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The distribution of *Perilla* species

Miyuki Nitta[1,2,*], Ju Kyong Lee[2,3], Churl Whan Kang[4], Masumi Katsuta[5], Satoko Yasumoto[5], Dajun Liu[6], Tsukasa Nagamine[1] and Ohmi Ohnishi[2]
*[1]Genebank, National Institute of Agrobiological Sciences, 2-1-2, Kannondai, Tsukuba, 305-8602, Japan; [2]Plant Germ Plasm Institute, Graduate School of Agriculture, Kyoto University, Nakajo 1, Mozume-cho, Mukoh city, 617-0001, Japan; [3]Division of Applied Plant Sciences, College of Agriculture and Life Science, Kangwon National University, Chunchon, 200-701, Korea; [4]Industrial Crop Division, National Crop Experimental Station, Rural Development Administration, Suwon, 441-100, Korea; [5]Department of Field Crop Research, National Institute of Crop Science, Tsukuba, 305-8666, Japan; [6]Jinling Academy, College of Agriculture, Nanjing Agricultural University, Nanjing, 210095, China; *Author for correspondence (e-mail: mnitta@affrc.go.jp; phone: +81-29-838-7051; fax: +81-29-838-7408)*

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Abstract

Perilla (Lamiaceae) contains one tetraploid species, *P. frutescens* (L.) Britt. and three diploid species, *P. citriodora* (Makino) Nakai, *P. hirtella* Nakai and *P. setoyensis* G. Honda. Tetraploid species have been traditionally cultivated in Asia for their seed oil and for their fragrant leaves that are used as medicine or as a garnish for fish. The center of diversity is still obscure. To conserve the genetic resources, it is important to know the diversity of the tetraploid species. The three diploid species, which are possible parents of the tetraploid species, are all believed to be indigenous to Japan. Their distribution in China and Korea was clarified on the basis of herbarium and field surveys. The tetraploid species is assumed to have originated somewhere around the mid-to downstream area of the Changjiang River. Though *Perilla* is not cultivated as often in these areas as in northern China, Korea, the Himalayan region, or Myanmar, these areas should also be important for the conservation of genetic resources of tetraploid *Perilla* crops because of the expected high genetic diversity.

Introduction

The genus *Perilla* (Lamiaceae) is composed of one cultivated species, *P. frutescens* (L.) Britt., which includes an oil and a medicinal crop, and three wild species, *P. citriodora* (Makino) Nakai, *P. hirtella* Nakai and *P. setoyensis* G. Honda. *P. frutescens* (L.) Britt. is tetraploid ($2n = 40$) (Yamane 1950; Honda et al. 1994) whereas *P. citriodora* (Makino) Nakai, *P. hirtella* Nakai and *P. setoyensis* G. Honda are diploid ($2n = 20$) (Honda et al. 1994; Ito and Honda 1996; Honda et al. 1996). It is supposed that *P. frutescens* (L.) Britt. is allotetraploid and that *P. citriodora* (Makino) Nakai is a diploid genome donor (Honda et al. 1994). However, there is still incomplete information on the second diploid genome donor.

To conserve the genetic resources of *Perilla* crops, it is important to know where the genetic diversity is concentrated. Though the main area of diversity of *P. frutescens* (L.) Britt. is assumed to be China because of its long history of cultivation there (Li 1969; Zeven and de Wet 1982; Nitta et al. 2003), spontaneous, volunteer plants are also widely distributed in China, Korea and Japan. Even with the use of molecular markers

Table 1. Herbaria visited for survey of *Perilla* distribution.

Herbarium, Laboratory of Plant Biology, University of Tokyo, Tokyo, Japan (TI)
Herbarium, Botany Department, Faculty of Science, Kyoto University, Kyoto, Japan (KYO)
Herbarium, Botany Department, National Science Museum, Tsukuba, Japan (TNS)
Makino Herbarium, Tokyo Metropolitan University, Tokyo, Japan (MAK)
Herbarium, Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Beijing, China (PE)
Herbarium, Botanical Department, Shanghai Museum of Natural History, Shanghai, China (SHM)
Herbarium, Plant Taxonomy Department, Jiangsu Institute of Botany, Nanjing, Jiangsu, China (NAS)
Natural History Museum, Ewha Womans University, Seoul, Korea

AFLP and RAPD (Lee and Ohnishi 2001; Lee et al. 2002; Nitta et al. 2003), it is still hard to know where the genetic diversity is concentrated. The area with the longest history of the species distribution is expected to be especially important area for conservation. In such an area *P. frutescens* (L.) Britt. should be established through tetraploidization of diploid species.

It has been believed that all the three diploid species are endemic to Japan. Ito and Honda (1996) reported on the distribution of each diploid *Perilla* in Japan based on specimens. Recently, Ito et al. (2000) reported the distribution of *P. citriodora* (Makino) Nakai in Taiwan.

This study aims to clarify the distribution of *Perilla* species on the basis of herbarium and field surveys. It will offer useful information for conservation of genetic resources of *Perilla* crops.

Methods

Field surveys were conducted in Japan during a period from 1992 to 1999, in Korea in 1998 and 2002, and in China from 1999 to 2001. Weedy forms and wild relatives were found in bushes and along streamsides near mountains, as well as in farmers' fields, along roadsides or near rural paths.

Specimen surveys were carried out at herbaria in China, Korea and Japan (Table 1). For the identification of *Perilla* species, we referred to the report by Ito and Honda (1996).

Results and discussion

Tables 2–4 summarize the results of field surveys in Japan, Korea and China, respectively.

The distribution of three wild species in Japan is in agreement with the report by Ito and Honda (1996). Populations of *P. citriodora* (Makino) Nakai were found from Kyushu district to northern parts of Kanto district, often on mountainsides near streams. Populations of *P. hirtella* Nakai were distributed from Kyushu district to Kanto district, in a slightly drier habitat than *P. citriodora* (Makino) Nakai. The distribution of *P. setoyensis* G. Honda was restricted to a very few places in western Japan. Most populations of *P. setoyensis* G. Honda were small; for example, just one individual was found in the Taishakukyo valley of Hiroshima prefecture in 1999. Wild diploid species sometimes grow together with weedy forms of tetraploid or other wild diploid species.

In Korea, cultivation of *P. frutescens* (L.) Britt. for oil was seen everywhere we visited. Its weedy form was also frequently found along roadsides or in abandoned fields. *P. hirtella* Nakai and *P. citriodora* (Makino) Nakai were found in Bijarim Forest Park on Jeju Island. The habitats of these diploid species were slightly different from those in Japan and China. The habitats were not disturbed land, such as the roadsides or collapsed slopes/rubble slopes in Japan and China, but in stable forest dominated by *Torreya nucifera* Sieb. et Zucc.

In Jeju Island, diploid species grew in relatively sunny places under the forest canopy; *P. hirtella* Nakai was found along a path and *P. citriodora* (Makino) Nakai was found along a path and in open spaces between trees. This is the first report of the distribution of diploid *Perilla* in Korea.

In China, *P. frutescens* (L.) Britt. is widely distributed. Much cultivation for oil was found around the Wei River valley in northern China in

Table 2. Distribution of *Perilla* species based on field surveys in Japan in 1992–1999.

Species	Prefecture	City, Town or Village
P. frutescens	Aomori	Takko, Sannohe (1995)
	Akita	Nishiki, Yamauchi, Ani[a], Takasu, Kazuno, Odate (1995)
	Iwate	Sawauchi, Yuda, Karumai (1995), Shizukuishi (1998)
	Yamagata	Nishikawa, Tone, Tendo (1995)
	Miyagi	Nanagasyuku, Watari, Daiwa (1995), Oshika (Kinkazan, 1998)
	Fukushima	Tajima, Soma, Funehiki (1995)
	Ishikawa	Shiramine, Torigoe, Kawachi, Tsurugi (1995)
	Ibaraki	Suifu (1999)
	Gunma	Nanmoku, Katashina, Kawaba, Numata (1995)
	Nagano	Nagano, Matsumoto, Ueda, Suwa, Suzaka, Ina, Komagane, Nakano, Omachi, Iiyama, Shiojiri, Koshoku, Usuda, Kawakami, Minamimaki, Kitaaiki, Mochizuki Tateshina, Maruko, Sanada, Aoki, Fujimi, Hara, Takato, Tatsuno, Minamiminowa, Hase, Matsukawa-cho, Anan, Namiai, Tenryu, Takagi, Oshika, Kami, Minamishinano, Narakawa, Kiso, Hiyoshi, Kaida, Mitake, Yamaguchi, Akashina, Hata, Honjo, Sakakita, Sakai, Ikusaka, Yamagata, Nagawa, Azusa, Ikeda, Matsukawa-mura, Yasaka, Miasa, Hakuba, Otari, Ooka, Yamanouchi, Shinsyusin, Shinano, Togakushi, Kinasa, Ogawa, Nakajo, Toyoda, Sakae (1992)
	Gifu	Shirakawa-mura, Shokawa, Shirotori, Hachiman, Wara, Gero, Shirakawa-cho, Higashishirakawa, Furukawa, Kuguno, Asahi, Kawai (1995)
	Kyoto	Kyoto, Hiyoshi (1995), Ayabe (1998)
	Nara	Shimoichi, Kawakami, Tenkawa, Oto, Totsukawa, Kamikitayama (1995)
	Osaka	Toyono (1997)
	Wakayama	Wakayama (Tomogashima, 1998)
	Hiroshima	Miyajima, Fukuyama, Yuki (1998 and 1999)
	Kagawa	Shirotori (1998)
	Tokushima	Ichiba (1998)
	Kochi	Hongawa, Monobe (1998)
	Fukuoka	Sasaguri (Wakasugiyama, 1998)
	Okinawa	Taketomi[b] (1999)
P. citriodora	Ibaraki	Gozenyama, Suifu (1999)
	Tokyo	Hachioji (Takaosan, 1999)
	Kyoto	Kyoto (1995–1999)
	Osaka	Toyono (1998 and 1999)
	Hiroshima	Miyajima (1998 and 1999)
	Fukuoka	Sasaguri (Wakasugiyama, 1998)
P. hirtella	Tokyo	Hachioji (Takaosan, 1999)
	Wakayama	Wakayama (Tomogashima, 1998)
	Hiroshima	Miyajima (1998 and 1999)
	Nagasaki	Tamanoura (Fukuejima, 1998)
P. setoyensis	Kyoto	Kyoto (1995–1999).
	Hiroshima	Fukuyama (1998), Tojo (1999)
	Tokushima	Donari (1998)

[a]Interviewed about the situation in Moriyoshi town.
[b]Interviewed by telephone.

1999. In Sichuan and Yunnan Provinces in southwestern China, *P. frutescens* (L.) Britt. was also cultivated for oil. In southeastern China, *P. frutescens* (L.) Britt. was cultivated or grew spontaneously and was sometimes used for medicine. Here, *P. frutescens* (L.) Britt. frequently grew sometimes togethor with, *P. citriodora* (Makino) Nakai, *P. hirtella* Nakai or *P. setoyensis* G. Honda.

In China, *P. citriodora* (Makino) Nakai was found in Jiufeng Town, Lechang District, Guangdong Province in 1999; Wulingyuan National Park in Zhangjiajie City and Buermen Forest Park in Yongshun District, Hunan Province in 2000; and Gumiaohe Park in Huayuan District, Hunan Province, the precincts of Ling'yin Temple in Hanzhou City and Mt. Tianmu in Lin'an District, Zhejiang Province in

Table 3. Distribution of *Perilla* species based on field surveys in Korea in 1998 and 2002.

Species	Province	City or County
P. frutescens	Kangwon	Yongwol, Yangyang, Yanggu, Samchok, Pyongchang, Kosong, Inje, Hwachon, Hongchon*, Hoengsong, Chunchon, Chorwon, Chongson
	Kyonggi	Yonchon, Yoju, Yangpyong, Pochon, Kapyong, Yonchon**
	Kyongsangbuk	Mungyong, Yongju*, Yechon, Talsong, Sangju, Ponghwa, Chongdo, Andong
	Kyongsangnam	Yangsan, Ulsan, Sachon, Miryang*, Kochang, Hapchon, Hamyang, Chinju, Changnyong
	Chungchongbuk	Umsong, Tanyang, Okchon*, Chinchon
	Chungchongnam	Tangjin*, Taean, Sosan, Sochon, Kumsan, Chongyang, Asan
	Chollabuk	Sunchang, Puan, Muju, Kunsan, Kochang*, Chinan, Changsu
	Chollanam	Tamyang, Sunchon, Posong*, Kwangyang, Kwangju, Kohung, Kangjin, Hampyong, Changsong, Puyo
	Jeju	Jeju, Bukjeju, Namjeju**, Bukjeju (Bijarim Forest Park)**
P. citriodora	Jeju	Bukjeju (Bijarim Forest Park)**
P. hirtella	Jeju	Bukjeju (Bijarim Forest Park)**

*Observed in both 1998 and 2002, **in 2002, and no asterisk in 1998.

Table 4. Distribution of *Perilla* species based on field surveys in China in 1999–2001.

Species	Province	City, County or Mount
P. frutescens	Gansu	Tianshui City (1999)
	Shaanxi	Ningcheng County (1999)
	Jiangsu	Nanjing City (2001)
	Zhejiang	Lin'an County, Hanzhou City (2001)
	Jiangxi	Lushan (1999)
	Hunan	Jishou City, Fenghuang County, Yongshen County, Wulingyuan, Xinning County (2000), Huayuan County (2001)
	Xichuan	Guangyuan City, Doujiangyan County, Lixian County, Wenchuan County, Chengdu City, Mianning County (1999)
	Yunnan	Xichang City, Ninglang County, Yongsheng County, Heqing County, Lijiang County, Xiaguan County (Dali), Longling County, Baoshan City, Yiliang County, Kunming City (1999)
	Guangxi	Guilin City, Ziyuan County, Yangshuo County (2000)
	Guangdong	Lechang County, Yangshan County (1999)
P. citriodora	Zhejiang	Lin'an County, Hanzhou City (2001)
	Hunan	Yongshen County, Wulingyuan (2000), Huayuan County (2001)
	Guangdong	Lechang County (1999)
P. hirtella	Zhejiang	Lin'an County (2001)
	Jiangsu	Nanjing City (2001)
	Jiangxi	Lushan (1999)
P. setoyensis	Zhejiang	Lin'an County (2001)
	Hunan	Wulingyuan (2000)

2001. In Jiufeng Town, various fragrant *P. citriodora* (Makino) Nakai plants grew along roadsides and along the margins of farmer's fields. In Yongshun District and Wulingyuan National Park, *P. citriodora* (Makino) Nakai grew on mountainsides of protected forest.

P. hirtella Nakai was found on Mt. Lushan in Jiujiang City, Jiangxi Province in 1999; and on Mt. Zijin in Nanjing City, Jiangsu Province and Mt. Tianmu in Lin'an District, Zhejiang Province in 2001. At all three sites, *P. hirtella* Nakai grew along roadsides.

P. setoyensis G. Honda was found along a mountain path in Wulingyuan, Hunan Province, and in a collapsed rubble place between a bamboo forest and road on Mt. Tianmu in Lin'an District, Zhejiang Province in 2001. All four *Perilla* species were found on Mt. Tianmu.

There were specimens of diploid *Perilla* in Chinese herbaria (see the appendix). The distribu-

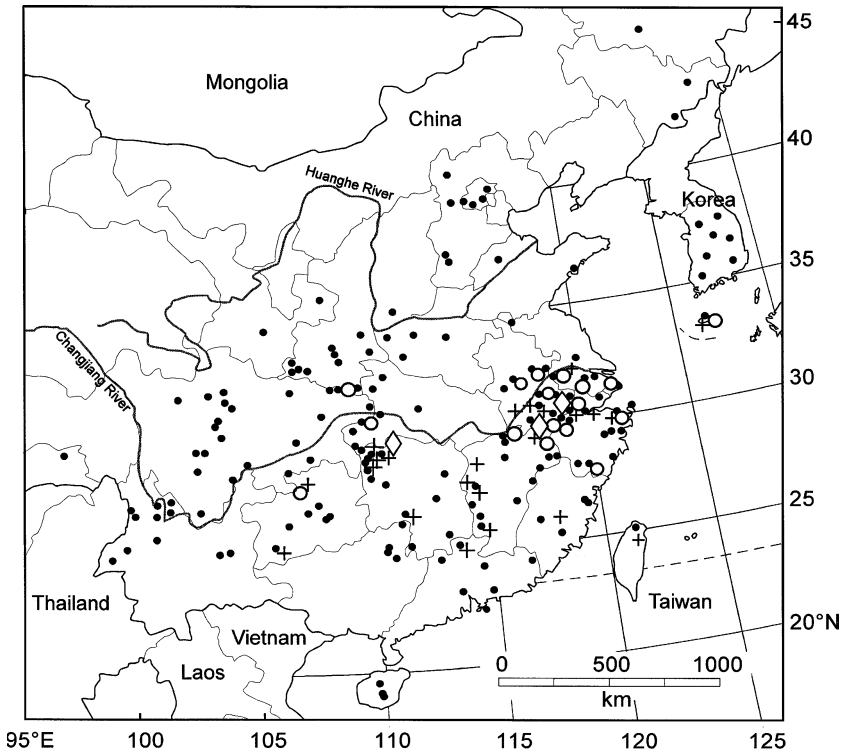

Figure 1. Distribution of four *Perilla* species in China and Korea derived by herbarium and field surveys in 1999, 2000, 2001 and 2002. A rich material from northern Korea was collected (Baik et al. 1986, Kulturpflanze 34, 69–144) and is available at IPK, Gatersleben. ●: *P. frutescens*, ○: *P. citriodora*, +: *P. hirtella*, ◇: *P. setoyensis*.

tion of *Perilla* species in Korea and China is illustrated in Figure 1.

There are exploration reports of cultivation of *P. frutescens* (L.) Britt. for oil in Shan State, Myanmar (Tetsuka et al. 2002) and in Bhutan (Nagamine and Shirata 2001). In Assam of northeastern India and in the Himalayas, *P. frutescens* (L.) Britt. is cultivated for oil, as seen from specimens in Kyoto University and the University of Tokyo. In Northern Vietnam, *P. frutescens* (L.) Britt. is cultivated for medicine. The western limit of distribution of *P. frutescens* (L.) Britt. is Kashmir (Hooker 1885).

Herbarium and field surveys showed that not only tetraploid species, *P. frutescens* (L.) Britt., but also diploid *Perilla* species, *P. citriodora* (Makino) Nakai, *P. hirtella* Nakai and *P. setoyensis* G. Honda are distributed in China, and *P. citriodora* (Makino) Nakai and *P. hirtella* Nakai occur on Jeju Island in Korea. In China, three diploid species were clarified to be mainly distributed along the midstream and downstream parts of the Changjiang (Yangtze) River. Therefore, the tetraploid species is assumed to have arisen somewhere around mid- to downstream Changjiang River. Though *Perilla* is not cultivated as often in these areas as in northern China, Korea, the Himalayan region, or Myanmar, these areas should also be important for the conservation of genetic resources of tetraploid *Perilla* crops because of the expected high genetic diversity.

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Appendix

Specimen information on diploid *Perilla* distributed in China.

Taxon	Province	City, county or name of mountain	Specimen	Herbarium	Habitat	Usage
P. citriodora	Jiangsu	Zhenjiang City; Baohuashan	K. L. Chu, 513, 24, Sep., 1931	PE	Open fields	
P. citriodora	Zhejiang	Ningbo City	Shi Chen, 4360, 12, Oct., 1934	PE	Mountainsides under forest canopies	
P. citriodora	Zhejiang	Ningbo City	Y. Y. Ho, 522, 6, Oct., 1931	PE		
P. citriodora	Zhejiang	Tianmushan	31292, 26, Oct., 1958	PE		
P. citriodora	Zhejiang	Hanzhou City	Koji Honda, Sep., 1909	TI		
P. citriodora	Zhejiang	Hanzhou City	M. Kato, Y. Ito and Y. Saito, 18, Oct., 1991	TI		
P. citriodora	Fujian	(no place-name)	312673	PE		
P. citriodora	Jiangxi	Pingxiang County	Jiangxi dui, 2458, 10, Oct., 1954	PE	Grassy land	
P. citriodora	Jiangxi	Pingxiang County	Jiangxi dui, 2741, 22, Oct., 1954	PE	Mountainsides	
P. citriodora	Jiangxi	Shangyou County	Jiangxi dui, 0682, 14, Sep., 1971	PE	Grassy mountain roadsides	
P. citriodora	Jiangxi	Wugongshan	Jiangxi dui, 1528, 24, Sep., 1954	PE	Roadsides and in shrubs	
P. citriodora	Jiangxi	Dexing County	Minxiang Nie and Shushen Dun, 5164, 29, Sep., 1958	SHM	Open grass land	
P. citriodora	Jiangxi	Tonggu County	Shushen Dun, 03823, 28, Sep., 1963	NAS		
P. citriodora	Anhui	Jiuhuashan	Xuanguo Fu, 0925, 11, Sep., 1957	PE		
P. citriodora	Anhui	Huangshan	Huadonggongzuozhan tongren, 6210, 26, Oct., 1951	SHM		
P. citriodora	Anhui	Anqing City	Fumio Maekawa, 994	TI		
P. citriodora	Hebei	Beijing City	T. P. Wang, w361, 5, Oct., 1931	PE		
P. citriodora	Hebei	Beiping	S. T. Wang, 276, 20, Sep., 1935	PE		
P. citriodora	Hunan	Wulingyuan (Zhangjiajie City)	Xian'yin Xi, 84071., Nov., 1984	PE		
P. citriodora	Hunan	Xinning County; Ziyunshan	Li Zhen-yu et. al., 1526, 6, Sep., 1984	TNS		
P. citriodora	Hunan	Xinning County	L. Zhen-yu et. al., 771, 5, Sep., 1984	KYO		
P. citriodora	Hunan	Baojing County	Linshu Liu, 9779, 12, Sep., 1958	PE	Mountainsides and roadsides	
P. citriodora	Guizhou	Zunyi City	Chuanqian dui, 1406, 6, Sep., 1956	PE	Dense and sparse forests on sunny mountainsides	
P. citriodora	Guizhou	Ceheng County	Cao Ziyu, 813, 22, Sep., 1958	PE	Ravines	
P. citriodora	Xichuan	Honghua County (uncertain location)	Chuanjingliang, 1110, 14, Sep., 1959	PE	Sunny places	Medicine
P. citriodora	Guangdong	Lechang County	Tsang, W. T., 20748, 1932	PE & KYO		Tea
P. citriodora	Guangxi	(no place-name)	539173	PE		
P. citriodora	Taiwan	Luodong County (uncertain location)	S. Sasaki, 5, Oct., 1930, TNS381559	TNS		
P. citriodora	Taiwan	Mt. Taihei	Y. Yamamoto., 1, Sep., 1925	TI		
P. hirtella	Jiangsu	Shanghai City (Dajinshan Is.)	8081, 16, Sep., 1975	SHM		
P. hirtella	Jiangsu	Yixing City	Wenzhe Fang, 7911, 10, Oct., 1979	NAS		
P. hirtella	Zhejiang	Ningbo City; Zhenhai Town	P. C. Tsoong, 1057, 20, Oct., 1934	PE		
P. hirtella	Zhejiang	Chunan County	Shi Chen, 2275, 5, Oct., 1933	PE and NAS	Mountainsides, shaded areas	

Appendix. Continued.

Taxon	Province	City, county or name of mountain	Specimen	Herbarium	Habitat	Usage
P. hirtella	Zhejiang	Lin'an City; Changhua Town	15, Sep., 1958, Changhua30334	PE	Ravines and forest canopies	
P. hirtella	Zhejiang	Ningbo City; Zhenhai Town	P. C. Tsoong, 1037, 20, Oct., 1934	PE		
P. hirtella	Zhejiang	Yunhe County	S. Chen, 767, 20, Sep., 1932	PE		
P. hirtella	Jiangxi	Lushan	Lu-shan, Kiangsi10024	PE		
P. hirtella	Jiangxi	Lushan	Jin Luo, 1077, 27, Sep., 1951	NAS	In sunny wetlands on mountainsides	
P. hirtella	Jiangxi	Dexing County (Damaoshan)	Minxiang Nie & Shushen Dun, 5352, 2, Oct., 1958	SHM	by the roadside	
P. hirtella	Jiangxi	(unclear writing)	Minxiang Nie, 6723, 15, Oct., 1960	NAS	Sunny wetlands	
P. hirtella	Jiangxi	Lushan	1935	KYO		
P. hirtella	Anhui	Shucheng County	Huadonggongzuozhan tongren, 4203, 2, Oct., 1951	PE, NAS and SHM	Beside a farmer's house on a mountainside	
P. hirtella	Anhui	Shucheng County	Huadonggongzuozhan tongren, 4255, 2, Oct., 1951	SHM	Growing around farmers' houses	
P. hirtella	Anhui	Chaohu City	Huadonggongzuozhan tongren, 3810, 21, Sep., 1951	PE, NAS and SHM	Beside bamboo forest	
P. hirtella	Anhui	Huangshan	T. N. Liou & P. C. Tsoong, 3132, 8, Sep., 1935	PE		
P. hirtella	Anhui	Jingxian County	Suhonggongshe, 661, 28, Sep., 1959	NAS	Ravines and roadsides	
P. hirtella	Anhui	Jingxian County	0552, 24, Sep., 1959	NAS	Small ravines and roadsides	
P. hirtella	Hubei	Jianshi County	Chienshih Hsien, 1634, 16, Sep., 1934	PE		
P. hirtella	Hunan	(no place-name)	0177998	NAS		
P. hirtella	Guizhou	Zunyi City	Chuanqian dui, 1541, 16, Sep., 1956	PE	Mountainsides, sunny places, sparse and dense forests	
P. hirtella	Xichuan	Chengkou County	Tianlun Dai, 102332, 2, Sep., 1958	PE	In shrubs	
P. hirtella	Xichuan	Chengkou County	Tianlun Dai, 102788, 17, Sep., 1958	PE	Grassy places	
P. setoyensis	Zhejiang	Xitianmushan	Xiankan He, 809, 4, Oct., 1952	NAS	Roadsides	
P. setoyensis	Anhui	Huangshan	Junsan Yue, 1818, 4, Oct., 1955	NAS		

References

Honda G., Yuba A., Kojima T. and Tabata M. 1994. Chemotaxonomic and cytogenetic studies on *Perilla frutescens* var. *citriodora* ("Lemon Egoma"). Nat Med 48: 185–190.

Honda G., Yuba A., Ito M. and Tabata M. 1996. A new species of *Perilla* (Labiatae) from Japan. J. Jpn. Bot. 71: 39–43.

Hooker J.D. 1885. Flora of British India. L. Reeve & Co., London.

Ito M. and Honda G. 1996. A taxonomic study of Japanese wild *Perilla* (Labiatae). J. Phytogeogr. Taxon. 44: 43–52.

Ito M., Kiuchi F., Yang L.L. and Honda G. 2000. *Perilla citriodora* from Taiwan and its phytochemical characteristics. Biol. Pharm. Bull. 23: 359–362.

Lee J.K. and Ohnishi O. 2001. Geographic differentiation of morphological characters among *Perilla* crops and their weedy types in East Asia. Breed. Sci. 51: 247–255.

Lee J.K., Nitta M., Kim N.S., Park C.H., Yoon K.M., Shin Y.B. and Ohnishi O. 2002. Genetic diversity of *Perilla* and related weedy types in Korea determined by AFLP analyses. Crop Sci. 42: 2161–2166.

Li H.L. 1969. The vegetables of ancient China. Econ. Bot. 23: 235–260.

Nagamine T. and Shirata K. 2001. Preliminary survey of exploration/collection of plant genetic resources in Bhutan. Shokutanhou 17: 141–144.

Nitta M., Lee J.K. and Ohnish O. 2003. Asian *Perilla* crops and their weedy forms: their cultivation, utilization and genetic relationships. Econ. Bot. 57: 245–253.

Tetsuka T., Uchida S., Sein T. and Oo T.M. 2002. Exploration for collecting millets in northern Shan state, Myanmar. Report of Kyushu Branch of Crop Sci. Soc. Jpn 68: 69–72.

Yamane Y. 1950. Cytogenetic studies in *Perilla* and *Coleus*. I. Chromosome numbers. Jpn. J. Genet. 25: 220 (in Japanese).

Zeven A.C. and de Wet J.M.J. 1982. Dictionary of Cultivated Plants and Their Regions of Diversity. Centre for Agricultural Publishing and Documentation, Wageningen.