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‘Qiao Ran Bao Ke’: A New Cultivar of *Xanthoceras sorbifolium* Bunge with Thin Skin

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Yellowhorn (*Xanthoceras sorbifolium* Bunge) is a deciduous shrub or small tree of the genus *Xanthoceras* in the family *Sapindaceae*. It is a unique oil tree species in northern China. Its kernels have a high oil content (>60%) and rich unsaturated fatty acids—such as oleic acid, linoleic acid, and neuronal acid—that have high edible and medicinal values. Unsaturated fatty acids scavenge free radicals and have antioxidant functions. Oleic acid and linoleic acid prevent and treat cardiovascular diseases and have significant effects on lowering blood pressure. Neurotic acid could repair and regenerate the damaged nervous system and enhance memory (Yu et al., 2017). The yellowhorn oil also has properties similar to those of ordinary diesel oil, and it is a good biomass energy tree species (Ma et al., 2020; Wang et al., 2012). Additionally, it is an ecological tree for landscaping and forestation that has high ornamental value, with colorful flowers and strong resistance to stress.

As a tree species with a high comprehensive value, many researchers have conducted research of yellowhorn. However, little has been known about the fruit characteristics of yellowhorn. ‘Qiao Ran Bao Ke’ (‘悄然薄壳’, the Plant Variety Right Number: 20180376) has a thin shell with a higher seed rate and is drought-tolerant and barren-resistance; therefore, it can be planted in arid and semi-arid areas with a better yield. The discovery and cultivation of ‘Qiao Ran Bao Ke’ will provide research materials for studying the fruit traits of yellowhorn, improve the enthusiasm of foresters to plant yellowhorn, promote the development of industry, and further contribute to increasing the capacity of healthy and high-quality wood oil.

Origin

‘Qiao Ran Bao Ke’ is named for its thin shell and is derived from selected seedlings. Its small shell thickness is 3.00 mm on average, which is significantly thinner than that of the wild type (Supplemental Table 1). In Aug. 2013, we discovered the maternal parent plant in the Heituozi nursery in Zhangwu County, Liaoning Province. Then, we collected 10 scions from the mother tree for grafting with a bud grafting method and observed it for 4 successive years. In Aug. 2015, scions were collected from the first generations and 20 plants were grafted with the same grafting method. By grafting propagation, the morphological characteristics and growth characteristics of clones were consistent, and there was no obvious difference among individuals. Through multiple grafting in different regions, the morphological and growth characteristics of clones of different ages were the same as those of the mother plant. Investigations and studies of the characteristics of the thin-shelled cultivar have found that the thickness variation was small, and that the traits are genetically stable (Supplemental Table 2).

Description

The characteristics of ‘Qiao Ran Bao Ke’ (Fig. 1) are its thin shell and large proportion of seeds. The proportion of seeds to shell is 65–67:35–33. The seed weighs almost twice as much as the shell and is greater than the 55–50:45–50 of other varieties. The fatty acid rates of its linoleic acid, oleic acid, palmitic acid, and neuronal acid are 41.4%, 27.9%, 4.97%, and 4.83%, respectively. In the western Liaoning region, it flowers in mid to early May, and the fruit ripens in early August, with a fruit development period of ≈75 d. It has strong stress resistance to drought and cold, fast growth, and high yield, and it can be widely planted in the northern regions of China.

Foliage. The foliage is small and lanceolate, with a moderate width but a short length. The foliage is flat without fold, and the new leaves are yellow–green and glabrous. The mature leaves are bottle green.

Flower. Yellowhorn has a cylindrical raceme, and the inflorescence rachis are green and glabrous. The flowers are single-petaled, and petals are white at the top, initially yellow at the base, and gradually turn purplish red. The calyxes are yellow–green and the pistils are less than half the length of the petals. Flowering begins (10% open flowers) in early May and lasts ≈10 d in western Liaoning Province, China.

Fruit. The fruits are round, moderate in size, and slightly dehiscent. The thin shell usually has three carpels; occasionally, it has four or five carpels. The seeds are dark brown, and the average single grain weight is moderate.

Cultivation. This cultivar is suitable for planting in loess mountains, hills, and sandy land in the north of China with more than a 50-cm soil layer and a slope ≤25°; however, it is not suitable in areas with poor drainage such as the low wetland, heavy saline alkaline land, or rocky mountain regions. The planting density is 2 m × 4 m or 3 m × 4 m. Pollination trees are required; if they are not available, then it needs to be manually pollinated. The organic base fertilizer is recommended after autumn fruit harvesting. The topdressing fertilizer is mainly applied with nitrogen fertilizer before July and in July. Later, phosphorus and potassium fertilizer are usually used. To avoid ponding and root rot, drainage should be conducted in a timely manner during the rainy season. Different pruning methods are used for different trees. It needs round pruning for fruit setting. During the planting period, dead leaves, branches, and diseased leaves should be removed, and it is necessary to control the aphids, whiteflies, and coal pollution diseases by using manual methods.

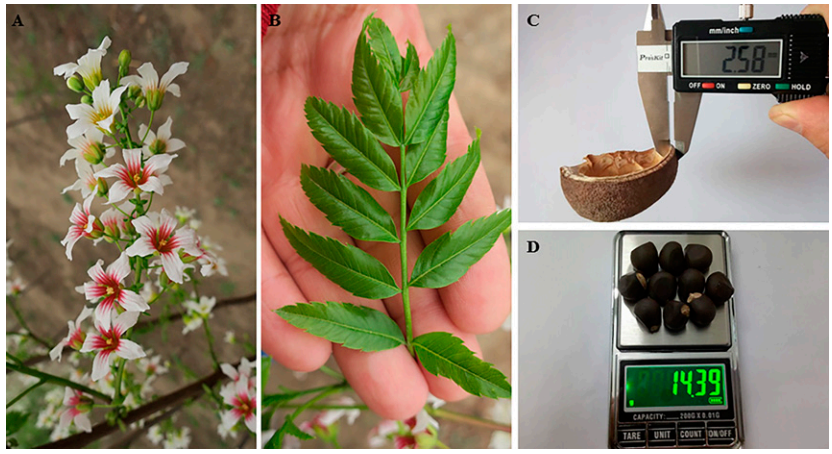

Fig. 1. Morphological characteristics of ‘Qiao Ran Bao Ke’: (**A**) racemose inflorescences, (**B**) leaves, (**C**) shell, and (**D**) seeds.

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Availability

The samples of 'Qiao Ran Bao Ke' are available commercially from Heituozi nursery, Zhangwu County, Liaoning Province. Requests for cuttings for research purposes may be addressed to Quanxin Bi (Research Fellow, e-mail: biquanxin@caf.ac.cn).

Literature Cited

Ma, Y.X., Q.X. Bi, G.T. Li, X.J. Liu, G.H. Fu, Y. Zhao, and L.B. Wang. 2020. Provenance variations in kernel oil content, fatty acid profile and biodiesel properties of *Xanthoceras sorbifolium* Bunge in northern China. Ind. Crops Prod. 151: https://doi.org/10.1016/j.indcrop.2020.112487.

Wang, L.B., H.Y. Yu, X.H. He, and R.Y. Liu. 2012. Influence of fatty acid composition of woody biodiesel plants on the fuel properties. J. Fuel Chem. Technol. 40:397–404, https://doi.org/10.1016/s1872-5813(12)60018-8.

Yu, H.Y., S.Q. Fan, Q.X. Bi, S.X. Wang, X.Y. Hu, M.Y. Chen, and L.B. Wang. 2017. Seed morphology, oil content and fatty acid composition variability assessment in yellow horn (*Xanthoceras sorbifolium* Bunge) germplasm for optimum biodiesel production. Ind. Crops Prod. 97:425–430, https://doi.org/10.1016/j.indcrop.2016.12.054.

Supplemental Table 1. Multipoint analysis of variance of the fruit shell thickness.

	Location	Cultivar	Min (mm)	Max (mm)	Mean (mm)	Variance	SD	CV (%)	Significance
2019	TL	Wild-type	4.89	9.06	6.48	0.92	0.96	14.81	0.00*
		Thin-shelled	2.49	3.28	2.79	0.06	0.24	8.71	
	Shandong Province	Wild-type	4.79	8.49	6.18	0.9	0.95	15.36	0.00*
		Thin-shelled	2.52	3.19	2.77	0.04	0.19	7.03	
	Beijing	Wild-type	4.57	8.41	6.12	0.68	0.82	13.44	0.00*
		Thin-shelled	2.42	3.27	2.78	0.04	0.21	7.55	
2020	TL	Wild-type	4.87	8.61	6.34	0.81	0.9	14.23	0.00*
		Thin-shelled	2.42	3.27	2.8	0.06	0.25	9.05	
	Shandong Province	Wild-type	4.37	8.58	6.26	0.77	0.88	14.04	0.00*
		Thin-shelled	2.39	3.31	2.8	0.06	0.25	8.97	
	Beijing	Wild-type	4.41	7.82	6.15	0.89	0.94	15.35	0.00*
		Thin-shelled	2.45	3.18	2.77	0.04	0.19	6.75	
2021	TL	Wild-type	4.65	8.83	6.39	0.97	0.98	15.4	0.00*
		Thin-shelled	2.37	3.24	2.8	0.07	0.27	9.51	
	Shandong Province	Wild-type	4.68	9.09	6.31	0.97	0.98	15.6	0.00*
		Thin-shelled	2.32	3.28	2.97	0.06	0.25	8.98	
	Beijing	Wild-type	4.22	7.85	6.09	0.87	0.93	15.34	0.00*
		Thin-shelled	2.47	3.23	2.81	0.06	0.25	8.79	

CV = coefficient of variation; TL = Tongliao of Inner Mongolia Autonomous Region.
*Very significant level.

Supplemental Table 2. Statistical analysis of the fruit shell thickness of the thin-shelled cultivar.

		Intersubjective effect test			
		Degree of freedom	Mean square	F	Significance
Thin-shelled	Location	2	0.002	5.5	0.96
	Year	2	0.011	5.053	0.82
	Location × year	4	0.004	2.244	0.99