

An Annotated List of the Ants
of the Thunder Bay District

by

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Submitted in partial fulfilment of the requirements for the
Degree of Master of Science in Biology at Lakehead University.

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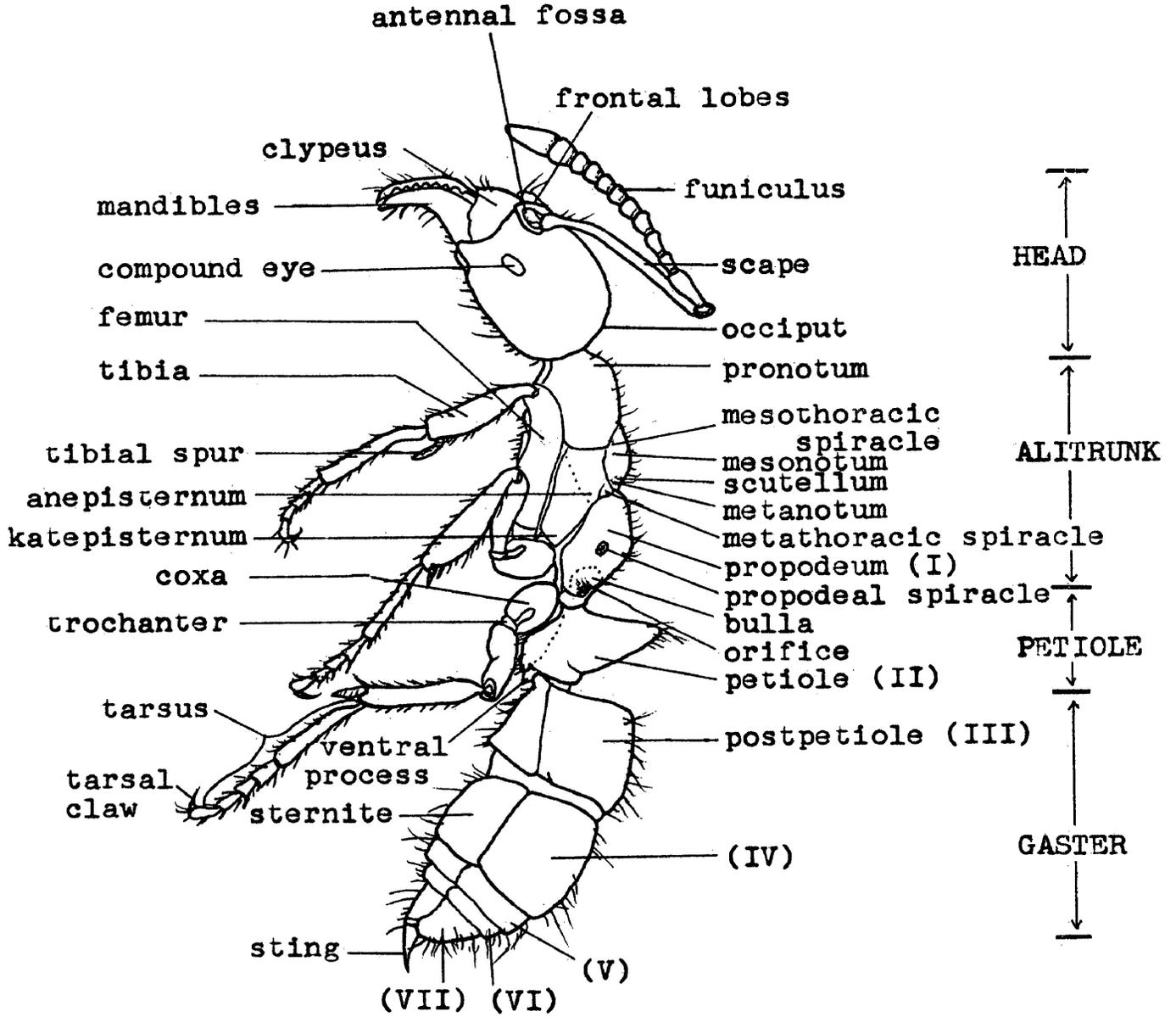
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Frontispiece. An illustration of an ant showing the features of greater taxonomic significance. The Roman Numerals represent the 'true' number of the abdominal segments. (After a drawing by W. L. Brown).



DECLARATION

I, Fawn Elaine Elsey, hereby declare that this thesis is an original composition, based on original research carried out under the supervision of Dr. W. M. Graham & Dr. R. Freitag of the Biology Department of Lakehead University, and has not been presented by me or, to my knowledge, by any other individual in any previous application for a degree or diploma or similar award, and furthermore, all quotations used herein have been distinguished as such and fully acknowledged.

Signature

Abstract

Thirty nine species and subspecies of ants were collected from the Thunder Bay District of Ontario, Canada, in the summer of 1970.

Extensions of known range were recorded for Leptothorax poss. texanus, Camponotus pennsylvanicus, Formica fossiceps, F. integra tahonensis, F. oreas, F. marcida, and F. montana.

Dates of reproductive flights were recorded for Dolichoderus taschenbergi, Camponotus herculeanus, Lasius pallitarsis, and Formica fossiceps.

Interesting habitats and behaviours were recorded for each of the species.

Acknowledgements

I would like to express my sincere gratitude to my supervisors, Dr. W. M. Graham and Dr. R. Freitag, for their encouragement and guidance in the course of the study. I would also like to thank Dr. Graham for accompanying me on some of the field trips.

I am grateful to G. L. Ayre, A. Francoeur, and C. J. Sanders for helping me with the identifications of the specimens. Their comments on specific collections were most appreciated.

I am also grateful for the assistance of the following persons: K. Andrews, G. Barker, D. Dutchak, C. A. Elsey, F. A. Elsey, L. E. Elsey, M. E. Elsey, C. E. Garton, W. Hartley, D. Lein, D. R. Lindsay, P. C. K. Ma, W. Mercer, B. Russel, J. Ryder, B. Staus, and G. Taylor.

Table of Contents

| | Page |
|-----------------------------|------|
| Frontispiece..... | 2 |
| Declaration..... | 3 |
| Abstract..... | 4 |
| Acknowledgements..... | 5 |
| Table of Figures..... | 7 |
| List of Tables..... | 8 |
| Introduction..... | 9 |
| Site Description..... | 16 |
| Methods..... | 20 |
| Results and Discussion..... | 24 |
| Summary..... | 96 |
| Conclusions..... | 97 |
| Appendix I | 99 |
| Appendix II | 104 |
| Literature Cited..... | 117 |

Table of Figures

| | Page |
|--|------|
| Frontispiece. An illustration of an ant showing the features of greater taxonomic significance. | 2 |
| Figure 1. A map of the Thunder Bay Administrative District showing the localities from which the collections were made. | 15 |
| Figure 2. A sample of the record sheets used for the collection data. | 101 |
| Figure 3. A diagram of the protractor adapted for measuring angles of the surfaces of ants nests in relation to the horizontal. | 103 |

List of Tables

| | Page |
|---|------|
| Table 1. The locality in which each species was collected is shown in this table. The first nine localities are those which received more intensive investigation. | 88 |
| Table 2. This table shows a comparison of the species collected in Alberta, British Columbia, Quebec, Minnesota, and North Dakota with those collected in the Thunder Bay District. | 90 |

Introduction

There has been considerable investigation of North American ant species during the past 80 years. There was some investigation before 1890, but apparently, Emery (1893-1894, 1895) was the author of the first major papers on these ants. It was not until Wheeler started to produce his voluminous works in 1900, and published his book entitled Ants, Their Structure, Development, and Behaviour in 1910a, that interest began to grow in North America. The first papers were concerned mainly with taxonomy and distribution of ants. More recent publications include these aspects, but there has been a definite increase in the number of behavioural, ecological, and physiological studies.

A review of the literature has revealed that, in spite of the numerous North American papers, very few of these have dealt with ants of Canadian areas. Hence, it was the primary aim of this study to collect and identify ants of the Thunder Bay District, Ontario, Canada, during the period from April 1, 1970, to August 1, 1970, with the object of preparing an annotated list, and a key based on Creighton's Ants of North America (1950) with necessary modifications.

The first lists of the ants of the North American continent appeared during the 19th century, but the majority of papers did not appear until Wheeler started to publish his lists at the turn of the century. Other workers have prepared lists of various regions, but even with the increased interest which has developed in the past half-century, many of the lists are still Wheeler's. The major contributors, in chronological order, are: Cresson, 1856; McCook, 1881; Mayr, 1886; Emery, 1893-1894, 1895; Wheeler, 1904, 1905a, 1905b, 1906, 1913a, 1916a, 1916b, 1917a; Burril and Smith, 1918; Smith, 1924; Wheeler, 1932; Smith, 1934, 1935, 1936; Cole, 1937; Wing, 1939; Cole, 1940; Wesson and Wesson, 1940; Mallis, 1941; Cole, 1942; Amstutz, 1943, Buren, 1944; Gregg, 1944, 1946; Cole, 1954, Gregg, 1963; Wheeler and Wheeler, 1963; La Rivers, 1968.

The number of Canadian lists is almost negligible. Provancher (1881) prepared a list of Canadian ants even before Emery's works appeared, but since that time there have been very few Canadian lists prepared. These include Buckell's (1932) list of the ants of British Columbia, Sharplin's (1966) list for Central and Southern Alberta, and Francoeur's (1966a) list for a sugar maple stand in Quebec.

There have apparently been no lists of the ants of the Thunder Bay District prepared (personal communication with G.L. Ayre, W.L. Brown, and C.J. Sanders). The only known records were made by Sanders who has collected Camponotus herculeanus (L.), C. pennsylvanicus (DeGeer), and C. noveborascensis (Fitch) from the Black Sturgeon Research Station in Thunder Bay District (personal Communication).

Preparation of the annotated list of the ants of the Thunder Bay District involved: 1. making collections of as many species as possible during the study period in various localities of the district; 2. identification of the specimens using the various keys available, with the assistance of G.L. Ayre, Canada Department of Agriculture, Research Branch, Belleville, Ontario, A. Francoeur, University du Québec à Chicoutimi, Chicoutimi, Québec, and C.J. Sander, Department of Fisheries and Forestry, Canadian Forestry Service, Forest Research Laboratory, Sault Ste. Marie, Ontario; 3. preparation of collections for Lakehead University's Natural History Museum; 4. preparation of a check-list of the species present in this district; 5. notes of observations made on each species as each collection was made; 6. preparation of a key to the ants of Thunder Bay.

The study also involved a brief experiment on the temperatures in four nests of Formica fusca L. This study was designed to determine what range of temperatures exists in ant mounds under particular conditions, and what effect death of the colony has on the temperatures within mounds. Unfortunately, this study was unsuccessful because of vandalism.

The investigation of temperatures was initiated because one of the most obvious phenomena to anyone collecting ants is that the temperature in the nests differ considerably from those of the surrounding soil. Ants are known to be temperature-dependent, but as Wheeler (1910) stated: "chained to the earth as they are, they have come to adapt themselves perfectly to its great thermal vicissitudes". Myrmecologists have been fascinated by these adaptations, and as a result, a number of investigations of temperatures in nests have been made. A majority of the studies have involved mound nests, since the differing temperatures are particularly evident in such nests.

In the literature, three theories on how the temperatures in the mounds are 'controlled' have been expounded: 1. the temperatures in the nests are affected by the metabolic activities of the ants; 2. the temperatures are affected by the behavioural activities of the ants; 3. the temperatures are affected by the physical structure of the nest.

In this experiment, temperatures in four similar nests of Formica fusca were measured using copper-constantan thermocouples attached at 50, 25, 10, and 1 cm. above the surface of the nests, at the nest surfaces and 1, 10, 25, and 50 cm. below the surface of the nests. The standards were inserted centrally in the nests. Temperatures were recorded twice on hot, sunny days, twice on cool, cloudy days and once on a rainy day both before and after poisoning of the ants of two of the nests. The results obtained from this study have not been recorded in this thesis because the nests were vandalized soon after the poisoning of the nests. Some interesting points which did arise from the study (although they are not related to the original objective) are:

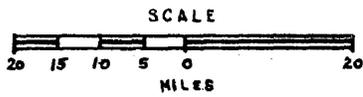
1. a maximum temperature range in a single nest of 39.8°C . was found;
2. on rainy days, the temperature range over the metre was very small;
3. on cool, cloudy days, the temperature in the surface 10 cm. was slightly higher than elsewhere in the nest;
4. on hot, sunny days, the temperature within the top 10 cm. was considerably higher than elsewhere in the nest;
5. the temperature 50 cm. below the surface varied very little during the study.

Figure 1. A map of the Thunder Bay Administrative District showing the localities from which the collections were made. The centres of more intensive study have been marked with red. (Courtesy of the Ontario Department of Lands and Forests)

- Legend:
1. Kashabowie
 2. Fallingsnow Lake
 3. South Gillies
 4. Stanley
 5. Redfern Farm
 6. Ware Township
 7. Island Lake
 8. Red River Road
 9. Mountain Road, South Neebing
 10. Thunder Bay Bypass
 11. Mount McKay (V),(T) *
 12. Tenth Avenue Heath
 13. Lakehead University Campus
 14. The City of Thunder Bay
 15. Shuniah Lake
 16. Trowbridge Falls Campground
 17. Spruce River Road
 18. McKenzie Station
 19. Palette Island
 20. Sunnyside Beach
 21. Amethyst Harbour
 22. Keshkabuon Island
 23. Sibley Peninsula
 24. Ouimet Canyon
 25. Black Sturgeon Research Station

* Since the habitats of Mt. McKay are distinct in the valley and at the top, these areas have been considered separately throughout the work, and have been referred to as (V) and (T) respectively.

THUNDER BAY ADMINISTRATIVE DISTRICT

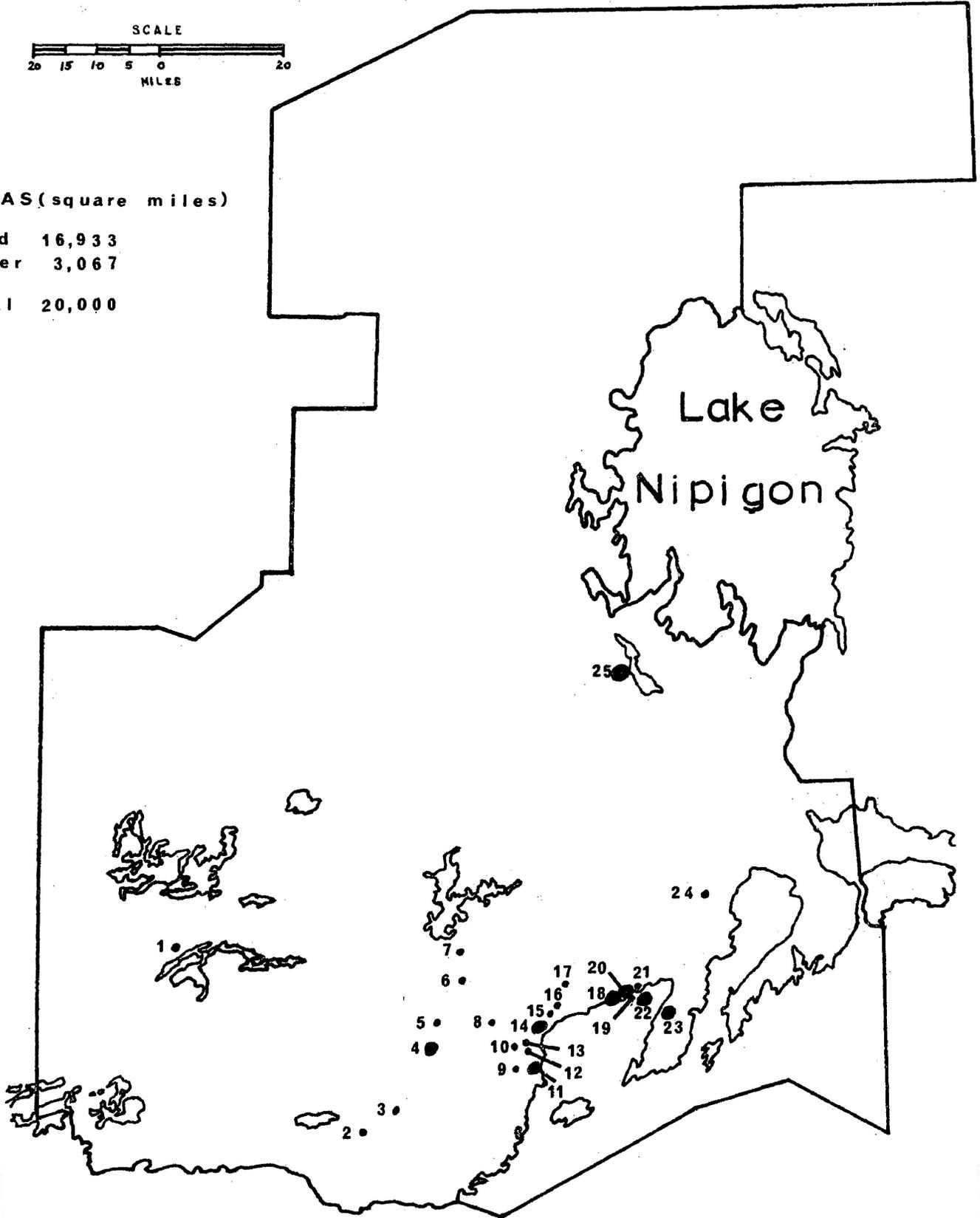


AREAS (square miles)

Land 16,933

Water 3,067

Total 20,000



Site Description

The Thunder Bay District is of particular interest from a biological aspect. One of the reasons for this is that the District is located centrally on the North American Continent. Because of this position, the climatic effects and past glaciations have had interesting influences on the flora (personal communication with D. R. Lindsay, Biology Department, Lakehead University) and presumably on the fauna.

The District is north of Lake Superior, south of Hudson' Bay. It includes part of the Precambrian Shield, the Boreal Forest, the Hudson' Bay Lowlands, and the Lake Forest, so it may be expected that the ant fauna will contain members typical of each and all of these regions.

In the last glaciation this District was on the eastern border of the corridor which was earlier to thaw--the large band extending from northern Alberta south-east across Manitoba through the Thunder Bay District and southward. Hence, it is possible that since that time species have invaded from the north-west and from the south, and that the area should have a varied fauna--not necessarily large, but interesting in its members. The flora of the District has proven to have a great variety, even including some Arctic species, and the ant fauna was expected to have a similar variety.

Stanley was chosen as an area for intensive collection because

it is an 'island community'. There is a stand of burr oak and a stand of black ash about one mile west of the Stanley Post Office. These are typical of a milder climate with longer summers and gentler winters, and I suspected that it might yield some interesting species of ants.

Two different habitats were investigated on Mount McKay. The first was a valley which is shaped so that the heat from the sun warms the area and is trapped. The trees in this area usually blossom about two weeks before trees in other parts of the District. There is a sugar maple stand in this area which is considered to be a relic or invasionary stand depending on who is discussing it. It is more typical of habitats found in southern Ontario than of those found here.

The second habitat on Mount McKay was the very dry, desert-like top of the mountain. It is constantly swept by wind, and consequently the vegetation is stunted. Incoming radiation has a very strong effect on the rocks, and as a result there must be a very large temperature range daily at the surface of the rock. This habitat was also expected to have some interesting species.

The City of Thunder Bay has the typical environment of a city of 100,000. It is, of course, of a more northern locality than most, but its climate is moderated by Lake Superior. It was expected to have some of the species which thrive on the effects of human population.

McKenzie Station is a sandy blueberry barrens type of habitat. I thought that since this area is so extensive--extending for several square miles, it might yield some species which inhabit drier localities.

Sunnyside Beach, Keshkabuon Island and Sibley Peninsula have more or less the same attributes, but since one of the most interesting features of the district is Lake Superior, and all of these are on the lake (fig. 1), I decided that more extensive investigations in these places should be made.

The habitat which was visited most frequently at Sunnyside Beach was a Poplar-Birch stand on a rocky area about 100 m. from the shore of Lake Superior.

On Keshkabuon Island, the west shore was studied for species which might have arrived on driftwood or have been blown onto the island. It was also interesting simply because it is a fairly large island about 1 mile from the nearest mainland.

Sibley Peninsula was also explored generally as an interesting habitat. It is a very large area, and could not be studied adequately in the few visits it received. It has Poplar-Birch stands, some very large and old White Pine, Black Spruce, and other interesting habitats.

These three habitats were expected to yield some unusual collections.

Black Sturgeon Research Station was chosen as another site for extensive investigation, for two reasons: it was readily accessible, and could be considered 'Boreal Forest'. It was expected to have fewer species but that these would be more 'northern' than any of the other collecting localities.

Methods

In order to determine which method(s) would be most suitable for making and preserving the collections, it was necessary to investigate methods used by other collectors. Most of the authors agree about the basic equipment to be included in a collecting outfit. The necessities include a trowel, a pair of 'soft' forceps, vials, fixative, a notebook and labels, a groundsheet, and bags or large jars. The use of these items is generalized: the trowel is used for digging up the nest and spreading the contents on the groundsheet. 'Soft' forceps are used for picking the ants off the groundsheet and placing them in a vial containing the fixative. The bags or large jars are used for taking whole nests and large samples back to the laboratory, and, of course, notes are made on all collections (Wheeler, 1910^a; Donisthorpe, 1943; Morley, 1955; Wheeler and Wheeler, 1963). Variations on this basic method are used by each individual collector, so there are some pieces of 'optional equipment'. Wheeler (1910^a) included cotton for separating the collections so that several collections may be kept in a single vial. He also suggested that a pocket lens might be a useful instrument to have handy in the field. Donisthorpe (1943) included a large amount of 'optional equipment' in his collecting outfit: a small sieve for sorting ants from sand; a U-tube pooter for picking up ants; a pocket lens; a small cyanide bottle in which he killed the ants; a saw, a spade, and an axe for more thorough examination of nests; a sweeping net for collecting ants from vegetation; and a camera. Wheeler and Wheeler (1963) suggested that a hunter's or fisherman's vest for carrying equipment, chloroform, a compass, and a tape measure would also be useful.

Various recipes for a fixative in which ants are placed for preservation have been suggested: 1. 95% commercial alcohol or "even strong whiskey" (Wheeler, 1910^a); 2. "5 parts by volume strong acetic acid, 35 parts absolute alcohol, and 60 parts of a 1/500 solution of aqueous mercuric chloride" (Donisthorpe, 1943); 3. "one-third of a solution of hydrochloric acid diluted to half-strength with water, with the remaining two-thirds made up with 50% alcohol" (Morley, 1955); 4. 85% alcohol (Wheeler and Wheeler, 1963; Gregg, 1963).

These researchers also suggested various places in which to look for ants: under stones and logs, under or in bark, in rotten wood, in hollow twigs, in old galls and rootstocks, in vegetable mould, among the roots of plants, in open soil, in mounds, in banks, in nests of other ants, and in houses (Wheeler, 1910^a; Donisthorpe, 1943; Wheeler and Wheeler, 1963; Gregg, 1963).

Wheeler (1910^a), Donisthorpe (1943), Morley (1955) and Wheeler and Wheeler (1963) suggested that two collections be kept: one reference collection which is appropriately pinned, and another, the remainder of the collection, kept in vials containing the fixative. Gregg (1963) and Sanders (personal communication) suggested that the entire collections be maintained in liquid fixative.

The investigation of the species of ants of the Thunder Bay District involved collecting expeditions to various parts of the district (fig. 1). Although some of the areas were visited only once or twice, more thorough investigations were attempted in several areas which include Stanley, Mount McKay, City of Thunder Bay, McKenzie Station, Sunnyside Beach, Keshkabuon Island, Sibley Park and Black Sturgeon R.Stn.

Some of the collections were made in the fall of 1969, but the majority of the collections were made between April 1, 1970, and August 1, 1970. During this latter period, an attempt was made to spend at least two days of each week collecting specimens in the field. This required that two more days weekly be spent in the laboratory sorting, labelling and identifying the specimens collected. Incidental collections were made throughout the study.

During the course of the study two study sheets were designed. The first was very simple, but was inadequate in several ways. It was abandoned for an improved version (Appendix I). This version was based on the first, combined with some ideas borrowed from G. L. Ayre (Personal communication). These sheets were completed in as much detail as possible at the site of the collection, although such data as latitude, longitude, and altitude were added in the laboratory.

The field collecting equipment included: 8 dram 'snap-cap' vials, 70% ethanol (this is the standard fixative used for preserving insects at Lakehead University), a protractor designed to measure the angle of inclination of nest surfaces (Appendix I), a compass, a metric tape measure, a hatchet, a hunting knife, a trowel, plastic bags, labels, a pocket thermometer, a groundsheet, pencils, clipboard, record sheets, 'soft' forceps, and a packsack.

The method used generally involved travelling to the site to be explored, seeking out the nests in almost any habitat, digging up part of the nest with the trowel or cutting with the hunting knife and/or hatchet (since no further studies were planned, the nests were destroyed), placing the collection in a plastic bag, labelling, and filling

in a record sheet (sometimes the compass, protractor, thermometer, and tape measure were employed, but, more often, the statistics were estimated). When the ants seemed very small or if there were only a few specimens, the sample was generally placed on the groundsheet, and the specimens placed in the vial of alcohol. If the specimens were placed in a plastic bag, they were carried to the laboratory and placed in the refrigerator overnight. Generally, collections were sorted the day after they were made. The contents of a bag were spread on a tray and the ants picked up with soft forceps and placed in a petri dish containing the fixative, which immobilized them. They were resorted from the debris (accidentally picked up with the ants) and placed in a vial containing 70% ethanol. These vials were labelled with a number on a piece of rough plastic placed inside the vial, and with number, species, date, locality, and collector on adhesive labels placed on the side of the vial and on the cap. These were then stored for later identification.

Specimens with tentative identifications were sent to G. L. Ayre and A. Francoeur for confirmation or correction. These specimens were sent in 4-dram 'screw-cap' vials in 70% ethanol. Labels containing number, date, locality, and collector were placed inside the vials, and a covering letter was also sent. Both Ayre and Francoeur were kind enough to make pertinent comments about the collections and identifications. C. J. Saunders identified some specimens of Camponotus and discussed the problems of that genus with me. He also sent some specimens of Camponotus pennsylvanicus which he had collected at the Black Sturgeon Research Station to add to my collection.

Results and Discussion

More than three hundred collections of ants were made in the course of the study. By counting a considerable number of samples, it was determined that the average collection contained slightly more than 100 ants. Hence, the collections probably contain more than 30,000 individual ants.

The ecological data collected with the ants is included on the following pages. The species are treated separately (with subspecies included with species) in the order found in Creighton's (1950) work.

With each species I have included the known range from the most recent publication available to me. In most cases this has been Wheeler and Wheeler (1963) in which cases I have quoted verbatim their description of range excluding comments pertinent only to North Dakota. In cases where Wheeler and Wheeler did not describe the species in question, appropriate acknowledgement has been made.

With each species, the localities in the Thunder Bay District in which it was collected, the number of records for each species (two numbers: the first is the total number of records including those nests which were seen and not collected; the second is the actual number of collections), the occurrence (less than five collections is considered rare, five to ten collections is uncommon, ten to twenty collections is moderately abundant and more than twenty collections is common), the microhabitats in which it was collected, and 'reproduction' or the reproductive phases of each species noted as it was

collected. With each species, comments on habits, nests, colour of workers (as described in the field notes, and as described in a publication on the species) and other ecological aspects of interest have been included.

Myrmica americana Weber

Range: Maine and Quebec to the Rocky Mountains and south to
Tennessee and Arizona.

Thunder Bay Localities: Black Sturgeon, 22-VI-70.

Number of Records: 1 (1)

Occurrence: rare.

Microhabitats: sand under a small dry piece of wood.

Reproduction: no records.

This genus is currently being revised by R. Béique, Laval University, Quebec City, Quebec.

This collection was found under a small piece of wood in a very dry sandy area in an abandoned baseball field. It is surprising that there was only one collection of this species made, particularly since that collection was made in a Boreal Forest biome, a more northern habitat than is found in other areas of the district, and Wheeler and Wheeler's (1963) description of the range of this species leads one to believe that the Boreal Forest is not a favoured habitat.

The workers were described as medium-sized and black, with very shiny gasters. Wheeler and Wheeler (1963) have described them: "Head dark red to yellowish red, thorax yellowish red to red, gaster bicolored dark reddish brown with light red to dark reddish brown with yellowish red." They have also noted that "In

the field, the workers appear medium sized and brown...".

These ants were very sluggish at the time of collection although the air temperature was approximately 20°C., and the nest temperature must have been at least 25°C.

Myrmica brevispinosa Wheeler

Range: From Newfoundland and Nova Scotia to Washington and California.

Thunder Bay Localities: Tenth Avenue Heath, 28-V-70; Lakehead University Campus, 10-VI-70; City of Thunder Bay, 1-VI-70, 5-VI-70; McKenzie Station, 9-VI-70.

Number of records: 15 (9)

Occurrence: uncommon.

Microhabitats: sand, sandy-clay, very small earthen mounds, in moss, grass roots, plesiobiosis.

Reproduction: males: 28-VIII-70;

alate females: 28-VIII-70;

dealate females: 28-V-70; 1-VI-70; 5-VI-70; 10-VI-70.

This species has been subdivided into M. b. brevispinosa Wheeler and M. b. discontinua Weber on the basis of the length of the epinotal spines. Ayre, who examined some of these collections for me, expressed some doubt about the subspecies. The majority of the specimens appeared to belong to the subspecies M. b. discontinua, but the lengths of the epinotal spines within each collection were variable, although a considerable majority in each were longer than "one-half as long as the distance which separates their tips" (Creighton, 1950). Ayre stated, "If an insect is sufficiently different (morphologically or ecologically) then it is worthy of being a species" (personal communication).

I tend to agree with him in this aspect, and have, therefore, designated all specimens of this group as Myrmica brevispinosa.

Most of the collections of M. brevispinosa were collected in very dry habitats. Of the 15 records, 14 were from areas of sand or sand and clay. Only one was recorded from a small Sphagnum sp. hummock in a very damp habitat.

The workers were described as red with a dark gaster, all red, red with a black gaster, yellowish red, and red head and thorax with a red-black gaster. Wheeler and Wheeler (1963) described them: "head dark reddish brown to yellowish red, thorax yellowish red to reddish yellow, the gaster very dusky red to dark reddish brown." The gaster of this species is strongly shining, a feature which is immediately evident even in the field.

M. brevispinosa was found living in plesiobiosis (i.e. "The occurrence of two entirely separate colonies of different species of ants under the same stone, or in the same colony. (Donisthorpe and Morley, 1945) with Myrmica emeryana Forel and M. lobicornis fracticornis Emery.

Myrmica emeryana Forel

Range: Newfoundland to Georgia and west to Manitoba and Arizona.

Thunder Bay Localities: South Gillies, 8-VI-70; Thunder Bay Bypass, 4-VI-70; Mount McKay, 10-VIII-70; Lakehead University Campus, 11-VI-70; City of Thunder Bay, 5-VI-70, 9-VI-70; Sunnyside Beach, 14-VIII-70; Amethyst Harbour, 21-VI-70; Sibley Peninsula, 13-VI-70; Quimet Canyon, 6-VI-70.

Number of Records: 12 (12)

Occurrence: uncommon

Microhabitats: sand, humus, wood, clay, under rock, plesiobiosis.

Reproduction: males: 10-VIII-70; 14-VIII-70;

alate females: 14-VIII-70;

delate females: 4-VI-70; 5-VI-70; 8-VI-70;

9-VI-70; 11-VI-70.

This species is relatively uncommon in this District, although from Wheeler and Wheeler's description of range, it should be expected here. Wheeler and Wheeler (1963) have recorded M. emeryana from moist, shady habitats only, whereas, in Thunder Bay, it was found both in shady habitats and dry habitats. One of the driest habitats found in the District was the top of Mount McKay. Three collections of M. emeryana were made there.

The description of the workers was similar in all cases: the head was described as reddish brown and dull, the thorax as reddish brown to reddish brown to reddish yellow, and dull, and the gaster as black or brownish black. Wheeler and Wheeler (1963)

have described them: "head and gaster very dusky red, thorax dark red. Head and thorax dull, gaster strongly shining."

These ants were considered very sluggish, and at no time was their activity described as high, although some of the collections were made in very warm temperatures.

These ants were found living in plesiobiosis with Myrmica brevispinosa, M. lobicornis fracticornis, Stenamma brevicorne (Mayr), Camponotus herculeanus, Formica lasioides Emery, and Formica fusca.

Myrmica incompleta Provancher

Range: Alaska, Canada, Labrador, and the northern half of the United States, with an extension down the Rockies to New Mexico (Wheeler and Wheeler, 1963--comments on Myrmica brevinodis from which M. incompleta has been removed as a subspecies). Francoeur, who gave this species specific status, described it: "Mostly temperate biome species" (personal communication).

Thunder Bay Localities: Thunder Bay Bypass, 18-VII-70; Mount McKay (T), 10-VIII-70; Shuniah Lake, 13-V-70.

Number of Records: 4 (4)

Occurrence: rare.

Microhabitats: wood, leaf mould.

Reproduction: males: 10-VIII-70;

alate females: 10-VIII-70;

dealate females: no records.

There has been some confusion about the species Myrmica brevinodis Emery. Francoeur recently separated M. incompleta from the forms involved around M. brevinodis. He outlined the characteristics of this species in a personal letter to me: "Male: antennal scape short, equal to 2 to 2.5 first funicular segments. Basal half of wing yellowish or brownish. Worker and female: median portion of clypeus straight or concave, head seen in full

face view. In a majority of a nest series, dorsal surface of post-petiole with rugae in the middle. Bigger species with smaller eyes statistically."

This species was found only in very moist habitats. It was never found active outside the nest, and was always considered sluggish.

In the field it was described as blackish brown. In one case the thorax was described as lighter than the head and gaster.

Myrmica kuschei Wheeler

Range: known only from Alaska (Creighton, 1950). Evidently, this species has been found elsewhere, because Francoeur has described it as a "Boreal biome species" (personal communication).

Thunder Bay Localities: Thunder Bay Bypass, 18-VI-70, 26-VI-70; Tenth Avenue Heath, 30-IX-69; Sibley Peninsula, 13-VI-70.

Number of Records: 8 (8)

Occurrence: rare.

Microhabitats: under wood, under leaf mould, under peat, under moss, plesiobiosis.

Reproduction: males: no records:

alate females: no records.

dealate females: 18-VI-70.

This species has been included in the confusion about the forms involved around M. brevinodis. It has been given specific status, and Francoeur outlined its characteristics for me: "Male: antennal scape long, equal to 3.0 to 4.5 first funicular segments. Wings colourless, appearing often whitish; nervation yellowish brown. Worker and female: median portion of clypeus convex, head seen in full face view. Dorsal surface of postpetiole smooth in the middle. Smaller species with bigger eyes statistically."

This species was found only in very moist conditions in Black Spruce-Sphagnum sp. bogs. It was found under a variety of

natural objects: wood, moss, leaf mould.

In the field notes it was described as black with a red thorax . It has a dull head and thorax and a very shining gaster.

It was very 'sluggish', and made no attempt to rescue the eggs and larvae when disturbed.

This species was found living in plesiobiosis with Camponotus herculeanus.

Myrmica lobicornis fracticornis Emery

Range: Newfoundland to Alaska and south over most of the United States except perhaps the extreme southern states.

Thunder Bay Localities: Kashabowie, 22-V-70; Stanley, 17-VI-70; Thunder Bay Bypass, 18-VI-70; Mount McKay, 3-VI-70; Lakehead University Campus, 13-V-70, 1-VI-70, 10-VI-70, 30-VI-70; City of Thunder Bay, 31-V-70, 5-VI-70; Trowbridge Falls Campground, 18-IV-70; Keshkabuon Island, 6-VIII-70; Black Sturgeon Research Station, 7-V-70, 22-VI-70.

Number of Records: 22 (22)

Occurrence: common.

Microhabitats: sand, sandy clay, plant debris, loam, wood, under moss, under rock, under grass, under wood, under lichen, plesiobiosis.

Reproduction: males: no records;

alate females: no records;

dealate females: 7-V-70, 13-V-70, 1-VI-70, 10-VI-70, 18-VI-70, 22-VI-70, 6-VI-70.

This species was found in much drier habitats than were most of the other species of this genus.

This species was described as concolorous black, and in one case it was noted that the thorax appeared red. Wheeler and Wheeler (1963) have described it: "Head very dusky red to dark reddish brown, thorax yellowish red to reddish yellow, gaster

very dusky red to dark reddish brown. Head and thorax dull, gaster shining."

At one time these ants were collected from the flowers of Cornus canadensis L. and Cornus stolonifera Michx. They seemed to be more active in general than the other species of Myrmica. Foragers were also collected from a compost heap in Thunder Bay, and from fruit of Amelanchier sp.

Ants of this species were found living in plesiobiosis with Myrmica brevispinosa, M. emeryana, Tapinoma sessile (Say), Brachymyrmex depilis Emery, Camponotus herculeanus, Formica fusca L. and F. lasiocides Emery

Stenammas brevicorne (Mayr)

Range: "From at least Nova Scotia, Quebec, and Ontario south to Virginia and west to Nebraska and Minnesota" (Smith, 1957).

Thunder Bay Localities: Red River Road, 9-VI-70.

Number of Records: 1 (1)

Occurrence: rare.

Microhabitats: rotting log under cover of moss, plesiobiosis.

Reproduction: no records.

This genus has recently been revised by Smith (1957).

This collection was found under the surface of a very rotten log, in a small opening in a Black spruce-Sphagnum sp. bog. The log was moss-covered, and the ants were just below this covering. The habitat was very moist, and appeared that it would remain so most of the time.

This species was described as reddish-brown. Smith (1957) has described the workers: "Head, thorax, petiole and postpetiole dark brown; antennae and legs light brown or yellowish brown. Gaster brown or blackish with the apex and the base lighter thus causing the dark area to appear as a more or less distinct, transverse band."

This species was found living in plesiobiosis with Myrmica emeryana.

Stenamma diecki Emery

Range: "Southeastern and southwestern Canada and most of the United States except the extreme central states and a few of the southern States" (Smith, 1957).

Thunder Bay Localities: Keshkabuon Island, 27-VII-70.

Number of Records: 1 (1)

Occurrence: rare

Microhabitats: humus under a thick layer of moss.

Reproduction: males: no records;

 alate females: no records;

 dealate females: 27-VII-70.

This collection was found under a thick moss layer in a shaded area in a Populus tremuloides Michx. stand. The habitat was very moist. Although this area may be included in "the extreme central states", it is noteworthy that Smith added this comment to the distribution: "No doubt the species has a much wider distribution in Canada than present records would indicate".

The workers were described as red but when examined in the laboratory appeared light brown to brown as Smith described them (1957).

There was a peculiar behaviour phenomenon observed while these specimens were being collected: they appeared to 'play dead'. This has also been observed by W. L. Brown and E. O. Wilson (in Smith, 1957).

Leptothorax muscorum (Nylander)

Range: Canada and the Southern United States, with an extension in the Rocky Mountains to Colorado.

Thunder Bay Localities: Thunder Bay Bypass, 18-VI-70; Mount McKay (T), 10-VIII-70; Lakehead University Campus, 13-V-70, 19-V-70; 2-VIII-70; McKensie Station, 25-VII-70, 7-VIII-70; Black Sturgeon Research Station, 6-V-70, 22-VI-70, 23-VI-70.

Number of Records: 15 (15)

Occurrence: moderately abundant. Common in the Boreal Forest Biome.

Microhabitats: wood, sand, gravel, under wood, under miscellaneous covering objects, plesiobiosis.

Reproduction: males: 22-VI-70 (pupae), 23-VI-70 (pupae), 23-VI-70, 23-VII-70 (pupae).

alate females: 22-VI-70 (pupae), 23-VI-70, 23-VI-70 (pupae), 2-VII-70.

dealate females: 6-V-70, 13-V-70, 19-V-70, 18-VI-70, 23-VI-70, 2-VII-70, 10-VIII-70.

This species has recently been named Leptothorax muscorum by Francoeur and Béique (1966a). Apparently, prior to this revision, it was L. canadensis Provancher, but Francoeur and Béique have decided that the variation from the European species is interspecific.

Most of the collections were made from rotting logs and trees, however, it was found carving its way through a living cherry

tree. It is amazing that such tiny ants could make tunnels in such strong wood--the hatchet would not penetrate this wood. Brown (1955) described it as "one of the very few truly boreal-alpine members of its family." Most of the collections were from the Boreal habitat.

The workers were described as concolourous black or dark brown. Wheeler and Wheeler (1963) described them: "dark reddish brown varying on head and thorax reddish black or thorax yellowish red, gaster very dusky red."

In two cases it was noted that the workers feigned death before carrying away the young.

This species was found living in plesiobiosis with Camponotus herculeanus, Camponotus noveborascensis Fitch, Formica fusca, F. montana Emery, and F. subnuda Emery.

Leptothorax provancheri Emery

Range: Eastern Canada and New England, west to Alberta, North Dakota and New Mexico.

Thunder Bay Localities: Lakehead University Campus, 13-V-70;
McKenzie Station, 25-VII-70.

Number of Records: 2 (2)

Occurrence: rare.

Microhabitats: under Sphagnum sp., under wood in sand, plesiobiosis.

Reproduction: males; no records;

alate females: 25-VII-70;

dealate females: 13-V-70.

This species was found in two very different habitats: very dry and very wet. This apparently agrees with previous findings.

The workers were described as small with a dark red head and gaster, and a lighter thorax, gaster strongly shining. Wheeler and Wheeler (1963) have described them: "Head and gaster dark reddish brown, thorax yellowish red. Head and thorax dull, gaster strongly shining."

Wheeler and Wheeler (1963) have noted that this species often lives in the nests of Myrmica incompleta, M. kuschei and M. lobicornis fracticornis as an inquiline. It was not found associated with these species here, but in nests of its own. The only species with which it was associated was Formica fusca and, in this case, it shared the area under a log.

Leptothorax poss. texanus Wheeler

Range: "central Texas to southern Ohio" (Creighton, 1950).

Thunder Bay Localities: Mount McKay (T); 10-VIII-70; Sunnyside,
17-V-70, 18-V-70, 9-VII-70; Sibley Peninsula, 13-VI-70.

Number of Records: 7.(7)

Occurrence: uncommon

Microhabitats: peat, wood, sand, plant debris, under rock.

Reproductions: males : 10-VIII-70;

alate females: 10-VIII-70;

dealate females: no records.

This species is most interesting because it is so far out of its range. It is ^{possible} ~~assumed~~ that this is an incorrect identification, but Creighton's key (1950) leads directly to the conclusion that this is the correct identification firstly because there is no trouble with the key, and secondly because in his discussion of the species, Creighton made the following comment, "Gregg (1946) has recorded this species from northeastern Minnesota. The record, which was based on a single worker is rather more than suspect. It is scarcely credible that texanus, whose range west of the Mississippi lies mainly below the northern border of Oklahoma, should occur in Minnesota. As to what species Dr. Gregg had is questionable but it seems clear that it was not texanus." Ayre made the following comments about the specimens which were sent to him: "This one has me completely confused. In all respects except for the tibial spurs it appears to be Myrmica. Creighton's

keys take it to Leptothorax but the largest known North American Leptothorax is about 3.3 mm and most are smaller. Most of the ants in this series are over 4 mm. M.R. Smith's keys take it to Aphaenogaster but the thoracic structure is completely wrong for this genus.

The identification of this species is questioned because of Creighton's and Ayre's comments, and because the record is so far from the known range. Dr. Ayre is currently investigating the possibility that this is a new species and possibly a new genus. At the very least, it is a new Canadian record.

The moisture levels in the nests of this species varied from very wet to very dry. The majority were found in sand, but others were from logs so rotten that the water could be wrung out of them.

The specimens were described as black to dark brown with a slightly lighter thorax. I have no comparative descriptions available at this time.

Dolichoderus taschenbergi (Mayr)

Range: Nova Scotia to South Carolina and west to Manitoba and
Louisiana

Thunder Bay Localities: Sunnyside Beach, 5-VII-70, 25-VII-70.

Number of Records: 2. (2)

Occurrence: rare.

Microhabitats: unknown.

Reproduction: males: no records;

alate females: 5-VII-70;

dealate females: 5-VII-70, 25-VII-70.

The identification of this species was difficult because only females (as opposed to workers) were collected. Ayre identified them as D. taschenbergi "more through a process of elimination than anything else. Since no other collections were made, it was postulated that perhaps these specimens were washed onshore by the strong south-west wind which preceded their collection. However, since many of the specimens were living, it is possible that ~~there~~ are nests very near the beach which have yet to be located.

These specimens were a concolourous shiny black.

The flight probably occurred on the night of July 4, 1970.

Tapinoma sessile (Say)

Range: Southern Canada and the entire United States except the southwestern deserts; rare in the Gulf States.

Thunder Bay Localities: Stanley, 9-X-69, 21-V-70, 17-VI-70;

Thunder Bay Bypass, 4-VI-70; Mount McKay, 3-VI-70; Tenth Avenue Heath, 28-V-70; Lakehead University Campus, 13-V-70;

City of Thunder Bay, 15-VII-70; Sunnyside Beach, 9-VII-70;

Black Sturgeon Research Station, 7-V-70.

Number of Records: 18. (13)

Occurrence: moderately abundant.

Microhabitats: gravel, wood, loam, plant debris, humus, sand, under rock, plesiobiosis.

Reproduction: males: 4-VI-70 (pupae), 17-VI-70 (pupae),

9-VII-70 (pupae), 15-VII-70 (pupae);

alate females: 4-VI-70 (pupae), 9-VII-70 (pupae),

15-VII-70 (pupae);

dealate females: 21-V-70, 28-V-70, 17-VI-70,

9-VII-70, 15-VII-70.

The taxonomy of this species was reviewed by Creighton (1950), and has not been revised.

This species was found in a variety of habitats most of which were neither dry nor wet. This species is apparently common in a large part of North America and it is adapted to a wide variety

of habitats as expected with such a distribution.

The workers were described as concolourous black . Wheeler and Wheeler have described them: "Concolourous dark reddish brown to dark brown."

A peculiar behaviour was noted when collections of these ants were made: the workers move about the nest with their gasters raised in the air, waving around the pointed abdomen as though it were some fearsome weapon. However, according to Wheeler and Wheeler, "They do not sting or bite, but they are annoying..." The colonies usually contained hundreds of ants.

These ants were found living in plesiobiosis with Myrmica lobicornis fracticornis, Brachymyrmex denilis, Formica lasioides, and Formica fusca.

Brachymyrmex depilis Emery

Range: Nova Scotia to British Columbia and south across the U.S.A., including Florida and California

Thunder Bay Localities: Stanley, 9-X-69, 21-V-70, 7-VI-70, 17-VI-70; Mount McKay (V), 3-VI-70.

Number of records: 51 (9).

Occurrence: uncommon; abundant in the two areas where it was found.

Microhabitats: gravel, sand, under rocks, under wood, under leaf mold, under moss and lichen, plesiobiosis.

Reproduction: males: 3-VI-70 (pupae); 17-VI-70 (pupae); alate females: 3-VI-70 (pupae); 17-VI-70 (pupae); dealate females: 17-VI-70.

This genus was last revised by Creighton (1950).

The minute workers (length: 1.5-2 mm. Wheeler and Wheeler, 1963) have been recorded as having a yellowish-brown head and thorax, and a slightly lighter gaster particularly on the ventral side. Wheeler and Wheeler (1963) have recorded its colour as "Concolorous strong brown to reddish yellow", but the specimens collected in this District have exhibited only the colour described from the field notes.

Workers were observed tending scale insects on roots of strawberries and grasses.

The study served to confirm previous reports that this ant is very versatile in habitat, particularly microhabitat (Wheeler and Wheeler, 1963). It was found in a large variety of nests in varied surroundings, but it was found only in two very specific localities, although it was abundant in both.

It was found living mainly in plesiobiosis with, or occupying vacated tunnels in nests of other species. It was generally found when collections of other species were being made. In the course of this study it was found living in plesiobiosis with Myrmica lobicornis fracticornis, Lasius alienus, L. nearcticus, Formica fusca, F. lasioides, F. oreas, F. ulkei, Tapinoma sessile.

Camponotus herculeanus (L.)

Range: "Holarctic; in North America, Alaska, and Canada, and the northern border of the United States, with extensions in the Eastern mountains to Pennsylvania, in the Rocky Mountains to New Mexico, and in the Cascades to Oregon; also mountains of Utah." (Gregg, 1963).

Thunder Bay Localities: Mountain Road, South Neebing, 15-IV-70; Thunder Bay Bypass, 16-V-70, 18-VI-70; Tenth Avenue Heath, 27-V-70; Lakehead University Campus, 30-IV-70, 19-V-70, 2-VII-70, City of Thunder Bay, 19-V-70; Shuniah Lake, 13-V-70; McKenzie, 5-VII-70; Palette Island, 16-V-70; Sunnyside Beach, 9-IX-69, 5-X-69, 17-V-70, 7-VI-70, 7-VII-70, 13-VIII-70; Keshkabuon Island 3-IX-69, 6-VII-70; Sibley Peninsula, 13-VI-70; Black Sturgeon Research Station 6-V-70, 20-VI-70, 22-VI-70.

Number of Records: 60.(32)

Occurrence: common.

Microhabitats: wood (all stages from living to very rotten), loam, sand, under rock, under wood.

Reproduction: males: 16-V-70, 17-V-70, 19-V-70, 7-VI-70;
alate females: 16-V-70, 17-V-70, 19-V-70, 7-VI-70;
dealate females: 6-V-70, 7-VI-70, 13-VI-70,
5-VII-70, 13-VIII-70.

Creighton (1950) last revised this species. There is currently some difficulty with C. herculeanus and C. noveborascensis (personal communication with Ayre and Sanders).

Collections of this species were mostly from wood in various stages of decay. This species is very common in this District, and may be found wherever there is a Boreal Forest biome. It is interesting to note that it was not found at Mount McKay or at Stanley, the two most 'southern' habitats investigated.

The colour of some of the workers collected is interesting: whereas most of the specimens were black with a dark reddish brown epinotum, 13 of the 60 records made were black with a reddish brown mesonotum, and the remainder of the thorax, except the prothorax, red. The colour pattern was constant throughout a nest series. Wheeler^b (1910) described the major workers: "Black; mandibles, anterior border of head, antennae, legs, petiole, posterior portion of thorax and the base of the first gastric segment, deep red." Hence, Sanders (personal communication) postulated that these specimens might be hybrids between C. herculeanus and C. noveboracensis. I have decided to include them with herculeanus because Creighton (1950) included the red thorax as a distinguishing feature in his key.

Some interesting behaviour patterns were also noted in this species. The collections made very early in the spring when the ground was still frozen were found by following a few workers to their nest. In several instances trees were cut open, and yielded a clump of ants about 5 cm. in diameter, and from 2 to 7 cm. in length. These clumps were solid with workers and surrounded with the fine crystals typical of ventilating shafts of mice in the snow. It is assumed that the winged forms and queen were deeper within

the nest, because they were not found in these clumps. The excavations in one particular nest were 5 cm. in diameter, and were tunnel-like--almost as if they might contain mice. The depth and difficulty of exploring further in the ice prevented closer study.

Another interesting behaviour was noted. When a nest was first discovered, there were usually hundreds of specimens evident. But by the time an attempt to collect them could be made, only a few were evident. This happened with each new opening in the nest until one began to wonder where they were going. They seem to hide just at the edges of an opened area. They exhibited a level of activity which was considered 'very high' whenever they were found (except when found inactive and frozen.)

Preparations for a flight of this species were observed on the afternoon of May 19, 1970. The winged females were lined up along large openings in a fallen log so that the opening was crowded with heads and antennae. The air temperature rose to 25° C. on that day, and was the first 'hot' day of 1970. The flight occurred in early evening--around 7:00 p.m. when the sun was setting and the temperature had dropped to about 18° C. The flight was very large and was reported by seven persons, all of whom were kind enough to bring some specimens for verification. Apparently the flight extended over at least a 30-mile area from a point 15 miles out Red River Road to Sunnyside Beach.

This species was found living in plesiobiosis with Myrmica emeryana, M. kuschei, M. lebicornis fracticornis, Leptothorax muscorum, F. lasioides, Formica fusca, F. montana, F. ulkei Emery and F. whympersi adamsi Wheeler

Camponotus noveborascensis (Fitch)

Range: Coast to coast, mainly in latitudes between 40° and 48°.

Thunder Bay Localities: Thunder Bay Bypass: 4-VI-70; Lakehead University Campus, 11-VI-70; McKenzie, 7-VIII-70; Keshkabuon Island, 6-VII-70; Black Sturgeon Research Station, 6-V-70, 7-V-70, 23-VI-70.

Number of Records: 9 (9)

Occurrence: uncommon.

Microhabitats: sand, sawdust, plant debris, gravel, humus, wood, under wood, under miscellaneous covering objects, plesiobiosis.

Reproduction: males: no records;

 alate females; 23-VI-70;

 dealate females: 6-V-70, 23-VI-70.

The taxonomy of this species has been discussed with that of C. herculeanus. A comment made by Sanders (personal communication) about this problem is worth repeating: "...this distinction between herculeanus and noveborascensis is tentative, based largely on the fact that noveborascensis mate later in the season than herculeanus. I have no other evidence of differences... Possibly there are no noveborascensis in that part of the world." If one follows Creighton's (1950) key, it is evident that there are no noveborascensis.

This species seemed to occupy more varied habitats than did C. herculeanus. Five of the nine collections were from under covering objects. Those collections made from stumps seemed to be primarily

just below the bark. There seemed to be little tunnelling involved especially in comparison with the extensive tunnels made by C. herculeanus. No other behavioural differences were noted.

The workers were described as black with entire thorax, epinotum, coxae and femurs bright red. Wheeler and Wheeler (1963) described them: "Major worker. Head and gaster black, thorax dusky red... Minor worker. Head and gaster black, thorax yellowish red." The specimens were identified according to Wheeler and Wheeler's (1963) key because it was used so extensively elsewhere.

This species was found only once living in plesiobiosis with Leptothorax muscorum and Formica fusca--under a large piece of tarpaper. There were remains of C. noveborascensis around the F. fusca entrances.

Camponotus pennsylvanicus (DeGeer)

Range: From Quebec to Florida and west to North Dakota and Texas.

Thunder Bay Localities: Sibley Peninsula, 13-VI-70;

Black Sturgeon Research Station.

Number of Records: 6. (3)

Occurrence: rare.

Microhabitats: unknown.

Reproduction: males: 7-VI-66

alate females: 7-V-66

dealate females: 13-VI-70.

Five of the six records were made by Sanders. The sixth, a single queen, was collected from a sand beach on Sibley Peninsula.

Camponotus (Myrmentoma) nearcticus Emery

Range: Ontario to Florida and west to North Dakota, Utah, and Texas.

Thunder Bay Localities: Mount McKay (V), 27-IV-70.

Number of Records: 2 (2).

Occurrence: rare.

Microhabitats: dead branches of Betula papyrifera Marsh, in solid wood only.

Reproduction: males: 4-IV-70;

alate females: 4-IV-70;

delate females: no records.

There is apparently no difficulty with the taxonomy of this species, and it has not been revised since Creighton (1950).

The two collections were made on Mount McKay, one of the warmer habitats in the district. Possibly a male was sighted at Stanley a short time later, but no collection was possible.

These specimens were described as entirely black. This is possibly because very few workers were found. Most of the specimens were males. Wheeler and Wheeler (1963) have described the workers: "Major worker. Head red to dark red with reddish black markings, thorax yellowish red to reddish yellow, gaster black to yellowish red anteriorly and black posteriorly... Minor worker. Head entirely very dusky red to reddish yellow, thorax dark reddish brown to reddish yellow, gaster very dusky red to dark reddish brown" The males were described as "black" by Wheeler and Wheeler.

These ants were living only in solid wood and had tunneled to the limit of the living wood. The colonies were consequently very small.

Lasius (Lasius) alienus (Foerster)

Range: Wilson (1955) recognized three distinct populations of L. alienus: the largest eastern one extending from southern Nova Scotia to southeastern Manitoba and south to the Gulf Coast in Alabama and into northern Florida; a northwestern population reaching from the Pacific to western Montana and from southern British Columbia to northernmost California; a small isolated population in southeastern Arizona.

Thunder Bay Localities: Mount McKay (V), 3-VI-70; Amethyst Harbour, 23-V-70

Number of Records: 10. (3)

Occurrence: rare.

Microhabitats: sand, gravel, under rock, among grass roots, plesiobiosis.

Reproduction: No records.

The taxonomy of this genus was revised in 1955 by E. O. Wilson.

Of the above ten records, nine were made on Mount McKay within 10 m. of each other. They were mostly under rocks and in soil, although one was found among grass roots. The other collection was quite separate from these collections.

The workers were described as small and gray. Wheeler and Wheeler (1963) described them: "Dark reddish brown, or head and gaster black, thorax dark reddish brown."

This species was found living in plesiobiosis with Brachymyrmex depilis and Lasius nearcticus Wheeler.

Lasius (Lasius) pallitarsis (Provancher)

Range: from Quebec to Massachusetts and west to southern Saskatchewan and southern South Dakota, thence spreading to southern Alaska in the north and to California, Arizona, and New Mexico in the south.

Thunder Bay Localities: Campus, 13-V-70, 19-V-70, 1-VI-70, 10-VI-70, 11-VI-70; City of Thunder Bay, 5-VII-70, 14-VIII-70; Sunnyside Beach, 9-IX-69, 13-IX-69, 27-IX-69, 2-V-70, 18-V-70, 14-VIII-70; Amethyst, 23-V-70, 21-VI-70.

Number of Records: 50 (20)

Occurrence: common in the localities where collected.

Microhabitats: loam, sand, humus, clay, gravel, under rock, under miscellaneous objects, on lawns, plesiobiosis.

Reproduction: males: 13-IX-69

 alate females: 14-VIII-70

 dealate females: 9-IX-69; 14-VIII-70

This species was known as Lasius sitkaensis Pergande after Wilson's (1955) revision until 1966 when it was revised to L. pallitarsis by Francoeur and Beique.

This species was collected mostly from grassland type of habitats. Most of the collections were from under some sort of cover although those on the campus were from a field and there were no covering objects.

There were a very large number of nests around Sunnyside Beach. Almost every object had L. pallitarsis under it. There was a very

large flight of this species on Sept. 7, 1969, in the area around Sunnyside Beach, which might account for the large number of nests found in 1970. In August 1970, numerous craters were observed on driveways and roads along the beach. These contained only a few ants. On August 26, 1970, numerous dealate females were observed along the road and clustered in large numbers under leaves fallen along the roadside. Known nests were then investigated and found to contain only males. No further observations have been made. These ants were not a particularly active species.

This species was described as brown, yellow, brown with a yellow thorax. Wheeler and Wheeler (1963) have described them: "Head and gaster dark reddish brown varying to head and thorax yellowish red, gaster reddish brown".

This species was found living in plesiobiosis with Formica fossiceps Buren and Formica fusca.

Lasius (Cautolasius) nearcticus Wheeler

Range: "eastern Canada, New England, and northern United States to the Rocky Mountains, with a southern extension along the Appalachian Highlands" (Gregg 1963).

Thunder Bay Localities: Stanley, 9-X-69, 21-V-70, 17-VI-70;
Mount McKay (V), 3-VI-70.

Number of Records: 11 (6)

Occurrence: uncommon

Microhabitats: leaf litter, loam, under rock, plesiobiosis.

Reproduction: males: no records

alate females: no records

dealate females: 17-VI-70

This species was found in the "southern" habitats of the district: Mount McKay and Stanley. The nests were found only in very moist areas.

The workers were described as tiny, bright yellow ants.

This species was found living in plesiobiosis with Brachymyrmex depilis and Lasius alienus.

Formica (Proformica) lasiodes Emery

Range: In the west from southern Canada to California and east through the Rocky Mountains; east of the Rocky Mountains the range narrows to southern Canada and the northern United States with an extension into the northern Appalachian Highlands.

Thunder Bay Localities: Stanley, 21-V-70, 17-VI-70; Bypass, 4-VI-70; Mount McKay (V), 3-VI-70; Tenth Ave. Heath, 28-V-70; Lakehead University Campus, 13-V-70, 10-VI-70, 30-VI-70; City of Thunder Bay, 20-IX-69, 1-VI-70, 14-VI-70, 15-VII-70; McKenzie, 9-V-70, 25-VII-70; Sunnyside, 9-IX-69, 13-VIII-70; Keshkabuon 27-VI-70; Black Sturgeon Research Station, 7-V-70, 22-VI-70, 23-VI-70.

Number of Records: 39 (31)

Occurrence: common.

Microhabitats: sand, gravel, wood, humus, lawns, moss, loam, under lichens, under wood, under rocks, under miscellaneous objects, among grass roots, plesiobiosis.

Reproduction: males: no record

alate females: 13-VIII-70

dealate females: 10-VI-70, 17-VI-70, 27-VII-70.

The taxonomy of this species was last revised by Creighton (1950).

This species was found in a wide variety of habitats throughout the district. It was usually found in areas in which the moisture level was classified "medium". On several occasions, a single worker was followed back to the nest--a nest which in these cases consisted of one or several openings in the sand with or without a small amount

of earth about the entrance. It was difficult to impossible to find the brood in nests of this species. Not only did the ants disappear very rapidly, but it was usually impossible to find them afterwards unless the weather was very cold, and the ants were sluggish. Most of the nests of this species had some inclination to the south. In one instance where a nest was excavated to its greatest depth, the tunnels extended 30 cm. into the soil.

The workers were described as fairly large shiny black ants with reddish black legs. Wheeler and Wheeler (1963) described them: "Head and gaster reddish black, thorax very dusky red or head dark reddish brown, thorax yellowish red, gaster very dusky red to dark reddish brown.

This species was found living in plesiobiosis with Myrmica emeryana, Tapinoma sessile, Camponotus herculeanus, Formica fusca, F. neorufibarbis Emery.

Formica (Raptiformica) subintegra Emery

Range: Newfoundland and Nova Scotia to South Carolina and west to Kansas and North Dakota.

Thunder Bay Localities: Lakehead University Campus, 13-V-70, 4-VI-70.

Number of Records: 2.(2)

Occurrence: rare.

Microhabitats: sandy clay mounds, plesiobiosis.

Reproduction: no records

The Raptiformica subgroup was revised in 1968 by Buren.

The two collections were made from peculiar mounds in abandoned fields on the Campus. These mounds were the shape of inner tubes with a slightly lesser depression centrally. They were composed of a mixture of coarse sand and clay. These mounds were also found harbouring other species.

The workers were described as "large red ants with black gasters". Some infuscation was also noted. There was also a variation from very light yellow-red head and thorax in the largest workers to a blackish red in the smaller ones. They were generally rather dull in appearance. Wheeler and Wheeler (1963) have described them: "Head yellowish red with infuscation extensive and dark reddish brown to infuscation restricted and reddish brown, thorax yellowish red with infuscation extensive and dark reddish brown to infuscation restricted and reddish brown, each segment of the gaster dark reddish brown anteriorly and black posteriorly."

This species was found living in plesiobiosis with Formica fusca.

Formica (Raptiformica) subnuda Emery

Range: Labrador to central Alaska and southward across the United States, except states south of a line from Virginia to Kansas.

Thunder Bay Localities: Mountain Road South Neebing, 15-IV-70; Mount McKay (V), 3-VI-70; Tenth Ave. Heath, 27-V-70; Lakehead University Campus, 10-VI-70; Shuniah Lake, 13-V-70; McKenzie, 21-VI-70; Keshkabuon Island, 13-IX-69; Sibley Peninsula, 13-VI-70; Ouimet Canyon, 6-VI-70; Black Sturgeon Research Station, 6-V-70, 23-VI-70.

Number of Records: 12 (12)

Occurrence: Moderately abundant

Microhabitats: loam, clay, sand, wood, plant debris, under rock, under mosses, under wood, plesiobiosis.

Reproduction: no records.

These collections were distributed very lightly throughout the District. The nests were built in the open, under rocks or in and under rotting wood. In one case they were found both in a rotting log and in the soil beneath it. In some cases there was "thatch" associated with the nest, and in others it was completely lacking.

The workers were described as "red with a black gaster". In one case infuscation was noted on the heads. There was also a smaller, paler caste associated with these ants--with yellow-orange thoraces. Wheeler and Wheeler (1963) have described the workers: "Major worker. Head red with dark red markings, thorax dark red, gaster with each

segment dark reddish brown anteriorly and black posteriorly varying to head yellowish red, thorax reddish yellow, gaster dark reddish brown... Minor worker. Head dark reddish brown dorsally and yellowish red ventrally, thorax reddish brown, gaster with each segment dark reddish brown anteriorly and very dusky red posteriorly varying to head and gaster dark reddish brown, thorax yellowish red."

Two interesting behaviours were observed in the course of making the collections. These ants tend to attack any disturbance by standing on the last pair of legs and placing the gaster between them so that they may attack simultaneously with the mandibles and formic acid. The acid smell is very evident when a nest of this species is disturbed. They do not attack under all conditions, and become "timid" on cold days.

The second behaviour observed in this ant was the moving of workers — apparently from one nest to another along a well-defined tunnel. This tunnel was approximately 3 metres in length and was on the surface in some places, and covered in others. Workers were observed carrying other workers (which were apparently quite healthy because when disturbed they defended themselves) from one nest to another. There was no apparent reason for this.

This species was found living in plesiobiosis with Leptothorax muscorum, and Formica fossiceps. It has also enslaved workers of F. fusca and F. whymperi adamsi.

Formica (rufa group) dakotensis Emery

Range: Southern Canada and the northern United States, south through the Rocky Mountains to New Mexico; also Iowa and Indiana.
Thunder Bay Localities: Tenth Ave. Heath, 28-V-70; Spruce River Road, 28-V-70.

Number of Records: 10.(2)

Occurrence: rare

Microhabitats: leaf litter, moss, sand and gravel.

Reproduction: no records.

There is some question about the subspecies montigena Wheeler. Wheeler and Wheeler (1963) have decided not to recognize this subspecies because they have found intergrades. Ayre (personal communication) made the following comment: "On the basis of the keys I am forced to call this dakotensis but it differs from other specimens I have collected in being completely void of hair on the thorax." Francoeur (personal communication) was also dubious about the identification of the specimens he received. "I am not completely sure about dakotensis."

Nine of the ten records were made from Tenth Avenue Heath. There are numerous hillocks in this Sphagnum-Black spruce bog, and a large number of these have plant debris on the south-facing side. Further investigation yielded numerous specimens of F. dakotensis. The other collection was made from a very dry sand-gravel roadside habitat with no thatch. Wheeler and Wheeler (1963) make no mention of either of these habitats. "In North Dakota, nests have been

collected from grasslands only."

The colour of the head and thorax of the major workers ranged from reddish-yellow to red with black gasters. The minor workers were much more heavily infuscated and tended to be reddish-black to brown with a black gaster. Wheeler and Wheeler (1963) have described them: "Major worker. Head dark red, thorax yellowish red, gaster with each segment dark reddish brown anteriorly and black posteriorly. Minor worker. Head dark reddish brown dorsally and dark red ventrally, thorax dark reddish brown, gaster with each segment dark reddish brown anteriorly and black posteriorly."

These ants attempted to bite with their mandibles, but did not adopt the position which was defined as the "Formica rufa group attack position".

Formica (rufa group) fossiceps Buren

Range: North Dakota, Iowa, and Quebec.

Thunder Bay Localities: Island Lake, 23-VI-70; Mount McKay (V), 27-IV-70;
Lakehead University Campus, 13-V-70; Sunnyside, 9-IX-69, 9-VII-70,
12-VIII-70, 14-VIII-70; Keshkabuon Island 13-IX-69.

Number of Records: 20 (10)

Occurrence: uncommon.

Microhabitats: loam, plant debris, sand, wood, under rock, under
wood, under lichens and mosses, under miscellaneous objects,
plesiobiosis.

Reproduction: males: 12-VIII-70, 14-VIII-70

 alate females: 9-IX-69, 12-VIII-70, 13-VIII-70,
 14-VIII-70

 dealate females: no records.

The taxonomy of this species evidently has not been revised since it was first named by Buren (1942).

It is most interesting that this species is moderately abundant in this district, since the known range is so limited. This species has been taken from Quebec and New Brunswick, but it is very rare in that area (personal communication with Ayre and Francoeur).

The nests of this species were found under covering objects. In cases where bedrock was exposed and the nest was under rocks on this layer, a large amount of plant debris, particularly spruce and balsam needles and bits of lichen were found under the rock. This evidently

has an excellent insulating capacity and retains moisture well because the nests were moist and cool in dry, hot conditions. This is the only species which was found on these exposed bedrock areas.

In the field notes, this species was described as red with a black gaster. Wheeler and Wheeler (1963) have described the worker: "Head red, thorax yellowish red, gaster with each segment dark reddish brown anteriorly and black posteriorly or head and thorax yellowish red, gaster with each segment dark reddish brown anteriorly and black posteriorly."

The workers of F. fossiceps are very aggressive. They attack with gasters forward and mandibles ready. They have very powerful mandibles and have caused small bleeding punctures on my legs and arms. They have been observed to 'shoot' formic acid a distance of 20 cm. On the morning of August 14, 1970 (about 9:00-10:00 A.M.), alate females were seen crawling out of the 'reindeer moss' layer on rocks in large numbers. This occurred only in a very localized area about 3 m. square. This area was exposed to sunlight at the time of these observations. Although I watched for a flight after that, none has yet been observed (September 1, 1970), and the winged forms are still present in the nests.

This species was found living in plesiobiosis with Lasius pallitarsis, Formica fusca, F. subnuda.

The flight occurred on the night of September 3, 1970.

Formica (rufa group) integra tahoensis Wheeler

Range: "mountains of eastern Nevada to the western slopes of the Sierras". (Creighton, 1950).

Thunder Bay Localities: Falling Snow Lake, 8-VI-70; Thunder Bay Bypass, 18-VI-70.

Number of Records: 3 (3)

Occurrence: rare

Microhabitats: humus, under rock.

Reproduction: males: no records

alate females: no records

dealate females: 8-VI-70, 18-VI-70.

The taxonomy of the integra subgroup is apparently in a state of considerable confusion. Wheeler and Wheeler (1963) have found this species, but rather than include it in their list of species they have relegated it to a group of four forms. Ayre (personal communication) has outlined the problem for me: "The eastern F. integra is very different from the western F. integra tahoensis both in appearance and nest structure. The question is whether they are truly distinct forms or do intergrades exist across the continent?... The integroides complex is particularly bad in this respect."

The three nests were found in Black spruce-Sphagnum bogs--areas of very high moisture levels. The nests consisted of moss and vascular plant debris. One of the three was under a rock on a hillock in a bog.

In the field notes, workers were described as black with a reddish-black thorax and legs.

Formica (rufa group) oreas Wheeler

Range: "northwestern Iowa west through Montana and southern Alberta to Washington" (Creighton, 1950).

Thunder Bay Localities: Stanley, 9-X-69, 21-V-70, 17-VI-70;
Red River Road, 9-VI-70.

Number of Records: 4 (4)

Occurrence: rare

Microhabitats: humus, wood chippings, loam, under rock, plesiobiosis.

Reproduction: no records.

Three of the collections apparently belong to F. oreas, but the fourth appears to be a member of the variety comptula Wheeler. This species and subspecies have apparently not been revised since first named by Wheeler in 1903 and 1913, respectively.

Three of the nests were found in grassland habitats and the fourth in a forest glade. (The 3:1 division is not according to variety.) "This would appear to be an eastern record". (Personal communication with Ayre.)

In the field notes the F. oreas were described as both major and minor workers red or reddish yellow with black gasters. The F. oreas comptula were described as major workers red or reddish yellow with black gasters; minor workers blackish-red with black gasters. Wheeler and Wheeler (1963) described the workers of F. oreas comptula: "Major worker. Head clear yellowish red or

mostly infuscated with dark reddish brown, thorax dark reddish brown to yellowish red, gaster with each segment very dusky red anteriorly and black posteriorly to dark reddish brown anteriorly and black posteriorly... Minor worker. Head very dusky red, thorax and gaster dark reddish brown varying to head and thorax strong brown with dark brown infuscation, gaster dark brown".

These ants were very aggressive and attacked with gasters forward when the nests were disturbed.

This species was found living in plesiobiosis with Brachymyrmex depilis.

Formica (rufa group) reflexa Buren

Range: Iowa, Minnesota, and North Dakota.

Thunder Bay Localities: Mountain Road South Neebing, 23-IV-70.

Number of Records: 1 (1)

Occurrence: rare

Microhabitats: sand and plant debris mound

Reproduction: no records.

This species is generally considered rare. The peculiar reflexed pubescence has resulted in a very simple taxonomy--the name has not been changed since it was first named by Buren (1942) although M. R. Smith (1947) placed it with the microgyna group in his genetic monograph.

The two specimens were found in a nest of Formica fusca. Buren (1942) concluded that since the workers were so considerably outnumbered by workers of F. fusca, and that since they are so relatively timid, that they must be a permanent inquiline.

The two specimens were red with black gaster. Wheeler and Wheeler (1963) described workers of this species: "Head yellowish red with dark reddish brown infuscation, thorax yellowish red with dark reddish brown infuscation, gaster dark reddish brown.

Formica (microgyna group) whymeri adamsi Wheeler

Range: "Michigan to Minnesota" (Creighton, 1950).

Thunder Bay Localities: Tenth Avenue Heath, 27-V-70; Lakehead
University Campus, 30-VI-70; McKenzie, 9-VI-70, 25-VII-70.

Number of Records: 6 (6)

Occurrence: uncommon

Microhabitats: gravel, sand, shale, clay, humus, loam, plant debris,
wood, under wood, plesiobiosis.

Reproduction: no records

The taxonomy of this species was last revised in 1917~~6~~ by
Wheeler.

The type locality for this species is Isle Royale, Michigan--
a location which is very close to this district. The range of this
species is very limited, but it is not surprising that it includes
the southern Thunder Bay District.

In the field notes, the workers were described as red with
black gasters; some infuscation on the head.

These ants moved about rather slowly and randomly when their
nests were disturbed. They did not attack, although some workers
were 'on guard'.

Plesiobiosis was noted in only one instance--with Formica subnuda.

Formica (exsecta group) ulkei Emery

Range: Nova Scotia westward to Manitoba, Montana and South Dakota;
also Indiana and Illinois.

Thunder Bay Localities: Stanley, 21-V-70; Red River Road,
22-V-70, 24-V-70, 9-VI-70; Lakehead University Campus, 11-VI-70;
Sunnyside Beach 27-IX-69; Amethyst Beach, 21-VI-70.

Number of Records: 12 (7)

Occurrence: uncommon

Microhabitats: gravel, sand, thatch, plesiobiosis

Reproduction: no records

Creighton (1950) last revised the exsecta group. There was some difficulty with identification of some of the specimens since they appeared to be intermediate between F. ulkei and F. opaciventris. Ayre and myself have agreed that these specimens should be classified as F. ulkei.

This species is definitely a mound building species. It nests in soil and builds very large (some were more than 1 m. in diameter) rounded or conical mounds. All records were from roadsides or the borders of wooded areas.

In the field notes, the workers were described as "black with red thoraces". Closer inspection revealed that the heads were heavily infuscated but basically red in colour. Wheeler and Wheeler (1963) described the workers: "Major worker. Head dark red ventrally and black dorsally, thorax yellowish red with dark reddish brown

infuscation, gaster very dusky red varying to head red with very dusky red infuscation, thorax yellowish red, gaster black...

Minor worker. Head strong brown with dark reddish brown infuscation, thorax strong brown with dark brown infuscation, gaster dark reddish brown.

These ants were observed feeding on the nectar flowing from nectaries at the base of leaves of aspen (Populus tremuloides). They also tended aphids on aspen. These aspen were more than 3 m. from the nest.

This species was found living in plesiobiosis with Brachymyrmex depilis and Camponotus herculeanus.

Formica (fusca group) fusca L.

Range: Holarctic. Canada and the United States, except perhaps Florida and Texas.

Thunder Bay Localities: Kashabowie, 22-V-70; Stanley, 10-IX-69, 21-V-70, 17-VI-70; Island Lake, 23-VI-70; South Neebing, 23-IV-70; Mount McKay (V), ~~27-IV-70~~, 3-VI-70; Tenth Avenue Heath, 28-V-70; Lakehead University Campus, 13-V-70, 19-V-70, 4-VI-70, 11-VI-70, 2-VII-70; City of Thunder Bay, 20-IX-69, 4-VI-70, 9-VI-70, 14-VIII-70; Shuniah Lake, 13-V-70; Trowbridge Falls Campground, 18-IV-70; McKenzie, 9-VI-70, 21-VI-70; Sunnyside Beach 9-IX-69, 9-XI-69, 16-V-70, 17-V-70, 18-V-70, 14-VIII-70; Amethyst, 23-V-70; Keshkabuon Island, 6-VII-70, 27-VII-70; Sibley Peninsula, 13-VI-70; Black Sturgeon Research Station, 6-V-70, 7-V-70, 22-VI-70, 23-VI-70.

Number of Records: 72 (61).

Occurrence: common.

Microhabitats: gravel, sand, sandy clay, clay, peat, under rocks, under wood, under miscellaneous covering objects, under bark, in living wood, in thatched mounds, in earthen mounds, in decaying wood, plesiobiosis

Reproduction: males: 2-VII-70 (pupae)

alate females: 2-VII-70 (pupae); 27-VII-70; 14-VIII-70

dealate females: 13-V-70; 23-V-70; 3-VI-70

Formica (fusca group) is currently being revised by Francoeur.

Formica fusca L. is probably the most common species present in this district. It was collected in all the localities that received more thorough investigation, and was usually among the species collected in the other localities. It occupied almost every type of habitat available.

This species is also very active. It was among the last species seen outside nests in 1969, and the first in 1970. A comment made repeatedly in the field notes was that it disappeared very quickly--even though the colonies were usually very large, the samples tended to be very small in comparison with those made for other species. On several occasions very near the first of the collecting year, when the ground was cold, large collections were made. They also removed young from sight with incredible haste.

Several notes on the colour of this species were made. Generally it was noted that the gaster was gray or silky and the head similarly coloured. The thorax was black and shiny in most cases where the colour of the body was noted in the field. According to Wheeler and Wheeler (1963) the silky sheen is due to pubescence. In some cases the entire body appeared to be black and shiny. Although Wheeler and Wheeler have described the worker as "black with legs and antennae dark reddish brown varying to head dark reddish, thorax and gaster dark brown", the specimens collected in the Thunder Bay District were generally described as concolourous brown or black. The reddish appearance was not noted in these specimens.

This species was found living in plesiobiosis with

Myrmica emeryana, M. lobicornis fracticornis, Leptothorax muscorum,
Tapinoma sessile, Brachymyrmex depilis, Camponotus herculeanus,
C. noveborascensis, Lasius pallitarsis, Formica lasioides.

F. fusca has been reported to be enslaved by Formica puberula,
F. subintegra, F. sublucida, F. pergandei, F. rubicunda, F. subnuda,
F. wheeleri, F. obscuriventris, F. oreas comptula, and Polyergus
refuscens. In this District, it was enslaved by Formica fossiceps,
F. subnuda, and F. subintegra. It has been recorded as host for
Formica reflexa in North Dakota (Wheeler and Wheeler, 1963) and
was found as host for that species here as well.

This species is found commonly in lawns in this area, and is
considered a pest. This was the species used for the temperature
studies of the second section of the thesis.

The nests of F. fusca were varied in construction but tended to
be large in comparison with the majority of nests of other species
found. The nests which were excavated to determine their extent
usually extended deeper than 60 cm. Their diameter was usually
greater than 50 cm. although in some immature nests the diameter
was considerably less than this--about 10 cm.

Formica (fusca group) marcida Wheeler

Range: Alaska, British Columbia and Alberta, southward through the mountains to central California and New Mexico; also Manitoba, North Dakota and the Black Hills in South Dakota.

Thunder Bay Localities: South Gillies, 8-VI-70; Mountain Road, South Neebing, 15-IV-70.

Number of Records: 2 (2)

Occurrence: rare

Microhabitats: very rotten stumps.

Reproduction: male: no records

alate female: no records

dealate female: 8-VI-70.

The taxonomy of the fusca group is currently being revised by Francoeur. He has indicated to me that F. marcida will be the subject of some changes when he has completed his revision.

The two collections were made from very wet, very rotten stumps in dense bush--a typical habitat for marcida (Wheeler and Wheeler, 1963).

In appearance, these specimens are very similar to the medium-sized black ants, Formica fusca, but have shiny gasters. Wheeler and Wheeler (1963) have described the workers: "Head and gaster black, thorax dark reddish brown, legs and antennae dark red varying to concolorous dark reddish brown.

Formica (fusca group) montana Emery

Range: Ohio to Colorado and North Dakota to New Mexico.

Thunder Bay Localities: Tenth Avenue Heath, 28-V-70; McKenzie,
7-VIII-70; Black Sturgeon Research Station, 6-V-70.

Number of Records: 4

Occurrence: rare

Microhabitats: wood, moss, sand, plant debris under rotting wood

Reproduction: males: 7-VIII-70

 alate females: 7-VIII-70

 dealate females: 6-V-70; 28-V-70

I have followed Creighton (1950) in designating this F. montana although Gregg (1953) and Wheeler and Wheeler (1963) have treated it as a subspecies of F. cinerea.

It is interesting to note that the specimens collected here were not from the type of habitat and nest described by Wheeler and Wheeler (1963). Instead of being from grassland area, three of the four collections were from heavily wooded areas and the fourth was from a roadside. All were associated with rotting wood whereas Wheeler and Wheeler (1963) suggested that this was a common "mound ant".

These ants appeared large and black in the field. There was no field evidence of the red on the workers that was described by Wheeler and Wheeler (1963): "Head very dusky red ventrally and black dorsally, thorax and gaster black varying to head dark red ventrally and very dusky red dorsally, thorax and gaster dark reddish brown".

This species was found living in plesiobiosis with
Leptothorax muscorum and Camponotus herculeanus.

Formica (fusca group) neorufibarbis Emery

Range: Alaska and British Columbia south to the mountains of Central California, northern Arizona and New Mexico; eastward to Manitoba (Riding Mountain), northeastern North Dakota and the Black Hills of South Dakota

Thunder Bay Localities: Falling Snow Lake, 8-VI-70; Lakehead University Campus, 13-V-70; 11-VI-70; Shuniah Lake, 13-V-70; Sunnyside Beach, 14-VIII-70; Keshkabuon Island, 27-VII-70; Sibley Peninsula, 13-VI-70; Black Sturgeon Research Station, 6-V-70.

Number of Records: 19 (10)

Occurrence: uncommon

Microhabitats: wood, peat, clay, plant debris, sawdust, under rock, under wood, plesiobiosis.

Reproduction: males: 27-VII-70 (pupae)

alate females: 27-VII-70; 27-VII-70 (pupae)

dealate females: 8-VI-70, 11-VI-70, 13-VI-70.

This species has been divided into three subspecies:

F. neorufibarbis, F. neorufibarbis algida Wheeler,

F. neorufibarbis gelida Wheeler. Creighton's (1950) revision is most recent. Of the 19 records, 10 records were neorufibarbis, 5 were algida and 4 were gelida.

The habitats of this species were mostly in small clearings in woods, and in fields. Mounds were not evident. Most collections were from soil or very rotten wood. In some collections there was

still ice present in the bottom of the nest, and the ants were inactive. The soil nests were under rocks or wood. One nest consisted of plant debris between two pieces of birchbark. This supports Wheeler and Wheeler's (1963) description of nests: "Elsewhere this species is reported to nest under logs and stones. In North Dakota all nests have been in rotten wood. No habitat differences were evident for the subspecies."

In the field, the workers appeared concolorous blackish-red. Wheeler and Wheeler (1963) have described them as: "Head dark red ventrally and very dusky red or black dorsally, thorax and gaster dark reddish brown or thorax strong brown with yellowish red infuscation, gaster with each segment dark reddish brown anteriorly and black posteriorly."

This species was found living in plesiobiosis with Formica lasioides.

In the preceding pages, each species has been discussed individually. The following pages constitute a look at the material as a whole, and a summary of the more interesting points noted about each species.

The number of collections made in each locality is as follows: Kashabowie, 2; Fallingsnow Lake, 2; South Gillies, 2; Stanley, 38; Redfern Farm, 1; Ware Township, 1; Island Lake, 1; Red River Road, 1; Mountain Road, South Neebing Township, 4; Thunder Bay Bypass, 17; Mount McKay (V and T), 23; Tenth Avenue Heath, 13; Lakehead University Campus, 42; residential property in the City of Thunder Bay, 24; Shuniah Lake, 11; Trowbridge Falls Campground, 3; Spruce River Road, 1; McKenzie, 18; Palette Island, Lake Superior, 1; Sunnyside Beach, 31; Sibley Peninsula, 10; Ouimet Canyon, 1; Black Sturgeon Research Station, Lakehead University, 31.

The number of collections made for each species is as follows:

Myrmica americana (1); M. brevispinosa (9); M. emeryana (12); M. incompleta (4); M. kuschei (8); M. lobicornis fracticornis (22); Stenamma brevicorne (1); S. diecki (1); Leptothorax muscorum (15); L. provancheri (2); L. poss. texanus (7); Dolichoderus taschenbergi (2); Tapinoma sessile (13); Brachymyrmex depilis (9); Camponotus herculeanus (32); C. noveborascensis (9); C. pennsylvanicus (3); C. nearcticus (2) Lasius alienus (3); L. pallitarsis (20); L. nearcticus (6); Formica lasioides (31); F. subintegra (2); F. subnuda (12); F. dakotensis (2); F. fossiceps (10); F. integra tahoensis (3); F. oreas (4); F. reflexa (1); F. whympersi adamsi (6); F. ulkei (7); F. fusca (61); F. marcida (2); F. montana (4); F. neorufibarbis (10); .

Table 1 shows the species which were collected in each locality. The first nine localities are those which received more intensive investigation. Myrmica lobicornis fracticornis, Tapinoma sessile, Camponotus herculeanus, Formica lasioides, and Formica fusca were found in more than half of these nine localities. Of these, five species all were considered common except T. sessile which was only moderately abundant. The only other species which was considered common was Lasius pallitarsis and it was found in only two of the nine localities. Perhaps the reason for this limitation is its preference for a sandy microhabitat.

In the course of the study I have found 39 species and subspecies of ants in the Thunder Bay District. In Table II these species are compared with records for Alberta, British Columbia, Quebec, North Dakota, and Northeastern Minnesota. Unfortunately, I was unable to compare the species with the ten collected by Wheeler on Isle Royale (1908), because I was unable to locate a copy of his paper.

Of the 40 species (Sharplin, 1966) recorded from Alberta, 21 were also collected in Thunder Bay. Of the 55 species (Buckell, 1932) recorded from British Columbia, only 11 were also collected in Thunder Bay. Of the 39 species recorded by Francoeur in Quebec (Francoeur 1966a, 1966b, 1968; Francoeur and Béique 1966a, 1966b, 1968, Béique and Francoeur, 1966) 19 were also collected in Thunder Bay. Of the 40 species recorded from Northeastern Minnesota by Gregg (1946) 23 have also been collected in Thunder Bay. And, of the 87 species recorded by Wheeler and Wheeler (1963) 28 were also collected here. It seems that

Table 1: The locality in which each species was collected is shown in this table. The first nine localities are those which received more intensive investigation.

| | Stanley | Mount McKay (V) | Mount McKay (T) | The City of Thunder Bay | McKenzie Station | Sunnyside Beach | Sibley Peninsula | Black Sturgeon Research Station | Keskabuon Island | Kashabowie | South Gillies | Redfern Farm | Ware Township | Island Lake | Red River Road | Mountain Road | Thunder Bay Bypass | Tenth Ave. Heath | Lakehead University Campus | Shuniah Lake | Trowbridge Falls Campground | Spruce River Road | Palette Island | Amethyst Harbour | Quimet canyon |
|---------------------------|---------|-----------------|-----------------|-------------------------|------------------|-----------------|------------------|---------------------------------|------------------|------------|---------------|--------------|---------------|-------------|----------------|---------------|--------------------|------------------|----------------------------|--------------|-----------------------------|-------------------|----------------|------------------|---------------|
| <i>M. americana</i> | | | | | | | | X | | | | | | | | | | | | | | | | | |
| <i>M. brevispinosa</i> | | | | X | X | | | | | | | | | | | | X | X | | | | | | | |
| <i>M. emeryana</i> | | X | X | X | X | | X | | | | X | | | | | | X | X | | | | | X | X | |
| <i>M. incompleta</i> | | X | | | | | | | | | | | | | | | X | | X | | | | | | |
| <i>M. kuschei</i> | | | | | | | X | | | | | | | | | | X | X | | | | | | | |
| <i>M. l. fracticornis</i> | X | X | | X | | | | X | X | X | | | | | | | X | X | | | X | | | | |
| <i>S. brevicorne</i> | | | | | | | | | | | | | | X | | | | | | | | | | | |
| <i>S. diecki</i> | | | | | | | | | X | | | | | | | | | | | | | | | | |
| <i>L. muscorum</i> | | X | | | X | | | X | | | | | | | | | X | X | | | | | | | |
| <i>L. provancheri</i> | | | | | X | | | | | | | | | | | | | X | | | | | | | |
| <i>L. texanus</i> | | X | | | | X | X | | | | | | | | | | | | | | | | | | |
| <i>D. taschenbergi</i> | | | | | | X | X | | | | | | | | | | | | | | | | | | |
| <i>T. sessile</i> | X | X | | X | X | | X | | | | | | | | | | X | X | X | | | | | | |
| <i>B. depilis</i> | X | X | | | | | | | | | | | | | | | | | | | | | | | |
| <i>C. herculeanus</i> | | | | X | X | X | X | X | X | | | | | | | X | X | X | X | X | | X | | | |
| <i>C. noveborascensis</i> | | | | | X | | | X | X | | | | | | | | X | X | | | | | | | |
| <i>C. pennsylvanicus</i> | | | | | | | X | X | | | | | | | | | | | | | | | | | |
| <i>C. nearcticus</i> | | X | | | | | | | | | | | | | | | | | | | | | | | |
| <i>L. alienus</i> | | X | | | | | | | | | | | | | | | | | | | | | | X | |
| <i>L. pallitarsis</i> | | | | X | X | | | | | | | | | | | | | | X | | | | X | | |
| <i>L. nearcticus</i> | X | | | | | | | | | | | | | | | | X | X | | | | | | | |
| <i>F. lasioides</i> | X | X | | X | X | X | X | X | | | | | | | | | X | X | X | | | | | | |
| <i>F. subintegra</i> | | | | | | | | | | | | | | | | | | X | X | | | | | | |
| <i>F. subnuda</i> | | X | | | X | | X | X | X | | | | | | | X | X | X | X | | | | | | X |
| <i>F. dakotensis</i> | | | | | | | | | | | | | | | | | X | | | | | | | | |
| <i>F. fossiceps</i> | | X | | | X | | | X | | | | | | X | | | | X | | | | | | | |
| <i>F. i. tahoensis</i> | | | | | | | | | | | | X | | | | | X | | | | | | | | |
| <i>F. oreas</i> | X | | | | | | | | | | | | | X | | | | | | | | | | | |
| <i>F. reflexa</i> | | | | | | | | | | | | | | | X | | | | | | | | | | |
| <i>F. w. adamsi</i> | | | | | X | | | | | | | | | | | | X | X | | | | | | | |
| <i>F. ulkei</i> | X | | | | X | | | | | | | | | | X | | | X | | | | | | X | |
| <i>F. fusca</i> | X | X | | X | X | X | X | X | X | X | | | | X | | X | X | X | X | X | X | | | X | |
| <i>F. marcida</i> | | | | | | | | | | X | | | | | X | | | | | | | | | | |
| <i>F. montana</i> | | | | | X | | | X | | | | | | | | | X | | | | | | | | |
| <i>F. neorufibarbis</i> | | | | | X | X | X | X | | | | | X | | | | | | X | X | | | | | |

Table 2: This table shows a comparison of the species collected in Alberta, British Columbia, Quebec, Minnesota, and North Dakota with those collected in the Thunder Bay District.

| | Alberta | British Columbia | Quebec | Minnesota | North Dakota |
|-----------------------------------|---------|------------------|--------|-----------|--------------|
| <u>Myrmica americana</u> | | | X | X | X |
| <u>M. brevispinosa</u> | X | | X | X | X |
| <u>M. emeryana</u> | X | | X | X | X |
| <u>M. incompleta</u> | X | | | X | X |
| <u>M. kuschei</u> | X | | | X | X |
| <u>M. lobicornis fracticornis</u> | X | | X | | X |
| <u>Stenamma brevicorne</u> | | | X | | |
| <u>S. diecki</u> | | | X | | X |
| <u>Leptothorax muscorum</u> | X | | X | | |
| <u>L. provancheri</u> | | | | | |
| <u>L. texanus</u> | | | | X | |
| <u>Dolichoderus taschenbergi</u> | | | X | X | X |
| <u>Tapinoma sessile</u> | X | X | | X | X |
| <u>Brachymyrmex depilis</u> | | | X | | X |
| <u>Camponotus herculeanus</u> | X | X | X | X | X |
| <u>C. noveborascensis</u> | X | | X | X | X |
| <u>C. pennsylvanicus</u> | | | X | | X |
| <u>C. nearcticus</u> | X | | X | X | X |
| <u>Lasius alienus</u> | X | X | X | X | X |
| <u>L. pallitarsis</u> | X | X | X | X | X |
| <u>L. nearcticus</u> | | | X | | |

| | Alberta | British Columbia | Quebec | Minnesota | North Dakota |
|--------------------------------------|---------|------------------|--------|-----------|--------------|
| <u>Formica lasioides</u> | X | | X | | X |
| <u>F. subintegra</u> | X | X | | | X |
| <u>F. subnuda</u> | X | | X | X | X |
| <u>F. dakotensis</u> | X | X | | X | X |
| <u>F. dakotensis montigena</u> | | | | X | |
| <u>F. fossiceps</u> | | | | | X |
| <u>F. integra tahoensis</u> | | | | | |
| <u>F. oreas</u> | X | | | | |
| <u>F. oreas comptula</u> | | X | | X | X |
| <u>F. reflexa</u> | | | | X | X |
| <u>F. whymperi adamsi</u> | | | | X | |
| <u>F. ulkei</u> | X | | | X | X |
| <u>F. fusca</u> | X | X | X | X | X |
| <u>F. marcida</u> | | X | | | X |
| <u>F. montana</u> | X | | | | X |
| <u>F. neorufibarbis</u> | X | X | | | X |
| <u>F. neorufibarbis algida</u> | | | | X | |
| <u>F. neorufibarbis gelida</u> | | X | | X | |

the ant fauna of Thunder Bay has been derived from several sources but that it does not likely have a west coast origin.

It is noteworthy that no collections of Solenopsis, Crematogaster, or Acanthomyops were made. This absence has been brought to my attention twice, by Ayre and by Brown (personal communication). I have no explanation for the deficit except that the habitats these genera apparently 'prefer' are uncommon in this District.

Of the thirty-nine species and subspecies, only seven showed an extension of range: Lepitothorax texanus has previously been recorded only from central Texas to southern Ohio and hence these are definitely more northern records. Camponotus pennsylvanicus has been collected from Quebec to Florida and west to North Dakota and Texas. This too is a more northern locality than those previously recorded. Formica fossiceps has previously been recorded only from North Dakota, Iowa and Quebec. Hence the Thunder Bay record is a definite extension of range. Formica integra tahoensis has been recorded from eastern Nevada to the western slopes of the Sierras. Thunder Bay definitely does not fit this definition of range. F. oreas has been recorded in northwestern Iowa west through Montana and southern Alberta to Washington. These collections are evidently eastern records. The collections of F. marcida are eastern records--it was previously collected in Alaska, British Columbia, Alberta and south to central California and New Mexico; also Manitoba, North Dakota and the Black Hills in South Dakota. F. montana has been recorded from Ohio to Colorado and North Dakota to New Mexico--so these collections are northern records.

The microhabitats recorded in the field notes have yielded some interesting results. Of the 39 species and subspecies collected, 25 were found in humus and loam; 24 were found in sand and gravel; 23 were found under covering objects; 21 were found in wood; 12 were found in moss and lichen; 9 were found in sandy clay; 7 were found under peat; 5 were found among grass roots; 3 were found in mounds; 3 were found in leaf mould.

It is of interest that only 3 species were found in mounds and 23 of the 39 were found under covering objects.

5/12/63
studied
found
on 1/10
- building
J

Some of the habitats recorded for individual species were of particular interest:

1. Myrmica emeryana was found both in wet and dry habitats in Thunder Bay whereas Wheeler and Wheeler (1963) have recorded only from moist shady habitats.
2. Camponotus noveborascensis was recorded from a variety of habitats: 5 of 9 collections were from under covering objects although this species is considered a carpenter ant--and has been confused with C. herculeanus which was found only in wood. C. noveborascensis exhibited little tenneling in comparison with that noted for C. herculeanus.
3. Camponotus nearcticus was found in dead but solid branches of Betula papyrifera. These branches were of approximately 2" diameter. The habitat recorded for it by Wheeler (1905b) was: "appears to have definite associations with pine trees." Gregg (1944) noted that it occurred on black oak dunes in the

the oak forest, in the beech-maple forest, and in the flood plain forest. Wheeler and Wheeler (1963) recorded it from wooded areas and in isolated trees or stumps--but in nests similar to those recorded here: all in dead wood.

4. Formica dakotensis was found mainly in a Sphagnum-black spruce bog in hillocks covered on the south side by plant debris--this differs considerably from the earthen mounds described by Wheeler and Wheeler (1963).
5. Formica montana was collected mainly from heavily wooded areas in this district--in contrast with the grassland habitat described by Wheeler and Wheeler (1963).

The records of plesiobiosis indicate that most species will be found in associations with other species if a large number of collections is made. The number of associated species apparently increases linearly with the number of collections made except in the case of Brachymyrmex depilis which was usually associated with nests of other species, and Lasius pallitarsis which was usually found alone.. Master-slave relationships were noted between Formica subnuda and F. fusca, and F. fusca and F. reflexa.

Information on the young forms was obtained and recorded for each species--this is available but has not been included because of bulk and lack of concentration on this aspect during the collecting season. It is interesting, nevertheless, that the Camponotus herculeanus flight was recorded on 19-V-70 and queens with eggs were found on 5-VII-70; queens with larvae and pupae on 13-VIII-70; and queens with workers and eggs on 13-VIII-70. The data on Tapinoma sessile is also interesting:

eggs and larvae with workers on 9-X-69; workers only until 21-V-70 when both eggs and larvae were collected; both winged and worker pupae appeared on 4-VI-70 along with eggs and larvae. This continued until 15-VII-70 after which date no further collections were made.

In the course of the study, several other interesting dates were recorded: November 9 was the last date on which observations of ants active outside the nest were made in 1969. The species were Formica fossiceps and F. fusca, and they were collected at Sunnyside Beach. The first date in 1970 when activity was noted outside the nest was March 18 at Trowbridge Falls Campground. The species on that date was Formica fusca. Evidently, F. fusca is very resistant to cold temperatures, and this is possibly one of the main reasons that it is so common in this District. The dates of reproductive flights recorded may also be of interest:

| | |
|----------|----------------------------------|
| 4-VII-70 | <u>Dolichoderus taschenbergi</u> |
| 19-V-70 | <u>Camponotus herculeanus</u> |
| 7-IX-69 | <u>Lasius pallitarsis</u> |
| 3-IX-70 | <u>Formica fossiceps</u> |

It is unfortunate that, because of a lack of intensive studies on the range and ecology of North American ant species, I have been unable to draw conclusions regarding interesting distribution of the ant ~~found~~ fauna as a result of the history of this District.

Summary

1. The primary aim of the study was to prepare an annotated list of the species of ants found in the Thunder Bay District.
2. Preparation of the list involved collecting as many species as possible in the period from April 1, 1970 to August 1, 1970.
3. Field notes were made on all the collections, and interesting behavioral and ecological data has been included with the discussion on each species.
4. Concentrated collecting efforts were made in the following localities: Stanley, Mount McKay, City of Thunder Bay, McKenzie Station, Sunnyside Beach, Keshkabuon Island, Sibley Peninsula, and Black Sturgeon Research Station.
5. The ants were identified using Creighton's (1950) key and other papers which were necessary to bring it up to date. Some of the specimens were sent to Ayre, Francoeur, and Sanders for verification.
6. 39 species and subspecies were collected in the District.
7. A checklist of the species present in the District was prepared.
8. A key to the species known to be present in the District was made.
9. A comparison between the species found in this District and those reported for other area (Alberta, British Columbia, Quebec, Minnesota, and North Dakota) was made.

Conclusions

In the course of this study, 39 species and subspecies of ants were collected in the Thunder Bay District. This number is similar in magnitude to the numbers of species collected in Quebec, Alberta, and Minnesota, but since 20 species collected in Quebec, and 17 collected in Northeastern Minnesota were not collected in this District, it has been postulated that further collecting may yield an additional 20 species for the district.

As was expected, only 20% of the species collected in British Columbia were collected here, whereas 57% of the species recorded in Northeastern Minnesota were collected.

The following extensions of known range were noted:

Leptothorax poss. texanus: northern record, first Canadian record

Camponotus pennsylvanicus: northern record

Formica fossiceps: northern record

F. integra tahoensis: northern and eastern record, first Canadian record

F. oreas: eastern record

F. marcida: eastern record

F. montana: northern record

In the event of more extensive research on the ranges and ecology of the species collected in this District, it should be possible to correlate the history of the region with its ant fauna.

Extensive rates of associations between different species of ants were recorded in the course of this study. Further investigation of this aspect may yield some interesting information regarding rate of association and degree of invasion or climate.

In the course of the study only three species of ants were collected from mounds. This is significant in that most studies which have been done on ant ecology have been done on mound-building species. Hence, it is probable that much of the information regarding behaviour and habitat cannot be applied to more than the single species on which the study was made.

In the course of the study the dates for reproductive flights were recorded:

| | |
|----------------------------------|----------|
| <u>Dolichoderus taschenbergi</u> | 4-VII-70 |
| <u>Camponotus herculeanus</u> | 19-V-70 |
| <u>Lasius pallitarsis</u> | 7-IX-69 |
| <u>Formica fossiceps</u> | 3-IX-70 |

The most interesting species collected in this District was Leptothorax ~~poss.~~ texanus which is being studied further to determine if this identification is correct, and if it is not, to determine if this is a new species, and possibly even a new genus of ants.

Appendix I

This appendix contains a sample of the record sheets used for making records of the phenomena observed when the collections were made, and a diagram of the instrument designed to measure the angles of the nest surfaces.

Figure 2: A sample of the recordsheets used for the collection data.

Species:

Det.:

Date:

Collector:

Number:

Date:

Time:

Major Location:

Minor Location:

Latitude:

Longitude:

Altitude:

Orientation:

Cover: size:

material:

Nest: size:

material:

Moisture:

Site description:

Comments:

Associated Plants:

Associated animals:

Weather: % cloud:

Temp. (lm.):

wind:

humidity:

Comments:

Ova:

Workers:

Larvae:

W. Females:

Pupae:

W. males:

W. Pupae:

Queens:

No. evident:

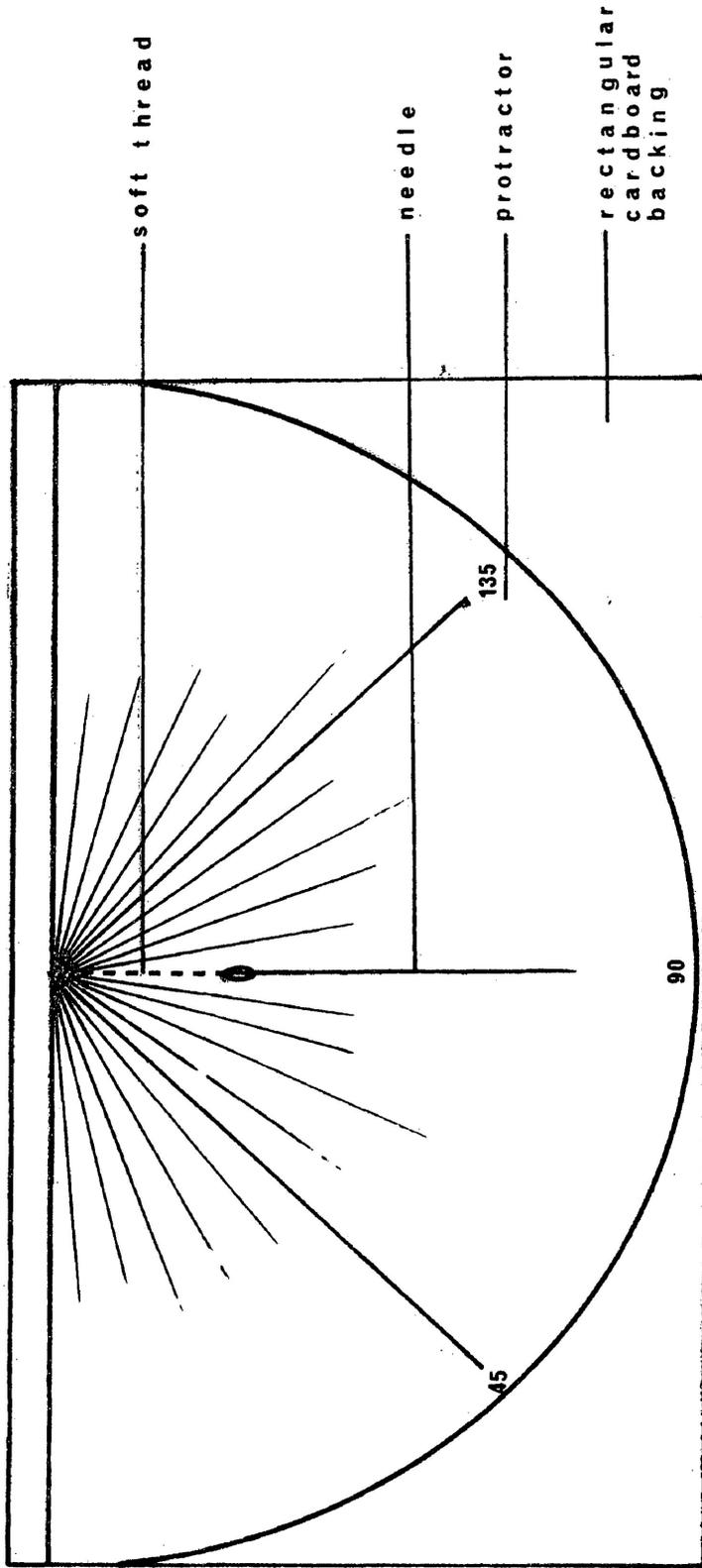
Description:

No. nests seen:

Activity: H M L Nil

Behaviour:

Figure 9. A diagram of the protractor adapted for measuring angles of the surfaces of ants nests in relation to the horizontal. In order to determine the angle, it was necessary to subtract the reading on the instrument from 90. The side of the protractor with the lower numbers was always placed 'down' for convenience.



Appendix II

This portion of the paper consists of a check list and an analytical key to all the species known to be present in the Thunder Bay District. The key is based on Wheeler and Wheeler's (1963) key. Some modifications were necessary because there was a smaller number of species to be treated, Wheeler and Wheeler did not treat all the species found, and in some aspects their key was out of date. A complete key to all the species found in North America includes the following papers: Brown (1949), Brown (1965), Brown (1967), Brown and Kempf (1968), Buren (1968a), Buren (1968b), Creighton (1950), Francoeur (1968a), Francoeur and Beique (1966), Smith (1957), Taylor (1967), Wilson (1955), Wilson and Brown (1955), and Wing (1968). Terms have been simplified whenever possible.

The bracketed numbers on the check-list refer to the number of collections which have been made for each species.

The following is a check-list of the species and subspecies of ant collected in the Thunder Bay District:

1. Myrmica americana Weber (1)
2. Myrmica brevispinosa Wheeler (9)
3. Myrmica emeryana Forel (12)
4. Myrmica incompleta Provancher (4)
5. Myrmica kuschei Wheeler (8)
6. Myrmica lobicornis fracticornis Emery (22)
7. Stenammas brevicorne (Mayr) (1)
8. Stenammas diecki Emery (1)
9. Leptothorax muscorum (Nylander) (15)
10. Leptothorax provancheri Emery (2)
11. Leptothorax poss. texanus Wheeler (7)
12. Dolichoderus taschenbergi (Mayr) (2)
13. Tapinoma sessile (Say) (13)
14. Brachymyrmex depilis Emery (9)
15. Camponotus herculeanus (L.) (32)
16. Camponotus noveborascensis (Fitch) (9)
17. Camponotus pennsylvanicus (DeGeer) (3)
18. Camponotus (Myrmentoma) nearcticus Emery (2)
19. Lasius (Lasius) alienus (Foerster) (3)
20. Lasius (Lasius) pallitarsis (Provancher) (20)
21. Lasius (Cautolasius) nearcticus Wheeler (6)
22. Formica (Proformica) lasioides Emery (31)
23. Formica (Raptiformica) subintegra Emery (2)

24. Formica (Raptiformica) subnuda Emery (12)
25. Formica (rufa group) dakotensis Emery (2)
26. Formica (rufa group) dakotensis montigena Wheeler
27. Formica (rufa group) fossiceps Buren (10)
28. Formica (rufa group) integra tahoensis Wheeler (3)
29. Formica (rufa group) oreas Wheeler (4)
30. Formica (rufa group) oreas comptula Wheeler
31. Formica (rufa group) reflexa Buren (1)
32. Formica (microgyna group) whymperi adamsi Wheeler (6)
33. Formica (exsecta group) ulkei Emery (7)
34. Formica (fusca group) fusca L. (61)
35. Formica (fusca group) marcida Wheeler (2)
36. Formica (fusca group) montana Emery (4)
37. Formica (fusca group) neorufibarbis Emery (10)
38. Formica (fusca group) neorufibarbis algida Wheeler
39. Formica (fusca group) neorufibarbis gelida Wheeler

A Key to the Ants of the Thunder Bay District

Key to the Subfamilies of Formicidae

- 1a. Abdominal pedicel of two segments (petiole and postpetiole)..... Myrmicinae
- 1b. Abdominal pedicel of one segment (petiole)... 2
- 2a. Cloacal orifice ('anus') circular, terminal and surrounded by a fringe of hairs..... Formicinae
- 2b. Cloacal orifice ventral and slit-like; hairs, when present, not forming an encircling fringe..... Dolichoderinae

Key to the Genera of Myrmicinae

- 1a. Antennae of eleven segments..... Leptothorax
- 1b. Antennae of twelve segments..... 2
- 2a. Spurs of middle and hind tibiae simple or absent; mostly small ants..... 3
- 2b. Spurs of middle and hind tibiae pectinate (comb-like) (magnification of at least 30x required); mostly large ants..... Myrmica
- 3a. Thoracic dorsum flat or feebly convex in profile, with the mesoepinotal suture faint or absent; small slender elongate ants..... Leptothorax
- 3b. Thoracic dorsum with the meso-epinotal suture well-marked..... 4
- 4a. Thorax seen in profile with the epinotum as high as the promesonotum, the thoracic dorsum forming an unbroken plane, more rarely with the epinotum separated from the mesonotum by a deep impression; antennal club of three segments..... Leptothorax

- 4b. Epinotum depressed well below the level of the pronotum, in profile the mesonotum forming a sloping declivity between them; antennal club indistinct, of 4-5 segments.... Stenamma

Key to the Species of Myrmica

- 1a. Antennal scape gradually and evenly bent at the base and never forming a right angle at the bend..... 2
- 1b. Antennal scape suddenly bent at the base and forming a right angle at the bend..... 4
- 2a. Frontal carina with an angular lobe which is thick and slightly but definitely deflected toward the head..... 3
- 2b. Frontal carina with a rounded lobe which is thin and moderately to strongly elevated..... brevispinosa
page 26
- 3a. Median portion of the clypeus convex; head seen in full-face view; postpetiole with a shining dorsal area which is largely free from rugae..... kuschei
page 32
- 3b. Median portion of the clypeus straight or concave, head seen in full face view; postpetiole ordinarily covered with rugae, rarely with a dorsal area free from rugae but in such cases this area is not shining... incompleta
page 30
- 4a. Ventral surface of postpetiole seen in profile flat or nearly so, the flat portion forming a rugose plate; lamina (raised portion) surrounds the bend of the scape like a collar..... americana
page 24
- 4b. Ventral surface of postpetiole seen in profile convex; lamina not as above..... 5

- 5a. Antennal lamina narrow and diagonally transverse across the bend of the scape but continued as a prominent transparent flange on that part of the scape that is proximal to the bend..... emeryana
page 29
- 5b. Antennal lamina not as above..... lobicornis fracticornis
page 34

Key to the Species of Stenamma

- 1a. Large species (length 2.75-4mm.); eye with 5-12 ommatidia in its greatest diameter..... brevicorne
page 36
- 1b. Small species (length 2.3-3.5 mm.); eye with 3-6 ommatidia in its greatest diameter..... diecki
page 37

Key to the Species of Leptothorax

- 1a. Dorsum of the postpetiole coarsely reticulo-rugose..... texanus
page 41
- 1b. Dorsum of the postpetiole punctate or granulose but not reticulo-rugose..... 2
- 2a. Dorsum of the postpetiole shining, the sculpture consisting of widely spaced small punctures with the surface between them smooth..... provancheri
page 40
- 2b. Dorsum of the postpetiole opaque or nearly so, the surface densely punctate or punctate granulose..... muscorum
page 38

Key to the Genera of Dolichoderinae

- 1a. Epinotal declivity strongly concave; integument hard and brittle; at least the epinotum heavily sculptured..... Dolichoderus taschenbergi
page 43
- 1b. Epinotal declivity straight; integument thin and flexible; sculpture everywhere fine..... Tapinoma sessile
page 44

Key to the Genera of Formicinae

- 1a. Antennae with nine segments..... Brachymyrmex depilis
page 46
- 1b. Antennae with 12 segments..... 2
- 2a. Profile of the thoracic dorsum evenly convex, the epinotum not depressed below the level of the mesonotum; the meso-epinotal suture not impressed or very slightly impressed; antennae inserted well above the dorsal edge of the clypeus..... Camponotus
- 2b. Profile of thoracic dorsum with the epinotum distinctly depressed below the level of the mesonotum; meso-epinotal suture always distinct, often deep; antennae inserted at or near the dorsal border of the clypeus..... 3
- 3a. Larger ants ($2\frac{1}{2}$ -9 mm long, usually $4\frac{1}{2}$ -9 mm); frontal carinae prominent, their lateral margins slightly raised; ocelli conspicuous.. Formica
- 3b. Smaller ants (2 - $4\frac{1}{2}$ mm, usually 2 - $3\frac{1}{2}$ mm); frontal carinae feebly developed, their lateral margin rounded or nearly flat; ocelli small or nearly absent..... Lasius

Key to the Subgenera of Camponotus

- 1a. Ventral border of the clypeus with a narrow median notch, above which is a short triangular impression; length of major at most 8 mm..... Myrmentoma nearcticus
page 54
- 1b. Ventral border of clypeus usually without a notch (or if one is present there is no impression above it); length of major worker more than 8 mm..... Camponotus

Key to the Species of the Subgenus Camponotus

- 1a. Colour dull black..... pennsylvanicus
page 53
- 1b. Thorax at least partly red..... 2
- 2a. Thorax black anteriorly, red posteriorly..... herculaneus
page 48
- 2b. Thorax red throughout; gaster shining..... noveborascensis
page 51

Key to the Species of Lasius

- 1a. Maximum worker eye length 0.17x the head width or less..... nearcticus
page 59
- 1b. Maximum worker eye length 0.20x the head width or more..... 2
- 2a. In a given nest series all larger workers and most smaller workers with one or more offset teeth at the basal angle of the mandible..... pallitarsis
page 57
- 2b. Workers of all sizes with the posterior basal tooth aligned with the adjacent teeth of the masticatory border..... alienus
page 56

Key to the Subgenera of Formica

- 1a. Slender; surface usually smooth and shining; frontal carinae subparallel, not diverging dorsally; epinotum rounded (i.e., base and declivity not clearly differentiated..... Proformica lasioides
page 60
- 1b. Robust; surface usually dull; frontal carinae varied; epinotum usually with base and declivity distinct..... 2
- 2a. Ventral border of the clypeus notched in the middle..... Raptiformica
- 2b. Ventral border of the clypeus convex or subangulate in the middle..... Formica

Key to the Species of Raptiformica

- 1a. Erect hairs present on the venter of the head ('gula' of authors) and are usually numerous on pronotum, mesonotum, crest of petiole, gaster, and often on angle of propodeum..... subintegra
page 62
- 1b. No erect hairs on venter of head, and very sparse on gaster..... subnuda
page 63

Key to the Species-Groups of Subgenus Formica

- 1a. Large workers with the occipital border very distinctly concave; pronotum (in profile) with basal and declivous faces meeting at an angle..... exsecta group
ulkei
page 74
- 1b. Large workers with the occipital border usually flat or slightly convex (at most slightly concave); pronotum (in profile) evenly convex, not angulate..... 2

- 2a. Females never more than $5\frac{1}{2}$ mm long and never larger (often smaller) than the largest workers; feebly shining or opaque; erect hairs (when present) on the pronotum of the worker often clavate or spatulate..... microgyna group
whymperi adamsi
page 73
- 2b. Females either more than 8 mm long and notably larger than the largest workers, or very smooth and shining; erect hairs on the pronotum of the workers not notably clavate or spatulate..... 3
- 3a. Bicolored, the head and thorax reddish or yellowish red and notably lighter than the gaster or, if infuscated, the infuscation does not completely mask the reddish ground color in the larger workers; frontal area usually shining frontal carinae strongly divergent..... rufa group
- 3b. Concolourous or bicolored; if bicolored, the thorax is lighter than the head and gaster; frontal area usually dull; frontal carinae at most moderately divergent, often parallel..... fusca group

Key to the Species of the rufa Group

- 1a. Crest of petiole extremely thick, with a profile in the shape of an inverted u; hairs forming the gastric pubescence often erect at the base but reflected at the tip so that they form little loops or wickets..... reflexa
page 72
- 1b. Crest of petiole much thinner; in profile the anterior face slopes rearward to the crest even when the latter is blunt; gastric pubescence usually appressed and never reflected..... 2
- 2a. Antennal scapes covered on all surfaces with numerous, delicate, erect or suberect hairs... 3

- 2b. Antennal scapes without erect hairs except for those at the extreme tip, rarely a few scattered suberect hairs on the inner surface near the tip..... 4
- 3a. Minor workers not extensively infuscated, the head and thorax in large part, or entirely, clear red as in the larger workers. oreas
page 70
- 3b. Minor workers extensively infuscated, the head and thorax in large part deep brown, their colour distinctly darker than that of the larger workers..... oreas comptula
page 70
- 4a. Scale of the petiole seen from behind with a flat or broadly concave crest, the sides in the upper half of the scale parallel, tapering inward only in the lower half of the scale..... 5
- 4b. Scale of the petiole seen from behind with the crest convex or angularly produced upward in the middle, rarely with a small central notch; the sides of the scale tapering inward evenly from crest to peduncle..... 6
- 5a. Erect hairs present on the gula and crest of the petiole; head and thorax clear yellowish red or ferrugineous..... dakotensis montigena
page 65
- 5b. Erect hairs absent on the gula and crest of the petiole; color decidedly variable, head and thorax deep ferrugineous red to deep blackish red..... dakotensis
page 65
- 6a. Median lobe of the clypeus descending abruptly to the clypeal fossae through steep side faces which make an angle with the upper face of the lobe; clypeal fossae deep and pit-like, the anterior edge of the clypeus which bounds them in front, sweeping up in an even curve to the median lobe..... fossiceps
page 67

- 6b. Median lobe of the clypeus descending to the clypeal fossae through an even curve which begins at the carina ; the clypeal fossae shallow and scarcely pit-like, the edge of the clypeus in front of the fossa very broadly united to the base of the lobe and not forming a distinct curve with it.....integra tahoensis
page 69

Key to the Species of the Fusca Group

- 1a. Gula with at least two erect hairs..... montana
page 80
- 1b. Gula without erect hairs..... 2
- 2a. Frontal area shining; bicolored, the thorax reddish and lighter than the head and gaster, which are dark brown or black..... 3
- 2b. Frontal area dull..... 5
- 3a. Erect hairs on the gaster sparse, largely confined to a row of widely spaced, short blunt hairs at the posterior edge of each segment; gastric pubescence very dilute, not sufficiently thick to obscure the distinctly shining surface..... neurufibarbis algida
page 81
- 3b. Erect hairs on the gaster more numerous and scattered over the entire dorsum; gastric pubescence dense enough to obscure the shining surface and give to the gaster a distinct grey cast..... 4
- 4a. Thorax deep reddish brown to blackish brown, at least the promotum heavily infuscated and only a little lighter in color than the head and gaster..... neurufibarbis gelida
page 81
- 4b. Thorax clear red to reddish yellow, sometimes lightly infuscated with spots of brown but always distinctly lighter in color than the head and gaster..... neurufibarbis
page 81

- 5a. Dorsum of the first gastric segment with erect hairs limited entirely or in part to the row at the rear edge, at most three hairs elsewhere; gastric pubescence very dilute, not obscuring the moderately shining surface. marcida
page 79
- 5b. Dorsum of the first gastric segment with erect hairs scattered over the entire surface; gastric pubescence usually obscuring the surface to some extent..... fusca
page 76

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