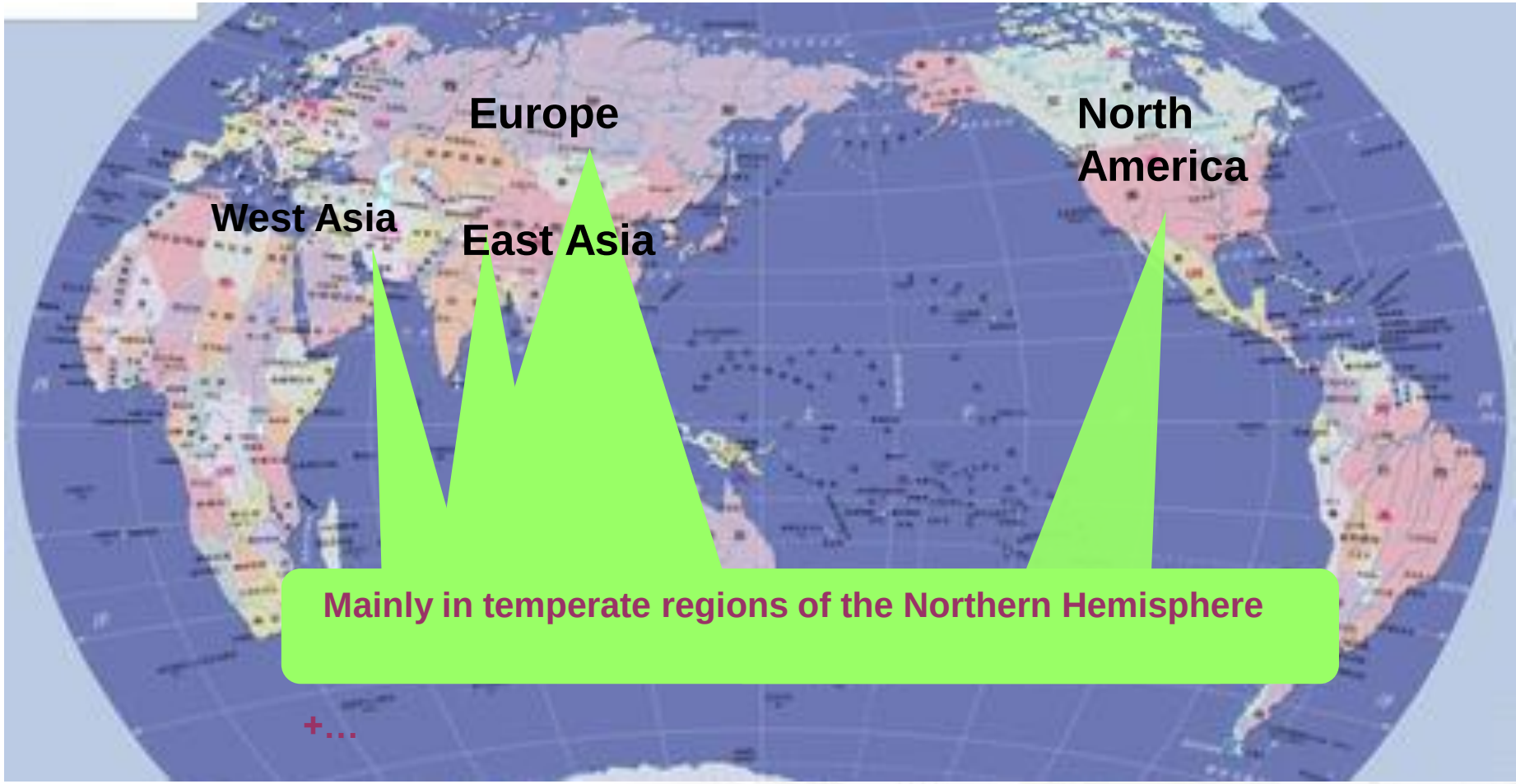
From breeding to Chinese lilac stories

中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Hongxia Cui

May 24, 2018, Russia

Cultivars in the world



Wild lilacs in the world

Balkan Peninsula

Europe

IB-CAS

中国科学院植物研究所

INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Why do we do lilac breeding ?

IB-CAS

中国科学院植物研究所

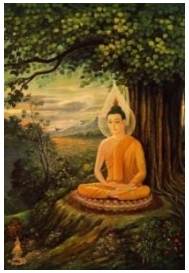
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Chinese love lilacs

Being culture carrier



- Cultivation records can be dated back to the late Tang Dynasty (618-907) and used in the royal gardens in Ming(1368-1644) and Qing dynasties(1644-1912)



- Being the Bodhi Tree in North China in ancient times owing to *Ficus religiosa* L. can not be alive in North China

- Being a spiritual symbol: be fearless of adversity, tenacious growth, flourishing and magnificent landscape





IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Case 1: Tanzhe Temple in Beijing（built in 307 in Xijin Dynasty）. The first Buddhist temple when Buddhism was introduced into Beijing

Case 2: Jietai Temple in Beijing（Built in 622 in Tang Dynasty）

Case 3: Fayuan Temple in Beijing

（Built in 645 in Tang Dynasty）

Case 4: Taer Temple in Qinghai（Built in 1377 in Qing Dynasty）

City flower

IB-CAS
中國科學院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Hohehot, provincial capital of Inner Mongolia

Harbin, provincial capital of Heilongjiang

Xining, provincial capital of Qinghai

City flower

Hohehot, provincial capital of Inner Mongolia



Harbin, provincial capital of Heilongjiang




Xining, provincial capital of Qinghai

Poems, songs, paintings, art work

Problems

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Seeding propagation

Color degradation

Less diversity in cultivars

Less colorful

High humidity+high temperature

Weak growth for semi-alpine- and abroad cultivars

Solusions

Fine genes in native wild species should be used in improving ornamental characteristics and stress resistance

IB–CAS

中國科學院植物研究所

INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

What we have been doing …

Outline

Wild species collections(1958-2018)→Cultivar collections(2005-2017) → Adaptation mechanism research (2003-2017) → Breeding (1967-2018)→Distinctness, Uniformity, Stability (DUS) testing (1970-2018)→PVP(2015-2018) →Propagation (1980-2018) →Practical application(2014-2018)

Breeding

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Diverse flowering seasons
(more earlier，more late, close connection)

Humid-hot resistance
(adaptative in North, central, East China)

Special color
(dark red, pink, yellow)

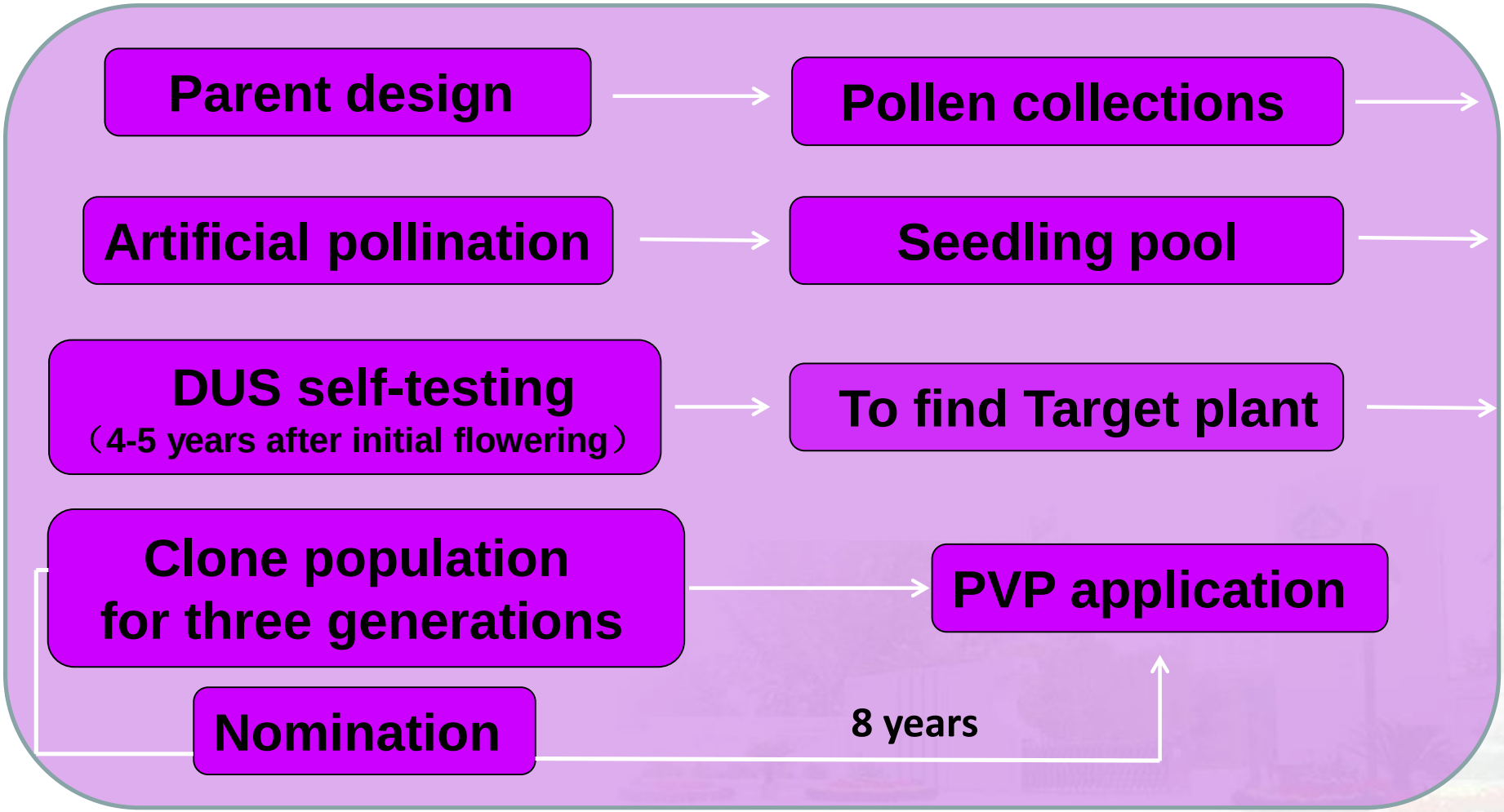
Strong fragrance
(more Octatriene & Benzene)

Diverse flower type
(lobe types, inflorescence(dense/large))

Strategies of breeding

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

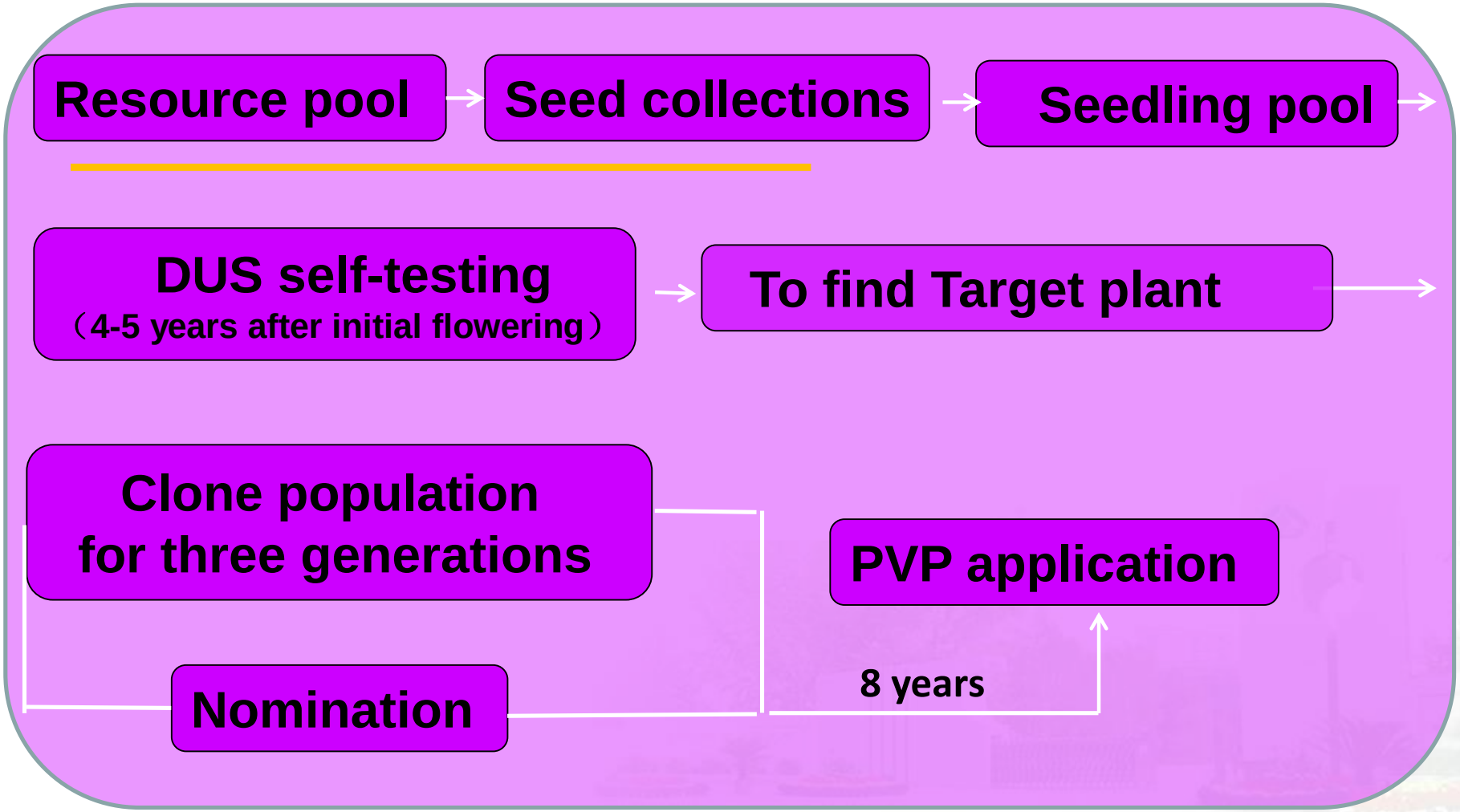
1. Artificial pollination (1960s-2017)



Strategies of breeding

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

2. Open pollination (2016-2017)



IB-CAS
中國科學院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Operation of artificial pollination


Get rid of stamen


Artificial pollination


Bagging


Seedlings hybrids


Mature plants of hybrid

8 years

DUS Test


Target hybrids


S. oblata (♀)


S. pekinensis (♀)

Case 1&2： Interspecific crossing -combine ornamental with resistance

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

S. protolaciniata ♀ × *S. oblata* ♂

Hybrid 1: reddish purple & vigorous growing in hot season in North China

S. meyeri ♀ × *S. microphylla* ♂

Hybrid: flowering continuation between parents

Case 3: Interspecific crossing -combine ornamental with resistance

S. oblata ♀ × *S. vulgaris* 'Alba-plena' ♂

×

S. × *hyacinthiflora* 'Luo Lan Zi

S. × *hyacinthiflora* 'Xiang Xue'

S. × *hyacinthiflora* 'Zi Yun'

Hybrids: diverse color and pleasant scent with vigorous growth in humid-hot season in North China
double petals for most of hybrids

Case 4&5 : Selection from open pollination -outstanding ornamental characteristics

Hybrids: darker coloration and late flowering season with vigorous growth in humid-hot season in North China

Some cultivars (1970-2017)

IB-CAS
中國科學院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES











Certified and protected cultivars

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Certified by National Forestry Bureau


林木良种证
（审 定）
良种名称 罗蓝紫
树种 丁香
学名 *Syringa oblata* × *S. vulgaris* cv.Luolanzi
良种编号 国 S-SV-SO-005-2005
适宜推广生态区域
辽宁、北京、内蒙等地区栽植。
编号：（2005）第 05 号 发证机关 2005 年 12 月 30 日


林木良种证
（审 定）
良种名称 香雪
树种 丁香
学名 *Syringa oblata* × *S. vulgaris* cv.Xiangxue
良种编号 国 S-SV-SO-006-2005
适宜推广生态区域
辽宁、北京、内蒙地区栽植。
编号：（2005）第 06 号 发证机关 2005 年 12 月 30 日


林木良种证
（审 定）
良种名称 晚花紫
树种 丁香
学名 *Syringa oblata* 'Wan Hua Zi'
良种编号 国 S-SV-SO-009-2011
适宜推广生态区域
北京、内蒙古等丁香适宜栽培区。
编号：（2011）第 09 号 发证机关 2011 年 12 月 30 日

Authorized by PVP of National Forestry Bureau

Being tested in Netherland for applying for PVP in abroad

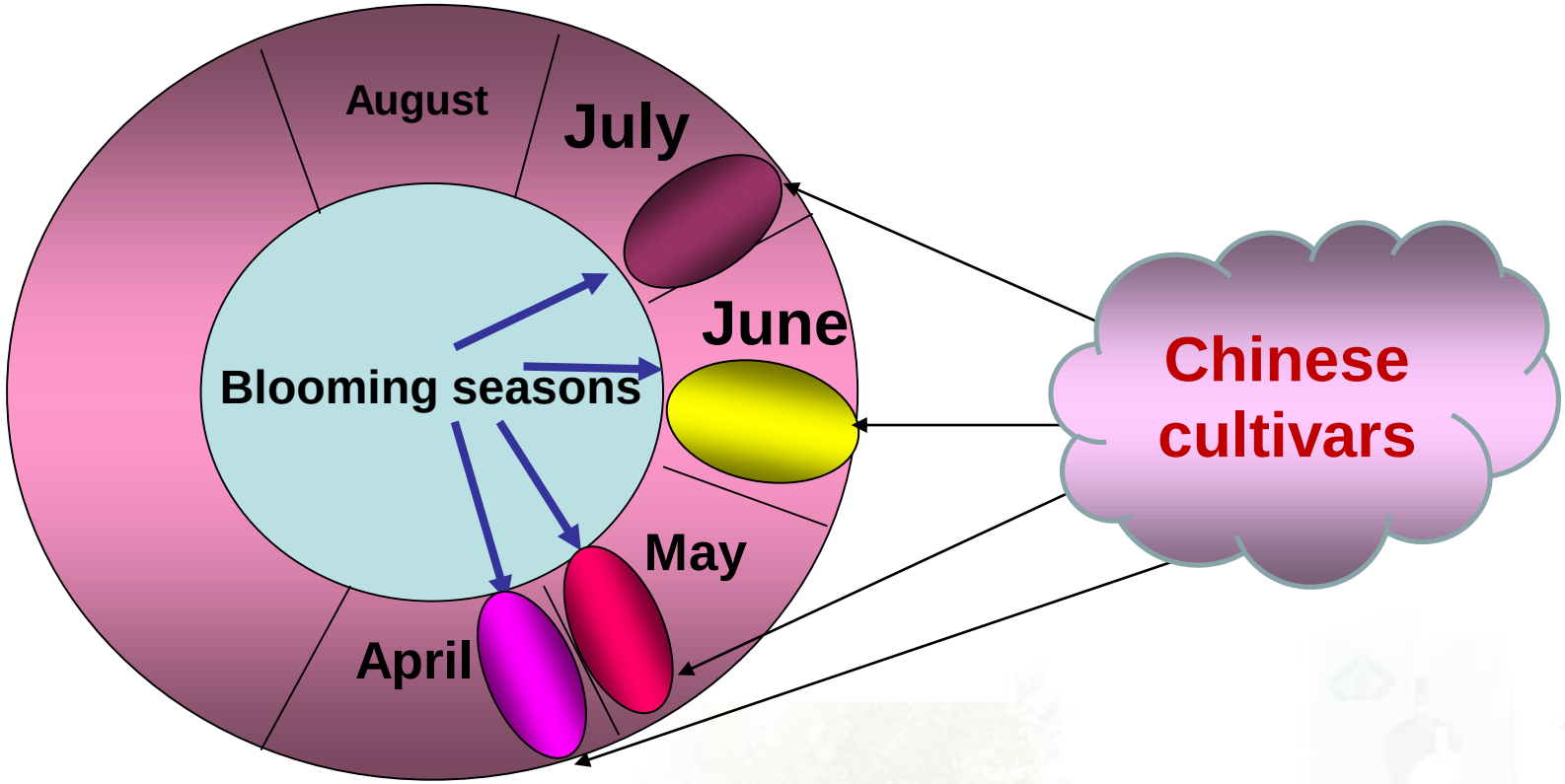
IB-CAS

中国科学院植物研究所

INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

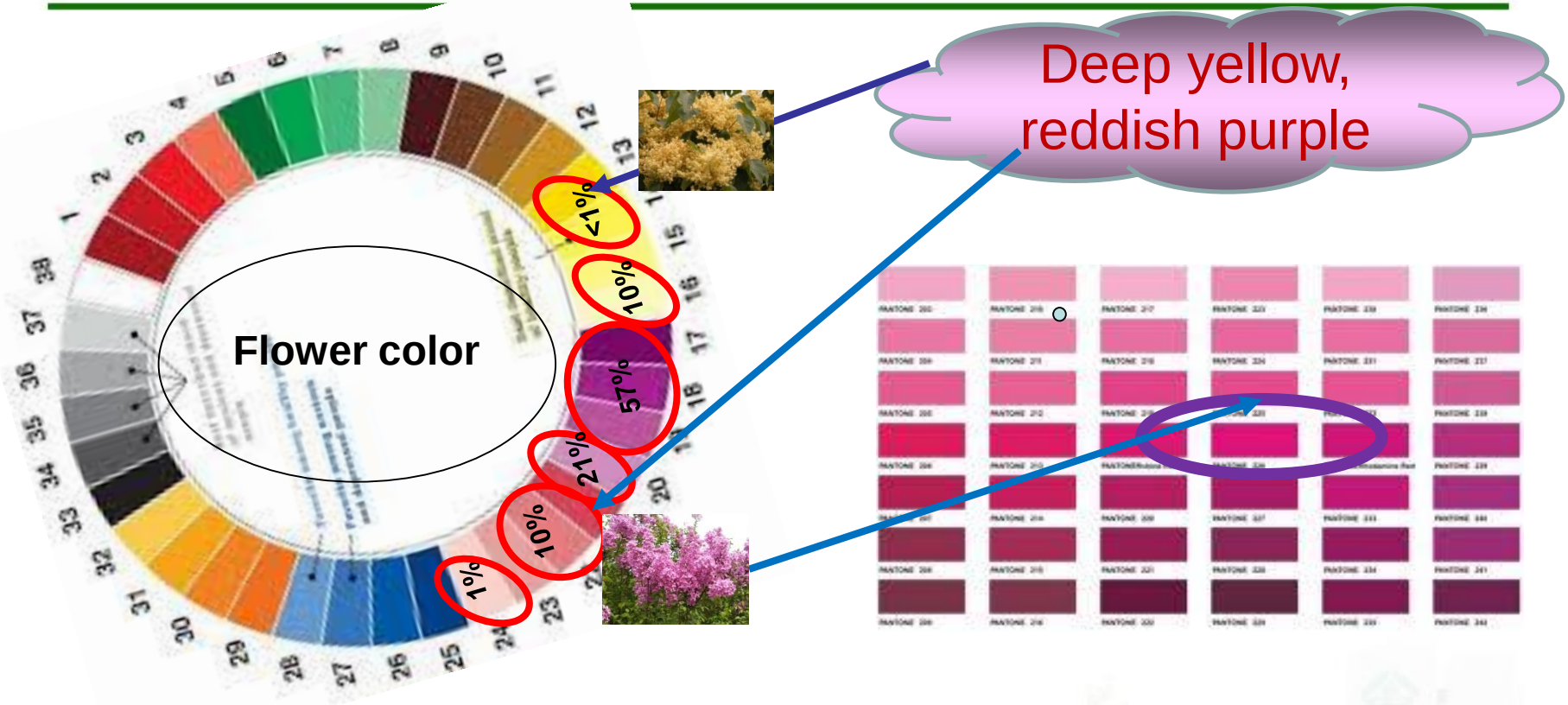
Characteristic analysis of Chinese cultivars

Blooming season of Chinese cultivars



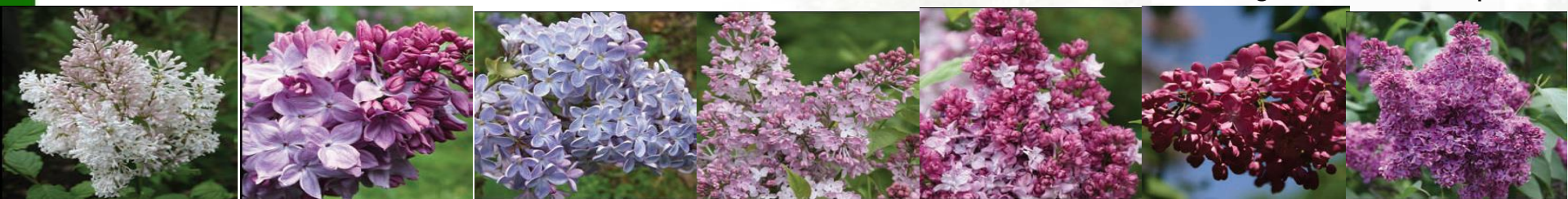
Pattern of blooming seasons of abroad cultivars (Beijing)

Coloration spanning of Chinese cultivars

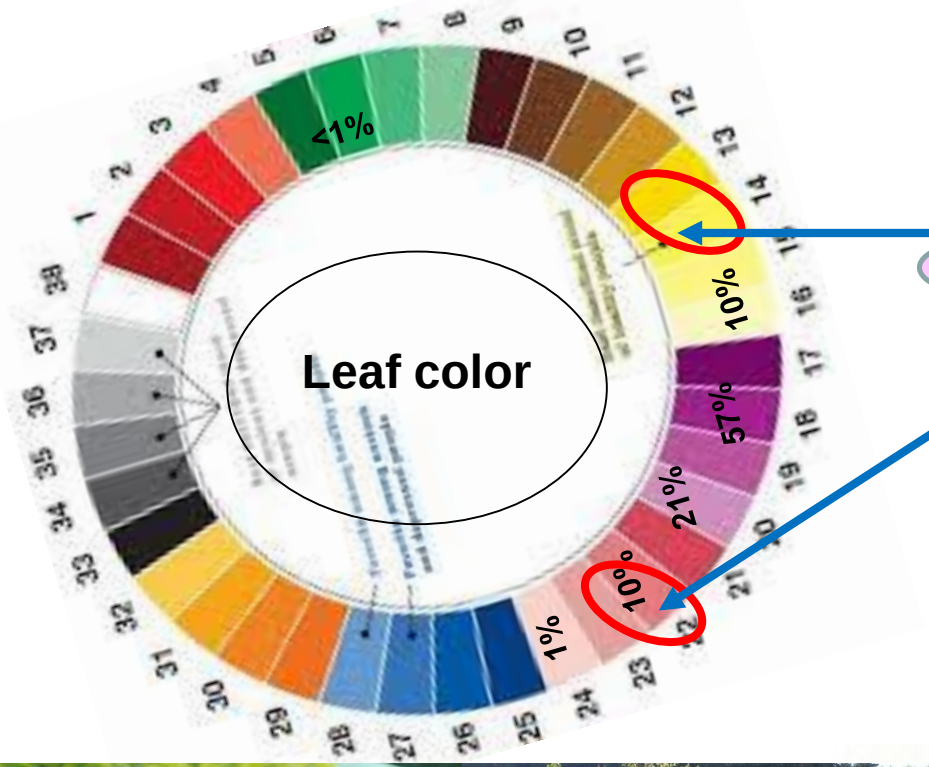


Pattern of coloration across all cultivars in the world

I. White | II. Violet | III. Blue | IV. Lilac | V. Pink | VI. Magenta | V. Purple



Leaf color of Chinese cultivars



Deep yellow
reddish green

Flower type of Chinese cultivars

Heteromorphic corolla

Multi–petalled

Dense inflorenscence

Large coralla

Dense inflorescence

Bigger floret

Humid-hot and cold resistance

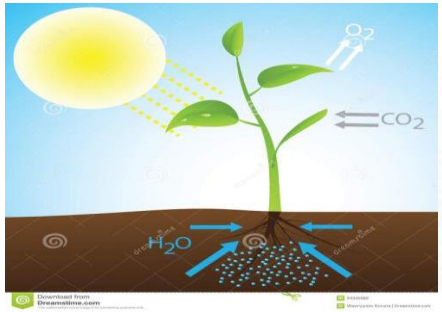
Hardy

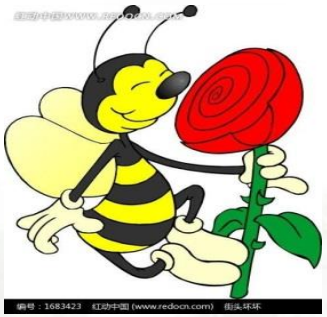
Resistance genes come from wild germplasms

Humid-hot resistance

Transplanting resistance

Other lilac stories



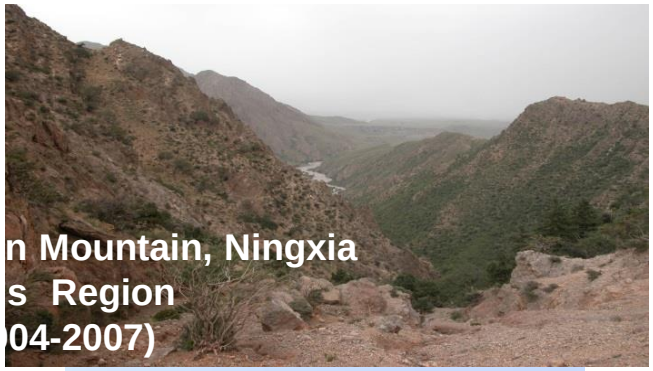


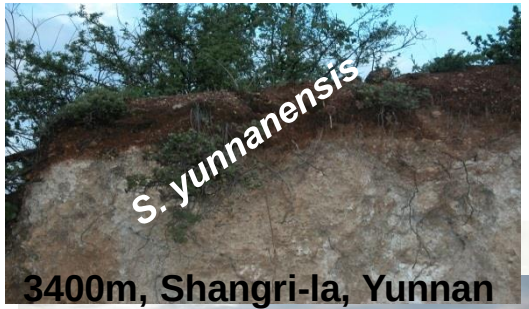
I. Collections

The north –northeast -northwest-southwest of China

1958-2004-2017

1700m Helan Mountain, Ningxia Autonomous Region (2004-2007)





3400m, Shangri-la, Yunnan (2004)

500m, Phoenix mountain,Liaoning (2016)

2400m,Four Girls Mountain, Sichuan （2017）

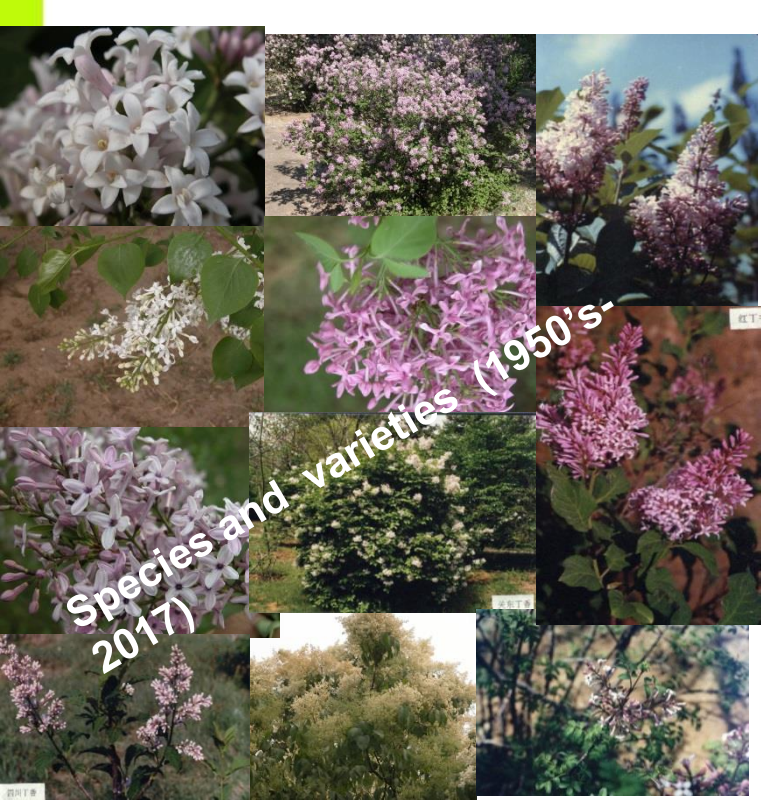
IB–CAS
中國科學院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Wild species

22 wild species and varieties involving all series had been collected and subalpine and narrowly distributed germplasms are also accessed.

Cultivars

100 cultivars were collected from Europe and North America, part of them were registered in ILS. Also, twenty cultivars are processing of selection.



II. Outline of research

Conservation

(to find general rules *in ex-situ* episode)

- Physiological adaptation mechanism of wild species (5 publications and 1 manuscript)
- Phenology (2 publications)

Breeding protocols

- Pollen preservation
- Compatibility of crossing
- Method of characteristic evaluation
- Genetic tendency

(3 publications, most unpublished)

Propagation

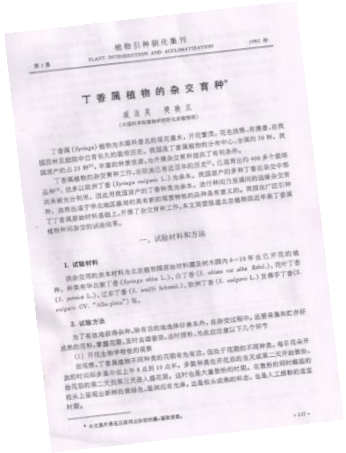
- Grafting
- Micro-propagation (1 publication)

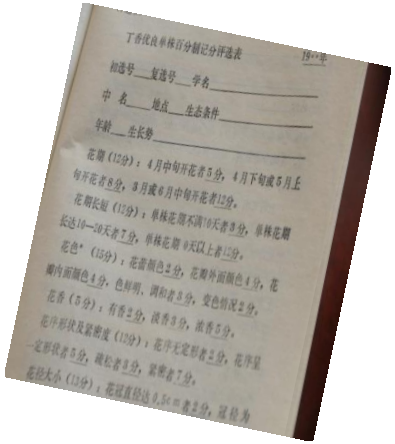
Flower scent

- Subsidiary classification of natural hybrids
- Flower scent inheritance

(1 manuscript)

Breeding protocol for artificial pollination


丁香属植物的杂交育种*


丁香优良单株百分制记分评选表

Key techanical points

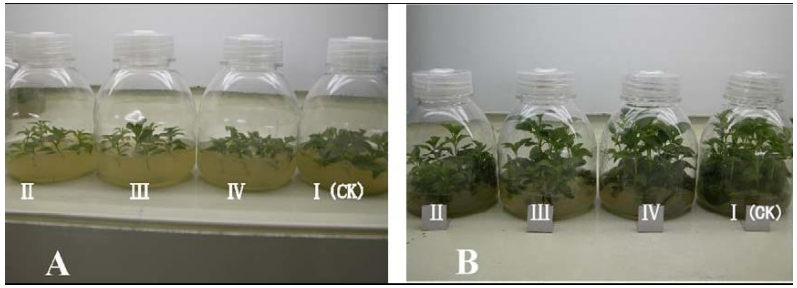
(published & unpublished 1960-2017)

- Condition of pollen preservation and germination
- Compatibility of interspecific within series & interseries cross:

Sect.1 Sect.1 *Syringa*		
Ser.1 *Villosae*	√	×
Ser.2 *Pubescentes*	√	×
Ser.3 *Vulgares*	√	√
Ser.4 *Pinnatifoliae*	√	√
Sect.2 *Ligustrina*	√	×

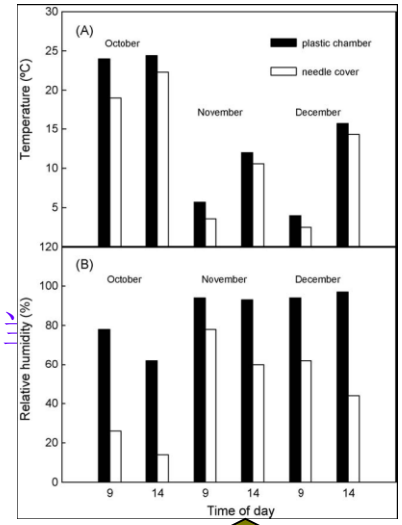
- Scored evaluation of characteristics to decide target individuals
- Genetic tendency revealing especially for interspecific cross:
  - petal type, fragrant scent-paternal inheritance
  - coloration-between and beyond parents
  - flowering season-same/later than the female
  - plant habit (height, stem fascicular)-maternal inheritance
- Providing guide for selecting parents

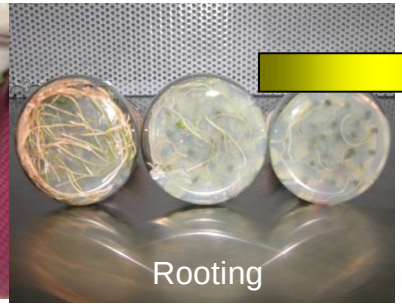
Micro-propagation

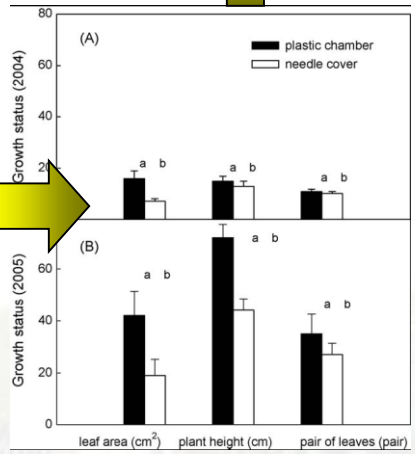


Explant proliferation

significant growth difference in biomass after initial overwinter treatment

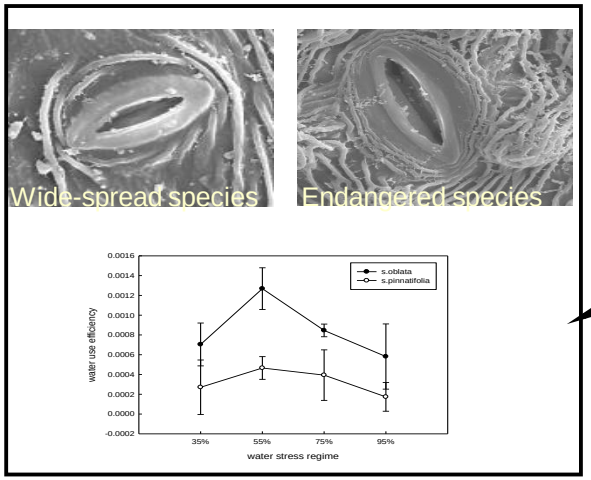




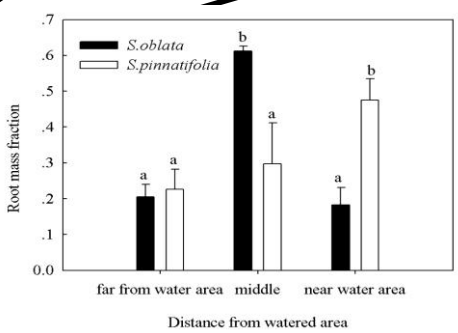


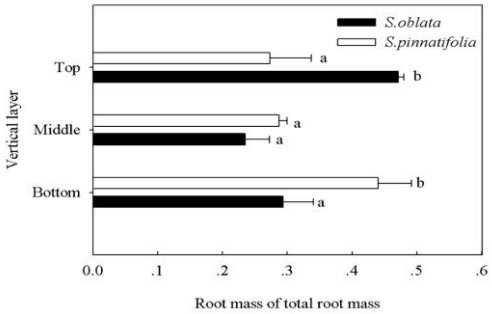
Cui *et al*. , 2009

Conservation: physiological adaptation mechanism



Stomata Low water use efficiency due to un-flexible regulation of stomata (Sam *et al*., 2000; Bosabalidis and Kofidis, 2002) was a dominant limiting factor for its growth in the wild





Dominant morphological plasticity means more energy cost

Physiological parameter	Plasticity index		Morphological parameter	Plasticity index	
	SO	SP		SO	SP
P_n	0.58	0.58	Leaf biomass	0.78	0.76
g_s	0.73	0.64	Stem biomass	0.84	0.86
Tr	0.65	0.46	Root biomass	0.49	0.47
Lp_r	0.85	0.55	Biomass increment	0.73	0.83
Mean	0.70	0.56	Mean	0.71	0.73

Hydrotropism as a compensation for strong transpiration paying heavy cost in under-ground assimilate allocation

Gao, Cui *et al*., 2008
Cui, Cong *et al*., 2016
Xu, Cui *et al*., 2017

Flower scents

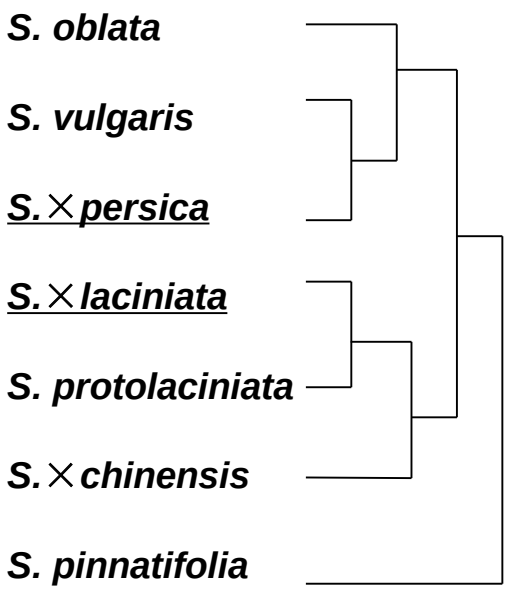


Fig. 1 Clustering relationship of seven species of *Syringa* from factor analysis based on floral volatile blend.

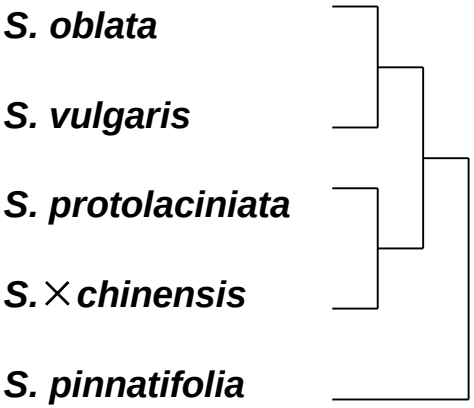


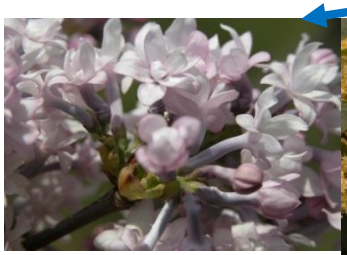
Fig. 2 The single most parsimonious tree of five species, which are selected from result of the chloroplast DNA restriction site data for 24-taxa of *Syringa* and was published by Kim and Jansen (1998) (*S.×persica* and *S.×laciniata* are excluded)

MS almost completed

III. Practical utilizations

IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Nursery production special for Chinese hybrids



IB-CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Urban landscape

Golden Beijing in urban landscape in Beijing and Inner Mongolia

IB–CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Ecological restoration

Lilacs park, 40 hect.
(2010-2017)

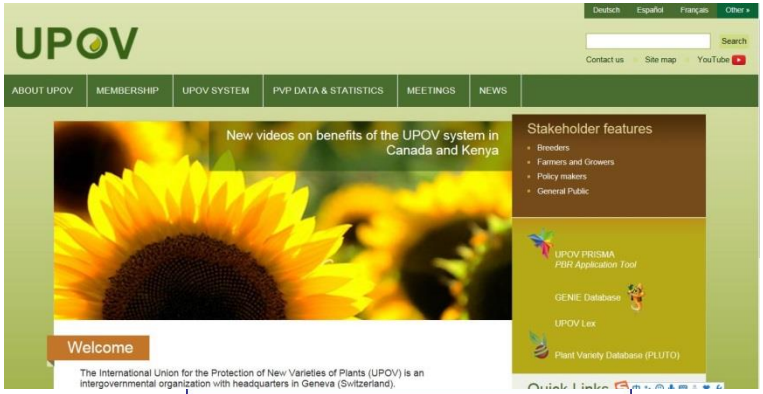
Lilacs valley, 200,000 plants.
(2010-2017)

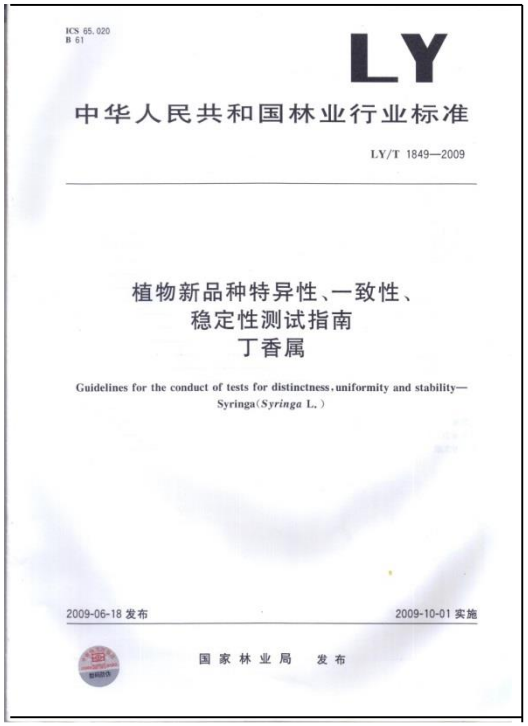
Lilacs in restoration in Inner Mongolia (2010-2017)

IV. Responsibility undertaking

1. DUS Test Guideline drafting

Updated our hybrid evaluation protocol to achieve DUS Test Guideline for China and UPOV during 2010-2014 after four-time discussions in UPOV TWO workshops




ICS 65.020
B 61

LY

中华人民共和国林业行业标准

LY/T 1849—2009

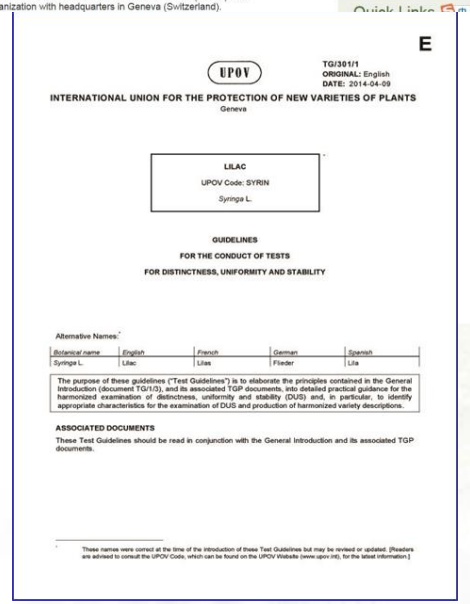
植物新品种特异性、一致性、
稳定性测试指南
丁香属

Guidelines for the conduct of tests for distinctness, uniformity and stability—
Syringa(*Syringa* L.)

2009-06-18 发布　　2009-10-01 实施

国家林业局　发布

China forestry industry standard(2007)


UPOV

TG/301/1
ORIGINAL: English
DATE: 2014-04-09

E

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
Geneva

LILAC
UPOV Code: SYRIN
Syringa L.

GUIDELINES
FOR THE CONDUCT OF TESTS
FOR DISTINCTNESS, UNIFORMITY AND STABILITY

Alternative Names:

Botanical name	English	French	German	Spanish
Syringa L.	Lilac	Lilas	Flieder	Lila

The purpose of these guidelines ("Test Guidelines") is to elaborate the principles contained in the General Introduction (document TG/1/3), and its associated TGP documents, into detailed practical guidance for the harmonized examination of distinctness, uniformity and stability (DUS) and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions.

ASSOCIATED DOCUMENTS

These Test Guidelines should be read in conjunction with the General Introduction and its associated TGP documents.

These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]

UPOV TG 301/1 (2014)

2. DUS Testing for PVP in China

IB–CAS
中国科学院植物研究所
INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

As leading expert to conduct the field DUS testing of lilac candidate varieties for plant breeder's protection on behalf of National Forestry Bureau since 2016

IB–CAS

中國科學院植物研究所

INSTITUTE OF BOTANY, THE CHINESE ACADEMY OF SCIENCES

Thank