Shoichi KAWANO*: A revision of *Hierochloe* in the northern islands of the Far East
(Studies on the natural variation of northern Pacific islands plants 1)

In Japan and its neighborhood there occur 5 species of *Hierochloe*; i.e. *H. odorata* var. *pubescens*, *H. alpina* f. *monstruosa*, *H. pluriflora*, *H. intermedia*, *H. pauciflora*, etc. *H. odorata*, *H. alpina* and *H. pauciflora* are distributed in circum-polar arctic region. *H. pluriflora* and *H. intermedia* are endemic in Japan; especially the former has only been found on Mt. Yupari in the province of Ishikari, and the latter is restricted to some limited localities of south-western Yezo. The present author reports the results of his reexamination on the genus. These 5 species can be keyed out according to the characteristics of ligules. The author has examined the specimens in the Herbarium of Faculty of Agriculture, Hokkaido University, the Herbarium of Kyoto University, the Herbarium of University of Tokyo, and the Herbarium of the National Science Museum of Tokyo.

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A key to species

A. Ligule short indistinct 0-1 mm long.
   B. Culm-blades 1-2, 0.5-1 cm long, glabrous; lemmas of imperfect florets unawned; spikelets 6-9; ligule deltoid ca. 1 mm long or less, glabrous...*H. pauciflora*

B. Culm-blades 0.5-5(10) cm long and pilose on the margin; lemmas of imperfect florets unequally awned; the longer awn subbasal, bent, 5-7 mm long; spikelets 10-12, ligule fimbriate. .........................................................*H. alpina*

A. Ligule very distinct, deltoid or truncate, 1-4 mm long; cauline blades 2-4, somewhat firm.
   B. Lemmas membranous or subscarious, awned or unawned; sheaths and culm-leaves glabrous.
   C. Ligule subhyaline truncate, 1.5-2 mm long; lemmas greenish unequally awned; the awn erect or rarely bent ca. 4 mm long; spikelets 12-25...........

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C. Ligule deltoid, subacute or truncate at the apex, ciliate on the margin, 2–4 mm long; lemmas straw-coloured unawned; spikelets 10–18... *H. pluriflora*

B. Lemmas coriaceous, unawned; sheaths and caulle blades minutely pilose or pubescent; spikelets very numerous 21–121... *H. odorata*

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f. monstrosa (Koidz.) Ohwi

This plant is comparatively common in the alpine meadow or gravelly bare ground of arctic Asia and America, and is usually solitary or caespitose with 2–3 culms. In Hokkaido it occurs mainly in Hidaka and Daisetsu ranges and on some
eastern mountains. It has leaves with pilose margins and veins, and fimbriate ligule is very short and 0–0.5 mm long (Fig. 1. Da, Db). Cauline blades are generally short, 1–5 cm long, and are usually involute. In Hidaka range specimens representing a special form are met with, which are caespitose, delicate in all appearances, having only ca. 7 spikelets. On Mt. Niseikasuhupe there occurs an interesting form with second spikelets as seen in *H. pauciflora*. Pollen grains are urceolate 3A\(\times\)1\(\mu\) type and 33.6–34\(\mu\) in diameter (M. Ikuse, 1956). Chromosome number is \(2n=56\) (T. Tateoka, 1954). Fl. Jul.–Aug. Form. *monstruosa* has much larger bulbiferous panicles.

2) **Hierochloe intermedia** (Hack.) S. Kawano*

At first this plant was described by Hackel (1899) as a variety of *H. alpina* based on the materials collected by Faurie. According to the isotype preserved in the Herbarium of Faculty of Science, Kyoto University, it seems to have been collected on the mountains in the vicinity of Tomari and Monbetsu near Peninsula Shakotan, Prov. Shiribeshi. But in the former herbarium only two poor materials are extant. Based on them Dr. Ohwi (1941) made a new combination, and regarded it as a variety of *H. pluriflora*, a unawed species endemic on Mt. Yubari.

In 1956 the present author collected an interesting *Hierochloe* in the undergrowth of *Betula Ermani* forest near the top of Mt. Washibetsu (ca. 940 m above sea level), Prov. Iburi. Previously, he erroneously treated it as a variety of *H. alpina*. However, after a thorough reexamination of the given materials and careful comparison with many materials of *H. alpina* and *H. pluriflora*, the reliable distinction from both of them has been clarified, and the Washibetsu plant no doubt matches quite well with the materials collected by Faurie. Namely it is clearly distinguished from the formers by having the entirely glabrous and smooth leaves and truncate glabrous subhyaline membranous ligules, 2–3 mm long. (Fig. 1. Ca, Cb).

* Hierochloe intermedia* (Hack.) S. Kawano, stat. nov.


Glumes are 3–5-nerved and lemmas 5–7-nerved, subscarious, generally almost greenish and awned. Furthermore it is different from the ecological point of view, i.e. it clumps on rather damp places in the shade of such trees as *Betula* and *Alnus*, etc. Fl. May–Jun.

Consequently *H. pluriflora* is an endemic species on Mt. Yubari in the province of Ishikari and the plant so far treated as var. *intermedia* certainly falls outside the variation range of other Japanese *Hierochloe* plants, by having the characteristic ligule. So that this plant occurring on the south-western Hokkaido mountains should be regarded as an independent species. Pollen grains ulcerate 3A*α*(1) type and its size ca. 34μ.


In 1917 Koidzumi described this species under the name of *H. pluriflora*. Later, however, some botanists erroneously identified it as *H. pauciflora* which is distributed in arctic Siberia, N. Kuriles and America. In 1941, Dr. Ohwi pointed out the mistake and treated it again as an independent species, *H. pluriflora*.

This plant has almost glabrous leaves and its ligule is 1–4 mm long, deltoid or often truncate, ciliate on the margin, and these characters are conspicuously different from other Japanese *Hierochloe* plants (Fig. 1. Ba, Bb). Cauline and radical leaves are very prominent and firm. Glumes are 3-nerved and lemmas are unawned. Fl. Jun. Pollen grain ulcerate 3A*α*(1) type and its size ca. 32μ.


b) var. *pubescens* Krylov

The typical form of this species is glabrous on sheaths and leaves. Previously the Japanese plant had been identified as *H. odorata* itself, but recently it has been regarded as var. *pubescens* Krylov of the former. Comparing with European specimens, the plant extending to the north-eastern Asia is considerably variable in the degree of hairiness on sheaths and leaves, shape and size of glumes, height of stems and number of spikelets. It is approximately divided into two main forms, one entirely glabrous on sheaths and culm-leaves and the other densely pubescent on them. Generally there is a gradual transition between the two and these characters are sometimes not persistent enough to warrant taxonomic segregation; but there exists more or less correlation between the degree of hairiness on
sheaths and the length, shape and nervation of glumes (Fig. 3), which would comparatively make easy to subdivide it into two groups. Namely plants glabrous on sheaths and leaves have ovate glumes with 1 prominent nerve and 2 indistinct nerves at the base, 3.5–5 mm long (average value; 3.70 ± 0.14 mm long), and lemmas 3–4 mm long (average value 3.30 ± 0.07 mm long). Whereas the other pubescent plants are characterized by having elliptic-ovate glumes with 3 prominent nerves, or sometimes in special cases 5 nerves, subattenuate at the top, 4–7 mm long (av.; 5.35 ± 0.10 mm long), and lemmas 3.5–4.5 mm long (av.; 4.10 ± 0.01 mm long) (Fig. 2. C, D, E; Fig. 3; Fig. 4). The variation of other features shows continuous variational ranges precluding clear taxonomical segregation, viz. the number of spikelets varies

1) S. D. (Standard deviation) = 0.69, C. V. (coefficient of variability) = 18%.
2) S. D. = 0.38, C. V. = 11.
3) S. D. = 0.83, C. V. = 16.
4) S. D. = 0.09, C. V. = 2.
Fig. 4. Histograms illustrating the variation ranges for length of lemma (A) and glume (B), in the materials studied from Japan, Kurile islands, Saghaliens, Aleutian, Korea, China (Manchuria), N. America and Europe. Measurement value is mean length of 3 panicles. Horizontal axis displays the ratio of constitution in each population. All measurement were made in dry flowers of herbarium specimens of the herbaria mentioned in the text.
21 to 121; height of culms 9 to 47 cm; hairiness of lemmas glabrous, pilose to densely pilose; colour of glumes purple, pale green, straw-coloured to lucid hyaline yellow.

As to the distinction between the European and the Japanese plants other than the hairiness of sheaths and leaves, Dr. Ohwi pointed out that the former has hairs at the base of lemma; nevertheless the latter (excepting the specimens from Shinshu in the province of Shinano, Honshu) generally lacks hairs. But the writer could not make certain of the difference stated above; namely as far as he has examined, the glabrous forms from Europe often lack hairs at the base of the lemma and those from Manchuria and Aleutian islands always have no hairs.

There is a tendency that the plants collected near the sea-coast have generally larger spikelets with larger extremely lucid elliptic-ovate glume and lower culms, this may partly be due to the environmental influences. As far as the author has examined, the pubescent form extends widely in Asia, and the glabrous form occurs sporadically in Japan and its neighborhood; while in Aleutian Islands and China the former gradually decreases and the latter occurs frequently (Fig. 4).

As the other characters excepting the hairiness of sheaths and leaves are unsuitable for the taxonomic division, the present author has adopted in this paper the name *H. odorata* to the form glabrous on sheaths and leaves with small ovate glume, and var. *pubescens* to the pubescent form with larger elliptic-ovate glume. Pollen grain ulcerate 3A\textdegree{1} type and its size 34\textmu. Chr. number is 2n=28, 56 (Church and Myers, 1947) and 42 (Tateoka, 1954).


New to the Kurile islands. This species is a typical arctic tunda plant, and Isl. Paramushir represents the southernmost area of this species.