

A Field Study to Explore Plant Genetic Resources in the Sagaing Region and Shan State of Myanmar in 2016

Ken NAITO ¹⁾, San San Aye ²⁾, Min San Thein ²⁾, Aung Phyoe Hein ³⁾,
Emiko TAKEI ⁴⁾, Toshiki OSADA ⁵⁾, Eiji DOMON ¹⁾,
Kazuo WATANABE ⁶⁾, Makoto KAWASE ^{1), 6)}

- 1) *Genetic Resources Center, National Agriculture Research Organization, 2-1-2, Kannondai, Tsukuba, Ibaraki 305-8602, Japan*
- 2) *Biotechnology, Plant Genetic Resources and Plant Protection Division, Department of Agricultural Research, Ministry of Agriculture, Livestock and Irrigation, Yezin, Nay Pyi Taw, Republic of the Union of Myanmar*
- 3) *Yezin Agriculture University, Ministry of Agriculture, Livestock and Irrigation, Yezin, Nay Pyi Taw, Republic of the Union of Myanmar*
- 4) *Faculty of International Studies, Osaka Gakuin University, 2-36-1 Kishibe-Minami, Suita-shi, Osaka 564-8511, Japan*
- 5) *Research Institute for Humanity and Nature, 457-4 Motoyama, Kamigamo, Kita-ku, Kyoto 603-8047, Japan*
- 6) *Faculty of Life and Environmental Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8577, Japan*

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Okayama University)

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Corresponding author: M. KAWASE (e-mail: setariakawase@gmail.com)

Summary

This is the report of a Myanmar-Japan cooperative field study designed to explore plant genetic resources, mainly in the northern Sagaing Region and Shan State of Myanmar, in October of 2016. This field study was based on previous works (Domon *et al.* 2015a, 2015b; Min San Thein *et al.* 2017) conducted in the Sagaing Region, which indicated that the hilly and mountainous areas in the region are home to a diversity of traditional crops and varieties mainly grown under a slash-and-burn cultivation scheme in fields and backyard gardens in Hkamti district and Lahe township, while, according to the preliminary survey, various rice landraces are also grown on terraces in Layshee township.

First, we focused on Layshee township and its vicinity, where the Naga people live. We explored diverse plant genetic resources including cucurbitaceous plants, surveyed the corresponding ethnobotanical

aspects, and collected crop wild relatives (CWRs), such as *Vigna* species. Slash-and-burn cultivation is commonly practiced on mountain slopes in the Sagaing Region, where rice, other cereals, food legume, roots and tuber crops, various vegetables, and miscellaneous herbs and spices are often planted in mixed cropping systems. We confirmed that rice-terrace farming is common where enough mountain stream water is available for irrigation in Layshee township.

Second, we ran a preliminary survey mainly of vegetables and CWRs in the Taunggyi district of Shan State. A total of 177 seed samples were collected in the Sagaing Region, which included cereal crops (42 samples), leguminous crops (43), various vegetables (46), herbs and spices (19), tea plant (1), and CWRs (26). Five and three samples of CWRs were collected during the survey in Taunggyi district of Shan State and during a short visit to Yangon/Bago area, respectively. The collected plant materials were divided into two subsets, one to be maintained at the Seed Bank of Myanmar, and the other at NIAS Genetic Resources Center (NIAS GRC, now NARO GRC) in Japan after transfer in accordance with national and international legislation and operative procedures. Various vernacular names were noted from interviews with local people in the Sagaing Region. Different names were used for each crop among Naga people, while similar names were given within a particular Naga tribe, for example within Para Naga or within Thunkle Naga. The present field study explored the agrobiodiversity in Layshee township of the Sagaing Region and successfully collected some components of such diversity as plant genetic resources. Detailed studies should be carried out by specialists in semi-domesticated cucurbitaceous species and some of the CWRs.

KEY WORDS: Sagaing Region, Shan State, Myanmar, Agro-biodiversity, Crop wild relatives

Introduction

This is the report of a Myanmar-Japan joint field study carried out in the hilly and mountainous areas of Myanmar in October of 2016. Earlier studies in Naga Self-Administered Zone (Naga SAZ) in the Sagaing Region, Kachin State, indicated that the people living in the scattered villages of the hilly and mountainous areas have been growing a diversity of traditional crops and varieties, mainly in a slash-and-burn traditional cultivation scheme, as well as in backyard gardens (home gardens) and in terrace; additionally, these people collect useful plants from their surrounding environments (Domon *et al.* 2015a, 2015b; Min San Thein *et al.* 2017; Kawase *et al.* 2011; Yamamoto *et al.* 2011; Watanabe *et al.* 2007). The present study was planned because an observation on our last visit implied that Layshee township of NAGA SAZ might be characterized by terrace cultivation of rice compared with Lahe township, another township in NAGA SAZ (Min San Thein *et al.* 2017).

We pursued four basic objectives in the study. First, we targeted Layshee township to explore and collect crop seeds as plant genetic resources (PGRs), and understand their traditional uses by interviewing local people from an ethnobotanical point of view. Collected PGRs could help future crop improvement and should be conserved in gene banks. Second, we wished to elucidate how traditional crops and their local landraces in the area have been influenced by socio-economical changes brought about by recent democratization in Myanmar. Influence could also be expected from neighboring India, since the township is near Nagaland State of India. Additionally, we paid special attention to locally cultivated and useful vegetables, including cucurbitaceous plants in the Layshee township of Sagaing Region, and the hilly areas in Taunggyi district of Shan State. Lastly, wild *Vigna* species were targeted as CWRs during the visit to the

Sagaing Region and other areas in Myanmar, because several populations of *Vigna* spp. were found in the previous visit to Lahe and Layshee townships, where limited systematic survey was done on those species.

Methods

We targeted three areas, Naga SAZ in the Sagaing Region, the lowland of the same region, and Taunggyi district in Shan State (Fig. 1). We planned to work in October, since most terraced-rice had already been harvested during our preceding visit to Layshee township in November of 2015 (Min San Thein *et al.* 2017). Access and field work in the hilly and mountainous parts of Myanmar, such as Naga SAZ, are not always easy, particularly for foreign researchers, due to poor transportation conditions, language barriers and/or time-consuming procedures for obtaining entry permits. The most productive field study was expected from a group of specialists in different areas of knowledge with specific, but interrelated objectives. The group also included preeminent Myanmar researchers. Therefore, we organized a collaborative field research-team in five Japanese scientists and two Myanmar counterparts financially supported by four independent funds described below. All members of the team agreed that all results obtained - including PGRs - would be shared as common achievements of the team, conserved in Myanmar and Japan and be open to public access, as deemed appropriate.

The members of the field study team in Naga SAZ were Kawase (MK, team leader), Osada (TO), Takei (ET), San San Aye (SSA), Watanabe (KW), Aung Phyoe Hein (APH) and Naito (KN) for PGRAsia. We gathered at Hommalin on October 8, traveled upstream to the small port town Htamanthi (also written Tamanthi or Tamanthe) by boat, went up to Layshee (Layshi or Leshi) and Somra (Sum Ma Rar) townships using two 4x4 vehicles locally hired, and came back to Hommalin via Htamanthi (Table 1, Fig. 1). The field survey in lowland Sagaing was done by all team members at Htamanthi before going to Naga SAZ and at Hommalin on the way back from Naga SAZ. From there, MK and SSA made a quick visit from north to south in Taunggyi district of Shan State. MK surveyed the area from Yangon through Bago. MK and SSA are specialists in PGRs conservation, TO is a linguist, ET is a ethnobotanist, KW is a plant geneticist and biotechnologist, KN is a specialist in plant genomics and genetics, and APH is an agricultural student native from Naga SAZ enrolled in Yezin Agriculture University (YAU). SSA was appointed by the Department of Agricultural Research (DAR) and APH was nominated in coordination by YAU and DAR. Domon (ED), Min San Thein (MST) and MK kept correspondences for coordination prior to the field trip.

We visited fields for exploring standing crops or just after harvest, and interviewed local people about their cultivation practices and utilization of their produce, particularly regarding cereals, legumes, vegetables, as well as herbs and spices. Geographical information of each site was recorded using Oregon 650TCJ (Garmin International, Inc.) and a free application Geo Tracker ver. 3.3.0 (<https://geo-tracker.org/>) with NEXUS 6P (Google Inc.). The different GPS devices used all rendered almost the same longitude and latitude data. Since altitude measurements by different GPS devices were contradictory with each other and, therefore, unreliable, altitude was obtained from Google Earth (Google Inc.) with the GPS location data at every site. We asked local people along the exploration route about crops produced and consumed in the area, such as rice, millets, pulses, and vegetables, in accordance with the International Society of Ethnobiology (ISE) Code of Ethics (<http://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/>). Photographs of 73 crops were shown to local people to collect vernacular names through an interview at 14 sites. We also collected CWRs particularly focusing on *Vigna* species, as well as semi-domesticated and wild cucurbitaceous plants.

Table 1. Itinerary of the field study in Sagaing Region, Shan State, and Yangon/Bago area of Myanmar in 2016

day	YY/MM/DD	date	route	KAKEN 16H05778	KAKEN 25257416	Genebank Project	PGRAsia
1	2016/10/7	FRI	arrive at Yangon	MK, TO, ET	KW		KN
2	2016/10/8	SAT	Yangon - Hommalin	MK, TO, ET, SSA	KW, APH		KN
3	2016/10/9	SUN	Hommalin - Htamanthi	MK, TO, ET, SSA	KW, APH		KN
4	2016/10/10	MON	around Htamanthi	MK, TO, ET, SSA	KW, APH		KN
5	2016/10/11	TUE	Htamanthi - Layshee	MK, TO, ET, SSA	KW, APH		KN
6	2016/10/12	WED	around Layshee	MK, TO, ET, SSA	KW, APH		KN
7	2016/10/13	THU	around Layshee	MK, TO, ET, SSA	KW, APH		KN
8	2016/10/14	FRI	Layshee - Somra	MK, TO, ET, SSA	KW, APH		KN
9	2016/10/15	SAT	around Somra	MK, TO, ET, SSA	KW, APH		KN
10	2016/10/16	SUN	around Somra	MK, TO, ET, SSA	KW, APH		KN
11	2016/10/17	MON	Somra - Layshee	MK, TO, ET, SSA	KW, APH		KN
12	2016/10/18	TUE	Layshee - Htamanthi	MK, TO, ET, SSA	KW, APH		KN
13	2016/10/19	WED	Htamanthi - Hommalin	MK, TO, ET, SSA	KW		KN
14	2016/10/20	THU	around Hommalin	TO, ET	KW	MK, SSA	KN
15	2016/10/21	FRI	around Hommalin	TO, ET	KW	MK, SSA	KN
16	2016/10/22	SAT	Yangon; some Japanese members leave Myanmar for Japan within a	TO, ET	KW	MK, SSA	KN
17	2016/10/23	SUN	Mandalay - Kalaw			MK, SSA	
18	2016/10/24	MON	Kalaw - Pinlaung - Yezin			MK, SSA	
19	2016/10/25	TUE	Yezin			MK, SSA	
20	2016/10/26	WED	Yezin			MK, SSA	
21	2016/10/27	THU	Yezin - Yangon			MK	
22	2016/10/28	FRI	Yangon			MK	
23	2016/10/29	SAT	leaving Yangon			MK	
24	2016/10/30	SUN	arriving at Japan			MK	

Note:

MK: Makoto Kawase, TO: Toshiki Osada, ET: Emiko Takei, KW: Kazuo Watanabe,
APH: Aung Phyeo Hein, SSA: San San Aye, KN: Ken Naito

Collected materials were divided into two subsets; one to be conserved at the Seed Bank, Plant Biotechnology, Plant Genetic Resources and Plant Protection Department (PBPGRPPD), DAR, Ministry of Agriculture, Livestock and Irrigation (MALI), located at Yezin, Nay Pyi Taw, Myanmar for further research and crop improvement. The other subset of materials was transferred under the Standard Material Transfer Agreement (SMTA) for the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of the United Nations Food and Agriculture Organization (FAO) and a phytosanitary certificate issued by the Plant Quarantine Office of DOA, Yangon, Myanmar to Japan, to be conserved at the NARO GRC in Tsukuba, Japan.

Results and Discussions

The field-study team visited the target areas around the time rice was harvested and collected local crops-varieties and CWRs as PGRs from crop fields as they underwent drying after harvest or from storage in farm houses, huts on the slash-and-burn cultivation fields or even by the roadside, and noted relevant data on geographical information, cultivation practices, characteristics and utilization of the product. Our activities were recurrently disturbed by showers almost every day until mid-October. The visit to Naga SAZ was just in time for rice harvest, but somewhat early for some of the crops or CWRs. We recorded crop names, village names, sources of the plant materials, cultural practices, sowing and harvesting months, GPS and topography data.

Plant genetic resources collected

A total of 177 seed samples were collected in the Sagaing Region, including cereal crops (42 samples), leguminous crops (43), various vegetables (46), spices and herbs (19), a tea plant (1), and numerous CWRs (26) (Tables 2 and 3). Five and three samples of CWRs were collected during the survey in Taunggyi district in Shan State, and during a short visit to the Yangon/Bago area, respectively. One sample of *Vigna radiata* var. *sublobata* that had been collected by MST and MK in Nay Pyi Taw on September 9, 2016, and conserved at the Seed Bank was included in the list.

Collected materials were divided into two subsets; one for the Myanmar Seed Bank, Myanmar and the other for the NARO GRC, Japan. Rice seeds that required a Special Permit application for introduction in Japan were temporally conserved at Myanmar Seed Bank.

Observation at Layshee and Somra townships

Layshee town, the capital of Layshee township, sits at about 1,300 m above sea level (Fig. 1a; Photograph 1). The town is inhabited by peoples of Thankul Naga, Makuri Naga, Para Naga and others, mostly engaged in agriculture. Thankul Naga and Makuri Naga people are mostly Christians, while some of the Para Naga people are Buddhists. Somra town in Somra township is found at 1,900 m above sea level (Photographs 2 and 3). Although most of the population in this town are Thankul Naga Christians who call themselves Somra Naga, some are Buddhist. Somra town is close to the border with Manipur State and Nagaland State in India. Local people told us they were trading across the border, which was confirmed by the fact that vehicles with Indian license plates were common in Layshee and Somra townships.

Layshee town and Somra town are both in the highlands. Lower sites lay between them at about 630 m above sea level, where rice terraces are irrigated with water from the mountain streams.

We recorded slash-and-burn cropping of various species in both townships (Photograph 4), similarly to other mountainous areas previously visited in Hkamti and Lahe townships (Domon *et al.* 2015a, 2015b; Min San Thein *et al.* 2017).

Rice was the major crop found in sloped slash-and-burn fields (Photograph 4), as well as in terraced paddy fields (Photograph 5). Tree spinach was sometimes mix-cropped in slash-and-burn rice fields that were often surrounded by sweet potatoes, yams, castor beans, sorghum, bananas, cassava, and other species. Non-branching and branching types of tree spinach were observed. The crops mixed in rice slash-and-burn fields seemed less diverse than those in Lahe township, where tree spinach, maize, sorghum, Job's tears, soybean, common bean, sword bean, pigeon pea, pumpkin, ash gourd, eggplant, cockscomb, cassava, yams, roselle, kenaf, sugarcane, edible canna, sesame, perilla, ginger, chili pepper, among others, were

Table 2. Summarized list of the plant materials collected in the Sagaing Region, Shan State, and Yangon/Bago area of Myanmar in 2016

Crops	English name	Latin name	No of collection
cereals	rice	<i>Oryza sativa</i> L	23
	maize	<i>Zea mays</i> L	15
	Job's tears	<i>Coix lacryma-jobi</i> L var <i>ma-yuen</i> Stapf	2
	foxtail millet	<i>Setaria italica</i> (L) P Beauv	2
legumes	common bean	<i>Phaseolus vulgaris</i> L	15
	soybean	<i>Glycine max</i> (L) Merr	6
	cowpea	<i>Vigna unguiculata</i> (L) Walp	6
	rice bean	<i>Vigna umbellata</i> (Thunb) Ohwi et Ohashi	4
	groundnut	<i>Arachis hipogaea</i> L	3
	lablab bean	<i>Lablab purpureus</i> (L) Sweet	3
	pea	<i>Pisum sativum</i> L	2
	chickpea	<i>Cicer arietinum</i> L	1
	runner bean	<i>Phaseolus coccineus</i> L	1
	faba bean	<i>Vicia faba</i> L	1
	mung bean	<i>Vigna radiata</i> (L) Wilczek	1
	vegetables including oil crops	Brassicac	<i>Brassica juncea</i> (L) Czern and <i>B. oleracea</i> L
edged gourd		<i>Luffa acutangula</i> (L) Roxb	5
cucumber		<i>Cucumis sativus</i> L	4
roselle		<i>Hibiscus sabdariffa</i> L	3
pod raddish		<i>Raphanus sativus</i> L	3
okra		<i>Abelmoschus esculentus</i> (L) Moench	1
tree spinach		<i>Chenopodium bengalense</i> (Lamarck) Spielm ex Steud	2
pumpkin		<i>Cucurbita moschata</i> Duchesne ex Poir	2
bottle gourd		<i>Lagenaria leucantha</i> (Duchesne ex Lam) Rusby, (syn <i>L. siceraria</i>)	2
bitter gourd		<i>Momordica charantia</i> L	2
eggplant		<i>Solanum melongena</i> L	2
black seed squash		<i>Cucurbita ficifolia</i> Bouché	1
lettuce		<i>Lactuca sativa</i> L	1
tomato		<i>Solanum lycopersicum</i> L	1
snake gourd		<i>Trichosanthes cucumerina</i> L	1
niger seeds		<i>Guizotia abyssinica</i> (L f) Cass	2
sesame		<i>Sesamum indicum</i> L	2
spices and herbs	chili pepper	<i>Capsicum annuum</i> L	7
	Chinese pepper	<i>Zanthoxylum alatum</i> Roxb (syn <i>Z. armatum</i> DC)	4
	coriander	<i>Coriandrum sativum</i> L	3
	perilla	<i>Perilla frutescens</i> (L) Britton	3
	dill	<i>Anethum graveolens</i> L	1
	elsholtzia basil	<i>Elsholtzia blanda</i> (Benth) Benth	1
tea plant	tea plant	<i>Camellia sinensis</i> (L) Kuntze	1
CWRs			
(semi-domesticated gourds)	wild edged gourd	<i>Gymnopetalum chinense</i> (Loureiro) Merrill	4
	wild bitter gourd	<i>Momordica balsamina</i> L	1
	wild bitter gourd	<i>Momordica subangulata</i> Blume	1
(grass)	wild barnyard grass	<i>Echinochloa crus-galli</i> (L) P Beauv	1
(legumes)	wild azuki bean	<i>Vigna hirtella</i> Ridley	4
	wild azuki bean	<i>Vigna angularis</i> (Willd) Ohwi et H Ohashi var <i>nipponensis</i> (Ohwi) Ohwi et H Ohashi	3
	wild mung bean	<i>Vigna radiata</i> (L) Wilczek var <i>sublobata</i> (Roxb) Verdcourt	2
	wild mung bean	<i>Vigna trinervia</i> (Heyne ex Wight et Arnott) Tateishi	2
(vegetables)	wild azuki bean	<i>Vigna tenuicaulis</i> N Tomooka et Maxted	1
	wild eggplant	<i>Solanum torvum</i> Sw	6
	wild eggplant	<i>Solanum violaceum</i> Ortega	4
	wild snake gourd	<i>Trichosanthes tricuspidata</i> Lour	3
	amaranth	<i>Amaranthus blitum</i> L	1
	wild cucumber	<i>Cucumis hystrix</i> Chakrav	1
	wild sesame	<i>Sesamum radiatum</i> Schumacher et Thonn	1
Total			185

observed (Min San Thein *et al.* 2017). There were also slash-and-burn fields of soybean, instead of rice, mixed with tree spinach, rice beans, common beans, yams, edible canna, sword beans, ginger, and others. Job's tears were also grown in these fields. Maize stalks are sometimes left in the fields after harvest, and used as supporting poles for climbing leguminous crops, like rice beans and common beans (Photograph 6). In addition to slash-and-burn fields, rice beans were observed growing on small flat fields near streams (Photograph 7), and on the edges of paddy fields (Photograph 5). Soybean was also found on the edges of some paddy fields.

Small fields located in the backyard of or near farm houses were used for various crops, such as common beans, garden peas, yams, edible canna, long-yard beans, bananas, nightshades, cockscomb, elephant foot yams, chili peppers, sugarcane, perilla, cassava, chayote, bitter gourds, edged cucumbers, coffee, avocados, tobacco, amaranth, brown mustard, black-seed pumpkins, Chinese broccoli, roselle, basils, ginger, and others.

Harvested crops were stored on the walls and above the fireplace inside farm houses and huts in the fields: foxtail millet, maize, rice, yard-long bean, chili pepper, onion, dried bottle gourd, cucumber seed, dried basils, coriander, and others. Fresh cucumber, Chinese broccoli, squash (pumpkin), mushrooms, and chayote were found in houses ready for food preparation. Yam petioles are dried in the sun (Photograph 8). Bottle gourds are used as water container. Rice is often spread on a sheet outside the farm house to dry in the sun.

In high altitudinal areas of Layshee and Somra townships, wild perennial buckwheat, *Fagopyrum cymosum* is widely distributed (Photograph 9). People told us that it is not used as food, but could be used for medicine. Wild *Vigna* species were sporadically found in grassy bushes along the roadsides. *Vigna hirtella* was found near houses and fields (Photograph 10), *Vigna tenuicaulis* formed a big population near a bridge across a stream in a valley (Photograph 11), while *Vigna angularis* var. *nipponensis* populated the roadsides. A limited number of wild *Vigna* samples were collected, because plants had not reached full maturity. It is interesting to note that a *Cucumis* species was found on a roadside cliff (Photograph 12). The specimen was regarded as *C. hystrix*, which is a not a wild ancestor, but a close relative of cucumber.

Observation at Htamanthi and Hommalin townships

Since Htamanthi town and Hommalin town are both near the Chindwin River, we could see those towns and their vicinity at an altitude of less than 200 m above sea level (Fig. 1b). Thus, we decided to visit some of the market places and farm houses in the area.

Although Htamanthi is a small port town, it is an important entrance to Layshee township and has a market place. We observed small bitter gourd, chili pepper, Mexican coriander, lablab bean, radish seed, fresh banana, roselle, chayote, pumpkin, eggplant, tamarind fruit, water mimosa (*Neptunia oleracea*), ash gourd, cowpea, betel leaf, basils, bean sprouts, chili powder, water spinach and other species, all sold at the market places. Fermented soybean, boiled black rice, and some local rice snacks were available at the market places we stopped by, while small amounts of cookies and processed foods made in India and China was also sold there. Tea plants were grown in the forest near Htamanthi town. There were slash-and-burn cultivation rice fields where Job's tears were mix-cropped, and cassava, rice bean, soybean, yam, cowpea, banana, and sweet potato were grown nearby.

We observed a slash-and-burn field where rice, soybean, banana, cassava, yard-long bean, Job's tears, rice bean, yams, sweet potato, chili pepper, bitter gourd, eggplant, and other species, were grown

near Htamanthi town.

Hommalin is a much larger town than Htamanthi, since for a time, it was an important base for trade on the Chindwin river. Tea production was also observed in Hommalin. They told us that tea production was important for Hommalin economy and that the famous Indian Assamese tea had originated from Hommalin.

There were two market places in Hommalin town, unlike Layshee or Somra, where there were no such markets but only small shops. One, which was of a rather simple, but wooden architecture, sits on the east end of the downtown. This market place was open the whole day, while the other was a cluster of mobile trolley-shops or ground stalls along the road on the west side of downtown, which was open only in the early morning. Fresh vegetables and fruits were available at those market places, particularly early in the morning. We observed yard-long bean, winged bean, chili pepper, cucumber, edged cucumber, eggplant, okra, bottle gourd, ivy gourd, wild edged gourd (*Gymnopetalum chinense*), banana, ginger, arrowroot, cassava roots, radish, pumpkin, taro, tomato, onion, bitter melon, chayote fruits and vines, water mimosa, roselle, Chinese broccoli leaves, shallot leaves, fruits of Indian trumpet flower tree, grape fruits, Indian nightshade, water spinach, passion fruit, basil, papaya fruit, coconuts, dragon fruit, orange, pomegranate, Mexican coriander, Asian pennywort, “gway dauk” (*Dregea volubilis*) leaves, various ornamental flowers and other species mostly produced in the vicinity of Hommalin, the smaller market. Apples are probably an import from Shan State, China, or other areas. In the larger market places, we found light meals, snacks and food materials, like a variety of noodle soups, steamed rice stuffed in bamboo stalk, steamed rice with beans, glutinous rice cakes, fermented bamboo shoot, fermented fish with rice, fermented soybean, fermented fish, living and cooked crickets, rice grains with husks and milled rice, rice bean seed, perilla seed, pepper seed, Chinese pepper seed, fresh fish, different meats, and chicken eggs, in addition to agricultural crops and useful plants like in the slammer one.

We visited several fields and farm houses in Hommalin and in the vicinity. Local farmers had various cultivated crops and semi-domesticates in small gardens near their houses. We saw, for example, yam, ivy gourd, turmeric, cassava, balsam apple, elephant foot yam, eggplant, ash gourd, sugarcane, pointed gourd (*Trichosanthes dioica*) (Photograph 13), water spinach on wet soil, Mexican coriander, cowpea, yard-long bean, winged bean, basil, grape fruit, pomelo, banana, papaya, taros, and coconut tree.

Farmers grow rice in lowland paddy fields and gently sloped slash-and-burn fields under different topographic conditions. Banana, Indian nightshade, roselle and pigeon pea are grown near the slash-and-burn rice fields.

Observation in Taunggyi district of Shan State and Yangon/Bago areas

Although it was a short visit to Taunggyi district in Shan State (1,200 to 1,500 m above sea level) (Fig. 1c), we observed various CWRs of cucurbitaceous plants and *Vigna* species - *Momordica balsamina*, wild edged gourd, wild form of *Trichosanthes cucumerina*, wild bitter melon (*Momordica subangulata*, not confirmed), redball snake gourd (*Trichosanthes tricuspoidata*), perennial buckwheat (*Fagopyrum cymosum*), *Vigna hirtella*, and *V. radiata* var. *sublobata*. Farmers grow rice, sorghum, maize, soybean, yard-long bean, rice bean, winged bean, velvet bean, sugarcane, pod radish, brown mustard, bottle gourd, sword bean, basil (Photograph 14), edible canna, banana, and other species. They grow rice as a staple and various vegetables widely as cash crops in the district. We visited this area before the harvest season. We concluded that November might be the best time for collecting many of the crops and several CWRs.

We visited Yangon/Bago areas for a half day (Fig. 1d). This is a lowland areas at some 20-30 m above sea level, where some CWRs were seen - e.g. wild rice populations (*Oryza rufipogon*) (Photograph 15) in ponds and wetlands, wild edged gourd (Photograph 16) climbing on a tree, a wild relative of sesame, *Sesamum radiatum* (Photograph 17) and *Vigna trinervia* (Photograph 18) on the roadside. It is noteworthy that there might be different kinds of CWRs distributed even near Yangon, an old capital, and an easily accessible place.

Vernacular names of crops in surveyed areas

Printed photographs of 73 crops used for previous trips were shown to local people at Htamanthi, nine villages in Layshee township, one in Somra township, two in Hommalin township and one in Taunggyi district of Shan State, to make sure which crop was grown, and to collect vernacular names *in-situ*. Since we were not aware of the language phonetic systems, the results might be only tentative records of vernacular names, which would hopefully be corrected by succeeding researcher or local people. Where people had their own writing system in Roman alphabet, we asked them to write crop names by themselves.

Many crop names used in Naga villages in the mountains were often rather unique and largely variable from village to village, except for some crops of whose names were loan words from Myanmar (Bama) language. Among these, some similarity was observed between villages belonging to the same tribes, for example, between Thunkul Naga (including Somra Naga) people at Htamanthi (waypoint K004), Ye Taung (K011), Sapyia (K014) and Somra (K036), and between Para Naga people at Lili Tashai Nta (K012) and Dhaein Ka Lain Saein Pya (K019). Shan people at Taung Ya Taw (K056) and Man Pan (K061) used crop names that sound like those used in Thailand.

Detailed data on vernacular names recorded during the present field survey, together with those obtained on our previous visit to the Sagaing Region, are being compiled and will be reported elsewhere.

Potential crop genetic diversity in the northern Sagaing Region

As suggested by preliminary work (Min San Thein *et al.* 2017), the people of the scattered villages in the hilly and mountainous areas in Layshee township and the vicinity maintained a diversity of traditional crops and varieties cultivated on slash-and-burn cultivation fields, terraced paddy fields and backyard gardens.

Through the democratization process, life and agriculture in Naga SAZ has changed rapidly and the speed of change continues to increase; thus, traditional crops and varieties are faced with the risk of genetic erosion. Construction of new roads enhanced border trade with India, and Indian rice varieties were introduced. Grape fruits and cardamon were introduced as cash crops. Traditional cereals like foxtail millet, finger millet and Job's tears were sporadically found. Field studies exploring and collecting plant genetic resources and their information should be carried out as soon as possible. The present results also suggest that miscellaneous vegetables, such as cucurbitaceous semi-domesticated species and/or some crop wild relatives need to be explored by specialists. At the same time, it is important to provide an opportunity for higher education along with the necessary support to promote appropriate technology, including the utilization of the local crops and useful plants, as well as the introduction of new crops in order to develop agricultural production in the areas, although there are obstacles on availability of arable lands, shortage of information and knowledge, limited investment, and scarcity of educated and trained people.

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ミャンマー Sagaing 地方域および Shan 州における 植物遺伝資源の探索収集, 2016 年

内藤 健¹⁾・San San Aye²⁾・Min San Thein²⁾・Aung Phyoe Hein³⁾・
竹井 恵美子⁴⁾・長田 俊樹⁵⁾・土門 英司¹⁾・渡邊 和男⁶⁾・河瀬 眞琴^{1), 6)}

- 1) 農業・食品産業技術総合研究機構 遺伝資源センター
- 2) ミャンマー連邦共和国 農業畜産灌漑省 農業研究局
- 3) ミャンマー連邦共和国 イエジン農業大学
- 4) 大阪学院大学 国際学部
- 5) 総合地球環境学研究所
- 6) 筑波大学 生命環境系

和文摘要

本報告書は 2016 年 10 月にミャンマーのザガイン地方域とシャン州を中心に実施した植物遺伝資源探索のための日本-ミャンマー共同現地研究に関する報告である。本現地調査は、ザガイン地方域において山岳地域において多様な伝統的作物・品種の栽培が続けられているというこれまでの調査結果 (Domon *et al.* 2015, 2016; Min San Thein *et al.* 2017) に基づいて計画された。ザガイン地方域のカムティ県とラヘー郡区やその周辺の山岳地域において焼き畑や家屋の近くの畑に農業生物多様性が見いだされたが、レイシー郡区ではそれに加えて伝統的棚田でさまざまなイネ地方品種の栽培も行なわれていた。そこで、本現地研究では第一に、ナガ人が居住するレイシー郡区とその周辺に注目してウリ科植物を含む多様な植物遺伝資源を探索し、その民族植物学的な側面を調査し、ササゲ属を含む作物近縁野生種も収集した。ザガイン地方域の山地の傾斜地では焼き畑栽培が広く行われ、イネその他の穀類、食料マメ類、根菜類、様々な野菜、ハーブや香辛料作物がしばしば混植されていた。レイシー郡区では山からの渓流水を灌漑用に利用できる場所ではイネの棚田栽培が広く行われていることを確認した。続いて、シャン州タウンジー県で野菜および作物近縁野生種を中心に予備的な調査を行った。ザガイン地方域では禾穀類(42点)、マメ類(43点)、野菜類(46点)ハーブと香辛料(19点)、チャノキ(1点)、作物近縁野生種(26点)を含む計 177 点の種子サンプルを収集した。シャン州タウンジー県とヤンゴン・バゴー地域ではそれぞれ 5 点と 3 点の作物近縁野生種を収集した。収集品は 2 つのサブセットに分け、一方はミャンマーのシードバンクで、他方は国内・国際法、手続きに則って導入しわが国の農研機構ジーンバンクで保存されることとなった。作物の方名の聞き取り調査では、ザガイン地方域内でも非常に多様な呼称があり、ナガ人の間でも異なる呼称で呼ばれることが多かったが、パラ・ナガ人同士やタンクル・ナガ人同士といった支族の間では似通った方名が見られた。本研究によって農業生物多様性がザガイン地方域レイシー郡区においても確認され、その一部分を遺伝資源として収集することができた。特にウリ科の半栽培種のような野菜類やいくつかの作物近縁野生種などは専門家による調査が望まれる。

Table 3 List of plant materials collected in the Sagaing Region, Shan State, and Yangon/ Bago area of Myanmar in 2016

Col No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage
							°	'	"	N	°	'	"	E													
1	257833	<i>Capsicum annuum</i>	chili pepper	10/10	Htamanthi	K001	25	19	54.7	N	95	17	21.9	E	148	local market	landrace	Shwelumbo				undulating	level				
2	257834	<i>Vigna unguiculata</i>	cowpea	10/10	Htamanthi	K003	25	20	9.3	N	95	16	12.9	E	165	farmland	landrace	Pae tauntshae	shifting	Jun/Jly	Nov		hilly	slope	none	Clay	Good
3	257835	<i>Luffa acutangula</i>	edged gourd	10/10	Htamanthi	K004	25	21	10.0	N	95	14	25.9	E	220	farmland	landrace	Ka well thee	shifting	Jun	Sep		hilly	slope	none	Clay	Good
4	257836	<i>Capsicum annuum</i>	chili pepper	10/10	Htamanthi	K005	25	22	2.9	N	95	14	8.2	E	193	farmland	landrace	Shwelumbo	shifting	Jun/Jly	Sep/Oct		undulating	slope	none	Clay	Good
5	257837	<i>Vigna unguiculata</i>	cowpea	10/10	Htamanthi	K005	25	22	2.9	N	95	14	8.2	E	193	farmland	landrace	Latha pe	shifting	Jun/Jly	Sep/Oct		undulating	slope	none	Clay	Good
6	257838	<i>Momordica charantia</i>	bitter gourd	10/10	Htamanthi	K005	25	22	2.9	N	95	14	8.2	E	193	farmland	landrace	Kyat Hin Kha	shifting	Jun/Jly	Sep/Oct		undulating	slope	none	Clay	Good
7	257839	<i>Solanum torvum</i>	wild eggplant	10/10	Htamanthi	K005	25	22	2.9	N	95	14	8.2	E	193	farmland	landrace	-	shifting	Jun/Jly	Sep/Oct		undulating	slope	none	Clay	Good
8	257340	<i>Phaseolus vulgaris</i>	common bean	10/11	Aung Zay Ya Village	K006	25	26	56.5	N	95	6	34.0	E	482	shop	landrace	Bosar pe				product from Kan Kine Lon Village					
9	257841	<i>Cucumis sativus</i>	cucumber	10/11	Aung Zay Ya Village	K006	25	26	56.5	N	95	6	34.0	E	482	shop	landrace	Tha Khawa									
10	257842	<i>Solanum torvum</i>	wild eggplant	10/11	Aung Zay Ya - Layshee	K007	25	26	16.7	N	95	0	46.8	E	867	wild	wild	Kha Yan Kha					mountainous	slope	low	clay	good
12	257843	<i>Vigna hirtella</i>	wild azuki bean	10/11	Layshee	K009	25	26	45.8	N	94	56	55.0	E	1,235	wild	wild						mountainous	slope		clay	
13	257844	<i>Phaseolus vulgaris</i>	common bean	10/11	Layshee	K010	25	26	44.3	N	94	56	52.5	E	1,219	farmland	landrace	Tai Hfaung Pe	shifting				mountainous	slope	none	clay	good
14	257845	<i>Setaria italica</i>	foxtail millet	10/11	Layshee	K010	25	26	44.3	N	94	56	52.5	E	1,219	farmland	landrace	Sat	shifting				mountainous	slope	none	clay	good
15	257846	<i>Solanum torvum</i>	wild eggplant	10/11	Layshee	K011	25	26	41.3	N	94	56	54.5	E	1,205	backyard	landrace	Kha Yan Ka Thee					mountainous	slope	none	clay	good
16	257847	<i>Zea mays</i>	maize	10/11	Layshee	K011	25	26	41.3	N	94	56	54.5	E	1,205	backyard	landrace	Bajak					mountainous	slope	none	clay	good
17	257848	<i>Cucumis sativus</i>	cucumber	10/12	Li Li Tasha	K012	25	28	10.4	N	94	57	5.3	E	1,311	farmer storage	landrace	Yi					mountainous				
18	257849	<i>Zanthoxylum alatum</i>	Chinese pepper	10/12	Li Li Tasha	K012	25	28	10.4	N	94	57	5.3	E	1,311	farmer storage	landrace	Nka Nkwai					mountainous				
19	257850	<i>Zanthoxylum alatum</i>	Chinese pepper	10/12	Li Li Tasha	K012	25	28	10.4	N	94	57	5.3	E	1,311	farmer storage	landrace	Mai Nka					mountainous				
20	257851	<i>Zea mays</i>	maize	10/12	Li Li Tasha	K012	25	28	10.4	N	94	57	5.3	E	1,311	farmer storage	landrace	Lai Sui Yi					mountainous				
21	257852	<i>Zea mays</i>	maize	10/12	Li Li Tasha	K012	25	28	10.4	N	94	57	5.3	E	1,311	farmer storage	landrace	Lai Sui Yu Pai Tsa					mountainous				
22	259829	<i>Oryza sativa</i>	rice	10/12	Li Li Tasha	K012	25	28	10.4	N	94	57	5.3	E	1,311	farmer storage	landrace	Ga Le Zha Fha					mountainous				
23	257853	<i>Perilla frutescens</i>	perilla	10/12	Sapya	K013	25	29	34.7	N	94	57	1.7	E	1,248	farmland	landrace	Atzi					mountainous				
27	257854	<i>Capsicum annuum</i>	chili pepper	10/12	She Da	K017	25	31	20.8	N	94	54	17.9	E	810	backyard	landrace	Shwelumbo		May/Jun	Oct		mountainous				
28	257855	<i>Capsicum annuum</i>	chili pepper	10/12	She Da	K017	25	31	20.8	N	94	54	17.9	E	810	backyard	landrace	Shwelumbo		May/Jun	Oct		mountainous				
29	257856	<i>Amaranthus bilute</i>	wild amaranth	10/12	She Da	K017	25	31	20.8	N	94	54	17.9	E	810	backyard	landrace	Vi Pak Pak		Apr/May	Oct		mountainous				
30	257857	<i>Solanum violaceum</i>	wild eggplant	10/12	She Da	K017	25	31	20.8	N	94	54	17.9	E	810	backyard	landrace	Keli Khak					mountainous				
31	257858	<i>Phaseolus vulgaris</i>	common bean	10/13	Saein Pya	K019	25	27	31.9	N	94	56	31.1	E	1,418	farmer storage	landrace	Ntzei Tui					mountaneous	slope	none	clay	good
32	259830	<i>Oryza sativa</i>	rice	10/13	Saein Pya	K019	25	27	31.9	N	94	56	31.1	E	1,418	farmer storage	landrace	A Zha	shifting/irrigated/transplanted	May	Oct	variety name: Ya Kyaw, transplanting in June	mountaneous	slope	none	clay	good

Table 3 (Continued)

Col No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage			
							°	'	"	N	°	'	"	E																
33	259831	<i>Oryza sativa</i>	waxy rice	10/13	Saein Pya	K019	25	27	31	9	N	94	56	31	1	E	1,418	farmer storage	landrace	Ga Lwer	shifting/irrigated/transplanted	May	Oct	glutinous rice, variety name: Ya Kyaw, transplanting in June	mountaneous	slope	none	clay	good	
34	257859	<i>Glycine max</i>	soybean	10/13	Saein Pya	K019	25	27	31	9	N	94	56	31	1	E	1,418	farmer storage	landrace	Saw Dha		Jly	Dec	curry sweatener, fermented soybean	mountaneous	slope	none	clay	good	
35	257860	<i>Echinochloa crus-galli</i>	wild barnyard grass	10/14	Ye Taung	K025	25	26	25	2	N	94	55	55	3	E	922	farmland	wild		terrace			weed	hilly					
36	257861	<i>Vigna tenuicaulis</i>	wild azuki bean	10/14	Nami Yupi	K027	25	25	43	2	N	94	54	55	4	E	631	wild	wild		roadside					hilly				
37	257862	<i>Sesamum indicum</i>	sesame	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	Ka jaw Kae Sae Ve	shifting	Mar/Apr	Oct/Nov	herb/spice, to make chili-sesame-paste with salt	hilly	slope				
38	259832	<i>Oryza sativa</i>	rice	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	La Ya	shifting/irrigated/terrace	Mar/Apr	Oct/Nov	if cultivated in terrace, sown in May and transplanted in June	hilly	slope				
39	259833	<i>Oryza sativa</i>	rice	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	Zi Tsa	shifting	Mar/Apr	Oct/Nov	glutinous	hilly	slope				
40	257863	<i>Capsicum annuum</i>	chili pepper	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	Shwelumbo	shifting	May	Oct	variety name "ma row ja paw"/put into curry, or pond with meat	hilly	slope				
41	257864	<i>Zea mays</i>	maize	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	Ma Tha	shifting	Mar/Apr	Jly/Aug	mainly forage, sometimes food	hilly	slope				
42	257865	<i>Glycine max</i>	soybean	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	Ma Ru	shifting, backyard			when cultivated, no other crops or vegetables with it	hilly	slope				
43	257866	<i>Brassica juncea</i>	brown mustard	10/14	Nami Yupi Sanpya	K028	25	25	4	2	N	94	54	2	2	E	792	farmer storage	landrace	La Klya						hilly	slope			
44	257867	<i>Vigna umbellata</i>	rice bean	10/14	near Pan Sat	K031	25	25	28	6	N	94	44	50	6	E	1,702	farmland	landrace	Ban Sap	terrace					mountainous	slope	low	clay	moderate
45	257868	<i>Vigna umbellata</i>	rice bean	10/14	Lay Yone	K033	25	23	34	8	N	94	42	47	6	E	1,703	farmland	landrace							mountainous				
46	257869	<i>Vigna angularis</i> var <i>nipponensis</i>	wild azuki bean	10/14	Lay Yone	K034	25	23	36	0	N	94	42	32	9	E	1,679	roadside/ streamside	wild							mountainous				
47	257870	<i>Vigna angularis</i> var <i>nipponensis</i>	wild azuki bean	10/14	200 m from Pun Tre	K035	25	22	23	3	N	94	42	13	0	E	1,720	roadside	wild							mountainous				
48	257871	<i>Brassica juncea</i>	brown mustard	10/15	Somra	K036	25	21	47	3	N	94	41	11	3	E	1,900	farmer storage	landrace	Ka Zi Yeng	backyard	Anytime	anytime	leaves and flowers as vegetables	mountainous					
49	257872	<i>Zea mays</i>	maize	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Ba Jeak	shifting	Apr/May	Jly/Aug	if fresh, toast it dried one should be boiled or fried	hilly/ mountainous	slope	none	clay	good	
50	257873	<i>Lagenaria leucantha</i>	bottle gourd	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Va Tei	shifting	Apr/May	Oct	as containers	hilly/ mountainous					
51	257874	<i>Glycine max</i>	soybean	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Ran Pei	cultivation field	Jun	Oct	fermented or fried	hilly/ mountainous					
52	257875	<i>Solanum torvum</i>	wild eggplant	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Ka Tha Tei	anywhere	Anytime	Anytime	but mainly cultivated in July-Aug	hilly/ mountainous					
53	257876	<i>Coriandrum sativum</i>	coriander	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	She Khwa	backyard	Anytime	anytime	herb	hilly/ mountainous					
54	257877	<i>Lactuca sativa</i>	lettuce	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Ka Tsei Ye ng Karun Nu Tsu Poh	backyard	Anytime	Anytime	fresh vegetable	hilly/ mountainous					
55	257878	<i>Capsicum annuum</i>	chili pepper	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Ka Ma Sung Tei	shifting/backyard	May	Oct	spice	hilly/ mountainous					
56	257879	<i>Brassica juncea</i>	brown mustard	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Ka Tei Yeung	backyard/ cultivation field	Oct	Nov-Apr	for soup or stirfry	hilly/ mountainous					
57	257880	<i>Phaseolus vulgaris</i>	common bean	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Mon Tei	shifting	Apr/May	Jly-Nov	intercropping with maiz, bamboo/young pods for soup and stirfry seeds are boiled or fried	hilly/ mountainous					
58	257881	<i>Vigna unguiculata</i>	cowpea	10/16	Somra	K037	25	21	51	0	N	94	41	4	8	E	1,924	farmer storage	landrace	Mon Tei Yeung	cultivation field	Jun	Oct	young pods and leaves as vegetables matured seeds are not eaten	hilly/ mountainous					

Table 3 (Continued)

Col No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage
							°	'	"	N	°	'	"	E													
59	257882	<i>Chenopodium bengalense</i>	tree spinach	10/16	Somra	K037	25	21	51 0	N	94	41	4 8	E	1,924	farmer storage	landrace	Tha Neyi	shifting/cultivation field	Apr/May	Nov	<i>C giganteum?</i> , <i>C formosanum?</i> for brewing or feeding animals leaves can be vegetables	hilly/mountainous				
60	259834	<i>Oryza sativa</i>	rice	10/16	Somra	K038	25	21	54 8	N	94	41	1 8	E	1,913	farmer storage	landrace	Ko Poh Tha	irrigated/transplanted	Apr	Oct	transplanted in Jun	hilly/mountainous				
61	257883	<i>Phaseolus vulgaris</i>	common bean	10/16	Somra	K038	25	21	54 8	N	94	41	1 8	E	1,913	farmer storage	landrace	Mon Tei	backyard	May	Oct		hilly/mountainous				
62	259835	<i>Oryza sativa</i>	rice	10/16	Somra	K038	25	21	54 8	N	94	41	1 8	E	1,913	farmer storage	landrace	Ye Lum Tha	shifting	Apr/May	Oct		hilly/mountainous				
63	257884	<i>Cucumis sativus</i>	cucumber	10/16	Somra	K038	25	21	54 8	N	94	41	1 8	E	1,913	farmer storage	landrace	Yin Tei	cultivation field	Mar/Apr	Oct	fresh vegetables	hilly/mountainous				
64	259836	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ta Ka Pi	irrigated/transplanted/terraced	Apr	Oct	transplanted in Jun/low land, semi waxy	hilly/mountainous				
65	259837	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Nao Tha Yung	irrigated/transplanted/terraced	Apr	Oct	transplanted in Jun/glutinous/boiled or steamed/brew alcohol/Cake	hilly/mountainous				
66	259838	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ra Cha Tha	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun	hilly/mountainous				
67	259839	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ten Nee Tha	irrigated/transplanted/terraced	Feb	Oct	transplanted in Jun/the best variety in Somra/high yield, hard texture, good flavor	hilly/mountainous				
68	259840	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Kanoa Kanwen Swen Poh	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/aromatic waxy/mixed with other rice to add flavor	hilly/mountainous				
69	259841	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ten Nee Tha Kare Poh	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/semi waxy/simple cook	hilly/mountainous				
70	259842	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Kanoa Lun Rau	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/the best variety for brewing/also boiled or cooked or pasted/glutinous	hilly/mountainous				
71	259843	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Kaeha - Apo Tha	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/the hardest texture/blend with soft varieties/	hilly/mountainous				
72	259844	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ti Kha Tha	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/blend with hard rice/soft texture/semi-glutinous	hilly/mountainous				
73	259845	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Khauk Chan	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/blend with hard rice/soft texture/semi-glutinous/from India?	hilly/mountainous				
74	259846	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ara Tha	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/simple cook/red rice/from India?	hilly/mountainous				
75	259847	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Khauk Chan	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/simple cook/from India?	hilly/mountainous				
76	259848	<i>Oryza sativa</i>	rice	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Khauk Chan	irrigated/transplanted/terraced	Mar	Oct	transplanted in Jun/simple cook/good for clay soil	hilly/mountainous				
77	257885	<i>Coix lacryma jobi</i> var <i>ma-yuen</i>	Job's tears	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Yee Tha	shifting/backyard/edges of paddy fields	Mar	Oct	for brewing	hilly/mountainous				
78	257886	<i>Vicia faba</i>	faba bean	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Mabou Muk Tei	backyard, near potato field	Aug	Nov-Mar	Young pods and seeds for curry, or simply boiled	hilly/mountainous				
79	257887	<i>Elsholtzia blanda</i>	elsholtzia basil	10/16	Somra	K036	25	21	47 3	N	94	41	11 3	E	1,923	farmer storage	landrace	Ni Pi Yen	wherever fertile	Mar	Oct-Dec	young leaves for flavoring curry	hilly/mountainous				

Table 3 (Continued)

Co1 No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage		
							o	'	"		o	'	"																
80	257888	<i>Zea mays</i>	maize	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Di Wa Thei	wherever fertile	Mar	Aug	simply toast if fresh/dried seeds are boil or fried	hilly/mountainous						
81	257889	<i>Zea mays</i>	maize	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Tha Va Nak Tei	wherever fertile	Mar/Apr	Aug	sweet, soft and big/the best variety	hilly/mountainous						
82	257890	<i>Zea mays</i>	maize	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Bachak Kanoa	wherever fertile	Apr/May	Oct/Nov	brewed/cake, waxy starch	hilly/mountainous						
83	257891	<i>Zea mays</i>	maize	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Di Wa Thei Kati Poh	wherever fertile	Mar	Aug	yellow corn/simply toast if fresh/dried seeds are boil or fried	hilly/mountainous						
84	257892	<i>Perilla frutescens</i>	perilla	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Kuk Twei	border of maize field	May	Oct-Nov	fry, pound and put into curry	hilly/mountainous						
85	257893	<i>Chenopodium bengalense</i>	tree spinach	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Ka Tha Ngy	in maize or potato fields	Mar/Apr	Nov/Dec	<i>C. giganteum?</i> , <i>C. formosanum?</i> brewed/feeding pig	hilly/mountainous						
86	257894	<i>Cucurbita ficifolia</i>	black seed squash	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Chi Rak Ma Thei	borders of maize/potato fields	Mar/Apr	Sep-Dec	young fruits for curry/seeds for fried nuts	hilly/mountainous						
87	257895	<i>Solanum violaceum</i>	wild eggplant	10/16	Somra	K036	25	21	47.3	N	94	41	11.3	E	1,923	farmer storage	landrace	Ka Tha Thei Kanak Poh	wherever fertile	Mar-May	Aug-Nov	used to be medicine for headache or cold/currently put into curry	hilly/mountainous						
88	257896	<i>Vigna hirtella</i>	wild bean	10/17	Pan Sat	K040	25	21	50.1	N	94	41	15.4	E	1,369	wild	wild						mountainous						
89	257897	<i>Vigna angularis</i> var <i>nipponensis</i>	wild azuki bean	10/17	Pan Sat	K041	25	25	29.5	N	94	45	5.2	E	1,691	wild	wild							mountainous					
90	257898	<i>Coix lacryma-jobi</i> var <i>ma-yuen</i>	Job's tears	10/17	Shwe Pi Aye	K043	25	22	8.2	N	94	48	34.3	E	1,578	farmland	landrace		shifting						mountainous				
91	257899	<i>Cucumis hystrix</i>	wild cucumber	10/18	Song Kem	K049	25	25	37.4	N	95	0	53.6	E	798	wild	wild								mountainous				
92	257900	<i>Trichosanthes tricuspidata</i>	wild snake gourd	10/18	Song Kem	K050	25	25	13.2	N	95	1	34.7	E	914	wild	wild								hilly				
93	259849	<i>Oryza sativa</i>	rice	10/18	Song Kem	K051	25	25	26.6	N	95	1	46.4	E	941	farmer storage	landrace	Chang Pel	shifting	May	Oct	simply cook	hilly						
94	257901	<i>Cucumis sativus</i>	cucumber	10/18	Song Kem	K051	25	25	26.6	N	95	1	46.4	E	941	farmer storage	landrace	Chan Mai	shifting/backyard	May	Oct		hilly						
95	257902	<i>Zea mays</i>	maize	10/18	Song Kem	K051	25	25	26.6	N	95	1	46.4	E	941	farmer storage	landrace	Kol Bu	shifting	May	Sep	toasted or bioled to eat	hilly						
96	257903	<i>Glycine max</i>	soybean	10/18	Song Kem	K051	25	25	26.6	N	95	1	46.4	E	941	farmer storage	landrace	Be Kan	shifting	July	Oct	fermented/simply fried/powdered to make teamix	hilly						
97	257904	<i>Zanthoxylum alatum</i>	Chinese pepper	10/18	Song Kem	K051	25	25	26.6	N	95	1	46.4	E	941	farmer storage	wild	Shing Pa Ling	wild		Oct	mixed with soybean before fermentation/spice	hilly						
98	257905	<i>Solanum melongena</i>	eggplant	10/18	Song Kem	K051	25	25	26.6	N	95	1	46.4	E	941	farmer storage	landrace	Doh Del	Shifting/Backyard	May	Sep-Mar	for curry/simply fried	hilly						
99	257906	<i>Glycine max</i>	soybean	10/18	Htamanthi	K054	25	20	25.4	N	95	16	38.2	E	164	farmer storage	landrace		Coch Khe Luvt	shifting/cultivation field	Jun/July (shifting), Mar (cultivation field)	Nov (shifting), Mar (cultivation field)	ferment/half fermented, dried and added to curry	undulating					
100	257907	<i>Phaseolus vulgaris</i>	common bean	10/18	Htamanthi	K054	25	20	25.4	N	95	16	38.2	E	164	farmer storage	landrace	Khu Luv Mei	cultivation field/backyard	Oct	Nov-Dec	can be harvested till Mar if planted on fertile soil young pods as vegetables, seeds for curry	undulating						
101	257908	<i>Phaseolus vulgaris</i>	common bean	10/18	Htamanthi	K054	25	20	25.4	N	95	16	38.2	E	164	farmer storage	landrace	Khu Luv Mei	sifting/backyard/	Oct	Dec	can be harvested till Jan if planted on fertile soil young pods as vegetables, sometimes mixed with fish seeds are edible but not favored	undulating						

Table 3 (Continued)

Col No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage
							°	'	"	N	°	'	"	E													
102	257909	<i>Vigna umbellata</i>	rice bean	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Tsa Shie	mostly shifting/ Backyard	Jly/Aug	Nov/Dec	can be harvested till Mar/ Apr if planted on fertile soil nearly matured seeds for curry matured seeds are boiled, mixed with chili and added to curry or boiled and mixed with onion shoot	undulating				
103	257910	<i>Arachis hipogaea</i>	groundnut	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Lei Tsa Shie	river bed	Dec/Jan	Apr/May	just as peanut	undulating				
104	257911	<i>Phaseolus coccineus</i>	runner bean	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Pheot Phur Tei Tsa Shie	backyard	Jun/Jly	Mar	only seeds are eaten usually in curry	undulating				
105	257912	<i>Luffa acutangula</i>	edged gourd	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Pan She Sei	shifting/backyard	Apr	Jun-Sep	for soup or stirfry	undulating				
106	257913	<i>Brassica juncea</i>	brown mustard	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Ve Phe Rak	backyard, riverbank	Oct	Oct-Jan	leaves, shoots and flowers as vegetables	undulating				
107	257914	<i>Vigna unguiculata</i>	cowpea	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Nyak Tei	shifting	Aug/Sep	Nov/Dec	long pod variety young pods for curry and soup seeds are not eaten	undulating				
108	257915	<i>Camelia sinesis</i>	tea plant	10/18	Htamanthi	K054	25	20	25 4	N	95	16	38 2	E	164	farmer storage	landrace	Je Ha Sei	in the forest/ backyard	Oct	spring and fall	sown in Oct germinates when next rainy season begins can be harvested 4-5 yrs later keep harvesting until the tree dies	undulating				
109	257916	<i>Gymnopetalum chinense</i>	wild edged gourd	10/20	Homalin	K055	24	51	52 8	N	94	54	58 3	E	134	local market	landrace	Kyet Khawei Thee	backyard			vegetable	plain level				
110	257917	<i>Zanthoxylum alatum</i>	Chinese pepper	10/20	Homalin	K055	24	51	52 8	N	94	54	58 3	E	134	local market	landrace	Ken Sein					plain level				
111	257918	<i>Perilla frutescens</i>	perilla	10/20	Homalin	K055	24	51	52 8	N	94	54	58 3	E	134	local market	landrace	Hnan Lone					plain level				
112	257919	<i>Guizotia abyssinica</i>	niger seeds	10/20	Homalin	K055	24	51	52 8	N	94	54	58 3	E	134	local market	landrace	So Hmone Net				medicine	plain level				
113	257920	<i>Brassica juncea</i>	brown mustard	10/20	Homalin	K055	24	51	52 8	N	94	54	58 3	E	134	local market	landrace	Hmone Nyin					plain level				
114	257921	<i>Solanum violaceum</i>	wild eggplant	10/20	Swei Kyar Pow	K057	24	50	35 6	N	94	52	6 1	E	141	farmer storage	landrace	Ma Kha Sel		Anytime	Anytime		undulating				
115	257922	<i>Solanum torvum</i>	wild eggplant	10/20	Swei Kyar Pow	K057	24	50	35 6	N	94	52	6 1	E	141	farmer storage	landrace	Ma Khu Shap					undulating				
116	257923	<i>Gymnopetalum chinense</i>	wild edged gourd	10/20	Swei Kyar Pow	K057	24	50	35 6	N	94	52	6 1	E	141	backyard	landrace	Ma Lai Se					undulating				
117	257924	<i>Luffa acutangula</i>	edged gourd	10/20	Swei Kyar Pow	K057	24	50	35 6	N	94	52	6 1	E	141	farmer storage	landrace	Ma Lai					undulating				
119	259850	<i>Oryza sativa</i>	rice	10/20	Ket Tha	K058	24	51	30 2	N	94	54	25 0	E	131	farmer storage	landrace	Y wet Thay Ka Lay	irrigated/ transplanted	Jun	Nov	transplanted in Aug/simply cooked/sometimes blended	plain level				
120	259851	<i>Oryza sativa</i>	rice	10/20	Ket Tha	K059	24	50	39 9	N	94	52	11 8	E	131	farmer storage	landrace	Man Khan Phauk	irrigated/ transplanted	Nov	Apr	transplanted in Feb/simply cooked	undulating				
121	257925	<i>Brassica juncea</i>	brown mustard	10/20	Swei Kyar Pow Kone	K059	24	50	39 9	N	94	52	11 8	E	131	farmer storage	landrace	Pa Khat	backyard/ cultivation field	Aug/Sep	Oct-Feb	oil extraction (by company)/ medicine	undulating			Loam/ Clay	
122	257926	<i>Raphanus sativus</i>	radish	10/20	Swei Kyar Pow Kone	K059	24	50	39 9	N	94	52	11 8	E	131	farmer storage	landrace	Pa Khat Chin Ma	backyard/ cultivation field	Oct-Dec	Feb/Mar	young pods only	undulating				
123	257927	<i>Sesamum indicum</i>	sesame	10/20	Swei Kyar Pow Kone	K059	24	50	39 9	N	94	52	11 8	E	131	farmer storage	landrace	Nga Phap	everywhere but paddy field	Sep/Oct	Feb	oil extraction/Sweets with sugar	undulating				
124	257928	<i>Solanum violaceum</i>	wild eggplant	10/20	Swei Kyar Pow Kone	K059	24	50	39 9	N	94	52	11 8	E	131	backyard	wild	Ma Hain Khom	naturally growing		Oct (anytime)	medicine for liver disease	undulating				
125	257929	<i>Solanum torvum</i>	wild eggplant	10/20	Swei Kyar Pow Kone	K059	24	50	39 9	N	94	52	11 8	E	131	backyard	wild	Ma Hain San	naturally growing		Anytime	Cooked with bamboo shoot/ curry	undulating				
126	257930	<i>Guizotia abyssinica</i>	niger seeds	10/20	Swei Kyar Pow Kone	K059	24	50	39 9	N	94	52	11 8	E	131	farmer storage	landrace	Nga Mouk Ya	riverbank	Sep	Dec	oil extraction	undulating				

Table 3 (Continued)

Col No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage			
							o	'	"	N	o	'	"	E																
127	257931	<i>Abelmoschus esculentus</i>	okra	10/20	Swe Kyar Pow Kone	K059	24	50	39	N	94	52	11	8	E	131	farmer storage	landrace	Ma Lai Thun	hilly field	Jun/Jly	Sep/Oct	vegetable/when cultivated in lowland, seeded in Aug/Sep and harvested in Dec/Jan	undulating						
128	257932	<i>Momordica charantia</i>	bitter gourd	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	backyard	landrace	Ma Khom Ka	backyard, fence				plain level						
129	257933	<i>Brassica juncea</i>	brown mustard	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	farmer storage	landrace	Pa Khat	backyard	Oct	Nov-Jan	vegetable/pickles/oil extraction	plain level						
130	257934	<i>Coriandrum sativum</i>	coriander	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	farmer storage	landrace	Kyi Hom	backyard	Oct	Jan/Feb	herb	plain level						
131	257935	<i>Zea mays</i>	maize	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	farmer storage	landrace	Ka Pan San	riverbank/hilly field	Oct	Jan/Feb	toast fresh ears/leaves and stems for feeding	plain level						
132	257936	<i>Zea mays</i>	maize	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	farmer storage	landrace	Khauk Pa Phet	riverbank/hilly field	Oct	Jan/Feb	toast fresh ears/leaves and stems for feeding, waxy	plain level						
133	257937	<i>Raphanus sativus</i>	radish	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	farmer storage	landrace	Ma Pa Khat	riverbank	Oct	Dec/Jan	young pods only	plain level						
134	257938	<i>Hibiscus sabdariffa</i>	roselle	10/21	Man Pan	K061	24	51	44	N	94	56	20	0	E	128	farmer storage	landrace	Chin Baung	riverbank/backyard/hilly field	Oct	Jan/Feb	for curry, stirfry, soups	plain level						
135	257939	<i>Phaseolus vulgaris</i>	common bean	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Mye Thaut	cultivation field	Sep	Dec	boiled/fermented	plain level						
136	257940	<i>Vigna unguiculata</i>	cowpea	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Thao Na Khaut	lowland, not on fertile soil	Sep	Nov	young pods for curry/seeds are not often eaten	plain level						
137	257941	<i>Brassica juncea</i>	brown mustard	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Pa Khat	backyard, lowland field	Oct	Dec-Jan	leaves and shoots as vegetables/oil extraction	plain level						
138	257942	<i>Brassica oleracea</i>	Chinese broccoli	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Kai Lan	backyard/lowland field	Oct	Dec-Jan	leaves, shoots and flowers as vegetables	plain level						
139	257943	<i>Cucurbita moschata</i>	pumpkin	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Ma Pa Kham	intercropping with common bean	Oct	Jan/Feb	curry, stirfry/leaves as vegetables/seeds as nuts	plain level						
140	257944	<i>Coriandrum sativum</i>	coriander	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Kyi Hom	backyard, Lowland field	Anytime	Anytime	herb	plain level						
141	257945	<i>Hibiscus sabdariffa</i>	roselle	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Chin Baung	backyard, lowland field	Anytime	Anytime	leaves and fruit coats for curry, soups and stirfry	plain level						
142	257946	<i>Zea mays</i>	maize	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Kau Phan San	lowland field/ Intercrop with legumes	Anytime wet	Feb	fresh ears toasted/deried seeds for popcorn	plain level						
143	257947	<i>Lagenaria leucantha</i>	bottle gourd	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Nan Dan Mu	anywhere (with pole)	Oct	Dec	shoots and fruits for curry, stirfry soups and fishpaste	plain level						
144	257948	<i>Luffa acutangula</i>	edged gourd	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Ma Ma Lai	backyard	Jun/Jly	Jly/Aug	vegetable	plain level						
145	257949	<i>Trichosanthes dioica</i>	pointed gourd	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	wild	wild	Ma Ma Thom					vegetable	plain level					
146	257950	<i>Solanum lycopersicum</i>	tomato	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Ma Pu Than Uh Se					vegetable	plain level					
147	257951	<i>Abelmoschus esculentus</i>	okra	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Youm Pu Thi						plain level					
148	257952	<i>Capsicum annuum</i>	chili pepper	10/21	Yae Lai	K062	24	51	43	N	94	56	52	0	E	121	farmer storage	landrace	Pow Thu Tho					vegetable	plain level					
149	257953	<i>Luffa acutangula</i>	edged gourd	10/21	Nyaung Pin Tha	K063	24	51	1	N	94	57	36	6	E	128	farmer storage	landrace						plain level						
150	257954	<i>Pisum sativum</i>	pea	10/21	Nyaung Pin Tha	K063	24	51	1	N	94	57	36	6	E	128	farmer storage	landrace						plain level						
151	257955	<i>Zea mays</i>	maize	10/21	Nyaung Pin Tha	K063	24	51	1	N	94	57	36	6	E	128	farmer storage	landrace	Khaut Pa Num	trapping crop for ground nut	Nov	Mar/Apr	boiled or fried	plain level						
152	257956	<i>Zea mays</i>	maize	10/21	Nyaung Pin Tha	K063	24	51	1	N	94	57	36	6	E	128	farmer storage	landrace	Khaut Pa Wan	trapping crop for ground nut	Nov	Mar/Apr	boiled or fried/sweet corn	plain level						

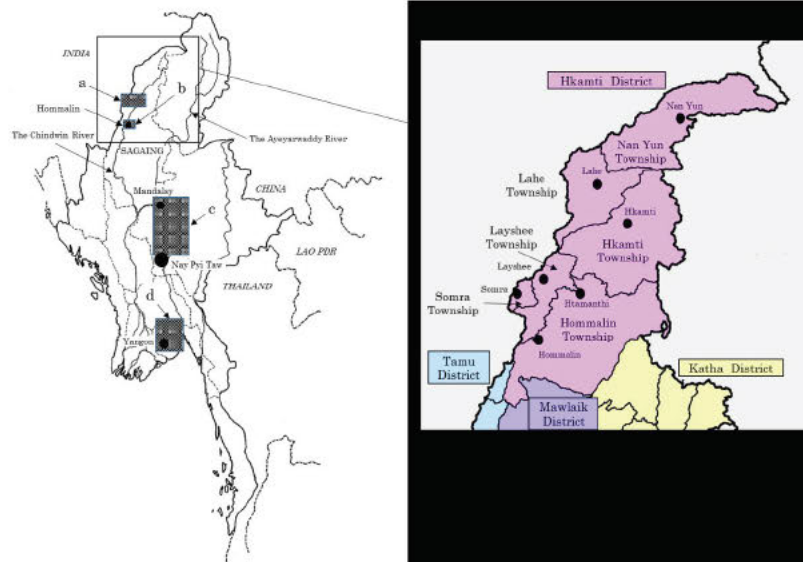
Table 3 (Continued)

Col No *	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage
							°	'	"		°	'	"														
153	257957	<i>Brassica oleracea</i>	Chinese broccoli	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Pa Khat Kai Lan	cultivation field	Oct	Feb	vegetable	plain level				
154	257958	<i>Brassica juncea</i>	brown mustard	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Pa Khat	cultivation field	Oct	Feb	vegetable	plain level				
155	257959	<i>Raphanus sativus</i>	radish	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Ma Pa Khat	cultivation field	Oct	Feb	vegetable	plain level				
156	257960	<i>Solanum melongena</i>	eggplant	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Ma Khu	anywhere	Oct	2yrs	vegetable	plain level				
157	257961	<i>Hibiscus sabdariffa</i>	roselle	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Chin Baung	anywhere	Anytime	Anytime		plain level				
158	257962	<i>Cucurbita moschata</i>	pumpkin	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Ma Pa Kham	anywhere	Anytime	anytime	in rainy season, eat leaves in dry season, eat matured fruits	plain level				
159	257963	<i>Anethum graveolens</i>	dill	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Kyi La	cultivation field	Oct	Nov	herb/seeds harvested in Feb	plain level				
160	257964	<i>Cicer arietinum</i>	chickpea	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Ka La Pe	cultivation field with ground nut	Nov/Dec	Feb/Mar	leaves as vegetable/seeds are boiled for soups or curry	plain level				
161	257965	<i>Arachis hypogaea</i>	groundnut	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Ning	cultivation field after other legumes	Dec	Apr/May	oil extraction, peanut/small seed variety	plain level				
162	257966	<i>Arachis hypogaea</i>	groundnut	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho A Nain	cultivation field after other legumes	Dec	Apr/May	oil extraction, peanut/Large seed variety	plain level				
163	257967	<i>Lablab purpureus</i>	lablab bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Tha	near trees	Oct	Jan-Apr	stirfry, curry	plain level				
164	257968	<i>Lablab purpureus</i>	lablab bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Nga Mu	near trees	Oct	Jan-Apr	stirfry, curry	plain level				
165	257969	<i>Lablab purpureus</i>	lablab bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Lu	near trees	Oct	Jan-Apr	stirfry, curry/seed coat should be removed because of bad smell	plain level				
166	257970	<i>Phaseolus lunatus</i>	lima bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Pa Pe	near trees	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried	plain level				
167	257971	<i>Phaseolus vulgaris</i>	common bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho No Sa Li	cultivation field	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried	plain level				
168	257972	<i>Phaseolus vulgaris</i>	common bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho No Khaut	cultivation field	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried	plain level				
169	257973	<i>Phaseolus vulgaris</i>	common bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Mye Thaut Khau	cultivation field	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried	plain level				
170	257974	<i>Phaseolus vulgaris</i>	common bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Pa Gan Pe	cultivation field	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried	plain level				
171	257975	<i>Phaseolus vulgaris</i>	common bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Num	cultivation field	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried	plain level				
172	257976	<i>Phaseolus vulgaris</i>	common bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Bo Za Pe	cultivation field	Sep	Jan-Mar	fresh seeds for stirfry/matured seeds are boiled and fried/from India/determinate growth	plain level				
173	257977	<i>Vigna unguiculata</i>	cowpea	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Na Khaut	near trees	Oct	Nov-Apr	young pods as vegetables/matured seeds are sometimes eaten	plain level				
174	257978	<i>Vigna umbellata</i>	rice bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho A Khan	cultivation field	Sep/Oct	Feb	for selling	plain level				
175	257979	<i>Vigna radiata</i>	mung bean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Pe Thi Sein	cultivatoin field	Oct	Feb	bean sprout	plain level				
176	257980	<i>Pisum sativum</i>	pea	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Se Tho Pe	cultivatoin field	Oct	Feb	bean sprout	plain level				
177	257981	<i>Glycine max</i>	soybean	10/21	Nyaung Pin Tha	K063	24	51	15	N	94	57	36	E	128	farmer storage	landrace	Tho Pen Nu	cultivation field	Oct/Nov	Feb	boiled and pasted	plain level				

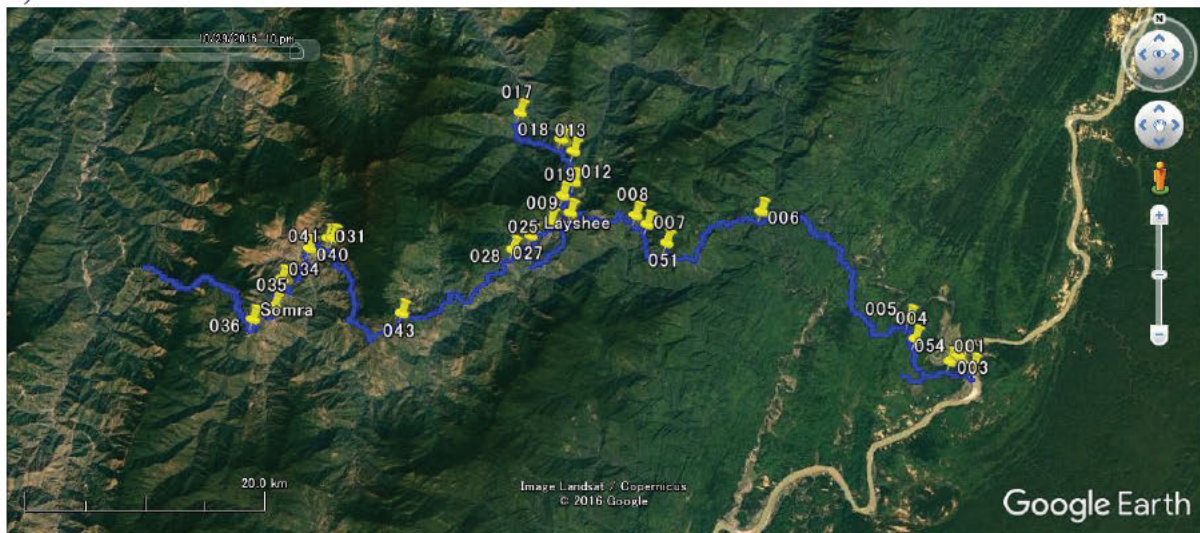
Table 3 (Continued)

Col No*	JP No	Scientific name	English name	Date MM/dd	Village name and/or nearest town/village	Waypoint	Latitude				Longitude				Altitude m	Source	Status of plant sampled	Local plant name "local variety name"	Cultural practices	Sowing month	Harvest month	Other observations	Topography	Site	Stoniness	Soil texture	Drainage
							°	'	"	N	°	'	"	E													
178	257982	<i>Momordica balsamina</i>	wild bitter gourd	10/21	Na None	K064	24	52	21 5	N	94	52	53 5	E	130	backyard	wild	Ma Kum Kha				plain level					
179	257983	<i>Gymnopetalum chinense</i>	wild edged gourd	10/21	Na None	K064	24	52	21 5	N	94	52	53 5	E	130	backyard	wild	Ma Ma Kyi Kha				plain level					
180	257984	<i>Trichosanthes cucumerina</i>	snake gourd	10/21	Na None	K064	24	52	21 5	N	94	52	53 5	E	130	backyard	wild	Ma Lai				plain level					
181	257985	<i>Momordica subangulata?</i>	wild bitter gourd	10/23	near Ywangan	K069	21	17	38 6	N	96	22	42 1	E	1,278	on a roadside cliff	wild				roadside cliff	mountainous	slope	rocky	loam	moderate	
182	257986	<i>Trichosanthes tricuspidata</i>	wild snake gourd	10/23	near Ywangan	K070	21	15	18 8	N	96	25	28 0	E	1,380	on a roadside cliff	wild				roadside cliff	mountainous	slope	rocky	loam	moderate	
183	257987	<i>Vigna hirtella</i>	wild bean	10/24	near Kalaw	K072	20	40	35 3	N	96	40	45 9	E	1,275	roadside	wild					hilly	slope	medium	loam	moderate	
184	257988	<i>Vigna radiata var sublobata</i>	wild mung bean	10/24	near Kalaw	K072	20	40	35 3	N	96	40	45 9	E	1,275	roadside	wild					hilly	slope	medium	loam	moderate	
185	257989	<i>Vigna hirtella</i>	wild azuki bean	10/24	near Pinglaung	K076	20	12	59 3	N	96	50	11 8	E	1,376	roadside	wild					hilly	slope	medium	clay	moderate	
186	257990	<i>Vigna radiata var sublobata</i>	wild mung bean	9/9	Nay Pyi Taw	K000	19	43	51 8	N	96	6	19 4	E	129	roadside	wild					plain level	level	low	loam	moderate	
187	257991	<i>Setaria italica</i>	foxtail millet	10/16	Somra	K037	25	21	51 0	N	94	41	4 8	E	1,924	farmland	landrace					hilly/ mountainous	slope	none	clay	good	
188	257992	<i>Gymnopetalum chinense</i>	wild edged gourd	10/29	Pan Da Gone	K080	17	20	33 3	N	96	10	30 8	E	22	roadside	wild				climbing on a tree	plain level	level	low	loam	moderate	
189	257993	<i>Vigna trinervia</i>	wild mung bean	10/29	Bago	K083	17	19	49 6	N	96	26	44 7	E	24	roadside	wild					undulating	slope	medium	clay	moderate	
190	257994	<i>Sesamum radiatum</i>	wild sesame	10/29	Bago	K084	17	17	47 5	N	96	27	19 3	E	28	roadside	wild					plain level	level	medium	clay	moderate	
191	257995	<i>Vigna trinervia</i>	wild mung bean	10/29	Bago	K085	17	16	42 1	N	96	27	56 6	E	19	roadside	wild					plain level	level	medium	loam	moderate	

Note: * Each collection is designated as COL/MYANMAR/2016/UT-NARO-DAR/Col No



a)



b)

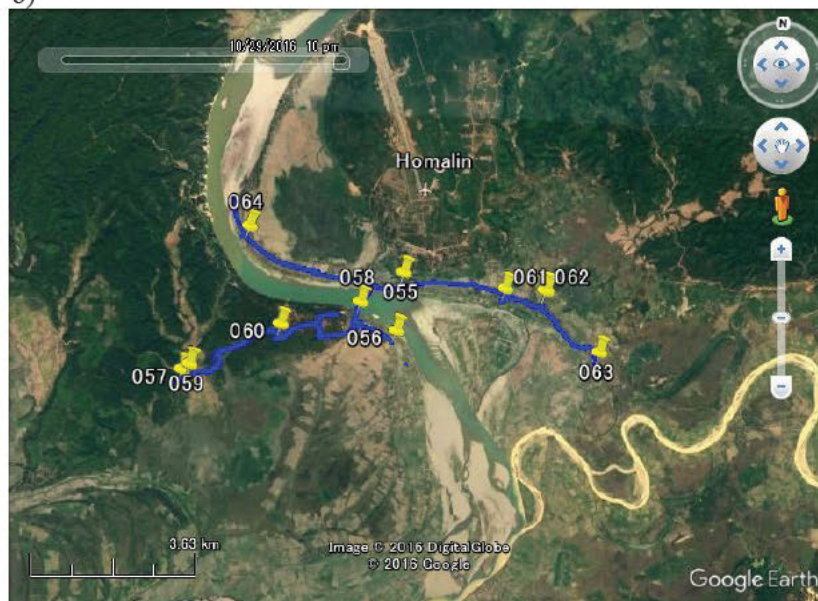
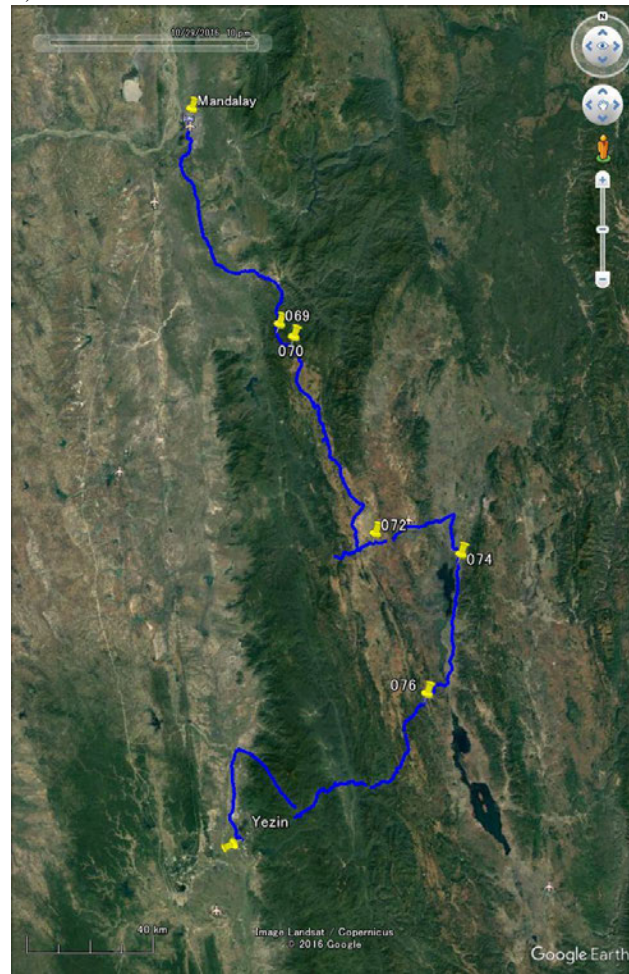


Fig. 1. A white map of Myanmar (left), a colored and magnified map of Hkamti district (right), and maps of routes and collection sites indicated by waypoints on Google Maps (Google Inc.) during the field study October 2016; a) in Htamanthi village, Layshee township and Somra township of Sagaing Region, b) in Hommalin town and its vicinity in the Sagaing Region, c) in Taunggyi district of Shan State, and d) in Yangon/Bago area of Myanmar.

c)



d)

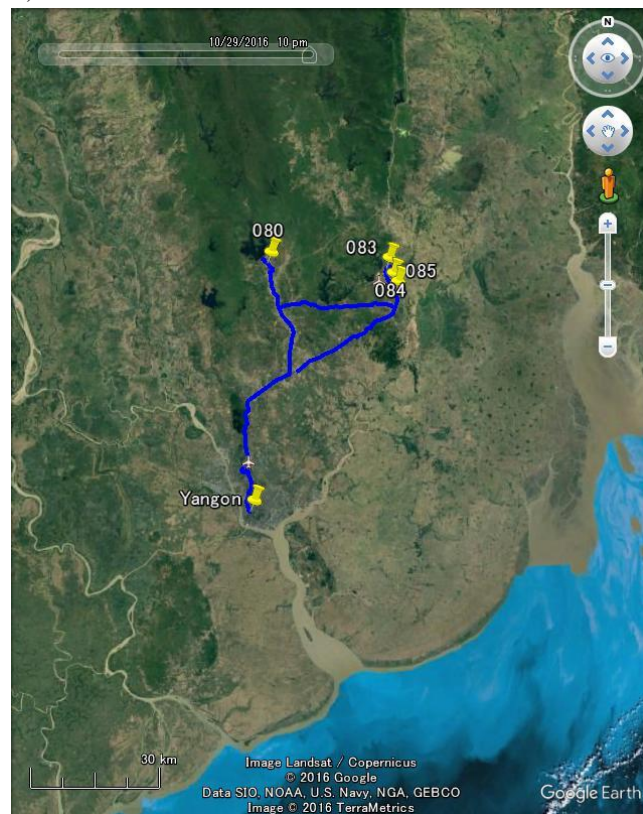


Fig. 1. (Continued).



Photograph 1. A distant view of Layshee town located on a sloping land at around 1,300 m above the sea level.



Photograph 2. Houses were sparsely built on slopes at Somra town. Perilla was flowering when the team visited.



Photograph 3. A bulletin board was placed in the central zone of Somra town. Its roof end was decorated in Naga style.



Photograph 4. Slash- and-burn cultivation fields at Sapy (near K013). Rice was cultivated there as the staple crop, where tree spinach was mix-cropped. Taro, sweet potato, castor bean, papaya, sorghum, banana and others were grown nearby



Photograph 5. Rice terrace at Ye Taung Village (near K025) in an undulating places between Layshee and Somra, where rice bean was grown at the edge of the terraced field.



Photograph 6. Maize stalks after harvest were sometimes left in the fields and used as supporting poles for climbing leguminous crops like rice bean and common bean. Photograph was taken inside Layshee (at K010).



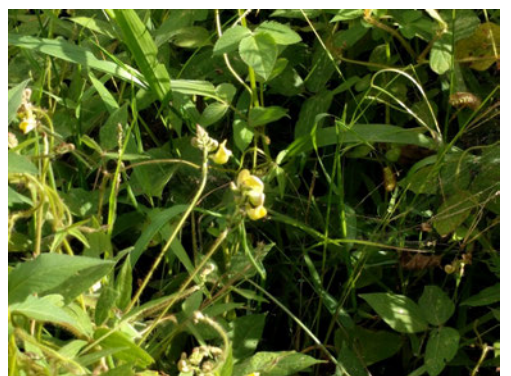
Photograph 7. Rice bean was grown on small fields near a stream in a valley.



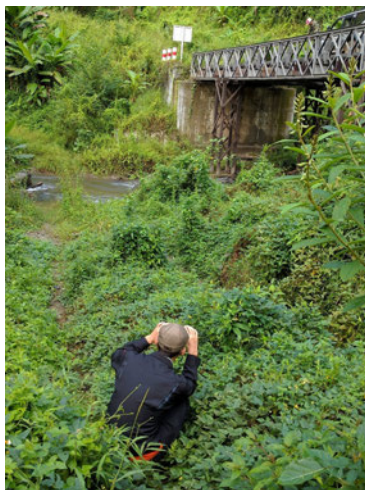
Photograph 8. Yam petiole being dried under sun at Saein Pya village near Layshee (K019).



Photograph 9. *Fagopyrum cymosum*, a perennial wild relative of buckwheat occurred widely in village places and on roadside in highland of Sagaing Region.



Photograph 10. *Vigna hirtella*, a wild relative of *Vigna* species was found near houses and fields in Layshee town (K009).



Photograph 11. *Vigna tenuicaulis*, a wild relative of *Vigna* species formed a big population near a bridge across a stream in a valley (K027).



Photograph 12. *Cucumis hystrix*, a relative of cucumber, *C. sativus* and melon, *C. melo* was found on a roadside cliff (K049).



Photograph 13. Pointed gourd, *Trichosanthes dioica*, was climbing on a palm tree and bearing fruits in a farmer's garden (K062). It was semi-cultivated rather than cultivated, but used as food materials, and sometimes sold at local market place.



Photograph 14. Basil was sporadically but widely grown in slash-and-burn cultivation fields and backyard gardens in Sagaing Region.



Photograph 15. Large populations of wild rice, *Oryza rufipogon* were found in southern Myanmar even near the biggest city Yangon. The photo was taken near Hlegu city in Yangon Division.



Photograph 16. *Gymnopetalum chinense*, wild edged gourd was found sporadically in various parts of Myanmar. The photo was taken at Pan Da Gone (K080)



Photograph 17. *Sesamum radiatum*, a wild ancestor of African cultivated sesame, *S. radiatum* and a wild relative of sesame, *S. indicum* occurred near Bago city (K083).



Photograph 18. *Vigna trinervia*, a wild relative of *Vigna* species occurred on the road side near Bago city (K085).