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Original Paper

Collaborative Exploration for *Amaranthus* and *Capsicum* Genetic Resources in Mid and Far Western Nepal, October and November 2016

Kazuhiro NEMOTO [1)], Kenichi MATSUSHIMA [1)], Norihiko TOMOOKA [2)], Yu TAKAHASHI [2)], Durga Man Singh DONGOL [3)], Santosh SHARMA [3)], Bal Krishna JOSHI [4)], Krishna Hari GHIMIRE [4)], Deepa Singh SHRESTHA [4)], Mina Nath PAUDEL [4)]

1) *Faculty of Agriculture, School of Agriculture, Shinshu University*, 8304 Minamiminowa, Nagano 399-4598, Japan
2) *Genetic Resources Center, National Agriculture and Food Research Organization (NARO)*, Kannondai 2-1-2, Tsukuba, Ibaraki 305-8602, Japan
3) *Food Research Division, Nepal Agricultural Research Council,* P. O. Box 3055, Kathmandu, Nepal
4) *National Agriculture Genetic Resources Center, Nepal Agricultural Research Council*, P. O. Box 3055, Kathmandu, Nepal

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Corresponding author: K. NEMOTO (e-mail: knemoto@shinshu-u.ac.jp)

Summary

Based on the agreement between the National Agriculture Genetic Resources Center (NAGRC), Nepal Agricultural Research Council (NARC), Nepal, and the Genetic Resources Center, National Agriculture and Food Research Organization (NARO), Japan, we began the second collaborative exploration for Amaranthus and Capsicum genetic resources in Nepal following the first one, which was conducted in the Mid and Far Western Development Region from October 29 to November 10, 2016. In this survey, a total of 98 samples were collected. Among them, 28 samples were of *Amaranthus* spp.—24 of *A. hypochondriacus*, two of *A. caudatus*; and two of weedy amaranths (*Amaranthus* spp.)—and 36 *Capsicum* spp.—33 of *C. annuum* and three of *C. frutescens*. All samples were conserved in the gene bank of NAGRC, Nepal. A subset was transferred to the NARO, Japan, under the Standard Material Transfer Agreement of the International Treaty on Plant Genetic Resources for Food and Agriculture.

KEY WORDS: *Amaranthus* spp., *Capsicum* spp., chili pepper, grain amaranths, Nepal

Introduction

Nepal has unique geography in elevation along the north to south. Crops are cultivated in the range from 60 m to 4,700 m, and this range covers climatic variation from tropical to alpine cold semi-desert (Joshi 2017). It is closely associated with diverse agroenvironments and remarkable crop variation. According to Joshi (2017), 6,973 flowering plant species, 790 food value plant species, and 577 cultivated plant species, including forage species, are cultivated in Nepal. However, because of replacement with modern varieties, 50 % of local landraces or traits have already been lost, and many landraces are becoming rare and endangered (Upadhyay and Joshi 2003).

Although the cultivation history of new-world crops such as maize, potato, common bean, chili, and amaranths is less than 500 years, these have many local landraces and play an important role as food resources as well as old-world crops in the agriculture of Nepal (Minami *et al.* 1998). For example, the production of maize ranks second following paddy rice, and potato dominates more than 70 % of the production of tuber crops (CBS Statistical Pocket Book of Nepal 2017). Chili is an indispensable spice to Nepalese food culture. Amaranths is a staple crop in high altitude areas (Nemoto *et al.* 1998). However, the germplasms of the major crops have been well collected (Gupta 2012), but not for the others.

The second collaborative exploration following the first one in February 2016 (Nemoto *et al.* 2016) was conducted by both NARO, Japan, and NAGRC, Nepal, in the Mid-Western and Far-Western Development Region of Nepal in October and November 2016 within the framework of the project of Plant Genetic Resources in Asia (PGRAsia) funded by the Ministry of Agriculture, Forestry and Fisheries, Japan. This report presents the results of the second exploration, especially focused on *Amaranthus* spp. and *Capsicum* spp.

Method

An exploration was performed in the Mid-Western and Far-Western Development Region of Nepal from October 29 to November 10, 2016 (Table 1). We surveyed five districts in Mid-Western Development Region—Banke, Jumla, Kalikot, Dailekh, and Surkhet—and four districts in Far-Western Development Region—Kailali, Dadeldhura, Baitadi, and Doti. During the survey, we collected samples mainly from farmers and local markets in hilly regions since summer crops have almost already been harvested in late October and early November. However, in lowlands (Terai region), we could collect samples from the field. We mainly focused on collecting amaranths and chili peppers. In addition, landraces of other field crops were collected. We also interviewed farmers to obtain information about the samples, such as local name, usage, and cultivation methods. The collection site information was obtained using a GPS instrument (GARMIN eTrex Legend HCx).

Results and Discussion

A total of 98 samples were collected from the Mid- and Far-Western Development Region (Fig. 1, Tables 2 and 3). Among them, 28 samples were of *Amaranthus* spp.—24 of *A. hypochondriacus*, 2 of *A. caudatus*, and 2 of weedy amaranths (*Amaranthus* spp.)—and 36 samples of *Capsicum* spp.—33 of *C. annuum* and 3 of *C. frutescens*. Other samples included *Brassica* spp., *Eleusine coracana*, *Glycine max*, *Vigna* spp., *Tricosanthes cucumerina* var. *anguina*, *Chenopodium* sp., and P*ellira frutescens*. Samples

were collected widely from 127 m to 2,294 m above sea level. All samples collected in this survey were conserved at the NAGRC genebank, Nepal, and a subset was transferred to the NARO, Japan, under the standard material transfer agreement of the International Treaty of Plant Genetic Resources.

Table 1. Itinerary of a field survey in Mid- and Far-Western Nepal, Oct and Nov, 2016

Date		Itinerary	Activity	Stay
Oct.	26	Haneda -- Bangkok -- (by airplane)	Transportation	BKK airport
	27	-- Kathmandu (by airplane)	Transportation	Kathmandu
	28	Courtesy visit and meeting at NAGRC gene bank	Preparation	Kathmandu
	29	Kathmandu -- Nepalgunj (by domestic air plane)	Exploration	Nepalgunj
	30	Nepalgunj (Banke district)	Exploration	Nepalgunj
	31	Nepalgunj -- Jumla (by domestic air plane)	Exploration	Jumla
Nov.	1	Jumla (Jumla district)	Exploration	Jumla
	2	Jumla -- Manma (Kalikot district) -- Dailekh (Dailekh district) by car	Exploration	Dailekh
	3	Dailekh -- Birendranagar (Surket district) -- Nepalgunj by car	Exploration	Nepalgunj
	4	Nepalgunj -- Dhangadhi (Kailali district) by car	Exploration	Dhangadhi
	5	Dhangadhi -- Dadeldhura (Dadeldhura district) by car	Exploration	Dadeldura
	6	Dadeldhura -- Dasharathchand (Baitadi district) by car	Exploration	Baitadi
	7	Dasharathchand -- Dadeldhura by car	Exploration	Dadeldura
	8	Dadeldhura -- Dipayal (Doti district) -- Dadeldhura by car	Exploration	Dadeldura
	9	Dadeldhura -- Dhangadhi by car	Exploration	Dhangadhi
	10	Dhangadhi -- Kathmandu by (domestic air plane)	Exploration	Kathmandu
	11	NAGRC, Kathmandu	Seed cleaning	Kathmandu
	12	NAGRC, Kathmandu	Seed cleaning	Kathmandu
	13	NAGRC, Kathmandu	Seed cleaning	Kathmandu
	14	Kathmandu -- Bangkok -- (by airplane)	Transportation	on flight
	15	-- Haneda (by airplane)	Transportation	

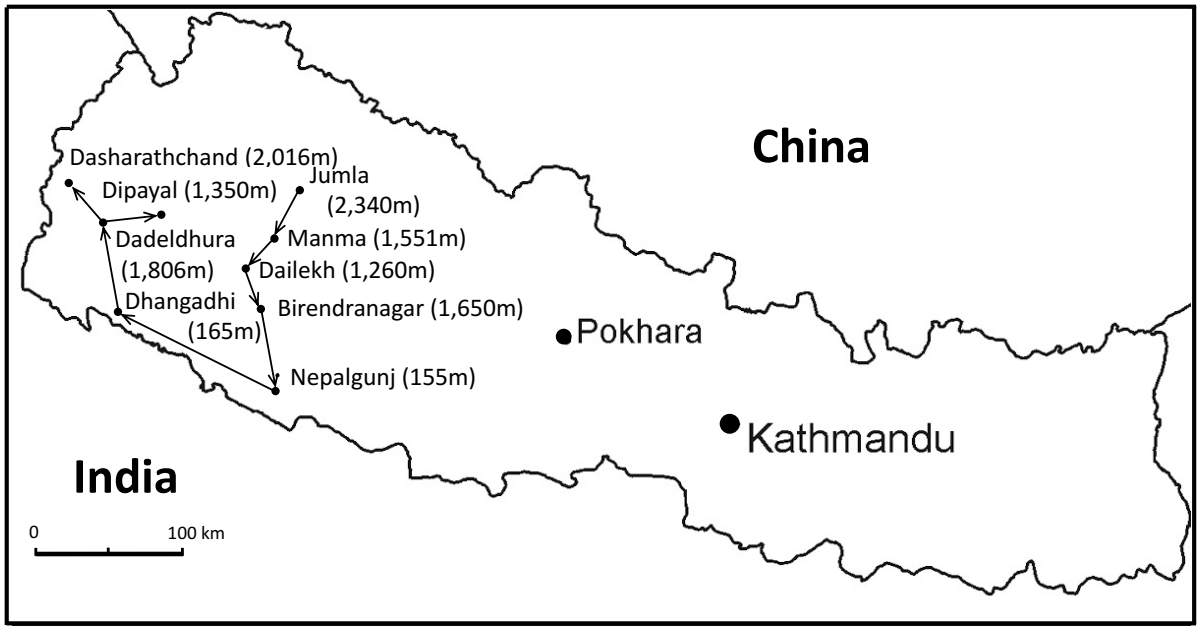

Fig. 1. Main route and collection sites of the exploration in Mid- and Far-Western regions, Nepal, Oct and Nov, 2016.

Table 2. Species and number of accessions collected in a field survey

Species	No. of accessions
Capsicum annuum	33
Capsicum frutescens	3
Amaranthus hypochondriacus	24
Amaranthus caudatus	2
Amaranthus spp.	2
Chenopodium sp.	1
Brassica juncea	3
Brassica napus	4
Eleusine coracana	1
Glycine max	7
Phaseolus vulgaris	1
Vigna umbellata	3
Vigna unguiculata	8
Vigna mungo	3
Vigna angularis	1
Trichosanthes cucumerina var. *anguina*	1
Perilla frutescens	1
Total	98

1) Amaranths

Cultivation of *A. hypochondriacus* (Photo 1) dominated in Mid- and Far-Western Development Region as well as the previous survey, we explored the Central Development Region (Nemoto *et al.* 2016). In this survey, few samples of *A. caudatus* (Photo 2) were collected, but no *A. cruentus* were collected. Both the weedy amaranths were collected near Nepalgunj, Banke district in the lowland (Terai region).

In hilly areas such as Jumla and Kalikhot districts in Mid-Western Development Region, almost all amaranths had been harvested during the survey period of early November. According to farmers' interview, they normally grow amaranths mixed with finger millet or maize (Photo 3). In this area, amaranths are called "marshe." People usually eat their popped grains with milk tea and make "roti" by using its powder mixed with wheat flour. In Jumla district, popped grains are occasionally provided to participants in funerals.

In Terai region, Banke district, we observed plants of *A. hypochondriacus* before their harvest in the field. They were planted around the field of chili pepper (Photos 4 and 5). In this area, amaranths are called "ramdana." We could also collect four weedy amaranths. Judging from their morphological characteristics, we identified them as *A. hybridus* (Photo 6): one was *A. spinosus* (Photo 7) and the other was *A. blitum* (Photo 8). People never grow them, but use their young leaves as vegetable. These species are popular as vegetable, although they are weed.

In the hilly areas of Far-Western Development Region, such as Baitadi, Dhadeldura, and Doti districts, amaranths had already been harvested (Photos 9 and 10). According to the information from farmers' interview, in recent years, cultivation of amaranths is decreasing, especially in villages. Farmers have shifted to cultivating cash crops such as vegetables and potato and use improved varieties. In this

area, amaranths are called “bethe” or “bathu,” which is a synonym for *Chenopodium* sp. in the area. The species is grown limitedly and presumed to be a *C. giganteum* (Sukhorukov and Kushunina 2014); the gray colored seed is used as a grain like of amaranths. Normally, people use the same local name for both species (or either one) without a clear distinction. In Dipayal, Doti district, we observed amaranth grains used for making plastic bags in front of a shop in the market (Photos 11 and 12). These were brought from mountain areas away from the city. The owner of the shop said that the grains were mostly brought from Bhajan and Bajhura districts located in the northern part of Far-Western Development Region. Farmers sell amaranth grain or exchange it for industrially produced salt from India at the market (Photo 13). For these people, amaranth grain have become a means of obtaining cash and salt. Collected grains were transported to Dhangadhi City near the border of India, Kailali district, by a truck.

In Dhangadhi, we visited a grain wholesaler and collected information about amaranth grains (Photo 14). The owner informed us that amaranth grains were exported to India even though he did not provide the exact amount and price. In the granary, several tons of amaranth grains were stored (Photo 15). In India, these grains are used for making sweets called “ladoo.”

2) Chili peppers

In the present survey, a total of 36 chili pepper samples were collected. Of these, 33 were identified as *C. annuum*. Three others were identified as *C. frutescens*. Only three samples (Photos 20 and 21) belonging to *C. frutescens* were collected from Bardiya, Kailali, and Baitadi in the Southern parts of Nepal, near the border to India. Since this species is distributed mainly in the tropical and subtropical regions of the world, it was likely suitable for cultivation in low altitude areas near the Indian border. At the time of field survey, the three samples that were identified as *C. frutescens* were called “jire khursani.” However, two samples of *C. annuum* were also called “jire khursani.” Plants with small and strongly pungent fruit, regardless of species, are named “jire khursani,” because the word “jire” means “the person who is small but strong” in Nepali. In Nepali, chili peppers were generally called “khursani,” whereas, in the south border to India, they were called “utar tedi” (Photo 19) in Kailali region and “mirch” in Bardiya region. They were also called as “daha” (Photos 17 and 18) in Dadeldhura and Doti regions in the far west area of Nepal.

The sample called “utar tedi” collected from Matera, Kailali, showed purple flowers and dark purple immature fruits. This was the only sample of *C. annuum* with colored flowers and immature fruits.

We collected a mixture of *C. annuum* sample from Amargadhi, Dadeldhura; it can be roughly divided into eight morphologically different accessions according to their fruit size and shape from elongate to short. We also collected a mixture of *C. annuum* sample from Gadhi, Baitadi; it can be roughly divided into three morphologically different accessions (Photo 16) according to their fruit size and shape.

The sample of chili pepper varieties such as the accessions called “dalle khursani,” “jyanmara khursani,” or “akbare khursani” collected in the former exploration in central Nepal in February 2016 were not collected in this exploration. These accessions could not be identified to their species level because they showed several different key characters hindering their identification; however, they were similar to *C. chinense*. In the present survey, this type of chili pepper variety was observed in Gadhi, Baitadi; however, we decided to not to collect it, because the chili pepper were grown from the seeds distributed by NGOs as a cash crop.

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ネパール中西部および極西部地域における アマランサスおよびトウガラシ遺伝資源の共同探索, 2016 年 10, 11 月

根本 和洋 [1)]・松島 憲一 [1)]・友岡 憲彦 [2)]・高橋 有 [2)]・
Durga Man Singh DONGOL [3)]・Santosh SHARMA [3)]・Bal Krishna JOSHI [3)]・
Krishna Hari GHIMIRE [4)]・Deepa Singh SHRESTHA [4)]・Mina Nath PAUDEL [3)]

1) 信州大学 学術研究院（農学系）
2) 国立研究開発法人 農業・食品産業技術総合研究機構 遺伝資源センター
3) ネパール農業研究評議会 食品研究所
4) ネパール農業研究評議会 国立農業遺伝資源センター

和文摘要

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) 遺伝資源センターとの合意に基づき，アマランサス属およびトウガラシ属を主な対象とした第 2 回目の植物遺伝資源共同探索調査を 2016 年 2 月に実施した第 1 回目に続いて 2016 年 10 月 29 日から 11 月 10 にかけて中西部および極西部地域において実施した．本探索において計 98 サンプルが収集され，そのうちアマランサス遺伝資源が 28 系統（*Amaranthus hypochondriacus* 24 系統，*A. caudatus* 2 系統，その他の雑草種 2 系統）およびトウガラシ遺伝資源が 36 系統（*Capsicum annuum* 33 系統および *C. frutescens* 3 系統）であった．すべての系統は NAGCR のジーンバンクに保存され，サブセットは食料およ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 NARO ジーンバンクに移転された．

Table 3. A list of plant materials collected in Mid- and Far-Western Nepal, Oct and Nov, 2016

JP No.	Species	Crop name	Local Name	Coll. No.	Coll. date	Coll. Sites	Latitude (N)	Longitude (E)	Alt. (m)	Coll. Source & Remarks
268723	*Brassica napus* L.	Rapeseed	Tori	SDN-01	2016/11/07	Baitadi, Siddhapur-1, Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
268724	*Amaranthus hypochondriacus* L.	Prince's feather	Bethu	SDN-04	2016/11/07	Baitadi Siddhapur-1 Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
268725	*Amaranthus hypochondriacus* L.	Prince's feather	Bethu	SDN-06	2016/11/07	Baitadi Siddhapur-1 Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
268726	*Brassica juncea* (L.) Czern. Cernua Group	Leaf mustard	Rayo	SDN-07	2016/11/07	Baitadi Siddhapur-1 Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
268727	*Brassica napus* L.	Rapeseed	Todo	SDN-08	2016/11/07	Baitadi Siddhapur-1 Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
259868	*Vigna umbellata* (Thunb.) Ohwi et Ohashi	Rice bean	Barmas	SDN-11	2016/11/07	Baitadi Siddhapur-1 Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
259869	*Vigna umbellata* (Thunb.) Ohwi et Ohashi	Rice bean	Barmas	SDN-11	2016/11/07	Baitadi Siddhapur-1 Gailek	N29-24-12.66	E80-38-06.12	2,016	farmland
268728	*Amaranthus caudatus* L.	Love-lies-bleeding	Ramdana	SDN-12	2016/10/30	Banke Opposite of Bageshwori Gharbari	N28-3-10.92	E80-37-51.48	155	market
268729	*Amaranthus hypochondriacus* L.	Prince's feather	Ramdana	SDN-13	2016/10/30	Banke Bageshwori-22 Karkadau Chowk	N28-3-10.92	E80-37-51.48	155	market
268730	*Amaranthus hypochondriacus* L.	Prince's feather	Marse	SDN-14	2016/10/31	Jumla Chandannath-6 Karkibada	N29-16-32.92	E82-10-59.18	2,340	market
268731	*Amaranthus hypochondriacus* L.	Prince's feather	Marse	SDN-15	2016/11/01	Jumla Lamra-5 Babira	N29-14-51.78	E82-6-44.34	2,294	farmland
268732	*Brassica juncea* (L.) Czern. Cernua Group	Leaf mustard	Rayo	SDN-18	2016/11/01	Jumla Lamra-6 Babira	N29-14-51.78	E82-6-44.34	2,294	farmland
268733	*Amaranthus hypochondriacus* L.	Prince's feather	Marse	SDN-20	2016/11/01	Jumla Lamra-7 Babira	N29-14-51.78	E82-6-44.34	2,294	farmland
259870	*Vigna unguiculata* (L.) Walp.	Cowpea	Kalo Bodi	SDN-25	2016/11/03	Dailekh Narayan-1 Gahatari	N28-50-28.74	E81-42-50.52	1,260	farmland
259871	*Vigna unguiculata* (L.) Walp.	Cowpea	Kalo Bodi	SDN-25	2016/11/03	Dailekh Narayan-1 Gahatari	N28-50-28.74	E81-42-50.52	1,260	farmland
259872	*Glycine max* Merrill	Soybean		SDN-28	2016/11/01	Jumla Lamra-5 Babira	N29-14-51.78	E82-6-44.34	2,294	farmland
259873	*Glycine max* Merrill	Soybean		SDN-28	2016/11/01	Jumla Lamra-5 Babira	N29-14-51.78	E82-6-44.34	2,294	farmland
268734	*Amaranthus hypochondriacus* L.	Prince's feather	Kalo Latte	SDN-30	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259874	*Glycine max* Merrill	Soybean		SDN-31	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259875	*Glycine max* Merrill	Soybean		SDN-31	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259876	*Glycine max* Merrill	Soybean		SDN-31	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268735	*Brassica napus* L.	Rapeseed	Tilkhudo	SDN-32	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268736	*Amaranthus caudatus* L.	Love-lies-bleeding	Rato	SDN-34	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268737	*Amaranthus hypochondriacus* L.	Prince's feather	Rato marse	SDN-37	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268738	*Trichosanthes cucumerina* var. *anguina* (L.) Haines	Snake gourd	Chichindo	SDN-38	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268739	*Brassica napus L.*	Rapeseed	Kalo Tilkhudo	SDN-39	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259877	*Vigna unguiculata* (L.) Walp.	Cowpea	Bodi	SDN-40	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259878	*Vigna unguiculata* (L.) Walp.	Cowpea	Bodi	SDN-40	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259879	*Vigna unguiculata* (L.) Walp.	Cowpea	Bodi	SDN-40	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
259880	*Vigna unguiculata* (L.) Walp.	Cowpea	Bodi	SDN-40	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268740	*Amaranthus hypochondriacus* L.	Prince's feather	Seto Marse	SDN-45	2016/11/02	Kalikot Daha-1 Bihani	N29-7-33.36	E81-39-54.00	1,551	farmland
268741	*Amaranthus hypochondriacus* L.	Prince's feather	Bethu	SDN-46	2016/11/06	Baitadi Musyachaur-8 Gurukhola	N29-31-14.52	E80-39-49.44	1,857	farmland; Spike Color Red & Seed Color Black
268742	*Amaranthus hypochondriacus* L.	Prince's feather	Seto Bethu	SDN-47	2016/11/06	Baitadi Musyachaur-8 Gurukhola	N29-31-14.52	E80-39-49.44	1,857	farmland
268743	*Amaranthus hypochondriacus* L.	Prince's feather	Bethu	SDN-48	2016/11/06	Baitadi Musyachaur-8 Gurukhola	N29-31-14.52	E80-39-49.44	1,857	farmland
268744	*Amaranthus hypochondriacus* L.	Prince's feather	Bethu	SDN-49	2016/11/05	Doti Katiwada-7 Raukalla	N29-17-34.80	E80-56-33.00	1,350	farmland
268745	*Eleusine coracana* (L.) Gaertn. ssp. *coracana* Hilu et de Wet	Finger millet	Janjali Kodo	SDN-50	2016/11/05	Doti Katiwada-7 Raukalla	N29-17-34.80	E80-56-33.00	1,350	farmland
268746	*Amaranthus* sp.	(*Amaranthus*)	Ghutta Wala Bethe	SDN-51	2016/11/05	Doti Silgudhi-6 Dwarikhola	N29-15-46.38	E80-57-12.18	590	farmland
268747	*Perilla frutescens* (L.) Britton var. *frutescens*	Perilla	Bhamero	SDN-52	2016/11/06	Baitadi Siddhapur-2	N29-24-13.50	E80-57-15.38	1,595	farmland
268748	*Amaranthus hypochondriacus* L.	Prince's feather	Range	SDN-53	2016/11/06	Dadeldhura Sallaghari-11 Palegaun	N29-9-21.91	E80-35-15.39	1,899	garden
268749	*Amaranthus hypochondriacus* L.	Prince's feather	Bethe, Range	SDN-56	2016/11/06	Doti Latamandau-8 Gopghat	N29-17-30.78	E80-49-05.52	626	farmland

Table 3. (Continued).

JP No.	Species	Crop name	Local Name	Coll. No.	Coll. date	Coll. Sites	Latitude (N)	Longitude (E)	Alt. (m)	Coll. Source & Remarks
268750	*Amaranthus hypochondriacus* L.	Prince's feather	Bethe Purana	SDN-57	2016/11/06	Dadeldhura Palegaun-11 Sallaghari	N29-9-21.91	E80-35-34.30	1,595	farmland
268751	*Chenopodium* sp.	Goosefoot	Falahari Bethe	SDN-58	2016/11/06	Dadeldhura Palegaun-11 Sallaghari	N29-9-21.91	E80-35-34.30	1,595	farmland
259881	*Vigna unguiculata* (L.) Walp.	Cowpea	Kalo Sotta	SDN-59	2016/11/06	Doti Chatiban-4 Budar	N29-5-16.50	E80-34-00.60	1,380	farmland
259882	*Vigna unguiculata* (L.) Walp.	Cowpea	Seto Sotta	SDN-60	2016/11/06	Doti Chatiban-4 Budar	N29-5-16.50	E80-34-00.60	1,380	farmland
268752	*Amaranthus hypochondriacus* L.	Prince's feather	Range	SDN-61	2016/11/07	Dadeldhura Amargadhi-3 Kotyawada	N29-17-50.34	E80-35-27.78	1,806	farmland; Spike Color Brownish Red & Seed Color Dark Black
268753	*Amaranthus hypochondriacus* L.	Prince's feather	Range	SDN-62	2016/11/07	Dadeldhura Amargadhi-3 Kotyawada	N29-17-50.34	E80-35-27.78	1,806	farmland; Spike Color Red & Seed Color Black
268754	*Amaranthus hypochondriacus* L.	Prince's feather	Range	SDN-63	2016/11/07	Dadeldhura Amargadhi-3 Kotyawada	N29-17-50.34	E80-35-27.78	1,806	farmland
268755	*Amaranthus hypochondriacus* L.	Prince's feather	Range	SDN-64	2016/11/07	Dadeldhura Amargadhi-3 Kotyawada	N29-17-50.34	E80-35-27.78	1,806	farmland; Spike Color Pink & Seed Color Black
268756	*Amaranthus hypochondriacus* L.	Prince's feather	Range	SDN-65	2016/11/07	Dadeldhura Amargadhi-3 Kotyawada	N29-17-50.34	E80-35-27.78	1,806	farmland; Spike Color Green & Seed Color Black
268757	*Amaranthus hypochondriacus* L.	Prince's feather	Phulmala, Dam Dana	SDN-68	2016/11/04	Bardiya Gulariya-2 Khairapur	N28-14-38.76	E81-12-39.57	127	farmland
268758	*Amaranthus* sp.	(*Amaranthus*)	Phulmala	SDN-69	2016/11/04	Bardiya Gulariya-2 Khairapur	N28-14-38.76	E81-12-39.57	127	farmland
259883	*Vigna mungo* (L.) Hepper	Black gram	Urud	SDN-76	2016/11/04	Bardiya Naulapur-5	N28-26-11.34	E81-19-01.02	165	farmland
259884	*Vigna mungo* (L.) Hepper	Black gram	Urud	SDN-76	2016/11/04	Bardiya Naulapur-5	N28-26-11.34	E81-19-01.02	165	farmland
259885	*Vigna mungo* (L.) Hepper	Black gram	Urud	SDN-76	2016/11/04	Bardiya Naulapur-5	N28-26-11.34	E81-19-01.02	165	farmland
259886	*Vigna umbellata* (Thunb.) Ohwi et Ohashi	Rice bean	Siltung	SDN-78	2016/11/04	Bardiya Naulapur-5 Naulapur	N28-26-11.34	E81-19-01.02	165	farmland
259887	*Glycine max* Merrill	Soybean	Bhatara	SDN-79	2016/11/04	Bardiya Naulapur-5 Naulapur	N28-26-11.34	E81-19-01.02	165	farmland
259888	*Vigna angularis* (Wild.) Ohwi et Ohashi	Wild azuki bean	Banmas	SDN-81	2016/11/03	Surkhet Cheda	N28-38-28.74	E81-37-16.79	1,650	garden
259889	*Phaseolus vulgaris* L.	Common bean		SDN-83	2016/11/08	Baitadi Siddheshwor-4 Gurukhola	N29-27-35.40	E80-37-16.80	2,012	farmland
259890	*Glycine max* Merrill	Soybean	Bhatta	SDN-84	2016/11/08	Baitadi Siddheshwor-4 Gurukhola	N29-27-35.40	E80-37-16.80	2,012	farmland
268759	*Amaranthus hypochondriacus* L.	Prince's feather	Bethe	SDN-85	2016/11/08	Baitadi Siddheshwor-4 Gurukhola	N29-27-35.40	E80-37-16.80	2,012	farmland
268760	*Amaranthus hypochondriacus* L.	Prince's feather	Bethu	SDN-86	2016/11/08	Doti Ghanteshwor-2 Gaira	N29-9-21.92	E80-35-34.30	1,899	market
268761	*Brassica juncea* (L.) Czern. Cernua Group	Leaf mustard	Rayo	SDN-88	2016/11/08	Dadeldhura Amargadhi-3 Kotyawada	N29-17-50.34	E80-35-27.78	1,806	farmland
260696	*Capsicum annuum* L.	Chili pepper	Budhani Mirchi	SU16WN01	2016/11/04	Bansagadi Municipality-3, Banmuduwa, Bardiya, Nepal	N28-15-10.3	E81-34-18.4	151	farmland
260697	*Capsicum frutescens* L.	Chili pepper	Jire Khursani	SU16WN02	2016/11/04	Bansagadi Municipality-3, Banmuduwa, Bardiya, Nepal	N28-15-10.3	E81-34-18.4	151	farmland
260698	*Capsicum annuum* L.	Chili pepper	Utar tedi	SU16WN03	2016/11/04	Patharaiya VDC-4, Matera, Kailali, Nepal	N28-35-28.3	E81-09-40.9	156	farmland
260699	*Capsicum annuum* L.	Chili pepper	Jire Khursani	SU16WN04	2016/11/04	Patharaiya VDC-4, Matera, Kailali, Nepal	N28-35-28.3	E81-09-40.9	156	farmland
260700	*Capsicum annuum* L.	Chili pepper	Utar tedi	SU16WN05	2016/11/04	Ghodaghodi Municipality-8, Dipanagar, Kailali, Nepal	N28-42-35.9	E80-58-08.3	173	farmland
260701	*Capsicum annuum* L.	Chili pepper	Utar tedi	SU16WN06	2016/11/04	Ghodaghodi Municipality-8, Dipanagar, Kailali, Nepal	N28-42-35.9	E80-58-08.3	173	farmland
260702	*Capsicum annuum* L.	Chili pepper	Jire Khursani	SU16WN07	2016/11/04	Ghodaghodi Municipality-8, Dipanagar, Kailali, Nepal	N28-42-35.9	E80-58-08.3	173	farmland
260703	*Capsicum annuum* L.	Chili pepper		SU16WN08	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260704	*Capsicum annuum* L.	Chili pepper		SU16WN09	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260705	*Capsicum annuum* L.	Chili pepper		SU16WN10	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260706	*Capsicum annuum* L.	Chili pepper		SU16WN11	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260707	*Capsicum annuum* L.	Chili pepper		SU16WN12	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260708	*Capsicum annuum* L.	Chili pepper		SU16WN13	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.

Table 3. (Continued).

JP No.	Species	Crop name	Local name	Coll. No.	Coll. date	Coll. Sites	Latitude (N)	Longitude (E)	Alt. (m)	Coll. Source & Remarks
260709	*Capsicum annuum* L.	Chili pepper		SU16WN14	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260710	*Capsicum annuum* L.	Chili pepper		SU16WN15	2016/11/04	Kailali, Nepal				Farmaer's stock; Divided accession from mixed stored fruit by farmer.
260711	*Capsicum annuum* L.	Chili pepper	Daha	SU16WN16	2016/11/05	Amargadi Municipality-3, Aaitabazar, Dadeldhura, Nepal	N29-17-23.10	E80-33-51.51	1,627	native
260712	*Capsicum annuum* L.	Chili pepper	Daha	SU16WN17	2016/11/06	Amargadi Municipality-3, Aaitabazar, Dadeldhura, Nepal	N29-17-23.10	E80-33-51.51	1,627	farmland
260713	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN18	2016/11/07	Dasharatha Municipality-3, Shahilek Gadhi, Baitadi, Npela	N29-33-30.3	E80-25-09.2	1,611	Agricultural Development Office
260714	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN19	2016/11/07	Dasharatha Municipality-3, Shahilek Gadhi, Baitadi, Npela	N29-33-30.3	E80-25-09.2	1,611	Agricultural Development Office
260715	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN20	2016/11/07	Dasharatha Municipality-3, Shahilek Gadhi, Baitadi, Npela	N29-33-30.3	E80-25-09.2	1,611	Agricultural Development Office
260716	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN21	2016/11/07	Gurukhola VDC-8, Satbanjha, Baitadi, Nepal	N29-31-14.84	E80-29-49.54	1,856	farmland
260717	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN22	2016/11/08	Silgadhi-6, Ddarikhola, Doti, Nepal	N29-15-46.3	E80-57-12.2	590	farmland
260718	*Capsicum annuum* L.	Chili pepper	Daha	SU16WN23	2016/11/08	Khatiwada VDC-7, Raukalla, Doti, Nepal	N29-17-35.2	E80-56-32.6	1,337	farmland
260719	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN24	2016/11/07	Siddheswari VDC-4, Bhattadi, Baitadi, Nepal				farmland
260720	*Capsicum annuum* L.	Chili pepper	Daha	SU16WN25	2016/11/08	Amargadi Municipality-3, Kotoidya Dadeldhura, Nepal				farmland
260721	*Capsicum annuum* L.	Chili pepper	Daha	SU16WN26	2016/10/31	Jumla market, Jumla, Nepal	N29-16-32.92	E82-10-59.18	2,357	market
260722	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN27	2016/11/02	Daha-1, Bihani, Kalikot Bazar, Kalikot, Nepal	N29-07-55.6	E81-39-09.0	1,551	market
260723	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN28	2016/11/03	Baskoti, Dailekh, Nepal	N28-45-39.34	E81-39-47.68	684	farmland
260724	*Capsicum annuum* L.	Chili pepper		SU16WN29	2016/11/03	Baskoti, Dailekh, Nepal	N28-45-39.34	E81-39-47.68	684	farmland
260725	*Capsicum annuum* L.	Chili pepper	Pire Khursani	SU16WN30	2016/11/01	Babira-4, Tatopani, Jumla, Nepal	N29-14-34.8	E82-04-34.0	2,284	farmland
260726	*Capsicum annuum* L.	Chili pepper	Ban pire khursani	SU16WN31	2016/11/01	Babira-4, Tatopani, Jumla, Nepal	N29-14-20.9	E82-04-20.4	2,284	farmland
260727	*Capsicum annuum* L.	Chili pepper	Bud Khursani	SU16WN32	2016/11/01	Babira-4, Tatopani, Jumla, Nepal	N29-14-20.9	E82-04-20.4	2,284	farmland
260728	*Capsicum annuum* L.	Chili pepper	Khursani	SU16WN33	2016/11/01	Nuwaghar, Jumla, Nepal	N29-14-51.68	E82-06-44.35	2,297	farmland
260729	*Capsicum annuum* L.	Chili pepper	Jire Khursani	SU16WN34	2016/11/01	Nuwaghar, Jumla, Nepal	N29-14-51.68	E82-06-44.35	2,297	farmland
260730	*Capsicum frutescens* L.	Chili pepper	Jire Khursani	SU16WN35	2016/11/04	Ghodaghodi Municipality-8, Dipanagar, Kailali, Nepal	N28-42-35.9	E80-58-08.3	173	farmland
260731	*Capsicum frutescens* L.	Chili pepper		SU16WN36	2016/11/07	Sidddhapur VDC-1, Gailek, Baitadi, Nepal	N29-24-10.5	E80-37-43.9	1,846	farmland

Photo 1. *Amaranthus hypochondriacus* cultivated at Kalikot Dist.

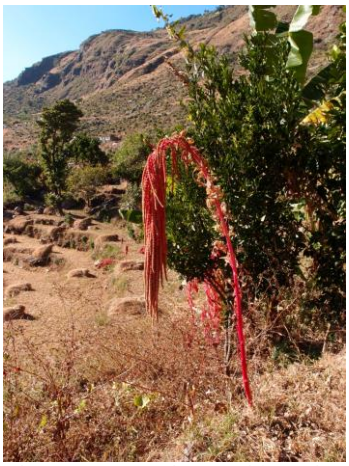

Photo 2. *A. caudatus* cultivated at Kalikot Dist.

Photo 3. Amaranth were cultivated with maize in Kalikot Dist.

Photo 4. Amaranth were cultivated around the field of chili pepper at Banke Dist.

Photo 5. Amaranth were also cultivated around the field of ground nuts at Banke Dist.

Photo 6. *A. hybridus* at Banke Dist.

Photo 7. *A. spinosus* at Banke Dist.

Photo 8. *A. blitum* at Banke Dist.

Photo 9. Cultivation field of amaranth at Baitadi Dist.

Photo 10. Color variation of inflorescence of *A. hypochondriacus* at Baitadi Dist.

Photo 11. Amaranth grain in plastic bags brought from mountain areas at Dipayal market.

Photo 12. Amaranth grains inside a bag.

Photo 13. Amaranth grains are exchanged with industrially produced salt from India.

Photo 14. The granary of a wholesaler at Dhangadhi.

Photo 15. Several tons of amaranth grains were stored in the granary.

Photo 16. Khursani (*C. annuum*) No. 18.

Photo 17. Daha (*C. annuum*) No. 5.

Photo 18. Daha (*C. annuum*) No. 6.

Photo 19. Utar tedi (*C. annuum*) No. 3.

Photo 20. Jire Khursani (*C. frutescens*) No. 2.

Photo 21. Jire Khursani (*C. frutescens*) No. 35.