



**STATUS OF IMPORTED AND NATIVE PREDATORS
OF THE BALSAM WOOLLY APHID ON MT. MITCHELL, NORTH CAROLINA**

Abstract. --On the Mt. Mitchell area during the summer of 1968, 20 stands of Fraser fir, *Abies fraseri* (Pursh) Poir., infested by the balsam woolly aphid, *Adelges piceae* (Ratzeburg), were examined for native and previously imported predators of the aphid. *Laricobius erichsonii* Rosenhauer (Coleoptera: Derodontidae) was the only foreign predator located, and it occurred on 30 percent of the sites sampled. In terms of distribution, this predator ranked below the native species, *Allothrombium mitchelli* Davis (Acarina: Trombidiidae), *Bdellidae* (Acarina), and *Hemerobius* spp. (Neuroptera: Hemerobiidae). *Aphidecta oblitterata* (L.) (Coleoptera: Coccinellidae) was not found at sites where it was previously released nor at other sites. Its survival, in the face of naturally diminishing populations of the aphid, is regarded as tenuous at best.

Since 1957 when the balsam woolly aphid, *Adelges piceae* (Ratzeburg), was first verified from specimens collected on Mt. Mitchell (Speers 1958), it has become the dominant insect pest in the discontinuous stands of Fraser fir, *Abies fraseri* (Pursh) Poir., in the southern Appalachians. Today, all important areas of Fraser fir in North Carolina and Tennessee are infested. Virtually all naturally occurring stands are situated in publicly owned parks and recreation areas. Consequently, maintenance of the scenic integrity of these forests is of paramount concern, and efforts to control the pest have been directed toward allaying further mortality within infested areas and preventing its spread into new ones.

RELEASE OF FOREIGN PREDATORS ON MT. MITCHELL

Efforts to determine methods of controlling the aphid were made from 1959 through 1966 when the Southeastern Station experimentally released foreign predators in the 2,914 hectares that comprise the Mt. Mitchell area. At various times during this period, 22 species of predators from Europe, Asia, and Australia were introduced (Amman and Speers 1964, 1971). Of these, *Laricobius erichsonii* Rosenhauer (Coleoptera: Derodontidae), *Aphidoletes thompsoni* Mohn (Diptera: Cecidomyiidae), *Pullus impexus* (Mulsant) (Coleoptera: Coccinellidae), and *Aphidecta oblitterata* (L.) (Coleoptera: Coccinellidae) were initially regarded as the most encouraging prospects because of their ability to consume aphids and at the same time survive the severe winters of the area (Amman 1961; Amman and Speers 1964, 1965). Since 1967, a diminishing food source has brought about a rapidly subsiding aphid population and added another stress factor affecting the long-range success of these predators. In order to evaluate the status of both the native and imported predators of the balsam woolly aphid, the Mt. Mitchell area was widely sampled during the summer of 1968.

¹Rauschenberger, J. L., and Lambert, H. L. Status of the balsam woolly aphid in the southern Appalachians 1969. USDA Forest Serv. Southeast. Area, State & Priv. For., Div. Pest Control Rep. 70-1-44, 20 pp. 1970.

METHODS

Twenty locations were investigated for predators from June 11 to October 7, 1968. During this period, all but the least accessible sites were examined two or more times. Wherever possible, sample areas were established at or near sites where foreign predators were previously released, and only trees supporting visible stem infestations were selected for observation. Because of the low numbers of aphids, few suitable trees were found at any given location, the number varying from 1 to 26. On all sample trees, the entire circumference of bark surface to a height of 6 feet was scrutinized for predators.

Efforts to locate the crown-dwelling coccinellid Aphidecta obliterated required climbing trees and systematically beating branches to dislodge predators onto an out-stretched cloth below. All sites where it was previously released and four trees already selected for predator checks in an additional plot were specifically examined for this predator.

RESULTS

Three species of native mites, Allothrombium mitchelli Davis, an unidentified Bdellidae, and Anystis sp., **were** the most important predators from the standpoint of overall distribution (table 1). The latter species, though, was thought to have minimal influence on the balsam woolly aphid, because peak numbers of this mite occurred primarily during the quiescent neosistens stage, which is rarely, if ever, attacked. Laricobius erichsonii, the only imported predator recovered, was present in less than half of the sites examined. In areas where it did persist, feeding larvae, and later, adults, were plentiful from June 20 to July 26. In all of the sites examined for Aphidecta obliterated, the only predators found besides the three species of mites were Hemerobius spp. and Mulsantina sp. Except for the single site examined on which Aphidecta had not been previously released, all of these sites consisted of areas where the majority of trees are now uninfested or dead.

DISCUSSION AND CONCLUSIONS

The specific findings relating to the predator samples conducted in 1968 indicate that:

1. Laricobius erichsonii is the only imported predator that can reliably be regarded as permanently established in the Mt. Mitchell environment. Its apparent ability to adjust to low densities of prey further strengthens that assessment. Its effect within the overall area, though, must be regarded as subordinate to that of the native mites, Allothrombium mitchelli and a species of Bdellidae, which **were** more widely distributed.
2. Aphidecta obliterated has either disappeared or is too minor a component of the predator complex to have been detected. Its fate hinges largely on its ability to move in to favorable centers of aphid activity.
3. Aphidoletes thompsoni was last reported in the Mt. Mitchell area during 1964 by Amman (1970). This species could not be verified from any of the cecidomyiids detected in the field during 1968.
4. Pullus impexus, which was introduced in small numbers in 1960, was not regarded by Amman and Speers (1964) as having become successfully established. Subsequent introductions were made in 1965 and 1966, totaling 23,420 individuals. In 1968, no evidence of this species was found at sites where it had previously been released or on any of the other sample trees.

² Mean wax masses/6.4 sq. cm. = 1.406 ± 1.96 wax masses (N = 20 sites). This compares to a density of 15.15 ± 11.64 wax masses from 49 trees sampled the same time at Roan Mountain, North Carolina, and characterized by moderate to heavy stem infestations.

Table 1. --Occurrence of predators of the balsam woolly aphid among 20 sites sampled in the Mt. Mitchell area during the summer of 1968

Site'	Infested trees examined ^a	<u>Allothrombium</u>	Bdellidae	<u>Anystis</u>	Hemerobius spp. (native)	<u>Laricobius</u>	<u>Syrphus</u>	Mulsantina sp.	Cecidomyiidae ³ (native)	<u>Aphidecta</u>
		<u>mitchelli</u> D a v i s		<u>sp.</u>		<u>erichsonii</u> Rosenhauer	<u>torvus</u> Osten Sacken			<u>obliterata</u> (L.)
	<u>NO.</u>									
Balsam Gap, South	9	+					+			
*Balsam Gap, Upper Ridge	10	+		+	+					
*Blackstock Knob	20	+	+	+			+	+		
*Blue Ridge Parkway	20	+	+	+						
Clingman's Peak Mortality Plot'	26	+	+	+	+	+	+	+	+	
Clingman's Peak Relay Station	17	+	+	+		+	+		+	
*Clingman's Peak Relay Station, Lower ⁵	10									
*Clingman's Peak Tower Road	5	+		+					+	
*Commissary Ridge ⁵	5	+	+	+						
*Commissary Ridge, Lower	12	+								
Commissary Ridge, Upper	21									
*End of Camp Alice Road ⁵	1				+					
*Mt. Craig	20	+	+					+		
*Mt. Mitchell Turnoff	13	+	+	+						
*Mt. Mitchell Turnoff, Lower''	2				+					
*Ogle Creek	22	+	+	+						
*Rainbow Gap	16	+	+		+					
*State Park Reservoir	21	+	+	+						
Stepps Gap, Lower Plantation	20	+	+	+	+	+	+		+	
Stepps Gap, Upper Plantation	21	+	+	+	+	+		+		
Number of sites infested		16	12	12	7	6	5	5	4	0
Percent of total sites infested		80	60	60	35	30	25	25	20	0

'Asterisks indicate sites where foreign predators were previously released. Four such sites--Balsam Gap, Camp Alice, Cattail Peak, and Mt. Hallback--are not included because the trees were either uninfested, dead, or treated with pesticides by the time these samples were taken.

^aA minimum of twenty trees was examined per site unless there were fewer infested trees at the site.

³Status as a predator is questionable.

'Includes four trees, all with heavy stem infestations, which were additionally checked for Aphidecta oblitterata in the crowns.

'Sites where Aphidecta oblitterata was previously released and which were specifically checked for this species.

For a multigeneration pest whose numbers tend to increase exponentially, the task of controlling the balsam woolly aphid is formidable indeed. The extreme sensitivity of Fraser fir to damage by the aphid allows scant opportunity for predators to reproduce and spread sufficiently to overtake the aphid on an area-wide basis before large numbers of trees are killed. To date, no tangible evidence has been found to substantiate the conclusion that native or foreign predators have either appreciably hampered the development of the infestation on Mt. Mitchell or altered its course. Whatever advantages may lie in small-scale introductions, the findings of 1968 indicate that imported predators have been far less able to maintain themselves in the scattered stands infested by the aphid than have the native species. As a result, grounds for anticipating a beneficial change in the control of the balsam woolly aphid in the Mt. Mitchell area by predators is not encouraging at this time.

LITERATURE CITED

- Amman, G. D.
1961. Predator introductions for control of the balsam woolly aphid on Mt. Mitchell, North Carolina. USDA Forest Serv. Southeast. Forest Exp. Stn. Res. Notes 153, 2 pp.
- _____
1970. Phenomena of Adelges piceae populations (Homoptera: Phylloxeridae) in North Carolina. Ann. Entomol. Soc. Am. 63: 1727-1734.
- _____
and Speers, C. F.
1964. Release of predators of the balsam woolly aphid in North Carolina. Southeast. Forest Exp. Stn., U. S. Forest Serv. Res. Note SE-32, 4 pp.
- _____
and Speers, C. F.
1965. Progress in biological control of the balsam woolly aphid in North Carolina. South. Lumberman 211(2632): 147-149.
- _____
and Speers, C. F.
1971. Introduction and evaluation of predators from India and Pakistan for control of the balsam woolly aphid (Homoptera: Adelgidae) in North Carolina. Can. Entomol. 103: 528-533.
- Speers, C. F.
1958. The balsam woolly aphid in the Southeast. J. For. 56: 515-516.

Gerhard F. Fedde, Entomologist
Forestry Sciences Laboratory
Research Triangle Park, North Carolina