

# Protection of Wild Fruit Forest in Tianshan Mountains



**Qiao Jianfang**

[jfqiao@ms.xjb.ac.cn](mailto:jfqiao@ms.xjb.ac.cn)

XINJIANG INSTITUTE OF ECOLOGY AND GEOGRAPHY CHINESE ACADEMY OF SCIENCES  
2022.12.9

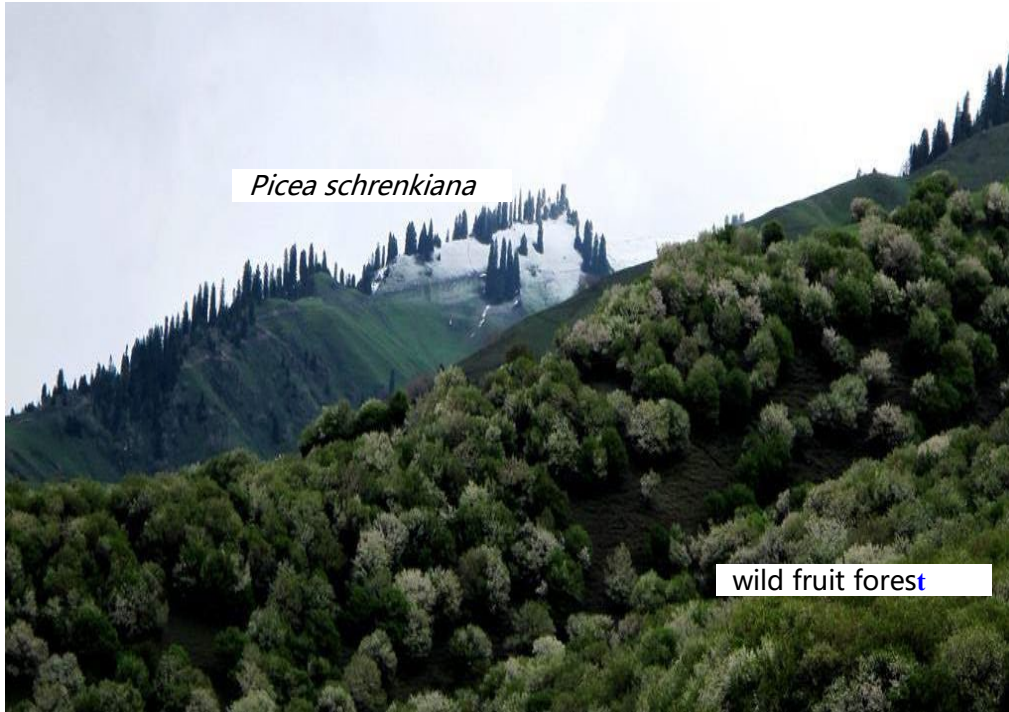
- Tianshan mountain is located in the hinterland of Eurasia, which is one of the seven mountain systems in the world, and one of the 36 biodiversity hotspots in the world.
- The total length of Tianshan Mountains is about 2500 kilometers, spanning China (Xinjiang), Kazakhstan, Kyrgyzstan and Uzbekistan







Tianshan wild fruit forest is a temperate deciduous broad-leaved forest with Xinjiang wild apple (*Malus sieversii*) as the dominant species.



Many species are the "**ancestors**" of modern cultivated fruit trees, including apple, apricot, walnut, hawthorn, plum, etc.



Wild fruit forests in Tianshan suffered from serious ecological degradation, with a death rate of 80% in some populations since 2012. The outbreak of diseases, including rust, valsa canker, powdery mildew, and invasive pest, *Agrilus mali*, cause severe harm.



Shot in the same place, in the same season  
and in different years

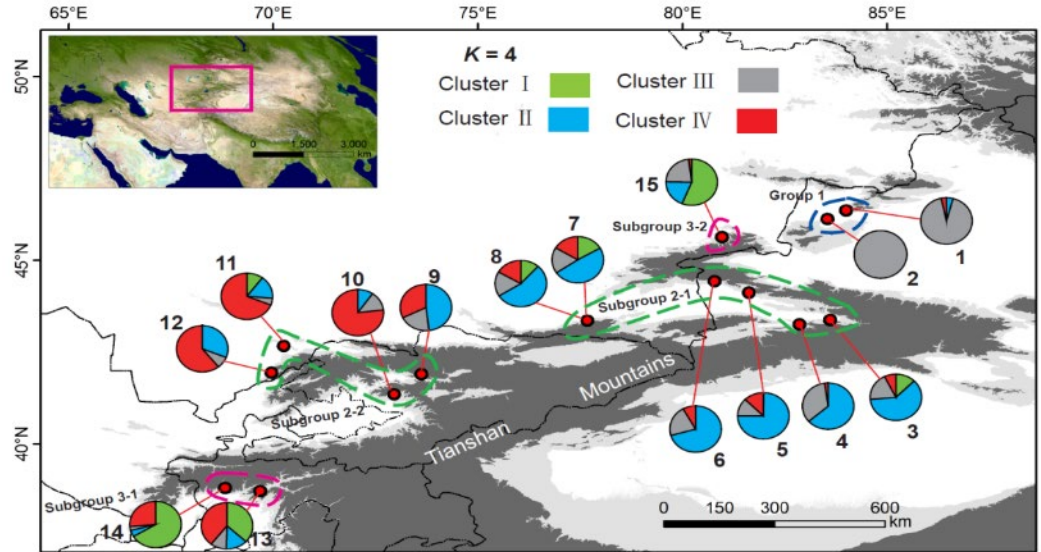
## **Science – Policy – Improve the Wild Apple Trees Conservation**

- ❑ In November 2014, XIEG put forward an advisory proposal report, entitled "Suggestions of CAS Experts on rescue protection of the Natural Gene Bank of Wild Fruit Forest in Tianshan Mountains" to Xinjiang government and had aroused wild public concern.**
- ❑ On January 14, 2015, the Ministry of Science and Technology organized relevant departments and experts to discuss the scientific and technological issues of rescue protection of wild fruit forests in Tianshan, Xinjiang.**
- ❑ Subsequently, the key research and development plan of the Ministry of Science and Technology, "Ecological Conservation and Health Control Technology of Degraded Wild Fruit Forest on the North Slope of Tianshan Mountains", was implemented, and got highlighted results as followed.**

## Highlights 1:

Verified wild apple is the ancestor of modern apples by genetic markers, which laying a foundation for the protection of germplasm resources

- Genetic Diversity and Genetic Differentiation Pattern of Wild Apple in Xinjiang
- Based on the analysis of reasonable genetic grouping structure, it is suggested that five protection units should be established for cross-border protection of wild apples.

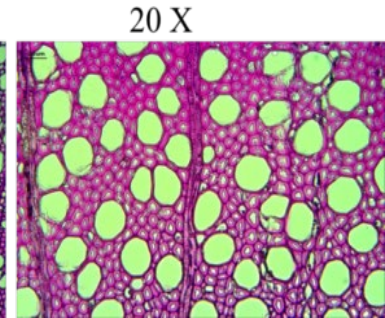
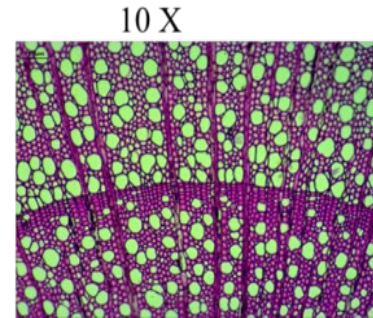
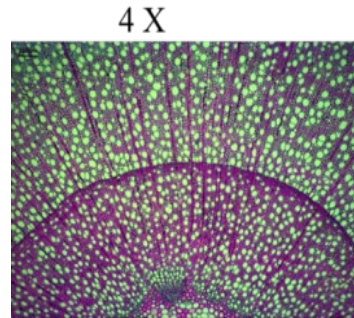


Pedigree distribution of wild apple populations in China and Central Asian countries (K=4)

## Highlights 2:

**Clarified the main causes of wild apple tree: the failure of water transportation was the direct cause of the decline and death.**

Nutrient absorption of plant is not the cause of plant degradation;  
Plants have a tradeoff relationship between efficient water use and transportation safety

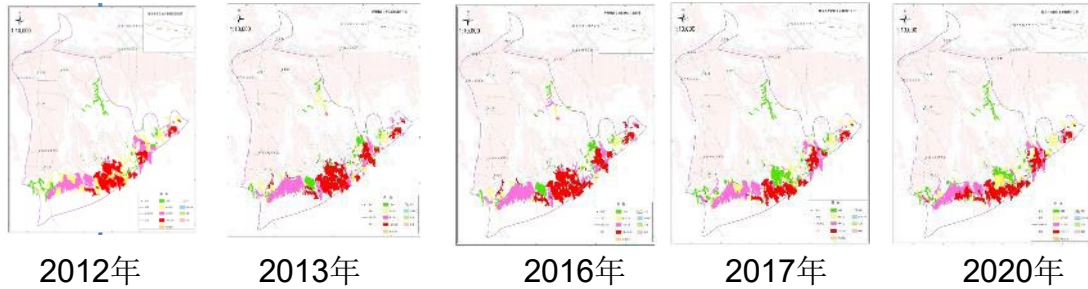


Degenerated individuals tend to have thicker ducts to increase transport capacity, but their safety is significantly reduced

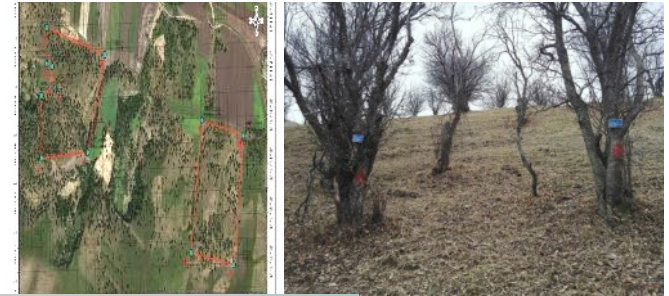


### Highlights 3:

Established remote sensing classification technology system and analyzed the spatial and temporal changes in the health status of wild fruit forests in the past decades.



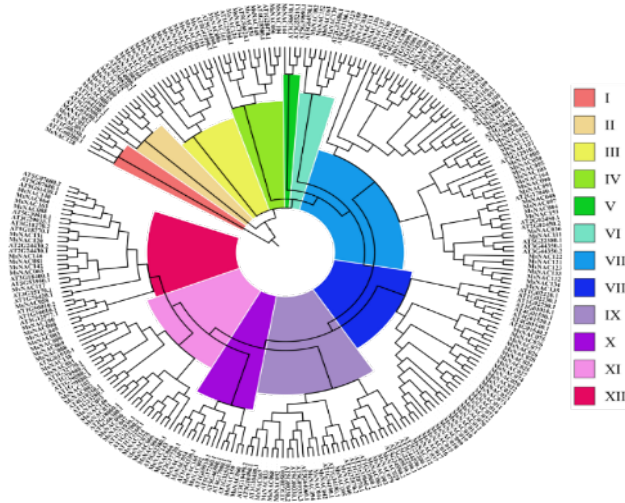
Monitoring, warning and control systems of wild fruit forests in TianShan were constructed



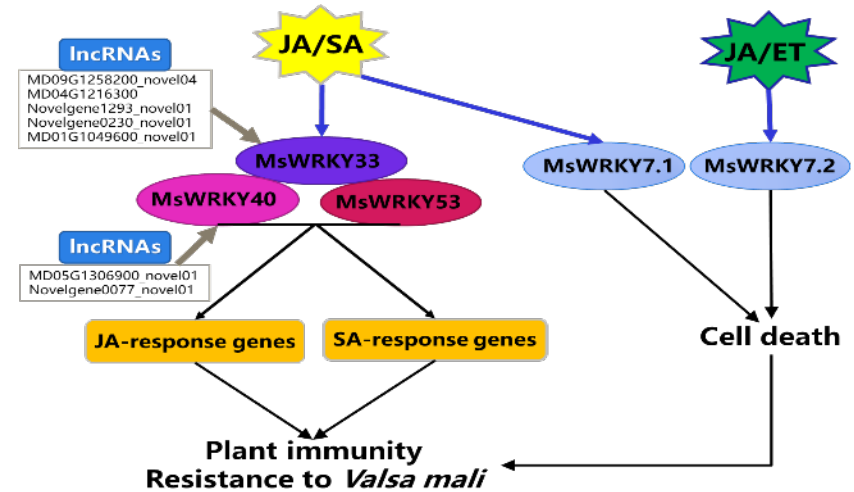
Prevention and treatment trial demonstration base (110 acre)

## Highlights 4:

Deeply mining genetic resources of will apple tree. More than 40 disease-resistance-related genes were identified and used for further genetic improvement



**NAC** Expression pattern and quantitative verification of qRT PCR



WRKY Transcription Factor Mediated Disease Resistance Regulation Pathway



## Highlights 5:

# Construction and demonstration of artificial renewal and rejuvenation technology system of wild apple forest in Tianshan Mountains



## 1 Biological control system combining natural enemy insects and fungal infection

- Release parasitic wasps separately
- Release Demodex separately
- Release Beauveria bassiana alone
- Parasitic wasps+mites
- Beauveria bassiana+Demodex



释放肿腿蜂和蒲螨



释放病原微生物

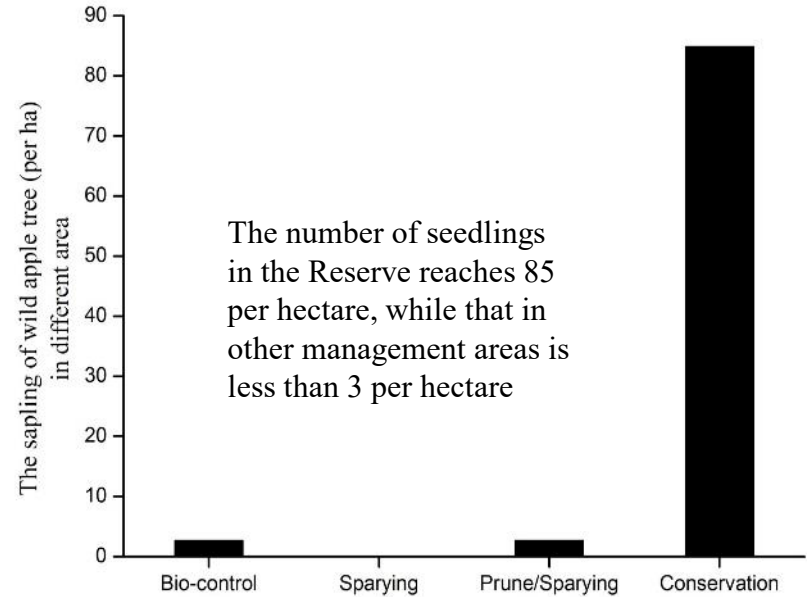
畸柄啮小蜂



球腹蒲螨

## 2 Application of rejuvenation technologies and demonstration

### Mode 1: seedling conservation and enclosure



Effect of establishing fence protection area



## 2 Application of rejuvenation technologies and demonstration

### Mode 2: Early sanitary nursery management facilitates stock rejuvenation Renewal



St ump



Low pr uni ng



Hi gh pr uni ng



## 2 Application of rejuvenation technologies and demonstration

### Mode 3: Construct artificial fast propagation, planting and nurturing technologies of wild apple tree

Artificial Breeding Techniques of Wild Apple Seedlings



Field planting technology of wild apple seedlings covered with film



Invention patent: "A method for accelerating the germination of Xinjiang wild apple seeds" (201710566588.0)



## 2 Application of rejuvenation technologies and demonstration

### Mode 3: Construct artificial fast propagation, planting and nurturing technologies of accompany plants

#### Species selection:

*Berberis thunbergii*, *Lonicera japonica*, *Rosa sp.*, *Ribes nigrum*,  
*Cerasus tianshanica*, *Prunus domestica*

#### Breeding technology:

Tissue culture propagation, cutting propagation, layering propagation and grafting propagation technology



忍冬绿枝扦插生根技术



蔷薇绿枝扦插生根技术



天山樱桃硬枝扦插技术



欧洲李组织培养技术



欧洲李芽接技术



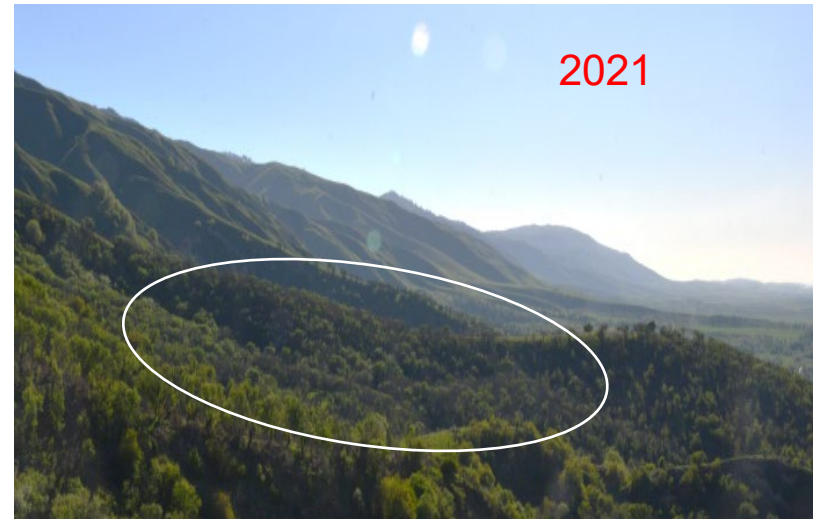
欧洲李绿枝扦插生根技术

## 2 Application of rejuvenation technologies and demonstration

### Mode 4: Demonstration of irrigation-free artificial seedling regeneration technology at different sites



- The above models, technologies and operating procedures were adopted by the government of Xinyuan County and the government of Yili Prefecture. 105 hectares of the core area and 1080 hectares of the demonstration area were completed, and the degraded wild fruit forest was recovering.





# Local people have been benefitting from wild apple forest conservation

1. A healthy ecosystem creates a harmonious living environment, which greatly increase the happiness of local residents
2. Modern apple innovation. Use flavonoid and anthocyanin regulation pathway related genes to create red flesh apple, full of nutrition and excellent commercial properties



鲁 S-SV-MD-010-2019; 鲁 S-SV-MD-009-2018;  
鲁 S-SV-MD-010-2018; 鲁 S-SV-MD-008-2018

3. Maintaining the healthy development of the local wild apples related biological industry, and improving the livelihood of local people



# Thanks for your attention







# Conservation and Sustainable Use of Biodiversity for Green Livelihood in Arid Lands

Conserving Biodiversity • Building a Community of All Life in Arid Lands

Time: 13:15-14:45

Date: December 11<sup>th</sup>, 2022

Venue: China Pavilion