

## Morphology and Germination of *Tchihatchewia isatidea* Boiss. (Brassicaceae)

<sup>1</sup>Meral Aslay, <sup>2</sup>Mehtap Teken, <sup>1</sup>Kemal Cukadar, <sup>1</sup>Hakan M. Unlu,  
<sup>1</sup>Zakyne Kadiodlu and <sup>3</sup>Erdal Kaya

<sup>1</sup>Horticultural Research Institute, 07058 Erzincan, Turkey

<sup>2</sup>Department of Biology, Faculty of Science and Letters,  
Aksaray University, 68100 Aksaray, Turkey

<sup>3</sup>Ataturk Central Horticultural Research Institute, 77102 Yalova, Turkey

**Abstract:** About Nineteen populations of *Tchihatchewia isatidea* Boiss. (Brassicaceae) were collected from the Eastern Anatolia Region of Turkey. By applying generative and vegetative propagation techniques the most suitable production technique was determined for the species. Germination tests were performed and different storage conditions were specified at different temperatures in germination cabinets under laboratory conditions. The optimum germination temperature, germination rate, mean germination time (day) and mean germination performance were determined. Adaptation capabilities and some selection criteria of populations were identified. The 2 years production period was reduced to 1 year and *Tchihatchewia isatidea* Boiss has been identified as a candidate species of ornamental plants.

**Key words:** Brassicaceae, germination, seeds, *Tchihatchewia isatidea*, Turkey

### INTRODUCTION

*Tchihatchewia* is a monotypic genus and a Turkish endemic and it belongs to the plant family Brassicaceae. *Neotchihatchewia isatidea* (Boiss.) Rauschert is synonym of *T. isatidea*. It is distributed in Giresun, Gumuphane, Erzurum, Sivas, Elazyo, Tunceli and Erzincan Provinces (Cullen, 1965). The flowers of *T. isatidea* have an overpowering perfume scented fragrance. The flowers of this plant were used for paint production (Baytop, 1994) and roots of this species are used for wound treatment by mixing with crushed roots of *Hesperis schischkinii* and resin of *Pistacia atlantica* in Tunceli (Tuzlaci and Dogan, 2010). *T. isatidea* is a perennial and biennial herb with its attractive flower colours, interesting indumentum and nice smell (Mutlu and Donmez, 2003). There are local names such as *allı gelin*, *boya cicegi* for this plant. This species grows on eroded hills and screes (Fig. 1).

Gumuscu *et al.* (2008) have investigated *in vitro* shoot regeneration and micro-propagation of *T. isatidea* (Gumuscu *et al.*, 2008). The purpose of current study was to sample seeds from each of these populations and to investigate their characteristics for the first time in order to evaluate the possibility to plan *ex situ* management strategies and to present it to the ornamental plants sector. Detailed morphological characters of the species



Fig. 1: *Tchihatchewia isatidea*. a) The natural appearance of the 2 years individual. b) 1 year individual at the research institute

were given. Detailed studies about adaptation, propagation and germination were made to present *T. isatidea* to ornamental plants sector.

### MATERIALS AND METHODS

Research materials of the genus *Tchihatchewia* were collected from eastern parts of Turkey. Localities are shown in the specimens investigated. All specimens were deposited at herbaria of Erzincan Horticultural Research Institute.

**Specimens investigated:** Tunceli: Tunceli-Erzincan, 2 km from Tunceli, 914 m, 28.04.2007, T62005; Erzincan: Erzincan-Pulumur, 6 km from Erzincan, 1218 m, 11.05.2007, T24017; Otlukbeli, Karadivan-Yenikoy, 1615 m, 16.05.2007, T24018; Merkez, Kurutilek village, 1398 m, 21.05.2007, T24020; Bayyrbao, 1502 m, 21.05.2007, T24021; Kemaliye, 1167 m, 01.05.2008, T24045; Kemah, 1483 m, 07.06.2009, T24073; Refahiye, Gunyuzu village, 1974 m, 07.06.2009, T24072; Artvin: Yusufeli- Kilickaya, 1137 m, 22.05.2007, T08022; Erzurum: Askale, Pirnakapan village, 1712 m, 25.05.2007, T25026; Bayburt: Asagi Kop village, 1836 m, 01.08.2007, T69040; Sivas: Divrigi, 1409 m, 28.04.2008, T58041; Malatya: Hekimhan, 1124 m, 28.04.2008, T44042; Gumushane: Arzular, Dolek village, 1387 m, 04.06.2008, T29058; Giresun: North of Sebinkarahisar, 1148 m, 05.06.2008, T28059; Sebinkarahisar 960 m, 05.06.2008, T28060; Erzurum: Tortum, Bagbasi village, 1813 m, 26.05.2009, T25066; cat, Cirisli village, 1835 m, 25.09.2005, T25070; Bingol: Karliova, 1815 m, 29.05.2009, T12061.

Plants collected from nature were cultured at Erzincan Horticultural Research Institute. Ten randomly selected individuals were measured. In terms of some of the important selection criteria, the average values were calculated (plant height, plant size, flowering date, flower number, flower life, flowering time, flower shape, flower size, tepal and petal size, petal count, petal color, smelling, hairiness, leaf arrangement, leaf color, leaf size and seed maturation time). In line with these findings, adaptation capabilities of populations were determined. Seed samples were stored in suitable conditions (room conditions) and the seeds were sown in pots with peat and perlite mix. The 50 seeds were used for sowing and depending on the amount of seed, three and four replications were established in the trial. Seeds were cultured in October. In order to ensure germination in a short time, the seeds were soaked in control, hot (in 72°C, 2 min) and cold water (in 25°C, 55 h) and wet-chilling in perlite media for 30, 40, 50, 60, 70, 80, 90 and 100 days at a temperature of 4°C. Germination rate, mean germination time (days) and mean germination capacity were determined.

## RESULTS AND DISCUSSION

The observed measurable features of *Tchihatchewia isatidea* in conservation plots at the research institute are shown in the Table 1. These plants were grown from seed. In culture media seeds of *Tchihatchewia isatidea* constituted taller than the specimens collected growing in the wild. Pinkish-purple flower color of this species are flat but in this study, petals are white and some petals have brown to eggplant purple with lines. Compound panicle and bouquet flowers are obtained in some plants.

Table 1: Properties of *Tchihatchewia isatidea* in conservation plots

Plants	Perennial or biennial taprooted herb
<b>Stem</b>	
Length	8-76 cm
Stem position, branching	Patent, simple, multi-forked
Indumentum	Rarely dendroid hollow hairs
<b>Basal leaves</b>	
Size	21-138×21-39 mm
Shape	Oblanceolate to spatulate
Petiolate or sessile	Distinctly petiolate
Leaf apex and margin	Obtuse and hairy and dentate margin towards the base
<b>Stem leaves</b>	
Size	89-177×16-26 mm
Shape	Lanceolate
Petiolate or sessile	Sessile
Leaf apex and margin	Irregularly acute lobes and dentate margin
Inflorescence	Paniculate or lower branched
Flowers	Showy and fragrant
<b>Sepals</b>	
Number	4
Lateral pair	9-10×1.9-2.8 mm, Distinctly saccate at base
Other pair	9-10×1.2-1.6 mm, Not saccate
<b>Petals</b>	
Number	4
Length	12-19 mm
Limbs	Distinctly divided to limb and claw, 4-7×2-4 mm, orbicular to elliptic, Purple, pink, lilac, variegated
Stamens	6 (4 long + 2 short)
Anthers	Oblong to linear
Style	Truncate, pale green
	Deciduous
<b>Fruit</b>	
Size	20-25×4-5 mm
Shape and wings	Obovate to narrowly elliptic, widely elliptic to orbicular appearance with wings
	Pendulous, indehiscent
Indumentum	Young fruits both simple and branched hairy with long, simple or 2-forked and short bifid or simply hairy
	Deciduous at maturity
Seeds	1-3, nonmucilaginous
Cotyledons	Accumbent, 2-3×1.1-1.6 mm

The seeds did not germinate in control, hot and cold water applications. The effects of wet-chilling applications on the germination of were identified in 15°C (77.41%) germination temperature which was found to be higher than 20°C (68.08%) germination temperature. Germination time and germination capacity in 15°C (14.33 day-1.25) were higher than 20°C (12 day-1.17). Germinating the seeds in 15°C after wet-chilling for 70-80 days was determined as the most suitable germination environment for this plant. In the study, it was determined that the seeds do not germinate under normal conditions and the seeds need to rest (Table 2 and 3). In germination experiments of *Tchihatchewia isatidea*, the average germination rate was 64.92% (Table 4). The seeds were treated wet-chilled. It was apparent that population T25026 has the highest germination rate with 86.5% and population T24045 has the lowest germination rate with 17.33%. Evaluating the germination ability, the differences between populations were revealed.

Table 2: The effects of different applications on germination rate, germination time and germination capacity in climate cabinet at 15°C on the collections of *T. isatidea* seeds from different locations (a. T44042, b. T24045 and c. T28059)

Applications	Germination rate (%)				Germination time (day)				Germination capacity			
	a	b	c	Mean	a	b	c	Mean	a	b	c	Mean
Control	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00
25°C w. 55 h	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00
72°C w. 2 min +4°C 30 day	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00
Wet-chilling +4°C 40 day	20.00	6.66	5.33	10.66	13	13	11	12.33	0.43	0.09	0.11	0.21
Wet-chilling +4°C 50 day	35.71	3.33	15.00	18.01	11	12	11	11.33	0.79	0.13	0.54	0.48
Wet-chilling +4°C 60 day	47.91	4.93	36.00	29.61	12	7	16	11.66	1.31	0.17	0.43	0.63
Wet-chilling +4°C 70 day	57.89	18.42	44.27	40.19	10	12	16	12.66	1.43	0.30	0.44	0.72
Wet-chilling +4°C 80 day	77.41	13.33	38.70	43.14	12	5	12	9.66	1.61	0.39	0.64	0.88
Wet-chilling +4°C 90 day	75.40	24.59	58.92	52.97	8	9	15	10.66	1.15	1.63	0.97	1.25
Wet-chilling +4°C 100 day	63.75	9.75	52.00	41.83	14	12	17	14.33	1.51	0.39	0.60	0.83
Wet-chilling	57.00	7.80	57.89	40.89	8	4	11	7.66	2.00	0.90	0.56	1.15

Table 3: The effects of different applications on germination rate, germination time and germination capacity in climate cabinet at 20 °C on the collections of *T. isatidea* seeds from different locations (a. T44042, b. T24045 and c. T28059)

Applications	Germination rate (%)				Germination time (day)				Germination capacity			
	a	b	c	Mean	a	b	c	Mean	a	b	c	Mean
Control	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00
25°C w. 55 h	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00
72°C w. 2 min +4°C 30 day	0.00	0.00	0.00	0.00	0	0	0	0.00	0.00	0.00	0.00	0.00
Wet-chilling +4°C 40 day	12.00	5.30	4.00	7.10	9	13	11	11.00	0.43	0.09	0.11	0.21
Wet-chilling +4°C 50 day	35.00	3.33	5.00	14.44	6	12	6	8.00	1.83	0.13	0.26	0.74
Wet-chilling +4°C 60 day	47.91	4.93	14.66	22.50	12	7	12	10.33	1.31	0.17	0.29	0.59
Wet-chilling +4°C 70 day	56.86	12.67	35.29	34.94	8	12	16	12.00	2.35	0.32	0.54	1.07
Wet-chilling +4°C 80 day	68.08	5.12	30.00	34.40	4	7	12	7.66	2.12	0.17	0.49	0.92
Wet-chilling +4°C 90 day	61.53	13.33	51.85	42.23	11	8	15	11.33	1.85	0.83	0.85	1.17
Wet-chilling +4°C 100 day	41.00	18.96	40.43	33.46	11	11	11	11.00	1.00	0.56	0.91	0.82
Wet-chilling	52.77	6.66	38.46	32.63	8	5	5	6.00	0.91	0.44	1.92	1.09

Table 4: Seed emergence of *T. isatidea* collected from different locations

Selection number	Open land		
	Cultivated (Unit)	Emergence (Unit)	Emergence Ratio (%)
T69040	200	140	70.00
T08027	200	135	67.50
T24018	200	150	75.00
T25026	200	173	86.50
T24021	200	170	85.00
T24020	200	170	85.00
T29058	150	90	60.00
T28059	150	63	42.00
T58041	150	52	34.70
T24045	150	26	17.33
T44042	150	97	64.60
Total	1950	1266	64.92

### CONCLUSION

As a result of the laboratory studies, plant flowering time has been reduced to 240 days from 510 days. In addition to the structure of showy flowers, pleasant smell, very nice features, drought tolerance and the shortening of breeding period contributed to the species may make it a candidate to the ornamental plants sector. Thus, the increased product variety of ornamental plants and the production of species will contribute to the country's economy. Growth was observed in the flower petals of *T. isatidea* in the Colchicine application prepared in 0.5% dose. While the highest petal size was 5×7 mm, *T. isatidea* species were obtained petals size of 7×9 mm as a result of the application.

### ACKNOWLEDGEMENTS

This research was supported in part by the Scientific and Technological Research Council of Turkey (TUBITAK) under the project number of KAMAG 106G022.

### REFERENCES

- Baytop, T., 1994. *Turkce Bitki Adlari Sozlugu*. Ataturk Kultur ve Dil Tarih Yuksek Kurumu, Ankara, Turkey.
- Cullen, J., 1965. *Tchihatchewia* Boiss. In: Flora of Turkey and the East Aegean Islands 1, Davis, P.H., R.R. Mill and K. Tan (Eds.). Edinburgh University Press, Edinburgh, pp: 352.
- Gumuscu, A.G., S. CuCu, S. Uranbey, A. Ipek, M. Caliskan and N. Arslan, 2008. *In vitro* micro-propagation of endangered ornamental plant-*Neotchihatchewia isatidea* (Boiss.) Rauschert. *Afr. J. Biotechnol.*, 7: 234-238.
- Mutlu, B. and A.A. Donmez, 2003. *Neotchihatchewia isatidea* Boiss. (Brassicaceae/Cruciferae). *Karaca Arboretum Magaz.*, 7: 75-80.
- Tuzlaci, E. and A. Dogan, 2010. Turkish folk medicinal plants, IX: Ovacik (Tunceli). *Marmara Pharmaceutical J.*, 14: 136-143.