MUSTARD /Brassica juncea L./ IN CHINA

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1. Origin and Distribution

Several hypotheses about the origin of B.juncea have been suggested. Prain D. /1898/ in India believed that the original place of mustard is in China and Indian mustard was introduced from China. Vavilov N.I. /1926/ suggested that Middle Asia and Northwest India are the first original centres of B.juncea and Central and West China. East India and Burma and Asia Minor and Iran are the three secondary centres. The rapeseeds /mustard or turnip/ found in the relics of Banpo, Xi'an are from 6,000-7,000 years ago according to C14 determination. It is therefore considered that China has a very long history of mustard cultivation.

Many wild kindred types of B.juncea have been found in recent years in Xinjiang and Qinghai, providing another evidence for the theory that B.juncea originated in China.

Because of its special adaptation, B.juncea is widely grown in the western plateaus and northern dry areas of China, concentrating mainly in the following two regions: one is the spring-sowing region of Xinjiang and Inner Mongolia in the dry zone of Eurasia and the other is the autumn-sowing Yunnan-Guizhou Plateau in Southwest China. The provinces in China in order of their mustard-growing area are Xinjiang, Inner Mongolia, Yunnan, Guizhou, Tibet, Gansu, Sichuan, Qinghai, Shanxi, Shaanxi, etc. The total area of B.juncea in China is about 300,000 ha.

2. Types and Cultivation Manners

Chinese mustard has two cultivated types. Although both of them have evolved from ordinary mustard, they nave

evident differences in morphological characters and ecological adaptability due to a long differentation. Accordingly their distributions and cultivation manners are also different.

/1/. Narrow-leaf mustard is a variant of B.juncea, peculiar to China. It has plants of large or middling size /usually 1.5 - 2.4 m in height/, well-developed axial roots and relatively weak branch roots. The radical leaves are small and narrow, covered with spiny hair and wax and have long stalks and incised and saw-toothed margin. The stem leaves have short stalks and rough surface. Seeds are yellow or red brown, with strong mustard taste. Upper branches are thin and the branching position is usually over 80 cm. Its resistance to drought and tolerance to hungry soil are stronger than B.napus and B.campestris. Narrow-leaf mustard is mainly found in the arid regions of West and North China. It is planted in pure stands at a density of 300,000 - 900,000 plants per hectare in Xinjiang and Inner Mongolia. Owing to its good tolerance to the xerothermic winds and resistance against pod dehiscence, it adapts well to the local conditions of high summer temperature and mechanical harvesting. Generally the yield is 1,000 - 1,200 kg/ha in non-irrigated land and 1,500 - 3,000 kg/ha in irrigated land. In the mountainous districts of Qinghai, Tibet and Gansu, B.juncea is planted in mixed stands with broad bean, pea or barley. Local farmers have made use of its specific property of high branching position. When it is mixed with crops of lower plants such as broad bean, pea and barley, the space is better used and the plants are more resistant to lodging, and this cropping manner is good for both crops. Baichenghuang in Xinjiang and Nuweishao in Qinghai are typical varieties of narrow - -leaf mustard.

/2/. Large-leaf mustard /B.juncea/

Large leaf mustard is grown for both oil and vegetable, and is morphologically similar to ordinary mustard. It has tall plants and middling axial roots. Some varieties have

inflated succulent roots. The radical leaves are large and tough, elliptically shaped, without or with a little spiny hair, covered with a little wax, and with obtuse apexes and indistinctly saw-toothed margins. It has strong branching ability and middling branching height. Seeds are yellow or red brown, with a little mustard taste. Large -leaf mustard is distributed mainly in Yunnan, Guizhou, Shanxi and Sichuan, mostly sown in autumn. The cultivation manner is similar to that of narrow-leaf mustard. Since its vegetative parts have large biomass, it can be used as vegetable in winter and spring and as a green manure crop or as a fodder crop apart from harvesting the seeds to get oil. Its seed yield is somewhat lower than narrow-leaf mustard. Varieties of this type that have relatively large growing areas are Niuerdo in Guizhou, Qingcaizi in Sichuan and Gaojiaola.

3. Qualities

Oil content and the essential oil content are the two main indices of seed quality of B.juncea. In China, oil content of B.juncea is generally lower than that of B. napus and B.campestris. However there are some varieties of high oil content. Varieties with yellow seed-coat are usually high in oil content. The average oil content of 405 varieties of B.juncea in China is 39.12%, 2.6% and 0.61% lower than that of B.napus and B.campestris respectively, according to the Oil Crops Institute, Chinese Academy of Agriculture. Varieties from Yunnan, Guizhou and Tibet usually have higher oil content than those from Qinghai, Xinjiang and Gansu /Table 1/. This is directly related to the temperature during seed formation and oil accumulation.

Recently breeders are interested in the composition of fatty acids in rapeseed oil, especially in linoleic acid, linolenic acid and erucic acid. Some local varieties have been analysed by the Oil Crops Institute, Chinese Academy of Agriculture. The results show that Chinese mustard has

lower erucic acid content and higher linoleic and linolenic acid content /Table 2/. Besides, there are more yellow seed-coat varieties in B.juncea than in other rapeseed types.

Table 1. Oil Content of B.juncea in Main Production Regions of China.

oil content /%/	Guizhou	Yunnan	Qinghai	Tibet	Xinjiang	Gansu
25-29.99			2		3	1
30-34.99			16		33	1
35-39.99	13	6	32		19	
40-44.99	52	39	5	3		
45-49.99	4	16				
total	69	61	55	3	55	2
average oil content %	41,85	43.32	36.14	43.97	33.95	27.5

Table 2. Content of some fatty acids in Chinese rapeseed /%/.

rapeseed types	number of varieties analysed	linoleic acid	linolenic acid	erucic acid
B.juncea	210	18.42	12.32	41.58
B.campestris	290	13.15	9.24	50.33
B.napus	70	12.94	9.00	51.15

Mustard is a condiment. This is another important use of mustard seed apart from the use of its oil. Food industry requires that allyl oil content in the first-class mustard should be over 1.1% and that of the second-class over 0.9%.

In China, varieties of B.juncea vary greatly in their allyl oil content, with a trend that autumn-sowing varieties are lower in allyl oil content than spring-sowing varieties and higher oil content varieties are lower in allyl oil content than lower oil content varieties. Allyl oil content of the same variety varies among years, but

there are some varieties whose allyl oil content is high and stable. These varieties are important material to make mustard powder. Recently, most varieties used for mustard powder are yellow seed-coat varieties.

4. Prospects

B.juncea has long been cultivated as an oil crop in China. Before 1950s, it made up of one-third or more of the total area of the country's rapeseed, about 1,000,000 ha each year, spreading almost all over the country. Since then its growing area has decreased sharply due to the popularization of B.napus, especially in the Changjiang River valley and other regions where the conditions for agriculture are good. This is because B.napus is superior to B.juncea in productivity, disease resistance and oil content. Nevertheless, B.napus does not adapt well to the western plateau and northern dry regions while B.juncea is one of the prevailing crops in these places because of its strong resistance to drought and good tolerance to poor soil and high temperature in late season. It shows a surprising adaptation in Xinjiang and some other regions where the inland xerothermic winds are frequent, and varieties with desirable agronomical characters have been developed. With the development of arid farming in China B. juncea is expected to have more growing area. It is anticipated that B.juncea will extend to some extent in the new non-irrigated land developed from the reclaimation of virgin land in Southwest and Northwest China. Furthermore, it is attracting much attention from breeders for its superiority over other rapeseed types in resistance to drought stress from both soil and atmosphere and to pod dehiscence and tolerance to poor soil fertility.