

ASH FLOWER GALL: WITHIN TREE DISTRIBUTION AND CHEMICAL MANAGEMENT

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Abstract. Ash flower gall (AFG) distribution within green ash (*Fraxinus pennsylvanica*), and the chemical control of *Eriophyes fraxiniflora*, which causes AFG are discussed. Gall density was found to be significantly different among three crown levels in trees studied. Percentages were approximately 62, 25 and 13 for the top, middle and bottom crown levels, respectively. This distribution may vary from tree to tree, and is therefore, most useful in large scale sampling programs. Chemical controls were erratic, with carbaryl (Sevin) 80S providing the best control. Dicolfol (Kelthane) 35WP and fluvalinate (Mavrik Aquaflo) treated trees had higher gall numbers.

Résumé. La distribution de la galle des fleurs du frêne sur le frêne rouge (*Fraxinus pennsylvanica*) et le contrôle chimique du *Eriophyes fraxiniflora* qui cause la galle sont discutés. La densité de la galle fut significativement différente lorsqu'évaluée à trois niveaux sur les arbres observés. Les pourcentages furent approximativement de 62, 25 et 13% pour la tête, le centre et le bas de la cime. La distribution peut varier d'un arbre à un autre et est ainsi plus utile lors de programmes d'échantillonnage réalisés à une plus grande échelle. Le contrôle chimique fut irrégulier, le carbaryl (Sevin) 80S donnant les meilleurs résultats. Les arbres traités au dicofol (Kelthane) 35WP et au fluvalinate (Mavrik Aquaflo) présentaient le plus grand nombre de galles.

Ash flower gall (AFG) is a common abnormality caused by *Eriophyes fraxiniflora* Felt. This mite feeds on the staminate (male) flowers of ash (*Fraxinus*) each spring, causing a disfigured, lobulate, gall structure (8). The gall occurs on various *Fraxinus* species throughout the northern hemisphere (6).

Ash flower gall has been viewed mainly as an aesthetic problem (2, 3, 9). Therefore, gall densities which instigate control measures vary, depending on individual perceptions of the problem. Little is known about the distribution of AFG in tree crowns, and how that distribution may relate to control measures.

Chemical control measures have been used to manage *E. fraxiniflora* as far back as 1932 (4), where dormant oil applications were suggested. More recently, sprays of carbaryl (Sevin) and

malathion have been recommended (2, 9). Increasing public concern about pesticide usage necessitates evaluations of less toxic chemicals and timing recommendations for more effective control of AFG.

The purpose of this study was to determine AFG's distribution within the tree crown and how it may relate to control measures. In addition, chemicals and their timing were evaluated for *E. fraxiniflora* control.

Materials and Methods

The sampling and control studies were conducted on the same 63 green ash (*F. pennsylvanica*) trees. Trees ranged in size from approximately 6.1-7.6 m. A randomized complete block design containing nine replications of seven treatments each, was used. Blocks were located throughout St. Paul, Minnesota.

Ash Flower Gall Sampling. Gall density estimates for each tree obtained on 1 and 8 July 1988. The crown of each tree was visually divided into thirds (top, middle, bottom). Three branches were randomly chosen from each crown level for a total of nine terminals per tree. The terminal 60 cm of each branch comprised the sample unit from which all current season's galls were counted and recorded. Previous season's (1987) galls were brown-black in color and easily distinguished from the current year's (1988) green galls.

Counts of galls per crown level were transformed using natural log ($x + 1$) and analyzed by 3-way analysis of variation (ANOVA). Means were separated using Tukey's honest significant difference (HSD), (7).

Insecticide Efficacy Testing. Treatments were applied on 18 April (prior to ash staminate flower bud break) and on 10 May 1988 (ash staminate flower full bloom stage) when winds were light and

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variable. Treatments were evaluated as above on 1 and 8 July 1988. Experimental treatments were: dicofol (Kelthane) 35WP, fluvalinate (Mavrik Aquaflow) 22.3% flowable, insecticidal soap (Safer), carbaryl (Sevin) 80S, carbaryl (Sevin) 80S + insecticidal soap (Safer) and an untreated control (UTC). Trees were sprayed to run-off by a professional applicator.

The 10 May 1988 application differed slightly in procedure. Carbaryl was not sprayed on this date, and dicofol was applied to a different (previously untreated) tree in each replicate.

Post-treatment counts of galls per tree were transformed using natural log ($x + 1$) and analyzed by 2-way analysis of variation (ANOVA). Means were separated using Tukey's honest significant difference (HSD).

Results and Discussion

Sampling/Crown Distribution. Significant differences existed in mean gall density among the three crown levels over the 63 trees sampled (Table 1). Approximately 62%, 25% and 13% of the galls were contained in the top, middle and bottom crown levels, respectively. However, there was an interaction between height and replication ($P = .047$) suggesting that gall distribution can vary from tree to tree. In seven of nine replicates, galls in the top crown level outnumbered the other two levels, while middle and bottom crown levels were more variable.

An accurate assessment of gall density will require top crown level sampling. However, municipalities, or other operations involved in large scale spray programs for AFG, could reduce sampling time by first examining the lower crown level. Those trees having unacceptably high gall numbers in the lower crown will not require additional sampling since the middle and top crown levels will have at least as many galls. Only those trees with tolerable gall numbers in the lower crown would require upper crown sampling.

It is possible that the chemicals applied to the trees in this study may have influenced gall distributions. However, the results show that trees in the UTC, which should represent naturally occurring distributions, did not differ significantly from the treated trees with respect to mean gall distribution (Table 2). Apparently, in this study,

chemical treatments did not significantly affect gall density and distribution within trees. Therefore, data reported here should accurately reflect natural conditions.

Insecticide Trials. Significant differences in efficacy existed among the seven treatments, however, none of the treatments differed significantly from the untreated control (Table 2). Trees treated with dicofol 35WP applied on 10 May 1988 and fluvalinate applied on 18 April and 10 May 1988 had more galls than the UTC trees. The carbaryl 80S treatment applied on 18 April 1988, had the lowest gall numbers (Table 2).

Carbaryl 80S appears to be the most promising treatment. This is interesting since it was only applied once compared with fluvalinate, insecticidal soap and the carbaryl/insecticidal soap mix which were all applied twice. In addition, trees treated with dicofol 35WP on 18 April 1988 had significantly lower gall numbers than trees treated with dicofol 35WP on 10 May 1988, also indicating that a single effective treatment prior to bud break may provide sufficient control.

Dicofol 35WP (the previous standard for AFG control in the tree care industry) applied at flower full bloom stage and fluvalinate (applied on both dates) resulted in higher gall numbers. Predator mites of unknown species were consistently observed on flowers at full bloom stage. Therefore, it is possible that predators of *E. fraxiniflora* may be most active at flower full bloom stage and susceptible to these chemicals. However, carbaryl 80S would also have to be tested at full bloom stage to accurately assess this assumption. In addition, the carbaryl/insecticidal soap treatment (applied on both dates) resulted in lower gall numbers as compared with the other treatments. The lower gall numbers may indicate that carbaryl is not affecting the *E. fraxiniflora*

Table 1. ANOVA for crown level distribution for ash flower gall on green ash in St. Paul, Minnesota.

Crown level	Mean* gall number	S.E.	Mean ln ($x + 1$)	% Crown distribution
Top	89.5	15.7	2.8 A	61.8%
Middle	35.7	8.9	1.8 B	24.7%
Bottom	19.7	5.6	1.1 C	13.5%

Note: Means followed by a common letter not significantly different, ANOVA/Tukey's (HSD); $P = .05$. *Mean is arithmetic mean gall #.

predators which were observed or that the first application reduced *E. fraxiniflora* numbers enough that predator mortality was insignificant.

The 1988 season was the second consecutive year that *E. fraxiniflora* was inadequately controlled (Wawrzynski, unpublished data) using standard treatments applied at the recommended times (2, 9). This suggests that the life history of *E. fraxiniflora* as briefly discussed by Felt (3), Connold (1), Felt and Rankin (4), Garcia (5), and Wawrzynski and Ascerno (9) may need further study.

Overwintering mites were observed approximately three weeks prior to bud break. Because the mites are active this early, it is possible that they have penetrated beneath the flower bud scales before the recommended treatment time of flower bud break (2, 9). To be most effective, a material with sufficient chemical residue should be applied a few weeks prior to bud break. Dormant oil application, as suggested by Felt and Rankin (4) may be the most effective treatment.

Ash flower gall, although a very common problem, may not be as well understood as thought. Lack of previously published information on AFG distribution in tree crowns, has limited options for more efficient control. It is obvious from these data that more attention needs to be given to spray applications in top crown portions of the

tree. In addition, if AFG is an aesthetic problem, gall distribution could be used to begin aesthetic injury level studies. A better understanding of public perceptions of AFG and how these relate to gall distribution, could be used to influence control measures. Finally, chemical controls were shown to be erratic and mostly ineffective. Increased study of *E. fraxiniflora* is more likely to yield information useful for control than screening new chemicals.

Acknowledgement. We would like to thank R.A. Blanchette, R.D. Moon and D.W. Ragsdale for reviewing the manuscript. This manuscript was in partial fulfillment for M.S. degree. This research was supported by the Agricultural Experiment Station, University of Minnesota, and project number MN 17027, Management of shade tree insects in urban areas.

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Table 2. Ash flower gall insecticide treatments, rates, dates and ANOVA.

Treatment	Rate per 50 Gal.	Treatment dates		Mean* Gall #	S.E.	Mean ln (x + 1)
		4/18/88	5/10/88			
dicofol 35WP	0.304 g.		*	357.3	108.6	5.1 A
fluvalinate	74.0 ml.	*	*	189.7	72.2	4.1 AB
insecticidal soap	4.44 l.	*	*	115.4	50.1	3.1 AB
UTC				90.3	39.7	2.9 AB
carbaryl 80S + insecticidal soap	0.142 g. + 2.22 l.	*	*	85.1	42.0	2.6 AB
dicofol 35WP	0.304 g.	*		123.6	95.4	2.3 B
carbaryl 80S	0.284 g.	*		53.2	28.3	1.9 B

Note: Means followed by a common letter not significantly different, ANOVA/Tukey's (HSD); $P = .05$. The 4/18/88 and 5/10/88 treatments were done at pre-flower bud break and flower full bloom stage, respectively. * Mean is arithmetic mean gall number.

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Abstracts

ALLISON, BRUCE A. 1989. **The role of the consulting arborist on construction sites.** *Arbor Age* 9(3):40-42.

"We have met the enemy and he is us." Our role as consulting arborists is to mitigate this recurring tragedy, to bring the light of knowledge and the power of experience to this situation. Our goal should be maximum credibility and minimum site disturbance—which isn't always easy to accomplish. The key to doing so is professionalism. As professionals, we must address the problem realistically. We as arborists are representatives of the science of arboriculture, the knoweldge of landscape and amenity trees. As consulting arborists, we contract with an individual, corporation, or others. We do so in order to gather data on a particular problem, to apply our knowledge of arboriculture to that set of data, and to make a reasoned and professional report to our employer.

WHITLOW, THOMAS, H. 1989. **Trees for wet soils.** *Grounds Maintenance* 24(3):42, 46, 48.

I am frequently asked by extension agents or landscape architects for a list of trees suited to wet sites. Anyone specifying plants for a problem location should try to have an accurate picture of soil conditions, and this includes gathering information about the site. Trees are a long-term investment in the landscape, and as such, you should place them carefully. Consult a soil survey. Visit the site, and dig or auger some test holes. Why is the site wet, and can you correct the conditions? Correction may be neither possible nor desirable, but if tree health is paramount, it is always preferable to use careful site engineering to reduce the environmental stresses imposed on the plant material. The following list of trees for wet sites is not exhaustive, but it does represent trees with proven flood tolerance.