POPULATION STUDIES OF TWO SPECIES OF ANTS, LEPTOTHORAX LONGISPINOSUS ROGER AND LEPTOTHORAX CURVISPINOSUS MAYR.

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Population studies of social insects, while on the increase, are still in the beginning stages. Possible reasons for this lack of study are: (1) taxonomic and economic studies have dominated the field, (2) there is lack of interest in population problems by those who have the necessary background knowledge of social insects, and (3) there are difficulties in controlling the environment of social insects in such a way that successful laboratory studies may be made upon them. However, social insects are valuable for population studies because of the fact that each colony is a closed unit of society which shows all the phases of population phenomena of incipiency, growth, and decline. Moreover these populations are stable units of a restricted environment, because each centers around a nest which is usually maintained in one particular spot throughout the life of the colony. Ants are favorable social insects for population studies because they are so abundant, so numerous in varieties, and so varied in habitat.

Few population studies of ants have been made and such work as has been completed has been largely the incidental counting of colonies or individuals of colonies as part of some other ant study. Various population studies should include such intraspecific social relationships as size of colony, proportion of all phases of brood to adults, egg fertility, time span of each developmental stage, length of adult life, colony development and decline, and nest construction as an expression of colony activity. They should include such interspecific social relationships as average size variations of colonies within a species, distribution of nests within a restricted habitat, the amount of territory each colony needs to maintain itself, and the relationship of the ant population to the ecological community as a whole. This paper attempts to work on only one phase of these problems, namely, to make a quantitative study of the ant *Leptothorax longispinosus* Roger, and to a smaller extent the closely related *Leptothorax curvispinosus* Mayr, as to variation in size of colonies and relationships of all developmental stages throughout the seasons of a year, in a restricted nest habitat (acorns) and in a restricted ecological environment (an oak woods bordering on a beech-maple-hemlock ravine).

This phase of population study is fundamental to further work but to date it has been rather restricted in extent. Talbot's (1943) work on *Prenolepis imparis* is perhaps the most complete since it carried on a year's study and included counts of eggs as well as larvae, pupae, and adults for 20 colonies. Wesson (1939) counted 31 colonies of *Harpagoxenus americanus* which were parasitizing colonies of *Leptothorax curvispinosus*, and Wesson and Wesson (1940) recorded 8 nests of the

Leptothorax schaumi-Leptothorax fortinodis group. Pricer (1908) counted 24 mature colonies of *Camponotus herculeanus pennsylvanicus* and its variety *ferrugineus* but he counted in the winter when only adults, winged forms and larvae, were present. Pickles (1940), over a period of five years, made counts of 16 colonies of *Lasius flavus*, 27 of *Formica fusca* and 29 of *Myrmica ruginodis* but in these counts eggs were ignored, no attempt was made to procure a year round picture of population fluctuation, and some of the records represent recounts of colonies which had been dug and then returned to their nesting site with the expectation that they would reorganize and thrive as usual. This technique, as Pickles himself admits, is not a suitable method of studying ant populations since the colony is thoroughly disrupted by such treatment. Other countings have been fragmentary in nature and include such records as: 6 colonies of *Formica rufa* (Andrews, 1929), 3 of *Formica exsectoides* (Cory and Haviland, 1938, and Andrews, 1929), 2 of *Leptothorax curvispinosus* (Sturtevant, 1925), and one each of *Formica rufa obscuripes* (Weber, 1935), *Eciton hamatum* (Schneirla 1934), *Prenolepis imparis* (Dennis, 1941), *Solenopsis fugax*, and *Monomorium pharaonis* (Donisthorpe, 1915).

The ants *Leptothorax longispinosus* and *Leptothorax curvispinosus* were chosen for this study because in previous collecting a place had been found in which these ants were unusually available, nesting in acorns. The acorn nests are considered valuable because they give a definite, restricted, and uniform nesting space for each colony, and they can be collected abundantly.

Description of the Collecting Area.—The ants were secured in Ashtabula County, Ohio, approximately a mile and a half southwest of the village of Harpersfield. The collecting ground is a part of the R. T. Hauptfear farm and may be located by traveling from Harpersfield southward on route 534 until it makes a left angle, at which point a macadam road leads directly ahead. The woods is on the right side of the macadam three hundred yards west of the main road.

This part of Ohio is unique in that it is cut by a series of hemlock ravines bordering on Lake Erie. As the Grand River cut its way westward through a terminal moraine it dug a deep gulf 25 to 125 feet deep along its course into Lake Erie. In this region on the south side of the gulf are many deep ravines leading into this main one. The ravines leave fingerlike projections of upland which are sometimes wooded, sometimes merely fringed with woods, for 20 feet or more back from the ravine. These upland woods form a beech-maple climax with a scattering of oaks, shagbark hickory, elm and ash. Near the top border of the ravines, where the ants were collected, is a mixed woods of white, red, chestnut and scrub oaks and white pine, with an occasional beech or maple tree. Here the ground vegetation is very sparse due to the poor quality of the clay-and-shale mixture found along the top edges of the ravines. There are some hazelnut bushes, ground pine, wild grape-vine runners, a little moss, and tufts of grass here and there. Some flowers bloom in the spring before the trees shade the ground but no conspicuous flowers of summer or fall are found. In some spots the fallen leaves are blown over into the ravine below leaving

the ground barren. This is a great aid in collecting acorn nests. The soil is very moist during the rainy season of the year but drains off so quickly that it is usually hard and dry. This condition proves very favorable for ant nests in acorns because the rapid drainage and scarcity of dead leaves prevents mold from accumulating in the nuts.

Distribution of Nests.—Leptothorax longispinosus nests occur most abundantly about 15 feet from the rim of the ravine, where shade of trees is dense, while *L. curvispinosus* are more numerous under the outer branches of the fringe of oak trees, where the sun penetrates. Acorn nests are the predominant nests in the area. In the months of collecting no ant nests were seen in the ground nor were any located in dead sticks on the ground. One *Aphaenogaster tennesseensis* nest occurred in a large beech tree which had fallen over, but, aside from this, acorns were the main habitat in the area collected. Beside the *Leptothorax* species, the acorns housed *Ponera coarctata pennsylvanica* Buckley, *Crematogaster lineolata* Say, *Myrmecina graminicola americana* Emery, *Myrmica punctiventris* Roger, and *Brachymyrmex heeri depilis* Emery. Acorns seem to form unusually fine niches for many kinds of insects. With the exception of each year's new fall, there is a 95% infestation by some kind of insect. The acorn supplies many larvae with abundant food as well as an excellent protection against predators. The 5% not inhabited by insects usually have some kind of life in them: spiders, snails, mold, etc.

Density of Population of Nests per Area.—In order to determine the abundance of ant colonies and ants in this habitat two areas 50 feet long and 5 feet wide were selected, giving twenty 5-foot-square plots, and the positions of all the acorn ant nests in these plots were recorded on squared paper as the colonies were collected for counting. On this 500 square feet of ground there were found 58 acorn nests which consisted of 41 of *L. longispinosus*, 13 of *L. curvispinosus*, 2 of *Myrmecina graminicola americana* and one each of *Myrmica punctiventris* and *Ponera coarctata pennsylvanicus*. This gave an average of 2.9 nests for each 5-foot square, of which 2.1 were *L. longispinosus* and .65 were *L. curvispinosus*. When all of the 58 colonies were counted it was found that they gave a total of 8962 ants in the 20 plots or an average of 448.2 for each 5-foot square. There were 3180 worker ants in the 20 plots or an average of 158.0 workers for each 5-foot square. Thus on every square foot of ground there were 6.4 workers foraging for food to feed 17.9 ants (workers plus brood).

In order to determine the proportion of acorns inhabited by ants the total number of acorns lying on the ground were counted for several 5-foot squares and they were found to average 27.5 Acorn ant nests averaged 2.9 nests per 5-foot square, which equals 2.9 nests per 27.5 acorns or one nest for 9.5 acorns.

In these plots there were 3.2 *L. longispinosus* to every *L. curvispinosus* and in the complete collection of 132 colonies the proportion was 2.8 *L. longispinosus* to every one *L. curvispinosus*. This was due to the fact that collecting was done beneath the dense shade of trees. If the collecting area had been in the more open, sunny places, the proportion of the two species might have been reversed.

Description of the Acorn Nest and of the Colony Within It.—The acorns are approximately ¾ inch long and ½ inch at the greatest diameter. They are usually of white oak although there are red oak nests also. The ones used by the ants are several years old; those too hard to be broken easily with the fingers never have colonies in them. There is no break in the surface except for the little round entrance, which is always a perfectly symmetrical opening 1/16 inch in diameter. It is located in the area of greatest diameter or at the edge of the cap where it fits down over the acorn, never in the narrow end. The normal position of the entrance is along the side close to the ground; if the entrance is at the top side, the acorn has been disturbed by wind or by some animal. Occasionally it is next to the ground on the under side; in this case there is usually a little circle of soil stuck onto the acorn around the hole. Sometimes a leaf will be stuck to the acorn and the entrance will penetrate through this.

The shell is always tight enough so that even in winter when snow covers the acorn it never becomes soggy. The nest may become bone dry during drought periods but it usually contains some moisture. Ants are never found in a moldy acorn or a soggy one. There is little debris inside and this is composed chiefly of tiny pellets. Occasionally a part of the kernel is still there; in that case the nest is divided into compartments. Generally the acorn is entirely hollow, with the larvae lying on the bottom next to the ground. The inside surface of the shell is almost always laminated and much of the brood lies in the crevices. Winter conditions of the nest are the same as summer conditions except that in the winter the workers and larvae are massed into a ball with the queen in the center.

Season of Activity for Leptothorax.—The months of active foraging are from April to the middle or latter part of October, depending on the weather. However, when the temperature has cooled off to somewhat below 50° F., there is no further evidence of outside foraging even though the temperature should rise for a short period. This is not like the mound-building *Formica* for they will appear at the surface during the winter if the temperature rises above 44° F. (Weber, 1935). *Leptothorax* are not entirely immobile during hibernation, for, when a nest is opened during the winter, antennae will wave slowly and legs will move somewhat. The spring of 1942 was unusually wet and cool and more workers were seen out on the ground than had ever before been observed by the writer. The temperature at which they were most active was between 60° and 70° F. *L. curvispinosus* consistently moved faster than did *L. longispinosus.*

Population Counts of Leptothorax longispinosus.—A total of 97 *L. longispinosus* colonies were collected and these had an average population of 135.9. The largest colony had 419 members, of which 141 were workers. The average number of workers to a colony was 45.8. These small colonies are typical of many ants which live in inconspicuous, out-of-the-way crevices and are in contrast to colony populations of medium strength such as *Prenolepis imparis* with its mean population of 1519 (Talbot, 1943) or those of tremendous size whose workers alone may total the 8,228 of *Formica exsectoides* (Andrews, 1929), the 30,000

of *Eciton hamatum* (Schneirla, 1934), or the 237,103 of *Formica exsectoides* (Cory and Haviland, 1938). The confines of an acorn do not seem to restrict colony size in any way, for these colonies average as large as or larger than those collected from snail shells, twigs, and the like. There is no evidence that *Leptothorax* ever reach a colony size which forces them to move from the acorns.

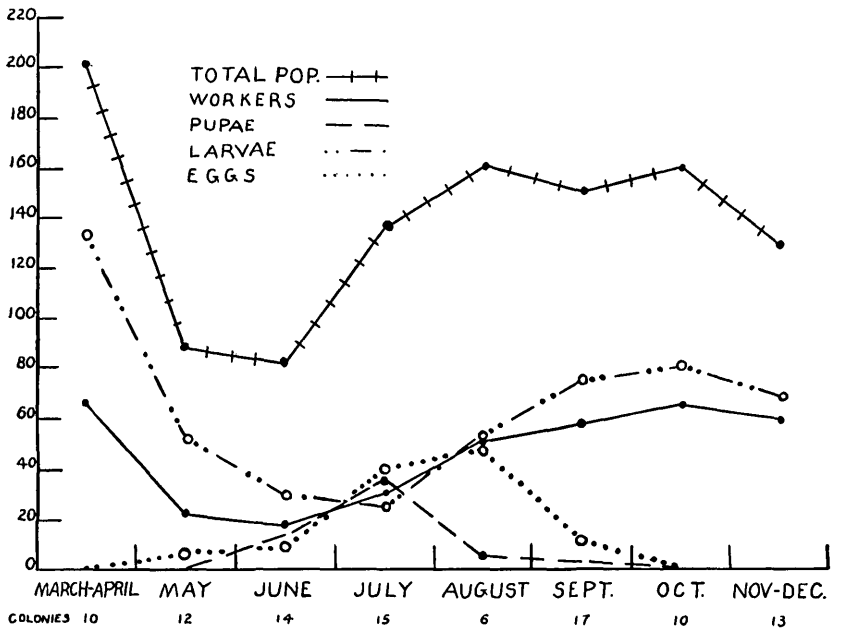

FIGURE 1. Population counts of *Leptothorax longispinosus* colonies throughout the year, showing fluctuations in numbers of eggs, larvae, pupae, and adults at the various seasons of the year.

L. longispinosus overwinters many larvae of small to medium size. In the inactive months, when no other brood was present, there was an average of 1.6 larvae to every worker or 61.2 to the colony. Larvae began their spring growth by the first of May and by May 10 (1942) a number had grown to full size, while the rest remained medium to small in size. Evidently a few had been selected for the early feeding. By May 31 some larvae were found that were larger than adult workers and were destined to become females. The overwintered larvae did not begin to pupate until the second week of June. Egg laying began about the middle of May, but no record of hatching was obtained because spring larvae could not be distinguished from the retarded overwinter ones. Egg laying continued into September. During late June and July there were male and female as well as worker pupae in the nests, but the August and September pupae were all worker. Pupation ceased during the early part of September and all the remaining larvae overwintered in the nest.

Workers reached their lowest numbers in June, before the year's crop of pupae had begun to emerge, and built up to their full strength by September, when pupation ceased. At all seasons of the year the immature forms more than equaled the adults and in the total population of 97 colonies there was one worker for every three colony members (workers plus brood). (See fig. 1.)

Queenless (?) colonies were amazingly abundant, 34 of the 97 colonies being without dealate queens. Fourteen of these can be accounted for by the fact that they were parasitized by *Harpagoxenus americanus* and so may have had their queens killed by the invaders. Of the remaining 20, only 4 were obviously decadent in that they had no eggs at a time when eggs would be expected. The other 16 colonies might have recently been deprived of a queen, the queen might have been out of the nest at the time when it was collected, or workers might have taken over the function of laying. This subject of substitute and parthenogenetic egg-laying has recently been reviewed by O. Mackenson (1943) in the case of the honey bee.

Parasitism.—The slavemaking *Harpagoxenus americanus* was found 15 times associated with *L. longispinosus*. This number gives an average of 1 to 6.5 infestation. In a previous collection by the writer 24 nests of *L. longispinosus* had 3 invaded by *Harpagoxenus*, or an average of 1 to 8. The proportion is similar to the proportion of 1 to 7.8 of Sturtevant (1927) and is considerably greater than the 1–15 ratio given by Wesson (1939) and tends to confirm Wesson's view that the dulotic *Harpagoxenus* is not so rare as has been supposed. Wesson and Sturtevant found their *Harpagoxenus* in *L. curvispinosus* nests but, strangely enough, in this acorn collection *Harpagoxenus* were confined to *L. longispinosus* and were never found parasitizing *L. curvispinosus*. Of the 15 colonies collected, 4 were evidently recently invaded by a queen for there were no *Harpagoxenus* workers; 7 colonies represented well established relationships with workers as well as having the parasitic queen present; while 3 colonies represented what Wesson calls "secondary colonies" or establishment of mixed colonies by a few workers which stay behind in a raided colony and take up residence with the remnants of the *Leptothorax*. One colony had a *Leptothorax* female in addition to the *Harpagoxenus* queen.

Population Counts of L. curvispinosus.—While the study of *L. longispinosus* was the main obejctive, enough *L. curvispinosus* nests occurred in the acorns of the woods to make it seem worth while to collect these in order to compare and contrast the two closely related species. There were 38 *L. curvispinosus* colonies collected and these had an average population of 235.0 members. The largest colony had 727 members, of which 369 were workers. The average number of workers to a colony was 82.6, which is almost twice the number in the *L. longispinosus* colonies. As in *L. longispinosus* small to medium sized larvae were overwintered. During the inactive months, when only workers and larvae were present in the nest, there was an average of one worker to 1.3 larvae. Spring egg laying began in the middle of April, a month earlier than for *L. longispinosus*, and continued until the early part of September. By Oct. 20 all eggs had developed into larvae. These

larvae were retained in the nest all winter and began to pupate during the early part of the following June.

Queenless colonies were even more abundant than with *L. longispinosus*, almost one third of the colonies being without functional queens.

L. curvispinosus are much more active and move more quickly than *L. longispinosus*. No *L. curvispinosus* colonies were found parasitized by *Harpagoxenus americanus*.

TABLE I

POPULATION COUNTS OF COLONIES OF *Leptothorax longispinosus* ROGER

Date	Queen	Worker	Male	Female	Pupa			Larva	Egg	Total in Colony
					w.	m.	f.			
3-28-42	1	8	.....	.....	...	...	...	8	.....	17
	2	82	.....	.....	...	...	...	165	.....	249
	1	141	.....	.....	...	...	...	277	.....	419
	2	36	.....	.....	...	...	...	52	.....	90
	1	108	.....	.....	...	...	...	175	.....	284
	.....	40	.....	.....	...	...	...	40	.....	80
	1	90	.....	.....	...	...	...	167	.....	258
	2	46	.....	.....	...	...	...	114	.....	162
4-19-42	1	60	.....	.....	...	...	...	144	.....	205
4-26-42	.....	64	.....	.....	...	...	...	194	.....	258
5- 3-42	.....	5	.....	.....	...	...	...	37	.....	42
	1	6	.....	.....	...	...	...	25	.....	32
	1	16	.....	.....	...	...	...	43	.....	60
5-10-42	.....	30	.....	.....	...	...	...	104	.....	134
5-17-42	1	16	.....	.....	...	...	...	24	1	44
		2[1]								
		14	.....	.....	...	...	...	29	4	47
	.....	36	.....	.....	...	...	...	112	1	149
5-24-42	1	56	.....	.....	...	...	...	79	26	162
	1	16	.....	.....	...	...	...	49	10	76
5-31-42	1	33	.....	.....	...	...	...	82	25	141
	1	12	.....	.....	...	...	...	71	22	106
	1	28	.....	.....	...	...	...	47	6	82
6- 7-42	1	13	.....	.....	6	...	...	45	7	72
	.....	5	.....	.....	...	...	...	17	.....	22
	.....	11	.....	.....	...	...	...	68	.....	79
6-14-42	1	42	.....	.....	7	...	...	140	34	224
	.....	21	.....	.....	5	...	...	49	18	93
	1H[2]	7	.....	.....	...	...	...	6	.....	14

[1] *Leptothorax curvispinosus.*
[2] *Harpagoxenus americanus.*

TABLE I—(Continued)

Date	Queen	Worker	Male	Female	Pupa			Larva	Egg	Total in Colony
					w.	m.	f.			
6-21-42	1H	18	.....	.....	7	...	...	1	4	31
	1	9	.....	.....	22	...	...	19	8	59
	1	7	.....	.....	4	...	...	126	19	157
	1	1	.....	.....	4	...	...	22	2	30
6-28-42	1H	16	.....	.....	22	...	...	9	1	49
	1H	64, 5H	.....	.....	11	7	45	27	40	200
	.....	21, 2H	.....	.....	11	7	8	6	.....	55
	.....	18, 2H	.....	.....	19	15	6	6	.....	66
7- 5-42	1	6	.....	.....	14	...	...	14	22	57
	1	23	.....	.....	40	...	...	79	44	187
	1H	52, 7H	.....	.....	16	5	19	3	21	124
	.....	16	.....	.....	10	11	7	3	.....	47
7- 9-41	1	22	.....	.....	32	...	...	40	82	177
	1	28	.....	.....	92	...	...	47	75	243
	.....	31	.....	.....	92	...	...	44	26	193
7-10-41	1	5	.....	.....	10	...	...	24	28	68
	.....	8	.....	.....	16	...	...	5	31	60
	1	22	.....	.....	1	1	...	5	6	36
7-12-41	2	43	.....	.....	54	13	...	41	68	221
	1	36	.....	.....	52	...	...	26	74	189
	.....	86	.....	10	47	1	15	48	49	256
	.....	7	1	10	2	...	2	.....	.....	22
	.....	55, 6H	7	.....	...	5	1	8	105	187
8-16-41	1	54	1	.....	2	2	...	84	109	252
	1	43	.....	.....	17	...	...	80	73	214
	1	38	.....	.....	1	...	...	38	39	117
	.....	13	3	3	1	...	...	63	25	108
	1	125	.....	.....	3	...	...	1	.....	130
	1	41	.....	.....	9	...	...	58	44	153
9- 2-42	.....	51	.....	.....	...	...	...	14	1	66
	1	11	.....	.....	2	...	...	38	3	55
	1	90	.....	.....	8	...	...	73	20	192
	1	105	.....	.....	26	...	...	207	16	355
9- 4-41	1	79	.....	.....	8	...	...	114	10	212
	1H	33, 3H	.....	.....	2	...	...	12	30	81
	1H	29	.....	.....	4	...	...	7	18	59
	1, 1H	157, 12H	.....	.....	1	...	...	183	38	393
	.....	79, 6H	.....	.....	2	...	...	112	28	227
	1	40	.....	.....	...	...	...	74	7	122
	1	84	.....	.....	8	...	...	106	13	212
	1	28	.....	.....	3	...	...	73	4	109
	1	1	.....	.....	1	...	...	4	.....	7
	1	46	.....	.....	...	...	...	112	7	166
	.....	37	.....	.....	3	...	...	47	.....	87
	1	39	.....	.....	5	...	...	51	6	102
	1	74	.....	.....	1	...	...	67	.....	143

TABLE I—(Continued)

Date	Queen	Worker	Male	Female	Pupa			Larva	Egg	Total in Colony
					w.	m.	f.			
10-11-42	1H	99, 5H	.....	.....	...	...	...	35	.....	140
	4	68	.....	.....	...	...	...	195	.....	267
	1	44	.....	.....	...	...	...	97	.....	142
10-20-41	4	79	.....	.....	...	...	...	192	.....	275
.....		10	.....	.....	...	...	...	13	.....	23
10-24-42	1	92	.....	.....	...	...	...	65	.....	158
	4	36	.....	.....	...	...	...	172	.....	212
	1H	77, 6H	.....	.....	...	...	...	33	.....	117
	2	78	.....	.....	...	...	...	101	.....	181
.....		78	.....	.....	...	...	...	20	.....	98
11-17-41	1	96	.....	.....	...	...	...	146	.....	243
12-14-40	.....	21	.....	1	...	...	...	50	.....	72
12-23-40	1	8	.....	.....	...	...	...	14	.....	23
	1H	144, 4H	.....	.....	...	...	...	53	.....	202
	1	35	.....	.....	...	...	...	81	.....	117
	1	37	.....	.....	...	...	...	52	.....	90
12-24-40	1	27	.....	.....	...	...	...	36	.....	64
	1	27	.....	.....	...	...	...	49	.....	77
	1	74	.....	.....	...	...	...	104	.....	179
	1	66	.....	.....	...	...	...	49	.....	116
	1	77	.....	.....	...	...	...	56	.....	134
	1	89	.....	.....	...	...	...	87	.....	177
	1	95	.....	.....	...	...	...	106	.....	202

TABLE II

POPULATION COUNTS OF COLONIES OF *Leptothorax curvispinosus* MAYR

Date	Queen	Worker	Male	Female	Pupa			Larva	Egg	Total in Colony
					w.	m.	f.			
3-28-42	1	369	.....	.....	...	...	...	357	.....	727
	1	92	.....	.....	...	...	...	144	.....	237
	1	134	.....	.....	...	...	...	113	.....	248
4-19-42	1	75	.....	.....	...	...	...	85	6	167
5-10-42	1	51	.....	.....	...	...	...	175	26	253
5-17-42	.....	18	.....	.....	...	...	...	90	.....	108
5-24-42	1	84	.....	.....	...	...	...	89	71	245
	1	138	.....	.....	...	...	...	78	153	370
	.....	61	.....	.....	...	...	...	126	96	283

TABLE II—(Continued)

Date	Queen	Worker	Male	Female	Pupa			Larva	Egg	Total in Colony
					w.	m.	f.			
5-31-42	1	204	.....	.....	...	...	...	169	167	541
	1	24	.....	.....	...	...	...	27	24	76
6- 7-42	.....	22	.....	.....	...	...	12	86	28	148
	.....	39	.....	.....	...	...	...	77	45	161
	1	90	.....	.....	...	...	3	71	88	253
6-14-42	1	168	.....	.....	...	1	16	257	141	584
	.....	42	.....	.....	1	...	22	62	6	133
6-21-42	1	41	.....	.....	24	16	...	89	37	208
	1	38	.....	.....	...	106	...	44	89	278
6-27-42	1	84	.....	.....	1	3	62	192	86	429
6-28-42	.....	14	.....	.....	...	26	2	16	6	64
7- 5-42	.....	53	35	11	...	31	10	98	19	257
	1	7	.....	.....	47	...	...	48	16	119
8-16-41	1	125	.....	.....	49	...	...	108	31	314
	1	124	.....	.....	42	...	...	137	4	308
	1	31	.....	.....	10	...	...	31	23	96
	.....	41	.....	.....	7	...	...	76	15	139
	.....	14	.....	.....	...	...	...	17	.....	31
	1	121	.....	.....	7	...	...	66	194	389
9- 2-42	1	55	3	.....	11	...	...	136	33	239
	1	78	.....	.....	21	...	...	104	28	232
9- 4-41	1	117	.....	.....	6	...	...	134	12	270
	1	158	.....	.....	17	...	...	156	33	365
10-11-42	.....	87	.....	.....	...	...	...	114	.....	201
10-20-41	1	54	.....	.....	...	...	...	88	.....	143
11-17-41	.....	25	.....	.....	...	...	...	101	.....	126
	.....	45	.....	.....	...	...	...	41	.....	86
12-14-40	1	165	.....	.....	...	...	...	79	.....	245
	1	61	.....	.....	...	...	...	52	.....	114

SUMMARY

1. In order to make a quantitative study of populations of two ant species, 97 colonies of *Leptothorax longispinosus* and 38 colonies of *Leptothorax curvispinosus* were collected in an oak woods in Ashtabula Co., Ohio. All of these colonies were nesting in acorns. They were collected throughout the year in order to make a year-round study of fluctuations of total populations and of the various developmental stages.

2. *Populations of Individuals in the Colony.*

	L. longispinosus	*L. curvispinosus*
Average population per colony	135.9	235.0
Largest colony collected	419.0	727.0
Average number of workers per colony	45.8	82.6
Largest number of workers per colony	141.0	367.0
Proportion of workers to total population	1 to 3.0	1 to 2.8
Brood overwintered	larvae only	larvae only
Beginning of spring egg laying	mid May	mid April
Peak of egg production	August	August
End of egg laying season	mid Sept.	mid Sept.
Overwintered larvae began pupating	first of June	first of June
Summer larvae all pupated by	mid Sept.	mid Sept.

3. *Populations of Nests in an Area.*—In the woods investigated almost the entire ant population nested in acorns. In a plotted area of 500 sq. ft., there were 58 acorn ant nests. These nests contained 8962 ants or 17.9 ants per sq. ft. There were 3180 workers or 6.4 workers per sq. ft. Thus each worker foraged for itself and 2 others of the colony. Of these 58 colonies, 41 were of *Leptothorax longispinosus*, 13 were of *Leptothorax curvispinosus*, and 4 were of other species of ants. There was an average of one ant colony for 9.5 acorns.

4. *Parasitism by Harpagoxenus americanus.*—Fifteen colonies of *L. longispinosus* were infested by the slave making ant *Harpagoxenus americanus;* thus 1 out of 6.5 were parasitized. No *Harpagoxenus* were found in *L. curvispinosus* colonies.

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