

The Collaborative Fir Germplasm Evaluation Project

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Background The Collaborative Fir Germplasm Evaluation (CoFirGE) Project was organized during Summer 2010 to fund and implement the collection and evaluation of fir germplasm for use in the Christmas tree industry. This collaboration includes members from universities and grower associations in five regions of the United States (Connecticut, Michigan, North Carolina, the Pacific Northwest, and Pennsylvania) and Denmark. The initial focus of the CoFirGE Project is to obtain seeds of Turkish (*Abies bornmuelleriana*) and Trojan (*A. equi-trojani*) fir and to evaluate these species as Christmas trees in a coordinated series of field trials. Each region originally donated \$5,000 toward the seed collection and as expenses are incurred, additional funds are being collected for growing the plant material and managing field trials.

CoFirGE Members	
Connecticut Christmas Tree Association	Connecticut Agricultural Experiment Station
Danish Christmas Tree Growers Association	University of Copenhagen
Michigan Christmas Tree Association	Michigan State University
North Carolina Christmas Tree Association	North Carolina State University
Pacific Northwest Christmas Tree Association	Oregon & Washington State Universities
Pennsylvania Christmas Tree Growers Association	Penn State University

Cone Collection Trip During early October 2010, Dr. Gary Chastagner (Washington State University), Dr. Fikret Isik (NCSU), Chal Landgren (Oregon State University) and I, travelled to Turkey for the cone collection effort (Figure 1). Mr. Muzaffer Topak, who manages a commercial seed collection company in Turkey, was our guide and handled most of the logistics including obtaining permission from the Turkish Ministry of Environment and Forestry, contracting climbers, reserving lodging, and providing transportation. We collected about 60 cones from each of 100 trees representing a range of elevations within each of three provenances of Turkish fir (Akyazı, Bolu, Karabük) and two provenances of Trojan fir (Çan and Kazdağı) (Figures 2 and 3). For each tree we also collected the following data: latitude, longitude, elevation, vigor score, crown score, color score, height class, diameter at breast height, total height, presence and frequency of subtending branchlets, and presence or absence of needle cast. Dr. Chastagner collected four branches from each tree for a needle retention

assessment (Figure 4) and I collected needle samples for DNA extraction. The overall elevation of the mother trees averaged 3,954 ft. and ranged from 919 ft. up to 5,545 ft. A total of 156 lbs of seeds was collected (Table 1).

After the cone collection trip, Mr. Topak transported the cones to his nursery in Anakara for drying. Seeds were extracted and cleaned and then in early January 2011, shipped to Seattle, WA. Mr. Topak also conducted the needle retention assessment according to Dr. Chastagner's protocol. DNA was extracted from the needles by the lab of Dr. Zeki Kaya, a colleague in the Dept. of Biological Sciences at the Middle East Technical University, Ankara. These DNA samples are now at NCSU and are being used to develop genetic fingerprints for each tree. Using digital photographs taken during the collection trip, NCSU undergraduate student, Stephane Kinane, measured the lengths and widths of 20 needles and four cones from each tree.

Current Status and Future Plans Kintigh's Mountain Home Ranch in Springfield, OR, has been contracted to grow containerized seedlings to be used to establish the U.S. portion of the field trial series (Figure 5). After germination tests, the seeds were stratified and sown during June 2011. Ideally, 30 seedlings from each of the 100 open-pollinated families will be established in two field trials in each region using a common experimental design. Additionally, genetically improved Nordmann fir seedlots contributed by our Danish collaborator as well as Fraser fir and noble fir seedlots will be included in the test series for comparison.

Once established, these tests will be cultured according to regional Christmas tree practices. Throughout the rotation, survival, growth and quality traits will be assessed using common protocol. Eight years after planting, each region will be permitted to thin their tests for seed production and/or to collect scion material to establish a grafted clonal seed orchard. Additional seeds will be available from most seedlots and it is anticipated that other collaborative studies involving this material will develop including evaluating frost hardiness (date of budbreak), Phytophthora root rot resistance, and post-harvest needle retention.

The CoFirGE Project is a long-term large-scale effort. Collectively, we will accumulate a wealth of information about these 100 mother trees and their progeny. This cooperation not only leverages scarce resources, but will also provides us with a much more comprehensive picture of the variation in these species not to mention supplying improved and locally adapted material to benefit the real Christmas tree industry.

Table 1. Weight of seeds collected and elevation of Turkish and Trojan fir mother trees for each provenance.

Provenance	Seeds Collected		Elevation of Mother Trees (ft.)	
	Weight (lbs)	Average	Low	High
Turkish Fir				
Akyazı	32.40	4,095	3,360	4,751
Bolu	44.37	4,414	3,720	5,545
Karabük	23.05	4,289	3,379	4,829
Trojan Fir				
Çan	38.06	1,955	919	2,674
Kazdağı	50.58	5,017	4,764	5,190



Figure 1. Chal Landgren, Fikret Isik, John Frampton and Gary Chastagner (l to r) at the Trojan fir Natural Conservation Area in Kazdağı

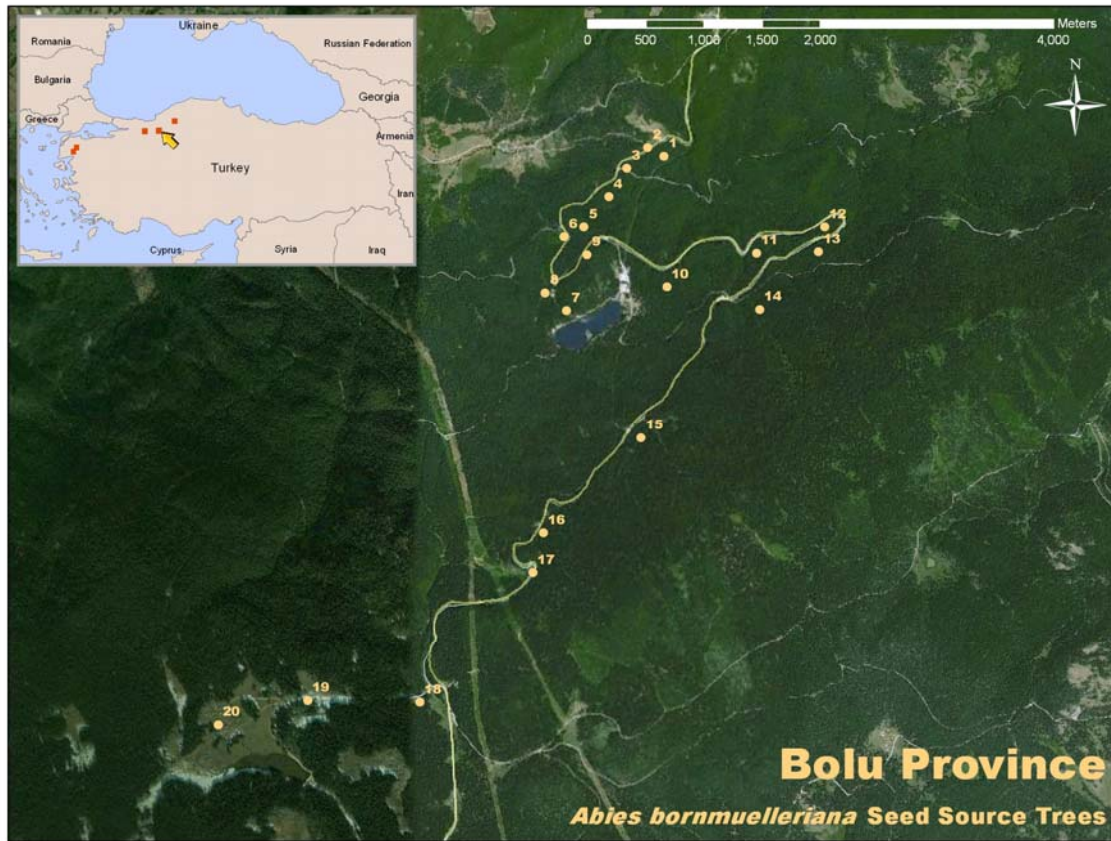


Figure 2. Location of the 20 Turkish fir trees from which cones were collected in Bolu. The inset map shows the location of Bolu relative to the four other geographic sources sampled. (Map by Gel Dermott, WSU.)



Figure 3. Natural stand of Turkish fir in the Bolu region.



Figure 4. Gary Chastagner collected four branch samples from each of the 100 select trees. These were used in a needle retention study conducted in Ankara by Muzaffer Topak.



Figure 5. Turkish and Trojan fir seedlings being grown in a greenhouse at Kintigh's Mountain Home Ranch, Springfield, Oregon. These seedlings will be distributed across five fir production regions to establish the CoFirGE Project field trials.