STATE OF UTAH
Annual Report for Calendar Year 2018
to the W-6 Technical Committee
Compiled by Kevin B. Jensen

Germplasm Activities of Silvana Martini (Department of Nutrition, Dietetics, and Food Science; Utah State Univ.)

Report: We receive cocoa pods in September 2018 (about 10 cocoa pods). The cocoa pods were used for educational purposes. We opened the pods and tasted the seeds. We planted a couple of seeds in a container, which germinated resulting in the growth of a small tree (less than one foot tall). This was performed under uncontrolled conditions (I don't know how many seeds were planted to obtain one germination – one of my TA's did this). The tree lasted for about 6 months and it dried out.

Germplasm Activities of David Gedge

Lupine report for 2018

Report: I obtained from GRIN 2 accessions of *L. albifroms*, 2 accessions of *L. polyphylus*, and 9 accessions of *L. mutabilis*. My plan was to make seed increase and make crosses if possible.

All accessions died before any seed set took place. I do not know the exact reason but I suspect that my irrigation water had too high of a salt content and/or temperature were too high at flower. Nothing came of my lupine efforts and I do not plan on working any more with this potential crop, at least not at my current location.

Sunflower report for 2018

Report: I obtained from GRIN, 2 accessions of H. anomalus, PI 468638 and PI 649860. I successfully made a cross using H. anomalus pollen to cross onto a proprietary inbred sunflower line of my own. That F1 cross in now growing (2019) in my sunflower nursery. My plan is to screen material derived from that cross for drought tolerance or ornamental potential.

Sunflower report for years prior to 2018.

Report: Previous sunflower accessions obtained from GRIN are in process of development in my sunflower program.

Some of the accessions are open pollinated varieties that are being selected into inbred lines as A,B pairs to be used as female parents in ornamental hybrids.

A few of the accessions were inbred lines that are suitable to use as a parent in a hybrid as is. If the inbred line were a B line it first has to be converted into an A,B pair.

All of the accessions have been crossed to proprietary materials for further development into inbred lines, both A,B pairs and R lines.

A few years ago, twenty accessions of *H. cusicikii* and ten accessions of *H. pumilus* were obtained from GRIN with the intent to attempt crosses to *H. annuus*. Pollen came from *H. cusicikii* and *H. pumilus*. *H. annuus* was the female. Very little seed set was obtained on the attempted crosses. Growing out the seed showed that the potential crossed seed was in fact inadvertent self's from not getting 100% removal of pollen during hand emasculation.

Collecting open pollinated seed from the various accessions of *H. cusickii* and *H. pumilus* and growing it out under dry land conditions has proven interesting. It appears that H. cusickii and *H. pumilus* are closely related and probably readily cross. Therefore I call what I have a genetic mixture of *H. cusickii* and *H. pumilus*. This genetic mixture is an attractive perennial small flowered sunflower than can be established and thrive in limited rainfall areas.

I currently market this genetic mixture on the ETSY web site Lone Peak Sunflower. As of to date no one has wanted to purchase this seed.

Germplasm Activities of Eric N. Jellen (College of Life Science; Brigham Young Univ.)

Report: This year we have mostly been taking photographs at high resolution of the fruits/seeds of our *Chenopodium* collections. Here are some changes based on what we have seen, from what is reported in GRIN:

Ames 29768 = BYU 876, *Chenopodium arizonicum*

PI 666288 = BYU 578, mix of *C. strictum* and *C. berlandieri* var. *zschackei*

PI 666312 = BYU 854, either *C. leptophyllum* or *C. desiccatum*

Ames 29801 = BYU 843, undefined *Chenopodium* sp.

Ames 32980 = BYU 1454, *C. album*

Ames 33016 = BYU 1488, *C. berlandieri* var. *macrocalycium*

Germplasm Activities of Matthew Cook (Department of Microbiology; Weber State Univ.)

Report: In 2018 I requested 50 accessions from the US NPGS. I received seeds or leaf material for 43 of these accessions. I was contacted and notified that 2 of the accessions I'd requested were no longer available (and these have since been listed as 'unavailable on the NPGS website). The other 5 accessions were simply never sent and I never received any communications about them (and they are all still listed as available on the NPGS website). The staff that contacted me about my requests were very helpful and professional and the orders that were fulfilled were send in a timely manner.

I requested these accessions with the intent to extract DNA and sequence their genomes in hopes of achieving broad coverage of the diversity of the Fabids clade. Negotiations with the sequencing center have delayed any efforts to move forward on this project, so I have not attempted any germination or

DNA extraction on any of these accessions. I also have no publications related to these accessions, yet. Please note, however, that it is still my intent to use these accessions for whole-genome sequencing in the future.

The US NPGS is a very useful resource for acquiring germplasm. I hope to be able to use it again in the future to acquire germplasm.

Germplasm Activities of David Hole (Plants and Soils Department; Utah State Univ.)

Report: We continue to utilize Bunt resistance differential lines in our breeding research. Specifically, in 2018, a RIL population developed from the BT12 differential PI554106 and Heines VII (PI201195) was phenotyped for the second year for dwarf bunt infection, and the population is undergoing GBS. Other accessions from the collection have been used to develop RIL populations for BT3, 5, 8, and 10. The International Biennial workshop on smuts and bunts was held in Logan in May 2018 with representatives of 9 countries and the NPGS repository in Aberdeen was visited as part of the workshop due to the value of the collection in worldwide bunt resistance research.

Germplasm Activities of Yuxing Wang (Utah State Univ.) and Jhong Chen (Xinjiang Agricultural Univ.)

Report:

Objective:

To evaluate the relative salt tolerance of different *Trifolium* species and/or accessions obtained from USDA Germplasm Repository.

Introduction

Trifolium (clover) includes about 300 species distributed in the temperate northern hemisphere. It is an important forage crop that is a widely grown crop around the world. *Trifolium* can form symbiosis with nitrogen fixing bacteria and is considered as a plant that can fertilize the soil. Additional information on the salt tolerance of *Trifolium* species is needed. Different *Trifolium* seedlings were evaluated by examining their responses to salt water irrigation in terms of height, number of branches, leaf area, and shoot dry weight.

Materials and Methods

Seeds of *Trifolium aureum, T. tumens, T. striatum, Trifolium pretense, T. montanum, T. lupinaster, T. fragiferum, T. campestre*, and *T. ambiguum* (Table 1) were provided by USDA Germplasm Repository and germinated, and seedlings were grown in a USU research greenhouse. *Trifolium* accessions (PI 664075, PI 663846, and PI 663843) and *Bromus intermis* accessions (PI 655218, PI 659970, PI 642844, W6 25152, PI 576974, W6 21403, PI 494631, W6 49587, PI 685580, PI 659980, W6 49587, PI 685580, PI 659980, W6 19685, PI 502312, PI 494631, PI 345966, PI 234045, PI 196321, and PI 368862) were excluded due to large variations in the germination and seedlings' growth.

Seedlings (≈10 cm) were irrigated with a nutrient solution at electrical conductivity (EC) of 1.2 $dS \cdot m^{-1}$ (control) or saline solution at EC of 2.5 (EC 2.5), 5.0 (EC 5.0), or 7.5 (EC 7.5) $dS \cdot m^{-1}$ every three days for 30 days. During each irrigation, seedling was irrigated with 50 mL nutrient or saline solutions. Height, number of branches, leaf area, and shoot dry weight were recorded at the termination of experiment. The experiment was conducted from Dec. 15, 2018 to Jan. 16, 2019.

Results

The height, number of branches, leaf area, and shoot dry weight of seedlings were shown in Table 2 and Table 3. We haven't analyzed the data yet. Once analyzed, the relative salinity tolerance among different species and/or accessions will be obtained according to their responses to salinity stress.

Table 1. *Trifolium* seeds used in the experiment. All seeds were provided by USDA Germplasm Repository.

Species	Accession no.
Trifolium ambiguum	PI 641368
Trifolium aureum	PI 664075
Trifolium campestre	PI 663843
Trifolium fragiferum	NSL 5464
Trifolium fragiferum	PI 236484
Trifolium lupinaster	PI 631632
Trifolium montanum	PI 234912
Trifolium pratense	G 24476
Trifolium pratense	NSL 53977
Trifolium pratense	NSL 4776
Trifolium repens	PI 300156
Trifolium repens	PI 200372
Trifolium repens	PI 202717
Trifolium repens	PI 226596
Trifolium repens	PI 232942
Trifolium repens	PI 234400
Trifolium repens	PI 234793
Trifolium striatum	PI 663846
Trifolium tumens	PI 631719

Table 2. Height and number of branches of *Trifolium* seedlings irrigated with a nutrient solution [electrical conductivity (EC) = 1.2 $dS \cdot m^{-1}$; control] or saline solution [EC = 2.5 $dS \cdot m^{-1}$ (EC 2.5), EC = 5.0 $dS \cdot m^{-1}$ (EC 5.0), or 7.5 $dS \cdot m^{-1}$ (EC 7.5)] in the greenhouse. Height and number of branches were recorded after the 10th irrigation.

Species	Accession no.	Height (cm)				Number of branches			
		Control	EC 2.5	EC 5	EC 7.5	Control	EC 2.5	EC 5	EC 7.5
Trifolium ambiguum	PI 641368	17	18	17	14	10	8	4	6
Trifolium aureum	PI 664075	13	50	37	16	3	4	3	3
Trifolium campestre	PI 663843	31	52	28	17	8	6	5	2
Trifolium fragiferum	NSL 5464	20	17	14	9	3	4	7	2
Trifolium fragiferum	PI 236484	16	15	15	12	6	6	4	5
Trifolium lupinaster	PI 631632	24	20	20	13	8	6	6	4
Trifolium montanum	PI 234912	39	15	11	12	6	4	7	3
Trifolium pratense	G 24476	17	34	37	17	3	6	3	3
Trifolium pratense	NSL 53977	20	38	20	10	4	3	4	2
Trifolium pratense	NSL 4776	33	37	25	16	5	5	4	3
Trifolium repens	PI 300156	18	26	13	33	9	8	5	1
Trifolium repens	PI 200372	14	20	14	14	7	4	8	4
Trifolium repens	PI 202717	41	22	17	10	3	6	5	4
Trifolium repens	PI 226596	13	40	14	12	3	5	3	4
Trifolium repens	PI 232942	40	17	14	33	3	5	6	1
Trifolium repens	PI 234400	26	43	35	10	6	1	5	6
Trifolium repens	PI 234793	14	35	12	10	9	6	4	3
Trifolium tumens	PI 631719	20	17	16	14	9	10	5	4
Trifolium striatum	PI 663846	38	22	30	17	5	4	1	3

Table 3. Leaf area and shoot dry weight of *Trifolium* seedlings irrigated with a nutrient solution [electrical conductivity (EC) = 1.2 $dS \cdot m^{-1}$; control] or saline solution [EC = 2.5 $dS \cdot m^{-1}$ (EC 2.5), EC = 5.0 $dS \cdot m^{-1}$ (EC 5.0), or 7.5 $dS \cdot m^{-1}$ (EC 7.5)] in the greenhouse. Leaf area and shoot dry weight were recorded after the 10th irrigation.

Species	Accession no.	Leaf area (cm^2)				Shoot dry weight (g)			
		Control	EC 2.5	EC 5	EC 7.5	Control	EC 2.5	EC 5	EC 7.5
Trifolium ambiguum	PI 641368	257	245	81	79	0.31	1.09	0.41	0.34
Trifolium aureum	PI 664075	72	218	309	56	0.75	0.96	0.52	0.54
Trifolium campestre	PI 663843	326	95	297	55	0.62	1.09	0.42	0.74
Trifolium fragiferum	NSL 5464	232	125	430	-	1.55	0.35	0.73	0.36
Trifolium fragiferum	PI 236484	311	260	229	129	2.63	1.58	2.65	1.4
Trifolium lupinaster	PI 631632	222	164	169	79	1.19	0.44	0.9	0.47
Trifolium montanum	PI 234912	192	413	341	178	1.05	1.83	0.56	0.81
Trifolium pratense	G 24476	75	304	160	-	1.02	1	0.58	0.42
Trifolium pratense	NSL 53977	49	142	154	23	0.42	0.45	0.7	0.64
Trifolium pratense	NSL 4776	190	185	232	-	1.33	0.7	0.69	0.48
Trifolium repens	PI 300156	201	519	168	63	1.95	2.95	1.04	0.41
Trifolium repens	PI 200372	257	86	177	63	1.21	1.08	0.56	0.55
Trifolium repens	PI 202717	294	185	154	112	1.75	1.71	1.61	0.62
Trifolium repens	PI 226596	111	295	87	151	1.51	1.11	0.96	0.43
Trifolium repens	PI 232942	224	149	203	63	1.26	0.95	0.55	0.41
Trifolium repens	PI 234400	233	123	197	139	1.61	0.85	0.91	0.51
Trifolium repens	PI 234793	291	278	207	135	2.1	1.63	0.7	0.92
Trifolium striatum	PI 663846	295	293	-	59	0.78	1.11	0.5	0.55
Trifolium tumens	PI 631719	238	276	195	118	0.61	1.52	0.56	0.63

Figure 1. Uniform *Trifolium* seedlings (20 days) were selected for the experiment (A). The *Trifolium* seedlings during the experiment (B and C) and at the end of the experiment (D). White tag: nutrient solution; blue tag: saline solution at an EC of 2.5 $dS \cdot m^{-1}$; purple tag: saline solution at an EC of 5.0 $dS \cdot m^{-1}$; red tag: saline solution at an EC of 7.5 $dS \cdot m^{-1}$.