1975

A Faunal Study of Illinois Silphidae (Coleoptera)

Brian Baldwin
Eastern Illinois University

A Faunal Study of Illinois

Silphidae (Coleoptera)

(TITLE)

BY

Brian Baldwin

B.S. in Ed., Eastern Illinois University, 1971

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science in Zoology

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

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I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
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ABSTRACT OF A THESIS

Submitted in partial fulfillment of the requirements for the degree of Master of Science at the Graduate School of Eastern Illinois University

CHARLESTON, ILLINOIS

1975

A faunal study of the family Silphidae in Illinois was made through examination of over 1400 specimens. A brief history of the taxonomy of the family and a description of silphid ecology was presented. Keys to the tribes, genera, and species of adult Silphidae occurring in Illinois were divised. Four genera and sixteen species of silphids are described, supplemented with drawings and distribution maps.

The undersigned, appointed by the Head of the Department of Zoology,

have examined a thesis entitled

A Faunal Study of Illinois Silphidae (Coleoptera)

Presented by

Brian Baldwin

a candidate for the degree of Master of Science

and hereby certify that in their opinion it is acceptable.

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ACKNOWLEDGEMENTS

The author would like to thank Dr. Michael A. Goodrich for his advice and guidance during the research and writing of this paper. The author is also indebted to Dr. Richard Funk for his comments and criticism of the paper, and Dr. M. W. Sanderson for help in preparing a key. The following curators and individuals have contributed suggestions and/or specimens for this study: Dr. Rupert Wenzel and Dr. Henry Dybas, Field Museum of Natural History; Dr. M. W. Sanderson, Natural History Survey; Dr. Yale Sedman, Western Illinois University; Dr. Garland Riegel, Eastern Illinois University; Dr. J. E. McPherson, Southern Illinois University; Dr. Stewart Peck, Carleton University; and Dr. R. H. Arnett Jr., Biological Research Institute of America, Inc.

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INTRODUCTION

The common members of the family Silphidae are medium to large size beetles often found on carrion. Placed in the Staphylinoidea they may be distinguished from other members of the superfamily by their clavate or capitate 10 - 11 segmented antennae with pubescence on at least segments 9 - 11, large front coxae, and enlarged pronotum. The elytra often bear red or orange markings.

In this paper the author has attempted to list the species of silphids which have been found in Illinois. Keys, descriptions, illustrations and distribution maps have been developed to aid in identification.

LITERATURE REVIEW

Taxonomy

A number of workers have made contributions to the taxonomy of the family Silphidae. Horn (1880), in his review of the genera of the world, listed 43 genera in six tribes; 30 genera were described from the U.S. (20 of these genera are now placed in other families). Horn (1880) described several new species, including one found in Illinois (Necrophilus pettiti). He listed 10 species of Nicrophorus which are considered to be valid, and described three varieties which are now viewed as full species. In the genus Silpha, tribe Silphini, he placed 10 species including surinamensis, subsequently placed by some authors in Necrodes.

Portevin (1926) included the tribes Nicrophorini for Nicrophorus; Necrodini with the genera Necrodes, Protonecrodes and Diamesus; and Silphini including twenty genera and three subgenera.

Hatch (1927) reviewed the tribes, genera, and species of Silphidae and reduced the family to a subfamily of the family Staphylinidae. He included seven tribes and 35 genera (Table 1) and provided keys to genera, subgenera, species, and aberrations or varieties of species, and included keys to larvae. Hatch included a phylogenetic key to species groups of the tribe

Nicrophorini. Included in the keys were several fossil species from the Miocene of France and Colorado.

Hatch (1927) mentioned that two species of Necrophilus, subterraneus and pettiti, are the only species that tend to show by their distribution a North Atlantic connection between Europe and North America. The distribution of other species demonstrate a Bering Strait connection.

Arnett (1944) included only the Neartic Silphini and Nicrophorini in his revision based on the female genitalia. He listed 19 species of Nicrophorini (all Nicrophorus) and 13 species of Silphini which he placed in three genera and two subgenera. He later (Arnett, 1963) abandoned his 1944 scheme and accepted that of Hatch (1927). Arnett (1944) listed 46 species of Silphidae from North America and included synonomies of the various forms and abberations described by others.

Arnett (1963) divided the world Silphidae into two subfamilies: the Bathysciinae of Europe (310 species); and the Silphinae (254 species) which occur throughout the world. The Silphinae include four tribes occuring in North America (Table 1), and representatives of three occur in Illinois. He also included a concise classification and key to the genera of the United States.

Ecology

Many papers have been written about the habits of silphids, especially the Nicrophorini; however, only a few authors have an in depth coverage of even a few species.

Balduf (1935) described several European species of silphids that eat snails, caterpillars, or fly larvae. He notes an observation by Bell in 1830 as the earliest recorded observation of Nicrophorus feeding on maggots. Bell observed about 40 specimens of N. humator, N. vespillo, and N. littoralis removing maggots from the carcass of a dog. Each beetle ate about one maggot every five minutes. Balduf (1935) also reports that Pukowski found that at least six species of Nicrophorus (N. humator, N. vespillo, N. vespilloides, N. fossor, N. investigator and N. germanicus) all eat dipterous larvae; at least for part of their adult diet. In addition to feeding on worms, snails, and insects, Nicrophorus will eat flesh of vertebrates but prefer fresh animals to the highly decomposed flesh. Larvae feed on snails (Phosphuga, Ablattaria), caterpillars (Xylodrepa), and at least in some cases Nicrophorus are fed partly by the adult female on liquified carrion. In captivity larvae and adults of some species may be cannibalistic. After finding a small (mouse to robin size) dead vertebrate animal, one or more Nicrophorus carry or drag the carcass to a suitable site for burial. Usually one or a pair of the same species work together, driving off other species of beetles, flies, ants, etc. Burial may take five to eight hours depending on the size of the carrion, soil type, and terrain. Nicrophorus mate before, during and/or after burial of the vertebrate animal. Frequently one or both members of a pair of beetles leave the carcass, running or flying away and returning again in a few minutes. Milne and Milne (1944)

observed an individual of N. tomentosus leave and return to the carcass four times within an hour, each time flying out of sight. Burial is effected by plowing the earth with head and cutting any roots or obstructions in the way. The beetles usually cooperate in carrying and digging and plowing the ground around the carcass.

Balduf (1935) noted that when mating or when bothered by a competitor or an obstruction Nicrophorus stridulates audibly by rubbing the upper surface of the abdomen under the elytra. (This sound can be demonstrated in specimens preserved in alcohol as well). After the carcass is buried a few inches, the hair or feathers are removed and the carcass more or less formed in a ball by the beetle pressing with its feet into the soft body while bracing the back against the surrounding earth. Eggs are laid in a tunnel or passage-way a few inches from the covered carrion. An average of 14 - 15 eggs are laid by females of N. vespillo (Balduf, 1935).

During the five days it takes for the eggs to hatch, the female (usually) eats, digs into the carrion, or rests on or near it. Upon hatching the larvae dig or crawl to the carrion. Apparently the female beetle feeds the larvae at least for five or six hours during the first instar after which the larvae start feeding on their own. After the first and second molt the larvae again depend on the female for food for a shorter amount of time. The three instars of the larvae of Nicrophorus take about one week, the first molt at 12 hours, and the second at 24 hours. The third instar pupates after crawling through

the soil as far as 30 cm. The newly emerged adults remain in the pupal cell for up to four days before coming to the surface. Bulduf (1935) states most studies show Nicrophorus over-winter in the "prepupal" condition. The pupal stage in species observed by Pukowski lasted 14 to 15 days.

Other works on behavior were published by Steele (1927), Abbott (1927), Fabre (1899), and Shubeck (1968; 1970).

Table 1. The classification of tribes and genera of North American Silphidae as recognized by Horn, Hatch and Arnett.

Horn (1880)	Hatch (1927)	Arnett (1963)
Silphini	Nicrophorini	Nicrophorini
Nicrophorus	*Nicrophorus*	*Nicrophorus* (19)*
	Necrodini	Silphini
Necrodes	*Necrodes*	*Necrodes* (2)
	Silphini	
Silpha	*Silpha*	*Silpha* (9)
		Blitophaga (2)
	Agyrtini	Agyrtini
Necrophilus	*Necrophilus*	*Necrophilus* (2)
Agyrtes	*Agyrtes*	*Agyrtes* (2)
Pelates	*Pelatines*	*Pelatines* (1)
Sphaerites		
	Lyrosomini	Lyrosomini
Pteroloma		*Pteroloma* (5)
Apatetica		
Lyrosomini		
Lyrosoma	*Lyrosoma*	*Lyrosoma* (1)
	Apteroloma	*Apteroloma* (3)

* The number within the parentheses indicates the number of species recorded for North America.

METHODS AND MATERIALS

A total of 1407 specimens from Illinois were examined in the course of this study. Collections studied were from the Field Museum of Natural History, Chicago; Natural History Survey, Urbana; Southern Illinois University, Carbondale; Eastern Illinois University, Charleston; Western Illinois University, Macomb; personal collections of Dr. Michael Goodrich, Dr. Stewart B. Peck, and the author.

Specimens were collected by the author from 1970 to 1975 from road kills *in situ*, bait traps of the type employed by Shubeck (1970), covered and uncovered carrion in the manner employed by Ratcliffe and Luedtke (1969), and black light traps.

The date of collecting, the collector, and location as well as any ecological information was recorded from each specimen examined. An American Optical stereo dissecting microscope providing from 7x to 30x was used in examining specimens. Genitalia were dissected and studied from 25 specimens. Keys used initially were those of Arnett (1944; 1963); Madge (1958); Dillon and Dillon (1960); Hatch (1927); and Dr. M. W. Sanderson (personal communication).

RESULTS AND DISCUSSION

Key to the Silphidae of Illinois

1. Second article of antennae at least one-half length of third article. Antennae distinctly eleven segmented.....2

   Second article of antennae less than one half length of third article, hidden in tip of first segment so antennae appear ten segmented (Fig. 1)..... .....tribe Nicrophorini

2. Antennae slender to strongly clavate (Fig. 2), eight basal segments glabrous, terminal three pubescent. Body shape depressed, broadly ovate to oblong, dull. Metathoracic wings present.....tribe Silphini

   Antennae slender, clavate (Fig. 3), six basal segments glabrous, terminal five segments pubescent. Body shape ovate, convex, shining. Metathoracic wings lacking.....tribe Agyrtini

Tribe Silphini - Key to Genera

1. Eyes large and prominent, occipital ridge prominent, pronotum nearly round, black, shining (Fig. 4), body elongate.....Genus Necrodes

   Eyes not prominent, occipital ridge not prominent, pronotum and elytra not shining, pronotum as in Fig. 5.....Genus Silpha

Genus Silpha

Pronotum much wider than head, as wide as base of elytra, (Fig. 5); variously colored, glabrous or tomentose. Elytra black or brown; frequently costate, tuberculate or rugose. Antennae eleven segmented, clavate, terminal three segments

pubescent. Body shape depressed, broadly ovate, not shining.

Genus Silpha - Key to Species

1. Pronotum yellow or reddish with central black area.....2

   Pronotum black.....3

2. Elytra rugose, pronotum yellow with central small black spot.....Silpha americana

   Elytra with prominent costae, pronotum reddish with large black spot.....Silpha novaboracensis

3. Pronotum tomentose with dense yellow hairs, elytral costae tuberculate.....Silpha lapponica

   Pronotum glabrous; elytra costae without tubercles..... .....Silpha inaequalis

Genus Necrodes

Pronotum oval (Fig. 4), black, shining, form elongate; elytra black usually with red apical spots forming a bar, sometimes with red basal markings or immaculate. Antennae eleven - segmented, strongly clavate, basal eight segments glabrous, last three pubescent; eyes large, prominent; occipital ridge prominent. One species found in Illinois. .....Necrodes surinamensis

Tribe Agyrtini

Genus Necrophilus

Pronotum brownish, shining (Fig. 6), glabrous. Elytra brownish, shining, with nine rows of punctures. Antennae clavate with basal six segments glabrous, last five with pubescent club. Body shape oval. One species found in Illinois.....Necrophilus pettiti

Tribe Nicrophorini

Genus *Nicrophorus*

Pronotum variously shaped (Fig. 7, 8), glabrous or tomentose. Elytra shortened, truncate, frequently with red or orange spots. Antennae apparently of ten segments, the second segment short and more or less hidden in the tip of the first segment. Antennae capitate, the last four segments forming a distinct club (Fig. 1). Beetles thick-bodied, not depressed or oval.

Genus *Nicrophorus* - Key to Species

1. Pronotum oboval, dense punctation on anterior third (Fig. 7); epipleural fold very narrow (Fig. 9).....*N. carolinus*

   Pronotum orbicular, transverse or cordate, punctation of pronotum not as above (Fig. 8); epipleural fold wider (Fig. 10).....2

2. Pronotum orbicular, hind tibiae straight, epipleural fold black.....*N. orbicollis*

   Pronotum not orbicular, or if orbicular hind tibiae not straight, epipleural fold red or black.....3

3. Pronotum densely tomentose; epipleural fold red.....*N. tomentosus*

   Pronotum not densely tomentose; with at most a few short hairs; epipleural fold red or black.....4

4. Pronotum with large red or orange spot and frons red; epipleural fold red.....*N. americanus*

   Pronotum and frons entirely black; epipleural fold red or black.....5

5. Elytra entirely black or with one small subbasal and one or two apical orange or red spots; epipleural fold black.....*N. pustulatus*

   Elytra with large red or orange bands; epipleural fold red.....6

6. Antennal club entirely black.....*N. vespilloides*

   Antennal club partly red or orange.....7

7. Subapical black bands not quite reaching edge of epipleural fold; basal plates of antennal club orange; lobe of metepimeron with long golden hairs.....*N. marginatus*

   Subapical black bands reach edge of epipleural fold; basal plate of antennae black; lobe of metepimeron with or without golden hairs.....8

8. Lobe of metepimeron with long golden hairs.....*N. obscurus*

   Lobe of metepimeron without golden hairs.....9

9. Hind tibiae straight.....*N. investigator*

   Hind tibiae curved.....*N. sayi*

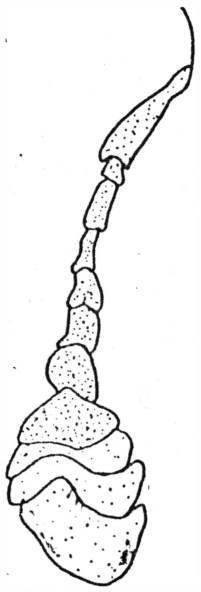

Fig. 1. Antenna of Nicrophorus

Fig. 2. Antenna of Necrodes

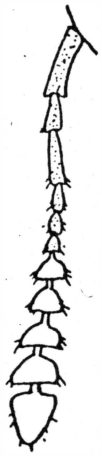

Fig. 3. Antenna of Necrophilus

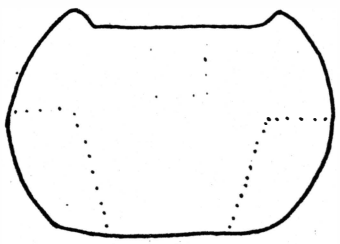

Fig. 4. Pronotum of Necrodes

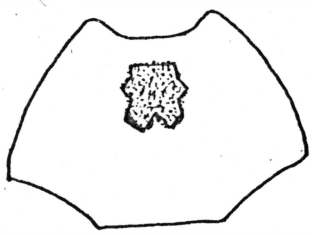

Fig. 5. Pronotum of Silpha

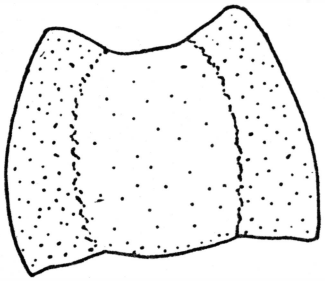

Fig. 6. Pronotum of Necrophilus

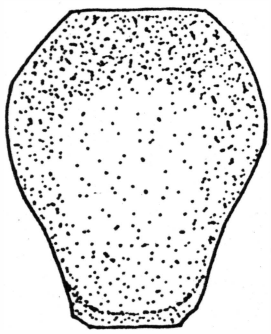

Fig. 7. Pronotum of Nicrophorus carolinus

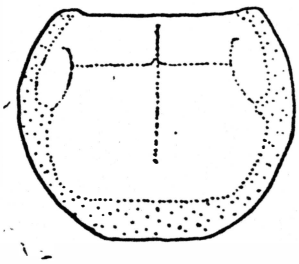

Fig. 8. Pronotum of Nicrophorus orbicollis

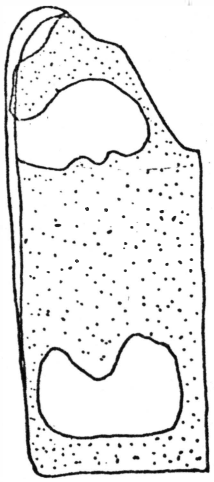

Fig. 9. Left elytron of N. carolinus

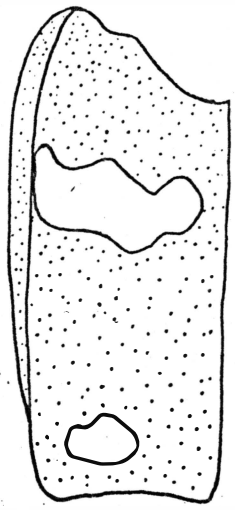

Fig. 10. Left elytron of N. orbicollis

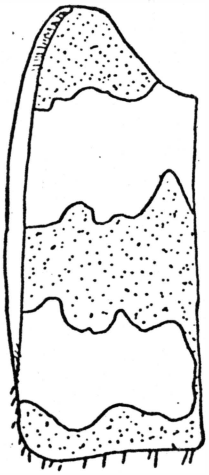

Fig. 11. Left elytron of N. tomentosus

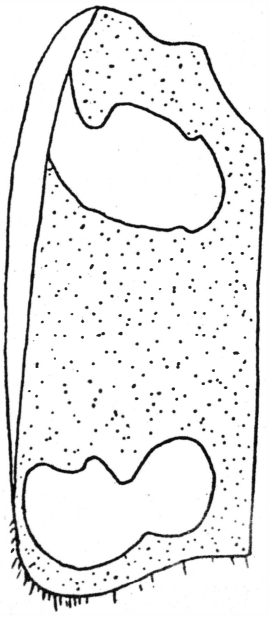

Fig. 12. Left elytron of N. americanus

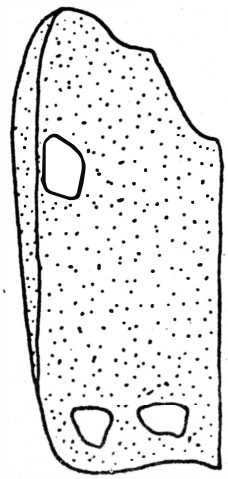

Fig. 13. Left elytron of N. pustulatus

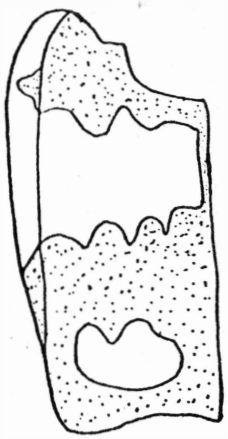

Fig. 14. Left elytron of N. vespilloides

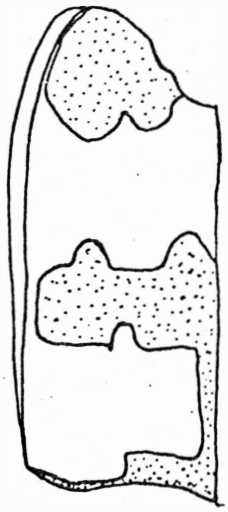

Fig. 15. Left elytron of N. marginatus

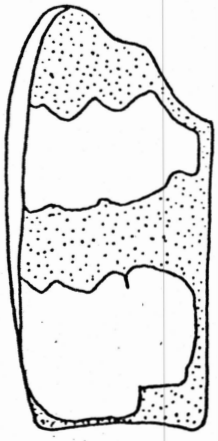

Fig. 16. Left elytron of N. obscurus

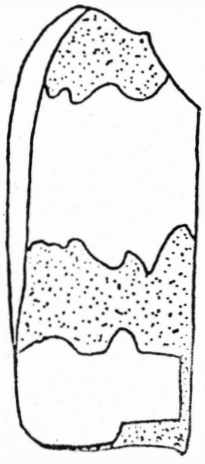

Fig. 17. Left elytron of N. investigator

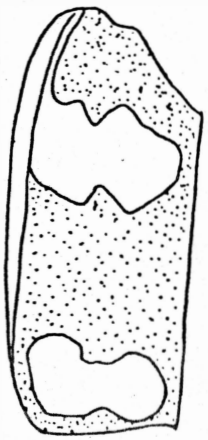

Fig. 18. Left elytron of N. sayi

Description of the Species

Silpha americana Linnaeus, 1759

Antennae eleven-segmented, clavate; basal eight segments glabrous, last three pubescent. Eyes and occipital ridge not prominant. Pronotum transverse, nearly twice as wide as long (Fig. 5), yellow with small central black spot. Elytra blackish; rugose with indistinct costae, punctate; length 11 - 13 mm. Body ovate.

Range: Eastern North America. In Illinois: widespread and common.

Adults collected in Illinois from 14 April - 29 September.

Remarks: Collected from carrion of both warm and cold-blooded vertebrates and fungi.

Silpha noveboracensis Forster, 1771

Antennae eleven-segmented, clavate, basal eight segments glabrous, last three pubescent. Eyes and occipital ridge not prominent. Pronotum transverse, one-half wider than long; reddish-yellow with large central black spot. Elytra brown; tricostate, outer costa meets or nearly meets second costa posterior to small tubercule, punctate; length from 8 - 10 mm. Body oblong-ovate.

Range: Eastern North America. In Illinois: common and widespread.

Adults collected in Illinois from 18 March - 5 November.

Silpha lapponica Herbst, 1793

Antennae eleven-segmented, clavate, basal eight segments glabrous, last three pubescent. Eyes normal; occipital ridge lacking; head covered with yellow pubescence. Pronotum transverse; usually densely covered with yellow pubescence; tuberculate. Elytra brown; with four rows of distinct tubercles; length 7 - 9 mm. Body oblong-ovate.

Range: Northern United States; Canada. In Illinois: Cook and McHenry counties.

Adults collected in Illinois from 5 May - 15 August.

Silpha inaequalis Fabricius, 1781

Antennae eleven-segmented, clavate, basal eight segments glabrous, last three pubescent. Eyes and occipital ridge not prominent. Pronotum transverse, twice as wide as long; black. Elytra black; tricostate, outer costae ending in slight tuberosity, punctate; length from 7 - 10 mm. Body oblong-ovate.

Range: Eastern North America. In Illinois: common and widespread.

Adults collected in Illinois from 23 March - 20 July.

Necrodes surinamensis Fabricius, 1792

Antennae eleven-segmented, strongly clavate, basal eight segments glabrous, last three pubescent. Eyes large, prominant; occipital ridge prominant. Pronotum oval (Fig. 4); black, shining. Elytra black, usually with red apical spots forming a bar, sometimes with red basal markings or immaculate; with three distinct costae extending the length of disc; length 10 - 18 mm. Body elongate.

Range: Eastern North America. In Illinois: common and widespread.

Adults collected in Illinois from 9 April - 25 October.

Remarks: Males show allometric growth with large males having much more enlarged femora and strongly curved tibiae. Females do not show this development.

Necrophilus pettiti Horn, 1880

Antennae eleven-segmented, clavate, basal six segments glabrous, last five pubescent. Pronotum as in Fig. 6, shining, punctures along lateral margin, disc with few punctures. Elytra convex with nine rows of punctures, truncate at extreme apex, brown and shining. Metathoracic wings lacking.

Range: Eastern U.S., Indiana, Illinois, Kentucky, Tennessee, Ohio. In Illinois: Carbondale, Jackson County.

Adult collected in Illinois: 19 May, 1971.

Remarks: This species named and described by Horn in 1880, is listed as rare and found in fungi by Hatch, 1927; has been taken in carrion bait traps in Tennessee in 1971.

Nicrophorus carolinus (Linnaeus), 1771

Antennae with basal plate red, terminal three red, last segment flattened. Pronotum oboval (Fig. 7), narrowed behind, sinuate at the sides, lacking anterior transverse impression; anterior third of pronotum densely punctate, central disc weakly and sparsely punctate; black, glabrous. Elytra 7 - 13.5 mm long (Madge, 1958); pattern as in Fig. 8; epipleural fold narrow. Metasternum with long golden pubescence; lobe of metepimeron glabrous or with a few brown to golden hairs. Mesotibiae and metatibiae strongly incurved.

Range: Atlantic and Gulf Coast states, from Texas northward through Oklahoma, Kansas, Nebraska, Colorado, and westward into New Mexico and Arizona. Also in Alberta, Canada. In Illinois: Urbana, Champaign County.

Adults collected from 21 July - 1 August.

Remarks: This species has not been seen by the author in any collection of Illinois silphids, but is listed by Madge (1958) as occuring in Urbana. The range of the species, with an eastern and separate western population is unusual and poses questions regarding the actual distribution of the species.

Nicrophorus orbicollis Say, 1825

Antennae with basal segment piceous, terminal three red. The pronotum is orbicular, well rounded at the sides, with a wide margin at base and sides; black (Fig. 9). Elytra 9.45 - 12.45 mm long (8.5 - 15.5 mm [Madge, 1958]); color pattern as in Fig. 10, elytral disc with long erect hairs, epipleural fold brownish-black. Metasternum with golden pubescence, lobe of metepimeron nearly glabrous. Mesotibiae slightly curved, metatibiae straight, distal end widened in males.

Range: Central and eastern United States, as far west as Texas, records for California and Colorado; also in Ontario and Nova Scotia. In Illinois: widespread.

Adults collected in Illinois from 16 April - 21 October.

Nicrophorus tomentosus Weber, 1801

Antennae with basal plate and terminal segments piceous. Pronotum transverse, somewhat squarish, moderately narrowed behind, sinuate at sides; densely tomentose with golden pubescence except for two elliptical areas on disc. Elytra 6.8 - 10 mm long (5.5 - 11 mm [Madge, 1958]); color pattern as in Fig. 11; epipleural fold red. Metasternum with long golden pubescence, lobe of metepimeron glabrous or with a few brown to golden hairs. Mesotibiae slightly incurved; metatibiae straight; spine of metatrochanter short, straight in females, strongly hooked in males.

Range: Eastern U.S. to Georgia, west to New Mexico, north to Canada, Manitoba, Nova Scotia, Ontario. In Illinois: widespread and common.

Adults collected in Illinois from 1 May - 16 October.

Nicrophorus americanus Oliver, 1791

Antennae with basal plate and terminal three segments red; frons red. Pronotum orbicular, with disc red, margins black and glabrous. Elytra 13 - 20 mm long (Madge, 1958); color pattern as in Fig. 12; epipleural fold red. Metasternum with long golden hairs; lobe of metepimeron with short brown to golden hairs mostly on the lateral surface. Mesotibiae slightly curved; metatibiae strongly curved.

Range: Eastern U.S. from Massachusetts to Georgia, westward through Arkansas, Texas, north into Ontario, Canada. In Illinois: widespread.

Adults collected in Illinois from 16 May - 26 August.

Remarks: I have not seen any specimens collected more recently than May 16, 1944 from Illinois. Because of its large size and colorful appearance this is surprising unless it has become rare.

Nicrophorus pustulatus Herschel, 1807

Antennae with basal segment black, terminal three red. Pronotum transverse, slightly narrowed behind; black and glabrous. Elytra 7 - 11.85 mm long (8 - 13 mm [Madge, 1958]); color pattern as in Fig. 13; epipleural fold black. Metasternum usually with golden pubescence; lobe of metepimeron glabrous or with short brown hairs. Mesotibiae slightly curved; metatibiae straight.

Range: Eastern and central U.S. to Florida; Ontario and Quebec in Canada. In Illinois: widespread and common.

Adults collected in Illinois from 30 March to 24 October.

Nicrophorus vespilloides Herbst, 1784

Antennae with basal plate and terminal club black. Pronotum transverse, slightly to moderately narrowed behind, sinuate at the sides, with a strong anterior transverse impression. Elytra 6 - 12 mm long (Madge, 1958); pattern as in Fig. 14; epipleural fold color usually black at humerus and apex, red in midportion. Metasternum with long golden pubescence, sparse at center; lobe of metepimeron with short brown hairs. Mesotibiae slightly curved; metatibiae straight.

Range: Northeastern U.S., Tennessee and North Carolina, separate western population from Utah and Colorado north to Alaska. In Illinois: Volo bog, Lake Co.

Adults collected in Illinois from 15 July - 27 August.

Remarks: This species is rare in Illinois collections. As Madge (1958) suggested, it may be a resident of cool forested regions. A subspecies N. v. defodiens is recorded by Madge as occurring from the coastal regions of California north to Alaska.

Nicrophorus marginatus Fabricius, 1801

Antennae with basal plate and terminal three segments red. Pronotum cordate, moderately narrowed; sinuate at the sides, anterior transverse impression strong on sides, weak or lacking in center; glabrous, black. Elytra 8.25 - 10.55 mm long (6.5 - 13 mm [Madge, 1958]); pattern as in Fig. 15; epipleural fold red. Metasternum and lobe of metepimeron with long golden hairs. Mesotibiae strongly curved; metatibiae weakly to strongly curved.

Range: Almost entire U.S. and Alberta and Ontario, Canada. In Illinois: widespread and common.

Adults collectied in Illinois from 7 April - 16 October.

Remarks: This common species is easily identified by the characteristics in the key. The subapical and sometimes the subbasal black bands do not quite reach the epipleural fold.

Nicrophorus obscurus Kirby, 1837

Antennae with basal plate black, terminal three red. Pronotum cordate, sinuate at sides, anterior transverse impression weak or lacking at center of disc, strong at sides; black and glabrous. Elytra 7.5 - 13 mm long (Madge, 1958); pattern as in Fig. 16; epipleural fold red. Metasternum and metepimeron with long golden hairs. Mesotibiae slightly curved; metatibiae usually strongly curved.

Range: Northern U.S., Pennsylvania, Illinois, Iowa, Minnesota, west to Idaho and Utah; also in Alberta, Canada. In Illinois: Algonquin, McHenry Co.

Remarks: Rare in Illinois collections, and rare or infrequently collected elsewhere, although Madge (1958) collected specimens at Calgary, Alberta.

Nicrophorus investigator Zetterstedt, 1824

Antennae with basal plate piceous, terminal three red. Pronotum transverse, weakly to strongly narrowed behind, usually sinuate at sides; anterior transverse impression strong; black, glabrous. Elytra 8 - 14 mm long (Madge, 1958); pattern as in Fig. 17; epipleural fold red. Mestasternum with golden hairs; metepimeron usually glabrous, or with a few yellow or brown hairs. Mesotibiae slightly curved; metatibiae straight.

Range: In eastern U.S. from Pennsylvania, Illinois, and Minnesota with a separate widely distributed western

population. In Canada from Newfoundland, Quebec, British Columbia, and Alberta. In Illinois: Normal, McClean Co.

Remarks: The species was divided by Madge (1958) into three subspecies: N. i. investigator with the range given above; N. i. nigrita which Madge says is "essentially" allopatric from N. i. investigator and believes to be a subspecies rather than a species as listed by Arnett (1944); and N. i. mexicanus, found in the southwest, also given species rank by Arnett. Madge stated that N. i. mexicanus is morphologically identical to N. i. nigrita except for elytral pattern, and that these differences could be caused by environmental factors.

Nicrophorus sayi Castelnau, 1840

Antennae with basal plate piceous, terminal three red. Pronotum slightly squarish, lateral margins nearly straight, slightly narrowed behind, anterior transverse impression strong at sides, weak at center; black, glabrous. Elytra 8 - 14.5 mm long (Madge, 1958); pattern as in Fig. 18; epipleural fold red, color continuous with subbasal spot. Metasternum with long golden hairs; lobe of metepimeron with brown hairs. Mesotibiae slightly curved; metatibiae strongly curved.

Range: Northeastern North America, from Newfoundland south to North Carolina, west to Minnesota and in Manitoba,

Ontario and Quebec in Canada. In Illinois: widespread.

Adults collected from Illinois from 1 July - 15 July (16 April - 15 July, [Madge, 1958])

Remarks: This species is similar to N. orbicollis but is much rarer. The elytral hairs are much smaller than in the typical orbicollis and the epipleural fold is red rather than black as in orbicollis. Uncommon in Illinois.

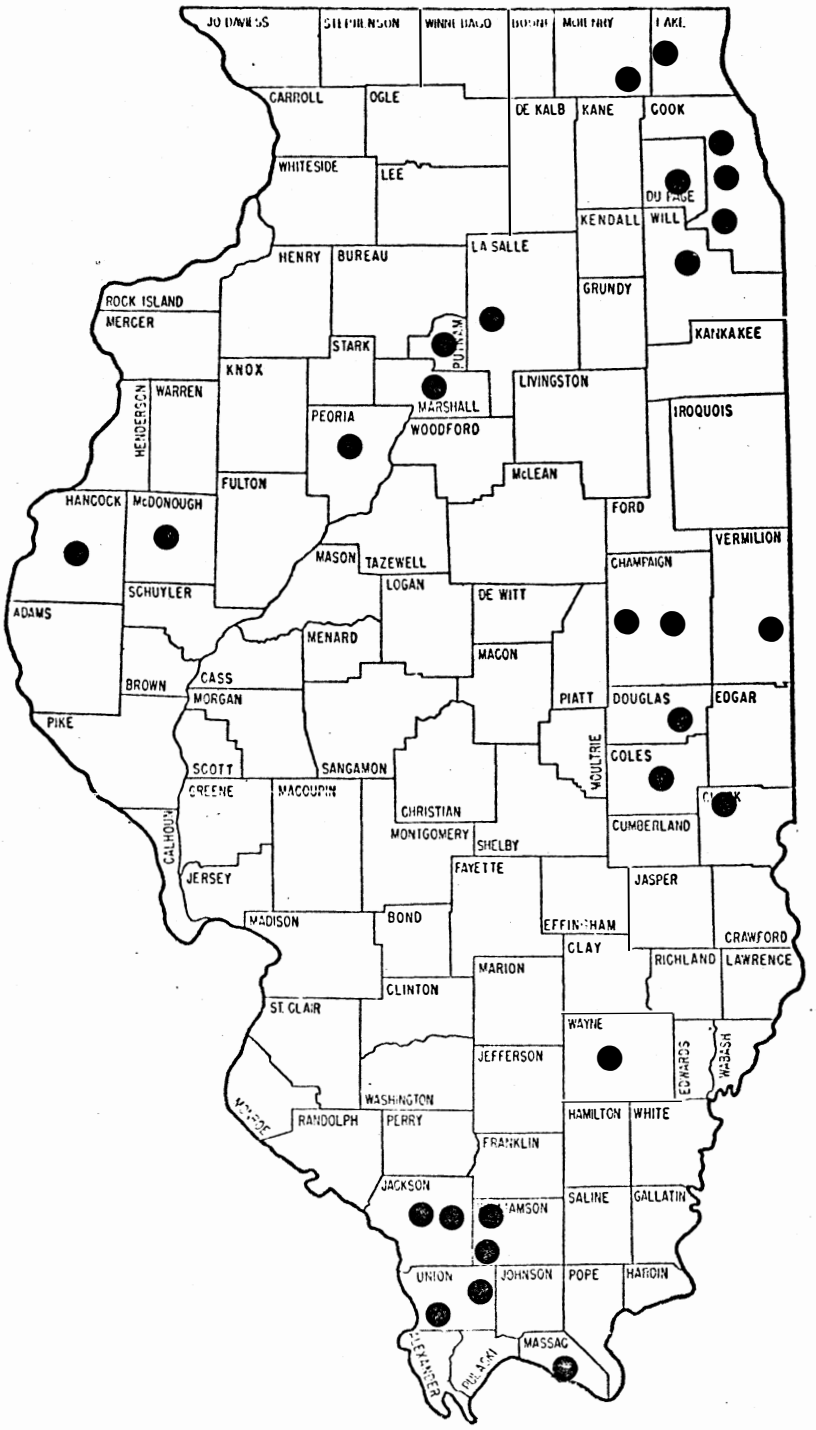

Fig. 19. Silpha americana collection sites in Illinois

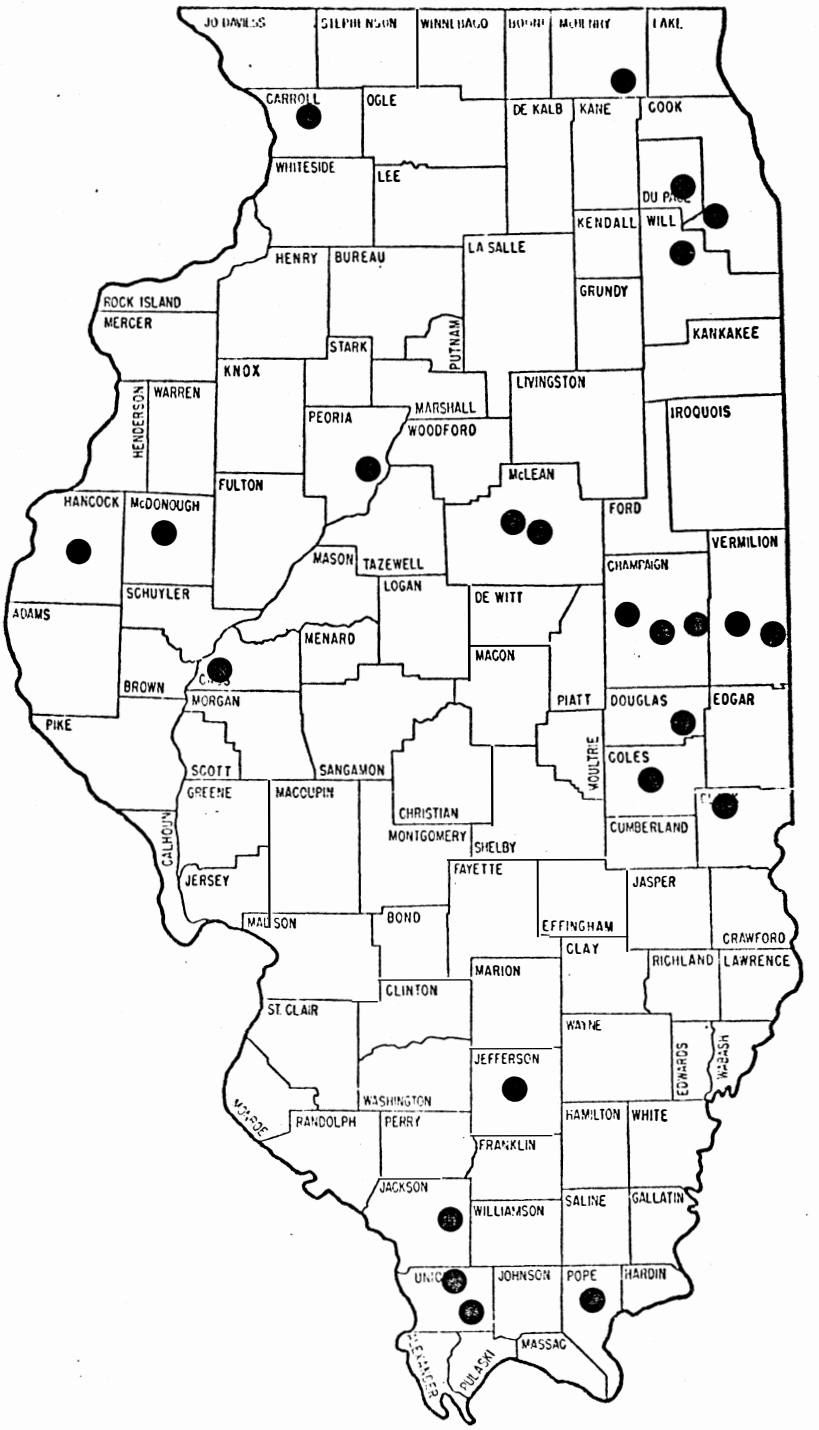

Fig. 20. Silpha novaboracensis collection sites in Illinois

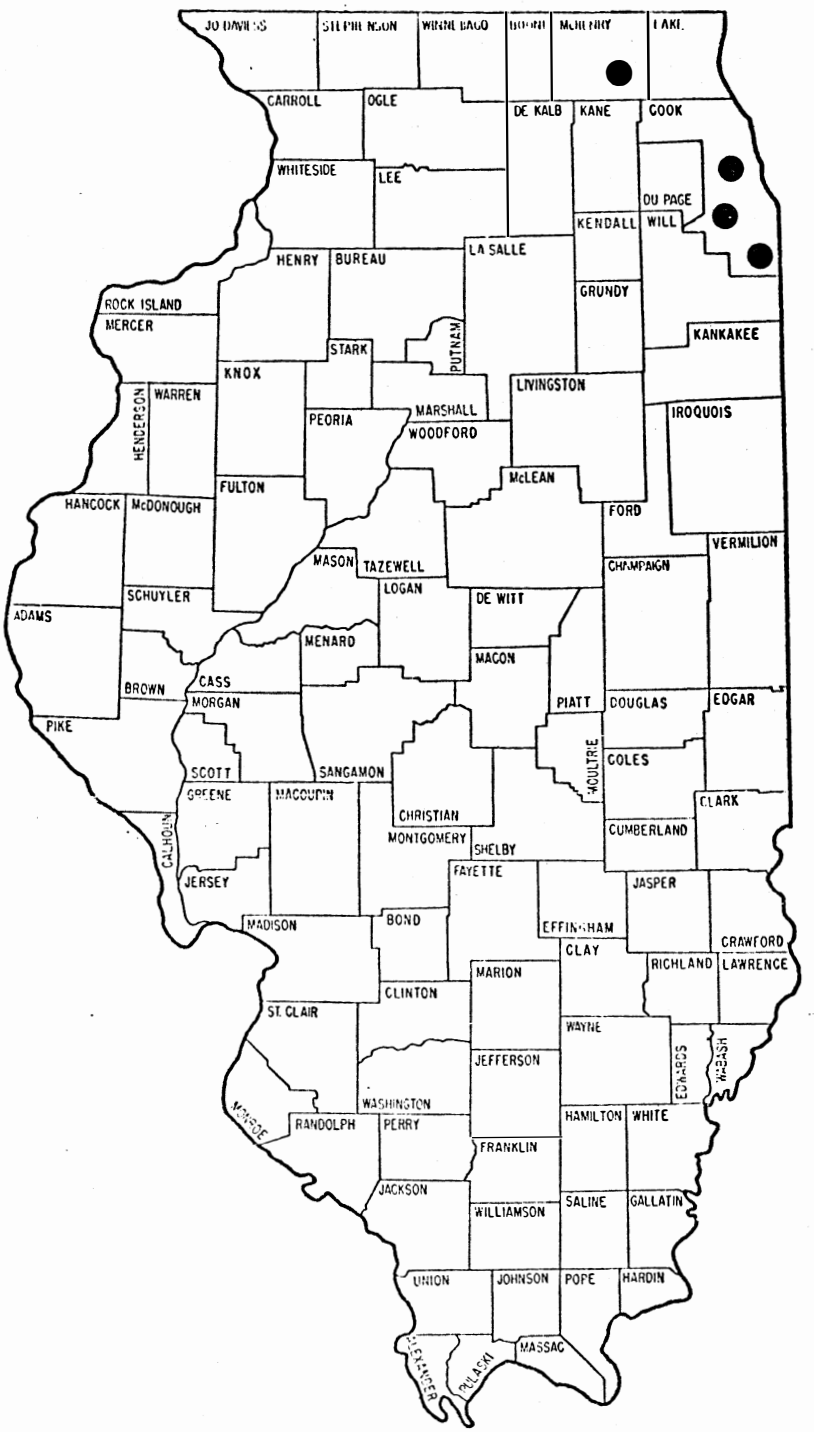

Fig. 21. Silpha lapponica collection sites in Illinois

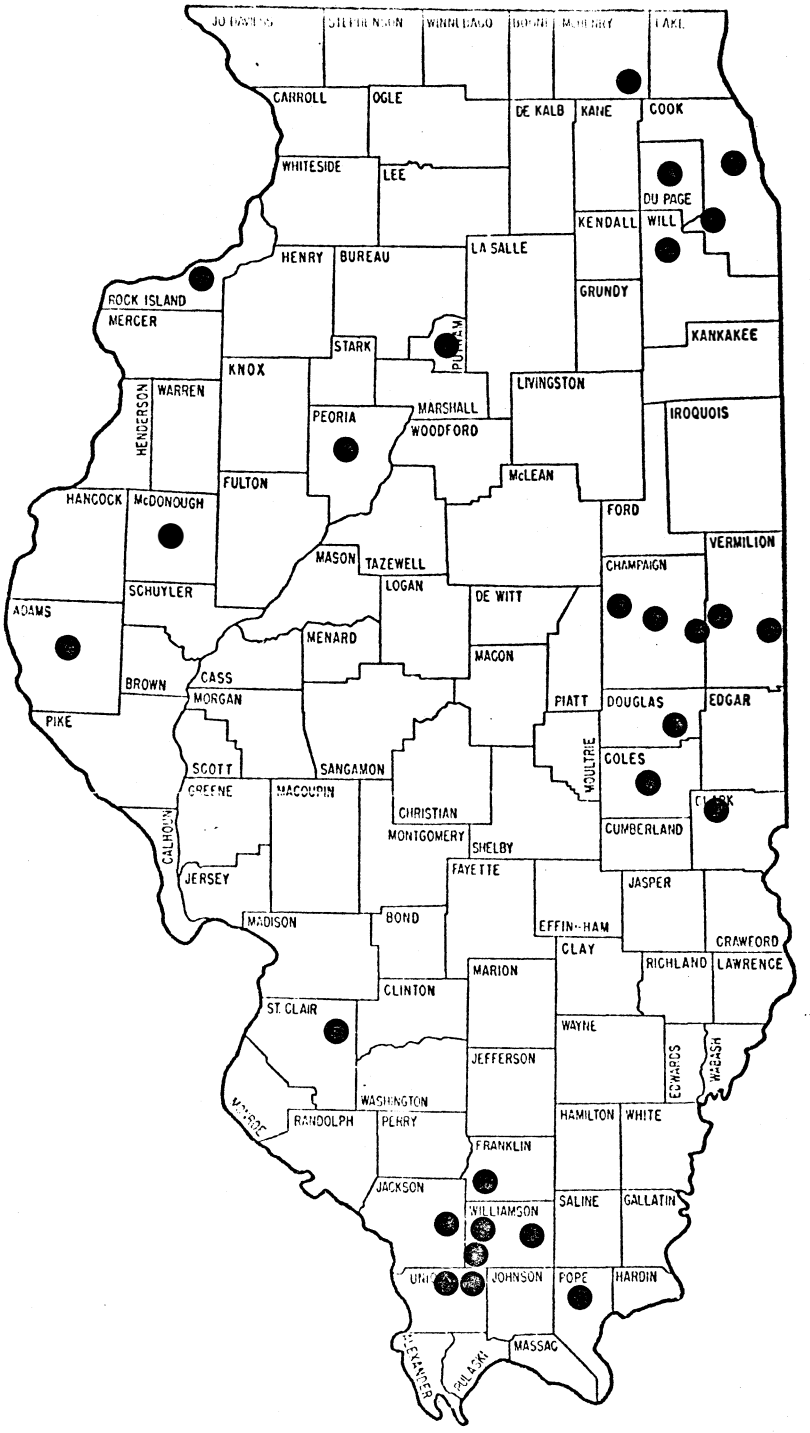

Fig. 22. Silpha inaequalis collection sites in Illinois

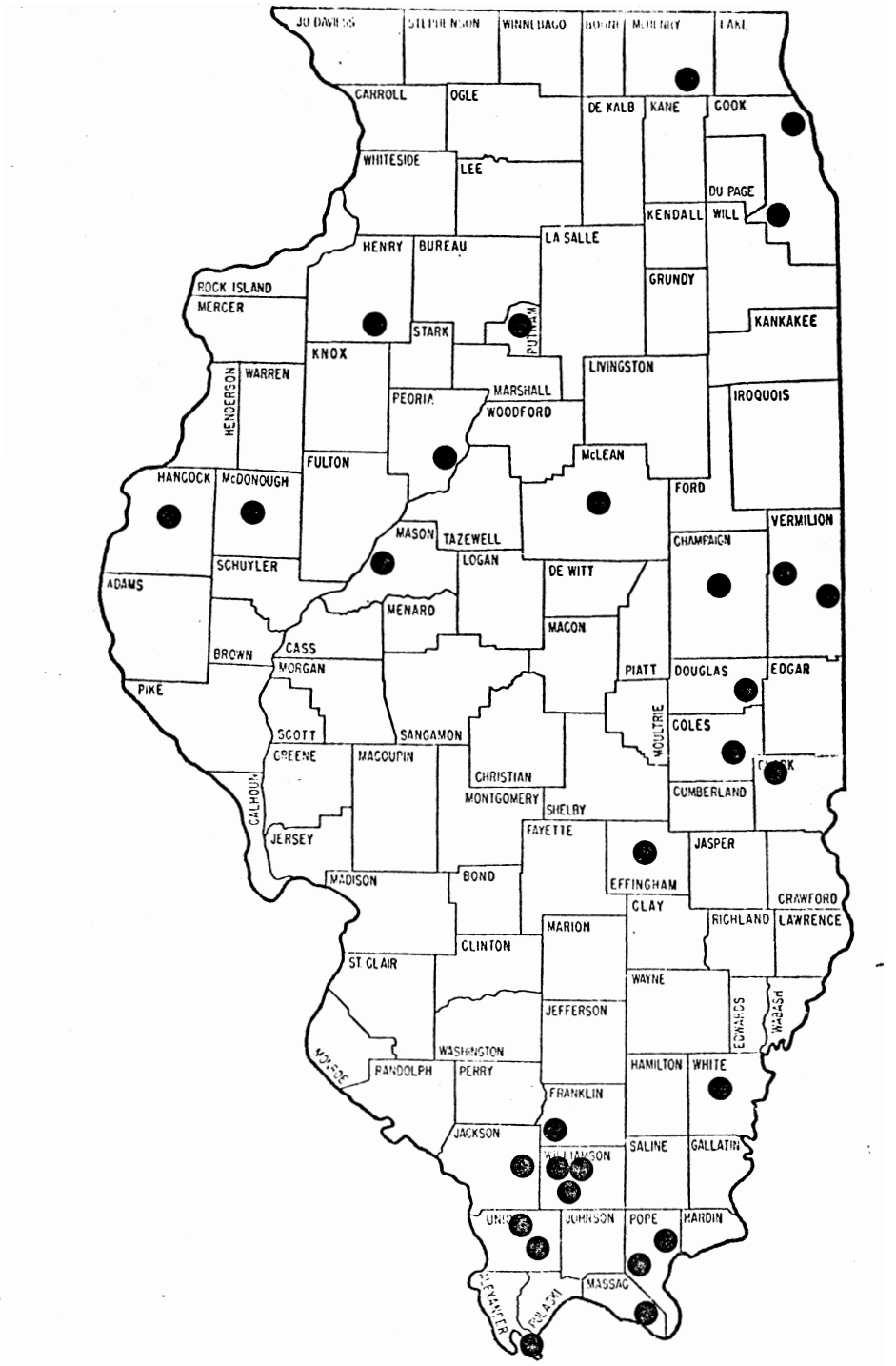

Fig. 23. Necrodes surinamensis collection sites in Illinois

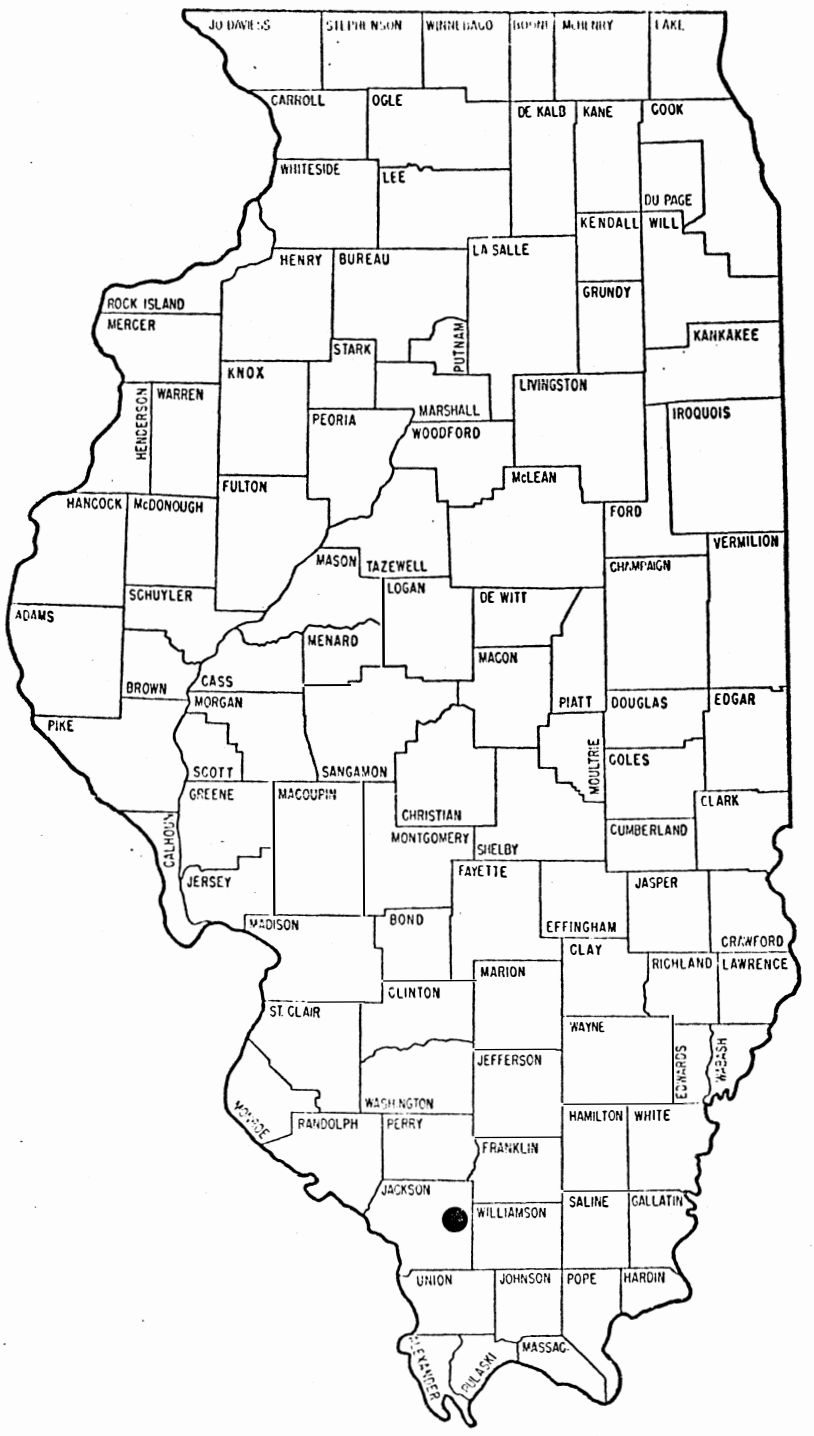

Fig. 24. Necrophilus pettiti collection sites in Illinois

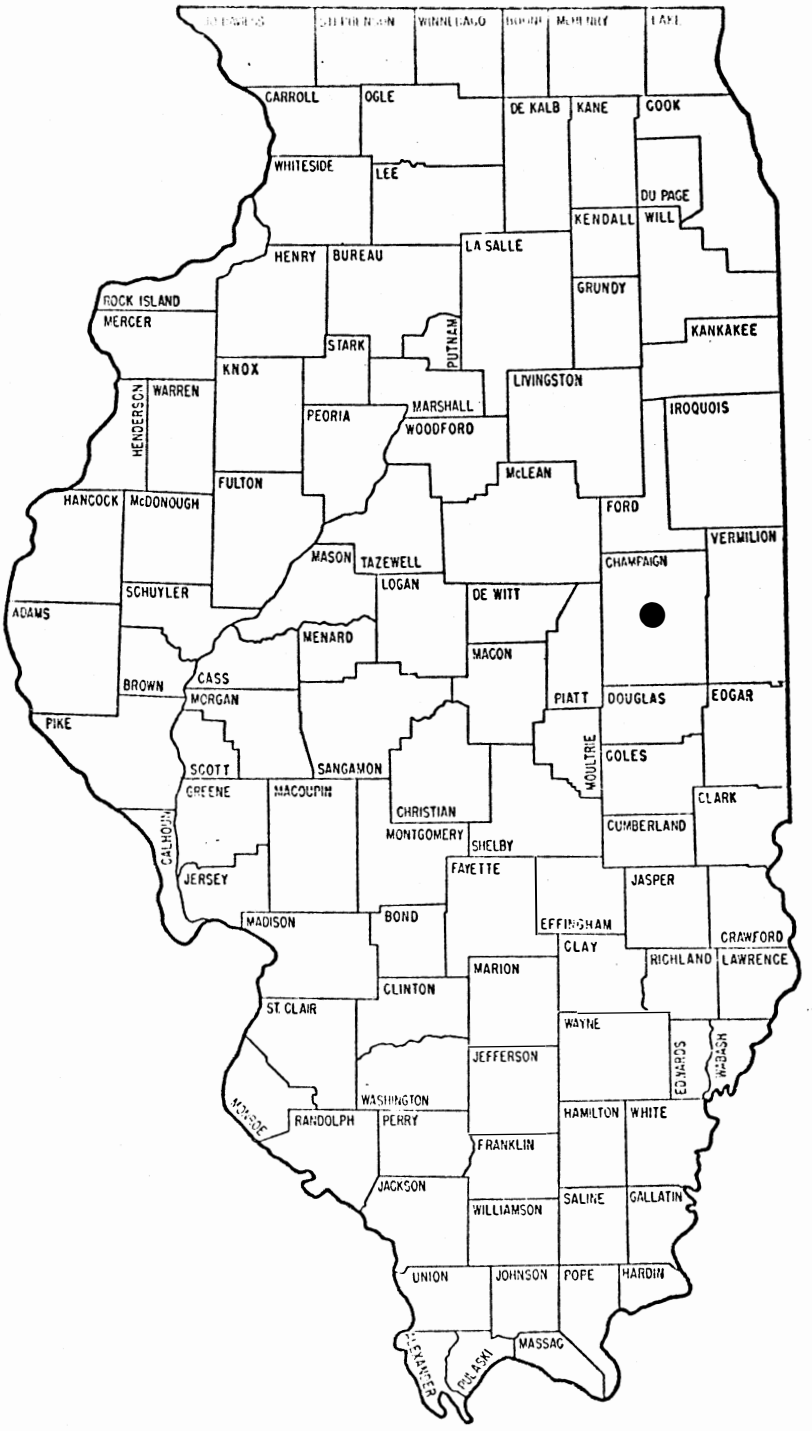

Fig. 25. Nicrophorus carolinus collection sites in Illinois

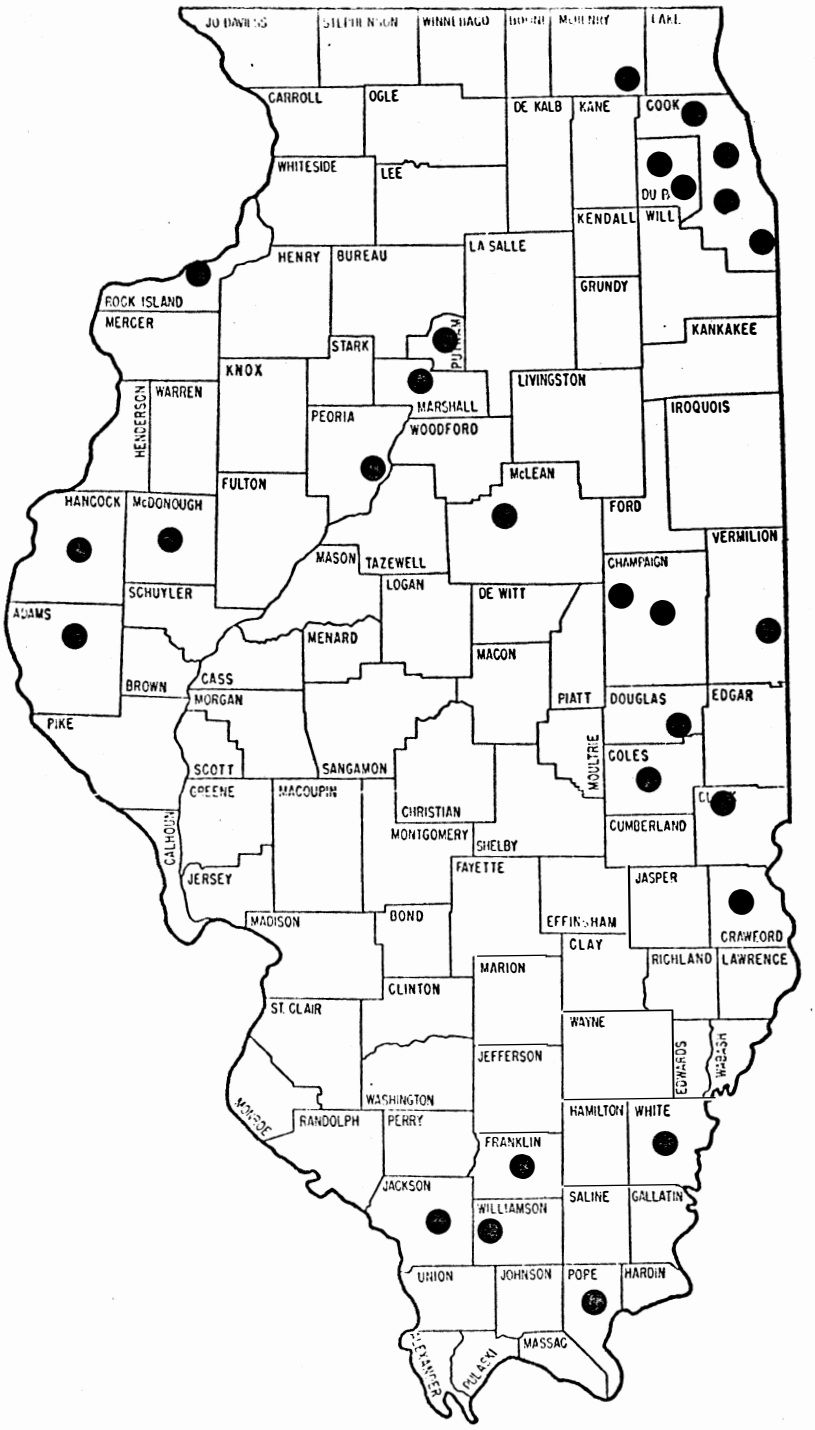

Fig. 26. Nicrophorus orbicollis collection sites in Illinois

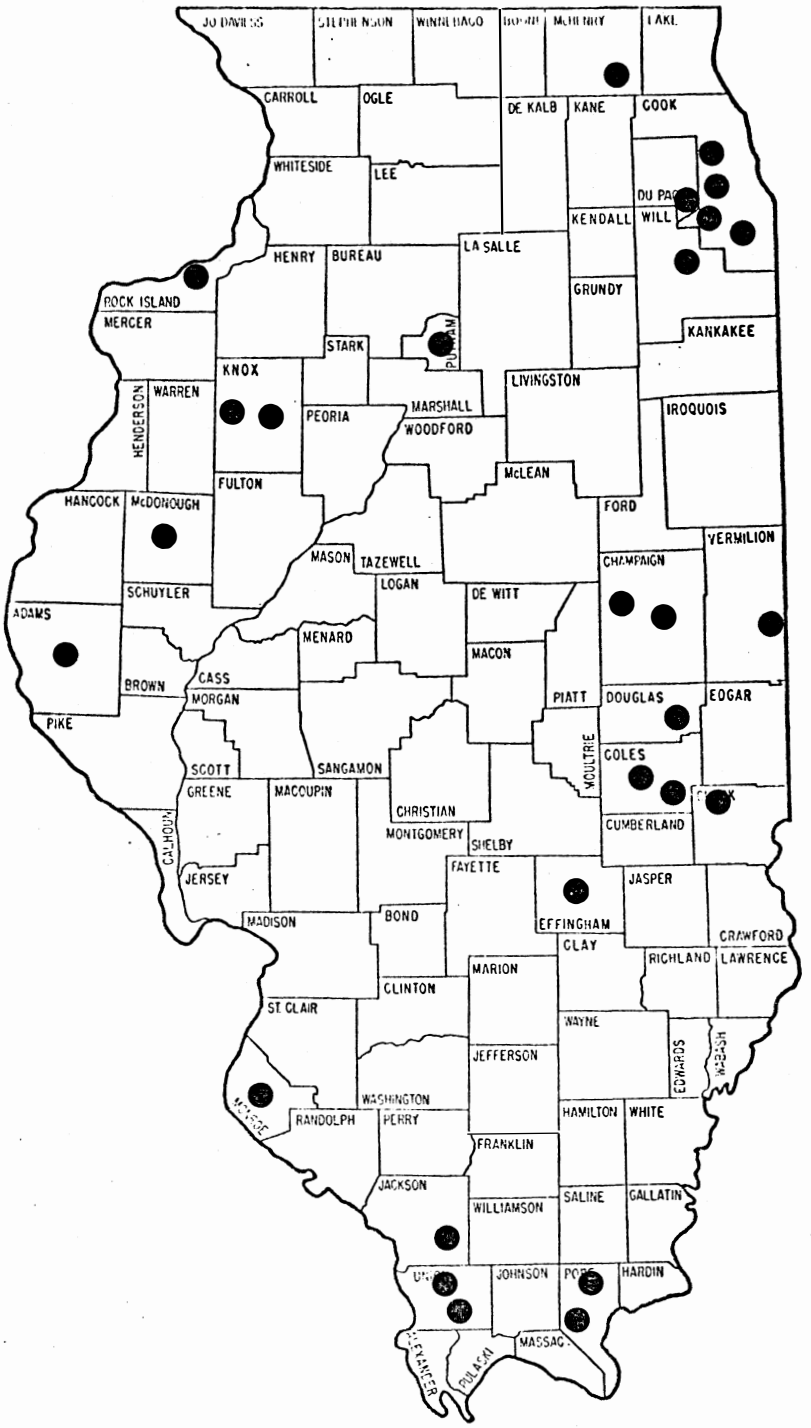

Fig. 27. Nicrophorus tomentosus collection sites in Illinois

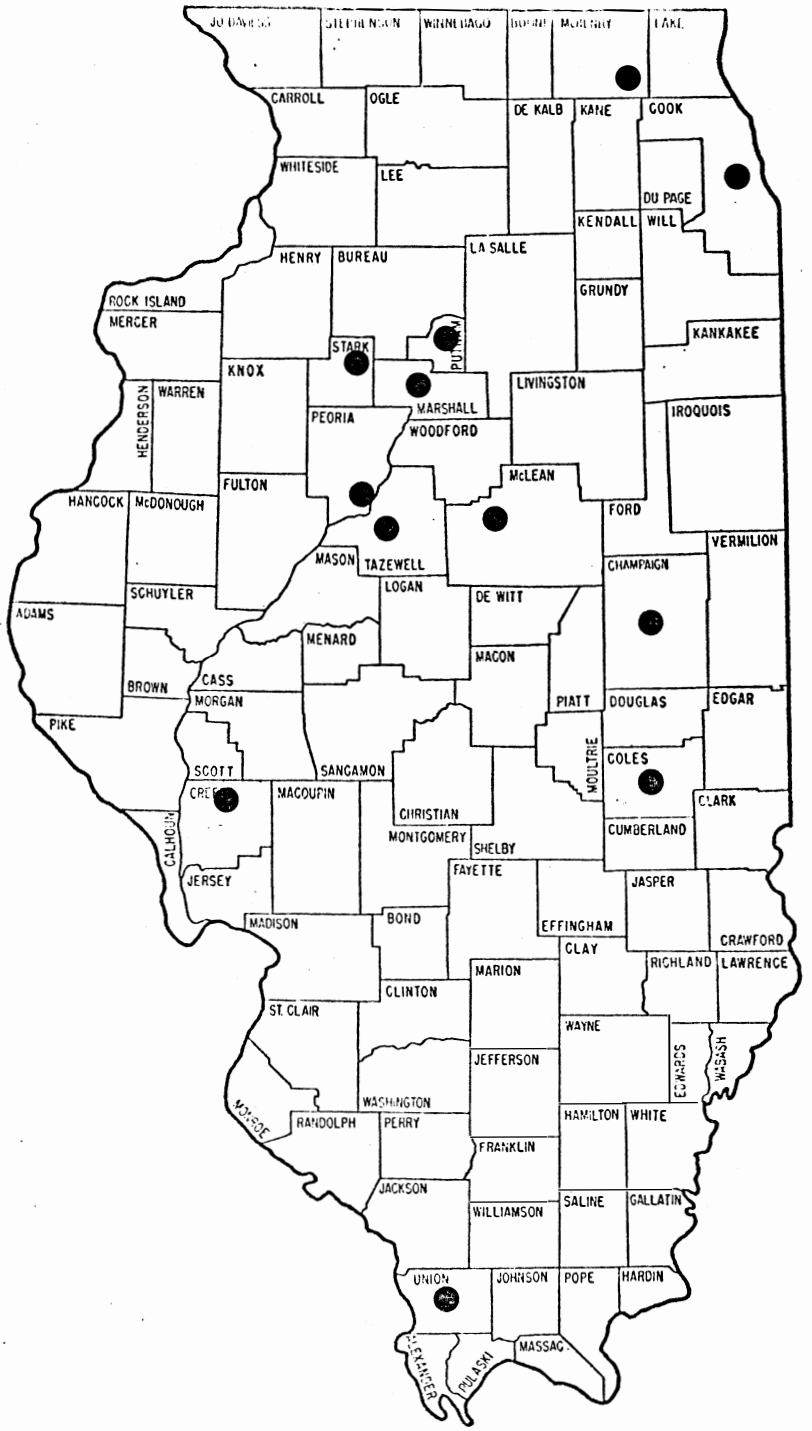

Fig. 28. Nicrophorus americanus collection sites in Illinois

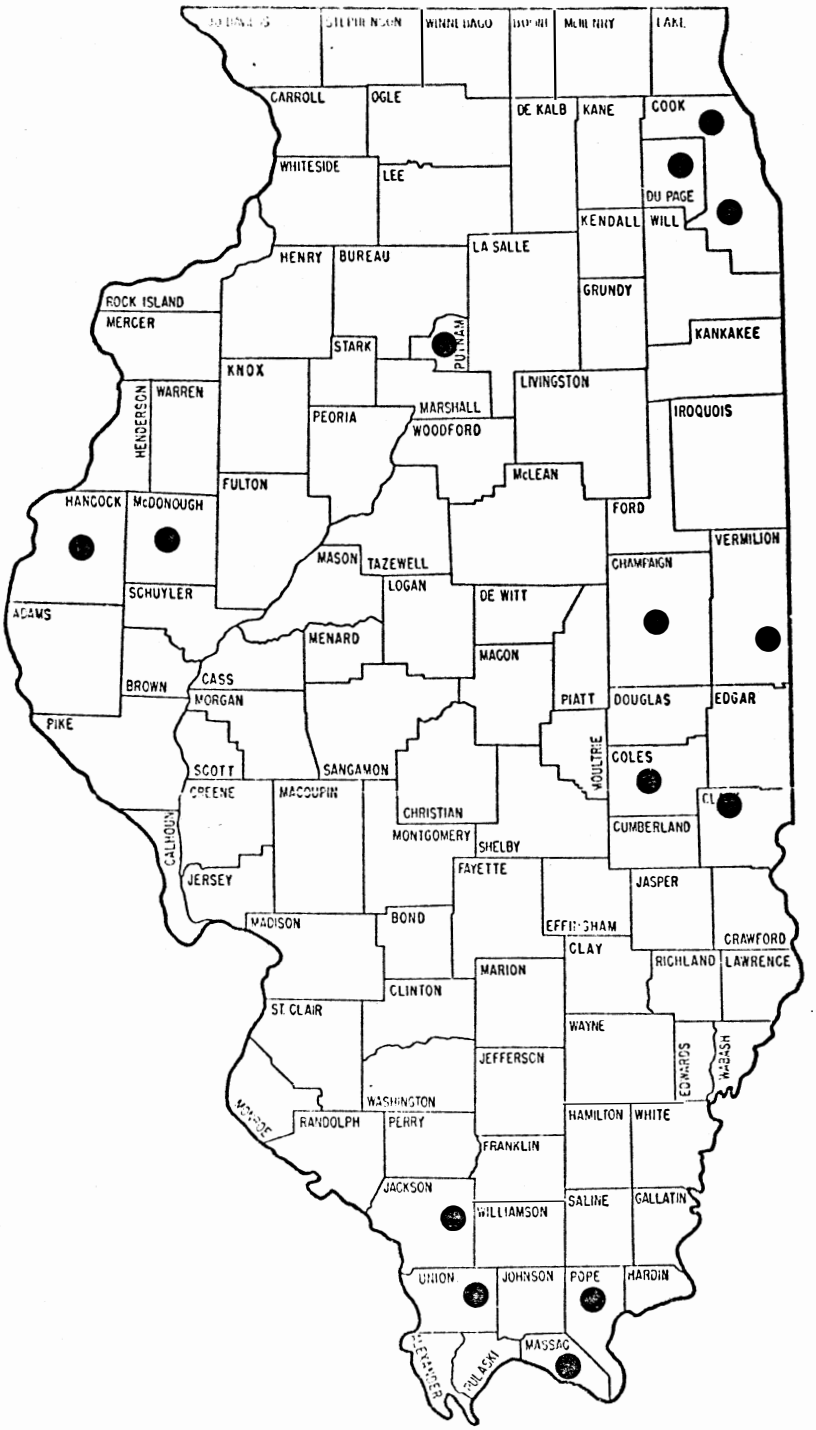

Fig. 29. Nicrophorus pustulatus collection sites in Illinois

Fig. 30. Nicrophorus vespilloides collection sites in Illinois

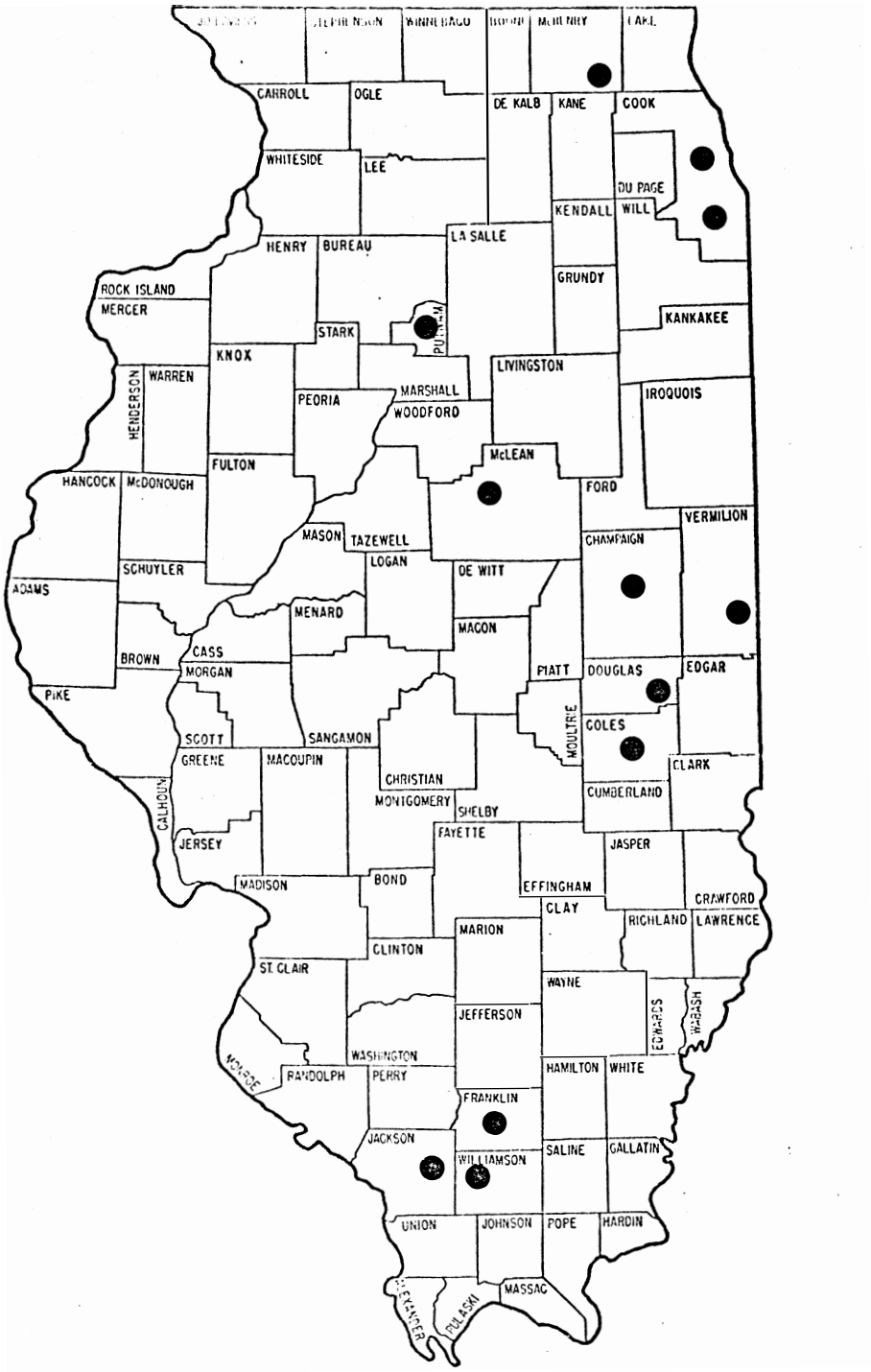

Fig. 31. Nicrophorus marginatus collection sites in Illinois

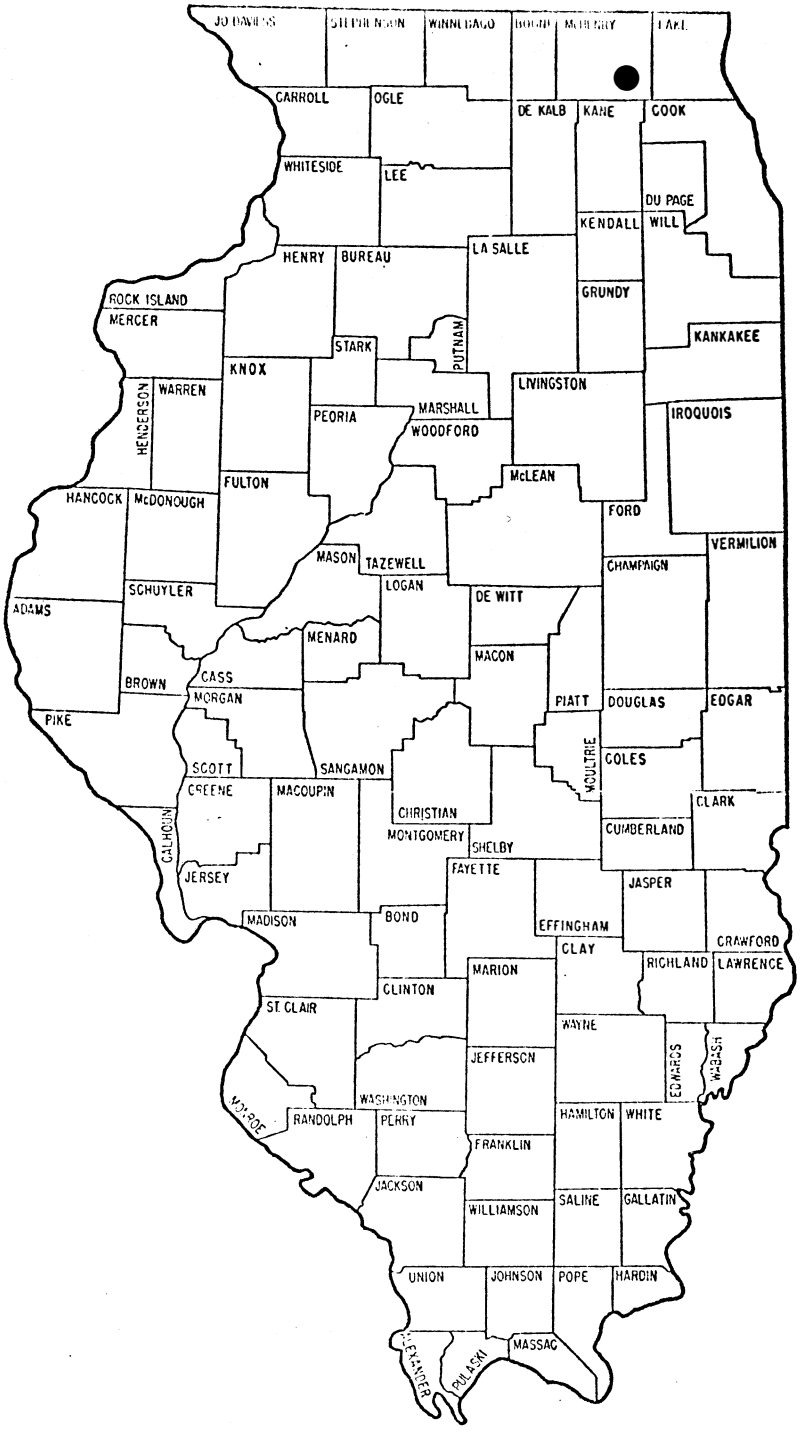

Fig. 32. Nicrophorus obscurus collection sites in Illinois

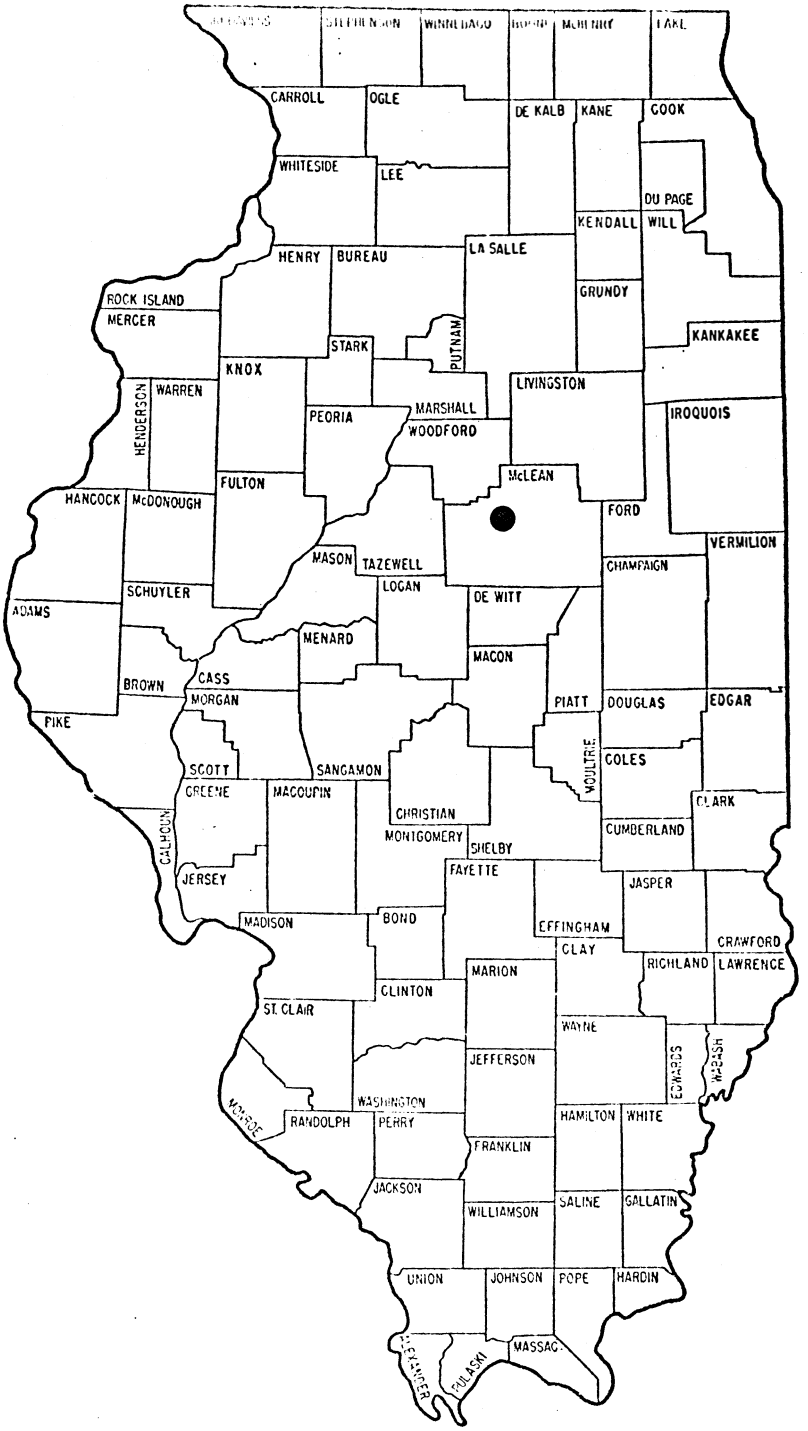

Fig. 33. Nicrophorus investigator collection sites in Illinois

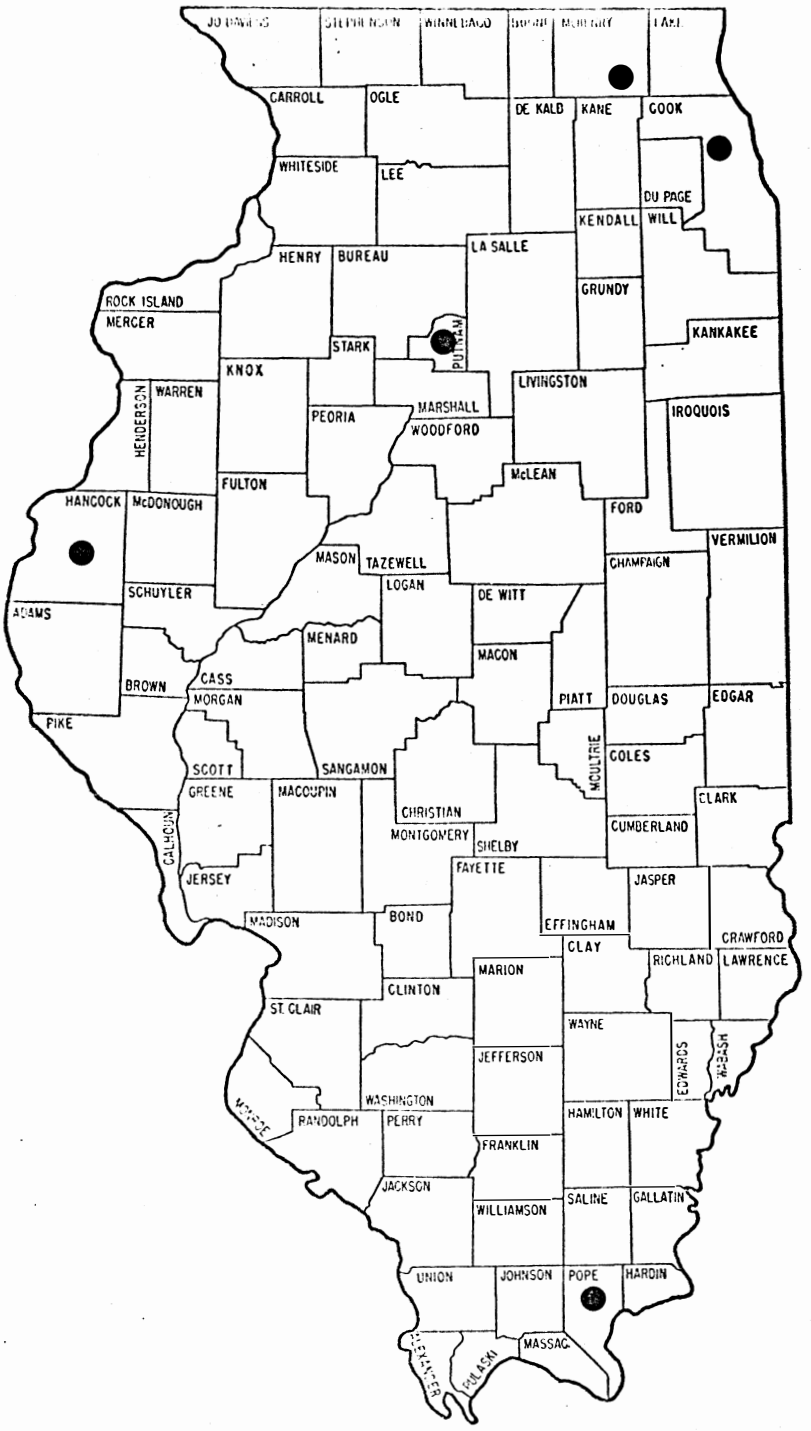

Fig. 34. Nicrophorus sayi collection sites in Illinois

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