

# Field Survey and Collection of Leguminous Genetic Resources and Their Root Nodules on Tanegashima, Yakushima, and Amami Oshima Islands in Japan in 2021

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## Summary

We conducted a field survey to collect leguminous genetic resources, such as *Vigna marina*, *Vigna reflexo-pilosa* and their symbiotic rhizobia, on Tanegashima, Yakushima, and Amami Oshima Islands in the Kagoshima Prefecture, Japan, from September 26 to October 1, 2021. As a result of the field survey, 22 accessions of *V. marina*, 3 accessions of *V. reflexo-pilosa*, and 2 accessions of other leguminous crops were collected. Notably, the *V. reflexo-pilosa* accessions of Amami Oshima Island were the first northmost collection for the National Agriculture and Food Research Organization (NARO) Genebank. A total of 27 root nodules were collected from *V. marina* and *V. reflexo-pilosa* to isolate their symbiotic rhizobia. All the collected materials were conserved at the NARO Genebank of Japan. Multiple seeds will become available upon request for research, breeding, and educational purposes.

KEY WORDS: Leguminous genetic resources, *Vigna marina*, *Vigna reflexo-pilosa*, Root nodule, Rhizobia, Tanegashima, Yakushima, Amami Oshima

## Introduction

The National Agriculture and Food Research Organization (NARO) Genebank has been conducting collection trips for *ex-situ* conservation of crops and their wild relatives distributed in Japan and abroad (see Annual Report on Exploration and Introduction of Plant Genetic Resources, [https://www.gene.affrc.go.jp/publications.php#plant\\_report](https://www.gene.affrc.go.jp/publications.php#plant_report)). The first author of this paper has undertaken seven field surveys concerning leguminous plants and their symbiotic rhizobia (Muto *et al.* 2015; Baba-Kasai *et al.* 2016, 2017, 2018, 2019; Takahashi *et al.* 2017, 2018). Through the experience from these surveys, we noticed that wild legumes collections in the subtropical zone had been mostly

conducted on the islands of Okinawa Prefecture, with few collections on the islands of Kagoshima Prefecture.

Kagoshima Prefecture is one of the most remote island prefectures in Japan, with a population of 149,620, an island area of 2,482 km<sup>2</sup>, and 28 inhabited islands (see “Kagoshima Prefecture HP”. <https://www.pref.kagoshima.jp/ac07/pr/shima/gaiyo/pamph2022.html>). These islands, including the Osumi and Amami Islands, are scattered over 600 km from north to south. These islands have temperate to subtropical zones, and such a wide range of climatic zones is rare worldwide. This wide range of climatic conditions is caused by variations in latitude and longitude and by the complex geography of the islands, such as the flat Tanegashima Island

adjacent to Yaku Island, where Kyushu's highest peak, Mt. Miyaura, is located, or the flat Okinoerabu Island and Kikai Island scattered beside the mountainous Amami Oshima and Tokunoshima Islands. Owing to these diverse environmental factors, each island is expected to have its unique genetic resources. We decided to perform a 2021 field survey of subtropical wild legumes and their symbiotic rhizobia on Tanegashima and Yakushima Islands, which belong to the Osumi Islands, and Amami Oshima Island.

This survey was conducted in two ways: 1) Solo exploration by Baba-Kasai in Tanegashima and Yakushima Islands. The main objective of this study was to collect root nodules from *Vigna marina* (Burm.) Merr., as a potential source of salt-tolerant rhizobia. Due to time constraints, this could not be carried out during the field survey in Tanegashima and Yakushima Islands in 2016 (Baba-Kasai *et al.* 2017). The second objective was to accurately survey the distribution and determine the northern limit of *V. marina* habitat on both islands. 2) Three-person team exploration on Amami Oshima Island. This was the first exploration of wild legume species on Amami Oshima Island for the NARO Genebank; the main objectives were to collect first *V. marina* and *Vigna reflexo-pilosa* Hayata, which were expected to inhabit this island, and to survey their habitat distribution. It is also necessary to collect root nodules to isolate diverse rhizobia.

## Methods

A field survey of Tanegashima, Yakushima, and Amami Oshima Islands in the Kagoshima Prefecture, Japan, was conducted by car from September 26 to October 1, 2021. The survey began at Tanegashima Airport and ended at Amami Airport (the itinerary is shown in Table 1). When we found naturally growing

*V. marina*, *V. reflexo-pilosa*, and other legumes or came across a habitat with suitable conditions, we stopped our car and searched the area for natural populations.

Bulk seed samples were collected from each population. Seeds of each morphotype were collected separately when the population contained plants with different traits.

The recorded passport data included the location of the collection sites, that is, latitude, longitude, and altitude, as shown in Table 3. The collection points of genetic resources were recorded on Google Map using a smartphone in the search area, and longitude and latitude information was retrieved from the Google Map after returning from the field survey. Altitude information was obtained using Google Earth. Maps of the habitats were sketched and any special characteristics of the collected plants were noted. This information was stored in our Genebank database when the collected plant was registered as an accession.

Root nodules were collected from *V. marina* and *V. reflexo-pilosa* from 19 habitats (*V. marina*: 18, *V. reflexo-pilosa*: 1). The collected root nodules were placed in a screw bottle for each habitat with desiccant silica gel. Soils in each legume habitat were collected at a depth of approximately 10 cm to perform soil and microflora analyses in the laboratory.

## Results and Discussion

### Through all field surveys

The sites indicated by the [r + number] in Fig. 1 represent the places that we visited to survey legume habitat but could not collect genetic resources. Although it is not practical to describe all these sites in detail, we describe those sites where the legume habitat was confirmed, but we were not able to collect their seeds in the following text.

Table 1. Itinerary of the field survey in the Tanegashima, Yakushima, and Amami Oshima islands, Kagoshima Prefecture (September 26 to October 1, 2021)

Date	Itinerary	Stay	Person in charge
2021/9/26	Tsukuba -- Haneda Airport 8:15 -- (JAL643) -- Kagoshima Airport -- (JAL3795) -- Tanegashima Airport 11:40 -- Exploration on Tanegashima	Nishinoomote-shi	Baba-Kasai
2021/9/27	Moved to Yakushima Island from Tanegashima Island by a ferry, then, exploration on Yakushima Island	Yakushima-cho	Baba-Kasai
2021/9/28	Yakushima Airport 9:55 -- (JAL3740) -- Kagoshima Airport -- (JAL3795) -- Amami Airport 11:40 -- Exploration on Amami Oshima Island	Naze-cho	Baba-Kasai, Matsuo, Akiba
2021/9/29	Exploration on Amami Oshima Island	Setouchi-cho	Baba-Kasai, Matsuo, Akiba
2021/9/30	Exploration on Amami Oshima Island	Naze-cho	Baba-Kasai, Matsuo, Akiba
2021/10/1	Exploration on Amami Oshima Island until noon; Amami Airport 15:15 -- (JAL658) -- Haneda Airport 18:15 -- Tsukuba		Baba-Kasai, Matsuo, Akiba

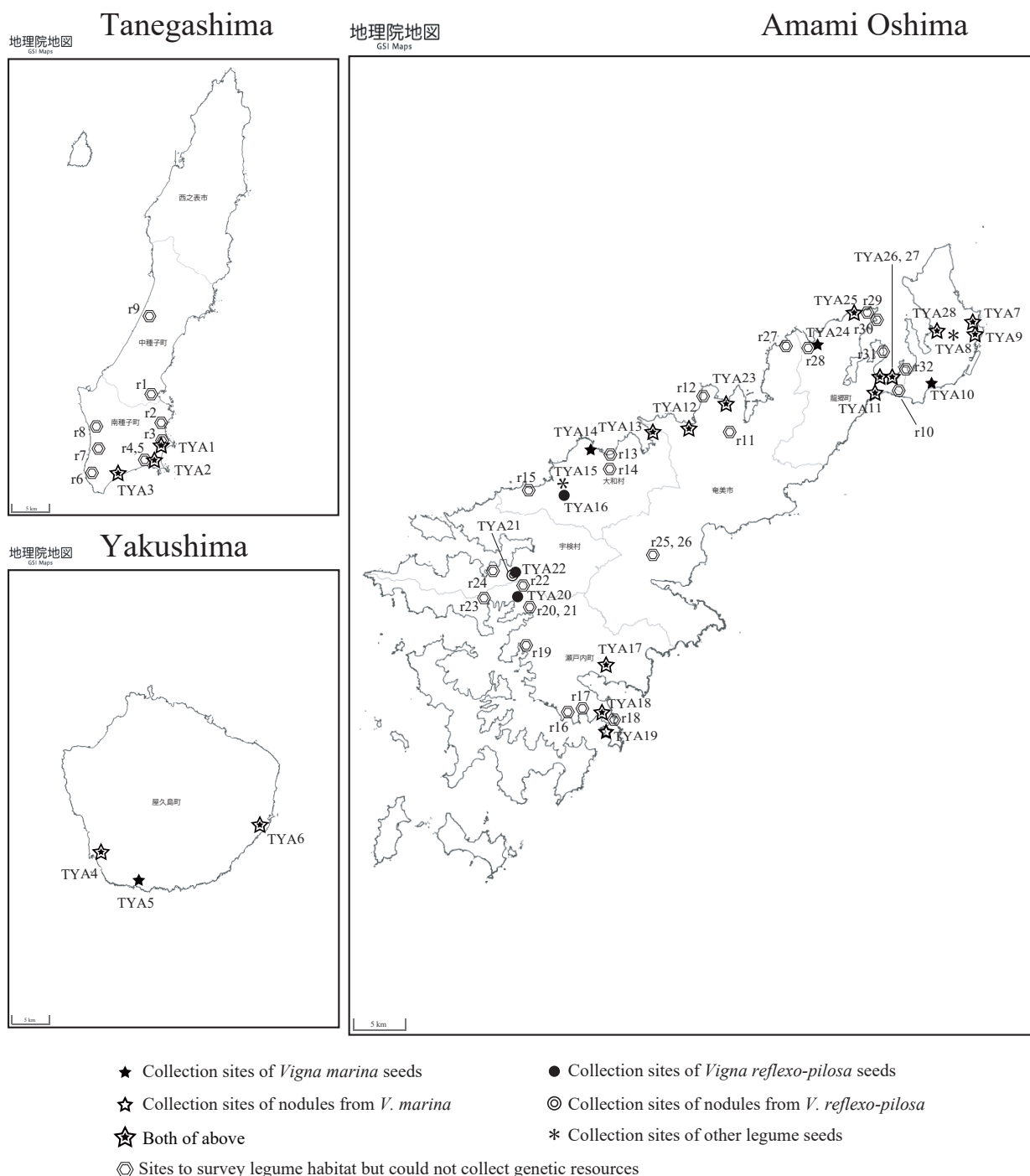


Fig. 1. Collection and search sites in the Tanegashima, Yakushima, and Amami Oshima islands, Kagoshima Prefecture.

In the Tanegashima and Yakushima islands, we aimed to determine the northern limit of *V. marina* habitat and collect their seeds and root nodules. In Amami Oshima, since this was the first survey of wild relatives of leguminous crops for the NARO Genebank project, we conducted an exhaustive survey mainly in coastal areas where genetic resources, *V. marina*, and their root nodules could be reliably collected. Regrettably, we did not have sufficient time to survey the eastern side of the island.

The materials collected from Tanegashima, Yakushima, and Amami Oshima Islands are summarized in Table 2, and their details are listed in Table 3.

#### Tanegashima Island

Seeds, root nodules, and soils from *V. marina* were collected from three locations, TYA-01, 02, and 03 (Photos 1–3). In this field survey, seeds were collected by distinguishing between stems with roots having root nodules and stems that did not have root nodules



Table 2. Summary of collected materials in the Tanegashima, Yakushima, and Amami Oshima islands

Species	Collected number
Seeds of <i>Vigna marina</i>	22
Seeds of <i>Vigna reflexo-pilosa</i>	3
Seeds of <i>Crotalaria spectabilis</i>	1
Seeds of <i>Psophocarpus tetragonolobus</i>	1
Nodule samples from <i>V. marina</i>	26
Nodule samples from <i>V. reflexo-pilosa</i>	1
Soil samples of <i>V. marina</i> habitat	17
Soil samples of <i>V. reflexo-pilosa</i> habitat	1
Total	72

identified. Therefore, the collected samples were differentiated and managed with branch number\_0Z, following TYA-XY. This resulted in TYA-01 having samples with two branch numbers, TYA-01\_01 and TYA-01\_02. Specifically, TYA-01\_01 had roots with root nodules (Photo 4), and three types of samples were collected: seeds, root nodules, and soil. In contrast, TYA-

01\_02 was a seed reserve of TYA-01\_01, where the pods were collected in bulk from the surrounding area and was only a seed sample (see Table 3). Conversely, TYA-02\_02 was a stem with root nodules, and three samples were collected: seeds, root nodules, and soil. TYA-02\_01 was only a seed sample collected in bulk; from TYA-02\_03, there were no seeds on the stem, although root



Photo 1. *Vigna marina* flowered among other beach plants at Osaki Kaigan near the Tanegashima Space Center Rocket Launch Pad of JAXA. The location is marked as TYA1 on the map (Fig. 1).



Photo 2. Landscape from the cliff behind a beach near the SRB-A Combustion test site in the Tanegashima Space Center. The location is marked as TYA2 on the map (Fig. 1).



Photo 3. Root nodules that were symbiotic with *Vigna marina* growing at TYA3 are shown on the map (Fig. 1).



Photo 4. Root nodules were collected as TYA-01\_01. The stems with these nodules had few pods, which were collected as TYA-01\_01 seed samples. Soils around these nodules were collected at a depth of approximately 10 cm. The location is marked as TYA1 on the map (Fig. 1).



nodules were collected, so only a root nodule sample was collected (See Table 3). Thus, in this survey, several sampling processes were conducted on one search site. The details of each location are omitted hereafter; please refer to Table 3.

As mentioned in the beginning of this section, the sites indicated by [r + number] in Fig. 1 include legume habitat areas that we visited but could not collect genetic resources. On Tanegashima Island, the first author confirmed that *V. marina* grows at r3–r5 and r9 but could not ensure that *V. marina* and other legume genetic resources inhabited r1 and r2. At r6, *Lotus corniculatus* L. subsp. *japonicus* (Regel) H. Ohashi and *Canavalia rosea* (Sw.) DC. were found (Photos 5 and 6), while only *C. rosea* was found at r7 and r8. The beach at r6–r8 is rather rocky compared to other beaches in Tanegashima, and on such beaches, *C. rosea* is often found instead of *V. marina*. This is supported by the fact that *V. marina* was found at r9 (Photo 7), a wide sandy beach with shallow water named Nagahama (Photo 8), although it is located north of r8. In this survey, r9 was the northern limit of *V. marina* habitat.

## Yakushima Island

The original schedule of the Yakushima survey was to take a ferry from Tanegashima to Yakushima on the morning of September 27, arriving at Miyanoura at 10:30, and flying to Kagoshima from Yakushima Airport at 16:35, so that only five hours were available for this survey. Therefore, in Yakushima, the first author focused on two known *V. marina* habitats, Kuriohama (TYA4 in Fig. 1) and Harutahama (TYA6 in Fig. 1), which were identified in a 2016 field survey (Baba-Kasai *et al.* 2017), with an emphasis on collecting root nodules. Unfortunately, the flight to Kagoshima was canceled owing to strong crosswinds, and the schedule had to be changed, as shown in Table 1. This was an unpredictable situation, and the amount of time available for field exploration in Yakushima could not be changed.

Although there was not enough time to confirm the northern limit of the habitat or to find new habitats, as was the case in Tanegashima, it was confirmed that *V. marina* continued growing at the Kuriohama and Harutahama beaches and found a new habitat near Yudomari (TYA5 in Fig. 1) hot spring (Photos 9 and 10).

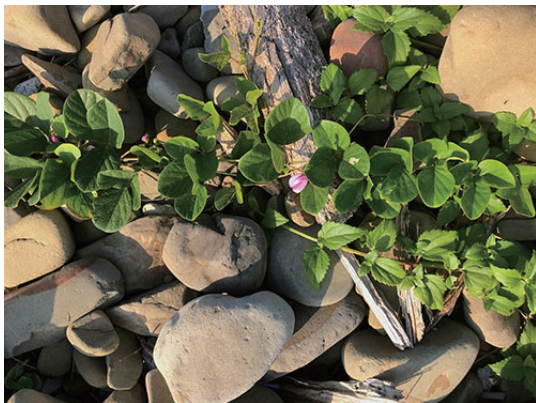


Photo 5. *Canavalia rosea* flowered at the rocky beach Tajiri port near Cape Kadokura in Tanegashima. The location is marked as r6 on the map (Fig. 1).

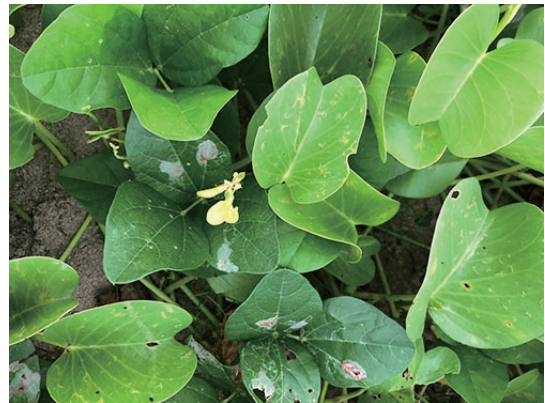


Photo 7. *Vigna marina* flowered at Nagahama Beach near the Nokan Elementary School in Tanegashima. The plants were too young to collect the pods. The location is marked as r9 on the map (Fig. 1).



Photo 6. *Lotus corniculatus* also flowered adjacent to *Canavalia rosea*. The location is marked as r6 on the map (Fig. 1).



Photo 8. Landscape around the *Vigna marina* habitat at Nagahama Beach. The location is marked as r9 on the map (Fig. 1).



The distribution of *V. marina* in Yakushima is thought to be located between Kuriohama and Harutahama, assuming that there are other places besides Yudomari and that the northern limit is Harutahama.

During our 2016 field survey, the northern coast of Tanegashima was comprehensively surveyed (Baba-Kasai *et al.* 2017). However, we did not find *V. marina* to the north of the 2021 survey site. The same was observed on Yakushima Island. As the latitude of Nagahama in Tanegashima is higher than that of Harutahama, we can conclude that the northern limit of *V. marina* in these two islands is Nagahama in Tanegashima according to this (2021) survey and the 2016 field survey (Baba-Kasai *et al.* 2017).

### Amami Oshima Island

The northern part of Amami Oshima has a rather flat terrain consisting mainly of uplifted coral reefs, making it a suitable habitat for *V. marina*. Although we were unable to survey the northern end of the island, it is reasonable to assume that *V. marina* inhabits almost all sandy beaches on the north coast. Although the sand on

most beaches in that area was coral sand (Photo 11), it was characterized by black sand at TYA-25 (Photo 12). We look forward to analyzing the collected root nodules and soils (Photo 13). In contrast, at r29, immediately next to TYA-25, a white sandy beach that appeared to be coral sand stretched. Unfortunately, we could not find *V. marina* and its root nodules at r29, whereas we could detect TYA-25.



Photo 11. Typical coral sand was found on the beaches of the northern part of Amami Oshima Island. *Vigna marina* flowered well. On the map (Fig. 1), the locations of TYA10.



Photo 9. Landscape from the Yudomari hot spring is adjacent to the newly discovered *Vigna marina* habitat on Yakushima Island. The location is marked as TYA5 on the map (Fig. 1).



Photo 12. An atypical beach with black sand near the Imaizaki lighthouse at TYA25 on the map (Fig. 1).



Photo 10. *Vigna marina* had overgrown through a rocky beach adjacent to the Yudomari hot spring. The location is marked as TYA5 on the map (Fig. 1).



Photo 13. *Vigna marina* root nodules were collected as TYA-25\_01 from an unusual beach with black sand. One pod and one soil sample were collected. The location of this collection site is marked as TYA25 on the map (Fig. 1).



Contrary to the north coast, it was difficult to confirm the presence of *V. marina* in the south coast facing Kakeroma Island because of its complicated shoreline and steep beach (Photo 14). However, some *V.*



Photo 14. Typical landscape of the southern coast of Amami Oshima Island. There are several complicated shorelines and steep beaches. The location is marked as r24 on the map (Fig. 1).



Photo 15. Mature pods of *Psophocarpus tetragonolobus* growing in a small vegetable garden along the Naon River in the inland area of Naon. The location is marked as TYA15 on the map (Fig. 1).



Photo 16. *Vigna reflexo-pilosa* flowered near a small vegetable garden. The location is marked as TYA16 on the map (Fig. 1).

*reflexo-pilosa* were found growing along an irrigation channel and near a small vegetable garden in the inland areas (Photos 15 and 16), suggesting the possibility of collecting diverse genetic resources from the southern part of Amami Oshima. In the southern part, we also collected *V. reflexo-pilosa* seeds from two accessions (TYA 20 and TYA22) and the root nodule from one accession (TYA21).

The western part of Amami Oshima has well-developed prefectural roads along the coast, which was conducive for this survey to focus on the coastal areas. In the coastal area, we collected *V. marina* and its root nodules with certain species at equal intervals, as intended (Photos 17 and 18). We also searched for *V. reflexo-pilosa* in areas where we could enter inland along the irrigation canal but it could not be found until we reached the southern part. At the start of the inland search, we did not comprehend the habitat



Photo 17. Mature pods of *Vigna marina* growing near the Chinese fishing port in the western part of Amami Oshima Island. On the map (Fig. 1), the location is marked as TYA12.



Photo 18. Large root nodules were developed with *Vigna marina* roots at TYA12 on the map (Fig. 1). These were designated as TYA-12\_01. The stems with these nodules had pods that were collected as TYA-12\_01 seed samples. The soil around these nodules was also collected.



characteristics, mainly humidity. We cannot rule out the possibility that this may have affected our inability to detect *V. reflexo-pilosa* in the northern part.

We did not have sufficient time to explore the western part of Amami Oshima. Although a rather old specimen, *Vigna luteola* (Jacq.) Benth. has been reported to inhabit the western part of Amami Oshima. We hope to explore the western part in the future.

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# 2021 年の種子島，屋久島，奄美大島における マメ科植物遺伝資源とその根粒の現地調査・収集について

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## 和文摘要

本報告は，2021 年 9 月 26 日から 10 月 1 日に行なった鹿児島県の種子島，屋久島，奄美大島におけるマメ科植物遺伝資源の調査報告である．現地調査の結果，*V. marina* 22 点と *V. reflexo-pilosa* 3 点，その他のマメ科作物 2 点を収集した．なお，奄美大島の *V. reflexo-pilosa* が NARO ジーンバンクに登録されるのは今回が初めてであり，NARO ジーンバンクに登録される *V. reflexo-pilosa* としては国内最北端のものである．また，共生根粒菌の単離を目的として，*V. marina* と *V. reflexo-pilosa* から根粒 27 点を採取した．収集した材料はすべて農業・食品産業技術総合研究機構（NARO）ジーンバンクに保存し，増殖した種子は，研究，育種，教育目的のために，要望に応じて提供する予定である．

Table 3. Passport information of collected materials

Col. site No. Map ID	JP No.	Scientific name	Col. Date	Status	Collection Site (Address)	Latitude	Longitude	Altitude (m)	Soil	Seed	Herbarium	Nodule	Soil sample	Remarks
TYA-01_01	286205	<i>Vigna marina</i>	26 Sep, 2021	Wild	Kukinaga, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 茎永	N30°23'51.6"	E130°58'12.6"	12	sandy loam	1 Plant	no	yes	yes	At Osaki Kaigan near Tanegashima Space Center Rocket Launch Pad of JAXA
TYA-01_02	286206	<i>Vigna marina</i>	26 Sep, 2021	Wild	Kukinaga, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 茎永	N30°23'51.6"	E130°58'12.6"	12	sandy loam	bulk	no	no	no	At Osaki Kaigan near Tanegashima Space Center Rocket Launch Pad of JAXA
TYA-02_01	286207	<i>Vigna marina</i>	26 Sep, 2021	Wild	Kukinaga, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 茎永	N30°22'45.3"	E130°57'45.5"	9	loam	bulk	no	no	no	At a cliff behind a beach near SRB-A Combustion test site in Tanegashima Space Center
TYA-02_02	286208	<i>Vigna marina</i>	26 Sep, 2021	Wild	Kukinaga, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 茎永	N30°22'45.3"	E130°57'45.4"	10	loam	1 Plant	no	yes	yes	At a cliff behind a beach near SRB-A Combustion test site in Tanegashima Space Center
TYA-02_03	286209	<i>Vigna marina</i>	26 Sep, 2021	Wild	Kukinaga, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 茎永	N30°22'45.2"	E130°57'45.5"	9	loam	no	no	yes	no	Seeds was not collected: At a cliff behind a beach near SRB-A Combustion test site in Tanegashima Space Center
TYA-03_01	286210	<i>Vigna marina</i>	26 Sep, 2021	Wild	Nishino, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 西之	N30°21'48.3"	E130°54'06.6"	6	sandy loam	1 Plant	no	yes	yes	At Motomura Kaigan near Maenohama Seaside Park
TYA-03_02	286211	<i>Vigna marina</i>	26 Sep, 2021	Wild	Nishino, Minamitane, Kumage District, Kagoshima 鹿児島県 熊毛郡 南種子町 西之	N30°21'48.3"	E130°54'06.6"	6	sandy loam	bulk	no	no	no	At Motomura Kaigan near Maenohama Seaside Park
TYA-04_01	286212	<i>Vigna marina</i>	27 Sep, 2021	Wild	Kurio, Yakushimaao, Kumage District, Kagoshima 鹿児島県 熊毛郡 屋久島町 栗生	N30°16'04.3"	E130°25'02.9"	0	sandy loam	1 Plant	no	yes	yes	On tetrapods at the west end of Kurio Beach, near the helipad by the intrusion cannal into the fishing port
TYA-04_02	286213	<i>Vigna marina</i>	27 Sep, 2021	Wild	Kurio, Yakushimaao, Kumage District, Kagoshima 鹿児島県 熊毛郡 屋久島町 栗生	N30°16'04.1"	E130°25'03.0"	0	sandy loam	no	no	yes	yes	Seeds was not collected: At the west end of Kurio Beach
TYA-04_03	286214	<i>Vigna marina</i>	27 Sep, 2021	Wild	Kurio, Yakushimaao, Kumage District, Kagoshima 鹿児島県 熊毛郡 屋久島町 栗生	N30°16'04.1"	E130°25'03.0"	0	sandy loam	no	no	yes	no	Seeds was not collected: At the west end of Kurio Beach
TYA-05	286215	<i>Vigna marina</i>	27 Sep, 2021	Wild	Yudomari, Yakushimaao, Kumage District, Kagoshima 鹿児島県 熊毛郡 屋久島町 湯泊	N30°14'03.7"	E130°28'38.9"	7	gravel	bulk	no	no	no	At a seashore near Yudomari Onsen
TYA-06_01	286216	<i>Vigna marina</i>	27 Sep, 2021	Wild	Anbo, Yakushimaao, Kumage District, Kagoshima 鹿児島県 熊毛郡 屋久島町 安房	N30°18'04.2"	E130°39'09.8"	4	cobble	bulk	no	yes	yes	At a wayside into Harutahama Beach
TYA-06_02	286217	<i>Vigna marina</i>	27 Sep, 2021	Wild	Anbo, Yakushimaao, Kumage District, Kagoshima 鹿児島県 熊毛郡 屋久島町 安房	N30°18'04.2"	E130°39'09.8"	4	cobble	no	no	yes	no	Seeds was not collected: At a wayside into Harutahama Beach
TYA-07_01	286218	<i>Vigna marina</i>	28 Sep, 2021	Wild	Kasaricho Oaza Ushuku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 宇宿	N28°27'42.0"	E129°43'07.4"	3	sandy loam	1 Pod	no	yes	no	At Tomori Beach on the north side of Amami Airport
TYA-07_02	286219	<i>Vigna marina</i>	28 Sep, 2021	Wild	Kasaricho Oaza Ushuku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 宇宿	N28°27'42.0"	E129°43'07.4"	3	sandy loam	bulk	no	no	no	At Tomori Beach on the north side of Amami Airport
TYA-08	286220	<i>Crotalaria spectabilis</i>	28 Sep, 2021	escape	Kasaricho Oaza Sato, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 里	N28°27'09.5"	E129°41'35.8"	56	loam	bulk	no	no	no	At a sunny slope on a roadside from Tomori Beach to Prefectural Road 601
TYA-09_01	286221	<i>Vigna marina</i>	28 Sep, 2021	Wild	Kasaricho Oaza Ushuku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 宇宿	N28°27'08.2"	E129°43'08.5"	5	sandy loam	1 Plant	no	yes	no	At Ose Beach, the nearest beach on the north side of Amami Airport
TYA-09_02	286222	<i>Vigna marina</i>	28 Sep, 2021	Wild	Kasaricho Oaza Ushuku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 宇宿	N28°27'08.2"	E129°43'08.5"	5	sandy loam	bulk	no	yes	no	At Ose Beach, the nearest beach on the north side of Amami Airport



Table 3. (Continued).

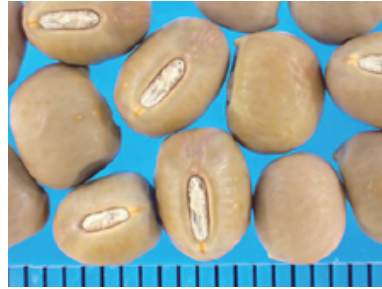
Col. site No. / Map ID	JP No.	Scientific name	Col. Date	Status	Collection Site (Address)	Latitude	Longitude	Altitude (m)	Soil	Seed	Herbarium	Nodule	Soil sample	Remarks
TYA-09_03	286223	<i>Vigna marina</i>	28 Sep, 2021	Wild	Kasaricho Oaza Ushuku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 宇宿	N28°27'08.2"	E129°43'08.5"	5	sandy loam	no	no	yes	yes	Seeds was not collected: At Ose Beach, the nearest beach on the north side of Amami Airport
TYA-10	286224	<i>Vigna marina</i>	28 Sep, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'42.1"	E129°40'20.5"	11	sandy loam	bulk	no	no	no	At a wayside of the entrance of Tohama Beach on the south side of Amami Airport
TYA-11_01	286225	<i>Vigna marina</i>	28 Sep, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'42.1"	E129°40'20.5"	11	sandy loam	1 Plant	no	yes	yes	On the entrance of Tebiro Beach
TYA-11_02	286226	<i>Vigna marina</i>	28 Sep, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'42.1"	E129°40'20.5"	11	sandy loam	bulk	no	no	no	On the entrance of Tebiro Beach
TYA-12_01	286227	<i>Vigna marina</i>	29 Sep, 2021	Wild	Naze Oaza Chinase, Amami, Kagoshima 鹿児島県 奄美市 名瀬 大字 知名瀬	N28°22'49.9"	E129°26'51.9"	2	sandy loam	1 Plant	no	yes	yes	At a sandy area of Chinase fishing port
TYA-12_02	286228	<i>Vigna marina</i>	29 Sep, 2021	Wild	Naze Oaza Chinase, Amami, Kagoshima 鹿児島県 奄美市 名瀬 大字 知名瀬	N28°22'49.9"	E129°26'51.9"	2	sandy loam	bulk	no	no	no	At a sandy area of Chinase fishing port
TYA-13_01	286229	<i>Vigna marina</i>	29 Sep, 2021	Wild	Kuninao, Yamato, Oshimai District, Kagoshima 鹿児島県 大島郡 大和村 国直	N28°22'20.5"	E129°24'23.9"	8	sandy loam	1 Plant	no	yes	yes	At Kuninao Beach
TYA-13_02	286230	<i>Vigna marina</i>	29 Sep, 2021	Wild	Kuninao, Yamato, Oshimai District, Kagoshima 鹿児島県 大島郡 大和村 国直	N28°22'20.5"	E129°24'23.9"	8	sandy loam	bulk	no	no	no	At Kuninao Beach
TYA-14	286231	<i>Vigna marina</i>	29 Sep, 2021	Wild	Oganeku, Yamato, Oshimai District, Kagoshima 鹿児島県 大島郡 大和村 大金久	N28°21'43.7"	E129°21'02.8"	8	gravel	bulk	no	no	no	At a seashore near Oganekuturusu Park
TYA-15	286232	<i>Psophocarpus tetragonolobus</i>	29 Sep, 2021	escape	Naon, Yamato, Oshimai District, Kagoshima 鹿児島県 大島郡 大和村 名音	N28°19'55.5"	E129°19'03.4"	18	loam	bulk	no	no	no	Beside a kitchen garden at a roadside to Naongawa Power Station near Naon river
TYA-16	286233	<i>Vigna reflexo-pilosa</i>	29 Sep, 2021	Wild	Naon, Yamato, Oshimai District, Kagoshima 鹿児島県 大島郡 大和村 名音	N28°19'54.8"	E129°19'04.0"	18	loam	1 Pod	no	no	no	At a roadside to Naongawa Power Station along Naon river
TYA-17_01	286234	<i>Vigna marina</i>	29 Sep, 2021	Wild	Aminoko, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 網野子	N28°10'13.0"	E129°21'38.5"	11	sandy loam	1 Plant	no	yes	yes	At a seashore near Aminoko village
TYA-17_02	286235	<i>Vigna marina</i>	29 Sep, 2021	Wild	Aminoko, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 網野子	N28°10'13.0"	E129°21'38.5"	11	sandy loam	bulk	no	yes	no	At a seashore near Aminoko village
TYA-18_01	286236	<i>Vigna marina</i>	30 Sep, 2021	Wild	Sokaru, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 蘇刈	N28°08'09.9"	E129°21'30.5"	5	sandy loam	1 Plant	no	yes	yes	At a beach beside Sokaru village
TYA-18_02	286237	<i>Vigna marina</i>	30 Sep, 2021	Wild	Sokaru, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 蘇刈	N28°08'09.9"	E129°21'30.5"	5	sandy loam	bulk	no	yes	no	At a beach beside Sokaru village
TYA-18_03	286238	<i>Vigna marina</i>	30 Sep, 2021	Wild	Sokaru, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 蘇刈	N28°08'09.9"	E129°21'30.5"	5	sandy loam	bulk	no	no	no	At a beach beside Sokaru village
TYA-19	286239	<i>Vigna marina</i>	30 Sep, 2021	Wild	Sokaru, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 蘇刈	N28°07'31.7"	E129°21'43.4"	6	sandy loam	no	no	yes	yes	Seeds could not be collected because the plants were at vegetative stage: At a beach beside Yadorihama Camping Ground
TYA-20	286240	<i>Vigna reflexo-pilosa</i>	30 Sep, 2021	Wild	Koshi, Setouchi, Oshimai District, Kagoshima 鹿児島県 大島郡 瀬戸内町 古志	N28°14'14.1"	E129°16'34.3"	84	loam	bulk	no	no	no	Beside the bridge over the irrigation canal of Koshi village
TYA-21	286241	<i>Vigna reflexo-pilosa</i>	30 Sep, 2021	Wild	Buren, Uken, Oshimai District, Kagoshima 鹿児島県 大島郡 宇検村 部連	N28°15'20.9"	E129°16'47.4"	105	loam	no	no	yes	yes	Seeds could not be collected: At flowering stage, only young pods: At a roadside into mountainous area along a small river

Table 3. (Continued).

Col. site No. / Map ID	JP No.	Scientific name	Col. Date	Status	Collection Site (Address)	Latitude	Longitude	Altitude (m)	Soil	Seed	Herbarium	Nodule	Soil sample	Remarks
TYA-22	286242	<i>Vigna reflexo-pilosa</i>	30 Sep, 2021	Wild	Buren, Uken, Oshimai District, Kagoshima 鹿児島県 大島郡 宇検村 部蓮	N28°15'21.5"	E129°16'44.9"	90	loam	1 Plant	no	no	no	At a roadside into mountainous area along a small river
TYA-23_01	286243	<i>Vigna marina</i>	01 Oct, 2021	Wild	Naze Oaza Asani, Amami, Kagoshima 鹿児島県 奄美市 名瀬 大字 朝仁	N28°24'00.3"	E129°28'49.7"	6	sandy loam	1 Plant	no	yes	yes	At a sandy beach of the Asani shore neighboring the center of Naze city
TYA-23_02	286244	<i>Vigna marina</i>	01 Oct, 2021	Wild	Naze Oaza Asani, Amami, Kagoshima 鹿児島県 奄美市 名瀬 大字 朝仁	N28°24'00.3"	E129°28'49.7"	6	sandy loam	bulk	no	no	no	At a sandy beach of the Asani Shore neighboring the center of Naze city
TYA-24	286245	<i>Vigna marina</i>	01 Oct, 2021	Wild	Ikusato, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 幾里	N28°26'54.7"	E129°33'41.1"	1	gravel	bulk	no	no	no	On a gravel ground at a roadside by a seashore of Ikusato
TYA-25_01	286246	<i>Vigna marina</i>	01 Oct, 2021	Wild	Ankiyaba, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 安木屋場	N28°28'26.8"	E129°35'53.4"	13	sandy loam	1 Pod	no	yes	yes	At a blackish sand beach nearby Prefectural Road 81
TYA-25_02	286247	<i>Vigna marina</i>	01 Oct, 2021	Wild	Ankiyaba, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 安木屋場	N28°28'26.8"	E129°35'53.4"	13	sandy loam	1 Pod	no	no	no	At a blackish sand beach nearby Prefectural Road 81
TYA-26_01	286248	<i>Vigna marina</i>	01 Oct, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'52.1"	E129°37'53.9"	2	sandy loam	1 Plant	no	yes	yes	At Akaogi beach facing Akaogi Bay
TYA-26_02	286249	<i>Vigna marina</i>	01 Oct, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'52.1"	E129°37'53.9"	2	sandy loam	bulk	no	no	no	At Akaogi beach facing Akaogi Bay
TYA-27_01	286250	<i>Vigna marina</i>	01 Oct, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'51.5"	E129°37'51.2"	3	sandy loam	1 Plant	no	yes	no	Beside the entrance of Akaogi Beach
TYA-27_02	286251	<i>Vigna marina</i>	01 Oct, 2021	Wild	Akaogi, Tasugochoo, Oshimai District, Kagoshima 鹿児島県 大島郡 龍郷町 赤尾木	N28°24'51.5"	E129°37'51.2"	3	sandy loam	bulk	no	no	no	Beside the entrance of Akaogi Beach
TYA-28_01	286252	<i>Vigna marina</i>	01 Oct, 2021	Wild	Kasaricho Oaza Sotoganeku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 外金久	N28°27'20.8"	E129°40'17.3"	1	sandy loam	1 Plant	no	yes	yes	At a sandy beach of the Akakina Coast
TYA-28_02	286253	<i>Vigna marina</i>	01 Oct, 2021	Wild	Kasaricho Oaza Sotoganeku, Amami City, Kagoshima 鹿児島県 奄美市 笠利町 大字 外金久	N28°27'20.8"	E129°40'17.3"	1	sandy loam	bulk	no	no	no	At a sandy beach of the Akakina Coast



Sample Photo 1.  
TYA-01\_01, JP286205,  
*Vigna marina*



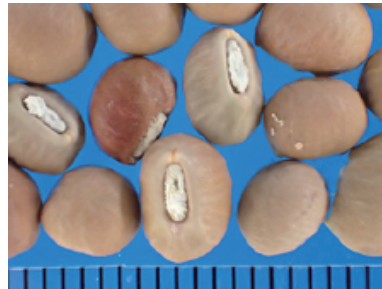
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TYA-01\_02, JP286206,  
*Vigna marina*



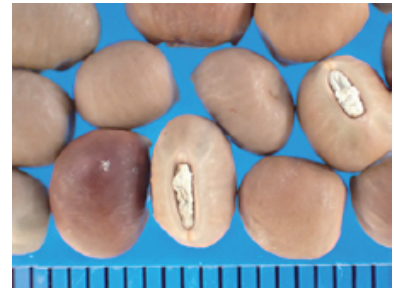
Sample Photo 3.  
TYA-02\_01, JP286207,  
*Vigna marina*



Sample Photo 4.  
TYA-02\_02, JP286208,  
*Vigna marina*



Sample Photo 5.  
TYA-03\_01, JP286210,  
*Vigna marina*



Sample Photo 6.  
TYA-03\_02, JP286211,  
*Vigna marina*



Sample Photo 7.  
TYA-04\_01, JP286212,  
*Vigna marina*



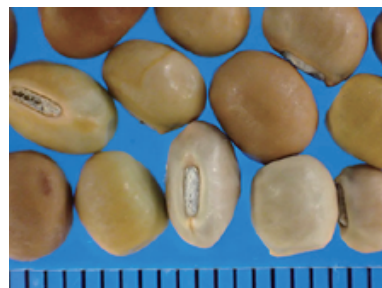
Sample Photo 8.  
TYA-05, JP286215,  
*Vigna marina*



Sample Photo 9.  
TYA-06\_01, JP286216,  
*Vigna marina*



Sample Photo 10.  
TYA-07\_01, JP286218,  
*Vigna marina*



Sample Photo 11.  
TYA-07\_02, JP286219,  
*Vigna marina*



Sample Photo 12.  
TYA-08, JP286220,  
*Crotalaria spectabilis*



Sample Photo 13.  
TYA-09\_01, JP286221,  
*Vigna marina*



Sample Photo 14.  
TYA-09\_02, JP286222,  
*Vigna marina*

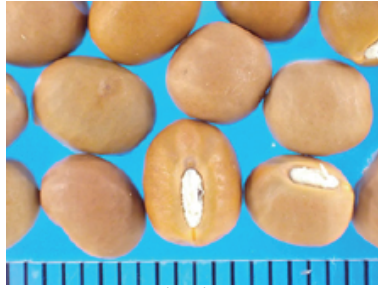


Sample Photo 15.  
TYA-10, JP286224,  
*Vigna marina*





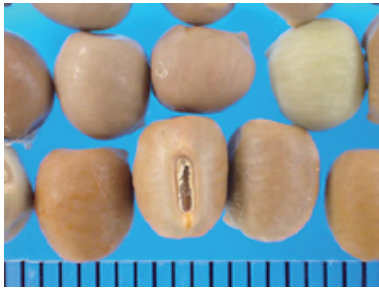
Sample Photo 16.  
TYA-11\_01, JP286225,  
*Vigna marina*



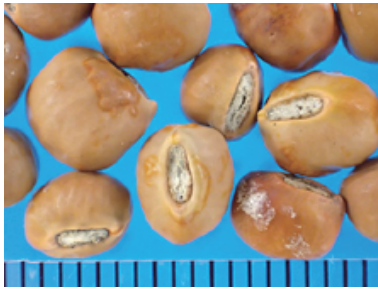
Sample Photo 17.  
TYA-11\_02, JP286226,  
*Vigna marina*



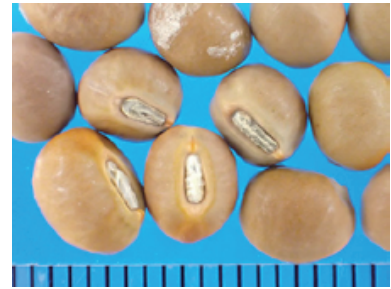
Sample Photo 18.  
TYA-12\_01, JP286227,  
*Vigna marina*



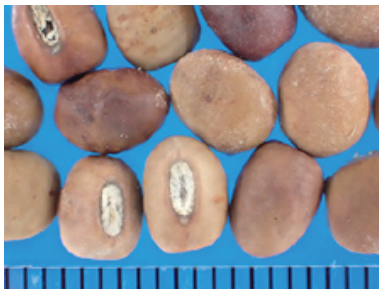
Sample Photo 19.  
TYA-12\_02, JP286228,  
*Vigna marina*



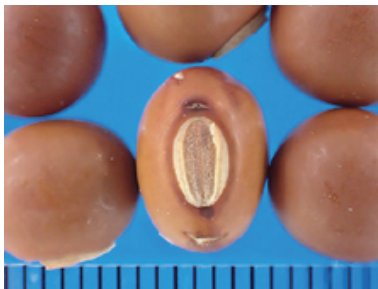
Sample Photo 20.  
TYA-13\_01, JP286229,  
*Vigna marina*



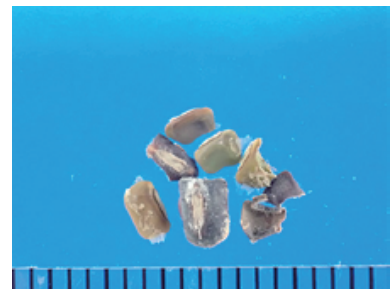
Sample Photo 21.  
TYA-13\_02, JP286230,  
*Vigna marina*



Sample Photo 22.  
TYA-14, JP286231,  
*Vigna marina*



Sample Photo 23.  
TYA-15, JP286232,  
*Psophocarpus tetragonolobus*



Sample Photo 24.  
TYA-16, JP286233,  
*Vigna reflexo-pilosa*



Sample Photo 25.  
TYA-17\_01, JP286234,  
*Vigna marina*



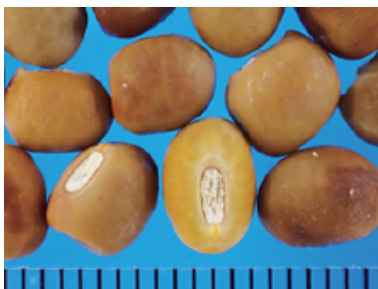
Sample Photo 26.  
TYA-17\_02, JP286235,  
*Vigna marina*



Sample Photo 27.  
TYA-18\_01, JP286236,  
*Vigna marina*



Sample Photo 28.  
TYA-18\_02, JP286237,  
*Vigna marina*



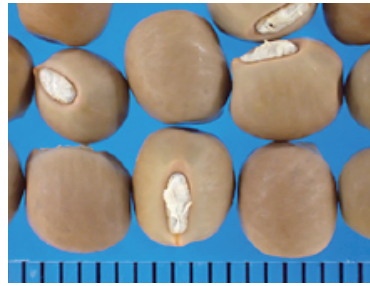
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TYA-18\_03, JP286238,  
*Vigna marina*



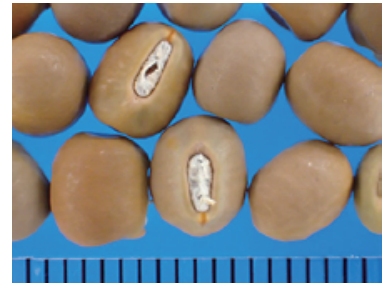
Sample Photo 30.  
TYA-20, JP286240,  
*Vigna reflexo-pilosa*



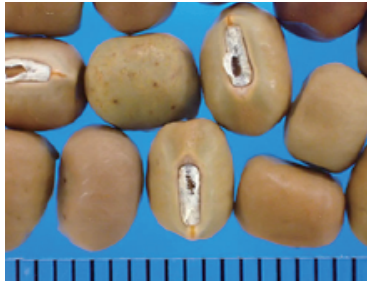
Sample Photo 31.  
TYA-22, JP286242,  
*Vigna reflexo-pilosa*



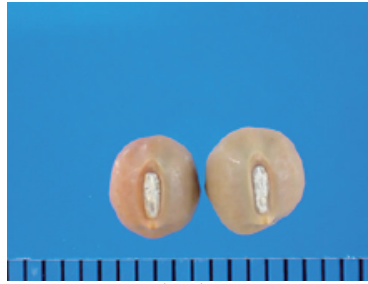
Sample Photo 32.  
TYA-23\_01, JP286243,  
*Vigna marina*



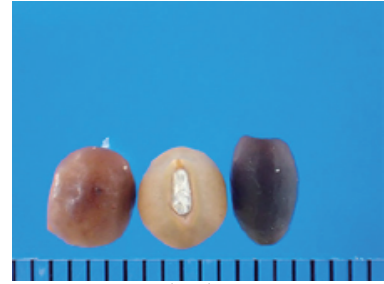
Sample Photo 33.  
TYA-23\_02, JP286244,  
*Vigna marina*



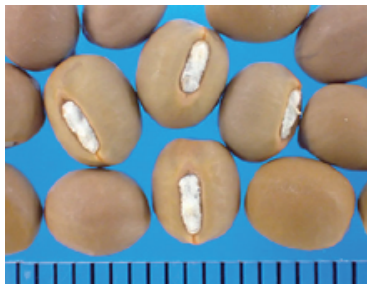
Sample Photo 34.  
TYA-24, JP286245,  
*Vigna marina*



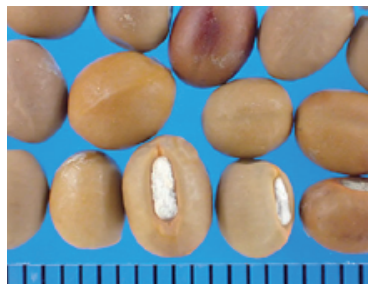
Sample Photo 35.  
TYA-25\_01, JP286246,  
*Vigna marina*



Sample Photo 36.  
TYA-25\_02, JP286247,  
*Vigna marina*



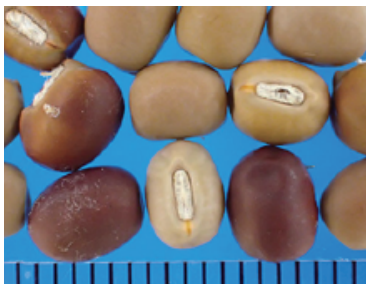
Sample Photo 37.  
TYA-26\_01, JP286248,  
*Vigna marina*



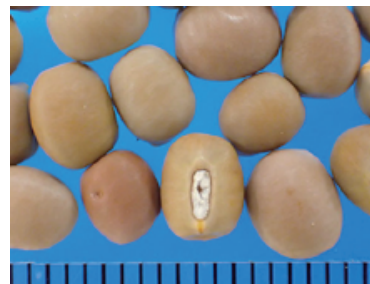
Sample Photo 38.  
TYA-26\_02, JP286249,  
*Vigna marina*



Sample Photo 39.  
TYA-27\_01, JP286250,  
*Vigna marina*



Sample Photo 40.  
TYA-28\_01, JP286252,  
*Vigna marina*



Sample Photo 41.  
TYA-28\_02, JP286253,  
*Vigna marina*