

Use of *Capsicum* Peppers in the Karimunjawa Islands, Central Java, Indonesia

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Abstract

We conducted a field survey of *Capsicum* peppers in the Karimunjawa Islands, Central Java, Indonesia, to investigate the local nomenclature for, and distribution and usage of, *Capsicum* peppers. There were two species in the Karimunjawa Islands: *C. annuum* and *C. frutescens*. The general name for *Capsicum* peppers is *lombok* for Javanese, *ladang*, *cabe*, or *cabe-cabe* for Buginese, and *cabih* for Madurese. Fresh and dried fruit and fruit soaked in sweet soy sauce are used as spices and condiments. Some people use *Capsicum* leaves as a vegetable. Medicinally, leaves are applied to boils and roots are used to treat stomach-ache. The fruit are used as offerings in Javanese rituals and to stop rain. It is also widely believed that women should not eat any (or too many) fruit while pregnant or breastfeeding.

Key words: *Capsicum frutescens*, ethnobotany, leaves as a vegetable, local nomenclature, medicinal use, rituals

Introduction

Approximately 35 species of *Capsicum* peppers are currently recognized (CARRIZO GARCÍA *et al.* 2016). They are native to tropical and temperate regions of the Americas (ESHBAUGH 1993) and are thought to have been introduced to Europe in 1493 by Columbus (BOSWELL 1949) and to Southeast Asia, via Africa and India, in the sixteenth century (ANDREWS 1995, STURTEVANT 1885). *Capsicum* peppers are an essential spice/condiment in daily meals and very important economically in Indonesia, with 2,588,633 tons of “chilies and peppers, green” produced in 2019, making Indonesia the fourth largest producer of *Capsicum* peppers globally (FAO 2019).

In Southeast Asia, *C. annuum* and *C. frutescens* are primarily used as food, while the distributions of other species were unknown until recently. YAMAMOTO *et al.* (2013, 2016) revealed that *C. pubescens*, which originated at mid-elevations in Bolivia (ESHBAUGH 1975), is cultivated in highland areas on Java, Sumatra, and Sulawesi islands. Moreover, YAMAMOTO *et al.* (2014) found that *C. chinense*, which was domesticated in the lowlands east of the Andes Mountains (PICKERSGILL 1969), is distributed widely in Indonesia, with several morphologically different fruit types on Java, Kalimantan, and Sulawesi islands. Outside the Americas, Indonesia is unique in having four domesticated species: *C. annuum*, *C. frutescens*, *C. pubescens*, and *C. chinense*.

Despite the importance of *Capsicum* peppers, few studies have examined the local nomenclature for, and use and distribution of, *Capsicum* peppers in Indonesia, especially on remote islands. Recently, YAMAMOTO and GIRSANG (2021) reported a detailed study of *Capsicum* peppers on the islands of Maluku Province, in eastern Indonesia. Here, we report an ethnobotanical survey of *Capsicum* peppers in the Karimunjawa Islands, Central Java, which is geographically distant from Maluku Province, to investigate the distribution of *Capsicum* peppers and compare the local nomenclature and usage with those in Maluku Province and other Asia-Pacific areas to understand relationships between people in the Karimunjawa Islands and *Capsicum* peppers.

Study Site and Data Collection

Fieldwork was conducted in June 2011 on the islands of Karimunjawa, Kemujan, Parang, Nyamuk, and Genting, the Karimunjawa Islands, Central Java, Indonesia (Fig. 1). This consisted of interviews and visual observations of *Capsicum* peppers in local markets, home gardens, and fields. Twenty-six people (15 males and 11 females; 18 Javanese, five Buginese, and three Madurese) were interviewed regarding the local nomenclature for, and use of, *Capsicum* peppers, the perceptions of pungent *Capsicum* peppers, knowledge of weedy forms of *Capsicum* peppers, bird behavior toward *Capsicum* fruit, use as a condiment, vegetable, or medicine, and rituals and popular beliefs related to this genus. The interviewees ranged in age from 17 to 90 (median 52.5) years.

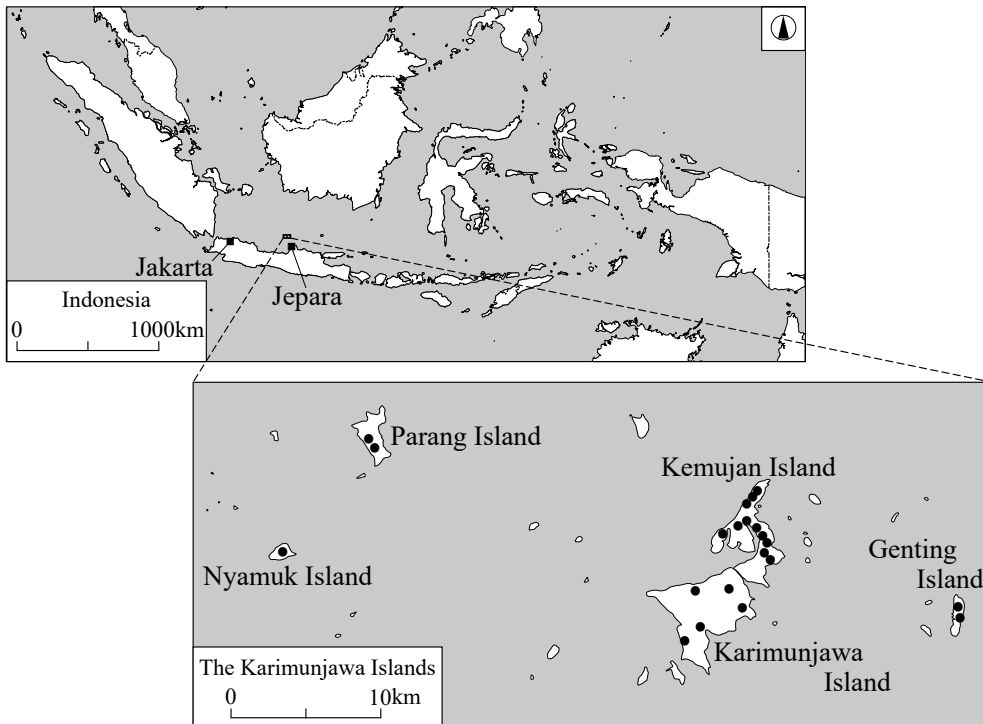


Fig. 1. The study sites (●) in the Karimunjawa Islands, Central Java, Indonesia.

Results and Discussion

Local nomenclature for *Capsicum* peppers and perceptions of pungent peppers

The survey indicated that *C. annuum* and *C. frutescens* are cultivated and used in the Karimunjawa Islands, while *C. pubescens* and *C. chinense* are not. General names for *Capsicum* peppers in the Karimunjawa Islands are *lombok* in Javanese, *ladang*, *cabe*, or *cabe-cabe* in Buginese, and *cabih* in Madurese (Table 1). Some Buginese used *ladang* for *C. frutescens* and *cabe* for *C. annuum*.

Among the 26 interviewees, 12 recognized two kinds of pungent *Capsicum* pepper, seven recognized three kinds, six recognized four kinds, and one recognized five kinds (Table 2). Local terms such as *keriting*, which means curly (fruit length 10-15 cm, fruit width ± 1 cm; Fig. 2A), *besar*, which means big (fruit length 10-15 cm, fruit width 1.5-2 cm), and *panjang*, which means long (similar to the *besar* type), are commonly used to describe *C. annuum* fruit in the Karimunjawa Islands (Table 1). These are well-known terms throughout Indonesia. *C. frutescens* fruit are also described using *lete*, *baecu*, *cilik*, or *rawit*, which means small, and *puteh* or *putih*, which means white (especially for cultivars with fruit that are greenish-yellow when immature).

Eight Javanese said that *lombok caplak* (= louse/fleas), *lombok jemprit*, or *lombok murutu*, which is a *C. frutescens* cultivar with very small fruit that are green when immature, was present once, but they had not seen any during the 1960s to 1980s depending on the

Table 1. Local names for *Capsicum* peppers in the Karimunjawa Islands, Central Java, Indonesia.

Mainly <i>C. annum</i>	Mainly <i>C. frutescens</i>	
	Immature fruit color	
	Green	Greenish-yellow
<i>cabe Arab</i> (=Arab people)	<i>cabe-cabe mereni</i>	<i>cabih petak</i>
<i>cabe hijau</i> (=green)	<i>cabih biru</i> (=blue)	<i>ladang putih</i> (=white)
<i>cabe hitam</i> (=black)	<i>cabih lete</i> (=small)	<i>lombok cempluk</i>
<i>cabe keriting</i> (=curly)	<i>cabih rajeh</i> (=big)	<i>lombok cilik</i>
<i>cabe-cabe meraya</i>	<i>ladang baecu</i> (=small)	<i>lombok hibrida</i> (=hybrid)
<i>ladang cala'</i> (=red)	<i>ladang merica</i>	<i>lombok nyonya</i> (=madam/lady)
<i>ladang jawa</i> (=Java I. or Javanese)	<i>lombok caplak</i> (=louse/fleas)	<i>lombok petak</i>
<i>ladang prigi</i>	<i>lombok cilik</i> (=small)	<i>lombok plonto</i>
<i>lombok ageng</i>	<i>lombok hijau</i>	<i>lombok putih</i>
<i>lombok besar</i> (=big)	<i>lombok hijau cilik</i>	<i>lombok putih</i> (=white)
<i>lombok bodong</i> (=a protruding navel)	<i>lombok ijo</i>	<i>lombok rawit</i>
<i>lombok dowo</i> (<i>gede</i> [=big])	<i>lombok jemprit</i>	<i>lombok rawit putih</i>
<i>lombok grompiong</i>	<i>lombok merutu</i>	<i>lombok retak</i>
<i>lombok hijau besar</i>	<i>lombok rawit</i> (=fine/small)	
<i>lombok ijo</i> (=green)	<i>lombok rawit hijau</i>	
<i>lombok jamgan</i>		
<i>lombok keriting</i>		
<i>lombok merah</i> (=red)		
<i>lombok merica</i>		
<i>lombok panjang</i> (=long)		
<i>lombok rawit hijau</i>		
<i>lombok sayur</i> (=vegetable)		

Table 2. Perceptions of pungent *Capsicum* peppers in the Karimunjawa Islands, Central Java, Indonesia.

How many kinds of pungent <i>Capsicum</i> peppers do you know?	Questions for 26 interviewees													
	Which fruit is hotter?		Which fruit smells better?		Which fruit do you prefer to eat?									
	2	3	4	5	Total	C. f. ^{*1}	C. a. ^{*1}	S ^{*1}	C. f.	C. a.	S	C. f.	C. a.	S
12	7	6	1	26	23	3	0	21	2	3	22	2	2	2
					[GR:11, GY:4, B:8] ^{*2}			[GR:11, GY:4, B:6]			[GR:11, GY:4, B:7]			

*1: C.f.: *C. frutescens*, C.a.: *C. annum*, and S: same.

*2: GR: fruit (fruit length: 1-5 cm) with green immature fruit color, GY: fruit (fruit length: 2-5 cm) with greenish-yellow immature fruit color, and B: both of GR and GY.



Fig. 2. *Capsicum* peppers and their use in the Karimunjawa Islands, Central Java, Indonesia. Cultivars of *C. annuum* (A, *keriting* type) and *C. frutescens* [fruit that are (B) green and (C) are greenish-yellow when immature]. Fish soup called *pindang serani* (D) and a spicy paste called *sambal* (E). Ritual offerings: *sego [nasi] bucet* (F); offerings put on the ground at an intersection for *tolak bala* [to ward off misfortune] (G); and offerings for *sunatan* [circumcision] (H).

interviewee. Some people also stated that *lombok jemprit/lombok chaplak* grew naturally in the forest. Two Buginese and two Madurese referred to the same fruit as *ladang merica* or *ladang baecu* in Buginese and *cabih lete* in Madurese. A 55-year old Madura man said that all the cultivars currently on the Karimunjawa Islands had been introduced from Jepara on Java Island (approximately 80 km to the southeast; ferries operate between Karimunjawa Island and Jepara).

The 26 interviewees were asked to comment on each pepper's spiciness and smell, and which pepper they preferred (Table 2). Overall, 11 considered a *C. frutescens* cultivar with green immature fruit ("GR" type hereafter; Fig. 2B) to be hotter, four favored a *C. frutescens* cultivar with greenish-yellow immature fruit ("GY" type hereafter; Fig. 2C), eight just preferred "small" fruit, i.e., they favored both the GR and GY types ("B" hereafter), and three favored *C. annuum*. Many people remarked that smaller fruit were much hotter and those who preferred spicy flavors tended to prefer the GR type, whereas others tended to prefer the GY type or *C. annuum* cultivars. Some people nostalgically said that *lombok chaplak* (*lombok jemprit*, *ladang merica*, *cabih lete*, etc.) was the hottest cultivar. Regarding aroma, 21 people thought that *C. frutescens* smelled better (GR 11, GY 4, and B 6), two thought that *C. annuum* smelled better, and three thought that there was no difference in aroma between the two species. As for eating preferences, 22 respondents preferred *C. frutescens* (GR 11, GY 4, and B 7), two preferred *C. annuum*, and two had no preference. These perceptions and preferences are very similar to those reported from Maluku Province, Indonesia (YAMAMOTO and GIRSANG 2021), the Batanes Islands, Philippines (YAMAMOTO 2010b), the Federated States of Micronesia (YAMAMOTO 2011, 2012, 2013, 2021), and Cambodia (YAMAMOTO and MATSUMOTO 2008).

Weedy forms of *Capsicum* peppers and bird behavior toward *Capsicum* fruit

Weedy forms of *Capsicum* peppers, especially those of *C. frutescens*, are often found along forest edges, in fields or orchards, and along roadsides in the Asia-Pacific region.

Of the 26 interviewees, 16 had seen weedy forms of *Capsicum* peppers (Table 3), a lower percentage (61.5%) than in Maluku Province, Indonesia (79.5%; YAMAMOTO and GIRSANG 2021), the Batanes Islands, Philippines (94.1%; YAMAMOTO 2010b), and Yap (100%; YAMAMOTO 2021), Chuuk (90.8%; YAMAMOTO 2012), Pohnpei (100%; YAMAMOTO

Table 3. Perceptions of weedy forms of *Capsicum* peppers in the Karimunjawa Islands, Central Java, Indonesia.

Do you know weedy forms of <i>Capsicum</i> peppers?		Do you have <i>Capsicum</i> plants in your home garden?		How did you get the plants? ^{*2}	
Yes	No	Yes	No	Seeds or plants from villagers	Weedy forms ^{*3}
16 ^{*1}	10	23	3	23	0

^{*1}: probably *C. frutescens*.

^{*2}: questions for 23 interviewees who had *Capsicum* plants in their home gardens.

^{*3}: including transplantation of weedy forms growing in the villages or fields to their home gardens.

Table 4. Bird behavior toward *Capsicum* fruit in the Karimunjawa Islands, Central Java, Indonesia.

Do you know birds eat <i>Capsicum</i> fruit?		What kinds of birds eat its fruit? ^{*1}				
		<i>Trucukan</i> ^{*2}	Common domestic fowl	<i>Betet</i> ^{*2}	<i>Jalak</i> ^{*2}	Others
Yes	No					
21	5	16	3	3	2	2

^{*1}: questions for 21 interviewees who knew birds eat *Capsicum* fruit. Multiple answers allowed.

^{*2}: *trucukan* would belong to Pycnonotidae, *betet* would belong to Psittaculidae, and *jalak* would belong to Sturnidae.

2011), and Kosrae states (81.8%; YAMAMOTO 2013) of the Federated States of Micronesia, and Cambodia (91.0%; YAMAMOTO and MATSUMOTO 2008). Of the 23 interviewees who grew *Capsicum* in their home gardens, all started seedlings from available fruit themselves or obtained seeds (or plants) from other villagers or markets in Jepara; nobody transplanted weedy forms of *Capsicum* peppers growing in the villages or fields to their home gardens. It is unclear why the above percentages are very low and no one transplanted weedy forms of *Capsicum* to their home gardens, but a possible reason is related to the disappearance of the cultivar *lombok chaplak*, which once grew naturally in the forest.

More than 80% of the interviewees knew that birds eat *Capsicum* fruit or have observed such behavior (Table 4). Birds eating *Capsicum* fruits included *trucukan* (would belong to Pycnonotidae), common domestic fowl, *betet* (would belong to Psittaculidae), *jalak* (would belong to Sturnidae), *jangkrik*, and *peking*. These birds are well-known dispersers of *Capsicum* seeds in the Asia-Pacific region: *Hypsipetes* (synonym *Microscelis*) spp. (in Pycnonotidae) in the Batanes Islands, Philippines (YAMAMOTO 2010b), and Japan (YAMAMOTO 2010a); *Aplonis* spp. (in Sturnidae) in Maluku Province, Indonesia (YAMAMOTO and GIRSANG 2021), and the Federated States of Micronesia (YAMAMOTO 2011, 2012, 2013, 2021); and common domestic fowl in all regions mentioned above.

Use of *Capsicum* peppers

Fresh, dried, or preserved fruits as spices and condiments

Fresh *Capsicum* fruit are added to many kinds of dish (e.g., *lalapan*, a vegetable dish with a spicy sauce and *ikan pindang*, a fish soup; Fig. 2D) to make them spicy. People who prefer spicy flavors like to bite fresh fruit when they eat rice and other dishes. They also consume a spicy paste called *sambal* that is made by combining *Capsicum* fruit with *kemiri* (candle nuts), garlic, shallots, tomato, *terasi* (a fish or shrimp paste), sugar, and other ingredients (Fig. 2E).

Twelve of the 26 interviewees dried *Capsicum* fruit in several ways: eight steamed fresh fruit, dried it in the sun, and then kept it in bottles; three dried fresh fruit in the sun and kept it in bottles or plastic bags; and one poured hot water on fresh fruit, dried it in the sun, and kept it in bottles. One respondent also soaked fresh fruit in *kecap manis* (sweet soy sauce). Dried/preserved *Capsicum* fruit can be used for at least 3 months.

Table 5. Uses of the leaves of *Capsicum* peppers (mainly *C. frutescens*) in the Karimunjawa Islands, Central Java, Indonesia.

Uses of the leaves of <i>Capsicum</i> peppers as a vegetable			Frequency of use ^{*1}	
			Several times per month	A few times per year
Yes	No	Total		
9	17	26	4	5

*1: questions for 9 interviewees who eat leaves of *Capsicum* peppers.

Use of Capsicum leaves (mainly those of C. frutescens)

Capsicum leaves, especially those of *C. frutescens*, are used in soups called *sayur bening* or *sayur kunci* in the Karimunjawa Islands. However, only 9 of the 26 interviewees still used *Capsicum* leaves as food (Table 5). Far fewer people (34.6%) eat *Capsicum* leaves in the Karimunjawa Islands than in the Batanes Islands, Philippines (89.7%; YAMAMOTO 2010b), Yap (100%; YAMAMOTO 2021), Chuuk (64.5%; YAMAMOTO 2012), Pohnpei (81.3%; YAMAMOTO 2011), and Kosrae states (77.3%; YAMAMOTO 2013) of the Federated States of Micronesia, and Cambodia (95.1%; YAMAMOTO and MATSUMOTO 2008). The frequency of leaf use was also much lower than in the countries and areas mentioned above. YAMAMOTO (2009) reported that the indigenous peoples of Taiwan used to add *C. frutescens* leaves to gruel or soups as a vegetable, but today the leaves are rarely used because other vegetables can be bought in markets.

Only 19.2% of the population of Maluku Province, Indonesia, still eat *Capsicum* leaves, and the frequency of leaf consumption was also low (YAMAMOTO and GIRLANG 2021), which is consistent with our results. *C. frutescens* leaves are sometimes sold in local markets in Cambodia and the Batanes Islands, but they were not observed in local markets in the Karimunjawa Islands or on islands in Maluku Province. It is not clear why few people use *Capsicum* leaves as food; the frequency of leaf consumption was also low in the Karimunjawa Islands.

Medicinal, ritual, and other uses of Capsicum peppers

A 55-year old Madura male said that *Capsicum* leaves are used to treat *bisul* (boils) by grinding *Capsicum* leaves and turmeric and applying the mixture to boils. The medicinal usage of *Capsicum* leaves for boils is well known in many parts of the Pacific region, including Maluku Province, Indonesia (YAMAMOTO and GIRLANG 2021), Pohnpei and Kosrae states of the Federated States of Micronesia (YAMAMOTO 2011, 2013), Tonga (WHISTLER 1992b), Samoa (UHE 1974), the Cook Islands, and Tahiti (WHISTLER 1992a). A 46-year old Buginese male reported that roots of *Capsicum* pepper, *Imperata cylindrica*, *Cocos nucifera*, and *Cymbopogon nardus* are pounded together, added to hot water, and strained and the liquid is taken for stomach-ache.

Offerings (e.g., *sego [nasi] bucet* or *nasi barikan*; Fig. 2F) including *Capsicum* fruit were used for *tolak bala* (warding off misfortune) in Javanese marriage rituals, *krayanan* (childbirth), *among-among* (once a month for a baby from childbirth to 18 months), *puputan* (when a baby's umbilical cord drops off), *selapanan* (when a baby is 35 days old), *sunatan* (circumcision), *jumat wage* (joint Fridays in the 5-day [Java Calendar] and 5-day [Gregorian Calendar] weeks, which recur every 35 days). Two Madurese interviewees had already adapted to these Javanese rituals.

A 28-year-old Javanese woman mentioned that *Capsicum* fruit, shallots, and turmeric attached to the tips of a broom are put under a baby's bed for *tolak bala* until the baby is 35 days old. A 50-year-old Javanese woman said that *Capsicum* fruit attached to the tip of a broom is put on the ground with the tips facing up to stop or prevent rain. A 46-year-old Buginese man reported that one would be stronger in battle after consuming many *Capsicum* fruits. Ten respondents stated that women should not eat any (or too many) *Capsicum* fruit while pregnant or breastfeeding. One respondent reported that eating of *Capsicum* seeds would cause appendicitis.

Conclusion

Capsicum peppers are called *lombok* in Javanese, *ladang*, *cabe*, or *cabe-cabe* in Buginese, and *cabih* in Madurese; two species are used in the Karimunjawa Islands, *C. annuum* and *C. frutescens*. The perceptions of, and preferences for, pungent *Capsicum* peppers in the Karimunjawa Islands are similar to those in other parts of Indonesia and the Pacific islands. Few people use *Capsicum* leaves as food, and the frequency of leaf consumption was also low compared to previous studies in the Asia-Pacific region. However, it is unclear whether this was due to modernization or because using *Capsicum* leaves as a vegetable is not popular in Indonesia. Few studies have examined the use of *Capsicum* leaf and root in the Asia-Pacific region because studies of *Capsicum* fruit usually focus on its economic importance. Additional ethnobotanical research, including studies of the use of leaves as food and plant parts as local medicines and for rituals, are needed to elucidate how *Capsicum* peppers have been integrated into cultures in the Asia-Pacific region.

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