

Collection and Conservation of Leguminous Crops and Their Wild Relatives in Western Nepal from October 29 to November 10, 2016

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Summary

This is the first report on the collaborative collection and conservation of legume genetic resources in Nepal under the agreement between the National Agriculture Genetic Resources Center (NAGRC), Nepal Agricultural Research Council (NARC), Nepal, and the Genetic Resources Center (GRC), National Agriculture and Food Research Organization (NARO), Japan. Three wild *Vigna* species, *Vigna hirtella* Ridley (a close relative of azuki bean), *Vigna radiata* (L.) Wilcz. var. *sublobata* (Roxb.) Verdc. (wild ancestor of mung bean) and *Vigna sahyadriana* Aitawade, K. V. Bhat & S. R. Yadav (formerly recorded only from Northern Western Ghats, Maharashtra, India), were recorded for the first time in Nepal. In addition, *Vigna angularis* (Willd.) Ohwi & Ohashi var. *nipponensis* (Ohwi) Ohwi & Ohashi (wild ancestor of azuki bean) was recorded for the first time in Western Nepal.

A field survey was conducted in Western Nepal from October 29 to November 10, 2016. A total of 68 samples were recorded in Nepal and 67 seed materials were collected (no seeds were collected for sample N62) and conserved in the gene bank at NAGRC, Nepal. A subset was transferred to the GRC

(NARO Genebank), Japan, using the Standard Material Transfer Agreement (SMTA) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR). In Japan, introduced samples were separated and registered as 97 accessions (no seeds for N62) based on the differences of species (N25 contained *Vigna radiata* and *Vigna mungo*), seed coat colors and/or seed sizes. These accessions consisted of 15 species from eight genera, including soybean, common bean, azuki bean, mung bean, and the four wild *Vigna* species mentioned above. NARO Genebank plans to evaluate the growth characters of the collected materials and to propagate using these seeds in the summer of 2017. Multiplied seeds will be conserved and distributed upon request for agricultural research, breeding, and educational purposes.

KEY WORDS: legume, *Vigna*, genetic resources, collection, Nepal

Introduction

Nepal exhibits extreme variations in topography, climate, and agriculture; therefore, living organisms have become diversified in the course of adaptation to such environmental diversity (Gupta 2012). Nepal borders India and China, and is made up of three regions; the mountainous region (altitude: 3,000 - 8,848 m) in the north, the hilly region (altitude: 1,000 - 3,000 m) in the central part, and the Terai region (altitude: 60 - 1,000 m) in the south. Although climate depends on latitude, longitude, and altitude, the most dominant climate is Cwa - temperate with a dry winter and a hot summer, according to the Köppen climate classification (Karki *et al.* 2016, World maps of Köppen - Geiger climate classification). The Nepal investment guide 2016 stated that 81% of the Nepali population is Hindu; many residents are therefore vegetarians (Government of Nepal 2016). For this reason, legume crops are highly important as they constitute the main source of protein (Messina 2014). Based on the diverse agro-environmental conditions, and the importance of legume crops as the main protein source, considerable diversity in legume crops in Nepal is expected. We therefore undertook a collection of legume crops in Nepal.

Recently, the collection and conservation of wild relatives of crop plants have become increasingly important, because of their high potential as sources of biotic and abiotic stress-tolerance genes for breeding. However, many wild relatives of crop plants currently face high risk of extinction (Castañeda-Álvarez *et al.* 2016). To cope with this problem, the Global Crop Diversity Trust and the Millennium Seed Bank of the Royal Botanic Gardens, Kew have launched the project “Crop Wild Relatives” in agreement with national and international gene banks. Considering the importance of wild relatives of crop plants in Nepal, the NAGRC, NARC, Nepal joined the project (<https://www.cwrdiversity.org/malaysia-nepal-and-ghana-visits/>). The information on the flora of Nepal can be obtained from the “Catalogue of Nepalese Flowering Plants” edited by the National Herbarium and Plant Laboratories, Ministry of Forests and Soil Conservation, Government of Nepal. Based on this publication, only *Vigna angularis* (Willd.) Ohwi & Ohashi var. *nipponensis* (Ohwi) Ohwi & Ohashi was listed as a wild *Vigna* species in Nepal. Collection and conservation of wild *Vigna* plants are two of the main objectives of our collaborative survey in Nepal. This is the first report on the collaborative collection and conservation of legume genetic resources between the NARO Genebank, Japan, and NAGRC gene bank, Nepal.

Method

A field survey was conducted in Western Nepal from October 29 to November 10, 2016 (Table 1), just after the summer crops were harvested in the hilly region. The harvest of summer crops had not

Table 1. Itinerary of the field survey in Western Nepal, 2016

Date	Itinerary	Stay	
		District	Zone
27-Oct	Haneda 00:30 -- (NH0849) -- 05:00 Bangkok 10:15 -- (TG319) -- 12:25 Kathmandu	Kathmandu	Bagmati
28-Oct	visit NAGRC and prepare exploration	Kathmandu	Bagmati
29-Oct	Kathmandu 11:00 -- (Buddha air 405) -- 12:00 Nepalgunj	Nepalgunj	Bheri
30-Oct	Nepalgunj	Nepalgunj	Bheri
31-Oct	Nepalgunj -- (Tara air) -- Jumla	Jumla	Karnali
01-Nov	Jumla	Jumla	Karnali
02-Nov	Jumla - Dailekh	Dailekh	Dailekh
03-Nov	Dailekh - Nepalgunj	Nepalgunj	Bheri
04-Nov	Nepalgunj - Dhangadhi	Dhangadhi	Kailali
05-Nov	Dhangadhi - Dadeldhura	Dadeldhura	Seti
06-Nov	Dadeldhura - Baitadi	Baitadi	Mahakali
07-Nov	Baitadi - Dadeldhura	Dadeldhura	Seti
08-Nov	Dadeldhura -Dipayal - Dadeldhura	Dadeldhura	Seti
09-Nov	Dadeldhura - Dhangadhi	Dhangadhi	Kailali
10-Nov	Dhangadhi 13:30 -- (Buddha air 252) -- 14:45 Kathmandu	Kathmandu	Bagmati
11-Nov	NAGRC (seed cleaning, packing, making lists)	Kathmandu	Bagmati
12-Nov	NAGRC (seed cleaning, packing, making lists)	Kathmandu	Bagmati
13-Nov	NAGRC (seed cleaning, packing, making lists)	Kathmandu	Bagmati
14-Nov	Kathmandu 13:55 -- (TG320) -- 18:30 Bangkok 22:55 -- (NH0850) --	on flight	
15-Nov	-- 06:30 Haneda, move to Tsukuba	-	-

-- : travel by air plane, flight number indicated in the parenthesis

- : travel by car

yet taken place in the Terai region. Bheri, Karnali, Dailekh, Seti and Mahakali Zones of Western Nepal were surveyed. During this survey, we collected leguminous crops from farmers and markets, as well as crop wild relatives of the genus *Vigna*, which we found in their natural habitat. We recorded the latitude, longitude, and altitude. Identification of the *Vigna* species was based on a taxonomic key (Tomooka *et al.* 2002; Aitawade *et al.* 2012).

Results and discussion

In all, 68 samples were recorded (no seeds for N62) in Nepal, and 67 seed materials were conserved in the gene bank of NAGRC, Nepal (Table 2, Fig. 1). A subset was transferred to the GRC (NARO Genebank), Japan, using the SMTA of ITPGR. In Japan, introduced samples were separated and registered as 97 accessions based on the differences of species (N25 contained *Vigna radiata* and *Vigna mungo*), seed coat colors and/or seed sizes (Table 3). These accessions consisted in 15 species from eight genera, including soybean, common bean, azuki bean, mung bean, and 4 wild *Vigna* species - *Vigna angularis* var. *nipponensis* (wild ancestor of azuki bean), *V. hirtella* Ridley, *V. radiata* (L.) Wilcz. var. *sublobata* (Roxb.) Verdc. (wild ancestor of mung bean), and *V. sahyadriana* Aitawade, K. V. Bhat & S. R. Yadav. The altitude of the collection sites ranged from 140 to 2,359 m. Three crop wild relatives, *Vigna hirtella*, *Vigna radiata* var. *sublobata* and *Vigna sahyadriana* (formerly recorded only from Northern Western Ghats, Maharashtra,

Table 2. Number of collected samples in Western Nepal and accessions registered at NARO Genebank, Japan

Scientific name (common name)	Crop (Cultivated)	Naturally growing plant		No. of samples collected in Nepal	No. of accessions in NARO genebank *
		Intermediate form	Wild form		
<i>Cicer arietinum</i> (chick pea)	1	-	-	1	1
<i>Glycine max</i> (soybean)	12	-	-	12	19
<i>Lablab purpureus</i> (hyacinth bean)	2	-	-	2	3
<i>Lathyrus sativus</i> (grass pea)	1	-	-	1	1
<i>Lens culinaris</i> (lentil)	1	-	-	1	1
<i>Macrotyloma uniflorum</i> (horse gram)	1	-	-	1	1
<i>Phaseolus coccineus</i> (scarlet runner bean)	1	-	-	1	2
<i>Phaseolus vulgaris</i> (common bean)	11	-	-	11	22
<i>Vigna angularis</i> (azuki bean)	4	-	4	8	9
<i>Vigna mungo</i> (black gram)	9	-	-	9	9
<i>Vigna hirtella</i> (wild relative of azuki bean)	-	-	1	1	1
<i>Vigna radiata</i> (mung bean)	2	-	1	3	5
<i>Vigna sahyadriana</i> (wild relative of mung bean)	-	-	1	1	1
<i>Vigna umbellata</i> (rice bean)	3	1	-	4	8
<i>Vigna unguiculata</i> (cowpea / yardlong bean)	11	-	-	11	14
Total	59	1	7	67	97

* When collected samples were registered as accessions at NARO Genebank, Japan, some samples were separated based on species, seed color, and seed size.

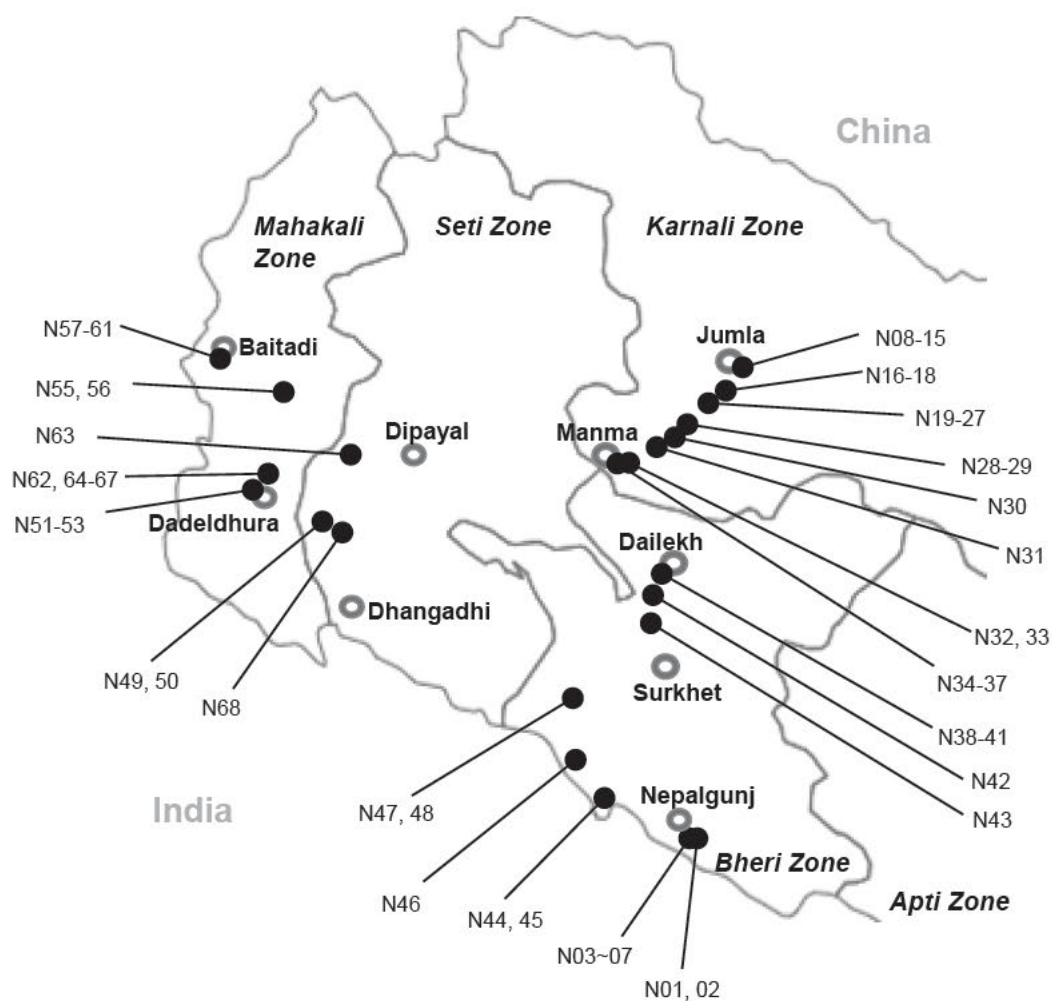


Fig. 1. Collection map in Western Nepal
(collection site of N54, not shown, It is was between Dadeldhura and Baitadi)

India, Aitawade *et al.* 2012), were found for the first time in Nepal (Rajbhandari *et al.* 2011). In addition, *Vigna angularis* var. *nipponensis* was collected for the first time in Western Nepal.

We next describe the details of each collection (Table 3) and summarize the characteristics of each species collected.

Crops

***Glycine max* (L.) Merr., Interpr. Herb. Amb.: 274 (1917): Soybean**

Soybean is an annual legume crop domesticated in East Asia from a wild ancestor, *Glycine max* (L.) Merr. subsp. *soja* (Sieb. & Zucc.) Ohashi (= *Glycine soja* Sieb. & Zucc.). It is cultivated mainly in Asian and American countries. Its wild ancestor has a twinning habit, dormant seeds, shattering pods, and blackish flat small seeds, while soybean has domestication traits, such as an erect habit, non-dormant seeds, non-shattering pods, and roundish larger seeds of various colors.

Soybean collections in this survey included traditional and modern cultivars. Their 100-seed weight ranged from 5.3 to 39.1 g. Sample 'N17', collected in Jumla, has the smallest seeds with blackish and flat morphology (Seed Photograph N17). In Jumla, a traditional cultivar with a twinning tendency was found, which had already been harvested and used as cattle feeds (Photograph 1). It appears to have had shattering pods because dried pods exhibited a strong twist (Photograph 2). As described above, although traditional cultivars with primitive traits were found in the hilly region, modern cultivars were sold in the markets of Kathmandu and Nepalgunj (Photograph 3).

***Phaseolus vulgaris* L., Sp. Pl.: 723 (1753): Common bean**

Common bean is an annual legume crop that has been domesticated at least twice, in Mesoamerica, and in South America, from a wild ancestor, *Phaseolus vulgaris* var. *aborigineus* (Burk.) Baudet. (Schmutz *et al.* 2014). Partly because of independent domestication at two different locations, common bean shows extreme variations for seed size. It is cultivated mainly in Africa and the Americas.

In Jumla, common beans with different seed-coat color (N-8) were sold together in the same sack (Photograph 4). This sample was separated into seven accessions in Japan, based on seed-coat color (Seed Photograph N8-1 - N8-7). Similarly, a common bean that was piled up for drying beside a farm house also showed various seed-coat colors (Photograph 5). Farmers appeared to cultivate common bean plants with different seed colors together in the same field.

In Jumla, the regional office of NARC performs breeding of common bean and distributes selected lines to local farmers (Photograph 6). Even in rural areas, the use of modern cultivars seems to be increasing and replacing traditional cultivars. Consequently, the collection and preservation of traditional common bean cultivars have become urgent tasks to facilitate future breeding.

***Vigna angularis* (Willd.) Ohwi & Ohashi, J. Jap. Bot. 44: 29 (1969): Azuki bean**

Azuki bean is an annual legume crop domesticated in East Asia from the wild ancestor, *Vigna angularis* (Willd.) Ohwi & Ohashi var. *nipponensis* (Ohwi) Ohwi & Ohashi (Tomooka *et al.* 2014). This species seems to have the highest level of cold-tolerance among *Vigna* crops, judging from its geographical distribution. Azuki bean is cultivated even in the areas classified as Dfb, Warm-summer humid continental climate, in the Köppen climate classification (for example, in Hokkaido, the northernmost island of Japan).

In this survey, azuki bean was found only in the hilly region. Four samples were collected from

Jumla and Baitadi districts. In Jumla, farmers stocked red and pale brown azuki bean seeds mixed together (N16-1, N16-2). In Baitadi, azuki bean with pale brown seeds was sold in local shop (N55 and N57). One hundred-seed weight ranged from 5.2 - 6.2 g. In both areas, azuki bean was called 'guras'. The altitude of collection sites ranged from 1,616 to 2,305 m, and these areas are classified as Cwa, Monsoon-influenced humid subtropical climate, or Cwb, Subtropical highland climate or temperate oceanic climate with dry winters, according to the Köppen climate classification (Karki *et al.* 2016).

In our former study on azuki bean SSR and morphological diversity (Xu *et al.* 2008), azuki bean accessions from Eastern Nepal and Western Nepal showed different SSR profiles and seed morphology. Azuki bean accessions from Eastern Nepal showed similar SSR and seed morphology to those from Bhutan. This group showed a unique SSR profile and small red or tan seed. In contrast, accessions from Western Nepal showed SSR profile similar to Chinese accessions, and seeds were larger with a pale, creamy yellow seed-coat. This result indicates that azuki bean accessions from Western Nepal reported in that study are cultivars recently introduced from China. Therefore, Xu *et al.* (2008) have considered that the westernmost traditional azuki bean cultivation area is Eastern Nepal.

However, seed size and seed-coat color of the azuki bean accessions collected in this survey seem to be similar to those of Eastern Nepal - Bhutan group. This suggested that traditional azuki bean cultivation expanded to Western Nepal (up to Baitadi where 'N57' was collected). As the Indian Himalaya area neighboring Western Nepal has a similar climate and formerly belonged to Nepal, it is possible that traditional cultivars of azuki bean are also cultivated in this area (Uttarakhand and Himachal Pradesh provinces, India). We believe we should conduct an exploration for azuki bean genetic resources in northern India, in the areas classified as Cwa and Cwb, according to the Köppen climate classification.

***Vigna mungo* (L.) Hepper Kew Bull. 11:128 (1956): Black gram**

Black gram was domesticated in India from the wild ancestor *V. mungo* var. *silvestris* Lukoki, Maréchal & Otoul (Chandel *et al.* 1984). According to the herbarium specimen survey in Europe, wild black gram has not been collected in Nepal (Tomooka *et al.* 2002).

In this survey, we confirmed black gram cultivation in both Terai and hilly regions (within an altitude range from 172 to 2,295 m). In the Terai region, it was cultivated on the ridge of a paddy field (N47, Bardiya district). As plants were still at the pre-mature stage, we could not collect seed samples. However, we did seed harvested seeds stored in farm storage in the hilly region (Jumla, Kalikot, Dailekh districts). In Dadeldhura district (hilly region), harvested plants were hung on a tree beside the farmland for drying (N65). The community seed bank manager at Dadeldhura told us that farmers in this area grew black gram, but not mung bean, because the area is too cold for mung bean production.

In the market in Nepalgunj, we purchased seed samples of several kinds of beans. The price of black gram was 220 Rs/kg, which is higher than that of soybean (100 Rs/kg), common bean (140 Rs/kg) and mung bean (200 Rs/kg). The price of chickpea was the highest (300 Rs/kg) in this market. The shopkeeper told us that chickpea price was high at this time (Tihar festival), because this bean is used in the Tihar celebrations.

***Vigna radiata* (L.) Wilczek, Fl. Congo Belge 6: 386 (1954): Mung bean**

Mung bean is an annual legume crop domesticated in Southern Asia from wild ancestor *Vigna radiata* (L.) Wilcz. var. *sublobata* (Roxb.) Verdc. (Sangiri *et al.* 2007). It is cultivated throughout Africa,

Asia, and Oceania. Because it has high drought tolerance and needs only a short growing period to reach maturity, it is used as a component crop in various cropping systems. The 100-seed weight of the cultivars with the largest seeds in the world is approximately 10 g.

Three samples were collected. One sample (N3) was collected from a local market in Nepalgunj. It has a shiny green seed coat. The other two samples (three accessions) were collected from a farmer stock in Jumla district (N24-1, N24-2, N25-1). They have green, green with black mottle and black seeds, respectively. The 100-seed weight of the mung bean samples collected in this survey ranged from 1.9 to 3.4 g. Since the wild ancestor has a 100-seed weight of 1 to 3 g, seed size of mung bean has not increased much in Western Nepal. Nonetheless, these primitive cultivars may have some desirable traits such as disease, drought, and/or low-temperature tolerance.

***Vigna umbellata* (Thunb.) Ohwi & Ohashi, J. Jap. Bot. 44:31 (1969): Rice bean**

Rice bean is believed to have been domesticated in Southeast Asia and is cultivated in South, Southeast Asia, and on the Pacific islands (Duke 1981; Isemura *et al.* 2010, 2011). Wild rice bean distributes naturally from southern China through the north of Vietnam, Laos, and Thailand into Myanmar and India (FOSRIN project web page, Ohashi *et al.* 1988). Based on the genetic diversity study using SSR markers, Nepal is one of the worldwide diversity centers for domesticated rice bean (Tian *et al.* 2013). Tian *et al.* (2013) also clarified that many accessions from western regions were quite distinct from any other, and formed a specific group. These Nepalese accessions could be considered a unique gene source for rice bean breeding. In contrast, eastern Nepalese accessions showed SSR profiles similar to those of Southeast Asian rice beans.

In this survey, we found several plants (N64) growing naturally on a roadside slope near Dadeldhura (altitude 1,142 m). The plants produced seeds with different seed-coat color and seed size (Seed photograph, N64-1, 64-2, 64-3). This population seemed to be a hybrid swarm between wild and domesticated plants. For domesticated rice bean, we collected harvested seed samples from farm storages (N33, N37, N40) in the hilly region (Kalikot district, altitudes 1,142 - 1,550 m). In contrast, rice bean plants cultivated in the Terai region, by mixed cropping with sorghum or grown on a ridge of a paddy field, were still at the pre-mature stage.

***Vigna unguiculata* (L.) Walp., Rep. I:779 (1842): Cowpea & Yard long bean**

Cowpea was domesticated in Africa from *V. unguiculata* subsp. *dekindtiana* (Harms) Verdc. (Ng and Maréchal 1985). The diversity center of domesticated cowpea is located in Central and West Africa, and its cultivation spread to Asia in ancient times. Maréchal *et al.* (1978) described four cultivar groups, of which the following three were cultivated in Asia, 1) *V. unguiculata* cv-gr. Unguiculata E. Westphal, mainly used as dry seeds, 2) *V. unguiculata* cv-gr. Biflora E. Westphal, which has short pods and small seeds, 3) *V. unguiculata* cv-gr. Sesquipedalis E. Westphal (yard long bean), which has long soft pods used as vegetable. However, in our experience, there are cultivars that are difficult to assign to a certain cultivar group. Among the 11 samples collected, we classified nine samples as cv-gr. Unguiculata and two samples as cv-gr. Sesquipedalis.

We observed cowpea and yard long bean cultivation in the Terai region. On the other hand, as the summer cropping season had already ended, we did not see cultivation of cowpea or yard long bean in the hilly region; nonetheless, although we could not confirm where seeds were produced, we did collect

cowpea seed samples from local markets in this region.

Other crops

In addition to the above, we collected chickpea (*Cicer arietinum* L.), lablab bean (*Lablab purpureus* (L.) Sweet), grass pea (*Lathyrus sativus* L.), lentil (*Lens culinaris* Medik.), horse gram (*Macrotyloma uniflorum* (Lam.) Verdc.) and scarlet runner bean (*Phaseolus coccineus* L.) (Tables 2 and 3).

Wild Vigna

***Vigna angularis* (Willd.) Ohwi & Ohashi var. *nipponensis* (Ohwi) Ohwi & Ohashi, J. Jap. Bot. 44: 30 (1969): Wild ancestor of azuki bean**

Vigna angularis var. *nipponensis* is a wild legume characterized by its yellow flowers, curved keel, hypogeal germination, petiolate cordate-shaped primary leaves, hairy leaves, hairless pods, and grayish brown seeds with black spots (Tomooka *et al.* 2002). Based on these traits, it is classified in the section *Angulares* in the subgenus *Ceratotropis*. *Vigna angularis* var. *nipponensis* has a twinning habit, dormant seeds, shattering pods, and smaller seeds.

Vigna angularis var. *nipponensis* showed phenotypic variation among samples in Western Nepal. They inhabited rocky roadside slopes and pine-forests floor, where grasses grow (Photographs 8 and 9). Pod lengths ranged from 4.7 ± 0.3 to 6.5 ± 0.5 cm (Photograph 10). The darkness of their seed coats differed among samples (Fig. 2). Accession 'N43' produced short pods ranging from 1 to 2 cm near the soil surface (Photograph 11). It seems that they produce bi-morphic pods, long pods on aerial shoots and short pods on lateral shoots near ground level. Bi-morphic pods of this type were reported in *Vigna yadavii* S. P. Gaikwad, R. D. Gore, S. D. Randive & K. U. Garad and *Vigna pandeyana* RD Gore, SP Gaikwad & SD Randive (Gaikwad *et al.* 2014, 2015). This bi-morphic pod production might result from adaptation to the slope habitat. In other words, by producing short pods near the soil surface (or sometimes under the ground), plants emerged from seeds of short pods might be able to grow at the same site even in the steep habitat where dispersed seeds are likely to roll down.

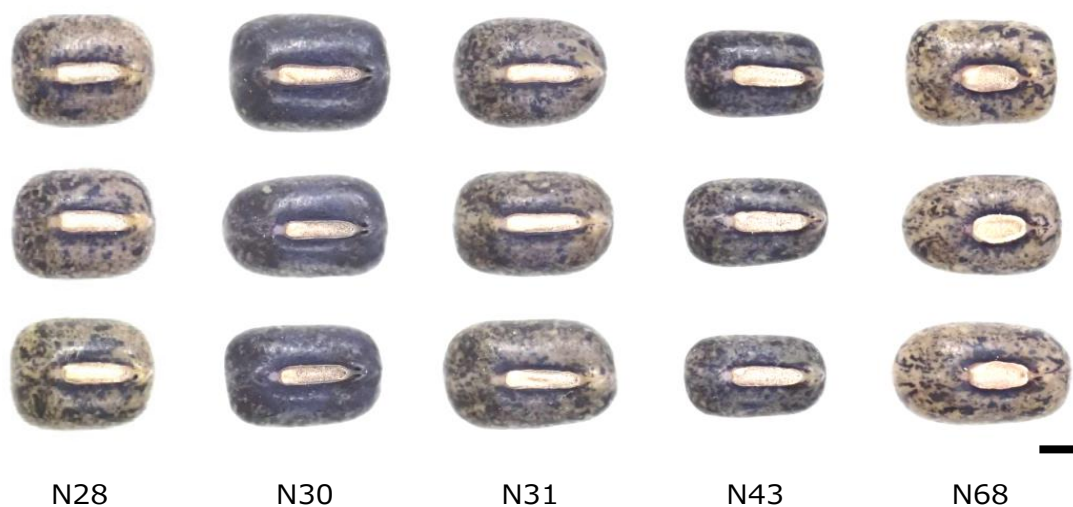


Fig. 2. Seeds of *V. angularis* var. *nipponensis* (N28, 30, 31, 43) and *V. hirtella* (N68). Scale bar = 1mm

***Vigna hirtella* Ridley, J. Fed. Malay States Mus. 10: 132. (1920)**

Vigna hirtella was recorded for the first time in Nepal in this survey. We found one population of *V. hirtella* 'N68' at an altitude of 1,428 m. *V. hirtella* plants were growing on a slope along a hill trail near Phaltude in Doti district (Photograph 12). They had ovate acuminate leaflets and hairy stems which were twinning on other plants in a bush (Photograph 13). They had long pods (8.4 ± 0.4 cm) (Photograph 14) and a short seed hilum, compared to *V. angularis* var. *nipponensis* (Fig. 2).

The taxonomic treatment of *V. hirtella* is still confusing. Based on the molecular studies of the accessions currently conserved as *V. hirtella* in the NARO genebank, it was suggested that *V. hirtella* is a species complex consisting of 3 groups (Seehalak *et al.* 2006; Tomooka *et al.* 2006; Chankaew *et al.* 2014). It is therefore necessary to reveal whether clear morphological differences exist among these groups differentiated at the molecular level.

***Vigna radiata* (L.) Wilcz. var. *sublobata* (Roxb.) Verdc. Kew Bull. 24:559 (1970): Wild ancestor of mung bean**

Vigna radiata var. *sublobata* is a wild ancestor of mung bean. This wild legume is found in Africa, Asia, and Oceania. However, it has not been reported in Nepal (Tomooka *et al.* 2002). It is characterized by its pale greenish yellow flowers, curved keel, epigeal germination, petiolate lanceolate primary leaves, hairy leaves, and pods, as well as a blackish, rough seed coat. Wild mung bean is considered a useful genetic resource for mung bean breeding, since it has wide geographical distribution and has adapted to diverse environments.

In this survey, we found two *V. radiata* var. *sublobata* populations for the first time in Nepal. The collection site was a roadside slope east of Dadeldhura, in Dadeldhura district. The altitudes were 1,022 m and 1,114 m, respectively. On these sites, the plants were at post maturity stage, thus, many of their seeds had already dispersed due to pod shattering (Photograph 15). Therefore, we collected only nine shriveled seeds for 'N66', and none for 'N62'.

***Vigna sahyadriana* Aitawade, K. V. Bhat & S. R. Yadav, Rheedeia 22: 1 (2012): Wild relative of black gram and mung bean**

In this survey, a population of *V. sahyadriana* ('N29') was identified for the first time in Nepal. *V. sahyadriana* is a wild legume recently described in India by Aitawade *et al.* (2012), who reported that its distribution was confined to the Northern Western Ghats, Maharashtra, India. This species is most closely related to black gram (*V. mungo*), based on the DNA sequence analysis (Takahashi *et al.* 2016).

Plants of *V. sahyadriana* were found on a rocky roadside slope along a valley in Kalikot district. They had hairy pods, peltate lanceolate stipules and a developed seed hilum (Photograph 16). Our discovery expanded the geographical distribution of *V. sahyadriana* much further northeast than previously thought (Takahashi *et al.* 2016).

Useful traits of *V. sahyadriana* have not been studied yet. For this reason, we are going to evaluate its growth characteristics and stress tolerances.

Future perspectives

Since this survey was conducted in late autumn (late October to early November), summer crops had been harvested and many wild plants were at the post-maturity stage or had already dried out in the hilly

region. Thus, it was too late to observe crops cultivated in the fields and to collect mature seeds of wild legumes. Therefore, we propose that late September to early October is an appropriate time for exploration and collection of legumes in the hilly region in Western Nepal. In contrast, in the Terai region, some leguminous crops, such as rice bean and black gram, did not reach the maturity stage, and we therefore could not collect mature seeds. Therefore, mid-November to late November would be a more suitable time for collection of summer legumes in this region.

The 68 samples collected in this survey were conserved at the NAGRC genebank, Nepal and a subset was transferred to the NARO Genebank, Japan under the SMTA. NARO Genebank plans to multiply the seeds during the summer in 2017, and to conserve them as genetic resources for research and breeding programs.

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ネパール西部におけるマメ科作物および その近縁野生種の収集・保全， 2016年10月29日～11月10日

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和文摘要

これはネパール農業研究評議会（NARC）国立農業遺伝資源センター（NAGRC）と農業・食品産業技術総合研究機構（NARO）遺伝資源センター（GRC）との合意に基づき、ネパールにおいて実施したマメ科植物遺伝子資源の共同収集および保全に関する最初の報告である。本共同探索において、3種類のササゲ属野生種、*Vigna hirtella* Ridley（アズキの近縁種）、*Vigna radiata* (L.) Wilcz. var. *sublobata* (Roxb.) Verdc.（リョクトウの祖先野生種）および *Vigna sahyadriana* Aitawade, K. V. Bhat & S. R. Yadav（これまでに、この種はインドマハラシュトラ州北西ガーツ山脈においてのみ確認されている。）をネパールで初めて確認した。また、ネパール西部において、*Vigna angularis* (Willd.) Ohwi & Ohashi var. *nipponensis* (Ohwi) Ohwi & Ohashi（アズキの祖先野生種）も初めて確認した。

10月29日から11月10日までのネパール西部における現地探索において、合計68のマメ科植物遺伝資源を発見し、種子が得られなかったN62を除く67の遺伝資源をNAGRCのジーンバンクに入庫した。そのサブセットを食料及び農業のための植物遺伝資源に関する国際条約の標準材料移転契約に基づき、GRC（NAROジーンバンク）に移管した。日本において、種（N25はリョクトウとケツルアズキを含んでいた）、種皮色や種子サイズの違いに基づいて、導入した67の遺伝資源を97系統に分類し、これらをジーンバンクに登録した。本探索において、ダイズ、インゲンマメ、アズキ、リョクトウおよび上記4種のササゲ属野生種を含む8属の15種の遺伝資源を収集した。NAROのジーンバンクでは、2017年夏季にこれら遺伝資源の生育特性を評価するとともに、これらの種子を増殖する計画である。増殖した種子は保存し、農業研究、育種および教育目的のために配布する計画である。

Table 3. Passport data of plant materials collected or recorded in Western Nepal, 2016

No	Col No	JP No (Accession No)	Scientific Name	Local Name	Col Date	Status	Col Site	Latitude	Longitude	Altitude (m)	Remarks
1	N1	257502	<i>Vigna unguiculata</i>	Kartik Bodi	2016/10/30	Landrace	south of the airport, farmland, Manikapur, Nepalgunj	N28-5-46 00	E81-39-54 40	155	Kartik is a name of month (October-November), longer pod compared with JP257503, soft pod
2	N2-1	257503	<i>Vigna unguiculata</i>	Hiude Bodi	2016/10/30	Landrace	south of the airport, farmland, Manikapur, Nepalgunj	N28-5-45 87	E81-39-54 29	155	Hiude means winter, bodi means bean, shorter pod compared with JP257502, soft pod, larger seeds compared with N2-2
3	N2-2	257504	<i>Vigna unguiculata</i>	Hiude Bodi	2016/10/30	Landrace	south of the airport, farmland, Manikapur, Nepalgunj	N28-5-45 87	E81-39-54 29	155	Hiude means winter, bodi means bean, shorter pod compared with JP257502, soft pod, smaller seeds compared with N2-1
4	N3	257505	<i>Vigna radiata</i>	Mung	2016/10/31	Landrace	Nepalgunj market, Nepalgunj	N28-3-01 82	E81-37-08 58	152	200 Rs/kg, small seeds
5	N4	257506	<i>Cicer arietinum</i>	Chana	2016/10/31	Landrace	Nepalgunj market, Nepalgunj	N28-3-01 82	E81-37-08 58	152	300Rs/kg Expensive because this bean is used during on-going festival (Tihar)
6	N5	257507	<i>Glycine max</i>	Bhatamas	2016/10/31	Landrace	Nepalgunj market, Nepalgunj	N28-3-01 82	E81-37-08 58	152	100Rs/kg
7	N6	257508	<i>Vigna mungo</i>	Mas	2016/10/31	Landrace	Nepalgunj market, Nepalgunj	N28-3-01 82	E81-37-08 58	152	220Rs/kg
8	N7	257509	<i>Phaseolus vulgaris</i>	Simi	2016/10/31	Landrace	Nepalgunj market, Nepalgunj	N28-3-01 82	E81-37-08 58	152	140 Rs/kg
9	N8-1	257510	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land, black seeds separated from N-8 sample
10	N8-2	258006	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	Jumla market, slopy land, pale brown seeds separated from N-8 sample
11	N8-3	258007	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land, red seeds separated from N8 sample
12	N8-4	258008	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land, purple mottled seeds separated from N8 sample
13	N8-5	258009	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land, brown mottled seeds separated from N8 sample
14	N8-6	258010	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land, red mottled seeds separated from N8 sample
15	N8-7	258011	<i>Phaseolus vulgaris</i>	Jumli Simi	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land, grayish brown seeds separated from N8 sample
16	N9	257511	<i>Glycine max</i>	Bhatta	2016/10/31	Landrace	Jumla market, Jumla	N29-16-32 92	E82-10-59 18	2,357	slopy land terrace around rice land
17	N10-1	257512	<i>Phaseolus coccineus</i>	Ghogate Simi	2016/10/31	Landrace	Jumla city, in front of house, Jumla	N29-16-32 21	E82-11-01 48	2,359	pale purple with black mottled seeds separated from N-10 sample, ornamental
18	N10-2	258012	<i>Phaseolus coccineus</i>	Ghogate Simi	2016/10/31	Landrace	Jumla city, in front of house, Jumla	N29-16-32 21	E82-11-01 48	2,359	white with purple mottled seeds separated from N-10 sample, ornamental
19	N11-1	257513	<i>Glycine max</i>	Sieto (White) Bhatta	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	large round seeds separated from N-11 sample
20	N11-2	258013	<i>Glycine max</i>	Sieto (White) Bhatta	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	middle size oval seeds separated from N-11 sample
21	N11-3	258014	<i>Glycine max</i>	Sieto (White) Bhatta	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	small size oval seeds separated from N-11 sample
22	N12-1	257514	<i>Phaseolus vulgaris</i>	-	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	black seeds separated from N-12 sample
23	N12-2	258015	<i>Phaseolus vulgaris</i>	-	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	red seeds separated from N-12 sample
24	N12-3	258016	<i>Phaseolus vulgaris</i>	-	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	white with red mottled seeds separated from N-12 sample
25	N12-4	258017	<i>Phaseolus vulgaris</i>	-	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	red mottled seeds separated from N-12 sample
26	N12-5	258018	<i>Phaseolus vulgaris</i>	Kalo (Black) Male (Mottled) Simi	2016/10/31	Landrace	farmer's storage, Jumla city, Jumla	N29-16-26 69	E82-11-00 95	2,350	black mottled seeds separated from N-12 sample, higher yield compared with improved red colored variety
27	N13	257515	<i>Phaseolus vulgaris</i>	KBL-8	2016/10/31	Landrace	NARC local station, Jumla	N29-16-19 80	E82-10-40 95	2,342	white seeds with red color around hilum
28	N14	257516	<i>Phaseolus vulgaris</i>	KBL-5	2016/10/31	Landrace	NARC local station, Jumla	N29-16-19 80	E82-10-40 95	2,342	brown seeds, bush type
29	N15	257517	<i>Phaseolus vulgaris</i>	KBL-3	2016/10/31	Landrace	NARC local station, Jumla	N29-16-19 80	E82-10-40 95	2,342	moth green shiny seeds
30	N16-1	257518	<i>Vigna angularis</i>	Guras	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	red seeds separated from N-16 sample, bushy (very short) seeding: March to April, harvest: end of October, making dhal
31	N16-2	258019	<i>Vigna angularis</i>	Guras	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	white seeds separated from N-16 sample, bushy (very short) seeding: March to April, harvest: end of October, making dhal
32	N17	257519	<i>Glycine max</i>	Kalo Bhatta	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	grow in finger millet field, crawling making dhal

Table 3. (Continued).

No	Col No	JP No (Accession No)	Scientific Name	Local Name	Col Date	Status	Col Site	Latitude	Longitude	Altitude (m)	Remarks
33	N18-1	257520	<i>Glycine max</i>	Bhatta	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	black seeds separated from N-18 sample, around rice field roast and eat In winter time, it makes body hot
34	N18-2	258020	<i>Glycine max</i>	Bhatta	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	round yellow with black hilum seeds separated from N-18 sample, around rice field roast and eat In winter time, it makes body hot
35	N18-3	258021	<i>Glycine max</i>	Bhatta	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	round yellow with brown hilum seeds separated from N-18 sample, around rice field roast and eat In winter time, it makes body hot
36	N18-4	258022	<i>Glycine max</i>	Bhatta	2016/11/1	Landrace	farmer's storage, Nuwaghar, Jumla	N29-14-51 68	E82-06-44 35	2,297	small oval yellow seeds separated from N-18 sample, around rice field roast and eat In winter time, it makes body hot
37	N19	257521	<i>Phaseolus vulgaris</i>	Simi	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, a raod side village on slope, black seeds
38	N20	257522	<i>Vigna angularis</i>	Guras	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, farmer's storage, a raod side village on slope, pale brown seeds
39	N21	257523	<i>Glycine max</i>	Bhatta	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, a raod side village on slope, pale brown seeds
40	N22	257524	<i>Glycine max</i>	Bhatta	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, a raod side village on slope, brown seeds
41	N23	257525	<i>Macrotyloma uniflorum</i>	Gahat	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, a raod side village on slope, dhal, also medical use (kidney)
42	N24-1	257526	<i>Vigna radiata</i>	Mung	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	green seeds separated from N-24 sample, Mr Prem Bahadur Budha, a raod side village on slope
43	N24-2	258023	<i>Vigna radiata</i>	Mung	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	black mottled seeds separated from N-24 sample, Mr Prem Bahadur Budha, a raod side village on slope
44	N25-1	257527	<i>Vigna radiata</i>	Mung	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	<i>Vigna radiata</i> (black) separated from N-25 sample (black gram), Mr Prem Bahadur Budha, a raod side village on slope
45	N25-2	257528	<i>Vigna mungo</i>	Mas	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	<i>Vigna mungo</i> separated from N-25 sample, Mr Prem Bahadur Budha, a raod side village on slope
46	N26	257529	<i>Vigna mungo</i>	Mas	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, a raod side village on slope
47	N27	257530	<i>Phaseolus vulgaris</i>	Simi	2016/11/1	Landrace	farmer's storage, Babira-4, Tatopani, Jumla	N29-14-21 0	E82-4-20 40	2,295	Mr Prem Bahadur Budha, a raod side village on slope
48	N28	257531	<i>Vigna angularis</i> var <i>nipponensis</i>	Sauo Mugi Mas	2016/11/2	Wild	road side slope, Kudari, Kalikot	N29-11-04 6	E81-53-16 9	2,008	short pod, small bracteole Seeds as medicine for headache
49	N29	257532	<i>Vigna sahyadriana</i>	Thulo Mugi Mas	2016/11/2	Wild	road side slope, Kudari, Kalikot	N29-11-04 6	E81-53-16 9	2,008	first record in Nepal
50	N30	257533	<i>Vigna angularis</i> var <i>nipponensis</i>	-	2016/11/2	Wild	road side slope, before police check point, Jubitha, Kalikot	N29-09-40 8	E81-50-31 9	1,934	seed color black
51	N31	257534	<i>Vigna angularis</i> var <i>nipponensis</i>	-	2016/11/2	Wild	road side slope, Jubitha, Kalikot	N29-09-37 2	E81-49-35 6	1,885	a little larger seeds than N-28
52	N32	257535	<i>Vigna mungo</i>	Mas	2016/11/2	Landrace	road side village, farmer's storage, east of Manma, Kalikot	N29-7-33 60	E81-39-53 60	1,550	large seeds
53	N33	257536	<i>Vigna umbellata</i>	-	2016/11/2	Landrace	road side village, farmer's storage, east of Manma, Kalikot	N29-7-33 60	E81-39-53 60	1,550	pale brown seeds
54	N34	257537	<i>Glycine max</i>	Bhatta	2016/11/2	Landrace	road side village, farmer's storage, east of Manma, Kalikot	N29-7-33 60	E81-39-53 60	1,550	black seeds
55	N35-1	257538	<i>Phaseolus vulgaris</i>	Simi	2016/11/2	Landrace	road side village, farmer's storage, east of Manma, Kalikot	N29-7-33 60	E81-39-53 60	1,550	brownish red seeds separated from 2016N-35 sample

Table 3. (Continued).

No	Col No	JP No (Accession No)	Scientific Name	Local Name	Col Date	Status	Col Site	Latitude	Longitude	Altitude (m)	Remarks
56	N35-2	258938	<i>Phaseolus vulgaris</i>	Simi	2016/11/2	Landrace	road side village, farmer's storage, east of Manma, Kalikot	N29-7-33 60	E81-39-53 60	1,550	red seeds separated from 2016N-35 sample
57	N36	257539	<i>Vigna unguiculata</i>	Bodi	2016/11/2	Landrace	farmer's house down from the road, east of Manma, Kalikot	N29-7-45 20	E81-39-38 20	1,500	pale brown small seeded cowpea, cowpea not found at higher altitude between Jumla and this site
58	N37	257540	<i>Vigna umbellata</i>	-	2016/11/2	Landrace	farmer's house down from the road, east of Manma, Kalikot	N29-7-45 20	E81-39-38 20	1,500	pale brown seeds
59	N38-1	257541	<i>Glycine max</i>	Bhatta	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	yellow seeds separated from N-38 sample, roast and eat at breakfast
60	N38-2	258024	<i>Glycine max</i>	Bhatta	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	brown seeds separated from N-38 sample, roast and eat at breakfast
61	N39	257542	<i>Lens culinaris</i>	Kalo Mosuro	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	
62	N40-1	257543	<i>Vigna umbellata</i>	Siltung	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	black seeds separated from N-40 sample, eat as dhal
63	N40-2	258025	<i>Vigna umbellata</i>	Siltung	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	pale brown large seeds separated from N-40 sample, eat as dhal
64	N40-3	258026	<i>Vigna umbellata</i>	Siltung	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	pale brown small seeds separated from N-40 sample, eat as dhal
65	N41	257544	<i>Vigna mungo</i>	Mas	2016/11/3	Landrace	farmer's house down from the road, Dailekh city, Dailekh	N28-50-28 70	E81-42-50 60	1,280	dhal mustard oil, ash residue to protect from bruchid
66	N42	257545	<i>Vigna unguiculata</i>	Soita Bodi	2016/11/3	Landrace	grown in front of farmer's house, Baskoti, Dailekh	N28-45-39 34	E81-39-47 68	684	eat young pods as vegetable and mature seeds as dhal
67	N43	257546	<i>Vigna angularis</i> var <i>nipponensis</i>	Bon Shelton	2016/11/3	Wild	growing on the floor of pine forest, north of Jarbuta, Surket	N28-38-47 90	E81-37-28 0	1,700	short pods containing 1 or 2 seeds found near soil surface, seems they have bi-morphic pods
68	N44	257547	<i>Vigna unguiculata</i>	Bodi	2016/11/4	Landrace	grown in backyard garden, Gulariya, Bardiya	N28-11-28 90	E81-21-36 2	140	yardlong bean, soft spongy pods
69	N45	257548	<i>Vigna unguiculata</i>	Bodi	2016/11/4	Landrace	grown in backyard garden, Gulariya, Bardiya	N28-11-28 90	E81-21-36 2	140	yardlong bean, normal long pods
70	N46	257549	<i>Lathyrus sativus</i>	Matara	2016/11/4	Landrace	farmer's storage, Beluwa, Bardiya	N28-19-35 70	E81-16-19 7	162	grind powder to make dhal, cut into two and make dhal, grind and mixed with chick pea powder to make dhal, raw seeds were given to goat, Tharu ethnic group = Mongolian origin
71	N47	257550	<i>Vigna mungo</i>	Mas	2016/11/4	Landrace	grown on a ridge of paddy field, Neutapur, Bardiya	N28-26-18 90	E81-19-01 7	172	rice bean was also cultivated on a ridge of paddy, but we could not collect seeds because plants were still maturing stage
72	N48	257551	<i>Glycine max</i>	Bhattal	2016/11/4	Landrace	farmer's storage, Neutapur, Bardiya	N28-26-18 62	E81-19-00 03	172	black seeds
73	N49	257552	<i>Vigna unguiculata</i>	Kalo Sota	2016/11/5	Landrace	sold at road side shop, Budar, Doti	N29-05-16 40	E80-34-00 6	1,355	seeds with large black area around hilum
74	N50	257553	<i>Vigna unguiculata</i>	Seto Sota	2016/11/5	Landrace	sold at road side shop, Budar, Doti	N29-05-16 40	E80-34-00 6	1,355	seeds with small black area around hilum
75	N51	257554	<i>Vigna unguiculata</i>	Guras	2016/11/5	Landrace	seed shop, Dadeldhura city, Dadeldhura	N29-18-17 00	E80-35-31 8	1,837	this cowpea was sold by the name 'guras' usually used for azuki bean, size and color of seeds are similar to those of true 'guras' (<i>V. angularis</i>) collected in the vicinity
76	N52	257555	<i>Vigna mungo</i>	Mas	2016/11/5	Landrace	seed shop, Dadeldhura city, Dadeldhura	N29-18-17 00	E80-35-31 8	1,837	Community seed bank manager said mung bean was not grown because it is too cold here
77	N53	257556	<i>Vigna unguiculata</i>	Bodi	2016/11/5	Landrace	seed shop, Dadeldhura city, Dadeldhura	N29-18-17 00	E80-35-31 8	1,837	pale brown seeds with small black area around hilum
78	N54	257557	<i>Lablab purpureus</i>	-	2016/11/6	Landrace	collected by Dr Matsushima	-	-	-	reddish seeds
79	N55	257558	<i>Vigna angularis</i>	Guras	2016/11/6	Landrace	small local shop, Siddhapur, Baitadi	N29-24-22 51	E80-39-25 58	1,595	true <i>V. angularis</i> seeds were sold by the name 'guras' here

Table 3. (Continued).

No	Col No	JP No (Accession No)	Scientific Name	Local Name	Col Date	Status	Col Site	Latitude	Longitude	Altitude (m)	Remarks
80	N56	257559	<i>Vigna mungo</i>	Mas	2016/11/6	Landrace	small local shop, Siddhapur, Baitadi	N29-24-22 51	E80-39-25 58	1,595	mungbean seeds were not sold here
81	N57	257560	<i>Vigna angularis</i>	Guras	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	true <i>V. angularis</i> seeds were sold by the name 'guras' here
82	N58	257561	<i>Glycine max</i>	Bhatta Mas	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	yellow seeds
83	N59-1	257562	<i>Vigna unguiculata</i>	Seto Sota	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	pale brown seeds with small black area around hilum separated from N-59 sample
84	N59-2	258027	<i>Vigna unguiculata</i>	Seto Sota	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	pale brown seeds with small brown area around hilum separated from N-59 sample
85	N59-3	258028	<i>Vigna unguiculata</i>	Seto Sota	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	pale brown seeds with large black area around hilum separated from N-59 sample
86	N60	257563	<i>Phaseolus vulgaris</i>	Rajma	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	red seeds
87	N61	257564	<i>Phaseolus vulgaris</i>	Sota	2016/11/6	Landrace	seed shop at Dehimandou, Baitadi	N29-31-16 60	E80-28-09 10	2,017	ivory seeds with brown color around hilum, name 'sota' was used for both cowpea and common bean with pale brown seeds here
88	N62	257565	<i>Vigna radiata</i> var <i>sublobata</i>	-	2016/11/7	Wild	road side slope, east of Dadeldhura, Dadeldhura	N29-18-31 30	E80-39-36 70	1,022	This is the first record of wild mungbean in Nepal. No seeds were collected because plants were at post-maturity stage
89	N63-1	257566	<i>Glycine max</i>	-	2016/11/7	Landrace	seed shop, between Dadeldhura and Dipayal, Golmeswar, Doti	N29-17-51 30	E80-49-09 20	628	black seeds separated from N-63 sample
90	N63-2	258029	<i>Glycine max</i>	-	2016/11/7	Landrace	seed shop, between Dadeldhura and Dipayal, Golmeswar, Doti	N29-17-51 30	E80-49-09 20	628	brown seeds separated from N-63 sample
91	N64-1	257567	<i>Vigna umbellata</i>	-	2016/11/8	Weedy	grassland above road side slope, east of Dadeldhura, Dadeldhura	N29-18-19 51	E80-39-25 45	1,142	small black seeds separated from N-64 sample
92	N64-2	258030	<i>Vigna umbellata</i>	-	2016/11/8	Weedy	grassland above road side slope, east of Dadeldhura, Dadeldhura	N29-18-19 51	E80-39-25 45	1,142	black mottled pale brown seeds separated from N-64 sample
93	N64-3	258031	<i>Vigna umbellata</i>	-	2016/11/8	Weedy	grassland above road side slope, east of Dadeldhura, Dadeldhura	N29-18-19 51	E80-39-25 45	1,142	pale brown seeds separated from N-64 sample
94	N65	257568	<i>Vigna mungo</i>	-	2016/11/8	Landrace	farmer's field, east of Dadeldhura, Dadeldhura	N29-18-19 52	E80-39-20 92	1,141	plants were hanged on a tree for drying
95	N66	257569	<i>Vigna radiata</i> var <i>sublobata</i>	-	2016/11/8	Wild	road side slope, east of Dadeldhura, Dadeldhura	N29-18-23 73	E80-39-15 83	1,114	A few shriveled seeds were found and collected because plants were at post-maturity stage
96	N67-1	257570	<i>Lablab purpureus</i>	-	2016/11/8	Landrace	near the road side ditch, east of Dadeldhura, Dadeldhura	N29-18-25 10	E80-39-16 70	1,108	black seeds separated from N-67 sample
97	N67-2	258032	<i>Lablab purpureus</i>	-	2016/11/8	Landrace	near the road side ditch, east of Dadeldhura, Dadeldhura	N29-18-25 10	E80-39-16 70	1,108	mottled seeds separated from N-67 sample
98	N68	257571	<i>Vigna hirtella</i>	-	2016/11/9	Wild	slope of road side undulating hill, near Phaltude, Doti	N29-02-48 51	E80-35-58 49	1,428	Pods longer than <i>V. angularis</i> var <i>nipponensis</i> , flower buds developed also near soil surface, roots elongate near soil surface, still have young pods, many trees growing on hills, indicating wet environments



Photograph 1. Soybean cultivar with a twining habit (Jumla)



Photograph 2. Shattering pods of soybean (Jumla)



Photograph 3. Soybean sold at market in Kathmandu



Photograph 4. Common beans sold at market, N08 (Jumla)



Photograph 5. Common beans compiled for drying in Jumla



Photograph 6. Common bean strains selected by NARC branch in Jumla



Photograph 7. Habitat of naturally growing *V. umbellata* (N64) in Dadeldhura



Photograph 8. Habitat of *V. angularis* var. *nipponensis* (N28) in Kalikot



Photograph 9. Habitat of *V. angularis* var. *nipponensis* (N43) in Surkhet



Photograph 10. Pods of *V. angularis* var. *nipponensis* (N28) in Kalikot



Photograph 11. Habitat of *V. angularis* var. *nipponensis* (N43) in Surkhet



Photograph 12. Habitat of *V. hirtella* (Kailali)



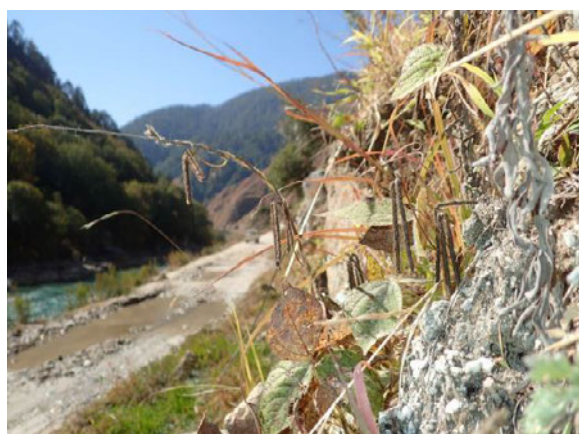
Photograph 13. *V. hirtella* (N68) in Kailali



Photograph 14. Pod of *V. hirtella* (N68) in Kailali



Photograph 15. Stipule of *V. radiata* var. *sublobata*



Photograph 16. *Vigna sahyadriana* (N29) in Kalikot

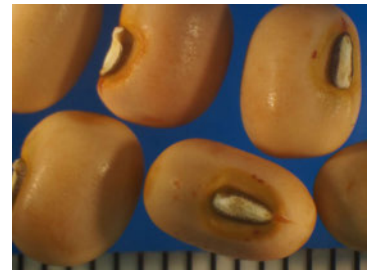
Seed Photographs



N1: JP257502,
Vigna unguiculata



N2-1: JP257503,
Vigna unguiculata



N2-2: JP257504,
Vigna unguiculata



N3: JP257505,
Vigna radiata



N4: JP257506,
Cicer arietinum



N5: JP257507,
Glycine max



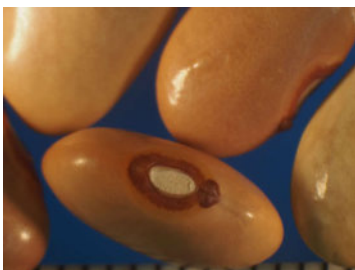
N6: JP257508,
Vigna mungo



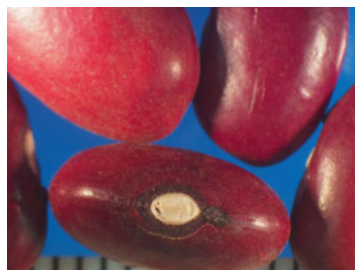
N7: JP257509,
Phaseolus vulgaris



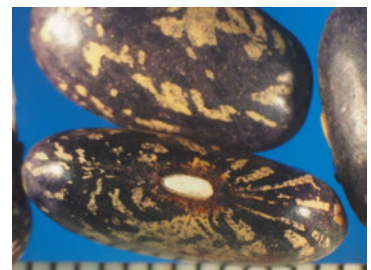
N8-1: JP257510,
Phaseolus vulgaris



N8-2: JP258006,
Phaseolus vulgaris



N8-3: JP258007,
Phaseolus vulgaris



N8-4: JP258008,
Phaseolus vulgaris



N8-5: JP258009,
Phaseolus vulgaris



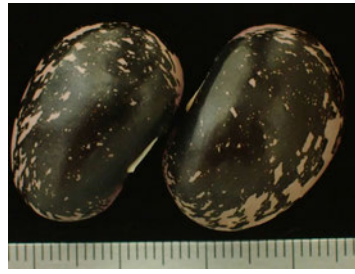
N8-6: JP258010,
Phaseolus vulgaris



N8-7: JP258011,
Phaseolus vulgaris



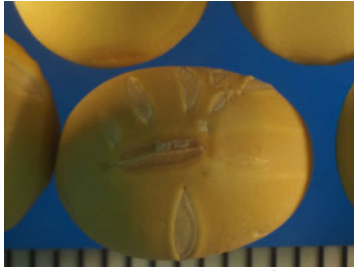
N9: JP257511,
Glycine max



N10-1: JP257512,
Phaseolus coccineus



N10-2: JP258012,
Phaseolus coccineus



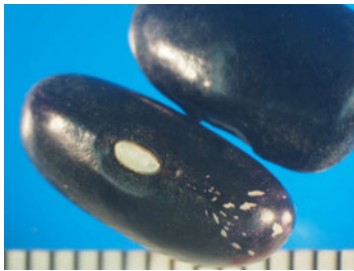
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N11-2: JP258013,
Glycine max



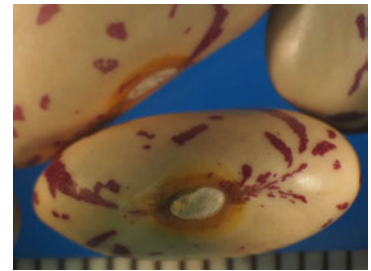
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Glycine max



N12-1: JP257514,
Phaseolus vulgaris



N12-2: JP258015,
Phaseolus vulgaris



N12-3: JP258016,
Phaseolus vulgaris



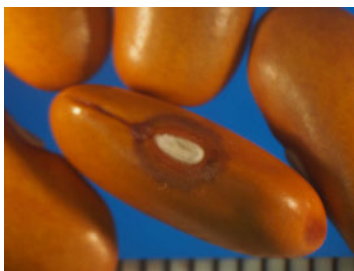
N12-4: JP258017,
Phaseolus vulgaris



N12-5: JP258018,
Phaseolus vulgaris



N13: JP257515,
Phaseolus vulgaris



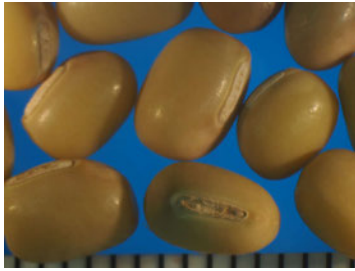
N14: JP257516,
Phaseolus vulgaris



N15: JP257517,
Phaseolus vulgaris



N16-1: JP257518,
Vigna angularis



N16-2: JP258019,
Vigna angularis



N17: JP257519,
Glycine max



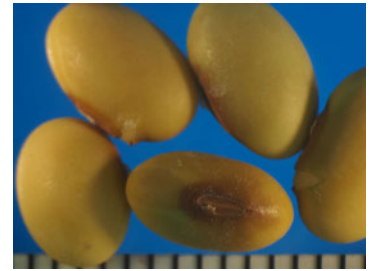
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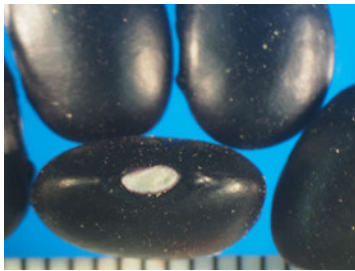
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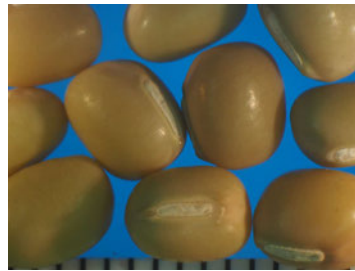
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Glycine max



N18-4: JP258022,
Glycine max



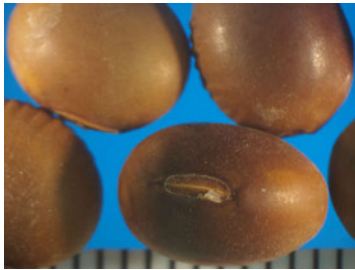
N19: JP257521,
Phaseolus vulgaris



N20: JP257522,
Vigna angularis



N21: JP257523,
Glycine max



N22: JP257524,
Glycine max



N23: JP257525,
Macrotyloma uniflorum



N24-1: JP257526,
Vigna radiata



N24-2: JP258023,
Vigna radiata



N25-1: JP257527,
Vigna radiata



N25-2: JP257528,
Vigna mungo



N26: JP257529,
Vigna mungo



N27: JP257530,
Phaseolus vulgaris



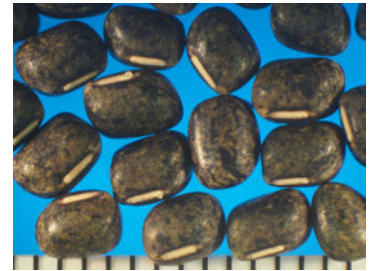
N28: JP257531,
Vigna angularis var. *nipponensis*



N29: JP257532,
Vigna sahyadriana



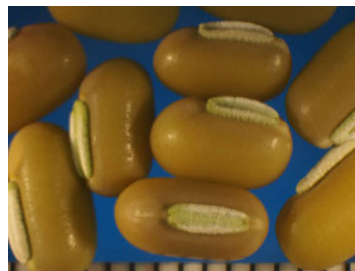
N30: JP257533,
Vigna angularis var. *nipponensis*



N31: JP257534,
Vigna angularis var. *nipponensis*



N32: JP257535,
Vigna mungo



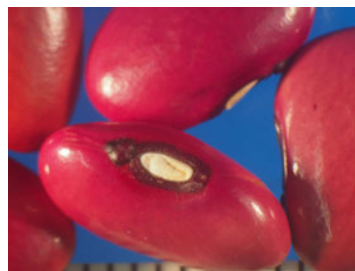
N33: JP257536,
Vigna umbellata



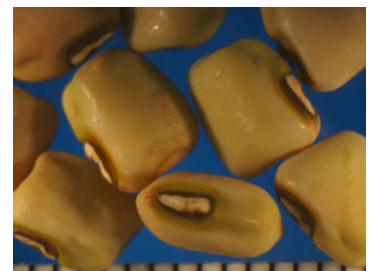
N34: JP257537,
Glycine max



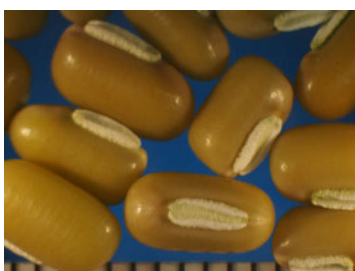
N35-1: JP257538,
Phaseolus vulgaris



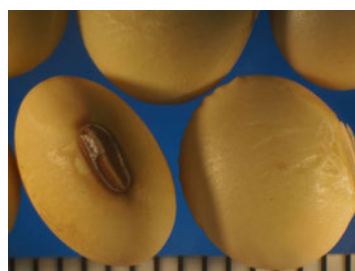
N35-2: JP258938,
Phaseolus vulgaris



N36: JP257539,
Vigna unguiculata



N37: JP257540,
Vigna umbellata



N38-1: JP257541,
Glycine max



N38-2: JP258024,
Glycine max



N39: JP257542,
Lens culinaris



N40-1: JP257543,
Vigna umbellata



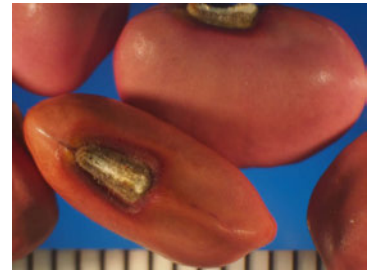
N40-2: JP258025,
Vigna umbellata



N40-3: JP258026,
Vigna umbellata



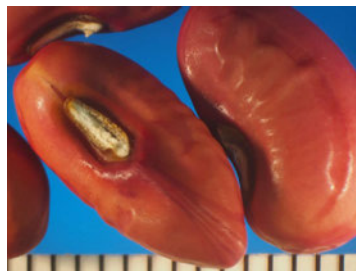
N41: JP257544
Vigna mungo



N42: JP257545,
Vigna unguiculata



N43: JP257546,
Vigna angularis var. *nipponensis*



N44: JP257547
Vigna unguiculata



N45: JP257548,
Vigna unguiculata



N46: JP257549,
Lathyrus sativus



N47: JP257550
Vigna mungo



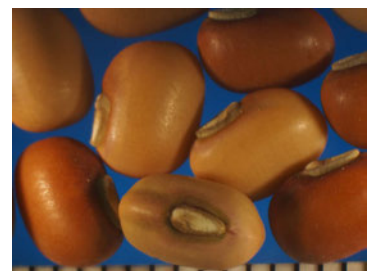
N48: JP257551,
Glycine max



N49: JP257552,
Vigna unguiculata



N50: JP257553
Vigna unguiculata



N51: JP257554,
Vigna unguiculata



N52: JP257555,
Vigna mungo



N53: JP257556
Vigna unguiculata



N54: JP257557,
Lablab purpureus



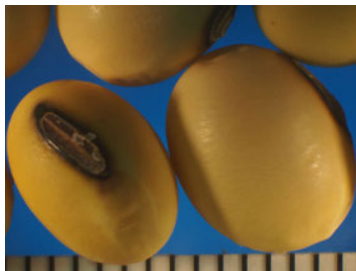
N55: JP257558,
Vigna angularis



N56: JP257559
Vigna mungo



N57: JP257560,
Vigna angularis



N58: JP257561,
Glycine max



N59-1: JP257562
Vigna unguiculata



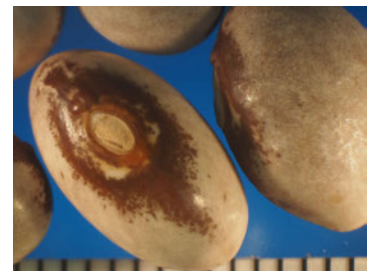
N59-2: JP258027,
Vigna unguiculata



N59-3: JP258028,
Vigna unguiculata



N60: JP257563
Phaseolus vulgaris



N61: JP257564,
Phaseolus vulgaris



N63-1: JP257566,
Glycine max



N63-2: JP258029
Glycine max



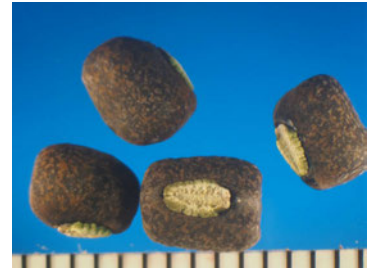
N64-1: JP257567,
Vigna umbellata



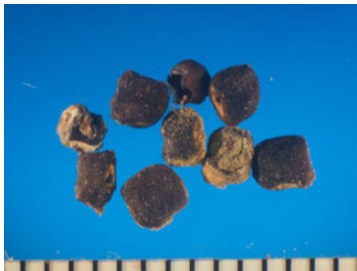
N64-2: JP258030,
Vigna umbellata



N64-3: JP258031,
Vigna umbellata



N65: JP257568,
Vigna mungo



N66: JP257569,
Vigna radiata var. *sublobata*



N67-1: JP257570,
Lablab purpureus



N67-2: JP258032,
Lablab purpureus



N68: JP257571,
Vigna hirtella