March 2010

7.6
WEB July 2010

R. Ladd Livingston

Lee Pederson,
US Forest Service

Management Guide for

Balsam Woolly Adelgid

Adelges piceae (Ratzeburg)

Subalpine fir is most susceptible.
Grand fir is most resistant to damage.
All true firs may be hosts.

This European invader was first found in northern Idaho in 1983. It has expanded south to the Sawtooth National Forest, killing substantial numbers of subalpine fir.

Topics

Overview	1
Life History	2
Natural Control	2
Silvicultural Alternatives	3
Chemical Control	3
Recognizing adelgid damage	4
Other Reading	4
Field Guide	
Management Guide Index	

Key Points

- It is a non-native species that has only been known in Idaho since 1983.
- We know little about its real potential for ecological damage.
- Natural and environmental influences have not stopped its spread.
- Silvicultural management may reduce damage.

Damage depends on population density

Balsam woolly adelgid was discovered in northern Idaho in 1983 feeding predominantly on subalpine fir and to a less extent, grand fir. Since that time, it has been found from the Canadian border to as for south as the Sawtooth National Forest in Idaho. It has caused extensive mortality of subalpine fir, especially in low-elevation drainage bottoms.
Nymphs feed on the bark of stems, branches, and twigs, and at the base of new shoots and buds, but never on needles. Their feeding causes stunting of terminal growth with distinct swellings (gouting) around the buds and branch nodes.

All sizes of trees are attacked. but the infestations may be concentrated on the stems or in the crowns. Stem-attacked trees can die after only 2-3 years of heavy infestation and without any apparent gouting.

In the crowns, gouts occur on the fastest growing parts of the tree, and on trees that have been lightly infested for a long time. These trees decline slowly, growth is reduced, and the dead and dying upper stem is often infected by wood-destroying fungi.

An Invasive Species

- **This insect is still advancing in Idaho and mortality is increasing.**
- **It causes tremendous ecological changes on low elevation subalpine fir sites.**
- **Control at stand or landscape levels is not feasible with insecticides. Individual tree protection with an approved insecticide can provide effective control.**

- Balsam woolly adelgids insert their mouthparts into the cortical parenchyma of the bark.
- A chemical in their saliva affects the hormonal action of the tree.
- This causes abnormal cell division and differentiation in the bark and newly formed wood.
- Abnormally wide annual rings are produced in the stem, which are composed of thick cells (compression wood).
- Stunting of terminal growth also occurs, with distinct swellings around the buds and branch nodes.
- The abnormal swelling is called "gouting".

Life History

Balsam woolly adelgid generally overwinters in the first instar (neosistens) of the hiemosistens generation. They are about 0.35 mm long, amber colored, flattened. and fringed with wax. They can be found on any part of the tree where the bark is thin enough for them to reach the conductive tissue (cortical parenchyma). About May they start feeding, go through two more instars, and change into adults by June.

Adults are all females and are about 1 mm long, dark purple to black, wingless, and become covered with whitish "wool". Up to 250 eggs can be laid under the wool. The egg laying period can last about 6 weeks.

Crawlers (first instar nymphs) emerge from the eggs and settle on the bark during July. These neosistens of the new aestivosistens (summer) generation go into a dormant period for several weeks then start feeding and develop into adults by late summer.

Egg laying can occur from late August to late October. and nymphs from these eggs overwinter. Two generations a year commonly occur in the mountainous areas of the West. Three to four generations can occur in milder climates.

Natural Control

Hosts: Heavy balsam woolly adelgid feeding modifies the bark and after a few years they can't penetrate the thicker layers. Attractive feeding space on the tree diminishes and populations die out. If a tree survives the initial infestaton, mortality will likely be avoided.

Weather: Freezing is fatal and chances are increased as temperatures fall below -5° F. There are no survivors at –30° F. Adelgids below the snowline usually survive. Cold, wet springs can reduce populations of developing nymphs. Abnormally cold periods in the fall will also decimate populations.

Biological: North American predators are not very efficient, so three beetles and three flies were introduced from Europe and have become established. Balsam woolly adelgid populations increase so rapidly that these predators have been shown to be virtually ineffective.

Silvicultural Alternatives

Along the West Coast the most severe outbreaks occurred at the lower end of the host species elevation range, i.e.. from 3,000-5,500 feet in subalpine fir and below 1,000 feet in grand fir. Although we do not have anything below 1000 feet, elevational restrictions may exist in the Northern Rocky Mountains also.

The literature indicates there are not many effective measures of prevention through forest management practices. Under intensive forest management, the following measures may reduce damage:

1. Slow the rate of infestation spread that is caused by crawlers being transported by the wind or carried on logs and vehicles, and nursery stock:

- Refrain from moving infested logs through non-infested stands.
- Take into account prevailing wind direction when establishing cutting boundaries.
- Fall infested trees away from non-infested ones.
- Clean all logging equipment before moving it to new areas.
- Cut and remove infested trees in winter when nymphs are not motile.
- Don't establish nurseries in the vicinity of infested stands. Inspect outgoing seedlings for aphids.

2. Grow fir on short rotation cycles.

3. Favor other non-host species.

4. Selective cutting and removal of heavily infested trees.

5. Maintain full stocking and increase vigor of stands.

6. Introduce or develop less susceptible species of firs, and genetically resistant strains or hybrids.

There are few effective measures for prevention through forest management practices.

Chemical Control

Insecticidal sprays have to drench this insect which is fairly well hidden on the tree. Thus, aerial spraying is unfeasible.

There are five insecticides registered for balsam woolly adelgid control in Idaho (as listed in the Pacific Northwest Insect Management Handbook 2009).

- Carbaryl
- Chlorpyrifos (Lorsban 4E): A restricted use pesticide.
- Endosulfan (Thionex 3EC, Thionex 50W): Nursery use only.
- Imidacloprid (Provado 1.6F)
- Sucrose octanoate (SucraShield): A sugar based insecticide/miticide/ovicide that quickly acts to desiccate or suffocate the target insect.

Always check for current registration and restrictions before using any of the chemicals listed above.

White "wool"- covered female balsam woolly adelgid on the bark of a subalpine fir.

Recognizing Balsam Woolly Adelgid

The most obvious indicator of balsam woolly adelgid presence is the white "wool" covered females on the bark of stems or branches. This is most noticeable during summer months.

Swellings of the outer branch nodes and terminal buds (gouting) with a concurrent stunting of growth is another symptom. If the gouts enclose reproductive buds, no new shoots or needles are produced.

Dying or dead branches and crowns are other symptoms.

Internet Resources

http://insects.ippc.orst.edu/pnw/insects
http://www.oregon.gov/fh/BalsamWoollyAdelgid.pdf
http://www.fs.fed.us/r6/nr/fid/fidls/fidl-118.pdf
http://cru.cahe.wsu.edu/CEPublications/eb1456/eb1456.html

Forest Health Protection and State Forestry Organizations

Assistance on State And Private Lands	Assistance on Federal Lands
Montana: (406) 542-4300	US Forest Service Region One Missoula: (406) 329-3605 Coeur d'Alene: (208) 765-7342
Idaho: (208) 769-1525	
Utah: (801) 538-5211	
Nevada: (775) 684-2513	US Forest Service Region Four Ogden: (801) 476-9720 Boise: (208) 373-4227
Wyoming: (307) 777-5659	
N. Dakota: (701) 228-5422	

Other Reading

Balch. R.E. 1952. Studies of the Balsam Woolly Aphid. Adelges piceae (Ratz.) and its effects on balsam fir. Abies balsamea (L.) Mill. Can. Dept. of Ag., Pub. 867, 76 p., illus.

Livingston. R.L., and J. Dewey. 1983. Balsam Woolly Aphid. Report of an Idaho infestation. Idaho Dept. of Lands and USDA For. Serv., Northern Region. IDL Rpt. No.83-7. 9 p., illus.

Pederson, L., J. Fidgen, L. Lazarus, D. Beckman, B. Burkhead, and N. Kittelson. 2010. Distribution of Balsam Woolly Adelgid in Idaho: numbered report in Draft. USDA-Forest Service, Forest Health Protection, Coeur d'Alene Field Office.

Ragenovich, I.R. and R.G. Mitchell. 2006. Balsam Woolly Adelgid. USDA Forest Service, For. Pest Leaf. 118. 12p., illus.