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The current issue of the Cruciferae Newsletter (vol. 37) is published online from the Brassica website (<http://www.brassica.info/info/publications/cruciferae-newsletter.php>). The present issue contains 6 contributions in three different topics: Agronomy and variety trial; Breeding strategies and General information on Brassica. Members of the editing board would like to acknowledge the authors for the quality of their contributions. For future issues, we would be grateful if all the authors could read and follow carefully the author recommendations before submitting their manuscript, in order to facilitate the editing process. In particular, it is necessary to mention one of the listed topics that is the most relevant to the presented work (see the list at the end of the present issue).

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FEW LINES FROM *LE ROBERT CRUCIFÈRE*: BOTANICAL, AGRONOMIC AND COMMON NAMES RELATING TO *BRASSICA JUNCEA*

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Introduction: *Brassica juncea*

The species *Brassica juncea* (L.) Czern. is one of the economically most important mustard species in the world (Rakow 2004). It belongs to the genus *Brassica* L., the tribe *Brassicaceae* de Candolle and the family *Brassicaceae* Burnett (syn. *Cruciferae* Juss.). This species originated in the African centre of diversity, from which it subsequently spread to East and South Asia and East Europe (Zeven & Zhukovsky 1975), having, in the end, become naturalised elsewhere, as far as Oceania (Wilcox 2003). According to the theory known as the *U Triangle*, *B. juncea* is, in fact, a result of the amphidiploidisation, with the chromosome number of $2n = 36$ and comprising the whole genomes of *Brassica napus* L., $2n = 20$, and *Brassica nigra* (L.) W. J. D. Koch, $2n = 16$ (Koh et al. 2017).

Apart from the most widely designation of *B. juncea*, there is a rather vast number of its synonyms in plant taxonomy. We may mention the following few, which witness how wide is its intraspecific variation, ultimately leading to its positioning in several different genera: *Crucifera juncea* E. H. L. Krause, *Raphanus junceus* (L.) Crantz, *Rhamphoserium volgense* Andr. ex Rupr., *Sinabracca juncea* (L.) G. H. Loos and *Sinapis juncea* L. (The Plant List 2013). The adjective *juncea* (Linnaeus 1753, Linnaeus 1758) means *juncus-like* and is based upon the Latin noun *iuncus*, denoting rushes or reeds, and has an ultimate origin in the Proto-Italic **joinikos* and the Proto-Indo-European **yoy-ni-*, referring to the same (Nikolayev 2012, Wiktionary 2018).

This variability of diverse morphological traits has led to the development of mutually rather contrasting cultivar types, as a consequence of the goals of local breeding programmes adapting to the traditional uses and consumers preferences of a specific region. The goal of this paper is to offer a hopefully comprehensive and useful guide through the treasury of botanical, agronomic and common names relating to *B. juncea*. In order to carry out this intention, the following paragraphs are designed in a hierarchical fashion, with the widely recognised botanical categories within this species (The Plant List 2013, NPGS 2018) as the primary, the agronomic types as the secondary (Porcher 2008) and the common names in diverse world's languages as the third level (Kew Science 2017, Logos 2018, Wiersema & León 2016, Wikipedia 2018, Wiktionary 2018).

B. juncea* subsp. *integrifolia

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. This subspecies is extremely rich in botanical varieties and cultivar groups and subgroups. Despite its rather complex morphological diversity, it may be said that all its botanical and agronomic members are used dominantly in the form of leaves of a whole range of diverse shapes of leaflets and peduncles, mostly as vegetable in numerous local cuisines. The subspecies *integrifolia* is also a source of an antifungal protein juncin (Wong et al. 2010).

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *crispifolia* L. H. Bailey. This taxon and the cultivars developed within it are most recognisable for a very prominent curliness of the leaflet edges (Fig. 1, first row, left). In the countries, where *crispifolia* is a popular food, there are certain advances in transgenic breeding (Dai et al. 2011). The common names in various European and Asian languages consist mostly of the native name denoting mustard combined with an adjective pointing out the aforementioned morphological characteristic of *integrifolia* (Table 1).

Table 1. Cultivar groups and common names relating to *Brassica juncea* subsp. *integrifolia* var. *crispifolia*

Cultivar groups and subgroups		Language	Common names
Curled Mustards	Curled-Leaf Mustards	Chinese	juan bian ye jie cai; měiguó-zhòuyè-jiècài; yang jie cai
		Dutch	krulmosterd
		English	American mustard; curled mustard; curly-leaved mustard; cut-leaf mustard; dissected-leaf mustard; green mustard cabbage; ostrich-plume; southern giant curled mustard; southern curled mustard; southern mustard; Texas mustard
		French	moutarde frisée; moutarde plume
		German	Krausblättriche-Senf
		Japanese	hagoromo karashina
		Korean	gyeoja-ip
		Latvian	lapu sinepe

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *integrifolia* (H. West) Sinskaya. The variety is cultivated mainly for its leaves. A whole range of shapes, colours and dimensions serves as an abundant basis for developing several distinctive cultivar subgroups (Fig. 1, first row, middle and right, and the whole second row). The common names are mostly of descriptive nature, linking var. *integrifolia* with other crops of similar habit, use or taste, such as garlic (*Allium sativum* L.) or common bamboo (*Bambusa vulgaris* Schrad. ex J. C. Wendl.). They may also contain, in some European names a clear reference to the Asian countries and cities, such as Swatow or modern-day Shantou, where these agronomic types were introduced from or, more generally, the adjectives related to their leaf size, shape and colour (Table 2). It is noteworthy that the pigment anthocyanin, present in many of the cultivar groups of var. *integrifolia*, is also active as an antioxidant (Cheigh 2003).

Table 2. Cultivar groups and common names relating to *B. juncea* subsp. *integrifolia* var. *integrifolia*

Cultivar groups and subgroups		Language	Common names
Leaf Mustards	Garlic Mustards	English	garlic mustard; hedge garlic; jack-by-the-hedge; sauce-alone
		English	giant-leafed mustard; Japanese mustard
	Japanese Giant Red Mustards	Japanese	takana
		Latvian	japānu sinepes
	Korean Red Mustards	English	Korean red mustard
		Korean	jeogkat
	Leaf Mustards	Bengali	laaii
		Chinese (Cantonese)	chiu chau taai kaai ts'oi
		Chinese (Mandarin)	bao xin jie cai; chang jiao jie cai; chao zhou da jie cai; da jie cai; da xin jie cai; da wang jie; kuan ye jie cai; xiǎo jiè cài
		English	bamboo mustard; broad-leaved mustard; cabbage leaf mustard; heading leaf mustard; leaf mustard; mustard cabbage; small gai choy; Swatow mustard

		Filipino	mustasa
		French	moutarde à feuilles larges; moutarde chou
		German	Breitblättrige-Senf
		Hindi	baralaaii; pahaadii raaii; raaii
		Japanese	setsuriko
		Korean	gat
	Narrow-leaf mustards	Chinese	sheng cai; shui cai
	English	Japanese water cabbage	

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *japonica* (Thunb.) L. H. Bailey. This variety of subsp. *integrifolia* is easily recognisable because of its highly dissected leaflets (Fig. 1, third row, left) and is one of the most popular microgreens in local East Asian cuisines and most minimally processed vegetables (Able et al. 2003). It is also one of the plant sources of beneficial phytochemicals in treating chronic and serious illnesses as cancer and cardiovascular disease (Schreiner 2007). One of the Japanese names for var. *japonica* is *mizuna*, meaning *water greens* or *water vegetable*, because of high content of water when cut and used as a fresh salad. This name entered some of the European languages (Table 3), while other common names denoting this variety often incorporate a geographical reference to Japan as its native country and cabbage (*Brassica oleracea* L.) and mustards as the plants it is most akin to.

Table 3. Cultivar groups and common names relating to *B. juncea* subsp. *integrifolia* var. *japonica*

Cultivar groups and subgroups		Language	Common names
Cut-Leaf Mustards	Mizuna Mustards	Chinese	qian jing shui cai; riběn wújīng; shui cai
		English	cut-leaf mustard; dissected-leaf mustard; Japanese mustard greens; mizuna; spider mustard
		Finnish	mizuna
		French	mizuna; moutarde des rizières
		Icelandic	mizunakál
		Japanese	irana; kyōna; mibuna; mizuna
		Lithuanian	japoninis kopūstas; mizuna
Spanish	berro japonés; mostaza araña; mostaza de hoja; mostaza Japonesa; pimienta de California		

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *longidens* L. H. Bailey. Known in English as *hakka mustard*, this variety got its name after the Hakka people, who speak Hakka, a variety of Chinese language, and live prevalingly in southern regions of China's mainland and islands, including Taiwan, and neighbouring countries (Fig. 1, third row, middle). The variety *longidens* is one of the extensively used ingredients of the distinguished Hakka cuisine, fresh, salted, pickled and preserved (Anusasananan 2012) and used in popular traditional meals like *fu-tsai* and *suan-tsai* (Chao et al. 2009).



Figure 1. Cultivars groups and subgroups of *Brassica juncea*: (from left to right and from top to bottom) curled-leaf mustard, garlic mustard, Japanese giant red mustard, Korean red mustard, leaf mustard, narrow-leaf mustard, mizuna mustard, hakka mustard, head mustard, horned mustard, hornless mustard, snow mustard, canola mustard, root mustard and zha cai mustard

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *rugosa* (Roxb.) M. Tsen & S. H. Lee. This variety of subsp. *integrifolia* is highly appreciated in the local cuisines of moderate environments of South and East Asia, not only because of its chemical composition and culinary properties, but also due to a rather rapid growth of leaves, forming a head-like rosette, much smaller than those in cabbage (Fig. 1, third row, right), non-demanding agronomic efforts and generally low input (Rauniyar & Bhattarai 2017). All these attributes may be found in various common names, such as to cabbage in Chinese, head- or heart-like shaped form in English, Chine as its homeland in French or a great closeness to the soil in Spanish (Table 4).

Table 4. Cultivar groups and common names relating to *B. juncea* subsp. *integrifolia* var. *rugosa*

Cultivar groups and subgroups		Language	Common names
Head Mustards	Head Mustards	Chinese	dai gai choy

		English	head mustard; heart mustard; Swatow mustard; wedge-shape leaved mustard
		French	moutarde de Chine
		Nepalese	rayo
		Spanish	mostaza de la tierra

B. juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *strumata* M. Tsen & S. H. Lee. With its two cultivar types, var. *strumata* is also one of the traditional vegetables cultivated across the China's mainland, which is becoming more and more popular in healthy, light and vitamin-rich meals providing good prevention from diverse chronic diseases across the globe. The variety's chief characteristic is a very wide and water-rich and delicious petiole, edible together with its leaflet, which as are used as cut or chopped pieces and other forms (Table 5). Its diversity among the Chinese native populations is considerable and gives a solid base for advanced breeding and enhancing various desirable traits according to the market demands (Fu et al. 2006). The cultivar types with a tooth-like formation in the middle of the petiole is classified under a name of *horned mustards* (Fig. 1, fourth row, left), with identical way of cultivation and use in comparison to the so-called *common* or *non-horned mustards* (Fig. 1, fourth row, middle).

Table 5. Cultivar groups and common names relating to *B. juncea* subsp. *integrifolia* var. *strumata*

Cultivar groups and subgroups		Language	Common names
Large-Petiole Mustards	Horned Mustards	Chinese	bao bao qing cai
		English	chopped mustard; horned mustard; large-petiole mustard; Szechuan mustard
		Japanese	unzen-kobu-takana
	Hornless Mustards	Chinese	dàjiècài
		English	large-petiole mustard

Brassica juncea (L.) Czern. subsp. *integrifolia* (H. West) Thell. var. *subintegrifolia* Sinskaya. Although primarily used in the form of leaves prepared in various ways (Fig. 1, fourth row, right), there are certain morphological characteristics and genetic traits that make this variety not identical to the var. *integrifolia*. It is a popular as a cool season vegetable, especially in China and Japan (Table 6). An addition value of this variety is a high potential of accumulating heavy metals, especially cadmium (Cd) and nickel (Ni), and thus may play an important role in environment-friendly roles and phytoremediation (Cao 2008).

Table 6. Cultivar groups and common names relating to *B. juncea* subsp. *integrifolia* var. *subintegrifolia*

Cultivar groups and subgroups		Language	Common names
Leaf Mustards	Snow Mustards	Chinese	xuělihóng
		English	green-in-snow mustard; hsueh li hung; red-in-snow mustard; snow mustard
		Japanese	setsuriko

B. juncea* subsp. *juncea

This subspecies is economically the most important taxon within the species *B. juncea*. Among its numerous synonyms are *Brassica cernua* (Thunb.) F. B. Forbes & Hemsl., *Brassica juncea* var. *gracilis* M. Tsen & S. H. Lee, *Brassica juncea* var. *multisecta* L. H. Bailey, *Brassica juncea* var. *oleifera* Prain, *Sinapis cernua* Thunb. or *Sinapis juncea* L. Apart from its traditional use as spice in contrasting Asian cuisines (Oram et al. 2005), the subsp. *juncea* is cultivated mostly for mature grain, remarkably rich in oil (Fig. 1, fifth row, left). This is the reason why its cultivar groups and agronomic types, grown for oil extraction, are named *canola mustards*, thus corresponding to the worldwide-known types with an identical use in its close botanical relatives, such as *Brassica napus* L. (Marjanović Jeromela et al. 2007) and *Brassica rapa* L. subsp. *oleifera* (DC.) Metzger (Nesi et

al. 2008).

Table 7. Cultivar groups and common names relating to *B. juncea* subsp. *juncea*

Cultivar groups and subgroups	Language	Common names	
Oil-seed mustard	Canola mustards	Arabic	khardal hindiin
		Assamese	jatilai
		Azerbaijani (Azerbaijan)	Sarept xardalı
		Azerbaijani (Iran)	Sarpat ghardali
		Bengali	sarsapa
		Bulgarian	sarepska gorchitsa
		Catalan	mostassa bruna
		Chinese (Cantonese)	jiècài
		Chinese (Mandarin)	dà jiè, dà cài, dāngnián cài, gai cai; jiè cài, jièzǐ, tien jie cai
		Croatian	indijska gorušica; smeđa gorušica
		Czech	brukev sítinovitá; hořčice černá sítinovitá
		Dutch	Indische bruine mosterd; junceamosterd; Sareptamosterd
		English	brown mustard, Chinese mustard, India mustard; Indian mustard, leaf mustard, oriental mustard, vegetable mustard
		Esperanto	bruna sinapo; ĉina sinapo
		Finnish	Mustasinappi; Sareptansinappi
		French	chou des Indes; chou faux jonc; moutarde brune; moutarde chinoise; moutarde de Chine; moutarde de Sarepta; moutarde frisée; moutarde indienne; moutarde jonciforme
		Frisian (North)	brûn senep
		Georgian	sarep'tis mdogvi
		German	Braune Senf; brauner Senf; Chinesischer Senf; Indischer Senf; Ruten-Kohl; Sarepta-Senf; Sareptasenf
		Gujarati	rāyaḍō
		Hindi	sarason; sarson
		Hungarian	barna mustárnak, indiai mustárnak, indiairépa; oroszrépa; szareptai mustár
		Icelandic	sinnepskál
		Indonesian	atau sesawi sayur; mustar coklat; mustar india; sawi; sesawi india; tergantung pemanfaatannya
		Italian	senape bruna; senape indiana
		Japanese	karashi-na; seiyō karashi-na
		Kannada	saasive; sarshspa; sāsive gīḍa hū
		Kazakh	dalalıq qısa, kögildir qısa, kögiltim qısa, sarept kapwsta; sarept qısaı
		Khmer	khat naa
		Korean	gas
		Kusunda	jing
		Lao	kaad khièw
		Latvian	Sareptas sinepe; zilganā sinepe
		Lithuanian	indiška garstyčia; sareptinis bastutis
		Malay	biji sawi; kai choy; sawi; sawi pahit
		Malayalam	Sarshapam
		Maldivian	muśi revī
		Marathi	mohari
		Min (Eastern)	gái-chái
		Min (Southern)	kòa-chhài
		Mingrelian	sarep'tish dongi
		Mongolian	gaimuu baitsaa
		Nepali	asal raaii; rāyō; laahaa
		Newar	tukaṁ
		Norwegian	Sareptasennep
Odia	sōriṣa		
Pashto	sh'shm		
Persian	xrdl tcini		
Polish	gorczyca sarepska; kapusta sarepska; kapusta sitowata		
Portuguese (Brazil)	mostarda-indiana; mostarda-marrom; mostarda-vermelha		
Portuguese (Portugal)	mostarda-castanha; mostarda-chinesa; mostarda-da-india; mostarda-oriental		
Punjabi (Eastern)	rā'ī		
Punjabi (Western)	torīa		
Russian	gorchitsa; gorchitsa russkaia; gorchitsa sareptskaia; gorchitsa sizaia; kapusta sareptskaia		
Sanskrit	rajīka; sarshapa; sarshapah		

	Serbian	indijska gorušica; sareptska gorušica; smeđa gorušica
	Sicilian	sinapi
	Sindhi	srnX'n
	Spanish	mostaza castaña, mostaza china, mostaza de hoja; mostaza de la China; mostaza de la India; mostaza hindu; mostaza india
	Swahili	haradali; mastadi
	Swedish	Sareptasenap
	Tagalog	mustasa
	Tamil	kadugu; katuku; kaṭukuk kīrai
	Telugu	bhāratīya āvālu; sarsapamu; sasuvulu
	Thai	phakkat khiao, phakkat khieo, phakkat khieo pli
	Turkish	yaprak hardal
	Ukrainian	hirchytisia salatna; hirchytisia sarepts'ka
	Urdu	sarson
	Vietnamese	cải bẹ xanh; cải canh; cải cay; cải xanh; giới tử; mù tạc ăn đỏ; mù tạc nâu
	Welsh	mwstard tsieina
	Zhuang	byaekgat

There is one attested root in the large and old Afroasiatic family, which is responsible for the modern common names denoting *B. juncea* subsp. *juncea* in its modern descendants, but also in the languages of the peoples that, in various historical epochs, were influenced by Arabic and, later, Turkish Ottoman, cultures, such as the Altaic Azerbaijani, the Indo-European Bulgarian and Persian or the Niger-Congo Swahili (Table 7). It is **xarw-* or **xary-*, generally denoting edible grain, seed and kernel, with the direct derivatives in Proto-Berber **hawr-an*, Proto-Chadic **x'r*, Proto-Egyptian **'ivry* Proto-Omotiic **yār-* and Proto-Semitic **harw-*, with identical or very close meanings (Militarev and Stolbova 2007).

The common names denoting *B. juncea* subsp. *juncea* in some modern Indo-European ethnolinguistic family are derived from several Proto-Indo-European roots. The Slavic languages are almost mutually uniform in their common names, all of which owe their genesis to the Proto-Slavic verb *gorěti* and the Proto-Indo-European root **gwher[e]-*, **gwhrē-*, both meaning *to burn, to heat* (Vasmer 1959, Mikić 2018). The common names in various Germanic and Romance Italic languages, as well as in the languages of other families that borrowed them by imperial colonisation and trade, have their origin in the Latin adjective *mustus* and, ultimately, in the Proto-Indo-European **meus-*, **mūs-*, referring to a plant preferring wet habitats (Nikolayev 2012). From the Vulgar Latin forms, this root began to designate mustards in general, in the form of the Old French *moustarde*, evolving into its modern forms in English, French and many other languages and dialects (Table 7).

The attribute *sarepta* is directly based upon the name of Old Sarepta, today a district of modern Volgograd, Russia, which was established by the Moravian German colonists in mid-18th century (Kohls 1993). The settlement has eventually become a primary centre of mustard production in the country, where the first Russian cultivars were developed by the producer Conrad Nietz, using existing British and French varieties and abundance of local wild populations (Rudukhina 2015). The name *Sarepta* was used by these Protestant community in memory of the ancient Phoenician city of the same name, mentioned in the first Book of Kings the Old Testament, as a place where the prophet Elijah multiplied the meal and, interestingly, oil (17:8-24): whether made from olive (*Olea europaea* L.) or mustard, we cannot know, but it seems that there is a thin and millennia-long line linking two Sareptas.

B. juncea* subsp. *napiformis

B. juncea (L.) Czern. subsp. *napiformis* (Pailleux & Bois) Gladis. Among the synonyms of this taxon *Brassica juncea* var. *megarrhiza* M. Tsen & S. H. Lee, *Brassica juncea* var. *napiformis* (Pailleux & Bois) Kitam., *Brassica napiformis* (Pailleux & Bois) L. H. Bailey and *Sinapis juncea* var. *napiformis* Pailleux & Bois. This subspecies of *B. juncea* is characterised with largely developed tuber-like roots, accumulating starch and other nutrients (Tarakanov & Wang 2009; Fig. 1, fifth row, middle). According to literary sources, it has been cultivated in China for at least 2500 years, where it is still considered a delicious and low-input food and feed, in the form of

both leaves and root (Bonjean 2016). This country is also one of the leaders of the recent advances of applying various omics in order to improve the genetic base of var. *napiformis* for developing new and improved cultivars (Xiaonan et al. 2017). The common names of this variety mostly refer to its root, as well as to a resemblance to *Brassica rapa* L. subsp. *rapa* and its homeland of China (Table 8).

Table 8. Cultivar groups and common names relating to *B. juncea* subsp. *napiformis*

Cultivar groups and subgroups		Language	Common names
Root Mustards	Root Mustards	Chinese	da tou cai; jie cai ge da; jing yong jie cai
		English	large-root mustard; Pailleux's large-rooted mustard; root mustard; Sichuan large-rooted mustard; tuberous-root mustard; turnip-root mustard; turnip-rooted mustard
		French	moutarde tubéreuse; moutarde tubéreuse de Chine

B. juncea* subsp. *tsatsai

With its two varieties, the subspecies *tsatsai* comprises local landraces and advanced cultivars that are traditionally grown as vegetable in Chinese cuisine (Wiersema & León 2016), where it is an ingredient of numerous delicious meals.

B. juncea (L.) Czern. subsp. *tsatsai* (T. L. Mao) Gladis, nom. nud.? var. *multiceps* M. Tsen & S. H. Lee. This variety is morphologically distinctive for its numerous stems per one plant, what is, with a popular term of *shoot*, a part of almost all collected common names (Table 9). Its main use in human diets is as a vegetable (Steward 2002), while one of its significant scientific roles is as one of the plants with the most-rapid cycles, useful in basic research, such as genetics and physiology (Williams & Hill 1988).

Table 9. Cultivar groups and common names relating to *Brassica juncea* subsp. *tsatsai* var. *multiceps*

Cultivar groups and subgroups		Language	Common names
Multishoot Mustards	Multishoot Mustards	Chinese (Cantonese)	hsueh li hung; ngan sz kaai; suet lui hungts'in kan ts'oi
		Chinese (Mandarin)	duo lie jie; duo lie ye jie; jin si jie; qian jin cai; xue li hong; yin si jie; zha cai
		English	chicken mustard; cut-leaved green in snow; multishoot mustard; nine-head mustard; silverthread mustard; thousand nerved cabbage
		French	moutarde de Chine à mille têtes

B. juncea (L.) Czern. subsp. *tsatsai* (T. L. Mao) Gladis, nom. nud.? var. *tumida* M. Tsen & S. H. Lee. The variety *tumida* is one of the most easily recognisable taxa within the species *B. juncea*, due to a large number of the stem, which consists of hypertrophic tissue. This anatomical and morphological anomaly, unofficially referred to as *swollen* or *tumorous* stems, is present in the form of knob-like and fist-sized stems (Wu & Zeng 2011; Fig. 1, fifth row, right). It is usually used fresh or as a pickle, predominantly in China, Japan and Korea (Niu et al. 2012). Its common name in Chinese means *pressed cabbage*, *pressed greens* or *pressed vegetable* (Table 10). The European languages, spoken in the countries where the products of this variety are imported, mainly preserved and more or less adapted its original name, while the English language contains associations with China and its southwest province of Sichuan.

Table 10. Cultivar groups and common names relating to *Brassica juncea* subsp. *tsatsai* var. *tumida*

Cultivar groups and subgroups		Language	Common names
Multishoot Mustards	Zha Cai Mustards	Catalan	zha cai
		Chinese (Cantonese)	cha tsoi; ja choy; jar choy; jar choy
		Chinese	cha tsai; tsa tsai; zhàcài

	(Mandarin)	
	Dutch	tsa tsai
	English	big-stem mustard; Chinese pickled vegetable; Sichuan pickling mustard; Sichuan swollen stem mustard; Sichuan vegetable; swollen-stem mustard; Szechwan vegetable; Yangtze river mustard
	French	moutarde à pied renflé
	German	Tsa Tsai
	Japanese	zazai; zazei
	Korean	jachai
	Norwegian	zhacai
	Polish	zha cai
	Spanish	zha cai
	Swedish	inlagd sichuangrönsak; sichuangrönsak; zhacai

Conclusions

The presented taxonomic diversity within the species *B. juncea*, with peculiar anatomical, morphological, physiological and agronomic characteristics, demonstrates a very wide basis and, thus, quite desirable genepool for present and future breeding efforts and developing the cultivar types with enhanced yield, quality and other requirements. The botanical variation is, on the other hand, recognised by a rather wide variation of the common names in diverse languages, contributing all together to a more articulated need for preventing this cruciferous species from neglect and underutilisation.

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References

- Able AJ, Wong LS, Prasad A, O'Hare TJ (2003) The effects of 1-methylcyclopropene on the shelf life of minimally processed leafy Asian vegetables. *Postharvest Biol Technol* 27:157-161
- Anusasananan LL (2012) *The Hakka Cookbook: Chinese Soul Food from Around the World*. University of California Press, Berkeley - Los Angeles - London
- Bonjean AP, Dequidt C, Sang T (2016) Rapeseed in China. *Oilseeds Fats Crops Lipids* 23:D605
- Cao L, Jiang M, Zeng Z, Du A, Tan H, Liu Y (2008) *Trichoderma atroviride* F6 improves phytoextraction efficiency of mustard (*Brassica juncea* (L.) Coss. var. *foliosa* Bailey) in Cd, Ni contaminated soils. *Chemosph* 71:1769-1773
- Chao SH, Wu RJ, Watanabe K, Tsai YC (2009) Diversity of lactic acid bacteria in suan-tsai and fu-tsai, traditional fermented mustard products of Taiwan. *Int J Food Microbiol* 135:203-210
- Cheigh HS (2003) Antioxidative activities of anthocyanins in red mustard leaf kimchi. *J Korean Soc Food Sci Nutr* 32:937-941
- Dai FG, Hu ZL, Chen GP, Wang BQ, Zhou S (2011) A simple method to obtain transgenic mustard. *Life Sci Res* 15:19-23
- Fu J, Zhang MF, Qi XH (2006) Genetic diversity of traditional Chinese mustard crops *Brassica juncea* as revealed by phenotypic differences and RAPD markers. *Genet Resour Crop Evol* 53:1513-1519
- Kew Science (2017) *The International Plant Names Index and World Checklist of Selected Plant Families*. Kew Science, Plants of the World Online. Royal Botanical Gardens, London
- Koh JCO, Barbulescu DM, Norton S, Redden B, Salisbury PA, Kaur S, Cogan N, Slater AT (2017) A multiplex PCR for rapid identification of *Brassica* species in the triangle of U. *Plant Methods* 13:49
- Kohls WS (1993) Chapters in the history of foreign colonization in Russia: The Sarepta crisis in its historical context. *Russ Hist* 20:35-60
- Linnaeus C (1753) *Species plantarum exhibentes plantas rite cognitatas, ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas, I-II*. Impensis Laurentii Salvii, Stockholm
- Linnaeus C (1758) *Systema naturae per regna tria naturae: secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Impensis Laurentii Salvii, Stockholm

- Logos (2018) Logos - Multilingual Translation Portal. Logos, Modena
- Marjanović-Jeromela A, Marinković R, Mitrović P (2007) Breeding of rapeseed (*Brassica napus* L.). Ratar Povrt 43:139-148
- Mikić A (2018) The echoes of the distant past of mustards (*Brassica* and *Sinapis*) among Slavic peoples. Genet Resour Crop Evol 65:11-16
- Nesi N, Delourme R, Brégeon M, Falentin C, Renard M (2008) Genetic and molecular approaches to improve nutritional value of *Brassica napus* L. seed. Comptes Rendus Biol 331:763-771
- Nikolayev SL (2012) Indo-European Etymology. The Tower of Babel, an International Etymological Database Project, <http://starling.rinet.ru>
- Niu GC, Wei WY, Wang HL, Zhu D, Jiang MZ (2012) Preparation of low-salt root mustard pieces with comminuted meat. North Hortic 23:054
- NPGS (2018) National Plant Germplasm System (NPGS). Germplasm Resources Information Network. United States Department of Agriculture, Agricultural Research Service, Washington - Beltsville
- Oram RN, Kirk JTO, Veness PE, Hurlstone CJ, Edlington JP, Halsall DM (2005) Breeding Indian mustard [*Brassica juncea* (L.) Czern.] for cold-pressed, edible oil production - A review. Crop Pasture Sci 56:581-596
- Porcher MH (2008) Multilingual Multiscript Plant Name Database. The University of Melbourne, Melbourne
- Rakow G (2004) Species origin and economic importance of *Brassica*. In: Pua EC, Douglas CJ (eds) *Brassica*. Biotechnol Agric For 54, Springer, Berlin - Heidelberg
- Rauniyar K and Bhattarai BP (2017) Growth, yield and oil nutrient status of broad leaf mustard (*Brassica juncea* var. *rugosa*) under integrated nutrient management. Nepal J Agric Sci 15:98
- Rudukhina I (2015) History of Sarepta Mustard. New St. Isaac's Office Centre, St. Petersburg
- Schreiner M (2005) Vegetable crop management strategies to increase the quantity of phytochemicals. Eur J Nutr 44:85-94
- Tarakanov IG, Wang J (2009) Light trophic and signal roles in the control of morphogenesis of the Brassica plants developing storage roots. Russ J Plant Physiol 56:232-241
- The Plant List (2013) The Plant List - A Working List of All Plant Species. Royal Botanic Gardens, Kew - Missouri Botanical Garden, St. Louis
- Wiersema JH, León B (2016) World Economic Plants: A Standard Reference. CRC Press, Boca Raton
- Wikipedia (2017) Wikipedia, the Free Encyclopedia, <https://www.wikipedia.org>
- Wiktionary (2017) Wiktionary, the free dictionary, <https://www.wiktionary.org>
- Wilcox M (2003) Vegetables, fruits and culinary herbs sold in the Avondale and Otara Markets: A contribution to the ethnobotany of Auckland. Auckl Bot Soc J 58:71-80
- Williams PH, Curtis BH (1986) Rapid-cycling populations of *Brassica*. Sci 232:1385-1389
- Wong JH, Ng TB, Cheung RC, Ye XJ, Wang HX, Lam SK, Lin P, Chan YS, Fang EF, Ngai PH, Xia LX (2010) Proteins with antifungal properties and other medicinal applications from plants and mushrooms. Appl Microbiol Biotechnol 87:1221-1235
- Wu R-z, Zeng K-f (2011) Effect of ethanol fumigation on storage quality of tumorous stem mustard. Storage Process 3:005
- Xiaonan L, Wenxing P, Zhongyun P (2017) Omics meets phytonutrients in vegetable brassicas: For nutritional quality breeding. Hortic Plant J 3:247-254
- Zeven AC, Zhukovsky PM (1975) Dictionary of Cultivated Plants and Their Centres of Diversity. Centre for Agricultural Publishing and Documentation, Wageningen