Determining seed germination requirements for Navajo Spinach, *Cleome serrulata*

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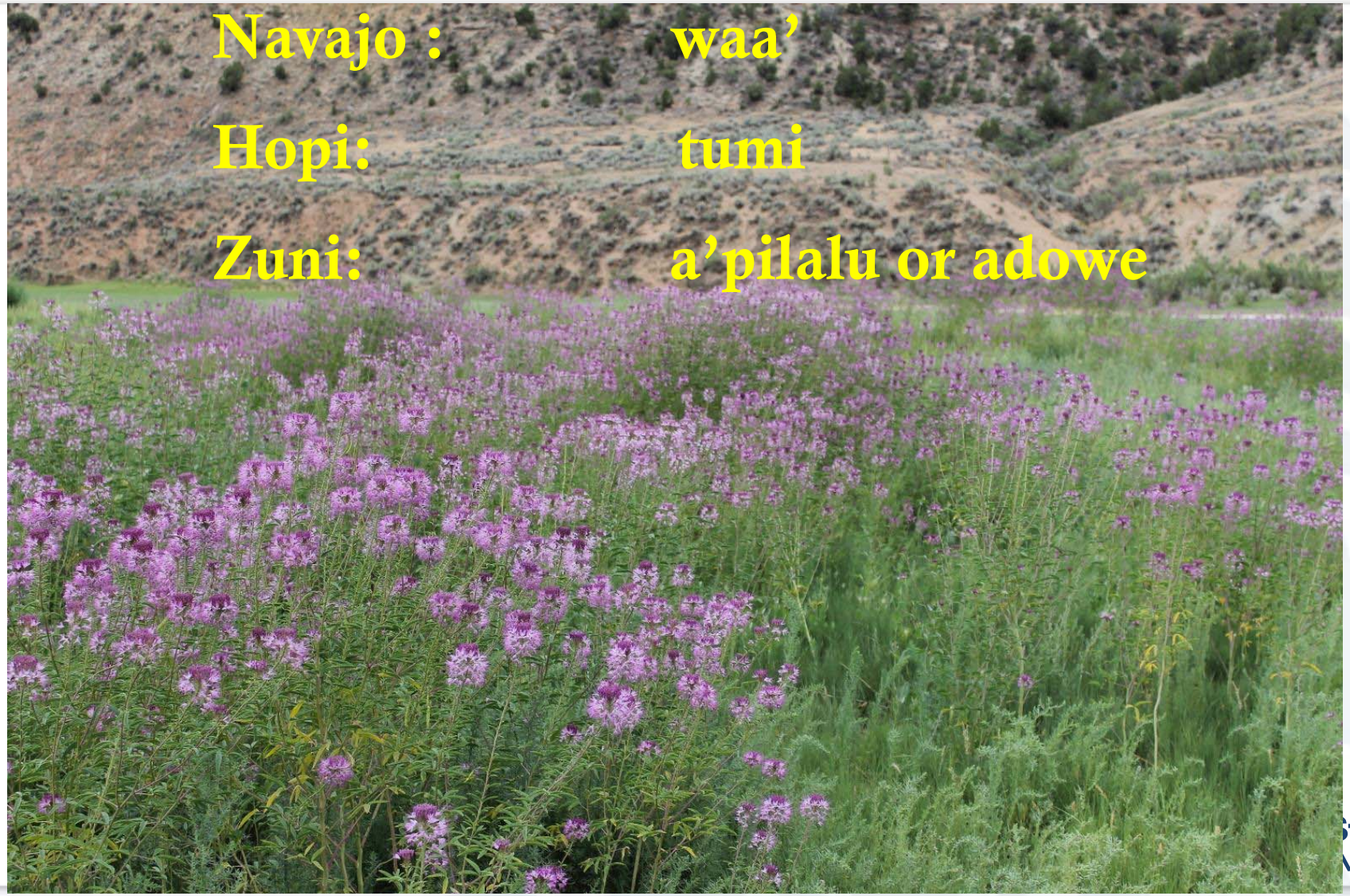

Navajo : waa’

Hopi: tumi

Zuni: a’pilalu or adowe

State
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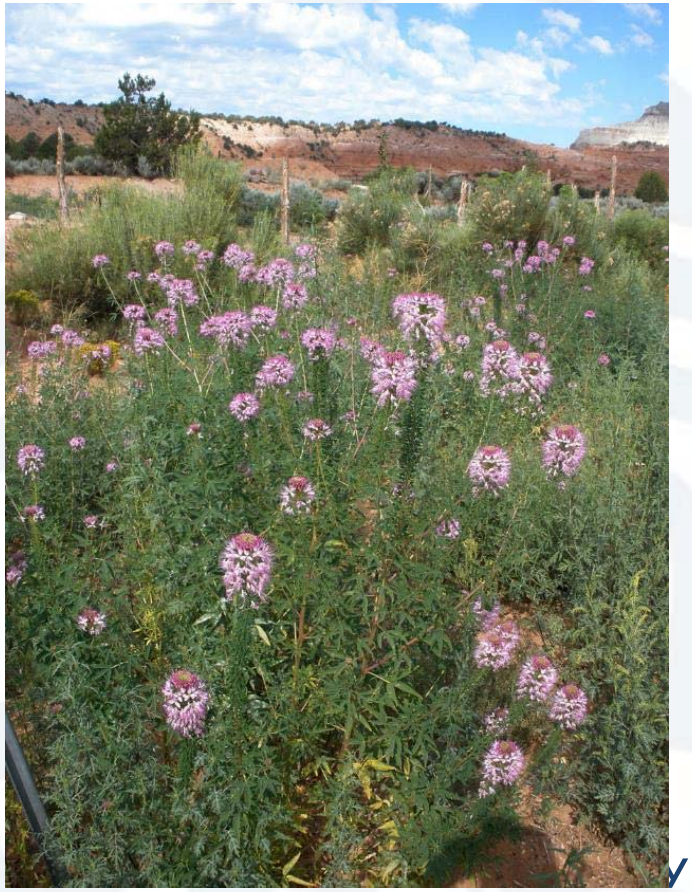
Navajo Spinach

- COMMONLY KNOWN as:
- Bee Spider flower
- Bee Plant
- Rocky Mountain Bee Plant
- Stink/Skunk weed
- Stinking Clover



Navajo Spinach

Classification

- Caper Family (Capparaceae)
- Cleome Family (Cleomaceae)
- Closely related to Mustard Family (Brassicaceae)

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Objectives

- Explore the Historical Practices, Cultural Uses, and Preservation Techniques of Navajo Spinach
- Collect Navajo Spinach from unique locations across Navajo, Hopi, and Zuni Reservations
- Determine germination and growth requirements of Navajo Spinach
- Develop Outreach products relevant to Navajo Spinach use

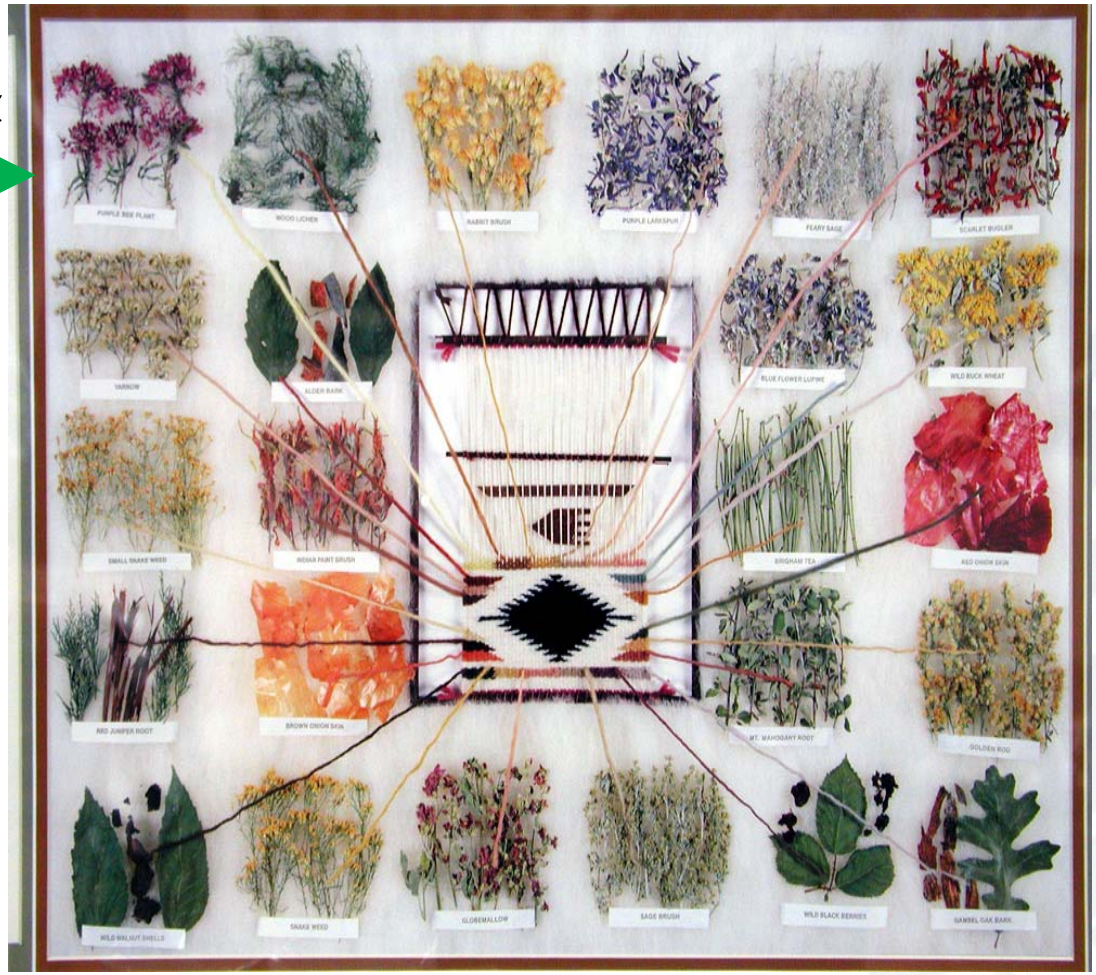
Conservation Uses

- Pollinator habitat improvement
- Range renovation
- Game bird food source
- Conservation cover

Poor forage for livestock or wildlife (unpleasant odor and flavor)

Seeds are viable (PLS) but germination variable.

Bee Plant



Cultural Uses

- Food source (vitamin A, calcium, iron)
- Medicinal plant (stomach, fever reduction, blood fortifier)
- Leaves as a potherb; seeds as gruel, flour, or bread
- Leaves (yellow dye), stems (black dye) for rugs or blankets.
- Black resin for painting pots or baskets

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Navajo Spinach

- No known research or literature.
- Germination parameters unclear.
- Seed company reports say:
  - Fluctuating D/N (30/20C)
  - Chilling: needed/not needed
  - Scarify seeds (?)
  - Fall sow/Spring Sow
- Gardener report:
  - Does not sprout
  - Will not grow

S. Afr. J. Plant Soil 2005, 22(1) 49

Temperature and light requirements for the germination of *Cleome gynandra* seeds

J.O. Ochuodho* and A.T. Modi
School of Agricultural Sciences and Agribusiness, Crop Science Discipline, University of KwaZulu Natal, Private Bag X01, Scottsville 3209, Pietermaritzburg.

FACTORS INFLUENCING SEED GERMINATION OF *CLEOME AMBLYOCARPA* BARR. & MURB. (CAPPARIDACEAE) OCCURRING IN SOUTHERN TUNISIA

Tahar TLIG[1], Mustapha GORAI[1*] & Mohamed NEFFATI[1]

Pak. J. Bot., 47(6): 2189-2193, 2015.

EFFECTS OF ENVIRONMENTAL FACTORS AND SOWING DEPTH ON SEED GERMINATION IN *CLEOME GYNANDRA* L. (CAPPARACEAE)

LINDA IFEANYICHUKWU SOWUNMI AND ANTHONY JIDE AFOLAYAN*

Genet Resour Crop Evol (2013) 60:2183–2189
DOI 10.1007/s10722-013-0036-7

NOTES ON NEGLECTED AND UNDERUTILIZED CROPS

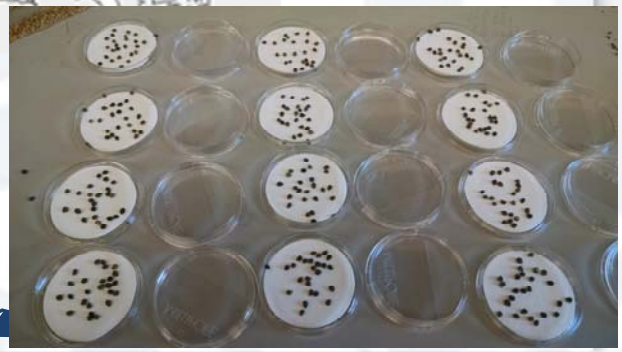
Current status on production and utilization of spider plant (*Cleome gynandra* L.) an underutilized leafy vegetable in Kenya

Cecilia M. Onyango · Catherine N. Kunyanga · Edward G. Ontita · Rama D. Narla · John W. Kimenju

Materials & Methods

Seeds collected from wild population in:

- Canyon De Chelly & Shonto, AZ
- Gallup & Zuni, NM
- Sourced from Great Basin Seed Co, UT



Materials & Methods

2016 Germination Treatments

- 4 week chilling at 4, 10 or 20°C; ± Scarification
- 25 seeds per replication; 5 replications
- Hydrated in petri dish with 1.5mL distilled H_2O
- Captan (1%) used as fungicide
- Germinated seed was counted twice a week

2017 Germination Treatments

- 4 or 8 weeks chilling at 4, 7, 10, or 20°C; ± GA_3 (500, 750, 1000 ppm); ± Promalin (600 ppm); ± H_2O_2 (3%).
- Seed soaked for 2 or 4 hours in designated solutions
- 25 seeds per replication; 5 replications
- Canyon De Chelly seed used for 2017 germination trials

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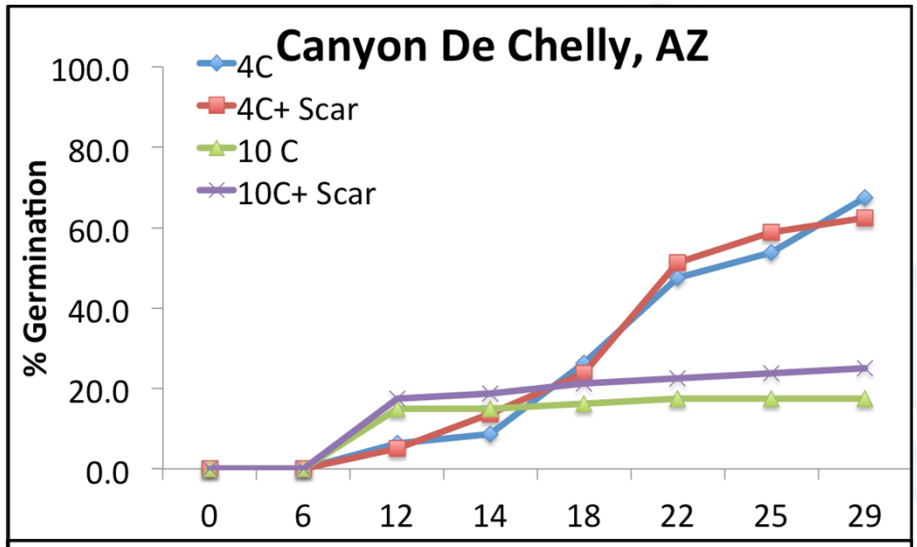
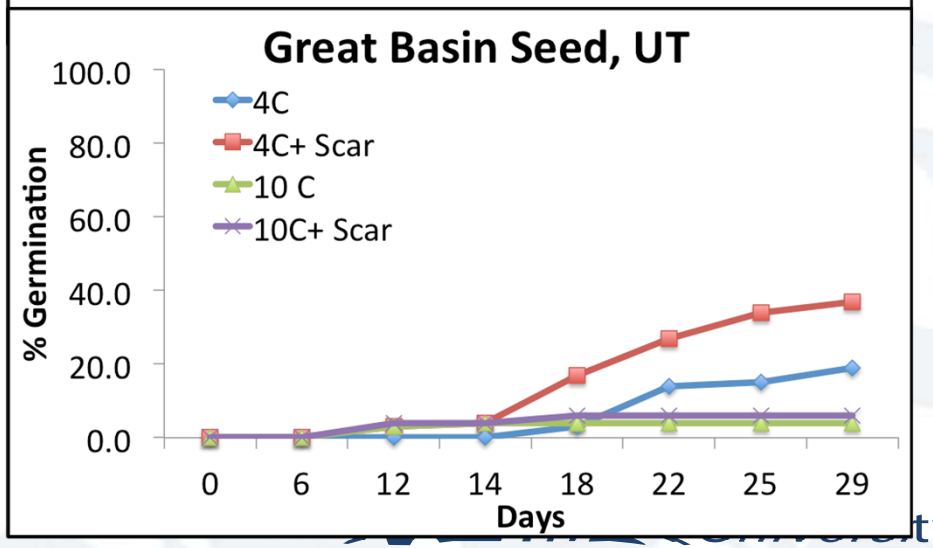
2016 Results

- Seeds germinate earlier at 10°C but have a lower % germination than 4°C treatments
- Little or no germination at 20°C in wild seed lots (No T50)
- Scarification did not improve germination





2016 Results

Time to 50% Germination (T50 in Days)			
	Great Basin Seed, UT	Chinle, AZ	Zuni, NM
4 °C	16.5	15.6	29.0
4 °C + Scar	14.8	14.2	-
10 °C	11.7	10.7	12.0
10 °C + Scar	11.6	12.4	-

- T50 is longer at 4°C than 10°C
- Zuni, NM seed had low germination possibly due to immature seed

$$T50 = t_i + \left[\frac{\frac{N+1}{2} - n_i}{n_j - n_i}\right](t_j - t_i)$$

Planted seed from 2016 treated trials grown out after additional chilling…Double Dormancy?

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2017 Results

- GA3 increased % germination compared to other treatments at all temperatures except 20°C (**Bold Numbers**)
- As temperatures increases, % germination decreases and Navajo Spinach does not germinate at 20°C
- Increasing chilling time does not improve germination
- Inconsistent T50 and T10-90. Chilling for 8 week increased T50 and T10-90 compared to 4 week chill.

Chilling (wks)	Soak (hrs)	Temp (°C)	Control	H_2O_2	$GA_3 + H_2O_2$	Control	H_2O_2	$GA_3 + H_2O_2$	Control	H_2O_2	$GA_3 + H_2O_2$
			Final Germination (%)			T50 (days)			T10-90 (days)		
4	2	4	19	10	16	20	17	21	11	10	19
		7	2	3	1	11	17	5	19	9	3
		10	2	1	-	12	3	-	14	1	-
4	4	4	67	76	**87**	16	17	17	14	16	17
		7	46	41	**62**	15	18	17	17	18	19
		10	13	8	**26**	13	7	14	12	11	21
8	2	4	7	24	**69**	27	41	38	32	51	42
		7	2	7	6	3	37	34	40	34	41
		10	-	1	2	-	17	15	-	7	33
8	4	4	25	27	**50**	33	34	40	53	51	38
		7	2	5	**13**	1	24	43	9	34	42
		10	2	-	-	3	-	-	13	-	-

Only GA_3 at 750ppm used for this trial.

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2017 + Giberellin Results

TREATMENTS	Temp (°C)	Final % Germination	T50 (Days)	T10-90 (Days)	Temp (°C)	Final % Germination	T50 (Days)	T10-90 (Days)
GA_3(500)+PRO+H_2O_2	4C	79	16	15	7C	**86**	16	15
GA_3(500)+PRO		**92**	16	16		**85**	15	12
GA_3(500)+H_2O_2		9	17	18		9	10	21
GA_3(500)		21	19	15		6	11	25
GA_3(750)+PRO+H_2O_2		**90**	16	14		**90**	15	11
GA_3(750)+PRO		**89**	16	14		79	16	14
GA_3(750)+H_2O_2		8	23	18		14	16	14
GA_3(750)		24	18	15		9	12	24
GA_3(1000)+PRO+H_2O_2		77	16	13		66	16	17
GA_3(1000)+PRO		**91**	16	15		72	15	16
GA_3(1000)+H_2O_2		10	22	23		13	20	24
GA_3(1000)		19	20	19		11	14	13
H_2O_2		13	23	18		7	19	17
Control		9	20	13		10	18	21

- Seed germination improves when seed are treated with GA_3 and Promalin
- % germination at 10°C was too low to compare to 4°C or 7°C treatments
- Seed germinate faster (lower T50) at 7°C than at 4°C
- Germination uniformity (T10-90) varied by treatment

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Discussion

- Soaking seed in H_2O_2 does not appear to break physiological dormancy
- Stratification at lower temperatures with Promalin increases % germination
- Additional testing with various GA concentrations and soaking
- Outreach products in the making

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Questions?