Masami Mizushima*: A preliminary revision of the genus Sagina of Japan and its adjacent regions. 3
(Critical studies on Japanese plants. 7)**

水 島 正 美* 日本及び近隣地域のツメクサ属 (3)
(日本植物寸評. 7)**


An entirely glabrous perennial or sometimes annual with non-flowering central rosette of leaves. Branches prostrate, rooting at the nodes, then ascending; leaf-fascicles conspicuous at the nodes. Leaves linear, shorter than 10 mm long, mucronate at the tip. Pedicels deflexed near the top after anthesis. Flowers tetramerous; sepals 4, broadly ovate, cucullate and obtuse at the tip, feebly white-margined, 2 mm long; petals minute or none. Stamens often 4. Capsules longer than the calyx which is typically spreading when ripe but is erect-patent to patent in ours. Seeds blackish brown, broadly deltoid, grooved dorsally, flattish laterally, smooth (under high magnification shallowly sculptured), more or less 0.4 mm across but less than 0.5 mm. Chromosome number 2n = 22.


Distr. Subcosmopolitan; entire Europe northwards reaching the northernmost Norway and Iceland, east to the central Siberia and the Himalayas (Sikkim, acc. Hultén), north Africa, N. America (partly introduced ?), south Greenland; widely introduced in the southern hemisphere, and in north Japan.

The Japanese plant which I have once cultivated for observation differs from the typical form in not spreading sepals at maturity of the capsule. S. muscosa Jordan

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which is sometimes called var. *intermedia* Martinis of the species in discussion agrees with the Japanese plant in the character of the caryx, but is different therefrom in larger petals and broader upper leaves. The report from Toyohara in south Saghalien (Sugawara, Ill. Fl. Sagh. 2: 823, t. 385, 1939) may well be this species and the plant can be introduced there. It has also been reported from Isl. Alaid of the northern Kuriles by Prof. Tatewaki in 1927. Possibly it may be a tetramerous form of *S. intermedia* (see the note under 4) *s. int.*) Although Hultén says that this species ascends up to 5000 m in Sikkim in the Himalayas (cf. The Amph-Atlantic Plants 124, map 106, 1958), I could not examine any specimen which exactly agrees with *S. procumbens* from that area. On the sheet numbered H/2196/59-8 from the Kew Herbarium, there are 6 plants from 5 localities. On the principal label of this specimen run the followings: “Herb. Ind. Or. Hook.-fil. & Thomson” *Sagina procumbens* L. var. *Linnaei*; Hab. Him. Bor.-occ. Regio Temp. Alt. 7–14000 ped. Coll. T. T. (homson). Though it forms doubtlessly a part of “*Sagina procumbens* Linn.” in Flora of British India 1: 242 (1874), Thomson’s collection belongs to *S. saginoides*.

In the second article of this title, series *Sagina* containing tetramerous species was dealt with. Series Subulatae containing pentameric species is herein treated.


*S. micrantha* Bunge in Ledeb., Fl. Alt. 2: 183 (1830).


'S. saginoides' (L.) Dalla Torre var. micrantha (Bunge) Kudo, Fl. Paramushir 103 (1922), quoad pl. ex Param.

A glabrous perennial forming a small mat or tuft. Leaves linear, mucronate to awned with a very short awn not attaining to 1/2 the width of blade. Pedicels (6—) 10—25 mm long, ascending or erect, recurved near the top in young fruit, finally becoming strict. Sepals 5 rarely 4, (1.3—) 1.5—2 (—2.4) mm long, ovate-oblong, elliptical to ovate, narrowly white- or rarely purple-margined, often convex dorsally with midrib prominent especially in the lower half, cucullate and obtuse to rounded at the tip, appressed to erect-patent in mature fruit. Petals 5 rarely 4 or less, nearly rounded to obovate, sometimes broadly spathulate, usually rounded rarely slightly emarginate at the tip, often equalling 2/3 to 1/2 the sepals, sometimes about as long. Stamens 10—5. Capsules equalling to or surpassing the calyx to 1.5 times, opened valves attaining to twice as long as the sepal. Seeds light brown, 0.3—0.4 mm across, somewhat broad deltoid, laterally flat or nearly so, smooth, rugose, or obsoletely granulate chiefly about the back, distinctly grooved dorsally. Chromosome number 2n=22.


INDIA (important specimens only). W. Himalaya: Simla (1832, Royle—K); Jacat, Simla (Royle, no. 493—DD); Kunawar (Royle—DD); Dhowli valley, 7—9000 ped. alt. (1844, M. P. Edgeworth, no. 179—K); Kashmir (Falcoquer, no. 263—P); the following 5 specimens together form one sheet (H/2196/59—8 in K), above Pangi, Kunawar, 9—10000 ft. alt. (Aug. 18, 1847, T. Thomson), Kuro, Shayuk valley, 8000 ft. alt. (Nov. 8, 1847, T. Thomson), Kishtwar, 13—14000 ft. alt. (Kashmir) (June 21, 1848, T. Thomson), Drat, 10000 ft. alt. (Sept. 25, 1848, T. Thomson), Theog, Simla Hills, 8000 ft. alt. (June 5, 1849, T. Thomson); east of Dakhwani, Garhwal, 11—12000 ft. alt. (Sept. 11, 1885, J. F. Duthie, no. 3867—DD); Jhelum valley near Pirni, Kashmir, 5—6000 ft. alt. (May 13, 1892, J. F. Duthie, no. 10888—DD), in part; Shingo valley, Golteri nullah, Baltistan, 11000 ft. alt. (July 6, 1892, J. F. Duthie, no. 11880—DD); Sharhan, Kagan, Hazara, Punjab (June 14, 1899, Inayat—DD). E. Himalaya: regio alpina, Sikkim, 16000 ped. alt. (J. D. Hooker—P); "Indiae orientalis" (V. Jacquemont, nos. 767, 1025, 1046—P): Kili valley near Kaivla, Nepal, 10—11000 ft. alt. (July 28, 1886, J. F. Duthie, no. 5393—DD).


Reports of this species from our area are in many instances incorrect being
confused with *S. japonica* and *S. maxima*. Although I have not got the chance to examine the specimens from Manchuria and the main island of Sakhalien, *S. saginoides* surely occurs in the latter region. Hultén threw doubt on reports from the northern Kuriles in his Fl. Kamtch. 2: 77 (1928), but specimens from Isl. Shumushir, Paramushir, and Alaid are doubtlessly referable to this species. The alpine zone of Hokkaidō and central Honshū in Japan also provides the species with habitat disjunctively. Specimens from the Himalayas and the highlands of western China belong here too. S. Komatsu collected a tufted plant on Aug. 12, 1915 on Isl. Todomosiri (or Kaibatō) situated near the southeasternmost Sakhalien. It bears old capsules mixed with unopened ones, and all the pedicels are strict or nearly so below the entirely glabrous calyces. This plant is clearly separable from *S. maxima f. crassicaulis* (=*S. crassicaulis*) which is also known for the island in having the grooved seed. A specimen collected by H. Koidzumi at the top of Mt. Tokachi (or Mt. Kamuimetok-nupuri) in the central highland of Hokkaidō in Aug. 1915 has both tetra- and pentamericous flowers with hooded sepals which are scarcely the case in *S. japonica* or *S. maxima*. 

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Map showing the distribution of *Sagina saginoides* in temperate eastern Asia. ○: locality of specimen. ◎: locality from report. ///: general distribution within our area.
Seeds are lost from the capsule but pedicels are near to those of *S. saginoides*. Leaves are linear and not subulate as in *S. intermedia*. Other specimens in the H. Koidzumi's collection are from Mt. Kami-furano in Hokkaido and Mt. Shirouma in Honshu which are exactly referable to *S. saginoides*.

As mentioned by Edgeworth and Hooker fil. (Fl. Brit. Ind. 1: 243, 1874), the north Indian plants have very often shorter petals than the European in 2/3-1/2 of the calyx in length. The proportion of the capsule to the 1.3-2.4 mm sepals fluctuates 1-1.5 times freely from the size of calyx. All the specimens which I examined can not be referred to *S. procumbens* as labels show but to *S. saginoides*. This opposes to the statement in Fl. Brit. Ind.

Comparing the Shino-Himalayan plants with those of Japan, northern Kuriles, and of Kamtschatka, the continental plants are more variable than those of the northeast. The top of pedicels is more strongly hooked in the Sino-Himalayan plants. The shape and size of petals vary far more, but the capsules are 1.2-1.5 times the length of sepals in common to both populations. Stamens are in most cases 10 but not rarely reduced even to 5. The general habit varies as the variety of condition of habitats. These are also common to both populations. Considering the great variation within the species, it is impossible to me from the outer-morphology to distinguish these geographically separated populations as distinct races.

Among the temperate eastern Asiatic species of the genus, *S. saginoides* is characterized by hooked pedicels and grooved mature seeds which are at most 0.4 mm across. Afghan *S. quinquevalvis* Gilli is much alike to the present species, but is described to be annual. In some possibility it may be attributed to a plant representing the developmental stage of the first year of the perennial habit of *S. saginoides*. A few specimens from the Himalayas appear to be annual or obsolescely so. Although I could not examine the Gilli's type collection because of a sad happening, *S. quinquevalvis* is hardly maintainable as specifically distinct. See notes under that entity.

In our area this species distributes from 2000-5000 m (north India) and easterly it comes down perhaps to 100 m on Isl. Shumushu in the northernmost Kuriles. There exists a distributional gap in the far eastern Siberia according to Hultén (Fl. Alaska & Yuk. 4: 673, 1943), Popov, and Karavajev, viz. *S. saginoides* does not occur in the Ochotsk Sea region, Amur and Ussuri region, and in Transbaicalia. Oppositely Vasiljev says that the species spreads in Ussuri, Ochotsk, Anadyr, and Chuketch regions. This conflict is quite serious in discussing the possible routes of
migration to the Kuriles, Saghalien, Hokkaidō, Honshū, and to east Manchuria. If Vasiljev's citation be true, the explanation becomes easier, though the occurrence in Korea is still opened to the further verification.


A densely tufted, dwarf and glabrous perennial with only one central rosette of leaves and not radicant branches. Leaves subulate, mostly less than 5 mm long: bracts often dilated and navicular-form. Flowers 5–4–merous, often solitary, up to 3 on often simple branches. Pedicels straight, (2—) 5–8 (—15) mm long. Sepals 5–4, elliptical to oval, 1.5–2 mm long, narrowly scarious and often fringed with dark purple on the margin, rounded and scarcely hooded at the apex, enerved or weakly 1–nerved and convex on the back, appressed to the ripe capsule. Petals 5–4, usually narrow-elliptical, rounded to obtuse at the apex, 2/3 the length of sepals to as long. Stamens 10–8. Capsules about 1.5 times the length of sepals. Seeds yellowish-brown, pyriform-deltoid, 0.4–0.6 mm across, flattish laterally, p ebbled to granulate especially about the distinctly grooved back. Chromosome number 2n=84.


Distr. **Circumpolar, arctic-alpine**: n. & c. Kuriles (Isl. Shumushu! Isl. Para-
mushir! Isl. Alaid! Isl. Rashiwa!); arctic Europe and Russia, east to the Chuktch Peninsula then south to the Commander Isl. (?), the Aleutians, Alaska and Yukon, disjunctively e. Canada, Greenland.

In the northern Kuriles this species seems to grow on rocks near seashore rather than inland places, therefore it is separated from *S. saginoides* which is a near relative in habit. It is distinguished from the latter by its more compact and stouter habit, shorter and broader leaves, upright, thicker and shorter capsules, and by bigger seeds mostly 0.5 mm across or more. Flowers are in many cases 5-parted in the specimens examined, but 4-parted ones are not rare even in one and the same tuft of plant. Stamens are in our plant 10–8 as in the British plant against 4 or 5 in Norway or arctic Canada. In the specimens from Isl. Shumushu (Yendo, 1903) which Hultén (1928) doubted the occurrence there, flowers are still young, but vegetative characters are of *S. intermedia*. Sepals are oval, enerved, and flushed with dark purple dorsally which is scarcely the case with *S. saginoides*.

According to Vasiljev (Fl. Command. 98, 1957) the report of *S. intermedia* by Hultén from the Aleutians should have been attributed to *S. saginoides* and it does not grow within the Commander Islands. If Vasiljev's opinion is correct, *S. intermedia* in the northern Kuriles must have finished the migration from the Chuktch region which is the nearest growing area at sometime during the Plio-Pleistocene glacials, and the population in the interconnecting area has been suppressed thereafter.

There is a specimen from Todozaki on Isl. Alaid (Jul. 5, 1926, H. Ito & G. Komori) which was reported as *S. procumbens* by Prof. Tatewaki. It consists of poor flowering plants with no basal rosette. Flowers are tetra- or pentamorous with absolutely 1–nerved purple-margined sepals and narrowly elliptical petals. Sepals are 1.5 mm long and longer than petals. Pedicels appear to be strict when fresh. Leaves are simply opposite on each node without an axillary tuft of leaves which is one of the characteristics of *S. procumbens*, and are thicker than in *S. saginoides* and *S. procumbens*. Thus the specimen seems to be placed under *S. intermedia* as Prof. Miyabe has annotated on the label.

(to be continued)
Pl. I. *Sagina saginoides* from top of Mt. Shirouma in central Honshū, Japan. Upper ×1.3, Lower ×2.7

M. MIZUSHIMA: *Sagina*
Pl. II. *Sagina saginoides*: from Simla, NW India (upper); from prov. Balti of E Tibet, NW China (lower). Upper ×0.7. Lower ×3.

M. MIZUSHIMA: *Sagina*
Pl. III. *Sagina intermedia* from Isl. Shumushu (Yendo, 1903). ×4.

M. Mizushima: *Sagina*

M. MIZUSHIMA: *Sagina*