quattuor, lobis corollae alternatis, brevibus, filamentis linearibus, brevibus, in partibus inferioribus intus corollis affixis, quam corollae 2/3-plo longioribus, antheris ellipticis, pistillo uno, ovario oblongo unilocularique, fusiforme, sessile, stylo subnullo, stigmate bipartito, parvo. Capsulae sessiles,

corollis subaequilongae, seminibus oblongis, laevibus, ca. 1 mm longis.

Nom. Jap. Hana-ikari.

Specim. exam.

Hokkaidô. Prov. Kitami: Rebun-tô (aug. 1882. S. HORI-KYO; julio, 1892. U. FAURIE-KYO; aug. 1952. M. HIROE-KYO; aug. 1956. H. TOYOKUNI; aug. 1960. H. TOYOKUNI). Bihoro-tôge (aug. 1933. R. NOGUCHI-TNS; aug. 1956. S. KITAMURA-KYO). Prov. Kushiro: Mashû-dake (aug. 1935. T. KAWADA-TNS). Akan-ko (aug. 1928. S. AKIYAMA). Daikoku-jima, Akkeshi (aug. 1930. Y. YAMADA; aug. 1955. G. MURATA-KYO). Prov. Nemuro: Ochiishi (aug. 1884.–TI). Nemuro (aug. 1909. H. TAKEDA-TNS; aug. 1921. K. TSUCHIYA-KYO). Prov. Ishikari: Ochiai (aug.–sept. 1904. U. FAURIE-KYO). Prov. Iburi: Inter Uenai et Numanohata (sept. 1952. S. AKIYAMA). Tomakomai (aug. 1928. S. AKIYAMA; sept. 1930. S. KITAMURA-KYO). Washibetsu-dake (aug. 1955. H. TOYOKUNI et S. KAWANO). Muroran (oct. 1935. S. KITAMURA-KYO). Prov. Hidaka: Niikappu (TNS). Erimo-misaki (aug. 1955. Y. MOMOTANI-KYO). Prov. Oshima: Hakodate (sept. 1885. H. SAKURAI-TNS; sept. 1886. U. FAURIE-KYO).

Honshû. Prov. Mutsu: Hakkôda-san (K. KORIBA-TI; aug. 1902. N. KINASHI-KYO). Prov. Ugo: Asahi-dake (aug. 1932. S. MURAMATSU-TI et KYO). Prov. Rikuzen: Chausu-dake (aug. 1932. Y. FUKUDA-KYO). Prov. Iwashiro: Bandai-zan (oct. 1905. K. NEMOTO-TNS; aug. 1920. S. HATTORI-TI). Prov. Echigo: Ohhasuba-yama (aug. 1908. M. NAKAMURA-TNS). Naeba-yama (julio, 1950. M. TAKEUCHI-TI). Prov. Shimotsuke: Nikkô (KYO; sept. 1951. H. KUBOTA-TNS et KYO). Senjôga-hara, Nikkô (sept. 1929. S. AKIYAMA). Prov. Kôdzuke: Akagi-yama (oct. 1924. T. SATÔ-TI). Shirane-san (sept. 1885. H. SAKURAI-TNS). Prov. Musashi: Mitsumine-san (oct. 1900. Y. YABE-TI). Prov. Shinano: Nyûgasa-yama (oct. 1949. H. UEMATU-TI; sept. 1954. M. FURUSE-TNS et KYO). Ikeno-taira, Tateshina-yama (oct. 1955. M. TOGASHI-TNS et KYO). Yatsuga-take (aug. 1924. S. MURAMATSU-TI). Inter Yokodake-tôge et Nokogiri-yama (aug. 1958. T. SHIMIZU-KYO). Oiwake (1927. T. KONDÔ-TI). Kiriga-mine (sept. 1936. H. TOBITA-TI; aug. 1952. T. HORIKAWA-KYO). Arafune-yama (oct. 1954. I. KATÔ-TI). Hachibuse-yama (aug. 1930. S. MOMOSE-TI). Usui-tôge (oct. 1919. K. HISAUCHI-TI). Karuizawa (aug. 1902. B. HAYATA). Togakushi-yama (julio, 1884.–TI). Shirouma-dake (aug. 1902. Y. YABE-TI; aug. 1908. M. NAKAMURA-TNS; sept. 1934. Y. SATAKE-TI). Inter Jûmonji-tôge et Azusa-shiraiwa (aug. 1958. G. MURATA-KYO: Ibid. N. KITAGAWA-KYO). Goza-yama (aug. 1958. H. HARA-TI). Suga-daira (aug. 1954. S. KOBAYASHI-KYO). Shiraiwa-yama (sept. 1959. T. SHIMIZU-KYO). Inter Matsumine et Kashiwagi (sept. 1959. T. SHIMIZU-KYO). Sampuku-tôge (julio, 1953. T. YAMAZAKI-TI). Toyokuchi-yama (oct. 1956. G. MURATA et T. SHIMIZU-KYO). Todai, Miwa-mura (sept. 1954. G. MURATA-KYO). Komaga-take (aug. 1911. J. NIKAI-TI; aug. 1948. S. KITAMURA-KYO). Prov. Sagami: Tanzawa-yama (sept. 1921. Y. OGURA-TI; sept. 1949. T. YAMAZAKI-TI). Prov. Kai: Inter lacum Yamanaka et Ishiwari-yama (oct. 1947. M. MIZUSHIMA-TI). Kushigata-yama (sept. 1955. H. MATSUDA-TI). Hôwô-zan (oct. 1949. H. UEMATU-TI). Daibosatsu-tôge (sept. 1949. H. UEMATU-TI). Ishiwari-yama (oct. 1947. I. HURUSAWA-TI). Shichimen-zan (sept. 1947. M. HONDA-TI). Nishiyatsushiro-gun (sept. 1957. H. KANAI-TI). Ashiyasu-mura (aug. 1957. H. MATSUDA-TI). Misaki-yama (oct. 1959. H. KANAI-TI). Komaga-take (aug. 1895. K. WATANABE-TNS). Mittsu-tôge (oct. 1931. S. KITAMURA-KYO; sept. 1934. K. HISAUCHI-TI; sept. 1937. M. TOGASHI-TNS). Aka-dake (aug. 1902. B. HAYATA). Prov. Suruga: Fuji-san (aug. 1924. B. HAYATA-TI; julio, 1933. J. SUGIMOTO-KYO; aug. 1948. M. TAKEUCHI-TI; sept. 1954. J. SUGIMOTO-TNS).

Area geogr. Ural, Sibiria (Altai, Dahuria), Ussuri, terrae ochotenses, Kamtschatka, Sachalin, insulae Kurilenses, Mongolia, Manchuria, China bor., Japonia, etc.

Typus: '*Habitat in* Sibiria, *Gmelin*' (in LINN).

The present species is characterised by having a spur-bearing corolla among the species of the Japanese Gentianaceae, but in seedlings as well as at younger stage, the present plant shows a strong resemblance to some members of the genus *Ophelia* sect. Stellera or of the genus *Gentianella*, indicating that *Halenia* may have been derived primarily from the common ancestral line from which *Ophelia* or *Gentianella* originated.

Genus 3. **Ophelia** D. DON

Ophelia D. DON in Trans. Linn. Soc. **17**: 524. 1837.-GRISEBACH, Gen. et Sp. Gent. 72. 1839.; in DE CANDOLLE, Prodr. **9**: 123. 1845.-GROSSHEIM in Fl. URSS **18**: 625. 1952.-POPOV, Fl. Sr. Sib. **2**: 595. 1959.

Syn.—

Swertia LINNAEUS, Sp. Pl. (ed 1) **1**: 226. 1753, pro parte.; Gen. Pl. (ed 5), 107. 1754, pro parte.-LING, Fl. Ill. N. Chine **2**: 5. 1933.-ST. JOHN in Amer. Midl. Nat. **26**: 1. 1941, pro parte.-HARA, Enum. Spermat. Jap. **1**: 140. 1949, excl. *S. obtusa*.-OHWI, Fl. Jap. (ed. 1), 954. 1953, pro parte.

Sczukinia TURCZANINOW in Bull. Soc. Nat. Mosc. **13**: 165. 1840.

Swertia subg. *Ophelia* (D. DON) C. B. CLARKE in HOOKER, Fl. Brit. Ind. **4**: 121. 1883.-SATAKE in Jour. Jap. Bot. **20**: 339. 1944. *Swertia* sect. *Ophelia* (D. DON) BENTHAM et HOOKER ex GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 88. 1895.-H. SMITH in HANDEL-MAZZETTI, Symb. Sin. **7** (4): 986. 1936.

Herbae annuae vel biennes. Radices graciles aut subcrassae. Caulis vulgo erectus, simplex vel ramosus—ramosissimus. Folia radicalia sub anthesi rosulata v. opposita v. emarcida, sessilia—petiolata. Flores plerumque quinarii rare tetrameri, in cymatibus terminalibus atque in paniculis racemosis axillaribus dispositi, calycibus profunde 5-4-partitis, corollis late campanulatis—infundibularibus, 5-4-partitis, lobo corollae in parte media vel basali 1 glandula sive 2 glandulis ornato, glandulis nudis vel fimbrillis capillaribus circumdatis, rotundatis—cordiformibus—linearibus, staminibus 5 vel 4, cum lobis corollae alternatis. Semina nunquam alata, processibus ornata vel pilosella vel laevia.

Typus: *Ophelia paniculata* D. DON[4]

By adopting the opinion of GROSSHEIM proposed in 1952, the genus *Ophelia* separated from the genus *Swertia* by D. DON in 1837, reappeared here. This

4) No type species of the genus is designated in the original description (DON, D.: Descriptions of Indish Gentianeae. Trans. Linn. Soc. **17**: 503-532).

would result in a much greater conformity from a morphological standpoint, though this separation seems to be not satisfactory, because the present genus still includes groups of considerable diversity.

7 species belonging to 5 sections are met with in Japan.

Clavis sectionum[5]

1. Foveae setis sive fimbrillis circumdatae rare nudae, seminibus plerumque laevibus rare processibus instructis 2
1. Foveae nudae, seminibus processibus ornatis 4
2. Flores tetrameri; foveae solitariae et basibus apicibusque nudae sed lateralibus fimbriatae rare toto nudae . . . . . sect. Stellera
2. Flores quinarii sive tetrameri; foveae duae 3
3. Flores terminales et axillares, seminibus laevibus et parvis . . . . . sect. Japonicae
3. Flores axillares, inflorescentiis abbreviatis, seminibus processibus instructis . . . . . sect. Swertopsis
4. Foveae duae; folia radicalia sub anthesi emarcida . . sect. Bimaculatae
4. Foveae solitariae; folia radicalia sub anthesi magna et rosulata . . . . . sect. Rosulatae

Ophelia sect. **Stellera** (TURCZANINOW) TOYOKUNI, comb. nov.

Syn.—

Stellera TURCZANINOW in Bull. Soc. Nat. Mosc. **13**: 167. 1840.-GRISEBACH in DE CANDOLLE, Prodr. **9**: 123. 1845. *Swertia* subg. *Ophelia* sect. *Stellera* (TURCZANINOW) SATAKE in Jour. Jap. Bot. **20**: 62. 1944.

Only one species in Japan.

Ophelia tetrapetala GROSSHEIM

[Figs. 5 & 6, Plate I (1)]

Ophelia tetrapetala [subsp. tetrapetala var. tetrapetala] (PALLAS) GROSSHEIM in Fl. URSS **18**: 627. 1952.

Syn.—

Swertia tetrapetala PALLAS, Fl. Ross. **1**(2): 99, t. 90, f. 2. 1789.-MIYABE, Fl. Kuril. 251. 1890.-MATSUMURA, Ind. Pl. Jap. **2**(2): 504. 1912.-KUDO, Fl. Param. 151. 1922.-HULTÉN, Fl. Kamtchat. **4**: 68. 1930.-TATEWAKI in Bull. Biogeogr. Soc. Jap. **4**: 294. 1934.-HARA in Bot. Mag. Tokyo **51**: 18. 1937.; Enum. Spermat. Jap. **1**: 143. 1949.-SATAKE in Jour. Jap. Bot. **20**: 342. 1944.-OHWI, Fl. Jap. (ed. 1), 955. 1953.-HONDA, Nom. Pl. Jap. (ed. em.), 208. 1957.-KITAMURA

5) As regards the divisions into sections, the system used here is, in the most part, that proposed by SATAKE (1945 & 1947) under *Swertia* subg. Ophelia.

et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 216, f. 67(3). 1957. *Anagallidium*? *tetrapetalum* (PALLAS) GRISEBACH, Gen. et Sp. Gent. 312. 1839.

Swertia Pallasii G. DON, Gen. Hist. **4**: 176. 1838.

Stellera cyanea TURCZANINOW in Bull. Soc. Nat. Mosc. **13**: 168. 1840.-GRISEBACH in DE CANDOLLE, Prodr. **9**: 123. 1845. *Rellesta cyanea* (TURCZANINOW) TURCZANINOW in Bull. Soc. Nat. Mosc. **22**: 337. 1849.

Ophelia papillosa FRANCHET et SAVATIER, Enum. Pl. Jap. **2**: 450. 1877. *Swertia tetrapetala* f. *papillosa* (FRANCHET et SAVATIER) HARA in Bot. Mag. Tokyo **51**: 19. 1937, in nota.

Ophelia yesoensis FRANCHET et SAVATIER, l. c. 451. 1877. *Swertia yesoensis* (FRANCHET et SAVATIER) MATSUMURA, Shokubutsu Mei-i (ed. 2), 287. 1895.; Ind. Pl. Jap. **2**(2): 505. 1912.

Swertia Bisseti MOORE et BURKILL in Jour. As. Soc. Bengal, n. s. **2**: 329. 1906.; in FEDDE, Repert. **8**: 242. 1910.

S. tetrapetala f. *variegata* TATEWAKI in Jour. Fac. Agr. Hokkaido Imp. Univ. **29**: 234. 1933.-HARA, Enum. Spermat. Jap. **1**: 143. 1949.

S. tetrapetala f. *albiflora* TATEWAKI, l. c. 1933.-HARA, l. c. 1949.

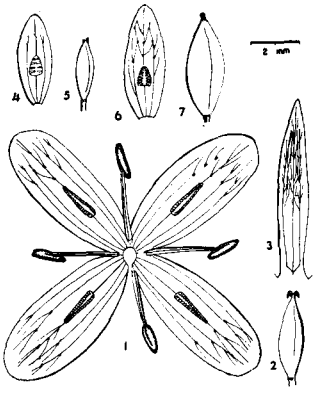

Fig. 5. *Ophelia tetrapetala* subsp. *tetrapetala* (1-3), var. *yezo-alpina* (6 & 7) and subsp. *micrantha* (4 & 5):
1. Open corolla, 2, 5 & 7. Pistil, 3. Calyx-lobe, and 4 & 6. Corolla-lobe.

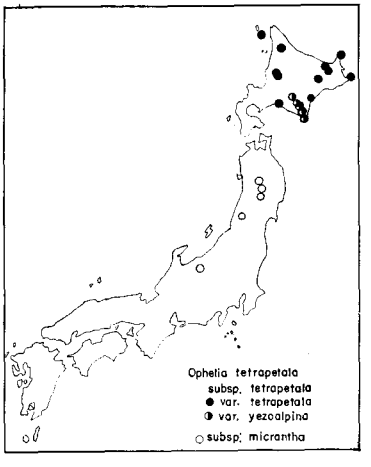

Fig. 6. Distribution of *Ophelia tetrapetala* subsp. *tetrapetala* var. *tetrapetala* (black dots), var. *yezo-alpina* (black and pellucid dots), and subsp. *micrantha* (circles).

Planta biennis, glabra, (3-)4-30(-40) cm alta. Radix gracilis interdum subcrassa, nigrobrunnescens, 1-10 cm longa, vulgo simplex et prope apicem ornata radiculis paucis gracillimis. Caulis simplex interdum in media superioreque parte pauciramosus rare a basi pauci—multiramosus, longitudinaliter angustoalatim quadristriatus, 0.2-1.5 mm crassus. Folia radicalia sub anthesi vulgo emarcida rare abbreviatoscariosa vel opposita, obovata vel obovatospathulata,

usque 2 cm longa et usque 5 mm lata, tri—quinquenervigera, apice obtusa seu obtusiuscula, basi in caulem subcuneatim angustata sed sessilia; folia caulina deltoideoövata—oblongolanceolata—lanceolata, eis radicalibus majora, tri- v. quinque- v. septemnervia, apice acuta vel acutiuscula, basi obtusa v. rotundata v. subtruncata, sessilia, margine integra, sed saepe minute spinulosim scabriuscula, 0.7–3 cm longa, 0.2–1.8 cm lata, utrinque viridia, glabra. Flores tetrameri, in caulis ramorumque apicibus solitarii—pauci rare plures, pedunculis gracillimis, 0.5–4 cm longis, calycibus late campanulatis, 2–2.5 mm longis, profundissime quattuorpartitis, sepalis oblongolanceolatis—lanceolatis—linearilanceolatis, quam tubi 7–9-plo longioribus, apice acutis sive acutiusculis, corollis late campanulatis, 3–10 mm longis, profunde quattuorpartitis, purpureocaeruleis vel albis, lobis corollae ellipticis—late oblongis, trinerviis (sed nervis lateralibus prope bases iterum bipartitis quasi subquinquenerviis), in partibus superioribus gravipurpureopunctulatis, in partibus mediis foveis solitariis instructis, foveis triangularilinearibus aut angustodeltoideis aut subcordatis, apicibus basibusque nudis, lateralibus fimbrillis multis—paucis instructis, staminibus quattuor et lobis corollae alternatis, filamentis linearibus, antheris oblongis—linearioblongis, pistillo uno, ovario uniloculari, haud stipitato, stigmate bipartito, parvo, stylo nullo. Capsulae post anthesin corollas superantes et demum in segmenta duo dehiscentes, seminibus numerosis, parvis, toto laevibus.

Nom. Jap. Chishima-semburi (MIYABE, 1893), Ko-akebonosô (MATSUMURA, 1895).

Specim. exam.

Hokkaidô. Prov. Kitami: Shari-dake (julio, 1960. E. OHTAKE). Shiretoko-dake (julio, 1952. J. SAMEJIMA et Y. TSUJI et H. MIZUSAWA). Shiretoko-misaki (julio, 1959. H. TOYOKUNI). Prov. Teshio: Nupromapporo, Toikambetsu (sept. 1952. H. TOYOKUNI; aug. 1960. T. IGARASHI). Prov. Ishikari: Kakure-genya (julio, 1960. K. INAGAKI). Prov. Tokachi: Shikaribetsu-dake (aug. T. HARA).

Area geogr. Kuriles, Japonia (insula Hokkaidô), Korea, Sibiria, Kamtschatka, etc.

Typus: 'Hujus in Camtschatca observatae elegantissimae plantae iconem inter reliquias Stellerianas invenio, et miror a *Gmelino* Florae sibiricae non fuisse insertam. *Stellerus* eandem in uno saltem loco, ad ostium Appallae fl. in dextra ripa elata, ostio opposita observavit' (in LE).

var. **yezo-alpina** (HARA) TOYOKUNI, comb. nov.

Syn.—

Swertia yezo-alpina HARA in Bot. Mag. Tokyo **51**: 19, f. 15. 1937. *S. tetrapetala* var. *yezo-alpina* (HARA) HARA, l. c. 1937, pro syn.-OHWI, Fl. Jap. (ed. 1), 955. 1953, excl. syn. *S. micrantha* et *S. chrysantha*.-HONDA, Nom. Pl. Jap. (ed. em.), 208. 1957. *S. chrysantha* var. *yezo-alpina* (HARA) SATAKE in Jour. Jap. Bot. **21**: 22. 1947.-HARA, Enum. Spermat. Jap. **1**:

141. 1949.

Caulibus humilioribus, foveis corollae latioribus, vulgo cordatodeltoideis vel cordatis, lateralibus nudis sive fimbrillis paucis instructis, a var. *tetrapetala* distat.

Nom. Jap. Yezo-takanesemburi (HARA, 1937).

Specim. exam.

Hokkaidô. Prov. Hidaka: Enrumu-misaki (julio, 1928. K. INAGAKI). Inter Aburakoma et Samani (aug. 1960. M. NAKAJIMA). Erimo-misaki (aug. 1955. Y. MOMOTANI-KYO).

Area geogr. Endemica (Hokkaidô).

Typus: 'on Mt. Rakko and Mt. Tokachi (H. HARA–Aug. 10, 1933–typus; Aug. 8, 1933)' (in TI).

subsp. **micrantha** (TAKEDA) TOYOKUNI, comb. nov.

Syn.—

'*Swertia tetrapetala* PALLAS' sensu YABE in Bot. Mag. Tokyo **17**: 25. 1903.

S. micrantha TAKEDA in Bot. & Zool. **4**: 181, f. 85 (A–B). 1936.–OKUYAMA in Jour. Jap. Bot. **13**: 37. 1937.–SATAKE in Jour. Jap. Bot. **21**: 22. 1947.–HARA, Enum. Spermat. Jap. **1**: 142. 1949. *S. tetrapetala* subsp. *micrantha* (TAKEDA) KITAMURA ex KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 217. 1957, nom. nud.–KITAMURA et MURATA in Acta Phytotax. Geobot. **17**: 12. 1957.

S. chrysantha HONDA et TATEWAKI in Trans. Sapporo Nat. Hist. Soc. **14**: 192 & 268. 1936.–SATAKE in Jour. Jap. Bot. **21**: 22. 1947.–HARA, Enum. Spermat. Jap. **1**: 141. 1949.–HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.

A typo floribus paucioribus et duplo minoribus, corollis intus minutissime denseque pilosellis, fimbrillis foveae paucioribus (4–8) rare deficientibus recedit.

Nom. Jap. Takane-semburi (TAKEDA, 1936), Yakeishi-semburi (H. IWABUCHI ex HONDA et TATEWAKI, 1936).

Specim. exam.

Honshû. Prov. Ugo: Asahi-dake (aug. 1932. S. MURAMATSU-TNS). Prov. Uzen: Asahi-dake (julio, 1933. S. OKUYAMA-TNS). Prov. Rikuchû: Yakeishi-dake (aug. 1935. H. IWABUCHI-TI et KYO; aug. 1947. M. KIKUCHI). Prov. Shinano: Shirouma-dake (aug. 1902. Y. YABE-TI; aug. 1928. M. HONDA-TI; sept. 1934. Y. SATAKE-TI).

Area geogr. Endemica (Honshû bor. et med.).

Typus: 'Habitat in herbosis regionis alpinis montium Shiromma et Happô, Nippon media' (? in herb. priv. TAKEDAE).

This lovely plant is rather common in the circumboreal regions of the Far East, and also within our boundaries, restricted only to the northern part, i.e., the island of Hokkaidô and central and northern Honshû.

In Hokkaidô, the typical form of the present species is met with either on mountains or along the sea-shore as well as in the valleys of ultrabasic rocks. In the coastal areas, the plant varies a good deal morphologically, changing

from a 1 to several-flowered, comparatively lower, simple-stemmed type to a many-flowered, tall, much branched type; the former seems identical with the figure given by PALLAS in his elaborate work 'Flora rossica', but the structure of flowers of the above two extremes is not so different from one another, each having uniform petals with narrow, linear-lanceolate foveae surrounded on both sides perpendicular to their longer axes with linear fimbrillae (Fig. 5), while in the valleys as well as on the mountains, constructed of ultrabasic rocks, there is *O. tetrapetala* having twice or thrice smaller flowers with foveae similar to those of the typical form.

On the other hand, on the mountains and along the coasts of southernmost Hidaka Province, there grows such a type as that with triangular to obcordate foveae on the corolla-lobes, and the setae of fimbrillae surrounding the foveae are much fewer in number or are quite lacking; this type is called *O. tetrapetala* var. *yezo-alpina*.

In the middle and northern parts of Honshû, there occurs another form which resembles, in most parts, that in ultrabasic rock mountains and valleys. The foveae of corolla in this type, however, are obcordate-triangular. Some authors regard this type as identical with the var. *yezo-alpina* type, but it seems not adequate because of the reason mentioned in the above description. However, variation patterns in *Ophelia tetrapetala*-Complex must be clarified in the future by means of parallel culture experiments.

Ophelia sect. **Japonicae** TOYOKUNI, sect. nov.

Syn.—

Swertia subg. *Ophelia* sect. *Japonicae* SATAKE in Jour. Jap. Bot. **21**: 27. 1947, nom. nud.

Caulis erectus. Folia radicalia sub anthesi saepe emarcida v. viva, parva, subrosulata v. opposita. Lobi corollae foveis duabus instructi, foveis squamis fimbriatis circumdatis. Semina plerumque globosa v. ovoidea, fere laevia.

Typus: *Ophelia japonica* GRISEBACH

Three species in Japan.

Clavis specierum

1. Folia vulgo oblanceolata, 3–10 mm lata, apice obtusa, calycis lobis lanceolatis vel latolanceolatis, in bases versus plus minusve angustatis, capillis foveae sub microscopio undulatotuberculatis . . . . . *O. diluta*
1. Folia linearia vel lanceolata, 1–5(–8) mm lata, lobis calycis linearibus vel leviter latioribus, in bases non angustatis 2
2. Capillae foveae sub microscopio undulatotuberculatae . . . . . *O. pseudochinensis*
2. Capillae foveae sub microscopio laeves . . . . . *O. japonica*

Ophelia diluta LEDEBOUR var. **tosaensis** TOYOKUNI

[Figs. 7 & 8]

Ophelia diluta [var. diluta] (TURCZANINOW) LEDEBOUR, Fl. Ross. **3**: 73. 1847.–MAXIMOWICZ in Bull. Acad. St.-Pétersb. **20**: 434. 1875, pro parte.–GROSSHEIM in Fl. URSS **18**: 626. 1952.–POPOV, Fl. Sr. Sib. **2**: 595, f. 70 (2). 1959.

Syn.—

Gentiana diluta TURCZANINOW in Bull. Soc. Nat. Mosc. **11**: 97. 1838, nom. nud.; ibid. **22**: 338. 1849. *Sczukinia diluta* (TURCZANINOW) TURCZANINOW in Bull. Soc. Nat. Mosc. **13**: 166. 1840. *Swertia diluta* (TURCZANINOW) BENTHAM et J. D. HOOKER, Gen. Pl. **2**: 817. 1876.

Ophelia chinensis BUNGE ex GRISEBACH in DE CANDOLLE, Prodr. **9**: 126. 1845, cum *β. daurica* BUNGE. *Swertia chinensis* (BUNGE) FRANCHET ex FORBES et HEMSLEY in Jour. Linn. Soc. **26**: 139. 1890.–FRANCHET in Bull. Soc. Bot. France **46**: 322. 1890, cum f. *stenopetala*.–LING, Fl. Ill. N. Chine **2**: 55, t. 23. 1933.

var. **tosaensis** (MAKINO) TOYOKUNI, comb. nov.

Syn.—

Swertia chinensis var. *tosaensis* MAKINO in Bot. Mag. Tokyo **6**: 53. 1892, nom nud. *S. tosaensis* (MAKINO) MAKINO in Bot. Mag. Tokyo **17**: 54. 1903.–MATSUMURA, Ind. Pl. Jap. **2** (2): 505. 1912.–HONDA, Nom. Pl. Jap. (ed. 1), 281. 1939.–KITAGAWA, Lin. Fl. Mansh. 361. 1939.–SATAKE in Jour. Jap. Bot. **21**: 30. 1947.–HARA, Enum. Spermat. Jap. **1**: 143. 1949. *S. diluta* var. *tosaensis* (MAKINO) HARA in Jour. Jap. Bot. **25**: 89. 1950.–OHWI, Fl. Jap. (ed. 1), 956. 1953.–HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1), **1**: 216, pl. 65, n. 532. 1957.

Planta gracilis, glaberrima, biennis. Radix 5–7 cm longa, pro planta subcrassa vel tenuis, dilute flavobrunnea, simplex vel aliquot ramosa iterumque in parte radiculis nonnulis—multis fibrosis ornata. Caulis simplex vel in caulium mediis partibus vel a basibus ramosus, quadriangulatus et angustissime semialatus, cum inflorescentiis (4–)15–50 cm altus. Folia basalia sub anthesi emarcida vel viva, abbreviata vel opposita rare subrosulata, parva, oblanceolatospathulata, 7–18 mm longa, 2–7 mm lata, saepe rugosa, apice obtusa, vel acutiuscula, foliis inferioribus sessilibus aut leviter petiolatis, oblongis, apice acutiusculis vel obtusis, in bases angustatis et plus minusve cuneatis, (1–)1.5–4 cm longis, 3–12 mm latis, eis caulinis mediis superioribusque anguste lanceolatis aut oblongo-lanceolatis aut oblongis, margine minute undulatis, 2–3.5 cm longis, 3–6 mm latis, in apices versus gradatim acutatis, basi acutis, trinerviis sed nervis lateralibus vulgo indistinctis. Flores in caulium ramorumque apicibus atque in foliorum caulinorum axillis solitarii—nonnuli, pentameri, calycibus late infundibularicampanulatis, 4–10 mm longis, profunde quinquepartitis, sepalis linearilanceolatis sive lanceolatolinearibus, vulgo 5–8 mm longis, apice obtusis obtusiusculisve, plerumque trinerviis, corollis albis vel alboviolascentibus, quam calyces leviter longioribus, profunde quinquepartitis, lobis ovatis vel oblongoövatis,

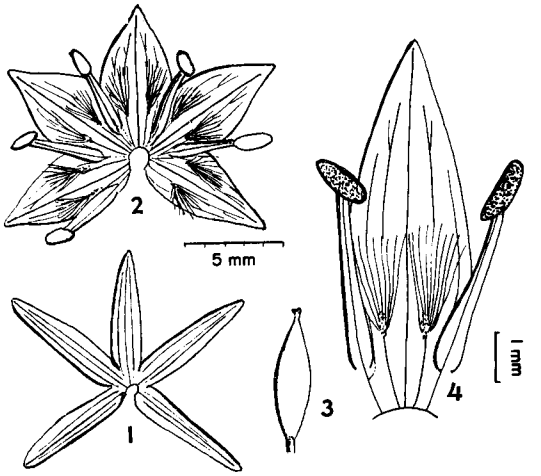

Fig. 7. *Ophelia diluta* var. *tosaensis*: 1. Open calyx, 2. Open corolla, 3. Pistil, and 4. Corolla-lobe.

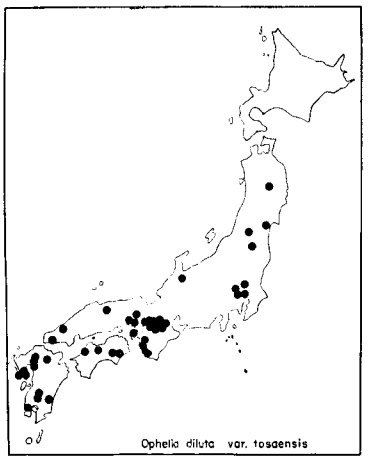

Fig. 8. Distribution of *Ophelia diluta* var. *tosaensis*.

nervis duobus lateralibus cum filamentis conexis, glandulis duabus epipetalis a basibus petalorum 1–2 mm distantibus ornatis, squamis fimbriatis glandulas (foveas) circumdantibus, fimbrillis squamarum filiformibus, numerosis, ca. 2 mm longis, laevibus, staminibus 4.5–6 mm longis, filamentis fusiformilinearibus, ca. 3 mm longis, in partibus inferioribus intus ad corollas affixis, antheris oblongis, ca. 1 mm longis, pistillo uno, dilute viride, ovario uniloculare, stylo brevissimo, stigmate parvo, bipartito. Capsulae demum corollas leviter superantes, seminibus subglobosis, plerumque laevibus.

Nom. Jap. Inu-semburi (MAKINO, 1892).

Specim. exam.

Honshû. Prov. Rikuzen: Kamega-oka, Sendai (sept. 1914. Y. OGURA-TI). Prov. Rikuchû: Yonauchi (oct. 1926. G. TOBA-TI). Prov. Hitachi: Hebinuma (oct. 1947. S. OKUYAMA et N. MARUYAMA-TNS). Prov. Iwaki: Kozeki-mura (nov. 1928. N. IMAI-KYO). Fushi-mura (oct. 1932. T. SUZUKI-KYO). Prov. Iwashiro: Sine loco speciali (oct. 1913.-KYO). Prov. Shimôsa: Abiko (oct. 1957. S. OKUYAMA). Prov. Musashi: Shimura (oct. 1933. K. HIYAMA-TNS). Edogawa (oct. 1895. K. WATANABE-TNS). Prov. Kôdzuke: secus lacum Tatara (oct. 1929. BABA-TI). Prov. Etchû: Higashi-futomi-mura (oct. 1933. T. OTAYA-KYO). Prov. Owari: Inter Hirabari et Nishimiya-guchi (oct. 1891. T. ITÔ-TNS). Prov. Ohmi: Nangô (oct. 1930. C. HASHIMOTO-KYO). Ohtsu (oct. 1926. C. HASHIMOTO-KYO). Hiramatsu (oct. 1925. S. MIKI-KYO). Prov. Yamashiro: Nishiyama, Kyôto (nov. 1927. M. TANBE-KYO). Prope Yamada (oct. 1929. T. TAKEUCHI-KYO). Tanabe-chô (oct. 1950. G. NAKAI-KYO). Prov. Yamato: Katagiri-chô (oct. 1956. G. MURATA-KYO). Prov. Ise: Tamagaki-mura (nov. 1928. S. MATSUYAMA-KYO). Prov. Kii: Tanabe (nov. 1924. K. MATSUSHIMA-TNS). Akitsugawa-mura (oct. 1915. H. UI-TNS).

Shinshô-mura (oct. 1921. S. NAKAJIMA-TI et KYO). Prov. Awaji: Taga (nov. 1943. A. ISHIGAMI-TI). Prov. Tanba: Miwa-mura (nov. 1935. S. HOSOMI-TNS). Gomagô-mura (oct. 1949. G. NAKAI-KYO). Prov. Settsu: Mishima-gun (nov. 1932. S. TANAKA-KYO). Prov. Mimasaka: Kenashi-yama (oct. 1930. Z. TASHIRO-KYO). Prov. Bitchû: Kamogata-machi (oct. 1932. K. YOKOMIZO-TNS).

Shikoku. Prov. Iyo: Saijô (nov. 1937. K. OCHI-TNS). Prov. Tosa: Hirata-mura (oct. 1885. K. WATANABE-TNS). Mikazuki-mura (nov. 1951. S. KITAMURA et G. NAKAI-KYO).

Kyûshû. Prov. Hizen: Ohnoga-hara (sept. 1919. Z. TASHIRO-KYO). Prov. Higo: Yunomae (nov. 1957. K. MAYEBARA-TI). Prov. Chikugo: Tamagawa-mura (oct. 1920. T. SUGINO-KYO). Prov. Ohsumi: Nishi-ichiki-mura (oct. 1927. Y. DOI-KYO).

Area geogr. Japonia (Honshû—Kyûshû), Korea, Manchuria, China, etc.

Typus: 'TOSA (T. Makino)' (in TMH)[6].

The type species of the present variety had long been cited under the name *Swertia chinensis* (BUNGE) FRANCHET. However, after having examined a photograph and a fragment of the type specimen of *Ophelia chinensis* BUNGE conserved in the Herb. Geneve, HARA pointed out in 1950 that the plant of BUNGE was identical with *Ophelia diluta* (=*Gentiana diluta*=).

The plant of our boundaries with smaller flowers and broader leaves had better be treated as a variety of the former.

Ophelia pseudochinensis TOYOKUNI

[Figs. 9 & 10]

Ophelia pseudochinensis (HARA) TOYOKUNI, comb. nov.

Syn.—

'*Swertia rotata* LINNAEUS' sensu THUNBERG, Fl. Jap. 115. 1784.

Narketis japonica RAFINESQUE, Fl. Tellur. **3**: 26. 1837, in nota.

Swertia chinensis f. b. *violacea* MAKINO in Bot. Mag. Tokyo **17**: 55. 1903.-MATSUMURA, Ind. Pl. Jap. **2**(2): 504. 1912.

'*Swertia chinensis* FRANCHET' sensu KOMAROV, Fl. Mansh. **3**: 271. 1905, pro parte.; Opera Selecta **5**: 263. 1950.-MAKINO in Bot. Mag. Tokyo **24**: 296, f. 20. 1910, excl. syn. nonnul.-NAKAI, Fl. Koreana **2**: 100. 1911.-MASAMUNE, Fl. & Geobot. Yakus. 374. 1934.; in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.-HARA, Enum. Spermat. Jap. **1**: 140. 1949.-SATAKE in Jour. Jap. Bot. **21**: 29. 1947.

S. pseudochinensis HARA in Jour. Jap. Bot. **25**: 89. 1950, cum f. *glandiflora*.-OHWI, Fl. Jap. (ed. 1), 956. 1953.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 217. 1957.

Planta glaberrima. Radix biennis, tenuis, gracilis, dilute flavescentibrunnea, 2.5–10 cm longa, usque 4 mm in diametro, simplex aut aliquot ramosa, radicibus ramisque saepe ornatis radiculis fibrosis. Caulis simplex vel in inferioribus—

6) The Makino Herbarium of the Metropolitan University, Tôkyô.

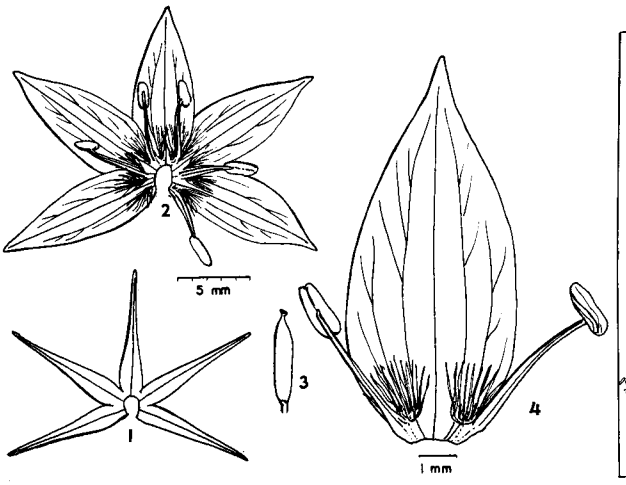

Fig. 9. *Ophelia pseudochinensis*: 1. Open calyx, 2. Open corolla, 3. Pistil, and 4. Corolla-lobe.

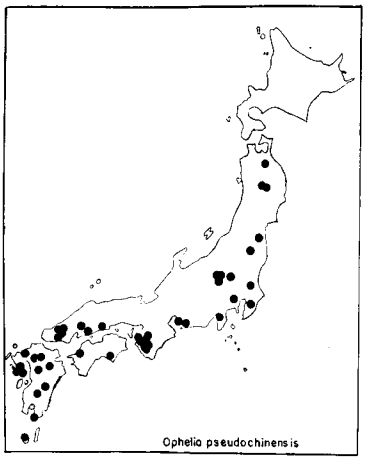

Fig. 10. Distribution of *Ophelia pseudochinensis*.

superioribus partibus pauci—multiramosus, rarius a basi intense ramosus, cum inflorescentiis 7–70–100 cm altus, atropurpurascens, quadriangulatus, angulis longitudinaliter angustissimeque semialatis. Folia basalia sub anthesi vulgo emarcida rarius viva opposita, oblanceolata vel oblanceolatospathulata, parva, 5–10 mm longa, 1–3 mm lata, uninervia, eis caulinis inferioribus mediisque eis radicalibus subconformibus sed majoribus, oblongis vel lanceolatoöblongis vel linearioblongis, in utrosque apices angustatis, uni—trinerviis sed nervis lateralibus indistinctis et in apices versus evanescentibus, apice acuminatocuspidatis, (1–) 2–5 (–7) cm longis, 1–2 mm latis, eis superioribus linearibus sive lanceolatolinearibus, angustissimis. Flores pentameri et in apicibus caulium ramorumque et in axillis solitarii—pauci, calycibus latoinfundibularicampaniformibus, 7–14 mm longis, profunde quinquepartitis, sepalis lanceolatis vel acicularilanceolatis, in apices versus angustissime attenuatis et apice acutis, trinerviis tamen lateralibus nervis duobus vix cognitis, quam tubi 7–9-plo longioribus, corollis caeruleopurpureis, calycibus subaequilongis, 7–15 mm longis, profunde quinquepartitis, trinerviis sed nervis lateralibus iterum ex partibus inferioribus bipartitis, ornatis glandulis epipetalis binis cum squamis fimbriatis circumdatis et a basibus petalorum ca. 0.5 mm distantibus, fimbrillis squamarum linearifiliformibus, 1–1.5 mm longis, scabris, staminibus 5–7 mm longis, filamentis linearibus, in apices gradatim angustatis, antheris oblongis, 1.2–1.7 mm longis, pistillo uno, oblongo, sessile, sub anthesi corollis ca. 2/3-plo longiore, ovario uniloculare, stylo brevissimo, stigmate parvo, bipartito. Capsulae secundum incrementum demum

corollas paulo superantes vel eis aequilongae, seminibus subglobosis, plerumque laevibus.

Nom. Jap. Murasaki-semburi (MAKINO, ?).

Specim. exam.

Honshû. Prov. Mutsu: Shiwa-mura (sept. 1946. U. NARITA-TI). Prov. Rikuchû: Morioka (oct. 1947. M. KIKUCHI). Prov. Iwaki: Nakabatake-mura (oct. 1932. T. SUZUKI-TNS). Shirakawa (oct. 1930. T. SUZUKI-KYO). Prov. Musashi: Kunitachi (oct. 1931. K. HISAUCHI-TI). Prov. Shimotsuke: Arafune-yama (oct. 1948. N. MARUYAMA-TNS). Prov. Kadzusa: Mobara (oct. 1933. K. HIYAMA-TNS). Prov. Shinano: Karuizawa (oct. 1949. H. HARA-TI, 'holotypus'). Ohkubo-yama (oct. 1939. K. SAITÔ-TI). Prov. Idzu: Daruma-yama (oct. 1957. T. YAMAZAKI). Prov. Owari: Tashiro-machi (T. MAKINO-TI). Prov. Mikawa: Asuke (oct. 1891. T. ITÔ-TNS). Yoshikawa-tôge (oct. 1950. K. TORII-KYO). Prov. Kii: Ryûmon-zan (nov. 1954. Y. OGURA-KYO). Prov. Nagato: Akiyoshi-dai (nov. 1936. M. YONENAGA-TI).

Shikoku. Prov. Iyo: Kanna-san (oct. 1924. K. YAMASHITA-TNS). Prov. Tosa: Shakushigoe (oct. 1885. K. WATANABE-TNS).

Kyûshû. Prov. Hizen: Iwaya-yama (nov. 1911. Z. TASHIRO-KYO). Nagasaki (oct. 1931. GRAETREX-TI). Prov. Higo: Aso (nov. 1947. T. SAITÔ-KYO). Prov. Hiuga: Sobo-san (oct. 1958. Y. MOMIYAMA-TI). Prov. Ohsumi: Sata-mura (nov. 1954. Y. SHIMADA-KYO).

Area geogr. Japonia (Honshû—Kyûshû), Korea, China bor., Manchuria, Amur, etc.

Typus: 'Honshu, Prov. Shinano: Karuizawa (H. Hara, Oct. 15, 1949)' (in TI).

The plant had long been regarded as identical with *Ophelia chinensis* until HARA pointed out in 1950 that *O. chinensis* was a synonym of *O. diluta* and that the so-called *S. chinensis* in our boundaries was a new species.

As compared with *O. diluta*, the present species has microscopically minute-papillose filaments and fimbrillae surrounding foveae, larger flowers and broader corolla-lobes which are narrowly ovate and acuminate at the apex.

Ophelia japonica GRISEBACH

[Figs. 11~13]

Ophelia japonica (SCHULTES) GRISEBACH, Gen. et Sp. Gent. 321. 1839.

Syn.—

Gentiana? japonica SCHULTES, Syst. Veg. **6**: 174. 1820.–BUNGE in Nuov. Mém. Soc. Nat. Mosc. **1**: 256. 1829. *Swertia japonica* (SCHULTES) MAKINO in Bot. Mag. Tokyo **24**: 294, f. 19. 1910.–MIYABE et KUDO in Trans. Sapporo Nat. Hist. Soc. **6**: 173. 1917.–SATAKE in Jour. Jap. Bot. **21**: 27. 1947.–HARA, Enum. Spermat. Jap. **1**: 141. 1949.–OHWI, Fl. Jap. (ed. 1), 956. 1953.–HONDA, Nom. Pl. Jap. (ed. em), 207. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 217, pl. 65, f. 533. 1957.

'*Swertia rotata* THUNBERG' sensu GRISEBACH in DE CANDOLLE, Prodr. **9**: 134. 1845.

'*Pleurogyne rotata* GRISEBACH' sensu SIEBOLD et ZUCCARINI in Abh. Akad. Münch.

4 (3): 159. 1846, pro parte.

'*Swertia diluta* LEDEBOUR' sensu MAXIMOWICZ in Bull. Acad. St.-Pétersb. **20**: 434. 1875, pro parte.

S. japonica f. *chionantha* F. MAEKAWA in Jour. Jap. Bot. **12**: 140. 1936.-HARA, Enum. Spermat. Jap. **1**: 141. 1949.

Herbae annuae aut biennes, glabrae et laeves. Radices tenues, avellaneo-cremeae, usque 10 cm longae sed vulgo breviores. Caules cum inflorescentiis 5–40 cm alti, a basibus aut in partibus mediis aut in partibus superioribus ramosi, interdum simplices, angustissime quadriangulati iterumque plus minusve subalati, intense virides et saepius purpurascentes. Folia parva, opposita interdum subrosulata rare toto deficientia, oblanceolata vel subspathulata, (5–) 10–18(–22) mm longa, usque 5 mm lata, foliis caulinis oppositis, sessilibus, quam ea radicalia majoribus, linearibus vel latolinearibus vel oblanceolatolinearibus rare in planta humillima spathulatoöblanceolatis vel oblanceolatis, 10–40 mm longis, (1–) 2–5(–7) mm latis, uninerviis, apice acutis sed interdum obtusiusculis, basi

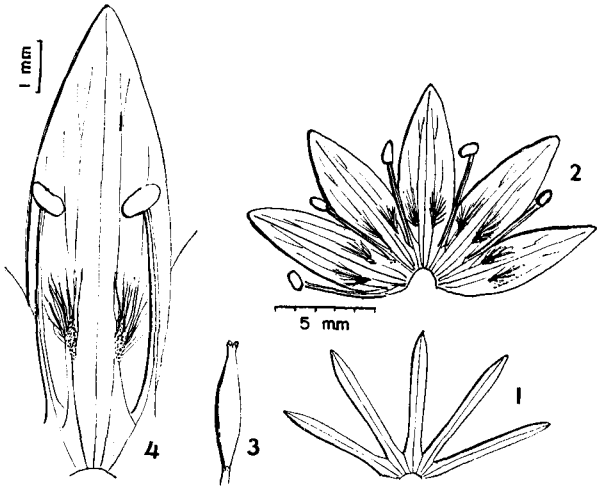

Fig. 11. *Ophelia japonica*:
1. Open calyx, 2. Open corolla,
3. Pistil, and 4. Corolla-lobe.

acutiusculis et semiamplexicaulibus, margine plus minusve recurvatis. Flores in ramorum apicibus axillisque paniculatim dense dispositi, pentameri, longe pedunculati, pedunculis laevibus, gracilibus, 10–25 mm longis, dilute viridibus, calycibus (3–)4–13(–15) mm longis, profundissime quinquepartitis, tubis calycis 0.2–0.5 mm longis, sepalis linearibus aut lanceolatis, in apices versus gradatim angustatis et apicibus acutis vel acutiusculis, marginibus scabriusculis, corollis

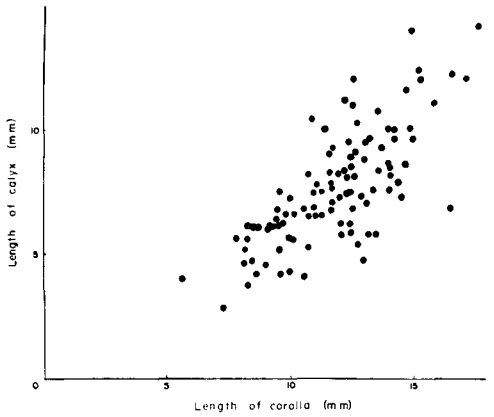

Fig. 12. A graph showing the correlation between the length of corolla and that of calyx in *Ophelia japonica*.

albis vel lutescentibus, profunde quinquepartitis, simplicibus rare semiplenis, lobis corollae latolanceolatis, apice acutis, purpureonervigeris, usque 25 mm longis, prope basin foveis duabus instructis, foveis capillis fimbriatis circumdatis, fimbrillis inaequalibus, 2–3 mm longis, staminibus ca. 5 mm longis, antheris ellipticis, 0.8–1.1 mm longis, filamentis linearibus, pistillo uno, ovario sessile et uniloculari, stylo nullo, stigmate distincte bipartito. Capsulae corollis aequilongae sive quam eae paulo longiores; semina globosa fere laevia.

Nom. Jap. Semburi.

Specim. exam.

Honshû. Prov. Mutsu: Kôchi-mura (oct. 1911. Y. KUDO-KYO). Shiwa-mura (sept. 1946. U. NARITA-TI). Prov. Rikuzen: Karakuwa-mura (sept. 1928. G. KOIDZUMI-KYO). Daino-hara, Sendai (oct. 1915. Y. OGURA-TI). Prov. Ugo: Akita (sept. 1931. K. YAMATSUTA-TNS). Prov. Uzen: Fukazawa (aug. 1883. T. NAGASAWA-TNS). Nadera-yama (oct. 1914. G. KOIDZUMI-TI). Prov. Iwashiro: Sasakino-hara (oct. 1887. K. NEMOTO-TNS). Prov. Shimôsa: Matsudo (nov. 1928. S. OKUYAMA-TNS). Prov. Hitachi: Tsukuba-san (oct. 1928. S. AKIYAMA). Prov. Musashi: Komaba (sept. 1924.–TI). Kobotoke (oct. 1934.–TI). Mitsumine-san (oct. 1900. Y. YABE-TI). Sayama-kyûryô (nov. 1949. S. HATTORI-TI). Takao-san (nov. 1890. S. MATSUDA-KYO). Asakawa (oct. 1957. H. TOYOKUNI). Mitake (oct. 1927. S. AKIYAMA). Prov. Shinano: Asama-yama (oct. 1954. H. SATÔ-TI). Nyûgasa-yama (sept. 1954. T. YAMAZAKI-TI). Karuizawa (oct. 1949. H. HARA-TI). Prov. Idzu: Mikura-jima (oct. 1932. TAKAHASHI & MATSUO-TI). Oh-shima (sept. 1950. M. MIZUSHIMA-TI). Miyake-jima (nov. 1935. K. HAYASHI-TNS). Prov. Suruga: Fujikawa-machi (oct. 1959. T. OHMURA-KYO). Prov. Noto: Hôtatsu-zan (oct. 1953. M. HIROE & H. TOYOKUNI). Prov. Sado: Sadoga-shima (oct. 1949. M. TOGASHI-TNS). Prov. Echigo: Honai-mura (oct. 1952. M. TOGASHI-KYO et TNS). Prov. Mikawa: Prope Toyohashi (oct. 1947. K. INAGAKI). Kampachi-yama (oct. 1891. T. ITÔ-TNS). Prov. Owari: Nagoya (oct. 1927. K. INAGAKI). Prov. Ohmi: Yamanaka-mura (oct. 1908. I. SONO-TNS). Prov. Yamashiro: Sugi-

tani (oct. 1959. G. MURATA-KYO). Hiei-zan (oct. 1921. G. KOIDZUMI-KYO). Prov. Yamato: Prope Muroo (nov. 1922. G. KOIDZUMI-KYO). Prov. Ise: Isozaki-machi (nov. 1957. T. KOIDE-KYO). Asama-yama (oct. 1932. T. NAKAI-TI; oct. 1960. H. TOYOKUNI). Prov. Kii: Toro-hatchô (nov. 1950. G. NAKAI-KYO). Kohyô-san (sept. 1921. S. FUSHIMI-KYO). Prov. Awaji: Awaji-shima (nov. 1949. Y. KÔNO-KYO). Prov. Tanba: Sine loco speciali (maio. G. KOIDZUMI-KYO). Shiro-yama, Idzumo (nov. 1955. G. MURATA-KYO). Chôrôga-take (oct. 1949. G. NAKAI-KYO). Prov. Settsu: Rokkô-san (oct. 1949. G. NAKAI-KYO). Prov. Suô: Ohuchi-mura (oct. 1898. J. NIKAI-TNS).

Shikoku. Prov. Iyo: Kanayama (oct. 1954. Y. NOMURA-KYO). Prov. Awa: Konji-san (oct. 1913. J. NIKAI-TI).

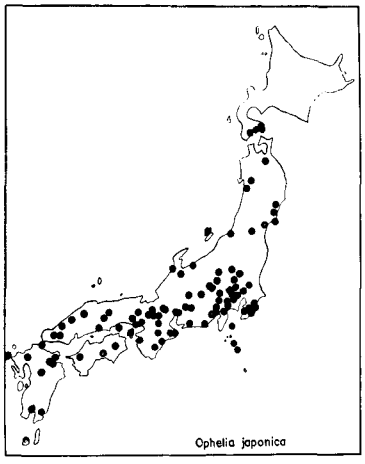

Fig. 13. Distribution of *Ophelia japonica*.

Kyûshû. Prov. Hizen: Byôbu-san, Hirato-jima (nov. 1950. S. KITAMURA et M. TAMURA-KYO). Hirato-jima (aug. 1951. T. HASHIMOTO-TI). Prov. Bungo: Handa-kôgen (oct. 1952. T. YAMAZAKI-TI). Prov. Ohsumi: Yaku-shima (sept. 1921. G. KOIDZUMI-KYO).

Area geogr. Japonia et Korea et China.

Typus: 'Thunb. In Japonia' in (B).

This is one of the commonest *Opheliae* in Japan, and is distributed from the south-western part of Hokkaidô southwards through Honshû to the island of Yaku, Kyûshû, as well as in Korea and China. As the distributional area of the plant is rather wide, the plants vary a good deal: some are low with simple, thick stems, while some have tall, intensely branched, slender stems. And among the normal forms, there sometimes occurs a form with white flowers or one with tetramerous flowers, but such a form may be non-separable from the typical form as an independent taxon, because even on the same individual tetra- and pentamerous flowers intermixed are often observable.

Ophelia sect. **Swertopsis** (MAKINO) TOYOKUNI, comb. nov.

Syn.—

Swertopsis MAKINO, Ill. Fl. Jap. **1** (11): t. 66. 1891.; in Bot. Mag. Tokyo **8**: 435. 1894. *Swertia* subg. *Ophelia* sect. *Swertopsis* (MAKINO) SATAKE in Jour. Jap. Bot. **21**: 25. 1947.

This section is monotypic.

Ophelia umbellata TOYOKUNI

[Figs. 14 & 15]

Ophelia umbellata (MAKINO) TOYOKUNI, comb. nov.

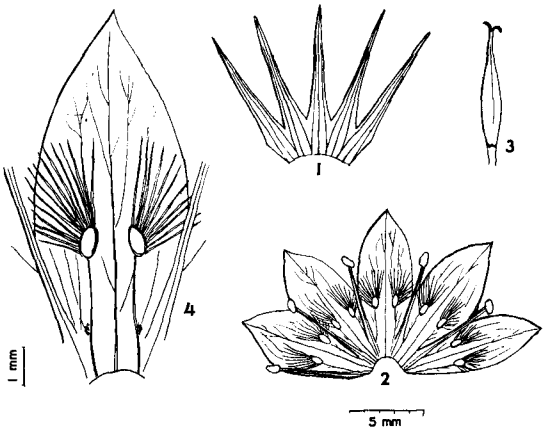

Fig. 14. *Ophelia umbellata*: 1. Open calyx, 2. Open corolla, 3. Pistil, and 4. Corolla-lobe.

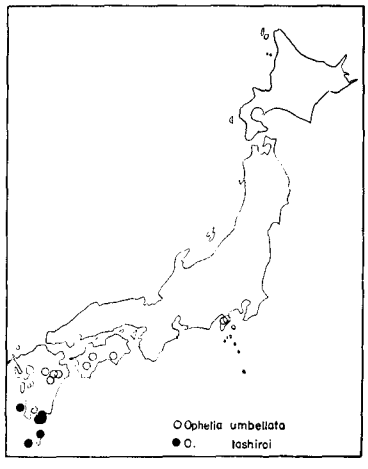

Fig. 15. Distribution of *Ophelia umbellata* (circles) and *O. tashiroi* (black dots).

Syn.—

Swertopsis umbellata MAKINO, Ill. Fl. Jap. **1**(11): 1, t. 66. 1891.; Phan. et Pterid. Jap. Ill. **2**(2): t. 67. 1901. *Swertia umbellata* (non RUIZ et RAVON, 1802) (MAKINO) MAKINO in Bot. Mag. Tokyo **8**: 436. 1894. *Sweertia umbellata* (non RUIZ et RAVON, 1802) (MAKINO) GILG in ENGLER et PRANTL, Nat. Pfl.-fam. Nachtr. **1**: 283. 1897.

Swertia Swertopsis MAKINO, Bot. Notes Author's Priv. Cabin. **2**: 33. 1898.; in Bot. Mag. Tokyo **15**: 47. 1901.-MATSUMURA, Ind. Pl. Jap. **2**(2): 504. 1912.-HONDA, Nom. Pl. Jap. (ed. 1), 281. 1939.-SATAKE in Jour. Jap. Bot. **21**: 25. 1947.-HARA, Enum. Spermat. Jap. **1**: 142. 1949.-OHWI, Fl. Jap. (ed. 1), 957. 1953.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 216, pl. 65, n. 530. 1957.

Herbae biennes, glabrae, laeves. Radices plerumque subcrassae, 1.5–12 mm crassae, interdum leviter rhizomatae, aliquot—multiramosae, flavobrunneae. Caules plerumque in partibus inferioribus—mediis rare a basibus ramosi, virides, 20–60 cm alti, glabri, 1–4 mm in diametro. Folia radicalia plerumque abbreviata et scariosa rare spathulatoöblonga, minima. Folia caulina infima sessilia vel brevipetiolata, parva, oblongoöblanceolata vel oblongoövata, apice obtusa vel subrotundata, foliis caulinis inferioribus mediisque ovatis sive ovatoëllipticis, utrinque acuminatis, quinque—septemnerviis, 6–14 cm longis, 2–6 cm latis, longepetiolatis, petiolis usque 4 cm longis, foliis caulinis superioribus et supremis quam media ea minoribus sed conformibus, quinque- rare septemnervigeris. Flores in caulium et ramorum apicibus axillisque umbellatim sessiliterque dispositi, pentameri, 7–12 mm longi, calycibus infundibularihypocraterimorphis, profunde quinquepartitis et corollis subaequilongis vel brevioribus, sepalis acicu-

laribus lineariacicularibusve, a basibus in apices gradatim acutatis, trinerviis, corollis albis, campanulatis, profunde quinquepartitis, petalis ellipticis, apice acutis et mucronulatis, leviter infra medium vel ad medium glandulis epipetalis duabus ornatis, capillis setulosis et 2.5–3 mm longis glandulas circumdantibus, staminibus quam corollae 2/3-plo longioribus, filamentis linearibus, ca. 5 mm longis, antheris linearielliptici, ca. 1 mm longis, pistillo uno, fusiformi, ovario uniloculare, stylo breve, stigmate longo, bipartito; capsulae anguste ovatae, corollas vix superantes, seminibus pro planta generis *Opheliae* magnis, oblongis, 3–3.5 mm longis, dense ornatis processibus minutis.

Nom. Jap. Shinonome-sô (MAKINO, 1891).

Specim. exam.

Honshû. Prov. Idzu: Amagi-san (aug. 1905. H. TAKEDA-TNS; aug. 1927. Z. TASHIRO-KYO; julio. 1930. Z. TASHIRO-KYO; aug. 1930. J. SUGIMOTO-TI).

Shikoku. Prov. Tosa: Dôga-mori (oct. 1891. K. WATANABE-TI; julio, 1927. H. YAMAMOTO-KYO). Iogi-mura (aug. 1930. M. TAGAWA-KYO). Nanokawa-mura (aug. 1889. K. WATANABE-TI et TNS).

Kyûshû. Prov. Higo: Fukaba-yama (sept. 1907. Z. TASHIRO-KYO et TNS; aug. 1927. S. TOKUNAGA-KYO). Prov. Bungo: Sobo-san (aug. 1911. S. NAKAJIMA-TI; aug. 1912.-TNS; oct. 1952. T. YAMAZAKI-TI). Ohgi-san (sept. 1913. Z. TASHIRO-KYO). Prov. Hiuga: Sugigagoe (aug. 1933. K. Nakajima-KYO).

Area geogr. Endemica (a parte media insulae Honshû usque insulam Kyûshû, Japoniae).

Typus: 'TOSA: Nanokawa, *T. Makino*, 1885' (in TMH).

Of all the *Opheliae* of Japan, the present species is probably the most interesting one, because of its abbreviated inflorescence. Emphasising this fact, MAKINO once established the independent genus *Swertopsis* differing from both *Swertia* and *Ophelia* (MAKINO, 1891). However, as the characters of the plant other than abbreviated inflorescence are those of *Swertia*, s.l., MAKINO transferred it to *Swertia* in 1894, while GILG published a similar opinion independently in 1897. But as the combinations mentioned above are antedated by *Swertia umbellata* RUIZ et RAVON (1802), MAKINO introduced *Swertopsis* as the specific name of the plant in 1898. If *Ophelia* is accepted, however, *O. umbellata* is valid, because this combination has not hitherto been proposed.

Ophelia sect. **Bimaculatae** TOYOKUNI, sect. nov.

Syn.—

Swertia subg. *Ophelia* sect. *Bimaculatae* SATAKE in Jour. Jap. Bot. **21**: 23. 1947, nom. nud.

Caulis erectus. Folia radicalia sub anthesi vulgo rosulata, petiolata. Lobi corollae foveis duabus et nudis instructi. Semina processibus ornata.

Typus: *Ophelia bimaculata* SIEBOLD et ZUCCARINI
Only one species in Japan.

Ophelia bimaculata SIEBOLD et ZUCCARINI

[Figs. 16 & 17]

Ophelia bimaculata SIEBOLD et ZUCCARINI in Abh. Akad. Münch. **4**(3): 159. 1846.

Syn.—

Swertia bimaculata (SIEBOLD et ZUCCARINI) HOOKER et THOMSON ex C. B. CLARKE in Jour. Linn. Soc. **14**: 449. 1875.-MATSUMURA, Ind. Pl. Jap. **2**(2): 503. 1912.-NAKAI in Bot. Mag. Tokyo **47**: 261. 1933, var. *typica*.-HONDA, Nom. Pl. Jap. (ed. 1), 281. 1939.-SATAKE in Jour. Jap. Bot. **21**: 24. 1947.-HARA, Enum. Spermat. Jap. **1**: 140. 1949.-OHWI, Fl. Jap. (ed. 1), 956. 1953.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 216, pl. 65, n. 531. 1957.

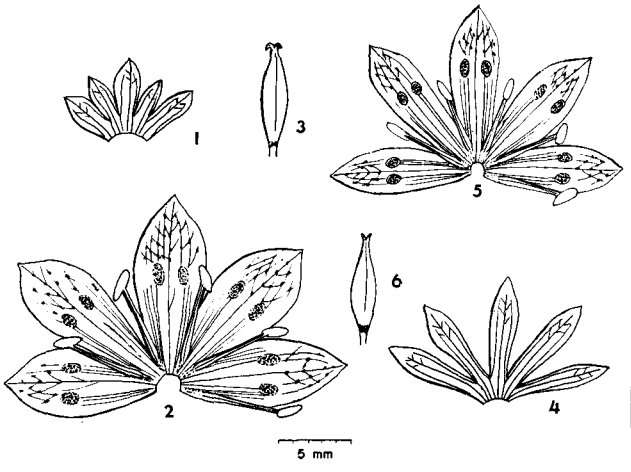

Fig. 16. *Ophelia bimaculata*:
1 & 4. Open calyx, 2 & 5. Open corolla, and 3 & 6. Pistil (Note that a big corolla not always possesses a big calyx).

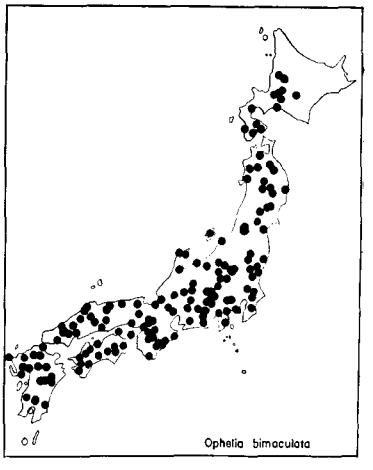

Fig. 17. Distribution of *Ophelia bimaculata*.

Herba subrobusta, glabra, biennis. Radix subcrassa, ad 1 cm in diametro, vulgo intense ramosa. Caulis simplex sive ramosus, quadriangulatus, viridis, 30–120 cm altus. Folia radicalia primum fasciculata vel rosulata, oblonga, magna, in bases versus petiolatim angustata, sed sub anthesi plerumque emarcida et destituta. Folia caulina inferiora opposita, ovata, tri-—quinquenervia, apice acuminata, basi cuneata aut subcuneatim subito angustata, petiolata, 4–7 cm longa, 2–4 cm lata, petiolis 1–1.5 cm longis. Folia caulina media superioraque opposita, iis inferioribus conformia sed acropetaliter gradatim sessilia minoraque

esse vertantia, basibus in caule vaginantim connata. Flores pentameri aut tetrameri, longe pedunculati, pedunculis 1–3 cm longis. Calyces 4–10 mm longi, profunde quinquepartiti, sepalis oblanceolatis vel spathulatoöblanceolatis, trinerviis, apice acutis vel acuminatis, inaequalibus (quand corolla maxima est non semper sit calyx maximus). Corollae albae, 7–15 mm longae, profundissime quinque- sive quattuorpartitae, petalis obovatis sive latoöblanceolatis, apice acutis vel mucronatis, leviter supra medium duabus glandulis epipetalis ca. 1.5 mm in diametro et flavoviridibus maculatis et superioribus in partibus purpureonigropunctulatis. Stamina quinque sive quattuor et petalis alternata, 5–8 mm longa, filamentis linearibus, in apices versus leviter angustatis, antheris oblongis, 1–1.7 mm longis, pistillo uno, oblongofusiformi, sessile, stylo brevissimo, subnullo, stigmate bipartito. Capsulae corollis leviter longiores; semina minuta, atrobrunnescentia, ornata processibus minutissimis.

Nom. Jap. Akebono-sô.

Specim. exam.

Hokkaidô. Prov. Ishikari: Horomui (aug. 1887. S. MATSUDA-KYO). Sapporo (1882. H. SAKURAI-TNS; sept. 1891. S. MATSUDA-KYO; sept. 1897. Y. TOKUBUCHI-TI). Nopporo (sept. 1932. Y. YAMADA; sept. 1952. S. AKIYAMA). Ochiai (sept. 1904. U. FAURIE-KYO). Prov. Iburi: Tomakomai (aug. 1928. S. AKIYAMA). Prov. Oshima: Oh-numa (sept. 1928. S. AKIYAMA).

Honshû. Prov. Mutsu: Aomori (sept. 1905. U. FAURIE-KYO). Shiwa-mura (aug. 1949. U. NARITA-TI). Prov. Ugo: Oga (sept. 1956. R. FUJII-TI). Prov. Rikuchû: Prope Morioka (julio, 1924. G. TOBA-TI). Haruyama-mura (sept. 1930. G. TOBA-TI). Ohsawa (sept. 1947. S. SASAMURA-TI). Prov. Uzen: Shirotaka-yama (sept. 1931. S. OKUYAMA-TNS). Prov. Iwashiro: Arai-mura (oct. 1890.-TNS). Prov. Sado: Sadoga-shima (TI). Prov. Hitachi: Tsukuba-san (maio, 1925. M. HONDA-TI). Prov. Shimotsuke: Nasu-no (aug. 1901. H. SAKURAI-TNS). Yumoto, Nikkô (sept. 1919. T. NAKAI-TI). Nikkô (1931. H. ITÔ-TI). Senjôga-hara (sept. 1929. S. AKIYAMA; julio, 1952. H. KANAI-TI). Prov. Kôdzuke: Kôdzu-bokujô (aug. 1955. T. SATOMI-TNS). Inter Kôdzu-bokujô et Arafune-yama (oct. 1954. I. KATÔ-TI). Prov. Musashi: Inter Hirayama et Takahata, Tama-kyûryô (oct. 1948. M. MIZUSHIMA-TI). Kamabuse-tôge (oct. 1940. S. OKUYAMA-TNS). Takao-san (oct. Y. YAMADA). Prov. Etchû: Busshô-ji (dec. 1929. T. OTAYA-KYO). Prov. Shinano: Nyûgasa-yama (sept. 1954. T. YAMAZAKI-TI). Karuizawa (aug. 1935. K. SHIRAI-TNS; aug. 1954. K. SAITÔ-TI). Prov. Idzu: Amagi-san (junio, 1883.-TI; nov. 1952. S. KITAMURA-KYO; oct. 1953. J. SUGIMOTO-TNS). Prov. Sagami: Kamakura (oct. 1931. Y. MOMIYAMA-TI). Hakone (sept. 1929. T. NAKAI-TI). Prov. Suruga: Ashitaka-yama (sept. 1925. S. MURAMATSU-TI; apr. 1954. H. KANAI-TI). Prov. Mino: Yôrô-san (sept. 1890. T. ITÔ-TNS). Kitano-mura (sept. 1926. K. SHIODA-KYO). Prov. Mikawa: Tsukude-mura (sept. 1954. G. MURATA-KYO). Sumire-dani, Dando-san (sept. 1953. G. MURATA-KYO). Prov. Tôtômi: Hakkô-san (oct. 1951. J. SUGIMOTO-TI). Prov. Ohmi: Ibuki-yama (sept. 1901. Y. YABE-TI; nov. 1924. K. INAGAKI; oct. 1953. M. TOGASHI-TNS). Yamanaka-mura (sept. 1908. I. SONO-TNS). Prov. Yamashiro: Hiei-zan (oct. 1920. N. KINASHI-KYO; sept. 1921. S. FUSHIMI-KYO). Sakajiri (oct. 1920. N. KINASHI-KYO). Kurama-yama (sept. 1915. T. YAMADA-KYO; sept. 1936.

S. KITAMURA-KYO; sept. 1956. N. KITAGAWA-KYO). Kibune (oct. 1958. S. KITAMURA-KYO). Atago-yama (nov. 1915. T. YAMADA-KYO; oct. 1943. K. HIYAMA-TNS). Prov. Kôchi: Chihaya-mura (nov. 1921. T. NAKAI-TI). Kongô-san (oct. 1921. M. HONDA-TI). Prov. Yamato: Kasuga-yama (julio, 1883.–TI). Kawakami-mura (oct. 1954. M. TAGAWA-KYO). Totsukawa-mura (aug. 1957. H. KANAI-TI). Prov. Ise: Ohsaka-yama (oct. 1893. T. ITÔ-TNS). Prov. Shima: Katagami-mura (oct. 1893. T. ITÔ-TNS). Prov. Kii: Kinomoto (oct. 1921. Y. OGURA-TI). Shinden prope Owase (nov. 1956. M. TAGAWA-KYO). Kôya-san (sept. 1924. S. FUSHIMI-KYO; sept. 1955. G. MURATA-KYO). Hyôgi-tôge (nov. 1928. Y. TSUCHIYA-KYO). Nachi (oct. 1931. J. OHWI et M. TAGAWA-KYO; oct. 1952. T. KOYAMA-TNS). Akitsugawa-mura (oct. 1924. NAKAJIMA-TI). Tomita (oct. 1948. H. KANAI-TI). Yahata-mura (sept. 1935. S. OKAMOTO-TI). Prov. Harima: Seppiko-yama (sept. 1951. M. TAGAWA-KYO; sept. 1951. T. YAMAZAKI-TI). Prov. Tanba: Koganega-take (oct. 1954. M. TAGAWA-KYO). Haiya (sept. 1951. T. YAMAZAKI-TI). Prov. Awaji: Inohana-dani (nov. 1949. Y. KONO-KYO). Prov. Etchû: Abe-yama (oct. 1930. K. SATÔ-TNS). Kozaki (oct. 1948. Z. YOSHINO-TI, 'flores tetrameri'). Idono, Hokubô-chô (oct. 1953. M. TAGAWA-KYO). Prov. Idzumo: Wanibuchi-dera (oct. 1904. K. HIRATA-TI). Prov. Sanuki: Shôdo-shima (julio, 1953. K. IMAHORI-TI). Prov. Aki: Kammuri-yama (oct. 1952. M. HIROE-KYO). Prov. Iwami: Nanokaichi-mura (oct. 1958. H. KANAI-TI). Ichiki-mura (oct. 1958. H. KANAI-TI). Prov. Suô: Ohuchi-mura (oct. 1898. J. NIKAI-TNS et TI). In sylvis nationalibus (oct. 1949. T. NAKAI et N. MARUYAMA-TNS). Prov. Nagato: Ohkuraga-take (oct. 1949. T. NAKAI et N. MARUYAMA-TNS). Akiragi-mura (oct. 1918. J. NIKAI-TNS).

Shikoku. Prov. Iyo: Naose (sept. 1891.–TI.) Rogajô-san (nov. 1950. M. HIROE-KYO). Ohnoga-hara (nov. 1950. M. HIROE-KYO). Kanna-san (oct. 1916. H. YAMAMOTO-KYO). Prov. Tosa: Yokogura-yama (oct. 1943. S. OKUYAMA-TNS). Kuishi-yama (sept. 1957. G. MURATA-KYO). Hoshidate-mura (H. YAMAGUCHI-KYO). Nanokawa-mura (sept. 1894. S. MATSUDA-KYO). Prov. Awa: Todoroki-dani (oct. 1943. S. OKUYAMA-TNS). Takamaru-yama (aug. 1936. S. TAKAHASHI-KYO). Higashi-myôtô-yama (oct. 1918. T. ASA-TNS).

Kyûshû. Prov. Buzen: Moji (oct. 1952. T. HASHIMOTO-TI). Prov. Hizen: Unzen-dake (sept. 1906. Z. TASHIRO-TNS). Ten-zan (oct. 1950. T. HASHIMOTO-TI). Hirato-jima (nov. 1950. S. KITAMURA et M. TAMURA-KYO). Prov. Hiuga: Nakagô-mura (maio, 1949. Shinske HATTORI et I. HURUSAWA-TI). Shiba-mura (oct. 1958. H. KANAI-TI). Prov. Ohsumi: Kirishima-zan (mart. 1947. M. TOGASHI-TNS).

Area geogr. Japonia (ab Hokkaidô usque Kyûshû) et China.

Typus: Japonia[7] (in L).

Like *Ophelia japonica*, the present plant is one of the commonest *Opheliae* in our boundaries; the distributional areas in both species, too, are very similar to each other, though this species extends slightly more north (Figs. 13 & 17). The form without orbicular dots on the corolla-lobes was described by MAKINO (i. e., forma *impunctata* MAKINO in Bot. Mag. Tokyo **24**: 16. 1910.; in Jour. Jap. Bot. **6**: 38. 1930, sub *Swertia bimaculata.*), but the author has had no opportunity of observing any materials of this form either in fields or in herbaria.

7) No exact locality is stated in the original description.

Ophelia sect. **Rosulatae** TOYOKUNI, sect. nov.

Syn.—

Swertia subg. *Ophelia* sect. *Rosulatae* SATAKE in Jour. Jap. Bot. **20**: 340. 1944, nom. nud.

Caulis erectus. Folia radicalia sub anthesi viva, magna, rosulata, brevipetiolata. Lobi corollae foveis solitariis magnis et nudis instructi. Semina processibus prismaticis ornata.

Typus: *Ophelia tashiroi* MAXIMOWICZ

Only one species in Japan.

Ophelia tashiroi MAXIMOWICZ

[Figs. 15 & 18]

Ophelia tashiroi MAXIMOWICZ in Bull. Acad. St.-Pétersb. **31**: 68. 1886.

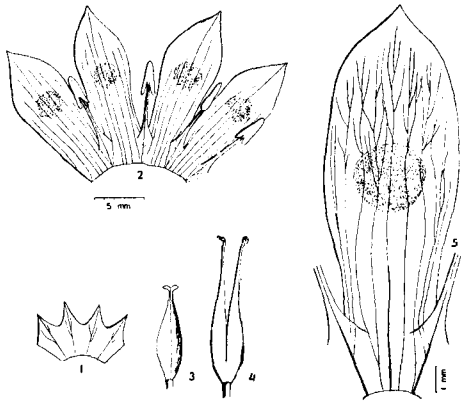

Fig. 18. *Ophelia tashiroi*:
1. Open calyx, 2. Open corolla, 3. Pistil, 4. Capsule, and 5. Corolla-lobe.

Syn.—

Swertia Tashiroi (MAXIMOWICZ) MAKINO in Bot. Mag. Tokyo **10**: 57. 1896.-MATSUMURA, Ind. Pl. Jap. **2** (2): 504. 1912.-MASAMUNE, Fl. & Geobot. Yakus. 375. 1934.; in Sci. Rep. Kanazawa Univ. **3**: 323. 1955.-F. MAEKAWA in Jour. Jap. Bot. **12**: 159. 1936, cum var. *cruciata*.-SATAKE in Jour. Jap. Bot. **20**: 340. 1944.-HARA, Enum. Spermat. Jap. **1**: 142. 1949.-OHWI, Fl. Jap. (ed. 1), 956. 1953.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 216. 1957, incl. *S. Kuroiwai* MAKINO.

S. Kuroiwai MAKINO in Bot. Mag. Tokyo **17**: 53. 1903.; ibid. **18**: 143. 1904.-MATSUMURA, l. c. 504. 1912.-F. MAEKAWA, l. c. 160. 1936, cum varr. *laxa* et *condensata*.-SATAKE in Jour. Jap. Bot. **20**: 341. 1944.-HARA, Enum. Spermat. Jap. **1**: 141. 1949.-MASAMUNE in Sci. Rep. Kanazawa Univ. **3**: 323. 1955.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.

Herba robusta, biennis. Radix crassa, 3–7 mm in diametro, simplex vel

aliquot ramosa, usque 10 cm longa, atrobrunnescens, radiculosa. Caulis simplex vel superioribus in partibus ramosus, striatus, glaber, 21–50 cm altus. Folia radicalia subrosulata, petiolata, obovata, apice acuminata, basi in petiolos gradatim angustata, utrinque glabra, margine plus minusve undulata quasi margines serrulatae, 4–25 cm longa, 2.3–10 cm lata, cum una costa media et 2–4 nervis lateralibus; folia caulina inferiora sessilia, latolanceolata—lanceolato-linearia, 3–4 cm longa, 7–25 mm lata, basi rotundata et amplexicaulia, apice acuta, eis caulinis medianis superioribusque sessilibus, plerumque lanceolatis—lanceolatolinearibus, apicibus acuminatis, basibus obtusis et subcuneatim attenuatis. Flores pentameri aut tetrameri, in caulis ramorumque apicibus vulgo solitarii rare bini—tres, 1–1.8 cm longi, longepedunculati, pedunculis 1–5 cm longis, calycibus parvis, 5- vel 4-fidis, infundibularibus, lobis deltoideis, apice acutis, uninerviis, corollis infundibularibus, viridibus, 5–4-partitis, petalis late spathulato-oblanceolatis, 7–9-nerviis, leviter supra medium glandula una orbiculata et magna flavoviridi et 2–2.5 mm in diametro maculatis, iterumque superioribus in partibus purpureobrunnescentipunctulatis, staminibus quam corollae 3/5-plo longioribus, filamentis linearibus, in bases versus obtriangulariter dilatatis, antheris anguste deltoideoöblongis, ca. 2 mm longis, pistillo uno, fusiforme, stylo brevissimo, stigmate bipartito. Capsulae corollis subaequilongae, sessiles, seminibus plus minusve rectangularibus, minutissimis, ornatis processibus breviprismaticis.

Nom. Jap. Hekka-rindô (TASHIRO ex MAXIMOWICZ, 1886).

Specim. exam.

Kyûshû. Prov. Ohsumi: Tanega-shima (oct. 1921. Z. TASHIRO-KYO). Yaku-shima (sept. 1921. G. KOIDZUMI-KYO; julio, 1924. G. MASAMUNE-TI; aug. 1935. S. MURAMATSU-TI). Miyanoura-dake, Yaku-shima (julio, 1918.-KYO). Kosugi-dani, Yaku-shima (aug. 1933. M. TAGAWA-KYO). Anpô-gawa, Yaku-shima (oct. 1934. T. TERASAKI-TI, 'holotypus *Swertiae tashiroi* var. *cruciatae*'). Amami-ôshima (apr. 1910. T. KARIYA-KYO; maio. 1923. G. KOIDZUMI-KYO). Sata-mura (dec. 1924. Z. TASHIRO-KYO, calycis lobis brevissimis). Uchinoura-mura (aug. 1916. Z. TASHIRO-KYO). Inao-dake (sept. 1916. Z. TASHIRO-TNS).

Area geogr. Endemica (Japonia austr.).

Typus: '*Kiusiu*: prov. Osumi, japonice Hetsuka rindo (Tashiro, Octobri fructif., fl. ult.)' (in LE).

Some authors hold the opinion that there is only one species belonging to the section Rosulatae, found from Kyûshû southwards to Formosa, against the recognition of four species under this section by some others, emphasising the nerves in calyces. The present author agrees *pro tempore* with the former opinion until the finding of more satisfactory characteristics that are clearly or fully creditable to justify division of the present plant into several species.

Genus 4. **Swertia** LINNAEUS

Swertia LINNAEUS, Sp. Pl. (ed. 1) **1**: 226. 1753, pro parte.; Gen. Pl. (ed. 5), 107. 1754, pro parte.–BLUME, Bijdr. Fl. Nederl. Ind. **14**: 897. 1826, pro parte.–GRISEBACH, Gen. et Sp. Gent. 331. 1839.; in DE CANDOLLE, Prodr. **9**: 131. 1845.–CLARKE in Jour. Linn. Soc. **14**: 448. 1875, pro parte.; in HOOKER, Fl. Brit. Ind. **4**: 127. 1883, pro parte.–GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 88. 1895, quoad sect. *Eusweertia*.–HEGI, Ill. Fl. Mitt.-Eur. **5**(3): 1973. 1927, pro parte.–ST. JOHN in Amer. Midl. Nat. **26**: 1. 1941, pro parte.–SATAKE in Jour. Jap. Bot. **20**: 334. 1944, quoad subg. *Ophelia* sect. *Euswertia*.; ibid. **21**: 26. 1947, quoad sect. *Euswertia*.–HARA, Enum. Spermat. Jap. **1**: 140. 1949, pro min. parte.–GROSSHEIM in Fl. URSS **18**: 629. 1952.–POPOV, Fl. Sr. Sib. **2**: 596. 1959.

Herbae perennes. Radix brevis. Caulis erectus, simplex vel ramosus. Folia radicalia opposita, longe petiolata, foliis caulinis oppositis, interdum alternatis. Flores quinarii, in caulis ramorumque apicibus dispositi, calycibus late campanulatis—infundibularibus, profunde quinquepartitis, corollis late campanulatis—infundibularibus, nigrescenticaeruleis rare albis, quinquepartitis, lobo corollae prope basin glandulis orbiculatis duabus ornato, glandulis capillis circumdatis, staminibus 5 et cum lobis corollae alternatis, filamentis linearibus, pistillo uno, ovario sessile. Capsulae corollas non superantes, seminibus alatis.

Nomen genericum in memoriam E. SWERTI Hollandiae est nominatum.

Typus: *Swertia perennis* LINNAEUS

The genus *Swertia* defined here is that in the narrowest sense: it is represented by *Swertia perennis*, the type of the genus, and allied perennial species with long radical leaves at anthesis.

One species in Japan.

Swertia perennis LINNAEUS subsp. **cuspidata** HARA

[Figs. 19 & 20, Plate I (3)]

Swertia perennis [subsp. perennis] LINNAEUS, Sp. Pl. (ed. 1) **1**: 226. 1753.–GRISEBACH in DE CANDOLLE, Prodr. **9**: 132. 1845, cum *β. obtusa*.–LEDEBOUR, Fl. Ross. **3**: 74. 1847.–DURAND in Rep. Superint. U. S. Coast. Surv. **1867**: 324.–HERDER in Acta Hort. Petrop. **1**: 470. 1872, cum *β. obtusa*.–MACOUN, Cat. Canad. Pl. **2**: 326. 1884.–GRAY, Syn. Fl. N. Amer. **2**(1): 125. 1878.–GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 88. 1895.–HEGI, Ill. Fl. Mitt.-Eur. **5**(3): 1974, n. 2234, ff. 2951–2, t. 214(4). 1927.–RIGG in Amer. Jour. Bot. **24**: 194. 1937.–HULTÉN, Fl. Aleut. 279 & 342. 1937.; Fl. Alaska & Yuk. **8**: 1314. 1948.–ST. JOHN in Amer. Midl. Nat. **26**: 8. 1941, pro parte.–STAIR et PENNELL in Bartonia **24**: 18. 1946.–GROSSHEIM in Fl. URSS **18**: 630, t. 34(3).

1952.

subsp. **cuspidata** (MAXIMOWICZ) HARA in Jour. Fac. Sci. Univ. Tokyo, sect. 3, **6**: 361. 1956.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.

Syn.—

Swertia perennis δ. *cuspidata* MAXIMOWICZ in Bull. Acad. St.-Pétersb. **20**: 434. 1875.-MATSUMURA, Ind. Pl. Jap. **2** (2): 504. 1912.-TAKEDA in Bot. & Zool. **4**: 179, f. 83 (a). 1936.-SATAKE in Jour. Jap. Bot. **21**: 26. 1947.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 215, pl. 65, n. 529, f. 67 (1). 1957. *S. cuspidata* (MAXIMOWICZ) KITAGAWA, Lin. Fl. Mansh. 361. 1939, in nota. *S. obtusa* var. *cuspidata* (MAXIMOWICZ) HARA, Enum. Spermat. Jap. **1**: 142. 1949.-OHWI, Fl. Jap. (ed. 1), 957. 1953.

'*S. perennis* var. *obtusa* GRISEBACH' sensu MIYABE, Fl. Kuril. 251. 1890.-MATSUMURA, Ind. Pl. Jap. **2** (2): 504. 1912.-TATEWAKI in Jour. Jap. Bot. **5**: 39. 1928.

'*S. perennis* γ. *stenopetala* (REGEL et TILING) MAXIMOWICZ' sensu TAKEDA in Bot. & Zool. **4**: 180, f. 84. 1936, quoad pl. ex Hokkaidô.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 216. 1957, quoad pl. ex Hokkaidô.

S. perennis f. *leucantha* TAKEDA, l. c. 180, f. 83 (b). 1936, in textu et nom. nud. *S. obtusa* var. *cuspidata* f. *leucantha* (TAKEDA) HARA, Enum. Spermat. Jap. **1**: 142. 1949.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957, ut subsp. *cuspidata* f. *leucantha*.

Herba perennis, glabra, (5–) 12–30 (–33) cm alta. Radix gracilis, brevis, saepe leviter rhizomata et ornata radiculis gracillimis paucis—multis, colore atrobrunnescens. Caulis erectus, plerumque simplex rare in superiore parte 1–2 ramis ornatus, longitudinaliter quadristriatus. Folia radicalia longe petiolata, petiolis 1–12 cm longis, laminis late lanceolatis—ovatis—late ovatis—subrotundatis, 4–10 cm longis, 1.7–5.5 cm latis, vulgo quinquenerviis vel septemnerviis rare trinerviis, apice obtusis—rotundatis et saepe minutissime mucronulatis, basi cuneatis—rotundatis et in petiolos angustoalatim angustatis; folia caulina inferiora eis radicalibus conformia sed eorum petioli eis foliorum radicalium multo breviores, usque 5 cm longi; folia caulina media et superiora sessilia rare brevissime petiolata, oblonga vel late lanceolata, apice obtusiuscula, trinervia sive subquinquenervia, 1.5–7 cm longa, 0.7–3.5 cm lata, basi in caulem petiolatim angustata et vaginantim semiamplexicaulia, opposita vel alternata. Flores pentameri, 1–7 rare 10 in caulis apice umbellatim corymbose rare in ramorum apicibus dispositi, pedunculati, pedunculis 1–5 cm longis, bracteatis, bracteis latolanceolatis—linearilanceolatis, vulgo 1–3.5 cm longis, calycibus late campanulatis, 6–12 mm longis, profundissime quinquepartitis, sepalis latolinearibus—lanceolatolinearibus, trinerviis, apice acutiusculis, marginibus plus minusve scabris, corollis late campanulatis, nigrescenticaeruleis, 1–2.2 cm longis, profundissime quinquepartitis, lobis oblongolanceolatis vel lanceolatis, in apices versus gradatim angustatis, prope apices longe cuspidatis sed apice vulgo acutiusculis, valde variabilibus, plerumque quinque—septemnerviis, prope bases glandulis duabus

0.5–1 mm in diametro (a basibus ca. 1–1.8 mm) ornatis, eis fimbrillis capillaribus 1–3 mm longis circumdatis, staminibus 4–8 mm longis, filamentis linearibus, antheris late oblongis vel oblongis, 1.7–2.5 mm longis, pistillo uno, ovario sessile unilocularique, stylo nullo, stigmate bipartito. Capsulae corollas haud superantes, seminibus secus margines anguste alatis.

Nom. Jap. Miyama-akebonosô, Komagatake-akebonosô, Yezo-miyamaakebonosô, Kita-miyamaakebonosô.

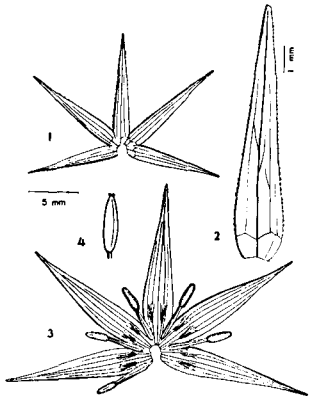

Fig. 19. *Swertia perennis* subsp. *cuspidata*: 1. Open calyx, 2. Calyx-lobe, 3. Open corolla, and 4. Pistil.

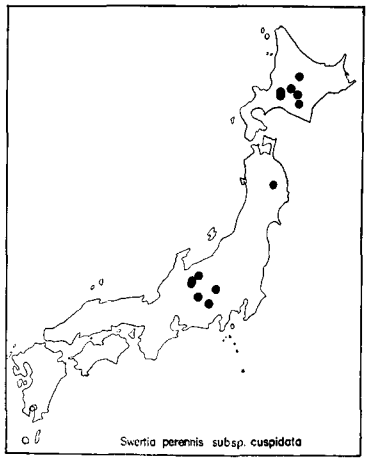

Fig. 20. Distribution of *Swertia perennis* subsp. *cuspidata*.

Specim. exam.

Hokkaidô. Prov. Ishikari: Kuro-dake, Taisetsu-san montium (aug. 1951. M. HIROE-KYO). Taisetsu-san (aug. 1928. S. AKIYAMA; aug. 1956. H. TOYOKUNI). Yûpari-dake (aug. 1954. H. TOYOKUNI; aug. 1959. H. TOYOKUNI; aug. 1960. H. TOYOKUNI). Ashibetsu-dake (julio, 1948. N. SUGIHARA-TI).

Honshû. Prov. Rikuchû: Hayachine-san (aug. 1894. U. FAURIE-KYO; aug. 1903. S. MASADA-KYO; julio, 1936. H. MUROI-KYO; julio, 1954. M. KIKUCHI). Prov. Shinano: Yoko-dake, Yatsuga-take montium (aug. 1907; aug. 1928. J. OHWI-KYO). Yatsuga-take (aug. 1906. H. SAKURAI-TNS; julio, 1928. K. INAGAKI). Shirouma-dake (aug. 1902. Y. YABE-TNS; aug. 1921. S. MIKI-KYO; aug. 1936. K. HISAUCHI-TI). Kita-dake (aug. 1954. H. MATSUDA-TI). Sampuku-tôge (aug. 1937. H. KUBOTA-TNS). Prov. Etchû: Tsurugi-dake (aug. 1936. S. YOSHIZAWA-KYO). Prov. Kai: Aka-dake (aug. 1902. B. HAYATA). Prov. Suruga: Akaishi-dake (aug. 1938. J. MASADA-KYO).

Area geogr. Japonia (ab Hokkaidô usque Honshû med.).

Typus: 'Hab. in monte Fudzi-yama ins. *Nippon* (Tschonoski! 1864. fl.)' (in LE).

The Japanese representative was separated at first from the European

species, *Swertia perennis*, by MAXIMOWICZ in 1875 as a variety. He compared the Japanese one with another variety of his, *γ. stenopetala*, and said, 'petala fere var. *γ. stenopetalae* Rgl. (ex *Ajan* et *Sitka*), sed valde acuminata'. Although he cited the habitat of his var. *δ. cuspidata* as 'in monte Fudzi-yama', it may be wrong, because there are neither specimens of the plant collected on Mt. Fuji nor evidence of its occurrence on the mountain; the specimen may have been collected on some other mountain. The taxonomic status of the Japanese representation of *Swertia* proposed by MAXIMOWICZ had been accepted by Japanese botanists until TAKEDA in 1933 reported that the Honshû plant belonged to var. *cuspidata*, but the Hokkaidô one to var. *stenopetala*. His opinion was again emphasised in his later work of 1936, and was taken up by SATAKE in 1947, while HARA, in 1949, transferred var. *cuspidata* to *S. obtusa* and revived *S. obtusa* var. *stenopetala* REGEL et TILING for the type distributed in the Kuriles and Saghalien, but he doubted the occurrence of the true *stenopetala* in Hokkaidô. His new combination was seemingly based on MAXIMOWICZ's note '*Sw. perennis* L. *β. obtusa* Led. (petalis obtusis) in *Caucaso* rarior, ab *Ural*, *Altai* ad *Dahuriam* optime evoluta, orientem versus jam obscurior et in typicam transiens, est forma *δ. cuspidatae* opposita, *Asiae* centrali propria'. However, LEDEBOUR compared his plant with *S. perennis* in the original description of *S. obtusa* in 1812, and said, 'corollis majoribus: laciniis multo latioribus apice rotundatis, obtusis'; and he also described in his 'Flora Rossica 3', the nature of the corolla in detail, namely, 'corollae segmentis ellipticis utrinque rotundatis v. apice retusis, foveolis binis distantibus suborbiculatis fimbriato-marginatis; fimbriis erectis foveolarum diametro triplo v. quadruplo longioribus'. According to the above description, our plant is less closely allied to *S. obtusa* than to *S. perennis*. And the figures of *S. obtusa* given by GROSSHEIM (1952) confirm this strongly. Probably for such reason, HARA (1956) again transferred var. *cuspidata* to *S. perennis*, giving it, this time, the rank of subspecies. In the same paper, he regarded var. *stenopetala* as being different from the Japanese plant. As the original description of REGEL and TILING (1859) runs, 'corollae segmentis oblongo-lanceolatis, subacutis', this variety seems to bear some resemblance to the Hokkaidô type of HARA's subsp. *cuspidata*.

ST. JOHN (1941) and HULTÉN (1948) united LEDEBOUR's *S. obtusa* with *S. perennis*. ST. JOHN finds, 'no basis for segregation in the shape of the corolla lobes or the blades, and in all the leaves are normally opposite, only rarely on a few individuals are the leaves subopposite or even single at one or a few nodes. These few individuals occur with the normal ones and seem to be mere fluctuations'. But, in our meterials, there exists a clear cut-line of

demarcation between *S. perennis* subsp. *perennis* and subsp. *cuspidata*, though a good many fluctuations can be observed within the latter subspecies, as regards the shape of corolla, the correlation between the calyx-length and the corolla-length, etc.

Genus 5. **Lomatogonium** A. BRAUN

Lomatogonium A. BRAUN in Flora **13**: 221. 1830.–REICHENBACH, Fl. Germ. Excurs **1** (3): 421. 1831.–FERNALD in Rhodora **21**: 193 et 194. 1919.–HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1976. 1927.–HARA, Enum. Spermat. Jap. **1**: 138. 1949.–GROSSHEIM in Fl. URSS **18**: 620. 1952.

Syn.—

Swertia LINNAEUS, Sp. Pl. (ed. 1) **1**: 226. 1753, pro min. parte.; Gen. Pl. (ed. 5), 107. 1754, pro min. parte.

Pleurogyna ESCHSCHOLZ ex CHAMISSO et SCHLECHTENDAL in Linnaea **1**: 187. 1826, pro syn.-G. DON, Gen. Hist. **4**: 188. 1838.–LING, Fl. Ill. N. Chine **2**: 4. 1933.

Pleurogyne ESCHSCHOLZ ex GRISEBACH, Observ. Gent. 31. 1836.; Gen. et Sp. Gent. 309. 1839.

Narketis RAFINESQUE, Fl. Tellur. **3**: 26. 1837, pro parte.

Swertia subg. *Lomatogonium* (A. BRAUN) SATAKE in Jour. Jap. Bot. **20**: 338. 1944.

Herbae annuae sive biennes, glaberrimae, laeves. Radix brevis, gracilis, simplex vel aliquot ramosa. Caulis erectus, simplex aut in parte inferiore mediave ramosus, rare a basi ramosissimus, longitudinaliter quadriangulatus. Folia radicalia sub anthesi opposita v. subrosulata rare emarcida. Folia caulina plerumque sessilia, vulgo eis radicalibus majora. Flores in caulis ramorumque apicibus solitarii—bini atque in axillis solitarii—bini, pentameri seu tetrameri, calycibus infundibularibus, tubis brevissimis, corollis infundibularibus, profunde 5–4-partitis, lobis vulgo quinquenerviis, in partibus inferioribus ornatis glandulis binis epipetalis, glandulis fimbriata squama circumdatis, laciniis fimbrillae linearibus nec capillaribus, stigmate secus suturas ovarii decurrente. Semina fusiformia vel oblonga, non alata, laevia.

Nomen genericum ert λῶμα (lóma) et γυνή (gyné).

Typus: *Lomatogonium carinthiacum* REICHENBACH

A. BRAUN (1830) established the genus *Lomatogonium*. This genus was accepted by REICHENBACH and the new combination *L. carinthiacum* (WULFEN) REICHENBACH was published in 1831.

However, the generic name *Pleurogyne* had become rather fixed in a number of local floras enumerating alpine and boreal plants. FERNALD stated in 1919 that *Lomatogonium* was carefully and properly published as a genus, and that *Pleurogyna* was at first published as a synonym.

Some noted authors regard the present genus as identical with the genus

Swertia, but the decurrent stigma, the linear fimbrillae which surround epipetalous glands in pairs, and the oblong or fusiform smooth seeds clearly exhibit the characteristics of a distinct genus.

Lomatogonium carinthiacum is the only representative of the present genus within our boundaries.

Lomatogonium carinthiacum REICHENBACH

[Figs. 21 & 22]

Lomatogonium carinthiacum (WULFEN) REICHENBACH, Fl. Germ. Excurs. **1** (3): 421. 1831.-HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1977, t. 214, f. 5 et ff. 2935 d, 2953, 2955 c. 1927.-HARA in Jour. Jap. Bot. **13**: 27. 1937.; Enum. Spermat. Jap. **1**: 138. 1949.-HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.; ibid. (ed. em.), 207. 1957.-TAKEDA et TANABE et TAKENAKA, Ill. Man. Alp. Pl. Jap. (ed. 1), 104, f. 88. 1950.-GROSSHEIM in Fl. URSS **18**: 620, t. 33 (2). 1952.-POPOV, Fl. Sr. Sib. **2**: 595. 1959.

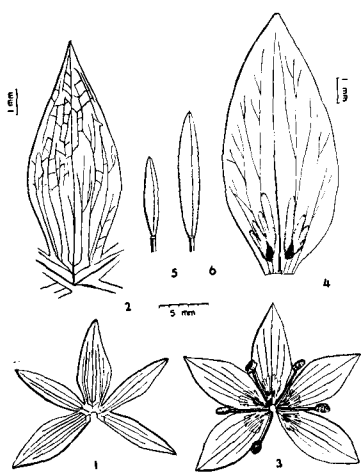

Fig. 21. *Lomatogonium carinthiacum*: 1. Open calyx, 2. Calyx-lobe, 3. Open corolla, 4. Corolla-lobe, and 5 & 6. Pistil.

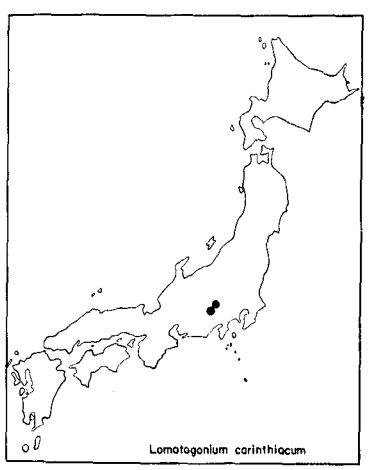

Fig. 22. Distribution of *Lomatogonium carinthiacum*.

Syn.—

Swertia carinthiaca WULFEN in JACQUIN, Misc. Austr. **2**: 53, t. 6. 1781.-SATAKE in Jour. Jap. Bot. **20**: 338. 1944.-OHWI, Fl. Jap. (ed. 1), 955. 1953.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 216. 1957. *Gentiana carinthiaca* (WULFEN) FROELICH, De Gent. 103. 1796. *Pleurogyna carinthiaca* (WULFEN) G. DON, Gen. Hist. **4**: 188. 1838. *Pleurogyne carinthiaca* (WULFEN) GRISEBACH, Gen. et Sp. Gent. 310. 1839.-GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 87. 1895.-MAKINO in Bot. Mag. Tokyo **23**: 90. 1909.-MATSUMURA, Ind. Pl. Jap. **2** (2): 503. 1912.-TAKEDA in Bot. & Zool. **4**: 177, f. 82. 1936.

Gentiana Stelleriana CHAMISSO et SCHLECHTENDAL in Linnaea **1**: 188. 1826. *Lomatogonium carinthiacum* var. *Stellerianum* (CHAMISSO et SCHLECHTENDAL) FERNALD in Rhodora **21**: 197. 1919.

Pleurogyne himalayensis KLOTZSCH ex KLOTZSCH et GARCKE, Bot. Erg. Prinz. Wald. Jahr. 1845 u. 1846, 91, t. 68 (a-f). 1862.

Planta biennis, glaberrima, humilis. Radix brevis, prope apicem ornata nonnulis radiculis. Caulis simplex vel in media caulis parte pauciramosus, viridis vel atropurpureus, quadriangulatus, (2–) 5–15 cm altus. Folia radicalia minima, opposita vel subrosulata, interdum sub anthesi emarcida, spathulata sive rotundatospathulata, 5–8 mm longa, 2–5 mm lata, apice obtusa vel rotundata, basi in caulem petiolatim angustata. Folia caulina inferiora sessilia vel brevissime petiolata, anguste elliptica vel anguste obovata vel spathulatoöbovata, quam ea radicalia majora, usque 13 mm longa. Folia caulina media superioraque ovata vel oblongoövata, 6–13 mm longa, 2–7 mm lata, apice obtusa, basi rotundata, viridia. Flores in caulis ramorumque apicibus solitarii—bini, rarissime in inferioris caulis partis axillis dispositi, pentameri rare tetrameri, 7–20 mm longi, calycibus (5–) 7–10 (–13) mm longis, anguste infundibularibus, profunde quinquepartitis, sepalis oblongoövatis vel latolanceolatis, inaequalibus et tubis 7–9-plo longioribus, 3–5–7–9-nerviis, apicibus acutis vel acuminatis, corollis dilute caeruleis, profunde quinquepartitis, lobis ellipticis vel ellipticoövatis, apice acutis vel acutiusculis, vulgo quinquenerviis, in parte inferiore ornatis epipetalis glandulis binis a basi 0.5–0.7 mm distantibus, glandulis ovatis, ca. 0.5 mm latis, ornatis squama fimbriata, fimbrillis 4–5-partitis, laciniis linearibus, inaequalibus, 1–3 mm longis, staminibus quinque vel quattuor, 4–6 mm longis, filamentis linearibus et in inferioribus partibus intus corollis affixis, antheris ellipticis, ca. 1 mm longis, pistillo uno, ovario sessile et uniloculari, stylo nullo, stigmate secus suturas ovarii ad medium decurrente. Capsulae post anthesin corollis aequilongae vel paulo longiores, seminibus fusiformibus vel oblongis, laevibus, ca. 0.7 mm longis.

Nom. Jap. Hime-semburi.

Specim. exam.

Honshû. Prov. Shinano: Kita-dake (sept. 1953. H. MATSUDA-TI). Prov. Suruga: Inter Senmai-dake et Higashi-dake (sept. 1959. H. TOYOKUNI).

Area geogr. Japonia (Honshû med.), Kamtschatka, Sibiria, Himalaya, Caucasus, Europa (Alp. et Carpath.), etc.

Typus: '…nusquam adhucdum quam in Grosskirchheimii alpibus mihi visa, abunde supra Sagriz & Döllach in altissimis alpium jugis apricis lapidosis inter Mocher & auriferum Waschgang.' (in W ?).

The habit of the present species is similar to that of the next one, *Comastoma pulmonarium* subsp. *sectum*.

Genus 6. **Comastoma** TOYOKUNI

Comastoma TOYOKUNI in Bot. Mag. Tokyo **74**: 198. 1961.; in Acta Phytotax. Geobot. **20**: 137. 1962.

Syn.—

*Gentiana**** *Endotrichae* FROELICH, De Gent. 86. 1796, pro parte.-MURBECK in Acta Hort. Berg. **2**(3): 1. 1892, ut sectio, pro parte.

*Gentiana*** *Amarella* GAUDIN, Fl. Helv. **2**: 270. 1828, pro parte.-GRISEBACH, Gen. et Sp. Gent. 238. 1839, ut sectio, pro min. parte.

Gentiana sect. *Comastoma* WETTSTEIN in Österr. Bot. Zeitschr. **46**: 174. 1896.-HEGI, Ill. Fl. Mitt.-Eur. **5**(3): 1983. 1927.-GROSSHEIM in Fl. URSS **18**: 613. 1952. *Lomatogonium* sect. *Comastoma* (WETTSTEIN) Á. et D. LÖVE in Acta Hort. Gotob. **20**: 117. 1956. *Gentianella* subg. *Comastoma* (WETTSTEIN) GILLETT in Ann. Miss. Bot. Gard. **44**: 262. 1957.-SATAKE in Bull. Nat. Sci. Mus. **43**: 276. 1959.

Herbae annuae aut biennes, humiles, glaberrimae et laeves. Radices tenues, breves, simplices vel aliquot ramosae. Caules simplices vel ramosi vel fasciculati, quadriangulati, laeves. Folia radicalia sub anthesi rosulata vel subrosulata, parva, foliis caulinis oppositis. Flores 4–5-meri, in caulium ramorumque apicibus vulgo solitarii, longepedunculati, calycibus cylindricoinfundibularibus v. infundibularibus, 4–5-partitis, tubis brevissimis, lobis vulgo inaequalibus, marginibus minute scabriusculis et interdum rugosorepandis, corollis cylindricocampanulatis, prope bases glandulis epipetalis cum staminibus alternatis in pari instructis, apicibus 4–5-lobatis, ad bases loborum squamis fimbriatis et bifissis nec fibris vasalibus percurrentibus ornatis, fimbrillis squamellarum linearibus et vulgo obtusis, filamentis plerumque minute pilosellis, pistillo uno, ovario uniloculari, stylo nullo, stigmate bipartito, brevissimo. Semina subglobosa, parva, numerosa, laevia.

Typus: *Comastoma tenellum* TOYOKUNI

In 1896, WETTSTEIN separated this group from the section Amarella of *Gentiana* as a distinct section. This treatment was accepted by many authors until 1956, when Á. and D. LÖVE transferred it to *Lomatogonium*, giving emphasis on its chromosome number. As has been stated by Á. and D. LÖVE (1956 & 1961), the haploid number of chromosomes of both *Lomatogonium rotatum* and so-called *Gentianella tenella* is actually 5, but the form of stigma, the number of vascular bundles in each corolla-lobe and the position and shape of fimbriated scales at corolla-orifice draw a clear cut-line of demarcation between the two genera. GILLETT, on the other hand, considered the present genus as a subgenus of *Gentianella*; in the genus *Gentianella*, however, the fimbriated scales at corolla-orifice are run through by vascular bundles and the epipetalous gland is always only one, not occurring in pairs.

About 7 species of the present genus are known from the circumboreal

or alpine regions of the Northern Hemisphere. However, only one has hitherto been reported from Japan.

Comastoma pulmonarium TOYOKUNI subsp. **sectum** TOYOKUNI

[Figs. 23~25]

Comastoma pulmonarium [subsp. pulmonarium] (TURCZANINOW) TOYOKUNI in Bot. Mag. Tokyo **74**: 198. 1961.

Syn.—

Gentiana Pulmonaria TURCZANINOW in Flora **1** Beibl. 19. 1834, nom. nud.; in Bull. Soc. Nat. Mosc. **22**: 317. 1849.-LEDEBOUR, Fl. Ross. **3**: 55. 1847.-GROSSHEIM in Fl. URSS **18**: 614. 1952. *Gentianella pulmonaria* (TURCZANINOW) H. SMITH in HANDEL-MAZZETTI, Symb. Sin. **7**(4): 980. 1936.

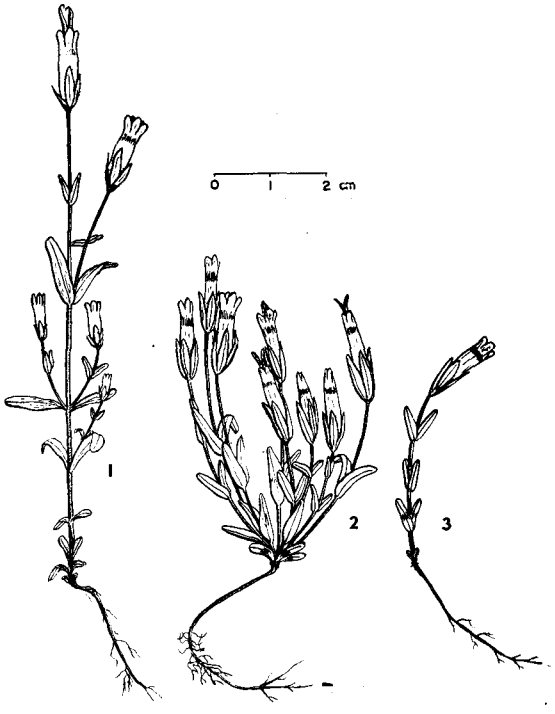

Fig. 23. *Comastoma pulmonarium* subsp. *sectum*: 1-3. Habit.

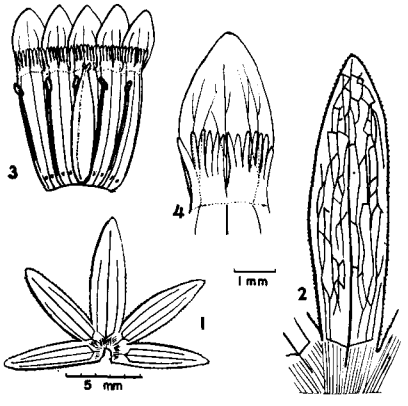

Fig. 24. *Comastoma pulmonarium* subsp. *sectum*: 1. Open calyx, 2. Corolla-lobe, 3. Open coroila, and 4. Corolla-lobe.

'*Gentiana tenella* ROTTBØLL' sensu GRISEBACH in DE CANDOLLE, Prodr. **9**: 98. 1845.

subsp. **sectum** (SATAKE) TOYOKUNI, l. c.

Syn.—

Gentiana Takedai var. *secta* SATAKE in Jour. Jap. Bot. **16**: 423, f. 2. 1940.-HARA, Enum.

Spermat. Jap. **1**: 135. 1949.-TAKEDA et TANABE et TAKENAKA, Ill. Man. Alp. Pl. Jap. (ed. 1), 102. 1950, in nota. *G. secta* (SATAKE) OHWI in Bull. Nat. Sci. Mus. **33**: 83. 1953.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.-SATAKE in Natur. Sci. Mus. **24**: 144. 1957.-TAKEDA, Alp. Fl. Jap. (ed. 1), 14. 1959, in nota. *Gentianella secta* (SATAKE) SATAKE in Bull. Nat. Sci. Mus. **43**: 277. 1959. *Gentianella pulmonaria* subsp. *secta* (SATAKE) TOYOKUNI in Jour. Jap. Bot. **35**: 226. 1960.

Herba biennis seu annua, glaberrima, sublaevis. Radix tenuis, gracilis, ad 4 cm longa, apice radiculos tenuissimos paucos emittens. Caulis erectus seu ascendens, gracilis, glaber, indistincte quadristriatus, inferioribus superioribusque in partibus interdum a basi ramosus rare simplex, cum inflorescentiis 5–20 cm altus. Folia radicalia sub anthesi emarcida rare viva subrosulata; folia caulis ramorumque opposita, submembranacea, angustoöblonga aut oblongospathulata aut late lanceolata, (0.5–) 0.8–2 (–2.2) cm longa, (2–) 4–8 (–10) mm lata, apice obtusa sive rotundata, basi rotundata, sessilia, margine saepe scabriuscula. quinquenervia sed nervi laterales interdum vix distincti. Flores 1–20, in caulis ramorumque apicibus singuli, pedunculati, pedunculis 5–18 mm longis, laevibus, calycibus infundibularibus, 4–7 mm longis, profunde quinquepartitis, sepalis inaequalibus, margine minute scabriusculis, apice acutiusculis seu obtusiusculis et interdum acuminatis, tubis calycis 0.5–1 mm longis, corollis cylindricocampanulatis, colore pallide caeruleis, 11–15 mm longis, in fauce squamis fimbriatis bifissis instructis, fimbrillis brevibus, ca. 1.7 mm longis, linearibus, albis, apicem versus non angustatis et apice obtusiusculis, lobis corollae ovalibus, quam tubi 1/3-plo longioribus, obtusis, subaequalibus, prope bases glandulis epipetalis binis ornatis, staminibus ca. 9 mm longis, filamentis linearibus, antheris oblongis, pistillo uno, fusiformi, stigmate bipartito, parvo, stylo nullo, ovario sessile et uniloculari. Capsulae sessiles, primum corollis vix longiores sed demum secundum incrementum eis multo longiores esse vertantes, seminibus brunnescentifulvis, ellipsoideis, laevibus lucidisque, ca. 0.7 mm in diametro.

Nom. Jap. Sampuku-rindô (SATAKE, 1940).

Specim. exam.

Honshû. Prov. Shinano: Sampuku-tôge (sept. 1938. H. KUBOTA-TNS, 'holotypus'; sept. 1940. H. KUBOTA). Arakawa-dake (sept. 1953. T. YAMAZAKI-TI & TNS; sept. 1959. H. TOYOKUNI). Prov. Suruga: Senmai-dake (aug. 1938. J. MASADA-KYO). Inter Higashi-dake et Arakawa-dake (sept. 1959. H. TOYOKUNI).

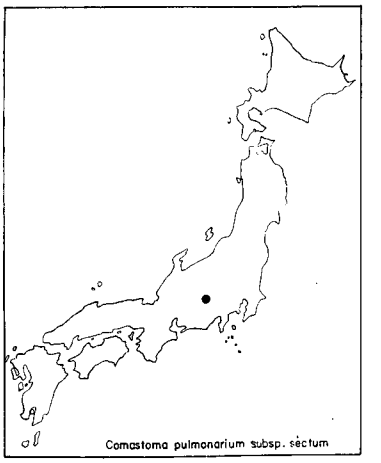

Fig. 25. Distribution of *Comastoma pulmonarium* subsp. *sectum*.

Area geogr. Endemica (Honshû med).

Typus: 'Honsyû: Prov. Sinano, Sanpuku-pass near mt. Toyokuti-yama (H. KUBOTA, Sept. 1938, n. 9—type in Herb. Tokyo Sci. Museum.)' (in TNS).

This lovely plant was discovered on Sampuku Pass by H. KUBOTA in 1938. The plant was regarded at first as a variety of *Gentiana Takedai* (=*Gentianella yuparensis* subsp. *takedai*=) in 1940, but later in 1953, it was regarded as a good species. However, as this plant seems not so far from *Comastoma pulmonarium*, a continental species, the present author transferred it to a subspecies of the above continental species.

Genus 7. **Gentianella** MOENCH

Gentianella MOENCH, Meth. Pl. 482. 1794. emend. SCHUSTLER in Věstn. 1. Sjezdu Česk. Bot. v Praze, 34. 1923, pro parte.–H. SMITH in HANDEL-MAZZETTI, Symb. Sin. **7** (4): 979. 1936, pro parte.; in HYLANDER, Syst. u. Nomenkl. St. N. Gefässpfl. 48. 1945, pro parte.–D. LÖVE in Hereditas **39**: 226. 1953, pro parte.–Á. et D. LÖVE in Acta Hort. Gotob. **20**: 156. 1956.–GILLETT in Ann. Miss. Bot. Gard. **44**: 208. 1957, excl. subg. *Eublephis* et *Comastoma*.–SATAKE in Bull. Nat. Sci. Mus. **43**: 273. 1959, excl. subg. *Eublephis* et *Comastoma*.

Syn.—

Gentiana LINNAEUS, Sp. Pl. (ed. 1) **1**: 227. 1753, pro parte.; Gen. Pl. (ed. 5), 107. 1754, pro parte.

'*Anthopogon* NECKER' sensu RAFINESQUE, Fl. Tellur. **3**: 25. 1837, pro parte.

*Gentiana**** *Endotrichae* FROELICH, De Gent. 86. 1796, pro parte.–MURBECK in Acta Hort. Berg. **2** (3): 1. 1892, ut sectio, pro parte.

*Gentiana*** *Amarella* GAUDIN, Fl. Helv. **2**: 270. 1828, pro parte.–GRISEBACH, Gen. et Sp. Gent. 238. 1839, pro parte.

Perimelitae HUXLEY in Jour. Linn. Soc. **24**: 103. 1888, pro parte.

Gentiana subg. *Gentianella* (MOENCH) KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 3. 1894, pro parte.; in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 85. 1895, pro parte.; in Acta Hort. Petrop. **15**: 7. 1896, pro parte.–HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1983. 1927, excl. sect. *Comastoma* et *Crossopetalum*.–GROSSHEIM in Fl. URSS **18**: 590. 1952, excl. sect. *Crossopetalum Comastoma*-que.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 117. 1956, pro parte.; in Hokuriku Jour. Bot. **6**: 33. 1957, pro parte.

Herba annua sive biennis. Radix plerumque erhizomata, brevis, gracilis. Caulis inferiore in parte ramosissimus aut fasciculatus aut simplex, vulgo quadri-angulatus, fulvoviridis. Folia radicalia sub anthesi emarcida vel opposita vel rosulata, foliis caulinis oppositis, vix verticillatis. Flores vulgo parvi, 5- seu 4-meri (rare 6–8-meri), in caulis ramorumque apicibus dispositi, calycibus membrana internali destitutis, apicibus 5–4(rare 6–8)-dentatis v. -fidis, corollis 5–4(rare 6–8)-lobatis, in fauce squamis fimbriatis et fibris vasalibus percurrentibus ornatis

(series Amarellae) sive eis deficientibus (series Arctophilae), fimbrillis capillaribus, inaequalibus, marginibus vulgo scabris, basibus corollae glanduliferis, glandulis lobis aequinumeris et cum staminibus alternatis, lobis corollae ovatis aut triangulariovatis aut oblongis et plerumque 5-nervigeris (1-principalibus et 4-lateralibus), staminibus intus corollis affixis, antheris oblongis, filamentis linearifusiformibus, glabris, pistillo uno, ovario uniloculari, plerumque non stipitato rare brevistipitato. Capsulae plerumque sessiles, post anthesin corollas superantes, in segmenta duo dehiscentes. Semina parva, subglobosa, laevia, 1 mm in diametro.

Typus: *Gentianella campestris* BÖRNER (=*G. tetrandra* MOENCH=)

This genus including a considerable number of species is one of the largest genera in the Gentianaceae. Among the European species of the present genus, some have been proved to have both aestival and autumnal life forms: the former has elongated and less branched stems, and flowers from May to July, while the latter having lower but thick and much branched stems flowers from August to October. But the Japanese members of the present genus are found either in alpine or in subarctic regions, where they can not remain alive for such a long period to exhibit seasonal dimorphism without being covered with snow. This, the author thinks, is the reason why seasonal dimorphism has not been found among the Japanese members of the genus.

Two species including one subspecies have hitherto been reported from our boundaries.

Clavis specierum subspecieique

1. Sepala cordata v. ovatocordata, apice obtusa, basi plus minusve auriculata, eorundemque longitudo latitudine plerumque aequans . . . *G. auriculata*
1. Sepala linearilanceolata v. oblongolanceolata, apice acuta vel acuminata, basi non auriculata, eorumque longitudo latitudine semper longe longior . . . . . *G. yuparensis* 2
2. Flores vulgo quinarii, corollis vulgo 18–30 mm longis, intus minus pilosis, calycibus usque ad 22 mm longis, eorumque lobis tubo duplo–quadruplo longioribus, rarissime subaequilongis, vulgo linearilanceolatis . . . . . subsp. *yuparensis*
2. Flores quinarii vel tetrameri, corollis 16–23 mm longis, lobis eorumque vulgo oblongolanceolatis tubo paulo brevioribus v. aequilongis . . . . . subsp. *takedai*

Gentianella auriculata GILLETT

[Figs. 26 & 27, Plate II (7)]

Gentianella auriculata (PALLAS) GILLETT in Ann. Miss. Bot. Gard. **44**: 261.

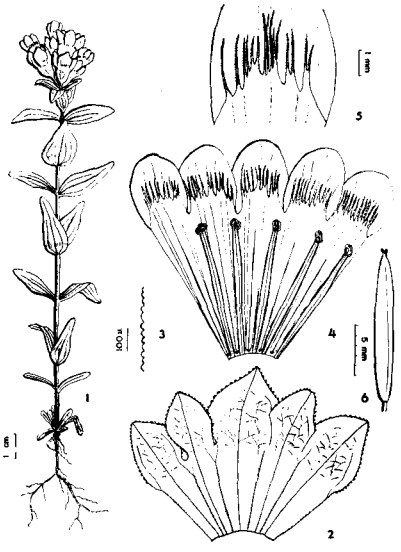

Fig. 26. *Gentianella auriculata*: 1. Habit, 2. Open calyx, 3. Margin of the calyx-lobe, 4. Open corolla, 5. Corolla-lobe with fimbrillae, and 6. Pistil.

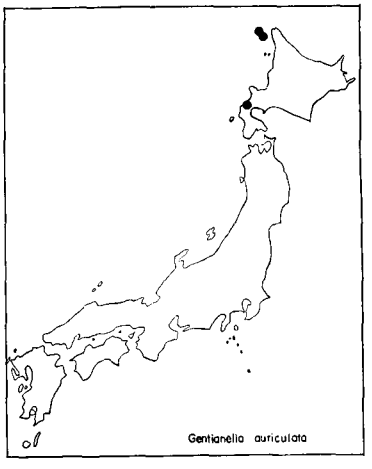

Fig. 27. Distribution of *Gentianella auriculata*.

1957.–SATAKE in Bull. Nat. Sci. Mus. **43**: 274. 1959.

Syn.—

Gentiana auriculata PALLAS, Fl. Ross. **1**(2): 102, t. 92, f. 1. 1789.–GRISEBACH, Gen. et Sp. Gent. 248. 1839, cum *β. flexuosa.*; in DE CANDOLLE, Prodr. **9**: 97. 1845.–FR. SCHMIDT, Reis. Amurl. u. Sachal. 160. 1868.–MATSUMURA, Ind. Pl. Jap. **2**(2): 500. 1912.–KUDO, Fl. Param. 150. 1922.–HULTÉN, Fl. Kamtchat. **4**: 62. 1930.; Fl. Alaska & Yuk. **8**: 1302. 1948.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 946. 1931.–TATEWAKI in Jour. Fac. Agr. Hokkaido Imp. Univ. **29**: 208 et 234 et 256 et 270 et 285 et 300. 1933.; in Bull. Biogeogr. Soc. Jap. **4**: 294. 1934.–HARA, Enum. Spermat. Jap. **1**: 132. 1949.–GROSSHEIM in Fl. URSS **18**: 601. 1952.–OHWI, Fl. Jap. (ed 1), 950. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 118. 1956.–SATAKE in Natur. Sci. Mus. **24**: 144. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 219. 1957.

G. Fauriei LÉVEILLÉ et VANIOT ex LÉVEILLÉ in Bull. Soc. Bot. France **53**: 648. 1906.–MATSUMURA, Ind. Pl. Jap. **2**(2): 500. 1912.

G. auriculata f. *albiflora* TATEWAKI in Jour. Fac. Agr. Hokkaido Imp. Univ. **29**: 256 et 285. 1933, nom. nud.–HARA. Enum. Spermat. Jap. **1**: 132. 1949. *Gentianella auriculata* f. *albiflora* (TATEWAKI) SATAKE, l. c. 275. 1959.

G. auriculata f. *intercedens* TOYOKUNI, mss. in Herb. SAP., quoad pl. ex monte Oh-hira.

Herbae annuae vel biennes, glabrae. Radices simplices vel aliquot ramosae raro crebre ramosae, ad 10 cm longae, radiculis tenuibus, gracilibus, elongatis. Caules saepe subcrassi subligneosique, ad 4 mm in diametro, cum inflorescentiis

5–30 cm alti, obsoletissime quadriangulati, simplices sive ramosi, glabri. Folia radicalia parva, oblanceolata vel spathulata, opposita rare subrosulata, apice obtusa vel rotundata, basi petiolatim attenuata, ad 1 cm longa, ad 4 mm lata, uninervia, caulinis iis inferioribus iis radicalibus conformibus sed paulo majoribus et trinerviis, caulinis medianis superioribusque iis ovalibus vel late lanceolatis vel anguste ovalibus, apice acutiusculis vel obtusiusculis, basi rotundatis et in caules subito angustatis, sessilibus, margine minutissime scabriusculis, trinerviis, 1–3 cm longis, 5–15 mm latis, ascendentipatentibus. Flores in caulis ramorumque apicibus solitarii—pauci, brevipedunculati vel sessiles, pedunculis usque 1 cm longis, calycibus 7–16 mm longis, infundibularibus, minute 5-alatis, ad medium 5-lobatis, sepalis late ellipticis vel late ovatis vel lanceolatis, 4–8 mm longis, apice acutiusculis, basi plus minusve auriculatis rarissime vix auriculatis, corollis lilacinoviolaceis, 15–30 mm longis, tubosocampanulatis, in fauce squamis fimbriatis ornatis, fimbrillis subaequalibus sive inaequalibus, lobis corollae 1/3-plo longioribus, in apicem versus acicularianguststis, apice acutissimis, corollae lobis ovatis—oblongis, 6–8mm longis, apice rotundatis vel obtusis, sub anthesi patentibus seu leviter reflexis, staminibus tubis corollae subaequilongis, filamentis fulvis, complanatolinearibus, antheris atris, triangularioblongis, ca. 1 mm longis, pistillo uno, staminibus paulo longioribus, stigmate bipartito, parvo, stylo nullo, ovario primum brevissime stipitato, sed secundum incrementum demum sessile. Capsulae corollis persistentibus subaequilongae sive quam eae paulo longiores, sessiles, seminibus ellipsoideis, laevibus.

Nom. Jap. Chishima-rindô (MIYABE, 1893).

Specim. exam.

Hokkaidô. Prov. Kitami: Rebun-tô (aug. 1899. U. FAURIE-KYO, 'isotypus *G. Fauriei*'). Skoton, Rebun-tô (aug. 1960. H. TOYOKUNI). Rishiri-dake, Rishiri-tô (aug. 1949). Prov. Shiribeshi: Oh-hira-yama (aug. 1954. T. IGARASHI et S. WATANABE).

Area geogr. Japonia (Hokkaidô), Kuriles, Sachalin, Aleutiae, regiones frigidae continentis Asiae orientalis, etc.

Typus: 'In locis herbidis et palustribus circa mare Ochotense atque Penshinense, ut et per omnem Camtschatcam insulasque versus Japoniam et Americam sitas, imo usque in Americae littus, frequens planta' (in LE).

Two types are encountered within the present species: one agrees well with the original description and drawings of PALLAS, but the other is taller and more robust, of which the flowers usually are much larger and their calyx-lobes are from time to time not auriculate; this form is found in Saghalien as well as on Mt. Oh-hira in Hokkaidô, and seems to be interconnected with the former.

Gentianella yuparensis SATAKE

[Figs. 28~33, Plate II (5)]

Gentianella yuparensis [subsp. yuparensis] (TAKEDA) SATAKE in Bull. Nat. Sci. Mus. **43**: 275. 1959.

Syn.—

Gentiana yuparensis TAKEDA in Notes Roy. Bot. Gard. Edinb. **8**: 234. 1915.; Kôzan-shokubutsu-Dzui (ed. 1), 15, pl. 67. 1933.; in Bot. & Zool. **3**: 2212, f. 80. 1935.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 950. 1931.–HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.; ibid. (ed. em.), 206. 1957.–HARA, Enum. Spermat. Jap. **1**: 136. 1949.–OHWI, Fl. Jap. (ed. 1), 951. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 118. 1956, excl. pl. ex monte Makkari-nupri.–SATAKE in Natur. Sci. Mus. **24**: 144. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 219. 1957, in textu.–S. WATANABE in Jour. Geobot. **7**: 17. 1958.

Fig. 28. *Gentianella yuparensis* subsp. *yuparensis*: 1–3. Habit.

Gentiana yezoalpina KOIDZUMI in Bot. Mag. Tokyo **30**: 79. 1916.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 950. 1931. *G. yuparensis* var. *yezoalpina* (KOIDZUMI) KUDO, Med. Pl. Hokkaidô, t. 73. 1922, in nota.

G. yuparensis f. *albiflora* MIYABE et TATEWAKI in Trans. Sapporo Nat. Hist. Soc. **13**: 70. 1933.–HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.; ibid. (ed. em.), 206. 1957.–HARA, Enum. Spermat. Jap. **1**: 137. 1949.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 118. 1956. *Gentianella yuparensis* f. *albiflora* (MIYABE et TATEWAKI) SATAKE, l. c. 276. 1959.

Gentianella yuparensis f. *gigantea* TOYOKUNI, mss. in Herb. SAP., quoad pl. ex parte inferiore montis Yûpari.

Herba annua, glabra, sublaevis. Radix tenuis, avellaneocremea, ad 8 cm longa, aliquot ramosa, radiculis saepe fuliginescentibus et interdum iterum aliquot ramulosis. Caulis erectus, 4–40 cm altus, a

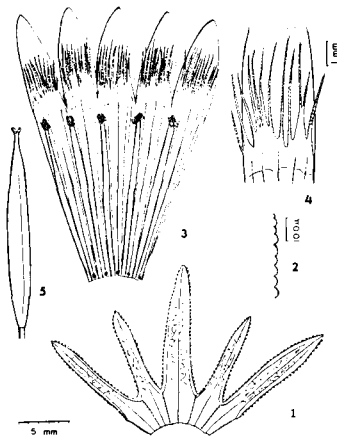

Fig. 29. *Gentianella yuparensis*: 1. Open calyx, 2. Margin of calyx-lobe, 3. Open corolla, 4. Corolla-lobe with fimbrillae, and 5. Pistil.

basi vel a caulis parte ramosus rare simplex, ramis caulibus plerumque tenuibus, dilute viridibus, caulibus ramisque anguste quadriangulatis. Folia basalia sub anthesi vulgo viva, opposita, duo rare pluria et subrosulata, oblonga vel spathulata, parva, abbreviata, 5–20 mm longa, 2–8 mm lata, utrinque intense viridia, apice obtusa vel rotundata, basi in caulem petiolatim angustata, sessilia et articulatim vaginantimve connata, secus margines saepe abbreviatoundulata, foliis caulinis inferioribus eis basalibus conformibus sed majoribus, usque ad 3 cm longis, uni- sive trinerviis, caulinis mediis superioribusque eis oppositis, ovatis vel angustoövatis, sessilibus, apice acutiusculis v. obtusiusculis v. obtusis, basi rotundatis, semiamplexicaulibus, tri—quinquenervigeris, 1–4 cm longis, 5–15 mm latis, margine scabriusculis, utrinque intense viridibus, foliis ramorum eis caulis similibus, sed minoribus et acutioribus, apice vulgo acutis. Flores in caulis ramorumque apicibus plerumque singuli, magnitudine valde inaequales, vulgo quinarii rarius tetrameri sive sexnati, pedunculati, pedunculis subnullis, tenus 7 mm longis, laevibus, paucistriatis, dilute viridibus, interdum purpurascentibus, calycibus (5–) 7–20 (–25) mm longis, infundibularibus, foliis concoloribus, profunde quinquepartitis, tubis brevissimis, 2–6 mm longis, dorso subcarinatis, in pedunculos gradatim acutatis, sepalis magnospere inaequalibus, 7–20 mm longis, 1–4 mm latis, linearibus v. linearilanceolatis v. lanceolatis, apice acutis vel acutissimis, margine scabriusculis, corollis (10–) 15–25 (–30) mm longis, violaceocyaneis v. purpurascentibus, cylindricocampanulatis, intus pilosellis, in fauce squamis fimbriatis ornatis, fimbrillis valde inaequalibus, tenuibus, apicem versus longe attenuatis, ca. 10 mm longis, lobis corollae ellipticis v. ovatoëllipticis v. late lanceolatis, quam tubi duplo brevioribus, apice rotundatis vel acutiusculis, sub anthesi subholizontaliter patentibus, staminibus tubis corollae paulo longioribus vel subaequilongis, filamentis linearicomplanatis, antheris triangularioblongis, atris, ca. 1.5 mm longis, pistillo uno, fusiforme, stylo nullo, stigmate bipartito, parvo, ovario uniloculare, vix stipitato. Capsulae sessiles, corollas persistentes superantes, seminibus parvis, ellipsoideis, laevibus, ca. 1 mm longis.

Nom. Jap. Yûpari-rindô, Yezo-onoërindô (KOIDZUMI, 1916), Usuaka-rindô.

Specim. exam.

Hokkaidô. Prov. Ishikari: Taisetsu-san montes; Hakuun-dake (aug. 1959. H. TOYOKUNI; aug. 1961. H. TOYOKUNI; aug. 1962. H. TOYOKUNI), Chûbetsu-dake (aug. 1927. H. KOIDZUMI-TNS), Kuro-dake (aug. 1924. H. KOIDZUMI-TNS). Yûpari-dake (aug. 1954. S. NOSAKA et H. TOYOKUNI; aug. 1956. S. NOSAKA; aug. 1957. H. TOYOKUNI et S. NOSAKA). Prov. Tokachi: Nipesotsu-zan (aug. 1957. S. WATANABE).

Area geogr. Endemica (Hokkaidô med.).

Typus: 'Alpine region of Yuparo Mountains, Yezo (H. Yanagisawa. 8th August 1913)' (in E; isotypus in SAPA).

subsp. **takedai** (KITAGAWA) TOYOKUNI in Jour. Geobot. **10**: 6. 1961.

Syn.—

'*Gentiana auriculata* PALLAS' sensu YABE in Bot. Mag. Tokyo **17**: 24. 1903.

'*G. Amarella* var. *uliginosa* GRISEBACH' sensu TAKEDA in Bot. Mag. Tokyo **19**: (290). 1905.; in Bot. & Zool. **3**: 2211, f. 79 (a, b). 1935.

'*G. Amarella* LINNAEUS' sensu MAKINO et NEMOTO, Fl. Jap. (ed. 1), 344. 1925.

G. Takedai KITAGAWA in Bot. Mag. Tokyo **51**: 156. 1937.-HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.-HARA, Enum. Spermat. Jap. **1**: 135. 1949.-OHWI, Fl. Jap. (ed. 1), 951. 1953.-SATAKE in Natur. Sci. Mus. **24**: 144. 1957. *G. yuparensis* subsp. *Takedai* (KITAGAWA) TOYOKUNI in Acta Phytotax. Geobot. **16**: 118. 1956.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 219, pl. 66, n. 536. 1957. *Gentianella Takedai* (KITAGAWA) SATAKE in Bull. Nat. Sci. Mus. **43**: 276. 1959.

Gentiana Takedai f. *leucantha* HAYASHI in Jour. Jap. Bot. **29**: 199. 1954.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957, ut subsp. *Takedai* f. *leucantha*.

Gentianella Takedai f. *arakawaensis* (YAMAZAKI) SATAKE, l. c. *Gentiana Takedai* f. *arakawaensis* YAMAZAKI ex SATAKE, l. c. pro syn.

Planta humilior, 5–20 cm alta, caule vulgo simplice, saepe ramoso, tenuiore, floribus minoribus, plerumque 16–23 mm longis, calycibus cylindricocampanulatis, sepalis latioribus, ovatoöblongis, apice obtusis—acutiusculis, tubis aequilongis seu paulo longioribus, margine scabriusculis.

Nom. Jap. Onoë-rindô (TAKEDA, 1905), Okuyama-rindô.

Specim. exam.

Hokkaidô. Prov. Shiribeshi: Yôtei-zan (aug. 1951. H. TOYOKUNI; aug. 1958. H. TOYOKUNI; aug. 1960. H. TOYOKUNI).

Honshû. Prov. Shinano: Yatsuga-dake (aug. 1913. U. FAURIE-KYO; aug. 1922. H. KOIDZUMI-TNS). Shirouma-dake (aug. 1902. Y. YABE-TI, 'holotypus'; aug. 1920. G. KOIDZUMI-KYO; aug. 1922. H. KOIDZUMI-TNS; sept. 1934. Y. SATAKE-TI). Arakawa-dake (aug. 1918. G. KOIDZUMI-KYO; sept. 1953. T. YAMAZAKI). Kita-arakawa-dake (aug. 1953. T. SUZUKI-KYO). Prov. Suruga: Senmai-dake (aug. 1938. J. MASADA-KYO). Inter Arakawa-dake et Senmai-dake (sept. 1953. T. YAMAZAKI et H. MATSUDA).

Area geogr. Endemica (Hokkaidô austr.-occid. et Honshû med).

Typus: 'Prov. SINANO: In monte Sirouma-ga-take (Y. YABE Aug. 26, 1902—Typus)' (in TI).

Some authors regard the subspecies *takedai* as a good species, but *Gen-*

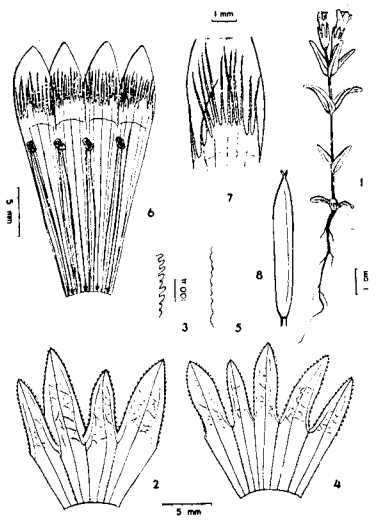

Fig. 30. *Gentianella yuparensis* subsp. *takedai*:
1. Habit, 2. Open calyx, 3. Margin of the calyx-lobe of 2, 4. Open calyx, 5. Margin of the calyx-lobe of 4, 6. Open corolla, 7. Corolla-lobe with fimbrillae, and 8. Pistil.

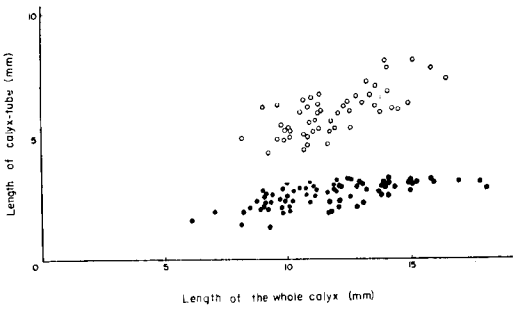

Fig. 32. A graph showing the correlation between the length of the whole calyx and that of calyx-tube in *Gentianella yuparensis* subsp. *yuparensis* (black dots) and subsp. *takedai* (circles).

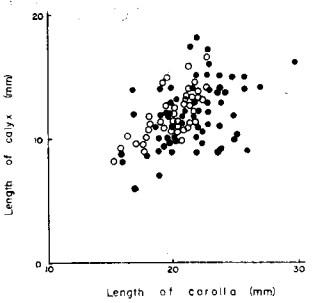

Fig. 31. A graph showing the correlation between the length of corolla and the length of calyx in *Gentianella yuparensis* subsp. *yuparensis* (black dots) and subsp. *takedai* (circles).

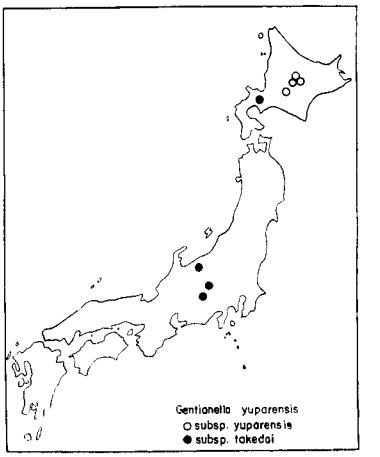

Fig. 33. Distribution of *Gentianella yuparensis* subsp. *yuparensis* (circles) and subsp. *takedai* (black dots).

tianella yuparensis subsp. *yuparensis* bears a striking resemblance to the former. After having finished careful field observations on Mt. Yûpari, the writer has come to the conclusion that *Gentianella Takedai* SATAKE had

better be transferred to a subspecies of *G. yuparensis*. The view was published by the author in 1956 under *Gentiana*, and has been borne out by HONDA (1957) and KITAMURA *et al.* (1957).

Investigations on some variation patterns between *Gentianella yuparensis* subsp. *yuparensis* and subsp. *takedai* were carried out, with results as follows: there is no significant difference in the correlation between corolla-length and calyx-length in the two plants, though *G. yuparensis* subsp. *yuparensis* has larger flowers in general (Fig. 31), but as regards the correlation between the length of calyx-tube and that of the whole calyx, there is a clear cut-line of demarcation (Fig. 32).

Genus 8. **Gentianopsis** MA

Gentianopsis MA in Acta Phytotax. **1**: 7. 1951.–SATAKE in Bull. Chichibu Mus. Nat. Hist. **6**: 3. 1955.

Syn.—

Gentiana LINNAEUS, Sp. Pl. (ed. 1) **1**: 227. 1753, pro parte.; Gen. Pl. (ed. 5), 107. 1754, pro parte.

'*Anthopogon* NECKER' sensu RAFINESQUE, Fl. Tellur. **3**: 25. 1837, pro parte.–Á. et D. LÖVE in Acta Hort. Gotob. **20**: 147. 1956. *Gentiana* subg. *Anthopogon* ('NECKER' sensu RAFINESQUE) TOYOKUNI in Hokuriku Jour. Bot. **6**: 33. 1957, pro syn.

Gentianella MOENCH, Meth. Pl. 482. 1794. emend. SCHUSTLER in Věstn. 1. Sjezdu Česk. Bot. v Praze, 34. 1923, pro parte.–H. SMITH in HANDEL-MAZZETTI, Symb. Sin. **7** (4): 979. 1936, pro parte.; in HYLANDER, Nomenkl. u. Syst. St. N. Gefässpfl. 48. 1945, pro parte.–D. LÖVE in Hereditas **39**: 226. 1953, pro parte.–GILLETT in Ann. Miss. Bot. Gard. **44**: 208. 1957, quoad subg. *Eublephis*.–SATAKE in Bull. Nat. Sci. Mus. **43**: 273. 1959, quoad subg. *Eublephis*. *Gentiana* subg. *Gentianella* (MOENCH) KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 3. 1894, pro parte.; in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 85. 1895, pro parte.; in Acta Hort. Petrop. **15**: 7. 1895, pro parte.

*Gentiana***** *Crossopetalae* FROELICH, De Gent. 109. 1796.–GRISEBACH in DE CANDOLLE, Prodr. **9**: 101. 1845. ut sectio.–KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 86. 1895.–HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1983. 1927.–GROSSHEIM in Fl. URSS **18**: 590. 1952.

Crossopetalum ROTH, Enum. Pl. Phaen. Germ. **1**: 516. 1827.

Gentiana subg. *Eublephis* RAFINESQUE, Med. Fl. **1**: 208. 1828. *Gentianella* subg. *Eublephis* (RAFINESQUE) GILLETT in Ann. Miss. Bot. Gard. **44**: 210. 1957.

Gentiana subg. *Gentianopsis* (MA) TOYOKUNI in Hokuriku Jour. Bot. **6**: 33. 1957. *Gentiana* sect. *Gentianopsis* (MA) SATAKE in Natur. Sci. Mus. **24**: 141. 1957, comb. nud.

Herbae annuae sive biennes rarissime perennes. Radices tenues, graciles, breves, plerumque erhizomatae. Caules simplices aut aliquot ramosi aut ramosissimi, plerumque quadriangulati, fulvovirides. Folia radicalia sub anthesi parva, rosulata v. abbreviata v. emarcida, foliis caulinis oppositis nec verticillatis. Flores vulgo pro plantis magni, plerumque tetrameri, in caulium ramorumque

apicibus dispositi, calycibus plus minusve membranaceis, membranis internalibus ornatis, apicibus 4-dentatis v. -fidis, corollis 4-lobatis, nec plicis nec squamis fimbriatis ornatis, lobis corollae margine saepe fimbriatis rare integris, basibus corollae epipetaliter glanduliferis, glandulis cum staminibus alternatis, staminibus inferioribus in partibus intus ad corollas affixis, antheris oblongis, filamentis linearifusiformibus, marginibus saepe fimbriatis, pistillo solitario et uniloculare. Capsulae in segmenta duo dehiscentes, seminibus vulgo pilosis.

Typus : *Gentianopsis barbata* MA

In 1951, MA established the genus *Gentianopsis* characterised by the following points : '(1) its large and somewhat flattened ellipsoidal flower bud, (2) two dissimilar pairs of calyx lobes which are distichously imbricate in aestivation, (3) four triangular, ciliated intracalyx membranes at the base of and alternate with the calyx lobes, (4) distinct gynophore and (5) enlarged stigma'. This genus is identical with *Crossopetalum* proposed by ROTH (1827), but the latter name has an older homonym and is inadequate for use. The present author agrees with MA's opinion, for the above characters hold good for the purpose of validating a distinct genus.

Clavis specierum

Lobi corollae non fimbriati . . . . . *G. contorta*
Lobi corollae basi secus margines fimbriati . . . . . *G. yabei*

Gentianopsis contorta MA

[Figs. 34 & 35, Plate I (4)]

Gentianopsis contorta (ROYLE) MA in Acta Phytotax. **1**: 14. 1951, cum var. *Wui*.-SATAKE in Bull. Chichibu Mus. Nat. Hist. **6**: 3. 1955.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.

Syn.—

Gentiana contorta ROYLE, Ill. Bot. Himal. 278, t. 68, f. 3. 1839.-GRISEBACH in DE CANDOLLE, Prodr. **9**: 94. 1845.-FORBES et HEMSLEY in Jour. Linn. Soc. **26**: 125. 1890.-KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 85. 1895.-TOYOKUNI in Hokuriku Jour. Bot. **6**: 33, ff. 1-3. 1957.-SATAKE in Natur. Sci. Mus. **24**: 145. 1957.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 219. 1957. *Gentianella contorta* (ROYLE) H. SMITH in HANDEL-MAZZETTI, Symb. Sin. **7** (4): 977. 1936.-SATAKE in Bull. Nat. Sci. Mus. **43**: 274. 1959.

Gentiana Yamatsutae KITAGAWA in Bot. Mag. Tokyo **48**: 104. 1934.; in NAKAI, Iconogr. Pl. As. Or. **1** (1): 10, t. 5. 1935.; Lineam. Fl. Mansh. 358. 1939.

Gentiana contorta var. *Shimizuana* TOYOKUNI in Hokuriku Jour. Bot. **6**: 33. 1957, pro syn.

Herba biennis sive annua, mollis, glaberrima, (6-) 8-15 (-17) cm alta. Radix simplex aut aliquot ramosa, brevis. Caulis circularis, viridis seu flavoviridis,

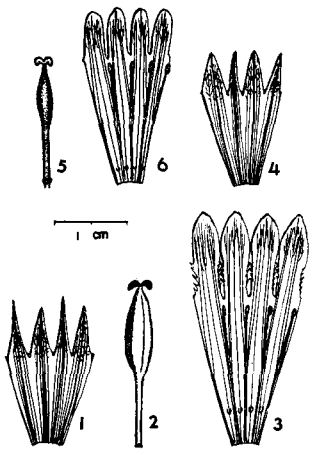

Fig. 34. *Gentianopsis yabei* (1–3) and *G. contorta* (4–6):
1 & 4. Open calyx, 2 & 5. Pistil, and 3 & 6. Open corolla.

Fig. 35. Distribution of *Gentianopsis contorta* (circles) and *G. yabei* (black dots).

indistincte angusteque membranaceoalatus, plerumque tantum supra medium pauciramosus rare a basi ramosus, interdum toto simplex, ramis inaequilongis, plerumque brevibus. Folia basalia minima et squamosa interdum toto deficientia, foliis caulinis sessilibus, oppositis, 10–15 mm longis, 4–9 mm latis, ellipticis—ovatoëllipticis, apice obtusis sive obtusiusculis, basi cuneatis et plus minusve vaginantim connatis, integris sed minute undulatis in sicco, subcrassis tamen non rigidis, plus minusve lucidis, trinerviis sed nervis lateralibus indistinctis et in apicem versus gradatim evanescentibus. Flores plerumque parvi, in apicibus caulis ramorumque solitarii, tetrameri, calycibus anguste tubulosoinfundibularibus, octonerviis, 10–15 mm longis, sepalis calycibus totis 1/4–1/5-plo longioribus, inaequalibus, tamen aequilongis, triangularibus, duobus exterioribus quam interiores duo leviter angustioribus, margine albis et membranaceis, inter sese membrana internali conexis, corollis tubulosocampaniformibus, calycibus paulo longioribus, ca. 20 mm longis, lilacinoviolascenticaeruleis, 4-fidis, lobis corollae ovatoëllipticis, ca. 5 mm longis, parallele quinquenerviis, basi nervi principalis staminodiis ca. 0.6–1 mm longis ornatis, staminibus 4, cum lobis corollae alternatis, filamentis filiformibus, ca. 15 mm longis, 1 mm latis, antheris versatilibus, linearioblongis, ca. 1 mm longis, pistillo uno, ca. 15 mm longo, ovario linearioblanceolato et uniloculari, stipitato, stigmate 2-partito, plus minusve magno et recurvo, stylo brevissimo. Capsulae demum corollas paulo superantes.

Nom. Jap. Hiroha-higerindô (KITAGAWA, 1934), Chichibu-rindô (SATAKE, 1955).

Specim. exam.

Honshû. Prov. Shinano: Shiroiwa-dake (sept. 1952. Y. ODAI). Jûmonji-tôge (sept. 1954. Y. SATAKE et D. SHIMIZU-TNS; sept. 1956. K. YAMANAKA et H. TOYOKUNI).

Area geogr. India (Himalaya), China, Manchuria, Japonia centr., etc.

Typus: 'Mussooree, near Captain Debude's house and the Abbey-hill' (in LIV).

SATAKE announced the circumstances of discovery of the present interesting species in 1955 (SATAKE, 1955; TOYOKUNI, 1957).

According to the fine figures of the present plant given by ROYLE (1839), the Japanese plant seems somewhat smaller than the Himalayan one, but no essential difference can be seen between the two as regards the habit as well as the floral structure.

Gentianopsis yabei MA

[Figs. 34 & 35]

Gentianopsis yabei (TAKEDA et HARA) MA in Acta Phytotax. **1**: 19. 1951, comb. nud.-HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957, nom. nud.

Syn.—

Gentiana detonsa var. *albiflora* YABE in Bot. Mag. Tokyo **17**: 24. 1903.-MATSUMURA, Ind. Pl. Jap. **2**(2): 500. 1912.-MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 946. 1931.-TAKEDA in Bot. & Zool. **3**: 2210, f. 78. 1935.

Gentiana Yabei TAKEDA et HARA ex HARA in Jour. Jap. Bot. **13**: 600, f. 45. 1937.; Enum. Spermat. Jap. **1**: 136. 1949.-HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.-SATAKE in Natur. Sci. Mus. **24**: 144. 1957.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 219. 1957. *Gentianella Yabei* (TAKEDA et HARA) HARA in Jour. Jap. Bot. **13**: 600. 1937, pro syn.-SATAKE in Bull. Nat. Sci. Mus. **43**: 273. 1959.

Herba biennis vel annua, glaberrima. Radix gracillima, tenuis, simplex vel aliquot ramosa, radiculis indistinctis. Caulis erectus, (2-) 5-25 (-40) cm altus, ca. 1 mm in diametro, simplex vel inferiore—superiore in parte pauciramosus, glaberrimus, laevis, anguste subalatostriatus. Folia radicalia sub anthesi viva, duo rare quttuor—sex et subrosulata, abbreviata, obovata vel spathulata vel obovatorhomboidea, in basin angustata attenuataque vel petiolatim elongata et vaginantim connata, parva, 5-20 mm longa, apice rotundata, margine saepe leviter undulata, uninervia, caulinis inferioribus iis radicalibus iis subconformibus sed paulo majoribus latioribusque, late ellipticoöbovatis, eis caulinis mediis superioribusque ellipticis v. ovatolanceolatis v. lanceolatis v. oblongis, apice obtusiusculis vel acutiusculis rare subrotundatis, basi rotundatis, sessilibus, vaginantim connatis, semiamplexicaulibus, margine saepe minutissime undulatis, (1-) 2-5 (-7) cm longis, (4-) 8-20 (-25) mm latis, glabris, trinerviis, internodiis vulgo brevioribus. Flores tetrameri rarissime quinarii, in caulis ramorumque apicibus singuli, pedunculati,

pedunculis elongatis, (1–) 3–10 cm longis, bracteis nullis, calycibus campaniformiinfundibularibus, 1.5–2.5 cm longis, 4-lobatis, sepalis duobus interioribus ovatotriangularibus seu ovatolanceolatis, apice acutis, 2–5 mm latis, margine membranaceis, duobus exterioribus quam interiores angustioribus sed paulo longioribus, linearilanceolatis, in apicem versus gradatim acutatis et acutissimis, 1–2 mm latis, margine anguste membranaceis, dorso subcarinatis, corollis cylindrico-campaniformibus, caerulescentialbis, 25–38 mm longis, 4-fidis, intus prope basin 4 glandulis ca. 0.3 mm longis latisque cum staminibus alternatis ornatis, lobis tubis subduplo brevioribus, oblongis vel oblongospathulatis, ca. 10 mm longis, ca. 3.5 mm latis, apice obtusis vel rotundatis, margine minutissime erosodenticulatis, infra medium fimbriatis sed ima basi integris, staminibus 4, corollae tubis subaequilongis, ca. 17 mm longis, circa medium tubis corollae affixis, filamentis complanatis, filiformibus, antheris ellipticis, ca. 1 mm longis, pistillo uno, stigmate bipartito, subsessile, ovario fusiformi unilocularique, longe stipitato. Capsulae corollis paulo breviores vel aequilongae, longe stipitatae, seminibus ellipticis, ca. 0.8 mm longis, minute squamulosoaculeolatis.

Nom. Jap. Takane-rindô, Shirouma-rindô (MAKINO et NEMOTO, 1925).

Specim. exam.

Honshû. Prov. Shinano: Shirouma-dake (aug. 1902. Y. YABE-TI, 'holotypus'; aug. 1922. H. KOIDZUMI-TNS; aug. 1933. M. NAKAJIMA-TI). Shirouma-onsen (aug. 1948. T. SHIMOKAWA-TNS). Kita-dake (sept. 1953. H. MATSUDA). Prov. Etchû: Shimizu-dake (oct. 1937. Y. KATÔ-TNS). Prov. Suruga: Inter Senmai-dake et Arakawa-dake (sept. 1959. H. TOYOKUNI). Inter Higashi-dake et Senmai-dake (sept. 1953. T. YAMAZAKI).

Area geogr. Endemica (Honshû med.).

Typus: 'Honshu. prov. Shinano: in monte Shirouma (Y. YABE–Aug. 26, 1902, fr.—typus)' (in TI).

This species was at first named *Gentiana detonsa* var. *albiflora* YABE, as a whith-flowered variety of *G. detonsa* ROTTBØLL. But later, TAKEDA and HARA (1937) regarded it as a good species giving the new name *Gentiana Yabei*. MA (1951) transferred the present plant to his new genus *Gentianopsis*.

Genus 9. **Pterygocalyx** MAXIMOWICZ

Pterygocalyx MAXIMOWICZ, Prim. Fl. Amur. 198, t. 9. 1859.; in Bull. Acad. St.-Pétersb. **20**: 435. 1875.–HARA, Enum. Spermat. Jap. **1**: 140. 1949.–OHWI, Fl. Jap. (ed. 1), 948. 1953.

Syn.—

? *Crawfurdia* sect. *Tripterospermum* (BLUME) CLARKE in Jour. Linn. Soc. **14**: 442. 1875, pro parte.

? *Gentiana* sect. *Dipterospermum* (CLARKE) MARQUAND in Kew Bull. **1931**: 69.; ibid. **1937**: 155, pro parte.

Herbae perennes, glabrae. Radices tenues, longae. Caules simplices sive ramosi, longitudinaliter striati, volubiles. Folia opposita, vulgo trinervia, basi petiolatim angustata. Flores in caulium ramorumque apicibus et in foliorum axillis solitarii, tetrameri seu quinarii, calycibus cylindricocampaniformibus—cylindricis, apicibus 4–5-dentatis vel -fidis, dentibus angustis, corollis cylindricocampaniformibus—cylindricis, caerulescentipurpureis sive albis, 4–5-fidis, lobis contortis, inter lobos plicis deficientibus, staminibus intus corollae lobis affixis, pistillo uno, stylo breve, stigmate bipartito. Capsulae in segmenta duo dehiscentes, seminibus numerosis, parvis, marginibus alatis.

Typus: *Pterygocalyx volubilis* MAXIMOWICZ

The genus name *Pterygocalyx* was proposed by MAXIMOWICZ in his 'Primitiae florae amurensis 1859'. He gave a detailed description of the new genus along with its type species, *P. volubilis*, and suggested its affinity to *Crawfurdia*. Some authors (CLARKE, 1875; GROSSHEIM, 1952; etc.), on the other hand, think that the present genus is identical with *Crawfurdia*, against the opinion of regarding it as a distinct genus (HARA, 1949; OHWI, 1953; KITAMURA *et al.*, 1957; etc.). Although it has customarily been placed next to *Tripterospermum* (*Crawfurdia*) even when treated as a distinct genus, the genus *Pterygocalyx*, in its morphology, is quite different from *Tripterospermum* in the following respects: in *Tripterospermum*, flowers are mostly pentamerous, plicae are present between corolla-lobes, and fruits are baccate, while in *Pterygocalyx*, flowers are almost always tetramerous, there are no appendages between corolla-lobes, and fruits are capsular. These items of evidence clearly indicate that *Pterygocalyx* has originated from an ancestral line quite different from that of *Tripterospermum*; in other words, *Pterygocalyx* has derived from a primitive type of such a genus as *Gentianopsis*, while *Tripterospermum* from that of *Gentiana*. In accordance with this view, *Pterygocalyx* may be more correctly placed close to *Gentianopsis*.

Only one species in Japan.

Pterygocalyx volubilis MAXIMOWICZ

[Figs. 36 & 37]

Pterygocalyx volubilis MAXIMOWICZ, Prim. Fl. Amur. 198, t. 9. 1859.; in Bull. Acad. St.-Pétersb. **31**: 68. 1886.–HARA in Bot. Mag. Tokyo **51**: 18. 1937.; Enum. Spermat. Jap. **1**: 140. 1949.–OHWI, Fl. Jap. (ed. 1), 948. 1953.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 218. 1957.

Syn.—

Crawfurdia Pterygocalyx HEMSLEY in Jour. Linn. Soc. **26**: 123. 1890.-MATSUMURA, Ind. Pl. Jap. **2**(2): 498. 1912.

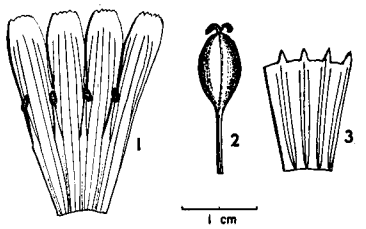

Fig. 36. *Pterygocalyx volubilis*: 1. Open corolla, 2. Pistil, and 3. Open calyx.

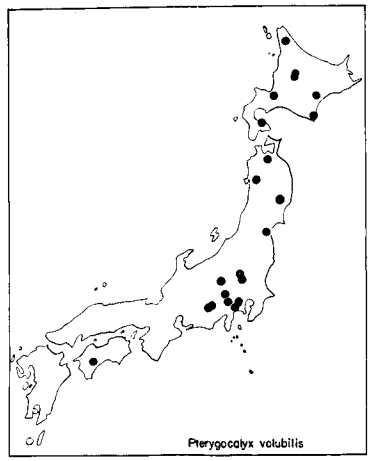

Fig. 37. Distribution of *Pterygocalyx volubilis*.

C. volubilis (MAXIMOWICZ) MAKINO in Bot. Mag. Tokyo **4**: (86). 1890.-GROSSHEIM in Fl. URSS **18**: 537. 1952. *C. volubilis* (MAXIMOWICZ) GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 79. 1895.-OKUYAMA in Jour. Jap. Bot. **13**: 34. 1937.

Herba perennis, volubilis, glabra. Radix longissima, atrobrunnea. Caulis gracillimus, in terra longe repens et herbis arboribusque in spiram contorquens, usque 100 cm longus, longitudinaliter striatus, ex nodorum partibus saepe ramosus, ramis caule multo tenuioribus gracilioribusque. Folia latolanceolata—linearilanceolata, subtrinervia (i.e. nervis lateralibus duobus indistinctis sive in apicem versus evanescentibus), in apicem versus gradatim acutata et apice acuta, basi in petiolos cuneatim angustata, margine integra, 2–8.5 cm longa, 5–15 mm lata, utrinque toto glabra. Flores tetrameri, in caulis et ramorum apicibus atque in axillis solitarii—tres, pedunculati, pedunculis usque 2 cm longis, gracilibus, calycibus infundibularibus, apice quattuordentatis, 8–16 mm longis, dentibus angustissime triangularilanceolatis, quam tubi 1/5–1/7-plo longioribus, irregulariter paucinervigeris, apice acutis, secus nervos principales plus minusve carinatis, corollis 17–35 mm longis, dilute caeruleis nec albis, campanulato-infundibularibus, apicibus quattuorlobatis, lobis erectis, oblongis—latolinearibus, quam tubi 1/3–2/5-plo longioribus, apicibus rotundatis et saepe minutissime paucidentatis, plicis et squamis fimbriatis toto deficientibus, staminibus quattuor, tubis corollae subaequilongis, filamentis linearibus, tenuibus, antheris oblongis, ca. 1.2 mm longis, pistillo uno, ovario longe stipitato et uniloculari, stipite gracili, ovario subaequilonga, stylo breve, gracile, stigmate bipartito. Capsulae angusto-oblongae, cum stipitibus gracilibus 12–20 mm longae, seminibus valde minutis,

marginibus membranaceoalatis.

Nom. Jap. Hosobano-tsururindô.

Specim. exam.

Hokkaidô. Prov. Teshio: Horonobu (aug. 1934. H. HARA-TI). Prov. Ishikari: Maruyama, Sapporo (oct. 1942. H. HARA-TI). Asahigawa (sept. 1935. J. ARAI-TNS). Hippu-mura (julio, 1923. T. YAMACUCHI).

Honshû. Prov. Mutsu: Hakkôda-san (oct. 1953. K. HOSOI-TNS). Prov. Rikuchû: Senninntôge (oct. 1957. M. KIKUCHI). Prov. Rikuzen: Kamega-oka, Sendai (aug. 1914. Y. OGURA-TI). Prov. Ugo: Yamase-mura (sept. 1935. M. MATSUDA-TNS; oct. 1936. G. FURUYA-KYO). Prov. Shinano: Jûmonji-tôge (sept. 1881.-TNS). Hoshino-onsen, Kutsukake-machi (oct. 1956. H. KANAI-TI). Kamihisano-mura (oct. 1955. H. RYÔKADÔ-TNS). Prov. Musashi: Takao-san (sept. 1932.-TI). Prov. Shimotsuke: Yumoto, Nikkô (aug. 1884.-TNS). Chûzenji, Nikkô (sept. 1879.-TI). Prov. Sagami: Oh-yama (julio, 1953. S. OKUYAMA-TNS). Prov. Kai: Komaga-take (oct. 1954. H. MATSUDA-TI). Kurodake-yama (sept. 1943. Y. SATAKE & S. OKUYAMA-TNS).

Shikoku. Prov. Tosa: Nanokawa-mura (oct. 1889.-TI; maio, 1890. K. WATANABE-TNS).

Area geogr. Dahuria orient., Ussuri, China, Japonia, etc.

Typus: 'Am *Ussuri*: an der Mündung, bei Turrme, in schattigem dichtem Laubwalde, sehr selten, 31 Juli (nond. flor.)' (in LE).

As the present species bears a striking resemblance to *Tripterospermum japonicum*, these two plants are often mixed on the same sheet of specimens in herbaria, but the tetramerous flowers and the capsular fruits of this plant tell us its peculiar characteristics.

Genus 10. **Gentiana** LINNAEUS

Gentiana [TOURNEFORT, Inst. Rei Herb. (ed. 1) **1**: 80. 1700] LINNAEUS, Sp. Pl. (ed. 1) **1**: 227. 1753.; Gen. Pl. (ed. 5), 107. 1754. emend. ADANSON, Fam. Pl. **2**: 503. 1763, pro parte.–FROELICH, De Gent. 19. 1796, pro parte–BUNGE in Nuov. Mém. Soc. Nat. Mosc. **1**: 197. 1829, pro parte.–GRISEBACH, Gen. et Sp. Gent. 210. 1839, pro parte.; in DE CANDOLLE, Prodr. **9**: 86. 1845, pro parte.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 3. 1894, excl. subg. *Gentianella*.; in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 80. 1895, excl. subg. *Gentianella*.; in Acta Hort. Petrop. **15**: 7. 1896, quoad subg. *Eugentiana*.–LÉVEILLÉ in Bull. Soc. Bot. France **53**: 646. 1906, pro parte.–LING, Fl. Ill. N. Chine **2**: 2. 1933, pro parte.–TAKEDA in Bot. & Zool. **3**: 2060. 1935, pro parte.–HARA, Enum. Spermat. Jap. **1**: 131. 1949, pro parte.–GROSSHEIM in Fl. URSS **18**: 538. 1952, excl. subg. *Gentianella*.–OHWI, Fl. Jap. (ed. 1), 949. 1953, pro parte.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 113. 1956, excl. subg. *Gentianella*.–SATAKE in Natur. Sci. Mus. **24**: 136. 1957, pro parte.

Syn.—

Dasystephana ADANSON, Fam. Pl. **2**: 502. 1763.

Pneumonanthe GLEDITSCH ex NECKER, Elem. Bot. **2**: 11. 1790.
Pneumonanthe A. GRAY, Syn. Fl. N. Amer. **2**(1): 120. 1878.
Mesomelitae HUXLEY in Jour. Linn. Soc. **24**: 103. 1888, pro maj. parte.
Ptycanthe HUXLEY, l. c. 110. 1888, excl. *Crawfurdia*.
Kudoa MASAMUNE in Jour. Trop. Agr. **2**: 29. 1930.

Herba annua v. biennis v. perennis, parva v. magna. Radices rhizomatae aut erhizomatae. Caules humiles sive alti, simplices ramosive fasciculative; folia radicalia rosulata aut pauperia aut emarcida aut opposita, foliis caulinis oppositis rare triphyllo- tenus hexaphylloverticillatis, plerumque sessilibus rare brevipetiolatis, integris, tamen non semper toto integris magis plerumque minutissime scabriusculis interdum scabris aut minute undulatis, lanceolatis, oblongolanceolatis, oblongoëllipticis, ellipticis, ovatis, etc. rare linearilanceolatis v. linearibus, uni—septemnervigeris. Flores in plerisque speciebus false umbellatim dispositi, vulgo terminales et/vel axillares sive singulariter unifloroterminales, sessiles aut pedunculati, erecti sive ascendentes, bracteolati seu ebracteolati, quinarii v. tetrameri rare hexa—octomeri, calycibus cylindricis—campanulatis, quinque- sive quattuor- rare sex- tenus octofidis, sepalis parvis vel plus minusve magnis, corollis cylindricocampanulatis aut infundibularibus aut hypocraterimorphis, coloribus caeruleis, caeruleopurpureis, purpureis, violaceis, albis, fulvis, viridescentibus, etc., rarissime rubris v. viridibus, inter lobos earum plicis ornatis, earum lobis convolutis, quinque vel quattuor rare sex—octo, tamen etiam intra speciem unam secundum locum numerus loborum corollarum magnospere variabilis esse agnoscitur, staminibus lobis corollae aequinumeris et cum lobis alternatis et intus corollis affixis, antheris liberis, oblongis v. linearioblongis et media in parte filamenta insertis, pistillo uno, ovario uniloculare bicarpellareque, basi vulgo glandulifero, stipitato sive sessile, stylo nullo aut vix cognito aut breve, stigmate vulgo bipartito; capsulae plerumque sessiles brevistipitataeve et ultimum duo in segmenta dehiscentes; semina parva, numerosa, 0.5–2 mm longa, utrinque attenuata et scabinate depressolenticularia v. oblonga et interdum alata supra laevia v. oblonga et supra minute protuberantia v. globosa et laevia.

Nomen genericum est ductum e GENTIO, Illyriae rege qui aperivit potentiam medicinalem gentianarum.

Typus: *Gentiana lutea* LINNAEUS

The genus *Gentiana* defined here is in its strict sense, and corresponds to KUSNEZOW's Eugentiana, though the genus still includes diverse members. The section Gentiana (=Coelanthe=), to which the type of this genus, *G. lutea* belongs, is quite different from other sections, e. g., Pneumonanthe, Kudoa, Chondrophylla, etc. This fact suggests to the writer that the latter sections should be divided into several smaller independent genera after perusing a much more complete bibliography.

About 200–350 species are distributed in the world except Africa, but in Japan only 15 species are met with.

Clavis sectionum

1. Perennis, radice vulgo rhizomata, caule elatiore, erecto ascendenteve, foliis radicalibus erosulatis et plerumque squamosis, margine non cartilagineis, caulinis oppositis, rarissime trifolioverticillatis . . . sect. Pneumonanthe
1. Perennis v. annua v. biennis, foliis radicalibus saepe rosulatis, margine in plerisque cartilagineis 2
2. Caulis plerumque humilis, simplex v. ramosus, decumbens v. ascendens v. erectus, corollis vulgo parvis, hypocraterimorphis aut infundibuliformibus rare cylindricocampanulatis, plicis plerumque bene explicantibus aequantibusque . . . . . sect. Chondrophylla
2. Caulis vulgo altior, decumbens v. ascendens rare erectus, corollis cylindricocampaniformibus v. infundibularibus, plicis interdum plus minusve explicantibus inaequantibusque 3
3. Folia opposita, plicis corollae integris v. brevidentatis . . . sect. Frigida
3. Folia semper verticillata, plicis corollae bi–paucipartitis . . . sect. Kudoa

Gentiana sect. **Chondrophylla** BUNGE in Mém. Soc. Nat. Mosc. **7**: 203 et 231. 1829.–GRISEBACH, Gen. et Sp. Gent. 264. 1839.; in DE CANDOLLE, Prodr. **9**: 104. 1845.–CLARKE in J. D. HOOKER, Fl. Brit. Ind. **4**: 110. 1883.–KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 83. 1895.; in Acta Hort. Petrop. **15**: 344. 1898.–HEGI, Ill. Fl. Mitt.-Eur. **5**(3): 1982. 1927.–MARQUAND in Jour. Roy. Hort. Soc. **57**: 210. 1932.; in Kew Bull. **1937**: 168.–GROSSHEIM in Fl. URSS **18**: 570. 1952.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 116. 1956.

Syn.—

Hippion F. W. SCHMIDT in ROEMER, Arch. Bot. **1**: 8. 1796, pro parte.

Gentiana sect. *Eurythalia* GRISEBACH in Gött. Gel. Anz. **1840**: 815.; in DE CANDOLLE, Prodr. **9**: 108. 1845.

Clavis subsectionum serierumque gregumque

1. Radix perennis, foliis radicalibus vulgo non rosulatis . . . . . subsect. Orbiculatae
1. Radix annua v. biennis, foliis radicalibus vulgo rosulatis . . . . . subsect. Annuae. 2
2. Folia radicalia vix rosulata . . . . . series Zollingerianae
2. Folia radicalia rosulata . . . . . series Humiles 3
3. Sepala sub anthesi recurvata . . . . . grex *G. squarrosae*

3. Sepala sub anthesi adpressa nec patentia nec recurvata . . . . . grex *G. thunbergii*

Subsectio 1. **Annuae** TOYOKUNI in Jour. Jap. Bot. **36**: 241. 1961, in adnota.

Syn.—

Gentiana sect. *Chondrophylla* II Einjährige KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 84. 1895.

Series 1. **Humiles** MARQUAND in Kew Bull. **1937**: 146 et 172.

Syn.—

Gentiana sect. *Chondrophylla* series *Aquaticae* GROSSHEIM in Fl. URSS **18**: 578. 1952.

Gentiana sect. *Chondrophylla* series *Orbiculatae* MARQUAND in Kew Bull. **1937**: 146 et 170, pro parte.

Grex ***Gentianae thunbergii***

Calycis lobi sub anthesi adpressi.

Clavis specierum

1. Caulis erectus vel ascendens, foliis vulgo laevibus, corollis calycibus 2–2.5-plo longioribus 3
1. Caulis ascendens rare erectus, humilior, foliis margine plus minusve scabriusculis, corollis minoribus et calycibus 1.5-plo longioribus 2
2. Calyces 7.5–13 mm longi, sepalis erectis deltoideoëllipticis v. latolanceolatis v. longe deltoideolanceolatis, corollis 10–17 mm longis . . . *G. aquatica*
2. Calyces 4–8 mm longi, sepalis deltoideis, corollis 6–12 mm longis . . . . . *G. laeviuscula*
3. Planta in herbosis crescens, caule ascendente vel erecto, corollis calycibus duplo longioribus, calycibus 5-fidis . . . . . *G. yakumontana*
3. Planta in locis palustribus crescens, caule erecto, corollis calycibus 2–2.5-plo longioribus, calycibus 5-lobatis . . . . . *G. thunbergii*

Gentiana aquatica LINNAEUS

[Figs. 38 & 39]

Gentiana aquatica LINNAEUS, Sp. Pl. (ed. 1) **1**: 229. 1753.–GROSSHEIM in Fl. URSS **18**: 579. 1952.–POFOV, Fl. Sr. Sib. **2**: 592. 1959.–KITAMURA, Fl. Afghan. 303. 1960.–TOYOKUNI in Jour. Jap. Bot. **36**: 240, f. 1, f. 2 (2–3), f. 3. 1961.

Syn.—

Gentiana humilis STEVEN in Mém. Soc. Nat. Mosc. **3**: 258. 1812.–BIEBERSTEIN, Fl. Taur.-Cauc. **3**: 191. 1819.–KUSNEZOW in Acta Hort. Petrop. **15**: 379. 1904.

'*G. prostrata* HAENKE' sensu BOISSIEU, Fl. Or. **4**: 72. 1879.

G. pseudo-humilis MAKINO in Bot. Mag. Tokyo **18**: 16. 1904.–LÉVEILLÉ in Bull. Soc. Bot. France **53**: 650. 1906.–MATSUMURA, Ind. Pl. Jap. **2** (2): 501. 1912.–TAKEDA in Bot. & Zool. **3**: 2207, f. 75 (a–b). 1935.–HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.; ibid. (ed. em.), 205. 1957.–

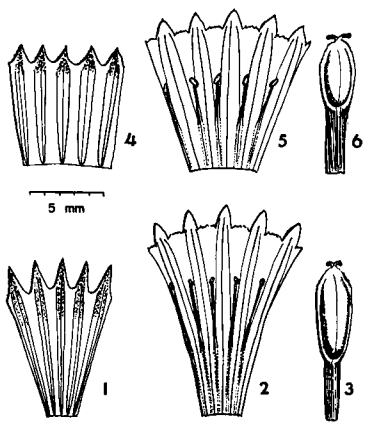

Fig. 38. *Gentiana aquatica* (1–3) and *G. laeviuscula* (4–6): 1 & 4. Open calyx, 2 & 5. Open corolla, and 3 & 6. Pistil.

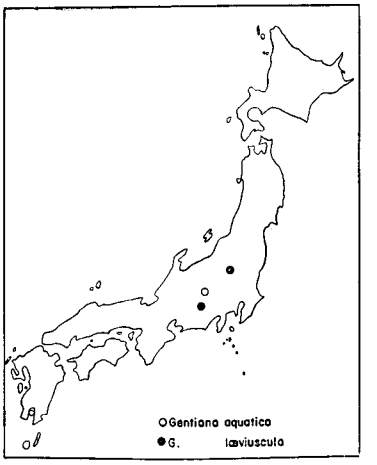

Fig. 39. Distribution of *Gentiana aquatica* (circle) and *G. laeviuscula* (black dots).

HARA, Enum. Spermat. Jap. **1**: 133. 1949.–OHWI, Fl. Jap. (ed. 1), 952. 1953.–SATAKE in Natur. Sci. Mus. **24**: 144. 1957. *G. aquatica* var. *pseudo-humilis* (MAKINO) TOYOKUNI, in sched. Herb. SAP.

Herbae biennes, glaberrimae. Radices graciles, filiformes, cremeobrunnescentes, 1.5–4.5 cm longae, prope apices aliquot radiculosae. Caules erecti vel inferioribus in partibus subascendentes, simplices aut aliquot ramosi, cum inflorescentiis 5–8 cm alti, longitudinaliter quadriangulati. Folia radicalia plerumque rosulata rarissime opposita, obovata v. latoëlliptica v. subrotundata, uninervia, parva, 2–5 mm longa, 1–4 mm lata, apice acutiuscula v. acuta v. acuminatomucronulata; folia caulina inferiora eis radicalibus conformia sed leviter angustiora, subrotundata v. spathulatoöblonga v. spathulatoöblanceolata, apicibus vulgo mucronulata, eis caulinis mediis superioribusque subulatis v. subulatolinearibus v. subulatolanceolatis, 4–7 mm longis, 0.5–2 mm latis, apice spinulatim mucronulatis, margine scabris, basi amplexicaulibus et in caulibus vaginantim connatis, uninerviis, nervis subtus plus minusve carinatis, internodiis foliis longioribus. Flores in caulium ramorumque apicibus rare in foliorum axillis plerumque solitarii rare nonnuli, brevissime pedunculati, pentameri; calyces tubulosocampaniformes, viridescentes, membranacei, in parte semihyalini, 7.5–13 mm longi, apicibus 5-fidis, sepalis erectis, deltoideoëllipticis aut latolanceolatis aut longedeltoideolanceolatis, apice mucronulatis, quam tubi 1/4–1/5-plo longioribus; corollae dilute caeruleae, infundibularicampaniformes, 10–17 mm longae, apice 5-fidae, lobis corollae deltoideolanceolatis aut deltoideoëllipticis, apicibus

minute mucronulatis, plicis corollae parvis, latotruncatodeltoideis, apicibus irregulariter paucifissis aut -dentatis; stamina 0.5–1.2 mm longa, filamentis subulatolinearibus, inferioribus in partibus intus corollis affixis, antheris oblongis, ca. 0.5 mm longis, pistillo uno, capitato, prope apicem secus suturam serrulatoscabro, stylo nullo subnullove, stigmate bipartito, recurvato, ovario breviter latostipitato; capsulae post anthesin gradatim elongatae et demum corollas multo superantes, seminibus fusiformibus, secus marginem unum striatis.

Nom. Jap. Hina-rindô (MAKINO, 1904).

Specim. exam.

Honshû. Prov. Shinano: Yatsuga-take (aug. 1902. B. HAYATA-TI; aug. 1924. S. MURAMATSU-TI).

Area geogr. Sibiria, Japonia (Honshû med.), India (Himalaya), Asia centr. (Afghanistan), etc.

Typus: '*Habitat in* Sibiria' (in LINN).

For a long period, the present species has been called *Gentiana pseudo-humilis*. However, the writer had the opportunity of examining the Siberian specimens of *G. aquatica*, and came to the conclusion that the Japanese plant could not be distinguished from the Siberian one (TOYOKUNI, 1961).

Gentiana laeviuscula TOYOKUNI

[Figs. 38 & 39]

Gentiana laeviuscula TOYOKUNI in Jour. Jap. Bot. **36**: 241, f. 2(1), f. 3. 1961.

Syn.—

Gentiana pseudo-humilis var. *laeviuscula* OHWI, Fl. Jap. (ed. 1), 952. 1953.; in Bull. Nat. Sci. Mus. **33**: 83. 1953.-HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.-SATAKE in Natur. Sci. Mus. **24**: 144. 1957.

Herbae biennes, humiles, toto glaberrimae. Radices graciles, fibrosae, 1–5 cm longae, prope apices pauciradiculosae. Caules erecti vel ascendentes, simplices aut pauci—pluriramosi, cum inflorescentiis (1–) 3–5 cm alti, indistincte quadristriati; folia radicalia plerumque rosulata, obovata v. subrotundata, 5–15 mm longa, 3–12 mm lata, utrinque rotundata, trinervia, marginibus subcartilagineis, albomarginatis et minutissime scabriusculis; folia caulina inferiora obovata sive latoöblanceolata, apice obtusiuscula sive acutiuscula, saepe mucronulata, eis caulinis superioribus adpressis, subulatolanceolatis vel subulatolinearibus, apice acute cuspidatis, conduplicatis, 4–9 mm longis, marginibus albomarginatis. Flores solitarii—pauci, in ramorum caulisque apicibus sessiles aut breviter pedunculati, pedunculis usque 1 mm longis, calycibus tubulosocampaniformibus, viridescentibus, quinquecarinatoangularibus, membranaceis et in parte semihyalinis, (2.5–) 4–8 mm longis, 5-fidis, ornatis membranis intracalycinis, sepalis deltoideis, 0.9–1.5 mm longis, apicibus acutiusculis, saepe mucronulatis, corollis

tubosocampaniformibus, caeruleopurpureis, 0.6–1.2 cm longis, 5-fidis, lobis semicirculis, apicibus minutomucronulatis, corollae plicis late truncatodeltoideis et corollae lobis paulo minoribus, apice irregulariter paucidentatis, rarissime subintegris, 0.5–1 mm longis, staminibus 4–6 mm longis, filamentis linearisubulatis, antheris oblongis, ca. 0.5 mm longis, pistillo uno, capitato, stylo nullo aut subnullo, stigmate bipartito, minimo, plus minusve recurvato, ovario breviter lateque stipitato. Capsulae longe stipitatae, demum corollas superantes, seminibus fusiformibus et uno in margine striatis.

Nom. Jap. Ko-hinarindô (OHWI, 1953).

Specim. exam.

Honshû. Prov. Shinano: Sampuku-tôge, Toyokuchi-yama (junio, 1940. H. KUBOTA-TNS, 'holotypus *Gentianae pseudo-humilis* var. *laeviusculae*'; aug. 1953. T. YAMAZAKI-TI). Usagi-dake (junio, 1954. H. MATSUDA-TI). Prov. Suruga: Senmai-dake (junio, 1954. H. MATSUDA-TI, 'holotypus', et 'isotypus' in SAP et TNS).

Area geogr. Endemica (Honshû med.).

Typus: 'Japan: Prov. Suruga—Mt. Senmai (H. Matsuda, 21 June, 1954 TI)' (in TI).

The present species was discovered by H. KUBOTA on Sampuku Pass, Prov. Shinano, in June, 1940. OHWI (1953) regarded it as a variety of *G. pseudo-humilis*, giving stress to its laeviuscule leaf-margins. However, besides the character of the leaf-margins, there are the following differences between the present plant and *G. aquatica*: the flowers of the former are much smaller than those of the latter; the corollae are cylindrical-campanulate in the former, while infundibular-campanulate in the latter; calyx-lobes of the former are deltoid, not deltoid-lanceolate as in the latter; accordingly the writer has come to the conclusion that this plant is worthy of specific rank.

Gentiana thunbergii GRISEBACH

[Figs. 40 & 41, Plate II (6)]

Gentiana thunbergii [f. thunbergii] (G. DON) GRISEBACH in DE CANDOLLE, Prodr. **9**: 108. 1845.–FAWCETT in Jour. Bot. **21**: 183. 1883.–MAXIMOWICZ in Bull. Acad. St.-Pétersb. **32**: 508. 1888.–KUSNEZOW in Acta Hort. Petrop. **15**: 374. 1904.–LÉVEILLÉ in Bull. Soc. Bot. France **53**: 651. 1906, pro parte.–NAKAI, Fl. Koreana **2**: 98. 1911.–MATSUMURA, Ind. Pl. Jap. **2** (2): 502. 1912.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 949. 1931.–HARA, Enum. Spermat. Jap. **1**: 135. 1949.–OHWI, Fl. Jap. (ed. 1), 951. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 117. 1956.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220, pl. 66, n. 539. 1957.

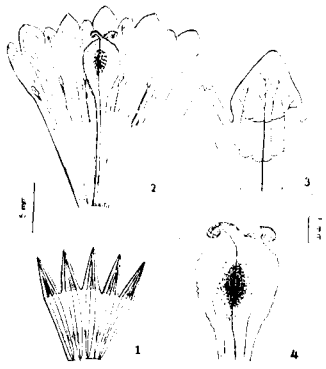

Fig. 40. *Gentiana thunbergii* f. *minor*:
1. Open calyx, 2. Open corolla, 3. Corolla-lobe with a plica, and 4. Upper part of pistil.

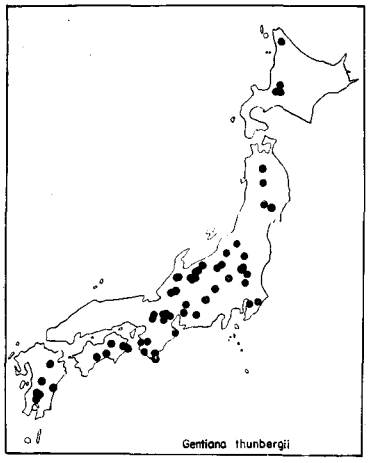

Fig. 41. Distribution of *Gentiana thunbergii*.

Syn.—

'*Gentiana aquatica* LINNAEUS' sensu THUNBERG, Fl. Jap. 115. 1784, pro parte.

Ericala Thunbergii G. DON, Gen. Hist. **4**: 192. 1838.

Gentiana japonica (non ROEMER et SCHULTES, 1820) MAXIMOWICZ in Bull. Acad. St.-Pétersb. **20**: 433. 1875.-FRANCHET et SAVATIER, Enum. Pl. Jap. **2**: 449. 1877.

G. Thunbergii f. *grandis* NAKAI in Jour. Jap. Bot. **23**: 99. 1949.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

G. Thunbergii f. *gracilis* NAKAI, l. c. 100.-HONDA, l. c.

Herba annua, glaberrima. Radix gracilis, tenuis, ad 15 cm longa, prope apicem radiculos graciles et fibrillosos emittens. Caules digitales vel a basibus fasciculati, 5–15 cm alti, distincte striati, internodiis sub foliis saepe purpurascentibus. Folia basalia dense rosulata, ovalia vel anguste ovalia vel rhomboideo-ovalia, apice acuta, basi acute attenuata, abbreviata, margine integra, utrinque glabra, saepe purpurascentia, (0.5–) 1–3.5 cm longa, 5–20 mm lata, trinervia, nervis subtus speciale distinctissimis, foliis caulinis oppositis, parvis, ovato-lanceolatis vel ovatoöblanceolatis, ascendentibus, 5–12 mm longis, 2–8 mm latis, apicem versus acutatis, basi vaginantim connatis, internodiis longe brevioribus, uninerviis. Flores in apicibus ramorum et caulium solitarii—nonnuli, pedunculati, pedunculis 1–3 cm longis, calycibus tubosoinfundibularibus, 7–15 mm longis, submembranaceis, 5-lobatis, sepalis triangularilanceolatis vel linearilanceolatis et in apices versus acutatis, albomarginatis, corollis caeruleis, (15–) 18–30 (–35) mm longis, 5-fidis, lobis lanceolatorotundatis, apice acuminatis, 2–5 mm longis, plicis semicirculis, apice dentatis, lobis corollae minus quam duplo brevioribus, staminibus corollis 2/3-plo longioribus, filamentis filiformibus, antheris oblongis,

pistillo uno, staminibus subaequilongo, ovario stipitato, stigmate bipartito, recurvo. Capsulae stipitatae et demum corollas superantes, seminibus fusiformibus, indistincte reticulatis.

Nom. Jap. Haru-rindô.

Specim. exam.

Honshû. Prov. Mino: Hiyoshi-mura (feb. 1927. K. INAGAKI). Prov. Owari: Kakuô-zan (apr. 1930. K. INAGAKI). Prov. Ise: Asama-yama (maio, 1955. G. MURATA-KYO). Gozaisho-yama (apr. 1917. T. YAMADA-KYO). Mitsukuchi-dani (maio, 1958. K. IWATSUKI et N. KITAGAWA-KYO). Prov. Kii: Ema, Yura-chô (mart. 1959. T. SHIMIZU-KYO). Shinjô-mura (mart. 1944. G. NAKAI-KYO). Tanabe (apr. 1896. H. SAKURAI-TNS; maio, 1922. S. NAKAJIMA-TI). Shiono-misaki (mart. 1931. S. AKIYAMA). Kushimoto (apr. 1931. S. AKIYAMA).

Shikoku. Prov. Awa: Tsunomine (TI; maio, 1910. J. NIKAI-TNS). Prov. Tosa: Sagawa-mura (apr. 1889. T. MAKINO-TI: apr. 1896. K. WATANABE-TNS).

Kyûshû. Prov. Bungo: Kujû-zan (maio, 1959. T. YAMAZAKI-TI). Prov. Hizen: Nagasaki (maio, 1904. N. KINASHI-KYO). Prov. Higo: Ya-dake (maio, 1917. Z. TASHIRO-KYO). Prov. Hiuga: Kirishima-zan (apr. 1913. Z. TASHIRO-TNS; junio, 1936. S. MURAMATSU-TI).

Area geogr. Japonia (occidentali-austr.), Korea, China, Manchuria, etc.

Typus: 'Native of Japan' (in K?).

forma **minor** (MAXIMOWICZ) TOYOKUNI, stat. nov.

Syn.—

Gentiana Thunbergii var. *minor* MAXIMOWICZ in Bull. Acad. St.-Pétersb. **32**: 508. 1888.–KUSNEZOW in Acta Hort. Petrop. **15**: 375. 1904.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 949. 1931.–TAKEDA in Bot. & Zool. **3**: 2206, f. 74. 1935.–HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.; ibid. (ed. em.), 206. 1957.–HARA, Enum. Spermat. Jap. **1**: 135. 1949.–OHWI, Fl. Jap. (ed. 1), 952. 1953.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220. 1957, in textu.–TOYOKUNI in Jour. Geobot. **10**: 8. 1961, cum fig. *G. minor* (MAXIMOWICZ) NAKAI in Jour. Jap. Bot. **23**: 100. 1949.–TAKEDA et TANABE et TAKENAKA, Ill. Man. Alp. Pl. Jap. (ed. 1), 100, f. 80. 1950.

G. Thunbergii f. *ochroleuca* HONDA in Bot. Mag. Tokyo **46**: 419. 1932.–HARA, Enum. Spermat. Jap. **1**: 135. 1949.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957. *G. minor* f. *ochroleuca* (HONDA) TAKEDA ex TAKEDA et TANABE et TAKENAKA, l. c. 1950, in textu et comb. nud.

G. Thunbergii var. *caerulea* MAKINO, Ill. Fl. Nippon (ed. 1), 214. 1940, in textu et nom. nud.

G. minor var. *minima* HONDA in Bot. Mag. Tokyo **65**: 168. 1952. *G. Thunbergii* var. *minor* f. *minima* (HONDA) HONDA, Nom. Pl. Jap. (ed. em.), 206 (nomen) et 378. 1957.

A forma *thunbergii* differt caulibus paucioribus gracilioribusque, foliis caulinis angustioribus saepe solum vaginatis, floribus minoribus 1–2 cm longis.

Nom. Jap. Tateyama-rindô, Ko-miyamarindô.

Specim. exam.

Hokkaidô. Prov. Ishikari: Bibai (junio, 1957. H. TOYOKUNI et A. TANAKA; junio, 1960. H. TOYOKUNI; junio, 1961. H. TOYOKUNI et M. NAKAJIMA). Nopporo (K. INAGAKI). Nakagoya (maio, 1959. M. IWABUCHI).

Honshû. Prov. Ugo: Hachiman-dai (julio, 1951. M. KIKUCHI). Prov. Rikuchû: Sugawa-

dake (aug. 1952. M. KIKUCHI et J. SAITÔ). Hagishô-machi (maio, 1952. J. SAITÔ). Prov. Iwashiro: Numayama-tôge (julio, 1898. B. HAYATA). Ozega-hara (julio, 1903. B. HAYATA). Ayame-daira (julio, 1950. A. TAKAHASHI). Prov. Shimotsuke: Inter Hiuchi-dake et Miike-tashiro (aug. 1956. T. TSUJII et S. KAWANO). Prov. Kôdzuke: Tanigawa-dake (julio, 1953. T. YAMAZAKI-TI). Prov. Shinano: Shirouma-dake (julio, 1935. J. OHWI-KYO). Kiriga-mine (junio, 1908). Prov. Echigo: Komaga-dake (aug. 1903. B. HAYATA-TI). Prov. Etchû: Tate-yama (aug. 1931. S. KITAMURA-KYO). Tarô-dake (aug. 1952. S. YOSHIZAWA-KYO). Yakushi-dake (aug. 1953. S. OKUYAMA-TNS). Prov. Kii: Oh-ike, Mie-mura (maio, 1950. N. YASUI-TI, 'holotypus *G. minoris* var. *minimae*').

Area geogr. Endemica (Hokkaidô et Honshû et ? Shikoku).

Typus: 'Cum typo crescit et in illum insensibiliter transire videtur. Vidi e *Yezo*, *Tate-yama* et *Sikoku*' (in LE).

Gentiana thunbergii and its form *minor* are so similar to each other that one can hardly draw a sharp demarcation between them, because of the existence of a lot of transitional forms between the two types. MAXIMOWICZ was aware of this fact, and when he established *G. thunbergii* var. *minor* in 1888, he stated that the plant existed with *G. thunbergii* and seemed insensibly to transform into that.

Gentiana yakumontana MASAMUNE

[Figs. 42 & 43]

Gentiana yakumontana MASAMUNE, Prel. Rep. Veg. Yakus. 112. 1929, nom. nud.; Fl. & Geobot. Yakus. 374. 1934.; in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.–HARA, Enum. Spermat. Jap. **1**: 136. 1949.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

Syn.—

Gentiana yakuinsularis SUGIMOTO, mss. in Herb. TI.

Herbae annuae, glabriusculae. Radices breves, 1.5–3.5 cm longae, pauci-radiculosae. Caules cum inflorescentiis 2.5–10.5 cm alti. Folia radicalia 3–5-rosulata, ovata vel ovatoëlliptica vel ovatorotundata vel elliptica, glabra, sessilia aut brevissime petiolata (petiolis 1–1.5 mm longis), basi attenuata, apice obtusa vel rotundata et interdum mucronulata, margine irregulariter obtuseque paucidentata et paulo undulata, 7–15 mm longa, 4–10 mm lata, caulinis eis oppositis, sessilibus et radicalibus eis conformibus sed minoribus, ellipticis vel ellipticoövatis, ca. 7 mm longis, ca. 3.5 mm latis, uninerviis. Flores terminales axillaresque, erecti, pedunculati, pedunculis 1–6 mm longis, bracteis oppositis, oblongis vel oblongolanceolatis, apice mucronulatis vel interdum subito brevi-cuspidatis, 1.5–4 mm longis; calyx late campanulatus, papyraceomembranaceus, tenuis, 4–5.5 mm logus, 5-fidus, sepalis anguste deltoideis sive lanceolatodeltoideis, ca. 1.5 mm longis, ca. 1 mm latis, purpureoviridibus, tenuibus; corolla virides-

centicaeruleopurpurea, tubulosocampanulata, 6–12 mm longa, ca. 5 mm in diametro, 5-lobata, lobis deltoideis, ca. 2 mm longis, 1–2 mm latis, acutis, contortis, plicis brevideltoideis, apice saepe mucronulatis, staminibus 5, intus corollae tubis affixis, 5–7 mm longis, antheris albis, oblongis, 1–1.5 mm longis, filamentis dilute viridibus, 4–6 mm longis, filiformibus, glabris, pistillo uno, ovario subsessili et uniloculari, ca. 6 mm longo, ca. 2 mm lato, ellipticoöbovato, dilute viride, stigmate bipartito, reflexo.

Nom. Jap. Yakushima-kokerindô (MASAMUNE, 1929).

Specim. exam.

Kyûshû. Prov. Ohsumi: Yaku-shima; inter Kosugi-dani et Kusunoki-gawa (mart. 1923. G. MASAMUNE-KYO); Yae-dake (maio, 1927. J. SUGIMOTO-TI; julio, 1926. G. MASAMUNE-TI).

Area geogr. Endemica (Yaku-shima).

Typus: 'Yaegadake, ca. 1800 m alt.' (in TAI).

There is an opinion regarding the present plant as identical with *G. zollingeri*, but it is much more related to *G. forrestii* of China than to any other species in Japan; the former may be regarded as a subspecies or a variety of the latter, or *vice versa*.

Grex ***Gentianae squarrosae***

Calycis lobi recurvati.

Only one species in Japan.

Gentiana squarrosa LEDEBOUR

[Figs. 42 & 44]

Gentiana squarrosa LEDEBOUR in Mém. Acad. St.-Pétersb. **5**: 527. 1812.; Fl. Ross. **3**: 64. 1847.–BUNGE in Nuov. Mém. Soc. Nat. Mosc. **1**: 234, t. 9, f. 3. 1829.–FRANCHET et SAVATIER, Enum. Pl. Jap. **1**: 323. 1875.; ibid. **2**: 450. 1877.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 267. 1894.; in Acta Hort. Petrop. **15**: 410. 1904.–LÉVEILLÉ in Bull. Soc. Bot. France **53**: 650. 1906.–NAKAI, Fl. Koreana **2**: 98. 1911.; in Bot. Mag. Tokyo **28**: 330. 1914, a. *typica* NAKAI.; in Bull. Nat. Sci. Mus. **31**: 93. 1952.–MATSUMURA, Ind. Pl. Jap. **2**(2): 502. 1912.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 949. 1931.–MASAMUNE, Fl. & Geobot. Yakus. 374. 1934.; in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.–MARQUAND in Kew Bull. **1937**: 170.–KITAMURA in Acta Phytotax. Geobot. **10**: 183. 1941.–HARA, Enum. Spermat. Jap. **1**: 134. 1949.–GROSSHEIM in Fl. URSS **18**: 581. 1952.–OHWI, Fl. Jap. (ed. 1), 951. 1953.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 219, pl. 66, n. 537. 1957.

Syn.—

'*Gentiana aquatica* LINNAEUS' sensu THUNBERG, Fl. Jap. 115. 1784, pro parte.–M BIEBERSTEIN, Fl. Taur.-Cauc. **3**: 192. 1819.

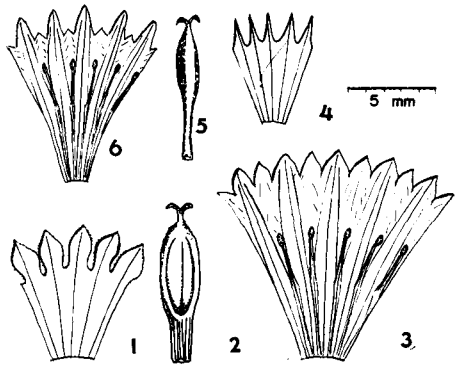

Fig. 42. *Gentiana squarrosa* (1-3) and *G. yakumontana* (4-6): 1 & 4. Open calyx, 2 & 5. Pistil, and 3 & 6. Open corolla.

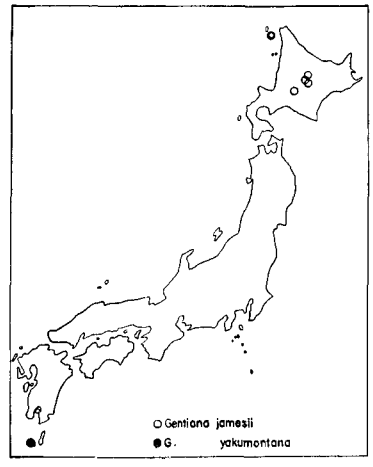

Fig. 43. Distribution of *Gentiana jamesii* (circles) and *G. yakumontana* (black dot).

Herba annua, in parte scabriuscula. Radix simplex, 2–7 cm longa, subarticulata et in articulis radiculos fibrillosos breves emittens. Caulis ramosus sive a basibus fasciculatus, indistinctissime striatus sed minute scabriusculus, dense foliatus, cum inflorescentiis (2–) 5–15 cm altus. Folia radicalia rosulata, lanceolatoövata, apice acutatoacuminata, basi obtusa, vaginata, sessilia, 5–23 mm longa, 3–12 mm lata, interdum purpurascentia, uni- vel subtrinervia, foliis caulinis oppositis, eis radicalibus conformibus sed minoribus et latioribus, 4–10 mm longis, 3–7 mm latis, submembranaceis, margine albomarginatis. Flores pauci—subplures, pedunculati, pedunculis brevibus vel nullis, calycibus 5–9 mm longis, 5-fidis, sepalis ovatis, membranaceis, apice acuminatis, 2–4 mm longis, dilute viridibus, margine albomarginatis, patentibus, corollis 7–12 mm longis, tubulosoinfundibularibus, dilute purpureis, 5-fidis, lobis corollae subrotundatis, apice acuminatis, ca. 2 mm longis, plicis lobis conformibus sed leviter minoribus et interdum paucidentatis, staminibus calycibus leviter longioribus, filamentis subulatofiliformibus, antheris oblongis, 1–1.5 mm longis, pistillo uno, staminibus

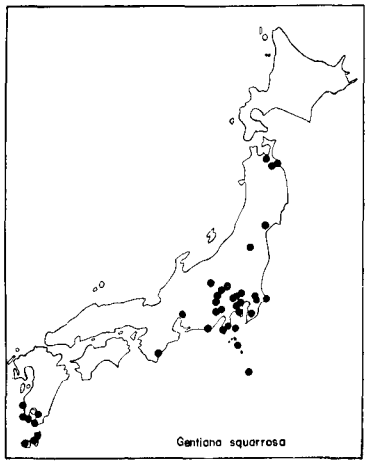

Fig. 44. Distribution of *Gentiana squarrosa*.

subaequilongo, ca. 8 mm longo, fusiformi, stigmate bipartito, subcrasso, ovario brevistipitato et uniloculari. Capsulae demum longe stipitatae et corollas longe superantes, seminibus latofusiformibus, laeviusculis.

Nom. Jap. Koke-rindô.

Specim. exam.

Honshû. Prov. Mutsu: Shiwa-mura (junio, 1946. U. NARITA-TI). Gonohe-shi (julio, 1958. M. KIKUCHI). Hachinohe-shi (julio, 1957. M. KIKUCHI). Prov. Rikuzen: Daino-hara, Sendai (maio, 1914. Y. OGURA-TI). Prov. Iwashiro: Sasaki-no (maio, 1889. K. NEMOTO-TNS). Prov. Shimôsa: Noda (apr. 1921. K. HISAUCHI-TI). Prov. Musashi: Takao-san (apr. 1903. B. HAYATA). Tônosu-yama, Hannô (junio, 1931. T. NAKAI-TI). Hodo-gaya (maio, 1958. T. SAITÔ-TNS). Prov. Kôdzuke: Akagi-yama (junio, 1903. B. HAYATA-TI). Prov. Sagami: Abura-tsubo (maio, 1942. T. YAMAZAKI-TI). Prov. Shinano: Matsumoto (maio, 1936. S. MOMOSE-TI). Kayano-shi (junio, 1908). Prov. Idzu: Kamitsuki-mura (apr. 1937. K. HAYASHI-KYO). Daruma-yama (apr. 1947. K. TERAMOTO-TI). Oh-shima (maio, 1931. Y. JÔTANI-TNS; apr. 1933. S. AKIYAMA; maio, 1956. N. SATOMI). Miyake-jima (apr. 1937.-TNS). Hachijô-jima (maio, 1887. M. SHIRAI-TNS; apr. 1930. S. KITAMURA-KYO). Prov. Suruga: Tomioka-mura (maio, 1925. S. MURAMATSU-TI). Prov. Owari: Tashiro-mura (T. MAKINO-TI). Prov. Tôtômi: Omae-zaki (maio, 1930. Y. KUROSAWA-KYO).

Kyûshû. Prov. Satsuma: Ikeda-ko (Z. TASHIRO-KYO). Kushiki-no (aug. 1909. Z. TASHIRO-KYO). Ibusuki (maio, 1921. Z. TASHIRO-KYO). Nagasaki-bana (mart. 1937. S. MURAMATSU-TI). Prov. Ohsumi: Sata-mura (maio, 1921. Z. TASHIRO-KYO). Takara-jima (maio, 1925. Z. TASHIRO-KYO). Tanega-shima (apr. 1924. Y. SHIMOMURA-KYO; junio, 1932. T. DOI-KYO).

Area geogr. Japonia, Korea, Formosa, China, India bor., Sibiria, etc.

Typus: 'in Sibiria transbaicalensi' (in LE).

In sterile localities, there occurs a dwarf form, of which the leaves as well as flowers are smaller than those of the typical one, but the author thinks that such differences are ecotypic, so he can not divide the species into varieties or forms taxonomically.

Series 2. **Zollingerianae** GROSSHEIM in Fl. URSS **18**: 582. 1952, cum descr. ross.

Syn.—

Gentiana sect. *Chondrophylla* series *Humiles* MARQUAND in Kew Bull. **1937**: 146 et 172, pro parte.

Folia radicalia haud sive vix rosulata.

Only one species in Japan.

Gentiana zollingeri FAWCETT

[Figs. 45 & 46]

Gentiana zollingeri FAWCETT in Jour. Bot. **21**: 183. 1883.–MAXIMOWICZ in

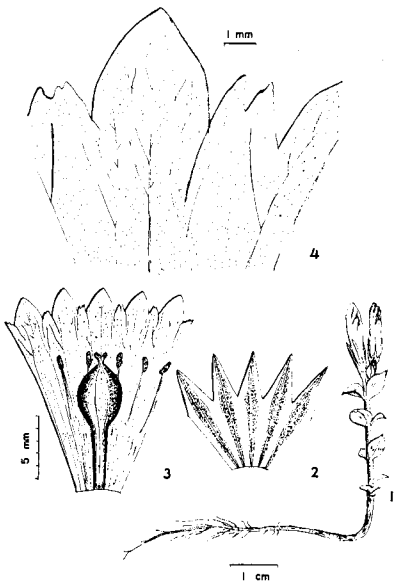

Fig. 45. *Gentiana zollingeri*: 1. Habit, 2. Open calyx, 3. Open corolla, and 4. Corolla-lobe with plicae.

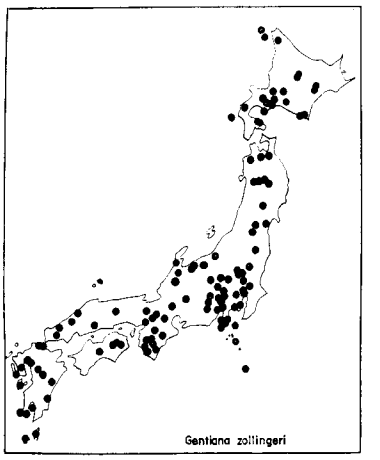

Fig. 46. Distribution of *Gentiana zollingeri*.

Bull. Acad. St.-Pétersb. **32**: 508. 1888.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 273. 1894.; in Acta Hort. Petrop. **15**: 416. 1904.–MATSUMURA, Ind. Pl. Jap. **2** (2): 502. 1912.–KUDO, Rep. Veg. N. Saghal. 205. 1924.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 950. 1931.–MASAMUNE, Fl. & Geobot. Yakus. 374. 1934.; in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.–HARA in Bot. Mag. Tokyo **51**: 17. 1937.; Enum. Spermat. Jap. **1**: 137. 1949.–NAKAI in Bull. Nat. Sci. Mus. **31**: 93. 1952.–Ohwi, Fl. Jap. (ed. 1), 952. 1953.–GROSSHEIM in Fl. URSS **18**: 582. 1952, excl. syn.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 117. 1956.–SATAKE in Natur. Sci. Mus. **24**: 144. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220, pl. 66, n. 538. 1957.

Syn.—

'*Gentiana Thunbergii* GRISEBACH' sensu ZOLLINGER, Syst. Verz. **3**: 49. 1855.–HERDER in Acta Hort. Petrop. **1**: 450. 1873.

G. aomorensis LÉVEILLÉ in Bull. Soc. Bot. France **53**: 648. 1906.–MATSUMURA, Ind. Pl. Jap. **2** (2): 500. 1912, ut *awomorensis*.

G. Zollingeri f. *albiflora* TUYAMA in Jour. Jap. Bot. **16**: 502. 1940.–HARA, Enum. Spermat. Jap. **1**: 137. 1949.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

Herba humilis, annua, glaberrima. Radix simplex, 1.5–15 cm longa, prope apicem radiculos fibrosos nonnulos vel multos emittens. Caulis simplex, (2–) 5–

10 cm altus, ascendens, subdistincte angulatostriatus, brunnescens, interdum purpurascentiviridis. Folia radicalia sub anthesi plerumque destituta sed rare opposita, foliis caulinis parvis, oppositis, ovalibus vel latoövalibus vel latoellipticis, apice minute acuminatis, basi subito abbreviatis et vaginantim connatis, sessilibus, margine albomarginatis, patentibus, 5–15 mm longis, 4–10 mm latis, utrinque concoloribus sed rare subtus purpurascentibus, glabris, trinerviis. Flores pauci—multi, pedunculati, pedunculis nullis vel brevibus, ad 4 mm longis, calycibus (6–) 11–20 mm longis, cylindricocampanulatis, submembranaceis, 5-fidis, sepalis lanceolatis vel oblongolanceolatis, (2–) 6–8 mm longis, margine hyalinomembranaceis et albomarginatis, a medio in apicem varsus acutatis, corollis tubosocampanulatis, caeruleopurpureis, 12–30 mm longis, 5-fidis, lobis ellipticis vel ovalibus, quam corollae 1/4–1/5-plo longioribus, plicis corollae deltoideis vel latodeltoideis, 1/2–2 mm longis, apice 2–3-dentatis, dentibus obtusis, staminibus 5, calycibus subaequilongis, filamentis subulatofiliformibus, antheris oblongis, pistillo uno, staminibus aequilongo, capitato, alatoangulato, stigmate bipartito, distincto, crasso, ovario longe stipitato et uniloculari. Capsulae longe stipitatae, demum corollas valde superantes, seminibus minutissimis, fusiformibus, sublaevibus.

Nom. Jap. Fude-rindô.

Specim. exam.

Hokkaidô. Prov. Kitami: Rebun-tô (junio, 1956. H. TOYOKUNI et S. KAWANO). Prov. Ishikari: Kobetsu-tôge (maio, 1957. S. AKIYAMA et H. TOYOKUNI). Bankei-tôge (junio, 1960. M. NAKAJIMA). Horomi-tôge (maio, 1961. M. IWABUCHI). Ashiribetsu (junio, 1960. M. NAKAJIMA). Sôunkyô (maio, 1960. S. AKIYAMA). Ishikiri-yama (maio, 1948. H. TOYOKUNI). Moiwa-yama (maio, 1949. H. TOYOKUNI). Prov. Iburi: Inter Kohan et Môrappu, Shikotsu-ko (junio, 1957. H. TOYOKUNI et S. ENOMOTO). Tokushunbetsu-dake (junio, 1957. H. TOYOKUNI). Prov. Hidaka: Nittô-kôzan (junio, 1951. H. TOYOKUNI). Apoi-dake (maio, 1959. H. TOYOKUNI).

Honshû. Prov. Mutsu: Shiwa-mura (maio, 1946. U. NARITA-TI). Sukayu, Hakkôda-san (aug. 1956. T. YAMAZAKI-TI). Prov. Rikuchû: Takadô-san (maio, 1958. K. MUKAIDA). Koiwai (maio, 1932. G. TOBA-TI). Prov. Iwashiro: Benten-yama (maio, 1904. G. NAKAHARA-TNS). Prov. Musashi: Takao-san (apr. 1903. B. HAYATA). Asakawa (apr. 1939. I. HURUSAWA-TI). Prov. Shimotsuke: Nasu-mura (apr. 1940. S. IDE-TNS). Prov. Shinano: Karuizawa (mart. 1903. B. HAYATA). Yatsuga-take (maio, 1924. F. OKA-TNS). Asama-yama (maio, 1937. H. ITÔ-TI). Prov. Idzu: Sekirô-zaki (apr. 1954. S. YANO). Oh-shima (apr. 1887. H. SAKURAI-TNS). Miyake-jima (apr. 1938. K. HAYASHI-TNS). Hachijô-jima (apr. 1936. Y. SATAKE-TI). Prov. Noto: Hôtatsu-zan (maio, 1952. K. NAKAO). Prov. Kai: Mittsu-tôge (maio, 1935. K. HIYAMA-TNS; maio, 1952. T. SHIMIZU-KYO). Prov. Yamashiro: Fushimi (apr. 1946. G. NAKAI-KYO). Prov. Settsu: Kanbi-san (maio, 1960. M. HIROE). Prov. Mimasaka: Hirusen-zan (maio, 1959. G. MURATA-KYO). Prov. Suô: Minakami, Ohuchi-mura (apr. 1892. J. NIKAI-TI).

Shikoku. Prov. Awa: Kamodani-mura (apr. 1913. J. NIKAI-TNS). Konji-san (maio, 1913. J. NIKAI-TI). Prov. Tosa: Nanokawa-mura (apr. 1890. K. WATANABE-TNS).

Kyûshû. Prov. Buzen: Moji (apr. 1946. S. TOYAMA-TNS). Prov. Satsuma: Kaimon-dake (apr. 1894. T. ITÔ-TNS). Prov. Ohsumi: Sakura-jima (apr. 1933. S. KAJIWARA-TNS).

Area geogr. ? Sachalin, Japonia (ab Hokkaidô tenus Kyûshû), Korea, China, Manchuria, etc.

Typus: 'Ex Japonia 331' (in BR).

This species does not show many variations, but the Hokkaidô as well as n. Japan type is smaller than normal forms. The present writer once considered that the former might be separated from the latter as a form. However, these two types are interconnected with many transitional forms, and the demarcation between the two is not very distinct.

Subsectio 2. **Orbiculatae** (MARQUAND) TOYOKUNI, stat. nov. et mut. charact.

Syn.—

Gentiana sect. *Chondrophylla* I Mehrjährige KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 84. 1895.

Gentiana sect. *Chondrophylla* series *Orbiculatae* MARQUAND in Kew Bull. **1937**: 146 et 170, excl. sp. annuis.

Gentiana sect. *Chondrophylla* series *Pyrenaicae* et *Nipponicae* GROSSHEIM in Fl. URSS **18**: 572 et 575. 1952.

Clavis specierum

Flores breves, vulgo 1–2 cm longi, corollis tubulosoinfundibularibus et in orem versus gradatim dilatatis, plicis angustodeltoideis . . . . . *G. nipponica*

Flores longiores, vulgo 2–3 cm longi, corollis tubulosocampanulatis et in ore subito dilatatis, plicis deltoideis et orem protegentibus . . . . . *G. jamesii*

Gentiana nipponica MAXIMOWICZ

[Figs. 47 & 48, Plate III (10)]

Gentiana nipponica [var. nipponica] MAXIMOWICZ in Bull. Acad. St.-Pétersb. **32**: 507. 1888.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 215. 1894.; in Acta Hort. Petrop. **15**: 356. 1904.–LÉVEILLÉ in Bull. Soc. Bot. France **53**: 649. 1906.–MATSUMURA, Ind. Pl. Jap. **2** (2): 501. 1912.–TAKEDA in Bot. & Zool. **3**: 2207, f. 76. 1935.–HARA in Bot. Mag. Tokyo **51**: 17. 1937.; Enum. Spermat. Jap. **1**: 133. 1949.–OHWI, Fl. Jap. (ed. 1), 952. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 116. 1956.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220, pl. 66, n. 541. 1957.

Syn.—

Gentiana Makinoi (non KUSNEZOW, 1893) LÉVEILLÉ et VANIOT ex LÉVEILLÉ in Bull. Soc. Bot. France **53**: 649. 1906.

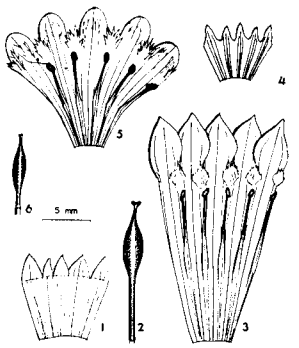

Fig. 47. *Gentiana jamesii* (1-3) and *G. nipponica* (4-6): 1 & 4. Open calyx, 2 & 6. Pistil, and 3 & 5. Open corolla.

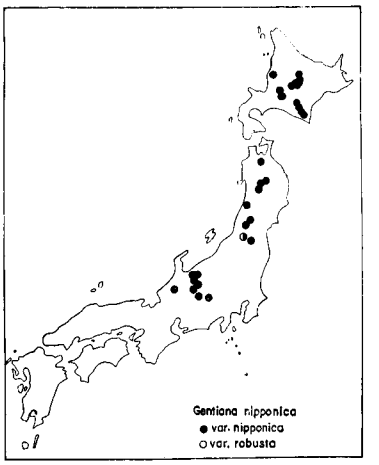

Fig. 48. Distribution of *Gentiana nipponica* var. *nipponica* (black dots) and var. *robusta* (circle).

G. nipponica var. *leucantha* TAKEDA, Kôzan-shokubutsu Dzui (ed. 2), 25. 1937, in nota.; Alp. Fl. Jap. t. 81. 1938, in textu. *G. nipponica* f. *leucantha* (TAKEDA) HARA, Enum. Spermat. Jap. **1**: 133. 1949.-TOYOKUNI in Acta Phytotax. Geobot. **16**: 116. 1956.-HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.

Herba perennis, humilis parvaque, sed plantae in locis palustribus crescentes altiores gracilioresque esse vartant. Radix plerumque simplex, brevis, ad 5 cm longa, fibrillis gracilibus sed brevibus saepius emittens, erhizomata. Caulis humilis, cum inflorescentiis 5–10 cm rare usque 20 cm altus, semiquadriangulatus, ascendens sive erectus et inferiore parte repens aut procumbens, internodiis foliis brevioribus vel aequilongis vel longioribus; folia radicalia sub anthesi destituta, caulinis eis oppositis, latolanceolatis vel anguste ovatoöblongis, 5–12 mm longis, 3–5 mm latis, apice obtusis, margine saepe plus minusve crispis, basi subito angustatis, sessilibus et vaginantim connatis, uninerviis rare trinerviis. Flores 1–5, in caulis ramorumque apicibus subumbellatim dispositi, sessiles aut brevipedunculati, calycibus tubosoinfundibularibus, 5–10 mm longis, 5-fidis, sepalis lanceolatis vel angustoövatis, apice acutis et apicali in parte plus minusve recurvis, 1–5 mm longis, corollis 15–20 mm longis, purpurascenticaeruleis rare albis, tubis corollae calycibus subaequilongis vel longioribus, 5-fidis, lobis corollae ovalibus vel ovatolanceolatis, margine integris aut minute asperulis, ca. 5 mm longis, plicis anguste deltoideis, 1–2 mm longis, apice irregulariter dentatis rare integris et lobis corollae aequicoloratis, staminibus 0.9–1.5 cm longis, filamentis subulatis, antheris oblongis, pistillo capitato, stigmate bipartito, parvo, ovario longe stipitato. Capsulae longestipitatae, seminibus fusiformibus, laevibus.

Nom. Jap. Miyama-rindô.

Specim. exam.

Hokkaidô. Prov. Teshio: Shokambetsu-dake (julio, 1952. H. TOYOKUNI). Prov. Ishikari: Takanega-hara montium Taisetsu (julio, 1957. H. TOYOKUNI et H. NAKA). Kaun-dake montium Taisetsu (aug. 1956. H. TOYOKUNI). Yûpari-dake (julio, 1960. H. TOYOKUNI).

Honshû. Prov. Mutsu: Oh-dake, Hakkôda-san (aug. 1932. Y. YAMADA). Hakkôda-san (julio, 1953. M. KIKUCHI). Prov. Rikuchû: Yakeishi-dake (aug. 1947. M. KIKUCHI). Inter Kunimi-onsen et Komaga-take (sept. 1958. M. KIKUCHI). Prov. Ugo: Chôkai-zan (aug. 1930. T. SUTÔ). Prov. Uzen: Gas-san (julio, 1927. T. HAGA). Prov. Iwashiro: Komaga-take (sept. 1956. T. TSUJII et S. KAWANO). Prov. Shinano: Shirouma-dake (B. HAYATA). Komaga-take (B. HAYATA). Prov. Kaga: Haku-san (aug. 1929. K. INAGAKI; aug. 1952. N. SATOMI).

Area geogr. Endemica (Hokkaidô et Honshû bor. et med.).

Typus: '*Nippon*: prov. Echiu monte Tate-yama' (in LE).

var. **robusta** HARA in Jour. Jap. Bot. **21**: 19. 1947.; Enum. Spermat. Jap. **1**: 133. 1949.–OHWI, Fl. Jap. (ed. 1), 952. 1953.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220. 1957, in textu.

Syn.—

Gentiana Jamesii var. *robusta* (HARA) OHWI in sched. Herb. TNS.

Planta typo major robustiorque, foliis latioribus, ad 7 mm latis, floribus longioribus, ad. 2.8 cm longis, plicis late deltoideis, ad 4 mm longis, apicibus marginibusque irregulariter brevilaciniatis.

Nom. Jap. Iide-rindô.

Specim. exam.

Honshû. Prov. Iwashiro: Iide-san (aug. 1924. J. OHWI-KYO; aug. 1926. S. SAITÔ-TI; aug. 1931. T. SAITÔ-KYO; aug. 1952. M. NODA).

Area geogr. Endemica (Iide-san).

Typus: 'Honsyu. Prov. Iwashiro: m. Iide (S. Saito, Aug. 26, 1926 in Herb. Univ. Tokyo)' (in TI).

This species and the next one, *G. jamesii* appear to have sprung from the common ancestral stock because of their similarity, and thereby the demarcation between them sometimes becomes somewhat difficult when they are growing together, though the distinction between the typical forms of the two species may be made without any difficulty. *G. nipponica* usually grows in grassy places in the alpine regions of middle and northern Japan, but it likes wet places and swamps as well; in such places the stems tend to elongate attaining a height of 20 cm or more, but they are slender.

On Mt. Iide of Province Iwashiro, there occurs a robust variety of *G. nipponica*. The variety seems more similar to *G. jamesii* than to *G. nipponica* at a glance, but the internal characters of the flower in the variety suggest that

it must be a derivative of *G. nipponica*. It is an important variety connecting *G. nipponica* with *G. jamesii*.

Gentiana jamesii HEMSLEY

[Figs. 43 & 47, Plate III (8)]

Gentiana jamesii HEMSLEY in Jour. Linn. Soc. **26**: 128. 1890.–KUSNEZOW in Acta Hort. Petrop. **15**: 285. 1898.–NAKAI, Fl. Koreana **2**: 97. 1911.; in MATSUMURA, Icon. Pl. Koisikav. **3**: 25, t. 158. 1916.–MARQUAND in Kew Bull. **1937**: 170.–HARA in Jour. Jap. Bot. **21**: 17. 1947, in textu.; Enum. Spermat. Jap. **1**: 132. 1949.–OHWI, Fl. Jap. (ed. 1), 952. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 116. 1956.–SATAKE in Natur. Sci. Mus. **24**: 143. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220. 1957.

Syn.—

Gentiana nipponica var. *Kawakamii* MAKINO in Bot. Mag. Tokyo **17**: 212. 1903. *G. Kawakamii* (MAKINO) MAKINO in Bot. Mag. Tokyo **18**: 67. 1904.–MATSUMURA, Ind. Pl. Jap. **2** (2): 500. 1912.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 948. 1931.–TATEWAKI in Jour. Fac. Agr. Hokkaidô Imp. Univ. **29**: 208 et 234 et 236 et 285. 1933.; in Bull. Biogeogr. Soc. Jap. **4**: 294. 1934.–TAKEDA in Bot. & Zool. **3**: 2208, f. 77. 1935. *G. jamesii* var. *Kawakamii* (MAKINO) NAKAI in Bull. Nat. Sci. Mus. **31**: 93. 1952, comb. nud.

G. Jamesii var. *albiflora* NAKAI in MATSUMURA, Icon. Pl. Koisikav. **3**: 25. 1916.; l. c. 1952. *G. Jamesii* f. *albiflora* (NAKAI) TOYOKUNI in Acta Phytotax. Geobot. **16**: 116. 1956, in adnota.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.

'*G. nipponica* MAXIMOWICZ' sensu SUGAWARA, Ill. Fl. Saghal. **4**: 1549, t. 709. 1940.–GROSSHEIM in Fl. URSS **18**: 576. 1952.

G. kurilensis GROSSHEIM, l. c. 576 et 750, t. 30, f. 1. 1952.

Herba perennis, humilis sed robusta, graviviridis, glaberrima. Radix vulgo simplex, brevis, radiculos graciles saepe emittens et erhizomata. Caulis subcrassus, ad 2 mm in diametro, 5–15 cm altus, indistincte quadristriatus, erectus sed inferiore in caulis parte saepe repens, interdum rubropurpurascens, media superioraque in parte aliquot ramosus, internodiis quam folia vulgo brevioribus sed rare longioribus aut aequilongis. Folia radicalia sub anthesi destituta, foliis caulinis oppositis, ovatolanceolatis v. latolanceolatis v. oblongis, apice obtusis vel acutiusculis, basi subito angustatis, sessilibus, vaginatoconnatis, margine semihyalinomembranaceis, integris, 5–20 mm longis, 3–7 mm latis, vulgo uninerviis rare trinerviis. Flores vulgo sessiles, in apicibus ramorum caulisque solitarii vel duo vel tres, subumbellatim dispositi, calycibus tubosocampaniformibus, interdum violascentibus, 7–11 mm longis, 5-fidis, sepalis ovalibus aut angustoövalibus, apice acutiusculis vel subacuminatis, sub anthesi patentibus recurvisque, 3–6 mm longis, corollis anguste tubosocampanulatis, purpurascenticaeruleis, (15–) 20–

25(–30)mm longis, 5-fidis, lobis corollae ovalibus vel ellipticis, vulgo 5–8 mm longis, margine asperulis, apice obtusis sive obtusiusculis, sub anthesi patentibus, plicis ceteris corollae concoloribus vel dilutius coloratis et violaceis seu flavescentibus, deltoideis, 1.5–2.5(–3) mm longis, margine breviter fimbriatis laciniatisve, sub anthesi faucem protegentibus, staminibus tubo corollae paulo brevioribus, filamentis subulatofiliformibus, antheris oblongis, ca. 1 mm longis, pistillo uno, capitato, stylo breve, stigmate bipartito, distincto sed parvo, ovario longe stipitato et uniloculari. Capsulae primum longe stipitatae sed demum secundum incrementum brevistipitatae esse vertantes et corollas paulo superantes; semina laevia, fusiformia.

Nom. Jap. Rishiri-rindô, Kumoma-rindô, Kawakami-rindô.

Specim. exam.

Hokkaidô. Prov. Kitami: Rishiri-dake, Rishiri-tô (aug. 1949; aug. 1960. H. TOYOKUNI). Prov. Ishikari: Taisetsu-san (aug. 1928. S. AKIYAMA). Takanega-hara montium Taisetsu (julio, 1931. Y. YAMADA; aug. 1953. H. TOYOKUNI et T. KIMURA; julio, 1957. H. TOYOKUNI et H. NAKA). Yûpari-dake (aug. 1960. H. TOYOKUNI).

Area geogr. Sachalin, Kuriles, Japonia (Hokkaidô), Korea bor., etc.

Typus: 'CHANGPEISHAN: on the borders of Mandshuria (*James*!)' (in K).

HARA says that the plant referred to *G. nipponica* by GROSSHEIM in 'Flora URSS **18**' is nothing but the typical form of the present species, and his interpretation is right. This view causes one to think that GROSSHEIM himself may have mistaken it in that work. However, the error is not due to him but due to SUGAWARA's carelessness, GROSSHEIM having but followed the opinion of SUGAWARA.

Gentiana sect. **Frigida** KUSNEZOW in Acta Hort. Petrop. **13**: 61. 1893.; ibid. **15**: 254. 1896, pro maj. parte–HEGI, Ill. Fl. Mitt.-Eur. **5**(3): 1982. 1927, pro parte.–GROSSHEIM in Fl. URSS **18**: 556. 1952.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 115. 1956.

Syn.—

Gentiana sect. *Cyane* GRISEBACH, Gen. et Sp. Gent. 276. 1839, pro parte.

Gentiana sect. *Pneumonanthe* NECKER, El. Bot. **2**: 11. 1790, ut species. emend. GRISEBACH in DE CANDOLLE, Prodr. **9**: 109. 1845, pro parte.

Clavis subsectionum

Caulis plerumque humilis, colore corollae caerulescenti cyanove . . . . . subsect. Glaucae

Caulis vulgo altus, corolla albida aut fulvescenti et iterum caeruleoviridi- v. purpureocaeruleo- v. violaceopunctulata . . . . . subsect. Frigidae

Subsectio 1. **Glaucae** (GROSSHEIM) TOYOKUNI in Acta Phytotax. Geobot. **16**: 115. 1956.

Syn.—

Gentiana sect. *Frigida* series a KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 83. 1895, pro parte.

Gentiana sect. *Frigida* series *Glaucae* GROSSHEIM in Fl. URSS **18**: 561. 1952, nom. nud.

One species in Japan.

Gentiana glauca PALLAS

[Figs. 49 & 50, Plate III (9)]

Gentiana glauca PALLAS, Fl. Ross. **1** (2): 104, t. 93, f. 2. 1789.–LEDEBOUR, Fl. Ross. **3**: 66. 1847, cum *α. minor* et *β. major*.–? MIYABE, Fl. Kuril. 251. 1890.–? MATSUMURA, Ind. Pl. Jap. **2** (2): 500. 1912.–KOIDZUMI in Bot. Mag. Tokyo **32**: 57. 1918.–HULTÉN, Fl. Kamtchat. **4**: 64. 1930.; Fl. Alaska & Yuk. **8**: 1306. 1948.–? MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 947. 1931.–HARA, Enum. Spermat. Jap. **1**: 132. 1949.; in Jour. Fac. Sci. Univ. Tokyo, sect. 3, **6**: 360. 1956.–GROSSHEIM in Fl. URSS **18**: 561. 1952.–OHWI, Fl. Jap. (ed. 1), 952. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 115. 1956.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 221. 1957.

Herba perennis, laevis, glabra. Radix rhizomata, rhizomate tenui, repenti, brevi et folia abbreviatoëmarcida exteriori in facie terrae praedito. Caulis

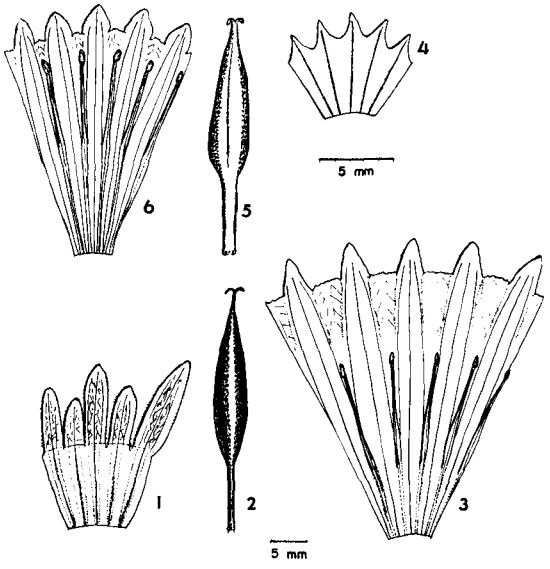

Fig. 49. *Gentiana algida* (1–3) and *G. glauca* (4–6): 1 & 4. Open calyx, 2 & 5. Pistil, and 3 & 6. Open corolla.

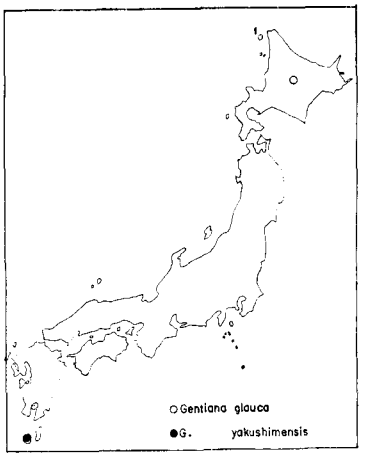

Fig. 50. Distribution of *Gentiana glauca* (circles) and *G. yakushimensis* (black dot).

simplex, erectus vel in parte inferiore ascendens, cum inflorescentiis 2–10 cm altus, angulatostriatus, cyaneoviridis. Folia radicalia crassa, subrosulata, sessilia, apice rotundata, basi rotundata vel obtusa et vaginantim connata, vulgo uninervia rare tri- sive quinquenervia (sed nervis lateralibus in apices versus gradatim evanescentibus), colore cyaneoviridia, 10–22 mm longa, 7–11 mm lata, foliis caulinis eis radicalibus conformibus sed minoribus, oppositis, uninerviis, 6–17 mm longis, 5–12 mm latis, apice rotundatis, basi rotundatis vel obtusis et subito angustatis vaginatisque. Flores 1–5(–7), pedunculati, pedunculis brevibus, 0–3 mm longis, calycibus tubosocampanulatis, apice 5-fidis, sepalis anguste triangularibus, corollis tubosocampanulatis, 14–17 mm longis, cyaneocaerulescentibus, apice 5-fidis, lobis ca. 1.2–1.5 mm longis, rotundatotriangularibus, plicis humiliter triangularitruncatis, 0.2–0.4 mm longis, staminibus 12–13 mm longis, filamentis subulatolinearibus, antheris angustotriangularibus, ca. 1 mm longis, pistillo uno, ca. 15 mm longo, oblongofusiforme, stylo nullo, stigmate bipartito, distincto et recurvo, ca. 2 mm longo, ovario distincte stipitato et uniloculari. Capsulae longestipitatae, corollas superantes, seminibus reticulatis, irregulariter parvialatis.

Nom. Jap. Yokoyama-rindô.

Specim. exam.

Hokkaidô. Prov. Ishikari: Asahi-dake montium Taisetsu (julio, 1957. H. TOYOKUNI et H. NAKA). Inter Pippu-dake et Nagayama-dake montium Taisetsu (aug. 1953. H. TOYOKUNI et T. KIMURA; aug. 1960. H. TOYOKUNI).

Area geogr. Japonia (Hokkaidô med.), Kuriles, Kamtschatka, continens Asiae orientalis, continens Americae borealioccidentalis.

Typus: 'Crescit in summis alpibus Camtschatcae, a latere humido plegam septentrionalem spectante' (in LE).

Like *Gentiana algida*, this species shows the tendency of disjunct distribution in Japan, though it is bipolar in the distribution area as a whole. In Japan, the species is found only in an extremely restricted place in the alpine region of the Taisetsu Mts. of Province Ishikari, Hokkaidô. The present writer made some careful observations on this species in that only locality of the plant in Japan, respectively in 1953 and 1957, where it is growing either on volcanic ashes mixed with small pieces of volcanic stone or pumice or in subdry alpine meadows with such species as *Bryanthus gmelini*, *Saxifraga laciniata*, *Arcterica nana*, etc. In the former case, the stems seem usually to be lower than those in the latter, but the plant is not so much variable in the two localities. As the plant produces rhizomes, it is usually found as a mass of several to many individuals, and such a mass is scattered here and there in the above-mentioned localities.

Gentiana glauca appears to play an important rôle in connecting the section Frigida with the section Chondrophylla, because of its similarity to the perennial series species of the latter section.

Subsectio 2. **Frigidae** (GROSSHEIM) TOYOKUNI in Acta Phytotax. Geobot. **16**: 115. 1956.

Syn.—

Gentiana sect. *Frigida* series 1 KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 83. 1895, pro parte.

Gentiana sect. *Frigida* series *Frigidae* GROSSHEIM in Fl. URSS **18**: 559. 1952, cum descr. ross.

Gentiana sect. *Frigida* subsect. *Sympodiae* H. SMITH in Kew Bull. **15**: 54. 1961, pro parte.

One species in Japan.

Gentiana algida PALLAS

[Figs. 49 & 51, Plate IV (13)]

Gentiana algida [f. algida] PALLAS, Fl. Ross. **1** (2): 107, t. 95. 1789.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 114. 1894.; in Acta Hort. Petrop. **15**: 259. 1898.–HULTÉN, Fl. Kamtchat. **4**: 61. 1930.; Fl. Alaska & Yuk. **8**: 1300. 1948.–HARA, Enum. Spermat. Jap. **1**: 131. 1949.–GROSSHEIM in Fl. URSS **18**: 559. 1952.–OHWI, Fl. Jap. (ed. 1), 953. 1953.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 221, pl. 66, n. 542. 1957.

Syn.—

Pneumonanthe algida (PALLAS) F. W. SCHMIDT in ROEMER, Arch. Bot. **1**: 10. 1796. *Gentiana frigida* β. *G. algida* (PALLAS) FROELICH, De Gent. 39. 1796. *G. frigida* β. *algida* (PALLAS) GRISEBACH in DE CANDOLLE, Prodr. **9**: 111. 1845. *G. frigida* γ. *algida* (PALLAS) LEDEBOUR, Fl. Ross. **3**: 65. 1847.–FRANCHET et SAVATIER, Enum. Pl. Jap. **2**: 449. 1877.–LÉVEILLÉ in Bull. Soc. Bot. France **53**: 649. 1906.

Gentiana nikoensis FRANCHET et SAVATIER, Enum. Pl. Jap. **1**: 322. 1875, nom. nud.

G. algida α. *sibirica* KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 114. 1894.; in Acta Hort. Petrop. **15**: 259. 1898.–MATSUMURA, Ind. Pl. Jap. **2** (2): 499. 1912.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 945. 1931.–TAKEDA in Bot. & Zool. **3**: 2060, f. 71. 1935.

'*G. algida* var. *frigida* KUSNEZOW' sensu YABE in Bot. Mag. Tokyo **17**: 24. 1903.

'*G. frigida* HAENKE' sensu LÉVEILLÉ in Bull. Soc. Bot. France **53**: 649. 1906.

G. algida f. *maculosa* TOYOKUNI, mss. in Herb. SAP, quoad pl. ex monte Senmai.

Herba perennis, glaberrima, fulvescentiviridis. Radix rhizomata, rhizomate tenui sed longissimo, dense articulato et radiculos plures emittenti. Caulis simplex, ascendens v. suberectus, 7–30 cm altus, angulatostriatus (caule antiquo cum nonnulis foliis radicalibus in rhizomate manenti et caulem novum sequenti in parte facienti). Folia radicalia fasciculata, oblanceolatolinearia vel spathulatolinearia, in apices versus acutata, apice acuta sive obtusa, basi attenuatoangustata

et vaginata, 7–15 cm longa, 5–12 mm lata, foliis caulinis oppositis lanceolatis v. oblongolanceolatis rare oblanceolatis, vulgo trinerviis, apice acutis vel obtusis, basi rotundatocuneatis vel attenuatoangustatis et vaginatis, 2–5 cm longis, 3–10 mm latis. Flores terminales, 1–pauci, calycibus ca. 3 cm longis et 5-lobatis, sepalis acicularilinearibus et valde inaequalibus et tubis subaequilongis, corollis cylindricocampanulatis, dilute fulvis et iterum caerulescentiviridipunctulatis, 3.5–5 cm longis, apice breviter 5-lobatis, lobis triangularibus, ca. 6 mm longis, ca. 4 mm latis, plicis truncatis, apice brevissime paucidentatis vel integris, pedunculis brevibus, 0–10 (–20) mm longis, staminibus 24–30 mm longis, filamentis subulatofiliformibus, antheris anguste deltoideis, ca. 2 mm longis, pistillo uno, ca. 32 mm longo, fusiformi, stigmate bipartito, lineari, usque 6 mm longo, stylo vulgo nullo, ovario longe stipitato unilocularique. Capsulae brevistipitatae, corollas haud superantes, seminibus reticulatis, anguste 3-alatis.

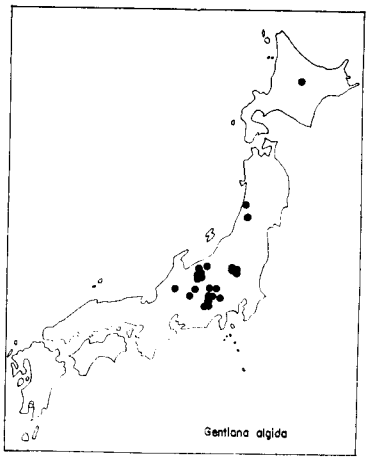

Fig. 51. Distribution of *Gentiana algida*.

Nom. Jap. Tôyaku-rindô.

Specim. exam.

Honshû. Prov. Shimotsuke: Nikkô (KYO). Shirane-zan (sept. 1902. T. ITÔ-TNS; julio, 1921. Y. YAMADA; sept. 1930. T. SUTÔ). Prov. Shinano: Senjô-dake (sept. 1954. G. MURATA-KYO; sept. 1959. T. SHIMIZU-KYO). Inter Sampuku-tôge et Shiomi-dake (oct. 1956. G. MURATA-KYO). Norikura-dake (aug. 1905. U. FAURIE-KYO). Yatsuga-dake (aug. 1913. U. FAURIE-KYO; aug. 1924. S. MURAMATSU-TI; julio, 1925. J. OHWI-KYO). Shirouma-dake (aug. 1902. Y. YABE-TI; aug. 1906. S. KODAMA-TI). On-take (sept. 1902. B. HAYATA; aug. 1911. J. NIKAI-TI et TNS). Prov. Kai: Asayo-mine (aug. 1958. G. MURATA-KYO). Hô-wô-zan (aug. 1936. S. ISHIZUKA-TI; aug. 1958. G. MURATA-KYO). Shirane-zan (aug. 1928; aug. 1932. M. TAGAWA-KYO). Prov. Echigo: Myô-kô-zan (aug. 1953. G. MURATA-KYO). Prov. Etchû: Kajima-yari-dake (aug .1957. G. MURATA et T. SHIMIZU-KYO). Tate-yama (aug. 1927. Z. TASHIRO-KYO; aug. 1931. S. KITAMURA-KYO). Prov. Kaga: Haku-san (aug. 1914. S. NAKAJIMA-TI).

Area geogr. Japonia (Honshû med.), Korea septentr., in Asiae regionibus frigidis (e. g., Sibiria, Dahuria, etc.), America septentr., etc.

Typus: 'In summis cacuminibus et jugis nivalibus alpium Sibiriae orientalis, ad Jeniseam, circa Baicalem, in Dauuria et in Camtschatca (vulgo simul cum *Rhododendro Chrysantho*) copiose crescit' (in LE).

forma **igarashii** (MIYABE et KUDO) TOYOKUNI, stat. nov.

Syn.—

Gentiana algida var. *Igarashii* MIYABE et KUDO ex NISHIDA in Trans. Sapporo Nat.

Hist. Soc. **7**: 164. 1920, nom. nud.–TAKEDA in Bot. & Zool. **3**: 2061, f. 72. 1935.–TATEWAKI in Jour. Sapporo Soc. Agr. & For. **28**(131): 33. 1936.–HARA, Enum. Spermat. Jap. **1**: 131. 1949.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 116. 1956.–HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957. *G. Igarashii* (MIYABE et KUDO) MIYABE et KUDO in Trans. Sapporo Nat. Hist. Soc. **8**: 5. 1921.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 947. 1931.

'*G. algida* PALLAS' sensu KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 221. 1957, pro min. parte.

A forma typica caulibus humilioribus, usque 15 cm altis, foliis radicalibus brevioribus latioribusque eorumque testis crassioribus, floribus pro planta majoribus differt.

Nom. Jap. Kumoi-rindô, Yezo-tôyakurindô (H. KOIDZUMI, 1926).

Specim. exam.

Hokkaidô. Prov. Ishikari: Takanega-hara montium Taisetsu (aug. 1950. H. TOYOKUNI; aug. 1951. H. TOYOKUNI). Inter Hakuun-dake et Koidzumi-dake montium Taisetsu (aug. 1948. H. TOYOKUNI).

Honshû. Prov. Shinano: Arakawa-dake (sept. 1956. H. TOYOKUNI).

Area geogr. Japonia (Hokkaidô med. et Honshû med.) et Kuriles septentr. (insl. Paramushir).

Typus: 'Hokkaido, Prov. Ishikari: Mt. Nutakkamshube (S. IGARASHI! July 1917)' (in SAPA).

Gentiana algida is a subarctic species having tricentric trends in distribution. The first centre is in the subarctic as well as arctic zone of Continental Asia, namely from Siberia (Obi, Altai, east to Chukch, Kamtchatka, Ochotsk) southwards through the mountain regions of Central Asia (Tyanshan, Turkestan, Mongol, Tibet, etc.) to Manchuria and northern Korea, the second in N. America, from Alaska and Yukon southwards to Montana, Utah and Colorado, and the third in the alpine region of central and northernmost Japan.

As mentioned above, the range of distribution being rather wide, the species varies a good deal, but the Japanese species falls at least into two types of variation patterns, the Honshû type and the Hokkaidô type. The former has tall stems attaining a height of 30 cm, narrow linear-oblanceolate or linear-spathulate radical leaves which well attain 15 cm in length, and comparatively small flowers, while the latter honoured with the name f. *igarashii*, is characterised by lower stems less than 15 cm in height, shorter but broader oblong-lanceolate to oblanceolate radical leaves, and larger magnificent flowers. Although only one sheet of specimen exists in the herbarium of the Kyôto University (KYO), the plant collected by OHWI and YOSHII in the island of Paramushir in the northern Kuriles agrees well with the latter type, so that it is incontroversible that f. *igarashii* may probably be found in the islands of N. Pacific. It is also found in wind-swept places on high mountains in central

Honshû.

The distribution of the present plant in Hokkaidô, too, is very interesting from the phytogeographical point of view, for it is distributed only within the quite limited area of the Taisetsu Mts. Where it came from, from North (through the Kuriles) or South (through Honshû) is still called in question. But it seems that the present plant is a remainder of the Ice Age. Such a type of disjunct distribution appears to be rather common in the Gentianaceae.

The chromosome number of *G. algida* is counted to be $2n=26$.

Gentiana sect. **Kudoa** (MASAMUNE) SATAKE et TOYOKUNI ex TOYOKUNI in Jour. Jap. Bot. **35**: 202. 1960, excl. syn. nonnul.

Syn.—

? *Gentiana* sect. *Pneumonanthe* NECKER, El. Bot. **2**: 11. 1790, ut species, emend. GRISEBACH in DE CANDOLLE, Prodr. **9**: 109. 1845, pro parte.

Gentiana sect. *Frigida* KUSNEZOW in Acta Hort. Petrop. **13**: 61. 1893, pro parte.

Gentiana sect. *Frigida*-Reihen 1 et 3 KUSNEZOW in ENGLER et PRANTL, Nat. Pfl.-fam. **4** (2): 83. 1895, pro parte.

Gentiana sect. *Frigida*-A. Typicae-series 1 KUSNEZOW in Acta Hort. Petrop. **15**: 259. 1898, pro parte.

Kudoa MASAMUNE in Jour. Trop. Agr. **2**: 29. 1930.

Only one species in Japan.

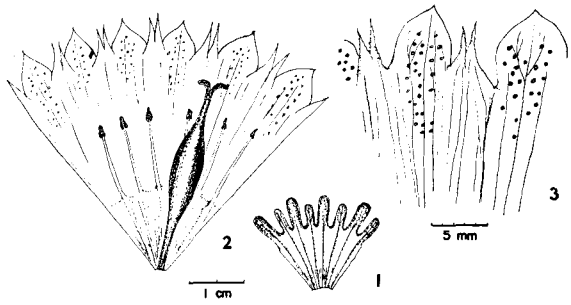

Fig. 52. *Gentiana yakushimensis*:
1. Open calyx, 2. Open corolla,
and 3. Corolla-lobes with plicae.

Gentiana yakushimensis MAKINO

[Figs. 50 & 52]

Gentiana yakushimensis MAKINO in Bot. Mag. Tokyo **23**: 252. 1909.–MASAMUNE in Bot. Mag. Tokyo **44**: 219. 1930.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 949. 1931.–HONDA, Nom. Pl. Jap. (ed. 1), 280. 1939.–HARA, Enum. Spermat. Jap. **1**: 136. 1949.–OHWI, Fl. Jap. (ed. 1), 954. 1953.–SATAKE in

Natur. Sci. Mus. **24**: 141. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 220, pl. 66, n. 540. 1957.–TOYOKUNI in Jour. Jap. Bot. **35**: 202. 1960.

Syn.—

Kudoa yakushimensis (MAKINO) MASAMUNE in Jour. Trop. Agr. **2**: 29. 1930.; Fl. & Geobot. Yakus. 373. 1934.; in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.; Shokubutsu-Chirigaku Shinkô, 73. 1956, in textu.–HONDA, Nom. Pl. Jap. (ed. em.), 207. 1957.

Herba perennis, glaberrima, ex una caudice multos caules (usque 25) emittens. Radix rhizomata, rhizomate crasso et longo. Caules indistincte striati, cum inflorescentiis (5–) 7–20 cm alti. Folia radicalia vulgo deficientia, foliis caulinis inferioribus squamosis, eis medianis superioribusque crassis, haud petiolatis, quam internodii longioribus, dense 4-verticillatis, linearilanceolatis v. linearioblongis, (5–)10–20 (–22) mm longis, 2–4 mm latis, supra graviviridibus, subtus albescentiviridibus, cum costis mediis distinctis, margine integris et membranaceocartilagineis, apice obtusis aut subrotundatis, basi attenuatocuneatis et vaginantim connatis, vaginis glabris, brunneofuscescentibus. Flores solitarii—pauci, sessiles, terminales, 3–4 cm longi, calycibus ca. 2.5 cm longis, vulgo 8- sive 6- rare 7-lobatis, sepalis 4 magnis, ca. 5 mm longis et ca. 2 mm latis et uninerviis, ceteris 4 minoribus, ca. 3 mm longis, ca. 1.5 mm latis, uninerviis sed distincte nervulosis, corollis tubosocampaniformibus, caeruleopurpureis et iterum gravioripurpureopunctulatis, pulcherrimis, plicis ca. 5 mm longis, explicantibus, profunde bipartitis, staminibus ca. 22 mm longis, filamentis subulatis, antheris anguste deltoideis, ca. 2 mm longis, pistillo ca. 32 mm longo, stylo nullo, stigmate bipartito et recurvo, 7–9 mm longo, ovario distincte stipitato et uniloculari, oblongofusiformi. Capsulae brevistipitatae, corollas non superantes, seminibus numerosis, subangulatis, una in parte cauda filiformi auctis, linearilanceolatis et cum cauda ca. 3.5 mm longis.

Nom. Jap. Yakushima-rindô (MAKINO, 1909).

Specim. exam.

Kyûshû. Prov. Ohsumi: Yaku-shima; Miyanoura-dake (julio, 1917. K. YAMAGUCHI et T. NAGAO-KYO; aug. 1918. Z. TASHIRO-KYO; aug. 1933. Y. DOI-TNS; aug. 1933. M. TAGAWA-KYO; aug. 1934. M. TOGASHI-TI; julio, 1936. S. IWAMASA-TI). Nagata-dake (aug. 1923. Z. TASHIRO-KYO & TNS; aug. 1933. M. TAGAWA-KYO). Yae-dake (sept. 1909. Y. NAKANO-KYO). Kurio-dake (aug. 1911. Y. NAKANO-KYO et TNS).

Area geogr. Endemica (Yaku-shima).

Typus: 'Prov. ŌSUMI: Summit of Mt. Miyanouradake in Yakushima (*Y. Kudo*! communicat. *T. Uchiyama*; *T. Makino*! Sept. 1909.)' (in TMH).

This striking plant is growing within the very restricted area in the alpine region of the island of Yaku, with its thick and long roots penetrating deeply into limestone crevices. No allied species has hitherto been found in Japan, but species like this are growing here and there in the continent of Asia. When

MASAMUNE established *Kudoa*, making *K. yakushimensis* the type, in 1930, he did not quote any related species, but later in 1956, he amended the distribution area of the genus by pointing out that it is distributed from the Caucasus range through the Kwen Lun range to the island of Yaku, where *K. yakushimensis* became palaeo-endemic.

Gentiana sect. **Pneumonanthe** NECKER, El. Bot. **2**: 11. 1790, ut species. emend.-GRISEBACH in DE CANDOLLE, Prodr. **9**: 109. 1845, pro parte.-KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 179. 1894.; in ENGLER et PRANTL, Nat. Pfl.- fam. **4** (2): 81. 1895.-HEGI, Ill. Fl. Mitt.-Eur. **5** (3): 1982. 1927.-CLAUSEN in Bull. Torrey Bot. Club **68**: 660. 1941.-GROSSHEIM in Fl. URSS **18**: 541. 1952.-TOYOKUNI in Acta Phytotax. Geobot. **16**: 114. 1956.

Syn.—

Cyane RENEALMI ex GRISEBACH, Gen. et Sp. Gent. 276. 1839, pro parte.

Clavis specierum

1. Caulis paucifoliatus, foliis ovalibus v. rhomboideoangustoëllipticis, margine plus minusve undulatis, in basin versus attenuatis et brevipetiolatis, sepalis ovatis v. ovatocordatis et patentibus . . . . . *G. sikokiana*
1. Caulis nonnulifoliatus tenus multifoliatus, foliis lanceolatis v. late lanceolatis v. ellipticis, basi sessilibus, sepalis semper erectis, linearibus-lanceolatis . . 2
2. Folia subtus dilute viridia, margine scabriuscula, caulibus vulgo rubescenti-purpureis, rhizomatibus, gracilibus, brevibus v. subattenuatis, plicis plus minusve distinctis . . . . . *G. scabra*
2. Folia subtus glaucina vel alboviridia, margine minute scabriuscula aut integra esse videntur, caulibus plerumque dilute viridibus vix purpurascentibus, rhizomatibus crassioribus 3
3. Folia elliptica v. latolanceolata v. oblonga, floribus parvis, 20–30 mm longis, lobis corollae semper erectis . . . . . *G. makinoi*
3. Folia angustiora, lanceolata v. linearilanceolata rare late lanceolata v. angustoövalia, floribus majoribus, 35–50 mm longis, lobis corollae primum erectis sed demum patentibus . . . . . *G. triflora*

Gentiana triflora PALLAS var. **japonica** HARA

[Figs. 53 & 54, Plate IV (11)]

Gentiana triflora [var. triflora] PALLAS, Fl. Ross. **1** (2): 105, t. 93, f. 1. 1789.-FR. SCHMIDT, Reis. Amurl. u. Sachal. 160. 1868.-HERDER in Acta Hort. Petrop. **1**: 455. 1873.-KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 79. 1894.; in Acta Hort. Petrop. **15**: 225. 1898, cum f. *angustifolia* et f. *latifolia*.-KUDO, Rep.

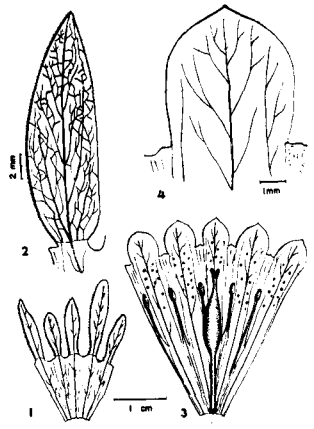

Fig. 53. *Gentiana triflora* var. *japonica* f. *montana*:
1. Open calyx, 2. Calyx-lobe, 3. Open corolla, and 4. Corolla-lobe.

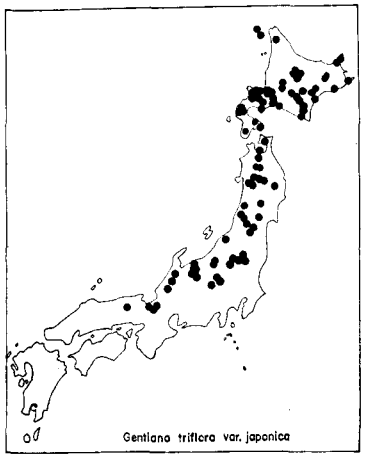

Fig. 54. Distribution of *Gentiana triflora* var. *japonica*.

Veg. N. Saghal. 205. 1924.–KOMAROV et KLOBUSKOVA-ALISOVA, Key Pl. Far East. Reg. USSR **2**: 863. 1932.–GROSSHEIM in Fl. URSS **18**: 547. 1952.–POPOV, Fl. Sr. Sib. **2**: 587. 1959.

Syn.—

Pneumonanthe triflora (PALLAS) F. W. SCHMIDT in ROEMER, Arch. Bot. **1**: 10. 1796. *Dasystephana triflora* (PALLAS) BORCKHAUSEN in ROEMER, Arch. Bot. **1**: 26. 1796.

var. **japonica** [f. japonica] (KUSNEZOW) HARA, Enum. Spermat. Jap. **1**: 136. 1949.–OHWI, Fl. Jap. (ed. 1), 954. 1953.–TOYOKUNI in Acta Phytotax. Geobot. **16**: 114. 1956.–SATAKE in Natur. Sci. Mus. **24**: 142. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

Syn.—

Gentiana rigescens β. *japonica* KUSNEZOW in Acta Hort. Petrop. **13**: 60. 1893.; in Trav. Soc. Nat. St.-Pétersb. **24**: 92. 1894.; in Acta Hort. Petrop. **15**: 235. 1898, excl. pl. ex 'Nippon, Jokohama (Maximowicz)'.–NAKAI in Bot. Mag. Tokyo **23**: (114). 1909.–MATSUMURA, Ind. Pl. Jap. **2**(2): 501. 1912.

G. axillariflora LÉVEILLÉ et VANIOT ex LÉVEILLÉ in Bull. Soc. Bot. France **53**: 648. 1906.–MATSUMURA, Ind. Pl. Jap. **2**(2): 500. 1912.–KOIDZUMI in Bot. Mag. Tokyo **37**: 44. 1923.–KUDO, Rep. Veg. N. Saghal. 205. 1924.–HARA in Bot. Mag. Tokyo **51**: 16. 1937.–GROSSHEIM in Fl. URSS **18**: 549. 1952.

G. Naitoana LÉVEILLÉ et VANIOT ex LÉVEILLÉ, l. c. 649. 1906, pro parte.–MATSUMURA, l. c. 501. 1912. *G. axillariflora* var. *Naitoana* (LÉVEILLÉ et VANIOT) KOIDZUMI in Bot. Mag. Tokyo **37**: 44. 1923.

G. jesoana NAKAI in Bot. Mag. Tokyo **23**: 106. 1909.; Fl. Koreana **2**: 99. 1911.–MIYABE

et MIYAKE, Fl. Saghal. 328. 1915.

'*G. triflora* PALLAS' sensu KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 222, pl. 66, n. 546. 1957, quoad pl. ex Jap.

Planta sublaevis, perennis. Radix crassa, rhizomata, rhizomatibus crassis, longis, aliquot radiculos emittentibus. Caulis erectus, simplex vel a radice pauciramosus, indistincte striatus, dilute viridis, cum inflorescentiis 15–80 cm altus. Folia radicalia et caulina inferiora vaginata et scariosa, foliis caulinis mediis superioribusque oppositis, rarissime triphylloverticillatis, ovatis vel late lanceolatis vel oblongis vel lanceolatis, (3–) 5–10 cm longis, 1–3.5 cm latis, apice acutis aut obtusis, basi acute cuneatis vel obtuse cuneatis rare rotundatis, sessilibus, vaginatis, semiamplexicaulibus, supra viridibus, subtus dilute viridibus v. glaucinis, utrinque glabris, margine vulgo integris rare scabriusculis, tri—quinquenerviis. Flores (1–) 5–20, terminales atque superioriaxillares, sessiles, bracteae linearioblanceolatae, calycibus breviores interdum longiores, subfoliaceae, calycibus 5-fidis, tubis calycum 10–15 mm longis, sepalis valde inaequalibus et quam tubi 1—duplo longioribus, vulgo lanceolatolinearibus, corollis tubosocampaniformibus, gravicaeruleis rare dilute caeruleis v. caerulescentibus v. albis sed nunquam purpureis, 3–4.5 cm longis, 5-fidis, lobis corollae apice rotundatis v. subrotundatis v. acutis v. subacuminatis, plicis valde humilibus, subtruncatis, integris rare brevissime 2–3-dentatis, staminibus 24–28mm longis, filamentis fusiformibus, membranaceis, media inferioraque partibus intus corollis affixis, antheris ca. 2.5 mm longis, pistillo uno, stigmate aequilongo sive leviter longiore, ovario stipitato, stylo brevi, stigmate bipartito, indistincto. Capsulae stipitatae, lanceolatae, corollas non superantes, seminibus reticulatis, lanceolatis.

Nom. Jap. Yezo-rindô (NAKAI, 1909).

Specim. exam.

Hokkaidô. Prov. Kitami: Rausu-ko (sept. 1960. HONDA). Takinoue (sept. 1950. S. OKAMOTO-KYO). Onnemêmu (sept. 1945. M. MIZUSHIMA-TI). Prov. Teshio: Nupromapporo (junio, 1956. H. TOYOKUNI). Prov. Ishikari: Orochiga-hara, Muine-yama (aug. 1953. H. TOYOKUNI). Nopporo (oct. 1930. S. AKIYAMA). Hippu (sept. T. YAMAGUCHI-TNS). Inter Kamifurano et Fukiage-onsen (aug. 1948. M. TATEWAKI-TNS). Prov. Kushiro: Meakan-dake (julio, 1954. H. TOYOKUNI). Prov. Shiribeshi: Shioya (sept. 1932. T. KAWADA-TNS). Nisekoan-nupri (sept. 1933. T. KAWADA-TNS). Prov. Iburi: Tokushunbetsu-dake (aug. 1955. H. TOYOKUNI). Chitose (sept. S. MATSUDA-KYO). Tomakomai (aug. 1899. J. MATSUMURA-TI). Prov. Oshima: E-san (aug. 1931. K. TSUKAMOTO-TI).

Honshû. Prov. Mutsu: Aomori (sept. 1907. N. KINASHI-KYO). Prov. Rikuchû: Iwate-zan (julio, 1927. M. HONDA-TI). Prov. Ugo: Chôkai-zan (aug. 1915. Y. OGURA-TI). Taihei-zan (oct. 1933. S. MURAMATSU-TNS; aug. 1952. H. HARA et S. KUROSAWA-TI). Moriyoshi-yama (sept. 1957. M. MATSUDA-TNS; aug. 1959. S. KUROSAWA-TI). Tegata-yama (oct. 1932. S. MURAMATSU-TI). Hachiman-dai (aug. 1928. S. MURAMATSU-TI). Prov. Uzen: Shiratake-yama (sept. 1931. S. OKUYAMA-TNS). Inter Haguro-yama et Gas-san (junio, 1937. F. MAEKAWA et H.

HARA-TI). Gas-san (aug. I. ISHIZUKA-TI). Prov. Iwashiro: Issaikyô-yama (aug. 1912. G. KOIDZUMI-TI). Prov. Shinano: Asama-yama (sept. 1895. K. WATANABE-TNS). Shiga-kôgen (sept. 1955. M. FURUSE-TNS). Kami-kôchi (julio, 1927. T. NAKAI-TI). Prov. Echigo: Honai-mura (oct. 1953. M. TOGASHI-TNS). Kirin-yama (oct. 1950. T. NAKAI et N. MARUYAMA-TNS). Prov. Kaga: Koma-gaeri (oct. 1955. I. SHIMOZAWA). Prov. Echizen: Arashima-dake (aug. 1954. G. MURATA et T. SHIMIZU-KYO). Prov. Ohmi: Mikuni-yama (oct. 1927. Z. TASHIRO-TNS). Mie-dake (oct. 1927. Z. TASHIRO-TNS).

Area geogr. 'Japonia (Hokkaidô et Honshû), Sachalin, Kuriles austr., ? Korea, etc.

Typus: *Japonia*, Jeso; Hakodate (Maximowicz)' (in LE).

forma **crassa** TOYOKUNI et SATOMI in Jour. Geobot. **7**: 52. 1958.

Planta robustior, 60–80 cm alta, foliis caulinis crassis, lanceolatoöblongis, 7–10 cm longis, 22–28 mm latis, floribus densius dispositis, caule crassiore, ad 8 mm crasso.

Nom. Jap. Hama-yezorindô (TOYOKUNI et SATOMI, 1958).

Specim. exam.

Honshû. Prov. Noto: Shibagaki, Kamiamata-mura (oct. 1954. N. SATOMI-KZU[8]), 'holotypus' et SAP, 'isotypus').

Area geogr. Endemica (Honshû med.).

Typus: 'Honshu: Sibagaki, Hakuigun, Prov. Noto (N. Satomi, Oct. 4, 1954)' (in KZU).

forma **montana** (HARA) TOYOKUNI et TANAKA in Hokuriku Jour. Bot. **4**: 38. 1955.

Syn.—

Gentiana axilliflora var. *montana* HARA in Jour. Jap. Bot. **21**: 19. 1947. *G. triflora* var. *montana* (HARA) HARA, Enum. Spermat. Jap. **1**: 136. 1949.-OHWI, Fl. Jap. (ed. 1), 954. 1953.-SATAKE in Natur. Sci. Mus. **24**: 142. 1957. *G. triflora* var. *japonica* subvar. *montana* (HARA) TOYOKUNI in Acta Phytotax. Geobot. **16**: 115. 1956.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

Caules simplices vel a radicibus pauciramosi, humiliores, 13–30 cm alti, foliis caulinis ovatis v. lanceolatoövatis v. lanceolatoöblongis, floribus plerumque solum terminalibus.

Nom. Jap. Yezo-oyamarindô (HARA, 1947).

Specim. exam.

Hokkaidô. Prov. Ishikari: Yûpari-dake (aug. 1957. H. TOYOKUNI). Muine-yama (aug. 1953. H. TOYOKUNI; aug. 1955. H. TOYOKUNI et A. TANAKA). Soranuma-dake (aug. 1948. H. TOYOKUNI; sept. 1957. S. ENOMOTO). Kaun-dake montium Taisetsu (aug. 1956. H. TOYOKUNI).

Honshû. Prov. Rikuchû: Iwate-zan (aug. 1940. S. KITAMURA-KYO).

Area geogr. Endemica (Hokkaidô et Honshû bor.).

8) Herbarium of the Faculty of Science, Kanazawa University, Kanazawa.

Typus: 'Hokkaido, Prov. Ishikari: m. Yubari (Koidzumi, Aug. 1916 in Herb. Univ. Tokyo)' (in TI).

forma **horomuiensis** (KUDO) TOYOKUNI, stat. nov.

Syn.—

Gentiana horomuiensis KUDO, Med. Pl. Hokkaidô, t. 70. 1922. *G. axillariflora* var. *horomuiensis* (KUDO) HARA in Jour. Jap. Bot. **21**: 19. 1947. *G. triflora* var. *horomuiensis* (KUDO) HARA, Enum. Spermat. Jap. **1**: 136. 1949.-OHWI, Fl. Jap. (ed. 1), 954. 1953.- SATAKE in Natur. Sci. Mus. **24**: 142. 1957. *G. triflora* var. *japonica* subvar. *horomuiensis* (KUDO) TOYOKUNI in Acta Phytotax. Geobot. **16**: 114. 1956.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

A forma praecedente distat, foliis caulinis angustioribus, linearilanceolatis v. anguste oblongolanceolatis, minus quam 8 mm latis. Crescit solum in locis palustribus.

Nom. Jap. Horomui-rindô (KUDO, 1922).

Specim. exam.

Hokkaidô. Prov. Kitami: Inter Iwô-zan et Sashirui-dake (julio, 1951. H. TOYOKUNI). Prov. Teshio: Toikambetsu (aug. 1931. K. KIKUCHI-KYO). Prov. Ishikari: Bibai (junio, 1960. H. TOYOKUNI).

Honshû. Prov. Iwashiro: Ozega-hara (aug. 1950. M. MIZUSHIMA-TI).

Area geogr. Endemica (Hokkaidô et Honshû med.).

Typus: 'Ishikari-koku, Horomui oyobi Tsuishikari no deitanchi ni shôzu' (in SAPA).

Clavis formarum

1. Caulis 30–80 cm altus, foliis caulinis late lanceolatis v. lanceolatoöblongis v. oblongis v. lanceolatis, floribus terminalibus axillaribusque 2
1. Caulis humilior, 15–30 cm altus, foliis caulinis ovatis v. linearilanceolatis, floribus plerumque solum terminalibus 3
2. Caulis ad 5 mm crassus, foliis caulinis tenuibus, papyraceis . . f. *japonica*
2. Planta robustior, caule crassiore, ad 8 mm crasso, foliis caulinis crassioribus et subcoriaceis, floribus densius dispositis . . . . . f. *crassa*
3. Folia caulina lanceolatoövata v. lanceolatoöblonga v. ovata . . f. *montana*
3. Folia valde angustiora, linearilanceolata v. angustissime oblongolanceolata . . . . . f. *horomuiensis*

The present species varies a good deal according to the oecological condition of habitats. Although three forms, viz., f. *crassa*, f. *montana* and f. *horomuiensis* can be recognised under var. *japonica*, they are sometimes interconnected with transitional forms.

The Japanese variety *japonica* differs from the mother plant on the continent of Asia by having thicker but shorter leaves, fewer-flowered inflorescences

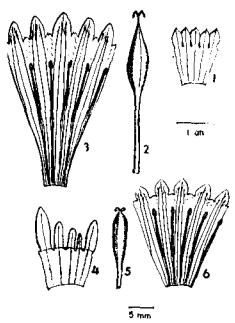

Fig. 55. *Gentiana sikokiana* (1-3) and *G. makinoi* (4-6): 1 & 4. Open calyx, 2 & 5. Pistil, and 3 & 6. Open corolla.

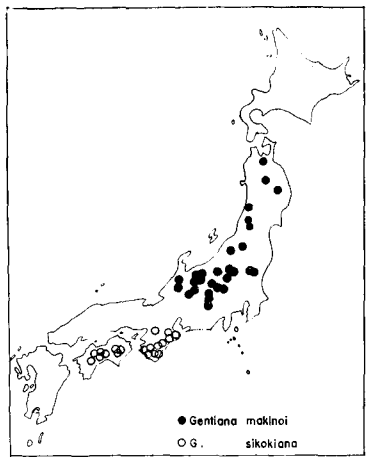

Fig. 56. Distribution of *Gentiana makinoi* (black dots) and *G. sikokiana* (circles).

and shorter stems.

Gentiana makinoi KUSNEZOW

[Figs. 55 & 56]

Gentiana makinoi [f. makinoi] KUSNEZOW in Acta Hort. Petrop. **13**: 60. 1893.; in Trav. Soc. Nat. St.-Pétersb. **24**: 89. 1894.; in Acta Hort. Petrop. **15**: 233. 1898.-MAKINO in Bot. Mag. Tokyo **10**: (72). 1896.-MATSUMURA, Ind. Pl. Jap. **2** (2): 501. 1912, pro parte.-TAKEDA in Bot. & Zool. **3**: 2205, f. 73. 1935.-HARA in Jour. Jap. Bot. **21**: 16. 1947, in textu.; Enum. Spermat. Jap. **1**: 132. 1949.-OHWI, Fl. Jap. (ed. 1), 953. 1953.-SATAKE in Natur. Sci. Mus. **24**: 142. 1957.-HONDA, Nom. Pl. Jap. (ed. em.), 205. 1957.-KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 221, pl. 66, n. 545. 1957.

Syn.—

Gentiana Makinoi f. *albiflora* NAKAI ex HARA, l. c. 19. 1947.-SATAKE, l. c. 142. 1957.

Planta glabra, sublaevis, perennis. Radix rhizomata, rhizomatibus crassis et nonnulos radiculos emittentibus. Caulis ex basi ramosus aut simplex, erectus rare subascendens nec repens nec procumbens, vulgo dilute viridis nec purpurascens, indistincte striatus, cum inflorescentiis (15-) 20-60 cm altus. Folia radicalia inferioraque valde abbreviata et vaginatoscariosa, foliis caulinis lanceolatis v. anguste ovalibus v. ovalibus, apice obtusis sive obtusiusculis, basi late cuneatis vel rotundatis et vaginantim connatis, semiamplexicaulibus, margine integris rarius minutissime scabriusculis, supra viridibus, subtus glaucinis, trinerviis rare quinquenerviis, (3-) 4-7 cm longis, 1-2.5 cm latis. Bracteae foliaceae. Flores 1-7,

terminales rare atque superioriaxillares, sessiles, corollis caeruleopurpureis rare caeruleorubris v. albis, 18–30 mm longis, plicis parvis et humilibus, subtruncatis, toto integris, calycum tubis 5–8 mm longis, sepalis inaequalibus, oblanceolato-linearibus, vulgo quam tubi 1/2—duplo longioribus, staminibus ca. 17 mm longis, filamentis fusiformibus, submembranaceis, angustoalatis, antheris attenuate angustodeltoideis, 2–2.8 mm longis, pistillo uno, staminibus subaequilongo, stylo brevi, ovario stipitato, stigmate bipartito, subdistincto. Capsulae stipitatae, corollis aequilongae, seminibus reticulosis, utrinque attenuatis, lanceolatis.

Nom. Jap. Oyama-rindô, Kiyama-rindô.

Specim. exam.

Honshû. Prov. Rikuchû: Hayachine-san (aug. 1912. A. KUDO-KYO). Iwate-zan (sept. 1900. H. SAKURAI-TNS). Prov. Iwashiro: Iide-san (aug. 1898. U. FAURIE-KYO; aug. 1905. G. KOIDZUMI-TI). Hiuchi-dake (aug. 1933. S. OKAMOTO-KYO). Prov. Shimotsuke: Nantai-zan (aug. 1913. B. HAYATA). Nyohô-zan (aug. 1930. S. AKIYAMA). Shirane-zan (sept. 1929. T. ITÔ-TNS; sept. 1945. M. HIROE-KYO). Prov. Kôzuke: Suga-numa (sept. 1929. S. AKIYAMA). Tanigawa-dake (julio, 1948. T. YAMAZAKI-TI). Prov. Shinano: Shirouma-dake (sept. 1934. Y. SATAKE-TI). Ohtaki-yama (julio, 1934. S. MOMOSE-TI). Kita-dake (sept. 1953. H. MATSUDA-TI). Yatsuga-take (julio, 1907; julio, 1928. K. INAGAKI; julio, 1930. J. OHWI-KYO). Senjô-dake (aug. 1949. T. YAMAZAKI-TI; sept. 1959. T. SHIMIZU-KYO). On-take (aug. 1902. B. HAYATA; aug. 1910. G. KOIDZUMI-TI). Inter Sampuku-tôge et Shiomi-dake (oct. 1956. G. MURATA-KYO). Yariga-take (aug. 1933. M. NISHIJIMA-TI). Hachibuse-yama (julio, 1933. S. MOMOSE-TI). Prov. Suruga: Senmai-dake (sept. 1956. H. TOYOKUNI; sept. 1959. H. TOYOKUNI). Prov. Echigo: Naeba-yama (julio, 1950. M. TAKEUCHI-TI). Komaga-take (aug. 1908. M. NAKAMURA-TNS). Prov. Kai: Komaga-take (aug. 1958. G. MURATA-KYO). Hôwô-zan (sept. 1954. T. YAMAZAKI-TI). Prov. Kaga: Haku-san (aug. 1909. J. NIKAI-TI; aug. 1947. G. NAKAI-KYO; aug. 1953. G. MURATA-KYO). Prov. Etchû: Inter Harinoki-dake et Taira, Ushiro-tateyama (aug. 1957. G. MURATA et T. SHIMIZU-KYO). Tate-yama (aug. 1927. Z. TASHIRO-KYO).

Area geogr. Endemica (Honshû bor. et med.).

Typus: 'Japonia: Nippon, Nikko (Scient. Depart. of Tokio University No. 199). In paludosis Wakamatsu atque Inawashiro (Rein, No. 41). Tosa, Shikoku, Shimizu toge, Ko-duke (T. Makino, No. 153)' (in LE).

forma **stenophylla** TOYOKUNI, form. nov.

A typo differt foliis angustioribus, minus quam 1 cm latis.

Nom. Jap. Hosobano-oyamarindô (nom. nov.).

Holotypus: Honshû. Prov. Kôdzuke: Akagi-yama, Kakuman-ko (aug. 1932. Y. SHIOBARA-TNS, no. 40264).

Area geogr. Endemica (Honshû med.).

This species is also polymorphic and exhibits a good many variations, but the nature of its variations seems comparatively easy of description because of its restricted occurrence amongst the Japanese species of the section Pneumonanthe.

The specific epithet of the present plant was given in honour of the late

Dr. Tomitarô MAKINO, the collector of the type specimen.

Gentiana scabra BUNGE var. **buergeri** MAXIMOWICZ

[Figs. 57 & 58, Plate IV (12)]

Gentiana scabra [var. scabra] BUNGE in Mém. Acad. Sci. St.-Pétersb. **2**: 543. 1835.–KUSNEZOW in Acta Hort. Petrop. **15**: 220. 1898.–NAKAI, Fl. Koreana **2**: 98. 1911.

var. **buergeri** [subvar. buergeri f. buergeri] (MIQUEL) MAXIMOWICZ ex FRANCHET et SAVATIER, Enum. Pl. Jap. **2**: 449. 1877.–MAXIMOWICZ in Bull. Acad. St.-Pétersb. **32**: 509. 1888, in nota sub *G. sikokiana*.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 77. 1894.; in Acta Hort. Petrop. **15**: 223. 1898, cum f. *latifolia*, pro parte.–MATSUMURA, Ind. Pl. Jap. **2** (2): 501. 1912, pro parte.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 948. 1931.–HARA, Enum. Spermat. Jap. **1**: 133. 1949.–OHWI, Fl. Jap. (ed. 1), 953. 1953, pro parte.–SATAKE in Natur. Sci. Mus. **24**: 142. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 221, pl. 66, n. 544. 1957, pro parte.

Syn.—

Gentiana Buergeri MIQUEL in Ann. Mus. Bot. Lugd.-Bat. **3**: 124. 1867.

G. scabra γ. *intermedia* KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 77. 1894.; in Acta Hort. Petrop. **15**: 223. 1898.–NAKAI in Bot. Mag. Tokyo **42**: 12. 1928.

Herba perennis, vulgo elata. Radix subcrassa rarissime tenuis, sublignosa, pauciramosa—ramosissima, brevirhizomata, ad 20 cm longa. Caulis erectus vel ascendens, anguste quadristriatus, cum inflorescentiis 15–100 cm altus, saepe purpurascens, glaber sed superne denticulatoscaberulus. Folia radicalia sub anthesi scariosa, foliis caulinis mediis superioribusque triangulariovalibus v. ovatis v. ovatolanceolatis v. lanceolatis, trinerviis v. subtrinerviis, supra viridibus, subtus dilute viridibus, apices versus attenuatis et acutatis, basi rotundatis, sessilibus et vaginantim connatis, margine nervoque denticulatoscaberulis, (2–) 3–8 (–10) cm longis, (1.2–) 1.5–3 (–3.5) cm latis. Flores terminales axillaresque, sessiles, solitarii—pauci—multi, bracteati, bracteis angustolanceolatis, parvis, corollis (3.5–) 4–6 cm longis, caeruleopurpureis v. purpureorubris v. albis, cylindrico-campanulatis, plicis latodeltoideis, parvis, ca. 3 mm longis, apices versus saepe brevissime dentatis, staminibus ca. 30 mm longis, filamentis fusiformibus, antheris ca. 3.5 mm longis, pistillo uno, ca. 35 mm longo, distincte stipitato, stigmate bipartito, parvo, calycis tubis 10–18 mm longis, sepalis subinaequalibus, linearilanceolatis et tubis longioribus brevioribusve. Capsulae distincte stipitatae, corollas haud superantes, seminibus numerosis, depressolenticularibus.

Nom. Jap. Tsukushi-rindô (NAKAI, 1928).

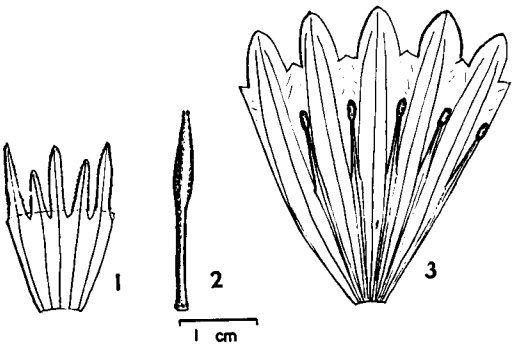

Fig. 57. *Gentiana scabra* var. *buergeri* subvar. *orientalis*: 1. Open calyx, 2. Pistil, and 3. Open corolla.

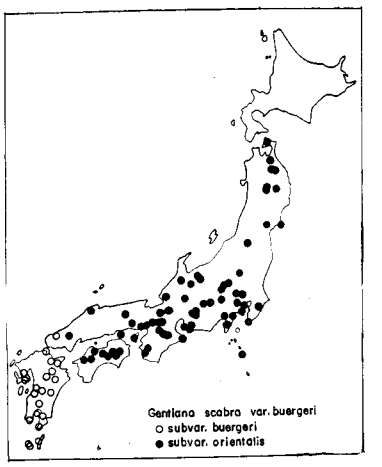

Fig. 58. Distribution of *Gentiana scabra* var. *buergeri* subvar. *buergeri* (circles) and subvar. *orientalis* (black dots).

Specim. exam.

Honshû. Prov. Nagato: Oh-kuraga-take (oct. 1949. T. NAKAI & N. MARUYAMA-TNS).

Kyûshû. Prov. Hizen: Kyôga-take (oct. 1922. Z. TASHIRO-KYO). Prov. Higo: Oh-mura (oct. 1922. K. MAYEBARA-TNS). Aida-mura (nov. 1924. K. MAYEBARA-KYO). Aso-zan (oct. 1934. J. SUGIMOTO-KYO). Prov. Satsuma: Kaimon-dake (julio, 1915. Z. TASHIRO-KYO). Prov. Ohsumi: Kirishima (nov. 1919. Z. TASHIRO-TNS).

Area geogr. Japonia (Honshû austr.-occid. et Kyûshû), insula Quelpaert, etc.

Typus: 'In vallibus humidis principatus Fizen ins. Kiusiu PIEROT' (in L).

forma **saxatilis** (HONDA) TOYOKUNI, stat. nov.

Syn.—

Gentiana scabra var. *Buergeri* subvar. *saxatilis* HONDA in Bot. Mag. Tokyo **42**: 508. 1928.- HARA, Enum. Spermat. Jap. **1**: 133. 1949.

G. saxatilis (HONDA) HONDA in Bot. Mag. Tokyo **43**: 191. 1929.

G. sino-ornata f. *saxatilis* (HONDA) NAKAI in Bot. Mag. Tokyo **46**: 608. 1932.-MASAMUNE, Fl. & Geobot. Yakus. 373. 1934.

G. scabra var. *saxatilis* (HONDA) MASAMUNE in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

A forma *buergeri* est diversa, caulibus abbreviatis, subcaespitosis, gracilioribus, foliis angustioribus, linearilanceolatis, 3–7 cm longis, 5–15 mm latis, apicibus acutis sive acuminatis.

Nom. Jap. Kumagawa-rindô (HONDA, 1928).

Specim. exam.

Kyûshû. Prov. Higo: Secus flumen Kuma-gawa (oct. 1953. Y. SHIMADA-TNS). Kônose (nov. 1924. K. MAYEBARA-TI, 'holotypus'). Prov. Ohsumi: Sata-mura (nov. 1954. Y. SHIMADA-TNS). Takakuma-yama (oct. 1923. G. MASAMUNE-TI; oct. 1937. M. TAKENOUCHI-TI).

Area geogr. Endemica (Kyûshû med. et austr.).

Typus: 'Kiusiu: Kônose, prov. Higo (K. MAYEBARA, no. 170, anno 1924)' (in TI).

forma **procumbens** TOYOKUNI, form. nov.

Caulibus longe humilioribus, 10–25 cm altis, inferiore in parte repentibus procumbentibusve, foliis lanceolatolinearibus v. linearilanceolatis, uninerviis a varietate typica facile est distinguenda.

Nom. Jap. Kirishima-rindô.

Holotypus: Kyûshû. Prov. Ohsumi: Kirishima-zan (oct. 8, 1956. T. IGARASHI-SAP, n. 28017).

Specim. exam.

Kyûshû. Prov. Ohsumi: Kirishima-zan (sept. 1926).

Area geogr. Endemica (Kyûshû austr.).

subvar. **orientalis** [f. orientalis] (HARA) TOYOKUNI, stat. nov.

Syn.—

'*Gentiana scabra* var. *Buergeri* MAXIMOWICZ' sensu KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 77. 1894, pro parte.; in Acta Hort. Petrop. **15**: 223. 1898, pro parte.–MATSUMURA, Ind. Pl. Jap. **2**(2): 501. 1912, pro parte.

G. subpetiolata HONDA in Bot. Mag. Tokyo **47**: 434. 1933.

G. scabra var. *orientalis* HARA, Enum. Spermat. Jap. **1**: 133. 1949.–SATAKE in Natur. Sci. Mus. **24**: 142. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.

A varietate *buergeri* distat, foliis angustioribus, elongatis, longius attenuatis, corollae plicis minoribus, triangularibus, apicibus acuminatis et vulgo integris.

Nom. Jap. Rindô, Sasa-rindô, Tonami-rindô (HONDA, 1933).

Lectotypus: Honshû. Prov. Sagami: Kamakura (nov. 3, 1934. Y. MOMIYAMA-TI)[9].

Specim. exam.

Honshû. Prov. Mutsu: Osore-yama (sept. 1934. Z. TASHIRO-KYO). Shiwa-mura (sept. 1946. U. NARITA-TI). Prov. Rikuchû: Kuriyagawa (oct. 1932. G. TOBA-KYO). Nagaoka, Shiba-machi (sept. 1957. M. KIKUCHI). Prope Morioka (oct. 1958. M. KIKUCHI). Prov. Shimotsuke: Nikkô (oct. 1953. H. KUBOTA-KYO). Prov. Musashi: Takao-san (nov. 1923. S. MURAMATSU-TI). Shimura (nov. 1911.–TI). Asakawa (oct. 1957. H. TOYOKUNI). Hizaori (oct. 1929. S. AKIYAMA). Prov. Kôdzuke: Kôdzu-bokujô (oct. 1954. T. YAMAZAKI-TI). Haruna-zan (oct. 1939. M. TOGASHI-TNS). Prov. Sagami: Dzushi (oct. 1917. T. YAMADA-KYO; nov. 1935. S. KITAMURA-KYO). Hakone (oct. 1930. T. NAKAI-TI). Prov. Shinano: Karuizawa (oct. 1949. H. HARA-TI). Asama-

9) In designating the Lectotype, the author has followed the opinion of Prof. H. HARA of the University of Tokyo (in personal communication).

yama (nov. 1933. H. ITÔ-TI). Inter Kashio et Sampuku-tôge (sept. 1956. G. MURATA et T. SHIMIZU-KYO). Prov. Idzu: Amagi-san (nov. 1952. S. KITAMURA-KYO). Atami (nov. 1934. S. OKUYAMA-TNS). Mikura-jima (TAKAHASHI & MATSUO-TI). Prov. Ohmi: Mikuni-yama (oct. 1923. G. KOIDZUMI-KYO). Ibuki-yama (aug. 1922. G. KOIDZUMI-KYO; nov. 1924. K. INAGAKI; sept. 1957. H. KANAI-TI). Prov. Mikawa: Prope Toyohashi (oct. 1947. K. INAGAKI). Prov. Yamashiro: Sugi-tani (oct. 1959. G. MURATA-KYO). Kyôto (nov. 1922. S. FUSHIMI-KYO). Sakajiri (oct. 1920. N. KINASHI-KYO). Prov. Yamato: Takami-mura (oct. 1922. G. KOIDZUMI & Y. OGAWA-KYO). Shaka-dake (aug. 1923. Y. YAMADA). Prov. Mimasaka: Ushiro-yama (oct. 1957. M. HIROE-KYO). Prov. Aki: Kammuri-yama (oct. 1952. M. HIROE-KYO). Noro-san (aug. 1929. S. AKIYAMA).

Shikoku. Prov. Iyo: Higashi-akaishi-yama (sept. 1956. T. YAMANAKA-KYO). Ohnogahara (nov. 1950. M. HIROE-KYO). Prov. Awa: Fukuhara-mura (nov. 1951. S. KITAMURA et G. NAKAI-KYO). Tsurugi-san (sept. 1949. G. NAKAI-KYO). Nokogiri-yama (nov. 1937. Y. SATAKE-TI). Prov. Tosa: Ichinomiya (oct. 1949. F. YANAGIDA-KYO). Nanokawa-mura (oct. 1889. K. WATANABE-TI). Matsubara (nov. 1956. K. MORISHITA).

Area geogr. Endemica (Honshû et Shikoku et ? Kyûshû).

forma **stenophylla** (HARA) TOYOKUNI, comb. nov.

Syn.—

Gentiana scabra ß. *Buergeri* f. *angustifolia* KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 78. 1894.; in Acta Hort. Petrop. **15**: 224. 1898, in textu, non *G. scabra* var. *Bungeana* f. *angustifolia* KUSNEZOW 1894.

G. scabra var. *Buergeri* subvar. *angustifolia* MAKINO in Bot. Mag. Tokyo **10**: 313. 1896.; ibid. **16**: 36. 1902.-MATSUMURA, Ind. Pl. Jap. **2** (2): 501. 1912.

G. scabra var. *stenophylla* HARA, Enum. Spermat. Jap. **1**: 134. 1949.-SATAKE in Natur. Sci. Mus. **24**: 142. 1957. *G. scabra* var. *Buergeri* f. *stenophylla* (HARA) OHWI in Bull. Nat. Sci. Mus. **33**: 83. 1953.-HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957, ut var. *orientalis* f. *stenophylla* OHWI.

Caulibus subcaespitosis, foliis linearilanceolatis, indistincte trinerviis, est haec forma a subvarietate *orientali* distincta.

Nom. Jap. Hosoba-rindô (MAKINO, 1896).

Lectotypus: Honshû. Prov. Mikawa: Takashi-mura (oct. 29, 1894. T. MAKINO-TI).

Specim. exam.

Honshû. Prov. Kadzusa: Mobara (oct. 1933. K. HIYAMA-TNS). Prov. Shimôsa: Hobara (nov. 1953. T. KOYAMA-TI). Prov. Shimotsuke: Meguriya-shitsugen, Nasu (aug. 1959. H. HARA-TI.). Prov. Mikawa: Atsumi-gun (oct. 1894. T. MAKINO-TI). Ino in paludosis (nov. 1952. S. KITAMURA-KYO). Prov. Yamato: Nara (T. NISHIZAWA-KYO). Prov. Kii: Hoshiga-tani, Shinjô (nov. 1953. K. MIHASHI-TNS).

Shikoku. Prov. Tosa: Kajiga-mori (oct. 1931. H. ASAHIYAMA-TNS). Prov. Awa: Minomachi (nov. 1947. T. INOBE-TI).

Area geogr. Endemica (Honshû med. et austr. et Shikoku).

Clavis subvarietatum formarumque

1. Folia vulgo ovata v. ovatolanceolata v. late lanceolata, plicis corollae magnis, apice plerumque paucidentatis . . . . . subvar. *buergeri* 2
1. Folia angustiora, elongata, attenuata, plicis corollae apice acuminatis et integris . . . . . subvar. *orientalis* 4
2. Caulis altus, simplex, foliis ovatis v. ovatolanceolatis . . . . f. *buergeri*
2. Caulis subcaespitosus, foliis angustioribus, linearilanceolatis v. lanceolato-linearibus 3
3. Caulis erectus v. ascendens, foliis vulgo linearilanceolatis . . . f. *saxatilis*
3. Caulis humilior, ascendens et inferiore in parte repens v. procumbens, foliis vulgo lanceolatolinearibus, plerumque uninerviis et vix trinerviis . . . . . f. *procumbens*
4. Caulis simplex, foliis ovatolanceolatis v. oblongolanceolatis . . f. *orientalis*
4. Caulis humilior, subcaespitosus, foliis linearilanceolatis . . . f. *stenophylla*

Gentiana scabra is a very polymorphic collective species with a wide range of variation. The typical form of the Japanese variety *buergeri* is allied to *Gentiana asclepiadea* at a glance, but the subvariety *orientalis* as well as its narrow-leaved form *stenophylla* resemble another continental species, *G. pneumonanthe* which is the type of the section Pneumonanthe.

Many authors have described several varieties under the Japanese *G. scabra*-Complex, but the author can not agree with their opinions, because there is no clear cut-line of demarcation between them. Almost all the varieties that have hitherto been named by different authors are reduced here to *forma* rank in order to bring the genus *Gentiana* as a whole into greater conformity.

Gentiana sikokiana MAXIMOWICZ

[Figs. 55, 56 & 59]

Gentiana sikokiana MAXIMOWICZ in Bull. Acad. St.-Pétersb. **32**: 508. 1888.–MAKINO in Bot. Mag. Tokyo **4**: 87. 1890.–KUSNEZOW in Trav. Soc. Nat. St.-Pétersb. **24**: 73. 1894.; in Acta Hort. Petrop. **15**: 219. 1898.–MATSUMURA, Ind. Pl. Jap. **2**(2): 502. 1912.–MAKINO et NEMOTO, Fl. Jap. (ed. rev.), 949. 1931.–HARA, Enum. Spermat. Jap. **1**: 134. 1949.–OHWI, Fl. Jap. (ed. 1), 953. 1953.–SATAKE in Natur. Sci. Mus. **24**: 141. 1957.–HONDA, Nom. Pl. Jap. (ed. em.), 206. 1957.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 221, pl. 66, n. 543. 1957.

Herba mediocris, glaberrima. Radix perennis, rhizomata, rhizomate tenue, aliquot ramoso, colore umbrinoso v. umbrinosobruneolo, breve, radiculoso, radiculis nonnulis, crassis, 3–20 cm longis, usque ad 3 mm in diametro. Caulis

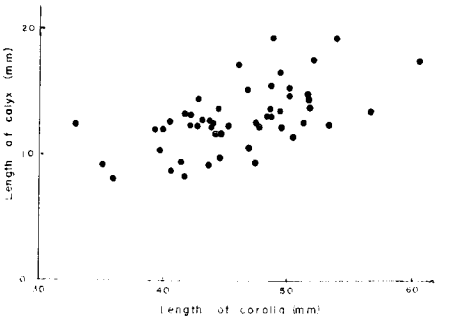

Fig. 59. A graph showing the correlation between the length of corolla and that of calyx in *Gentiana sikokiana*.

erectus vel ascendens, cum inflorescentiis 7–35 cm altus, simplex sive e rhizomate bis—aliquot ramosus rare inferiore in parte bis usque aliquot ramosus, 4-striatus. Folia radicalia plerumque abbreviata et scariosa, foliis caulinis inferioribus papyraceis, ellipticis—obovatis—latoöbovatis, apice saepe apiculatis, 1.5–5 cm longis, (0.5–) 1–3 cm latis, eis caulinis mediis oppositis, sublaxis, ovatis v. rhomboideoövatis v. obovatis, supra viridibus, subtus dilute viridibus, uni—tri—quinquenerviis, apice acutis sive attenuatosubacuminatis, basi in petiolos breves subalatim attenuatis et acutis, margine minutissime rotundatoserrulatis et leviter undulatis, (1.5–) 2–11 cm longis, (0.6–) 1–4 cm latis, petiolatis, petiolis brevibus, 0–1.5 cm longis. Inflorescentia terminalis atque prope bases ramorum axillaris, (1–) 3–10-flora, floribus plerumque sessilibus, rarissime subpedunculatis, bracteatis, bracteis parvis, latoëllipticis, corollis infundibularibus, caeruleis iterumque viridipunctulatis, 4–6 cm longis, 5-fidis, lobis deltoideis aut deltoideorotundatis, 3–9 mm longis et latis, plicis parvis, integris vel pauce dentatis, triangularibus, ca. 2 mm longis, calycibus 15–20 mm longis, hypocraterimorphis, 5-fidis, lobis subaequantibus, latoövalibus, sub anthesi patentibus recurvisque, margine minutissime repandis, ca. 1 cm longis, ca. 7 mm latis, inter sese membrana intracalycina conexis, staminibus 23–30 mm longis, in parte inferiorilaterali intus ad corollas affixis, antheris liberis, pistillo uno, ovario uniloculari. Capsulae stipitatae, lanceolatae, seminibus lanceolatis, utrinque anguste alatis.

Nom. Jap. Asama-rindô.

Specim. exam.

Honshû. Prov. Yamato: Inter Tamaki-yama et Torohatchô (julio, 1922. G. KOIDZUMI-KYO). Kasuga-yama (julio, 1883.-TI). Akeguchi-tôge (oct. 1946. M. HARA-KYO). Prov. Ise: Inter Momonoki-goya et summum montem Ohdaira-yama (julio, 1952. M. HIROE-KYO). Ohsugidani-mura (oct. 1921. K. YATÔ-TNS, 'f. *leucantha*'; oct. 1953. Y. KOBAYASHI-TNS; nov. 1956. Y. HAYASHI-TNS). Kôtai-jingû (aug. 1927. M. HONDA-TI). Asama-yama (aug. 1922. S. MIKI-KYO; oct. 1927. J. SUGIMOTO-TI; oct. 1932. T. NAKAI-TI; oct. 1960. K. INAGAKI et H. TOYO-

KUNI). Prov. Shima: Toba (oct. 1893. T. ITÔ-TNS). Prov. Kii: Owase (aug. 1952. T. YAMAZAKI-TI; oct. 1957. J. SUGIMOTO-TNS). Prope Ohga (nov. 1952. M. TAGAWA-KYO). Nachi-zan (oct. 1931. J. OHWI et M. TAGAWA-KYO; oct. 1942. Y. SATAKE et S. OKUYAMA-TNS; nov. 1950. G. NAKAI-KYO). Yuno-mine (julio, 1922. G. KOIDZUMI-KYO). Takao-yama, Tanabe (nov. 1916. K. MATSUSHIMA-TNS). Shirahama (nov. 1958. K. MIHASHI-TNS). Kasane-yama (maio, 1953. K. MIHASHI-TNS). Tsutsujô-san (aug. 1955. G. MURATA-KYO). Ishizuchi-yama (aug. 1890. S. YANO-TI; oct. 1954. N. KARIZUMI-TNS; oct. 1956. M. HIROE-KYO).

Shikoku. Prov. Awa: Kôtsu-san (oct. 1903. J. et S. NIKAI-TI). Sawadani-mura (sept. 1949. G. NAKAI-KYO). Furumiya-mura (sept. 1946. T. INOBE-TI). Nakatsu-mine (oct. 1954. N. SATOMI). Prov. Tosa: Hameno-no (dec. 1888. H. SAKURAI-TNS). Kajiga-mori (oct. 1931. H. ASAHIYAMA-TNS). Kuishi-yama (sept. 1957. G. MURATA-KYO). Nanokawa-mura (sept. 1891.-TI). Shimo-nanokawamura (sept. 1891. K. WATANABE-TI). Irazu-yama (sept. 1939.-KYO). Yokogura-yama (sept. 1913. Z. TASHIRO-KYO; aug. 1926. S. HATTORI-TI; oct. 1952. S. FUDÔ-TNS).

Area geogr. Endemica (Honshû austr. et Shikoku).

Typus: 'Ins. *Sikoku*: prov. Tosa in Yokogura yama (T. Makino)' (in LE).

This striking species characterised by its patent sepals as well as shortly petioled leaves was honoured with the name *Gentiana sikokiana* by MAXIMOWICZ in 1888, as it was collected first in the island of Shikoku. In the original description, he states, 'floribus···brevissime infinisve longius pedicellatis', but in accordance with the writer's field observation as well as investigations made by using about fifty dried specimens of the present plant, the flowers are hardly pedicellate. The correlation between calyx-length and corolla-length in the present species is graphed (Fig. 59).

HYBRIDA NATURALIS PROBABILIS

Gentiana iseana MAKINO in Jour. Jap. Bot. **4**: 8. 1927.

? *G. scabra* var. *buergeri* subvar. *orientalis* × *Gentiana sikokiana*.

Herba perennis, ca. 30 cm alta, glabra. Caulis gracilis, teres cum quadrilineis longitudinaliter elevatis, plus minusve ramosus. Folia opposita, lanceolata vel ovatolanceolata, apice acuminata, basi acuta et sessilia vel brevissime petiolata, margine scabriuscula aut crispata, 3–6.5 cm longa, 1.2–1.8 cm lata, trinervia. Flores in caulis ramorumque apicibus 1–2–4, cum bracteis foliaceis oppositis sub flore, 3–5.5 cm longi. Tubi calycis obconicotubulosi, 1.2–2 cm longi; lobi quinque, patentes, lanceolati sive ovatolanceolati, apice acuminati, basi plerumque obtusi, 0.5–2.2 cm longi, virides. Corolla campanulata, in basin versus attenuata, 1.5–2 cm in diametro, cum quinque lobis ovatodeltoideis apice acutiusculis obtusisve et cum quinque plicis brevibus, violaceocaerulea.

Nom. Jap. Ise-rindô (MAKINO, 1927).

Typus: 'Prov. ISE: Yamada, on hill (T. MAKINO! 1924.)' (in TMH).

The writer was not able to find any specimens of the present plant in the

herbaria he visited. The above description is based on MAKINO's original description written in English. This plant seems to be a hybrid between *G. scabra* var. *buergeri* subvar. *orientalis* and *Gentiana sikokiana*.

SPECIES INCERTA

Gentiana brevidens FRANCHET et SAVATIER, Enum. Pl. Jap. **1**: 323. 1875, nom. nud.

Genus 11. **Tripterospermum** BLUME

Tripterospermum BLUME, Bijdr. Fl. Nederl. Ind. **14**: 849. 1826.–ENDLICHER, Gen. Pl. 605, n. 3563. 1838.–GRISEBACH in DE CANDOLLE, Prodr. **9**: 121. 1845.–MAXIMOWICZ in Bull. Acad. St.-Pétersb. **20**: 435. 1875, in textu.–HARA in Bot. Mag. Tokyo **51**: 20. 1937.; Enum. Spermat. Jap. **1**: 143. 1949.–SATAKE in Jour. Jap. Bot. **26**: 107. 1951.

Syn.—

Crawfurdia WALLICH, Tent. Fl. Nap. **2**: 63–64, t. 47 et t. 48. 1826, pro parte.–MIQUEL, Fl. Nederl. Ind. **2**: 560. 1856.–BENTHAM et HOOKER, Gen. Pl. **2**: 815. 1876, pro parte.–MERRIL, Enum. Phil. Fl. Pl. **3**(3): 318. 1923.

Calixnos RAFINESQUE, Fl. Tellur. **4**: 82. 1838.

Golowninia MAXIMOWICZ in Bull. Acad. St.-Pétersb. **4**: 252. 1861.

Crawfurdia sect. *Tripterospermum* (BLUME) CLARKE in Jour. Linn. Soc. **14**: 442. 1875. *Crawfurdia* subg. *Tripterospermum* (BLUME) CLARKE in Hooker, Fl. Brit. Ind. **4**: 107. 1883.–GILG in ENGLER et PRANTL, Nat. Pfl.-fam. **4**(2): 80. 1895. *Gentiana* sect. *Tripterospermum* (BLUME) MARQUAND in Kew Bull. **1931**: 70.; ibid. **1937**: 157.

Herba perennis, glaberrima. Radix longa, tenuis. Caulis simplex vel ramosus, tenuis et gracilis, longitudinaliter striatus, volubilis. Folia basalia sub anthesi emarcida vel viva et abbreviata, foliis caulinis oppositis vulgo trinerviis, basibus petiolatim angustatis. Flores in apicibus caulis ramorumque atque in axillis foliorum 1–3, pentameri, calycibus cylindricis vel cylindricocampanulatis, 5-alatis vel 5-angulatis, 5-fidis, lobis angustis, corollis caerulescentipurpureis v. caerulescentirubripurpureis v. albis, cylindricis vel cylindricocampaniformibus, 5-fidis, lobis contortis et inter lobos plicis ornatis, staminibus intus corollis affixis, filamentis filiformibus, pistillo uno, ovario stipitato et uniloculari, stylo gracili, stigmate bipartito. Baccae globosae vel ellipsoideae, seminibus numerosis, parvis, 3-alatis.

Typus: *Tripterospermum trinerve* BLUME

For many years, confusion has prevailed among taxonomists as regards the name of the present genus. The earliest name that appeared in literature is *Tripterospermum* BLUME in 1826 (Type: *T. trinerve* BLUME). Next to it is *Crawfurdia* established by WALLICH in the same year. He mentioned two

species, *C. speciosa* and *C. fasciculata*, under his genus, without designating its type species. Many authors, such as SIEBOLD & ZUCCARINI (1846), MIQUEL (1856), CLARKE (1875 & 1885), BENTHAM & HOOKER (1876), GILG (1895), HAYATA (1911), MERRIL (1923), GROSSHEIM (1952), etc. adopt WALLICH's name. Among them, CLARKE (1875), particularly, divided the contents of the genus into two sections, *Tripterospermum* and *Dipterospermum*: the former includes the plants mainly with baccae, while the latter those with capsules. Ten years later, however, he amended the above opinion, changing these two sections to the rank of subgenus (CLARKE, 1885).

MARQUAND (1931 & 1937), on the other hand, transferred these two subgenera to the genus *Gentiana* as sections. In 1937, HARA stated that the name *Tripterospermum* was earlier than *Crawfurdia*, and adopted the former as the correct name for the genus. SATAKE, in 1951, discussed the Japanese as well as Formosan members of *Tripterospermum*, stating, 'The writer believes, however, *Tripterospermum* which has berry and triquetrous seed is well worthy to be a different genus from *Gentiana*'.

In 1956, IKUSE, from the palynological point of view, stated, '*Pterygocalyx volubilis* and *Tripterospermum japonicum* of Gentianaceae are liable to be misidentified by oversight but palynologically they are natural to belong to two different genera. Their grains are all 3-colporate, but in the former the sexine pattern is adorned with reticulum $<2\mu$ and the size of grain is $35\text{–}37 \times 38\text{–}40\mu$, while that of the latter is striated and the size of grain is $30\text{–}32 \times 32\text{–}35\mu$'.

Although the structure of the flower in *Tripterospermum* is not so different from that in *Gentiana*, the baccate fruits as well as the thin, coiling stems in the former are of generic value. The genus *Crawfurdia* in its broadest sense should therefore be divided into three genera as follows:

1) *Tripterospermum* (*Crawfurdia*, s. str., pro parte): stem coiling, corolla plicate and almost pentamerous, with baccae, seeds winged.

2) *Gentiana*, pro parte: stem sometimes more or less coiling, corolla plicate and almost pentamerous, with capsules, seeds winged.

3) *Pterygocalyx*: stem coiling, corolla not plicate and almost tetramerous, with capsules, seeds winged.

In our boundaries only one representative of the present genus has hitherto been reported.

Tripterospermum japonicum MAXIMOWICZ

[Figs. 60 & 61]

Tripterospermum japonicum (SIEBOLD et ZUCCARINI) MAXIMOWICZ in Bull. Acad. St.-Pétersb. **20**: 435. 1875, in textu.–HARA in Bot. Mag. Tokyo **51**: 20.

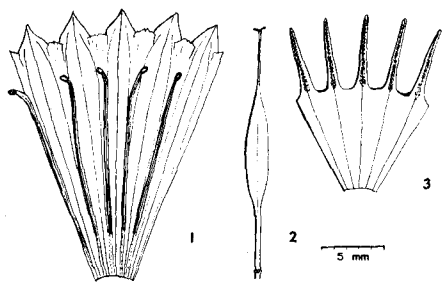

Fig. 60. *Tripterospermum japonicum*: 1. Open corolla, 2. Pistil, and 3. Open calyx.

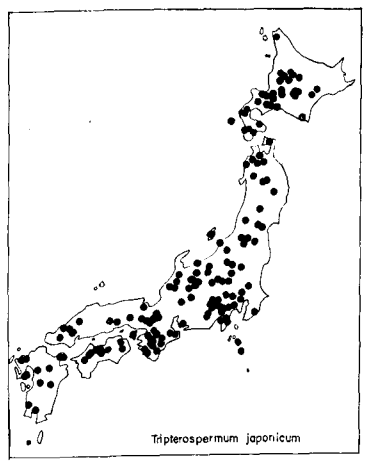

Fig. 61. Distribution of *Tripterospermum japonicum*.

1937.; Enum. Spermat. Jap. **1**: 143. 1949.–HONDA, Nom. Pl. Jap. (ed. 1), 281. 1939.; ibid. (ed. em.), 208. 1957.–SATAKE in Jour. Jap. Bot. **26**: 108, f. 1(a), f. 2(a). 1951.–OHWI, Fl. Jap. (ed. 1), 948. 1953.–MASAMUNE in Sci. Rep. Kanazawa Univ. **3**: 322. 1955.–KITAMURA et MURATA et HORI, Col. Ill. Herb. Pl. Jap. (ed. 1) **1**: 217, pl. 66, n. 535. 1957.

Syn.—

Convolvulus trinervis THUNBERG, Fl. Jap. 85. 1784. *Calixnos trinervius* (THUNBERG) RAFINESQUE, Fl. Tellur. **4**: 82. 1838. *Crawfurdia trinervis* (non DIETRICH, 1840, nec HASSKARL, 1844) (THUNBERG) HALLIER in Bull. Herb. Boiss. **6**: 722. 1898, pro parte. *C. trinervis* (non DIETRICH, 1840, nec HASSKARL, 1844) (THUNBERG) MAKINO in Bot. Mag. Tokyo **16**: 171. 1902.–MATSUMURA, Ind. Pl. Jap. **2**(2): 498. 1912. *Gentiana trinervis* (THUNBERG) MARQUAND in Kew Bull. **1937**: 157.

Crawfurdia japonica SIEBOLD et ZUCCARINI in Abh. Akad. Münch. **4**: 160. 1846.–KOIDZUMI in Bot. Mag. Tokyo **40**: 347. 1926.–MASAMUNE, Fl. & Geobot. Yakus. 373. 1934.; in Trans. Nat. Hist. Soc. Formosa **30**: 65. 1940. *Golowninia japonica* (SIEBOLD et ZUCCARINI) MAXIMOWICZ in Mél. Biol. **4**: 37, cum tab. 1861.

Gentiana Golowninia MARQUAND in Kew Bull. **1931**: 70.; in Jour. Roy. Hort. Soc. **57**: 192. 1932.

Crawfurdia japonica var. *tenuis* MASAMUNE in Jour. Trop. Agr. **4**: 76. 1932.; Fl. & Geobot. Yakus. 373. 1934. *Tripterospermum japonicum* var. *tenue* (MASAMUNE) HONDA, Nom. Pl. Jap. (ed. 1), 282 & 520. 1939.–HARA, Enum. Spermat. Jap. **1**: 144. 1949.

Herba perennis, volubilis, glabra. Radix longa, tenuis, saepe rhizomatibus brevibus tenuibus repentibus ornata. Caulis simplex rare ramosus, tenuis et gracilis, 20–80 cm longus, viridis vel viridipurpurascens, longitudinaliter semialatimque striatus. Folia radicalia sub anthesi vulgo emarcida vel abbreviata,

foliis caulinis ovatodeltoideis—deltoideolanceolatis, in apices versus gradatim angustatis et apice acutis vel minute acuminatis, basi rotundatis vel rotundato-truncatis vel leviter cordatis, margine integris interdum minute serrulatim undulatis, plerumque trinerviis rare subquinquenerviis, (1.5–)3–8(–12)cm longis, (0.9–) 1.5–4.5 (–6) cm latis, petiolatis, petiolis brevibus usque 1.8 cm longis. Flores infundibulares, dilute purpurei vel dilute purpureocaerulei, pentameri, in axillis foliorum solitarii—pauci, calycibus 12–25 mm longis, quinquefidis, anguste quinquealatis, sepalis acicularilinearibus, tubis aequilongis vel leviter brevioribus vel leviter longioribus, apicibus acutis, corollis 18–35 mm longis, anguste infundibularibus, ex basibus in apices gradatim dilatatis, apicibus leviter quinquefidis, lobis deltoideis vel anguste deltoideis, quam tubi 1/8–1/9-plo longioribus, apicibus acutis, plicis truncatis, plus minusve prominentibus, apice paucidenticulatis, staminibus calycibus subaequilongis aut leviter longioribus, antheris minute ellipticis, ca. 0.5 mm longis, pistillo uno, ovario oblongofusiformi et uniloculari, longe stipitato, stylo longo, gracillimo, stigmate linearilanceolato, bipartito. Fructus baccati, longeovoidei, rubropurpurei, 7–12 mm in diametro, apice ornati stylis persistentibus, demum corollas paulo superantes, petiolati, petiolis 1.5–2.5 cm longis, seminibus alatis.

Nom. Jap. Tsuru-rindô.

Specim. exam.

Hokkaidô. Prov. Ishikari: Yûpari-dake (julio, 1956. H. TOYOKUNI). Hassamu-gawa (maio, 1956. S. AKIYAMA et H. TOYOKUNI). Soranuma-dake (junio, 1931. Y. YAMADA). Moiwa-yama (sept. 1957. H. TOYOKUNI). Jôzankei (aug. 1899. J. MATSUMURA-TI; oct. 1906.-TNS). Maruyama (aug. 1932. T. KAWADA-TNS). Muine-yama (aug. 1953. H. TOYOKUNI). Inter Tenninkyô et Tomuraushi-dake montium Taisetsu (julio, 1955. G. MURATA et Y. MOMOTANI-KYO). Taisetsu-san (aug. 1928. S. AKIYAMA). Inter Tenninkyô et Kaun-dake montium Taisetsu (aug. 1956. H. TOYOKUNI). Nopporo (aug. 1928. S. AKIYAMA). Prov. Shiribeshi: Shiribeshi-dake (aug. 1955. G. MURATA-KYO). Tengu-tôge, Otaru (sept. 1935. T. KAWADA-TNS). Prov. Iburi: Tomakomai (aug. 1928. S. AKIYAMA). Tokushunbetsu-dake (aug. 1955. H. TOYOKUNI). Prov. Oshima: Esashi (aug. 1890. K. MIYABE et Y. TOKUBUCHI-TI).

Honshû. Prov. Mutsu: Iwaki-zan (aug. 1902. N. KINASHI-KYO). Aomori (oct. 1901. N. KINASHI-KYO). Hakkôda-san (aug. 1902. N. KINASHI-KYO). Prov. Rikuchû: Hayachine-zan (oct. 1915. Y. OGURA-TI; aug. 1923. F. OKA-TNS). Prov. Uzen: Gas-san (sept. 1897. U. FAURIE-KYO). Prov. Iwashiro: Iide-san (aug. 1879.-TI). Ozega-hara (aug. 1931. T. SUZUKI-KYO). Hiuchi-dake (aug. 1935. J. OHWI et M. TAGAWA-KYO). Adzuma (julio, 1898. B. HAYATA). Prov. Hitachi: Tsukuba-san (nov. 1928. S. AKIYAMA). Prov. Shimotsuke: Konsei-tôge (sept. 1929. S. AKIYAMA). Prov. Musashi: Takao-san (maio, 1890. S. MATSUDA-KYO). Mitake (sept. 1931. K. HISAUCHI-TI). Asakawa (oct. 1957. H. TOYOKUNI). Prov. Kôdzuke: Akagi-yama (aug. 1932. Y. SHIOBARA-TNS; nov. 1934. S. ADACHI-TI). Prov. Shinano: Togakushi-yama (aug. 1892. H. SAKURAI-TNS; julio, 1893. S. MATSUDA-KYO). Karuizawa (sept. 1954. K. SATÔ-TI). Asama-yama (aug. 1933. H. ITÔ-TI). Norikura-dake (aug. 1938. H. TOBITA-TI). Ontake-san

(sept. 1902. B. HAYATA). Prov. Idzu: Amagi-san (dec. 1900. S. MATSUDA-KYO). Miyake-jima (oct. 1937. K. HAYASHI-TNS). Mikura-jima (TAKAHASHI et MATSUO-TI). Prov. Suruga: Fuji-san (julio, 1891. S. MATSUDA-KYO). Prov. Kai: Hôwô-zan (oct. 1947. H. UEMATU-TI). Prov. Echigo: Komaga-take (aug. 1939. S. OKUYAMA-TNS). Prov. Etchû: Tate-yama (aug. 1932. M. NISHIJIMA-TI). Inter Baba-dani et Karamatsu-dake (aug. 1954. G. MURATA et T. SHIMIZU-KYO). Asahi-machi (julio, 1958. H. KANAI-TI). Prov. Echizen: Arashima-dake (aug. 1954. G. MURATA et T. SHIMIZU-KYO). Prov. Mikawa: Dando-san (sept. 1953. G. MURATA-KYO). Prov. Yamashiro: Hiei-zan (aug. 1921. G. KOIDZUMI-KYO). Kurama-yama (aug. 1892. S. MATSUDA-KYO). Prov. Yamato: Ohdaigahara-yama (aug. 1956. G. MURATA-KYO). Kashi-yama (aug. 1923. Y. YAMADA). Prov. Ise: Myôken-zan (sept. 1956. T. KOIDE-KYO). Nii (nov. 1951. M. TAGAWA-KYO). Asama-yama (oct. 1960. K. INAGAKI et H. TOYOKUNI). Prov. Kii: Kôya-san (sept. 1924. S. FUSHIMI-KYO). Prov. Kôchi: Kongô-zan (aug. 1895. H. MATSUDA-KYO). Prov. Aki: Kammuri-yama (oct. 1952. M. HIROE-KYO). Noro-san (aug. 1929. S. AKI-YAMA). Prov. Nagato: Ohkuraga-take (oct. 1949. T. NAKAI et N. MARUYAMA-TNS).

Shikoku. Prov. Iyo: Ohnoga-hara (nov. 1950. M. HIROE-KYO). Prov. Tosa: Kuishi-yama (sept. 1957. G. MURATA-KYO).

Kyûshû. Prov. Hizen: Kinugasa-yama (oct. 1941. H. HARA-TI). Prov. Bungo: Kujû-zan (oct. 1955. T. YAMAZAKI-TI). Prov. Satsuma: Yae-dake (sept. 1933. S. IDE-TNS). Prov. Ohsumi: Uchinomaki (oct. 1956. T. ICARASHI). Yaku-shima (sept. 1910. Y. NAKANO-KYO).

Area geogr. Japonia, Formosa, China, Kuriles austr., etc.

Typus: Japonia[10] (in L).

This species is found everywhere within our boundaries. It looks like *Pterygocalyx volubilis* at a glance, but the leaves of the present plant are much larger than those of *P. volubilis*. The flowers of the former are pentamerous and plicate. Among the members of the Gentianaceae of Japan, this is the only one with baccae.

IV. Phylogeny of the Gentianaceae with Special Reference to the Japanese Species

As has been suggested in the preceding pages, the phylogeny of the Gentianaceae as a whole can be considered from various standpoints, such as floral morphology, cytology, phytogeography, etc.

In the family, 11 flower types are met with; some of them are similar to each other, while some others at a glance seem to be quite dissimilar. Detailed analyses of the flowers, however, have gradually lead the writer to the conclusion that all these floral patterns, except Centaurioid type, are derived at least from an only one presumable ancestral type, to which the writer gave the name *Pregentiana* in 1957 (Fig. 62). From *Pregentiana*, two main lines of evolution seem to have sprung; they are the *Ophelia-Gentianopsis*-line and

10) No exact locality is stated in the original description.

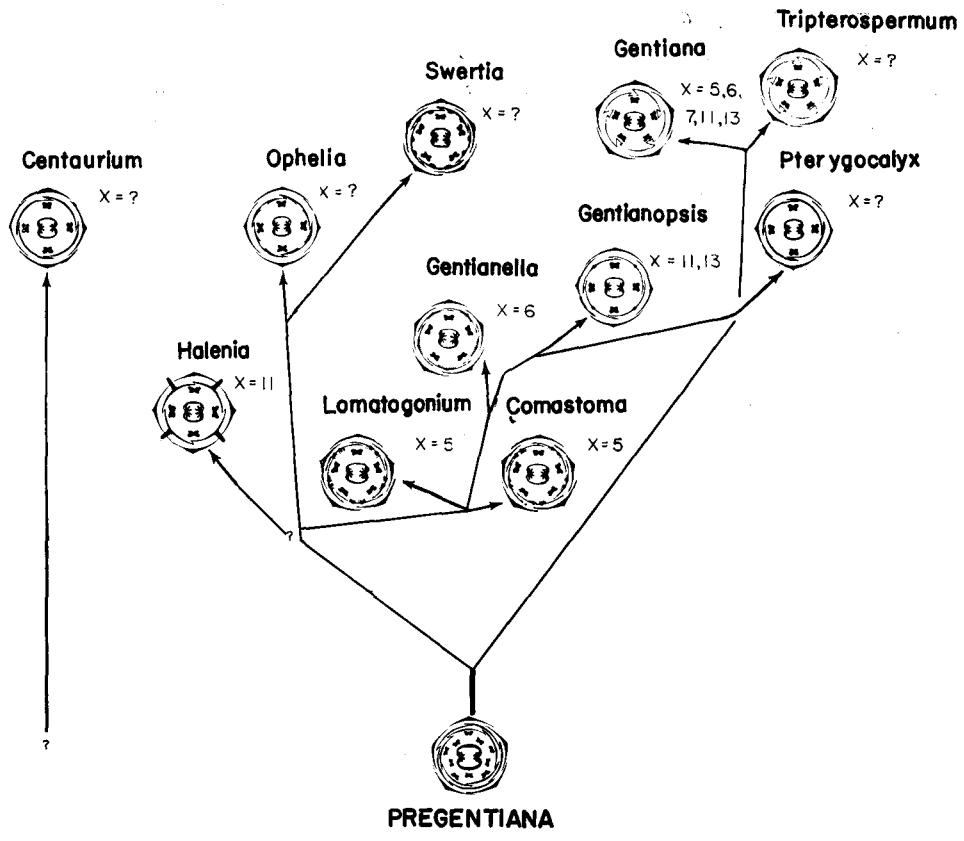

Fig. 62. Presumable relationships between the genera of Japanese members of the Gentianaceae. Formulae x=5, x=6, etc. indicate the basic number of chromosomes; when the number is not known, x=? is noted.

the *Gentiana*-line. The former is characterised by epipetalous foveae or glands which sometimes are wanting or transformed into spurs as in *Halenia*, and by having no plicae. It appears to have arisen from *Pregentiana* by the simple reduction of the outer ring of stamens into foveae or glands or by the transformation of the outer ring of corolla into spurs. The latter having plicae as well as nectariferous ovaries (in *Tripterospermum* not nectariferous) developed from *Pregentiana* by the reduction of the inner ring of the corolla into plicae and by the reduction, and the transformation as well, of the inner ring of stamens into glands at the base of ovary. In the *Ophelia–Gentianopsis*-line, there are three major types of flowers: the Halenioid type with spurs, the Ophelioid or Swertioid type with 1 or 2 foveae, whilst the remainings

have, except *Pterygocalyx*, epipetalous glands. In the *Gentiana*-line, there are met with two flower types; in *Gentiana*, there are nectaries at the base of ovary, but they are wanting in *Tripterospermum*. However, well-developed plicae and stigmata, and winged seeds in *Tripterospermum* suggest to the author its origin from some members of *Gentiana*.

Chromosomal data available to a consideration of the phylogenetic relationships of the members of the Gentianaceae are rather scarce and can not be applied satisfactorily. A few items of evidence on chromosomes, however, might hold good in assisting in phylogenetic understanding of several genera. Namely, the genera *Lomatogonium* and *Comastoma* have the same basic number, x=5. This similarity is borne out by several other characters: both genera have smooth and almost globose seeds, epipetalous glands in pairs, and similar distributional patterns, viz., alpine and circumboreal in the Northern Hemisphere. Á. and D. LÖVE (1956 & 1961) gained evidence of a greater conformity of the family principally by means of chromosomal data.

Distribution patterns also assist in considering phylogeny in the case of minor taxa, namely *Ophelia tetrapetala* and so-called *Swertia chrysantha* or *S. micrantha* are regarded as a single species not only morphologically but distributionally as pointed out in the treatment of the family.

Postscript

ZELTNER reported the chromosome numbers of some species of *Centaurium*: *C. maritimum* (n=10), *C. spicatum* (n=11), *C. chloodes* (n=20), and *C. pulchellum* (n=10 and 20) (ZELTNER, L. 1961. Contribution à l'étude cytologique des genres Blackstonia Huds. et Centaurium Hill (Gentianacées). Ber. Schweiz. Bot. Gesell. **71**: 18–24).

The author is grateful to his wife, Yanagi for reading the proof.

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(Most of the literature cited in the taxonomic enumeration omitted)

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VI. Index

to the names of taxa recognised in the present paper; names above the rank of species are in ALL CAPS.

Explanation of Plates

Plate I: 1. *Ophelia tetrapetala* subsp. *tetrapetala* var. *tetrapetala* (Cape Shiretoko, Prov. Kitami, Hokkaidô). 2. *Halenia corniculata* (Wennai, Isl. Rebun, Prov. Kitami, Hokkaidô). 3. *Swertia perennis* subsp. *cuspidata* (Mt. Yûpari, Prov. Ishikari, Hokkaidô). 4. *Gentianopsis contorta* (Jûmonji Pass, Prov. Shinano, Honshû).

Plate II: 5. *Gentianella yuparensis* subsp. *yuparensis* (Mt. Yûpari, Prov. Ishikari, Hokkaidô). 6. *Gentiana thunbergii* f. *minor* (Bibai Bogland, Prov. Ishikari, Hokkaidô). 7. *Gentianella auriculata* (Mt. Oh-hira, Prov. Shiribeshi, Hokkaidô, photo by S. WATANABE).

Plate III: 8. *Gentiana jamesii* (the Taisetsu Mts., Prov. Ishikari, Hokkaidô). 9. *G. glauca* (the same locality). 10. *G. nipponica* var. *nipponica* (Mt. Yûpari, Prov. Ishikari, Hokkaidô).

Plate IV: 11. *Gentiana triflora* var. *japonica* f. *montana* (Mt. Muineshiri, Prov. Ishikari, Hokkaidô). 12. *G. scabra* var. *buergeri* subvar. *orientalis* (Oh-uda, Prov. Yamato, Honshû). 13. *G. algida* f. *igarashii* (the Taisetsu Mts., Prov. Ishikari, Hokkaidô).

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