State of Oregon Annual Report for Calendar Year 2016
W-6 Technical Committee

Compiled by Shawn A. Mehlenbacher

Oregonians continue to use the PI system extensively. Users include state and federal researchers as well as private seed companies and private individuals. Oregon is a major user in the western region, along with California and Washington.

Progress Reports:

1. **Shawn A. Mehlenbacher**, Dept. of Horticulture, Oregon State University, 4017 ALS Bldg., Corvallis, OR 97331

Hazelnut – eastern filbert blight (EFB). In cooperation with Tom Molnar (Rutgers University), tests over several years identified more than 100 accessions with a very high level of EFB resistance. M.S. student Gehendra Bhattarai mapped resistance from *C. americana* 'Rush' and hybrid selection 'Yoder #5' to LG7 in the same region as resistance from the Spanish cultivar 'Ratoli'. This was recently published in Tree Genetics and Genomes. Although the Serbian cultivar 'Uebov' transmits resistance to only about 25% of its offspring because of segregation distortion, the resistance was mapped to LG6 in the same region as 'Gasaway' resistance. A manuscript on 'Uebov' resistance will soon appear in the Journal of the American Society for Horticultural Science (in press). When crossed with susceptible selections, OSU 1187.101 (Holmskij, Russia), OSU 1185.126 (Crimea) and OSU 955.028 (resistance from *C. americana*) transmitted resistance to ~50% of their offspring. EFB resistance in selections from the Republic of Georgia were studied at OSU and Rutgers University, and the results published in the Journal of the American Pomological Society. Ph.D. student Golnaz Koma Komaei is continuing the EFB resistance studies, including mapping resistance genes in progenies that segregate 1:1. Recent tests detected resistance in a dozen selections from seeds collected in Turkey. High levels of quantitative EFB resistance have also been detected in a dozen selections of diverse origin.

Hazelnut – simple sequence repeat markers. Brooke Peterschmidt Colburn developed 111 new simple sequence repeat (SSR) markers from transcriptome sequences and characterized them using 63 diverse hazelnut accessions. Her work was published in Molecular Breeding. Gehendra Bhattarai developed 343 new polymorphic SSR markers (tri-, tetra-, penta- and hexa-repeats). The 'Jefferson' sequence (115× coverage), assembled from Illumina reads, served as the reference genome sequence for hazelnut. Genomic DNA of seven other cultivars was also sequenced using Illumina. Alignment of reads from these seven cultivars with the 'Jefferson' sequence allowed in silico comparisons and identification of polymorphic SSRs. The new polymorphic SSRs were characterized by amplification of 50 accessions with fluorescent primers and sizing with capillary electrophoresis, and 232 were placed on the linkage map. The 150 tri-nucleotide SSRs are described in a recent article in PLOS One. The remaining 193 SSRs are described in a manuscript in preparation. A multiplex set of 14 SSR markers was identified by PhD student Meleksen Akin and Nahla Bassil, and published in the European Journal for Horticultural Science. Fourteen primer pairs are used to amplify a single PCR reaction. After sizing by capillary electrophoresis, all accessions could be distinguished. New hazelnut cultivars from OSU are being increased by private companies using micropropagation, and this fingerprinting set simplifies testing for trueness-to-name.

Hazelnut cultivar releases. 'McDonald' (OSU 880.027) was released in January, 2014. It combines 'Gasaway' resistance to EFB with high yield and excellent kernel quality. A release notice was published in HortScience. 'Burgundy Lace' ornamental was released in April, 2015. It

combines the cutleaf trait with red leaf color and 'Gasaway' resistance to EFB. The cutleaf trait comes from 'Cutleaf' (PI 557078). A manuscript has been prepared for submission to HortScience.

Genome sequencing. In 2016, we sent leaves of 'Jefferson' hazelnut for Pacific Biosciences sequencing at the Arizona Genomics Institute. The long reads were assembled into about 2,000 contigs, which is a large improvement over the 36,000 contigs in the Illumina draft assembly. 'Jefferson' carries EFB resistance from 'Gasaway' on LG6. Based on this good experience, we chose two additional selections for PacBio sequencing in 2017. One has resistance from Georgian selection OSU 759.010 (LG2) and the other has resistance from the Spanish cultivar 'Ratoli' (LG7).

2. Kelly Vining, Dept. of Horticulture, Oregon State University, 4017 ALS Building, Corvallis, OR 97331

Her project is using *Mentha* accessions from the Corvallis National Clonal Germplasm Repository (NCGR) in genomics research and breeding. She has generated genome sequence data for representative accessions of *Mentha longifolia*, *M. suaveolens*, and *M. aquatica*. The *M. longifolia* genome assembly was recently published, and represents the first genome sequence published for *Mentha* (Vining et al., 2017). *M. longifolia* is a diploid species ancestral to cultivated peppermint and spearmint. The genome is small (353 Mb). In the breeding program, four *M. longifolia* accessions and four *M. suaveolens* accessions have been used in interspecific crosses.

3. Ryan Contreras, Dept. of Horticulture, Oregon State University, 4017 ALS Building, Corvallis, OR 97331

Pyrus accessions (PI541615, 541616, 325930, 541603, and 541608) were requested for observation and possible use in a new ornamental pear breeding project that he is considering initiating. He is also observing PI 256000 (*X Sorbopyrus auricularis*) for its ornamental potential. PI 635973 (*Sorbus torminalis*) has looked outstanding at the North Farm and he is keen to assist the NCGR by bringing this selection to the attention of the nursery industry. Three plants of PI 635973 will be propagated and planted to display to industry visitors.

4. Robert Zemetra, wheat breeding program, Crop and Soil Science Department, Oregon State University, Corvallis, OR 97331

The OSU wheat breeding project released two soft white winter wheat cultivars in 2016, 'Norwest Duet' and 'Norwest Tandem'. Both cultivars were developed through a collaborative effort with Limagrain Cereal Seeds and targeted to the wheat production areas in the Pacific Northwest. Germplasm from Europe (via Limagrain) was used for crossing in 2016 and 2017 in the soft white winter, hard white winter and hard red winter wheat crossing blocks. The primary traits of interest included yield, stripe rust resistance, early heading date and straw strength. Crosses were also made to Michigan and New York breeding lines to transfer resistance genes for *Fusarium* head blight, soilborne Wheat Mosaic Virus and tolerance to pre-harvest sprout. Genetic studies have been initiated to study the genetics of novel seed colors and their potential impact on bread flavor. Two articles were published in 2016. See Martins et al. and Tiwari et al. (below).

5. Thomas G. Chastain, Crop and Soil Science Department, Oregon State University, Corvallis, OR 97331

Dr. Chastain is investigating seed shattering as a key constraint to seed yield in perennial ryegrass seed production. Seeds of USDA PI and private sector plant breeder accessions of *Lolium perenne* were planted in the greenhouse and grown into plants robust enough for cloning. These

accessions were categorized by PI or the plant breeder either as shattering resistant or susceptible phenotypes. Each accession was represented by 4 plants derived from 4 different seeds to better understand the variation within accessions. These plants were used as the source for creating vegetative clones of each of the lines for field planting. A total of 160 genotypic lines were established from the clonal lines and planted in the field in four replicated blocks. The assessment of shattering (seed loss and retention) is underway. The progress to maturity in each clone is also being ascertained through periodic seed moisture testing and is being tracked by growing degree day accumulation. Extreme variation in spike size and spike architecture has been observed among the genotypes. The work is expected to span several years in the field to gain a better understanding the impacts of environment on seed shattering losses in perennial ryegrass.

6. **Shaun Townsend**, aroma hops breeding program, Crop and Soil Science Department, Oregon State University, Corvallis, OR 97331

The four hop accessions (CHUM 1447, CHUM 1449, CHUM 1452, PI617284) were received as seed (25 seeds per accession) in 2015. The seed were cold-treated for 8 weeks to break dormancy, and planted in a greenhouse in February 2016, and the survivors later transplanted to a short trellis in the field for observation. They were then moved to a space-planted field nursery in February, 2017. The plants will be evaluated for several years for disease and pest resistance, vigor, and general growth characteristics. Superior genotypes will be utilized in crosses to introgress traits into germplasm developed by the Aroma Hops Breeding program. The 'Newport' plants that he received in 2016 are being propagated and established as check cultivars in advanced testing nurseries on two hop grower farms.

7. **Vidyasagar Sathuvalli,** Hermiston Ag Research & Extension Center, Oregon State University, 2121 South 1st Street, Hermiston, OR 97838

The Oregon State University Potato Breeding Program is screening wild potato accessions for resistance to Columbia root-knot nematode (*Meloidogyne chitwoodi*) and *Verticillium dahliae*, both major soil-borne pathogens of potatoes in the Pacific Northwest. They screened 45 potato accessions for their response to Columbia root-knot nematode and 23 accessions for Verticillium wilt. It appears that many accessions of *S. hougasii* confer strong resistance to the Roza pathotype of *M. chitwoodi*, including PI161726, PI239423, PI239424, PI283107, PI558402, and PI558422. In addition, selected clones from *S. stenophyllidium* PI545815 and *S. bulbocastanum* PI255518 also appear to be sources of untapped resistance to *M. chitwoodi*.

Strong resistance to *V. dahlia* was more difficult to observe; the majority of the wild potato clones tested appear to be much more susceptible than the 'Ranger Russet' control. However, some accessions, including a clone from *S. andreanum* PI498148, may have moderate resistance that could be introgressed into elite potato germplasm.

The next step will be to begin introgression of resistance to these two pathogens into elite potato germplasm and to gain a better understanding of each resistance source.

8. **Chad Finn**, Research Geneticist, USDA-ARS Hort Crops Research Lab, 3420 NW Orchard Ave., Corvallis, OR 97330

Dr. Finn uses plant germplasm in his berry breeding program, and has released many cultivars in recent years. He has been involved in the RosBREED project "Enabling Marker-Assisted Breeding in Rosaceae" and in a black raspberry SCRI project. He reported a long list of publications from these efforts.

9. Ruth Martin, USDA-ARS National Forage Seed Production Research Center, 3450 SW Campus Way, Corvallis, OR 97331

'Rondo' and a salt-sensitive rice cultivar were requested to look at the effect of endophytes on salt stress. Unfortunately, the rice grew very poorly and she was not able to produce seed. She decided to use a *Lolium* species to test for the effect of endophyte on salt tolerance.

10. Kristina Gill, University of Oregon Museum of Natural and Cultural History, 1680 E. 15th Avenue, Eugene, OR

She received a number of diverse taxa from the National Plant Germplasm System to include as part of her comparative collection for identifying ancient plant remains in archaeological sites, primarily on the Channel Islands off southern California. She does not have any new published articles with significant results yet, but does have a technical report that provides results of a study aimed at identifying the composition of native plant communities prior to the introduction of European taxa, by examining archaebotanical remains from a number of village sites dating to within the last ~1500 years on the west end of Santa Cruz Island. One taxon (*Sesuvium verrucosum*) assisted identification of ancient specimens to the same species, the results of which are significant because this taxon appears to have been extirpated from the island during the historic era. The results of this study are aiding restoration ecologists as they make decisions about restoration goals and the influence of ancient anthropogenic forces in shaping the native landscape.

11. Jerry Hall, Grassland Oregon, 4455 60th Avenue NE, Salem, OR

Several *Trifolium* and *Brassica oleraceae* accessions were requested and seeded in Spring, 2017 at the Grassland Oregon research facility in Salem, Oregon. These accessions were requested to assess their ability to grow in Western Oregon, as part of their ongoing commitment to develop and/or introduce new alternative crops for farmers in Western Oregon. At this time, it is too early to tell if any of this material will be suitable for including in our variety development program. Some of the *Trifolium* accessions tested in prior years looks very promising.

12. Stephen Johnson, Peak Plant Genetics, LLC, 32674 Dever-Conner Drive NE, Albany, OR

He requested seeds of grass species (*Agrostis*, *Festuca*, *Lolium*) for use as standards for measurements. The data were included in Plant Variety Protection applications.

13. Don Floyd, DLF Pickseed USA, PO Box 229, Halsey, OR

Perennial ryegrass germplasm (8 accessions of *Lolium perenne*) were requested to establish true-to-type spaced plants of known/landmark varieties to use as standards for comparison against new varietal candidates of turf-type perennial ryegrass. Morphological data collected from these plants will be part of future applications for Plant Variety Protection and the National Grass Variety Review Board of The Association of Seed Certifying Agencies, as they bring their new varieties to the commercial market place in the U.S. He states, "We value the availability and use of such germplasm".

14. Peter Mes, P&R Seeds, 2397 NW Kings Boulevard, Corvallis, Oregon, 97330

Dr. Mes been working with a few PI *Cucurbita* lines. He initially screened the material last summer, and continued with one line as a potential source for improved field 'tolerance' to stress. I don't know if the one line. PI 483347 held up last year better than the other PIs and was similar to the best of the commercial material with which he is working, but he is not sure if it a source of

stress tolerance. He is continuing with field observations and breeding efforts to see if any improvements can be made in the cucurbits he is working with. The other line of note was PI 209783, which he was using as a check for comparison with commercial lines grown in the Willamette Valley. It is similar, but not superior to the local material.

15. Ely Black, (no address?) **Orders #** 286511 and 286534.

Seeds of *Beta vulgaris* and *Capsicum* spp. were requested to see how they would perform in a community garden. All seeds arrived in good condition and were planted on 2/21/17. Accessions of *Beta vulgaris* (PI 546391 and 663876) were soaked in hydrogen peroxide for 3 hours, and 5 and 10 out of ten seeds germinated in two weeks. The *Capsicum* accessions were hot water treated at 125* for 25 minutes. The number (out of ten) seeds that germinated were 5 for PI 586661, 10 for PI 586675, 6 for PI 593545, and 6 for PI 639649.

16. Niki Swearingin, The Least of These, 883 SE 18 Ave, Hillsboro, OR

Seeds were requested to study "the effects of varying conditions on the germination and production of a variety of *Phaseolus coccineus* and *Solanum lycopersicum* to determine viability in relation to nutrition disparities and hunger in impoverished populations". Of the *Phaseolus coccineus* seeds planted, G35027 was the only seed to produce a plant. The students believe that may have been due to the location they chose to plant the seeds (a southern facing area with well-drained soil) or the extreme weather experienced last year. She noted that "The students appreciate you allowing them to take part", but feel that their findings offer no significance.

17. Donald Wirth, Saddle Butte Ag, Inc., P.O. Box 50, Shedd, OR

Seeds of four *Vicia faba* accessions were requested for a home garden. He had some success last season, but did have a disease issue. He harvested the following: 110 seeds of WH-1, 92 seeds of WH-2, 80 seeds of WH-3, and 201 seeds of WH-4. The seeds were planted on a farm in the Terrebonne area trying to see if that will reduce disease pressure.

18. Jeanette Uhden, Project Manager, Essex Labs LLC, 5549 Lone Pine Road, Terrebonne, OR

The *Mentha suaveolen* selections are currently being maintained in the Essex Labs breeding program and examined for attributes that could be used to improve disease resistance and unique flavor components. As of this date there are no results to report.

19. Paul Halladin, Iseli Nursery Inc., 30590 SE Kelso Road, Boring, OR

Cuttings of the rare conifer *Nothotsuga longibracteata* we received from the US National Arboretum in 2016. The 50 cuttings were rooted and then potted last fall and it appears about 25 are still alive. All are very small but have some new foliage and should continue to grow. He is looking forward to growing this rare conifer species.

20. Brian Moore, Rookshire Lane, 34377 Seavey Loop Road, Eugene, OR

Scions of cider apple accessions 'Coloradona' (GMAL 4860), 'Solarina' (GMAL 4865) and 'Collaos' (PI 666188) were chip budded in Sept. 2016 to M7 rootstock that had been growing for one season. Buds emerged in mid-May around the same time as many French cider apples varieties. Growth for all scions has been slow at about 2-3 inches in early June.

21. Kiawe Elliott, Forest Island Farm, 97755 Elk Creek Road, Myrtle Point, OR 97458

He requested scions of four *Malus* accessions. They are now second-year grafts and were planted in Coos and Benton counties. They are healthy and haven't shown signs of major disease. They are still under evaluation for breeding and dissemination. He also requested four accessions of *Ribes uva-crispa*. Unfortunately, none of the rooted cuttings survived, although he used the same propagation protocol that had given him consistent success with American/hybrid gooseberries, but this batch failed despite showing the promise of early initial rooting. The flat may have succumbed to some root pathogen.

22. Eric Hammond, Heritage Seedlings and Liners, Inc., 4194 71st Avenue SE, Salem, Oregon

He received 5 accessions of *Acer*, 30 scions each, and propagated them for the National Arboretum in Washington, D.C. He received the scions in Feb 2016, whip and tongue grafted them, and placed them on a hot callus pipe. After they were healed, he potted and grew them for one growing season. They were shipped back to Kevin Conrad at the National Arboretum this winter. He says, "We like to help the National Arboretum as much as we can and always offer to graft trees for them."

23. Will McClatchey, Thousand Island Refuge, 28281 Hamm Road, Eugene, OR

Will was trained as a plant taxonomist and is trying to grow *Malus* accessions in a common garden study with some other taxa that he acquired in Oregon. Although he has morphological data from wild populations and cultivated collections, he has not found published data on a range of global *Malus* species growing under the conditions of the Pacific NW coastal climate. He is collecting growth and development data and hopes over the course of the next 10 years to be able to say something useful about how the various species perform both as free-standing trees, scion grafts onto standard rootstocks, and as rootstocks for several standard varieties.

24. Pete Scott, Scott Farms, 922 NW Circle, Corvallis, OR Order #274383

Of the four apple varieties that he received ('James Grieve', 'Dunning', 'Freyberg' and 'Golden Nugget'), only two were successful – 'Dunning' and 'Golden Nugget'. He has fruit this year on both. The 'James Grieve' scion wood was very thin and weak. The 'Freyberg' looked better but also did not take. He might try again next year.

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