

## 長野県と新潟県におけるソラマメ (*Vicia*) 野生種の探索と収集

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## Exploration and Collection of Wild *Vicia* Species in Nagano and Niigata Prefectures, Japan 17th-19th October 1999

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### 要 約

1999年10月17日から10月19日にかけて、長野県および新潟県でのソラマメ近縁野生種の探索を行

った。その結果、松本市周辺および白馬山において *Vicia venosa* 2 変種を含めたソラマメ属計 6 種を収集することができた。それらは標高650mから1285mまで分布し、森の中、森の周辺、傾斜地といった様々な場所で確認することができた。これらの素材は栽培種が所属する亜属とは異なる亜属に所属するが、日本固有種として重要と考えられ、ソラマメ属進化の研究にも大きく貢献するものと期待される。

## Summary

From 17th-19th October 1999 an international group visited Nagano and Niigata prefectures to explore and collect Japanese *Vicia* (Fig. 1). A total of six species including two varieties of *Vicia venosa* were collected around Matsumoto city and Mount Hakuba. Many native Japanese *Vicia* species are readily found in Nagano in a wide variety of habitats: forest under storey, forest margin and grassy banks. The altitude at which the populations were growing varied from 650m to 1285m. The native Japanese *Vicia* are of evolutionary interest. The Japanese native *Vicia* species have been little studied for their economic value thus further attention to these native Japanese wild legumes is warranted.

**Keywords:** *Vicia* subgenus *Vicilla*, wild species, Japanese native legumes, genetic resources

### 1. Introduction (はじめに)

The Leguminosae (Fabaceae) is one of the largest of plant families within which there are two clusters of genera that contain the major legume cultigens of the world. One cluster consists of the primarily tropical legume genera such as *Phaseolus*, *Vigna*, *Cajanus* and *Glycine*. The other cluster consists of the primarily temperate genera such as *Trifolium*, *Medicago* and *Vicia*. The genus *Vicia* includes 7 cultigens, *V. benghalensis* L., *V. ervilia* (L.) Willd., *V. faba* L., *V. monantha* Retz., *V. pannonica* Crantz., *V. sativa* L., *V. villosa* Roth. Of these cultigens 3 occur in Japan, *V. faba*, *V. sativa* and *V. villosa*.

There are about 17 species of *Vicia* in Japan (Ohwi, 1965). They include:

1. Introduced and naturalized species (*V. sativa*, *V. sepium*, *V. hirsuta* and *V. villosa*). The species are of interest because of their economic importance in countries of temperate climates as fodder and cover crops. In the relatively isolated conditions of Japan they have a broad spectrum of forms not found elsewhere, which may well be of economic importance, but are still not described precisely. This group of species was not collected during this trip since these are mostly annual species which flower and set seeds between May and June.
2. Species of the Siberia-Chinese-Japanese floristic zone (*V. amoena*, *V. amurensis*, *V. japonica*). They are distinguished by their resistance to frost, polyploidy and extreme polymorphism due to their broad ecological amplitude.
3. The oroboid species of great phylogenetic and taxonomic interest, because they are considered to be the

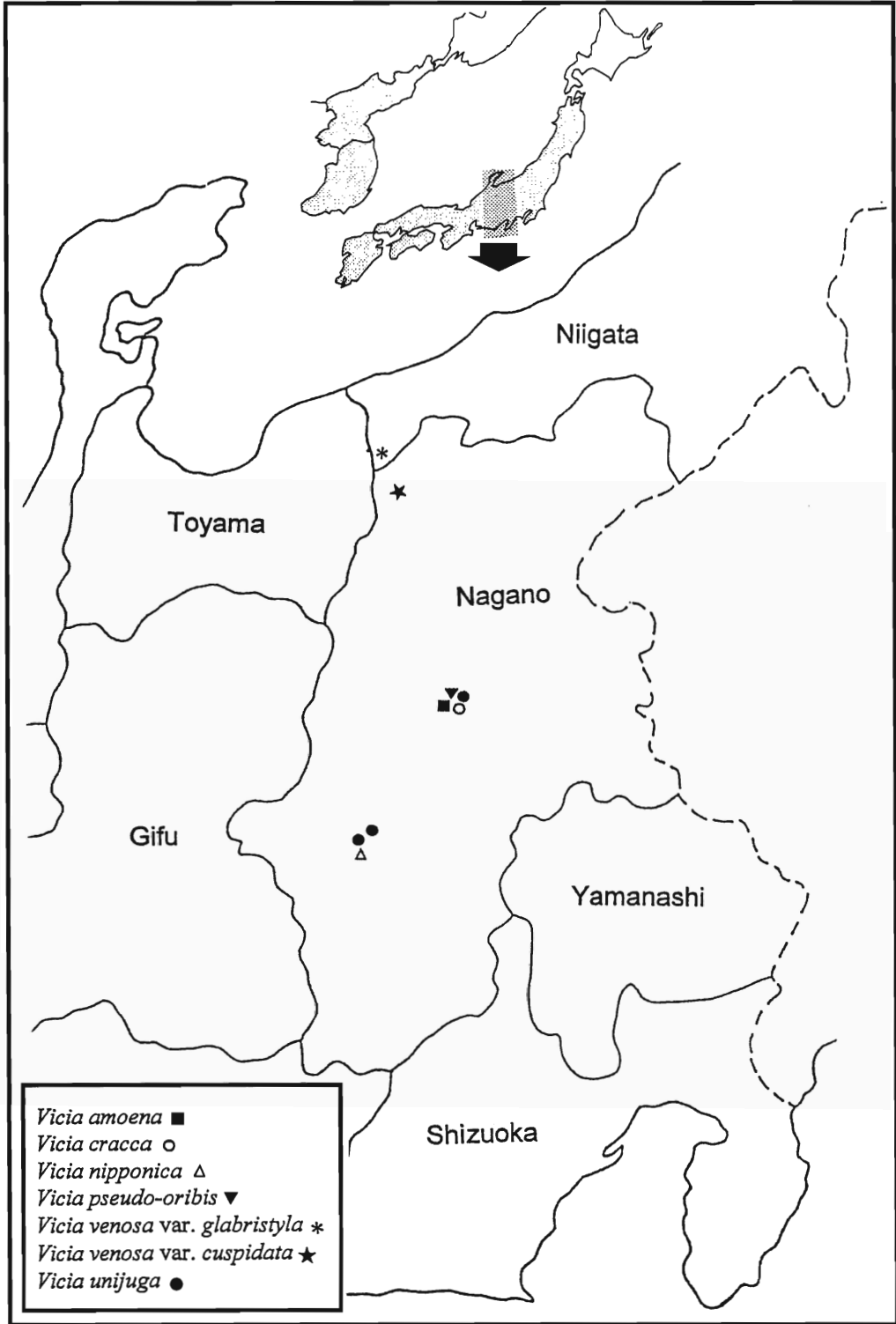


Fig. 1 Collecting sites of *Vicia* species in Nagano and Niigata Prefectures.  
 長野および新潟におけるソラマメ属野生種の収集

most ancient taxa of the tribe Viciae, relicts of the tertiary period. Taxonomically they form an evolutionary link between the genus *Vicia* and the very closely related genus *Lathyrus*.

The native perennial Japanese species are of interest since almost all the species are represented by polyploid series. Polyploidy is not common in the genus *Vicia* and is found mainly in species of East Asian origin. For example, both species *V. amoena* and *V. cracca* are represented in Japan by several cytotypes (with different chromosome numbers). It is thought by some that polyploidy is related to frost resistance. The distribution pattern of populations with different chromosome numbers from the northern to southern latitudes of Japan would perhaps help elucidate the relationship, if any, between chromosome number and climate. In addition the intra-population variation for various cytotypes may be revealing.

The native Japanese *Vicia* species are in the subgenus *Vicilla*. Most of the native species in Japan are in section *Vicilla* of the subgenus *Vicilla*. Some Japanese species occur in other sections particularly *V. cracca*, *V. villosa* and *V. hirsuta* which occur in section *Cracca* (Kupicha, 1976). The native Japanese species of *Vicia* are of particular interest because of their use or potential use as forage species, cover crops and as a potential source of new biodynamic compounds (such as allelochemicals, Fujii, 2000). *V. villosa* is an important forage in many countries it is particularly tolerant of adverse soils and climate (Duke, 1983).

During October 1999 two scientist who have considerable research experience with the genus *Vicia*, Dr. Nigel Maxted and Dr. Elena Potokina, visited Japan to attend the 7th MAFF International Workshop on Genetic Resources. After the workshop they agreed to join with staff of NIAR and others to collect Japanese native *Vicia* in Nagano and Niigata prefectures. Dr. Yasuhiko Endo of Ibaraki University, Mito city, kindly furnished precise information on the locations of some particularly interesting populations of *Vicia* around Hakuba-san (白馬山) which became one objective of the trip.

## 2. Field observations (野外調査) (Table 1, Table 2)

*Vicia amoena* Fisch. [2n=12, 24]

This species looks very similar to *V. cracca*. We found both species growing within a few metres of each other. For those unfamiliar with these two species it is necessary to carefully consult a key to be sure they are correctly identified. A helpful key character for this species is its firm, dentate stipules. In the field we were able to collect abundant seeds of this species compared to *Vicia cracca* which seems to mature earlier at this location.

Both *Vicia cracca* and *V. amoena* may have potential as a cover crop and may be a source of bioactive compounds given its close relationship with *Vicia hirsuta*, hairy vetch, a useful cover crop with allelochemicals. Seeds of these collections have been supplied to Dr. Yoshiharu Fujii, National Institute of Agro-Environmental Sciences, for testing.

*Vicia cracca* L. [2n =14, 28]

This is a weedy species and can be found readily on grassy banks. The large scattered population found at Inakura (稲倉), Matsumoto city (松本市), Nagano prefecture (長野県), was affected by mildew and plants

could be seen from a distance by their white sheen.

Based on information from the Kyoto herbarium *V. cracca* has been collected in Nagano during August and September at:

from Shionosawa (塩ノ沢) to Tsubakisouri (波木井), Minobu-cho (身延町), Minamikoma-gun (南駒郡), Yamanishi (山梨県); Narahara to Mt. Yunomaru, Shinano (信濃), Tobucho Chiisatagata-gun; Togakushi (戸隠村), Nagano (長野県); kurio (栗尾), Minami aiki (南相木村), Minami-saku-gun (南佐久郡), Nagano (長野県); Mt. Sekibutsu (石物山), Minami-saku-gun (南佐久郡); Shitakaize (下海瀬), Saku-cho (佐久町), Minami-saku-gun (南佐久郡), Nagano (長野県).

### *The Oroboid species collected*

*Vicia nipponica* Matsum. (= *Orobus nipponicus* (Matsum.) Stankev. et Roskov) [2n=12]

This species was found on a bank which had been formed by cutting away a forested hillside to make space for an agricultural building. Since soil may have been moved to this location it is possible that the population we found had been transported there. Of the species collected this species is notable for its large leaflets (70-80mm and up to 110mm in length and 40-50mm wide) and long pods (80-90mm). The population was not flowering but many pods could be collected. This species occurs throughout Japan and in China and Korea.

*Vicia pseudo-orobus* Fisch. & Mey (= *Orobus fischerianus* Stankev). [2n=12]

This species was collected adjacent to *V. unijuga* at site 5 and was growing in an orchard. It was also found in a small clump about one kilometer away on the bank of a field. *V. pseudo-orobis* is of considerable phylogenetic interest because of its close relationship with the genus *Lathyrus*.

*Vicia unijuga* A. Br. (= *Orobus lathyroides* L. = *Lathyrus messerschmidii* Fr. & Sav.)

Three different cytotypes can occur in Japan [2n=12, 24, 36]

*Vicia unijuga* was found at three sites (1, 2 and 5) around Matsumoto city (松本市), Nagano prefecture (長野

Table 1 *Vicia* samples collected  
収集したソラマメ属植物の内訳

| Species   | Number of populations |
|---|-----------------------|
| <i>Vicia unijuga</i>  | 3                     |
| <i>Vicia cracca</i>   | 1                     |
| <i>Vicia amoena</i>   | 1                     |
| <i>Vicia venosa</i> var. <i>cuspidata</i> f. <i>cuspidata</i> | 1                     |
| <i>Vicia venosa</i> var. <i>glabristyla</i>                   | 1                     |
| <i>Vicia nipponica</i>  | 1                     |
| <i>Vicia pseudo-orobus</i>                                    | 1                     |

Table 2 A list of collected samples in Nagano prefecture, Japan, 1999.  
長野県で収集した作物近縁野生種遺伝情報, 1999.

| No. | Coll. date | Coll. No. | Species                   | Japanese standard | Status | Site | Collecting site address  | Latitude /longitude         |
|-----|------------|-----------|---------------------------|-------------------|--------|------|--|-----------------------------|
| 1   | 10/17      | CED990041 | <i>Vicia unijuga</i>      | ナンテンハギ            | wild   | 1    | 塩尻市、北小野、分水嶺駐車場 (beside Watershed parking, Kitaono, Shiojiri, Nagano pref.) | N36-04-15.6<br>E137-58-58.1 |
| 2   | 10/17      | CED990042 | <i>Vicia unijuga</i>      | ナンテンハギ            | wild   | 2    | 辰野町、小野 (Ono, Tatsuno, Nagano pref.)  | N36-02-17.9<br>E137-57-38.3 |
| 3   | 10/17      | CED990043 | <i>Vicia nipponica</i>    | ヨツバハギ             | wild   | 2    | 辰野町、小野 (Ono, Tatsuno, Nagano pref.)  | N36-02-17.9<br>E137-57-38.3 |
| 4   | 10/18      | CED990044 | <i>Vicia venosa</i>       | エビラフジ             | wild   | 3    | 糸魚川市、蓮華温泉 (Renge, Itoigawa, Nagano pref.)                                  | N36-49-00.0<br>E137-47-00.0 |
| 5   | 10/18      | CED990045 | <i>Vicia venosa</i>       | エビラフジ             | wild   | 4    | 白馬村、松川 (Matsukawa, Hakuba, Nagano pref.)                                   | N36-43-24<br>E137-49-40     |
| 6   | 10/19      | CED990046 | <i>Vicia pseudoorobus</i> | オオバクサフジ           | wild   | 5    | 松本市、稲倉 (Inakura, Matsumoto, Nagano pref.)                                  | N36-16-56.5<br>E137-58-43.3 |
| 7   | 10/19      | CED990047 | <i>Vicia cracca</i>       | クサフジ              | wild   | 5    | 松本市、稲倉 (Inakura, Matsumoto, Nagano pref.)                                  | N36-16-56.5<br>E137-58-43.3 |
| 8   | 10/19      | CED990048 | <i>Vicia amoena</i>       | ツルフジバカマ           | wild   | 5    | 松本市、稲倉 (Inakura, Matsumoto, Nagano pref.)                                  | N36-16-56.5<br>E137-58-43.3 |
| 9   | 10/19      | CED990049 | <i>Vicia unijuga</i>      | ナンテンハギ            | wild   | 5    | 松本市、稲倉 (Inakura, Matsumoto, Nagano pref.)                                  | N36-16-56.5<br>E137-58-43.3 |

県). This perennial herbaceous species was found both in heavy shade of forest floors and also grassy banks in full sun. At site 1 only one flowering plant was found and very few pods were collected since many plants had been cut in this disturbed habitat. Plants were scattered on the forest floor, in a small park and on a rock garden beside an abandoned building. At the second site, which was less disturbed both flowering plants and many mature pods were found. The plants were scattered in woodland and the grassy banks of a small river. The third site (site 5) was at the edge of an orchard on a hillside close to a conifer tree.

*Vicia unijuga* appears to be adapted to a wide range of habitats but the typical habitat appears to be semi-shade in woodland.

*Vicia venosa* (Willd.) Maxim (= *Orobus venosus* Willd. ex Link)

This species is highly polymorphic for morphological characters.[2n=12, 24, 36]

This species has been intensively studied by Dr. Y. Endo (Endo and Ohashi, 1986) who has recognized four varieties, var. *cuspidata*, var. *glabristyla*, var. *stolonifera* and var. *yamanakae*. Within *Vicia venosa* var. *cuspidata* two forms have been recognised f. *cuspidata* and f. *minor*. During this trip we visited two sites where *Vicia venosa* grows. At the first site visited *V. venosa* var. *glabristyla* was found at 1285m altitude on the Niigata (新潟) side of Mount Hakuba (白馬山). At this site var. *glabristyla* was growing by a marshy area with peat soil. Most of the plants were found widely scattered under bushes and trees. The habitat was natural. The plants were past maturity and only a few mature pods were seen low down on some plants.

| Altitude (m) | Habitat                                       | Shading      | Disturbance | Population size           | Growth stage      | Geography | Seed sample | Herbarium | rhizobium | Remarks   |
|--------------|---|--------------|-------------|---------------------------|-------------------|-----------|-------------|-----------|-----------|---|
| 880          | steep slope or rocks                          | light        | medium      | scattered single plants   | flowering ~mature | stoness   | bulk        | yes       | yes       | flower color: purple blue   |
| 810          | forest margin                                 | medium, open | low         | scattered over several ha | mature            | loam      | bulk        | yes       | no        | flower color: purple blue   |
| 810          | forest margin                                 | light        |             | 10m <sup>2</sup>          | mature            | loam      | bulk        | yes       | no        |   |
| 1285         | edge of grass swamp middle of mountain forest | medium, open | low         | scattered over 2ha        | past maturity     | silt      | bulk        | yes       | no        |   |
| 800          | forest at edge of river                       | heavy        | medium      | 1ha                       | mature            | sandy     | bulk        | yes       | yes       |   |
| 650          | forest edge                                   | open         | medium      | scattered all over        | mature            | clay      | bulk        | yes       | yes       |   |
| 650          | in waste along road                           | open         | medium      | scattered                 | mature            | clay      | bulk        | yes       | yes       |   |
| 650          | in waste along road                           | open         | medium      | scattered                 | past maturity     | clay      | bulk        | yes       | yes       | flower color: purple blue, many pods ( <i>V. cracca</i> few pods) |
| 650          | in waste along road                           | open         |             |                           | flowering ~mature | clay      | bulk        | yes       | yes       |   |

At the second site reached just before it became dark. *Vicia venosa* var. *cuspidata* f. *cuspidata* was found in forest under storey at the edge of a seasonally large river (River Matsukawa, 松川). Since this site was at a lower altitude, about 800m, the plants had many mature pods though flowering was over.

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