Comparison of Variability in Wild *Camellia sasanqua* THUNBERG in Connection with Possible Origin of Cultivated Variety

Katsuhiko KONDO¹⁾, Kouichi TSURUDA²⁾, Akio TANAKA³⁾,
Masahiro HIZUME³⁾, Hisashi YOSHIOKA⁴⁾ and Özcan SEÇMEN⁵⁾

¹⁾ Department of Environmental Sciences, Faculty of Integrated Arts
and Sciences, Hiroshima University, Naka-ku, Hiroshima, 〒730

²⁾ Department of Botany, The University of Malaya, Kuala Lumpur
22-11, Malaysia

³⁾ Biological Institute, Faculty of Education, Ehime University, Ma-
tsuyama, 〒790

⁴⁾ Hiroshima Prefecture Forest Experiment Station, Miyoshi, 〒728

⁵⁾ Department of Botany, Ege University, Bornova, Izmir, Turkey

A comparative study of variability in the wild *Camellia sasanqua* was conducted in 69 study sites covered the majority of the natural populations of the species in Japan. Less-disturbed broad-leaved evergreen forests within the study sites exhibited canopy trees of *C. sasanqua* up to 10 m in height, up to 46 cm in DBH (trunk diameter at breast height) and average 125 years in age, while well-disturbed forests of either coppice forests or afforested plantations exhibited mostly sapling trees of *C. sasanqua* up to 2 m in height, up to 2 cm in DBH and average 10 years in age, which had large stumps up to 75 cm in diameter. All of the plants from the study sites had the same chromosome number of $2n=90$ (hexaploid). The buried seeds of the seed bank have never been long-lived and stored for more than a year. Seed germination, recruitment and plant growth of more open habitats, plentifully supplied with light were expected to allow many more modules to develop. However, the seedlings appeared in low relative light intensity of 12.1% or less suffered a constant probability of death within the first two years. Significant correlations were seen between mean leaf length and mean petal length, between mean leaf width and mean petal width, between mean leaf area and mean petal area, between mean leaf length and mean leaf width, and between mean petal length and mean petal width. Nevertheless, those quantitative variations in leaf and flower-petal could not be correlated with differences in habitats. Only four variant forms found were as follows: (1) semi-double flower form of a bud variation in the study site No. 6, (2) pinkish-white flower form in the study site No. 20, (3) larger petal form in the study site No. 64, and (4) deeply crenate-margin leaf form in the study site No. 69. No hybrid was seen in cross-combination between the wild *C. sasanqua* and its cultivars or other sympatric species which were not seasonally isolated. Since the present wild *C. sasanqua* was highly adapted to morphological uniformity and quantitative constancy and showed no segregation of morphological and quantitative characteristics, it could involve rarely with cultivar occurrence.

KEY WORDS : *Camellia sasanqua*, natural populations in Japan, origin of cultivated variety, variability.

Introduction

Camellia sasanqua THUNBERG is naturally distributed in the western part of Japan from Takeyashiki, Aki-Gun, Kochi Prefecture, Shikoku (ca. 134°15' E. L.) to Fukuejima Island, Nagasaki Prefecture, Kyushu (ca. 128°45' E. L.) and down to Yakushima Island, Kagoshima Prefecture, Kyushu (30°15' N. L.) (TOKUI 1955, HAKODA *et al.* 1974 a). Although in respect to the "index of warmth" of 130~135° the wild *Camellia sasanqua* is considered to be a member of Asiatic subtropical flora commonly associated with

Received May 14, 1985.

Distylium racemosum Sieb. et Zucc., *Illicium religiosum* Sieb. et Zucc., *Litsea aciculata* Blume and *Machilus* sp. (TOKUI 1955), many cultivars of *C. sasanqua sensu lato* survive the winter with a minimum of injury and are, thus, extensively cultivated within and outside the naturally distributed areas (NAKAI 1950, SEALY 1958, UEHARA 1969, HAKODA *et al.* 1974a, KONDO 1975). Thus, at least 330 cultivars of *Camellia sasanqua sensu lato* have been registered and cultivated in the world (WOODROOF 1984).

Since variation between the wild *Camellia sasanqua* and *C. miyagii* (Koidz.) Makino *et* Nemoto of the Ryukyu Islands is slight, the taxa are often reduced to varietal rank (SEALY 1958). Recently, HAKODA *et al.* (1974b) treats *C. sasanqua* and *C. miyagii* as distinct species according to their isozyme approach. PARKS *et al.* (1981) support this finding of HAKODA *et al.*, using different data in color pigments. On the other hand, CHANG (1981) and CHANG and BARTHOLOMEW (1984) speculate that *C. sasanqua* might be only a geographic variety of *C. oleifera* Abel, although they still treat both species being different. Thus, *Camellia miyagii* and *C. oleifera* are carefully excluded among the samples of the wild *C. sasanqua* for the present study.

A tendency toward the characteristics of *Camellia japonica* L. can be observed in a large number of cultivars of *C. sasanqua sensu lato*, and more so in the clones of *C. hiemalis* Nakai and *C. vernalis* (Makino) Makino. These morphological trends toward *C. japonica* found in *C. sasanqua sensu lato* include a tendency to bloom later in the autumn or early in the winter, some fusion of petal and filament bases, pink and red shades of floral pigmentation, cork-wart presence on the lower surface of the leaf-blade, and relatively coarser branch and foliage texture (HAKODA *et al.* 1977, PARKS *et al.* 1981). Thus, PARKS *et al.* (1968, 1981) conclude that a large number of cultivars of *C. sasanqua sensu lato* and the cultivars of *C. hiemalis* and *C. vernalis* carry varying degree of genetic influence from *C. japonica*. This conclusion suggests a further speculation that some local populations of the wild *C. sasanqua* might be caused continuously by introgressive hybridization flowed from those hybrid cultivars planted in some local gardens and might, therefore, get highly variable. Variability in population level in the wild *Camellia sasanqua*, however, are poorly characterized in most standard references, especially with respect to quantitative details.

Thus, in order to detect cultivarietal significance in variation pattern it is necessary to study and compare variation in the wild *Camellia sasanqua*.

Materials and Methods

Figure 1 shows the locations of 69 study sites of naturally-occurring *Camellia sasanqua* populations studied in 1980~1984 in Kyushu, western Chugoku and southwestern Shikoku, Japan. The site of Shizuki-Zan, Hagi City, Yamaguchi Prefecture (study site No.1) is only a population in Chugoku District of Honshu, which is speculated to be escaped from some individuals transplanted long time ago for economic purpose (BUNKACHO, BUNKAZAIHOGOBU 1971, p.211). Since its habitat and growth form are exactly same as those in the center of the distribution, it is included in this study. Thus, these sixty-nine study sites are enough to cover most of all populations of the wild *C. sasanqua* recorded in the previous papers (NAKAI 1950, TOKUI 1955, HAKODA *et al.*

1974 a).

Some environmental characteristics such as inclination of slope, relative light intensity, soil pH, soil water holding capacity, soil hardness, soil organic matter at different depth and vegetation were measured in the study sites. However, many of the habitats of the wild *C. sasanqua* localities have been well-disturbed as coppice forest, plantation or agricultural farm-land.

Analyses of trees of the wild *Camellia sasanqua* were made in each study site by sampling in a 10 m×10 m quadrat. All of the living trees, from sapling to canopy trees, in each quadrat were numbered and then population density, tree age, height and trunk diameter at breast height (DBH) were measured. Tree ages were determined from annual growth rings from either cross-sections of cut-trunks or cores collected by an increment borer. Trunk bases were carefully detected whether or not they had appeared as coppice trees. Soon after 200 sunlit leaves and 50 sunlit flowers and 200 shade leaves and 20 shade flowers were collected, if available, from lower stems to the crown and from new shoots to older, well-branched stems of each of all trees within each quadrat, they were carefully pressed and dried because especially petals and stamens of flowers came easily into pieces. Thus, all measurements of leaf and flower characters were obtained from flat, dried materials. Areas of the leaves and flower-petals were measured with an automatic area meter (Hayashi-Denkoh AAM-7).

Scions of the wild *Camellia sasanqua* from all trees from sapling to canopy trees in the study sites were collected and made cuttings for the materials of chromosome counts. Root-tips from those cuttings were treated with 0.002 M 8-hydroxyquinoline for two hours at 18°C. They were fixed in 45% acetic acid at 4°C for 15 minutes, hydrolyzed in 2:1 mixture of 1N hydrochloric acid and 45% acetic acid at 60°C for ten seconds, and then stained and squashed in 1% aceto-orcein. The voucher specimens used for chromosome counts are deposited in the Herbarium, Faculty of Integrated Arts and Sciences, Hiroshima University.

Patterns of seedling mortality and recruitment in plants of the wild *Camellia sasanqua* were studied in a sunny population in Uzu, Sugeta-Cho, Oozu City, Ehime Prefecture, Shikoku (study site No.23) and a shade population in Mt. Sengokuyama, Nagayama, Higashi-Sefuri-Mura, Kanzaki-Gun, Saga Prefecture, Kyushu (study site No.58), by sampling in 1 m×1 m quadrat.

Results and Discussion

Although some wild *Camellia sasanqua* populations were dense at 300~600 m elevation, many of them were thinly scattered with a few old trees at ages between 100~150 years, DBH between 1.2~46 cm and height between 300~1,000 cm, which might be leftover after clear-cut at regular intervals. Thus, habitats of those populations were placed mostly and originally in well-disturbed, temperate, broad-leaved evergreen forests or their coppice forests. Some habitats of wild *C. sasanqua* were found in plantations of *Chamaecyparis obtusa* Endl. or *Cryptomeria japonica* D. DON or various bamboos. Many of the wild *Camellia sasanqua* trees in those disturbed or man-made forests were coppice-originated and sapling-sized, at DBH between 0.6~2.0 cm and at

Fig. 1. Sixty-nine study sites in the wild *Camellia sasanqua* populations in Chugoku, Shikoku and Kyushu Districts, western part of Japan. Chugoku District : Yamaguchi Prefecture, (1) Hagi City, Shizuki-Zan. Shikoku District : Kochi Prefecture, (2) Aki-Gun, Take-yashiki, (3) Aki City, 0.2km north of Tochino-ki, (4) Kochi City, Kakegawa Shinto Shrine, (5) Takaoka-Gun, Sagawa-Cho, Kamigou, (6) Takaoka-Gun, Sagawa-Cho, Torino-su, (7) Takaoka-Gun, Naka-Tosa-Cho, Daishin-kai, (8) Hata-Gun, Saga-Cho, Kumai, (9) Hata-Gun, Ukitsu, Ukitsu-Kaisuiyoku-jyo, (10) Nakamura City, Kozuka, Hashi-no-uchi, (11) Nakamura City, Kozuka, Kozuka Ancient Tomb, (12) Nakamura City, Arioka. Ehime Prefecture, (13) Minami-Uwa-Gun, Jyohen-Cho, Renjy-oji, (14) Minami-Uwa-Gun, Jyohen-Cho, Kajigou, (15) Minami-Uwa-Gun, Jyohen-Cho, Souzu, (16) Minami-Uwa-Gun, Jyohen-Cho, Souzu, Nishimuraguchi, (17) Kita-Uwa-Gun, Matsuno-Cho, Nojiri, (18) Kita-Uwa-Gun, Matsuno-Cho, Yoshino, Zao-Guu Shinto Shrine, (19) Kita-Uwa-Gun,

Hiromi-Cho, Narukawa, (20) Kita-Uwa-Gun, Hiromi-Cho, Narukawa, (21) Kita-Uwa-Gun, Hiromi-Cho, Narukawa, (22) Higashi-Uwa-Gun, Uwa-Cho, Inou, (23) Oozu City, Sugeta-Cho, Uzu, (24) Oozu City, Tori-kubi, (25) Kita-Gun, Hijikawa-Cho, Dounou. Kyushu District : Ohita Prefecture, (26) Naomi, 10km southwest of Saeki City, on National Road 10, (27) Oono-Gun, Mie-Machi, Imaichi, Ijibeta Hachiman Shinto Shrine, (28) Minami-Amabe-Gun, Onoichi, on National Road 326. Kyushu District : Miyazaki Prefecture, (29) Hi- uga City, Mimitsu-Cho, 2.5km west of Biyoubu, (30) Miyazaki City, Uchiumi, (31) Nichinan City, Obi, Futohara, (32) Nichinan City, Obi, Futohara, (33) Minami-Naka-Gun, Nango-Cho, Yowara, (34) Minami-Naka-Gun, 1 km north of Furu-Oouchi, (35) Kushima City, 0.2km northeast of Douen Busstop on National Road 220, 0.1km north of Downtown Kushima City, (54) Kobayashi City, Mt. Kirishima between Ebino Highland and Kobayashi City on Kirishima National Highway. Kagoshima Prefecture, (36) Soo-Gun, Ariake-Cho, Futsuhara, (37) Soo-Gun, Oosaki City, Hon-nyu-do, on National Road 220, (38) Kimotsuki-Gun, Tashiro-Cho, Uchinomaki, (39) Kimotsuki-Gun, Tashiro-Cho, Nitta, (40) Kimotsuki-Gun, Tashiro-Cho, 7.5 km west of Nitta, (41) Yaku Island, Hirauchi, (42) Kimotsuki-Gun, Nejime-Cho, 0.2 km north of Mizunojiri Busstop, on National Road 269, (43) Kaseta City, Oosaki, Takeda Shinto Shrine, (44) Hioki-Gun, Kinpo-Cho, Juren, Mt. Kinpo, (45) Kawabe-Gun, 0.2km northwest of Kurose-Chuo Busstop, Mt. Noma-Dake, (46) Hioki-Gun, 0.5 km southeast of Oosaka Primary and Junior High Schools, between the Schools and Ushi-no-kawa-guchi, Mt. Kinpo, (47) Hioki-Gun, north base of Mt. Kinpo, (48) Hioki-Gun, 2.9 km from Oosaka Primary and Junior High Schools toward Ushi-no-kawaguchi, Kinpo-Cho, Hase, (49) Hioki-Gun, 5km from Hase toward Suzu-Yama Interchange of Highway Ibusuki Skyline, (50) Hioki-Gun, Kouri-yama-Cho, Mt. Yaeyama, near Yaeyama Dog Training Center, (51) Hioki-Gun, Kouri-yama-Cho, Yae, 5.85 km northwest of Kami-Jyoban on Prefecture Road 36, (52) Aira-Gun, Kurino-Cho, Koba, (53) Aira-Gun, Makizono-Cho, Maruo. Nagasaki Prefecture, (55) Minami-Takaki-Gun, Kajiki on National Road 57, southeast base of Mt. Unzen, (63) Kita-Matsuura-Gun, Tabira on National Road 204, (64) Hirado Island, Hirado City, 300m north of Kawachi-goe Busstop on Prefecture Road, (65) Iki Island, Iki-Gun, Gounoura-Cho, Hatsuyama, (66) Fukuejima Island, Minami-Matsuura-Gun, Kishuku-Machi, Oomagari, (67) Fukuejima Island, Minami-Matsuura-Gun, Tomie-Cho, 1km west of Tao, (68) Fukuejima Island, Minami-Matsuura-Gun, Miiraku-Cho, Kaitsu-Nakami- chi, (69) Fukuejima Island, Minami-Matsuura-Gun, Tamanoura-Cho, Tachiya. Kumamoto Prefecture, (56) Hotaku-Gun, Kawachi-Machi, Mt. Kinpo, 0.7km northwest of To uge-no-chaya, (57) Kumamoto City, Kurokami, Tatsuta Nature Park. Saga Prefecture, (58) Kanzaki-Gun, Higashi-Sefuri-Mura, Nagayama, Mt. Sengokuyama, (59) Higashi-Matsuura-Gun, Genkai-Cho on National Road 204, (60) Higashi-Matsuura-Gun, Hatazu on National Road 204, (61) Imari City, 1km south of Hat azu Junior High School, (62) Nishi-Matsuura-Gun, Urano-saki.

Table 1. Comparisons of some quantitative characters of wild *Camellia sasanqua* in 69 study sites

Study ¹ site No.	Coppice trees or not	Density ² (m ⁻²)	Mean ³ DBH (cm)	Mean height (cm)	Leaf ⁴			Petal ⁶				
					Area (cm ² ±S.D.)	Length (mm±S.D.)	Width (mm±S.D.)	L/W ⁵ ratio	Area (cm ² ±S.D.)	Length (mm±S.D.)	Width (mm±S.D.)	L/W ⁵ ratio
1	no	0.19	1.0	180	5.9±1.5	43.5±6.2	18.5±2.5	2.35	4.2±1.5	32.4±7.8	16.2±2.5	2.00
2	no	0.02	6.0	321	8.4±2.4	57.5±7.9	20.5±3.5	2.80	6.3±1.7	36.2±5.2	23.7±3.1	1.53
3	no	0.03	34.0	566	6.0±1.6	48.9±7.7	16.8±2.2	2.91	2.3±0.6	21.0±4.1	14.9±1.7	1.41
4	no	0.12	28.9	986	4.6±1.0	38.5±4.4	17.1±2.1	2.25	1.2±0.4	19.9±1.8	8.5±1.4	2.34
5	no	0.03	43.0	645	4.3±0.8	32.8±3.3	17.8±1.6	1.84	2.5±0.7	20.9±4.6	15.8±1.9	1.32
6	no	0.04	15.0	527	4.9±1.5	40.6±7.2	16.5±2.3	2.46	4.7±1.2	29.4±5.3	20.6±3.7	1.43
7	yes	0.24	1.5	447	4.2±1.4	33.6±5.6	16.1±2.9	2.09	4.2±1.2	30.0±5.0	19.3±3.4	1.55
8	no	0.02	18.1	463	9.6±3.1	54.6±9.7	24.3±4.1	2.25	7.6±1.9	37.7±5.1	27.7±4.1	1.36
9	no	0.09	5.5	345	4.8±1.4	39.3±8.2	16.6±2.8	2.37	4.4±1.7	29.7±6.7	19.7±4.5	1.51
10	no	0.03	6.9	792	7.1±1.5	49.0±5.1	20.4±2.9	2.40	5.4±1.4	35.6±5.4	22.5±3.5	1.58
11	yes	0.02	0.8	121	5.2±2.1	42.1±8.7	17.1±4.1	2.46	2.7±0.6	22.8±2.5	17.7±1.9	1.29
12	yes	0.04	0.7	128	5.7±1.7	39.5±5.8	19.6±3.1	2.01	4.4±1.3	28.9±6.8	19.9±4.8	1.45
13	no	0.07	2.3	720	5.7±1.4	41.7±5.2	18.6±2.7	2.24	3.8±1.5	27.9±7.1	17.6±3.4	1.59
14	no	0.02	11.5	450	5.8±1.5	42.3±5.6	18.5±2.6	2.29	4.8±1.7	31.7±6.1	22.0±2.9	1.44
15	yes	0.01	5.6	499	5.2±1.7	41.8±7.5	17.2±3.1	2.43	5.1±2.1	30.9±5.3	21.5±5.8	1.44
16	yes	0.12	5.9	386	7.9±1.5	54.9±4.9	20.3±2.5	2.70	—	—	—	—
17	yes	0.06	16.5	707	6.1±1.4	43.5±4.9	19.7±2.8	2.21	4.0±1.4	28.8±7.0	18.3±3.6	1.57
18	no	0.11	3.7	342	6.9±1.7	51.2±6.5	19.2±2.7	2.67	6.5±2.1	36.3±8.1	23.8±4.5	1.53
19	no	0.01	10.5	378	5.1±1.2	43.4±4.5	16.5±2.4	2.63	4.9±1.5	32.1±5.9	20.0±3.6	1.61
20	no	0.02	14.1	376	4.9±1.7	36.0±7.2	13.0±3.4	2.00	5.0±2.4	33.0±3.8	20.8±2.9	1.59
21	no	0.01	15.3	368	5.6±1.1	41.3±4.3	18.6±2.6	22.2	4.9±2.6	32.3±4.1	20.4±2.2	1.58
22	yes	0.06	0.6	142	5.9±2.3	43.8±8.2	18.1±4.0	2.42	5.2±2.7	31.9±3.1	22.2±3.5	1.44

¹ Number follows Fig. 1.² Density×100=number of trees observed in quadrat³ DBH=diameter at breast height⁴ Number of leaves measured in each study site=400×number of trees⁵ L/W=mean length÷mean width⁶ Number of petals measured in each study site=70×number of trees

Table 1. ... continued

Study ¹ sire No.	Coppice trees or not	Density ² (m ⁻²)	Mean ² DBH (cm)	Mean height (cm)	Leaf*			L/W ³ ratio	Petal ⁶			
					Area (cm ² ±S.D.)	Length (mm±S.D.)	Width (mm±S.D.)		Area (cm ² ±S.D.)	Length (mm±S.D.)	Width (mm±S.D.)	L/W ⁵ ratio
23	no	0.02	38.6	876	4.4±1.0	36.9±5.1	15.9±2.1	2.32	3.2±0.6	25.4±2.9	15.6±1.8	1.63
24	yes	0.18	1.3	200	5.6±1.7	44.3±8.3	17.6±2.9	2.52	3.4±1.0	23.4±5.4	16.3±3.0	1.44
25	yes	0.22	2.5	170	4.5±1.5	39.1±7.5	15.9±2.6	2.46	2.8±0.8	25.5±5.2	15.1±2.6	1.69
26	no	0.01	7.2	241	4.0±1.1	38.4±5.7	15.8±2.2	2.43	3.0±2.3	27.1±3.9	15.3±4.1	1.77
27	no	0.04	32.8	664	5.4±1.3	41.8±5.5	19.0±2.6	2.20	3.4±1.5	29.0±2.8	13.8±3.3	2.10
28	yes	0.16	1.7	210	6.2±1.7	44.3±6.1	20.4±2.9	2.17	3.5±1.7	31.1±4.7	19.2±2.8	1.62
29	no	0.03	7.5	368	5.1±1.0	38.3±3.8	18.5±2.1	2.07	3.2±1.4	26.0±2.1	15.8±2.1	1.65
30	no	0.02	7.0	449	4.9±1.2	45.2±5.2	15.3±2.0	2.95	3.4±1.6	23.1±5.1	15.8±2.7	1.46
31	no	0.04	26.0	698	6.0±1.8	43.0±6.6	19.0±3.4	2.26	3.6±1.8	30.0±5.4	21.8±3.8	1.38
32	no	0.07	24.9	645	5.1±1.2	43.4±6.3	16.1±2.4	2.70	3.8±0.8	32.2±3.9	18.7±2.2	1.72
33	no	0.03	45.6	928	5.7±1.6	41.6±7.2	18.4±3.0	2.26	3.7±1.3	31.9±4.1	20.2±3.1	1.58
34	no	0.02	36.0	388	6.4±1.2	44.4±4.8	19.4±1.9	2.29	3.1±2.1	28.0±2.9	15.4±2.1	1.82
35	no	0.15	18.8	221	3.4±0.6	28.9±2.0	15.7±2.0	1.84	3.2±0.5	25.3±2.8	15.6±2.0	1.62
36	no	0.03	1.2	126	4.6±1.1	38.8±5.2	15.6±2.5	2.49	3.5±1.9	28.8±5.1	22.3±2.9	1.29
37	no	0.07	19.4	694	7.2±1.5	46.2±5.6	21.2±2.6	2.18	3.3±2.2	22.8±7.6	16.7±3.5	1.37
38	yes	0.02	6.7	318	4.9±1.5	41.9±5.0	16.4±3.3	2.55	4.2±2.6	31.1±3.4	22.5±2.7	1.38
39	no	0.06	2.6	289	5.2±1.2	41.9±5.0	16.9±2.2	2.42	3.9±2.4	32.1±3.1	18.8±1.8	1.70
40	no	0.14	5.4	477	6.4±1.8	47.7±7.6	19.0±2.7	2.51	3.3±1.2	24.9±3.7	15.5±2.9	1.61
41	no	0.19	6.5	517	7.1±1.9	45.7±6.5	22.7±3.4	2.01	6.1±3.1	37.3±4.9	25.1±4.4	1.49
42	no	0.02	2.2	387	3.4±0.7	35.4±3.4	13.3±1.7	2.66	3.3±4.1	25.6±1.8	13.9±3.6	1.84
43	no	0.03	7.2	422	4.6±1.0	40.0±4.2	15.8±2.0	2.53	4.9±3.8	32.6±2.1	24.3±2.1	1.34
44	no	0.16	6.6	487	7.3±1.8	48.4±6.6	20.5±2.7	2.36	4.5±2.2	30.3±2.8	24.1±2.1	1.26
45	yes	0.08	2.4	217	4.6±1.8	33.1±7.3	16.0±3.5	2.38	3.4±1.8	28.1±3.7	22.9±2.6	1.23
46	no	0.19	3.8	412	4.9±1.0	42.7±4.4	16.1±2.0	2.65	3.5±1.8	27.9±3.8	23.4±3.1	1.19
47	no	0.06	27.6	749	8.1±1.6	49.6±5.7	22.6±2.3	2.19	4.1±2.2	30.9±2.8	22.2±1.8	1.39
48	yes	0.02	1.5	160	5.5±1.6	45.1±6.4	17.1±3.0	2.64	—	—	—	—
49	no	0.04	30.4	844	4.4±1.0	42.7±5.8	14.6±1.6	2.92	3.4±1.6	27.5±2.6	23.1±2.1	1.19
50	yes	0.11	1.9	84	6.4±1.5	45.6±5.6	19.4±3.5	2.35	—	—	—	—

Table 1. ... continued

Study ¹ site No.	Coppice trees or not	Density ² (m ⁻²)	Mean ³ DBH (cm)	Mean height (cm)	Leaf ⁴			Petal ⁶				
					Area (cm ² ±S.D.)	Length (mm±S.D.)	Width (mm±S.D.)	L/W ⁵ ratio	Area (cm ² ±S.D.)	Length (mm±S.D.)	Width (mm±S.D.)	L/W ⁵ ratio
51	no	0.02	4.8	311	4.9±1.7	43.1±7.9	16.1±3.0	2.67	3.6±2.1	26.6±2.9	24.8±3.1	1.07
52	no	0.03	34.7	845	6.4±1.0	48.8±4.0	18.9±1.8	2.58	4.8±2.7	32.2±3.8	21.6±2.4	1.49
53	no	0.15	5.4	508	5.4±1.7	44.7±7.3	16.3±3.2	2.69	2.6±1.2	24.5±8.9	13.5±2.6	1.81
54	no	0.04	6.8	477	6.3±1.1	48.0±5.4	18.5±2.2	2.59	3.2±2.1	23.9±2.8	14.4±2.1	1.66
55	no	0.03	3.7	379	5.3±1.8	43.5±7.6	16.6±3.2	2.62	3.2±1.6	21.5±3.1	16.8±1.8	1.28
56	yes	0.22	1.9	159	6.1±2.0	50.6±7.1	18.5±3.8	2.74	3.5±1.9	26.9±2.2	23.8±2.5	1.13
57	no	0.19	2.8	316	5.9±2.8	51.2±4.9	19.1±2.6	2.68	3.6±2.1	27.1±1.9	24.1±3.3	1.12
58	no	0.05	45.5	756	5.6±1.0	44.7±4.9	18.8±1.8	2.38	3.3±0.3	28.8±2.5	16.6±1.6	1.73
59	yes	0.02	3.3	214	6.9±1.9	51.8±7.1	19.6±3.4	2.64	3.4±1.7	28.1±2.7	22.4±3.1	1.25
60	no	0.03	3.5	338	5.1±1.2	44.1±5.3	17.0±2.1	2.59	2.2±0.5	25.7±2.5	12.5±2.2	2.06
61	yes	0.03	2.1	211	5.2±1.3	44.5±6.0	17.5±2.5	2.54	2.4±1.3	27.1±1.8	13.0±2.5	2.03
62	yes	0.02	3.3	278	5.8±2.3	46.1±9.8	18.4±4.2	2.51	3.6±3.1	27.0±2.8	24.2±3.1	1.12
63	yes	0.02	1.5	157	5.8±2.3	45.1±8.8	18.2±4.1	2.48	—	—	—	—
64	no	0.02	8.4	549	10.8±2.7	60.4±8.9	25.5±3.4	2.37	6.7±1.1	37.5±7.6	20.8±3.5	1.80
65	no	0.09	6.7	375	4.1±1.6	41.2±4.8	14.6±2.1	2.82	4.5±1.0	32.5±3.3	19.1±3.0	1.70
66	no	0.17	8.1	483	5.8±1.6	44.8±7.3	18.0±2.8	2.49	4.0±2.0	30.5±8.9	16.8±4.5	1.82
67	yes	0.14	2.3	357	5.2±1.1	44.2±4.6	16.7±2.3	2.65	4.2±1.8	30.8±4.1	23.0±2.1	1.34
68	no	0.12	26.7	699	7.4±2.1	46.8±10.5	21.8±3.0	2.15	4.5±1.5	27.9±4.8	21.6±4.3	1.29
69	yes	0.27	3.7	339	4.9±1.6	42.0±6.9	16.3±3.3	2.58	4.1±1.7	28.8±3.3	22.8±2.4	1.26

height between 100~200 cm. Then, some stumps of these coppice trees were quite large, up to 75 cm in diameter, while dry-masses of the above-ground portions were quite small, average 246.3 g of the photosynthetic organs and average 1869.2 g of the non-photosynthetic organs per tree. No flower was set in relative light intensity of less than 12% (e.g., study site Nos. 16, 48, 50, 63; Table 1).

Patterns of seedling mortality and recruitment in plants of wild *Camellia sasanqua* indicated itself to be a sun tree. Seed and seedling populations on the ground in the mature forest of wild *C. sasanqua* of Mt. Sengokuyama, Saga Prefecture (study site No. 58), in the relative light intensity of 12.1%, declined as time passed: In middle November, 126.5 ± 23.7 seeds per m^2 fell onto the ground and by middle December $36.6 \pm 21.7\%$ of those seeds germinated while the others did not due to empty seeds (only the seed-coats were available), or small-sized holes or superficial scar produced by larva of *Curculio* sp., or consumption or carry-over by *Microscelis amaurotis amaurotis* and *Streptopelia orientalis* (KONDO *et al.* 1982) or members of the Gryllidae and possibly mice and rats, or decomposition by some fungi; and finally by middle June they were gradually reduced to 1.25 ± 0.5 seedlings and no viable seed per m^2 . Those live seedlings had 3~7 elliptical leaves with crenate leaf-margin.

In contrast, seed and seedling populations on the ground in open, sparsely populated forest of wild *C. sasanqua* after screening of clear-cut, in the relative light intensity of 100%, in Uzu, Ehime Prefecture (study site No. 23), also gradually decreased in number as time passed: In late October, 262.1 ± 31.6 seeds per m^2 fell onto the ground; by early December, $41.7 \pm 19.6\%$ of those seeds germinated although average 81.4% of the seeds were viable and the others were abortive; and by early May $56.6 \pm 12.2\%$ seeds germinated while the others did not and even decreased in number either by continuous dormancy with their well-dried, hard seed-coats and no break of dormancy which might be caused on the sunny ground condition much drier than the shaded ground or consumption or carry-over by *Microscelis*

amaurotis amaurotis and *Streptopelia orientalis* or foraging by larva of *Curculio* sp. and possibly mice and rats. After June, seedling mortality in both the shaded and sunny populations started to be derived primarily from grazing insects such as larvae of

Fig. 2. Relationships of mean leaf length with mean leaf width (A) and mean petal length with mean petal width (B). Each solid circle indicates mean values given in each study site.

Euproctis pseudoconspersa Strand and members of the Psychidae, and otherwise the majority of the live seedlings survived for next one more year until their mortality got rapidly occurred by some reason, perhaps lost in competition to densely growth of annual herbaceous plants or human interference of grass mowing and bush gathering. Perfect loss of all leaves or defoliation of the young plant of wild *C. sasanqua* at once during summer-winter directly kills their healthy plant-body. On the other hand, the buried seeds of the seed bank have never been stored in living condition for more than a year and got decomposed gradually and no germination in the second or further year after dispersion. Thus, morphological and quantitative variations of leaves of the seedlings of wild *C. sasanqua* were quite similar to each other.

The chromosome numbers of all of the mature plants of wild *Camellia sasanqua* of the 69 study sites were all $2n=90$, hexaploid, that was same as those of the previous counts (KONDO 1977). However, no variation in chromosome number was observed in the wild populations studied.

Table 1 shows measurements of the quantitative characters of flowers and leaves of wild *Camellia sasanqua* from all study sites and considered to have significance in this research; area, length, width and length/width ratio of leaf and petal.

Leaf lengths of the wild *Camellia sasanqua* studied ranged from 16.3~81.2 mm, leaf widths ranged from 5.7~32.7 mm, and leaf areas ranged from 1.59~16.31 cm², while petal lengths ranged from 10.7~50.8 mm, petal widths ranged from 7.0~35.0 mm, and petal areas ranged from 0.79~10.56 cm². Thus, length/width ratios of leaves ranged from 1.84~2.95 and those of petals ranged from 1.07~2.34. Wild *Camellia sasanqua* in the study site numbers 24 and 25 seemed to exhibit small flowers with short petals and low numbers of stamens, average 46, in the shade flowers and large flowers with long and narrow petals and more stamens in the sunlit flowers. In contrast, the study site numbers 8, 41 and especially 64 included individually large petaled form. There were significantly correlated proportions ($P<0.05$) between mean leaf length and mean leaf width ($r=0.672$) and between mean petal length and mean petal width ($r=0.637$) (Fig. 2). Then, quantitative traits in leaves varied with those in petals (Fig. 3); mean leaf length increased significantly with mean petal length ($r=0.366$, $P<0.05$); and mean leaf area increased significantly with mean petal area ($r=0.580$, $P<0.05$). However, these quantitative characters in leaf and flower-petal were not correlated with differences in the environments of the habitats of the study sites measured.

Four variant forms were found in the trees of the wild *Camellia sasanqua* in the study sites: (1) Semi-double flower form of a bud variation in the study site No. 6, while the wild form usually sets single flowers. (2) Pinkish-white or pale pink flower form in the study site No. 20, while the wild form usually sets white flower-petals sometimes with pale pink margin due to the absence of red pigmentation (PARKS *et al.* 1981). (3) Quantitatively large-petal form in the study site No. 64. and (4) Deeply crenate margin leaved form in the study site No. 69, while the wild form usually has serrulate margin leaves.

No interspecific hybrid between wild *Camellia sasanqua* and other sympatric species of *Camellia* such as *C. japonica* L. and *C. sinensis* (L.) O. Kuntze or no intervarietal

hybrid between wild *C. sasanqua* and its cultivars was found in points of morphological and chromosomal characters during the course of investigation, even though many of their flowering seasons overlapped with each other. Cultivars of *Camellia* have been sometimes found in contaminated populations in overlapped distribution of two or more sympatric species or cultivars in both natural and cultivated conditions (HAGIYA and ISHIZAWA 1961, PARKS and CASE 1969, PARKS and KONDO 1974). This might occur spontaneously as results of outcrossing and furthermore introgressively hybridizing between *C. sasanqua* and other sympatric species or cultivars of *Camellia*. For instance, *Camellia hiemalis* and *C. vernalis* are considered to be cultivated groups of hybrids between *C. sasanqua* and *C. japonica* according to the previous reports (e.g., MAKINO 1918, PARKS *et al.* 1968, UEMOTO *et al.* 1980, NAGATO and HAKODA 1984, NAGATA and SAKAI 1985, TANAKA *et al.* 1985). According to UEMOTO *et al.* (1980), a cultivar of *C. vernalis*, 'Gaisen' ($2n=60$, tetraploid) cultivated in Hirado Island, Nagasaki Prefecture, Kyushu, might be a primary hybrid between *C. sasanqua* and *C. japonica*. Moreover, a recent study by TANAKA *et al.* (1985) suggested that there are at least ten cultivars similar to 'Gaisen' in the Japanese cultivar collection and then, called them the

'Gaisen' type tetraploid varieties. However, it is, generally speaking, quite difficult to make artificial hybrid between wild *C. sasanqua* and wild *C. japonica* by hand-pollination. In contrast, a combination between *C. sasanqua* and colchicine-induced tetraploid *C. sinensis* both in cultivated condition can be readily crossed by hand-pollination, while another combination between *C. sasanqua* and diploid cultivars of *C. sinensis* cannot be crossed (FUCHINOUE 1975). The majority of the wild and cultivated *C. sinensis* is diploid. It seems that no or scarcely hybrid occurs within the natural populations of the wild *C. sasanqua* which would be well-isolated from its cultivars and other sympatric species

Fig. 3. Relationships of mean leaf length with mean petal length (A), mean leaf width with mean petal width (B), and mean leaf area with mean petal area (C). Each solid circle indicates mean values given in each study site.

of *Camellia* and that cultivar collections of *C. sasanqua* and its related *C. hiemalis* and *C. vernalis* could contribute to derive many more cultivars. In addition, some cultivars could be originated from bud variation.

Since the wild *Camellia sasanqua* flowers in full bloom from late September-January gave out some fragrance and had some points between the petal base and the stamen-filament base secreted much nectar although they had non-attractive, white-colored petals, they were visited by numerous nectarivores although visitation rates varied through relatively long season; insects such as members of the Apidae, the Cleptidae, the Colletidae, the Syrphidae, and the Vespidae, and members of butterflies including the Nymphalidae especially in September-November, and some birds including *Zosterops japonica japonica* Temminck et Schlegel in winter. Thus, most of the pollinators for the wild *C. sasanqua* were of short-distance pollen-carriers which might contribute insufficient gene flows between long-distance populations by random but sufficient gene flows within local population or between short-distance populations. Moreover, these insects visit randomly flowers of various species although they were more selective in their visits to plants in the high density flower populations, and perhaps they might carry pollen from cultivars of *C. sasanqua* and other sympatric species of cultivars of *Camellia* growing and flowering near by wild *C. sasanqua* populations.

It was expected that the wild *Camellia sasanqua* in natural populations could accumulate various genotypic and clinal variabilities within individuals and local populations with regard to reproductive fitness and natural selective pressures since this species was long-lived. However, the wild *Camellia sasanqua* populations did not show any hybrid of *C. sasanqua* and other taxon and drastic differences in variation but showed relatively, morphologically and quantitatively steady variability within certain extremes during the course of investigation. All of the wild *Camellia sasanqua* populations studied had involved, no matter how strong or weak it was, human interferences until not too long ago because of land usages for plantation and charcoal products, seed oil products of *C. sasanqua*, and so on. Seeds of the wild *Camellia sasanqua* have still been being harvested and manufactured for oil extraction in local areas in Kochi Prefecture, Shikoku, and in Fukuejima Island, Nagasaki Prefecture, Kyushu. Many man-made, isolated individual trees of the wild *C. sasanqua* are seen in house-yards, agricultural farm-lands and plantations throughout the distribution and could be previously used for seed harvesting and flower decoration. Thus, high-seed-producing and decorative flowered forms or individual trees of the wild *C. sasanqua* locally, rarely and spontaneously appeared might have been artificially selected, propagated by scion-cuttings and transplanted for economic cultivation for local revenue or self sustenance (e. g., wild *C. sasanqua* population in Mt. Sengokuyama, Saga Prefecture, study site No. 58; MITA 1968). On the other hand, the wild *Camellia sasanqua* demonstrated high fecundity in high light intensity. According to WILLIAMS' hypothesis (1975) high fecundity in plant provides larger numbers of genetically different individuals but allows for more genetically selective deaths. Moreover, the wild *Camellia sasanqua* encounters with much of its seedling mortality for the first and the second years after the beginning of germination. These main factors might have important consequences for rates of

morphological and quantitative stabilities throughout the populations of the wild *C. sasanqua*.

Since cultivated *Camellia sasanqua* are artificially selected for economic purposes and numerous genetical factors have been accumulated and incorporated into variability (KONDO 1975, 1977), many more cultivars or varieties could be much more expected in genetically contaminated, cultivated populations but not in rather steady wild populations.

Acknowledgments

We wish to thank Prof. Dr. A. J. SHARP, Department of Botany, The University of Tennessee, Knoxville, for carefully reading the manuscript and contributing suggestions. This research was supported by Grant-in-Aid for Scientific Research 566005 and 57560008 and Grant-in-Aid for Co-operative Research 58360006 from the Ministry of Education, Science and Culture, Japan, to Katsuhiko KONDO.

Literature Cited

- BUNKACHO, BUNKAZAIHOGOBU 1971. Dictionary of natural monuments. Daiichi-Hoki Publ. Co., Tokyo, pp. 351 (*in Japanese*).
- CHANG, H. T. 1981. A taxonomy of the genus *Camellia*. Journ. Sun Yatsen Univ. (Nat. Sci.) 1: 1~80.
- and B. BARTHOLOMEW 1984. Camellias. Timber Press, Portland, Oregon, pp. 211.
- FUCHINOUE, Y. 1975. Growing a hybrid between *Camellia sasanqua* and *C. sinensis*. Saitama Pref. Tea Exp. Station Bull. 5: 1~53 (*in Japanese*).
- HAGIYA, K. and S. ISHIZAWA 1961. Studies on snow-camellia (*Camellia rusticana*) I. On variation and distribution of native and domesticated camellia in Niigata Prefecture. Journ. Jap. Soc. Hort. Sci. 30: 82~103.
- HAKODA, N., J. TAKENAGA and M. MATSUMOTO 1974 a. A historical review of cultivar occurrences in *Camellia sasanqua*. Mem. Agric. Exp. Station, Fac. Agric., Tokyo Univ. Agric. Tech. (6): 1~65 (*in Japanese*).
- , S. SUZUKI, J. TAKENAGA and M. MATSUMOTO 1974 b. Studies on cultivars of *Camellia sasanqua*. II. Intercultivarietal relationships within *Camellia sasanqua* and interspecific relationships between this species and other species of *Camellia* based on peroxidase zymogram patterns. Proc. Ann. Spring Meeting Japan. Soc. Hort. Sci. for 1974: 332~333 (*in Japanese*).
- , M. MATSUMOTO and T. AKIHAMA 1977. Studies on cultivars of *Camellia sasanqua*. III. Principal component analysis and cluster analysis based on morphological characteristics. Proc. Ann. Spring Meeting Japan. Soc. Hort. Sci. for 1977: 292~293 (*in Japanese*).
- KONDO, K. 1975. Cytological studies in cultivated species of *Camellia*. PhD. Dissert., Univ. N. C., Chapel Hill, N. C., pp. 260+ X (Dissert. Abstracts International No. 75-29043).
- 1977. Cytological studies in cultivated species of *Camellia*. II. Hexaploid species and their hybrids. Japan. J. Breed. 27: 333~344.
- , Ö. SEÇMEN, M. SEGAWA and T. NAKANO 1982. Ecology of dispersal systems in polymorphic seeds of *Camellia* in Japan. Phytom (Buenos Aires) 42: 133~141.
- MAKINO, T. 1918. Miscellaneous notes. Journ. Jap. Bot. 2: 40.
- MITA, C. 1968. Morphological and ecological notes on *Camellia* distributed in Kyushu, Japan. Personal Publ., pp. 21.
- NAGATA, T. and S. SAKAI 1985. Caffeine, flavanol and amino acid contents in leaves of hybrids and species of the section Dubiae in the genus *Camellia*. Japan. J. Breed. 35: 1~8.
- NAGATO, K. and N. HAKODA 1984. Interrelationships of *Camellia sasanqua*, *C. hiemalis*, *C. vernalis* and *C. japonica* based on esterase isozyme variation. Japan. J. Breed. 34: 439~444.
- NAKAI, T. 1950. On *Camellia japonica*, *C. sasanqua* and tea-plants. Natural Sci. and Museum 17: 1~17+42~45.
- PARKS, C. R. and K. F. CASE 1969. Chromatographic evidence for the genetic contamination of *Camellia saluenensis* in cultivation. Amer. Camellia Yrbk. 1970: 124~134.

- and K. KONDO 1974. Breeding studies in the genus *Camellia* (Theaceae). I. A chemotaxonomic analysis of synthetic hybrids and backcrosses involving *Camellia japonica* and *C. saluenensis*. *Brittonia* 26 : 321~332.
- , A. GRIFFITHS and K. R. MONTGOMERY 1968. A possible origin of anthocyanin (red) pigmentation in the flowers of *Camellia sasanqua*. *Amer. Camellia Yrbk.* 1968 : 229~242.
- , K. KONDO and T. SWAIN 1981. Phytochemical evidence for the genetic contamination of *Camellia sasanqua* Thunberg. *Japan. J. Breed.* 31 : 168~182.
- SEALY, J. R. 1958. A revision of the genus *Camellia*. Royal Hort. Soc., London, pp. 239.
- TANAKA, T., N. HAKODA and S. UEMOTO 1985. Studies on the grouping of *Camellia vernalis*. Grant-in-Aid for Co-operative Research Report 58360006, Ministry of Educ., Sci. and Cult., Japan, p. 46~51 (in Japanese).
- TOKUI, O. 1955. On the natural distribution of *Camellia sasanqua* Thunb. and its ecological relationships. *Japan. J. Ecol.* 5 : 6~10 (in Japanese).
- UEHARA, K. 1969. Theaceae, p. 1~96 : In *Jyumoku Dai Zusetsu* Vol. 3, Akane Shobo, Tokyo, pp. 1276.
- UEMOTO, S., T. TANAKA and K. FUJIEDA 1980. Cytogenetic studies on the origin of *Camellia vernalis*. I. On the meiotic chromosomes in some related *Camellia* forms in Hirado Island. *Journ. Japan. Soc. Hort. Sci.* 48 : 475~482.
- WILLIAMS, G. C. 1975. Sex and evolution. Princeton Univ. Press, Princeton, N. J., pp. 582.
- WOODROOF, W. E. (ed.) 1984. *Camellia* nomenclature. Southern Calif. Camellia Soc., Pasadena, Calif., pp. 154.

野生サザンカにみられる変異性と栽培品種分化

近藤 勝彦¹⁾・鶴田 幸一²⁾・田中 昭男³⁾
日詰 雅博³⁾・吉岡 寿⁴⁾・Ö. SEÇMEN⁵⁾

¹⁾ 広島大学総合科学部, 広島市, 〒 730. ²⁾ マレー大学植物学科, マレーシア.

³⁾ 愛媛大学教育学部生物学教室, 松山市, 〒 790. ⁴⁾ 広島県林業試験場, 三次市, 〒 728. ⁵⁾ エーゲ大学植物学科, トルコ.

野生サザンカの葉や花の変異性やデモグラフィーの調査をおこない、栽培品種分化に最も関与していると考えられる地域個体群または個体の分析を試みた。その調査地点として、四国地方南西部、九州地方沿岸部、そして中国地方山口県萩市指月山の分布域内において、69 個所を選んだ。人為干渉の少い常緑広葉樹林中では、野生サザンカはまばらに生えており、樹高 10m まで伸びて林冠に達し、胸高直径は最大 46cm までになり、樹令は平均 125 年であった。これに対し、薪炭林、人工造林、竹林となったために人為干渉の高い生育地では、伐採後再萌芽した株がほとんどであり、根株は直径 75cm までに達するものが多かった。したがって、それらは、樹高 2m 以下、幹の直径 2cm 以下、樹令平均 10 年、地上部の同化器官乾物重量平均 246.3g、非同化器官乾物重量平均 1,869.2g の稚樹であった。一方、人工造林地の中にも、まれに、故意に切られずに、残されて、生長を続けてきた高木個体がみられた。全調査地点で得られた個体は、すべて六倍体 ($2n=90$) であり、それ以外の染色体数をもつ個体は 1 本も見つからなかった。着花は、林内相対照度 12% 以下の生育地では全くみられなかった。種子は 10 月下旬~11 月中旬までに散布され、そのうちのいくらかは 12 月初~中旬に発芽を始めた。しかし、その後は発芽個体数に増減がくり返されたものの、林内相対照度 12.1% では、6 月中旬までに生き残った実生はほんのわずかであった。これに対し、日照条件のよい場所では、散布種子の約半数が春までに発芽した後、実生となった個体は夏までそのまま生育した。日照条件に区別なく、1 年目を生き残った実生は、様々な異なった影響を受けて、2 年目でほとんど全て枯れた。実生がもつ数枚の本葉は、どの個体群においても、だ円形で、円きょ歯状縁をもち、同じような量的形質を示した。埋土種子は短命であり、乾燥のために稔性を失ったり、小動物に捕食されたり、菌類により腐敗がおきたりして、1 年以上生存するものはなかった。野生サザンカの萌芽稚樹から高木までの葉と花の量的諸形質の変異を分析したところ、葉において、長さは 16.3~81.2mm、幅は 5.7~32.7mm、面積は 1.59~16.31cm² の範囲にあった。また花卉において、長さは 10.7~50.8mm、幅は 7.0~35.0mm、面積は 0.79~10.56cm² の範囲にあった。葉の長さ、花卉の長さ、葉

の長さ、と花弁の長さ、葉の幅と花弁の幅、葉の面積と花弁の面積との間には、それぞれ相関がみられた。また、葉と花弁の長さ/幅比は、69 調査地点に、すべて近似の値を得た。しかし、葉と花弁の量的形質と生育地の環境諸条件との間には何ら相関はみられなかった。この調査を通して、次のような4 変異個体を見つけた。(1) 第6 調査地点で得たセミダブル花個体、(2) 第20 調査地点で得た淡ピンク色花個体、(3) 第64 調査地点で得た大形花弁個体、(4) 第69 調査地点で得た深い円きょ歯葉縁個体。以上のことから、野生サザンカは、その分布を通して全体的に変異が均質的で、地域によって変異が集中することではなく、生態勾配もはっきりしなかった。一方、野生サザンカとその同所種のヤブツバキやヤマチャ、またはサザンカの栽培品種との間には、花期が重なり合っても、雑種はまったくみられなかった。野生サザンカが寿命の長い樹木植物であるにもかかわらず、高い均質性が維持されているのは、すでに人間が長い年月かけて地域個体群から変りものや隔離機構が弱くて育種に向いた個体などを選抜してしまっているからではないかと考察した。したがって、野生サザンカ個体群中で今後変りものが選抜、栽培品種化される確率は非常に低いと考えられる。