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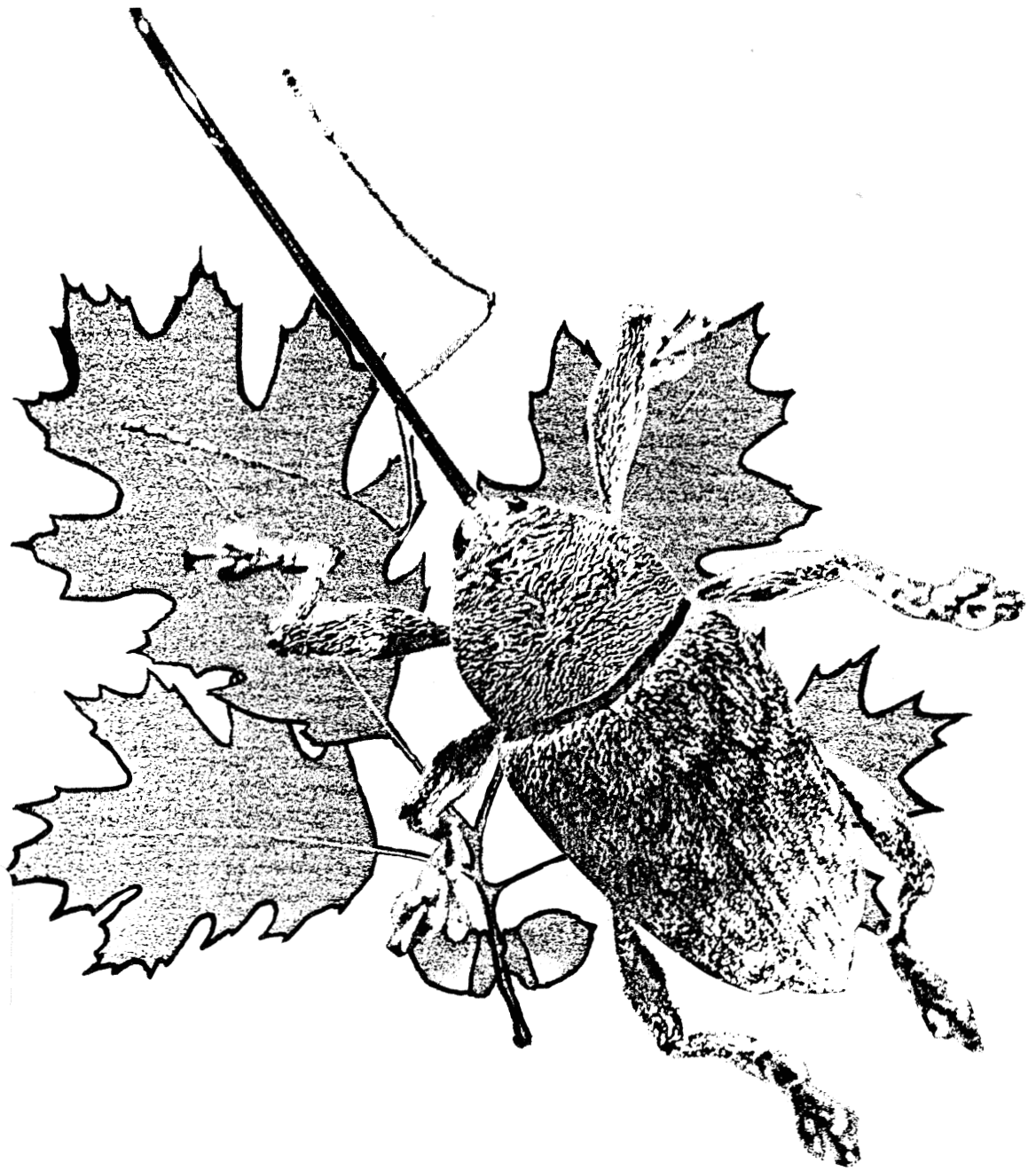
Insects that Damage
Northern Red Oak Acorns

Lester P. Gibson



The Author

Lester Paul Gibson received his B.S. degree in 1957, his M.S. degree in 1962, and his Ph.D. in 1974, all from the Ohio State University. He joined the Forest Service in 1957 and has served as a Biological Aid (Survey Entomologist) and Research Entomologist at Columbus and Delaware, Ohio. He is a specialist on insects (and their parasites) of nut crops and hardwood seeds. He is the world authority on the biology and systematics of *Curculio* in the New World and of the braconid genus *Urosigalphus.* He has spent several years investigating the insect vectors of tree viruses. Currently he is engaged in research on the impact of insects on oak seed production and oak seedling establishment at the Northeastern Forest Experiment Station, Forestry Sciences Laboratory at Delaware, Ohio.

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Abstract

From 1961 to 1964 and in 1979, the insects found damaging acorns of northern red oak (*Quercus rubra* L.) in their relative order of abundance were: *Curculio proboscideus* F., *C. sulcatulus* (Casey), *Melissopus latiferreanus* (Wals.), *C. nasicus* (Say), *C. orthorhynchus* (Chttn.), *C. longidens* Chttn., *Callirhytis operator* (O.S.), *Callirhytis fructuosa* Weld., *Conotrachelus posticatus* Boh., *Conotrachelus carinifer* Casey, *Conotrachelus naso* LeC., and *Valentinia glandulella* (Riley). During 1961 to 1964, 1979, and 1980 insects damaged an average of 52.32 percent of *Q. rubra* acorns (range 0 to 100 percent).

Introduction

Northern red oak, *Quercus rubra* L., is an important tree species in the eastern United States for timber and for wildlife. Each year insects heavily attack northern red oak acorns and destroy a large percentage of them, greatly reducing the number of acorns available to produce seedlings and feed wildlife.

Methods

Acorns from several locations throughout the eastern U.S. and Canada were collected and placed in chambers until larvae emerged. The emergent larvae were sorted by genus, counted, and placed in rearing containers to obtain adults and their parasites. After most larvae had emerged, a sample of acorns from each collection was examined. The nuts were cracked open to determine their condition and the type of damage they had sustained. Larvae found in the acorns were combined with the emerged larvae to determine the degree of infestation. The amount of insect damage, the insect species responsible, and their relative importance were tabulated for various sites within the range of *Q. rubra.*

The distribution and relative abundance of individual species of *Conotrachelus, Curculio,* Lepidoptera, and their parasites were computed on the number of emergent adults.

Results and Discussion

Weevils of the genus *Curculio* cause the most insect damage to mature acorns. Five species were found infesting northern red oak acorns. The majority of those reared from 1961 to 1964 and in 1979 were *Curculio proboscideus F.* (54.35 percent), followed by *C. sulcatulus* (Casey) (31.77 percent). *Curculio orthorhynchus* (Chttn.) were found infesting 4.07 percent. *Curculio nasicus* (Say) infestations (which averaged 9.76 percent) varied considerably; in the northern part of the range of *Q. rubra,* northern Ohio, Massachusetts, Pennsylvania, New Brunswick, Quebec, and Ontario, some collections produced only *C. nasicus;* in southern parts of the range some collections produced few or no *C. nasicus. C. longidens* Chttn. infested northern red oak only in the southern half of its range, and then only rarely (0.05 percent). These percentages are based on 1,600 adult *Curculio* reared from acorns collected throughout the range of northern red oak.

Three species of *Conotrachelus* weevils have been reared from northern red oak: *C. naso* LeConte and *C. posticatus* Boheman were reared from the northern half of the range and *C. posticatus* and *C. carinifer* Casey from the southern half of the range. Usually less than 3 percent of the acorns were infested by *Conotrachelus.*

The reason for the low infestation rate is that *Conotrachelus* cannot infest a sound nut. Therefore only previously infested or physically damaged nuts are available for oviposition.

The Lepidoptera infesting northern red oak acorns were *Melissopus latiferreanus* (Walsingham) and *Valentinia glandulella* (Riley). The latter is a secondary invader. These two species infested from 0 to 36.1 percent of acorns sampled from 1961 to 1964. In collections in Missouri from 1973 to 1976, Steven Myers (1978) found from 0 to 63 percent of mature northern red oak acorns and from 0 to 30 percent of immature acorns infested by lepidopterous larvae. Combining these data to make them comparable to my data (my data included immature acorns) yields an infestation rate ranging from 0 to 34.5 percent which closely agrees with the 0 to 36.1 percent rate I found.

Three types of galls were found in or on northern red oak acorns: 1) a large gall on the acorn cup produced by *Amphibolips prunus* Walsh., 2) a pip gall in the side of the acorn shell produced by the agamic fall form of *Callirhytis operator* (O.S.), and 3) a mass of stony gall cells that fills the entire interior of the nut, produced by *Callirhytis fructuosa* Weld. The last two usually kill the acorn: the pip gall causes the nut to fall prematurely and the stone gall replaces the seed.

Samples showed that the infestation rate for *Callirhytis* sp. galls varied from 0 to 31 percent in the United States collections and 0 to 37 percent in Canadian collections made during 1961 to 1964. Myers found the infestation rate to be 0 to 31 percent in Missouri (0 to 48 percent in immature acorns and 0 to 24 percent in mature acorns).

Table 1 shows the percentage of acorns in each sample that were infested by any species of insect. The degree of infestation varies from year to year and from tree to tree in the same area as well as throughout the northern red oak range. Thus the data presented in Table 1 indicate only the infestation of the acorns on each sampled tree. However, the data do suggest the density and diversity of the insect infestation.

Secondary invading insects similar to those found in bur oak (Gibson 1971) and white oak (Gibson 1972) were found in northern red oak acorns. Some of these added to the destruction of acorn viability.

Table 2 shows the infestation rates for *Curculio, Conotrachelus, Melissopus,* and *Callirhytis* spp. The rates for the first three are for individual insects per 100 acorns but the rate for *Callirhytis* is the percentage of galled acorns that may contain 1 to 2 dozen gall wasp larvae. The number of insects per 100 acorns sometimes exceeds the percentage of acorns infested. For example, in the Delaware Co. Ohio sample for 1979 the rates were 295.2 percent for *Curculio,* 0.9 percent for *Conotrachelus,* 15.2 percent for *Melissopus,* and 3.8 percent for *Callirhytis* galls, for a total of 315.1 per 100. The infestation rate was 90.4 percent. This shows that several insects infested the same acorn. Usually acorns infested with *Callirhytis fructuosa* do not contain any of the other infesting insects. However, acorns infested by *Callirhytis operator* (fall form) may also contain *Melissopus latiferreanus* larvae. The acorns infested by *Curculio* usually contain only one species of *Curculio* but normally contain two to five *Curculio* larvae, and may contain one or more *Conotrachelus* larvae or a moth larva, or both.

Table 1. — Conditions of northern red oak acorns (in percent)

Locality	Sound	Insect infested	Rotten	Malformed
1961				
Auglaize Co., OH	76.4	21.8	1.8	0
Erie Co., OH	35.9	58.4	4.4	1.3
Madison Co., OH	3.2	79.3	11.2	6.3
Ottawa Co., OH	39.1	48.7	11.9	0.3
Union Co., OH	1.5	67.1	0	31.4
Average	31.22	55.06	5.86	7.86
1962				
Auglaize Co., OH	14.7	52.8	27.0	5.5
Champaign Co., OH	1.0	82.5	11.3	5.2
Champaign Co., OH	1.1	91.2	7.7	0
Clinton Co., OH	0	73.3	10.0	16.7
Madison Co., OH	5.5	55.6	37.3	1.6
Madison Co., OH	10.4	72.9	11.5	5.2
Ottawa Co., OH	76.6	22.5	0.9	0
Putnam Co., OH	58.1	24.7	17.2	0
Ross Co., OH	28.1	56.9	11.1	3.9
Shelby Co., OH	0	86.9	11.9	1.2
Trumbull Co., OH	67.0	12.5	19.6	0.9
Trumbull Co., OH	0.9	6.3	88.9	3.9
La Crosse Co., WI	19.2	56.5	10.6	13.7
New Haven Co., CT	79.8	14.0	6.2	0
Average	25.89	50.61	19.37	4.13
1963				
Auglaize Co., OH	5.0	65.0	25.0	5.0
Marion Co., OH	0	77.0	22.0	1.0
Marion Co., OH	10.0	73.0	17.0	0
Ottawa Co., OH	53.0	8.0	39.0	0
York Co., N.B.	17.0	55.0	24.0	4.0
Ste. Foy, Que.	22.0	49.0	27.0	2.0
Berthier Co., Que.	92.0	4.0	0	4.0
Sault Ste. Marie, Ont.	14.0	41.0	37.0	8.0
Kings Co., N.B.	1.0	8.0	91.0	0
Penobscot Co., ME	63.0	0	37.0	0
Berkshire Co., MA	9.0	61.0	30.0	0
Belknap Co., NH	25.0	22.0	52.0	1.0
Chittenden Co., VT	5.0	63.0	—	—
Chittenden Co., VT	0	81.0	17.0	2.0
Schenectady Co., NY	0	63.0	27.0	10.0
Middlesex Co., NJ	69.0	26.0	1.0	4.0
New Castle Co., DE	28.0	40.0	32.0	0
Washington, D.C.	4.0	27.0	—	—
Monongalia Co., WV	3.0	75.0	18.0	4.0
McKean Co., PA	26.0	26.0	48.0	0
Rowan Co., KY	5.0	84.0	11.0	0
Franklin Co., TN	9.0	20.0	70.0	1.0
Macon Co., GA	53.0	19.0	26.0	2.0
Harris Co., GA	17.0	40.0	41.0	2.0
Owen Co., IN	2.0	79.0	17.0	2.0
Du Page Co., IL	42.0	48.0	10.0	0
Hardin Co., IL	1.0	77.0	20.0	2.0
Iowa Co., IA	1.0	60.0	38.0	1.0
Oceana Co., MI	50.0	30.0	20.0	0
Dane Co., WI	50.0	9.0	41.0	0

Locality	Sound	Insect infested	Rotten	Malformed
Marathon Co., WI	6.0	66.0	27.0	1.0
Trempealeau Co., WI	20.0	55.0	25.0	0
Larimer Co., CO	74.0	0	24.0	2.0
Average	23.52	43.97	29.48[a]	1.87[a]
1964				
Auglaize Co., OH	8.0	86.0	6.0	0
Champaign Co., OH	0	84.0	16.0	0
Crawford Co., OH	4.0	84.0	12.0	0
Harrison Co., OH	0	97.0	3.0	0
Marion Co., OH	28.0	64.0	8.0	0
Trumbull Co., OH	0	100.0	0	0
Average	6.67	85.83	7.5	0
1979			(combined)	
Delaware Co., OH	6.0	90.4	3.6	
Delaware Co., OH	0	80.0	20.0	
Delaware Co., OH	15.0	82.0	3.0	
Marion Co., OH	45.9	51.4	2.7	
Morrow Co., OH	9.0	87.0	4.0	
Morrow Co., OH	33.0	62.0	5.0	
Morrow Co., OH	10.2	80.6	9.2	
Centre Co., PA	87.0	7.0	6.0	
Centre Co., PA	95.2	3.9	0.9	
Huntingdon Co., PA	4.7	84.1	11.2	
Mifflin Co., PA	8.4	90.7	0.9	
Stone Creek Road, PA	1.8	81.0	17.2	
Licking Creek Dr., PA	0.9	91.3	7.8	
Dryden, NY	17.1	68.6	14.3	
McClure, NY	28.2	58.1	13.7	
Watkins Glen, NY	87.2	11.7	1.1	
Watkins Glen, NY	93.3	6.5	0.2	
Watkins Glen, NY	96.2	3.8	0	
Buffalo, NY	0	97.4	2.6	
Average	33.64	59.87	6.49	
1980				
Mt. Gilead, OH	58.0	37.0	5.0	
Dryden, NY	23.0	59.0	18.0	
Dryden, NY	58.0	42.0	0	
McClure, NY	8.0	56.0	36.0	
Hammond Hill, NY	44.0	40.0	16.0	
Watkins Glen, NY	78.0	21.0	1.0	
Average	44.83	42.50	12.67	
Average of all years	27.02	52.32	20.66	

[a] 1.16 percent error due to lack of data for Rotten and Malformed columns for collections from Chittenden Co., VT and Washington, D.C.

Table 2. — Insect infestation rates/100 acorns by location

Locality	*Curculio* weevils	*Conotrachelus* weevils	*Valentinia* and *Melissopus* moths	*Callirhytis* galls
1961				
Auglaize Co., OH	10.3	0	0	0
Auglaize Co., OH	21.8	0	0	0
Erie Co., OH	67.4	0	9.2	1.2
Madison Co., OH	104.1	0	21.4	0.5
Ottawa Co., OH	74.2	0.1	19.4	0.1
Union Co., OH	77.4	0	11.6	0
1962				
Auglaize Co., OH	68.1	0	2.5	1.8
Champaign Co., OH	149.5	0	3.1	0
Champaign Co., OH	112.1	0	7.7	2.2
Clinton Co., OH	83.3	0	13.9	0
Madison Co., OH	97.6	0	5.6	0
Morrow Co., OH	16.5	0.2	3.4	0
Ottawa Co., OH	22.5	—	—	—
Putnam Co., OH	34.4	0	2.7	0.3
Ross Co., OH	84.9	0	1.9	0
Shelby Co., OH	84.5	0	29.2	0
Trumbull Co., OH	6.3	0	0.6	0
Trumbull Co., OH	12.5	—	—	—
La Crosse Co., WI	56.5	0	2.8	0
New Haven Co., CT	14.0	0	0	0
Greene, Co., OH	90.6	0	19.6	1.0
Franklin Co., OH	16.2	0	0	0
Marathon Co., WI	11.4	0.2	0.8	0
Lawrence Co., PA	15.4	0	0.7	0
Clinton Co., MI	44.9	0.2	3.9	0
Franklin Co., TN	31.3	0.3	0	0
Buncombe Co., NC	27.1	0	0	0
Rabun Co., GA	10.1	0.9	0	0
Rabun Co., GA	18.0	2.9	.03	0
Fort Collins, CO	0	0	0	0
1963				
Auglaize Co., OH	60.0	1.2	10.0	0
Marion Co., OH	101.0	0	15.3	0
Marion Co., OH	93.0	0	8.0	0
Ottawa Co., OH	30.5	3.0	1.5	0
York Co., NB	58.0	0	14.0	14.0
Ste. Foy, Que.	44.0	0	11.0	10.0
Berthier Co., Que.	1.5	0	0	37.0
Sault Ste. Marie, Ont.	42.0	0	11.0	0
Penobscot Co., ME	6.5	0	0	0
Belknap Co., NH	26.4	0	1.3	7.0
Berkshire Co., MA	60.0	0	24.8	1.0
Schenectady Co., NY	60.0	0	14.8	6.0
Chittenden Co., VT	54.0	0	6.0	5.0
Chittenden Co., VT	38.0	0	22.0	31.0
Middlesex Co., NJ	74.8	0	0.8	7.0
New Castle Co., DE	49.6	0.4	7.0	0
Washington, D.C.	48.6	0.7	1.6	0
Monongalia Co., WV	96.0	0	21.5	0
Tucker Co., WV	0	0	0	0
Owen Co., IN	96.0	0	18.0	1.0

Locality	*Curculio* weevils	*Conotrachelus* weevils	*Valentinia* and *Melissopus* moths	*Callirhytis* galls
McKean Co., PA	29.0	0	1.9	0
Rowan Co., KY	170.0	0	14.0	0
Franklin Co., TN	50.0	0	.04	0
Macon Co., GA	17.5	0	0.7	0
Harris Co., GA	36.0	1.0	12.0	7.0
Du Page Co., IL	35.2	0	3.0	0
Hardin Co., IL	74.0	0	26.0	0
Iowa Co., IA	56.0	0	8.5	0
Oceana Co., MI	44.0	0	0	0
Dane Co., WI	6.9	0	0.2	1.0
Trempealeau Co., WI	71.0	0.4	3.0	0
Marathon Co., WI	54.0	0	21.8	0
Dent Co., MO	34.0	2.4	41.0	0
1964				
Auglaize Co., OH	132.0	0	3.2	0
Champaign Co., OH	66.1	0	16.4	1.0
Crawford Co., OH	66.1	0	16.8	0
Harrison Co., OH	110.3	0	14.5	0
Marion Co., OH	100.0	7.0	4.7	0
Trumbull Co., OH	83.3	0	36.1	16.0
1979				
Delaware Co., OH	295.2	0.9	15.2	3.8
Delaware Co., OH	82.2	0	60.0	20.0
Delaware Co., OH	238.0	18.0	9.0	0
Marion Co., OH	204.3	0	0.8	0
Morrow Co., OH	226.7	1.8	8.7	1.0
Morrow Co., OH	212.3	0	4.5	3.0
Morrow Co., OH	179.5	0	3.1	1.0
Centre Co., PA	8.1	0	0	4.0
Centre Co., PA	5.7	0	1.0	2.0
Huntingdon Co., PA	258.8	0	0.9	0
Mifflin Co., PA	294.4	0	8.4	0
Stone Creek Rd., PA	204.5	2.7	9.1	10.0
Licking Creek Dr., PA	170.2	0	2.9	0
Dryden, NY	58.1	0	27.6	8.6
McClure, NY[a]	109.9	0	0	4.0
Watkins Glen, NY	28.1	0	0.4	0
Watkins Glen, NY	11.4	0	0.4	0
Watkins Glen, NY	2.8	0	0	0
Buffalo, NY	0	0	0.9	97.4
1980				
Mt. Gilead, OH[b]	30.8	0	5.7	9.0
Dryden, NY	65.4	0.6	7.3	3.0
Dryden, NY[b]	35.4	0	1.1	0
McClure, NY	45.2	0	10.6	6.0
Hammond Hill, NY	46.1	1.3	2.9	0
Watkins Glen, NY	38.0	0	4.0	12.0

[a] 36.3% of acorns eaten by rodents.
[b] Some *Curculio* emergence prior to acorn collection.

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Gibson, Lester P. **Insects that damage northern red oak acorns.** Broomall, PA: Northeast. For. Exp. Stn.; 1982; USDA For. Serv. Res. Pap. NE-492. 6 p.

Insect damage to northern red oak acorns is extensive throughout the range of northern red oak, and greatly reduces the number of acorns available to produce seedlings and feed wildlife. Five species of *Curculio* weevils *(proboscideus* F., *sulcatulus* (Casey), *orthorhynchus* (Chttn.), *nasicus* (Say), and *longidens* (Chttn.), three species of *Conotrachelus* weevils (*posticatus* Boh., *carinifer* Casey, and *naso* LeC.), two species of moths (*Melissopus latiferreanus* (Walsh.) and *Valentinia glandulella* (Riley)), and two species of gall wasps (*Callirhytis operator* (O.S.) (fall form) and *C. fructuosa* Weld.) cause most of the damage.

ODC: 453-145.7 x [-18.09 - 18.27 -19.91 -21.3] (81):176.1

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