Dwarf Mistletoe Committee Report

Submitted by Katy Marshall

I. TAXONOMY, HOSTS, AND DISTRIBUTION.

a) Our work on the taxonomic status of the shore pine dwarf mistletoe is continuing. We now have a draft of a manuscript prepared and plan to submit it for publication soon. (E. Wass, Canadian Forest Service, PFC, Victoria, B.C.; R. Mathiasen, Northern Arizona University, Flagstaff, AZ).

b) Further observations of the phenology of Hawksworth's dwarf mistletoe *(A. hawksworthii*) were made in early November 2000 in Belize. The female plants were not quite ready to disperse seeds, but fruits could be squeezed out of their pericarps. Therefore, it appears that seeds are dispersed from late November into December for *A. hawksworthii*. Male plants were not flowering in early November. (R. Mathiasen, Northern Arizona University, Flagstaff, AZ).

c) A small population of large stemmed dwarf mistletoe (*A. globosum* ssp. *grandicaule*) was discovered on *Pinus hartwegii* in November 2000 at the summit of Cerro las Minas in Celaque National Park near Gracias, Department Lempira, Honduras. This is the first report for this dwarf mistletoe from Honduras and extends its distribution by approximately 300 km to the east from west-central Guatemala. (R. Mathiasen and B. Howell, Northern Arizona University, Flagstaff, AZ; J. Melgar, ESNACIFOR, Siguatepeque, Honduras).

d) Our field observations "suggest" that the Honduran dwarf mistletoe (*A. hondurense*) which was recently found in Chiapas, Mexico may also be present in Oaxaca, Mexico. A dwarf mistletoe strongly resembling *A. hondurense* was collected near Suchixtepec in December 2000. We are in the process of completing the molecular analysis of this collection in order to confirm that it is *A. hondurense* or not. (R. Mathiasen, Northern Arizona University, Flagstaff, AZ; D. Nickrent, Southern Illinois University, Carbondale, IL).

e) Specimens of Oaxacan dwarf mistletoe (*A. oaxacanum*) were collected from the type locality in Oaxaca, Mexico in December 2000. We are in the process of sequencing the ITS regions of the ribosomal DNA cistron for this species. Oaxacan dwarf mistletoe is one of the few dwarf mistletoes that has not yet be analyzed using molecular techniques. (D. Nickrent, Southern Illinois University, Carbondale, IL; R. Mathiasen, Northern Arizona University, Flagstaff, AZ).

f) In the never-ending quest for the World's largest dwarf mistletoe, our latest trophy-hunting expedition found us exploring the dangerous slopes of Nevada de Colima, Jalisco, Mexico in January 2001. A male plant of Mexican dwarf mistletoe (*Arceuthobium vaginatum* ssp. *vaginatum*) measuring **92.5 cm** in height was discovered on *Pinus hartwegii* at an elevation of nearly 11,000 feet. This represents the largest dwarf mistletoe plant discovered, thus far, in the Universe. The old record, held by *A. globosum* ssp. *grandicaule,* from Guatemala was 81 cm. More dwarf mistletoe trophy hunting in Guatemala is scheduled for December 2001. We anticipate that a male dwarf mistletoe plant will eventually be discovered that exceeds one meter in length! (R. Mathiasen and C. Daughety, Northern Arizona Univ., Flagstaff, AZ; Jaime Villa, Ciudad Obregon, Jalisco, Mexico).

g) We published a technical note in the Western Journal of Applied Forestry (Vol. 16, No. 2) on the susceptibility of foxtail and western white pines to limber pine dwarf mistletoe (*A.*

cyanocarpum). Foxtail pine remains classified as an occasional host and western white pine is a secondary host for this dwarf mistletoe in northern California. No infection by limber pine dwarf mistletoe was observed on Low's fir or Jeffrey pine during the study. (R. Mathiasen and C. Daugherty, Northern Arizona University, Flagstaff, AZ).

h) The juniper dwarf mistletoe, *Arceuthobium oxycedri*, is the dwarf mistletoe with the longest taxonomic history and greatest geographic range. We have published the results of a several year effort to update information on the hosts and distribution of this mistletoe as Research Note RMRS-RN-11 (Ciesla, Geils, and Adams at http://www.fs.fed.us/rm/pubs/rmrs_rn11/index.html. We recognize 26 host species and map the distribution for 30 countries from North Africa, Europe, Indian subcontinent, and Asia. (B. Geils, Rocky Mountain Research Station, Flagstaff, AZ; W. Ciesla, Forest Health International, Fort Collins, CO; R. Adams, Bishop Museum, Honolulu, HI).

i) Work is now proceeding well to catalog the mistletoe collection of the Forest Pathology Herbarium (FPF). This collection was assembled by Frank Hawksworth and Del Wiens to support their research on mistletoe taxonomy, hosts, and distribution. To maintain good curation of the collection, specimen sheets are being dispersed to several herbaria, primarily the US National Herbarium and the UC Herbarium at Berkeley, CA. When the project is completed later this year, I intend to publish a report identifying which institution has received each of the 5,000 accessions. (B. Geils, Rocky Mountain Research Station, Flagstaff, AZ).

II. PHYSIOLOGY AND ANATOMY

a) Fredrick Meinzer and David Shaw have begun a research project based at the Wind River Canopy Crane on the, "Impact of Dwarf Mistletoe on the Hydraulic Architecture and Whole-Tree Water Relations of Western Hemlock". In this study, a variety of approaches (including whole tree sapflow, leaf water potential, stomatal conductance, N, leaf area, conductance of basal segments) will be employed to characterize the impact of dwarf mistletoe infection on the hydraulic architecture and water relations of western hemlock over a range of scale from leaf to whole-tree. (F. Meinzer, USFS, PNW Research Station, Corvallis and D. Shaw, Wind River Canopy Crane Research Facility, University of Washington).

III. LIFE CYCLES

a) Our study of the sex ratio for Chihuahua pine dwarf mistletoe (*A. gillii*) is completed. We sampled an additional population of *A. gillii* in the Sierra Madre Occidental near the Sonora-Chihuahua state line in June 2001. So far the sex ratio of all the populations we have sampled is essentially 1:1. We plan to submit a manuscript to Madrono in the near future. (R. Mathiasen and C. Daugherty, Northern Arizona University, Flagstaff, AZ).

b) Although Hawksworth and Wiens (1996, see page 258) speculated that Yecoran dwarf mistletoe (*A. yecorense*) flowers in June, our observations from June 25-27, 2001 in Sonora and Chihuahua, Mexico indicated that no male flowers were near anthesis. We now estimate that this species flowers from sometime in late July through August, perhaps into September. The period for seed dispersal for *A. yecorense* remains unknown. (R. Mathiasen and C. Daugherty, Northern Arizona University, Flagstaff, AZ).

IV. HOST-PARASITE RELATIONS

a) Now that we have a greenhouse full of host trees suitable for inoculation, we will begin the pathology phase of a study on the ecophysiology of mistletoe latency. This cooperative study of

the Rocky Mountain Research Station and Northern Arizona University will examine the effects of water stress and of shading on mistletoe incubation, reproduction, and latency. Species under study are hemlock dwarf mistletoe, Douglas-fir dwarf mistletoe, lodgepole pine dwarf mistletoe, and southwestern dwarf mistletoe. We hope to better understand the physiology behind resurgence of mistletoe populations after partial stand opening. (B. Geils, Rocky Mountain Research Station, Flagstaff, AZ; T. Kolb, Northern Arizona University, Flagstaff, AZ).

V. EFFECTS ON HOSTS

a) The Southwest Oregon Forest Insect and Disease Service Center and Medford District, Bureau of Land Management, are conducting a study to examine the sequence of development of dwarf mistletoe brooms on Douglas-fir. We would like to know whether big brooms are old, whether brooms develop continuously during the life of the trees and whether trees infected early in life survived to become large in size. In the first part of the study, thirty large Douglas-fir were felled and each branch examined for infection. We collected data on the ages of the trees, infected branches and mistletoe brooms; characterized the brooms using Tinnin and Knutson's three broom types; and measured the brooms' volume, distance from the bole and height from the ground. The data will be analyzed this winter. In the second part of the study we will select small trees, monitor them for the initiation of new infections and collect data on the early development of the brooms. We hope to use this information to make recommendations about how to grow large Douglas-fir with large mistletoe brooms suitable for wildlife use. (K. Marshall and D. Goheen, SWOFIDSC, and D. Russell, Medford BLM).

VI. ECOLOGY

a) The objective of this research is to determine the relationship between avian relative abundance and species diversity, and infestation by Southwestern dwarf mistletoe (*A. vaginatum* subsp. *cryptopodum*) in ponderosa pine forests of northern Arizona. We hypothesized that birds occur in greater abundance and with wider species diversity in stands that are infested with dwarf mistletoe compared to similar non-infested stands. The fixed radius point-count method was used to determine an index of relative avian abundance and species diversity within stands of varying mistletoe infestation severity. Twenty 80-acre study sites were selected in pure pine forests west of the San Francisco Peaks in the Coconino National Forest. Five study sites in each of the following classes were selected: 1) severely infested (mean DMR > 2.0); 2) moderately infested (mean DMR 1.1-2.0); 3) lightly infested (mean DMR 0.1-1.0); and 4) uninfested (mean DMR 0). Eight point-count stations have been established within each stand. Birds were sampled at each point count station 6 times in 1999, and 6 times in 2000. Detailed stand characterization was completed in 40 0.1-acre plots within each stand. Each tree encountered was rated for dwarf mistletoe infection using Hawksworth's dwarf mistletoe rating, Tinnin's broom volume rating, % volume broomed, and an absolute broom volume rating. In addition, ground cover, shrub/sapling cover, canopy structure, and coarse woody debris data were collected to identify potential covariates. It is our goal to quantify how several avian species respond to different levels of dwarf mistletoe infestation and to recommend what levels of mistletoe infestation might be most beneficial to birds. Data are being analyzed at this time. (T. Parker, R. Mathiasen, and C. Chambers, Northern Arizona University, Flagstaff, AZ).

b) We investigated bird and mammal use of Douglas-fir dwarf mistletoe-induced witches' brooms in the Southwest. There were two phases of the study. The first phase was a comparison of wildlife use in broomed and unbroomed trees. Three stands were selected on the San Francisco Peaks on the Coconino National Forest in Northern Arizona. We laid out 4x4 grids (each point 80.5m apart) in each stand and systematically selected pairs of broomed and unbroomed trees (based on diameter at breast height) at each point to climb. We climbed trees in these stands in the fall of 1998 and 1999. We have found significantly more use in the broomed trees versus the unbroomed trees. Due to what appears to be preferential use of broomed trees by birds and mammals in these areas, a second phase was added to the study in order to increase the scope of inference. During the summer of 1999, 5 transects on 4 national forests in Arizona and New Mexico were randomly selected. Fifteen broomed trees (5 trees in 3 diameter classes) on each transect were systematically selected and climbed to examine for wildlife use. Red squirrels were the primary mammal to use witches' brooms in Douglas-fir in the Southwest. A masters thesis by Shaula Hedwall was completed in May 2000. We have submitted a manuscript to the Journal of Wildlife Management. (S. Hedwall, C. Chambers, R. Mathiasen, Northern Arizona University, Flagstaff, AZ; S. Rosenstock, AZ State Fish and Game, Flagstaff, AZ; B. Geils, RMRS, Flagstaff, AZ; M. Fairweather, FHP, R3, Flagstaff, AZ; and C. Parks, PNWRS, LaGrande, OR).

c) We are progressing into the second field season (2001) of our study examining wildlife use of witches' brooms in ponderosa pine in northern Arizona. The first field season (2000) involved locating study sites and selecting sample trees. This is a continuation of work on wildlife use of witches' brooms in Douglas-fir. (G. Garnett, R. Mathiasen, and C. Chambers, Northern Arizona University, Flagstaff, AZ).

d) **Potential impacts of herbivory on hemlock dwarf mistletoe.** We are beginning a research project on herbivores of hemlock dwarf mistletoe. We will be proposing a project centered at the Wind River Experimental Forest that will investigate the herbivores and their potential impacts on population control of mistletoe, i.e. does herbivory influence the spread and intensification of hemlock dwarf mistletoe? Initial observations suggest the mistletoe hairstreak is a common herbivore at this site, and we may do some additional work determining life cycle and ecology of this unique butterfly. (K. Ernest, Central Washington University and D. Shaw, Wind River Canopy Crane Research Facility, University of Washington).

e) We have developed a theory, presented at Northwest Scientific Association conference in Arcata, Calif. in March 2001. **We hypothesize that western hemlock dwarf mistletoe, a parasite of a secondary successional species, is maintained on the landscape in the Douglas-fir region by** 1. Survival of small clusters of infected hemlock trees that persist after stand replacement disturbances such as fires. These small clusters become the center of expanding infection centers as the surrounding forest changes from dominance by Douglas-fir to dominance by western hemlock. 2. Large scale refugia (200 ha +) that are only partially disturbed during major stand replacement disturbances. An example of a refugia exists on Trout Creek Hill, Wind River Experimental Forest (WREF). The infection center exceeds 300 ha and may be associated with poor soils and an especially low productivity site. The tree density on the site is low, shrub dominance is high, and every western hemlock is heavily infected with dwarf mistletoe. Perhaps fire does not carry well in this open canopy forest, and therefore, dwarf mistletoe persists indefinitely, never being totally eradicated. 3. Spread from refugia and infection centers is primarily a result of small scale dispersal from female plants, but on occasion, new infection centers develop from seed passively dispersed by birds (such as Stellar's Jay, Gray Jay, and Red Crossbill). We hope to test this hypothesis in a chronosequence of forest age classes on the WREF. (D. Shaw, Wind River Canopy Crane Research Facility, University of Washington and J.

Beatty, USDA Forest Service).

f) Studies of interactions among plants, microbes, and the soils they inhabit are critical to our understanding of ecosystem function, and hence our ability to successfully manage forested wildlands. We propose to use molecular-genetic methods to determine the effects of dwarf mistletoe infection of *Pinus contorta* in ectomycorrhizal (EM) communities in pure *P. contorta* and mixed *P. contorta/Picea engelmannii* stands. We will do so across a soil fertility gradient created by a transition from relatively nutrient-rich andesite, through a transition zone created by glacial activity, to nutrient-poor rhyolite. We will be the first to investigate alteration of carbon flow to roots and the effect this has on EM communities in a mixed tree species forest, and the first to combine these factors with soil fertility and plant pathogen infection. Using molecular methods, we will provide a more comprehensive picture of this aspect of ecosystem function than was previously possible without them. We will conduct this study in Yellowstone National Park, the centerpiece of the 11 million acre Greater Yellowstone Ecosystem, which includes several National Forests in three states. Thus we will add greatly to our understanding of a pristine, economically important, and geographically dominant ecosystem (K. Cullings, NASA-Ames Research Center, Mountain View, CA and D. Vogler, Institute of Forest Genetics, PSW Research Station, Davis, CA).

g) A cooperative study of the University of Colorado and Rocky Mountain Research Station is in progress to investigate the effects of multiple predators on ponderosa pine canopy herbivores and dwarf mistletoe demography. Field studies and experiments by Kailen Mooney have been completed or are still underway at the Manitou Experimental Forest. Kailen is investigating the effects of dwarf mistletoe on the canopy arthropod community and the interactions of birds and ants on predation and herbivory in mistletoe-broomed ponderosa pine. Early results confirm that mistletoe shoots are usually subject to herbivory (but consequences difficult to quantify) and that the composition of the arthropod community is affected by mistletoe, birds, and other arthropods. (B. Geils, Rocky Mountain Research Station, Flagstaff, AZ.; Y. Linhart and K. Mooney, University of Colorado, Boulder).

VII. GENETICS

a) In 1997, a dwarf mistletoe resistance test plantation was established at the Badger Hill Breeding Arboretum near Placerville, California. Ponderosa pine seedlings for this test are from resistant candidates selected on the Lassen and Plumas National Forests, heavily infected controls selected on these two forests, and controlled pollination seeds from six suspected resistant clones at the arboretum. Block 1 of this test plantation was used to test the effects of inoculation timing and protection from bird predation. Inoculation with dwarf mistletoe seed in December 1999 resulted in 84% seed retention, 50% seed germination, and 25% penetration of the germ tube into branch tissue. Inoculation in March 2000 resulted in 75% seed retention, 13% germination, and 2% penetration. In the December inoculation, seedlings were covered with bird netting or bridal veil, or were left uncovered. Protection with bird netting yielded 82% seed retention, 47%, germination, and 26% penetration. Protection with bridal veil resulted in 87% seed retention, 51% germination, and 26% penetration. Uncovered seedlings had 83% seed retention, 52% germination, and 22% penetration. In the March inoculation, protection with bird netting resulted in slightly better retention, germination, and penetration than the uncovered controls. No bridal veil was used in March. Because the earlier inoculation produced much better germination and penetration, the remaining four blocks were inoculated in late November, 2000. The seedlings were left uncovered since there were no significant differences between the control and the protection treatments. (D. Ringnes, USDA Forest Service, R-5 Genetic Resources Program).

Ponderosa pine - Dwarf mistletoe resistance trial

Block 1 inoculation test Test of inoculation timing and protection from birds

Evaluated July, 2000

Rep #	Date Treated	Treatment	# Seed Placed	# Seed Retained	**Percent Retained**	# Seed Germinated	**Percent Germ**	# Seed Penetrated	**Percent Penetrated**
1	Dec. 1999	Control	135	112	**83**	70	**52**	30	**22**
2	Dec. 1999	Bird net	135	111	**82**	64	**47**	35	**26**
3	Dec. 1999	Bridal veil	135	118	**87**	69	**51**	35	**26**
4	Mar. 2000	Control	150	105	**70**	19	**13**	4	**3**
5	Mar. 2000	Bird net	110	91	**83**	16	**15**	2	**2**

VIII. MANAGEMENT

a) The Southwest Oregon Forest Insect and Disease Service Center is assisting the Applegate Ranger District, Rogue River National Forest with monitoring large Douglas-fir that have been pruned to remove branches infected with Douglas-fir dwarf mistletoe. The District would like information about the feasibility of pruning large Douglas-fir in forest stands to reduce the level of mistletoe; including the cost of pruning and subsequent fuels treatments, growth and survival of the pruned trees and the development of latent infections. Thirty-four Douglas-fir with DMR of 4 or less were selected for pruning in a stand designated for harvest. The remaining infected trees in the stand were cut. Thirty of the trees were recently pruned. In five years they will be re-examined. Trees with new infections will be pruned again if they have live crown ratios of at least 20 percent. (K. Marshall, SWOFIDSC and B. Thomas, Applegate RD).

b) A field trial was established in the summer of 2000 to investigate the efficacy of *C. gloeosporioides* as a biological control agent for *A. americanum*. Initial assessment of this trial is very encouraging. The disease rating of the dwarf mistletoe treated with the fungus was significantly higher than the controls. The one year post inoculation assessment is currently underway. The final assessment of experiments that were designed to model the effect of biological control treatment is also underway. These experiments are part of my Ph.D. research, which is supervised by Drs. Bart van der Kamp, University of British Columbia, and Simon Shamoun, Canadian Forest Service. (T. Ramsfield, University of British Columbia).

IX. SURVEYS

a) We have completed a roadside reconnaissance survey for pinyon pine dwarf mistletoe (*A. divaricatum*) in the pinyon-juniper woodlands of the Coconino National Forest in northern Arizona. We surveyed 220 km of roads representing pinyon pine woodlands in 24 Townships. Our results estimate that only about 12 percent of the area surveyed are infested with pinyon pine dwarf mistletoe. However, we probably have underestimated the amount of pinyon pine dwarf mistletoe present in the Coconino National Forest because of the difficulty of observing low levels of infection in pinyon pine using a roadside survey procedure. (R. Mathiasen and C. Daugherty, Northern Arizona University, Flagstaff, AZ).

X. MODELING

a) Several major steps have been achieved in the calibration and development of the Spatial-Statistical spread model (see Robinson, Geils, Muir, and Sutherland online presentation at http://www.essa.com/forestry/mistletoe). Spatial analyses of mapped stands and artificial landscapes conduced by J.J. Smith and B. Geils have revealed the range and behavior of key spatial parameters for stem clumping and infection autocorrelation. Realistic simulations can be generated for stands without the need for a detailed stem map if the general patterns can be matched to those of a reference stand. The model has been tested against the observed performance of a ponderosa pine stand in Arizona and used to evaluate novel, silvicultural treatments in coastal western hemlock stands. Progress is being made to adapt the model for simulating spread across distinct boundaries (such as from old-growth to young plantation) and for use with stand models (FVS) and with tree models (TASS). (B. Geils, Rocky Mountain Research Station, Flagstaff, AZ; J.J. Smith, Northern Arizona University, Flagstaff, AZ; D. Robinson, ESSA Technologies, Vancouver, BC; J. Muir, BC Ministry of Forests, Victoria, BC).

XI. MISCELLANEOUS

a) 2002 Cairns Conference: The 3rd International Canopy Conference will be held in Cairns, Australia in June of 2002. This conference will focus on a broad range of issues associated with biology, ecology and use of global forest canopies (web site: http://www.premiers.qld.gov.au/about/science/canopyconference/html/index.html). Of particular interest will be a symposium being organized by David Shaw and Bryan Barlow.entitled: **Macroparasites in the Canopy: Mistletoe Evolution and Ecology**. The proposed speakers include: Dan Nickrent, Job Kuijt, Gerhard Glatzel, Nick Reid, Mark Smith, Jake Overton, Bob Mathiasen, Del Wiens, and Bryan Barlow. The conference organizers are accepting contributed papers and with enough contributions a session on mistletoes and other forest diseases of the canopy could be in the making.

Associated with this meeting, is a proposed international workshop: **Developing a global mistletoe research framework**. Catherine Parks and David Shaw are writing a NSF proposal to fund U.S. scientist travel to the workshop. We hope to include other international members of the scientific community, and get a group of about 25 to 30 individuals together. The purpose of the workshop is to determine whether interest exists in developing an integrated mistletoe research framework for understanding ecology, biology and evolution of mistletoes. Although many books and synthesis works on mistletoe ecology have been written, still relevant questions may include; "What are the existing needs in mistletoe research? What are the major gaps in our knowledge of mistletoes? Is THE emerging issue in applied ecology the relationship of mistletoes and biodiversity of forest canopies? " (D. Shaw, Wind River Canopy Crane Research Facility, University of Washington).

b) Project title: *Biological Control Approach for Management of Dwarf Mistletoes*
Research Objectives: The overall objective of the project is to survey and collect fungal hyperparasites and to investigate their potential use as biological control agents for dwarf mistletoes. Currently the focus of this research program is on biological control of western hemlock and lodgepole pine dwarf mistletoes. Most recently, research efforts are underway to explore the use of genetic control method for management of western hemlock dwarf mistletoe.

Research progress: Tissue culture of western hemlock dwarf mistletoe (*Arceuthobium tsugense* subsp. *tsugense*) – a novel procedure for *in vitro* culture of western hemlock dwarf mistletoe was developed for the first time. The tissue culture procedure will be useful for studying genetic

resistance and the physiological and biochemical mechanisms of the host-parasite interactions, as well as, to screen naturally occurring hyperparasitic fungi for their potential use as biological control agents against dwarf mistletoes. A full manuscript was published in Plant Cell, Tissue and Organ Culture 2001, Volume 66 (2): 97-105.

Histopathological investigation of the infection of germinated seeds and callus of western hemlock dwarf mistletoe by *Nectria neomacrospora* (Anamorph: *Cylindrocarpon cylindroides*) and Colleto*trichum gloeosporioides* in dual culture- the selection of these two hyperparasitic candidate fungi was based on their performance as promising biological control agents under field conditions. The potential use of these two fungi was evaluated for their pathogenicity on germinated seeds and callus grown *in vitro.* A full manuscript was submitted to the International Journal of Plant Sciences.

Field trials- continue monitoring of the field trials which were initiated in 1997 on the potential use of *Cylindrocarpon cylindroides* and *Colletotrichum gloeosporioides* as potential biological control of western hemlock dwarf mistletoe.

Exploring the use of genetic resistance strategy for management of western hemlock dwarf mistletoe- early results suggests levels of resistance to western hemlock dwarf mistletoe within western hemlock clones in conifer plantations in British Columbia. An understanding of the mechanisms involved and factors influencing resistance to western hemlock dwarf mistletoe will support the selection and breeding the host plants which are more resistant to infection. Research objectives include: 1) utilization of *in vitro* (tissue culture) system already developed at Dr. Shamoun's lab. as a rapid screening method for resistance in western hemlock populations to western hemlock dwarf mistletoe; 2) elucidation and characterization of inheritance of resistance in hemlock populations to western hemlock dwarf mistletoe. To date, we have inoculated 300 young seedlings of western hemlock representing 50 provenance under greenhouse conditions. This ongoing experiment will be monitored in the next 1-3 years for selection different resistance traits to western hemlock dwarf mistletoe. This research venture is a collaborative research effort with Charlie Cartwright- Hemlock Breeder, BC Ministry of Forests, Victoria, BC.
Biological control of lodgepole pine dwarf mistletoe- this project is part of a Ph.D. work conducted by Tod Ramsfield (Ph.D candidate at UBC- Dept. of Forest Sciences) who is working under the direction of Drs. Bart van der Kamp and Simon F. Shamoun. Overall objectives of Mr. Ramsfield's Ph.D work includes: 1) feasibility of potential use of *Colletotrichum gloeosporioides* as a biocontrol agent for lodgepole pine dwarf mistletoe under field conditions (to date, two years data has been collected. Results of this experiment will be presented as a poster at the WIFDWC meeting in Carmel, California, September 10-14, 2001. 2) effect of shoot removal on dwarf mistletoe (i.e., how lodgepole pine dwarf mistletoe responds to stress). 3) modeling dwarf mistletoe seed production. 4) *Caliciopsis arceuthobii*- description of the effects of this fungal parasite and it's impact on lodgepole pine dwarf mistletoe. 4) occurrence of *C gloeosporioides* and its frequency at different canopy level of the infected lodgepole pine with dwarf mistletoe. 5) Histopathological investigation- to determine if *C. gloeosporioides* penetrate the endophytic system of the lodgepole pine dwarf mistletoe. In addition molecular markers, including PCR-DNA/ ELISA tools be utilized to detect any evidence of *C. gloeosporioides* in the endophytic system.

Most recently, Forest Renewal BC (FRBC) has awarded a research grant to Drs. Simon Shamoun and Bart van der Kamp to continue their investigations on "Development of Biological Control Agents for Management of Western Hemlock and Lodgepole Pine Dwarf Mistletoes". As a result, two new graduate students at M.Sc. level, Lea Riteman and Sue Askew, as well as, a Research Technician Anna Mary Schmidt have joined this research program.

An I.U.F.R.O. working party has been established "Parasitic Flowering Plants in Forests". Dr. Simon Francis Shamoun has been selected as a Coordinator for this group. This working party is planning to have future international meetings in 2003 (proposed site-Poland) and in 2005 in Brisbane, Australia. For more information, please, contact Dr. Simon Shamoun, by e-mail: sshamoun@pfc.forestry.ca, phone: (250)363-0766, or fax: (250)363-0775. (Dr. Simon Francis Shamoun- Research Plant Pathologist & Adjunct Professor, Canadian Forest Service, Pacific Forestry Centre, and University of British Columbia- Dept. of Forest Sciences, Vancouver, BC & University of Victoria- Dept. of Biology, Victoria, BC).

c) The Mistletoe Literature Database is an annotated bibliography of journal articles and various published reports on the biology, ecology, management, and uses of mistletoe. Dan Huebner has recently upgraded the search capabilities of the database, and we continue to add new papers as they become available (if you want your paper listed, send a copy to B. Geils). We are continuing to add images, links, and text pages to the resident site, the Mistletoe Center (online at http://www.rms.nau.edu/mistletoe). (B. Geils and D. Huebner, Rocky Mountain Research Station, Flagstaff, AZ).

XII. COMMITTEE MEETING NOTES

24 people attended the committee breakfast on September 11th. The Chair suggested that notes from the meeting be added to the committee report, including a sentence or two describing items mentioned during the Round Robin that were not submitted prior to the meeting. The group agreed with this suggestion.

Revisions of Forest Insect and Disease Leaflets (FIDLs) are in progress for pinyon pine dwarf mistletoe, gray pine dwarf mistletoe and sugar pine dwarf mistletoe. They will be completed and printed in 2002. Layout was done by the Washington Office. Region Five provided the funds for printing 3000 copies of each FIDL. They will also be available as .pdf files on the Internet. J. Pronos hopes to finish the western dwarf mistletoe FIDL soon which would round out the FIDLs that needed revision. According to J. Beatty, the Washington Office is willing to do layout of FIDLs in the future.

The group discussed whether dwarf mistletoes are still a concern for forest managers, given the recent changes in management direction. A number of people expressed the importance of continuing research, particularly about wildlife/dwarf mistletoe interactions and fire effects, issues that are controversial under current management and about which there is little hard data. The importance of conducting research at the landscape level and providing good documentation was also discussed.

It was pointed out that last year dwarf mistletoe-related projects were low on the list for Suppression funding. According to the Washington Office (J. Beatty) the onus is on the Regions to set their own priorities. However, the Washington Office does categorize funds based on national priorities before they are allocated to the Regions.

T. Ramsfield: In his second season inoculating lodgepole pine dwarf mistletoe in the field with *C. gloeosporoides*. It was hard to see the fungus but it seems to have reduced the fruiting of the dwarf mistletoe (see VIII. Management).

D. Shaw: Initiating a project to look at the effect of dwarf mistletoe on tree hydraulic architecture using the Wind River Canopy Crane. This season a sap flow measuring system was installed in 170 to 180 feet tall trees. Also initiating a project on the mistletoe hairstreak butterfly, an

herbivore on dwarf mistletoes.

J. Muir: Has research on small block harvesting and impact on hemlock dwarf mistletoe and its effect on the trees. Also working on dwarf mistletoe simulator of FVS for British Columbia Coast and hemlock dwarf mistletoe, especially spatial relationships of dwarf mistletoe infection in mature trees.