# Seed Technology Research at AVRDC – The World Vegetable Center

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**AVRDC – The World Vegetable Center**

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**Module 1: Vegetables: From Seed to Table and Beyond**
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# Seed with special needs: Selected indigenous vegetable crops

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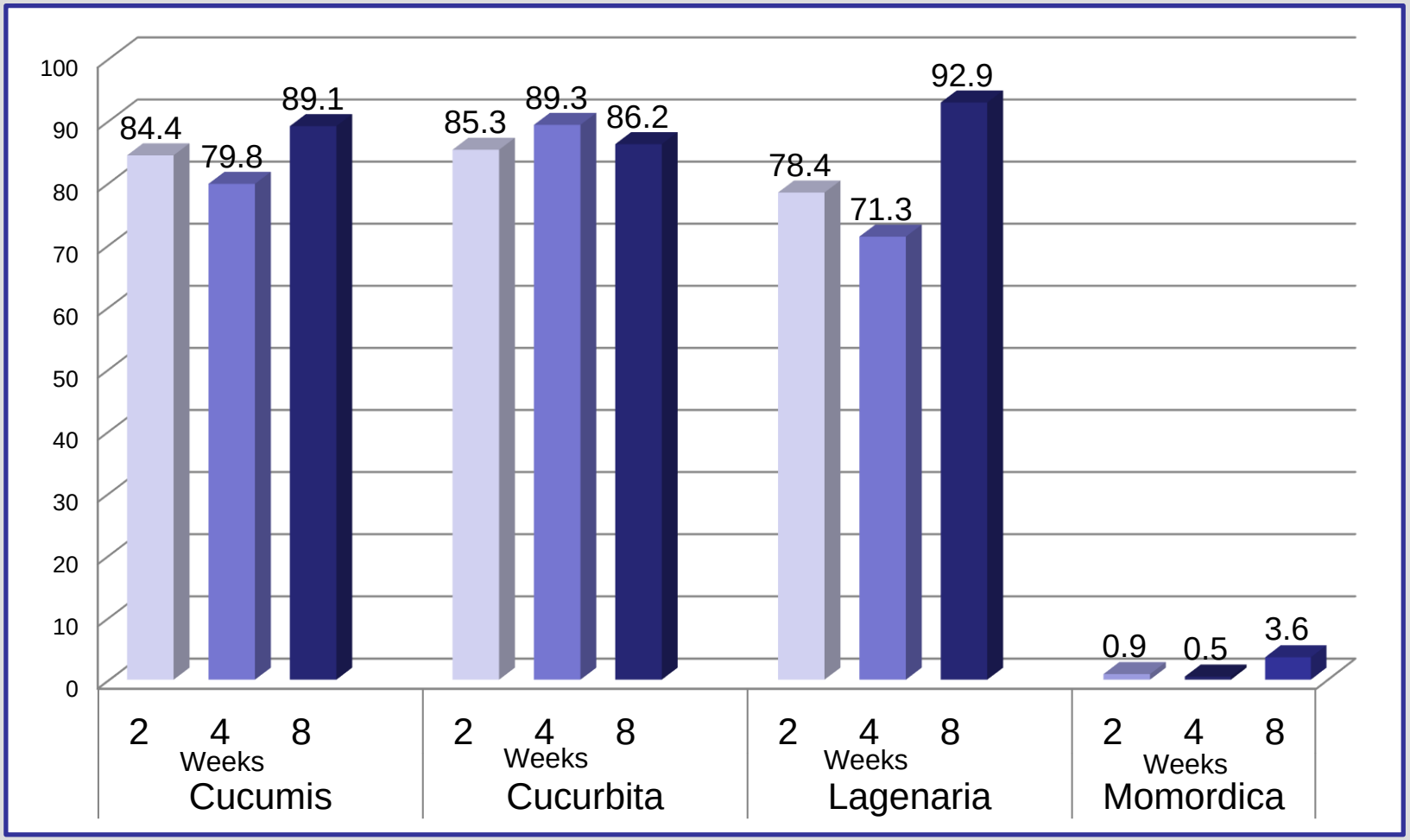
# Germination rates of *Cucumis*, *Cucurbita*, *Lagenaria*, and *Momordica* after 2, 4, and 8 weeks in subzero storage

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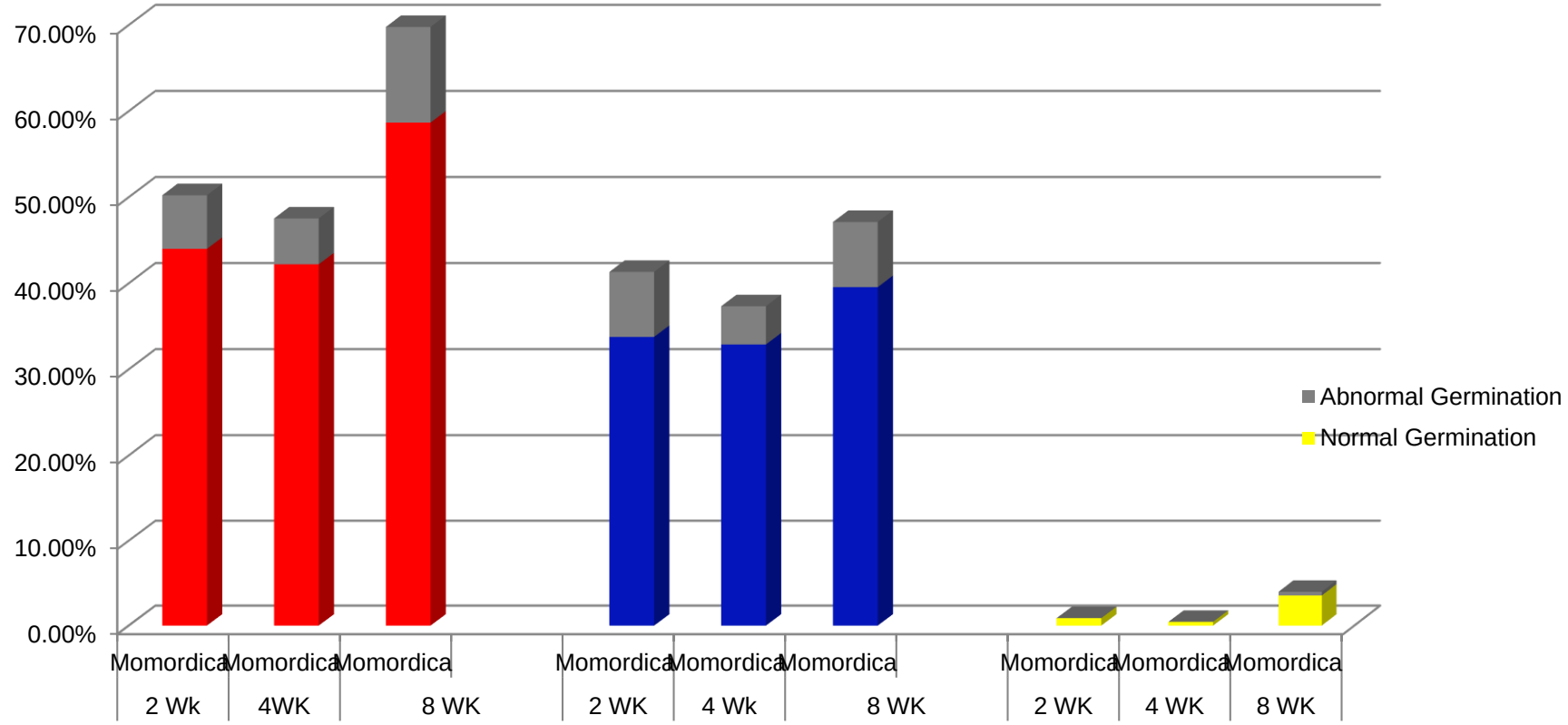
# Bitter gourd seed germination rates related to storage conditions




Short-term (15 °C)

Medium-term (5 °C)

Long-term (-18 °C)

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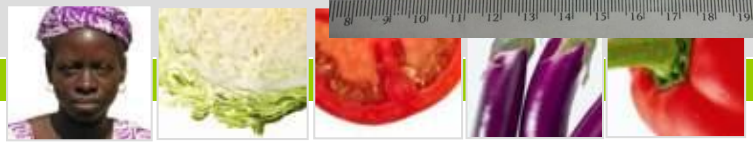
# Priming treatments

***T1 = control;***
***T2 = 24 h soaking in water;***
***T3 = partial removal of seed coat and 24 h soaking in water;***
***T4 = soaking in household vinegar for 2 h;***
***T5 = soaking in $KNO_3$ solution (0.3%) for 1 h;***
***T6 = 24 h soaking in water, followed by quick surface drying and then drying in a dehumidified chamber for 72 h.***

**VI049009 (Thailand)**

**VI049940 (India)**



# Germination rate (%) of seed of two bitter gourd accessions dried to 6% SMC in drying room, prior to storage and after a 6-month storage period as affected by priming treatments in 2013 and 2014

| Accession Country | Treat-ments[a] | Prior to storage 2013 | After a 6-month storage period at 5 °C 2013 | After a 6-month storage period at 15 °C 2013 | After a 6-month storage period at 15 °C 2014 |
|---|---|---|---|---|---|
| VI049009 Thailand | T1 | 16 cd | 42 b | 25 ab | 77 a |
| | T2 | 18 c | 49 b | 10 cd | 52 bc |
| | T3 | 10 d | 40 b | 34 a | 52 bc |
| | T4 | 52 a | 3 c | 3 d | 36 c |
| | T5 | 24 c | 73 a | 24 ab | 74 a |
| | T6 | 40 b | 33 bc | 13 bc | 67 ab |
| | | | | | |
| VI049940 India | T1 | 70 c | 86 ab | 84 a | 88 a |
| | T2 | 90 a | 93 a | 96 a | 75 a |
| | T3 | 86 ab | 90 a | 96 a | 76 a |
| | T4 | 82 abc | 4 c | 3 b | 86 a |
| | T5 | 78 abc | 72 b | 94 a | 79 a |
| | T6 | 74 bc | 94 a | 95 a | 91 a |

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# Conclusions – bitter gourd

- Among four cucurbit species stored under long-term conditions, *Momordica charantia* seeds did not survive and hence cannot be considered as completely orthodox.
- Bitter gourd genotypes clearly differed in their rates of germination, independently of storage and priming treatment.
- Compared with 15 $^{o}$C, seed storage at 5 $^{o}$C did not reduce seed viability when tested in incubator.
- In general, 6 months of storage at 5 $^{o}$C improved germination rate, indicating that seed dormancy can be partially overcome by low temperature storage.
- Several priming treatments enhanced seed germination.

# Okra (*Abelmoschus esculentus*)

- Cultivated under tropical and subtropical conditions
- Popular in West Africa, Brazil, India, Philippines, Thailand
- Longevity of okra seed is improved by drying and storage at sub-zero temperatures
- Okra has poor field establishment due to hardseededness
- Genotype, position of pods on plant, time of pod harvest, seed moisture content and micronutrient applications affect seed germination.

# Water spinach, kangkong (*Ipomoea aquatica*)

- Belongs to the Convolvulaceae family; originated in tropical Asia
- Popular in South and Southeast Asia; also known in Oceania, tropical Africa, South and Central America

- Germination rates vary with seed coat color: higher in black-seeded types
- Germination also varies with genotype
- Germination rates are often below 60% due to hardseededness induced by long storage periods, especially in genebanks where seed is stored much drier to extend storage life.

# Material and methods

- **Water spinach: VI050476 from Thailand; VI054533 from Taiwan; sown Sept. 2012, harvested March 2013**
- **Okra: VI046536 from Thailand; VI50958 from Zambia; sown March 2013 and harvested in June**
- **Water spinach fruits dried for 2 weeks in screenhouse, then crushed for manual seed extraction**
- **Cleaned seeds of okra and water spinach were dried for 3 and 8 days, respectively, in dehumidified drying room at 18 $^{0}$C and 15% RH to 6% SMC**
- **Sub-samples were packed in aluminum foil bags, heat-sealed and stored at 5 $^{o}$C and -15 $^{o}$C, for 6 months**

# Material and methods (2)

**Seed priming at end of storage period:**

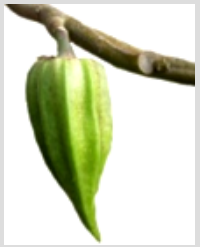
- **T1 = control**
- **T2 = 24 h soaking in water at room temperature**
- **T3 = partial removal of seed coat, followed by 24 h soaking in water**
- **T4 = soaking in rice vinegar (≥ 4.5% acidity) for 2 h**
- **T5 = soaking in KNO3 solution (0.3%) for 1 h**
- **T6 = 24 h soaking in water, quick surface drying and drying in dehumidified chamber for 72 h**

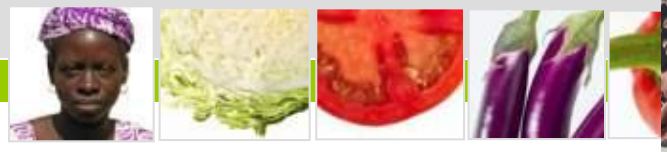
- **ISTA rules were followed for germination test of primed seed**
- **A second batch was sown in seedling trays for field transplanting to evaluate stand establishment**

# Okra accessions



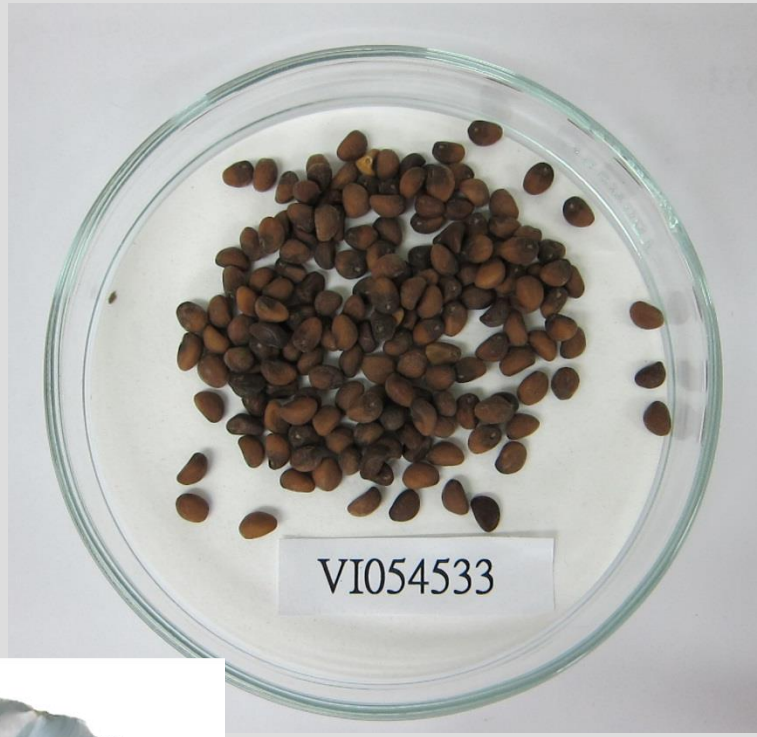

# Okra in the field and seed extraction





# Water spinach accessions


Thailand




Taiwan

# Water spinach in the field and seed extraction



**VI054533**
**Taiwan**

# Results

# Storage and germination of okra seeds

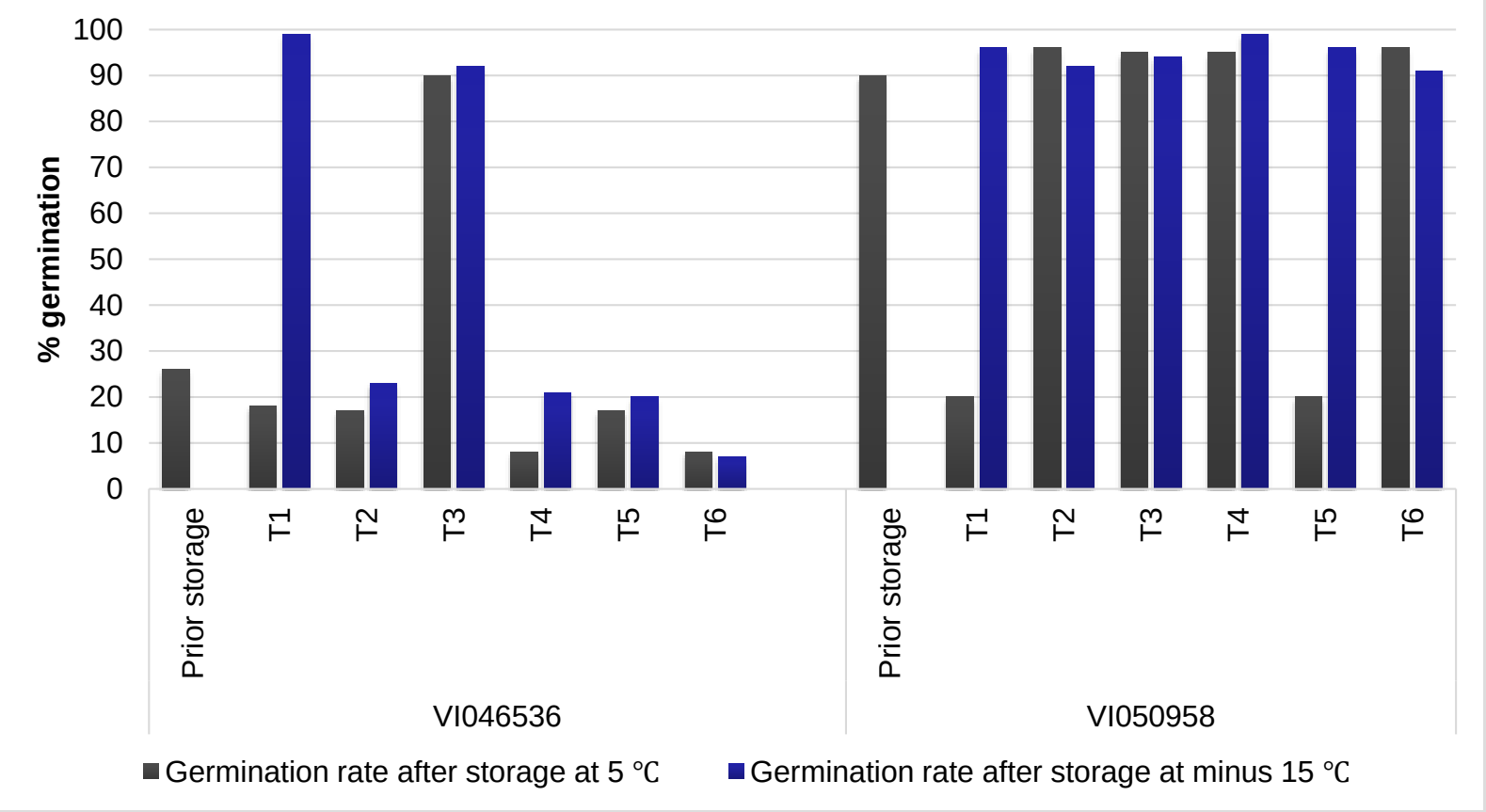



**Fig. 1. Germination rate (%) of primed seed of 2 okra accessions, prior to storage and after a 6-month storage period at 5 ºC and -15 ºC**

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# Okra seed germination in Lab and SH

| Treatment | Germination rate (%) in Lab | Germination rate (%) in SH | Survival rate (%) | Vigor - 3 weeks after transplanting |
|---|---|---|---|---|
| T1 | 54.77 ab | 44.88 b | 45.88 b | 86.39 a |
| T2 | 52.14 ab | 50.60 ab | 50.60 ab | 81.47 a |
| T3 | 75.14 a | 73.63 a | 73.63 a | 83.11 a |
| T4 | 52.64 ab | 47.24 ab | 47.24 ab | 86.39 a |
| T5 | 52.12 ab | 46.97 ab | 46.97 ab | 86.39 a |
| T6 | 45.15 b | 47.80 ab | 48.80 ab | 75.76 a |

Partial seed coat removal of okra seed, followed by 24 h soaking in water (T3) resulted in the highest germination rate in the lab and screenhouse and led to the highest survival rate of okra plants. Vigor of plants did not statistically differ among treatments.

# Storage and germination of water spinach seeds

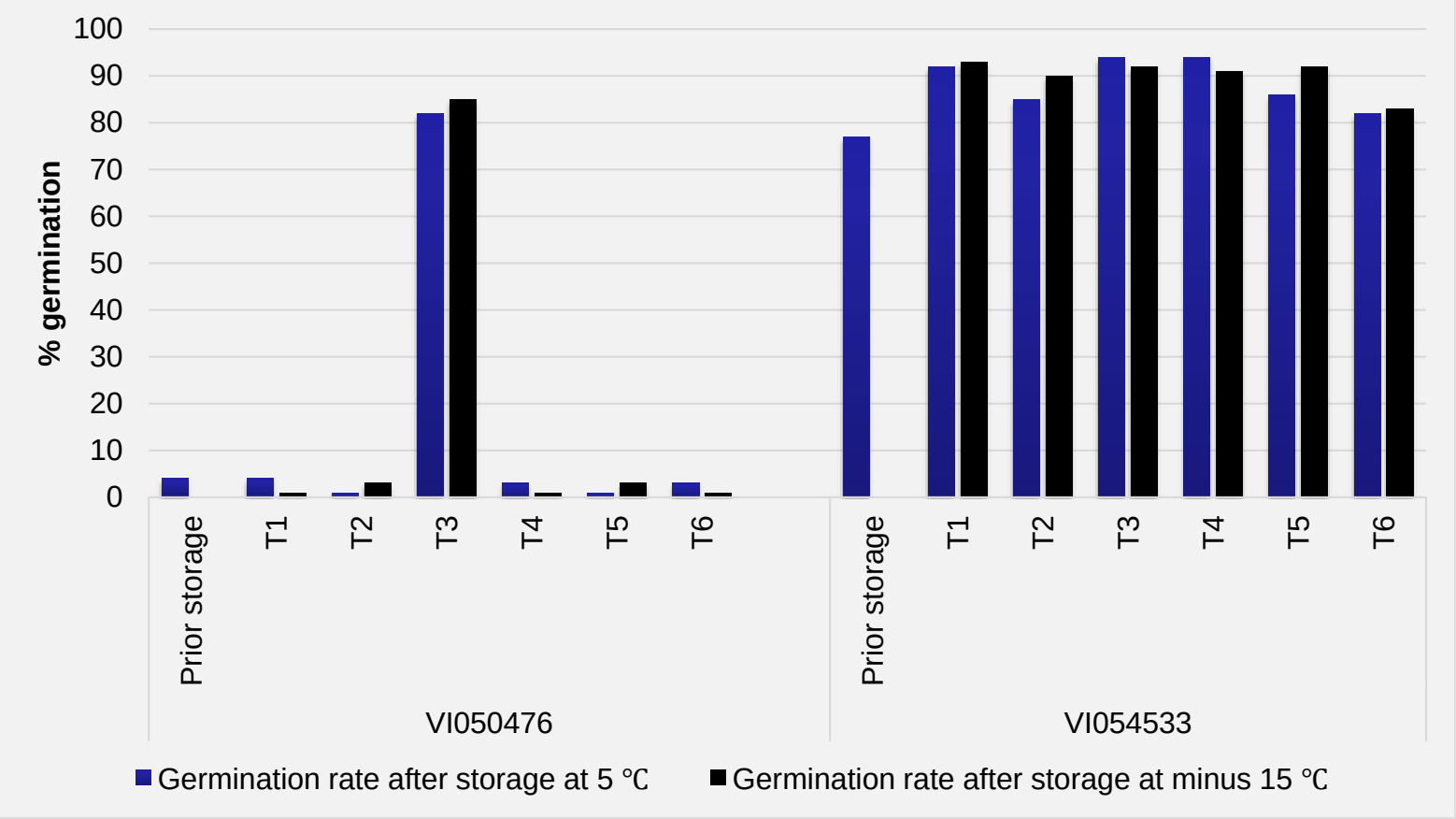


**Fig. 2. Germination rate (%) of primed seed of 2 water spinach accessions, prior to storage and after a 6-month storage period at 5 ºC and -15 ºC; T3 = partial removal of seed coat, followed by 24 h soaking in water.**

# Water spinach seed germination in Lab and SH

| Treatment | Germination rate (%) in Lab | Germination rate (%) in SH | Survival rate (%) | Vigor - 3 weeks after transplanting |
|---|---|---|---|---|
| T1 | 41.48 ab | 34.26 b | 42.32 b | 35.88 b |
| T2 | 37.73 ab | 34.57 b | 47.98 ab | 45.67 ab |
| T3 | 71.12 a | 68.30 a | 83.72 a | 75.10 a |
| T4 | 41.36 ab | 35.96 b | 70.37 ab | 50.33 ab |
| T5 | 39.57 ab | 33.62 b | 42.58 b | 32.73 b |
| T6 | 36.04 b | 33.89 b | 46.55 ab | 39.22 b |

**Partial seed coat removal of water spinach seed, followed by 24 h soaking in water (T3) resulted in the highest germination rate in the lab and screenhouse and led to the highest survival rate and the most vigorous plants, 3 weeks after field transplanting.**

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# Conclusions and outlook

- **The results obtained indicate major genotypic differences in the germination rate of okra and water spinach – an explanation of the poor field establishment reported by researchers and farmers**
- **Partial removal of seed coat, followed by soaking with water for 24 h was beneficial for both water spinach genotypes and elevated the germination rate substantially under both storage conditions, in the lab and screenhouse.**
- **Storage temperature of okra seed had a major impact on germination rate. Storage at -15 ºC boosted germination rate markedly, making priming treatments obsolete.**

# Thank you for your attention





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