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AN OVERVIEW OF OIL-BEARING ROSES IN CHINA

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Abstract

Essential oils from roses enjoy worldwide popularity due to their favourable aroma and diverse biological activities. Introduction and cultivation of oil-bearing roses is an essential step toward industrialization of the essential oils as enjoyable natural flavours and fragrances. China is the largest oil-bearing rose grower and has a long history of essential oil usage. In view of this, here, we generalized, in China, the status of introduction and cultivation of domestic and exotic oil-bearing roses, the chemical composition of the essential oils, as well as their hypnotic effect, one representative advance in functional analysis. The minireview enables quicker learning of the status of oil-bearing roses in China and provides informative guidance for further scientific research.

Keywords: oil-bearing roses, cultivation, essential oils, chemical composition, hypnotic effect.

INTRODUCTION

Rosa L., a genus of Rosaceae, consists of 200+ species, which are widely distributed across Asia, Europe, North Africa, and North America from the cold temperate to subtropics zones. Asia is the distribution centre of the genus *Rosa* L. as well as one of the major cradles (Wyile, 1954). *Rosa* L. is widely planted across north-south continental China as well as in alpine and plain areas. As recorded in 1985-version "Flora of China" (Yu, 1985), domestic and exotic species of *Rosa* L. in China were amounted to 82, and this number reached 115 in 2006 (Zhang and Zhu, 2004).

Plants of this genus boast major morphological characteristics such as creeping or upright shrubs, thorny branches, odd-pinnately compound leaves, and beautiful flowers with pleasant aroma (Liu, 1991). As early as in 2000, the Han Dynasty, *Rosa* L. has been introduced and domesticated in imperial gardens. The cultivars were classified into three categories, namely *Rosa rugosa*, *Rosa chinensis*, and *Rosa multiflora (Gao, 2011; Li, 2006)*, according to their botanical morphologies and flowering behaviours. Also, the application of these species based on their favourable qualities has been diversified till now. Roses in China are specifically referred to species with a scientific name of *Rosa rugosa* and their variant as well as their artificial and natural hybrids, exemplified by multi-petalled roses (*Rosa rugosa* cv. 'Plena'), and Kushui roses (*Rosa sertata×R. rugosa*), etc.

Historically, it has been well documented that rose petals per se or their extract were used as either medical materials or food additives. Nowadays, roses in China are cultivated majorly for ornamental purpose and, to a lesser extent, for essential oil (EO) production. Overall, in modern industrial production, the most paramount and economically effective application of roses is EO production. Species of genus *Rosa* L. whose flowers contained EOs are generally regarded as oil-bearing roses. The yield of EOs is extremely low, with 3-4 tons of fresh rose flowers merely yielding 1kg of pure Eos (Rusanov et al., 2011). Therefore, rose EOs are renowned for "liquid gold". The EOs, though expensive, enjoy great popularity with humans due to their sweet and pleasant aroma and see their wide application in areas

such as flavours, cosmetics, perfumes and aromatherapy as additives.

CULTIVATION OF OIL-BEARING ROSES

Since the rise and development of world flavour and fragrance industry in the 1950s, demand for rose essential oils increased substantially, which evoked a craze over the cultivation of oil-bearing roses in China. EOs of Damask roses feature internationally-accepted fragrance, optimal quality and the largest market demand (Wang and Yao, 2012; Wiley and Sons, 2010). Ever since the successful introduction of exotic roses in the 1980s in Shanxi and Hebei Provinces, other regions throughout China subsequently started the second-round introduction and cultivation techniques for rapid propagation (Rui et al., 2003). For instance, Institute of Botany, Chinese Academy of Sciences launched introduction experiments on Damask roses in Western Sichuan and Western Hubei Provinces and found that as the altitude of growing areas increased, the appearance of the incipient flowers delayed and the florescence prolonged (Chen et al., 2012). A whole set of effective breeding and cultivation techniques on root forming, compact planting and crown control were also generated (Xu and Su, 2006). Elsewhere, Damask roses were introduced from Weinan, Shanxi Province to Anji, Zhengjiang Province. The florescence was observed the next year and it was found that botanical characteristics remained unchanged (Wang et al., 2009). Recently, a new breed, “Zizhi” rose, was developed by Pingyin Rose Institute located in Shandong Province through artificial hybridization. Overall, the introduced rose species were mainly propagated through a cutting and tissue culture (Shou-Chao, 2008; Wang et al., 2012).

So far, major oil-bearing rose cultivars in China are Kushui rose, multi-petalled roses and Damask roses. China has the largest cultivation area in the world for oil-bearing roses (Wang and Yao, 2012). However, compared with Bulgaria and Turkey, China lagged behind in EO production, which was largely ascribed to limitations in cultivars and processing technologies. Additionally, nomination and genetic relationships among rose species cultivated in China were ambiguous. To rectify inappropriate nomination and elucidate the genetic relationships and further evaluate the rose germplasm resources in China, Wang (2013) performed a systematic investigation of oil-bearing resources and their genetic relationships. According to Wang (2013), a total of 11 cultivation bases were investigated which were majorly distributed between N 30º to N 40º. Among these sites, Pingyin base (in Shandong Province) had the longest cultivation history (1300 years) and a cultivation area as large as 30 000 acres. New bases located in Hetian, Xinjiang and Kushui, Gansu Provinces were also important planting sites which covered an area of 50 000 and 20 000 acres, respectively. Analysis of genetic diversity of 37 rose species based on DNA molecular marker, morphological marker and biochemical component marker technologies generally separated domestic species from exotic ones, indicating a remote relationship between the two categories. The results implied that crossbreeding of species from two categories is likely able to combine desirable qualities of the parents to maximize oil yield.

COMPONENT ELUCIDATION

The composition of rose EOs is very complicated with 400 more components identified so far, which are generally alcohols, esters, aldehydes, ketones and ethers, etc. Artificial rose oil products are extremely abundant; nevertheless, they are a far cry from the natural rose scent. So far, the internationally-recognized rose EOs with optimal quality are those from Damask roses planted in Bulgaria, from which 275 components have been identified according to authoritative reports (Ohloff, 1994). The oils consisted majorly of citronellol, geraniol and nerol, to name a few, as well as a trace amount of rose oxides, damascene and ionone, etc. which showed pretty high odour activity values (Mao and Li, 2006). The discovery of these trace components took the synthesis of rose-like scent one step further.

In China, concern was raised more over the composition of the EO from Kushui roses, which originates from Yongdeng, Ganshu Province and is the only nationally standardized rose oil (GB/T 22443-2008). Composition of the EOs was susceptible to extraction processes. For instance, main ingredients of EOs extracted through steam distillation reported by Zhou et al. (2009) were citronellol (54.58%), nerol (0.09%), geraniol (10.55%) and linalool (2.9%). By contrast, Niu et al. (2017) reported a dramatically different composition of the EO extracted by headspace solid-phase microextraction where the top three components were citronellol (18.9%), benzyl alcohol (14.92%) and geraniol (10.14%). Essential oils of Kushui roses shared similar major components (e.g., citronellol, geraniol and nerol) with that of Damask roses growing in India (Verma et al., 2011), Turkey (Baydar and Baydar, 2005) and Iran (Loghmani et al., 2007), while the scent was distinctive between them, possibly arising from the differences in trace components (Yu et al., 1994). Besides, EOs of rose cultivars from Pingyin (Song et al., 2018), Weinan (Zhang et al., 2003), Miaofengshan (Huang et al., 2011) and Xinjiang (Song et al., 2018) were also investigated.

HYPNOTIC EFFECT

Insomnia is a serious public health problem that a large number of people are suffering from. According to the statistics by the World Health Organization, the morbidity of insomnia among ordinary people is 10-30%, while in China the number of adults suffers reached 0.3 billion. Insomnia severely threats our mental and physical health (Buysse, 2013; Maquet, 2001; Walker, 2009). Traditional treatment for insomnia relies on medicine, which, however, exhibits all kinds of side effects. Essential oils could serve as a promising substitute for the medicine to control this problem with large efficacy and safeness.

Essential oil inhalation is a safe, soothing and reliable administration pathway for young and old adults. Numerous studies have demonstrated that some EOs extracted from aromatic plants such as lavender (Goel et al., 2005), valerian (Marder et al., 2003) and sweet orange (Kawai et al., 2018) were able to improve sleep quality with few side effects. As an example, Chen and Yao (2016) exposed 20 youths with sleep disorders to lavender and *Cinnamomum camphora* based complex plant EOs via continuous sniffing. The results turned out to be that 17 out of the 20 subjects witnessed variations of four types of sleep brain waves ≥ 2%, indicating obvious improvement in sleep quality. Compared with EOs from other aromatic plants, EOs from roses feature more pleasant odour, greater popularity and a higher degree of industrialization. Hypnotic effects of rose EOs together with other medicinal effects such as soothing and anxiolytic effects were reported abroad; nevertheless, the effect of rose oils on improving sleep quality of people, youths, in particular, a vulnerable group worth public care, are relatively less addressed in China. Recently, Luo (2018) reported that the hypnotic effect of essential oils of Kushui rose was better than that of Damask rose. The results showed that essential oils of Kushui rose at the concentration of 1 mg/mL prolonged the sleep duration by 131.69%, reduced the autonomous activity by 36.22% and decreased the body temperature of mice, compared with the blank control. As a special rose resource in China, Kushui rose shows a more favourable quality over Damask roses in improving sleep quality. This scientific finding may pave the way for exposing more rose resources in China to the world.

CONCLUDING REMARKS

Resources of oil-bearing roses in China, wild or breeded, are fairly abundant. The number and acreage of planting bases are expanding yearly. In addition to traditional rose species, a number of exotic species were successfully introduced and domesticated. Remarkable fruits have been yielded. Under these circumstances, to investigate the relationship between yield and composition of rose EO and geographical environment provides scientific proofs guiding base construction and production. In addition, the remote genetic relationship between domestic

roses and exotic species implies that cross-breeding between the two groups could be a promising approach to obtain new breeders with favourable oil-bearing genes. In the past decade, we saw soaring studies on cultivation and functionalities of oil-bearing roses and an expanding multi-purpose application of rose EOs in China. In future, with more advanced processing technology of EOs developed and employed, China's rose EO affairs will play a key role in world natural product market.

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