

Collaborative Exploration of Legume Crops and Wild Vigna Genetic Resources in Sagaing Region, Myanmar 2019

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Collaborative Exploration of Legume Crops and Wild *Vigna* Genetic Resources in Sagaing Region, Myanmar 2019

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Summary

To collect legume genetic resources, a field survey was conducted in the Sagaing Region, Myanmar, from November 1 to 17, 2019. We concentrated on the collection of wild legumes belonging to genus *Vigna*. As a result, we collected a total of 43 seed samples from 23 survey sites and recorded three additional survey sites from where no seed samples could be collected. Collected seed samples consisted of 2 accessions of domesticated *Glycine max* (soybean), 2 of domesticated *Lablab purpureus* (hyacinth bean), 1 of domesticated *Psophocarpus tetragonolobus* (winged bean), 20 of *Vigna angularis* var. *nipponensis* (wild azuki bean), 6 of *Vigna hirtella* complex (wild *Vigna*), 6 of *Vigna tenuicaulis* (wild *Vigna*), 3 of domesticated *Vigna umbellata* (rice bean), and 3 of domesticated *Vigna unguiculata* (cowpea/yardlong bean). The collected seed samples have been primarily conserved in the seed bank of the Department of Agricultural Research in Myanmar, and the subset was transferred to the National Agriculture and Food Research Organization (NARO) Genebank in Japan under the Standard Material Transfer Agreement of the International Treaty on Plant Genetic Resources for Food and Agriculture. After the multiplication of seeds in Tsukuba Japan, the NARO Genebank plans to conserve them as distributable genetic resources for research, breeding, and training purposes for food and agriculture.

KEY WORDS: crop wild relatives, genetic resources, legume, *Vigna*

Introduction

The NARO Genebank has been collecting and evaluating the stress tolerance of crop wild relatives belonging to the *Vigna* crops (Tomooka *et al.* 2010; Iseki *et al.* 2016, 2018). The diversity center of the Asian *Vigna* (subgenus *Ceratotropis*) is South and Southeast Asia, with more than 10 *Ceratotropis* species found in Myanmar (Tomooka *et al.* 2011). Northern mountainous areas of Myanmar including Chin State, Sagaing Region, Kachin State, and Shan State are classified as

temperate dry winter climates (Cw) (<http://themimu.info/node/64591>); thus, wild *Vigna* closely related to azuki bean (*Vigna angularis*) may exist in nature. In 2018, we conducted a survey in the southern Shan State and collected 31 seed samples, including a candidate for a new *Vigna* taxon (Takahashi *et al.* 2019). In 2019, we set the target survey area to the Sagaing Region where no systematic survey on the wild *Vigna* has been conducted yet (Domon *et al.* 2015; Min San Thein *et al.* 2017; Naito *et al.* 2017).

Methods

A collaborative field survey was conducted in the Lahe area, Lay Shi area, and Somra area of Sagaing Region from November 1 to 17, 2019 (Table 1, Figs. 1 - 3). The survey is based on the Memorandum of Understanding between the NARO Genebank of Japan and the DAR seed bank of Myanmar. At the collection site, we interviewed landowners and asked for their permission to collect seeds from their stocks and wild leguminous plants growing on their land. We recorded passport data, including latitude, longitude, and altitude, using a global navigation satellite system and Google Earth (Google Inc.). Identification of the wild *Vigna* species was based on taxonomic keys (Tomooka *et al.* 2002; Maxted *et al.* 2004). There exists an unsolved taxonomic problem in the treatment of plant samples conserved as *V. hirtella* in the NARO Genebank. These samples comprise more than two taxa based on molecular phylogenetic studies (Chankaew *et al.* 2014), the so-called *V. hirtella* complex (Takahashi *et al.* 2019). Thus, the *V. hirtella* complex was categorized into two groups: “*V. hirtella* (highland type)” and “*V. hirtella* (lowland type)”

Results and Discussion

We collected a total of 43 seed samples consisting of 2 accessions of domesticated *Glycine max* (soybean), 2 of domesticated *Lablab purpureus* (hyacinth bean), 1 of domesticated *Psophocarpus tetragonolobus* (winged bean), 20 of *Vigna angularis* var. *nipponensis* (wild azuki

bean), 6 of *Vigna hirtella* complex (wild *Vigna*), 6 of *Vigna tenuicaulis* (wild *Vigna*), 3 of domesticated *Vigna umbellata* (rice bean), and 3 of domesticated *Vigna unguiculata* (cowpea/yardlong bean) (Table 2). Collected seed samples were conserved primarily in the DAR seed bank, Myanmar, and the subset of the collection was transferred to the NARO Genebank, Japan, under the SMTA of ITPGRFA. In addition, three survey sites, from where no mature seeds could be collected, were recorded (Table 2). Seed weight (100 seed weight), pod length, and number of ovules per pod of collected samples were measured (Table 3). The passport data of the registered accessions to the NARO Genebank are shown in Table 4. The characteristics described are of samples collected from Lahe, Lay Shi, and Somra areas.

Lahe area (altitude of collection sites: 724 – 1,254 m above sea level)

Wild *Vigna*

As for the wild *Vigna*, only wild azuki bean populations (*V. angularis* var. *nipponensis*) were found in the Lahe area (Fig. 2, Table 4).

Vigna angularis var. *nipponensis* (wild azuki bean)

A total of 18 wild azuki bean populations were found, and 16 seed samples were collected. Morphological variations were recognized in hairiness, length, and shape of bracteoles and bracts as well as the shape of leaflets (Photos 1 - 12). All the 10 mountain roadside populations (altitude 724 - 1,257 m, average:

Table 1. An itinerary of Myanmar Sagaing Region exploration, November 2019

Days	Date	Itinerary	Stay
1	11/1 Fri	Narita Terminal 1S (11:00 NH813) - RGN(16:30) (transportation by airplane)	Yangon (Ten Mile Hotel)
2	11/2 Sat	Yangon (UB103 07:00 - 08:05, 129USD) - Mandalay - (UB587: 12:50 - 14:15, 117USD) - Hkamti (transportation by airplane) - survey in Hkamti farmer's fields (by car)	Hkamti (Mya Nan Taw Hotel)
3	11/3 Sun	survey from Hkamti - Lahe (by car) (collection No. MY1 - MY4)	Lahe (Government Guest House)
4	11/4 Mon	survey from Lahe - northeastern mountain ridge road - Lahe (by car) (MY5 - MY12-i)	Lahe (Government Guest House)
5	11/5 Tue	survey from Lahe - Hkamti (by car) (MY13-MY14-i)	Hkamti (Mya Nan Taw Hotel)
6	11/6 Wed	transport from Hkamti - (by boat 200,000K) - Hta Man Thi - (survey by car) - Lay Shi (MY15)	Lay Shi (Viewpoint Guest House)
7	11/7 Thu	survey along northern mountain road and northeastern mountain road of Lay Shi (by car) (MY16 - MY20)	Lay Shi (Viewpoint Guest House)
8	11/8 Fri	survey from Lay Shi - Somra - Lay Shi (by car) (MY21-i - MY24)	Lay Shi (Viewpoint Guest House)
9	11/9 Sat	survey along eastern mountain road of Lay Shi (by car) (MY25 - MY28)	Lay Shi (Viewpoint Guest House)
10	11/10 Sun	survey along southwestern mountain road of Lay Shi (by car) (MY29 - MY37-i)	Lay Shi (Viewpoint Guest House)
11	11/11 Mon	survey from Lay Shi - (by car, MY38 - MY41) - Hta Man Thi - (transport by boat) - Hkamti	Hkamti (Mya Nan Taw Hotel)
12	11/12 Tue	Hkamti - (by airplane UB588; 14:30 - 15:55, 115USD) - Mandalay - (by car) - Yezin - Naypyidaw	Naypyidaw (New Aye Yar Hotel)
13	11/13 Wed	report and seed cleaning at Seed Bank, Yezin (by car)	Naypyidaw (New Aye Yar Hotel)
14	11/14 Thu	transportation from Yezin - Yangon Plant Quarantine Office - Yangon (by car)	Yangon (Ten Mile Hotel)
15	11/15 Fri	stay Yangon	Yangon (Ten Mile Hotel)
16	11/16 Sat	get Phytosanitary Certificate, transport to Yangon airport (by airplane NH814; 22:10) - on flight	on flight
17	11/17 Sun	arrive Narita airport (6:45) Terminal 1S (deposit collected seeds for phytosanitary procedures in Narita Plant Quarantine Office - return to Tsukuba)	Japan

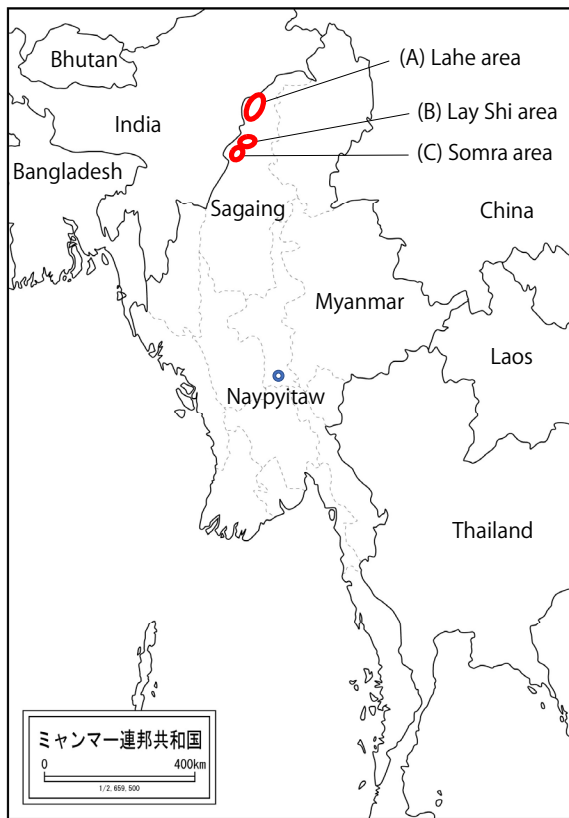
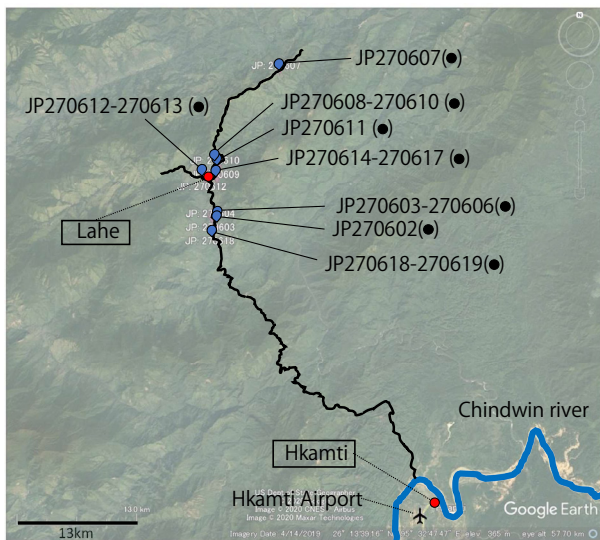


Fig. 1. Locations of survey areas in Sagaing Region, Myanmar.



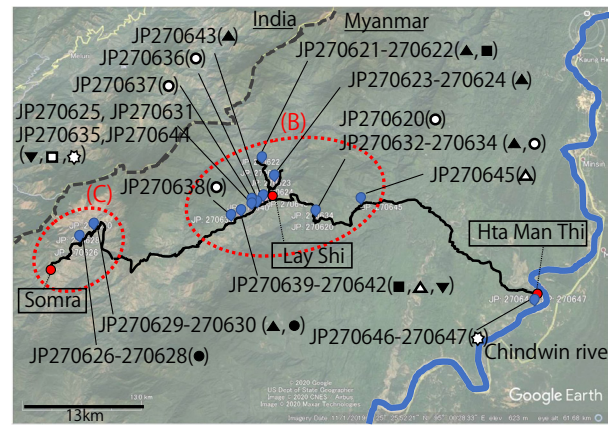
(A) Lahe area

- *Vigna angularis* var. *nipponensis* (wild azuki bean)

Fig. 2. Survey routes (-), major towns (●), and collection sites (●) in (A) Lahe area, Sagaing Region, Myanmar.

889 m) were at the pre-mature stage (e.g., Photo 13), while 8 populations found in Lahe town area (altitude 863-1,186 m, average: 979 m) were at the maturity stage (e.g. Photo 14) (Table 4, Remarks).

Wild azuki bean plants in the Lahe area generally had conspicuously long flower stalks (peduncles) compared with those growing in Japan (5- to 10-cm long) (Tomooka *et al.* 2002, p. 59-65). The flower stalks



(C) Somra area

(B) Lay Shi area

- *Glycine max* (Soybean)
- ⊗ *Lablab purpureus* (Hyacinth bean)
- *Psophocarpus tetragonolobus* (Winged bean)
- *Vigna angularis* var. *nipponensis* (wild azuki bean)
- ▲ *Vigna hirtella* (wild *Vigna*)
- *Vigna tenuicaulis* (wild *Vigna*)
- ▼ *Vigna umbellata* (Rice bean)
- ▲ *Vigna unguiculata* (Cowpea or Yardlong bean)

Fig. 3. Survey routes (-), major towns (●), and collection sites (●) in (B) Lay Shi area and (C) Somra areas, Sagaing Region, Myanmar.

of wild azuki bean in the Lahe area reached more than 40-cm long (Photo 15). Various kinds of ants gathered to extra-floral nectary glands developed at the base of flower buds (Photos 1, 7, and 8). These extra-floral nectar glands are observed in over 100 plant families and secrete extrafloral nectar that attracts ants and other arthropods, many of which protect the plant in return (Marazzi *et al.* 2013). The first author, NT, observed ants that gathered extra-floral nectars of wild *Vigna* plants in his previous field surveys in many countries. However, NT observed that ants constructed nest-like structures at the basal position of the inflorescence rachis of wild *Vigna* plants for the first time in the present survey (Photos 16 and 17 at the collection site of MY08). Wild azuki bean and ants in this area might have resulted in an advanced mutualistic mechanism.

Lay Shi area (collection sites: 654-1,263 m above sea level)

Legume crops

Four leguminous crop species were collected. Two samples of soybean, one of winged bean, three of rice bean, and three of cowpea and yardlong bean were collected from the Lay Shi area (Fig. 3, Table 4). Soybean (MY17) was provided by a village leader from his seed stock (Photo 18), and soybean (MY33) was collected from growing plants on the ridges of terrace paddy fields (Photos 19 and 20). Cowpea/yardlong bean (MY34 and 36) and rice bean (MY35) were collected at the same site where soybean (MY33) was collected.

Table 2. A summary of recorded survey sites and collected seed samples

Scientific name	English name	Status	Number of survey sites recorded	Number of seed samples collected
<i>Glycine max</i>	Soybean	Domesticated	2	2
<i>Lablab purpureus</i>	Hyacinth bean	Domesticated	3	2
<i>Psophocarpus tetragonolobus</i>	Wingedbean	Domesticated	1	1
<i>Vigna angularis</i>	Azuki bean	Wild	22	20
<i>Vigna hirtella</i> complex	Wild Vigna	Wild	6	6
<i>Vigna tenuicaulis</i>	Wild Vigna	Wild	6	6
<i>Vigna umbellata</i>	Rice bean	Domesticated	3	3
<i>Vigna unguiculata</i>	Yardlong bean or Cowpea	Domesticated	3	3
Total			46	43

MY34 had a black seed coat, whereas MY36 had a cream/brown mixed seed coat (Seed Photos 37 and 39). MY34 and MY35 were cultivated beside a farmer's hut (Photo 21), whereas MY36 was cultivated at the roadside edge of a terrace paddy field (Photo 22). MY35 had a yellow seed coat (Seed Photo 38). We noted that surrounding View Point Guest House, where we stayed, several legume crops were cultivated. From here, we collected rice beans (MY20 and 25; Photos 23 and 24), winged bean (MY29), and hyacinth bean (MY38; Photo 25). MY20 and MY25 both had black seed coats and soft green pods. In particular, MY20 had conspicuously soft pods and showed very low curling ability even after it matured and dried. Winged bean (MY29) had a brown seed coat and had long pods (Photo 26).

Wild *Vigna*

In contrast to the Lahe area, where only wild azuki bean populations were found, we could not find any wild azuki bean populations in the Lay Shi area. Instead, we found 6 populations of *V. hirtella* complex and 6 populations of *V. tenuicaulis* (Table 4).

Vigna hirtella complex (wild *Vigna*)

V. hirtella complex populations growing at the wet mountain roadside were at the pre-maturity stage (MY16, 26, and 37-I; e.g., Photo 27), while those crawling on an open dry space beside the road (MY18 and 19; e.g., Photos 28 and 29) were at the maturity stage (Table 4). Morphological characteristics of inflorescence, stipules, leaflets, pods, and flowers of *V. hirtella* complex populations in the Lay Shi area are shown (Photos 30-50). All the *V. hirtella* complex populations found in the Lay Shi area were considered "highland type" (Takahashi *et al.* 2019). However, MY18 plants showed morphological characters similar to "*V. hirtella* (lowland type)" despite their habitat being at a high

altitude (1,096 m above sea level, Table 4). This makes it necessary to conduct further molecular analyses. At the MY26 site, ants constructed nest-like structures at the base of inflorescence rachis (Photos 51 and 52), which were similar to those constructed on wild azuki bean plants of MY08 (Photos 16 and 17). Ants aggressively attacked investigator's fingers while obtaining photos and collecting pods, suggesting that these ants are considerably effective in protecting flowers and pods of wild *Vigna* plants against various kinds of herbivores, including non-prey species. Breeding crops for increased extra-floral nectar production could contribute to cost-effective and sustainable pest management (Jones *et al.* 2017).

Vigna tenuicaulis (wild *Vigna*)

All 6 *V. tenuicaulis* populations were found at wet open roadsides (Photos 53-56), and generally formed larger populations compared with wild azuki bean and *V. hirtella* complex. *V. tenuicaulis* plants were either pre-mature or at the flowering stage (Photos 57 and 58, Table 4). Morphological characteristics of inflorescence, stipules, leaflets, pods, and flowers of *V. tenuicaulis* populations in the Lay Shi area are shown (Photos 59-78). At the MY32 site, which was a very wet habitat, we observed powdery mildew disease symptoms on their leaves (Photo 72).

Somra area (collection sites: 1,185-1,709 m above sea level)

Wild *Vigna*

Interestingly, three wild azuki bean (*V. angularis* var. *nipponensis*) populations that could not be found in the Lay Shi area were observed (Fig. 3, Table 4). In addition, a *V. hirtella* complex population (MY23) was found sympatrically with wild azuki bean (MY24).

Table 3. Weight of 100 seeds (g), pod length (cm), and number of ovules per pod of collected samples

Col. No.	JP No.	Scientific name	Area	Status	100 seed weight (g)	Pod length (cm)	No of ovules / pod
<i>G. max</i> Average (range)					8.5 (7.0 - 9.9)		
MY17	270622	<i>Glycine max</i>	Lay Shi	Domesticated	9.9		
MY33	270639	<i>Glycine max</i>	Lay Shi	Domesticated	7.0		
<i>L. purpureus</i> Average (range)					38.3 (37.6 - 39.0)		
MY40	270646	<i>Lablab purpureus</i>	Hta Man Thi	Domesticated	37.6		
MY41	270647	<i>Lablab purpureus</i>	Hta Man Thi	Domesticated	39.0		
<i>P. tetragonolobus</i> Average (range)					56.3		
MY29	270635	<i>Psophocarpus tetragonolobus</i>	Lay Shi	Domesticated	56.3		
<i>V. angularis</i> Average (range)					1.5 (0.9 - 2.0)	7.3 (6.1 - 7.9)	14.1 (12 - 17)
MY02-e	270603	<i>Vigna angularis</i>	Lahe	Wild	1.6	7.2	13
MY02-i	270604	<i>Vigna angularis</i>	Lahe	Wild	1.2	6.2	15
MY03	270605	<i>Vigna angularis</i>	Lahe	Wild	1.4	7.9	14
MY04	270606	<i>Vigna angularis</i>	Lahe	Wild	1.2	7.5	17
MY06	270608	<i>Vigna angularis</i>	Lahe	Wild	1.7	7.4	14
MY07	270609	<i>Vigna angularis</i>	Lahe	Wild	1.8		
MY08	270610	<i>Vigna angularis</i>	Lahe	Wild	1.4	6.9	15
MY09	270611	<i>Vigna angularis</i>	Lahe	Wild	1.8		
MY10	270612	<i>Vigna angularis</i>	Lahe	Wild	2.0	8.7	16
MY10-i	270613	<i>Vigna angularis</i>	Lahe	Wild	1.8	7.4	14
MY11	270614	<i>Vigna angularis</i>	Lahe	Wild	1.6	7.6	15
MY11-i	270615	<i>Vigna angularis</i>	Lahe	Wild	1.5	7.1	14
MY12	270616	<i>Vigna angularis</i>	Lahe	Wild	1.6		
MY12-i	270617	<i>Vigna angularis</i>	Lahe	Wild	1.1		
MY13	270618	<i>Vigna angularis</i>	Lahe	Wild	0.9	7.3	13
MY14-i	270619	<i>Vigna angularis</i>	Lahe	Wild	1.3	7.7	14
MY21-i	270626	<i>Vigna angularis</i>	Somra	Wild	1.3	6.1	12
MY22	270627	<i>Vigna angularis</i>	Somra	Wild	1.4	7.9	14
MY22-i	270628	<i>Vigna angularis</i>	Somra	Wild	1.4	6.7	14
MY24	270630	<i>Vigna angularis</i>	Somra	Wild			12
<i>V. hirtella</i> Average (range)					0.8 (0.5 - 1.1)	7.8 (6.7 - 8.1)	16.4 (15 - 17)
MY16	270621	<i>Vigna hirtella</i>	Lay Shi	Wild	0.7	8.0	15
MY18	270623	<i>Vigna hirtella</i>	Lay Shi	Wild	0.7	7.7	16
MY19	270624	<i>Vigna hirtella</i>	Lay Shi	Wild	0.5		
MY26	270632	<i>Vigna hirtella</i>	Lay Shi	Wild	0.7	8.1	17
MY37-i	270643	<i>Vigna hirtella</i>	Lay Shi	Wild	1.1	8.7	17
MY23	270629	<i>Vigna hirtella</i>	Somra	Wild	1.0	6.8	17
<i>V. tenuicaulis</i> Average (range)					0.8 (0.7 - 1.0)	6.4 (5.4 - 7.2)	16.2 (15 - 17)
MY15	270620	<i>Vigna hirtella</i>	Lay Shi	Wild	0.6	6.7	16
MY27	270633	<i>Vigna tenuicaulis</i>	Lay Shi	Wild	0.7	5.4	15
MY28	270634	<i>Vigna tenuicaulis</i>	Lay Shi	Wild	0.8	6.0	17
MY30	270636	<i>Vigna tenuicaulis</i>	Lay Shi	Wild	0.9	7.2	17
MY31	270637	<i>Vigna tenuicaulis</i>	Lay Shi	Wild	1.0	6.6	17
MY32	270638	<i>Vigna tenuicaulis</i>	Lay Shi	Wild	1.0	6.3	15
<i>V. umbellata</i> Average (range)					15.2 (12.2 - 21.0)	10.9 (10.1 - 11.4)	7.7 (7 - 9)
MY20	270625	<i>Vigna umbellata</i>	Lay Shi	Domesticated	21.0	10.1	7
MY25	270631	<i>Vigna umbellata</i>	Lay Shi	Domesticated	12.2	11.2	7
MY35	270641	<i>Vigna umbellata</i>	Lay Shi	Domesticated	12.4	11.4	9
<i>V. unguiculata</i> Average (range)					10.7 (9.7 - 11.8)		
MY34	270640	<i>Vigna unguiculata</i>	Lay Shi	Domesticated	11.8		
MY36	270642	<i>Vigna unguiculata</i>	Lay Shi	Domesticated	9.7		
MY39	270645	<i>Vigna unguiculata</i>	Lay Shi	Domesticated	10.7		

***Vigna angularis* var. *nipponensis* (wild azuki bean)**

Wild azuki bean populations were found at a roadside grassland (MY21-i; Photo 79), beside a small stream in a village area (MY22 and MY22-i; Photo 80) and beside a big river (MY24; Photo 81). Because all of these populations were at the post-maturity stage, photos of inflorescence or leaves could not be captured. Some morphological characters are shown (Photos 82-87).

***Vigna hirtella* complex (wild *Vigna*)**

On the same river side where wild azuki bean (MY24) was found, a few *V. hirtella* complex plants (MY23) were growing very close to the river on sandy soil (Photo 88). Flower photos could not be captured because the plants were in the post-maturity stage. Some morphological characters are shown (Photos 89-91).

Wild *Vigna* plants as genetic resources

The wild azuki beans, *V. hirtella* complex and *V. tenuicaulis* are cross-compatible with domesticated azuki bean (Tomooka *et al.* 2002). These azuki bean wild relatives are expected to have biotic and abiotic stress tolerance genes. In the course of identification of novel resistance sources against serious azuki bean pests (soybean cyst nematode) and diseases (azuki bean brown stem rot and azuki bean *Fusarium* wilt) prevailed in Hokkaido (the commercial azuki bean production center in Japan), we have learned that the wild *Vigna* in Southeast Asian countries showed diverse resistance reactions with promising tolerance sources (Kondo and Tomooka 2012; Kushida *et al.* 2013). Therefore, wild *Vigna* samples collected in the present field survey might add valuable genetic diversity to be explored in future studies.

After the multiplication of the seeds in Tsukuba, Japan, we plan to conserve them in the NARO Genebank as a distributable germplasm for education, breeding, and research for food and agriculture (https://www.gene.affrc.go.jp/databases-plant_search_en.php).

Acknowledgment

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ミャンマーザガイン地方域における マメ科遺伝資源の探索収集，2019年

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和文適用

マメ科作物の遺伝資源を収集するために，2019年11月1日から17日にかけてミャンマー連邦共和国ザガイン地方域における二国間共同現地調査を実施した。調査は，特にササゲ属野生種遺伝資源を主対象として行われた。その結果，合計43サンプルの遺伝資源を収集し，それに加えて3地点の遺伝資源生育地情報を記録した。収集品の内訳は，ダイズ(*Glycine max*) 2点，フジマメ(*Lablab purpureus*) 2点，シカクマメ(*Psophocarpus tetragonolobus*) 1点，ツルアズキ (*Vigna umbellata*) 3点，ササゲ / ジュウロクササゲ (*Vigna unguiculata*) 3点，野生アズキ (*Vigna angularis* var. *nipponensis*) 20点，*Vigna* 属野生植物 (*Vigna hirtella* complex) 6点，*Vigna* 属野生植物 (*Vigna tenuicaulis*) 6点である。収集した遺伝資源は，原産国ミャンマーのシードバンクに保存し，そのサブセットをITPGRFAのSMTAを用いてNAROジーンバンクに移転した。NAROジーンバンクでは，本調査で収集した種子を用いて増殖・特性評価を行った後，食糧農業に関する教育・研究・育種利用目的のために配布可能な遺伝資源として公開予定である (https://www.gene.affrc.go.jp/index_en.php)。

Table 4. Passport information

Coll. No.	JP No.	Coll. Date	Area	Scientific Name	English name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
MY01 (no seed)	270602	11/3/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side under slash and burn field, 8.2 km S of Lahe, Sagaing, Myanmar	Mountains	26.281753	95.444683	745	pre-mature population, no mature seeds found
MY02-early	270603	11/3/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	slope near a stream, 7.8 km S of Lahe, Sagaing, Myanmar	Mountains	26.2844	95.446754	770	pre-mature population, seeds collected from earlier maturity plants compared with surrounding plants
MY02-early-i	270604	11/3/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	slope near a stream, 7.8 km S of Lahe, Sagaing, Myanmar	Mountains	26.2844	95.446754	770	pre-mature population, seeds collected from an individual earlier maturity plant with brighter yellow flower
MY03	270605	11/3/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	along road side ditch, 7.8 km S of Lahe, Sagaing, Myanmar	Mountains	26.284537	95.446508	766	pre-mature population
MY04	270606	11/3/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	along road side ditch, 7.8 km S of Lahe, Sagaing, Myanmar	Mountains	26.284526	95.446295	759	pre-mature population
MY05 (no seed)	270607	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	wet shady slope, Lahe-Nanyon road, 19.5 km NE of Lahe, Sagaing, Myanmar	Mountains	26.431595	95.519391	1,257	pre-mature population, only single plant found near a washing place, lady farmers washing clothes did not recognize this plant
MY06	270608	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side, 2.5 km NE of Lahe, Sagaing, Myanmar	Mountains	26.33668	95.452479	1,182	pre-mature population
MY07	270609	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side, 2.5 km NE of Lahe, Sagaing, Myanmar	Mountains	26.336763	95.452291	1,183	pre-mature population, immature yellowish pod collected
MY08	270610	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	slope of walk path, 2.5 km NE of Lahe, Sagaing, Myanmar	Mountains	26.336978	95.452257	1,186	maturity stage population, ant nests developed around flowers, probably ants gather to get extra-floral nectors, make nests and protect flowers and young pods
MY09	270611	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	large open grassland, 2.5 km NE of Lahe, Sagaing, Myanmar	Mountains	26.336079	95.453562	1,175	large maturity stage population, long flower stalk ca. 40 cm long
MY10	270612	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	opposite side of kindergarten, Lahe town, Lahe, Sagaing, Myanmar	Mountains	26.324505	95.437553	1,008	maturity stage population
MY10-i	270613	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	opposite side of kindergarten, Lahe town, Lahe, Sagaing, Myanmar	Mountains	26.324505	95.437553	1,008	maturity stage population, seeds collected from an individual plant in MY10 (JP270612) population
MY11	270614	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side near the river, 1.8 km SE of Lahe, Sagaing, Myanmar	Mountains	26.322205	95.450213	864	maturity stage population, many plants climbing on the road side fence

Table 4. (Continued).

Coll. No.	JP No.	Coll. Date	Area	Scientific Name	English name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
MY11-i	270615	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side near the river, 1.8 km SE of Lahe, Sagaing, Myanmar	Mountains	26.322205	95.450213	864	maturity stage population, seeds collected from an individual plant in MY11 (JP270614) population
MY12	270616	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side near the river, 1.8 km SE of Lahe, Sagaing, Myanmar	Mountains	26.322202	95.450006	863	maturity stage population, many plants climbing on the road side fence
MY12-i	270617	11/4/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side near the river, 1.8 km SE of Lahe, Sagaing, Myanmar	Mountains	26.322202	95.450006	863	maturity stage population, seeds collected from an individual plant in MY12 (JP270616) population
MY13	270618	11/5/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side, slope above stone wall, 9.9 km S of Lahe, Lahe, Sagaing, Myanmar	Mountains	26.271079	95.445915	730	pre-mature population, driver climbed up and collected a few mature pods
MY14-i	270619	11/5/2019	Lahe	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side, slope opposite side of stone wall, 9.9 km S of Lahe, Lahe, Sagaing, Myanmar	Mountains	26.270927	95.445676	724	pre-mature population, seeds collected from an individual plant
MY15	270620	11/6/2019	Lay Shi	<i>Vigna tenuicaulis</i>	Wild <i>Vigna</i>	Wild	road side, ca. 6 km SE of Lay Shi, Sagaing, Myanmar	Mountains	25.427279	95.014847	801	pre-mature stage, wet road side climbing population
MY16	270621	11/7/2019	Lay Shi	<i>Vigna hirtella</i> complex	Wild <i>Vigna</i>	Wild	road side, ca. 6 km N of Lay Shi, Sagaing, Myanmar	Mountains	25.501132	94.943406	1,118	pre-mature stage, wet road side climbing population
MY17	270622	11/7/2019	Lay Shi	<i>Glycine max</i>	Soybean	Cultivated	farmer's storage, ca. 6 km N of Lay Shi, Sagaing, Myanmar	Mountains	25.50104	94.942545	1,112	soybean seeds presented from a village leader
MY18	270623	11/7/2019	Lay Shi	<i>Vigna hirtella</i> complex	Wild <i>Vigna</i>	Wild	road side, ca. 2.5 km NNE of Lay Shi, Sagaing, Myanmar	Mountains	25.470571	94.95817	1,096	maturity stage, many plants crawling on a open dry space beside road
MY19	270624	11/7/2019	Lay Shi	<i>Vigna hirtella</i> complex	Wild <i>Vigna</i>	Wild	road side, ca. 3 km NNE of Lay Shi, Sagaing, Myanmar	Mountains	25.473836	94.961393	1,019	maturity stage, population beside a small bridge crawling on a open dry space
MY20	270625	11/7/2019	Lay Shi	<i>Vigna umbellata</i>	Rice bean	Cultivated	grown on the fence of View Point Guest House, ca. 1.5 km W of Lay Shi, Sagaing, Myanmar	Mountains	25.441545	94.941942	1,070	black seeded rice bean with very soft pods with weak curling ability after dry
MY21-i	270626	11/8/2019	Somra	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side, ca. 3 km NE of Somra, village with Layum Baptist Church, Lay Shi, Sagaing, Myanmar	Mountains	25.392852	94.714905	1,709	post-maturity stage, single plant found at road side bush, a half of a pod seems to be eaten by bird
MY22	270627	11/8/2019	Somra	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side beside stream near farmer's house, ca. 3 km NE of Somra, village with Layum Baptist Church, Lay Shi, Sagaing, Myanmar	Mountains	25.393009	94.716906	1,698	post-maturity stage, a lot of mature pods could be collected at this place
MY22-i	270628	11/8/2019	Somra	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	road side beside stream, ca. 3 km NE of Somra, village with Layum Baptist Church, Lay Shi, Sagaing, Myanmar	Mountains	25.393009	94.716906	1,698	post-maturity stage, seeds collected from an individual plant in population MY22
MY23	270629	11/8/2019	Somra	<i>Vigna hirtella</i> complex	Wild <i>Vigna</i>	Wild	big river side between Layum Baptist Church and Pansat Baptist Church, ca. 6 km NE of Somra, Lay Shi, Sagaing, Myanmar	Mountains	25.413877	94.727078	1,185	growing very near the river, wet sandy soil, climbing to the tree, a few plants, top half of mature pods were broken probably eaten by bird

Table 4. (Continued).

Coll. No.	JP No.	Coll. Date	Area	Scientific Name	English name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
MY24	270630	11/8/2019	Somra	<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	big river side between Layum Baptist Church and Pansat Baptist Church, ca. 6 km NE of Somra, Lay Shi, Sagaing, Myanmar	Mountains	25.413498	94.727002	1,185	post-maturity stage, several plants growing near the ditch separated from big river, most of pods already shattered and rotten
MY25	270631	11/9/2019	Lay Shi	<i>Vigna umbellata</i>	Rice bean	Cultivated	grown on the fence of View Point Guest House, ca. 1.5 km W of Lay Shi, Sagaing, Myanmar	Mountains	25.441538	94.941928	1,070	yellow seeded rice bean with white pod having soft pod with low shattering ability
MY26	270632	11/9/2019	Lay Shi	<i>Vigna hirtella</i> complex	Wild <i>Vigna</i>	Wild	rod side, ca. 6 km SE of Lay Shi, Sagaing, Myanmar	Mountains	25.430255	95.014255	808	pre-mature stage, wet road side climbing population, ants made nests around flowers on the top of flower stalks
MY27	270633	11/9/2019	Lay Shi	<i>Vigna tenuicaulis</i>	Wild <i>Vigna</i>	Wild	rod side, ca. 6 km SE of Lay Shi, Sagaing, Myanmar	Mountains	25.427358	95.014834	803	wet plain habitat between ditch and slope, population consist of many plants, flowering stage, only several pods matured
MY28	270634	11/9/2019	Lay Shi	<i>Vigna tenuicaulis</i>	Wild <i>Vigna</i>	Wild	rod side, ca. 6 km SE of Lay Shi, Sagaing, Myanmar	Mountains	25.427008	95.014888	787	population consist of many plants, pre-mature stage
MY29	270635	11/10/2019	Lay Shi	<i>Psophocarpus tetragonolobus</i>	Winged bean	Cultivated	grown on the fence of View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.441518	94.941889	1,069	winged bean with long pod
MY30	270636	11/10/2019	Lay Shi	<i>Vigna tenuicaulis</i>	Wild <i>Vigna</i>	Wild	road side, ca. 100 m N from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.443062	94.942597	1,064	many plants, flowering stage, only a few pods matured.
MY31	270637	11/10/2019	Lay Shi	<i>Vigna tenuicaulis</i>	Wild <i>Vigna</i>	Wild	road side beside terrace paddy field, ca. 500 m NW from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.444021	94.939283	975	a large population at flowering stage, only one mature pod found
MY32	270638	11/10/2019	Lay Shi	<i>Vigna tenuicaulis</i>	Wild <i>Vigna</i>	Wild	road side beside bridge, ca. 3 km SW from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.428857	94.915217	632	many plants growing in wet valley environment beside river bridge, flowering stage, many powdery mildew, few pod set.
MY33	270639	11/10/2019	Lay Shi	<i>Glycine max</i>	Soybean	Cultivated	grown on ridges of terrace paddy field, ca. 1.5 km SW from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.437838	94.929544	894	erect soybean plants with pale yellowish small seeds, pre-mature stage
MY34	270640	11/10/2019	Lay Shi	<i>Vigna unguiculata</i>	Cowpea/ Yardlong bean	Cultivated	grown beside terrace paddy field, ca. 1.5 km SW from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.437781	94.929765	895	black seeded cowpea/yardlong bean
MY35	270641	11/10/2019	Lay Shi	<i>Vigna umbellata</i>	Rice bean	Cultivated	grown beside farmer's hut near terrace paddy field, ca. 1.5 km SW from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.437883	94.93012	899	pale brown seeded rice bean
MY36	270642	11/10/2019	Lay Shi	<i>Vigna unguiculata</i>	Cowpea/ Yardlong bean	Cultivated	grown beside terrace paddy field, ca. 1.5 km SW from View Point Guest House, Lay Shi, Sagaing, Myanmar	Mountains	25.437781	94.929765	895	cowpea/yardlong bean with half brown half pale yellow seed

Table 4. (Continued).

Coll. No.	JP No.	Coll. Date	Area	Scientific Name	English name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
MY37-i	270643	11/10/2019	Lay Shi	<i>Vigna hirtella complex</i>	Wild <i>Vigna</i>	Wild	road side at the junction between View Point Guest House and Lay Shi, ca. 600 m W of Lay Shi town, Sagaing, Myanmar	Mountains	25.44689	94.94911	1,263	pre-mature stage, wet roadside climbing population, only a few plants growing
MY38	270644	11/11/2019	Lay Shi	<i>Lablab purpureus</i>	Hyacinth bean	Cultivated	grown on the fence of View Point Guest House, ca. 1.5 km W of Lay Shi, Sagaing, Myanmar	Mountains	25.441558	94.941977	1,071	Hyacinth bean with long tender pod, only immature pods remaining
MY39	270645	11/11/2019	Lay Shi	<i>Vigna unguiculata</i>	Cowpea/ Yardlong bean	Cultivated	farmer's back yard garden, mountain tea shop between Hta Man Thi and Lay Shi, ca. 10 km E of Lay Shi, Sagaing, Myanmar	Mountains	25.44796	95.075349	654	brown seeded yardlong bean presented from a owner of mountain tea shop
MY40	270646	11/11/2019	Hta Man Thi	<i>Lablab purpureus</i>	Hyacinth bean	Cultivated	farmer's storage at Hta Man Thi river port, Hta Man Thi, Sagaing, Myanmar	Plains	25.330633	95.291423	137	brown hyacinth bean seeds presented from a restaurant owner at Hta Man Thi port
MY41	270647	11/11/2019	Hta Man Thi	<i>Lablab purpureus</i>	Hyacinth bean	Cultivated	farmer's storage at Hta Man Thi river port, Hta Man Thi, Sagaing, Myanmar	Plains	25.330633	95.291423	137	black hyacinth bean seeds presented from a restaurant owner at Hta Man Thi port



Photo 1. Inflorescence (1), MY01, JP270602, *Vigna angularis* var. *nipponensis*, Lahe



Photo 2. Inflorescence (2), MY01, JP270602, *Vigna angularis* var. *nipponensis*, Lahe



Photo 3. Inflorescence (3), MY01, JP270602, *Vigna angularis* var. *nipponensis*, Lahe



Photo 4. Inflorescence, MY03, JP270605, *Vigna angularis* var. *nipponensis*, Lahe



Photo 5. Inflorescence, MY05, JP270607, *Vigna angularis* var. *nipponensis*, Lahe



Photo 6. Inflorescence, MY06, JP270608, *Vigna angularis* var. *nipponensis*, Lahe



Photo 7. Inflorescence, MY07, JP270609, *Vigna angularis* var. *nipponensis*, Lahe



Photo 8. Inflorescence, MY08, JP270610, *Vigna angularis* var. *nipponensis*, Lahe



Photo 9. Inflorescence, MY12, JP270616, *Vigna angularis* var. *nipponensis*, Lahe



Photo 10. Leaflets, MY01, JP270602, *Vigna angularis* var. *nipponensis*, Lahe



Photo 11. Leaflets, MY04, JP270606, *Vigna angularis* var. *nipponensis*, Lahe



Photo 12. Leaflets, MY09, JP270611, *Vigna angularis* var. *nipponensis*, Lahe



Photo 13. Inflorescence and young pods, MY03, JP270618, *Vigna angularis* var. *nipponensis*, Lahe



Photo 14. Habitats, MY10, JP270612, *Vigna angularis* var. *nipponensis*, Lahe



Photo 15. Long flower stalks, MY09, JP270611, *Vigna angularis* var. *nipponensis*, Lahe



Photo 16. Nest-like structures constructed by ants at the base of inflorescence rachis (1), MY08, JP270610, *Vigna angularis* var. *nipponensis*, Lahe



Photo 17. Nest-like structures constructed by ants at the base of inflorescence rachis (2), MY08, JP270610, *Vigna angularis* var. *nipponensis*, Lahe



Photo 18. A village leader who presented soybean (MY17, JP270622), Lay Shi



Photo 19. Soybean (MY33, JP270639) grown on ridges of terrace paddy, Lay Shi



Photo 20. Soybean (MY33, JP270639), Lay Shi



Photo 21. MY34 (JP270640, cowpea, or yardlong bean) and MY35 (JP270641, rice bean) site, Lay Shi



Photo 22. MY36 (JP270642, cowpea, or yardlong bean) site, Lay Shi



Photo 23. MY20, JP270625 (1), rice bean, Lay Shi



Photo 24. MY20, JP270625 (2), rice bean, Lay Shi



Photo 25. MY38, JP270644, hyacinth bean, Lay Shi



Photo 26. MY29, JP270635, winged bean, Lay Shi



Photo 27. MY26, JP270632, *Vigna hirtella* complex, wet roadside population, Lay Shi



Photo 28. MY18, JP270623, *Vigna hirtella* complex, open dry population, Lay Shi



Photo 29. MY19, JP270624, *Vigna hirtella* complex, open dry population, Lay Shi



Photo 30. Inflorescence, MY16, JP270621, *Vigna hirtella* complex, Lay Shi



Photo 31. Stipule, MY16, JP270621, *Vigna hirtella* complex, Lay Shi



Photo 32. Leaflets, MY16, JP270621, *Vigna hirtella* complex, Lay Shi



Photo 33. Young pods, MY16, JP270621, *Vigna hirtella* complex, Lay Shi



Photo 34. Flower, MY16, JP270621, *Vigna hirtella* complex, Lay Shi



Photo 35. Flower and bracteole, MY18, JP270623, *Vigna hirtella* complex, Lay Shi



Photo 36. Stipule, MY18, JP270623, *Vigna hirtella* complex, Lay Shi



Photo 37. Leaflets, MY18, JP270623, *Vigna hirtella* complex, Lay Shi



Photo 38. Young pods, MY18, JP270623, *Vigna hirtella* complex, Lay Shi



Photo 39. Flower, MY18, JP270623, *Vigna hirtella* complex, Lay Shi



Photo 40. Inflorescence, MY19, JP270624, *Vigna hirtella* complex, Lay Shi



Photo 41. Stipule, MY19, JP270624, *Vigna hirtella* complex, Lay Shi



Photo 42. Leaflets, MY19, JP270624, *Vigna hirtella* complex, Lay Shi



Photo 43. Young pods, MY19, JP270624, *Vigna hirtella* complex, Lay Shi



Photo 44. Flower, MY19, JP270624, *Vigna hirtella* complex, Lay Shi



Photo 45. Inflorescence, MY26, JP270632, *Vigna hirtella* complex, Lay Shi



Photo 46. Stipule, MY26, JP270632, *Vigna hirtella* complex, Lay Shi



Photo 47. Leaflets, MY26, JP270632, *Vigna hirtella* complex, Lay Shi



Photo 48. Inflorescence, MY37-i, JP270643, *Vigna hirtella* complex, Lay Shi



Photo 49. Leaflets, MY37-i, JP270643, *Vigna hirtella* complex, Lay Shi



Photo 50. Young pods, MY37-i, JP270643, *Vigna hirtella* complex, Lay Shi



Photo 51. Nest-like structures constructed by ants at the base of inflorescence rachis (1), MY26, JP270632, *Vigna hirtella* complex, Lay Shi



Photo 52. Nest-like structures constructed by ants at the base of inflorescence rachis (2), MY26, JP270632, *Vigna hirtella* complex, Lay Shi



Photo 53. Wet roadside habitat, MY27, JP270633, *Vigna tenuicaulis*, Lay Shi



Photo 54. Wet roadside habitat, MY28, JP270634, *Vigna tenuicaulis*, Lay Shi



Photo 55. Roadside habitat beside paddy terraces, MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 56. Wet roadside habitat, MY32, JP270638, *Vigna tenuicaulis*, Lay Shi



Photo 57. MY28, JP270634, *Vigna tenuicaulis*, Lay Shi



Photo 58. MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 59. Inflorescence, MY27, JP270633, *Vigna tenuicaulis*, Lay Shi



Photo 60. Inflorescence, MY28, JP270634, *Vigna tenuicaulis*, Lay Shi



Photo 61. Inflorescence, MY30, JP270636, *Vigna tenuicaulis*, Lay Shi



Photo 62. Inflorescence, MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 63. Inflorescence, MY32, JP270638, *Vigna tenuicaulis*, Lay Shi



Photo 64. Stipule, MY27, JP270633, *Vigna tenuicaulis*, Lay Shi



Photo 65. Stipule, MY28, JP270634, *Vigna tenuicaulis*, Lay Shi



Photo 66. Stipule, MY30, JP270636, *Vigna tenuicaulis*, Lay Shi



Photo 67. Stipule, MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 68. Leaflets, MY27, JP270633, *Vigna tenuicaulis*, Lay Shi



Photo 69. Leaflets, MY28, JP270634, *Vigna tenuicaulis*, Lay Shi



Photo 70. Leaflets, MY30, JP270636, *Vigna tenuicaulis*, Lay Shi



Photo 71. Leaflets, MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 72. Leaflets damaged by powdery mildew, MY32, JP270638, *Vigna tenuicaulis*, Lay Shi



Photo 73. Young pods, MY27, JP270633, *Vigna tenuicaulis*, Lay Shi



Photo 74. Young pods, MY30, JP270636, *Vigna tenuicaulis*, Lay Shi



Photo 75. Young pods, MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 76. Young pods, MY32, JP270638, *Vigna tenuicaulis*, Lay Shi



Photo 77. Flower, MY31, JP270637, *Vigna tenuicaulis*, Lay Shi



Photo 78. Flower, MY32, JP270638, *Vigna tenuicaulis*, Lay Shi



Photo 79. The roadside habitat, MY21-i, JP270626, *Vigna angularis* var. *nipponensis*, Somra



Photo 80. The roadside ditch habitat, MY22, JP270627, *Vigna angularis* var. *nipponensis*, Somra



Photo 81. The riverside habitat, MY24, JP270630, *Vigna angularis* var. *nipponensis*, Somra



Photo 82. Leaflets, MY21-i, JP270626, *Vigna angularis* var. *nipponensis*, Somra



Photo 83. Young pods, MY21-i, JP270626, *Vigna angularis* var. *nipponensis*, Somra



Photo 84. Mature pods, MY22, JP270627, *Vigna angularis* var. *nipponensis*, Somra



Photo 85. Stipule, MY22-i, JP270626, *Vigna angularis* var. *nipponensis*, Somra



Photo 86. Leaflet and shattered pods, MY24, JP270630, *Vigna angularis* var. *nipponensis*, Somra



Photo 87. Stipule, MY24, JP270630, *Vigna angularis* var. *nipponensis*, Somra



Photo 88. The riverside habitat, MY23, JP270629, *Vigna hirtella* complex, Somra



Photo 89. Mature pods, MY23, JP270629, *Vigna hirtella* complex, Somra



Photo 90. Leaflets, MY23, JP270629, *Vigna hirtella* complex, Somra



Photo 91. Stipule, MY23, JP270629, *Vigna hirtella* complex, Somra



Seed Photo 1.
MY02-early, JP270603,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 2.
MY02-early-i, JP270604,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 3.
MY03, JP270605,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 4.
MY04, JP270606,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 5.
MY06, JP270608,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 6.
MY07, JP270609,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 7.
MY08, JP270610,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 8.
MY09, JP270611,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 9.
MY10, JP270612,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 10.
MY10-i, JP270613,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 11.
MY11, JP270614,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 12.
MY11-i, JP270615,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 13.
MY12, JP270616,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 14.
MY12-i, JP270617,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 15.
MY13, JP270618,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 16.
MY14-i, JP270619,
Vigna angularis var. *nipponensis*, Lahe



Seed Photo 17.
MY15, JP270620,
Vigna tenuicaulis, Lay Shi



Seed Photo 18.
MY16, JP270621,
Vigna hirtella complex, Lay Shi



Seed Photo 19.
MY17, JP270622,
Glycine max, Lay Shi



Seed Photo 20.
MY18, JP270623,
Vigna hirtella complex, Lay Shi



Seed Photo 21.
MY19, JP270624,
Vigna hirtella complex, Lay Shi



Seed Photo 22.
MY20, JP270625,
Vigna umbellata, Lay Shi



Seed Photo 23.
MY21-i, JP270626,
Vigna angularis var. *nipponensis*, Somra



Seed Photo 24.
MY22, JP270627,
Vigna angularis var. *nipponensis*, Somra



Seed Photo 25.
MY22-i, JP270628,
Vigna angularis var. *nipponensis*, Somra



Seed Photo 26.
MY23, JP270629,
Vigna hirtella complex, Somra



Seed Photo 27.
MY24, JP270630,
Vigna angularis var. *nipponensis*, Somra



Seed Photo 28.
MY25, JP270631,
Vigna umbellata, Lay Shi



Seed Photo 29.
MY26, JP270632,
Vigna hirtella complex, Lay Shi



Seed Photo 30.
MY27, JP270633,
Vigna tenuicaulis, Lay Shi



Seed Photo 31.
MY28, JP270634,
Vigna tenuicaulis, Lay Shi



Seed Photo 32.
MY29, JP270635,
Psophocarpus tetragonolobus, Lay Shi



Seed Photo 33.
MY30, JP270636,
Vigna tenuicaulis, Lay Shi



Seed Photo 34.
MY31, JP270637,
Vigna tenuicaulis, Lay Shi



Seed Photo 35.
MY32, JP270638,
Vigna tenuicaulis, Lay Shi



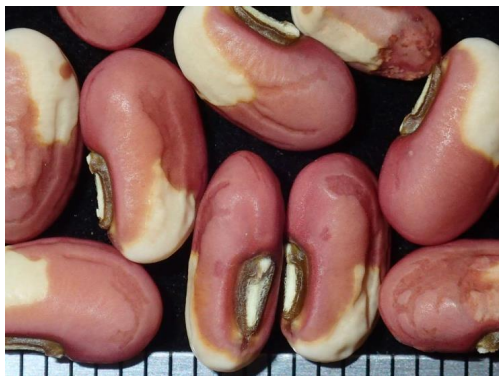
Seed Photo 36.
MY33, JP270639,
Glycine max, Lay Shi



Seed Photo 37.
MY34, JP270640,
Vigna unguiculata, Lay Shi



Seed Photo 38.
MY35, JP270641,
Vigna umbellata, Lay Shi



Seed Photo 39.
MY36, JP270642,
Vigna unguiculata, Lay Shi



Seed Photo 40.
MY37-i, JP270643,
Vigna hirtella complex, Lay Shi



Seed Photo 41.
MY39, JP270645,
Vigna unguiculata, Lay Shi



Seed Photo 42.
MY40, JP270646,
Lablab purpureus, Hta Man Thi



Seed Photo 43.
MY41, JP270647,
Lablab purpureus, Hta Man Thi