J. Ky. Acad. Sci. 64(1):29–35. 2003.

American Mistletoe (*Phoradendron leucarpum*, Viscaceae) in Rockcastle County, Kentucky

Ralph L. Thompson

Department of Biology, Berea College, Berea, Kentucky 40404

and

F. Dale Noe Jr.

Division of Environmental Analysis, Kentucky Transportation Cabinet, Frankfort, Kentucky 40601

ABSTRACT

American mistletoe (*Phoradendron leucarpum*), an obligate hemiparasitic shrub of certain eastern deciduous forest trees, was found on 3502 trees from 15 host species in 10 families in Rockcastle County, within the south-central region of eastern Kentucky. Black walnut (*Juglans nigra*), the preeminent of these host species, was most frequent in the Eastern Knobs and Eastern Highland Rim regions followed by wild black cherry (*Prunus serotina*). Blackgum (*Nyssa sylvatica*) was the most prevalent host tree in the Northern Cumberland Plateau. Post oak (*Quercus stellata*) and red elm (*Ulmus rubra*) were new host tree species documented for Kentucky. An aggregated or clumped spatial distribution pattern exists between American mistletoe and its host trees. The occurrence value was 4.35 infested trees per kilometer.

INTRODUCTION

American mistletoe, *Phoradendron leucarpum* (Raf.) Reveal & M. C. Johnston, is a shrubby evergreen hemiparasite on several deciduous trees within the Eastern Deciduous Forest of the eastern United States. The geographical distribution of the species is bounded by eastern Texas, southeastern Oklahoma, southern Missouri, Illinois, Indiana, and Ohio, southeastern Pennsylvania, and southern New Jersey southward to Florida and westward through the Gulf States (Scharpf and Hawksworth 1974; Wiens 1964).

American mistletoe is referred to as *P. flavescens* (Pursh) Nuttall or *P. serotinum* (Raf.) M. C. Johnston in most state floras and manuals of the eastern United States. Reveal and Johnston (1989) showed the correct nomenclatural combination to be *P. leucarpum* (Raf.) M. C. Johnston. Based on morphology, embryology, and cytology (Cronquist 1981; Kuijt 1982), *Phoradendron*, the New World mistletoes, are now classified in the Viscaceae, the Christmas mistletoe family, rather than in the Loranthaceae. The chromosome number of *P. leucarpum* is 2n = 28 (Baldwin and Speece 1957; Wiens and Barlow 1971).

This dioecious woody plant is characterized by opposite, glabrous, elliptic to obovate, coriaceous leaves. The inflorescence consists of short axillary spikes of inconspicuous, greenish white staminate or pistillate flowers. The fruits are white to whitish yellow, subglobose drupe-like berries with a viscin layer within the pericarp and one or two chlorophyllous seeds (Kuijt 1969, 1982). *Phoradendron leucarpum* has long been considered an obligate hemiparasite that obtains water and inorganic minerals from the woody host (Hull and Leonard 1964a) but producing its own photosynthate by chlorophylls (Freeland 1943; Hull and Leonard 1964b).

Fruit and seed dispersal mechanisms of *P. leucarpum* primarily include ornithophily, or avian vectors, and to a much lesser degree by arboreal mammals and gravity (Bray 1910; Martin et al. 1951; York 1909). After fruit dispersal, the viscid pericarp layer of the berry adheres to a woody host branch where germination occurs. The hypocotyl-primary radicle forms a disclike holdfast through which endophytic haustoria penetrate the bark, vascular cambium, and xylem to absorb water and minerals. New growth then can occur with eruptions of shoots through the bark from lateral cortical strands on the long axis of branches. A leafy shoot forms within the first 2 years and a mature American mistletoe plant can develop flowers within 3 to 5 years (Calvin 1967; Kuijt 1982; York 1909).

Several host specificity studies were conducted during 1976–1989 in Georgia (Cole and Hemmerly 1981), Mississippi (Eleuterius 1976), Ohio (Spooner 1983), and Tennessee by Thomas E. Hemmerly, Middle Tennessee State University, and his students (Anderson and Mundy 1980; Brown and Hemmerly 1979; Ferguson and Hemmerly 1976; Hemmerly 1981; Hemmerly et al. 1979; Hemmerly et al. 1987; Henderson and Pekala 1980; McKinney and Hemmerly 1977; Rucker and Hemmerly 1976; Sadler and Hemmerly 1984). The present study of Rockcastle County is the first mistletoe survey for an entire Kentucky county. The only report of American mistletoe for Rockcastle County was a sight record by Braun (1943). Only two previous mistletoe studies have been published in Kentucky (Reed and Reed 1951; Thompson 1992). Our objectives were to identify American mistletoe-infested trees, inventory them by physiographic province, determine relative abundance and spatial distribution patterns, and record bird species perched in mistletoe-infested trees.

THE STUDY AREA

Rockcastle County is in south-central southeastern Kentucky and consists of 80,552 ha (199,040 acres) with ca. 52,206 ha (129,000 acres) forested (Ross et al. 1981). The population of Rockcastle County was 16,600 in 2000. The largest town and county seat, Mount Vernon, had a population of 3300 (U.S. Census Bureau 2000).

The continental temperate climate of Rockcastle County typically exhibits warm humid summers followed by moderately cold winters. Mean annual precipitation is 118 cm (46.6 in). Mean annual temperature is 12.7°C (54.8°F). Mean growing season is 181 days with the first killing freeze in mid-October and the last killing freeze in mid-to-late April (Ross et al. 1981).

Three major physiographic regions present in Rockcastle County are the Eastern Knobs (Knobs), Eastern Highland Rim (EHR), and the Northern Cumberland Plateau (NCP) based on Smalley (1986). The Eastern Knobs (15,385 ha) lie in the extreme north-northwestern portions of Rockcastle County; the Eastern Highland Rim (27,090 ha) lies in the southwestern-central portions; and the Northern Cumberland Plateau (38,077 ha) is located in eastern and southern Rockcastle County (Figure 1). The NCP forms part of the western region of the Appalachian Plateaus Province of Fenneman (1938).

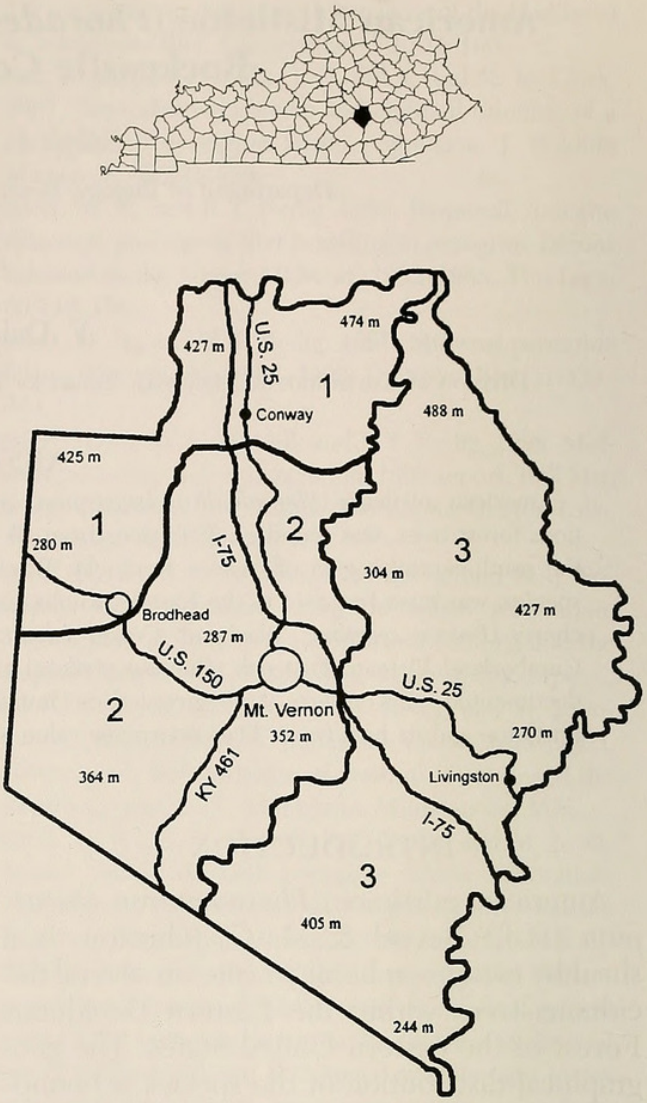

Figure 1. Rockcastle County, Kentucky, Physiographic Regions: (1) Eastern Knobs, (2) Eastern Highland Rim, (3) Northern Cumberland Plateau (Smalley 1986). Adapted from General Highway Map, Rockcastle County, Kentucky (Kentucky Department of Transportation 1991) and geologic map of Kentucky (McDowell et al. 1981).

In Rockcastle County, the Eastern Knobs are composed of Devonian and Mississippian shales, sandstones, siltstones, and dolomitic limestones. The terrain consist of moderately sloping conical rounded hills and ridges with U-shaped valleys drained by small streams. The EHR is composed principally of Mississippian limestones with some siltstones and shales, which results in a undulating dissected plateau with moderate side slopes and deep

valleys along natural drainages. The NCP is composed mainly of Pennsylvanian sandstones, siltstones, conglomerates, and some coal. The elevated landforms have very rugged and steep side slopes, narrow ridges, and V-shaped valleys (McDowell et al. 1981). The highest point in Rockcastle County is near the Rockcastle/Madison County boundary at 488 m (1600 ft); the lowest elevation, 244 m (800 ft), is at the junction of the Rockcastle River contiguous to Laurel County (Ross et al. 1981).

Braun (1950) classified the vegetation of the Eastern Knobs as part of the Mixed Mesophytic Forest and Western Mesophytic Forest regions with mixed oak-hickory-pine at upper elevations and mesic hardwood forests at lower elevations. The Eastern Highland Rim lies within the Western Mesophytic Forest Region with oak-hickory and mixed mesophytic hardwood forests surrounded by agricultural lands. The Northern Cumberland Plateau is occupied by the Mixed Mesophytic Forest Region of predominantly mixed oak-hardwoods-pine forest. Küchler (1964) classified the potential vegetation of the Mississippian Plateau (Eastern Highland Rim) as oak-hickory forest and the vegetation of the Cumberland Plateau as mixed mesophytic forest (maple-buckeye-beech-tuliptree-oak-basswood).

MATERIALS AND METHODS

Field methodology for our mistletoe survey was adapted from Hemmerly (1989). During December 1991–January 1992, we traversed the paved and passable gravel roads within the boundaries of Rockcastle County with a four-wheel-drive vehicle. We used a 1991 Rockcastle County highway map divided into three physiographic regions to designate roads travelled and to document infested trees. We spotted trees with mistletoe from the vehicle while driving slowly using binoculars when needed. After a host tree was sighted, we stopped, investigated, and recorded data. Additional stops in favorable terrain resulted in a more through tabulation of isolated and heavily infested trees. All trees encountered with visible signs of American mistletoe infection (i.e., branch clumps or clusters, cankers, swellings, limb die-back) were identified, counted, and recorded by physiographic region. We tallied road mileage with the vehicle odometer and eventually totaled all the sums together to obtain an occurrence factor value. An occurrence factor is the density value of infested trees per kilometer and it is determined by dividing the total number of infested trees by the total kilometers travelled (Hemmerly 1989; Hemmerly et al. 1987; Sadler and Hemmerly 1984). This density factor represents both spatial distribution and relative abundance of host trees (Hemmerly 1989).

We collected representative American mistletoe and winter twig vouchers for certain host species and deposited them in the Berea College Herbarium (BEREA) and Eastern Kentucky University Herbarium (EKY). We obtained most of these specimens from host trees with a 12 m (40 foot) extendable fiberglass linesman pole and used a 12-gauge shotgun to secure certain specimens beyond the reach of the linesman pole. Nomenclature for trees species follows Gleason and Cronquist (1991).

RESULTS AND DISCUSSION

Host Occurrence of Mistletoe-infested Trees

Over 805 km (500 miles) of surface roads in one direction were traversed within the boundaries of Rockcastle County. A total of 3502 host trees from 15 species in 10 families were found to be parasitized by *P. leucarpum* (Table 1). Mount Vernon, centrally located in Rockcastle County within the Eastern Highland Rim, had 455 mistletoe-infested trees from 11 host species. The number of mistletoe-infested trees per road kilometer was 4.35. The occurrence value in Rockcastle County was considerably higher than those reported for counties surveyed in Georgia (Cole and Hemmerly (1981) and in Tennessee (Anderson and Mundy 1980; Hemmerly et al. 1987; Henderson and Pekala 1980; Sadler and Hemmerly 1984).

Three host trees—black walnut (*Juglans nigra* L.), wild black cherry (*Prunus serotina* Ehrh.), and blackgum (*Nyssa sylvatica* Marsh.)—accounted for 2764 trees of the 3502 total (Table 1). Post oak (*Quercus stellata* Wangenh.) and red elm (*Ulmus rubra* Muhl.) were documented as a new host tree species for Kentucky based on Reed and Reed (1951). Shagbark hickory [*Carya ovata* (Mill.) K. Koch] and sugar maple (*Acer saccharum*

Table 1. Host occurrence of *Phoradendron leucarpum* in Rockcastle County, Kentucky. Physiographic Regions (Smalley 1986): Knobs = Eastern Knobs; EHR = Eastern Highland Rim; NCP = Northern Cumberland Plateau.

Tree species	Knobs	EHR	NCP	Total	Percentage
Juglans nigra	571	1102	23	1701	48.57
Prunus serotina	112	513	11	636	18.16
Nyssa sylvatica	10	20	397	427	12.19
Fraxinus americana	14	187	22	223	6.37
Robinia pseudoacacia	37	109	15	161	4.60
Acer saccharum	31	90	24	145	4.14
Ulmus americana	10	89	8	107	3.05
Ulmus rubra	5	9	27	41	1.17
Acer saccharinum	0	23	0	23	0.66
Carya ovata	4	14	0	18	0.51
Gleditsia triacanthos	2	13	0	15	0.43
Celtis occidentalis	0	2	0	2	0.06
Diospyros virginiana	0	1	0	1	0.03
Maclura pomifera	0	1	0	1	0.03
Quercus stellata	0	1	0	1	0.03
Total: 15	796	2179	527	3502	100.00
Tree Percent by Regions:	22.73	62.22	15.05	100.00	

Marsh.) were reported for the second time; they were Kentucky distributional records not indicated by Thompson (1992).

The most host trees were located within the Eastern Highland Rim (2179) followed by the Knobs (796) and the Northern Cumberland Plateau (527). Black walnut was found to be the preeminent host species of the Eastern Knobs followed by wild black cherry, black locust (*Robinia pseudoacacia* L.), and sugar maple (Table 1). In the EHR, all 15 host species were found with black walnut accounting for 1102 trees. Wild black cherry, white ash (*Fraxinus americana* L.), black locust, sugar maple, and American elm followed in occurrence. Other mistletoe-infested trees were silver maple (*Acer saccharinum* L.), shagbark hickory, honey locust (*Gleditsia triacanthos* L.), red elm, common hackberry (*Celtis occidentalis* L.), Osage-orange [*Maclura pomifera* (Raf.) Schneid.], common persimmon (*Diospyros virginiana* L.) and post oak (Table 1).

Calcicolous host-tree species—wild black cherry, black walnut, American elm, white ash, black locust, sugar maple, and shagbark hickory—were most important in a mistletoe survey from the Lexington-Blue Grass Army Depot (LBAD) in Madison County, the northern contiguous county to Rockcastle County. The LBAD is located in the Outer Bluegrass Physiographic Region where the bedrock is composed largely of Ordovician limestones and dolomitic limestones (Thompson 1992). In fact, 11 out of 15 host tree species present in the EHR were found in the LBAD by Thompson (1992).

The Northern Cumberland Plateau had only eight host tree species present although it is the largest physiographic region in Rockcastle County. The principal host tree in the NCP was the acidophilic blackgum, which accounted for 397 trees in the survey. Occasional red elm, sugar maple, white ash, and black walnut also were present. Hemmerly et al. (1979) documented blackgum as the predominant host tree in Lawrence County, Tennessee. Reed and Reed (1951) listed blackgum as the most important mistletoe host tree for the Cumberland Plateau of Kentucky.

Avian Species Observed

Frequent overwintering birds perched in mistletoe-infested trees during this survey were the European starling (*Sturnus vulgaris*), red-winged blackbird (*Agelaius phoeniceus*), brown-headed cowbird (*Molothrus ater*), common grackle (*Quiscalus quiscula*) and American crow (*Corvus brachyrhynchos*). Infrequent non-migratory birds observed in trees with mistletoe included blue jay (*Cyanocitta cristata*), American robin (*Turdus migratorius*), cedar waxwing (*Bombycilla cedrorum*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), mourning dove (*Zenaida macroura*), and eastern bluebird (*Sialia sialis*). These 12 bird spe-

cies have been reported as vectors of *Phoradendron* spp. in the combined studies of Bray (1910), Martin et al. (1951), and York (1909). Birds spread the infestation by ingesting the berries, defecating, and bill-wiping on bark and knocking fruits off onto the branches. The availability of avian vectors is another variable in the amount of tree infestation.

Analysis of Infested Trees

Mistletoe-infestation was observed in certain host tree species much more than others, and the degree of infestation was different among trees of the same species in a particular region and in contiguous physiographic regions. One factor in the amount of mistletoe infestation is correlated with the age and size of the host trees. Birds prefer to perch and feed in the upper crowns of older, larger, and taller mature trees. Other studies in *Phoradendron* spp. have made similar observations regarding host tree size (Hreha and Thomson and Mahall 1983; Weber 1979).

The amount of canopy closure in conjunction with available sunlight is also related to the incidence and degree of mistletoe infestation. In southern Mississippi, greater mistletoe infestation and mortality were observed in water oak (*Quercus nigra* L.) in open canopies than in closed canopies (Eleuterius 1976). More exposure to sunlight is beneficial for mistletoe photosynthesis, and light has also been observed to promote the germination of American mistletoe seeds (Gardner 1921).

Trees with open canopies of upland road corridors, forest edges, pastures, fields, yards, fencerows, and ridgetops of the Knobs and Eastern Highland Rim had a much higher incidence of infestation than host trees in closed forests of lower and upper slopes and forested riparian valleys of the Northern Cumberland Plateau. The prevalence of mistletoe in Mount Vernon was partly because available host trees and bird perching sites were available; we found that cities and towns typically provide host trees for infestation.

Another factor directly contributing to American mistletoe infestation is the increased availability of host trees along these open, upland habitats. More host trees for American mistletoe infestation were present in the EHR and Knobs than in the larger NCP. In Rockcastle County, the most severe infestations, which caused actual tree mortality in some cases, were most often observed in black walnut, wild black cherry, blackgum, and American elm.

The spatial distribution and dispersion of American mistletoe exhibits an aggregated (clumped) pattern (Barbour et al. 1999) or clustered distribution (Daubenmire 1968). American mistletoe surveys in Georgia (Cole and Hemmerly 1981) and in Tennessee showed the aggregated pattern of distribution (Hemmerly et al. 1979; Henderson and Pekala 1980; Panvini 1991; Sadler and Hemmerly 1984). An aggregated non-random pattern is indicated when the spread of mistletoe in a host tree by avian vectors increases the chance of further infection of that tree and the infestation of other host trees of the same species. Abundance and density of American mistletoe are also correlated with the actual fact that more specific host trees are available for infestation in physiographic regions or provinces with specific geological substrates (e.g., black walnut and wild black cherry are more likely to be found in calcareous-based soils than acid soils, and blackgum typically is more abundant in siliceous-based soils). Host preferences in specific physiographic regions have been observed in Kentucky and Tennessee. Reed and Reed (1951) reported that geological formations within physiographic regions were an indicator of the species and abundance of mistletoe-infested host trees in Kentucky. In Tennessee, American mistletoe has been found to differentially parasitize various tree hosts among different physiographic regions (Anderson and Mundy 1980; Brown and Hemmerly 1979; Ferguson and Hemmerly 1976; Hemmerly 1981; Hemmerly et al. 1979; Hemmerly et al. 1987; Henderson and Pekala 1980; McKinney and Hemmerly 1977; Panvini 1991; Rucker and Hemmerly 1976; Sadler and Hemmerly 1984).

CONCLUSIONS

Our American mistletoe survey in Rockcastle County, Kentucky, has revealed that mistletoe has a considerable specificity for certain host trees in certain physiographic regions and not in other, contiguous regions (i.e., host tree species greatly infested in a certain region may not be parasitized or rarely infested when present in another). Factors determining host

specificity probably include genetic parameters of both the mistletoe and the host trees in addition to local environmental, ecological, and physical conditions (Calder and Bernhardt 1983; Panvini 1991). Recommended future guidelines for American mistletoe research were outlined in Hemmerly (1989). Experimental and field studies by Clay et al. (1985), Glazner et al. (1988), May (1971, 1972), Panvini (1991), and Thomson and Mahall (1983) presented evidence for specific genetic races or ecotypes in *Phoradendron* spp. Ecotypes of American mistletoe could better explain the variations in host tree preferences and distributions. Further genetic studies are needed in American mistletoe to better understand ecological races and their interactions with various host trees.

ACKNOWLEDGMENTS

We express our appreciation to Dr. Thomas E. Hemmerly, Middle Tennessee State University, Murfreesboro, for his encouragement and advice while we conducted this American mistletoe survey.

LITERATURE CITED

Anderson, R., and P. Mundy. 1980. The host specificity of American mistletoe (*Phoradendron serotinum*) on the northwestern Highland Rim of middle Tennessee. Pages 2–7 in K. Blanchard, T.E. Hemmerly, and G. Murphy (eds). Humanizing science education in Tennessee. Middle Tennessee State Univ. Print Shop, Murfreesboro, TN.

Baldwin, J. T., Jr., and B. M. Speese. 1957. *Phoradendron flavescens*: chromosomes, seedlings, and hosts. Am. J. Bot. 44:136–140.

Barbour, M. G., J. H. Burk, W. D. Pitts, F. S. Gilliam, and M. S. Schwartz. 1999. Terrestrial plant ecology. 3rd ed. Benjamin/Cummings Publishing Company, Menlo Park, CA.

Braun, E. L. 1943. An annotated catalog of spermatophytes of Kentucky. Privately published, Cincinnati, OH.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York, NY.

Bray, W.L. 1910. The mistletoe pest in the southwest. U.S.D.A. Bur. Pl. Industry Bull. 166:7–39.

Brown, P. F., and T. E. Hemmerly. 1979. Host specificity of mistletoe in middle Tennessee IV: Bedford County. J. Tennessee Acad. Sci. 54:118–119.

Calder, M., and P. Bernhardt. 1983. The biology of mistletoes. Academic Press, Sydney, Australia.

Calvin, C. L. 1967. Anatomy of the endophytic system of the mistletoe, *Phoradendron flavescens*. Bot. Gaz. 128: 117–137.

Clay, K., D. Dement, and M. Rejanek. 1985. Experimental evidence for host races in mistletoe (*Phoradendron tomentosum*). Am. J. Bot. 72:1225–1231.

Cole, T. W., and T. E. Hemmerly. 1981. American mistletoe (*Phoradendron flavescens*) in Walker County, Georgia. Georgia J. Sci. 39:37–38.

Cronquist, A. 1981. An integrated system of classification of flowering plants. Columbia Univ. Press, New York, NY.

Daubenmire, R. 1968. Plant communities, a textbook of plant synecology. Harper & Row, Publishers, New York, NY.

Eleuterius, L. N. 1976. Observations on the mistletoe (*Phoradendron flavescens*) in south Mississippi, with special reference to the mortality of *Quercus nigra*. Castanea 41:265–268.

Fenneman, N. W. 1938. Physiography of eastern United States. McGraw-Hill. New York, NY.

Ferguson, K. G., and T. E. Hemmerly. 1976. Host specificity of mistletoe in middle Tennessee II. Maury County. Castanea 41:71–72.

Freeland, R. O. 1943. The American mistletoe with respect to chlorophyll and photosynthesis. Pl. Phys. 18: 299–302.

Gardner, W. A. 1921. Effect of light on germination of light-sensitive seeds. Bot. Gaz. 71:249–288.

Glazner, J. T., B. Devlin, and N. C. Ellstrand. 1988. Biochemical and morphological evidence for host race evolution in desert mistletoe, *Phoradendron californicum* (Viscaceae). Pl. Syst. Evol. 161:13–21.

Gleason, H. A., and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. 2nd ed. New York Botanical Garden, Bronx, NY.

Hemmerly, T.E., A.A. Forsythe, and M.L. Womack. 1979. Black gum—exclusive host of mistletoe in Lawrence County, Tennessee? J. Tennessee Acad. Sci. 54:89–90.

Hemmerly, T. E. 1981. Host specificity of mistletoe in middle Tennessee V: Williamson County. J. Tennessee Acad. Sci. 56:77–78.

Hemmerly, T.E., A.D. Gasperson, and A. McAlister. 1987. Occurrence of *Phoradendron serotinum* (Raf.) M. C. Johnston (Viscaceae) in the southeastern portion of middle Tennessee. Pages 335–350 in H. C. Weber and W. Forstreuter (eds). Proceedings of the 4th ISPFP, Parasitic Flowering Plants. Marburg, West Germany.

Hemmerly, T. E. 1989. Mistletoe parasitism in Tennessee. J. Tennessee Acad. Sci. 64:121–122.

Henderson, M., and G. Pekala. 1980. The host specificity of American mistletoe (*Phoradendron serotinum*) on the northeastern Highland Rim of middle Tennessee. Pages 8–16 in K. Blanchard, T. E. Hemmerly, and G. Murphy (eds). Humanizing science education in Tennessee. Middle Tennessee State Univ. Print Shop, Murfreesboro, TN.

Hreha, A. M., and D. J. Weber. 1979. Distribution of *Ar-*

ceuthobium divaricatum and *Phoradendron juniperinum* (Viscaceae) on the south rim of Grand Canyon, Arizona. Southwest. Naturalist 24:625–636.

Hull, R. J., and O. A. Leonard. 1964a. Physiological aspects of parasitism in mistletoes (*Arceuthobium* and *Phoradendron*). I. The carbohydrate nutrition of mistletoe. Pl. Phys. 39:996–1007.

Hull, R. J., and O. A. Leonard. 1964b. Physiological aspects of parasitism in mistletoes (*Arceuthobium* and *Phoradendron*). II. The photosynthetic capacity of mistletoe. Pl. Phys. 39:1008–1017.

Kentucky Department of Transportation. 1991. General highway map, Rockcastle County, Kentucky. Bureau of Highways, Division of Project Development, Frankfort, KY.

Küchler, A. W. 1964. Manual to accompany the map of potential natural vegetation of the conterminous United States. Am. Geogr. Soc. Spec. Bull. 36.

Kuijt, J. 1969. The biology of parasitic flowering plants. Univ. California Press, Berkeley, CA.

Kuijt, J. 1982. The Viscaceae of the southeastern United States. J. Arnold Arbor. 63:401–410.

Martin, A. C., H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants. McGraw-Hill, New York, NY.

May, D. S. 1971. The role of populational differentiation in experimental infection of *Prosopis* by *Phoradendron*. Am. J. Bot. 58:921–931.

May, D. S. 1972. Morphological and physiological differentiation of *Phoradendron* populations in Texas. Am. J. Bot. 59:12–22.

McDowell, R. C., G. J. Grabowski Jr., and S. L. Moore. 1981. Geologic map of Kentucky. U.S. Geological Survey, Washington, DC.

McKinney, L. E., and T. E. Hemmerly. 1977. Host specificity of mistletoe in middle Tennessee III: Davidson County. J. Tennessee Acad. Sci. 52:40.

Panvini, A.D. 1991. The physiological ecology and population genetics of *Phoradendron leucarpum* (Raf.) Rev. & M.C. Johnston, a hemiparasitic mistletoe. Ph.D. dissertation, Vanderbilt University, Nashville, TN.

Reed, C. F., and P. G. Reed. 1951. Host distribution of mistletoe in Kentucky. Castanea 16:7–15.

Reveal, J. L., and M. C. Johnston. 1989. A new combination in *Phoradendron* (Viscaceae). Taxon 38:107–108.

Ross, J. C., A. S. Johnson, and P. E. Avers. 1981. Soil survey of Laurel and Rockcastle counties, Kentucky. U.S.D.A. Soil Conservation Service and Forest Service, Washington, DC.

Rucker, E., and T. E. Hemmerly. 1976. Host specificity of mistletoe in middle Tennessee I: Rutherford County. Castanea 41:31–33.

Sadler, K. C., and T. E. Hemmerly. 1984. American mistletoe (*Phoradendron serotinum*) in the northeastern Central Basin and adjacent dissected Highland Rim of middle Tennessee. J. Tennessee Acad. Sci. 59:42–46.

Scharpf, R. F., and F. G. Hawksworth. 1974. Mistletoes on hardwoods in the United States. U.S.D.A. Forest Serv., Forest Insect & Disease Leafl. 147.

Smalley, G. W. 1986. Classification and evaluation of forest sites on the Northern Cumberland Plateau. U.S.D.A. Forest Serv. Gen. Techn. Rep. SO-60.

Spooner, D. M. 1983. The northern range of eastern mistletoe, *Phoradendron serotinum* (Viscaceae), and its status in Ohio. Bull. Torr. Bot. Club 110:489–493.

Thompson, R. L. 1992. Host occurrence of *Phoradendron leucarpum* in the Lexington-Blue Grass Army Depot, Blue Grass Facility, Madison County, Kentucky. Trans. Kentucky Acad. Sci. 53:170–171.

Thomson, V. E., and B. E. Mahall. 1983. Host specificity by a mistletoe, *Phoradendron villosum* (Nutt.) Nutt. subsp. *villosum*, on three oak species in California. Bot. Gaz. 144:124–131.

U.S. Census Bureau, Department of Commerce. 2000. Rockcastle County, Kentucky. http://quickfacts.census.gov/qfd/states/21/21203.html. Accessed 12 Dec 2002.

Wiens, D. 1964. Revision of the acataphyllous species of *Phoradendron*. Brittonia 16:11–54.

Wiens, D., and B. A. Barlow. 1971. The cytogeography and relationships of the viscaceous and eremolepidaceous mistletoes. Taxon 20:313–332.

York, H. H. 1909. The anatomy and some of the biological aspects of American mistletoe, *Phoradendron flavescens* (Pursh) Nutt. Univ. Texas Bull. 120, Sci. Ser. 13.