

# Study on Planting Techniques of Medicinal Plant *Anchusa italica* Retz.

Nurbolat Aidarhan<sup>1</sup>, Sawle Abaihan<sup>2</sup>, Geyu LIU<sup>1</sup>, Chunfang LU<sup>1</sup>, Haji Akber Aisa<sup>1\*</sup>

1. State Key Laboratory Basis of Xinjiang Indigenous Medicinal Plants Resource Utilization, Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Urumqi 830011, China; 2. Grassland Station of Xinjiang Uygur Autonomous Region, Urumqi 830049, China

**Abstract** *Anchusa italica* Retz., a perennial herb, has the effects of clearing away heat and toxic materials, and killing parasites to relieve itching. It is mainly used for breast abscess, sore swollen poison, scabies and so on, and serves as one of the commonly used medicinal materials in Uygur medicine. *A. italica* is distributed in Iran, Europe, Afghanistan and Kazakhstan. It is cultivated in China, and Xinjiang mostly imports it from Pakistan. This study belongs to the technical field of traditional Chinese medicine planting. The planting method solves the technical problems of sowing, field management, harvesting and processing of *A. italica*.

**Key words** Biological characteristic; Planting technique; Medicinal value; Chemical composition

**DOI:**10.19759/j.cnki.2164-4993.2024.05.004

*Anchusa italica* Retz., also known as Yangti and Yetiancai, is a perennial herb medicinal plant of Boraginaceae. It grows in areas with an altitude of 300–3 000 m, distributed in Europe, Iran, Afghanistan, Pakistan, Kashmir, Caucasus, Kazakhstan and other places. It is cultivated in some regions in China, such as Hotan and Kashgar in Xinjiang. *A. italica* is one of the commonly used medicinal materials in Uygur medicine, mainly with the aboveground part. Its Uighur medicine name is Gauzwan, which is a common medicinal material for treating cardiovascular and cerebrovascular diseases. It has the functions of generating damp and heat, regulating abnormal savda, nourishing brain, dispelling cold and nourishing heart, and relieving cough and asthma.

Among many classic compound preparations in Uygur medicine, *A. italica* is one of the main ingredients. This study belongs to the field of planting technology of exotic species, and the cultivation techniques solve the technical problems of sowing, field management, harvesting and processing of *A. italica*. Relevant research can solve the demand of researchers and pharmaceutical enterprises for *A. italica* medicinal materials while solving the shortage of *A. italica* resources and providing a basis for the development and application of *A. italica* resources.

## Biological Characteristics of *A. italica*

*A. italica* is a perennial herb. The stems are erect, 0.6–1.0 m high, usually unbranched or branched in the upper inflorescence, and densely strigose with long white bristles with basal plates. The basal leaves and the lower leaves of the stem are oblong to

oblanceolate, 10–30 cm long and 4–6 cm wide, and the upper leaves of the stem are sessile and small. The inflorescence is terminal and axillary, branched, and elongates during the fruiting stage. The inflorescence axis, bracts, pedicel and sepals are all densely strigose. The bracts are linear to linear lanceolate. The pedicel is nearly erect, 1–3 mm long and elongates to about 1 cm in the fruiting stage. The calyx is 10–12 mm long, 5-lobed to near the base, and the lobes are linear-lanceolate, acuminate at the apex, and about 2.0 cm long in the fruiting stage. The corolla is blue, about 5–8 cm long, and has a tube part as long as the calyx or slightly longer, slightly curved, hairless, and an eave part about 1.0 cm in diameter, and the lobes are nearly round, about 5 mm wide and about 2 mm long. The stamens are inserted below the throat, and the anthers are about 3 mm long, and the filaments are about 2.5 mm. The style is more than 1.0 cm in length. The nutlets are about 3–5 mm long, with raised reticulation and small wart spots on the surface.

## Medicinal Value of *A. italica*

*A. italica* is one of the commonly used medicinal materials in Uygur medicine for treating cardiovascular and cerebrovascular diseases, which has the functions of generating damp and heat, regulating abnormal savda, nourishing brain, dispelling cold and nourishing heart, refreshing heart, and relieving cough and asthma. As recorded in *Zhuyidian*, *Baidi Yiyaoshu* and *Yaowuzhiyuan*, *A. italica* has the effects of clearing away heat and toxic materials, killing parasites to relieve itching, generating damp and nourishing brain, dispelling cold and nourishing heart, refreshing heart, moistening dryness, diminishing inflammation, pneumonia and tuberculosis, and relieving cough and asthma due to cold; *A. italica* has the effects of widening chest and strengthening heart, and eliminating fear; *A. italica* is mainly used for treating indications for febrile palpitations, phobias, depression, and cough—*Zhuyidian*; *A. italica* can eliminate ulcers, moisten the

Received: July 26, 2024 Accepted: September 29, 2024

Supported by Scientific Research Project of Central Asian Center of Drug Discovery and Development, Chinese Academy of Sciences (CAM202204).

Nurbolat Aidarhan(1971–), male, P. R. China, PhD, associate researcher, devoted to research about medicinal plant resources and biotechnology.

\* Corresponding author. E-mail: haji@ms.xjb.ac.cn.

lungs and relieve cough; it is used for treating oral ulcer, cough and chest pain in children—*Baidi Yiyaoshu*; *A. italica* has the effects of generating damp, diminishing inflammation, calming nerves, eliminating jaundice, dissolving stones and expelling stones, and is used for treating meningitis, madness, kidney stone, bladder stones—*Yaowuzhiyuan*; the extract of *A. italica* can resist oxidation, cardiac injury and reduce cell apoptosis; *A. italica* has the function of killing protozoa, and can be used as a laxative and antidote; and *A. italica* can treat palpitation due to heat, phobia, depression, cough, *etc.*<sup>[1]</sup>.

## Chemical Components and Pharmacological Effects of *A. italica*

### Chemical Components

The whole herb of *A. italica* is used as a medicine, which contains steroids, triterpenoids, volatile oil, phenols, tannins, flavonoids, alkaloids, sugars, coumarins, amino acids, protein, lactones, saponins and other chemical components<sup>[2]</sup>. In many classic compound preparations of Uyghur medicine, such as Aifei Timeng Decoction and abnormal savda maturing agent, *A. italica* is one of the main components.

### Pharmacological effects

*A. italica* has the effects of relieving cough and phlegm, resisting bacteria and diminishing inflammation, clearing away heat and toxic materials, promoting blood circulation to remove blood stasis, and promoting diuresis. Therefore, it is found that *A. italica* has antiviral, antitumor, antioxidant, anti-inflammatory, cardiovascular protection, memory enhancement and other pharmacological effects<sup>[2]</sup>.

## Cultivation Techniques of *A. italica*

*A. italica* is required to be cultivated in sunny areas. It is cold-resistant, unsuitable for high temperature in summer and suitable for well-drained soil. *A. italica* is generally propagated by mature seeds, and can also be propagated by plants. In southern Xinjiang of China, spring sowing is carried out in early and mid April, and autumn sowing is in October – November<sup>[3-5]</sup>.

### Soil preparation and fertilization

Before sowing *A. italica* seeds, it is necessary to turn over the ground and prepare the soil. Combined with the soil preparation, 2 500 – 3 000 kg of decomposed organic fertilizer is applied per mu, and then the ground is subjected to rotary tillage by a rotary cultivator, and harrowed carefully to make flat ridges with a width of 1.5 – 2.0 m. Water is introduced as the bottom water once for use.

### Variety determination

According to the *Drug Standard of Ministry of Public Health of the People's Republic of China* (Volume of Uygur Medicine) [Xinjiang Science and Technology Health Publishing House, first printed in October 1999, page 14-*A. italica*] (compiled by Chinese Pharmacopoeia Commission), the Uyghur medicine *A. italica* is *A. italica* Retiz of Borraginaceae.

## Sowing

After pouring the bottom water for 4 – 5 d, the surface of the border can be raked and leveled for sowing, and the sowing method is generally drill sowing. Under suitable conditions, dry seeds of *A. italica* are directly sown. If conditions permit, seeds can also be soaked at 20 °C to accelerate germination, and then sown after germination, which is called germination-accelerating sowing method. Generally, the method of drill sowing is adopted, and furrows are made in the whole border with a row spacing of 30 – 40 cm, and the seeds are evenly scattered in the furrows, and covered with fine wet soil based on the standard that no seeds can be seen. After sowing, appropriate amount of water can be sprayed according to the soil moisture. The sowing amount depends on the germination rate of seeds in the current year, and generally ranges from 4 500 to 7 500 g/hm<sup>2</sup> under normal circumstances.

### Field management

After emergence, the early growth of *A. italica* seedlings is slow, and in order to prevent the growth of seedlings from being inhibited by weeds, it is necessary to perform intertillage and weeding in time. The seedlings are watered once when they have 1 – 2 true leaves to keep the soil moist, and then once every 10 d. The weather in southern Xinjiang of China is dry, so attention should be paid to watering. When the seedlings have 2 – 3 true leaves, the spacing between plants is generally 35 – 45 cm, which can promote development of the root system. If the soil fertility is sufficient, the yield can be increased by proper close planting. When the seedlings have 3 – 4 true leaves, water should be controlled properly. After thinning, topdressing should be done once, combined with watering. Generally, 75 – 120 kg/hm<sup>2</sup> of urea should be applied. *A. italica* can be harvested two months after sowing.

## Conclusions

Based on the study on the biological characteristics and planting techniques of the medicinal plant *A. italica*, firstly, according to the growth characteristics and environment of *A. italica*, the soil should be turned over and the base fertilizer is reasonably applied. Secondly, planting is carried out by drill sowing, and the conditions such as seed germination time, watering and temperature in planting base have been mastered. Thirdly, according to the different growth stages of *A. italica*, timely field management measures such as seedling thinning, topdressing, watering and weeding can meet the growth needs of *A. italica*. Finally, the harvesting time, harvesting, drying and storage methods of the whole herb have been determined, which provides mature technical support for large-scale planting in the future. It is believed that the planting techniques of *A. italica* can replace imported medicinal materials and provide technical support for the large-scale planting of *A. italica* in related pharmaceutical companies in China.

## Conclusions and Discussion

### 1.8% NaCl treatment significantly improved the salt tolerance of rice varieties at the seedling stage

According to the above results, after 1.8% NaCl treatment, the seedling survival rates of all tested lines were significantly improved. In specific, the seedling survival rate of line 151465 increased by 128%, and the values of lines 151425, 151343 and 151342 increased by 87%, 40% and 89%, respectively. The 2.2% NaCl salt treatment could also improve the seedling survival rate of rice lines, but the increase rate was smaller than that of the 1.8% NaCl treatment, indicating that the 1.8% NaCl seed soaking treatment was the best salt concentration.

### Soaking seeds with high concentrations of salt for 1 d could significantly improve the germination rate of rice seeds and the salt tolerance of rice seedlings

Through the analysis of the effects of different salt treatment time on the salt tolerance at the seedling stage of strain 151465, the average survival rate of seedlings treated for 1 d was 48%, which was significantly higher than 39% of seedlings treated for 2 d (39%), indicating that the appropriate salt soaking time was 1 d.

After soaking the seeds in 1.8% NaCl solution for 1 d, the average germination rate of the three lines was 94%, which was extremely significantly higher than that free of salt water soaking.

### Adversity training could improve the adaptability of plants or their ability to cope with adversity

The earliest research on the training effect of plants mainly focused on the adversity training effect induced by biological stress. Pretreatment of plants with sublethal dose of pathogenic bacteria can improve the resistance of plants to pathogenic bacteria<sup>[4-9]</sup>. As an active strategy to cope with adversity, adversity training has great application potential in production experiments, so it has attracted more and more attention<sup>[10]</sup>. Based on the type and time of subsequent abiotic stress, pretreating seeds with concentrated salt water in this study belong to the same type of adversity training effect in contemporary times, that is, the adversity training is the same as the subsequent actual stress. It can be seen by analyzing previous studies on contemporary training effects that there are still many aspects to be clarified in the pretreatment of

adversity training, such as the stage, degree and duration of adversity pretreatment. In this study, it was also found that there were significant differences among different salt water concentrations, different pretreatment days and different lines. Among them, soaking seeds in 1.8% NaCl solution for 1 d achieved the best effect on the salt tolerance of rice varieties at the seedling stage.

The mechanism of salt stress training of rice needs further study, so as to provide a basis for practical salt stress training with obvious effect, reduce the effect of salinization abiotic stress on rice growth and development, and improve the utilization rate of saline-alkali land.

## References

- [1] YU YL. Discussion on soil improvement and rice cultivation techniques in saline-alkali land[J]. Agricultural Science&Technology and Equipment, 2023, 314(2): 46-47. (in Chinese).
- [2] GER ONA M, DEOCAMPO MP, EGDANE JA, *et al.* Physiological responses of contrasting rice genotypes to salt stress at reproductive stage [J]. Rice Science, 2019, 26(4): 207-219.
- [3] ZHENG YJ. Discussion on soil improvement and rice cultivation techniques in saline-alkali land[J]. North Rice, 43(5): 71-74. (in Chinese).
- [4] CONRATH U, PIETERSE CMJ, MAUCH-MANI B. Priming in plant-pathogen interactions[J]. Trends in Plant Science, 2002, 7(5): 210-216.
- [5] HILKER M, SCHWACHTJE J, BAIER M, *et al.* Priming and memory of stress responses in organisms lacking a nervous system[J]. Biological Reviews of the Cambridge Philosophical Society, 2016, 91(4): 1118-1133.
- [6] CONRATH U, BECKERS GJM, FLORS V, *et al.* Priming: Getting ready for battle[J]. Molecular Plant-microbe Interactions: MPMI, 2006, 19(10): 1062-1071.
- [7] ENGELBERTH J, ALBORN HT, SCHMELZ EA, *et al.* Airborne signals prime plants against insect herbivore attack[J]. Proceedings of the National Academy of Sciences of the USA, 2004, 101(6): 1781-1785.
- [8] TON J, D'ALESSANDRO M, VIOLAINE JOURDIEI GJ, *et al.* Priming by airborne signals boosts direct and indirect resistance in maize[J]. The Plant Journal, 2007, 49(1): 16-26.
- [9] BECKERS GJ, JASKIEWICZ M, LIU Y, *et al.* Mitogen-activated protein kinases 3 and 6 are required for full priming of stress responses in *Arabidopsis thaliana*[J]. The Plant Cell, 2009, 21(3): 944-953.
- [10] WANG X, LIU F, JIANG D. Priming: A promising strategy for crop production in response to future climate[J]. Journal of Integrative Agriculture, 2017, 16(12): 60345-60347.

Editor: Yingzhi GUANG

Proofreader: Xinxiu ZHU

(Continued from page 15)

## References

- [1] State Administration of Traditional Chinese Medicine. Chinese materia medica[M]. Shanghai: Shanghai Scientific and Technical Publishers, 1999. (in Chinese).
- [2] HE YY, WANG JF, GUO LN, *et al.* Research progress of chemical components and pharmacologic effects of *Anchusa italica* Retz. [J]. Global Traditional Chinese Medicine, 2017, 10(1): 114-119. (in Chinese).
- [3] FU J, LI X. Research and application of Uighur drug *Anchusa italica* Retz. [J]. Journal of Anhui Agricultural Sciences, 2015, 11: 111-112, 115. (in Chinese).
- [4] YE JQ. Flower gardening[M]. Shanghai: Shanghai Literature & Art Publishing House, 1997. (in Chinese).

- [5] RAN XD. The ocean of Chinese medicine[M]. Haerbin: Haerbin Press, 1993. (in Chinese).
- [6] PENG C. China dictionary of clinical drugs; Chinese herbal pieces volume[M]. Beijing: China Medical Science and Technology Press, 2018. (in Chinese).
- [7] XIAO X. Several cultivation methods of wild vegetables[J]. Modern Agriculture Research, 2006, 1: 14. (in Chinese).
- [8] CHEN CC, PANG Z, XU WW. Research on chemical components of *Nioshecao* and its pharmacological activity[J]. Western Journal of Chinese Medicine, 2018(11): 140-145. (in Chinese).
- [9] CHANG W, DAI JG, MA GZ. Preliminary tests for chemical components of *Anchusa italica* Retz. [J]. Journal of Anhui Agricultural Sciences, 2015(10): 85-86. (in Chinese).

Editor: Yingzhi GUANG

Proofreader: Xinxiu ZHU