

First Records of the Dogwood Borer, *Synanthedon scitula* (Harris)(Sesiidae), in the Pacific Northwest: A Potential Threat to Ornamental and Fruit Tree Growers

Authors: Looney, Chris, LaGasa, Eric, and Passoa, Steven

Source: The Journal of the Lepidopterists' Society, 66(3) : 171-174

Published By: The Lepidopterists' Society

URL: <https://doi.org/10.18473/lepi.v66i3.a9>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

FIRST RECORDS OF THE DOGWOOD BORER, *SYNANTHEDON SCITULA*
(HARRIS)(SESIIDAE), IN THE PACIFIC NORTHWEST: A POTENTIAL THREAT TO
ORNAMENTAL AND FRUIT TREE GROWERS

Additional key words: introduced, distribution, *Cornus*, *Malus*

The family Sesiidae is comprised of predominantly diurnal mimetic moths, with 126 named species in North America (Eichlin & Duckworth 1988; Eichlin & Taft 1988; Eichlin 1992; Eichlin 1995). Larvae are primarily borers in woody and herbaceous plant tissue. Some sesiids are significant pests of crop and ornamental plants. More rarely, they are beneficial as biological control agents of weeds (e.g., Eichlin & Passoa 1983), and in two cases, carnivorous on scale insects (Bradley 1956; Duckworth 1969).

Synanthedon scitula, the dogwood borer, is the most polyphagous species in the family (Eichlin & Duckworth 1988). Females preferentially oviposit on injuries to the host plant, including pruning scars (Pierce & Nickels 1941), mechanical damage from weed-control equipment and tree wraps (Potter & Timmons 1981; Leskey & Bergh 2005), wounds due to plant diseases (Engelhardt 1946), and galls formed by cynipid wasps (Taft et al. 1991; Eliason & Potter 2000). Larvae feed within the inner bark, even below ground level (Pless & Stanley 1967), and in extreme cases can girdle and kill trees of any age (Underhill 1935; Schread 1965). Adults fly from April to October in the eastern United States (Eichlin & Duckworth 1988), but there is one Ohio specimen in the Charles A. Triplehorn collection at The Ohio State University from December, 1971. It is not clear if this moth was collected outdoors or emerged indoors. A larva from the Peterson collection at the same institution (Ohio, spring 1938, trunk of flowering dogwood) is consistent with the known life cycle in Eichlin and Duckworth (1988) of larval feeding in the spring to early summer, leading to one generation per year.

There is some evidence that high dogwood (*Cornus florida* L.) mortality in natural settings may be caused by *S. scitula* depredation (Walton 1986), although most data suggest a secondary role with mortality primarily due to dogwood anthracnose, *Discula destructiva* Redlin (Daughtrey et al. 1988; Anagnostakis & Ward 1996). Though *S. scitula* may be a secondary threat to wild dogwood populations, it is an expensive and destructive pest of cultivated dogwood. Rogers and Grant (1990) estimated average losses of \$1,800 per block in Tennessee nurseries with 7% infestation levels, due to the un-marketability of infested trees.

Previously, *S. scitula* was often called the pecan tree borer or pecan sesia because of the severe damage to pecan (Pless & Stanley 1967; Soloman 1995). Oak is another frequent host (Brown & Mizell 1993), but larvae can secondarily attack many hardwoods, shrubs, and even vines (Soloman 1995), or more rarely, pine trees (Engelhardt 1946). Over the past few decades, *S. scitula* has become a significant pest in production apple orchards. Infestations tend to build slowly, becoming a reoccurring and chronic management problem with time (Weires 1986). The emergence of this species as a tree-fruit pest was traced to the high density of burr knots in nurseries and production orchards, resulting primarily from the increased use of clonal, size-controlling rootstocks (reviewed in Bergh & Leskey 2003). Controlling *S. scitula* can cost growers as much as \$40 per acre using conventional controls; even higher costs are associated with mating disruption (P. McGhee personal communication).

The life stages and damage of *S. scitula* have been illustrated many times; recent examples include Pless and Stanley (1967), Eichlin and Duckworth (1988), Taft et al. (1991), Brown and Mizell (1993) and Soloman (1995). Diagnostic features of the adult were summarized by Eichlin and Duckworth (1988). The egg of *S. scitula* is “chestnut brown” with fine hexagonal lines (Wallace 1945), but like many sesiid eggs, is poorly known (Eichlin & Duckworth 1988: 14). Wallace (1945), Peterson (1962), and MacKay (1968) illustrated the larva. The pupa of *S. scitula* was partially described by Beutenmüller (1901: 231) and Mosher (1916). As is typical for the family, the pupal abdominal spine pattern is sexually dimorphic. *Synanthedon scitula* can usually be identified with the above publications if comparisons are also made with *Synanthedon myopaeformis* (Borkhausen), the apple clearwing moth. This sesiid pest was recently introduced from Europe to North America and is currently known from British Columbia, Canada (Judd & Philip 2006) and Whatcom County in Washington State (LaGasa 2009). As a result of this introduction, it would be incorrect to assume unusual pest outbreaks on apple must be *S. scitula*, and immature stages of sesiid borers should be reared to adults for a positive species determination.



FIG. 1. *Synanthedon scitula* male genitalia. The specimen was collected in Wenatchee WA, 22 Sept., 2008, in a sticky trap baited with a *Synanthedon exitiosa* lure. The arrow points to the distinctive crista sacculi.

Synanthedon scitula is found east of the Rocky Mountains (Eichlin & Duckworth 1988), with central Colorado being the western boundary (Meyer & Cranshaw 1994). Both Engelhardt (1946) and MacKay (1968) specifically mentioned it was absent from the Pacific coast of the United States. In 2008, the Washington State Department of Agriculture conducted surveys for *S. myopaeformis* in northern Washington using sticky-type pheromone traps baited with peachtree borer (*Synanthedon exitiosa* (Say)) lure (1 mg of Z3, Z13-Octadecadienyl acetate). During this survey, a non-target sesiid collected near a nursery in East Wenatchee, WA, was identified by genitalic dissection as *S. scitula*, not previously recorded from Washington State. The genitalia of this moth show the characteristic saccular ridge (crista sacculi) of *S. scitula* (see Eichlin & Duckworth 1988: fig. 19), illustrated in Fig. 1.

Following this initial discovery, commercial peachtree borer lure and a new dogwood borer lure (Z,Z-3,13-ODDA, E,Z-2,13-ODDA, ZE-2,13-ODDA; Zhang et al 2005) were deployed in several sites within the greater Wenatchee area in 2009. Two *S. scitula* specimens were captured at one peachtree borer lure site and 92 specimens at one dogwood borer lure site in East

Wenatchee (Douglas Co.). Twenty-four specimens were collected with a dogwood borer lure in Wenatchee (Chelan Co.) (Fig. 2).

In 2010, traps baited with concentrated custom dogwood borer lures (10mg blend of ZZ-3,13-ODDA, EZ-2,13-ODDA, ZE-3,13-ODDA) from Alpha Scents (West Linn, OR) were placed across Washington. Two traps, one in Chelan county and one at a new site in Spokane Co., were positive for dogwood borer, with three and 20 individuals trapped respectively (Fig. 2). Trap captures in Spokane Co. were likely even higher than indicated here; multiple unverifiable specimens damaged by bird predation within the trap could not be included in our results. Our data suggest that *S. scitula* has a localized distribution in Washington State (Fig. 2), although we lack complete data for the north-central region.

Examination of specimens in the James Entomological Museum at Washington State University and the Barr Entomological Collection at the University of Idaho revealed no *S. scitula* specimens from the Pacific Northwest. A single photograph from the Wenatchee area, posted on the Internet site bugguide.net in 2006, shows a possible dogwood borer

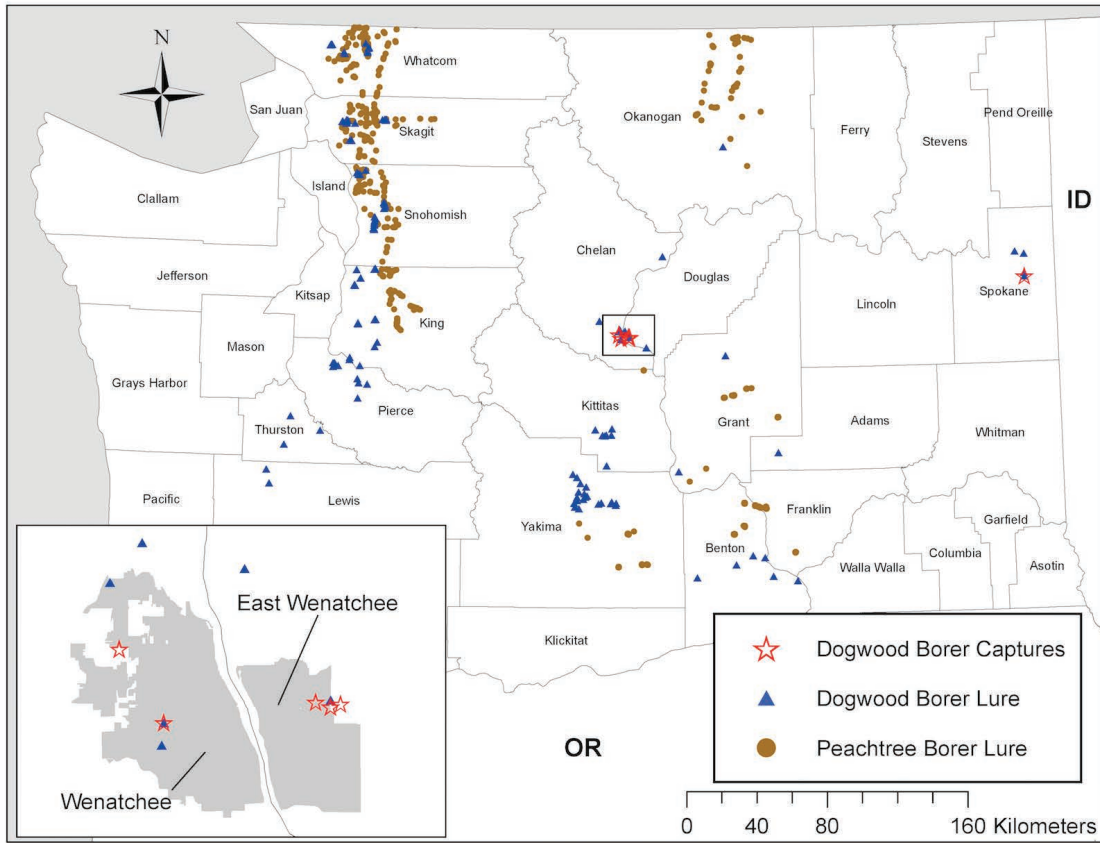


FIG. 2. *Synanthedon scitula* and *S. myopaeformis* trapping sites in Washington State, 2008-2010.

observation a few years before our captures (<http://bugguide.net/node/view/63432>). This suggests that *S. scitula* may have been present in Washington State for several years, but is only now being confirmed. We speculate that *S. scitula* was transported on nursery stock from the eastern United States, because the widely disjunct distribution from the known range seems to rule out natural spread. This sort of inter-state pathway for exotic insect introduction has been identified as a serious threat within the United States (Paini et al, 2010); indeed, other exotic Lepidoptera detected in the Pacific Northwest in 2010 were almost certainly transported via nursery stock (NAPPO 2010).

It remains to be seen what impact *S. scitula* will have in Washington State. This pest should be a concern for apple growers, particularly those using current, high-density cultivation techniques. Economic impact of *S. scitula* on fruit yields in the northeastern United States has not been thoroughly quantified; however, the ecologically similar *S. myopaeformis*, has reduced yields by up to 22% in southern Germany (Dickler 1976). Pacific dogwood (*Cornus nuttallii* Audubon ex Torr. & A. Gray) has been heavily impacted by dogwood anthracnose across the region; the addition of this

voracious insect pest may further harm dogwood populations.

Control strategies for sesiids include using resistant root-stock and fruiting varieties, cultural techniques to reduce burr knot density or insect access to host plants, mating disruption, and application of conventional pesticides (reviewed in Bergh & Leskey 2003). Attract-and-kill techniques are also being developed (Epstein et al. 2011), made possible by the recent isolation and synthesis of *S. scitula* sex pheromones (Zhang et al. 2005). The localized distribution of *S. scitula* in Washington State suggests that additional delimiting survey and eradication efforts should be considered to protect the region's tree fruit and nursery industries, homeowner landscaping, and native plants from an undesirable pest.

ACKNOWLEDGEMENTS

We are grateful to Thomas Eichlin for confirming the identification of *S. scitula*. Alexis Sarah and Kaile Adney assisted with data and specimen processing. Don Kitchen dissected and photographed all specimens. We are grateful to Aijun Zhang, Jason Hansen, the USDA-APHIS Otis Methods Development Center, and Darek Czokajlo (Alpha Scents, Inc.) for providing lures. Mike Klaus, Peter Smytheman, Diane MacLean and Ed Von Gray helped in the field. Vickie Bomba-Lewandoski scanned sev-

eral important publications from the Connecticut Agricultural Station library needed for this paper. We thank the curators of the James Entomological Museum at Washington State University, the Charles A. Triplehorn collection at The Ohio State University, and the Barr Entomological Collection at the University of Idaho for access to their specimens and data. Suggestions from two anonymous reviewers significantly improved the manuscript.

LITERATURE CITED

- ANAGNOSTAKIS, S. L. & J. S. WARD. 1996. The status of flowering dogwood in five long-term forest plots in Connecticut. *Plant Dis.* 80: 1403-1405.
- BERGH, J. C. & T. C. LESKEY. 2003. Biology, ecology, and management of dogwood borer in eastern apple orchards. *Can. Entomol.* 135: 615-635.
- BEUTENMÜLLER, W. 1901. Monograph of the Sesiidae of America, north of Mexico. *Mem. Amer. Mus. Nat. Hist.* 1: 217-352.
- BRADLEY, J. D. 1956. A new clearwing moth from South Africa predaceous on scale insects (Lep. Aegeriidae). *The Entomologist* 89: 203-205.
- BROWN, L. N. & R. F. MIZELL III. 1993. The clearwing borers of Florida (Lepidoptera: Sesiidae). *Tropical Lepidoptera* vol 4, supplement 4.
- DAUGHTREY, M. L., C. R. HIBBEN & G. W. HULDER. 1988. Cause and control of dogwood anthracnose in northeastern United States. *J. Arboric.* 14: 159-164.
- DICKLER, V. E. 1976. Zur Biologie und Schädwirkung von *Synanthedon myopaeformis* Brkh. (Lepid., Aegeriidae), einem neuen Schädling in Apfeldichtpflanzungen. *Z. Angew. Entomol.* 82: 259-266.
- DUCKWORTH, W. D. 1969. A new species of Aegeriidae from Venezuela predaceous on scale insects (Lepidoptera: Yponomeutidae). *Proc. Entomol. Soc. Wash.*, 71: 487-490.
- EICHLIN, T. D. 1992. A new Texas clearwing moth (Sesiidae: Sesiinae). *J. Lepid. Soc.* 46: 265-268.
- . 1995. A new North American clearwing moth and notes on a rare species (Sesiidae). *J. Lepid. Soc.* 49: 114-118.
- EICHLIN, T. D. & W. D. DUCKWORTH. 1988. The Moths of America North of Mexico, fascicle 5.1, Sesiioidea, Sesiidae. The Wedge Entomological Foundation, 176 pp.
- EICHLIN, T. D. & S. PASSOA. 1983. A new clearwing moth (Sesiidae) from Central America: a stem borer in *Mimosa pigra*. *J. Lepid. Soc.* 37: 193-206.
- EICHLIN, T. D. & W. H. TAFT. 1988. A new *Sesia* clearwing moth from Michigan (Sesiidae). *J. Lepid. Soc.* 42: 231-235.
- ELIASON, E. A. & D. A. POTTER. 2000. Dogwood borer (Lepidoptera: Sesiidae) infestation of horned oak galls. *J. Econ. Entomol.* 93: 757-762.
- ENGELHARDT, G. P. 1946. The North American clear-wing moths of the family Aegeriidae. *Bull. U. S. Natl. Mus.* 190: 1-222.
- EPSTEIN, D. L., L. J. GUT, L. TEIXEIRA & M. GRIESHOP. 2011. Management of the sessiid borer, *Synanthedon scitula* (Harr.) with mating disruption and mass trapping in Michigan apple orchards. In Abstracts of the 85th Annual Western Orchard Pest and Disease Management Conference. Hilton Hotel, Portland, Oregon.
- JUDD, G. & H. PHILIP. 2006. Apple clearwing moth, *Synanthedon myopaeformis* (Borkhausen): recent introduction to Pacific Northwest pest complex. In Proceedings of the 80th Annual Western Orchard Pest and Disease Management Conference. Hilton Hotel, Portland, Oregon.
- LAGASA, E. 2009. Apple Clearwing Moth Survey in Washington State and Northwestern Washington Detections, 2008. In Proceedings of 68th Pacific Northwest Insect Management Conference. Hilton Hotel, Portland, Oregon.
- LESKEY, T. C. & J. C. BERGH. 2005. Factors promoting infestation of newly planted, nonbearing apple orchards by dogwood borer (Lepidoptera: Sesiidae). *J. Econ. Entomol.* 98: 2121-2132.
- MACKAY, M. R. 1968. The North American Aegeriidae (Lepidoptera): a revision based on late-instar larvae. *Mem. Can. Entomol. Soc.* 58: 1-112.
- MEYER, W. L. & W. S. CRANSHAW. 1994. Capture of clearwing borers (Lepidoptera: Sesiidae) with three synthetic attractants in Colorado. *Southwest. Entomol.* 19: 71-76.
- MOSHER, E. 1916. A classification of the Lepidoptera based on characters of the pupa. *Bull. Ill. Nat. Hist. Surv.* 12: 17-159.
- NORTH AMERICAN PLANT PROTECTION ORGANIZATION. 2010. Thirteen new state detections of *Duponchelia fovealis*, United States. Last accessed 12 May 2010. Available at URL: <http://www.pestalert.org/oprDetail.cfm?oprID=466>
- PAINI, D. R., S. P. WÖRNER, D. C. COOK, P. J. DE BARRO & M. B. THOMAS. 2010. Threat of invasive pests from within national borders. *Nat. Commun.* 1:115 doi: 10.1038/ncomms1118 (2010).
- PETERSON, A. 1962. Larvae of insects. An introduction to Nearctic species. Part I. Lepidoptera and plant infesting Hymenoptera. Edwards Brothers, Inc. Ann Arbor, Michigan. 315 pp.
- PIERCE, W. C. & C. B. NICKELS. 1941. Control of borers on recently top-worked pecan trees. *J. Econ. Entomol.* 34: 522-526.
- PLESS, C. D. & W. W. STANLEY. 1967. Life history and habits of the dogwood borer, *Thamnosphesia scitula* (Lepidoptera:Aegeriidae) in Tennessee. *J. Tenn. Acad. Sci.* 42: 117-123.
- POTTER, D. A. & G. M. TIMMONS. 1981. Factors affecting predisposition of flowering dogwood trees to attack by the dogwood borer. *Hort. Science* 16: 677-679.
- ROGERS, L. E. & J. F. GRANT. 1990. Infestation levels of dogwood borer (Lepidoptera: Sesiidae) on dogwood trees in selected habitats in Tennessee. *J. Entomol. Sci.* 25: 481-485.
- SCHREAD, J. C. 1965. Dogwood borer. The Connecticut Agricultural Experimental Station Circular 199. New Haven, Connecticut.
- SOLOMON, J. D. 1995. Guide to insect borers in North American broadleaf trees and shrubs. U.S. Forest Service. U.S. Department of Agriculture. Agricultural Handbook AH-706.
- TAFT, W. H., D. SMITLEY & J. W. SNOW. 1991. A guide to the clearwing borers (Sesiidae) of the North Central United States. USDA North Central Region Publication 394: 1-30. East Lansing, Michigan.
- UNDERHILL, G. W. 1935. The pecan tree borer in dogwood. *J. Econ. Entomol.* 28: 393-396.
- WALLACE, P. P. 1945. Biology and control of the dogwood borer, *Synanthedon scitula* Harris. In R. B. Friend. Connecticut State Entomologist 44th Report. 1944. Connecticut Experimental Station Bulletin 488: 373-395.
- WALTON, G. S. 1986. Association of dogwood borer with the recent decline of dogwood. *J. Arboric.* 12: 196-198.
- WEIRES, R. 1986. Five years research and experience with control of dogwood borer and related burr knot problems. *Compact Fruit Tree* 19: 86-90.
- ZHANG, A., T. C. LESKEY, J. C. BERGH & J. F. WALGENBACH. 2005. Sex pheromone of the dogwood borer, *Synanthedon scitula*. *J. Chem. Ecol.* 31: 2463-2479.

CHRIS LOONEY, *Pest Program, Plant Protection Division, Washington State Department of Agriculture, P.O. Box 42560, Olympia, WA 98504-2560, USA; email: clooney@agr.wa.gov*, ERIC LAGASA, *Pest Program, Plant Protection Division, Washington State Department of Agriculture, P.O. Box 42560, Olympia, WA 98504-2560, USA; email: elagasa@agr.wa.gov*, and STEVEN PASSOA, *USDA/APHIS/PPQ, USDA/FS Northern Forest Research Station and The Ohio State University, Museum of Biological Diversity, 1315 Kinnear Road, Columbus, OH, 43212 USA; email: Steven.C.Passo@usda.gov*.

Submitted for publication on 16 May 2011; revised and accepted: 08 February 2012.