SOME HOUSE, LAWN, AND FIELD ANTS OF EASTERN KANSAS

by

ARTHUR JAMES MATTIS

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INTRODUCTION

Ants, undoubtedly, are the most abundant of the insects known to man. Only a busy colony or an active stream of workers occasionally catches the attention of the casual observer, and yet, among all the insects, the ants probably exhibit the nearest human social characteristics. A study of their colonial life reveals even more complicated social behavior than that represented by the Apidae.

Buckley (1866) estimated that in the United States there could be found approximately 200 different species of ants. Wheeler (1910) listed 265 known species that had been collected in the United States. Since Wheeler's publication, many other species have been added to the American Formicid list. Yet it has been estimated that not more than half the actual number of species has been identified.

All ants are classified under the family Formicidae, which is one of the largest families of the order Hymenoptera.

A large proportion of the ant population is harmless and in many instances ants are directly or indirectly beneficial. Occasionally, however, some species enter dwellings in search of a food supply or for other reasons. Some are persistent house pests, feeding on human food accessible to them and nesting in the various parts of the dwellings, often throughout the year and in some instances over a period of several years. The house-infesting forms have been classified either as sweet-eating or grease-eating species. The greater proportion of the

house-infesting ants nest in the soil out-of-doors, under stones, and under or in pieces of wood. They enter dwellings only in search of food. A few species become pests in lawns. on trees, or in open cultivated fields, and, while they do not ofter enter houses, vegetation may be damaged and in some cases completely destroyed for considerable distances around the nest.

AIMS AND LIMITATIONS OF THE SUBJECT

Since the ant population of Kansas is extremely large and the activities of the various species are as varied as are their habitats, a detailed account of their morphology and anatomy was herein not attempted. However, the purpose of this paper has been to describe the common species of ants found in Kansas, to estimate the relative abundance of each genus, species, and variety, to give a brief account of observations of nesting and feeding habits, and to present possible methods of control of pestiferous forms with particular attention to the house and lawn-infesting species.

METHODS OF COLLECTION AND IDENTIFICATION OF THE ANTS

Ant collections were made entirely at random and often only one worker ant at a time was collected. Colonies were sought under rocks, in old logs, in homes, about trees, and other favorable places where ants commonly establish colonies. In these cases, as many of the males, females, workers, and

queens as were considered necessary to represent the complete number of castes, were taken when present and discovered. The abundance and range of each species or variety was determined from repetitional collecting (Table 11). All the members of a colony were kept together in small vials containing 70 percent alcohol for future study and identification. Each vial was numbered and into it was placed a small card containing the (1) date of collection, (2) location of the colony or place of collection when taken singly, (3) general condition under which the ants were collected, whether pestiferous, parasitic, symbiotic, or free living, and (4) any other information peculiar to the colony or ant activity.

The vials were then taken to the laboratory where the specimens were temporarily keyed down to subfamily, genus, and in some cases to the species with the aid of Wheeler's (1910) key. (Plate I).

The specimens of each collection were divided into two lots, one of which was retained and the other sent to Dr. M. R. Smith, an authority on the Formicidae, United States National Museum, Washington, D. C., for authoritative identification. Upon return, the identified ants were placed in the Kansas State College permanent Formicid collection.

A LIST OF THE KNOWN SPECIES AND VARIETIES OF ANTS IN KANSAS

Subfamily PONERINAE

Genus Stigmatomma Roger

Stigmatomma pallipes Haldeman (Hayes, 1925)[1]
*Stigmatomma pallipes subsp. subterranea Creighton

Genus Proceratium Roger

Proceratium croceum Roger (Tucker, 1909)

Genus Ponera Latr.

Ponera coarctata subsp. pennsylvanica (Buckley)(Crevecoeur, 1922)
Ponera trigona var. opacior Forel (Hayes, 1925)

Subfamily DORYLINAE

Genus Acamatus Latr.

Eciton schmitti Emery (Crevecoeur, 1922)
Eciton commutatus Emery (Hayes, 1925)
Eciton opacithorax Emery (Hayes, 1925)
Eciton nigrescens (Cresson)(Hayes, 1925)

Subfamily MYRMICINAE

Genus Myrmecina Fabr.

Myrmecina graminicola subsp. americana Emery (Tucker, 1909)

Genus Monomorium Mayr

Monomorium pharaonis Linn. (Hayes, 1925)
Monomorium minimum (Buckley) (Hayes, 1925)
Monomorium minutum var. minimum(Buckley) (Tucker, 1909)

Genus Solenopsis Say

Solenopsis molesta (Say) (Crevecoeur, 1922)
*Solenopsis debilis (Say)
Solenopsis texana Emery (Tucker, 1909)

Genus Pheidole Westwood

Pheidole pilifera (Roger) (Hayes, 1925)
Pheidole sitarches Wheeler (Hayes, 1925)
*Pheidole sitarches subsp. rufescens Wheeler
*Pheidole dentata Mayr
*Pheidole dentata var. commutata Mayr
*Pheidole dentata var., (an unusually hairy variety)

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* Indicates first report for the state.

1 Names and dates refer to first report for the state.

*Pheidole sp. (bicarinata Mayr group)
Pheidole vinelandica Forel var. (Hayes, 1925)
Pheidole hayesi M. R. Smith (Hayes, 1925)

Genus Cremastogaster Lund.
Cremastogaster lineolata (Say) (Tucker, 1909)
*Cremastogaster lineolata var. cerasi (Fitch)
Cremastogaster lineolata subsp. laeviuscula Mayr (Tucker, 1909)
Cremastogaster lineolata var. clara Mayr (Hayes, 1925)
*Cremastogaster victima F. Smith subsp. missouriensis Pergande
*Cremastogaster minutissima subsp. missouriensis Emery
*Cremastogaster opaca depilis var. punctulata Emery
*Cremastogaster opaca var. punctulata Emery
*Cremastogaster laeviuscula Mayr
*Cremastogaster laeviuscula var. clara Emery
*Cremastogaster laeviuscula var. near clara Emery

Genus Stenamma Westwood
Stenamma sp. (Hayes, 1925)

Genus Aphaenogaster Mayr
Aphaenogaster mariae Forel (Hayes, 1925)
Aphaenogaster treatae Forel (Hayes, 1925)
Aphaenogaster fulva Roger (Hayes, 1925)
*Aphaenogaster fulva subsp. aquia (Buckley)
Aphaenogaster tennesseensis Mayr (Crevecoeur, 1922)
*Aphaenogaster texana Emery var.

Genus Pogonomyrmex Mayr
Subgen. Pogonomyrmex
Pogonomyrmex barbatus subsp. rugosus Emery (Hayes, 1925)
Pogonomyrmex occidentalis (Cresson) (Bridwell, 1899)
*Pogonomyrmex comanche Wheeler

Genus Myrmica Latr.
Myrmica rubra Linn. (Tucker, 1909)
*Myrmica rubra Linn. var. suloinodoides Emery (Crevecoeur, 1922)

Genus Leptothorax Mayr
Subgen. Leptothorax
Leptothorax schaumi Roger (Crevecoeur, 1922)
*Leptothorax fortinodis Mayr
Leptothorax curvispinosus Mayr (Crevecoeur, 1922)

Subgen. Dichothorax Emery
*Leptothorax pergandei Emery
Leptothorax sp (Crevecoeur, 1922)

Subfamily DOLOCHODERINAE
Genus Dorymyrmex Mayr
Dorymyrmex pyramicus (Roger) (Hayes, 1925)
Dorymyrmex pyramicus var. flavus McCook (Hayes, 1925)
Dorymyrmex pyramicus var. flavus Pergandei (Wheeler, 1910)
Dorymyrmex sp.

Genus Tapinoma Forester

*Tapinoma sessile (Say)

Genus Iridomyrmex Mayr

*Iridomyrmex pruinosus (Roger) var.
Iridomyrmex pruinosus var. analis Andre (Tucker, 1909)

Subfamily CAMPONOTINAE

Genus Prenolepis Mayr

Subgen. Prenolepis

Prenolepis imparis (Say) (Tucker, 1909)

Subgen. Nylanderia Emery

Prenolepis parvula Mayr (Crevecoeur, 1922)
Prenolepis vividula subsp. melanderi Wheeler (Hayes, 1925)
Prenolepis nietus Mayr (Crevecoeur, 1922)
Prenolepis sp. (Hayes, 1925)

Genus Lasius Fabr.

Subgen. Lasius

*Lasius niger var. neoniger Emery (Hayes, 1925)
Lasius niger var. americanus Emery (Tucker, 1909)
Lasius umbratus var. (Tucker, 1909)

Subgen. Acanthomyops Mayr

Lasius interjectus Mayr (Tucker, 1909)
Lasius claviger (Roger) (Crevecoeur, 1922)
Lasius latipes Walsh (Crevecoeur, 1922)
Lasius sp. (Hayes, 1925)

Genus Formica Linn.

Formica sanguinea Latr. subsp. subintegra Emery (Hayes, 1925)
Formica rufa var. apperans (Hayes, 1925)
Formica exsectoides Forel (Hayes, 1925)
Formica pallide-fulva Latr. (Hayes, 1925)
Formica pallide-fulva subsp. schaufussi Mayr (Tucker, 1909)
Formica pallide-fulva subsp. nitidiventris Emery (Crevecoeur, 1922)
*Formica pallide-fulva var. succinea Wheeler
*Formica pallide-fulva subsp. schaufussi var. incerta Emery
Formica fusca var. subaericea Say (Tucker, 1909)
Formica subpolita Mayr (Tucker, 1909)
Formica sp. (Hayes, 1925)

Genus Polyergus Latr.

Polyergus rufescens subsp. breviceps Emery (has not been reported from Kansas but Wheeler reports its range here)
Polyergus rufescens subsp. lucidus Mayr var. montivagus Wheeler (Hayes, 1925)

Genus Camponotus Mayr
Subgen. Camponotus

Camponotus maculatus var. nitidiventris Emery (Hayes, 1925)
Camponotus maculatus Fabr. sp. (Hayes, 1925)
Camponotus castaneus Latr. (Crevecoeur, 1922)
Camponotus castaneus var. americanus Mayr (Tucker, 1909)
Camponotus herculeanus Linn. (Bridwell, 1899)
Camponotus herculeanus subsp. pennsylvanicus (DeGeer) (Bridwell, 1899)
Camponotus herculeanus subsp. pennsylvanicus var. ferrugineus Fabr. (Hayes, 1925)
*Camponotus herculeanus subsp. ligniperdus var. noveboracensis (Fitch)
Camponotus fallax var. nearcticus Emery (Tucker, 1909)
Camponotus fallax var. minutus Emery (Tucker, 1909)
Camponotus fallax var. decipiens Emery (Tucker, 1913)
Camponotus fallax var. discolor Buckley (Hayes, 1925)
*Camponotus marginatus Latr. var. minutus Emery
Camponotus caryae var. (Fitch) (Hayes, 1925)
Camponotus (Myrmentoma) sp.

Total Genera, 22; species, 72; subsp., 16; var., 26.

THE SPECIES AND VARIETIES OF ANTS COLLECTED WITH A REVIEW OF THE LITERATURE AND ORIGINAL OBSERVATIONS

Subfamily PONERINAE

Stigmatomma pallipes subsp. *subterranea* Creighton

Previous records show that Hayes (1925) listed this species as a new record for the state; however, no reference to a subspecies was made. He collected specimens at Winfield in April, which were determined by Wheeler. Hayes stated further that the "colony was found under a stone which also sheltered a colony of *Solenopsis molesta* (Say)". The subspecies undoubtedly is new for the state. It is not included in Wheeler's (1910) list, and the distribution range is not definitely known.[2] Talbot (1934) reported the subspecies from the Chicago area.

A single collection of this subspecies was taken during this study on a rocky hillside under rocks near Manhattan in June.

Ponera coarctata Latr. subsp. *pennsylvanica* (Buckley)

Hayes (1925) stated that he collected workers of this subspecies in Riley County, and that in the Kansas State College collection were workers collected by J. B. Norton in Riley County in March which were determined by Dr. M. R. Smith as

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[2] All ranges given are from Wheeler's List of Described North American Ants (1910) or The Mountain Ants of Western North America (1917), unless otherwise stated.

P. pennsylvanica. Hayes further stated that,

> In the Crevecoeur list two separate species are cited as Ponera pennsylvanica and Ponera coarctata Latr. It is believed that there has been a misconception of these two names and that both refer to this species and subspecies.

One collection of the subspecies, pennsylvanica, was taken in the present study under a flat rock at Ottawa in June.

Buckley (1866) listed P. pennsylvanica taken at Philadelphia. The range of this species is confined to the Northeastern States and Canada according to Wheeler (1910). Talbot (1934) reported it from the vicinity of Chicago, and Buren (1941) stated that it was common in the Ames, Iowa area.

Ponera trigona Mayr var. opacior Forel

This variety was first reported for Kansas by Hayes (1925). Bridwell (1899) listed the genus but did not refer to specific determination. Two other species of this genus are recorded in the Crevecoeur (1922) list.

Twelve collections of this variety were obtained during this study, 10 of which were found under rocks at Howard in August. Several workers were taken under rocks at Ottawa, in June, and one collection of a large number of workers was taken in a rotten log at Valley in May.

Wheeler (1910) gave the range as Texas.

Subfamily DORYLINAE

Eciton (Acamatus) opacithorax Emery

This species was first reported for the state by Hayes (1925) who collected specimens while they were trailing over the ground in single file in April, 1916.

The writer obtained two collections at Howard in July. One group was taken from a rotten elm tree log, Ulmus americana, and the other from a decayed oak stump, Quercus macrocarpa, not far distant.

Wheeler (1910) gave the range as Texas to Missouri. Smith (1916) reported the species from South Carolina.

Eciton (Acamatus) nigrescens (Cresson)

No previous published records contain this species as having been taken in Kansas, although it is recorded in Wheeler's (1910) list as occurring from Kansas to Texas.

A total of six collections were taken during this study and in each case the ants were characteristically rushing about in a heavy stream, usually all in the same direction. In each case, the ants were engaged in rushing into holes in the ground or crevices in a tree or stump and they suddenly disappeared from sight. Five collections were taken at Manhattan, one in May and four in June.

Wheeler (1910) gave as the range Kansas to Texas. Buren (1941) reported it common in the Sioux City, Iowa area.

Subfamily MYRMECINAE

Myrmecina graminicola subsp. *americana* Emery

This rare subspecies was recorded by Tucker (1909) from Lawrence where he collected males in September and October. This ant is probably not abundant in the state since other collectors did not list it and only one collection of workers was taken during this study. It occurred under a rotten log at Valley Falls in May.

Wheeler (1910) indicated the range to be the Northeastern States. Talbot (1934) reported it from the Chicago area.

Monomorium minimum (Buckley)

Bridwell (1899) included the genus only in his list. This species of ant was included in the Kansas list by Hayes (1925), who stated that he found workers hibernating in a nest in December at a depth of 18 to 24 inches.

The workers are approximately 2.5 mm. to 3 mm. in length, and as the common name indicates, are black in color throughout. The frontal carinae cover the antennal insertions and the clypeus is armed with a pair of ridges which project forward. The antennae are 12-segmented, the last three segments forming a distinct club nearly as long as the remainder of the funiculus. Workers are monomorphic.[3]

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[3] Key, p. 45.

Fig. 1. Monomorium minimum (Buckley) worker.

A meager life-history study of this species involving only the pupal and larval stages, was conducted under laboratory conditions during July. Ten workers were placed with 10 eggs in a large vial and reared to adulthood under daily observations. The temperature range under developmental conditions varied from approximately a low of 75° F. to a high of 95° F. The humidity was kept relatively constant by the addition of a drop of water to the vial occasionally during the heat of the day when rate of evaporation was greatest. Granulated sugar was used as food. These conditions prevailed during all the life-history tests completed.

Table 1. Duration of larval and pupal stages in the life-history study of Monomorium minimum (Buckley) in days.

Egg number	Time in larval stage	Time in pupal stage
1.	18	13
2.	18	14
3.	18	14
4.	19	14
5.	19	15
6.	19	15
7.	20	16
8.	22	17
9.	23	17
10.	?	dead
	Average 19.55 days	Average 15.00 days

The duration of the egg stage is not considered in these studies, for the eggs were collected from a colony in the field and the age of the eggs at the time of collecting was unknown. One egg failed to develop into the larval form, and therefore the average duration for the larval and pupal periods was based on nine individuals.

This common, black species constructs characteristic crater nests in dry shady or gravelly soils. It frequently enters homes (Tables 8 and 11) in search of sweets. A total of 51 collections was taken of this "little black ant" during these studies, which was more than of any other species. The dates of collection (Table 11) ranged from April to late September, which indicates the presence of these ants in and around homes and in various other habitats from early spring to late fall, and occasionally even during the winter months.

During the extensive experiments conducted by Smith (1940) in regard to the poisonous effects of castor bean plants, Ricinus communis Linn., on insects attacking crops, he discovered that a number of Hymenopterous insects visited the succulent leaves and nectaries of the plants. Prominent among other Hymenopterans were workers of Monomorium minimum (Buckley).

The range as indicated by Wheeler (1917) included the Atlantic and Southern States as well as Texas, Nevada, Arizona, Colorado, and the lower New England States. Rau (1934) reported it common in northeastern Missouri, and Talbot (1934) in the Chicago area. It is interesting to note that Buren (1941) did not record this species from Iowa.

Monomorium pharaonis Linn.

Lists of Kansas Hymenoptera previous to Hayes (1925), did not include Monomorium pharaonis Linn., which is a close relative of M. minimum (Buckley). Hayes stated that "In this state, it is often confused with Solenopsis molesta (Say), both of which infest houses and are spoken of as 'red ants'. It occurs widespread over the state."

No specimens of this species were collected during this study. It is the opinion of the writer that this species was only occasionally introduced into this area through shipment of food or feed supplies or in other ways. In reference to previous collecting habitats, they indicate that the ants were found only in supply houses, hotels, cafes, and stores. Apparently this area is not favorable to their survival.

Solenopsis molesta (Say)

The first published record of this species appeared in the Tucker (1909) list of Insects Collected in Kansas and Colorado. This species was also recorded by Crevecoeur (1922) as Solenopsis debilis (Say), obviously referring to S. molesta (Say). According to Hayes (1925),

> This pernicious pest is known over the state as the "Kafir ant" or "Tiny thief ant". It attacks the planted seeds of sorghums and other crops and causes an immense amount of damage in southern Kansas.

Numerous collections of this species (Table 11) were made during this study at and near Manhattan, Ottawa, Valley Falls,

Howard, and other centers from April, 1939 to July, 1941. In almost every case they occurred as pests and attacked oily or greasy foods in kitchens, pantries, and store rooms. However, two collections of this species were obtained in August from sorghum plants near Howard. Dr. M. R. Smith stated in a recent letter that, "the tiny thief ant is most commonly found nesting outdoors in the soil or in rotten wood; occasionally, however, the ants nest in buildings."

Fig. 2. Solenopsis molesta (Say) worker.

There has arisen much taxonomic confusion among American writers with regard to this species. It was originally described as Myrmica molesta Say, but 30 years later it was redescribed and given the specific title Myrmica exigua by Buckley (1866). Fortunately, the latter name did not reach extensive publication, and 20 years later Mayr redescribed the same ant as Solenopsis debilis. Mayr was the first writer to place the ant under the genus Solenopsis Westwood. His description and change in nomenclature of the ant resulted in

considerable confusion between Solenopsis molesta and S. fugax Latr, which is a common European species, for the two show striking structural similarities. Emery (1894, p. 271) first stated that he believed that debilis was only a synonym of Say's molesta. According to Hayes (1925), Wheeler is quoted as stating that,

> Solenopsis fugax is a European species, and does not occur in this country. It is extremely close to Solenopsis molesta, however. Undoubtedly, all references to fugax in American literature refer to molesta.

Additional and more recent confusion has resulted between the determination of S. molesta (Say) and the little red house ant, Monomorium pharaonis Linn. Solenopsis molesta (Say) can be readily distinguished from the little red house ant, or Pharaoh's ant, as indicated by Marlatt (1922) and substantiated by the writer,

> by its much lighter color and smaller size. It is further distinguished by the possession of very rudimentary eyes and a two-jointed instead of a three-jointed club to the antennae.

Severin (1920) stated that the two species of ants have similar feeding habits, and showed considerable likeness in yellow-orange color but gave the approximate length of the workers of S. molesta as 1/32 of an inch, and that of workers of M. pharaonis as 1/16 of an inch.

In a recent letter from Dr. M. R. Smith regarding the current confusion of these two species of ants, he stated that,

> Pharaoh's ant, Monomorium pharaonis (L.) is distinguished from the tiny thief ant, Solenopsis molesta (Say) as follows:

Pharaoh's ant	Tiny thief ant
Antenna 12-segmented	Antenna 10-segmented
Antennal club 3-segmented	Antennal club 2-segmented
Length, 2-2.5 mm.	Length, 1.5-1.8 mm.
Head, thorax, petiole and postpetiole densely punctulate and subopaque	Head and thorax shining and bearing sparse but distinct punctures.

The range according to Wheeler (1917) was reported to be the Eastern and Northern States extending as far west as Colorado and New Mexico. According to Hayes (1925), the species is widespread throughout the United States and Mexico. He collected many specimens in the eastern half of the state from as far west as Smith and Barber Counties. M. R. Smith in recent correspondence, stated that Pharaoh's ant is an introduced species and is not as common or as widely distributed as the tiny thief ant but is almost always found in hotels, apartments, cafes, and wholesale stores. Rau (1934) reported S. molesta in the vicinity of Kirkwood, Missouri, and Buren (1941) indicated their abundance in the Ames, Iowa area.

Pheidole pilifera (Roger)

This generic name was first included for Kansas in the Bridwell (1899) list of Kansas Hymenoptera and later in the Crevecoeur (1922) list. However, the first reported collection of specimens of this species was made at Winfield in April by Hayes (1925) where they were attacking workers of S. molesta (Say). Only one collection of a few workers were taken during this research on the surface of the ground at Valley Falls in May.

The range is confined to the Eastern and Northern States

according to Wheeler (1910). Buren (1941) reported this species from Iowa, and Talbot (1934) from the vicinity of Chicago.

The large soldier-workers which have much enlarged heads are approximately 6 to 8 mm. in length; the smaller workers are 4 to 5 mm. in length. Both forms are orange-brown in color. The frontal carinae cover the antennal insertions. The antennae are 12-segmented, with a 3-segmented antennal club which is longer than the remainder of the funiculus. The workers are strongly dimorphic and usually without intermediate forms.[4]

Fig. 3. Pheidole Westwood sp. (workers).

The life-history study of this species was conducted in the same manner and under similar laboratory conditions as was mentioned for Monomorium minimum (Buckley). Two eggs did not hatch but were carried through the entire period of development, although only those that hatched were computed on the basis of average days spent in each stage.

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[4] Key, p. 45.

Table 2. Duration of larval and pupal stages in the life-history study of Pheidole Westwood sp., in days.

Egg number	Time in larval stage	Time in pupal stage
1.	19	12
2.	20	13
3.	20	13
4.	20	13
5.	20	14
6.	20	14
7.	21	14
8.	21	15
9.	?	dead
10.	?	dead
	Average 20.12 days	Average 13.50 days

Two of the adult worker ants died before the end of the development period. This might indicate that the factors of humidity or temperature were not favorable.

Pheidole sitarches Wheeler

Specimens of this species were first reported for Kansas by Hayes (1925) from Cowley County in 1916. Wheeler (1916) recorded specimens as a new species from Kansas, but did not describe them.

These ants are fairly abundant and apparently well distributed throughout the eastern half of the state (Table 11). Thirteen collections were made at Howard, Manhattan, and Ottawa during May and June. All specimens were obtained from a natural habitat of well drained, grassy lawns or pastures.

The distribution range given by Wheeler (1916) was Texas and Kansas.

Pheidole sitarches subsp. *rufescens* Wheeler

Hayes (1925) recorded "*Pheidole sitarches* Wheeler" from Kansas, and indicated that one was a new variety. No list of ants from Kansas has included this subspecies.

Seventeen collections were made as follows: at Manhattan, three were taken in June and two in July; at Ottawa, eight in June; and at Howard, three in August and one in July. All specimens were collected under rocks except two collections which were taken from sidewalks.

The distribution range was indicated by Wheeler (1910) as Texas.

Pheidole dentata Mayr

Specimens of this species have been common in the vicinity of Manhattan where numerous collections were made from May to September (Table 11). These collections were obtained in extremely diversified habitats as verified by the results of pestiferous ant collections in the vicinity of Manhattan (Table 8). It appears that normally this species of ants is free living, and nests in wood or under rocks. Occasionally the nest has an opening at the surface of the soil in grassy areas. In two cases, they were pests on sweets in kitchens.

No published record is available of the previous occurrence of this species in the state.

The range for the species indicated by Wheeler (1910) was the Southern States west to Texas.

Pheidole dentata var. *commutata* Mayr

This variety had not been recorded previously for the state. Two collections of this ant were obtained at Manhattan in June. One of these collections was obtained from a kitchen cabinet where the ants were feeding on bits of sugar scattered over the shelves. The other specimens were taken from a grassy lawn.

The distribution range was indicated by Wheeler (1910) as the Southern States west to Texas.

Cremastogaster lineolata (Say)

This species was first reported from Kansas by Tucker (1909) who collected females and workers at Lawrence in April and June, and males in September. Crevecoeur (1922) also listed the species without reference to subspecies or varieties.

Of the total number of 17 collections taken, eight were pests in search of sweets about kitchens, seven were from colonies in lawns, while two occurred on the bark of living elm trees (*Ulmus americana*). In castor bean studies carried out by Smith (1940) it was found that several species of ants of this genus were attracted to the succulent leaves and neataries of castor bean plants, *Ricinus communis* Linn. These were *C. opaca depillis* var. *punctulata* Emery and *C. lineolata* (Say).

Identification of eight collections as *C. lineolata* (Say) var., was not completed. Two collections occurred at Ottawa in June, five at Manhattan in July, and one at Howard in August. Specimens of two collections from Manhattan were

pests on sweets in kitchen cabinets while the others were taken under rocks or in rotten wood.

The range given by Wheeler (1917) for this species was the Northern States and Canada. Rau (1934) reported this species of ants as common in eastern Missouri, Talbot (1934) in Illinois, and Buren (1941) in central Iowa.

Workers of this genus vary considerably with the species and varieties, however typically they are approximately 0.5 cm. in length, with the posterior end of the gaster acutely pointed. The head and gaster are dark brown to black while the remaining portions of the body are light brownish-yellow. The post-petiole is articulated to the dorsal surface of the gaster which is flattened dorsally, while the ventral surface is deeply concave.[5]

Fig. 4. Cremastogaster lineolata var. (worker).

All the forms have a rank, indescribable odor. When in large colonies, they are often very courageous and sting and bite with great fury. Small colonies, however, or small groups of foraging workers, are very timid and

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[5] Key, p. 45.

> when disturbed take refuge in crevices in the bark or depressions in the soil. Like the other members of the genus, lineolata workers are able while walking or running to throw up and turn forward the tip of the gaster, so that its flattened dorsal surface becomes ventral and its convex ventral surface becomes dorsal in position. Another typical habit of C. lineolata is constructing, often at some distance from the ground or the nest, small inclosures variously designated at 'tents', 'pavilions', or 'cowsheds' over colonies of aphids or coccids.

This description of the habits of a representative species of the "acrobat" or "tent-building" ants by Wheeler (1916) has been verified by the writer many times. The nesting habits of these ants were confined almost entirely to wood, such as logs, stumps, hollow trees, and occasionally under trash. Some species of this genus were found frequently under rocks. They characteristically formed lines of living ants moving upward and downward on trees from which the sweet nourishing sap of the leaves, petioles, and twigs were eaten. Jones (1929), referring to these ants, stated that,

> Different species of ants vary greatly in the substances used as food, but in the majority of cases their nourishment appears to be sweet secretions secured directly from plants, as the nectar of flowers or as honey-dew from insects, such as aphids, coccids, membracids, aleyrodes or psyllids, which is eliminated as a waste product from the alimentary canal.

After several unsuccessful attempts to rear ants of this genus from the egg stage through the larval and pupal stages, one test was completed in July with the results indicated in Table 3.

Table 3. Duration of larval and pupal stages in the life-history study of Cremastogaster lineolata (Say), in days.

Egg number	Time in larval stage	Time in pupal stage
1.	18	15
2.	18	15
3.	18	15
4.	18	16
5.	20	16
6.	20	17
7.	20	19
8.	21	19
9.	21	?
10.	?	dead
	Average 19.33 days	Average 16.50 days

This study was conducted in connection with the life-history study of Monomorium minimum (Buckley) and methods and environmental factors were identical. One egg failed to develop into the larval stage and apparently was dead. One of the nine larvae remained in the larval stage, and consequently the average pupal development period was computed from the eight which completed development. The average larval development period was based on the nine stages completed.

It will be interesting to note that the average duration of the larval stages for Cremastogaster lineolata (Say) and Monomorium minimum (Buckley) were almost identical.

Cremastogaster lineolata var. cerasi (Fitch)

This variety of the species lineolata has not been reported previously for Kansas. A single collection was taken on the side of a living elm tree, Ulmus americana, near Manhat-

tan in June, which has been placed definitely in the variety cerasi.

The general range indicated by Wheeler (1910) was the Southern States. Rau (1934) reported specimens taken with termites at Wickes, Missouri, while Talbot (1934) obtained specimens in the Chicago area.

A total of 24 collections of ants near the variety cerasi was taken in a variety of conditions of habitat (Table 11). These ants appear to have been unusually abundant in this area and many specimens were found as household pests.

Wheeler (1910) indicated the range as the North Atlantic States.

Cremastogaster minutissima subsp. missouriensis Emery

This is another addition to the list of ants for the state. Only five collections of this species were made during these observations, two at Valley Falls on a rocky hillside in May, and three at Manhattan on rocky hillsides in June.

Wheeler (1910) gave the range as Texas.

Cremastogaster opaca depillis var. punctulata Emery

This is the first report of this species and variety for Kansas. One collection of this species was made at Manhattan under rocks and a second near Lorraine on a lawn.

Wheeler (1910) gave the range for this species under a different nomenclature from Texas, New Mexico, Mexico, and Colorado.

A few workers in each of four small collections which were determined as C. opaca var. punctulata Emery, were obtained at Manhattan on rocky hillsides under rocks in June. This variety has not been reported before from Kansas.

Cremastogaster laeviuscula var. clara Emery

Tucker (1909) recorded specimens presumably of this species and variety from Lawrence and Wichita under C. lineolata subsp. laeviuscula Mayr.

Several workers from Iola were received in June without further collection data, while two collections were obtained in hedge posts at Howard in July.

A few workers determined as C. laeviuscula Mayr, were collected under rotten logs at Howard in August. Four collections of worker specimens of the genus Cremastogaster were obtained that were not specifically determined. One each of these were obtained in elm firewood and on a sidewalk at Manhattan in July; one in a stump near Howard in July; and one under boards at Topeka in November.

Aphaenogaster mariae Forel

This species was first reported from Kansas by Hayes (1925); however, Dr. M. R. Smith had been sent specimens taken in Kansas by Dr. C. R. Jones of Colorado.

Only one collection of a few workers was taken during these studies. It occurred on a living elm tree, Ulmus fulva, along Wildcat creek near Manhattan in July. Specimens of this

species are also found in the Kansas State College collection which were taken in the vicinity of Manhattan.

Wheeler (1910) reported this species to be rare in this area and gave the range as South Atlantic States.

Aphaenogaster treatae Forel

This species was first reported by Hayes (1925) stating that workers were collected in abundance by J. B. Norton in March and April.

A number of workers were taken under rocks near a creek bed near Ottawa, in June. The range as given by Wheeler (1910) was the South Atlantic States north to Connecticut and west to Texas. Talbot (1934) reported this species from Illinois.

Aphaenogaster fulva subsp. aquia (Buckley)

Neither this species nor its subspecies appears in previous Kansas Formicid lists, and therefore is the first report for the state. The specimens were taken at Valley Falls in May. Although this species has not been reported previously for the state, the species A. tennesseensis Mayr is listed by Creveocoeur (1922) and Wheeler (1916) stated that A. tennesseensis Mayr occurred only in regions where A. fulva subsp. aquia Buckley appears.

The range as recorded by Wheeler (1917) included Colorado to Mexico. Talbot (1934) reported it from Illinois, and Buren (1941) from central Iowa.

Aphaenogaster texana Emery var.

This may be a first report for the state for this species. Wheeler (1910) listed A. fulva subsp. aquia var. texana Emery taken in Texas which might have been the earlier specific name, or perhaps the species had been placed with A. fulva subsp. aquia Buckley previously mentioned. Yet in 1917, Wheeler listed the range as Texas, Arizona, and Kansas under the specific name A. texana Emery.

Several workers were taken while feeding on sap exuding from an elm tree, Ulmus fulva, on Wildcat creek near Manhattan in July.

Pogonomyrmex occidentalis (Cresson)

This species was first recorded in Kansas Formicid literature by Bridwell (1899). This ant, which is very common in the western part of the state, is commonly known as the Mound-building Prairie ant, which name is particularly suitable, since its nesting habits are characterized in the construction of pyramidal mounds in arid regions, as described by Headlee and Dean (1908), (Plate IV),

> ---each located in a cleared, circular space, and beneath these mounds in chambers and galleries that penetrate the earth as far as ten feet, these chambers and galleries serve them as store rooms, nurseries, and workshops.

Several workers were taken at Wichita in the brick flue on a house in July.

The range given by Wheeler (1910) was Wyoming, Colorado,

western Kansas, New Mexico, and Arizona. Headlee and Dean (1908) stated that these ants were "distributed throughout western Kansas and over a large part of the western plains of the United States", and within the state these investigators found that the ants were active in their natural habitat as far east as Belleville, Minneapolis, Newton, Wichita, and Oxford.

Leptothorax fortinodes Mayr

This species has not before been reported from the state, although Crevecoeur (1922) listed an undetermined species of Leptothorax taken at Ottawa, as well as two determined species, L. schaumi Roger, and L. curvispinosus Mayr.

Three different groups of this species were collected during these experiments. One collection was taken from a column of ants crossing a path near Manhattan in July, one on the side of a living elm tree, Ulmus americana, near Ottawa in August, and another on the surface of the soil of a playground at Valley Falls in May.

The range given by Wheeler (1910) was the Atlantic States. Talbot (1934) collected specimens in the Chicago area, and Buren (1941) reported the species in the Clinton, Iowa region.

Leptothorax (Diehothorax) pergandei Emery

This is an addition to the list of Kansas ants. Neither the subgenus nor the species has previously been included from Kansas in the Formicid literature.

Three collections were obtained during these studies. Two were taken near Manhattan, one under rocks in June and the other in a path in July. The third was taken from a colony working at the edge of a sidewalk in Valley Falls in May.

Leptothorax curvispinosus Mayr

This species was included in the Crevecoeur (1922) list, specimens of which were collected near Ottawa.

Only one collection of this species was obtained during these studies at Valley Falls. It was collected under flat rocks early in April.

According to Wheeler (1910) the range at that time was given as the North Atlantic States. Talbot (1934) indicated this species to be common in Illinois, and Buren (1941) reported it from Iowa.

Subfamily DOLICHODERINAE

Dorymyrmex pyramicus (Roger)

Eight collections of this species were made in the eastern portion of the state. One was taken at Manhattan on a grassy fairway of the local golf course in June, and the other was collected on a city lawn in June. At Valley Falls, two collections were taken, both under rocks in May, while at Ottawa four were taken on city lawns in June.

The distribution range according to Wheeler (1910) was the Southern States.

Dorymyrmex pyramicus var. *flavus* MacCook

Hayes (1925) recorded this variety for the first time for the state. He stated that workers were taken at Manhattan in May.

Only a few specimens also in Manhattan were collected in July during these studies. These workers were active on a small "hill" at the side of a house with a concrete foundation.

This variety has been reported as having the same distribution range as its specific form mentioned above, Southern States.

Tapinoma sessile (Say)

This genus was listed by Bridwell (1899) but he made no reference to the species, which is commonly known as the "Odorous House Ant". Evidently, this is the first report of the species for the state for the Hayes (1925) list did not contain either the genus or the species.

Two collections were taken in May on a rocky hillside under rocks near Valley Falls.

The distribution range recorded by Wheeler (1917) was the Western States from New Mexico to Western Canada and as far east as Colorado. Talbot (1934) obtained specimens from the Chicago area, and Buren (1941) from the Ames, Iowa area.

Iridomyrmex pruinosus var. analis Andre

Specimens of this variety were first collected and recorded by Tucker (1909) at Lawrence in July.[6] Hayes (1925) stated that he collected specimens of this variety at Winfield in 1915, under stones in pasture land living with colonies of Solenopsis molesta (Say). Wheeler (1910) did not record the specific name pruinosus but gave the varietal name analis specific rank.

Nine collections were obtained during these studies, seven of which were made at Manhattan, three in June and three in July, and one under the bark of a dead elm tree, Ulmus fulva, in May. Two collections occurred under sidewalks at Howard in August.

The distribution range was not recorded by Wheeler. Rau (1934) collected specimens of this variety at St. Albans, Missouri.

A total of 18 collections of this species, I. pruinosus (Roger) var., which Dr. M. R. Smith was unable to determine further, was collected in the eastern section of the state (Table 11). Four collections were obtained at Howard, consisting of three under the bark of hedge posts and one in a cornfield in August; four at Valley Falls, two under rocks and two in rotten stumps in May; two at Ottawa on a dirt road in June; and eight at Manhattan, three on flat rocks in June and five on grassy lawns and under rocks in July.

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6 The generic name in this list is misspelled.

No distribution range has been recorded for this species.

The length of these workers varies from 5 to 7 mm. The abdomen is light tan with a darker brown band on each segment on the ventral and posteral region. The head, thorax, and legs are slightly darker orange-brown than the abdomen, particularly on the dorsal surfaces. The abdominal pedicel consists of a single segment with the scale slightly inclined forward and well developed. There is no construction between the first and second gastric segments. The sting is vestigial and the epinotum is without a conical elevation. A rancid butter odor is often associated with them.[7]

Fig. 5. Iridomyrmex Mayr sp. (worker).

Table 8 indicates that many of these ants were taken on golf courses, pastures, and lawns where the small but well distributed, and occasionally dense colonies had little regard for elaborate nests in sheltered environments. The nests were ordinarily located in well drained clay or gravelly soils with sparse vegetation. The individual nests were shallow with very little "hill" surrounding the entrances.

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[7] Key, p. 45.

The workers rushed about so rapidly that the collector usually had difficulty capturing them alive without injury. The pugnacious characteristic was not highly developed, since the collector was not attacked.

Due to the difficulty in rearing these ants two separate tests were conducted. Rearing conditions and methods were similar to those already mentioned. Table 4a shows the results obtained from the first test conducted in June, while Table 4b shows the results of the second test completed in July.

Table 4a. Duration of larval and pupal stages in the life-history study of Iridomyrmex Mayr sp., in days.

Egg number	Time in larval stage	Time in pupal stage
1.	21	14
2.	21	14
3.	21	14
4.	23	15
5.	23	15
6.	23	17
7.	23	dead
8.	?	dead
9.	?	dead
10.	?	dead
	Average 22.14 days	Average 14.83 days

Table 4b.

Egg number	Time in larval stage	Time in pupal stage
1.	20	15
2.	20	15
3.	20	16
4.	20	16
5.	21	16
6.	22	17
7.	22	17
8.	?	dead
9.	?	dead
10.	?	dead
	Average 20.71 days	Average 16.00 days

The average duration in each stage was computed only on the basis of stages completed. Apparently this genus of ants was more sensitive to the artificial laboratory conditions than were the other forms tested. The causes for the differences in results of the larval and pupal stages of these two tests were not evident. Possibly humidity and thermal differences were responsible factors.

Subfamily CAMPONOTINAE

Prenolepis imparis (Say)

This species was first reported for Kansas by Tucker (1909). He collected males at Lawrence in March and April. Crevecoeur (1922) also reported the specimens taken in Franklin County.

Eight small collections were taken at Manhattan in May, consisting of two under the bark of maple trees, Acer saccharinum, three on the surface of a rocky hillside, two on flat rocks, one on a grassy terrace, and one in a garden on the surface of the soil in June.

Wheeler (1910) indicated the general range of this species as temperate North America and in 1917 included most of the western states as far east as Colorado. Rau (1934) reported specimens taken at Creve Couer Lake, Missouri, Talbot (1934) reported them from Illinois, and Buren (1941) from central Iowa.

Hayes (1925) reported P. (Nylanderia) sp. without further identification from Manhattan in April.

One collection was taken during these studies in a kitchen

in Manhattan in July where it was a pest on sweets.

Lasius niger var. neoniger Emery

This variety was first reported for the state in the Bridwell (1899) list of Kansas Hymenoptera as Lasius alineus Forst. However, this name is synonymous with the more recent and accepted term Lasius niger var. neoniger. According to Dean[8], these ants are commonly referred to as "cornfield ant" since they attend aphids attacking the roots of corn in eastern Kansas, especially the southeast.

Only one collection of a few workers was obtained at Manhattan at the edge of a sidewalk in July.

Wheeler (1910) gave the range as the Northern States, but in 1917 he included California, South Dakota, Colorado, and Mexico. Rau (1934) reported this variety from St. Louis County, Missouri. Talbot (1934) reported it from Illinois, and Buren (1941) from Iowa.

Lasius (Acanthomyops) interjectus Mayr

This represents another species that was first reported for the state by Tucker (1909), Lawrence. He collected workers at Lawrence in April. The species is also recorded by Crevecoeur (1922). Smith (1928) stated that a large number of collections from Kansas had been sent him for identification requesting methods of eradication. In each case these ants, which are

[8]Professor G. A. Dean, Head of the Department of Entomology, Kansas State College.

called the "yellow ant", had been taken in basement habitats where they had become pests particularly during the mating seasons. Smith stated further that "they were often seen emerging from the soil near the foundation and crawling about over the foundation or vegetation". The ants when annoyed or crushed produced a characteristic "toilet soap" odor, which was proved to be due to a volatile substance produced in the heads of the ants.

Three separate collections of this ant were obtained, one under boards at Howard in August, and two at Valley Falls, one under a log and the other in the basement of the high school building in May.

Lasius (Acanthomyops) claviger (Roger)

Specimens of this species were first reported for Kansas by Crevecoeur (1922) who listed the ant under the misspelled specific name "clavagers". Collecting data were not included but it is probable that the specimens were taken in or near Franklin County.

Only one collection was made of this species during these studies. It occurred under a flat rock near Ottawa in June which is, as will be noticed, the same vicinity where Crevecoeur obtained his specimens.

The range of the species as recorded by Wheeler (1917) was the Northern States. According to Talbot (1934), specimens were taken from New Mexico and Illinois, and Buren (1941) reported them common in Iowa.

Formica pallide-fulva var. *succinea* Wheeler

Since this variety has not been included in the published records of insects from Kansas, it is the first report for it for the state.

Only one collection of this variety was taken on a sidewalk at Manhattan in July.

The distribution range was given by Wheeler (1910) as Texas.

Formica pallide-fulva subsp. *schaufussi* var. *inserta* Emery

Likewise, no record of this variety of the subspecies *schaufussi* was found in previous lists of Kansas ants. However, Tucker (1909) reported this subspecies as taken at Lawrence, where he collected a female in July. One worker was also obtained in Riley County by Hayes (1925).

Workers were taken during these studies at Manhattan in three separate collections, two of these while they were crossing a sidewalk in July, while one was obtained without habitat data in May.

The distribution range was recorded by Wheeler (1917) as Colorado, Mexico, Central and the Atlantic States. Talbot (1934) reported this variety from Illinois, and Buren (1941) indicated it rare in Iowa.

Several specimens in each of two collections determined only as *Formica* sp. (*pallide-fulva* group), were taken at Howard in July, while running about on the limbs and leaves of young elm trees, *Ulmus americana* L.

Camponotus castaneus subsp. americanus Mayr

Tucker (1909) first listed this for the state with the locality designation "Kansas". Hayes (1925) stated that specimens collected at Winfield in September and determined by Wheeler as C. castaneus var. americanus Mayr, might have been the same kind of ant referred to by Tucker.

At Manhattan two collections, one on a sidewalk and the other on the side of an oak tree, Quercus macrocarpa Michx., were taken in June, while at Howard one collection was taken on the side of a living elm tree, Ulmus americana L., in July.

The distribution range was indicated by Wheeler (1910) as the Northeastern States. Talbot (1934) reported specimens taken in the Chicago area, and Buren (1941) reported them common to the Ames and Clinton, Iowa areas.

The ants of this genera are the largest ants found in Kansas. The workers vary in length from 10 to 14 mm., and are black throughout except for very dark brown areas, namely, the posterior tip of the gaster, the petiole, and the ventral surfaces of the thorax and head. The abdominal petiole consists of a single segment; there is no constriction between the first and second gastric segments. The clocal orifice is terminal, circular, and surrounded by a fringe of hair. The workers are generally polymorphic.[9]

These ants are limited almost entirely to woody habitats. Favorite nesting conditions are hollow trees. The ants make

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[9] Key, p. 45.

Fig. 6. Camponotus herculeanus Linn (worker)

their entrance in the tree through a knot-hole, crevice, or partially decayed root or limb. According to Friend and Carlson (1937), the ants do not use the wood for food but excavate it only for the purpose of furnishing a home for the colony. This conclusion has also been substantiated by the collector, for in many instances they have been observed conveying and depositing the woody morsels through the entrance or exit, occasionally forming piles of dust below. Their favorite food consists of sweets. Under free living conditions the workers are frequently seen scurrying up and down the sides of trees and feeding upon the young sapwood and bark, and not infrequently upon the petioles and leaf blades. Nests of these ants were not observed in soil or under stones as is typical of almost every other free living species of ant in this section of the state.

The workers exhibit unusual cowardice when feeding and even when being attacked within the nest. It has been observed

that when they nest near a house they may over-run the house in search of food.

The life-history test of this genus of ants was completed in July under the same laboratory conditions and in the same manner as was described for Monomorium minimum (Buckley).

Table 5. Duration of larval and pupal stages in the life-history study of Camponotus herculeanus Linn., in days.

Egg number	Time in larval stage	Time in pupal stage
1.	22	15
2.	22	15
3.	23	15
4.	23	15
5.	23	16
6.	23	17
7.	24	17
8.	24	17
9.	24	17
10.	26	19
	Average 23.40 days	Average 16.30 days

This test was the most successful life-history test conducted on the basis of number of eggs carried through to adulthood. The average duration of the larval stage is long as compared to the larval stages of the other genera tested.

Camponotus herculeanus subsp. pennsylvanicus (DeGeer)

This ant was probably one of the first recorded for the state. The subspecies was included in the Bridwell (1899) list as well as in the Tucker (1909) list. (Plate V).

This is the common "large black ant", "carpenter ant", or "wood ant". Fourteen collections were made during these studies, each of them in the vicinity of a rotten or partly rotten or

hollow tree in which their nests invariably were found. These ants are common house pests resulting from their search for sweets (Table 8). Nine collections were taken at Manhattan, eight in July and one in June; four were taken at Howard, three in August and one in July; and one was collected at Ottawa in June.

The extensive range given the species by Wheeler (1910) was Canada to Texas and Louisiana. Rau (1934) reported these specimens as common at Kirkwood, Missouri, Talbot (1934) reported it from the Chicago area, and Buren (1941) from Iowa.

Camponotus herculeanus subsp. ligniperdus var. noveboracensis (Fitch)

Previous Kansas Formicid literature does not include this subspecies or variety.

Several specimens of one collection were taken on a living elm tree, Ulmus fulva Michx., near Manhattan in June. The ants were busy working around the hollow portion of the elm and always traveled upward toward the succulent leaves and branches.

The range as given by Wheeler (1917) was the Northern States and Canada. Talbot (1934) collected specimens in Illinois, and Buren (1941) in Iowa.

Camponotus caryae (Fitch) var.

This species without varietal designation was recorded in the Hayes (1925) list of Kansas ants. He stated that workers were taken from polygonum in Riley County by J. B. Norton on

September 8. Hayes listed this species for the first time for the state.

Three collections were obtained during these experiments, two of which were at Manhattan each in a kitchen in July, and one at Howard on an elm tree, Ulmus americana L., in August.

This species was not recorded in Wheeler's (1910) List of Described North American Ants, and no range has therefore been given. Rau (1934) reported specimens collected at Kirkwood, Missouri, Talbot (1934) from Illinois, and Buren (1941) from Iowa.

Camponotus (Myrmentoma) discolor Emery

Wheeler (1910) did not record this specific name. However, he did use it as a subspecific name in C. fallax subsp. discolor Buckley. In referring to Wheeler's determination, Hayes (1925) stated, "A new subspecies is here added to the state list. Workers have been taken by Marlatt in Riley County in April."

One collection of this species was taken at Manhattan on an apple tree, Malus malus Britt., in July, but it was not determined to the variety by Dr. M. R. Smith.

Workers in each of four separate collections of Camponotus (Myrmentoma) sp., taken at Manhattan in July, were not specifically determined. One collection was taken as a kitchen pest feeding on sugar, a second was taken on an elm tree, Ulmus americana L., another was from a hollow apple tree, Malus malus Britt., and still another was taken while crossing a sidewalk. A fifth collection was obtained under a rotten log near Valley Falls in May.

Paratrechina (*Nylanderia*) sp.

Wheeler's (1910) List of Described North American Ants does not contain this generic name nor do any of the Formicid records of Kansas mention it. The specimens collected during these studies were determined by Dr. M. R. Smith, and it is probable that this is a recently described genus.

Ten collections, identified as the above genus, were accumulated during the summers 1939 to 1940 inclusive. Six collections were taken at Manhattan of which three were obtained in June, two in July, and one in May; two were taken at Howard in August; one at Ottawa in June; while one was taken at Wichita in July.

The range of distribution of this species of ant (Table 11) is probably over the eastern part of the state. There is some indication that it is not uncommon over the state. Talbot (1934) reported *P.*(*N.*) *parvula* Mayr from Illinois.

A KEY TO THE WORKER ANTS BY SUBFAMILIES, GENERA, AND SUBGENERA OF THE KNOWN FORMICIDAE OF KANSAS[10]

1. Cloacal orifice ventral, slit-shaped; sting well developed or vestigial; abdominal pedicel consisting of one or two segments ..... 2.

   Cloacal orifice terminal, circular, surrounded by a fringe of hairs; abdominal pedicel consisting of only a single segment; no constriction between the first and second gastric segments; pupae usually enclosed in cocoons ..... Subfamily Camponotinae ...

2. Sting developed; sometimes very small but nevertheless exsertile; abdominal pedicel consisting of one or two segments; when of only one there is a distinct constriction between the first and second gastric segments ..... 3.

   Sting vestigial; abdominal pedicel consisting of a single segment; no constriction between the first and second gastric segments; anal glands which produce a secretion with a peculiar rancid-butter odor ("Tapinoma odor") are often present; pupae naked ..... Subfamily Dolichoderinae.

3. Pupae always enclosed in cocoons; abdominal pedicel consisting of a single segment; gaster with a distinct constriction between its first and second segments; frontal carinae separated or close together; when close together they are dilated to form oblique or horizontal laminae partly covering the insertions of the antennae . Subfamily Ponerinae.

   Pupae naked; abdominal pedicel consisting of two segments ..... 4.

4. Frontal carinae very close together, almost vertical, not at all covering the antennal insertions. Eyes always very small or absent; tropical and subtropical .....Subfamily Dorylinae.

   Frontal carinae of a different conformation and covering the antennal insertions. Eyes rarely vestigial or absent; cosmopolitan ... .
   ..... Subfamily Myrmicinae.

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[10] Adapted from Wheeler (1910).

PONERINAE

1. Frontal carinae closely approximated; antennae inserted very near the oral margin; tip of gaster strongly deflected downward; petiole surmounted by a scale ..... Proceratium Roger.

   Frontal carinae of a different conformation; tip of gaster not deflected downward; petiole rounded or flattened above ..... 2.

2. Mandibles long and slender with coarse, bidenticulate teeth; clypeus with numerous teeth on its anterior border; petiole not constricted posteriorly .... Stigmatomma Roger.

   Mandibles of different conformation; claws simple, median spur of middle and hind legs alone developed, lateral spurs lacking; small species with vestigial eyes ..... Ponera Latr.

DORYLINAE

1. Claws toothed ..... Eciton Latr.
   Claws simple ..... Subgen. Acamatus Emery.

MYRMICINAE

1. Postpetiole inserted at the anterior end of gaster which is of the usual shape ..... 2.

   Postpetiole articulated to the dorsal surface of the gaster which is flattened dorsally, more convex ventrally and acutely pointed .. Cremastogaster Lund.

2. Antennae 10-segmented and with a 2-segmented club .... Solenopsis Westwood.

   Antennae 11-segmented; antennal club, when develcped, with more than two segments ..... 3.

3. Portion of the clypeus in front of antennal insertion reduced to a mere ridge ..... Myrmecina Curtis.

   Antennae 12-segmented ..... 4.

4. Workers strongly dimorphic, usually without intermediates connecting the extreme forms; antennal club 3-segmented, longer than the remainder of the funiculus ..... Pheidole Westwood.

Workers monomorphic or polymorphic, i.e., with mediae intermediate between the major and minor forms; antennal club indistinct or shorter than the remainder of the funiculus ..... 5.

5. Last three antennal segments much shorter than the remainder of the funiculus and not forming a distinct club ..... 6.

Last three antennal segments forming a distinct club nearly as long as the remainder of the funiculus ... 7.

6. Thoracic dorsum without any traces of suture or impression ..... Pogonomyrmex Mayr.

Thoracic dorsum impressed at the mesoepinotal suture; premesonotal suture usually distinct ..... 8.

7. Clypeus armed with a pair of ridges which project forward in the form of teeth, rarely without teeth, but then the epinotum is quite unarmed; mesoepinotal suture marked ..... Monomorium Mayr.

Clypeus of a different conformation; rarely 2-toothed, but then the mesoepinotal suture is quite indistinct ..... Leptothorax Mayr.

8. Posterior tibial spurs simple ..... 9.

Posterior tibial spurs pectinated .. Myrmica Latr.

9. Small hypogaeic species, with vestigial eyes and two keels on the clypeus ..... Stenamma Westwood.

Medium-sized species, with well developed eyes and no keels on the clypeus; workers monomorphic, with moderately slender legs and thorax .... Aphaenogaster Mayr. s. str.

DOLICHODERINAE

1. Scale of petiole more or less inclined but well developed ..... 2.

Scale of petiole very small, but strongly inclined forward, or altogether absent ... Tapinoma Foerster.

2. Epinotum with a conical elevation ... *Dorymyrmex* Mayr.

   Epinotum without a conical elevation; ocelli absent or much reduced ..... *Iridomyrmex* Mayr.

CAMPONOTINAE

1. Workers not polymorphic though often of distinct variable size ..... 2.

   Workers polymorphic; head of largest workers not sharply truncated anteriorly .. *Camponotus* Mayr. s. str.

2. Clypeal fossa distinctly separated from the antennal fossa ..... 3.

   Clypeal fossa confluent with the antennal fossa ..... 4.

3. Antennal scapes and tibiae without erect hairs; mesonotum strongly constructed and sub-cylindrical ..... *Prenolepis* Mayr s. str.

   Antennal scapes and tibiae with erect hairs; mesonotum constricted but not subcylindrical .. .. Subgen. *Nylanderia* Emery.

4. Segments 2-6 of the funiculus shorter or not longer than the succeeding segments; ocelli usually absent. 5.

   Segments 2-5 of the funiculus longer than the succeeding segments; ocelli distinct ..... 6.

5. Maxillary palpi 6-segmented ..... *Lasius* Fabr. s. str.

   Maxillary palpi 3-segmented ..... Subgen. *Acanthomyops* Mayr.

6. Mandibles narrow, falcate and pointed ... *Polyergus* Latr.

   Mandibles with broad, dentate, masticatory border; fourth segment of maxillary palpi a little longer than fifth ..... *Formica* Linn.

COMMERCIAL ANTICIDE CONTROL TESTS ON SIX COMMON PESTIFEROUS GENERA OF ANTS IN KANSAS

Observations were made during the collecting and anticidal tests conducted at various points in eastern Kansas, principally at and near Manhattan. A summary of the more important observations follows.

Approximately 20 different kinds of commercial anticides were employed in these tests (see Tables 6, 7, 8, and 9). Some of these anticides were recommended by the manufacturer for all ants while others were recommended only for specific kinds of ants. Each pestiferous ant infestation was treated by a commercial anticide as directed by the manufacturer of the anticide, and data (Form 1, Appendix), preliminary and current, were kept as a temporary record of progress and results the duration of the test. All tests were conducted for 10 days, whether apparent effectiveness was immediate, delayed, or even not finally noticeable.

Most of the local infestations treated were reported to Dr. R. C. Smith through whose aid contacts were made with the homes that were infested in Manhattan.

In the use of some of the anticides an insufficient number of tests were conducted to determine final results. Also, because of the desperate attitude of some housekeepers, not all results were strictly dependable, for other means of control was sometimes employed on the same colony with which control data was sought.

Table 6 indicates the commercial names of the anticides used and a record of the data on the effectiveness of these baits on all ants tested with each.[11] The baits had been prepared commercially in one of the following five forms: (1) the safety "pill-box" form having small openings for entrance of ants, (2) tube preparations of liquid or paste that was spread on paper or cardboard, (3) liquid preparations that were poured in open saucers or lids, (4) powders that were spread over the infested areas, and (5) liquids, powders, or crystals which when vaporized formed poisonous fumigants.

It will be noticed by Table 6 that some of the anticides were used in a greater number of tests than some of the others were. This was in some cases imperative for throughout the series of tests it was the purpose of the student to use an anticide repeatedly when it proved effective against a particular species. Furthermore, quite often the request was made to eradicate or reduce annoying ants as soon as possible, which consequently affected the necessary duration of time to obtain specific data.

In the column under the title "tests ineffective", the figures refer to tests in which the colony might have been reduced very slightly but apparently not sufficiently to stem the attack of the workers. Undoubtedly, however, a few workers in each of such tests were killed.

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[11] The term "bait" is used in its broadest sense to indicate any form of bait to be eaten by ants. Fumigants are not baits.

The figures in the column under the title "ants reduced", refer to the number of those infestations in which their activity was reduced noticeably.

In the column titled "number eradicated", the figures indicate the number of colonies actually destroyed or produced inactive before or at the termination of the 10-day period. It will be noticed that the fumigant "Cyanogas" was 100 percent efficient. This anticide in powder form was obtained in spouted "oil-can" containers from which the powder was applied directly into or on the nest. The entrances were then covered with moist soil and packed with the foot or with stones. The powder coming in contact with the moisture in the air liberates the deadly hydrocyanic acid gas.

It appears that the secret of the prevention or control of ant infestations is strict cleanliness about the house with respect to food. The removal or sealing, therefore, of the attracting substances in the house wherever practical would be the first step to take toward prevention of an invasion.

It is shown (Table 8) that Solenopsis molesta (Say) and Paratrechina (Nylanderia) sp., were the only two grease-eating species obtained. However, since only two infestations of P. (Nylanderia) sp. were taken under household conditions and a number have been observed free-living in grassy lawns and pastures, the result of these data is not convincing. On the other hand, of a total of 28 infestations of Solenopsis molesta (Say), 24 showed a preference for greasy foods, one was attracted to sweets, and three were taken in a free-living environment.

Table 6. Relative effectiveness of commercial baits and fumigants as indicated by the random number of tests conducted under home conditions.

Anticide	Number of tests	Tests ineffective	Ants reduced	Number eradicated
"Acme Ant Kill" Sirup	11	4	6	1
"Antzix" Sirup	2	0	2	0
"A.F.C. Destroyer"	2	1	0	1
"Ant-X" Sirup	10	1	5	4
"Ant Buttons" Paste	3	2	1	0
"Ant Lic" Trap	4	4	0	0
"Antrol" Sirup	3	1	1	1
"Apex" Trap	8	0	0	8
"Buckeye" Jelly	4	1	2	1
"Chec" Jelly	17	0	2	15
"Chanogas" Powder	11	0	0	11
"Dolco" Trap	6	4	1	1
"Dolco" Powder	5	0	1	4
"Double Duty" Sirup	3	2	1	0
"Dr. Conn's" Sirup	5	4	0	1
"Formula A" Powder	6	3	3	0
"Fresnol" Sirup	11	6	1	4
"Key Brand" Powder	4	0	3	1
"Magi-kil" Jelly	5	2	2	1
"Ma-pex" Jelly	1	0	1	0
"Peterman's"Powder	6	2	4	0
"Tanglefoot" Powder	1	1	0	0
"Tat" Paste	5	1	3	1
"Terro" Sirup	11	6	3	2

Genus *Solenopsis* Say

Due to the greasy food preference of *Solenopsis molesta* (Say), the only species of the genus studied, baits having greasy attractive inert substances were selected and tested. Table 7 contains the data resulting from the completed tests. "Chee" and "Apex" anticides, containing small amounts of thallium sulphate, gave the best control, although "Dolco" trap, "Dolco" powder, and others were used with some success against small colonies. The nests of this species were located in only one instance when "Cyanogas" was applied and the nest eradicated. The little grease-eating ant was used in this series of experiments since it was particularly prevalent in Manhattan each summer. This ant is considered the most difficult to control under average home conditions.

Representative kitchens in homes in various sections of the city were used. From daily observations of cleanliness about each kitchen or area of infestation, this information was correlated with the degree of daily reduction in ant activity. The duration of the test in cases of small colonies was shortened intentionally in order to determine the possible reoccurrence of the ants after the total inactivity stage had been reached. In only one instance, did the ants reappear, and that after only a 4-day exposure to "Apex" anticide, as recorded in Table 7.

Sweet-eating species of ants (Tables 8, 9, and 10) were not attracted to baits containing a higher percentage of active in-

Table 7. Cleanliness and control measures for Solenopsis molesta (Say) as determined by experiments and observations at Manhattan in the summers of 1939 and 1940.

Home	Condition of cleanliness	Bait	Duration of tests (days)	Result
1	Clean, sanitary	Apex	10	Greatly reduced
2	Unwashed dishes on drain, food scraps about	Chec	10	Slightly reduced
3	New, clean, sanitary	Apex	10	Eradicated
4	Clean, sanitary	Chec	8	Eradicated
5	Clean, sanitary	Chec	10	Greatly reduced
6	Unusually filthy, food scattered around	Chec	10	Slightly reduced
7	Clean but greasy around sink and drain	Chec	9	Eradicated
8	Unusually clean, sanitary	Chec	6	Eradicated
9	Filthy, unwashed dishes on sink and drain	Chec	10	Apparently not reduced
10	Clean, sanitary	Chec	8	Eradicated
11	New, clean, sanitary	Apex	4	Eradicated
12	Food open, crumbs on table, sink, and floor	Apex	10	Slightly reduced
13	Clean, sanitary	Chec	5	Eradicated
14	Filthy and greasy on drain and sink	Chec	9	Eradicated
15	Clean, sanitary	Apex	10	Eradicated
16	Clean, but cracker crumbs scattered by baby	Apex	10	Greatly reduced
17	On bacon in old ice box on filthy back porch	Chec	10	Slightly reduced

gredient (sodium arsenate or thallium sulphate) than two percent. In general, it may be concluded that the attractiveness of a bait is inversely proportional to the quantity of active ingredient.

Genus Cremastogaster Lund

Only a few of the species and varieties were found in home conditions. In Table 8, the species and varieties were listed separately to indicate their particular habits. However, all varieties of this genus may occasionally enter houses in search of food but they normally exhibit arboreal feeding habits. The data in Table 8 indicate that the species lineolata was the most pestiferous in houses while lineolata var. near cerasi was most abundant but confined itself more strictly to its arboreal habitat.

Including all the species and varieties, 30 collections of this genus were taken under various states of pestiferous habitat. These ants were all attracted to baits with sweet inert substances, but not all of these baits indicated effective results. "Antsix" containing one percent thallium sulphate gave the best results.

Genus Monomorium Mayr

Only one species of this genus was represented in these studies as troublesome to the household. It is not strictly a house species, as it usually builds its nest out-of-doors, under stones, wood, or rubbish, or even out in the open where the

Table 8. Relative abundance of pestiferous ants in the vicinity of Manhattan based on collections and calls from home owners during the summers of 1939 and 1940.

Pestiferous ants	Number of collections	Pestiferous condition				
		House pest		Lawn pest		Free living
		Sweet	Grease	Grass	Tree	
Monomorium minimum (Buckley)	28	22			2	4
Solenopsis molesta (Say)	28	1	24			3
Iridomyrmex pruinosus (Roger)	16	1		3		12
Cremastogaster lineolata var. near cerasi (Fitch)	14	5			7	2
Pheidole dentata Mayr	12	2		8		2
Camponotus herculeanus subsp. pennsylvanicus (DeGeer)	12	8			4	
Cremastogaster lineolata (Say)	10	8		1	1	
Pheidole sitarches subsp. rufescens Wheeler	10	1		7		2
Iridomyrmex pruinosus var. analis Andre	9	1		7		1
Camponotus caryae (Fitch) var.	4	2			2	
Pheidole sp. (bicarinata Mayr group)	4			4		
Cremastogaster lineolata (Say) var.	4	2			2	
Pheidole sp.	4	1		3		
Camponotus herculeanus subsp. ligniperdus var. noveboracensis (Fitch)	3				3	
Paratrechina (Nylanderia) sp. (Formerly known as Prenolepis Nylanderia)	3		3			
Camponotus (Myrmentoma) sp.	2	2				
Camponotus castaneus subsp. americanus Mayr	1				1	
Pheidole dentata var. commutata Mayr	2	1		1		
Cremastogaster opaca var. punctulata Emery	2	1			1	
Prenolepis (Nylanderia) sp.	1	1				

tiny craters are characteristic of the species. Of a total of 28 collections taken at Manhattan under pestiferous conditions (Table 8), 22 were collected under sweet feeding environments, two were taken from the trunks of trees, and four from free living conditions.

Although this species is the most common ant in this vicinity, not a large number of anticidal tests were satisfactorily completed (Table 9). The occupants of most houses infested with the ants had on hand substances which would repel, control, or eradicate them, or baits were obtained from local firms and applied. This species was quite easily controlled and even eradicated with almost all anticides applied. The number of tests conducted using any particular bait was not sufficient to present definite evidence of effectiveness. Those baits containing sugar or honey as the attractive element and a percentage of thallium sulphate or sodium arsenate not greater than two as the active ingredient gave the best results. "Antrol" containing 0.31 percent sodium arsenate produced the most effective results.

Genus *Camponotus* Mayr

The most abundant group of this genus is *C. herculeanus pennsylvanicus* (DeGeer). All of the species and varieties include specimens commonly referred to as "carpenter ants", yet those with which the household is generally infested belong to the variety *pennsylvanica*. Twelve household collections were taken of this variety, while four were taken of *C. caryae* (Fitch)

var., three of C. herculeanus subsp. ligniperdus var. noveboracensis (Fitch), two of C. (Myrmentoma) sp., and one of C. castaneus subsp. americanus Mayr. These collections were not all taken in the kitchen habitat as is indicated in Table 8. Ten colonies of the genus were found active in or on trees of which the sapwood and succulent leaves and branches were eaten. (Plate V).

These sweet-eating ants were not successfully controlled with the appropriate sweet-feeding baits. Most of the baits showed reduction in activity and number but eradication was not permanent. The most favorable results were obtained with "Acme Ant Kill", which contained 0.43 percent sodium arsenate as the active ingredient. In the use of this bait three colonies were reduced in number of active specimens while four were definitely eradicated. The fumigant "Cyanogas" was employed in seven cases in which the entrances of the nests were closed after the fumigant had been introduced. Each of the seven colonies were completely eradicated.

Genus Pheidole Westwood

Observations of this common group of ants in their habitats have prompted the writer to apply the name "lawn ants" to members of this genus due to their unusual nesting habits on grassy lawns and pastures. The most numerous species, P. dentata Mayr, was also the most frequent pest in household environments. Twelve such colonies were studied, eight of which preferred grassy lawn or pasture habitats while only two were found feeding on sweet food and two were severe pests on garden vegeta-

Table 9. Result of anticides used against the six most pestiferous ant genera.

Name of anticide	Genera of ants																	
	Cremastogaster sp.			Solenopsis molesta			Monomorium minimum			Camponotus sp.			Pheidole sp.			Iridomyrmex sp.		
	Ineffective	Reduced	Eradicated	Ineffective	Reduced	Eradicated	Ineffective	Reduced	Eradicated	Ineffective	Reduced	Eradicated	Ineffective	Reduced	Eradicated	Ineffective	Reduced	Eradicated
"Acme Ant Kill"				2			1		1		3	4		3	1			1
"Antzix"		12	3	1					1		1				2			
"A.F.C. Destroyer	1		1		2													
"Ant X"	1	1	2	2	1				2					1	3			
"Ant Buttons"	1	1		2	1		1			3								
"Ant Lic"	1			3			1											
"Antrol"			2	1					3		2							
"Apex"			1			9												
"Buckeye"		1		1						1	1		2	3				
"Chec"			1		2	12			2			1			2			
"Cyanogas"			2			1			1			7			8			4
"Dolco" Trap	3	1			1	1	1			2			1					
"Dolco" Powder		1			1	2												
"Double Duty"				4	1			1			1						1	
"Dr. Conn's"				3								1	1					
"Formula A"				4	4			2										
"Fresnol"				6	4			1	1		1			1	2			
Household lye						1												
"Key Brand"		1			1				1		1				1			
"Magi-kil"		1		2					2					1	1			
"Petermen's"				1	1		1	1		1								
"Tat"			1	2				1	2			1		1				
"Terro"				2	1			1	1									2

tion. Undoubtedly these workers collected under house pestiferous conditions were foraging from colonies located in the grassy lawns nearby. Ten colonies of P. sitarches subsp. rufescens Wheeler were observed, seven of which were lawn pests, one preferred sweet food, and two were free living under rocks. Four colonies of P. (bicarinata Mayr group), four of P. sp., and two of P. dentata var. commutata Mayr were all active and observed on grassy lawns. (Plate II).

In Table 9, the results of anticidal tests conducted with these colonies indicate that the species and varieties of the genus are comparatively easy to control. "Ant-X" with 1.30 percent thallium sulphate and "Fresnol" containing 0.29 percent sodium arsenate produced the most favorable results with respect to reduction of number in the colony or complete eradication. The use of the fumigant "Cyanogas" in the conveniently formed hills was 100 percent effective.

Genus Iridomyrmex Mayr

The pestiferous habits of these are largely confined to lawn and pasture habitats. Of the 16 colonies of I. Pruinosus (Roger) observed, 12 appeared entirely free living, three were active in lawns, and one was a persistent pantry pest. Nine colonies of the variety I. pruinosus var. analis var., were studied, one of which was apparently free living, seven were active in grassy lawns, and one was attracted to sweet food in a kitchen cabinet.

Only three bait anticidea were employed on these ants, two

of which produced eradication and one resulted in reduction. Each of these baits contained less than 1.00 percent sodium arsenate and each contained sweet-feeding inert substances. Four complete eradications resulted by the use of "Cyanogas" applied into the nests.

It is indicated in Table 10 that the active ingredients used in the manufacture of the anticides by the manufacturer were sodium arsenate, thallium sulphate, sodium fluoride, sodium silicofluoride, and pyrethrum. The potency of the active ingredients in each of the baits varied considerably and under the column of "percent of active ingredient", it will be seen that the quantity also varied greatly for the different baits. The two most commonly used active agents, sodium arsenate and thallium sulphate, possessed approximately the same degree of anticidal property, depending largely upon whether the bait was in the form of a powder, liquid, or paste. The writer believes that the nature of the inactive ingredients might have affected the efficiency of the active ingredients.

The maximum amount of sodium arsenate used in any particular bait was 29 percent in "Key Brand", while the minimum amount used was 0.29 percent in "Fresnol". The maximum amount of thallium sulphate used in any bait was 1.30 percent in "Ant-X", "Tat", "Magi-kil", and "Dolco" trap, while the minimum amount used was 0.6 percent in "Apex". "Key Brand" as well as some of the thallium sulphate baits containing 1.30 percent active ingredient, were not particularly attractive to most species of ants. Although the palatability of "Fresnol", "Apex", and other

Table 10. Anticides, percent of inert ingredients, and address of manufacturer.

Anticide	Active ingredients		Manufacturer	Address
	Name	Percent		
"Acme Ant Kill"	Sodium arsenate	0.43	Acme White Lead & Color Works	Detroit, Mich.
"Antzix"	Thallium sulphate	1.00	Bonide Chem. Co., Inc.	Utica, N.Y.
"A.F.C. Destroyer"	Sodium silico-fluoride	65.00	American Fluoride Corp.	151 W. 19th, N.Y.C.
	Pyrethrum	15.00		
"Ant-X"	Thallium sulphate	1.30	Mott Mfg. Co.	New York City, N.Y.
"Ant Button"	Sodium arsenate	1.50	?	?
"Ant-Lie"	Sodium arsenate	0.30	The Zoro Co.	844 W. Erie, Chicago, Ill.
"Antrol"	Sodium arsenate	0.31	Antrol Lab.	Los Angeles, Calif.
"Apex Ant Killer"	Thallium sulphate	0.60	Clean Homes Products Co.	Chicago, Ill.
"Buckeye"	Sodium arsenate	8.00	Buckeye Chem. Corp.	131 E. 23rd, N.Y.C., N.Y.
"Chec"	Thallium sulphate	1.00	?	?
"Cyanogas"	Calcium cyanide	42.00	American Cyanamid & Chem. Co.	30 Rockefeller Plaza, N.Y.
"Dolco" Trap	Thallium sulphate	1.30	C. B. Dolge Co.	Westport, Conn.
"Dolco" Powder	Sodium fluorilicate & Sodium fluoride	2.00 38.00	C. B. Dolge Co.	Westport, Conn.
"Double Duty"	Sodium arsenate	0.80	Termite Control Co.	Box 794, Ft. Lauderdale, Fla.
"Dr. Conn's" "Formula A"	Sodium arsenate	3.00	Geo. H. Conn Co.	Freeport, Ill.
"Fresnol"	Sodium arsenate	0.29	Pacific Guano Co.	Los Angeles, Calif.
"Key Brand"	Sodium arsenate	29.00	Interstate Chem. Mfg. Co.	Reading, Pa.
"Magi-kil" "Peterman's"	Thallium sulphate	1.30	Lethelin Products Co.	Wood Ridge, N.J.
"Tat"	Thallium sulphate	1.30	Soilicide Lab.	Upper Montclair, N.J.
"Terro"	Thallium sulphate	1.50	?	?

baits containing a low percentage of anticidal substance was apparent, the number of eradications and reduction of members of a colony far exceeded that resulting from the use of baits containing a higher percentage of active ingredient.

"Cyanogas", the only fumigant used in the experiments, is the commercial name of a compound composed of 42 percent calcium cyanide. This material gives off hydrocyanic acid gas on exposure to air. Carbon disulphide was not used in these studies because its effectiveness as a fumigant against insects is generally accepted. It is also highly inflammable, and therefore it generally is not recommended for fumigation.

DISTRIBUTION AND COLLECTING DATE

Table 11 contains a summary of the complete collecting data of the generic, specific, and varietal forms taken from April, 1939 to July, 1941.

The six genera, Camponotus Mayr, Cremastogaster Lund., Monomorium Mayr, Pheidole Westwood, Solenopsis Say, and Iridomyrmex Mayr were collected most frequently. Monomorium minimum (Buckley) was obtained most abundantly and under the most varied conditions of habitat. Only one collection of each of the genera Myrmecina Fabr., and Stigmatomma Roger was obtained. The various species and varieties of Camponotus Mayr, Cremastogaster Lund., and Pheidole Westwood, determined as well as undetermined, represent an incomplete formicid study in eastern Kansas.

The most fruitful season for collecting is during the

months June, July, and August. Some of the species appear early in the spring and become inactive early in the fall, while others do not appear active until late spring and remain until the first frost in the fall. Two of the species, Monomorium minimum (Buckley) and Cremastogaster lineolata (Say), appeared active early and continued their activity until September. It is probable that additional collections might have been made earlier in the spring and later in the fall had time permitted it.

Much of the collecting was done at Manhattan and in the vicinity of Manhattan. The other collecting localities are listed in Table 11 in the order of time spent collecting there. The single collections taken at Halstead, Lorraine, Topeka, and Iola were from colonies which were pests in houses. Two species of Pogonomyrmex for which data are not included in the table are P. comanche Wheeler, taken at Wichita in October, and P. barbatus (F. Smith) var., taken at Scott City in July.

Table 11. Abundance, distribution, and general date of collection.

Genera, species, and varieties	No. collections	Location									Date					
		Manhattan	Howard	Valley Falls	Ottawa	Wichita	Halstead	Lorraine	Topeka	Iola	April	May	June	July	August	September
Stigmatomma pallipes subsp. subterranea Creighton	1	1											1			
Ponera coarctata subsp. pennsylvanica (Buckley)	1				1								1			
Ponera trigona var. opacior Forel	12		10	1	1							1	1		10	
Eciton (Acamatus) opacithorax Emery	2		2											2		
Eciton (Acamatus) nigrescens (Cresson). (Formerly known as E. (A.) schmitti Emery)	6	5		1								2	4			
Myrmecina graminicola subsp. americana Emery	1			1								1				
Monomorium minimum (Buckley)	51	22	3	13	11	2					1	19	18	8	4	
Solenopsis molesta (Say)	28	16	6	6								6	2	10	10	
Pheidole pilifera (Roger)	1			1								1				
Pheidole sitarches subsp. rufescens Wheeler	18	6	4		8							1	11	3	3	1
Pheidole dentata Mayr	15	13	2										4	9	2	
Pheidole dentata var. commutata Mayr	2	2											2			
Pheidole dentata Mayr var.	1	1												1		
Pheidole sp. (bicarinata Mayr group)	3			2		1						1			2	

Table 11 (Cont.).

Pheidole sp. (vinelandica group	3	2				1								2	1		
Pheidole sp.	5	4	1										1	2	2		
Cremastogaster lineolata (Say)	17	10	3	2	1	1					1	2	11	1	1	1	
Cremastogaster lineolata var. cerasi (Fitch)	1	1											1				
Cremastogaster lineolata var. near cerasi (F.)	24	9	8	4	2		1					5	8	9	2		
Cremastogaster lineolata (Say) var.	8	5	1		2								2	5	1		
Cremastogaster minutissima subsp. missouriensis Emery	5	3		2								2	3				
Cremastogaster opaca depillis var. punctulata Emery	2	1					1						1	1			
Cremastogaster opaca var. punctulata Emery	4	4										1	1	2			
Cremastogaster laeviuscula Mayr	1		1												1		
Cremastogaster laeviuscula var. clara Emery	2		2											2			
Cremastogaster laeviuscula var. near clara Emery	1									1			1				
Cremastogaster sp.	4	2	1						1					4			
Aphaenogaster mariae Forel	1	1												1			
Aphaenogaster treatae Forel	1				1								1				
Aphaenogaster fulva subsp. aquia (Buckley)	1			1								1					
Aphaenogaster texana Emery var.	1	1												1			
Pogonomyrmex comanche Wheeler																	
Pogonomyrmex barbatus (F. Smith	var.																
Pogonomyrmex occidentalis (Cresson)	1					1								1			
Leptothorax fortinodis Mayr	3	1		1		1						1		1	1		
Leptothorax curvispinosus Mayr	1			1								1					
Leptothorax (Dichothorax) pergandei Emery	2	2											1	1			
Dorymyrmex pyramicus (Roger)	8	2		2	4							2	6				
Dorymyrmex pyramicus var. flavus MacCook	1	1												1			

Table 11 (concl.).

Tapinoma sessile (Say)	2			2								2			
Iridomyrmex pruinosus var. analis Andre	9	7	2									1	3	3	2
Iridomyrmex pruinosus (Roger) var.	18	8	4	4	2							7	5	3	3
Prenolepis imparis (Say)	9	8			1							4	3	2	
Prenolepis (Nylanderia) sp.	1	1												1	
Lasius niger var. neoniger Emery	1	1												1	
Lasius (Acanthomyops) interjectus Mayr	3		1	2								2			1
Lasius (Acanthomyops) claviger (Roger)	1				1								1		
Formica pallide-fulva var. succinea Wheeler	1	1												1	
Formica pallide-fulva schaufussi var. incerta Emery	2	2												2	
Formica sp. (pallide-fulva group)	2		2											2	
Camponotus castaneus subsp. americanus Mayr	3	2	1										2	1	
Camponotus herculeanus subsp. pennsylvanicus (DeGeer)	14	10	3		1								5	8	1
Camponotus herculeanus ligniperdus var. noveboracensis (Fitch)	1	1											1		
Camponotus caryae (Fitch) var.	3	2	1											2	1
Camponotus (Myrmentoma) discolor Emery	1	1												1	
Camponotus (Myrmentoma) sp.	5	4		1								1	1	3	
Paratrechina (Nylanderia) sp.	8	4	2		1	1						2	2	2	2

SUMMARY

1. This study was undertaken in the hope of learning more about the habits of the common species of ants in eastern Kansas, how they are classified and distinguished from each other, and how they can be most easily controlled. An effort was also made to add some previously unreported species of ants to the state list.

2. The most recent check list of the Kansas Formicidae was that of Hayes (1925). His list included 20 genera, 60 species, 11 subspecies, and 14 varieties. This paper presents the following additions: 2 genera, 12 species, 5 subspecies, and 7 varieties.

3. The ant collections obtained were preserved in small vials containing 70 percent alcohol. These vials were then numbered and filed with the collecting data. Specimens of each vial were sent to Dr. M. R. Smith, an authority on ants, for specific identification.

4. The collecting was done in the vicinity of Manhattan. Other important centers of collecting in eastern Kansas were Howard, Ottawa, and Valley Falls.

5. The preliminary identification key adapted from Wheeler was used exclusively for local laboratory purposes. The key is based principally on structural differences but to some extent on colonial traits and body functions.

6. Twenty-four commercial anticides were employed in the control of colonies and their comparative effectiveness was determined.

7. The little grease ant, Solenopsis molesta (Say), was found most difficult to eradicate. "Chec" and "Apex", both thallium sulphate baits, were the two most effective in the control and eradication of this pest.

8. "Cyanogas", a commercial fumigant, was 100 percent effective against all species tested. It also had the important feature of producing almost immediate results.

9. In general, the prevalence of pestiferous ants is apparently inversely proportional to the degree of cleanliness around the kitchen and store rooms of the house.

10. The little grease ant, Solenopsis molesta (Say), may be distinguished from the similar Pharaoh's ant, Monomorium pharaonis Linn., by its structural characteristics, size, punctulation, and color.

11. The little black ant, Monomorium minimum (Buckley), is no doubt the most numerous as well as the most widely distributed. The ants of the genera Pheidole Westwood, Cremastogaster Lund., and Camponotus Mayr with their many species and varieties, are likewise numerous and widely distributed.

12. The eggs of Pheidole Westwood sp. required the minimum number of days for the development of the larval and pupal forms with a total average of 33.27 days. Camponotus herculeanus Linn., required the maximum number with a total average of 39.70 days. The average duration of the larval stage of this latter species was exceptionally long with 23.40 days.

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(Appendix follows)

APPENDIX

Form 1. Pestiferous and Collecting Data Sheet.

Specific name _____ Vial number _____

Common name (if any) _____ Date _____

Where collected _____

Weather conditions _____ Temperature _____

Topography _____

Time of day _____ Soil type _____

Soil humidity _____

Nocturnal or Diurnal _____

Vegetation around nest _____

Pestiferous condition _____

_____

Polymorphism _____

Anticide used _____

Anticidal application _____

_____

_____

Abnormal conditions _____

_____

Results _____

_____

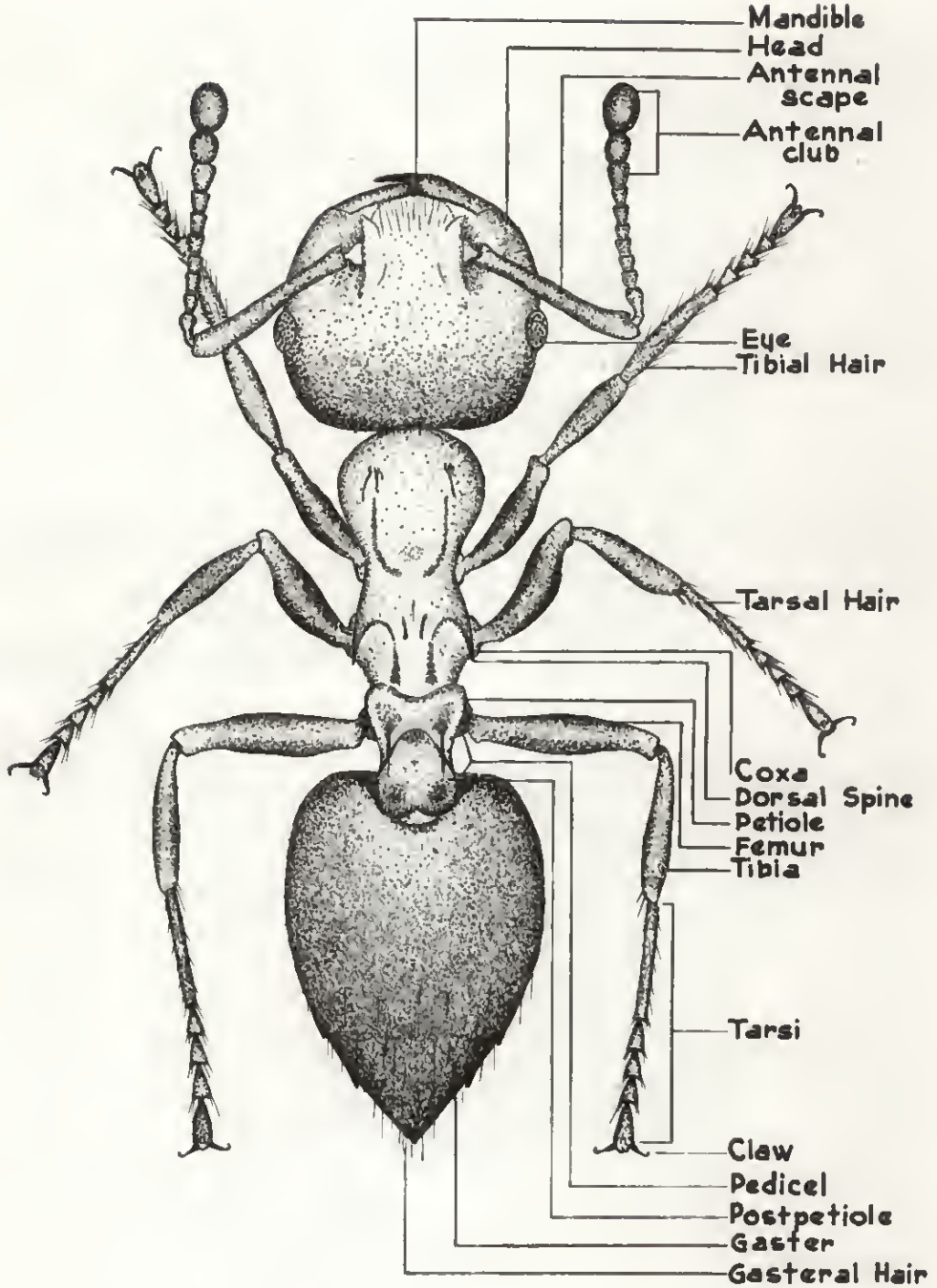
Conclusion _____

_____

EXPLANATION OF PLATE I

Fig. 1. Sketch of the typical acrobat ant, *Cremastogaster lineolata* (Say).

Plate I



A TYPICAL ANT

Fig. 1.

EXPLANATION OF PLATE II

Fig. 1. Parasitic attack of *Pheidole dentata* Mayr on succulent leaves and nectaries of the green bean plant, (Phaseolus vulgaris).

Plate II

Fig. 1.

EXPLANATION OF PLATE III

Fig. 1. Stages of metamorphosis of the acrobat ant Cremastogaster lineolata (Say)

a. The egg.

b. Early larval stage.

c. Late larval stage.

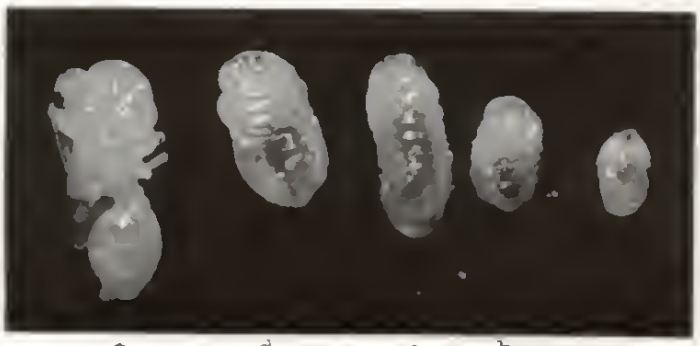
d. Early pupal stage.

e. Late pupal stage.

Fig. 2. Queen.

Fig. 3 and 4. Queen and worker attacking worker of "little black ant", Monomorium minimum (Buckley).

Plate III



e. d. c. b. a.

Fig. 1.

Fig. 2.

Fig. 3.

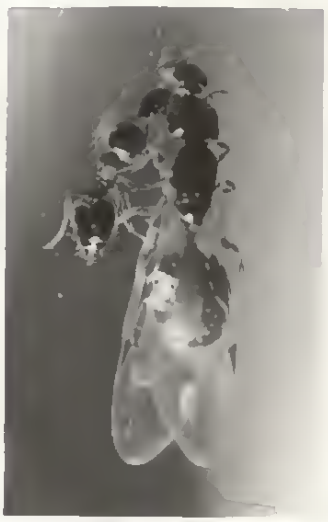


Fig. 4.

EXPLANATION OF PLATE IV

Fig. 1. A close-up view of a typical mound of the mound-building prairie ant.

Plate IV

Fig. 1.

EXPLANATION OF PLATE V

Fig. 1. Maple flooring perforated by the common carpenter ant, *Camponotus herculeanus pennsylvanicus* Degeer.

Plate V

Fig. 1.