

Collection of Glycine and Vigna Crops and their Wild Relatives in Kumamoto and Kagoshima prefectures, Japan, October 14 - 18, 2019

メタデータ	言語: eng 出版者: 公開日: 2021-02-22 キーワード (Ja): キーワード (En): 作成者: 友岡, 憲彦, 横山, 雄司, 秋葉, 光孝 メールアドレス: 所属:
URL	https://doi.org/10.24514/00005672

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 International License.



Collection of *Glycine* and *Vigna* Crops and their Wild Relatives in Kumamoto and Kagoshima prefectures, Japan, during October 14 – 18, 2019

Norihiko TOMOOKA ¹⁾, Yuji YOKOYAMA ²⁾, Mitsunori AKIBA ²⁾

1) *Genetic Resource Center, National Agriculture and Food Research Organization (NARO)*, Kannondai 2-1-2, Tsukuba, Ibaraki 305-8602, Japan

2) *Tsukuba Technical Support Center, NARO*, Kannondai 2-1-2, Tsukuba, Ibaraki, 305-8602, Japan

Communicated by H. NEMOTO (Genetic Resources Center, NARO)

Received Aug. 31, 2020, Accepted Nov. 6, 2020

Corresponding author: N. TOMOOKA (e-mail: tomooka@affrc.go.jp)

Summary

To collect legume genetic resources, a field survey was conducted in Kumamoto and Kagoshima prefectures from October 14 to 18, 2019. We concentrated on the collection of crop wild relatives belonging to the genera *Glycine* and *Vigna*, which include important agricultural crops such as soybean, azuki bean, cowpea, and mungbean. As a result, we collected 33 seed samples, comprising 16 samples of *Glycine soja* (wild soybean), 10 of *Vigna angularis* var. *nipponensis* (wild azuki bean), 1 of weedy *Vigna radiata* (weedy mungbean), 4 of cultivated and weedy *Vigna unguiculata* (cowpea), and 2 of *Vigna vexillata* (wild tuber cowpea). The collected seed samples were conserved in the NARO Genebank, Japan. After the multiplication of the collected seeds in Tsukuba, Japan, the NARO Genebank plans to distribute seed samples for research, breeding, and training purposes.

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

Introduction

The NARO Genebank has been evaluating the stress tolerance of crop wild relatives belonging to the genus *Vigna* (Tomooka *et al.* 2010; Iseki *et al.* 2016, 2018). In addition, the NARO soybean breeding group has been screening wild soybean germplasm for soybean breeding (Jiang *et al.* 2020). Hence, the NARO Genebank continued collection of wild *Glycine* and *Vigna* germplasm growing in Japan. Recently, we conducted several surveys in Oita, Miyazaki, Kumamoto, and Kagoshima prefectures on Kyushu Island (Baba-Kasai *et al.* 2017, 2018; Takahashi *et al.* 2017). In 2019, we set the target area to Amakusa, Yatsushiro, Ashikita, and Minamata in Kumamoto prefecture and Izumi,

Nagashima, Isa, Satsuma, Ibusuki, Makurazaki, and Minami-satsuma in Kagoshima prefecture, where the NARO Genebank has not conducted systematic surveys on the wild *Glycine* and *Vigna* (Fig. 1) (Baba-Kasai *et al.* 2018).

Methods

A field survey was conducted from October 14 to 18, 2019 (Table 1). At the collection site, we interviewed landowners and asked for their permission to collect seeds from the owner's stocks and wild leguminous plants growing on their land. We recorded passport data, including latitude, longitude, and altitude, from Google Earth (Google Inc.). Wild *Vigna* species were identified

based on taxonomic keys (Tomooka *et al.* 2002; Maxted *et al.* 2004). In some places, we found naturally growing (not cultivated by farmers) mungbean and cowpea near the farmer's field. As the detailed phenotypes on pod shattering and seed dormancy are not known, the status of these collections were tentatively designated as "weedy."

Results and Discussion

We collected 33 seed samples consisting of 16 samples of *Glycine soja* (wild soybean), 10 of *Vigna*

angularis var. *nipponensis* (wild azuki bean), 1 of weedy *Vigna radiata* (weedy mungbean), 4 of cultivated or weedy *Vigna unguiculata* (cowpea), and 2 of *Vigna vexillata* (wild tuber cowpea) (Table 2). Eleven seed samples were collected in Kumamoto and 22 in Kagoshima prefecture. Collected seed samples were conserved in NARO Genebank, Japan. 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 in the NARO Genebank are shown in Table 4. The characteristics of

Table 1. An itinerary of Kumamoto and Kagoshima Exploration, October 2019

Days	Date	Itinerary	Stay
1	10/14 Mon	Haneda (08:45) - (airplane) - Kumamoto (10:40) - (car) - Amakusa (Collection No. KK-01 - KK04)	Amakusa Prince Hotel
2	10/15 Tue	Amakusa - Izumi (survey by car) (Collection No. KK-05 - KK-15)	Hotel King (Izumi)
3	10/16 Wed	Izumi - Kagoshima (survey by car) (Collection No. KK-16 - KK-20)	Hotel Rexton (Kagoshima)
4	10/17 Thu	Kagoshima - Kagoshima (survey by car) (Collection No. KK-21 - KK33-3)	Hotel Rexton (Kagoshima)
5	10/18 Fri	Kagoshima - (car) - Kumamoto airport - (airplane) - Haneda	

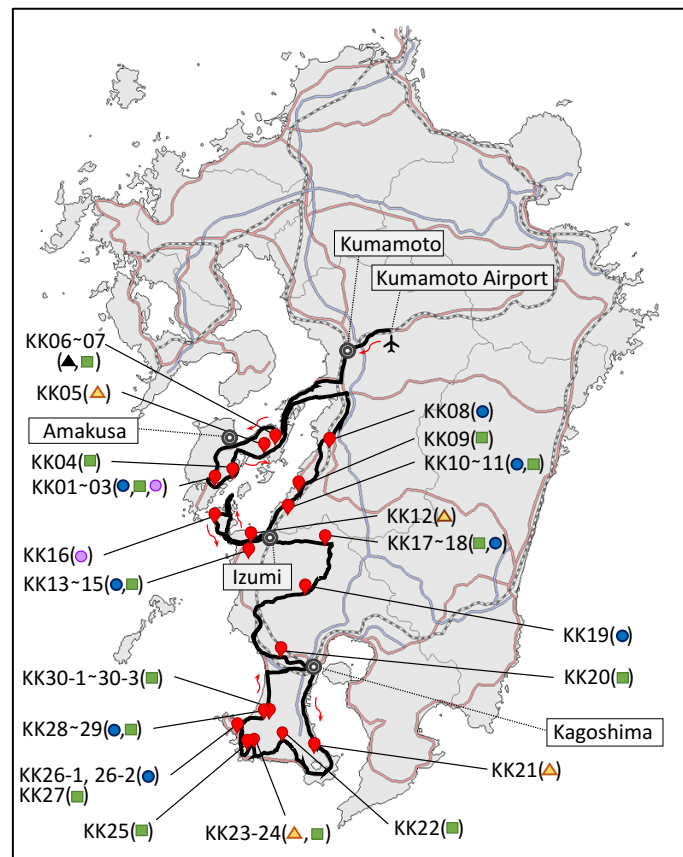


Fig. 1. Survey routes (—), major cities (⊙), and collection sites (♥) in Kumamoto and Kagoshima prefectures, Japan.

- *Glycine soja* (wild soybean)
- *Vigna angularis* var. *nipponensis* (wild azuki bean)
- ▲ *Vigna radiata* (mungbean)
- △ *Vigna unguiculata* (cowpea)
- *Vigna vexillata* (wild tuber cowpea)

the samples collected from Kumamoto and Kagoshima prefectures are described separately.

Kumamoto prefecture (altitude of collection sites: 19 – 157 m above sea level)

A total of 11 seed samples consisting of five samples of wild soybean, three of wild azuki bean, one of weedy mungbean, one of cultivated cowpea, and one of wild tuber cowpea were collected (Table 2).

***Glycine soja* (wild soybean)**

Five seed samples (KK02, 04, 07, 09, and 11) were collected from Amakusa, Kami Amakusa, Minamata cities, and Ashikita-gun, respectively (Tables 2 and 4, Fig. 1, Photos 01-07). Four populations were in the pre-mature stage (KK02, 07, 09, 11, e.g., Photo 06) and one roadside population (KK04, Photo 02) were at the early maturity stage (Photo 03). At site 6 (KK09), we could not find any mature pods; thus, pre-mature pods with pod-bearing shoots were collected (Photos 05 and 06). Mature seeds were collected from KK09 (Seed Photo 09). Conspicuous variations were not observed for 100 seed weight (2.7-3.0 g), pod length (2.5-3.0 cm), and number of ovules per pod (3.0) (Table 3).

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

Three seed samples (KK01, 08, and 10) were collected from Amakusa, Yatsushiro, and Minamata cities, respectively (Table 4, Fig. 1, Photos 08-10). The leaves of plants (KK01) at collection site 1 were severely damaged by spider mites (Photo 10). At site 1 (Amakusa) and site 7 (Minamata), wild soybeans (KK02, 11) grew sympatrically (Table 4). KK08 plants collected from Yatsushiro city (Photos 11-13) had the heaviest seeds (100 seed weight = 3.4 g, Table 3).

***Vigna radiata* (weedy mungbean)**

A naturally growing weedy population of mungbean (KK06) was found beside paddy fields in Kyouragi, Kami Amakusa city (Table 4, Fig. 1, Photos 16-20). Seeds were brownish and smaller than wild azuki bean

and wild soybean (Table 3, Seed Photo 06). Leaves showed brown spot disease symptoms (Photo 19). As reported by Takahashi *et al.* (2017), weedy mungbean (called intermediate type in their report) populations were also found in Saga (JP225160, JP226798, JP226803), Nagasaki (JP247287, JP252171, JP252173), Kumamoto (JP252193, JP252215, JP252220, JP252228), and Oita (JP257436) prefectures. Kurokawa (2017) suggested that the application of unripe cow dung manure produced using imported forage containing contaminated wild/weedy mungbean seeds could be a major driving force for the spread of alien weeds in Japan.

***Vigna unguiculata* (cowpea)**

A black seeded cowpea landrace (KK05) was cultivated and allowed to climb on the fence at the hill-top farmer's field (Table 4, Fig. 1, Photos 21 and 22, Seed Photo 05).

***Vigna vexillata* (wild tuber cowpea)**

A naturally growing population of tuber cowpea (KK03) was found at site 1 (Amakusa city) (Table 4, Fig. 1). There were only a few plants growing, and most plants were in the pre-mature stage. We collected seeds from only one mature pod (Photo 24, Seed Photo 03). At this site, wild azuki bean (KK01) and wild soybean (KK02) were also found.

Kagoshima prefecture (altitude of collection sites: 1 – 177 m above sea level)

A total of 22 seed samples consisting of 11 samples of wild soybean, 7 of wild azuki bean, 3 of cowpea, and 1 of wild tuber cowpea were collected (Table 2).

***Glycine soja* (wild soybean)**

Eleven seed samples were collected from Izumi, Isa, Hioki, Minami Kyushu, Makurazaki, and Minami-Satsuma cities (Tables 2 and 4, Fig. 1, Photos 25-38). All 11 samples were in the pre-mature stage (Photos 25, 28, and 33). Compared with other populations found in this survey, 'KK25' had a smaller leaf size and 'KK30-1,

Table 2. A summary of collected seed samples

Scientific name	English name	Status	Number of seed samples collected in Kumamoto	Number of seed samples collected in Kagoshima	Total number of seed samples collected
<i>Glycine soja</i>	Wild soybean	Wild	5	11	16
<i>Vigna angularis</i> var. <i>nipponensis</i>	Wild azuki bean	Wild	3	7	10
<i>Vigna radiata</i>	Weedy mungbean	Weedy	1	0	1
<i>Vigna unguiculata</i>	Cowpea	Cultivated/weedy	1	3	4
<i>Vigna vexillata</i>	Wild tuber cowpea	Wild	1	1	2
Total			11	22	33

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

Coll. No.	JP No.	Scientific name	Area	Status	100 seed weight (g)	Pod length (cm)	No. of ovule / pod
2019KK-02	270512	<i>Glycine soja</i>	Kumamoto	Wild		3.0	3.0
2019KK-04	270514	<i>Glycine soja</i>	Kumamoto	Wild	3.0	2.5	3.0
2019KK-07	270517	<i>Glycine soja</i>	Kumamoto	Wild	2.9	2.7	3.0
2019KK-09	270519	<i>Glycine soja</i>	Kumamoto	Wild	2.7	3.0	3.0
2019KK-11	270521	<i>Glycine soja</i>	Kumamoto	Wild		2.5	3.0
2019KK-14	270524	<i>Glycine soja</i>	Kagoshima	Wild	2.8	2.9	3.0
2019KK-17	270527	<i>Glycine soja</i>	Kagoshima	Wild	2.6	3.0	3.6
2019KK-20	270530	<i>Glycine soja</i>	Kagoshima	Wild		2.6	3.0
2019KK-22	270532	<i>Glycine soja</i>	Kagoshima	Wild		2.8	3.0
2019KK-24	270534	<i>Glycine soja</i>	Kagoshima	Wild		2.5	3.0
2019KK-25	270535	<i>Glycine soja</i>	Kagoshima	Wild		2.9	3.0
2019KK-27	270538	<i>Glycine soja</i>	Kagoshima	Wild		2.6	3.0
2019KK-29	270540	<i>Glycine soja</i>	Kagoshima	Wild		2.7	3.0
2019KK-30-1	270541	<i>Glycine soja</i>	Kagoshima	Wild	3.4	3.1	3.0
2019KK-30-2	270542	<i>Glycine soja</i>	Kagoshima	Wild	3.2	3.1	3.0
2019KK-30-3	270543	<i>Glycine soja</i>	Kagoshima	Wild		3.1	3.0
Average of wild soybean, <i>Glycine soja</i> (range)					3.0	2.8	3.0
					(2.6-3.4)	(2.5-3.1)	(3.0)
2019KK-01	270511	<i>Vigna angularis</i>	Kumamoto	Wild	2.3	5.7	9.2
2019KK-08	270518	<i>Vigna angularis</i>	Kumamoto	Wild	3.4	6.5	10.4
2019KK-10	270520	<i>Vigna angularis</i>	Kumamoto	Wild	2.5	6.2	9.2
2019KK-13	270523	<i>Vigna angularis</i>	Kagoshima	Wild	2.8	6.6	10.2
2019KK-15	270525	<i>Vigna angularis</i>	Kagoshima	Wild	2.9	5.8	9.4
2019KK-18	270528	<i>Vigna angularis</i>	Kagoshima	Wild	3.1	7.2	11.4
2019KK-19	270529	<i>Vigna angularis</i>	Kagoshima	Wild	2.9	6.5	9.6
2019KK-26-1	270536	<i>Vigna angularis</i>	Kagoshima	Wild		6.7	10.8
2019KK-26-2	270537	<i>Vigna angularis</i>	Kagoshima	Wild	2.3	5.9	9.6
2019KK-28	270539	<i>Vigna angularis</i>	Kagoshima	Wild	2.8	6.5	11.2
Average of wild azuki bean, <i>Vigna angularis</i> (range)					2.8	6.4	10.1
					(2.3-3.4)	(5.7-6.7)	(9.2-11.4)
2019KK-06	270516	<i>Vigna radiata</i>	Kumamoto	Weedy	1.0	6.7	12.8
Average of mungbean, <i>Vigna radiata</i> (range)					1.0	6.7	12.8
					(1.0)	(6.7)	(12.8)
2019KK-05	270515	<i>Vigna unguiculata</i>	Kumamoto	Landrace	7.0	13.6	15.0
2019KK-12	270522	<i>Vigna unguiculata</i>	Kagoshima	Weedy	6.5	12.0	14.8
2019KK-21	270531	<i>Vigna unguiculata</i>	Kagoshima	Landrace	6.3	12.9	16.0
2019KK-23	270533	<i>Vigna unguiculata</i>	Kagoshima	Weedy	7.0	12.7	15.2
Average of cowpea, <i>Vigna unguiculata</i> (range)					6.7	12.8	15.3
					(6.3-7.0)	(12.0-13.6)	(14.8-16.0)
2019KK-03	270513	<i>Vigna vexillata</i>	Kumamoto	Wild	3.9	10.1	14.0
2019KK-16	270526	<i>Vigna vexillata</i>	Kagoshima	Wild	3.2	10.2	15.8
Average of wild tuber cowpea, <i>Vigna vexillata</i> (range)					3.5	10.2	14.9
					(3.2-3.9)	(10.1-10.2)	(14.0-15.8)

2' had a larger leaf size (Photos 33, 37, and 38). The seed size of 'KK30-1, 2' was also large (100 seed weight = 3.4 and 3.2 g, respectively; Table 2, Seed Photos 31 and 32). Disease-like spots were observed on the leaves of 'KK22' (Photo 30).

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

Seven seed samples were collected from the Izumi, Isa, Satsuma, and Minami-Satsuma cities (Table 4, Fig. 1, Photos 39-48). 'KK13' plants were found growing in the ditch along with *Coix lacryma-*

jobi plants, suggesting that they require a moist/wet habitat (Photo 39). The leaves of 'KK13' plants were severely damaged by spider mites (Photo 40). Leaves of 'KK15' were conspicuously lobed and growing together with *Pueraria montana* plants (Photo 41). In Minami-Satsuma city, many young flowering wild azuki bean plants were found among the grasses growing after paddy rice cultivation (Photos 44, 46, and 48). At the edge of the harvested paddy rice field, we found some plants with mature pods (Photo 47). Two seed samples (KK26-1 and 2) were collected at this site (Table 4)

and corresponded to the southernmost wild azuki bean population (N31.358849, E130.230155), as determined by the accessions conserved in the NARO Genebank. The former southernmost wild azuki bean population was JP259475, collected at Urakawauchikami, Shinjo, Tarumizu-shi, Kagoshima prefecture (N31.44963888889, E130.74525) (Baba-Kasai *et al.* 2018). Before the present survey, JP259475 was reported to be the only wild azuki bean collected in Kagoshima prefecture and was collected on the eastern side (Osumi Peninsula) of the prefecture. Based on our findings, we could add seven Kagoshima wild azuki bean accessions from the western side (including the Satsuma peninsula).

***Vigna unguiculata* (cowpea)**

Two weedy and one cultivated cowpea seed samples were collected (Table 4, Fig. 1, Photos 49 - 53, Seed Photos 12, 21, and 23). ‘KK12’ plants were probably naturally growing on the ridge of a farmer’s paddy field, beside a ditch in Izumi city (Photo 49). Their seed colors were cultivar-like pale brown (Seed Photo 12), but they showed strong pod shattering ability (Photo 50). ‘KK21’ cowpea was cultivated on the sandy soil of a farmer’s field in Ibusuki city (Photo 51). The plants were crawling in the field, and their seeds were black (Seed Photo 21). ‘KK23’ had black seeds (Seed Photo 23) and was found in a roadside waste land in Makurazaki city (Photo 52). This accession was classified as weedy because the plants were naturally growing (Photos 52 and 53).

***Vigna vexillata* (wild tuber cowpea)**

A naturally growing population of tuber cowpea (KK16) was found growing in the slope grassland between paddy fields and route 379 on Nagashima Island (Table 4, Fig. 1, Photos 54 and 55). Black seeds and brown mottled seeds were mixed in the collection (Seed Photo 16). This is the first wild tuber cowpea accession in the NARO Genebank collected from Kagoshima prefecture.

Wild *Glycine* and *Vigna* plants as genetic resources

Wild soybean (*G. soja*) are cross-compatible with soybean (Kuroda *et al.* 2010). Wild azuki bean (*V. angularis* var. *nipponensis*) is cross-compatible with azuki bean (Tomooka *et al.* 2002), and wild tuber cowpea is cross-compatible with domesticated tuber cowpea (Damayanti *et al.* 2010). These crop wild relatives are expected to have biotic and abiotic stress tolerance genes (Kondo and Tomooka 2012; Kushida *et al.* 2013; Iseki *et al.* 2016, 2018; Jiang *et al.* 2020).

Therefore, wild *Glycine* and *Vigna* samples collected in the present field survey might add valuable genetic diversity that needs 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

This work was supported by the NARO Genebank Project, Japan.

References

- Baba-Kasai A, Akiba M, Iizumi T and Ito Y (2017) Field survey and collection of leguminous genetic resources in Tanegashima and Yakushima islands of Japan in 2016. AREIPGR 33: 29-47.
[View this article]
- Baba-Kasai A, Akiba M and Iizumi T (2018) Field survey and collection of leguminous genetic resources in Kagoshima and Kumamoto prefectures of Japan in 2017. AREIPGR 34: 17-33.
[View this article]
- Damayanti F, Lawn RJ and Bieligi LM (2010) Genetic compatibility among domesticated and wild accessions of the tropical tuberous legume *Vigna vexillata* (L.) A. Rich. Crop Pasture Sci 61 (10): 785-797.
[<https://doi.org/10.1071/cp10060>]
- Iseki K, Takahashi Y, Muto C, Naito K and Tomooka N (2016) Diversity and evolution of salt tolerance in the genus *Vigna*. PLOS ONE 11(10): e0164711.
[<https://doi.org/10.1371/journal.pone.0164711>]
- Iseki K, Takahashi Y, Muto C, Naito K and Tomooka N (2018) Diversity of drought tolerance in the genus *Vigna*. Front Plant Sci 9: 729.
[<https://doi.org/10.3389/fpls.2018.00729>]
- Jiang CJ, Sugano S, Ochi S, Kaga A and Ishimoto M (2020) Evaluation of *Glycine max* and *Glycine soja* for resistance to *Calonectria ilicicola*. Agronomy 10 (6): 887.
[<https://doi.org/10.3390/agronomy10060887>]
- Kondo N and Tomooka N (2012) New sources of resistance to *Cadophora gregata* f. sp. *adzukicola* and *Fusarium oxysporum* f. sp. *adzukicola* in *Vigna* spp. Plant Dis 96 (4): 562-568.
[<https://doi.org/10.1094/pdis-06-11-0463>]

- Kuroda Y, Kaga A, Tomooka N and Vaughan DA (2010) The origin and fate of morphological intermediates between wild and cultivated soybeans in their natural habitats in Japan. *Mol Ecol* 19 (11): 2346-2360.
[<https://doi.org/10.1111/j.1365-294x.2010.04636.x>]
- Kurokawa S (2017) Alien weeds in agricultural land: problems and solutions. *J Weed Sci Tech* 62 (2): 36-47 (in Japanese).
[<https://doi.org/10.3719/weed.62.36>]
- Kushida A, Tazawa A, Aoyama S and Tomooka N (2013) Novel sources of resistance to the soybean cyst nematode (*Heterodera glycines*) found in wild relatives of azuki bean (*Vigna angularis*) and their characteristics of resistance. *Genet Resour Crop Evol* 60 (3): 985-994.
[<https://doi.org/10.1007/s10722-012-9895-6>]
- Maxted N, Mabuza-Dlamini P, Moss H, Padulosi S, Jarvis A and Guarino L (2004) African *Vigna*: an ecogeographic study. International Plant Genetic Resources Institute, Rome, p. 454.
- Takahashi Y, Baba-Kasai A, Akiba M, Iizumi T and Tomooka N (2017) Collection and conservation of legume genetic resources in Oita and Miyazaki prefectures of Japan in 2016. *AREIPGR* 33: 1-27.
[View this article]
- Tomooka N, Vaughan DA, Moss H and Maxted N (2002) The Asian *Vigna*: genus *Vigna* subgenus *Ceratotropis* genetic resources. Kluwer Academic Publishers, Dordrecht, p. 270.
- Tomooka N, Kaga A, Isemura T, Vaughan DA, Srinives P, Somta P, Thadavong S, Bounphanousay C, Kanyavong K, Inthapanya P, Pandiyan M, Senthil N, Ramamoorthi N, Jaiwal PK, Jing T, Umezawa K and Yokoyama T (2010) *Vigna* genetic resources. *In: Proceedings of the 14th NIAS international workshop on Genetic Resources ‘Genetics and Comparative Genomics of Legumes (*Glycine* and *Vigna*)’*, pp. 11-21.
[View this article]

熊本県および鹿児島県における ダイズ属とササゲ属作物および近縁野生植物遺伝資源の 探索収集，2019年

友岡 憲彦¹⁾・横山 雄司²⁾・秋葉 光孝²⁾

1) 国立研究開発法人 農業・食品産業技術総合研究機構（農研機構）遺伝資源センター

2) 国立研究開発法人 農業・食品産業技術総合研究機構（農研機構）つくば技術支援センター

和文摘要

マメ科植物遺伝資源を収集するために，2019年10月14日から18日にかけて熊本県および鹿児島県における現地調査を実施した。調査では，特にダイズ属およびササゲ属に属する作物近縁野生種の収集に力を入れた。その結果，全体で33点の種子サンプルの収集に成功した。収集した種子サンプルは，野生ダイズ(*Glycine soja*) 16点，野生アズキ (*Vigna angularis* var. *nipponensis*) 10点，雑草型リョクトウ (*Vigna radiata*) 1点，在来あるいは雑草型ササゲ (*Vigna unguiculata*) 4点，野生アカササゲ (*Vigna vexillata*) 2点から構成される。収集した種子サンプルは，農研機構ジーンバンクに保存し，2020年度につくば市の圃場において種子の増殖と特性評価を実施した後，研究，育種，教育等の目的のために利用可能な植物遺伝資源として広く公開・配布を実施する計画である (https://www.gene.affrc.go.jp/index_en.php)。

Table 4. Passport information

No.	Site No.	Coll. No.	JP No.	Coll. Date	Prefecture	Scientific Name	Plant name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
1	site 1	KK 01	270511	2019/10/14	熊本 Kumamoto	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	熊本県 天草市 河浦町 新合 ダム横の道奥の放棄畑 abandoned farm land beside small road from dam, Shingou, Kawauramachi, Amakusa, Kumamoto	丘陵地 Hills	32.321707	130.1127	59	ハダニ多発 many spider mites observed
2	site 1	KK 02	270512	2019/10/14	熊本 Kumamoto	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	熊本県 天草市 河浦町 新合 ダム横の道奥の放棄畑 abandoned farm land beside small road from dam, Shingou, Kawauramachi, Amakusa, Kumamoto	丘陵地 Hills	32.322034	130.11229	50	未成熟期 pre-mature stage
3	site 1	KK 03	270513	2019/10/14	熊本 Kumamoto	<i>Vigna vexillata</i>	野生 アカササゲ Wild tuber cowpea	野生 Wild	熊本県 天草市 河浦町 新合 ダム横の道沿い grassland beside small road from dam, Shingou, Kawauramachi, Amakusa, Kumamoto	丘陵地 Hills	32.322132	130.110304	49	未成熟期, 成熟莢 1 莢のみ収穫 pre-mature stage, only one mature pod collected
4	site 2	KK 04	270514	2019/10/14	熊本 Kumamoto	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	熊本県 天草市 新和町 小宮地 県道 26 横放棄水田 abandoned paddy beside road (Route 26), Komiyaji, Shinwamachi, Amakusa, Kumoamoto	平地 Plain	32.354743	130.185558	20	成熟初期, セイタカアワダチソウ group内 early-maturity stage, with Solidago plants
5	site 3	KK 05	270515	2019/10/15	熊本 Kumamoto	<i>Vigna unguiculata</i>	ササゲ Cowpea	在来 Landrace	熊本県 天草市 倉岳町 浦 集落奥の山上の畑に栽培 growing on the fence of farmer's field on the mountain, Ura, Kuratakemachi, Amakusa, Kumamoto	山地 Mountains	32.43625	130.337926	157	黒種子, ハタササゲ品種群と思われる seems to belong cultivar-group Biflora, black seeds
6	site 4	KK 06	270516	2019/10/15	熊本 Kumamoto	<i>Vigna radiata</i>	雑草型 リョクトウ mungbean	雑草型 Weedy	熊本県 上天草市 松島町 教良木 県道 34 沿い水田脇溝 beside paddy field, Kyouragi, Matsushimamachi, Kami Amakusashi, Kumamoto	平地 Plain	32.465002	130.377785	43	雑草リョクトウ, 褐色小粒種子, 葉に茶斑点の病斑 small brownish seeds, brown spot disease symptoms seen on the leaves
7	site 4	KK 07	270517	2019/10/15	熊本 Kumamoto	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	熊本県 上天草市 松島町 教良木川に近い放棄水田雑草内 grassland growing on abandoned farmer's field, Kyouragi, Matsushimamachi, Kami Amakusashi, Kumamoto	平地 Plain	32.464714	130.378107	42	未成熟期, 成熟莢数莢のみ収穫 できた, ウィルス病に感染している恐れあり pre-mature stage, only a few mature pods collected, possibility of virus disease carrier
8	site 5	KK 08	270518	2019/10/15	熊本 Kumamoto	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	熊本県 八代市 坂本町 西部 ろ水田横の水路に沿って beside ditch of paddy field, Ro, Saibu, Sakamotomachi, Yatsushiro, Kumamoto	平地 Plain	32.470669	130.635029	25	球磨川に沿った谷合集落内 village beside Kuma river

Table 4. (Continued).

No.	Site No.	Coll. No.	JP No.	Coll. Date	Prefecture	Scientific Name	Plant name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
9	site 6	KK 09	270519	2019/10/15	熊本 Kumamoto	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	熊本県 葦北郡 芦北町 八幡 道路脇金網にからみつく growing on a fence, Yahata, Ashikitamachi, Ashikitagun, Kumamoto	平地 Plain	32.294742	130.52242	19	未成熟期, 成熟間近の莢を収集しそこからのちに成熟種子を得た pre-mature stage, near-maturity stage pods were collected
10	site 7	KK 10	270520	2019/10/15	熊本 Kumamoto	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	熊本県 水俣市 中鶴 水俣川沿い放棄畑横 abandoned field edge near Minamata river, Nakazuru, Minamata, Kumamoto	平地 Plain	32.19467	130.433944	20	セイタカアワダチソウ集団 with Solidago plants
11	site 7	KK 11	270521	2019/10/15	熊本 Kumamoto	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	熊本県 水俣市 中鶴 水俣川沿い草むら grassland beside Minamata river, Nakazuru, Minamata, Kumamoto	平地 Plain	32.195039	130.434005	20	未成熟期, 成熟間近の莢を収集 pre-mature stage, pre-mature pods were collected
12	site 8	KK 12	270522	2019/10/15	鹿児島 Kagoshima	<i>Vigna unguiculata</i>	雑草型ササゲ Weedy cowpea	雑草型 Weedy	鹿児島県 出水市 荘 出水市鶴観察センター横の水田脇水路に沿って群生 growing on the edge of ditch beside farmers field, beside Izumi Crane Observation Center, Shou, Izumi, Kagoshima	平地 Plain	32.102148	130.274912	1	裂莢性高い, 莢長い, 淡褐種子 high pod shattering ability, long pods, pale brown seeds
13	site 9	KK 13	270523	2019/10/15	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 出水市 野田町 上名 小河川に沿った用水路内草むら grassland in the ditch beside small river, Kamimyou, Nodachou, Izumi, Kagoshima	平地 Plain	32.036659	130.274391	42	湿った用水路内生息場所, ハダニ被害多い wet habitat, spider mite damage
14	site 9	KK 14	270524	2019/10/15	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 出水市 野田町 上名 小河川に沿った土手の金網 grassland beside small river, Kamimyou, Nodachou, Izumi, Kagoshima	平地 Plain	32.037631	130.273315	40	未成熟期, 開けた生息場所 pre-mature stage, open habitat
15	site 9	KK 15	270525	2019/10/15	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 出水市 野田町 上名 小河川に沿った草むら grassland beside small river, Kamimyou, Nodachou, Izumi, Kagoshima	平地 Plain	32.038103	130.272672	39	開けた生息場所 open habitat
16	site 10	KK 16	270526	2019/10/16	鹿児島 Kagoshima	<i>Vigna vexillata</i>	野生アカササゲ Wild tuber cowpea	野生 Wild	鹿児島県 出水郡 長島町 指江 県道379と小浜川に囲まれた水田 県道横斜面に生育 growing on slope grassland between pre-harvested paddy and route 379, near Obama river, Sasue, Nagashimachou, Izumigun, Kagoshima	丘陵地 Hills	32.166569	130.12915	26	日当たりの悪い生育場所, 長島 shady habitat, Nagashima island
17	site 11	KK 17	270527	2019/10/16	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 伊佐市 大口 鳥巢 羽月川自然堤防上の道路脇草むら Hatsuki river bank grassland, Torisu, Ookuchi, Isa, Kagoshima	平地 Plain	32.063283	130.596565	176	未成熟期, 開けた生息場所 pre-mature stage, open habitat

Table 4. (Continued).

No.	Site No.	Coll. No.	JP No.	Coll. Date	Prefecture	Scientific Name	Plant name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
18	site 11	KK 18	270528	2019/10/16	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 伊佐市 大口 鳥巢 羽月川自然 堤防上の道路脇草むら Hatsuki river bank grassland, Torisu, Ookuchi, Isa, Kagoshima	平地 Plain	32.065135	130.596736	177	開けた生息場所 open habitat
19	site 12	KK 19	270529	2019/10/16	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 薩摩郡 さつま町 白男川 泊野川沿い道路脇 roadside grassland below main road, Shiraogawa, Satsumachou, Satsumagun, Kagoshima	丘陵地 Hills	31.901711	130.429839	39	泊野川沿い habitat along Tomarino river
20	site 13	KK 20	270530	2019/10/16	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 日置市 東市来町 養母 県道 304 横 grassland beside route 304, Youbo, Higashi Ichikichou, Hioki, Kagoshima	丘陵地 Hills	31.663406	130.393456	99	未成熟期, 日当たりの悪い斜面 の集団 スズメバチ飛来 pre-mature stage, shady slope habitat
21	site 14	KK 21	270531	2019/10/17	鹿児島 Kagoshima	<i>Vigna unguiculata</i>	ササゲ Cowpea	在来 Landrace	鹿児島県 指宿市 小牧 生見 田貫川に 沿って入った砂質土壌畑 cultivated on sandy soil field, Nukumi, Komaki, Ibusuki, Kagoshima	平地 Plain	31.30334	130.578128	4	海から近い, 匍匐性, 黒種子, 淡褐色莢 near Tanuki river, near the sea, crawling, black seeds, pale brown mature pods
22	site 15	KK 22	270532	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 南九州市 知覧町 瀬世 永里川沿い草むら Nagasato river side grassland, Sese, Chiranchou, Minami Kyushu, Kagoshima	平地 Plain	31.336066	130.421165	120	未成熟期, 葉に病斑様斑点, 葉 が黄色に変色 pre-mature stage, disease like spots on the leaf, leaf become yellow
23	site 16	KK 23	270533	2019/10/17	鹿児島 Kagoshima	<i>Vigna unguiculata</i>	雑草型ササゲ Weedy cowpea	雑草型 Weedy	鹿児島県 枕崎市 桜山西町 abandoned field along route 270, Nishimachi, Sakurayama, Makurazaki, Kagoshima	平地 Plain	31.292409	130.283582	5	黒種子 black seeds
24	site 16	KK 24	270534	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 枕崎市 桜山西町 growing in grassland on Kedo river bank, Nishimachi, Sakurayama, Makurazaki, Kagoshima	平地 Plain	31.292409	130.283582	5	未成熟期 pre-mature stage
25	site 17	KK 25	270535	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 南さつま市 坊津町 泊 beside terrace paddy field along route 269, Tomari, Bounotsuchou, Minami Satsuma, Kagoshima	丘陵地 Hills	31.291	130.257326	63	未成熟期, 大きな野生ダイズ集 団, 小葉が小さい pre-maturity stage, big wild soybean population, small leaflet size
26	site 18	KK 26-1	270536	2019/10/17	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 南さつま市 大浦町 harvested paddy field along route 272, beside stream, near Shibauchi bridge, Ourachou, Minami Satsuma, Kagoshima	山地 Mountains	31.358849	130.230155	38	NARO ジーンバンク保存品では 日本最南端の野生アズキ集団と 思われる The southernmost wild azuki bean population in Japan

Table 4. (Continued).

No.	Site No.	Coll. No.	JP No.	Coll. Date	Prefecture	Scientific Name	Plant name	Status	Collection Site	Topography	Latitude	Longitude	Altitude (m)	Remarks
27	site 18	KK 26-2	270537	2019/10/17	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 南さつま市 大浦町 harvested paddy field along route 272, beside stream, near Shibauchi bridge, Oourachou, Minami Satsuma, Kagoshima	山地 Mountains	31.358849	130.230155	38	NARO ジーンバンク保存品では 日本最南端の野生アズキ集団と 思われる The southernmost wild azuki bean population in Japan
28	site 18	KK 27	270538	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 南さつま市 大浦町 harvested paddy field along route 272, beside stream, near Shibauchi bridge, Oourachou, Minami Satsuma, Kagoshima	山地 Mountains	31.358849	130.230155	38	未成熟期、完熟種子 1 粒のみ収 集できた pre-mature stage, only one mature seed obtained
29	site 19	KK 28	270539	2019/10/17	鹿児島 Kagoshima	<i>Vigna angularis</i> var. <i>nipponensis</i>	野生アズキ Wild azuki bean	野生 Wild	鹿児島県 南さつま市 金峰町 花瀬 万之瀬川自然堤防 Manose river bank grassland, Hanaze, Kinpouchou, Minami Satsuma, Kagoshima	平地 Plain	31.419736	130.340905	9	加世田市街地 Kaseda city area
30	site 19	KK 29	270540	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 南さつま市 金峰町 花瀬 Manose river bank grassland, Hanaze, Kinpouchou, Minami Satsuma, Kagoshima	平地 Plain	31.419736	130.340905	9	未成熟期、加世田市街地 pre-mature stage, Kaseda city area
31	site 20	KK 30-1	270541	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 日置市 吹上町 永吉 paddy field Nagayoshi, Fukiagechou, Hioki, Kagoshima	平地 Plain	31.558922	130.360628	9	未成熟期、大型葉の野生ダイズ pre-maturity stage, big leaflet size
32	site 20	KK 30-2	270542	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 日置市 吹上町 永吉 Nagayoshi, Fukiagechou, Hioki, Kagoshima	平地 Plain	31.559059	130.360037	9	未成熟期、大型葉の野生ダイズ pre-maturity stage, big leaflet size
33	site 20	KK 30-3	270543	2019/10/17	鹿児島 Kagoshima	<i>Glycine soja</i>	野生ダイズ Wild soybean	野生 Wild	鹿児島県 日置市 吹上町 永吉 Nagayoshi, Fukiagechou, Hioki, Kagoshima	平地 Plain	33.559081	130.35996	9	未成熟期 pre-mature stage



Photo 1. Kumamoto, Habitat of *Glycine soja*, KK02, JP270512



Photo 2. Kumamoto, Habitat of *Glycine soja*, KK04, JP270514

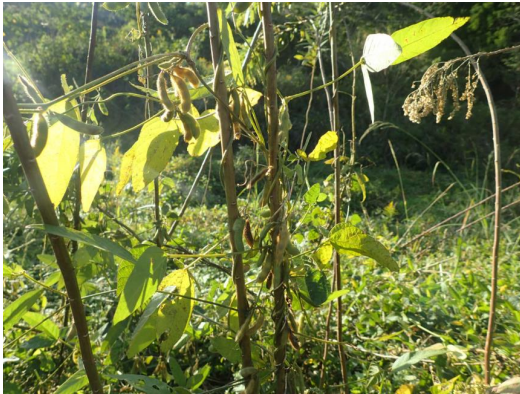


Photo 3. Kumamoto, Pods of *Glycine soja*, KK04, JP270514



Photo 4. Kumamoto, Habitat of *Glycine soja*, KK07, JP270517



Photo 5. Kumamoto, Habitat of *Glycine soja*, KK09, JP270519



Photo 6. Kumamoto, Immature pods of *Glycine soja*, KK09, JP270519



Photo 7. Kumamoto, Habitat of *Glycine soja*, KK11, JP270521



Photo 8. Kumamoto, Habitat (1) of *Vigna angularis* var. *nipponensis*, KK01, JP270511



Photo 9. Kumamoto, Habitat (2) of *Vigna angularis* var. *nipponensis*, KK01, JP270511



Photo 10. Kumamoto, Leaflets and pods of *Vigna angularis* var. *nipponensis*, KK01, JP270511



Photo 11. Kumamoto, Habitat of *Vigna angularis* var. *nipponensis*, KK08, JP270518



Photo 12. Kumamoto, Flower of *Vigna angularis* var. *nipponensis*, KK08, JP270518



Photo 13. Kumamoto, Bracteole of *Vigna angularis* var. *nipponensis*, KK08, JP270518



Photo 14. Kumamoto, Habitat of *Vigna angularis* var. *nipponensis*, KK10, JP270520



Photo 15. Kumamoto, Pods of *Vigna angularis* var. *nipponensis*, KK10, JP270520



Photo 16. Kumamoto, Habitat of *Vigna radiata*, KK06, JP270516



Photo 17. Kumamoto, Flower of *Vigna radiata*, KK06, JP270516



Photo 18. Kumamoto, Inflorescence of *Vigna radiata*, KK06, JP270516



Photo 19. Kumamoto, Leaves with brown spot disease symptoms, *Vigna radiata*, KK06, JP270516



Photo 20. Kumamoto, Pods of *Vigna radiata*, KK06, JP270516



Photo 21. Kumamoto, Habitat of *Vigna unguiculata*, KK05, JP270515



Photo 22. Kumamoto, Plants of *Vigna unguiculata*, KK05, JP270515



Photo 23. Kumamoto, Leaflets of *Vigna vexillata*, KK03, JP270513



Photo 24. Kumamoto, , Young pods of *Vigna vexillata*, KK03, JP270513



Photo 25. Kagoshima, Immature pods of *Glycine soja*, KK14, JP270524



Photo 26. Kagoshima, Habitat of *Glycine soja*, KK17, JP270527



Photo 27. Kagoshima, Immature pods of *Glycine soja*, KK17, JP270527



Photo 28. Kagoshima, Immature pods of *Glycine soja*, KK20, JP270530



Photo 29. Kagoshima, Habitat of *Glycine soja*, KK22, JP270532



Photo 30. Kagoshima, Leaflets of *Glycine soja*, KK22, JP270532



Photo 31. Kagoshima, Habitat of *Glycine soja*, KK24, JP270534



Photo 32. Kagoshima, Habitat of *Glycine soja*, KK25, JP270535



Photo 33. Kagoshima, Small leaflets of *Glycine soja*, KK25, JP270535



Photo 34. Kagoshima, Habitat of *Glycine soja*, KK27, JP270538



Photo 35. Kagoshima, Habitat of *Glycine soja*, KK29, JP270540



Photo 36. Kagoshima, Habitat of *Glycine soja*, KK30-1, 2, JP270541, JP270542



Photo 37. Kagoshima, Large leaflets of *Glycine soja*, KK30-1, JP270541



Photo 38. Kagoshima, Large leaflets of *Glycine soja*, KK30-2, JP270542



Photo 39. Kagoshima, Habitat of *Vigna angularis* var. *nipponensis*, KK13, JP270523



Photo 40. Kagoshima, Sympatric with Job's tears plants, *Vigna angularis* var. *nipponensis*, KK13, JP270523



Photo 41. Kagoshima, Conspicuously lobed leaflets of *Vigna angularis* var. *nipponensis*, KK15, JP270525



Photo 42. Kagoshima, Habitat of *Vigna angularis* var. *nipponensis*, KK18, JP270528



Photo 43. Kagoshima, Habitat of *Vigna angularis* var. *nipponensis*, KK19, JP270529



Photo 44. Kagoshima, Habitat of *Vigna angularis* var. *nipponensis*, KK26-1, 26-2, JP270536, JP270537



Photo 45. Kagoshima, Inflorescence of *Vigna angularis* var. *nipponensis*, KK26-1, 26-2, JP270536, JP270537



Photo 46. Kagoshima, Leaflets of *Vigna angularis* var. *nipponensis*, KK26-1, 26-2, JP270536, JP270537



Photo 47. Kagoshima, Pods of *Vigna angularis* var. *nipponensis*, KK26-1, 26-2, JP270536, JP270537



Photo 48. Kagoshima, Habitat of *Vigna angularis* var. *nipponensis*, KK26-1, 26-2, JP270536, JP270537



Photo 49. Kagoshima, Habitat of *Vigna unguiculata*, KK12, JP270522



Photo 50. Kagoshima, Shattering pods of *Vigna unguiculata*, KK12, JP270522



Photo 51. Kagoshima, Pods of *Vigna unguiculata*, KK21, JP270531



Photo 52. Kagoshima, Habitat of *Vigna unguiculata*, KK23, JP270533



Photo 53. Kagoshima, Pods of *Vigna unguiculata*, KK23, JP270533



Photo 54. Kagoshima, Habitat of *Vigna vexillata*, KK16, JP270526



Photo 55. Kagoshima, Site of *Vigna vexillata*, KK16, JP270526



Photo 56. Kagoshima, Mature pods of *Vigna vexillata*, KK16, JP270526

Photos of Seed samples



Seed Photo 1.
KK01, JP270511,
Vigna angularis var. *nipponensis*



Seed Photo 2.
KK02, JP270512,
Glycine soja



Seed Photo 3.
KK03, JP270513,
Vigna vexillata



Seed Photo 4.
KK04, JP270514,
Glycine soja



Seed Photo 5.
KK05, JP270515,
Vigna unguiculata



Seed Photo 6.
KK06, JP270516,
Vigna radiata



Seed Photo 7.
KK07, JP270517,
Glycine soja



Seed Photo 8.
KK08, JP270518,
Vigna angularis var. *nipponensis*



Seed Photo 9.
KK09, JP270519,
Glycine soja



Seed Photo 10.
KK10, JP270520,
Vigna angularis var. *nipponensis*



Seed Photo 11.
KK11, JP270521,
Glycine soja



Seed Photo 12.
KK12, JP270522,
Vigna unguiculata

Photos of Seed samples



Seed Photo 13.
KK13, JP270523,
Vigna angularis var. *nipponensis*



Seed Photo 14.
KK14, JP270524,
Glycine soja



Seed Photo 15.
KK15, JP270525,
Vigna angularis var. *nipponensis*



Seed Photo 16.
KK16, JP270526,
Vigna vexillata



Seed Photo 17.
KK17, JP270527,
Glycine soja



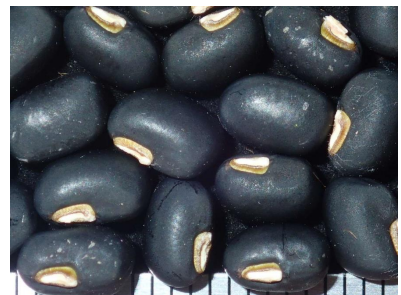
Seed Photo 18.
KK18, JP270528,
Vigna angularis var. *nipponensis*



Seed Photo 19.
KK19, JP270529,
Vigna angularis var. *nipponensis*



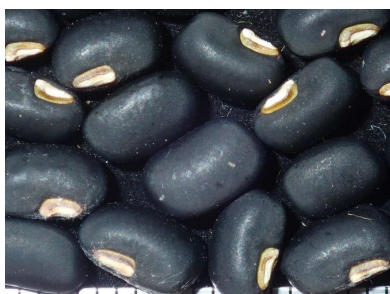
Seed Photo 20.
KK20, JP270530,
Glycine soja



Seed Photo 21.
KK21, JP270531,
Vigna unguiculata



Seed Photo 22.
KK22, JP270532,
Glycine soja



Seed Photo 23
KK23, JP270533,
Vigna unguiculata



Seed Photo 24.
KK24, JP270534,
Glycine soja

Photos of Seed samples



Seed Photo 25.
KK25, JP270535,
Glycine soja



Seed Photo 26.
KK26-1, JP270536,
Vigna angularis var. *nipponensis*



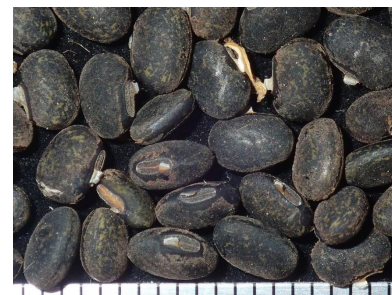
Seed Photo 27.
KK26-2, JP270537,
Vigna angularis var. *nipponensis*



Seed Photo 28.
KK27, JP270538,
Glycine soja



Seed Photo 29.
KK28, JP270539,
Vigna angularis var. *nipponensis*



Seed Photo 30.
KK29, JP270540,
Glycine soja



Seed Photo 31.
KK30-1, JP270541,
Glycine soja



Seed Photo 32.
KK30-2, JP270542,
Glycine soja



Seed Photo 33.
KK30-3, JP270543,
Glycine soja