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RESULTS OF THE MERSHON EXPEDITION TO THE
CHARITY ISLANDS, LAKE HURON.

THE FORMICIDAE OF CHARITY ISLAND.

BY FRÉDÉRIC M. GAIGE.

The collection upon which this paper is based was made on Charity Island during September, 1910, while the writer was a member of the Mershon Expedition. As has been stated in previous papers,* this expedition was sent out from the Museum of Zoology and was supported by Hon. W. B. Mershon of Saginaw, Michigan. The work was done under the general direction of Dr. Alexander G. Ruthven, Director of the Museum.

The Charity Island group is composed of three small islands and a rocky islet near the mouth of Saginaw Bay, several miles from the mainland. It lies at about 44° north latitude. The collection was made only on the largest of the islands, which has an area of about 640 acres. There is a lighthouse

*See note page 29.

on this island, on the north side, which is surrounded by a small clearing.

Habitats and Habitat Distribution.—Except for the rocky shores the island is built up of old dunes of varying size, and is nearly entirely covered with the original forest of oak, maple, birch, ironwood, with a few Norway and white pines. This forest becomes thinner at the south end, where the ridges support a very scattered stand of oak with a ground-cover of grasses. The north beach consists largely of an outcrop of limestone and is the narrowest of beaches. In some places back from the water's edge it has a thin covering of sand. The east beach is wide and sandy with thickets of willow and dogwood between the bare beach and forest. The south beach is similar to the east one except that it is separated from the true forest by grass-covered ridges, and is very dry. The west beach is the widest and has a large area covered with a sparse growth of coarse dune grass. Other localities noted are Rattlesnake Point, Lighthouse Point and South Point. There is a single pond on the island, surrounded by a grassy marsh which gives place on the north side to a cranberry bog and elsewhere meets the forest.

The following habitats for ants were distinguished:

1. Low hardwood forest. On the low ground the woods are damp, dark and cool with little ground-cover except for a few ferns and herbaceous flowering plants. The surface of the ground is covered with dead leaves overlying a rather loose, black leaf-mold.

2. High hardwood forest. On the ridges the forest is drier and more open than in the swales, with a more complete ground-cover of grasses and other plants. The top mold is looser and drier and the accumulation of dead leaves less than in the preceding habitat.

3. Open woodland. This habitat is distinguished from the dry forest by its scattered trees, sandy soil, scant amount of litter, and a ground-cover consisting almost entirely of xerophytic grasses.

4. Willow and dogwood thickets. The thickets are usually damp and well shaded and the soil covered by a damp layer of vegetable mold.

5. Margins of pond, marsh and cranberry bog. This habitat is of little importance as far as the ants are concerned. The ground is wet and cold and there is a dense ground-cover.

6. Grassy beach areas. The dry sandy beach back of the storm beach, where it exists, is covered with a sparse growth of coarse dune grasses and more or less beach debris. There are no trees.

7. Rocky beaches. These beaches, principally on the north side of the island, are not an important habitat for ants. There is a large amount of beach debris, logs, etc., with the rocks.

The collection comprises twenty-one forms distributed among four subfamilies and eleven genera. This seems a rather surprisingly large representation for so restricted and isolated an area, but *Myrmica punctiventris* is rare and *Lasius claviger* is only represented by a winged specimen which may have been a straggler from the mainland. Some of the forms, particularly *Aphaenogaster tennesseensis*, one is accustomed to associate with a more southern distribution. The habitat distribution may be briefly summarized as follows:

Low hardwood forest.

Ponera pennsylvanica. Data incomplete.

Cremastogaster cerasi.

Stenamma brevicorne. Peculiar to the habitat.

Aphaenogaster aquia.

Aphaenogaster tennesseensis. Apparently prefers this habitat.

Myrmica punctiventris. Data incomplete.

Tapinoma sessile.

Lasius americanus.

Lasius aphidicola. Data incomplete.

Lasius minutus.

Formica subsericea. Apparently prefers this habitat.

Formica subaenescens.

High hardwood forest.

Aphaenogaster aquia.

Myrmica punctiventris. Data incomplete.

Lasius americanus.

Lasius minutus. Apparently prefers this habitat.

Formica subsericea.

Formica subaenescens. Apparently prefers this habitat.

Camponotus pennsylvanicus. Peculiar to this habitat.

Open woodland.

Myrmica scabrinodis var. Peculiar to the habitat.

Lasius americanus.

Formica subaenescens.

Willow and dog-wood thickets.

Cremastogaster cerasi.

Lasius americanus.

Formica subaenescens.

Formica subsericea.

Camponotus noveboracensis. Peculiar to the habitat.

Marsh.

Tapinoma sessile.

Formica subsericea.

Grassy beach.

Ponera pennsylvanica. Data incomplete.

Pheidole vinelandica. Peculiar to the habitat.

Tapinoma sessile.

Lasius neoniger. Peculiar to the habitat.

Lasius americanus. Apparently prefers this habitat.

Formica nitidiventris. Data incomplete.

Rocky beaches.

Solenopsis molesta. Data incomplete.

Aphaenogaster aquia.

Aphaenogaster tennesseensis.

As would be expected, only a few of the species are confined to a single one of the listed habitats, and probably continued study would still further reduce the number, for there is an overlapping and interdigitation of the habitats, and certain conditions may be common to several of them. But it may be seen in the notes under each species in the list which follows, that, except in the case of *Lasius americanus* and *Formica subsericea*, the association of the species with certain general conditions is close, and that even these two notoriously generally distributed species show habitat preferences. *Lasius* (*Acanthomyops*) *claviger* has been omitted from the preceding list, as the only record was an isolated aleate female.

Acknowledgements.—I wish here to acknowledge my indebtedness to Professor W. M. Wheeler for the identification of the collection and to Professor A. S. Pearse under whose direction the laboratory study was made. I also take pleasure in expressing my appreciation of the hospitality and assistance of the lighthouse keeper, Capt. C. C. MacDonald, and the assistant keeper, Mr. J. Singleton, during the field work.

LIST OF SPECIES.

PONERINAE.

1. *Ponera coarctata* Latr. subsp. *pennsylvanica* Buckley.—The first specimen of this species seen on the island was a single worker taken in the very heart of a nest of *Pheidole vinelandica* in a rotten log on the dry beach. There were no others in the nest or in the vicinity. Another isolated specimen, also a worker, was taken in the damp, black leaf-mold under the dead leaves in the low hardwood forest. A nest found on September 21 was the only one seen on the island. It was located on the west beach in thoroughly rotted, dry, powdery wood. There were less than fifty in the colony. The ants were very secretive, immediately abandoning their few larvae and burrowing into the loose wood-dust when uncovered. After the lapse of a few minutes, three of them returned cautiously and each carried away a larva, but all the others were abandoned permanently. The species was decidedly rare on the island and the only representative of this primitive subfamily.

MYRMICINAE.

2. *Solenopsis molesta* Say.—A single individual of this genus and species was collected on the island. The writer was sitting on the rock outcrop of the north beach writing some field notes when he noticed this single ant on his boot. It furnished the only record for the island, for although the ant was a worker the colony could not be found.

3. *Pheidole vinelandica* Forel.—A large number of specimens of this species were found in the sand on the dry west beach, on September 19. There was no external evidence of the presence of so many ants, but on pulling up a clump of dune grass I found the roots literally covered with them. They

were rather secretive, or probably more properly speaking they were averse to the light, and hid by burrowing into the soft sand. A considerable area was dug over, but no evidence of a nest or even any larvae or pupae was found. The sand caved in very rapidly and easily, and that, with the confusion made by pulling up the grass at first, must have destroyed all evidences of a nest if one was present. There were certainly more than a thousand workers at a conservative estimate. Less than a hundred feet distant a smaller colony of a few hundred individuals was found in a decaying log. The outer shell of the log was still very hard and firm, but the center had become an almost earthy mass, damp and noticeably warm to the hand. Here again no larvae nor pupae were seen, while the nest was a very haphazard series of tunnels next to the firm wood. There was no external evidence here of the colony. Another colony was later found in the cement walk that ran from the lighthouse to the dock. This nest was a small one, and was started after the writer's arrival on the island. The ants in this colony were noticeably more active during cloudy periods, or just at the beginning of twilight, but they did not work at night. They built no regular mound, but deposited the excavated sand in a small irregular pile near the single entrance to the nest, which lay under the cement. The pile was so frequently destroyed owing to its exposed situation, either by wind or rain or an inadvertant footstep, that it is quite possible that the ants never had a chance to construct the usual form of nest.

The species was, on the whole, rare on the island. The few records obtained show that it occurs in exposed places, *i. e.*, places where there is little or no shade from trees and shrubs, such as on the bare beaches and the sparsely covered dunes, that it frequently has no mound at the nest entrance, and that

small supplies of seeds are stored up. The latter observation was made upon only two nests.

4. *Cre mastogaster lineolata* Say var. *cerasi* Fitch.—The first of this species noted was a small band of isolated workers in a much decayed pine log on the west beach, forty or fifty feet from the water. They were extremely timid and hurried frantically for shelter when alarmed, a reaction quite different from those observed later. The punky wood in which they were found was very wet, and in one end of the log, close to the band, was a small colony of *Lasius americanus*. There was apparently no intermingling of the two species, hostile or otherwise. On September 20 a very large colony was found in a soft, damp poplar log in a low dogwood thicket. The nest was fully five feet long and the colony must have comprised many thousands of individuals. Two aleate females were taken. Certain parts of the nest between the log and the earth had been constructed of a sort of vegetable felt, but the amount of this kind of structure was small compared with the extensive tunneling in the soft wood of the log. The lower part of the log was very soft, almost earthy in places, but the upper half was still comparatively sound. In this sounder part of the log there were numerous borer burrows, some still occupied by the larvae, and these ready-made burrows had been utilized by the ants which had continued and elaborated them greatly. During the opening of this nest, the decidedly repulsive odor so characteristic of the species was very noticeable. The ants themselves were ferocious, and made no attempt to escape or hide. This was by far the largest colony found on the island. In the same habitat several other smaller colonies were found, all living under the same conditions.

A few colonies were found along the north beach, all in very damp, small logs that were soft from decay. In one in-

stance a colony of *Aphaenogaster tennesseensis* occupied the same log. Another large colony was located in a small, punky pine log in the willows along the south beach. A large number of winged females were noted here on September 26, but no males were seen. In this nest, too, old borer burrows had been elaborated, but no borers were present. There were quantities of pupae in the upper part of this nest and a few larvae in the lower half of the log. In no case did the nests extend into the earth.

The species was quite generally distributed on the island but occurred in smaller numbers in the drier areas of beach and forest. It is evidently a moisture and shade requiring form. The tent-building habit (See Wheeler, Bull. Amer. Mus. Nat. Hist., Vol. 22, pp. 1-17 and plates 1-6) was nowhere seen, and in only one instance was there any nest construction from manufactured material. From September 20 to 26 nests were opened that contained a greater or less number of aleate females, but no flights were observed nor were the emigrated queens found widely distributed. No males were taken. The species is rather common on the island.

5. *Stenammina brevicorne* Mayr. — But two specimens of this species were secured on the island. Both were taken with other ants among the dead leaves on the ground in the low hardwood forest. See *Myrmica punctiventris* and *Aphaenogaster aquia*.

6. *Aphaenogaster fulva* Roger subsp. *aquia* Buckley. — The first record of this species was a carefully concealed nest found on September 16 in the low hardwood forest near the south end of the pond. The entrance was beneath the accumulation of dead leaves on the forest floor, and the burrow, a single passage, led from it almost straight down through the damp black leaf mold to a small twig ten inches below the sur-

face. The twig had become a mere shell through decay and probably also by the work of the ants, and in the chamber so formed were a number of larvae and a few pupae. There were also pupae on the ground beneath the leaves, which the ants immediately carried into the nest when disturbed. Three other species of ants were collected close to the nest in this same habitat—a single specimen of *Stenammas brevicorne*, one of *Myrmica punctiventris* and six of *Lasius minutus*. This one colony was the only record for the species in the habitat, but numerous colonies were found in the higher, drier and more open forest. Some of the nests were in dead wood which had become punky from decay others were in the earth beneath sticks and logs. There seemed to be no choice between these two situations as nest sites, the nests recorded being divided about equally between them.

On September 17 a nest was found in a stump occupied also by *Lasius minutus*. The two nests were very closely approximated, but the writer believes the relation to have been a very simple case of plesiobiosis. Old beetle larvae burrows had been utilized by *aquia* and from them a number of pupae were taken and a single aleate female. On the eighteenth a single isolated winged female was taken under a pine log in the dry hardwood forest, and on the same day a colony was found in the root of a rotten pine stump in which was a single winged male. On the nineteenth two aleate males were secured under debris on the west beach. A colony found on the twenty-first, in the moist sand under a log on the north beach, contained a winged female. This colony also occupied a portion of the under side of the log.

A rather curious nest of this species was found on September 17. The colony was a large one and had constructed the nest in the earth under a large granite boulder which was sunk

several inches below the surface. There was no external evidence of the presence of this large colony. In those passages that were laid bare by the removal of the rock there were quantities of pupae, all of which were immediately hurried below ground by the workers. In this colony a number of the pale yellow workers of *Lasius flavus nearcticus* were noted. The two species were apparently living in perfect harmony, as the Lasii ran about the complicated tunnels of the larger ants with freedom and apparent familiarity. It seems probable that this was essentially another plesiobiotic association, and that the nest of the Lasii had been destroyed in the disturbance caused by the removal of the stone; yet the free mingling of the two species without any show of mutual relations makes it seem possible that the association might be in the nature of parabiosis. (See Wheeler's *Ants*, p. 425 and *American Naturalist*, 35, pp. 524-528.) Although the writer cannot offer a definite interpretation of the relation, he can find no mention of its occurrence and takes this opportunity to record it.

7. *Aphaenogaster tennesseensis* Mayr. — Owing to the close association that exists between this parasitic species and the preceding form, it is not surprising to find it common on the island where the latter was so abundant. All the nests found were located in dead wood which was more or less punky, and the favorite habitat was the low, damp, hardwood forest. A large percentage of the nests were in the decayed hearts of living trees, which had openings to the outside at the base. At the base of almost every tree so decayed, could be seen accumulations of excavated wood-dust that varied in amount from a few particles to irregular piles that would fill a quart measure. Though this was certainly the characteristic site of the nests, others, and noticeably the largest, were found

in logs or stumps. This may mean that these tree colonies are the younger ones, and choose this well protected and sheltered site when they first leave their host colony of *A. aquia*, and the limited space available eventually forces them to emigrate to more spacious quarters. It must be noted here that the ant never burrows in live wood.

A very large colony was found in a decayed pine log on the north beach, on September 21. The log was nearly buried in the sand and was soft and punky. The outer and upper part was firm and dry, forming a stiff shell that held the soft interior in shape. On the dry upper surface a number of the dwarfed females so characteristic of this species were found together with workers. All the females were winged. The raising of the shell of dry wood laid bare a large part of the upper portion of the nest, and here in the complicated series of passages and chambers were many more of the aleate queens and thousands of workers. The nest was four feet long, but contained surprisingly few larvae or pupae for so large a colony. These large colonies were rare, and this was the only one noted outside of the low hardwood forest.

A smaller nest found in a birch stump in the low forest habitat was very simple. Most of it was in a punky root of the stump, two to ten inches under ground. From this a single passage, an old borer burrow, led up through a very sound part of the stump for a distance of a foot or more to a cavity in a softer portion. This cavity had been made by the ants, was as large as a walnut and contained a few workers and pupae. In the nest below there were many larvae. The same day another nest almost as simple as this was found in the base of a dead Norway pine in the same habitat. In it was a single aleate male, which was being dragged along a passage-

way by a worker when first seen. A single isolated winged male was taken on the north beach on September 21.

The interesting relation between this parasitic species and the several varieties of *A. fulva* is described in the chapter on temporary social parasites in Wheeler's *Ants*, pp. 447-8, and also in the *American Naturalist*, Vol. 35, p. 724, where it was first reported.

8. *Myrmica punctiventris* Roger.—But four specimens of this species were collected, and each of these were isolated. The first was taken on September 16 in the low hardwood forest near the pond. It was one of a miscellaneous collection made on the floor of the forest (see *Aphaenogaster aquia*). This specimen was collected in the damp black leaf mold beneath the accumulation of dead leaves that covered the surface of the ground. The ground-cover was a sparse growth of coarse grass. On the following day two specimens were secured. The first was collected in the leaf-mold beneath dead leaves on the floor of the poplar and birch forest, a rather higher and drier habitat than the preceding and lying nearer the dunes. A miscellaneous collection made in this spot contained *Formica subsericea*, *Stenammina brevicorne*, and *Lasius americanus*. None of these had colonies in the immediate vicinity. The second specimen was taken in the dry hardwood forest near the beach. The soil was a light, dry leaf mold, with a rather more complete ground-cover than the preceding habitats, with a much less complete covering of dead leaves (see *Camponotus pennsylvanicus*). The final record was obtained on September 20 when another specimen was collected in the damp black leaf mold in the low hardwood forest. Collected simultaneously were specimens of *Lasius aphidicola* and *Aphaenogaster aquia*.

The species was very secretive and apparently rare on the island. It was never noted outside of the hardwood forest, in which it ranged from a low damp environment to the high dry forest close to the beach. All four of the specimens collected were workers, and, as stated, no colonies were found.

9. *Myrmica scabrinodis* Nyl. var.—A small colony of this species was found on September 21 in the dry oak woods near the beach. The nest was in a small clearing in the forest, where there was a fairly complete cover of fine grass and brake ferns with a thin litter of dead leaves. The soil was very dry, the sand showing no moisture even at a depth of several inches. The entrance to the burrow was concealed beneath a dead leaf, and there was no exterior sign of the presence of the colony. No pupae or larvae were found. A few feet from this colony an isolated female of *Lasius minutus* was found (see notes under that species for September 21). On September 19 three specimens were collected in the open woodland by the east beach. This was another very dry habitat with a fairly complete ground-cover of fine grass and a few clumps of wild rose and serviceberry bushes. All three of these specimens were found among the grass roots, and were within a few inches of a colony of *Lasius americanus*. More specimens were collected on the high beach fifty yards from the place just noted, all from earth that was disturbed in pulling up some of the rose bushes and from the roots of the bushes themselves or the adhering grass. The ants were not numerous, less than thirty were seen, but there was undoubtedly a nest that was destroyed in the uprooting of the rose. A single specimen of *Formica nitidiventris* was taken here on the bare sand.

On September 26 six winged males were collected on the limestone outcrop of the north beach. They were not found together, but all occurred on a hundred yard stretch of beach.

Three were found under flat flakes of limestone so close to the water that they barely escaped the higher waves which kept the rocks wet and cool. The other three were found higher up on the beach in drier places beneath beach debris. Aleate females of *Lasius minutus* and a single one of *Lasius claviger* were taken with them.

The species was noticeably confined to the driest areas, the three winged males just noted obviously hardly counting as exceptions. It was not common on the island, though probably more plentiful than the records would indicate. The ants are very secretive and the nests always concealed effectively, both factors which would tend to cause the species to be overlooked.

DOLICHODERINAE.

10. *Tapinoma sessile* Say.—This species was first noted on September 17, when a small colony was found in a decayed log on the beach. The log was in the high grass and willow bushes, well back from the water and near the forest, and was very soft and so wet that water could easily be squeezed out of it. Neither larvae nor pupae were found. The species was next noted on the twentieth in the low hardwood forest. In the bare earth in the path that ran through the forest, several small mounds were noted, all appeared to be uninhabited, but a single ant of this species was found in one. Later other colonies were found in the edge of the forest along the north beach. These were in moist sandy loam and numbered about three hundred individuals to the colony. There were usually a number of yellow pupae, but larvae were rarely noted. A single colony was found under a log in the low damp hardwood forest, on September 22, and here, too, an abundance of yellow pupae was noted.

The species is very secretive and moves with a curiously rapid, erratic pace. It is also adept at burrowing, and frequently uses that means of escape when disturbed. It is interesting to note that the species was the only representative of its family that could be found in the cranberry bog about the pond. While no colonies were found in that habitat, a number of workers were collected in the dense growth of roots and stems on the ground.

CAMPONOTINAE.

11. *Lasius niger* L. var. *neoniger* Emery.—Though less abundant than the following species, *L. neoniger* was common on the island. It was restricted to the dry sandy beach areas, particularly along the west beach where colonies were frequent among the roots of the sparse dune grass. Often there was no exterior evidence of the presence of colonies, but this was not invariably true. In a dry, sandy, enclosed area that had been used as a hog pen and was entirely bare of ground cover, twelve colonies were counted in a ten foot square, each with a single entrance at the centre of the small crater that indicated the amount of excavation of the colony. These mounds were one to four inches in diameter and less than an inch high. It was also noted that when bare spaces were chosen as nest sites the mounds were present, but in the grassy areas none were constructed. The species did not occur in wood, and was never noted outside the one habitat mentioned, save of course the migrating queens. The latter were found all over the island, and numbers were seen and collected among the loose wet stones on Rattlesnake Point, in the long grass about the pond, and in the forest. This emigration of queens with their consequent wide distribution took place about four days previous to that of the *L. americanus*, so that by the time these queens were appearing the *neoniger* queens were no longer in evidence. The latter were, of course, never as abundant as the former.

12. *Lasius niger* L. var. *americanus* Emery.—The largest colony of this species was found on September 17 in a yellow oak log in the dry hardwood forest along the north beach. The tree had lodged in falling so that part of the log lay clear of the ground, and the region of contact between the bark and the wood was punky from decay. The nest was in this soft wood, so that it was laid bare by the removal of the loosely adhering bark. It extended for seven feet along the log and practically around it for the same distance. The first section of bark removed was from over the middle of the nest, and laid bare a number of small flat piles of eggs which the ants promptly abandoned to seek shelter for themselves. Later when larvae and pupae were uncovered the ants refused to leave them, but carried all away to undisturbed galleries.

About two feet from the place of initial disturbance a solitary queen of *Camponotus pennsylvanicus* was found in a small cavity which her body exactly fitted. She was extremely sluggish and paid little attention to the Lasii, which ran all about and even over her. Later three more queens of the same species were found under the same conditions except that one had in the cavity with her a few eggs which were apparently her own.

The network of passages beneath the bark was all in one plane but extremely complicated. The wood underneath was very hard, too much so to permit excavation by this species, while the bark was not used at all. That portion of the nest which was in the earth at the end of the log was of very minor importance, and few ants were present in it, though the log above swarmed with the disturbed workers. There was no direct opening to this part of the nest, the ants going under the bark and then down below ground between the bark and

the wood. Notwithstanding the size of the colony there was no outside evidence of its presence.

Many other colonies were found. On the sixteenth a small nest was uncovered in the low hardwood forest near the pond. It was in a very cool, shaded place and the major part of the nest was in the damp earth, with only a few passages in a small rotten log that was partially buried in the ground and covered the nest. No eggs, larvae nor pupae were in this nest, but all of the other colonies found in the same habitat contained one or all three of these in more or less abundance. Many colonies occurred along the sandy beaches. Here the species sometimes constructed small circular crater mounds one to six inches in diameter and one quarter to two inches high, with a single opening at the bottom of the crater. The burrows led straight down from the entrance for an inch or two before turning, but the extreme looseness of the sand prevented further accurate observation. This looseness of the sand also undoubtedly accounts for the fact that the mounds were not of the turret-like type that is so common in more compact soil. Sometimes no mounds were constructed and the nest would be located beneath logs and other beach debris. Frequently if this shelter were punky from decay, it would be utilized for a part of the nest and here the pupae would almost invariably be found. No other colonies were found that approached the size of the one first noted.

On the nineteenth and twentieth winged males and females became abundant. They were found everywhere on the island, and females which had just shed their wings were collected in greater or lesser numbers in all habitats. Large numbers of them fell on the water all around the island and were then extensively preyed upon by the common terns. The stomachs of several of these birds taken at that time were gorged with

the helpless insects. The fishermen reported that at this time their boats swarmed with these ants which alighted upon them several miles from shore.

A little before dark on the evening of the twentieth, a colony in a crater nest in the dry sand near the lighthouse was noticed to be in great agitation. A number of workers were hurrying about the surface of the ground and in and out of the single entrance to the nest. Just as it was becoming too dark to see, winged males began appearing in twos and threes until in a few minutes the entrance was filled with a swarm of aleate males and workers. The latter seemed to be driving out the former, which were very weak, hardly being able to surmount the sides of the crater and after doing so straggling off to any nearby cover without attempting flight. The rapid increase of darkness prevented any further observations that night and in the morning the colony presented a normal appearance, and no winged ants were in the vicinity. At the time of the excitement of the previous evening the surrounding colonies (and there were probably fifty in a thirty foot circle), were abnormally quiet, appearing almost deserted. This fact makes it seem probable that all were offshoots of the same parent nest and were so closely associated that the males made their exit by the same passages.

The species was one of the two most common forms on the island, as might be expected. This is easily accounted for by the great flights of the sexual phases and the distances they cover. It was nearly universal in its distribution in the island habitats, though most characteristic of the drier open forests and beach edges.

13. *Lasius flavus* L. subsp. *nearcticus* Wheeler.—This species was first noted on September 17, when a small colony was found in the dry hardwood forest near the north shore.

The colony was in the sand beneath a partially buried pile of pine chips. There was a single opening to the nest, which was about six inches below the surface and was simply an empty chamber less than an inch in each dimension. A number of winged males and females were present, the former outnumbering the latter about two to one. Both were very secretive, as indeed were the workers. In a very short time after the initial disturbance not an ant was visible, all having buried themselves in the sand or taken refuge under chips. The following day three workers of this species were collected beneath a dead poplar stub in a similar habitat on the south side of the island, but no colony was found. On the twentieth a second colony was found in a rather low damp hardwood forest. It was located at the base of a very badly decayed stump, part of the nest occupying one of the soft punky roots and part the damp black leaf mold. This colony was small—only a few hundred workers, with about thirty winged females which in this case were about twice as numerous as the males. It is to be noted that in none of the colonies found were there any eggs, larvae or pupae. (See *Aphenogaster fulva aquia* for a further note.)

The species was not common on the island. It was one of the most secretive forms, and was confined entirely to the hardwood forest, although there it ranged from the low areas to the high dry ones without apparent preference. Its very light yellow color makes it a conspicuous object in almost any environment, and this is particularly true in the black leaf-mold where it seems almost to shine. The noticeably retiring habits of the species could well be related to this fact.

14. *Lasius umbratus* Nyl. subsp. *mixtus* Nyl. var. *aphidicola* Walsh.—A single worker of this species was taken on September 20 in a miscellaneous collection from the damp

black leaf-mold in the low hardwood forest . (See data under *Myrmica punctiventris*.)

15. *Lasius umbratus* Nyl. subsq. *minutus* Emery.—On September 17 a large colony of this species was found in a punky stump in the dry hardwood forest near the north beach. The stump was very soft from decay, and a considerable amount of it was scattered about on the ground at the base as an accumulation of earthy wood several inches thick and a few square feet in area. On the surface of this decayed wood hundreds of ants were hurrying about, apparently in a state of great excitement, and when the earthy surface was slightly disturbed a number of winged ants were seen. The majority of these were males, but females were abundant. There was a hole a little less than an inch in diameter near the base of the stump, and at the end of it and in a little chamber several inches beneath the surface was a ball of winged males and females nearly an inch in diameter. Here again the males outnumbered the females two or three to one. When the ball was exposed to the light it gradually disintegrated and the individual ants secreted themselves in the debris. The females were the first to extricate themselves and hide; the males were slower, a fact not due to any defensive or protective instinct, but to a greater sluggishness. A number of dead males were noted about the nest, and several times workers were seen to seize the abdomen of a male and pinch it severely, a habit that might account for the dead males, for it resulted fatally in two observed cases. None of the winged ants tried to escape by flight, but ran like the workers. The stump was so soft that it could be torn to pieces with the fingers and in it were quantities of pupae, gallery after gallery above the surface of the ground being literally crammed with them. A single female and less than ten males were seen here. The colony occupied

all of the stump but a small portion on the north side, where a small colony, two hundred or less, of *Aphaenogaster fulva* subsp. *aquia* was found. (See notes under that species.) No relations of any nature were visible between the two colonies.

On the following day, September 18, a still larger colony was found in an oak stub in the same habitat. This stub was thirty inches or more in diameter at the base, and on the west side was badly decayed, making a very soft section of perhaps one-third the volume of the entire stub. It was probably a place that had started to decay previous to the death of the tree. To a height of five feet this weakened region was literally filled with ants—workers, winged males and females—and with pupae. Here, as in the former colony, the males predominated two or three to one, and were noticeably the more sluggish. The nest extended only a little distance into the earth, less than six inches, and was well concealed as there were no openings or entrances except at the base of the stub and these were in the earth close to the wood. No ants were seen outside the nest, a notable difference from the previous colony. On the same stub were found a few specimens of *Aphaenogaster tennesseensis*, but no colony was discovered.

A smaller colony was found in the low hardwood forest in the interior of the island, in a large, badly decayed oak log, on September 20. A single winged female was taken in this colony. No males were noted, and no pupae were present. On the same date a single aleate female was collected in a very damp, rotten poplar stump in the same habitat, but at a distance from the colony, and another aleate female was seen here but not collected. The next day, in a clearing in the dry hardwood forest near the beach, an isolated and very inactive dealated female was found in a small excavation in the earth beneath a leaf. On September 17 another dealated female was taken

beneath a flat scale of limestone rock on the north beach with winged females of *Lasius claviger* and *Myrmica scabrinodis*. All four of these females were at the very edge of the water, where the rock was cold and wet. Directly back of this spot, under driftwood on the dry sand behind the outcrop, another winged female was collected with two aleate females of *M. scabrinodis*.

The species was confined to the hardwood forest, except for the emigrating females, where it inhabited both the low, damp spots and the dry areas. The workers were not wide ranging and were never noted away from the nests, which leads the writer to believe that the species was more plentiful than the records would indicate, the close restriction to the nest rendering the colonies inconspicuous.

16. *Lasius (Acanthomyops) claviger* Roger.—The only record for this species is a single winged female taken under beach debris on the north beach, September 21. This individual might well have come from the mainland, if the flights of *L. americanus* are any criterion.

17. *Formica pallide-fulva* Latr. subsp. *nitidiventris* Emery.—This species must have been very rare on the island as the only record is a single isolated worker that was taken on the bare sand of the high west beach.

18. *Formica fusca* L. var. *subsericea* Say.—Notwithstanding its wide geographical and habitat range, *F. subsericea* was not common on the island. It nested without exception in rotten wood, and preferably in that which was underground, *i. e.*, either roots of stumps or partially buried logs. On one occasion a hill about eight inches high was found in the low hardwood forest, and this contained the largest colony found. It was a dome-shaped mound, much as one would expect from *F. glacialis*, but on being opened it proved to be the site of

an old stump. Only the decayed roots remained, and in them the nest was located. The mound was composed entirely of excavated wood and that which had weathered. No earth had been excavated, though much of the wood dust had become mixed with earth as it decayed. There were quantities of larvae and pupae in the lower recesses of the nest. In this same habitat colonies were found in logs that lay on the surface of the ground, but these were small colonies of perhaps a hundred or less individuals. Other colonies were situated on the beach—always in rotten and partly buried logs. The species is plainly to be associated with the damp or even wet places, as it was found in the cold wet marsh near the pond where the dense grass and ferns completely shaded the ground. It is noticeably active, though rather less so than the following variety of the same species. The workers are wide ranging, and were frequently seen isolated or in small bands many yards from the home nest.

An isolated winged female was taken in a large well-rotted pine log almost entirely buried in the wet sand of the beach. She was the only aleate queen noted. Brief references to the form will be found under *Camponotus noveboracensis* and *Myrmica punctiventris*.

19. *Formica fusca* L., var. *subaenescens* Emery. — *F. f. subaenescens* was much more abundant than the preceding form and was in fact one of the two most plentiful ants on the island. With a single exception the nests found were located in the hardwood forest. This exception was a large colony situated in a pine log on the open beach. Unlike *subsericea*, this variety seems to prefer the lighter and drier forest, and it was in that habitat that the greatest number of nests and largest colonies were found. The nests were always partly in wood; usually that which was rather soft and punky was chos-

en, but very firm logs were also occupied. In less decayed logs larval burrows were used and elaborated. These burrows of beetle larvae were very common in all dead wood on the island and undoubtedly are of great aid to the ants, particularly to young colonies, but to what extent it is difficult to determine as it is only in the firmest wood that one can be sure of the nature of the burrows. Frequently both the larvae and the ants are present at the same time. A single nest of this species was found in the earth among a pile of limestone rocks in the hardwood forest. In this one instance the nest was really in the earth, and not in buried wood or in old roots. No mound had been built, and there was no sign of a nest until a few rocks were moved.

On several occasions members of the genus *Aphaenogaster*, either *A. tennesseensis* or *A. aquia*, occupied the same stump or log. In each instance one of the colonies was very small, and there was no discernable relation between the two genera, the close approximation of the nests being evidently due to chance. The only other nest of *subaenescens* found in the earth besides the one mentioned above was a small one found beneath a log occupied by a colony of *Camponotus pennsylvanicus*. This, too, was a case of plesiobiosis determined by chance, and one colony was much smaller than the other.

A single isolated winged female of this species, the only one seen, was taken under drift debris on the east beach. Individuals are very active and move with such an erratic and jerky pace on their long slim legs that they are rather difficult of capture.

20. *Camponotus herculeanus* L. subsp. *pennsylvanicus* De-Geer.—This species was first collected on September 17, when a small colony was found in a badly decayed oak limb lying on the ground in the hardwood forest. In addition to honey-

combing the limb until it was a mere shell, the ants had constructed numerous chambers between the layers of fallen leaves to a distance of several inches beneath the surface at one end of the stick. Very few ants were present in this complicated series of chambers, but down in the underlying sand two of these irregular passages were nearly blocked with an accumulation of beetle wings and the heads and other chitinous parts of the different insects. In the stick itself were a few pupae and a number of pale, recently metamorphosed ants, which were feeble and inactive. In the sand beneath the limb were a number of further excavations, and a swarm of ants was hurrying about the openings. The instability of the sand did not allow accurate observations of this part of the nest, but a few pupae were unearthed at a depth of two inches. No queen was found in this colony.

A number of the smaller *Lasius niger* var. *americanus* seemed to be living in the same place. They were not noted until the other colony had been considerably disturbed, when quite a number were observed hurrying about the passageways of the Camponoti with perfect freedom and apparent familiarity. As no colony was found, it is very possible that the Lasii were simply attracted by the opportunity for plunder. Specimens of both species were collected. In the immediate vicinity of this colony in an area of three square yards or less, a miscellaneous collection was made. It comprised the following species: *Formica subsericea*, *Lasius umbratus* subsp. *minutus*, *Aphaenogaster fulva* subsp. *aquia*, and *Myrmica punctiventris*. None of these had colonies nor were numerous.

On the following day, September 18, four of the large queens were found in a colony of *Lasius niger* var. *americanus* (see notes under that species). Four more Camponoti were collected beneath the bark of a fallen oak tree that had become

slightly punky with decay. All of these were solitary, and there was no colony in the vicinity. Collected with them were four workers of another genus, *Aphaenogaster tennesseensis*. Both of these records were obtained in the dry hardwood forest, and later in the day, in the same habitat, a large colony of the *Camponotus* was found. It was located in a dry maple stub, ten feet high and fifteen inches in diameter. The center of the stub was comparatively firm, but the outer part had become punky and rather soft. To the height of six feet the stub was a network of passages, the major ones being parallel and vertical, with short, cross openings between them. The colony was confined to the central part of the stub, in a cylinder of perhaps ten inches diameter in the best preserved part of the wood. It required considerable effort to open the nest with a light belt axe, and when the interior was laid bare a large number of winged females were immediately seen. They were very secretive and at once retreated to lower recesses of the nest. Specimens were secured including a single aleate male—the only one seen. There was a surprisingly small number of pupae, a few chambers in the lower half of the nest being partially filled with them. It is interesting to note that there was not a trace of the presence of this large colony on the exterior of the stub—no evident openings to the surface, no accumulation of wood dust at the base, nor any other indication of so extensive an amount of work. It was only by the presence of a few individuals at the foot of the stump that the colony was found. It must have been an old one in which the construction period was nearly over, and natural processes had removed the evidences of the work.

On September 20, in the lower and more damp hardwood forest another colony was found. This occupied a badly decayed poplar log, six feet long and six inches in diameter. The

wood was so soft and wet that drops of moisture could easily be pressed out between the fingers. The colony occupied about one foot of the log, and was not a large one. Two small chambers full of pupae were opened and a few immature ants and a queen were found. The same day three individuals of this species, all workers, were collected in a wet, decayed pine log on the bare limestone outcrop on the north beach, less than ten feet from the water's edge, where no other ants were seen. On September 22 a single dealeate female was found alone just beneath the bark of an oak log in the hardwood forest. The log was only slightly decayed, but the ant lay in a small depression in the wood under the bark. It looked as if the ant had excavated the place for herself. No other ants were noted. The same day another small colony of this species was found in a dogwood thicket at the edge of the hardwood forest and the beach. It was located in the driest end of a small pine log, where a few pupae, forty or fifty in number, were uncovered, together with some pale, recently hatched workers and the queen.

This completes the records for the species on the island. It was not abundant and the workers were not wide-ranging. With the exception of the three isolated workers found near the water, the species was confined to the hardwood forest, and preferred the noticeably dry places.

21. *Camponotus herculeanus* L. subsp. *ligniperda* Latr. var. *novaboracensis* Fitch.—A colony was found in a large punky pine log beneath the willows on the east beach on September 17. The log was too large and sound to be opened, but, though few ants were visible, there was evidence of considerable work in the form of accumulations of small piles of wood-dust at the ends of the log. A few ants were at work when the log was first noted, at six a. m. on a cold wet morn-

ing. On the same log were collected three other species, *Cremastogaster cerasi*, *Tapinoma sessile*, and *Lasius americanus*.

Five days later a small and isolated band of this species, not exceeding fifty individuals, was found beneath a pine block in the damp sand in the willow area on the east beach. On the same day a very large colony was found in the same habitat. The nest was in a much rotted pine log ten feet long and eight inches in diameter. The whole log was so honeycombed with passages that it could little more than maintain its shape. It was partly buried in the damp sand and well shaded by the willows. It was torn open and a great number of ants were immediately exposed. Besides the polymorphic workers there were many of the secretive males and females, all winged. A few pupae were stored in warm dry chambers in the upper part of the nest, but these were very few in number for so large a colony. A little later a few isolated workers were discovered under a log on the beach very near a nest of *Lasius americanus*. These were the only records obtained. The form was apparently uncommon, almost rare, and was restricted to the willow and grass areas on the upper part of the beach.

The results of the Mershon Expedition and additional work carried on by the Michigan Geological and Biological Survey have been partially summarized in the following papers:

The Mershon Expedition to the Charity Islands, Lake Huron, by A. G. Ruthven, *Science*, N. S. XXIII, pp. 208-209.

Results of the Mershon Expedition to the Charity Islands, Lake Huron.

Birds, by N. A. Wood. *Wilson Bull.*, July, 1911, pp. 78-112.

Plants, by C. K. Dodge. 13th Ann. Rept. Mich. Acad. Sci., 1911, pp. 173-190.

Mammals, by N. A. Wood. *Ibid.*, pp. 131-134.

Preliminary Report on the Coleoptera, by A. W. Andrews. *Ibid.*, pp. 168-170.

The Amphibians and Reptiles of Charity Island, by Crystal Thompson and Helen Thompson. 14th Ann. Rept. Mich. Acad. Sci., 1912, pp. 156-158.

The Breeding birds of Charity Island with Additional Notes on the Migrants, by N. A. Wood. *Ibid.*, pp. 178-188.

