

Original Paper

## **Collection of Melon and Other Cucurbitaceous Crops in Cambodia in 2017**

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### **Summary**

Cucurbitaceae genetic resources have been collected in previous field surveys conducted in eastern and northern Cambodia; sample information regarding their cultivation and utilization and variations in fruit and seed traits in melon genetic resources is available. However, genetic resources of Cucurbitaceae crops from southern Cambodia are only a few. A field survey was conducted mainly in southern Cambodia to collect genetic resources of cucurbitaceous crops with variations in fruit and seed traits in melons. A total of 131 samples, consisting of seven kinds of cucurbit crops and maize, were collected from markets, farmers' houses, and fields in the special administrative city and seven provinces and the capital of Cambodia and Japan; they were registered as a germplasm collection. Of the 101 accessions of melon, 56 and 45 were collected as fruits and seeds, respectively. These melon accessions comprised landrace cultivars, improved varieties, and wild melon landraces. Cultivation, including open pollination, of the landrace cultivars and their utilization were very similar to those recorded in eastern, western, and northern Cambodia and are predicted to cause non-significant differences in fruit and seed traits between the geographical areas in Cambodia. However, agricultural chemical utilization is more frequent during melon cultivation, which is performed two to four times, and local insect and disease spreads are common at the melon fields in southern Cambodia. Fruit and seed lengths of collected melons in Cambodia, including those from previous field surveys, were greater than those collected in Yunnan Province, China, and Lao People's Democratic Republic (PDR), suggesting different combinations of quantitative trait loci related

to fruit and seed length in the landrace cultivars between Cambodia and other Southeast Asian countries. Other fruit characters such as powdery texture of fruits, gelatinous sheath around seeds, oblong fruit shape, and low sugar concentration (brix) of flesh juice found in the landrace cultivars from Cambodia were similar to those from South and East Asia; useful breeding materials for disease resistance were found among the landrace cultivars, especially for resistance to local insects and diseases. Thus, melon genetic resources in Cambodia should be analyzed for genetic components of fruit and seed traits and evaluated for disease resistance for melon breeding purposes.

**KEY WORDS:** *Cucumis melo*, field survey, fruit, genetic resource, melon, seed

## Introduction

Melon (*Cucumis melo* L.) is a diversified crop cultivated in tropical, subtropical, and temperate zones. It is classified as either cultivated or wild melon (Pitrat 2008). Many studies have classified melon by using intraspecific characters of plants, fruits, and seeds and have suggested that cultivated melon is classified into subspecies *melo* and *agrestis* and subsequently into 15 botanical groups (Pitrat 2008). Among these, subsp. *agrestis* comprises *C. melo* vars. *acidulus* Naudin, *conomon* (Thunberg) Makino, *momordica* (Roxburgh) Duthie & Fuller, *makuwa* Thunberg, and *chinensis* Pangalo, which are found in eastern Asia from India to Japan. Their immature fruit is eaten as a vegetable, whereas the mature fruit of vars. *momordica* and *makuwa* are eaten as a dessert (Kitamura 1950; Kato *et al.* 2006, 2010; Nhi *et al.* 2010; Tanaka *et al.* 2014a). The 15 botanical groups that easily hybridize with each other are found worldwide, but their hybrids have characters that render it difficult to classify them into proper botanical groups. Wild melon is free-living or weedy, having small fruits and seeds growing near farm fields. This melon also has self-compatibility with cultivated melon, and putative hybrids are found worldwide (Morii *et al.* 1980; Akashi *et al.* 2002; Decker-Walters *et al.* 2002; Tanaka *et al.* 2007; Roy *et al.* 2012; Hu *et al.* 2014).

Some South Asian melons show resistance to insects and diseases (Dhillon *et al.* 2012). East Asian melons, especially var. *conomon*, show resistance to various diseases, including fusarium wilt, gummy stem blight, and cucumber mosaic virus (Takada 1979, 1983). Molecular analysis has shown that South and East Asian melons are distantly related (Akashi *et al.* 2002; Yashiro *et al.* 2005; Tanaka *et al.* 2007). Both melons can be useful as breeding materials and might contribute to widen the genetic base of melons stored in gene banks for future use. However, access to melons from South Asia is difficult in Japan, unless a proper agreement for access and benefit-sharing is contracted between the provider under the Nagoya Protocol and user, or those genetic resources are introduced from a third party such as the U. S. National Plant Germplasm System (NPGS), where the largest number of accessions are preserved. Exotic melon genetic resources cannot ultimately be introduced in either case owing to a Japanese plant-protection policy aimed at preventing the introduction of bacterial fruit blotch (*Acidovorax avenae* subsp. *citrulli*) and melon fly (*Bactrocera cucurbitae*).

Southeast Asian melons are distantly related to East Asian melons, as shown by the analysis of complementary genes that cause bitterness in the immature fruit of F<sub>1</sub> hybrids (Fujishita *et al.* 1993). Vietnamese melons show geographical variation in fruit length: melon landraces from southern and northern Vietnam have an elongated and oblong fruit shape; their seed length differed,  $7.5 \pm 0.6$  mm and  $7.0 \pm 0.6$  mm, respectively, and both melon types showed genetic differentiation after random amplified

polymorphic DNA (RAPD) analysis (Nhi *et al.* 2010). Genetic similarity, as well as similarities in fruit traits such as fruit shape, skin color, and flesh color, is recognized in melon landraces among northern Vietnam, northern Laos, and southern Yunnan Province, China, which are mountainous areas (Tanaka *et al.* 2014b). Melons from Southeast Asia are also thought to be useful genetic resources to widen the genetic base of cultivated melons and should be used in exploring genetic variation in fruit and seed traits, both of which not only have valuable information to manage them effectively as genetic resources, but may also contribute to downsizing the number of tested materials for screening agricultural traits such as disease resistance.

Field surveys in Lao PDR, Vietnam, and Cambodia (Sakata *et al.* 2008; Saito *et al.* 2009; Kato *et al.* 2010; Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018) found various kinds of cucurbitaceous crops that are conserved in the gene banks of the respective countries. In particular, for melon landraces from eastern, western, and northern Cambodia, which were difficult to access previously, large variations in fruit and seed traits were recognized during field surveys and were expected to show genetic variations, including disease resistance (Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018). Thus, field surveys should be conducted in southern Cambodia to discover morphological and agricultural traits, and to increase genetic variation in overall Cambodian melon landraces.

Therefore, in this field survey, cucurbitaceous crops, including melon, were collected from southern Cambodia. Morphological traits such as fruit traits and seed size were measured to characterize cucurbitaceous crops, particularly melon landraces, and were compared with those of melon landraces from other Southeast Asian countries and South and East Asian countries.

## Materials and Methods

A field survey was successfully conducted as a part of the PGRAsia Project by the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan, according to a Letter of Agreement between the Cambodian Agricultural Research and Development Institute (CARDI; Cambodia) and Genetic Resources Center in the National Agriculture and Food Research Organization (NARO; Japan). Field surveys were conducted twice. The first survey was started on November 26, 2017, during the dry season (Table 1); the 17-day field survey included the special administrative city, Sihanoukville, of Cambodia and seven provinces of Southern Cambodia, including Svay Rieng, Prey Veng, Kandal, Takeo, Kompong Speu, Kampot, and Koh Kong (Fig. 1). The second survey was started on February 7, 2018, during the dry season (Table 1); the six-day field survey included Prey Veng and Kandal Provinces.

Samples were collected from local markets, roadside vegetable stands, farmers' houses, and cropping fields; the precise positions of the sites were recorded using a GPS. Other information, including local crop names and cultivation methods (e.g., cultivation place, sowing and harvest times, fertilizer application, and fruit usage), was also collected by interviews with residents. Seeds from each fruit or one seed-storage bag (in farmers' houses) were registered as one sample. Mixed stored seeds were separated into seeds of each crop and registered independently as corresponding to the individual seed samples.

We also investigated 13 fruit characteristics and recorded them for 55 melon fruits, except for one fruit from 17CJVC-96, which could not be evaluated for these fruit traits, as well as seed size, as explained below, because of fruit deterioration. Seed length and width were measured on 10 seeds for each of 100 melon accessions, and the seed samples were classified as large ( $\geq 9.0$  mm length) or small seeds ( $< 9.0$  mm length), according to Akashi *et al.* (2002). The seeds were selected randomly.

Table 1. Itinerary of the field survey in Cambodia, 2017

Itinerary <sup>1</sup>		Stay
26 Nov.	Haneda -- Bangkok -- Phnom Penh	Phnom Penh
27 Nov.	Phnom Penh -- CARDI -- Prey Veng (Prey Veng) -- Svay Rieng (Svay Rieng)	Svay Rieng
28 Nov.	Svay Rieng -- Visit to northern area	Svay Rieng
29 Nov.	Svay Rieng -- Kompong Speu (Kompong Speu)	Kompong Speu
30 Nov.	Kompong Speu -- Kampot (Kampot)	Kampot
1 Dec.	Kampot -- Takeo (Takeo)	Takeo
2 Dec.	Takeo -- Tuan Lap -- Kampot	Kampot
3 Dec.	Sample preparation	Kampot
4 Dec.	Kampot -- Sihanoukville (Sihanoukville city)	Kompong Som
5 Dec.	Sihanoukville -- Sre Ambel -- Koh Kong (Koh Kong)	Koh Kong
6 Dec.	Koh Kong -- Visit to northern and western area	Koh Kong
7 Dec.	Koh Kong -- Sre Ambel	Sre Ambel
8 Dec.	Sre Ambel -- Kompong Speu	Kompong Speu
9 Dec.	Kompong Speu -- Aoral -- Kompong Speu	Kompong Speu
10 Dec.	Kompong Speu -- Phnom Penh	Phnom Penh
11 Dec.	Sample preparation	Phnom Penh
12 Dec.	Visit to CARDI, Phnom Penh -- Haneda on 13 Dec.	On flight
7 Feb.	Haneda -- Bangkok -- Phnom Penh	Phnom Penh
8 Feb.	Phnom Penh -- Southern area along the Mekong River -- Prey Veng	Prey Veng
9 Feb.	Prey Veng -- Southern area along the Mekong River -- Phnom Penh	Phnom Penh
10 Feb.	Phnom Penh -- Northeastern area along the Mekong River	Phnom Penh
11 Feb.	Sample preparation	Phnom Penh
12 Feb.	Visit to CARDI, Phnom Penh -- Haneda on 13 Feb.	On flight

<sup>1</sup> Province is indicated in parenthesis.

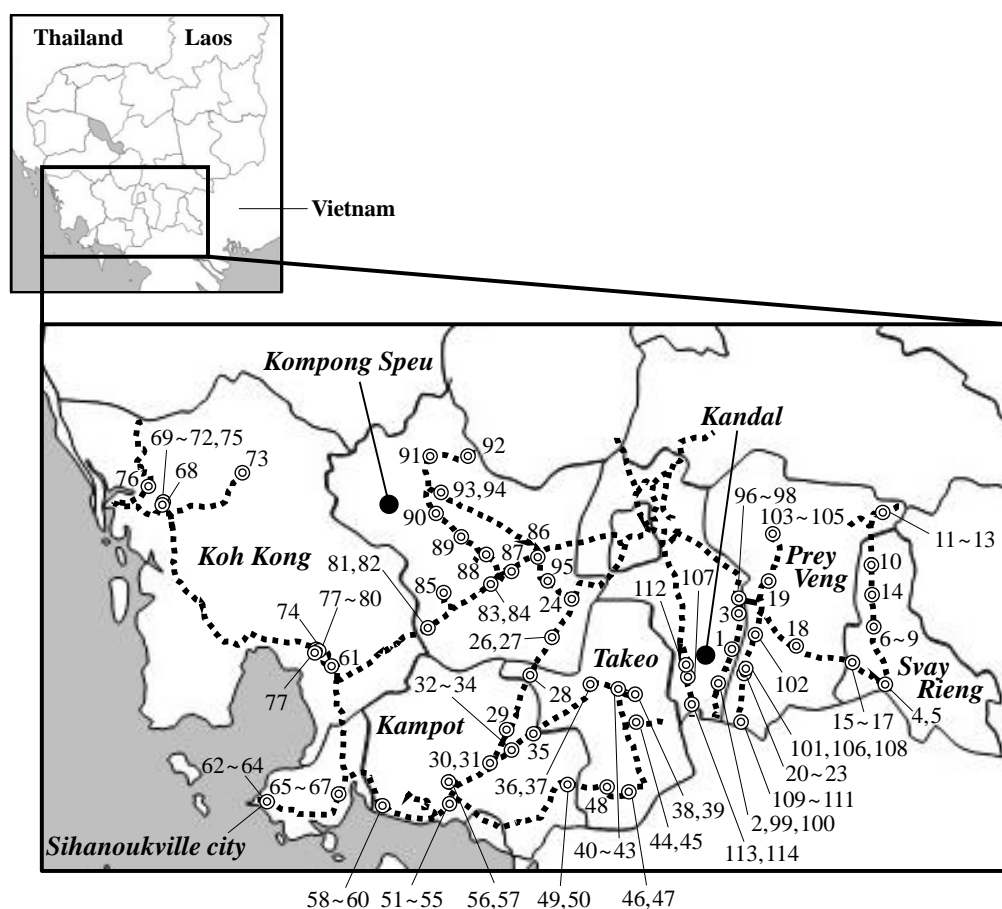


Fig. 1. A map of the explored routes in Cambodia. The routes are shown by bold dotted lines. Each collection site is indicated by a double circle with a corresponding accession number(s). Accession numbers "17CJVC-1," "17CJVC-2," "17CJVC-3," etc. are abbreviated as "1," "2," "3," etc. respectively.

Data were analyzed along with previously reported data for the characteristics and sizes of 364 melon accessions, of which 107 were from East India; 54 from southern China (mainly Yunnan Province); 117 from northern and southern Lao PDR; 40 from western, eastern, and northern Cambodia; and 46 from (*C. melo* vars. *makuwa* and *conomon*) China, Korea, and Japan (Saito *et al.* 2009; Kato *et al.* 2010; Nhi *et al.* 2010; Matsunaga *et al.* 2016; Tanaka *et al.* 2014a, 2017, 2018). One fruit of each accession was used for measurements. Seed size of each accession was measured for ten seeds, except for melon accessions from East India, for which seed size was measured for three seeds. By using the Tukey–Kramer multiple comparison test, we compared the seed lengths of the accessions from four geographical regions in Cambodia and from other countries. Quantitative data of fruit weight, length, width, flesh sugar content, seed length, and seed width were used for correlation coefficient calculation and principal coordinate (PCO) analysis, which were performed using EXCEL *Tahenryo-kaiseki* ver.7.0 (Esumi Co., Ltd., Japan).

### Study area

During the field survey, mainly in southern Cambodia, we visited the special administrative city and the provincial capitals of seven provinces as well as various villages along the route (Fig. 1). The survey was conducted on foot on paved roads in the city or arterial highway and by car on dirt roads; we also crossed long bridges, especially on the Mekong River (Photos 1 and 2). The field survey included lowland areas surrounding the Mekong River and coast along the Gulf of Thailand, at an altitude ranging from -15 to 379 m above sea level. During the survey, we observed the following three areas: a water-abundant area covered with many ponds near the Mekong River, dry area distant from the Mekong River, and tropical rain forest area in a natural sanctuary, especially in Koh Kong (Photos 3 and 4). Agricultural products had already been harvested in the dry area, but were cultivated in the water-abundant area even in the dry season (Photos 3, 5–7). The dry and water-abundant areas were also developed for the cultivation of cash crops, but different land utilization for cultivation of cash crops was found as follows: water-abundant area was utilized for the cultivation of tree fruits such as mango, jackfruit, sapodilla, star fruit, durian, and banana, and the dry area was utilized for the cultivation of tree fruits as well as rubber, cassava, pepper, and sugarcane (Photos 8–10). Local people used both wild and cultivated foodstuffs, including vegetables, fruits, animals, and fish, and sold them and their processed foods at city and local markets (Photos 11–14). Leaf, flower, and immature and mature fruits of cucurbitaceous crops such as bottle gourd, cucumber, melon, pumpkin, sponge gourd, squash, watermelon, and wax gourd were found at local markets and vegetable stands on the roadside, in which both improved varieties and landrace cultivars were often found (Photos 15–20). These foodstuffs were carried from both neighboring and distant areas by transportation over well-paved highways and dirt roads. In particular, along the Mekong River, local people carried cucurbit fruits from islands where farmlands are located, in Kandal and Prey Veng Provinces.

### Results

In this survey, 131 samples from 63 sites were collected; these included seven kinds of cucurbit crops and one type of maize (Fig. 1, Table 2). A total of 57 samples were collected as fruits from the markets or fields, and the remaining samples were collected as seeds from farmers' houses (Photos 19–22). Local farmers stored their seeds in storage cases such as plastic bottles and netted or plastic bags; furthermore, some farmers stored all their cucurbit crop seeds together (Photos 23–25). In particular, for melon genetic resources, local farmers harvested seeds from more than two fruits, which were set by open

Table 2. The total number of collections in Cambodia, 2017

Plant name	Total	Province							
		Svay Rieng	Prey Veng	Kandal	Takeo	Kompong Speu	Kampot	Koh Kong	Preah Sihaknok
Melon	101	7	12	29	14	13	13	9	4
Cucumber	7	1	1	0	0	1	3	1	0
Pumpkin	10	2	0	0	1	3	2	1	1
Watermelon	3	1	0	0	0	1	0	1	0
Wax gourd	5	2	1	0	0	1	0	1	0
Other crops <sup>1</sup>	5	1	2	0	0	0	0	2	0
Total	131	14	16	29	15	19	18	15	5

<sup>1</sup> Angled luffa, bitter gourd and maize included to “other crops”.

pollination, and the stored seeds showed considerable variation (Photo 26).

A total of 101 accessions were collected for melon during the field survey (Table 2). Among them, 56 accessions were collected as fruits, and 45 accessions were collected as seeds stored by farmers (Tables 3 and 4; Photos 19, 20, 22, 24, and 25). Of the seeds collected as fruits, one accession (17CJVC-96) could not be evaluated for fruit traits and seed size because of fruit deterioration (Photos 27 and 28). Based on interviews with local people, we learned that cultivation of melon landrace cultivars starts at the beginning of the rainy season (i.e., April to May), by single cropping in an open field, on flat land, or near a riverside. In particular, near a river, where sufficient water is available for farming, or in a field, where irrigation is operated, melon is cultivated for two to four times (Photos 29-31). Before cultivation, the soil

Table 3. Fruit characters of cultivated melon in the 2017 collection

Collection number	Fruit size				Fruit epicarp			Fruit flesh						Sheath around seed <sup>2</sup>
	Weight (kg)	Length (cm)	Diameter (cm)	Shape index	Color <sup>1</sup>	Stripe on rind	Sutures on rind	Outer color <sup>1</sup>	Inner color <sup>1</sup>	Thickness (cm)	Powder texture	Brix (° Bx )	Placenta color <sup>1</sup>	
17CJVC-4	2.40	29.5	12.5	2.4	Y	-	+	LG	LG	3.8	-	3.5	W	+
17CJVC-5	1.40	24.5	8.5	2.9	Y	+	+	LG	LG	2.7	-	2.0	WG	+
17CJVC-39	0.60	12.5	12.0	1.0	LG	-	+	LG	LG	2.2	-	2.0	W	+
17CJVC-40	0.67	9.5	12.5	0.8	LG	-	+	W	W	2.3	-	2.0	W	+
17CJVC-41	0.40	9.5	9.5	1.0	LG	-	+	W	W	2.1	-	2.0	W	+
17CJVC-42	0.37	9.0	9.0	1.0	LG	-	-	W	W	1.8	-	2.0	W	+
17CJVC-43	0.44	13.5	9.0	1.5	LG	-	-	W	W	1.5	-	1.8	W	+
17CJVC-51	2.05	31.0	13.5	2.3	Y	+	+	W	W	2.5	+	3.0	W	+
17CJVC-52	2.50	38.5	13.0	3.0	G	+	-	LG	W	2.5	+	3.0	W	+
17CJVC-53	2.05	28.5	13.0	2.2	LG	-	-	LG	LG	2.5	+	3.0	W	+
17CJVC-54	1.55	16.7	11.5	1.5	G	+	-	LG	W	2.2	+	3.0	W	+
17CJVC-55	1.05	21.3	11.3	1.9	Y	-	+	LG	LO	2.5	+	3.0	W	+
17CJVC-56	2.35	29.5	14.0	2.1	G	+	-	LG	W	3.7	+	3.0	W	+
17CJVC-57	1.95	30.8	12.5	2.5	Y	+	+	G	G	3.0	-	3.0	W	+
17CJVC-62	2.15	26.0	15.0	1.7	LG	-	-	G	G	2.8	-	4.0	W	+
17CJVC-63	2.25	26.5	14.0	1.9	LG	-	-	LG	LG	3.0	-	4.0	W	+
17CJVC-64	3.80	37.0	16.0	2.3	Y	-	-	G	G	3.5	-	3.0	W	+
17CJVC-74	1.35	28.0	11.0	2.5	Y	-	-	G	G	2.4	-	2.4	G	+
17CJVC-78	1.40	23.8	11.7	2.0	G	-	-	Y	Y	2.5	-	4.5	W	+
17CJVC-79	3.30	32.4	14.6	2.2	LG	-	-	Y	Y	3.4	-	4.0	W	+
17CJVC-80	3.12	54.5	11.0	5.0	Y	-	+	Y	Y	3.0	-	4.0	W	+
17CJVC-86	3.85	29.5	20.0	1.5	Y	+	+	LG	LG	3.5	-	3.0	W	+
17CJVC-103	1.85	24.5	12.0	2.0	OY	+	-	LG	Y	3.3	-	5.0	W	+
17CJVC-104	1.95	35.0	10.0	3.5	G	+	-	LG	LG	2.7	-	3.6	W	+
17CJVC-105	1.60	15.0	14.0	1.1	Y	+	-	G	O	3.7	-	6.2	W	+

<sup>1</sup> Y: Yellow, LG: Light green, OY: Orange yellow, G: Green, W: White, LO: Light orange, O: Orange, WG: Pale green.

<sup>2</sup> Gelatinous sheath surrounding seed in melon.



is plowed, and a ridge is made, in which seeds are sown or seedlings are transplanted. Very few farmers cultivate melon by mixed cropping with maize, upland rice, wax gourd, and pumpkin; they burn their field with harvest remains such as rice straw and dig a hole where seeds are sown with cow manure. Chemical fertilizers and agricultural chemicals are applied during cultivation. Cucurbit leaf beetle, powdery mildew, downy mildew, and wilt of seedling stage are often noted in melon fields. Immature and mature melon fruits were harvested one and two months after sowing, respectively. Immature fruits with elongate shape are used as a vegetable (e.g., being pickled or prepared as soups and salads) and are collected for self-consumption or to be sold at markets (Photos 32 and 33). Mature fruits are eaten as desserts with sugar, condensed milk, coconut milk, or crushed ice. Powdery texture with fragrance is a preferred trait for mature fruit in Cambodia, but not sweetness, which can be adjusted by adding sugar. Seeds for cultivation in the following year are collected from the first set fruit on the vine—big size fruit; good appearance of fruit or good taste; and number of fruits, normally two or three fruits, depending on the growing area. These seeds are often donated to other farmers and rarely sold in the market. Seeds produced in Thailand are also sold in the market. Based on information about cultivation methods and seed origin, we classified 13 accessions as improved varieties (Table 5). Furthermore, 57 accessions were registered as melon landrace cultivars. However, the remaining 31 accessions were naturally grown on the side of farmland and not cultivated

Table 4. Fruit characters of wild melon in the 2017 collection

Collection number	Fruit size				Fruit epicarp			Fruit flesh					Placenta color <sup>1</sup>	Sheath around seed <sup>2</sup>
	Weight (g)	Length (cm)	Diameter (cm)	Shape index	Color <sup>1</sup>	Stripe on rind	Sutures on rind	Outer color <sup>1</sup>	Inner color <sup>1</sup>	Thickness (cm)	Powder texture	Brix (° Bx)		
17CJVC-97	37.0	3.9	4.1	1.0	Y	-	-	W	W	0.8	-	7.8	W	+
17CJVC-98	28.3	3.9	3.8	1.0	G	-	-	W	W	0.1	-	4.5	W	+
17CJVC-99	14.7	3.8	2.8	1.4	G	+	-	W	W	0.3	-	4.2	W	+
17CJVC-100	12.5	2.9	2.7	1.1	Y	-	-	W	W	0.3	-	8.8	W	+
17CJVC-101	75.0	7.7	5.4	1.4	G	+	-	W	W	1.2	-	5.2	W	+
17CJVC-106	78.0	7.3	5.0	1.5	Y	-	-	W	W	0.9	-	4.0	W	+
17CJVC-108	22.6	4.5	3.2	1.4	G	-	-	W	W	0.3	-	4.0	W	+
17CJVC-109	18.9	3.6	2.9	1.3	Y	-	-	W	W	0.2	-	4.2	W	+
17CJVC-110	21.6	3.6	3.3	1.1	G	-	-	W	W	0.2	-	4.0	W	+
17CJVC-111	7.3	2.6	2.4	1.1	G	+	-	W	W	0.1	-	4.1	W	+
17CJVC-112	3.7	1.8	1.9	1.0	G	-	-	W	W	0.1	-	4.0	W	+
17CJVC-113	10.9	2.9	2.6	1.1	G	-	-	W	W	0.2	-	4.0	W	+
17CJVC-114	12.9	3.1	2.8	1.1	G	-	+	W	W	0.3	-	4.2	W	+
17CJVC-115	36.4	4.7	3.9	1.2	G	-	-	W	LG	0.5	-	6.4	W	+
17CJVC-116	32.8	4.5	3.8	1.2	G	-	-	LG	LG	0.5	-	6.8	W	+
17CJVC-117	80.8	6.8	4.9	1.4	G	-	-	W	W	1.0	-	5.6	W	+
17CJVC-118	46.1	5.4	4.1	1.3	G	-	-	W	W	0.5	-	8.2	W	+
17CJVC-119	40.9	5.1	3.9	1.3	G	-	-	W	LG	0.4	-	6.8	WG	+
17CJVC-120	35.8	4.8	3.8	1.3	G	-	-	LG	LG	0.4	-	8.6	W	+
17CJVC-121	28.2	4.5	3.6	1.3	G	-	-	W	W	0.5	-	6.2	W	+
17CJVC-122	21.7	4.0	3.2	1.3	G	-	-	W	W	0.3	-	7.0	W	+
17CJVC-123	29.6	3.9	3.8	1.0	G	-	-	W	W	0.6	-	5.0	W	+
17CJVC-124	37.6	4.6	4.0	1.2	G	-	-	W	W	0.4	-	6.0	W	+
17CJVC-125	28.8	4.2	3.6	1.2	G	-	-	W	W	0.1	-	4.5	W	+
17CJVC-126	20.3	4.0	3.3	1.2	G	-	+	W	W	0.3	-	6.0	W	+
17CJVC-127	32.6	4.7	3.7	1.3	G	-	+	W	W	0.4	-	6.4	W	+
17CJVC-128	32.1	4.7	3.6	1.3	G	-	-	W	W	0.4	-	4.6	W	+
17CJVC-129	31.3	4.6	3.5	1.3	G	-	-	W	W	0.4	-	5.6	W	+
17CJVC-130	15.9	3.7	2.8	1.3	G	-	-	W	W	0.1	-	4.0	W	+
17CJVC-131	11.5	3.4	2.6	1.3	G	-	-	W	W	0.1	-	4.0	W	+

<sup>1</sup> Y: Yellow, G: Green, W: White, LG: Light green, WG: Pale green.

<sup>2</sup> Gelatinous sheath surrounding seed in melon.

by local people who ate the fruit directly and occasionally sold them in the markets (Table 4; Photos 34–37). Based on interviews with local people, we identified two kinds of fruits, sweet and sour. These melon accessions shared characteristics similar to those of “wild melon,” which have been described by Pitrat (2008); thus, they were assigned as “wild melon” landraces in this study.

Moreover, 55 melon accessions varied in measured fruit traits (Tables 3 and 4). Fruit weight varied widely and ranged from 3.7 g for 17CJVC-112 to 3.85 kg for 17CJVC-86, although small fruits measured less than 80.8 g for 30 wild melon accessions (Fig. 2A; Table 4). Fruit length and diameter in these wild melon accessions also showed wide variations: they were smaller than those for the 25 accessions of cultivated melon, including the melon landrace cultivars and improved varieties ( $p < 0.01$ ; Fig. 2B and 2C; Photo 38). The ratio of fruit length to fruit diameter, shape index, ranged from 0.8 to 5.0 in cultivated melon accessions, which had various kinds of fruit shapes such as globular and elongated, although this factor showed narrow variation in wild melon, ranging from 1.0 to 1.5 (Fig. 2D). Flesh traits showed less variation in the 55 wild and cultivated accessions. Both the outer and inner flesh colors were green, yellow, or orange (Photo 39). The sugar concentration of the flesh was  $\leq 6.0$  °Bx in 42 accessions (76.4 %), and all seven accessions showing more than 6.8 °Bx sugar concentration were wild melon (Fig. 2E). Gelatinous sheaths around the seeds were recognized in all fruits collected (Photo 40). Powdery texture was observed in six fruits that had sticky fruit flesh normally known for mature fruit, as revealed by interviews at farmer houses visited.

Seed length varied widely, ranging from 3.29 to 9.95 mm among the 1,000 seeds of the 100 melon accessions collected during this field survey (Fig. 2F; Photo 26). Among them, 913 seeds (91.3 %) were under 9.0 mm long and were classified as small seeds, whereas the remaining seeds were classified as large seeds. In particular, most of the wild melon accessions had seeds were under 5.7 mm, and they obviously

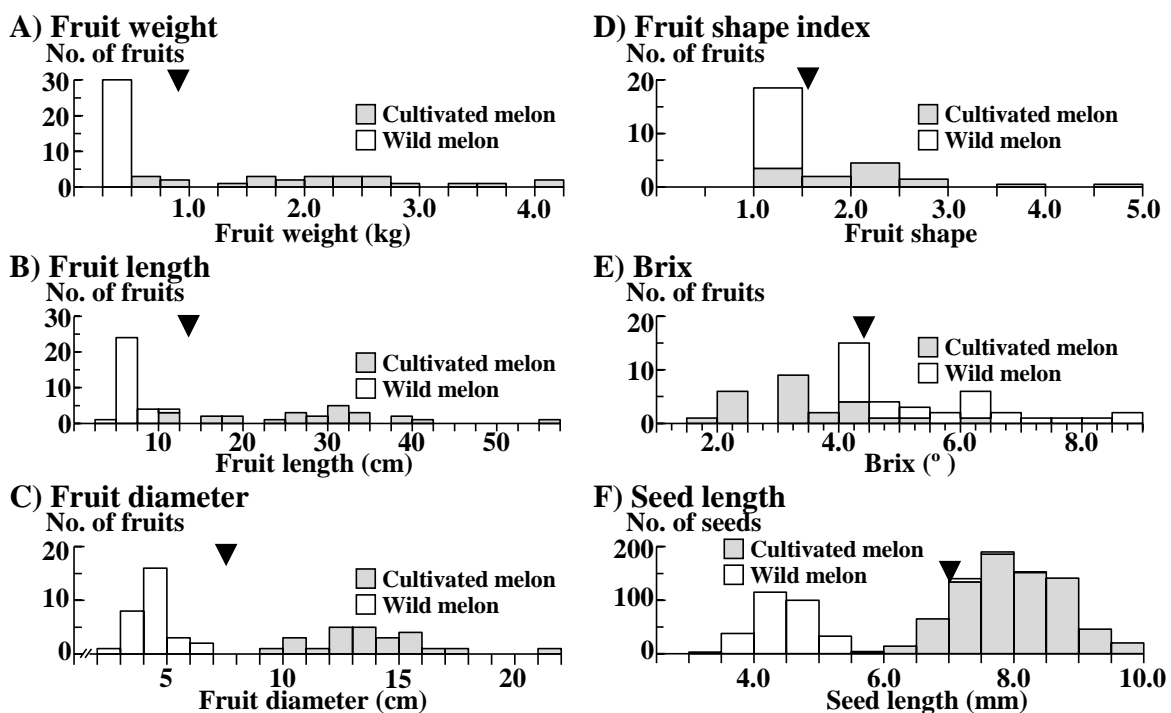


Fig. 2. Variations of fruit traits and seed length in 100 melon accessions from Southern Cambodia. An arrowhead indicates an average value in each trait.



differed from other small seeds. Fruit size and seed size differed between wild and melon landrace cultivars, resulting in a discrepancy between them on the scatter plot after PCO analysis (Fig. 3). PCO1 was related to fruit weight, length, and width; seed length; and seed width, although PCO2 was related to seed length and seed width.

About 65 accessions, including 40 accessions collected as fruit from Cambodia previously, were registered as melon landrace cultivars; they varied in fruit weight, length, and width; flesh sugar content by brix; seed length; and seed width, although no obvious differences were detected among the four geographical areas by PCO1 and PCO2, which could explain 48.4 % and 21.3 % of their total variance (Fig. 4). Of two PCO, PCO1 was related to fruit weight, length, width, seed length and seed width and PCO2, to fruit weight, width and flesh sugar content. In case of 237 melon accessions including melon collected as seeds, East and South area differed from West and North area by seed length ( $p < 0.01$ ).

As for 364 accessions from South-, Southeast- and East-Asia, fruit weight correlated with fruit length and diameter ( $r = 0.674$  and  $0.787$ , respectively;  $p < 0.01$ ). Seed length and width also correlated with fruit length ( $r = 0.641$  and  $0.561$ , respectively;  $p < 0.01$ ). These five traits showed no correlation with flesh sugar content by brix ( $r = -0.289$  to  $-0.042$ ). PCO analysis was performed using fruit traits and seed size in 364 accessions, and 53.4 %, 20.0 %, and 14.0 % of their total variance could be explained by PCO1, PCO2, and PCO3, respectively. PCO1 was related to fruit weight, length, and width; seed length; and seed width; PCO2 was related to fruit weight and width and flesh sugar content by brix; and PCO3 was related to flesh sugar content by brix. According to PCO1 and PCO2, most of the cultivated melon accessions from Cambodia were distributed within the range from the right upper and right lower zone, indicating that they

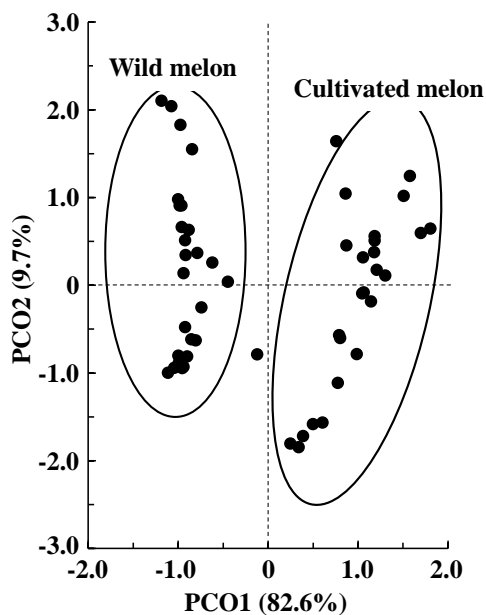


Fig. 3. Distribution on the first two principal coordinates of 53 fruits of melon landraces from Southern Cambodia. Principal component score of each accession was calculated in PCO analysis by using quantitative data of fruit weight, length, width, flesh sugar content, seed length, and seed width. Contribution rate of their total variance is indicated in parentheses under the two axes.

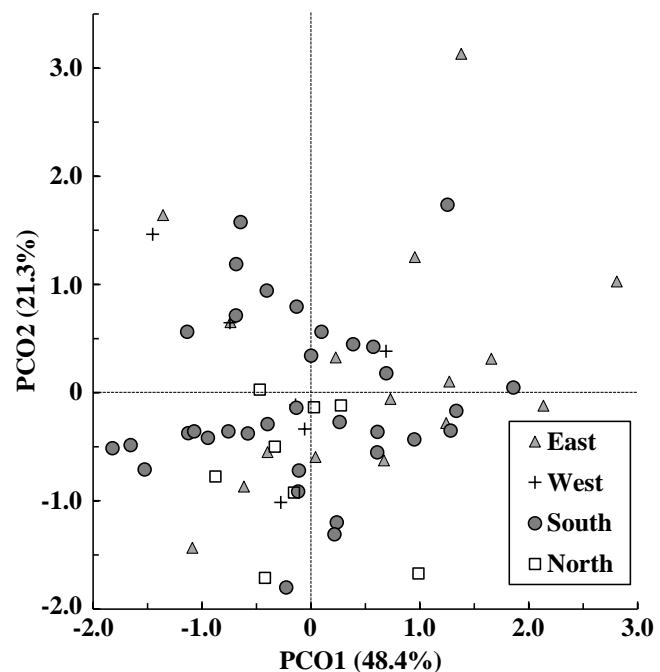


Fig. 4. Distribution on the first two principal coordinates of 65 fruits of cultivated melon from four regions in Cambodia. Principal component score of each accession was calculated in PCO analysis by using quantitative data of fruit weight, length, width, flesh sugar content, seed length, and seed width. Contribution rate of their total variance is indicated in parentheses under the two axes.

had large fruit size and seed size, with *C. melo* var. *conomon*, “Shiro-uri,” and a few of cultivated melon accessions from East India, Yunnan Province, and Northern Laos. In addition, a few of the cultivated melon accessions from Cambodia were distributed within the range from the upper vertical zone, with cultivated melon accessions from East India, northern and southern Lao PDR, and Yunnan Province in China. Thus, PCO analysis showed similarity of fruit size and seed size between melons from Cambodia and *C. melo* var. *conomon* and/or a few melons from East India, Yunnan Province, and Northern Laos.

## Discussion

We collected 131 samples and information about the cultivation and utilization of cucurbitaceous crops from lowland areas of southern Cambodia. Immature and mature fruits of cultivars of melon landraces were eaten as vegetable and dessert, respectively; the same trend has been noted in western, eastern, and northern Cambodia (Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018). Melon seeds were harvested from more than two fruits set by open pollination. This seed-collecting method was also observed in western, eastern, and northern Cambodia (Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018). Cultivation and utilization of cultivars of melon landraces, in addition to the sharing of their gene pool through open pollination, seemed to be similar throughout Cambodia, leading to consistency in fruit and agricultural

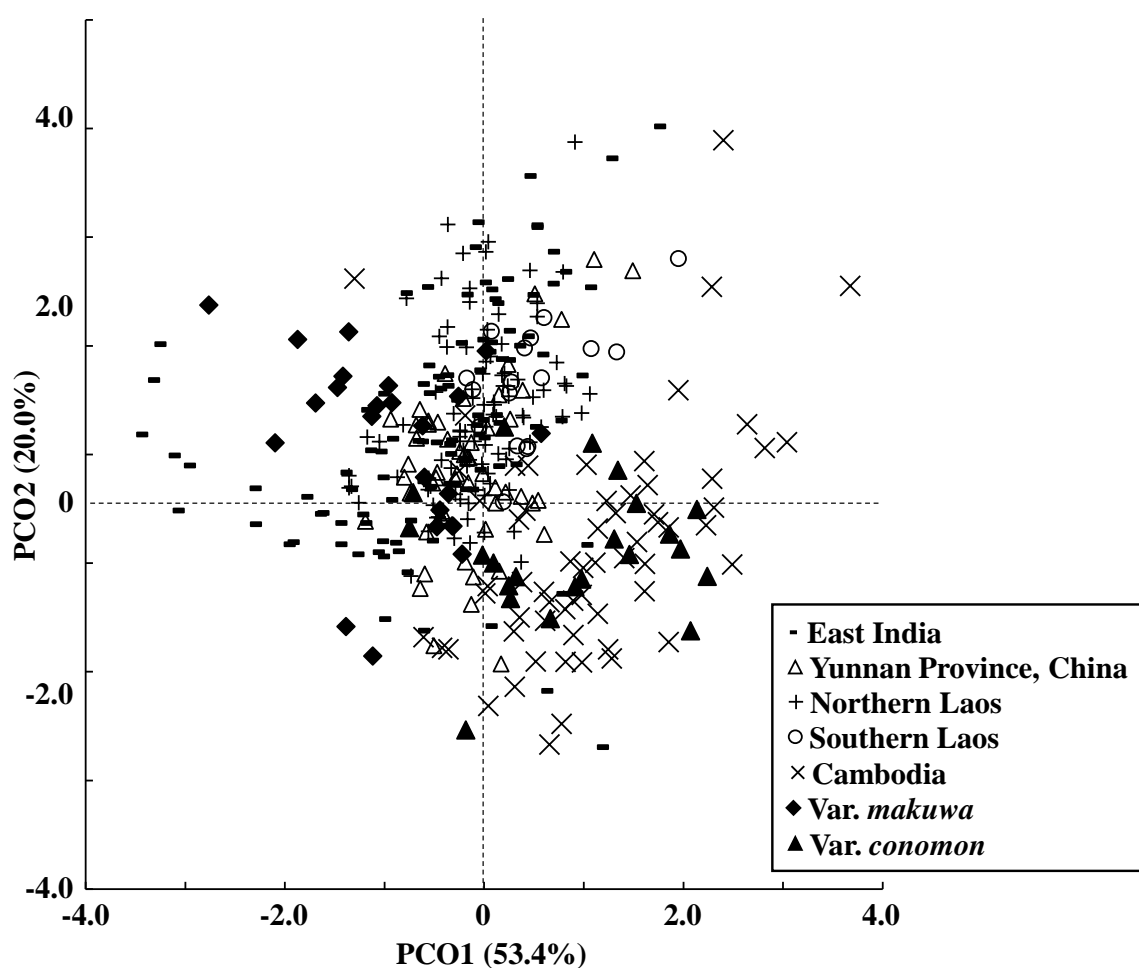


Fig. 5. Distribution on the first and second principal coordinates of 364 fruits of cultivated melon. Principal component score of each accession was calculated in PCO analysis by using quantitative data of fruit weight, length, width, flesh sugar content, seed length, and seed width. Contribution rate of their total variance is indicated in parentheses under the two axes.

traits among the melon landrace cultivars. Thus, fruit length and diameter, fruit flesh brix, and seed length of melon landrace cultivars were not different between the four geographical areas (Fig. 4), although wide variations were observed within the respective areas (Fig. 2A-2F; Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018).

Cultivated melons from Cambodia showed slight affinity with reference accessions examined using PCO analysis (Fig. 5), although they were distributed mainly on the right lower zone, indicating that the cultivated melons of Cambodia had an elongated fruit shape and longer seeds. This phenotype is thought to be common in cultivated melons from eastern, western, and northern Cambodia (Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018); in contrast, melon landrace cultivars from Yunnan Province and northern Lao PDR had an oblong fruit shape (Kato *et al.* 2006, 2010; Saito *et al.* 2009). Molecular analysis performed using single sequence repeat and RAPD markers in 287 melon accessions, including 62 Cambodian melons collected, separated them into eight groups by the unweighted pair-group method with arithmetic mean tree (Dung *et al.* 2018). Of these groups, two consisted of mainly Cambodian melons, and not Laos and Yunnan melons. Melon landraces of Cambodia also showed genetic differentiation from those of Yunnan Province and northern and southern Lao PDR. Fruit and seed length showed a wide variation in not only natural populations, as shown in this study (Fig. 5), but also, experimental lines; furthermore, this variation was controlled by quantitative trait loci (QTLs; Díaz *et al.* 2014, 2017; Wang *et al.* 2011). Cambodian melon landraces may have different QTL sets from those present in other countries in Southeast Asia.

Conversely, PCO analysis showed similarity of fruit traits and seed size between Cambodian melons and *C. melo* var. *conomon* or a few melon landraces from East India, Yunnan Province, and Northern Laos. Cultivars of Cambodian melons collected had powdery texture and gelatinous sheaths around the seeds, and these traits were also recognized in melons collected in northern, western, and eastern Cambodia (Table 3; Matsunaga *et al.* 2016; Tanaka *et al.* 2017, 2018) and in *C. melo* var. *momordica* from India (Kato *et al.* 2006; Dhillon *et al.* 2012). Cambodian melons, including the collection in this survey, had large and an elongated fruit shape with lower sugar concentration, like that in *C. melo* var. *conomon* from East Asia. Cambodia is located between South Asia and East Asia; not surprisingly, the country has melons with shared fruit traits from varieties *momordica* and *conomon*. Notably, both varieties are useful breeding materials for resistance to various kinds of insects such as cucumber beetle and aphid and diseases such as powdery mildew, fusarium wilt, gummy stem blight, and cucumber mosaic virus (Takada 1979, 1983; Dhillon *et al.* 2012). These similarities in fruit characteristics between Cambodian melon and other melon varieties and varietal characteristics for disease resistance might indicate that Cambodian melons have potential resistance against insects and diseases.

In conclusion, 130 samples of cucurbit crops and one type of maize were collected in this field survey; these were registered as genetic resources at national institutes in Cambodia and Japan. Characterization of the melon fruits and seeds revealed that Cambodian melons showed affinity with melons of neighboring countries based on fruit traits and seed length, but seemed to have different genetic components from those of melons of neighboring countries with regard to resistance to insects and diseases. We could collect wild melons from southern Cambodia, which are not available anywhere in the world. Wild melon seems to be resistant to canker and virus (Fujishita 1977; Sowell 1981; Sakata *et al.* 2000); therefore, they may be very useful for melon breeding. Thus, our collection should be analyzed for genetic components of fruit and seed traits and for disease resistance for melon breeding purposes.

## Genetic resources

All seeds of the 131 accessions collected have been stored as genetic resources in the CARDI gene bank, and a subset has been placed in the NARO Genebank with JP number under the Standard Material Transfer Agreement of the International Treaty on Plant Genetic Resources for Food and Agriculture (Table 5). We plan to multiply the genetic resources and evaluate them in 2017.

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# 2017 年度カンボジアにおけるウリ科作物遺伝資源の探索

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## 和文摘要

ウリ科作物遺伝資源を収集するためカンボジア南部において調査を実施した。調査で収集した遺伝資源は 131 点で、市場、畑や農家にて収集した。これらのうち、メロン遺伝資源は 101 点であり、56 系統および 45 系統をそれぞれ果実および種子として収集した。形質の分離が確認された 20 系統のメロンを含め、これら遺伝資源は、それぞれ、カンボジア農業調査開発研究所ならびに農業・食品産業技術総合研究機構 遺伝資源センターにおいて遺伝資源として登録した。農家からの聞き取りや形質調査に基づくと、収集したメロンは改良品種、雑草メロンおよび在来の栽培メロンで構成されていた。メロンの栽培方法や用途、特に、他家受精により遺伝子プールを共有できる状況はカンボジア東部、西部や北部と類似しており、果実や種子の形質で地域間差がほとんどない結果につながっているようであった。一方、カンボジア南部のメロン栽培では年に複数回の栽培が実施されて、農薬が利用されており、病害虫が蔓延しているようであった。カンボジアのメロン遺伝資源において果実や種子は隣国のラオス、雲南省を主とした中国の在来メロンよりも長く、これらの形質に関わる量的遺伝子座の組み合わせが隣国の在来メロンとは異なっていることを示唆していた。さらに、カンボジアのメロン遺伝資源は果肉の粉質や種子周辺のゼリー質では南アジアの在来メロンと類似性があるだけでなく、果実の形状や果肉の可溶性固形分濃度 (Brix) では東アジアの在来メロンと類似性が認められた。南アジアや東アジアの在来メロンが病害抵抗性の育種素材として利用されていることから、これらの類似性はカンボジアのメロン遺伝資源が病害抵抗性、特に土着の病害虫への抵抗性を有している可能性を示唆していた。収集したカンボジアのメロン系統は、さまざまな形質変異を有しており、個別の育種において有望形質を選択できる素材であるので、今後の評価が待たれる。

Table 5. Details of the collected materials in Cambodia, 2017

JP No.	Sample No.	Collected date	Species	Plant name	Local name	Cultivar / wild / improved	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
269527	17CJVC-1	27 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kandal	Leurk Daek	Pearn Reang	Pearn Reang	N11-7-11.9 & E105-12-39.1	25	Farmer	Yellow color on epicarp with stripes
269528	17CJVC- 2	27 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kandal	Leurk Daek	Pearn Reang	Chong Khos	N11-7-11.9 & E105-10-48.7	14	Farmer	Green color on epicarp with stripes, Seeds were bought at the market near village
269529	17CJVC-3	27 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kandal	Leurk Daek	Preak Tomloab	Preak Toch	N11-13-5.6 & E105-15-46.9	5	Farmer	Seeds were collected from several fruits
269530	17CJVC- 4	28 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Svay Rieng	Sangkat Svay Rieng		Vil Yon	N11-4-55.3 & E105-47-46.0	2	Treader 1 (Phsa Vil Yon market)	Yellow color on epicarp with rinds, From Vietnam
269531	17CJVC- 5	28 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Svay Rieng	Sangkat Svay Rieng		Vil Yon	N11-4-55.3 & E105-47-46.0	2	Treader 2 (Phsa Vil Yon market)	Yellow color on epicarp with stripes, From Svay Rieng Province
269532	17CJVC- 6	28 Nov., 2017	<i>Luffa</i>	Luffa	No Nong Moul	Cultivar	Seeds	Svay Rieng	Svay Chrum	Doun Sor	Ou Sangam	N11-15-3.0 & E105-43-44.0	5	Farmer	
269533	17CJVC- 7	28 Nov., 2017	<i>Cucumis sativus</i>	Cucumber	Tror Sork Srov	Cultivar	Seeds	Svay Rieng	Svay Chrum	Doun Sor	Ou Sangam	N11-15-3.0 & E105-43-44.0	5	Farmer	Cultivated plant without pesticide, Seeds were collected from several fruits
269534	17CJVC- 8	28 Nov., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Svay Rieng	Svay Chrum	Doun Sor	Ou Sangam	N11-15-3.0 & E105-43-44.0	5	Farmer	Cultivate plant without pesticide, Seeds were collected from one fruit
269535	17CJVC- 9	28 Nov., 2017	<i>Benincasa hispida</i>	Wax gourd	Tror Lach Srouv	Cultivar	Seeds	Svay Rieng	Svay Chrum	Doun Sor	Ou Sangam	N11-15-3.0 & E105-43-44.0	5	Farmer	Cultivate plant without pesticide, Seeds were collected from one fruit
269536	17CJVC-10	28 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Svay Rieng	Romeus Heuk	Chrei Thum	Onsoang	N11-26-33.2 & E105-43-2.0	14	Farmer	Green color on epicarp with stripes
269537	17CJVC-11	28 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Svay Rieng	Kam Chay Mear	Krabov	Preak Toul	N11-37-20.4 & E105-43-34.3	40	Farmer	Seeds were collected from several fruits
269538	17CJVC-12	28 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Svay Rieng	Kam Chay Mear	Krabov	Preak Toul	N11-37-20.4 & E105-43-34.3	40	Farmer	Green color on epicarp with stripes
269539	17CJVC-13	28 Nov., 2017	<i>Citrullus lanatus</i>	Watermelon	Ov lek	Cultivar	Seeds	Svay Rieng	Kam Chay Mear	Krabov	Preak Toul	N11-37-20.4 & E105-43-34.3	40	Farmer	
269540	17CJVC-14	28 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Svay Rieng	Romeas Heuk	Mok Da	Mok Da	N11-19-52.0 & E105-43-5.5	21	Farmer	Yellow color on epicarp with stripes, Young fruit is bitter taste
269541	17CJVC-15	29 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Svay Rieng	Svay Chrom	Kraul Kor	Prei Khla	N11-9-55.5 & E105-37-17.9	-15	Farmer	Pale green color on epicarp
269542	17CJVC-16	29 Nov., 2017	<i>Benincasa hispida</i>	Wax gourd	Tror Lach Srouv	Cultivar	Seeds	Svay Rieng	Svay Chrom	Kraul Kor	Prei Khla	N11-9-55.5 & E105-37-17.9	-15	Farmer	Cultivate plant without pesticide
269543	17CJVC-17	29 Nov., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Svay Rieng	Svay Chrom	Kraul Kor	Prei Khla	N11-9-55.5 & E105-37-17.9	-15	Farmer	Cultivate plant without pesticide
269544	17CJVC-18	29 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Prey Veng	Preas Sdach	Krang Svay	Sras KeO	N11-8-31.5 & E105-27-39.1	4	Farmer	Seeds were collected from several fruits
269545	17CJVC-19	29 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Prey Veng	Peam Ror	Bor Borl	Toul Chrei	N11-20-24.5 & E105-19-8.2	22	Farmer	Seeds were collected from several fruits
269546	17CJVC-20	29 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Farmer	Mixed with melons which had following fruit shape: oblong and round
269547	17CJVC-21	29 Nov., 2017	<i>Cucumis sativus</i>	Cucumber	Tror Sork Treig	Cultivar	Seeds	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Farmer	Cultivate plant without pesticide
269548	17CJVC-22	29 Nov., 2017	<i>Benincasa hispida</i>	Wax gourd	Tror Lach Srouv	Cultivar	Seeds	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Farmer	Cultivate plant without pesticide
269549	17CJVC-23	29 Nov., 2017	<i>Luffa cylindrica</i>	Luffa	No Nong Moul	Cultivar	Seeds	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Farmer	Cultivate plant without pesticide
269550	17CJVC-24	30 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Korng Pisey	Srang	Srang	N11-17-59.0 & E104-36-53.6	54	Farmer	Pale green color on epicarp

Table 5. (Continued).

JP No.	Sample No.	Collected date	Species	Plant name	Local name	Cultivar / wild / improved	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
269551	17CJVC-25	30 Nov., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Kompong Speu	Bor Set	Kork	Tror Peng KroSang	N11-11-28.5 & E104-34-12.1	45	Farmer	
269552	17CJVC-26	30 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Bor Set	Po Mareal	Ang Deak Kandal	N11-11-20.4 & E104-34-22.2	32	Farmer	Seeds were collected from several fruits
269553	17CJVC-27	30 Nov., 2017	<i>Citrullus lanatus</i>	Watermelon	Ov lek	Cultivar	Seeds	Kompong Speu	Bor Set	Po Mareal	Ang Deak Kandal	N11-11-20.4 & E104-34-22.2	32	Farmer	Green color with stripes on epicarp, Seeds were collected from several fruits
269554	17CJVC-28	30 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Takeo	Tram Kak	Tror Pang Kronhung	Tror Pang Kronhung	N11-5-8.5 & E104-28-26.9	48	Farmer	Seeds were collected from several fruits
269555	17CJVC-29	30 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kampot	Chumkiri	Chumpu Van	Kandal	N10-54-32.7 & E104-24-29.0	49	Farmer	Yellow color with stripes on epicarp, Seeds were collected from several fruits
269556	17CJVC-30	30 Nov., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kampot	Dorng tong	Laang	Damnak Ampil	N10-46-17.3 & E104-19-51.2	37	Farmer	Green color with stripes on epicarp, Seeds were collected from several fruits
269557	17CJVC-31	30 Nov., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Kampot	Dorng tong	Laang	Damnak Ampil	N10-46-17.3 & E104-19-51.2	37	Farmer	
269558	17CJVC-32	1 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kampot	Chouk	Boeuk Nimol	Prich	N10-49-40.2 & E104-25-14.1	34	Farmer	Seeds were collected from several fruits
269559	17CJVC-33	1 Dec., 2017	<i>Cucumis sativus</i>	Cucumber	Tror Sork Treig	Cultivar	Seeds	Kampot	Chouk	Boeuk Nimol	Prich	N10-49-40.2 & E104-25-14.1	34	Farmer	Original seeds for no. 34
269560	17CJVC-34	1 Dec., 2017	<i>Cucumis sativus</i>	Cucumber	Tror Sork Treig	Cultivar	Seeds	Kampot	Chouk	Boeuk Nimol	Prich	N10-49-40.2 & E104-25-14.1	34	Farmer	Cultivated plant without pesticides, Seeds were collected from several fruits
269561	17CJVC-35	1 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Takeo	Tram Kak	Tram Kak	Tror pang Khot	N10-53-52.5 & E104-33-55.1	46	Farmer	Seeds were collected from several fruits
269562	17CJVC-36	1 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Takeo	Tram Kak	Leay Bou	Slar	N11-00-15.4 & E104-41-39.3	8	Farmer	Green color with stripes on epicarp, Seeds were collected from several fruits
269563	17CJVC-37	1 Dec., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Takeo	Tram Kak	Leay Bou	Slar	N11-00-15.4 & E104-41-39.3	8	Farmer	Seeds were collected from three fruits
269564	17CJVC-38	1 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Improved	Seeds	Takeo	Trank	Sambour	Prey Dork	N10-57-21.7 & E104-50-44.4	2	Farmer	Seeds were collected from several fruits
269565	17CJVC-39	1 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Improved	Fruit	Takeo	Trank	Sambour	Prey Dork	N10-57-21.7 & E104-50-44.4	2	Farmer	Yellow color on epicarp with rinds
269566	17CJVC-40	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Improved	Fruit	Takeo	Dain Keo	Sagkat Roka Krao	Tuol Beak	N10-58-52.5 & E104-46-39.6	12	Farmer (Takeo)	Pale green color on epicarp with rinds, From the same site to no. 38
269567	17CJVC-41	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Improved	Fruit	Takeo	Dain Keo	Sagkat Roka Krao	Tuol Beak	N10-58-52.5 & E104-46-39.6	12	Farmer (Takeo)	Pale green color on epicarp with rinds, From the same site to no. 38
269568	17CJVC-42	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Improved	Fruit	Takeo	Dain Keo	Sagkat Roka Krao	Tuol Beak	N10-58-52.5 & E104-46-39.6	12	Farmer (Takeo)	Pale green color on epicarp and round fruit shape, From same site to no. 38
269569	17CJVC-43	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Improved	Fruit	Takeo	Dain Keo	Sagkat Roka Krao	Tuol Beak	N10-58-52.5 & E104-46-39.6	12	Farmer (Takeo)	Pale green color on epicarp and oblong fruit shape, From the same site to no. 38
269570	17CJVC-44	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Cultivar	Seeds	Takeo	Trang	Ang Knol	Kor	N10-51-40.6 & E104-48-15.0	13	Farmer	Seeds were collected from several fruits
269571	17CJVC-45	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Cultivar	Seeds	Takeo	Trang	Ang Knol	Kor	N10-51-40.6 & E104-48-15.0	13	Farmer	Seeds were collected from several fruits
269572	17CJVC-46	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Cultivar	Seeds	Takeo	Kirivong	Prey Ampork	Soben	N10-37-35.8 & E104-47-27.0	21	Farmer	Seeds were collected from several fruits
269573	17CJVC-47	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Cultivar	Seeds	Takeo	Kirivong	Prey Ampork	Soben	N10-37-35.8 & E104-47-27.0	21	Farmer	Seeds were collected from several fruits, from different seed bag from that of no. 46
269574	17CJVC-48	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Takeo	Kirivong	Kampaeng	Ang Kchao	N10-39-31.9 & E104-43-28.3	26	Farmer	Seeds were collected from several fruits

Table 5. (Continued).

JP No.	Sample No.	Collected date	Species	Plant name	Local name	Cultivar / wild / improved	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
269575	17CJVC-49	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Laving	Cultivar	Seeds	Kampot	Banteaymeas	Banteaymeas Khang Kert	Trarpaeng	N10-39-5.0 & E104-38-57.6	2	Farmer	Seeds were collected from several fruits
269576	17CJVC-50	2 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kampot	Banteaymeas	Banteaymeas Khang Kert	Trarpaeng	N10-39-5.0 & E104-38-57.6	2	Farmer	Green color on epicarp, Seeds were collected from several fruits
269577	17CJVC-51	3 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Krong Kampot	Kampong bay	Kampong bay Khang Throng	N10-36-55.3 & E104-10-52.5	15	Treader (Kampot market)	Fruit were carried from Stueng Keo village in Kampot district in Kampot Province
269578	17CJVC-52	3 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Krong Kampot	Kampong bay	Kampong bay Khang Throng	N10-36-55.3 & E104-10-52.5	15	Treader (Kampot market)	Fruit were carried from Stueng Keo village in Kampot district in Kampot Province
269579	17CJVC-53	3 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Krong Kampot	Kampong bay	Kampong bay Khang Throng	N10-36-55.3 & E104-10-52.5	15	Treader (Kampot market)	Fruit were carried from Stueng Keo village in Kampot district in Kampot Province
269580	17CJVC-54	4 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Krong Kampot	Kampong bay	Kampong bay Khang Throng	N10-36-55.3 & E104-10-52.5	15	Treader (Kampot market)	Fruit were carried from Stueng Keo village in Kampot district in Kampot Province
269581	17CJVC-55	4 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Krong Kampot	Kampong bay	Kampong bay Khang Throng	N10-36-55.3 & E104-10-52.5	15	Treader (Kampot market)	Fruit were carried from Stueng Keo village in Kampot district in Kampot Province
269582	17CJVC-56	4 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Teuk Chhu	Kampong Kreng	Andong Yeymeun	N10-40-22.5 & E104-9-56.9	28	Farmer	Green color with stripes on epicarp, Seeds were introduced from Kompong Cham
269583	17CJVC-57	4 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Kampot	Teuk Chhu	Kampong Kreng	Andong Yeymeun	N10-40-22.5 & E104-9-56.9	28	Farmer	Yellow color with stripes on epicarp, Seeds were introduced from Kompong Cham
269584	17CJVC-58	4 Dec., 2017	<i>Cucurbita moschata</i>	Melon	Tror Sork Srov	Improved	Seeds	Kampot	Teuk Chhu	Preak Hnout	Preakreang	N10-36-17.9 & E103-56-36.4	3	Farmer	Seeds were originated from Agricultural organization
269585	17CJVC-59	4 Dec., 2017	<i>Cucumis sativus</i>	Pumpkin	La Poa	Improved	Seeds	Kampot	Teuk Chhu	Preak Hnout	Preakreang	N10-36-17.9 & E103-56-36.4	3	Farmer	Seeds were originated from fruit sold at market
269586	17CJVC-60	4 Dec., 2017	<i>Cucumis melo</i>	Cucumber	Tror Sork Treig	Improved	Seeds	Kampot	Teuk Chhu	Preak Hnout	Preakreang	N10-36-17.9 & E103-56-36.4	3	Farmer	Seeds were collected from several fruits and originated from Agricultural organization
269587	17CJVC-61	4 Dec., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Kok Kong	Srae Ambil	Boeung Preav	Ou Chrov	N11-4-5.9 & E103-47-42.8	19	Farmer	Seeds were collected from several fruits
269588	17CJVC-62	5 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Preah Sihaknok	Preah Sihaknok	No.4	No.1	N10-37-27.3 & E103-31-46.4	31	Farmer (Leu market)	Fruit was carried from near Outrav village in Prey nob district in Sihaknovil
269589	17CJVC-63	5 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Preah Sihaknok	Preah Sihaknok	No.4	No.1	N10-37-27.3 & E103-31-46.4	31	Farmer (Leu market)	Fruit were carried from near Outrav village in Prey nob district in Sihaknovil
269590	17CJVC-64	5 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Fruit	Preah Sihaknok	Preah Sihaknok	No.4	No.1	N10-37-27.3 & E103-31-46.4	31	Treader (Leu market)	Fruit were carried from near Outrav village in Prey nob district in Sihaknovil
269591	17CJVC-65	5 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Preah Sihaknok	Prey Nov	Andong tmor	Outrav	N10-40-16.2 & E103-47-51.4	8	Farmer	Green color with stripes on epicarp
269592	17CJVC-66	5 Dec., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Preah Sihaknok	Prey Nov	Andong tmor	Outrav	N10-40-16.2 & E103-47-51.4	8	Farmer	Fruit were carried from Stueng Keo village in Kampot district in Kampot Province
269593	17CJVC-67	6 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Koh Kong	Mondul Seyma	Toul Korks	Toul Korks	N11-36-16.2 & E103-2-56.5	7	Farmer	Green color with stripes on epicarp
269594	17CJVC-68	6 Dec., 2017	<i>Zea mays</i>	Maize	Pourt	Cultivar	Seeds	Koh Kong	Koh Kong	Tatai	Am long	N11-35-36.4 & E103-8-31.0		Farmer	Sticky grain, Cultivated for a long time
269595	17CJVC-69	6 Dec., 2017	<i>Benincasa hispida</i>	Wax gourd	Tror Lach Srouv	Cultivar	Seeds	Koh Kong	Koh Kong	Tatai	Am long	N11-35-58.3 & E103-8-49.0	3	Farmer	20 cm in fruit length
269596	17CJVC-70	6 Dec., 2017	<i>Citrullus lanatus</i>	Watermelon	Ov lek	Cultivar	Seeds	Koh Kong	Koh Kong	Tatai	Am long	N11-35-58.3 & E103-8-49.0	3	Farmer	

Table 5. (Continued).

JP No.	Sample No.	Collected date	Species	Plant name	Local name	Cultivar / wild / improved	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
269597	17CJVC-71	6 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Koh Kong	Koh Kong	Tatai	Am long	N11-35-58.3 & E103-8-49.0	3	Farmer	Green color with stripes on epicarp
269598	17CJVC-72	6 Dec., 2017	<i>Cucumis sativus</i>	Cucumber	Tror Sork Paork	Cultivar	Seeds	Koh Kong	Koh Kong	Tatai	Am long	N11-35-58.3 & E103-8-49.0	3	Farmer	Seeds were collected from ten fruits
269599	17CJVC-73	7 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Koh Kong	Tmabang	Tutai Leu	Spaen Kda	N11-43-48.1 & E103-20-47.0	379	Farmer	Seeds were introduced from Kompong Cham
269600	17CJVC-74	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Improved	Fruit	Koh Kong	Sre Ambel	Sre Ambel	Tropong	N11-7-15.8 & E103-44-53.9	45	Farmer (Sre Ambel market)	Seeds were introduced from market two years ago, Fruit was harvested from the same field to no. 78 to 80
269601	17CJVC-75	6 Dec., 2017	<i>Zea mays</i>	Maize	Pourt	Cultivar	Seeds	Koh Kong	Koh Kong	Tatai	Am long	N11-35-58.3 & E103-8-49.0	3	Farmer	Sticky grain, Cultivated for a long time
269602	17CJVC-76	6 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Koh Kong	Koh Kong	Ta Yong	Kor G	N11-39-53.0 & E103-7-0.8	8	Farmer	Green color with stripes on epicarp, Seeds were collected from several fruits
269603	17CJVC-77	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Koh Kong	Sre Ambel	Tropong	Treak	N11-6-38.3 & E103-44-11.0	11	Farmer	Yellow color with stripes on epicarp
269604	17CJVC-78	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Improved	Fruit	Koh Kong	Sre Ambel	Tropong	Svay Prei	N11-6-39.7 & E103-44-25.2	13	Farmer	Fruit was harvested from the same field to no. 78 to 80
269605	17CJVC-79	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Improved	Fruit	Koh Kong	Sre Ambel	Tropong	Svay Prei	N11-6-39.7 & E103-44-25.2	13	Farmer	Seeds were introduced from market two years ago and collected from several fruits
269606	17CJVC-80	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Improved	Fruit	Koh Kong	Sre Ambel	Tropong	Svay Prei	N11-6-39.7 & E103-44-25.2	13	Farmer	Seeds were introduced from market two years ago and collected from several fruits
269607	17CJVC-81	8 Dec., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Kompong Speu	Phnum Srouch	Traeng Fror Yoeung	Chamka Chek	N11-14-41.5 & E104-10-0.4	122	Farmer	Cultivated for a long time, Seeds were collected from several fruits
269608	17CJVC-82	8 Dec., 2017	<i>Benincasa hispida</i>	Wax gourd	Tror Lach Srouv	Cultivar	Seeds	Kompong Speu	Phnum Srouch	Traeng Fror Yoeung	Chamka Chek	N11-14-41.5 & E104-10-0.4	122	Farmer	Cultivated for a long time, Seeds were collected from one fruit
269609	17CJVC-83	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Improved	Seeds	Kompong Speu	Phnum Srouch	Ou	Krang Pnov	N11-20-38.8 & E104-20-30.2	76	Farmer	Seeds were introduced from market and collected from three fruits
269610	17CJVC-84	8 Dec., 2017	<i>Cucumis sativus</i>	Cucumber	Tror Sork Treig	Improved	Seeds	Kompong Speu	Phnum Srouch	Ou	Krang Pnov	N11-20-38.8 & E104-20-30.2	76	Farmer	Seeds were introduced from market and collected from several fruits
269611	17CJVC-85	8 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Phum Srouch	Traeng Tror Yoeng	Le	N11-19-27.3 & E104-10-36.3	94	Farmer	Seeds were introduced from Kandal Province
269612	17CJVC-86	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Improved	Fruit	Kompong Speu	Krong Chbamun	Ror Kar Thum	Commerce	N11-27-42.9 & E104-31-15.3	35	Treader (Kompong Speu market)	Fruit was carried from Chum Pou Vaan village in Phnom Penh.
269613	17CJVC-87	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Phnum Srouch	Kiri Voan	Krang Brosrok	N11-22-59.6 & E104-23-26.4	81	Farmer	Seeds were collected from several fruits
269614	17CJVC-88	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Soang	Cultivar	Seeds	Kompong Speu	Phnum Srouch	Tang Kcha	Tnot Preak	N11-26-29.4 & E104-20-50.8	56	Farmer	Seeds were collected from several fruits
269615	17CJVC-89	9 Dec., 2017	<i>Cucurbita moschata</i>	Pumpkin	La Poa	Cultivar	Seeds	Kompong Speu	Phnum Srouch	Tang Sarong	Kambas Prei	N11-29-13.1 & E104-17-40.6	66	Farmer	Fruit length and diameter are 5.0 cm and 12.0 cm, respectively
269616	17CJVC-90	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Oral	Reaksmei Samaki	Snong Kear	N11-31-42.6 & E104-14-8.1	57	Farmer	Seeds were collected from several fruits
269617	17CJVC-91	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Oral	Tropeang Chou	Chrork Teak	N11-48-5.0 & E104-7-43.2	126	Farmer	Seeds were collected from several fruits
269618	17CJVC-92	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Tporng	Amlang	Ou Ang Korm	N11-48-33.1 & E104-18-5.5	95	Farmer	Seeds were collected from several fruits
269619	17CJVC-93	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Oral	Song Kae Satob	Tang Sreung	N11-38-58.5 & E104-11-53.5	64	Farmer	Yellow color with stripes on epicarp



Table 5. (Continued).

JP No.	Sample No.	Collected date	Species	Plant name	Local name	Cultivar / wild / improved	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
269620	17CJVC-94	9 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Oral	Song Kae Satob	Tang Sreung	N11-38-58.5 & E104-11-53.5	64	Farmer	Yellow color with stripes on epicarp
269621	17CJVC-95	10 Dec., 2017	<i>Cucumis melo</i>	Melon	Tror Sork Srov	Cultivar	Seeds	Kompong Speu	Samrong Trorng	Khrang Ampsl	Ang Vaer	N11-22-6.4 & E104-31-15.7	70	Farmer	Yellow color with stripes on epicarp. Seeds were intorduced from Ang Vaer villave near to the site of no. 24
269622	17CJVC-96	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Leurk Daek	Preak Toplob	Spean Daek	N11-15-34.5 & E105-15-47.8	10	Field	Weedy melon, Very small fruit size
269623	17CJVC-97	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Leurk Daek	Preak Toplob	Spean Daek	N11-15-34.5 & E105-15-47.8	10	Field	Weedy melon
269624	17CJVC-98	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Leurk Daek	Preak Toplob	Spean Daek	N11-15-34.5 & E105-15-47.8	10	Field	Weedy melon,
269625	17CJVC-99	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Leurk Daek	Sorn Da	Chong Khos	N10-58-53.7 & E105-10-40.3	11	Field	Weedy melon
269626	17CJVC-100	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Leurk Daek	Sorn Da	Chong Khos	N10-58-53.7 & E105-10-40.3	11	Field	Weedy melon
269627	17CJVC-101	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Field	Weedy melon
269628	17CJVC-102	8 Feb., 2018	<i>Momordica charantia</i>	Bitter gourd	Moreas Pres	Wild	Fruit	Prey Veng	Peam Jor	Svay Plous	Sang Kros	N11-10-47.8 & E105-15-47.8	9	Field	Weedy bitter gourd
269629	17CJVC-103	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork	Cultivar	Fruit	Prey Veng	Krong Prey Veng	Kompong Leav	Village no.4	N11-29-6.5 & E105-19-17.8	5	Market (Prey Veng)	Fruit was transported from Kandal across the Mekong River
269630	17CJVC-104	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork	Cultivar	Fruit	Prey Veng	Krong Prey Veng	Kompong Leav	Village no.4	N11-29-6.5 & E105-19-17.8	5	Market (Prey Veng)	Fruit was transported from Kandal across the Mekong River
269631	17CJVC-105	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork	Cultivar	Fruit	Prey Veng	Krong Prey Veng	Kompong Leav	Village no.4	N11-29-6.5 & E105-19-17.8	5	Market (Prey Veng)	Fruit was transported from Kandal across the Mekong River
269632	17CJVC-106	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Field	Weedy melon
269633	17CJVC-107	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork	Cultivar	Seeds	Kandal	Koh Thum	Chroy Keo	Village no.9	N11-3-43.3 & E105-4-36.3	8	Farmer	Seeds were collected from several fruits
269634	17CJVC-108	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Pomea	Wild	Fruit	Prey Veng	Peam Jor	Khos Chek	Khos Chek	N11-3-50.9 & E105-12-47.0	8	Field	Weedy melon
269635	17CJVC-109	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Prey Veng	Peam Jor	Kohroka	Kohroka	N10-54-57.8 & E105-11-50.7	10	Field	Weedy melon
269636	17CJVC-110	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Prey Veng	Peam Jor	Kohroka	Kohroka	N10-54-57.8 & E105-11-50.7	10	Field	Weedy melon
269637	17CJVC-111	8 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Prey Veng	Peam Jor	Kohroka	Kohroka	N10-54-57.8 & E105-11-50.7	10	Field	Weedy melon
269638	17CJVC-112	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Koh Thum	Chrauy Keo	Village no.4	N11-5-32.5 & E105-4-2.5	20	Field	Weedy melon
269639	17CJVC-113	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Koh Thum	Tnal Tang You	Preak Jrei	N10-58-8.0 & E105-6-4.2	1	Field	Weedy melon
269640	17CJVC-114	9 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Sva	Wild	Fruit	Kandal	Koh Thum	Tnal Tang You	Preak Jrei	N10-58-8.0 & E105-6-4.2	1	Field	Weedy melon
269641	17CJVC-115	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon
269642	17CJVC-116	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon
269643	17CJVC-117	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon, fruit size is larger than those of nos. 115 and 116



Table 5. (Continued).

JP No.	Sample No.	Collected date	Species	Plant name	Local name	Cultivar / wild / improved	Collection	Collected site							Remarks
								Province	District	Commune	Village	Latitude & Longitude	Altitude (m)	Source (Market name)	
269644	17CJVC-118	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon, Plant grow in cultivated-melon field
269645	17CJVC-119	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon, Plant grow in cultivated-melon field
269646	17CJVC-120	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon, Plant grow in cultivated-melon field
269647	17CJVC-121	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269648	17CJVC-122	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269649	17CJVC-123	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269650	17CJVC-124	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269651	17CJVC-125	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269652	17CJVC-126	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269653	17CJVC-127	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Koh Chouraam	Krom	N11-48-51.3 & E105-00-51.1	16	Field	Weedy melon, Fruit was collected near corn field
269654	17CJVC-128	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon
269655	17CJVC-129	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon
269656	17CJVC-130	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon
269657	17CJVC-131	10 Feb., 2018	<i>Cucumis melo</i>	Melon	Tror Sork Thmea	Wild	Fruit	Kandal	Ksach Kandal	Pok Roussei	Anhcheng Krom	N11-42-58.7 & E105-6-8.6	-3	Field	Weedy melon



Photo 1. Bumpy and muddy roads in lowland, Preah Vihear Province.



Photo 2. Neak Loeung Bridge between Kandal Province and Prey Veng Province across the Mekong River.



Photo 3. Paddy field near the Mekong River, Kandal Province.



Photo 4. Tropical rain forest area, Koh Kong Province.



Photo 5. Dried paddy field of improved variety on the brink of harvest, Kampot Province.



Photo 6. Stilted house, Svay Rieng Province. Rice is dried under the sun in the dry season.



Photo 7. Harvested paddy field of rice landrace, Koh Kong Province.



Photo 8. Sugarcane plantation, Kompong Speu Province.





Photo 9. Dorian plantation, Kandal Province. Banana, jackfruit, and sapodilla are also cultivated as plantation crop.



Photo 10. Fruits cultivated as plantation are also sold in the neighboring roadside market, Kandal Province.



Photo 11. Vegetable shop at Leu, Sihanoukville City.



Photo 12. Fish sellers in the market near the sea, Koh Kong Province.



Photo 13. Vegetable pickles sold at the market, Koh Kong Province. Leafy and fruit vegetable are commonly made as pickle.



Photo 14. Fish processing to make fermented food. Fermented fishes are commonly used in Cambodia and sold at the markets.



Photo 15. Immature cucumber fruit of improved variety sold in the market, Svay Rieng Province.



Photo 16. Immature fruit of bitter gourd landraces sold in the market, Koh Kong Province.





Photo 17. Flower and leaf of pumpkin sold in the market, Kandal Province.



Photo 18. Immature melon fruit of improved variety sold in the market, Takeo Province.



Photo 19. Mature fruits of cultivar melon sold in the market, Kampot Province. Two melon fruits shown in bottom left were registered as “17CJVC-56” and “17CJVC-57.”



Photo 20. Mature fruit of progeny of improved melon varieties “17CJVC-40” to “17CJVC-43” sold in the market, Takeo Province.



Photo 21. Farmer’s house, Kampot Province. Interview was conducted for stored seeds of melon “17CJVC-35” shown in the sample photo.



Photo 22. Melon fruit “17CJVC-80” with farmer and research assistant, Koh Kong Province.



Photo 23. Stored seeds of “17CJVC-69” to “17CJVC-72” and “17CJVC-75,” Koh Kong Province.



Photo 24. Stored seeds of “17CJVC-38” in a plastic bottle with air holes.





Photo 25. Stored seeds of “17CJVC-11” to “17CJVC-13” at a farmer’s house.



Photo 26. Ten melon seeds of “17CJVC-2” measured.



Photo 27. Wild melon “17CJVC-96.”



Photo 28. Fruit of wild melon “17CJVC-96.”



Photo 29. Melon field and seedlings at seven days after sowing, Koh Kong Province.



Photo 30. Melon cultivation at Andong tmor village, Koh Kong Province.



Photo 31. Melon cultivation at Svay Pre village, Koh Kong Province. “17CJVC-78,” “17CJVC-79,” and “17CJVC-80” were collected at the field.



Photo 32. Pickle of immature melon fruit sold at the market at one week after processing, Koh Kong Province.





Photo 33. Homemade pickle of immature melon at one year after processing. Upper surface was covered by rice bran, as shown in bottom-right photo.



Photo 34. Field of a fruit tree and banana. Seedlings of wild melons were observed at the field, as shown in bottom-right photo.



Photo 35. Seedlings of wild melon observed at the side of the road. The seedlings can be found in bottom left of the photo and are enlarged in the right-bottom photo.



Photo 36. Collection of wild melon “17CJVC-113” and “17CJVC-114” on farm road neighboring a paddy field, Kandal.



Photo 37. Wild melon “17CJVC-118” and “17CJVC-119” on melon field of improved variety, Kandal.



Photo 38. Wild melons collected during the day in Kandal Province.



Photo 39. Melon fruit of “17CJVC-56” collected in Kampot Province.



Photo 40. Gelatinous sheaths colored by orange around the seeds of melon fruit of “17CJVC-56.”