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Biogeography and hosts of poroid wood decay fungi in North Carolina: species of *Fomes*, *Fomitopsis*, *Fomitella* and *Ganoderma*

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Abstract—Distribution and host species are given for two species of *Fomes*, one species of *Fomitella*, four species of *Fomitopsis* and five species of *Ganoderma*. A county distribution map is provided for eight species. Numerous new fungus-host plant associations are reported. Species checklist and figures can also be accessed at:
http://www.cals.ncsu.edu/plantpath/people/faculty/grand/mycotaxon_4.pdf.

Key words—fungus distribution, polypores

Introduction

The importance of biodiversity and biogeography of fungi, especially in unique ecosystems and specific regions, was previously addressed by Grand & Vernia (2004ab, 2005). Studies by Jung (1987), Vernia & Grand (2000) and Grand & Vernia (2002, 2003) reported on the occurrence of host plants of poroid wood decay fungi in North Carolina. The distribution and host plants in North Carolina of species of *Phellinus* and *Schizopora* (Grand & Vernia 2004a), *Ceriporia*, *Ceriporiopsis* and *Perenniporia* (Grand & Vernia 2004b) and *Coltricia*, *Coltriciella* and *Inonotus* (Grand & Vernia 2005) were previously addressed. This report is the fourth in a continuing study of poroid wood-decay fungi in North Carolina and deals with species of *Fomes*, *Fomitella*, *Fomitopsis* and *Ganoderma*.

Materials and methods

Poroid wood-decay fungi were intensively collected in North Carolina over the past eight years (1997-2004). Collections, housed in the Mycological Herbarium, Department of Plant Pathology, North Carolina State University (NCSC), and records of the Plant Disease and Insect Clinic, Department of Plant Pathology, NCSU, were utilized in the results. Previous studies (Grand et al. 1975, Jung 1987) that contained data on county distributions were used in developing the distribution maps. Similarly, data from the BPI website (Farr et al. n.d.) provided some county data.

Collections were made of all species of *Fomes*, *Fomitella*, *Fomitopsis* and *Ganoderma* species on unusual hosts. Specimens were placed in paper bags in the field with a sample of decayed wood with most collections and field notes for all collections. Specimens were examined in the laboratory and identified using existing taxonomic treatments (Gilbertson & Ryvarden 1986, Jung 1987, Overholts 1953).

Nomenclature and authorities are from Gilbertson & Ryvarden (1986) and Index Fungorum (CABI Biosciences et al.) for the fungi and Kartesz (1994) for the host plant species.

The majority of collection sites were in state parks, gamelands and natural areas, Nantahala, Pisgah, Croatan and Uwharrie National Forests, the Blue Ridge Parkway and the Great Smoky Mountains National Park. A county distribution map is provided for all species that were recorded in three or more counties (Figs. 1–8).

Results and discussion

Fomes fomentarius (L. : Fr.) J. Kickx f. (Fig. 2) was found on six host species in 12 western counties, all in the Blue Ridge Mountains of the Southern Appalachian Mountain chain. *Fomes fasciatus* (Sw. : Fr.) Cooke (Fig. 1), a species with a distribution in the southern United States (Gilbertson & Ryvarden 1986), was collected for the first time in North Carolina, in three counties in the Coastal Plain and southern Piedmont regions. It appears that *F. fomentarius* reaches its southernmost distribution in the southern mountains of North Carolina and Tennessee and that *F. fasciatus* reaches its northernmost distribution in southern North Carolina.

Fomitopsis cajanderi (P. Karst.) Kotl. & Pouzar (Fig. 3) was found in 15 counties in the Blue Ridge Mountains and Piedmont regions and was recorded on five host species. *Fomitopsis pinicola* (Sw. : Fr.) P. Karst. (Fig. 4) was found in eight counties in the Blue Ridge Mountain region of western North Carolina.

Fomitella supina (Sw. : Fr.) Murrill, *Fomitopsis durescens* (Overh. ex J. Lowe) Gilb. & Ryvarden and *Fomitopsis spraguei* (Berk. & M.A. Curtis) Gilb. & Ryvarden were not collected frequently enough to determine any distributional patterns.

Five species of *Ganoderma* were recorded in this study. *Ganoderma applanatum* (Pers.) Pat. (Fig. 5) was found in 19 counties on 22 host species. *G. applanatum* is primarily distributed in the Blue Ridge Mountains of western North Carolina but collections were made in the eastern Piedmont and northern Coastal Plain regions as well. *Ganoderma tsugae* Murrill (Fig. 8), which is primarily found on *Tsuga canadensis* Carrière in North Carolina, was also found on *Abies fraseri* (Pursh) Poir. and *Pinus pungens* Lamb. *Tsuga caroliniana* Engelm. is most likely a host as well. Dead, needleless trees of *T. caroliniana* are difficult to distinguish from *T. canadensis*. *Ganoderma tsugae* is distributed in nine counties in the Blue Ridge Mountains in western North Carolina with a single report from a disjunct population of *T. canadensis* in the Piedmont.

Ganoderma lucidum (Curtis : Fr.) P. Karst. (*sensu lato*) is morphologically variable (Gilbertson & Ryvarden 1986) and considered by most taxonomists to be a species complex. With the exception of *Ganoderma curtisii* (Berk.) Murrill, *G. lucidum* was considered in the broad species concept in this study. *G. lucidum* (Fig. 7) is widely distributed in North Carolina and was found in 29 counties on 29 host species. The species concept of *G. curtisii* in this study was limited to those basidiocarps with a well-developed stipe, eccentric pileus and typically forming from underground roots near stumps. *G. curtisii* (Fig. 6) is widely distributed in North Carolina and was found in 11 counties on 14 host species.

List of species found in North Carolina

Previously unreported fungus-host associations for the United States are indicated by a double asterisk (**). Counties of record are listed in the second column.

<i>Fomes fasciatus</i> (Sw. : Fr.) Cooke		Fig. 1
<i>Persea borbonia</i> (L.) Spreng.	Brunswick	
<i>Quercus falcata</i> Michx. **	Anson	
<i>Quercus</i> sp.	Robeson	
<i>Fomes fomentarius</i> (L. : Fr.) J. Kickx f.		Fig. 2
<i>Acer rubrum</i> L.	Graham	
<i>A. saccharum</i> Marsh	Swain	
<i>Betula alleghaniensis</i> Brit.	Ashe, Avery, Buncombe, Cherokee, Clay, Macon, Transylvania, Watauga, Yancey	
<i>B. lenta</i> L.	Ashe, Buncombe, Macon, Watauga	
<i>Fagus grandifolia</i> Ehrh.	Haywood, Macon	
<i>Prunus serotina</i> Ehrh.	Avery, Macon	
<i>Fomitella supina</i> (Sw. : Fr.) Murrill		
<i>Quercus falcata</i> **	Johnston	
<i>Fomitopsis cajanderi</i> (P. Karst.) Kotl. & Pouzar		Fig. 3
<i>Picea rubens</i> Sarg.	Swain	
<i>Pinus echinata</i> Mill.	Catawba	
<i>P. pungens</i> Lamb.	Macon	
<i>P. virginiana</i> Mill.	Durham, Franklin, Gaston, Jackson, Stanly, Stokes, Swain, Wilkes	
<i>Pinus</i> sp.	Montgomery	
<i>Tsuga canadensis</i> Carrière	Polk, Watauga	
unidentified substrate	Henderson, McDowell	
<i>Fomitopsis durescens</i> (Overh. ex J. Lowe) Gilb. & Ryvarden		
<i>Quercus</i> sp.	Durham	
<i>Fomitopsis pinicola</i> (Sw. : Fr.) P. Karst.		Fig. 4
<i>Abies fraseri</i> (Pursh) Poir.	Transylvania, Yancey	
<i>Picea rubens</i>	Haywood, Mitchell, Swain, Yancey	
<i>Tsuga canadensis</i>	Macon, Swain	
unidentified substrate	Buncombe, Henderson	
<i>Fomitopsis spraguei</i> (Berk. & M.A. Curtis) Gilb. & Ryvarden		
unidentified substrate	Henderson	
<i>Ganoderma applanatum</i> (Pers.) Pat.		Fig. 5
<i>Acer pensylvanicum</i> L.	Swain	
<i>A. rubrum</i>	Avery, Currituck, Haywood, Jackson, Transylvania, Watauga	
<i>A. saccharinum</i> L.	Ashe	

<i>A. saccharum</i>	Henderson
<i>Amelanchier arborea</i> (Michx.) Fernald	Jackson
<i>Betula alleghaniensis</i>	Ashe, Avery, Haywood, Swain, Yancey
<i>B. lenta</i>	Avery, Macon, Watauga
<i>Betula</i> sp.	Swain
<i>Carya tomentosa</i> (Poiret) Nutt.	Jackson
<i>Cercis canadensis</i> L.	Wake
<i>Fagus grandifolia</i>	Graham, Haywood, Jackson, Swain
<i>Juglans cinerera</i> L.	Macon
<i>Liriodendron tulipifera</i> L.	Ashe, Graham, Macon, Swain, Watauga
<i>Magnolia fraseri</i> Walt. **	Burke
<i>Malus sylvestris</i> Mill.	Henderson
<i>Prunus pennsylvanica</i> L.	Swain
<i>Quercus alba</i> L.	Transylvania, Wake, Watauga
<i>Q. prinus</i> L.	Rutherford, Transylvania, Watauga, Yancey
<i>Q. rubra</i> L.	Ashe, Avery, Graham, Macon, Swain, Watauga, Wilkes
<i>Robinia pseudoacacia</i> L.	Graham
<i>Tilia heterophylla</i> Venten.	Franklin, Macon
<i>Tsuga canadensis</i>	Burke
<i>Ulmus rubra</i> Muhl.	Wake
unnamed substrate	Buncombe, Henderson, McDowell, Yancey

***Ganoderma curtisii* (Berk.) Murrill**

<i>Acer rubrum</i>	Dare, Johnston
<i>Carya</i> sp.	Wake
<i>Lagerstroemia indica</i> L. **	Wake
<i>Liquidambar styraciflua</i> L.	Wake
<i>Malus ×domestica</i> Borkh.	Richmond
<i>Pinus taeda</i> L. stump	Wake
<i>Quercus alba</i>	Wake
<i>Q. falcata</i>	Gaston
<i>Q. laevis</i> Walt.	Bladen, Columbus
<i>Q. laurifolia</i> Michx.	Robeson
<i>Q. prinus</i>	Wake
<i>Q. velutina</i> Lam.	Moore
<i>Quercus</i> sp.	Pender
<i>Robinia pseudoacacia</i>	Wake
<i>Zelkova serrata</i> (Thunb.) Makino **	Wake
unnamed substrate	Henderson, Wake

Fig. 6

***Ganoderma lobatum* (Schwein.) G.F. Atk.**

<i>Carya glabra</i> (P. Mill.) Sweet	Transylvania
<i>Quercus alba</i>	Anson

Ganoderma lucidum (Curtis : Fr.) P. Karst.

Fig. 7

<i>Acer rubrum</i>	Carteret, Guilford, Iredell, Wake, Wilkes
<i>A. saccharum</i>	Jackson
<i>Betula nigra</i> L.	Warren
<i>Carya</i> sp.	Wake
<i>Celtis laevigatus</i> L.	Bladen
<i>Cercis canadensis</i>	Wake
<i>Fagus grandifolia</i>	Wake
<i>Ilex opaca</i> Ait.	Wake
<i>Gleditsia triacanthos</i> L.	Wake
<i>Juglans nigra</i> L.	Jones
<i>Liquidambar styraciflua</i>	Gates, Wake
<i>Liriodendron tulipifera</i>	Ashe, Jones, Wilkes
<i>Malus ×domestica</i>	Montgomery
<i>Myrica cerifera</i> L. **	Wake
<i>Oxydendrum arboreum</i> L. **	Camden
<i>Platanus occidentalis</i> L.	Wake
<i>Quercus alba</i>	Surry
<i>Q. coccinea</i> Muench.	Watauga
<i>Q. falcata</i>	Alamance, Anson, Moore
<i>Q. laurifolia</i>	Robeson
<i>Q. lyrata</i> Walt.	Wayne
<i>Q. phellos</i> L.	Wake
<i>Q. prinus</i>	Harnett, Wake, Wilkes
<i>Q. rubra</i>	Clay, Franklin, Jones, Watauga, Wayne
<i>Q. velutina</i>	Wake
<i>Q. virginiana</i> Mill.	Carteret, Dare, New Hanover
<i>Quercus</i> sp.	Buncombe, McDowell
<i>Robinia pseudoacacia</i>	Wake
<i>Salix babylonica</i> L.	Wake
<i>S. nigra</i> Marsh	Gates
unnamed substrate	Johnston, Vance

Ganoderma tsugae Murrill

Fig. 8

<i>Abies fraseri</i>	Watauga
<i>Pinus pungens</i>	Macon
<i>Tsuga canadensis</i>	Buncombe, Burke, Graham, Henderson, Macon, McDowell, Swain, Transylvania, Wake, Watauga

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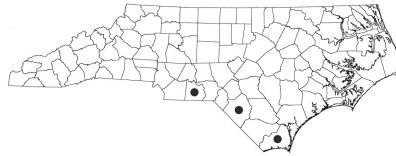


Fig. 1. Distribution of *Fomes fasciatus* in North Carolina.



Fig. 2. Distribution of *F. fomentarius* in North Carolina.

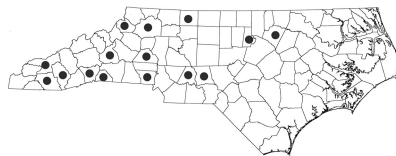


Fig. 3. Distribution of *Fomitopsis cajanderi* in North Carolina.



Fig. 4. Distribution of *F. pinicola* in North Carolina.



Fig. 5. Distribution of *Ganoderma applanatum* in North Carolina.



Fig. 6. Distribution of *G. curtisii* in North Carolina.

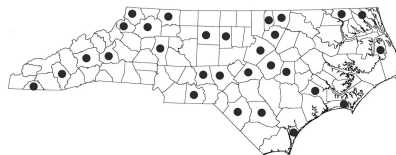


Fig. 7. Distribution of *G. lucidum* in North Carolina.



Fig. 8. Distribution of *G. tsugae* in North Carolina.