Shuichi NOSHIRO*: **Variations of *Ligustrum ovalifolium* and *L. tschonoskii* (Oleaceae) in the southern Kanto district, Honshu (1)**

能城修一*: 関東地方南部におけるオオバイボタとミヤマイボタの変異 (1)

Seven species and two varieties of *Ligustrum* have been recorded from the southern Kanto district of middle Honshu. Among these, *L. japonicum* Thunb. and *L. obtusifolium* Sieb. et Zucc. are quite distinct, but the others are very variable and often difficult to distinguish from each other. Nakai described *L. pacificum* (Nakai 1921) and *L. kiyozumianum* (Nakai 1927) as species similar to *L. ovalifolium* Hassk. (s. str.) distributed along the seashore of Honshu, Shikoku, Kyushu, and the southern part of the Korean Peninsula. *L. pacificum* has larger leaves together with almost inserted, short corolla tubes, and is distributed on Hachijo and Aogashima in the Izu Islands. Mizushima (1955) reduced it as a variety of *L. ovalifolium*. *L. kiyozumianum*, restricted in the Boso Peninsula and Prov. Hitachi, was thought to be similar to *L. ovalifolium*, and was characterized by dense hairs on the lower surfaces of leaves. Ohwi (1953), and Kitamura & Murata (1971) recognized *L. kiyozumianum* as a variety of *L. tschonoskii*. *L. tschonoskii* Decne., ranging from Sakhalin to the montane or cool-temperate zone of Hokkaido, Honshu, Shikoku, and Kyushu, has usually dense hairs on the lower surfaces of leaves.

Besides these taxa, one species and one variety, i.e., *L. hisauchii* and its variety, are described from the southern Kanto. *L. hisauchii* Makino was first described by Makino (1916) on a specimen collected at Akiya, Prov. Sagami, as a similar species with thinner leaves to *L. ovalifolium*. He also described a variety of this species, i.e., var. *pubescens* Makino, which has "leaves pubescent along the midrib beneath" from Yokohama, Prov. Musashi. *L. hisauchii* (incl. var. *pubescens*) ranges from Prov. Sagami to the southern part of Prov. Musashi. Kitamura & Murata (1971) regarded *L. hisauchii* as a synonym of *L. ovalifolium*.

* Laboratory of Forest Botany, Faculty of Agriculture, University of Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113. 東京大学 農学部森林植物学教室.

In the southern Kanto, *L. ovalifolium* and *L. tschonoskii* are quite variable, and their morphological ranges of these two species considerably overlap, so that the identity of *L. hisauchii* is still obscure.

The author, therefore, tried to elucidate the variation of flowers, inflorescences and leaves of each species and to contribute to their taxonomy.

The present author is greatly indebted to Dr. Toshio Hamaya, Faculty of Agriculture, the University of Tokyo, and Dr. Hideaki Ohba, the University Museum, the University of Tokyo, for their advice and encouragement throughout the study. Thanks are also due to the staff and members of the Laboratoy of Forest Botany, Faculty of Agriculture, the University of Tokyo for their help and discussion during the study. He also expresses gratitude to the directors and curators of the following herbaria for their permission to study the herbarium specimens: IUM, KAG, KANA, KYO, MAK, SAP, SHIN, TFA, TI, TNS, TOFO, TUS, TUSG, and Yamaguchi Prefectural Museum.

Materials and method Based on the morphological observations of the living individuals and herbarium specimens of Japanese *Ligustrum*, the individuals in this area can be divided largely into two groups, the *L. ovalifolium*-group and the *L. tschonoskii*-group. These two groups correspond to species in the other areas of Japan. The author distinguished the *L. ovalifolium*-group from the *L. tschonoskii*-group on the basis of pubescence on the lower surfaces of leaves. That is, the surfaces are quite glabrous, or, in some individuals, have sparse hairs along the midrib in the *L. ovalifolium*-group, but they have dense hairs on the whole, or, at least, some part of them in the *L. tschonoskii*-group. In this area, the lower (abaxial) surfaces of leaves are usually quite glabrous in the *L. ovalifolium*-group, so that no *L. ovalifolium* f. *heterophyllum* (Blume) Murata has been collected there. The *L. tschonoskii*-group has usually dense hairs here except for a few individuals (f. *glabrescens* (Koidz.) Murata) such as Mt. Kamiyama, Hakone (Yamazaki s.n. in TI), Wariishi Pass, Mt. Ashitaka (Kanai 7394 in TI), or Heta Pass, Izu Peninsula (Noshiro 2602, 2603, 2604, etc. in TOFO).

Judging from the morphology and geographical distribution, the *L. ovalifolium*-group in this area was then divided into three types: the *ovalifolium*-type on the Izu Peninsula and the southwestern tip of Pref. Kanagawa; the *hisauchii*-type in Oiso, and the Miura and the Boso Peninsula; and the *pacificum*-type in the Izu Isls. The *L. tschonoskii*-group was also divided into two types on the

basis of morphology and geographical distribution: the *tschonoskii*-type in the montane zone of the Izu Peninsula, Hakone, Fuji, Chichibu, Tanzawa, and Suwa; and the *kiyozumianum*-type in the Boso and the Miura Peninsulas. These types roughly correspond to infraspecific variations.

The specimens studied were collected at various localities shown in Tab. 1. To demonstrate the total ranges of variation of the *tschonoskii*-type, individuals growing in regions adjacent to the southern Kanto are included. Flowers were soaked in FAA in the field. One flower of each individual was measured, because preliminary observations showed that the characters variable in an individual were also variable within an population, and that those showing little variation within an individual also showed little variation within an population. Corolla tube length, filament length, and calyx depth were all measured from the base of ovary (Fig. 1). Measurement of leaves was made on the largest leaf among the flowering, one-year shoots, and that of inflorescence on the largest inflorescence in the specimen. The specimens used in this study are deposited in TOFO.

Results 1) Variation of flowers. Nine characters of flowers were observed in the five types (Fig. 1). Gynoecium length is largest in the *ovalifolium*-type, becoming a little smaller in the *pacificum*-type, the *tschonoskii*-type, and the *kiyozumianum*-type in this order, and smallest in the *hisauchii*-type (Fig. 2A, Tab. 2). The striking feature of this character lies in its being almost the same among the five types having been studied. Stigma length is largest in the *pacificum*-type, becoming smaller in the *ovalifolium*-type, the *hisauchii*-type, and the *kiyozumianum*-type in this order, and smallest in the *tschonoskii*-type (Fig. 2B, Tab. 2). Anther width is largest in the *pacificum*-type, becoming smaller in the *ovalifolium*-type, the *hisauchii*-type, and the *kiyozumianum*-type in this order, and smallest in the *tschonoskii*-type (Fig. 2B, Tab. 2). These two characters are largest in the *pacificum*-type, and a little smaller in the *ovalifolium*-type, and smallest in the *tschonoskii*-type, with the *hisauchii*-type and the *kiyozumianum*-type having intermediate values between those of the *ovalifolium*-type and the *tschonoskii*-type. Anther length was largest in the *pacificum*-type, becoming smaller in the *ovalifolium*-type, the *tschonoskii*-type, and the *hisauchii*-type in this order, and smallest in the *kiyozumianum*-type (Fig. 3A, Tab. 2). Filament length is largest in the *kiyozumianum*-type, becoming smaller in the *ovalifolium*-type, the *hisauchii*-type, and the *tschonoskii*-type in

Tab. 1. Numbers and localities of the studied individuals of the five types.

Type	No.	Locality
pacificum-type	10	Is. Hachijo, Tokyo Metropolis.
ovalifolium-type	32	Izu Pen., Pref. Shizuoka.
	4	En route from Odawara to Manazuru, Pref. Kanagawa.
hisauchii-type	2	Oiso, Pref. Kanagawa.
	25	Miura Pen., Pref. Kanagawa.
	11	Prov. Awa, Pref. Chiba.
	10	Prov. Kazusa, Pref. Chiba.
	1	Prov. Shimosa, Pref. Chiba.
tschonoskii-type	7	Izu Pen., Pref. Shizuoka.
	2	Hakone, Pref. Shizuoka and Pref. Kanagawa.
	5	Lake Yamanaka and Lake Shoji, Pref. Yamanashi.
	7	Mts. Chichibu, Pref. Yamanashi and Pref. Saitama.
	5	Mts. Tanzawa, Pref. Kanagawa.
	9	Suwa District, Pref. Nagano.
kiyozumianum-type	21	Prov. Awa, Pref. Chiba.
	21	Prov. Kazusa, Pref. Chiba.
	2	Miura Pen., Pref. Kanagawa.

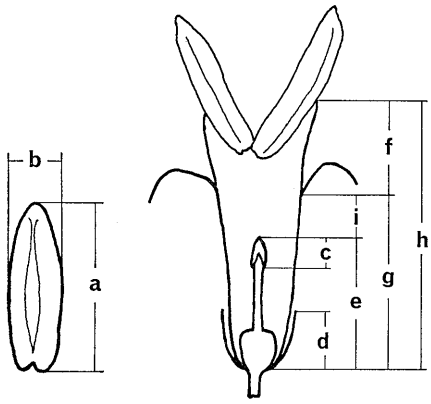

Fig. 1. Measured characters of a flower. a: Anther length. b: Anther width. c: Stigma length. d: Calyx depth. e: Gynoecium length. f: Anther protrusion. g: Corolla tube length. h: Filament length. i: Stigma insertion.

this order, and smallest in the *pacificum*-type (Fig. 3A, Tab. 2). These two characters are almost the same among the *ovalifolium*-type, the *hisauchii*-type, the *tschonoskii*-type, and the *kiyozumianum*-type, but they differ in the *pacificum*-type from the above four. Corolla tube length is largest in the *kiyozumianum*-type, becoming smaller in the *tschonoskii*-type, the *hisauchii*-type, and the *ovalifolium*-type in this order, and smallest in the *pacificum*-type (Fig. 3B, Tab. 2). Calyx depth is largest in the *pacificum*-type, becoming smaller in the *ovalifolium*-type, the

Tab. 2. Values of the measured characters of the five types. Ranges of each character are shown with averages and standard deviations in the parentheses.

Character	pacificum	ovalifolium	hisauchii	tschonoskii	kiyozumianum
Gynoecium Length (mm)	3.3 - 4.7 (3.96 ± 0.40)	3.0 - 5.0 (4.04 ± 0.43)	3.0 - 5.0 (3.80 ± 0.45)	2.9 - 4.8 (3.88 ± 0.37)	3.2 - 4.5 (3.83 ± 0.33)
Stigma Length (mm)	1.2 - 1.8 (1.43 ± 0.20)	0.8 - 1.7 (1.28 ± 0.23)	0.7 - 1.6 (1.08 ± 0.18)	0.7 - 1.4 (1.01 ± 0.16)	0.8 - 1.4 (1.04 ± 0.13)
Anther Length (mm)	3.6 - 4.6 (4.02 ± 0.37)	3.1 - 4.4 (3.60 ± 0.33)	2.6 - 4.5 (3.50 ± 0.41)	2.9 - 4.4 (3.59 ± 0.42)	2.8 - 4.0 (3.39 ± 0.32)
Anther Width (mm)	1.3 - 1.6 (1.47 ± 0.11)	1.1 - 1.7 (1.37 ± 0.12)	1.1 - 1.6 (1.30 ± 0.11)	1.0 - 1.4 (1.20 ± 0.10)	0.9 - 1.6 (1.21 ± 0.13)
Filament Length (mm)	4.5 - 6.0 (5.21 ± 0.57)	5.4 - 8.6 (6.64 ± 0.66)	4.7 - 7.8 (6.44 ± 0.77)	4.1 - 7.7 (6.23 ± 0.80)	5.3 - 8.3 (6.82 ± 0.68)
Corolla Tube Length (mm)	3.2 - 4.8 (4.25 ± 0.50)	4.1 - 6.1 (4.96 ± 0.50)	4.1 - 6.4 (5.14 ± 0.57)	4.1 - 6.7 (5.24 ± 0.81)	3.6 - 6.5 (5.30 ± 0.56)
Calyx Depth (mm)	1.7 - 2.2 (1.89 ± 0.19)	0.9 - 1.8 (1.32 ± 0.23)	0.9 - 1.9 (1.29 ± 0.23)	0.7 - 1.9 (1.23 ± 0.25)	0.7 - 2.0 (1.21 ± 0.24)
Stigma Insertion (mm)	-1.4 - 0.6 (-0.29 ± 0.67)	-2.1 - 0.1 (-0.92 ± 0.51)	-2.7 - -0.3 (-1.34 ± 0.52)	-2.8 - -0.1 (-1.36 ± 0.70)	-2.4 - -0.1 (-1.47 ± 0.49)
Anther Protrusion (mm)	0.1 - 1.8 (0.96 ± 0.47)	0.9 - 2.8 (1.68 ± 0.41)	0.5 - 2.1 (1.30 ± 0.41)	0.0 - 1.8 (0.99 ± 0.37)	0.6 - 2.1 (1.52 ± 0.33)
Leaf Blade Size (mm)	1350 - 4752 (2521 ± 1055)	476 - 4250 (1893 ± 903)	351 - 2480 (1037 ± 444)	225 - 1378 (674 ± 245)	336 - 2240 (1003 ± 425)
Inflorescence Length (mm)	62 - 143 (95.4 ± 25.7)	49 - 150 (101.2 ± 24.8)	37 - 106 (70.3 ± 17.1)	25 - 90 (49.3 ± 13.8)	41 - 100 (67.3 ± 14.5)
Inflorescence Width (mm)	25 - 66 (47.1 ± 14.8)	22 - 81 (48.0 ± 16.7)	14 - 56 (29.8 ± 9.8)	7 - 39 (19.1 ± 7.7)	14 - 53 (31.9 ± 8.4)

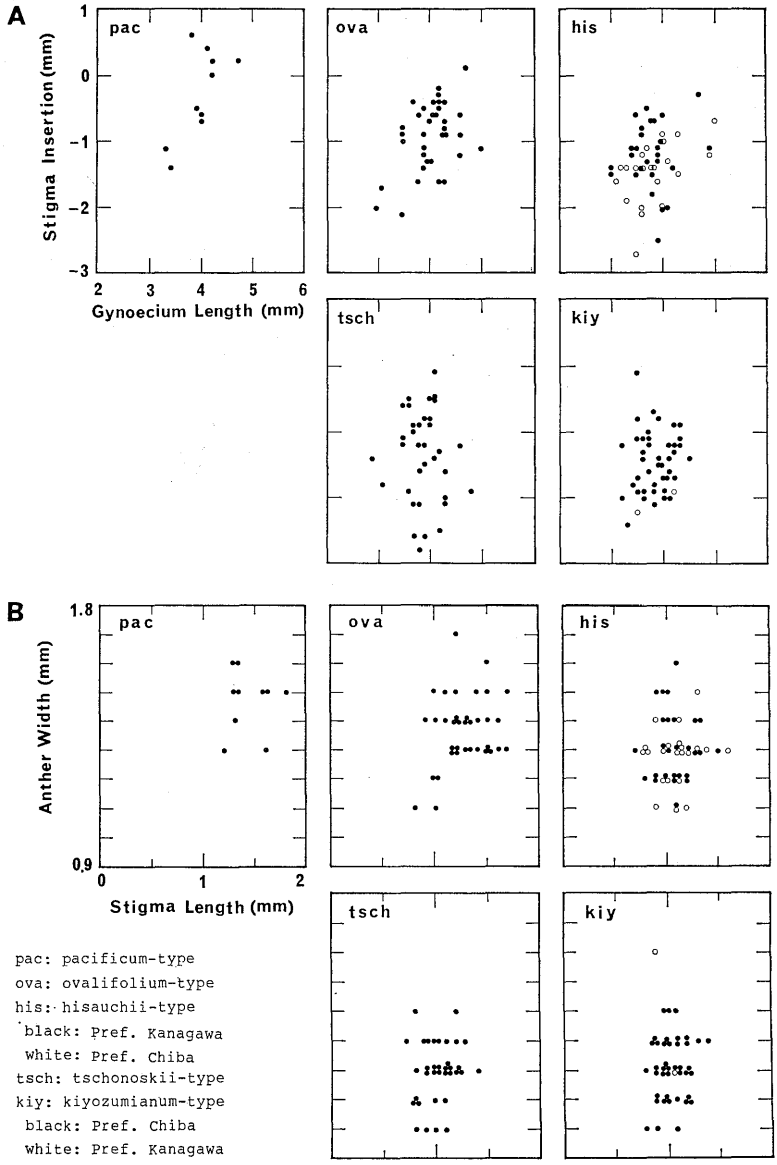

Fig. 2. Variations of gynoecium length and stigma insertion (A), and stigma length and anther width (B) in the five types. White circles in *hisauchii*-type and black circles in *kiyozumianum*-type represent individuals in Chiba Prefecture, while other circles in the two types those in Kanagawa Prefecture.

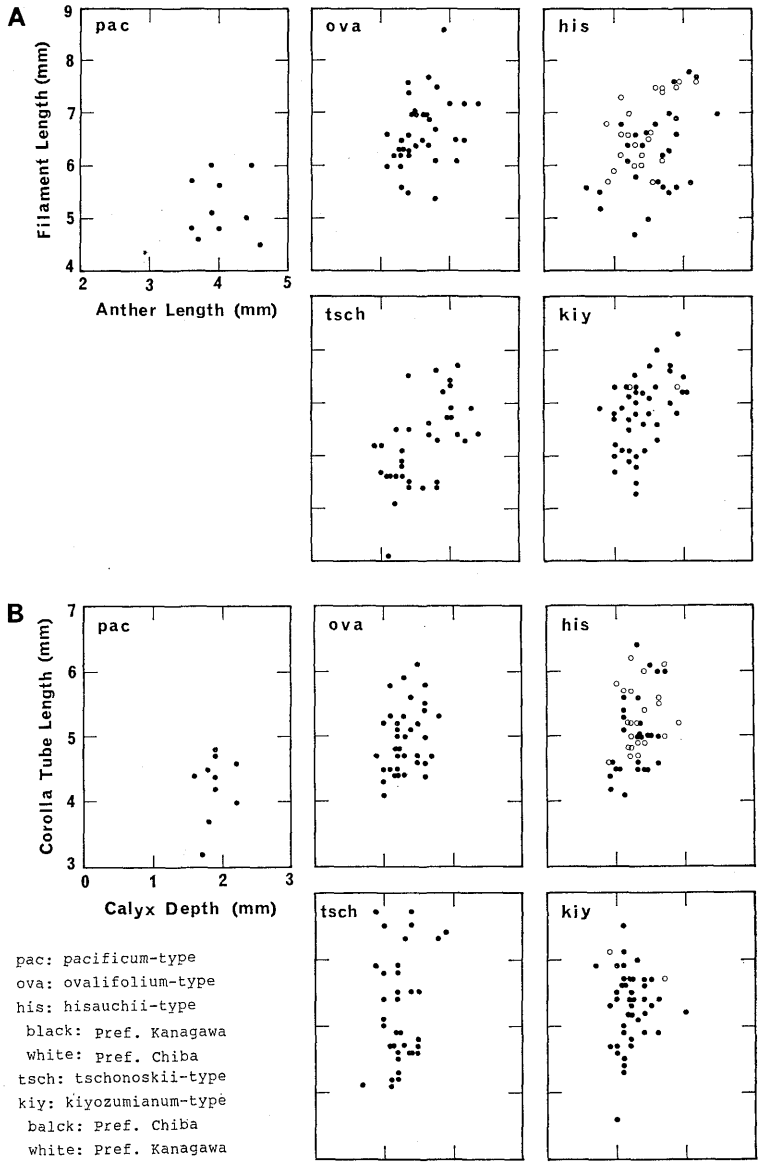

Fig. 3. Variations of anther length and filament length (A), and calyx depth and corolla tube length (B) in the five types. Symbols are the same as those in Fig. 2.

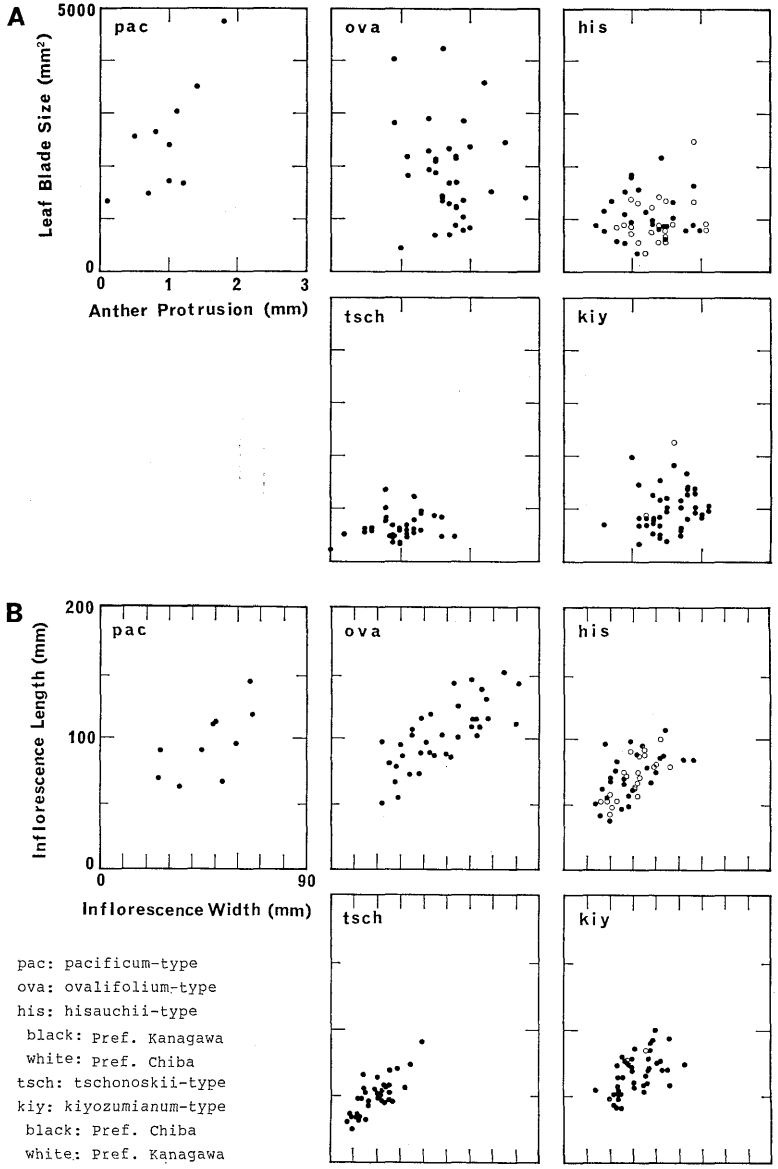

Fig. 4. Variations of anther protrusion and leaf blade size (A), and inflorescence width and inflorescence length (B) in the five types. Symbols are the same as those in Fig. 2.

hisauchii-type, and the *tschonoskii*-type in this order, and smallest in the *kiyozumianum*-type (Fig. 3B, Tab. 2). These two characters are also almost the same among the *ovalifolium*-type, the *hisauchii*-type, the *tschonoskii*-type, and the *kiyozumianum*-type, but differ in the *pacificum*-type from the above four. As deduced from the variation of gynoecium length and corolla tube length, stigma insertion is largest in the *pacificum*-type, becoming smaller in the *ovalifolium*-type, the *hisauchii*-type, and the *tschonoskii*-type in this order, and smallest in the *kiyozumianum*-type (Fig. 2A, Tab. 2). This character is quite different in the *pacificum*-type from the other four, among which it differs in the *ovalifolium*-type from the other three. Anther protrusion is largest in the *ovalifolium*-type, becoming smaller in the *kiyozumianum*-type, the *hisauchii*-type, and the *tschonoskii*-type in this order, and smallest in the *pacificum*-type (Fig. 4A, Tab. 2). This character is smallest in the *pacificum*-type, but, among the other four, it was largest in the *ovalifolium*-type, and smallest in the *tschonoskii*-type, being intermediate of these two in the *hisauchii*-type and the *kiyozumianum*-type.

2) Variation of leaves and inflorescences. Leaf blade size is largest in the *pacificum*-type, becoming smaller in the *ovalifolium*-type, the *hisauchii*-type, and the *kiyozumianum*-type in this order, and smallest in the *tschonoskii*-type (Fig. 4A, Tab. 2). This character shows the same tendency as calyx depth, stigma length, and anther width, being largest in the *pacificum*-type, a little smaller in the *ovalifolium*-type, and smallest in the *tschonoskii*-type, with the *hisauchii*-type and the *kiyozumianum*-type showing intermediate values between the *ovalifolium*-type and the *tschonoskii*-type. Inflorescence width is largest in the *ovalifolium*-type, becoming smaller in the *pacificum*-type, the *kiyozumianum*-type, and the *hisauchii*-type in this order, and smallest in the *tschonoskii*-type (Fig. 4B, Tab. 2). Inflorescence length is largest in the *ovalifolium*-type, becoming smaller in the *pacificum*-type, the *hisauchii*-type, and the *kiyozumianum*-type in this order, and smallest in the *tschonoskii*-type (Fig. 4B, Tab. 2). From these two characters, the following two points can be deduced: 1) inflorescence size is almost the same between the *pacificum*-type and the *ovalifolium*-type, and largest in both of them, smallest in the *tschonoskii*-type, and intermediate in the *hisauchii*-type and the *kiyozumianum*-type; 2) inflorescence form is narrow in the *tschonoskii*-type compared with the other four types, among which it is almost the same. (To be continued.)