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Original Paper

Collection and Conservation of Leguminous Crops and Their wild Relatives in Cambodia, 2011

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Summary

Based on a Letter of Agreement between the National Institute of Agrobiological Sciences (NIAS), Japan and the Cambodian Agriculture Research and Development Institute (CARDI), Cambodia, a field survey was conducted in Cambodia, from 8th to 19th November, 2011. As a result, 22 accessions of leguminous plants consist of *Lablab purpureus*, *Vigna minima*, *V. radiata* var. *sublobata*, *V. umbellata*, *V. unguiculata* and 2 unidentified species were recorded and 18 seed samples were collected. All the seed materials collected were deposited at CARDI genebank, Cambodia and a subset of the collection was transferred to NIAS genebank, Japan as a safety backup using standard Material Transfer Agreement (SMTA) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). These materials will be evaluated in 2012 and the multiplied seed materials will become available for research, breeding and educational purposes from the NIAS genebank (http://www.gene.affrc.go.jp/distribution_en.php?section=plant).

KEY WORDS : Cambodia, Crop Wild Relatives, Legumes, *Vigna*

Introduction

The NIAS genebank has been conducting domestic and overseas plant germplasm collections. Among them, those for collecting wild *Glycine* and *Vigna* germplasm were summarized in Appendix 1 and 2 of "*Glycine* Genetic Resources" in the proceedings of the 14th NIAS international workshop (Vaughan *et al*., 2010). Recent progress in our understandings on *Vigna* was reviewed (Tomooka *et al*., 2010, 2011).

In order to facilitate collaborative research activities on collection, evaluation and sustainable use of Plant Genetic Resources for Food and Agriculture (PGRFA), the National Institute of Agrobiological Sciences (NIAS), Japan and the Cambodian Agriculture Research and Development Institute (CARDI), Cambodia, agreed to establish a Letter of Agreement (LOA) on Joint Research of Plant Genetic Resources in November, 2011. This is a report of the first

Table 1. Itinerary of the field survey in Cambodia

Date	Day	Itinerary	Stay
2011/11/8	Tue	NIAS -- 9:30 Narita -- (VN301) -- 13:40 Ho Chi Minh 15:50 -- (VN920) -- 16:30 Phnom Penh	Phnom Penh
2011/11/9	Wed	Rent a car (11/9 - 11/18) and start survey around Phnom Penh	Phnom Penh
2011/11/10	Thu	Phnom Penh -- Kirirom	Phnom Penh
2011/11/11	Fri	Phnom Penh -- Kampot	Kampot
2011/11/12	Sat	Kampot -- Koh Tonsay -- Kep	Kep
2011/11/13	Sun	Kep -- Phnom Penh	Phnom Penh
2011/11/14	Mon	visit CARDI	Phnom Penh
2011/11/15	Tue	Phnom Penh -- Sen Monorom	Sen Monorom
2011/11/16	Wed	Survey around Sen Monorom	Sen Monorom
2011/11/17	Thu	Sen Monorom -- Phnom Penh	Phnom Penh
2011/11/18	Fri	visit CARDI and departure at 19:30 Phnom Penh -- (VN3856) -- 20:15 Ho Chi Minh 00:05 -- (VN300) --	on flight
2011/11/19	Sat	-- 7:45 Narita	Tsukuba

collaborative field survey on leguminous plants in Cambodia under this collaboration project.

Methods

We had 2 short trips by car from CARDI, Phnom Penh (Table 1). The first trip was from November 9 to 13, covering Kampong Speu, Kampot and Kep provinces (Fig. 1). These provinces are located on south of Phnom Penh. The second trip was from November 15 to 17, explored Kratie and Mondol Kiri provinces which are located on northeast of Phnom Penh.

Seeds, herbarium specimens and root nodules were collected. Information on collection sites including village name, altitude, latitude, longitude, habitat, cultural practices and other ecological data of the collection sites were recorded as passport data. Identification of wild *Vigna* plants was done based on a key prepared by Tomooka *et al*. (2002, p.26-28).

Results and Discussion

A total of 22 legume plants were recorded, from which 18 seed samples (accessions) were collected (Table 2). Collected samples consist of 5 species, i.e., *Lablab purpureus*, *Vigna minima*, *Vigna radiata*, *Vigna umbellata* and *Vigna unguiculata*. Their detailed passport information was recorded (Table 3). Collected seed samples were divided into 2 subsets and the first subset was conserved at CARDI genebank (Cambodia) and the second subset was transferred to NIAS with Standard Material Transfer Agreement (SMTA) of International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), and was conserved at NIAS genebank (Japan) as a safety backup.

***Lablab purpureus* (Hyacinth bean)**

An accession (JP244392) of *Lablab purpureus* was found cultivated in front of a farmer's house at Boos Ngang, Kampot province. A farmer (Ms. Chham Oeun) who cultivated *Lablab purpureus* said the crop can be harvested within 2 months.

Fig. 1. Exploration route and collection site of each collected accession in Cambodia, 2011.

Table 2. A summary of collected materials

Species	Cultivated	Escaped	Weedy	Wild	Total
Lablab purpureus	1				1
Vigna minima				7	7
Vigna radiata var. *sublobata*				1	1
Vigna umbellata	1	1	1	1	4
Vigna unguiculata (cowpea type)		2			2
Vigna unguiculata (intermediate type between cowpea and yard long bean)	1				1
Vigna unguiculata (yard long bean type)	2				2
Total	5	3	1	9	18

Vigna minima

In this survey, *Vigna minima* plants were found in three different ecological habitats, i.e., 1) pine forest floor grassland at Kirirom highland (alt. 680m, Kampong Speu province), 2) dry

lowland *Dipterocarpus* deciduous forest floor grassland at the side of the Mekong river (alt. 30 - 64m, Kratie province), and 3) deciduous forest floor grassland at Mondol Kiri highland (alt. 430 - 508m, Mondol Kiri province) (Fig. 1).

At Kirirom, 2 accessions were collected. They were crawling on the forest floor or climbing on the grasses growing on forest floor in rather open natural pine forest near the top of Kirirom highland (Photos 2 & 3). Seed size of Kirirom accessions (JP244390, JP244391) was small at this site compared with *Vigna minima* samples collected from the side of the Mekong river (see seed photo).

At Mekong river habitat (Kratie province), 3 accessions were collected (JP244397, JP244398 and JP244400). A *Dipterocarpus* forest was growing in the sandy soil accumulated by the flood of Mekong River. The forest had an open canopy and forest floor was covered mainly with grass species. However, *Vigna minima* plants were also one of the dominant components of forest floor grassland. They are crawling and climbing on the grass species. The leaflet shape of *V. minima* at this habitat is conspicuously narrow and long (Photo 10). The seed size is much larger compared with that of *V. minima* collected in other habitat (see seed photo).

At Mondol Kiri, 2 accessions were collected. One site was in an open forest located between farmer's house and a paddy field area (Photo 13). The site was near a small stream in a forest so the habitat was wet. Small leaves were produced from the stems crawling on the ground while much larger leaves were produced from the stems climbing on shrub trees (Photo 14). The seed size was small (see seed photos). Another site at Mondol Kiri was beside Bou Sra water fall (Photo 15). At this site, *V. minima* plants were crawling on the floor and also climbing on trunks of big trees (Photo 16). They have developed long roots spread near the soil surface.

Vigna radiata (wild mungbean)

One accession of wild mungbean (*Vigna radiata* var. *sublobata*, JP244399) was found growing sympatrically with *V. minima* at Mekong River (Photo 11). However, this site was not the forest floor. The site was open place because of the recent deforestation aiming to develop sugar cane plantation.

Vigna umbellata

In the first trip to the south of Phnom Penh, four naturally growing populations of *V. umbellata* were found in paddy field area of Kampong Speu and Kampot provinces (Fig. 1). However, all the plants were still in the flowering and maturing stage, so we could not collect any mature seeds and only herbarium specimens were made (Photos 1 & 8). About a month later, Ra and Vathany re-visited 2 sites (2011-Cambodia-01 and 11) and could collect the seeds. In Preak Keng, ca. 15km W of Kampot, an old lady (Mrs. Nut Chean) said she formerly ate mature seeds boiled with coconut milk. She also ate flower and young pods as vegetables. At another village (Tvea Thmeiy, N of Kampot), a young farmer (Mr. Sin Sarom) said plenty of *V. umbellata* could be found on the mountain, where he often visits to collect wild animals and plants.

In the second trip, we have found rice bean (*V. umbellata*) cultivation in Mondol Kiri province (Photo 12). It was cultivated in a home garden of a farmer's house in Pou Krang village,

ca. 20km NE of Sen Monorom, a capital of Mondol Kiri province. Seed color was red (JP244401, seed photo).

Vigna unguiculata

Two accessions of yard long bean (*V. unguiculata* cv-gr. Sesquipedalis) were collected in Kep province (Photo 4). One was brown seeded variety and the other was black seeded variety (JP244393 and JP244394, seed photo).

On the sandy beach of Ton Sai island, Kep province, two accessions of cowpea (*V. unguiculata* cv-gr. Unguiculata) were collected (JP244395 and JP244396). They were growing very vigorously on the beach, suggesting that they might have high levels of salinity tolerance (Photos 5 & 6). They developed numerous nodules on their roots (Photo 7). According to the persons living nearby, they were growing naturally. They might be natural populations escaped from old cultivation. The plants showed high level of pod shattering with small black seeds (seed photo).

Another accession of *V. unguiculata* was collected at Mondol Kiri province (JP244404). It showed an intermediate pod morphology between cowpea and yard long bean.

These materials will be evaluated in 2012 and the multiplied seed materials will become available for research, breeding and educational purposes from the NIAS genebank (http://www.gene.affrc.go.jp/distribution_en.php?section=plant).

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カンボジアにおけるマメ科植物遺伝資源多様性の保全，２０１１年

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和文摘要

本報告は，独立行政法人農業生物資源研究所ジーンバンクとカンボジア農業研究開発機構の間で 2011 年 11 月に締結した協同研究協定（LOA）に基づいて行ったカンボジアにおける第一回目のマメ科植物遺伝資源の調査報告である．調査は，2011 年 11 月 8 日～ 19 日にかけて行った．調査の結果，フジマメ（*Lablab purpureus*），ホゾバツルアズキ（*Vigna minima*），野生リョクトウ（*V. radiata* var. *sublobata*），ツルアズキ（*V. umbellata*），ササゲ類（*V. unguiculata*）等計 22 系統を記載し，その内 18 系統を遺伝資源として収集した．収集した遺伝資源は，カンボジア農業研究開発機構ジーンバンクにおいて保存するとともに，SMTA（FAO が提唱する標準材料移転契約）を用いて農業生物資源研究所ジーンバンクに材料を移転し，セーフティバックアップとして保存した．これらの材料は，2012 年度に種子増殖，特性評価を実施した後，研究，育種，教育目的での配布を開始する計画である．

Table 3. A passport data of collected materials in Cambodia, 2011

Record ID (JP No.)	Coll. Date	Species name	Status	Local Name	Collection Site (Farmer's name)	Province	Latitude	Longitude	Altitude (m)	Soil	Seed	Herba-rium	Nodule	Remarks
2011-Cambodia-01 (JP245229)	10 Nov. 2011	*Vigna umbellata*	weedy	Sandeak Prey	Traeog Trayueng	Kampong Speu	N11-17-17.1	E104-10-06.6	120 m	clay	bulk	yes	yes	between road and cassava field, wet place, long pod
2011-Cambodia-02-1 (JP244390)	10 Nov. 2011	*Vigna minima*	wild		Kirirom	Kampong Speu	N11-20-33.3	E104-02-43.7	680 m	red sandy silt	bulk	yes	yes	near the top of Kirirom mountain, beside road. crawling on the pine forest floor & also climbing on grasses, small flower, leaf shape variation observed
2011-Cambodia-02-2 (JP244391)	10 Nov. 2011	*Vigna minima*	wild		Kirirom	Kampong Speu	N11-20-33.3	E104-02-43.7	680 m	red sandy silt	bulk	yes	no	near the top of Kirirom mountain, beside road. about 20m apart from 2011-Cambodia-02-1, crawling on the pine forest floor & also climbing on grasses, small flower, leaf shape variation observed
2011-Cambodia-03 (no seeds collected)	10 Nov. 2011	*Vigna umbellata*	weedy		Preak Keng , ca. 15km W of Kampot (Mrs. Nut Chean)	Kampot	N10-36-29.7	E103-56-18.3	4 m	clay	no	no	no	road side water place, very thick stem, no mature pods found, old lady said she formerly ate mature seeds boiled with coconut milk, flower and young pods were also eaten as vegetables, seed color green
2011-Cambodia-04 (no seeds collected)	11 Nov. 2011	*Vigna umbellata*	weedy		Tvea Thmeiy, N of Kampot (Mr. Sin Sarom)	Kampot	N10-44-07.4	E104-17-10.4	40 m	clay	no	yes	yes	beside paddy, only young plants, no flower, herbarium specimen made, farmers said plenty of *V. umbellata* could be found on the mountain, where they often visit to collect wild animals and plants
2011-Cambodia-05 (JP244392)	11 Nov. 2011	*Lablab purpureus*	cultivated	Porpeay	Boos Ngang (Ms. Chham Oeun)	Kampot	N10-33-46.9	E104-16-29.3	30 m	sandy silt	bulk	no	no	home garden, white flower, old lady said she can harvest within 2 months.
2011-Cambodia-06 (JP244393)	11 Nov. 2011	*Vigna unguiculata* (yard long bean)	cultivated	Sandek Kour	Boos Ngang (Ms. Chham Oeun)	Kampot	N10-33-46.9	E104-16-29.3	30 m	sandy silt	bulk	no	no	home garden, brown seeds
2011-Cambodia-07 (JP244394)	11 Nov. 2011	*Vigna unguiculata* (yard long bean)	cultivated	Sandek Kour	Boos Ngang (Ms. Chham Oeun)	Kampot	N10-33-46.9	E104-16-29.3	30 m	sandy silt	bulk	no	no	home garden, black seeds, long succulent pod
2011-Cambodia-08 (no seeds collected)	12 Nov. 2011	*Vigna* sp.	wild		Sailing club, beach near Kep.	Kep	N10-29-39.4	E104-17-20.9	0 m	sand	no	yes	yes	growing on the beach, only herbarium specimen & nodules, no flower yet, only buds, seems to be *Vigna* but not sure
2011-Cambodia-09 (no seeds collected)	12 Nov. 2011	*Vigna* like plants	wild		Kangkaul, Kep	Kep	N10-27-32.4	E104-23-12.6	5 m	clay	no	yes	yes	beside paddy near the seashore, *Vigna* like plants, very big nodules, no mature seeds
2011-Cambodia-10-1 (JP244395)	13 Nov. 2011	*Vigna unguiculata* (cowpea)	maybe escaped from cultivation		Kampong The, Ton Sai island	Kep	N10-25-57.6	E104-19-46.7	1 m	sand (black)	bulk	yes	yes	growing very vigorously on the beach, flower purple, stem basal part become very thick, seems to be perennial, pod slightly shattering, small black seeds, big nodules
2011-Cambodia-10-2 (JP244396)	13 Nov. 2011	*Vigna unguiculata* (cowpea)	maybe escaped from cultivation		Kampong The, Ton Sai island	Kep	N10-25-57.5	E104-19-44.6	1m	sand (black)	bulk	no	no	ca. 30m apart from 2011-Cambodia-10-1 site, similar habitat

Table 3 (Continued).

Record ID (JP No.)	Coll. Date	Species name	Status	Local Name	Collection Site (Farmer's name)	Province	Latitude	Longitude	Altitude (m)	Soil	Seed	Herba-rium	Nodule	Remarks
2011-Cambodia-11 (JP245230)	13 Nov. 2011	*Vigna umbellata*	wild		Srae Khlong, ca. 60km SW of Phnom Penh, along R4	Kampong Speu	N11-24-07.9	E104-23-47.4	60m	red dirt	bulk	yes	no	beside road, ca. 10 m along the road
2011-Cambodia-12 (JP244397)	15 Nov. 2011	*Vigna minima*	wild		Okak, north of Kratie	Kratie	N12-59-49.3	E106-05-22.2	60m	fine sand	bulk	yes	yes	growing on *Dipterocarpus* forest floor beside Mekong River, very narrow leaflet, difficult to find leaves among grasses, long pod, flower size large. According to villagers of Okak, *Vigna minima* eaten as sweat (mature seeds steamed with glutinous rice). Young fruit & flower eaten as vegetable. They are still eating flower & fruits.
2011-Cambodia-13 (JP244398)	15 Nov. 2011	*Vigna minima*	wild		Okak, north of Kratie	Kratie	N12-55-48.9	E106-04-19.1	48m	fine sand	bulk	no	no	near Mekong River beside newly developed sugarcane field, ca. 8km S of 2011-Cambodia-12 site.
2011-Cambodia-14 (JP244399)	15 Nov. 2011	*Vigna radiata* var. *sublobata*	wild		Okak, north of Kratie	Kratie	N12-59-17.4	E106-03-43.1	45m	fine sand	bulk	yes	yes	near Mekong River, beside road and paddy (formerly *Depterocarpus* forest). leaf vein purple. Here, *V. minima* and *V. radiata* var. *sublobata* grow sympatrically.
2011-Cambodia-15 (JP244400)	15 Nov. 2011	*Vigna minima*	wild		Okak, north of Kratie	Kratie	N12-59-51.3	E106-06-33.1	64m	fine sand	bulk	no	no	near Mekong River, *Dipterocarpus* forest floor, ca. 3km E of 2011-Cambodia-12 site, only seeds collected
2011-Cambodia-16 (JP244401)	16 Nov. 2011	*Vigna umbellata*	cultivated	Sangdeak Vay	Pou Krang, ca. 20km NE of Sen Monorom (Mr. Chhek Chak)	Mondol Kiri	N12-34-27.0	E107-21-04.8	485m	clay	bulk	no	no	home garden, red seeds, 2$/kg
2011-Cambodia-17 (JP244402)	16 Nov. 2011	*Vigna umbellata*	maybe escaped from cultivation		Krang Tess, ca. 25km NE of Sen Monorom	Mondol Kiri	N12-38-43.2	E107-20-55.5	460m	red dirt	bulk	no	no	beside house (home garden), black seeds, grow naturally in a home garden, collect and use seeds for eating
2011-Cambodia-18 (JP244403)	16 Nov. 2011	*Vigna minima*	wild		ca. 28km NE of Sen Monorom	Mondol Kiri	N12-39-44.0	E107-20-50.0	430m	silt (dark)	bulk	yes	yes	in a forest (rather open), near the path, near the stream, leaflet size and shape variations are recognized. crawling plants have small leaflet, climbing plants have large leaflet
2011-Cambodia-19 (JP244404)	16 Nov. 2011	*Vigna unguiculata* (intermediate type between cowpea and yard long bean)	cultivated		ca. 28km NE of Sen Monorom	Mondol Kiri	N12-39-43.59	E107-21-09.5	430m	silt (dark)	bulk	no	no	home garden, intermediate between cultivar group Sesquipedalis and Unguiculata
2011-Cambodia-20 (JP244405)	16 Nov. 2011	*Vigna minima*	wild		beside parking area of Bou Sra Water Fall, ca. 24km NE of Sen Monorom	Mondol Kiri	N12-33-59.9	E107-25-01.9	508m	silt	bulk	yes	no	forest floor (beside car parking), roots elongate near the soil surface, *Vigna* grows around trees crawling on the floor and climbing to the trees


2011-Cambodia-01 (JP245229)


2011-Cambodia-02-1 (JP244390)


2011-Cambodia-02-2 (JP244391)

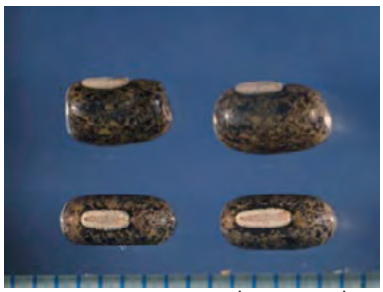

2011-Cambodia-05 (JP244392)


2011-Cambodia-06 (JP244393)


2011-Cambodia-07 (JP244394)


2011-Cambodia-10-1 (JP244395)


2011-Cambodia-10-2 (JP244396)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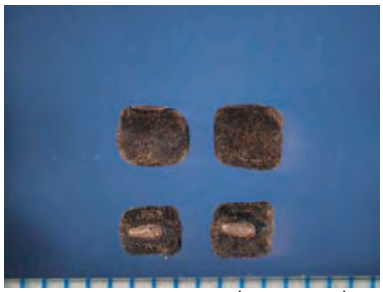
2011-Cambodia-12 (JP244397)


2011-Cambodia-13 (JP244398)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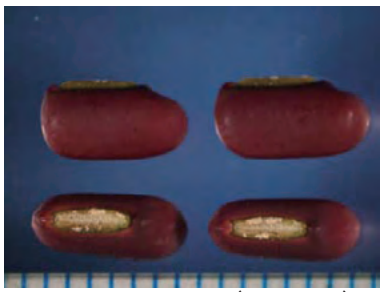
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2011-Cambodia-17 (JP244402)


2011-Cambodia-18 (JP244403)


2011-Cambodia-19 (JP244404)


2011-Cambodia-20 (JP244405)

Photo 1. A habitat of wild *V. umbellata* near Traeog Trayueng, Kampong Speu province (Cambodia-01). No mature pods found (10th November, 2011)

Photo 2. A habitat of *V. minima* (Cambodia-02) near the top of Kirirom mountain (alt. 680m).

Photo 3. *V. minima* plants grew among Gramineae grasses under natural pine forest (Cambodia-02 site). Seed size is conspicuously smaller than that of *V. minima* of Cambodia-12 site (see seeds photo).

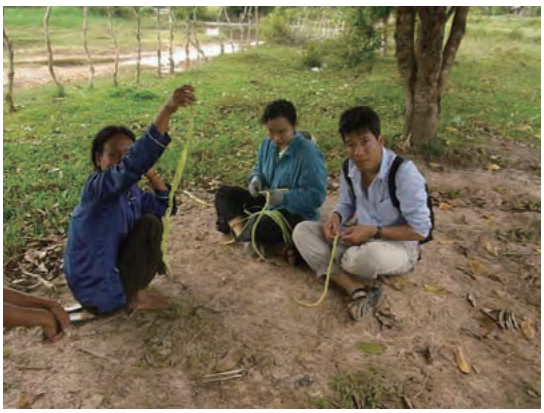

Photo 4. Collecting seeds from pods of yard long bean (JP244394) at Boos Ngang, Kampot province.

Photo 5. A population of *V. unguiculata* was found on the sandy beach at Ton Sai (rabbit) island, Kep province.

Photo 6. Flower and young pod of *V. unguiculata* (JP244395). They seems to be escaped from cultivation. However, seeds are small (see seed photo) and pod showed shattering habit.

Photo 7. *V. unguiculata* plants (JP244395) grew vigorously on the sandy beach and formed plenty of root nodules.

Photo 8. Preparing to make herbarium specimen of *V. umbellata* at site Cambodia-11, ca. 60km SW of Phnom Penh, Kampong Speu province.

Photo 9. A habitat of *V. minima* growing in a sparse dry deciduous Dipterocarpus forest along Mekong River (Cambodia-12) near Okak village in Kratie province.

Photo 10. Flower and leaves of *V. minima* (JP244397) at Cambodia-12 site. Conspicuously narrow leaflet is a specific character of plants at this site (compare leaflet photo of Cambodia-18 site).

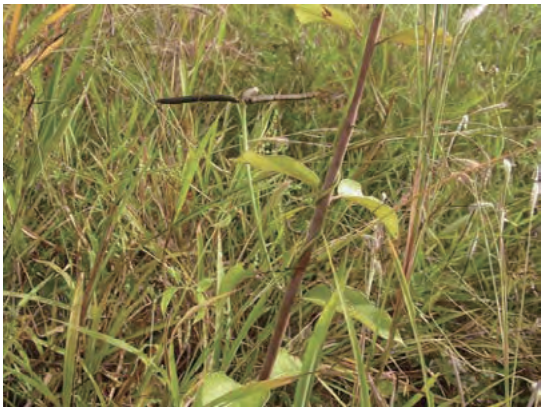

Photo 11. Near Okak village, a small population of *V. radiata* var. *sublobata* (JP244399) was found close to *V. minima* population.

Photo 12. *V. umbellata* (JP244401) was cultivated in a home garden at Sangdeak Vay village, ca. 20km NE from Sen Manorom, Mondol Kiri province.

Photo 13. A habitat of *V. minima* (JP244403) in a sparse forest at Cambodia-18 site (ca. 28km NE from Sen Monorom, Mondol Kiri province)

Photo 14. Leaflet of *V. minima* at Cambodia-18 site. Compare the leaflet of the same species at Cambodia-12 site.

Photo 15. A habitat of *V. minima* (JP244405) growing in parking area at Bou Sra Water Fall (Cambodia-20 sute), ca 24km NE from Sen Monorom, Mondol Kiri province.

Photo 16. *V. minima* plants at this site (Cambodia-20) can climb up on big tree.