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Original Paper

Field Survey and Collection of Leguminous Genetic Resources in Tanegashima and Yakushima islands of Japan in 2016

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Summary

In order to map the distribution of leguminous genetic resources in southern part of Japan, we conducted a field survey to collect them from two islands, namely, Tanegashima and Yakushima, in Kagoshima prefecture of Japan, October 24 to 28 in 2016. A total of 14 accessions were recorded, including 7 wild soybean (*Glycine soja*, Japanese name, Tsuru-mame) accessions, 5 *Vigna marina* (Japanese name, Hama-sasage) accessions, 2 *Canavalia lineata* (Japanese name, Hama-natamame) accessions. Since all of *V. marina* and *C. lineata* accessions grew near the sea, they are expected to show high salinity tolerance. In addition to collecting seed samples from each of the accessions, root nodules were collected from one accession of *V. marina* at Harutahama beach on Yakushima island to isolate salt-tolerant rhizobia. All collected seeds are conserved at the National Agriculture and Food Research Organization (NARO) Genebank of Japan. We plan to multiply the seeds of the collected accessions and to evaluate their growth traits at our experimental field in Tsukuba City in 2017. Additionally, we plan to isolate rhizobium from the collected nodules and to evaluate them. Multiplied seeds and isolated rhizobium will become available upon request for research, breeding, and educational purposes.

KEY WORDS: leguminous genetic resources, Tanegashima, Yakushima, Japan

Introduction

The genera *Glycine* and *Vigna* belong to the legume family (Leguminosae) and include a variety of crops, including soybean (*Glycine max* (L.) Merr., Japanese name, daizu), cowpea (*Vigna unguiculata* (L.) Walp., sasage), mung bean (*Vigna radiata* (L.) Wilczek, ryokutou) and adzuki bean (*Vigna angularis* (Willd.)

Ohwi & H. Ohashi, azuki). The National Agriculture and Food Research Organization (NARO) Genebank has been conducting field surveys for the collection and conservation of *Glycine* and *Vigna* germplasm distributed in Japan (see Annual Report on Exploration and Introduction of Plant Genetic Resources, https://www.gene.affrc.go.jp/publications.php#plant_report). According to the last field survey, the southern limit for collecting wild soybean (*Glycine soja* Sieb. & Zucc.) in Japan lies at 30º22'0.16"N/130º53'22.92"E in Nishino, Minamitanecho, Kumage-gun, Kagoshima (Oki and Kono, 2012), while the southern limit for collecting wild adzuki bean (*Vigna angularis* (Willd.) Ohwi & H. Ohashi var. *nipponensis* (Ohwi) Ohwi & H. Ohashi) is at 31º46'12"N/130º40'37"E in Kajikicho, Kira-gun, Kagoshima (Vaughan *et al*., 1999). Thus, we conducted a field survey on Tanegashima and Yakushima islands to determine whether these wild beans may be found further south in Japan.

Additionally, on occasion of this survey we pursued two other aims. One consisted in researching the geographical distribution of other leguminous wild plants, namely, *Vigna vexillata* (L.) A. Rich. (Japanese name, Aka-sasage), *Vigna marina* (Burm.) Merr. and *Canavalia lineata* (Thunb.) DC. We have already investigated the habitat of *V. marina* and *C. lineata* in the Ryukyu islands and collected their seeds (Tomooka *et al*., 2000, 2013). As concerns these two species, we aimed to continue the study of the habitat in northern Japan. Correspondingly, we have investigated the habitat of *V. vexillata* in Nagasaki, Oita, Miyazaki prefectures (Tomooka *et al*., 2010; Takahashi *et al*., 2017). According to Kagoshima prefecture version of the Red Data Book of endangered species, *V. vexillata* also inhabits Kagoshima prefecture. Therefore, in relation to *V. vexillata*, we aimed to extend our knowledge of the habitat in southern Japan in the present field survey.

A second additional aim was to collect root nodules from coastal leguminous plants, such as *V. marina*, to isolate salt-tolerant rhizobia. We have been studying about rhizobia isolated from root nodules of *V. marina* at the Sakishima islands in Okinawa prefecture (Tomooka *et al*., 2005). Results seem to indicate that isolated rhizobia could survive under high-salinity stress and establish a functional nitrogen-fixing symbiosis with various leguminous crops, such as cowpea, mung bean, and soybean. Therefore, there is a possibility that these salt-tolerant rhizobium isolates may be used for legume crop production in saline soils. That is the reason we wished to take the opportunity of the present field survey to collect more rhizobia from *V. marina*.

Methods

A field survey of Tanegashima and Yakushima islands in Kagoshima prefecture, Japan, was conducted from October 24 to 28, 2016. We started the survey from Tanegashima island and went to Yakushima island by high-speed boat (Table 1). When we saw naturally growing leguminous wild plants or when we came across a habitat where conditions suggested the possibility of finding these legumes growing, we stopped and searched the area for natural populations.

Bulk seed samples were generally collected from each population, and when a populations contained plants with different traits, the seeds of each morphotype were collected separately. Nodule samples were collected from coastal leguminous plants depend on soil conditions when it was easy enough to dig around the plants.

Passport data recorded included location of the collection sites, i.e., latitudes, longitudes, and altitudes; we sketched maps of the habitat, and noted any special characteristics of each sampled plants (Table 3). We use this information stored in the database of our gene bank when the sampled plants are

Table 1. Itinerary of the field survey at Tanegashima and Yakushima islands in Kagoshima Prefecture, Japan (October 24-28, 2016)

Date	Itinerary	Stay
2016/10/24	Tsukuba -- (Tsukuba Express train / JR) -- Haneda Airport 13:25 -- (JAL649) -- Kagoshima Airport 16:00 -- (JAC3775) -- Tanegashima Airport 16:40 --(car)--Nakanokami (Minamitane-cho)	Minamitane
2016/10/25	Exploration on the south part of Tanegashima around Mnamitane-cho and inland area of Nakatane-cho and Furuta of Nishinoomote city	Nishinoomote
2015/10/26	Exploration on the seashore area in the north part of Tanegashima and went to Yakushima by high speed boat	Yakushima-cho Miyanoura
2015/10/27	Exploration on the abandonded farmland in Yakushima and the seashore area ine the south part of it	Yakushima-cho Anbou
2015/10/28	Exploration on inland area of Yakushima; Yakushima Airport 14:15 -- (JAC3746) -- Kagoshima Airport 16:05 -- (JAL650) -- Haneda Airport 17:45 -- (JR/ Tsukuba Express train) --Tsukuba	

registered as accessions. Latitudes and longitudes were measured using the WGS84 world geodetic system and a Garmin GPSMAP 60sc handheld GPS device.

Results and Discussion

A total of 14 accessions, including 7 of *G. soja*, 5 of *V. marina*, 2 of *C. lineata*, were recorded, and seed samples were obtained for each (Tables 2 and 3). Collected seed samples were deposited at the NARO Genebank (Tsukuba, Japan) and will be propagated and evaluated in 2017 for primary characteristics, such as morphologic characteristics, flowering time and so on. Newly generated seed samples will be available for research, breeding, and educational purposes. The samples can be identified through the NARO Genebank website (http://www.gene.affrc.go.jp/databases-plant_search_en.php) and requested at the following website: http://www.gene.affrc.go.jp/distribution_en.php?section=plant.

***Glycine soja* (Japanese Tsuru-mame)**

We found only 7 accessions of *Glycine soja* at 10 sites on Tanegashima island (Table 3: TY-1–TY-7, Fig. 1: TY1–TY7 and r4, r6, r7. In Fig. 1, the 'TY' number indicates the location where we collected the corresponding seed sample, while the 'r' number indicates a location where we surveyed, but could not collect a seed sample as a reference); thus, wild soybean was not a common finding in the present field survey. In an earlier survey conducted by Oki and Kono in 2011 (Oki and Kono, 2012), 15 accessions of *G. soja* were successfully collected from riverside areas on Tanegashima island. We did not especially survey at riverside areas this time, since we wished to find novel accessions of wild soybean at different places from those searched during the preceding survey. That may be one of the reason we could find fewer accessions than that collected in the previous survey. Another potential cause could be the difference in planting date for rice on Tanegashima island. At the time of our visit to the banks of rice fields, which were considered a suitable habitat for wild soybeans and wild adzuki beans, all we encountered were harvested field with only a few weeds growing there. According to farmers in the area, rice was harvested by the end of July, because the old, late cultivar traditionally grown in Tanegashima was recently replaced by an earlier flowering variety. They said that rice fields would be kept clean until the beginning of winter, when a new crop would be seeded. Thus, the change in agricultural environment was likely the reason why we could not find any wild soybean in the inland area of rice fields at Furutacho, except for *Amphicarpaea bracteata* (Japanese name, Yabu-mame) (Fig.1, r7, Photograph 18), but even this species was very hard to

Table 2. Summary of materials collected in Kagoshima prefecture

Species	Riverside	Inland	Seashore	Total
Glycine soja	5	2		7
Vigna marina		1	4	5
Canavalia lineata		1	1	2
Total	5	4	5	14

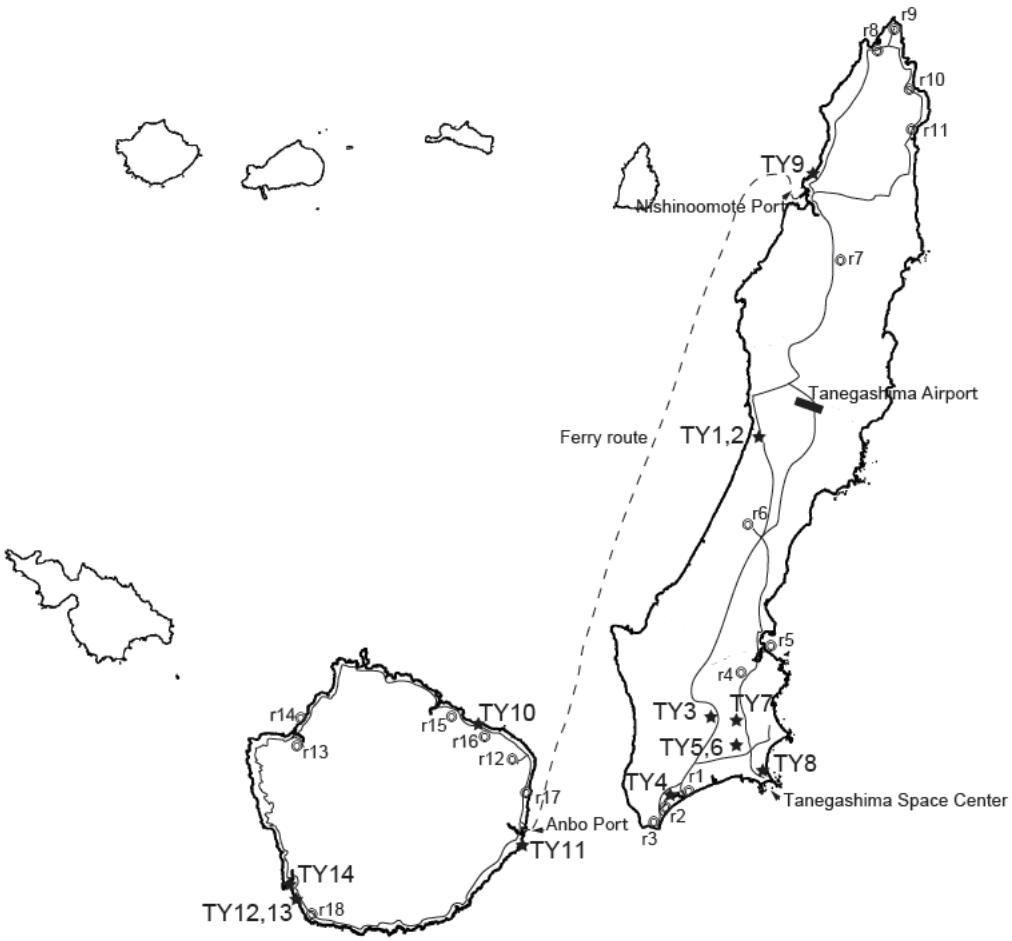

Fig. 1. Survey routes and collection and search sites on Tanegashima and Yakushima islands, Kagoshima Prefecture.

come across in Tanegashima and Yakushima islands.

As described in Table 3, 5 out of 7 accessions of *G. soja* were growing along river banks (Photographs 3, 8 and 11), while the remaining 2 were growing on a bank of a rice field (Photograph 1). Both are usual habitats for wild soybeans. All plants bore many young green pods but no mature dark brown pods, as referred to in the report from the earlier survey by Oki and Kono (2012).

Additionally, we surveyed almost all of potential wild soybeans habitats (Fig.1, r12, r13, r15, r16

and r17), although we did not find any wild soybeans on Yakushima island. This may partly have been because of the decline of agriculture on this island. As shown in Photographs 28, 33 and 35, many fallow fields were found there; most of which seemed unattended for a long time. *Arundo donax* (Japanese name, Danchiku) (Photograph 33) grew predominantly, with deep grass tussocks forming across the land (Photograph 35). An old farmer in Kusugawa (Fig. 1, r15, Photograph 33) said that he had seen wild soybeans over 20 years ago. He also said that the agriculture in the Kusugawa area had been active around that time. Although he did not mention about rice farming in particular, considering his observations as correct, it seems reasonable to assume that we could find *G. soja* around Nagata, where is the only rice paddy area and people are still actively farming the land. It is unfortunate that rice farming was concluded in the Nagata area by the time of our visit to the site in 2016. Thus, we only saw harvested field with few weeds growing, but could not find any *G. soja* (Fig. 1, r13, Photograph 31).

According to the results of the present survey, TY-4 (Table 3) was the southernmost wild soybean accession collected, at 30º21'54.6"N/130º53'28.4"E. However, the previous survey also found a wild soybean at 30º22'0.16"N/130º53'22.92"E. Since both accessions seem to inhabit almost the same area, we concluded that the southernmost habitat of wild soybeans in Japan lies in the vicinity of Rokumei river at Nishino, Minamitanecho, Kumage-gun, Kagoshima.

***Vigna angularis* var. *nipponensis* (Japanese, Yabutsuru-azuki)**

Unfortunately, we could not find any wild adzuki beans on either island surveyed at all. All of residents to whom we showed photographs of *V. angularis* var. *nipponensis* said they were not acquainted with such a leguminous plant.

A curator working for the Minamitanecho office introduced us to a retired researcher of the Research Center for Medicinal Plant Resources, who was a specialist in plants from Tanegashima island. This researcher declared he had once seen a similar plant with yellow flowers near his former office, in the Tanegashima Division of the Research Center for Medicinal Plant Resources, Matsubarayama, Nakatanecho, Kumage-gun, Kagoshima, but he could not identify it as *V. angularis* var. *nipponensis*, because the plant had no pods or seeds. He suspected that might be *Dunbaria villosa* (Thunb.) Makino (Japanese name, Noazuki). We tried to survey the area (Fig. 1, r6) but could find either *V. angularis* nor *D. villosa*.

All things considered, the probability of finding a wild adzuki bean in Tanegashima and Yakushima islands seems to be very slim. The fact that we could see neither a wild adzuki bean specimen ourselves or anybody who might have seen one, strongly supports that thought. Further, Tomooka *et al.* (1994) also failed to find cultivated adzuki beans on an earlier survey for collecting landraces of cultivated crops in Tanegashima and Yakushima islands, although they did find cultivated cowpeas (sasage) used in place of adzuki beans. Bearing such results in mind, it seems probable that environmental conditions, e.g., the climate of Tanegashima and Yakushima islands, might be unsuitable for growing of adzuki beans. According to the report of another survey on the state of vegetation in the Osumi Peninsula, Kagoshima prefecture (Kawagoshi, 1997), the southern limit on which *V. angularis* var. *nipponensis* would lie around Mount Inao on the Osumi Peninsula. We are planning a field survey to the location in 2017.

***Vigna marina* (Japanese, Hama-sasage)**

Vigna marina is a pan tropical species that grows mainly on sandy beaches (Tomooka *et al*., 2010).

Although the geographical distribution of *V. marina* was well documented in southern Japan, i.e., the Ryukyu islands (Tomooka *et al*., 2000, 2012, 2013; Takahashi *et al*., 2014), until recently, northern Japan had not been sufficiently surveyed in search of *V. marina*. However, till date, there are several reports about the northern limit of *V. marina* in Japan. Kawagoshi said that the northern limit of the species is around Sata Headland, Kagoshima prefecture, in the report previously cited (Kawagoshi, 1997), while the Kochi prefecture version of the Red Data Book (2010) state that *V. marina* inhabits in Kochi prefecture and the Kaiyocho museum in Tokushima prefecture posits that the northern limit of the species is at Nasa bay, in Kaiyocho (26th Exhibition "Coastal Plants," 2009). These reports suggest the possibility that *V. marina* could widen its distribution area in Japan with dispersal of seeds by the ocean Kuroshio current. We think the results of the present survey support this proposal.

We found 5 accessions of *V. marina* in 4 sites on Tanegashima and Yakushima islands (Table 3: TY-8, TY-11–TY-14, Fig. 1: TY8, TY11–TY14), and additionally one habitat at Motomurakaigan on Tanegashima island, although we could not collect any seeds, since the plants were only entering the flowering stage (Fig. 1, r1, Photographs 5 and 6). All sites inhabited by this species were found south of these islands. We also surveyed the shores of the north sides, but could not find *V. marina*'s habitat at all in this case (Fig. 1, TY9 and TY10, r8-r11, r14). This may well be case if the seeds of *V. marina* were dispersed from the southern islands, such as the Ryukyu islands, by the Kuroshio current, and had established there.

***Canavalia lineata* (Japanese, Hamanata-mame)**

Three wild species of genus *Canavalia* inhabit sea shores in Japan: *Canavalia lineata* (Thunb.) DC., which is distributed along the southern part from Bousou Peninsula, Chiba prefecture (Sauer, 1964); *Canavalia maritima* (Aubl.) Thouars (Japanese name, Nagami-hama-natamame), which is found distributed along the southern part from Amami islands, Kagoshima prefecture (Matsumura *et al*., 2004); and *Canavalia cathartica* Thouars, which is distributed along the southern part of the Ryukyu islands, Okinawa prefecture (Sauer, 1964; Yamashiro *et al*., 2013).

We collected the seeds of two accessions of *Canavalia* sp. from one site on each island (Fig. 1, TY9 and TY10, Photographs 19, 20, 29 and 30). Judging by the area over which they were found distributed, i.e., northern part from Amami islands, and the longer hilums (13 mm, as shown in seeds Photograph, TY-9 and TY-10) than those of *C. martima* (7 mm) (Sauer, 1964), we considered these accessions as *C. lineata*., which was also found on the southern sea shores of Tanegashima and Yakushima islands (Fig. 1, r2, TY11 and TY 13, Photograph 7). They sometime associated with *V. marina* on beaches (Table 3, Fig. 1, r2 and TY11).

Nodule samples

Nodule samples were collected from *V. marina* at Harutahama beach of Yakushima island (Fig. 1, TY11, Photographs 39 and 40). Soils, which were sandy silt and rich in humus, differed significantly in properties from those of previous sampling sites at coral sandy beaches of the Sakishima islands in Okinawa prefecture (Tomooka *et al*., 2005). Therefore, we expected that newly and diverse kinds of Rhizobium would be isolated.

We could not collect nodule samples at other site where *V. marina* and *C. lineata* were growing. It was too difficult to dig out for target roots and nodules at TY9, TY10, TY12 and TY13 because of many

other plants were fully grown around the target plants. TY8 was a site at the Tanegashima Space Center of the Japan Aerospace Exploration Agency (JAXA). At TY14, Kurio beach in Yakushima, an old villager kept recounting his life history during our seed sampling. These prevented us from digging around the plants.

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種子島および屋久島におけるマメ科植物遺伝資源の探索収集，2016 年 10 月 24 日～ 28 日

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和文摘要

本報告は，2016 年 10 月 24 日～ 28 日に行った鹿児島県種子島および屋久島でのマメ科植物遺伝資源の調査報告である. 結果として, 野生ダイズ(*Glycine soja*, ツルマメ)7 点, ハマササゲ（*Vigna marina*）5 点, ハマナタマメ（*Canavalia lineata*）2 点, 合計 14 点のマメ科植物遺伝資源を収集した. また，1 点のハマササゲに着生していた根粒を収集した．海岸近くに自生していたハマササゲやハマナタマメ，またこれに着生していた根粒菌は耐塩性に優れた特性を有する可能性がある．収集したすべてのマメ科植物遺伝資源は，つくば市にある農業・食品産業技術総合研究機構　遺伝資源センター圃場で栽培し，特性評価と種子増殖を行う計画である．また，根粒からは遺伝資源センター実験室で根粒菌を単離して，栽培室におけるマメ科作物への接種試験などの特性評価を行う予定である．増殖種子および単離根粒菌は，農業・食品産業技術総合研究機構のジーンバンクで保存するとともに，研究や教育で利用するために配布可能な遺伝資源とする.

Table 3. Passport information of materials collected in Kagoshima prefecture

Col No / Map ID	JP No	Scientific name	Col Date	Status	Collection Site (Address)	Latitude	Longitude	Altitude (m)	Soil	Seed	Herbarium	Nodule	Remarks	100 seed weight (g)
TY-1	257500	*Glycine soja*	24 Oct, 2016	Wild	Noukan, Nakatanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡中種子町納官	N30˚35'07 6"	E130˚57'15 9"	49	silt	bulk	no	no	growing at a slope beside paddy field and Route 58 道路（県道 58 号）と水田の間の斜面に生育．未成熟な莢が多い.	1 0
TY-2	257423	*Glycine soja*	24 Oct, 2016	Wild	Noukan, Nakatanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡中種子町納官	N30˚35'07 6"	E130˚57'15 9"	49	silt	bulk	no	no	growing at a slope beside paddy field and Route 58 道路（県道 58 号）と水田の間の斜面に生育．実入りの良い莢（成熟前）を収集.	1 7
TY-3	257424	*Glycine soja*	25 Oct, 2016	Wild	Nakanokami, Minamitanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡南種子町中之上５２５	N30˚24'29 1"	E130˚55'10 4"	18	silt	bulk	no	no	growing at a river wall of Koorikawa near Minamitane-cho Kawauti 南種子町河内温泉センター近傍，郡川護岸の法面に生育．実入りの良い莢（成熟前）を収集.	1 5
TY-4	257425	*Glycine soja*	25 Oct, 2016	Wild	Nishino, Minamitanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡南種子町西之	N30˚21'54 6"	E130˚53'28 4"	6	silt	bulk	no	no	growing beside a small bridge over the Rokumei river in paddy land area near Route 75 県道 75 号横の水田地帯 (本村地区) 内を流れる鹿鳴川の橋の袂に生育．実入りの良い莢（成熟前）を収集. 鹿鳴川の河口付近(砂浜)に *V. marina* が繁茂していたが，開花前で種子は収集できなかった.	1 5
TY-5	257426	*Glycine soja*	25 Oct, 2016	Wild	Kukinaga, Minamitanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡南種子町茎永	N30˚23'18 7"	E130˚56'20 1"	11	silt	bulk	no	no	growing along the "Miyase river" in vast paddy land area called "Kukinaga" that is named after a trait of culm length of the traditional red rice in this area 赤米伝承の地とされる豊満神社付近の広い水田地帯（茎永：赤米の稈長が長いことに由来するとされる地名）内を流れる宮瀬川に沿って生育．TY-5 と TY-6 の間は 20m 以上離れている．実入りの良い莢（成熟前）を収集.	1 6
TY-6	257427	*Glycine soja*	25 Oct, 2016	Wild	Kukinaga, Minamitanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡南種子町茎永	N30˚23'18 6"	E130˚56'20 2"	8	silt	bulk	no	no	growing along the "Miyase river" in vast paddy land area called "Kukinaga" that is named after a trait of culm length of the traditional red rice in this area 赤米伝承の地とされる豊満神社付近の広い水田地帯（茎永：赤米の稈長が長いことに由来するとされる地名）内を流れる宮瀬川に沿って生育．TY-5 と TY-6 の間は 20m 以上離れている．実入りの良い莢（成熟前）を収集.	1 4
TY-7	257428	*Glycine soja*	25 Oct, 2016	Wild	Kukinaga, Minamitanecho,, Kumage-gun, Kagoshima 鹿児島県熊毛郡南種子町茎永	N30˚24'01 6"	E130˚56'17 7"	7	silt	bulk	no	no	growing along the middle reaches of Miyase river in north part of vast paddy land area 宮瀬川中流域，茎永地区の水田地帯の北部に生育．実入りの良い莢（成熟前）を収集.	1 8
TY-8	257429	*Vigna marina*	25 Oct, 2016	Wild	Kukinaga, Minamitanecho, Kumage-gun, Kagoshima 鹿児島県熊毛郡南種子町茎永	N30˚22'33 8"	E130˚57'48 3"	15	silt	bulk	no	no	growing in the grass park at the bottom of small hill in "Tanegashima Space Center", at a distance of about 400m from the shoreline (sandy beach) 種子島宇宙センター内の小山の麓に展開する芝地（砂混じり）に生育．海（砂浜）からの距離は約 400m．鹿鳴川河口（本村海岸）のものより生育が早く開花盛期～熟莢期であった.	5 1
TY-9	257430	*Canavalia lineata*	26 Oct, 2016	Wild	Mihamacho, Nisninoomote, Nishinoomote-shi, Kagoshima 鹿児島県西之表市西之表美浜町	N30˚44'38 6"	E130˚59'55 2"	20	silt	bulk	yes	no	growing at a vacant land near the "Kerihama park" faces the seashore (sandy beach) of "Mihama area", at a distance of about 50m from the shoreline 美浜地区の花里浜公園近くの海岸（砂浜）に面した空き地に繁茂していた．海からの距離は約 50m.	56 5

Table 3. (Continued).

Col No / Map ID	JP No	Scientific name	Col Date	Status	Collection Site (Address)	Latitude	Longitude	Altitude (m)	Soil	Seed	Herbarium	Nodule	Remarks	100 seed weight (g)
TY-10	257431	*Canavalia lineata*	26 Oct, 2016	Wild	Kusugawa, Yakushimacho, Kumage-gun, Kagoshima 鹿児島県熊毛郡屋久島町楠川	N30˚24'18 8"	E130˚36'56 9"	24	silt	bulk	no	no	growing at a vacant land between a seashore and Route 77, at a distance of about 50m from the shoreline (a rocky coast) 道路（県道 77 号）と海岸 (岩場) の間の空き地（砂利）に繁茂．海からの距離は約 50m.	75 6
TY-11	257432	*Vigna marina*	27 Oct, 2016	Wild	Harutahama, Yakushimacho, Kumage-gun, Kagoshima 鹿児島県熊毛郡屋久島町春田浜	N30˚18'03 8"	E130˚39'09 3"	15	sandy	bulk	no	yes	growing beside a garden pathe to "Harutahama" beach although not in the beach where *C. lineata* and *Lathyrus japonicus* were growing 春田浜海水浴場に続く小道沿いに繁茂．ビーチには V marina は無く，ハマナタマメとハマエンドウが生育していた.	5 0
TY-12	257433	*Vigna marina*	27 Oct, 2016	Wild	Kurio, Yakushimacho, Kumage-gun, Kagoshima 鹿児島県熊毛郡屋久島町栗生	N30˚16'04 6"	E130˚25'05 9"	18	silt	bulk	no	no	growing along a pathe between "Kuriohama" beach and a heliport of the port of "Kuriokou" although not in the beach, sympatric with *Cassytha filiformis*（Japanese name: "Sunaduru"） 栗生浜海水浴場と栗生港のヘリポートをつなぐ護岸上の小道沿いに繁茂．海水浴場には *V.marina* は無かった．スナズル（日本国内の生息地では，屋久島栗生浜が北限とされている）と同所的に分布.	5 1
TY-13	257434	*Vigna marina*	27 Oct, 2016	Wild	Kurio, Yakushimacho, Kumage-gun, Kagoshima 鹿児島県熊毛郡屋久島町栗生	N30˚16'04 6"	E130˚25'05 9"	18	silt	bulk	no	no	growing along a pathe between "Kuriohama" beach and a heliport of the port of "Kuriokou" although not in the beach, sympatric with *Ipomoea pes-caprae*（Japanese name: "Gunbaihirugao"） 栗生浜海水浴場と栗生港のヘリポートをつなぐ護岸上の小道沿いに繁茂．TY11 とは 20m 以上離れており，TY12 の方がヘリポート寄り．グンバイヒルガオと同所的に分布.	6 3
TY-14	257435	*Vigna marina*	27 Oct, 2016	Wild	Kurio, Yakushimacho, Kumage-gun, Kagoshima 鹿児島県熊毛郡屋久島町栗生	N30˚16'04 4"	E130˚25'02 3"	8	sandy	bulk	no	no	growing at a narrow sandy beach remains in the sea front of the "Kuriokou" heliport 栗生港のヘリポート前面に残された砂浜に生育.	5 3

Photograph 1. Habitat of *G. soja* (TY-1, 2), Noukan, Nakatanecho, Kumage-gun, Kagoshima

Photograph 2. Plant and pods of *G. soja* (TY-2), Noukan, Nakatanecho, Kumage-gun, Kagoshima

Photograph 3. Habitat of *G. soja* (TY-3), Nakanokami, Minamitanecho, Kumage-gun, Kagoshima

Photograph 4. Plant and pods of *G. soja* (TY-3), Nakanokami, Minamitanecho, Kumage-gun, Kagoshima

Photograph 5. Geographical environment of a search location, Motomurakaigan, Nakanoshimo, Minamitanecho, Kumage-gun, Kagoshima (r1 in Fig. 1)

Photograph 6 *V. marina* at flowering stage (setting no seed), Motomurakaigan, Nakanoshimo, Minamitanecho, Kumage-gun, Kagoshima (r1 in Fig. 1)

Photograph 7. *C. lineata* at vegetative growth stage in a bush of *Juniperus conferta*, at Motomurakaigan (r2 in Fig. 1)

Photograph 8. Habitat of *G. soja* (TY-4), beside Rokumeigawa river, Nishino, Minamitanecho, Kumage-gun, Kagoshima

Photograph 9. Plant and pods of *G. soja* (TY-4), Nishino, Minamitanecho, Kumage-gun, Kagoshima

Photograph 10. *Lotus japonicus* at Kadokura headland (r3 in Fig. 1), Nishino, Minamitanecho, Kumage-gun, Kagoshima

Photograph 11. Habitat of *G. soja* (TY-5), beside Miyasegawa river, Kukinaga, Minamitanecho, Kumage-gun, Kagoshima

Photograph 12. Plant and pods of *G. soja* (TY-5), Kukinaga, Minamitanecho, Kumage-gun, Kagoshima

Photograph 13. Plant and pods of *G. soja* (TY-7), Kukinaga, Minamitanecho, Kumage-gun, Kagoshima

Photograph 14. Habitat of *V. marina* (TY-8) in a grass park beside Tanegashima Space Center, Kukinaga, Minamitanecho, Kumage-gun, Kagoshima

Photograph 15. Pods of *V. marina* (TY-8), in a grass park beside Tanegashima Space Center, Kukinaga, Minamitanecho, Kumage-gun, Kagoshima

Photograph 16. Ecological environment of a search location beside fallow fields, Hirayama, Minamitanecho, Kumage-gun, Kagoshima (r4 in Fig. 1)

Photograph 17. Geographical environment of a search location at Kumano beach, Hirayama, Minamitanecho, Kumage-gun, Kagoshima (r5 in Fig. 1)

Photograph 18. Plants of a *Amphicarpaea bracteata* found in a rice paddy area, Furuta, Nishinoomote-shi, Kagoshima (r7 in Fig. 1)

Photograph 19. Habitat of *C. lineata* (TY-9), Mihamacho, Nishinoomote, Nishinoomote-shi, Kagoshima

Photograph 20. Plant and pods of *C. lineata* (TY-9), Mihamacho, Nishinoomote, Nishinoomote-shi, Kagoshima

Photograph 21. Geographical environment of a search location at Urata beach, Kunigami, Nishinoomote-shi, Kagoshima (r8 in Fig. 1)

Photograph 22.Dominant specieses in a search location at Urata beach, Kunigami, Nishinoomote-shi, Kagoshima (r8 in Fig. 1)

Photograph 23. Geographical environment of a saerch location at Kishikasaki headland, Kunigami, Nishinoomote-shi, Kagoshima (r9 in Fig. 1)

Photograph 24. *C. lineata* at vegetative growth stage at Kishikasaki headland, Kunigami, Nishinoomote-shi, Kagoshima (r9 in Fig. 1)

Photograph 25. Geographical environment of a search location at a beach of Iseki, Nishinoomote-shi, Kagoshima (r10 in Fig. 1)

Photograph 26. Plants of *Ipomoea pes-caprae*, a dominant species around r10 in Fig. 1, Iseki, Nishinoomote-shi, Kagoshima

Photograph 27. Georaphical environment of a search location at other beach of Iseki, Nishinoomote-shi, Kagoshima (r11 in Fig. 1)

Photograph 28. A fallow field where *Crotalaria assamica* has dominantly grown, Koseda, Yakushimacho, Kumage-gun, Kagoshima (r12 in Fig. 1)

Photograph 29. Habitat of *C. lineata* (TY-10), Kusugawa, Yakushimacho, Kumage-gun, Kagoshima

Photograph 30. Pods of *C. lineata* (TY-10), Kusugawa, Yakushimacho, Kumage-gun, Kagoshima

Photograph 31. Ecological environment of search location in a rice paddy area, Nagata, Yakushimacho, Kumage-gun, Kagoshima (r13 in Fig. 1)

Photograph 32. Geographical environment of a search location at Nagata-Inakahama beach, Nagata, Yakushimacho, Kumage-gun, Kagoshima (r14 in Fig. 1)

Photograph 33. Ecological environment of large fallow fields, Kusugawa, Yakushimacho, Kumage-gun, Kagoshima (r15 in Fig. 1)

Photograph 34. Ecological environment beside a turmeric field, Tabugawa, Yakushimacho, Kumage-gun, Kagoshima (r16 in Fig. 1)

Photograph 35. Ecological environment of large fallow fields, Funayuki, Yakushimacho, Kumage-gun, Kagoshima (r17 in Fig. 1)

Photograph 36. A small kitchen garden in large fallow fields, Funayuki, Yakushimacho, Kumage-gun, Kagoshima (r17 in Fig. 1)

Photograph 37. Habitat of *V. marina* (TY-11), Harutahama beach, Yakushimacho, Kumage-gun, Kagoshima

Photograph 38. Flowers and a young pod of *V. marina* (TY-11), Harutahama beach, Yakushimacho, Kumage-gun, Kagoshima

Photograph 39. Symbiotic root nodules occured on the roots of *V. marina* (TY-11), Harutahama beach, Yakushimacho, Kumage-gun, Kagoshima

Photograph 40. Collected root nodules of *V. marina* (TY-11), Harutahama beach, Yakushimacho, Kumage-gun, Kagoshima

Photograph 41. Geographical environment of a search location at Nakamahama beach, Nakama, Yakushimacho, Kumage-gun, Kagoshima (r18 in Fig. 1)

Photograph 42. Geographical environment of Kurio beach where *V. marina* were grown (TY-12 ~ 14), Kurio, Yakushimacho, Kumage-gun, Kagoshima

Photograph 43. Ecological environment of habitat of *V. marina* (TY-12), Kurio beach, Kurio, Yakushimacho, Kumage-gun, Kagoshima

Photograph 44. Ecological environment of habitat of *V. marina* (TY-13), Kurio beach, Kurio, Yakushimacho, Kumage-gun, Kagoshima

Photograph 45. Flowers and young pods of *V. marina* (TY-13), Kurio beach, Kurio, Yakushimacho, Kumage-gun, Kagoshima

Photograph 46. Ecological environment of habitat of *V. marina* (TY-14), Kurio beach, Kurio, Yakushimacho, Kumage-gun, Kagoshima

TY-1, JP257500, *Glycine soja*

TY-2, JP257423, *Glycine soja*

TY-3, JP257424, *Glycine soja*

TY-4, JP257425, *Glycine soja*

TY-5, JP257426, *Glycine soja*

TY-6, JP257427, *Glycine soja*

TY-7, JP257428, *Glycine soja*

TY-8, JP257429, *Vigna marina*

TY-9, JP257430, *Canavalia lineata*

TY-10, JP257431, *Canavalia lineata*

TY-11, JP257432, *Vigna marina*

TY-12, JP257433, *Vigna marina*

TY-13, JP257434, *Vigna marina*

TY-14, JP257435, *Vigna marina*