Study on aroma variation of Armeniaca mume Sieb. f. viridicalyx (Makino)T. Y. Chen in different flowering stages and its suitability for scenting black tea

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Abstract: Headspace solid phase microextraction combined with gas chromatography-mass spectrometry (GC-MS) was used to study the aroma components of Calycium calycium at different flowering stages, and its tea suitability was analyzed. The results showed that the main aroma components were eugenol, benzaldehyde and phenylmethyl acetate, and the almond flavoured benzoic acid had the highest content. The different flowering stages and the different amount of flowers were studied and the suitability of the flower tea was analyzed by sensory evaluation. The results showed that the aroma was similar from bud stage to blooming stage, indicating that there was little change in aroma types during flowering. The aroma and flavor scores of flower scenting at bud stage and final flowering stage were lower than those at blooming stage, and the score of aroma and taste of flowers at 50/100kg was higher than 33/100kg. In the production of scented tea, 50/100kg matching amount of blooming flowers is appropriate.

Key words: Chlorosepalum; Flower tea; Aroma

Green sepalme flower tea is made of black tea and green sepalme flowers mixed with scenting. Its fragrance is rich and subtle. Green sepal flower tea is one of the special flower tea. Its development not only improves the economic benefits of tea farmers, but also makes a large number of waste green sepal flowers except for fresh cut flowers to be used again, increases the income of flower farmers, in addition to enrich the material and cultural life of the broad masses of people. In the past, the researches on flower tea mainly focused on jasmine tea, and the reports on the processing of plum tea were few. In order to meet the needs of people's material and cultural life, and to increase the variety of tea colors and improve the economic benefit of tea production, the process of scenting of green sepal flower tea was studied.

1. Frontier

Armeniaca mume Sieb. f. viridicalyx (Makino) T. Y. Chen), commonly known as the green plum, got its name from the green and white calyx and green twigs. It belongs to the true plum straight plum green calyx type in the plum variety classification system. It is the best of the plum varieties and has high ornamental value. The traditional application of the green plum is mainly in medicine and cosmetics industries (Chen Longqing and Chen Junyu, 1999; Dai Shugang et al., 2007). In recent years, wax plum tea has been developed based on the adsorption principle of tea and the aroma spitting property of wax plum (Yuan Linying et al., 2005; Pang Xiaoli et al., 2007), which has opened up a new field for the utilization of plum blossom resources. However, there are few researches on the processing technology and scenting theory of Meihua tea at home and abroad, especially on the determination of the mining period of chlorosepalus suitable for Meihua tea. The existing literature mainly focuses on the identification of aroma substances of Waxflower, and there are some problems such as unclear classification of varieties. Deng et al. (2004) used headspace solid phase microextraction combined with gas chromatography mass spectrometry (HS-SPME-GC-MS) for the first time to identify 31 and 28 aroma components in vivo and in vitro, respectively. Li et al. (2009) analyzed the difference of aroma components of a certain plum blossom (unspecified variety) at different flowering stages, and proposed that the aroma changed significantly during flowering. The author used the sensory evaluation method of flower tea to analyze the different flowering stages of the chlorosepalme, combined with the suitability of tea making, to find out the amount of flowers suitable for chlorosepalme flower tea and determine the date of flower picking, so as to provide the basis for the processing of chlorosepalme flower tea and promote the development of the Meihua tea industry.

2. Materials and methods

1. Materials

According to the classification method of Chen Longqing et al. (2004), the Armeniaca mume Sieb. f. viridicalyx （Makino）T. Y. Chen varieties in Xiangxuehai Scenic spot in Suzhou were selected, and the Armeniaca mume Sieb. f. viridicalyx （Makino）T. Y. Chen varieties in the initial, full and final flowering periods were picked on February 21 and 22, 2023, respectively. The green tea was Grade I blue snail red from Suzhou Yufeng Tea Factory in April 2022, with a water content of 5% and stored at room temperature.

2. Method

(1) Preparation of green sepal flower tea sample

The flowers and tea billets of different flowering stages were processed into green sepal flower tea according to the following methods. On the basis of the better combination of technological parameters, the influence of total amount of flowers on the quality of scented tea was further studied to find the best technological process and the most economical and effective total amount of flowers. The levels determined by the experimental factors were as follows: the total amount of flowers :50kg/ 100kg, 33kg/ 100kg, a scenting of flowers, scenting time 18 h, including the temperature of about 25 ℃ for the first 6 hours and 35 ℃ for 12 hours, and then drying in 85 ℃ oven for 80 min, raising the temperature to dry again for 40 min, leaving flowers.

(2) Headspace solid phase microextraction conditions

Weigh 1 g(accurate to 0.001 g) of the roughly cut samples of Calycalyx, thawed at room temperature, into a 20 mL sample bottle, and add 1.08 g NaCl and 5 μL internal standard 3-nononone (0.051 g/mL dilution of n-hexane), respectively. Mixed and sealed, the samples were balanced in a water bath at 60℃ for 15 min. The aging 50/30 μm DVB/CAR/PDMS extraction head was inserted above the sample bottle, adsorbed in the headspace for 30 min, and then inserted into the sample inlet of a gas chromatoc-mass spectrometry instrument for analysis for 3 min.

(3) Methods for sensory evaluation of scented tea

According to the method of "Sensory Evaluation Method of Tea" (GB/T 23776-2018), the special evaluation cup bowl (150mL) was used for brewing, and the amount of tea poured was 3 g. For accuracy, the evaluation method of internal quality was selected, and the two cups were brewed once, two cups were brewed at the same time for 5m. The first cup was brewed only for aroma and was divided into two brews, 3m for the first time and 5m for the second time; The second cup is for the evaluation of soup color, taste, leaf base, the principle of the last brewing 5m. All treatments are brewed with boiling water at 100℃.

3. Results and Analysis

1. Changes of aroma components at different flowering stages

The relative contents of flower aroma components at different flowering stages are shown in Table 1. A total of 9 aroma components were identified, and there were 3 common aroma components of all varieties, including eugenol, benzaldehyde and phenyl methyl acetate. Among them, the relatively high content was benzaldehyde, and these three compounds accounted for more than 80% of the total amount in each variety. It can be seen from Table 1 that the content of benzaldehyde in the initial flowering stage is significantly higher than that in the full flowering stage and the final flowering stage, and it can be seen from Table 2 that the retention time of benzaldehyde, limonene and benzyl alcohol in the outgoing flowering stage is longer.

Table 1 Relative contents of aroma components in different flowering stages

No.	Compounds	containing	The amount	
		Commencing period	Full bloom	Final flowering stage
1	eugenol	0.31	2.41	0.82
3	p-methylphenylether	0.65	one	one
4	Isoamyl acetate	one	3.43	1.52
5	Benzaldehyde	90.84	70.12	88.65
6	limonene	2.75	1.74	one
7	Benzyl alcohol	0.25	one	1.42
8	Decamethylcyclopentasiloxane	one	2.29	3.47
9	Phenylmethyl acetate	5.2	20	4.12

Table 2 Aroma residence time of Calyx calyx at different flowering stages

Serial Number	Compounds	Reservations	Time	
		Commencement Period	Full bloom	Final flowering stage
1	eugenol	2.3	2.26	2.26
3	p-methylphenylether	7.47	one	one
4	Isoamyl acetate	one	2.42	2.42
5	Benzaldehyde	10.46	7.41	7.38
6	limonene	13.39	8.78	one
7	Benzyl alcohol	14.97	one	8.72
8	Decamethylcyclopentasiloxane	one	9.99	9.99
9	Phenylmethyl acetate	8.64	10.5	10.5

2. Sensory quality analysis of scented tea at different flowering stages

Green sepalme flower tea was made from flower scenting at different flowering stages, and the sensory evaluation results were shown in Table 3. As can be seen from Table 3, the overall aroma was almond aroma. Flowers in full blossom stage and final blossom stage scented plum blossom tea with weak aroma and low flavor concentration, and its score was significantly lower than that in full bloom stage, indicating that flower aroma concentration in full blossom stage and final blossom stage was low, and the amount of tea adsorbing aroma components was less, resulting in poor scenting effect. The initial flowers were suitable for scenting the green sepalmeum tea.

Table 3 Scores and comments on aroma and taste of Armeniaca mume Sieb. f. viridicalyx （Makino）T. Y. Chen blossom tea at different flowering stages

Efflorescence	Armeniaca mume Sieb.f. viridicalyx (Makino)T. Y. Chen	
	Aroma	Flavor
Initial period	95 Fresh spirit, subtle fragrance lasting	93 Fresh alcohol 75 alcohols and
Full bloom period	67 Fragrant weak	73 Mellow
Final flowering period	65 Weak fragrance	73 mellow

3. Analysis of sensory quality of scented tea with different amount of flowers

Green sepalus flower tea was prepared with different flower scenting of 50kg/ 100kg and 33kg/ 100kg, and the sensory evaluation results were shown in Table 4. As can be seen from Table 2, compared with the two flower scenting quantities,33/100kg flower scenting of the green sepal flower tea was still fresh, and the fragrance durability was significantly lower than the flower scenting amount of 50kg/100kg, the taste was mellow, and the freshness was lower than 50kg/100kg. It shows that the amount of flowers in scented tea directly affects the quality of scented tea during scented tea scenting. When the amount of flowers is small, with the increase of the amount of flowers, the concentration of aroma substances increases gradually, and the aroma concentration gradient on the surface of flowers and tea billet increases gradually.

Table 4 Scores and comments on the sensory evaluation of aroma and taste of green sepal flower tea with different amount of flowers

Floral Quantity	Green sepal flower tea	
	Aroma	Flavor
50kg/100kg	95 Fresh spirit, fragrance lasting	93 Fresh alcohol
33kg/100kg	88 Still fresh spirit, fragrance lasting	80 Mellow and mellow

4. Discussion

The results showed that the relative contents of eugenol, benzaldehyde and methyl acetate were high, and the sum of the relative contents accounted for more than 80% of the total aroma. The alcohol compounds in the aroma mainly included benzyl alcohol, the total relative content of which was less than 2%, and they were not dominant in the aroma at different flowering stages. However, Zhou Mingqin et al. (2007) detected that the total relative contents of benzyl alcohol and linalool in 6 genotypes ranged from 8% to 30%, and Deng et al. (2004) and Li et al. (2009) detected that the total relative contents of benzyl alcohol and linalool were about 50%, which may be due to different test materials.

The results of aroma analysis at different flowering stages showed that there was little change in aroma types from the initial blooming stage to the blooming stage, which was different from the results of Li et al. (2009). The odoriferous habit of calysepalx is different from that of Jasmine. Jasmine needs to help certain environmental conditions and complete related physiological processes in vitro to form and release aroma substances (Shi Zhaopeng, 1997). Differences in odoriferous modes between the two may lead to differences in the processing techniques of green sepalus tea and Jasmine tea.

The sensory evaluation results showed that the main aroma type was almond aroma, which was closely related to the high benzaldehyde content in flowers. The aroma and taste quality of scented tea made of green calyx blossom scenting in full blossom and final blossom scenting were not as good as those in initial blossom, which may be due to the fact that the release of aroma substances in full blossom and final blossom scenting volatilized in large quantities by the leaves of the flowers, resulting in lower aroma concentration around the wax plum blossom in full blossom and final blossom. Thus, the adsorption capacity of tea was reduced, and the aroma of scented tea was weak and the taste concentration was low. Comparing the two different flower amounts, it was found that the quality of wax plum tea was improved with the increase of the total amount of flowers. When the total amount of flowers was 50kg/100kg, the score of sensory evaluation of plum tea was the highest.

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