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The Oxyporinae (Coleoptera: Staphylinidae) of Illinois

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THE OXYPORINAE (COLEOPTERA: STAPHYLINIDAE) OF ILLINOIS

By

Rodney S. Hanley

Thesis

Submitted in partial fulfillment of the requirements
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I hereby recommend this thesis be accepted as fulfilling
this part of the Graduate degree cited above

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ABSTRACT

The monogeneric subfamily Oxyporinae (Coleoptera: Staphylinidae) is composed of the genus Oxyporus Fabricius. Members of the genus are obligate inhabitants of higher, fleshy mushrooms. The Illinois fauna of Oxyporus includes nine species from two subgenera which are treated in this study. A key to the identification of adults, descriptions, fungal host lists, and distributional maps are provided for each species. The most commonly collected species in Illinois are O. occipitalis, O. stygicus, O. major, and O. vittatus; uncommon or rare species are O. lateralis, O. quinquemaculatus (a new record for Illinois), O. femoralis femoralis, O. rufipennis, and O. lepidus. Over 1000 host records were compiled for the fungal host lists of the subfamily. The most common fungal hosts for Illinois species of Oxyporus were: O. lateralis from Naematoloma fasciculare, O. occipitalis from Hygrophorus russula, O. quinquemaculatus from Pluteus cervinus, O. femoralis femoralis from Naematoloma fasciculare, O. stygicus from Pleurotus ostreatus, O. rufipennis from Pleurotus ostreatus, O. major from Lepiota acutaesquamosa, O. vittatus from Boletus sp., and O. lepidus from Pholiota sp. Aspects of the fungal habitat, structural and behavioral adaptations of the Oxyporinae to mushroom habitat, and patterns of Oxyporinae-host relationships are discussed.

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First, I would like to acknowledge Dr. Michael A. Goodrich, my major professor, for his steady guidance, leadership, helpful advice and encouragement throughout the course of this research. I also want to thank Dr. Andrew Methven for his assistance in the sometimes difficult task of identifying host mushrooms.

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INTRODUCTION

Members of the beetle family Staphylinidae are typically slender and elongate with short elytra which expose 3 or more abdominal tergites. The overall color can range from black to metallic blue to green to reddish. Vestiture ranges from entirely absent to densely pubescent. The head is usually quadrate or triangular. Antennae typically have 11 antennomeres; sometimes with 9 or 10. The pronotum is usually larger than the head with a variable shape. The tarsal formula is usually 5-5-5, but may also be 4-5-5, 4-4-4, 5-4-4, and rarely 3-3-3 or 2-2-2. The abdomen is usually laterally margined with 6 or 7 visible sternites. The larvae are campodeiform and frequently colored in shades of yellow, brown or black.

About 3100 species and 313 genera are currently recognized in the family Staphylinidae (Coleoptera) from North America (White 1983). These beetles are quite active and many typically run with the tip of their abdomen raised, much like a scorpion. Staphylinids occur in almost every type of habitat, but are probably most often seen about decaying materials, especially dung, carrion and fungi. Most species appear to be predaceous on other insects. The larvae typically occur in the same habitat and feed on the same materials as the adults.

The Oxyporinae is a small subfamily within the Staphylinidae. All members of this group are included in the single genus Oxyporus and are characterized by having a

large head with mandibles that typically cross and with the terminal segment of the labial palpi expanded apically.

Oxyporus was first described by Fabricius (1775) and later recognized as a distinct group of Staphylinidae by Thompson (1861). Nakane and Sawada (1956), in their treatment of the Japanese Oxyporinae, described a second genus Pseudoxyporus. Campbell (1969), in his revision of the New World Oxyporinae, reduced Pseudoxyporus to a subgenus of Oxyporus. Currently, there are 18 recognized species in the subgenus Oxyporus and 4 species in the subgenus Pseudoxyporus in the New World (Navarrete-Heredia and Novelo-Gutiérrez 1990).

Members of the genus Oxyporus are obligate inhabitants of higher, fleshy mushrooms (Campbell 1969, Ashe 1984a, 1984b, Leschen and Allen 1988, Hanley and Goodrich 1993). Adults and larvae of Oxyporus have been observed feeding on tertiary mycelia, pileus, and stipe tissue of mushrooms (Campbell 1969, Ashe 1984, Bruns 1984, Hanley and Goodrich 1993). Preoral digestion has been suggested as a feeding mechanism in Oxyporus adults (Newton 1984, Leschen and Allen 1988). Relatively few fungal host records have been published for the majority of species of North American Oxyporus.

Fleshy mushrooms offer one of the most unique habitats available to insects. Mushrooms are ephemeral, extremely heterogeneous in physical and chemical properties, and fairly predictable, but irregular in occurrence in time and

space (Ashe 1984a, 1984b, pers. observ.). As a result, oxyporines have evolved many behavioral and structural characteristics which allow them to exploit this unique habitat.

The purposes of this research were to (1) determine which Oxyporinae species occur in Illinois, (2) provide descriptions and a key to those species, (3) record the distribution and seasonal occurrence of each species within the state, (4) identify the known fungal hosts of each species, and (5) discuss the relationships between Oxyporinae species and their fungal hosts.

MATERIALS AND METHODS

This study is based upon the collection and/or examination of over 2600 specimens, 746 of which were from Illinois. Material for this research was either collected by me or borrowed from 24 institutions and private collections. Listed below are the institutions, abbreviations, locations and curators responsible for the borrowed specimens.

California Academy of Sciences (CASC), San Fransisco, D. Kavanaugh

Carnegie Museum of Natural History (CMNH), Pittsburgh, R. L. Davidson

Eastern Illinois University (EIU), Charleston, M. A. Goodrich

Florida State Collection of Arthropods (FSCA), Gainesville, P. E. Skelley

Illinois Natural History Survey (INHS), Urbana, K. R. Methven

Illinois State Museum (ISM), Springfield, E. D. Cashatt

Field Museum of Natural History (FMNH), Chicago, A. F. Newton

Hastings College (HC), Hastings, Nebraska, C. A. Springer

Museum of Comparative Zoology, Harvard University (MCZ), C. T. Graham

National Museum of Natural History, Smithsonian Institution (USNM), Washington, D. C., G. F. Hevel

North Carolina State University (NCSU), Raleigh, R. L. Blinn

Purdue University (PU), West Layfayette, A. Provonsha

Snow Entomological Museum, University of Kansas (SEM), Lawrence, R. W. Brooks

Southern Illinois University (SIU), Carbondale, S. Taylor

University of Arkansas (UARK), Fayetteville, C. Carlton

University of Idaho (UID), Moscow, F. W. Merickel

University of Michigan (UMI), Ann Arbor, M. O'Brien

University of Missouri (UMO), Columbia, K. Simpson

University of Vermont (UVT), Burlington, R. T. Bell

University of Wisconsin (UWI), Madison, S. Krauth

Western Illinois University (WILU), Macomb, Y. Sedman

In addition to the collections cited above, the following individuals loaned material from their private

collections.

R. A. B. Leschen (RABL), University of Kansas, Lawrence, Kansas

A. F. Newton (AFNC), Field Museum of Natural History, Chicago, Illinois

P. E. Skelley (PESC), Florida State Collection of Arthropods, Gainesville, Florida

The fungal host list for each species of Oxyporus was compiled from the literature, borrowed specimens and personal collecting. Names of host fungi were recorded as they appeared on museum specimens or in the literature, except for corrections of obvious misspellings or nomenclatural changes. Synonyms were identified under the currently accepted name. All fungal host authorships were listed according to Miller and Farr (1975) and Phillips (1991).

Oxyporinae specimens were collected in a variety of woodland habitats, especially wherever large numbers of mushrooms were found. When searching for Oxyporus specimens, every effort was made to check all habitats in which fungi could be found and to check all fungi within those habitats, even those fungi considered unlikely to be hosts. This was done to compile the most accurate fungal host list for each species. However, certain collection biases cannot be avoided. These biases include:

(1) In nature, many species of fungi are inconspicuous and easily overlooked, while others are easily seen and

more readily sampled.

(2) Groups or clusters of fungi are more conspicuous than single mushrooms.

(3) Fungus species with long seasonal occurrences tend to be sampled more than species with short seasonal occurrences.

(4) Host information gathered gives only limited data about fungus species on which Oxyporus does not occur.

(5) Rare or uncommon fungus species are more easily misidentified.

Despite such potential sources of biases, the data collected reflects general trends of abundance, distribution, seasonal activity and host utilization of Oxyporus species.

The most effective method of collecting Oxyporus specimens was to remove the host mushroom from the substrate and quickly place it inside a collecting net. Adult specimens typically crawled from the mushroom and were aspirated or picked up by hand and transferred to 80% ethanol. Malaise, flight and pitfall traps were also successful in capturing many specimens of Oxyporus, whereas light traps were not.

Measurements of body lengths were made from the anterior margin of the labrum to the apex of the abdomen. Other measurements are described in the text.

The terminology of Torre-Bueno (1962) is used in this study. To avoid possible confusion, some terms are defined.

Antennomere. Segment of the antenna.

Carina (pl. carinae). An elevated ridge or keel.

Coxa (pl. coxae). The basal segment of the leg.

Denticulate. With small teeth or notches.

Frons. Frontal sclerite of the head outlined by a U or V shape.

Metepimera. The area of the pleuron posterior to the pleural suture of the metathorax.

Metepisterna. The area the pleuron anterior to the pleural suture of the metathorax.

Paratergite. Lateral margin of dorsal surface (tergum) of the abdomen.

Pubescent. Covered with fine, erect setae.

Rugose. Wrinkled.

Sternite. Ventral portion of a segment.

Tarsal Formula. The number of tarsomeres making up the tarsi of the prothoracic, mesothoracic, and metathoracic legs.

Temple. The area posterior to the eye.

Tergite. Dorsal portion of a segment.

Vestiture. The general pubescence of the body.

Vitta (pl. vittae). Broad pigmented stripe.

RESULTS

Nine species of Oxyporus have been collected in Illinois. The most commonly collected species are O. occipitalis, O. stygicus, O. major, and O. vittatus; uncommon or rare species are O. lateralis, O. quinquemaculatus, O. femoralis femoralis, O. rufipennis, and

O. lepidus. Over 1000 host records were compiled for the fungal host lists of the subfamily.

KEY TO THE OXYPORINAE SPECIES OF ILLINOIS[1]

1. Antennomeres VI-X narrow, no more than 1 1/2 times wider than long; pubescent throughout (often more sparsely along midline) (Fig. 4) ..... subgenus Pseudoxyporus .. 2

   Antennomeres VI-X broad, at least 2 times wider than long; glabrous along midline (Fig. 5) ..... subgenus Oxyporus 4

2. Basal angles of pronotum lacking longitudinal carina (Fig. 6) 3

   Basal angle of pronotum with a distinct, longitudinal, convex carina; sides usually excavate beneath carina (Fig. 7) ..... O. quinquemaculatus

3. Pronotum uniformly reddish brown, or at most, with brownish stripe on deflexed sides; elytra without black sutural markings; body dull overall ..... O. lateralis

   Pronotum with two distinct, longitudinal, sublateral, black vittae which may be expanded to cover most of pronotum; elytra with black markings at suture; body shiny overall ..... O. occipitalis

4. Elytra with outer apical angles smooth, shining (Fig. 8) 5

   Elytra with outer apical angles distinctly rugose, not shining (Fig. 9) ..... O. femoralis femoralis

5. Body (excluding elytra) and femora piceous or black .. 6

   Body (excluding elytra) with some yellow or reddish yellow markings, femora usually pale 8

6. Elytra entirely black ..... O. stygicus

   Elytra with pale markings 7

7. Elytra mostly yellow to orange-red, with a small mark on outer apical angles ..... O. rufipennis

   Elytra black with one or two longitudinal, ivory-colored vittae on each elytron ..... O. major

8. Pronotum entirely reddish yellow dorsally ... O. lepidus

   Pronotum with color variable, ranging from yellow with at least anterior and posterior margins black to entirely brown or black ..... O. vittatus

[1]Modified from Campbell (1969, 1978).

SYSTEMATIC ACCOUNTS OF THE GENUS AND SPECIES

Genus Oxyporus Fabricius 1775

This genus differs from all other genera in the Staphylinidae by the large, curved, prognathous mandibles and by the widened to cresent-shaped terminal segment of labial palpi (Figs. 1 and 2). The head is typically wider than the thorax, and the antennae are inserted at the sides of the head. The anterior coxae are prominent, the middle

coxae are widely separated, and the posterior coxae are transverse. The tarsal formula is 5-5-5. Paratergites are prominent and six abdominal sternites are visible.

Specimens are usually found with the left mandible crossed over the right mandible which fits into a notched structure on the ventral surface of the left mandible (Fig. 3).

Subgenus Pseudoxyporus Nakane & Sawanda 1956

This subgenus differs from the subgenus Oxyporus by having antennae with antennomeres VI-X broad and slightly flattened, and with each antennomere no more than 1.5 times as wide as long. The apical seven segments are covered with short, fine pubescence throughout (Fig. 4). The terminal segment of the labial palpi is widened to a semicircular shape. The labrum is deeply, concavely emarginate along the anterior margin with the anterior third deflexed.

Males of each species have the width of the head (including eyes) subequal to, or greater than, the width of the pronotum; the length of the mandibles is generally subequal to the length of head; the right mandible is usually slightly longer than the left; and the fifth sternite of abdomen possesses a patch of long, medial setae. Females of each species generally differ from males by having a smaller head (width of head, including eyes, smaller than width of pronotum); smaller mandibles (shorter than length of head), subequal in length to each other;

acute apices of both mandibles; and the fifth abdominal sternite lacking the median patch of setae.

Nakane and Sawada (1956) divided the genus Oxyporus into two genera, Oxyporus and Pseudoxyporus. Campbell (1969) noted the relatively small differences separating these two groups of species and reduced Pseudoxyporus to subgeneric status.

The subgenus Pseudoxyporus includes four New World species. Three of these species, O. lateralis, O. occipitalis and O. quinquemaculatus, have been collected in Illinois. The fourth species, O. smithi, is known only from Mexico.

Oxyporus lateralis Gravenhorst 1802

Diagnostic Description.

This species differs from other North American species of Oxyporus by its finely granulate dorsal surface which gives it a very dull appearance. Color dark reddish-brown; outer apical angles of elytra black; sides of head, deflexed sides of pronotum, and round spot near middle of each side of abdominal tergites II-V usually piceous. Overall length 7.7-8.9 mm (Fig. 12).

Males with right mandible usually with inner surface of apex broadly, obliquely emarginate; left mandible usually with inner surface of apex very broadly, obliquely emarginate. Frons with two distinct longitudinal impressions between eyes. Females differ from males by the

longitudinal depressions of frons shallow or absent.

National Distribution.

Eastern and midwestern North America, ranging from southern Nova Scotia south to North Carolina, and west to eastern Minnesota, Iowa, Illinois, and Arkansas (Map 1). One specimen examined from the P. J. Darlington Collection (Museum of Comparative Zoology) with a Monticello, Utah label, is regarded as doubtful.

Illinois Distribution.

Known from 6 scattered counties throughout the state (Map 1). Most Illinois specimens have very limited collection data. Twelve specimens have only state labels ("Ill.") and were probably collected prior to 1950. The most recent specimen collected in Illinois was taken in 1961 from Des Plains (Cook Co.). This species appears to be uncommon in Illinois.

Habitat/Fungal Hosts.

Known from three families of fungi. Weiss and West (1920) reported O. lateralis from Pleurotus ostreatus (Tricholomataceae) and Pholiota sp. (Cortinariaceae). McCabe and Teale (1981) reared 10 O. lateralis larvae to adults from Armillaria mellea (Tricholomataceae). I have records of 6 specimens of O. lateralis from Naematoloma fasciculare (Strophariaceae) in Washington Co., AR. The only host data for O. lateralis in Illinois is a series of 9 specimens collected from Lake Shelbyville (Shelby Co.) labelled "fungi".

Seasonal Occurrence.

Specimens have been collected in Illinois from May through November, with most specimens being taken in September (Table 1).

Remarks.

Due to the lack of detailed collection data available for this species, additional distributional, seasonal and host information would be welcome. McCabe and Teale (1981) described the immature stages of O. lateralis.

Material Examined.

I have examined 244 specimens, 38 of which were from Illinois.

Oxyporus occipitalis Fauvel 1864

Diagnostic Description.

This species differs from other North American species of Oxyporus by the following: black, longitudinal vittae on the dorsolateral regions of the pronotum; absence of a carina near each basal angle of the pronotum; and an overall smooth, shiny surface of the body. Color geographically variable; specimens collected in Illinois have a yellow head dorsally except for a median black spot, the pronotal vittae are small and widely separated from the lateral margins of the pronotum, the elytra vary from black with the humeral angles and base obliquely reddish yellow to mostly yellow with sutural vitta broad and distinct (often enlarged medially), and the apical two segments of the abdomen are

pale. Overall length 6.2-10.9 mm (Fig. 13).

Males with right mandible strongly, abruptly, curved medially in apical fourth, apex acute; left mandible variable, usually with inner surface of apex obliquely truncate or occasionally acute; frons with a small longitudinal impression near base of each antenna and occasionally with a small median impression.

National Distribution.

Transcontinental from Maine south to North Carolina, and west to California, Oregon, Washington, British Columbia and the Yukon Territory (Map 2). Oxyporus occipitalis appears to be absent from the great plains region of the United States.

Illinois Distribution.

Known in Illinois from 8 counties (Map 2). This species has a scattered distribution throughout the state.

Habitat/Fungal Hosts.

Known from seven families of fungi. The primary fungal hosts for O. occipitalis are Hygrophorus russula, Armillaria gallica, Russula sp., Grifola frondosa, and Armillaria mellea (see Table 2 for a complete list of hosts). Leschen and Allen (1988) reared five O. occipitalis larvae to adults from Hygrophorus russula.

Seasonal Occurrence.

Specimens have been collected in Illinois from September through November, with most specimens being taken in October (Table 1).

Remarks.

Campbell (1969) reported geographical color variation in the head, pronotum and abdomen of O. occipitalis. California specimens have a mostly black head with pronotal vittae expanded to cover most of the pronotum and the apical three abdominal tergites black. Specimens collected in the southwest and Pacific northwest have reduced pronotal vittae. A majority of Canadian specimens have even more reduced pronotal vittae, a pale region at the base of the head, a distinct sutural vitta of the elytra, and the apical two abdominal tergites pale. Specimens collected in the eastern United States (including Illinois) have a pale head except for a median black spot; small, widely separated pronotal vittae; the sutural vitta of the elytra is broad and distinct; and the apical two segments of abdomen are pale.

Adult specimens of O. occipitalis have been collected in association with other species of Oxyporus as follows: with O. major in Armillaria gallica; with O. vittatus in Armillaria gallica, Armillaria mellea, and Grifola frondosa; and with O. stygicus in Grifola frondosa. Leschen and Allen (1988) described the immatures stages of O. occipitalis.

Material Examined.

I have examined 224 specimens, 67 of which were from Illinois.

Oxyporus quinquemaculatus LeConte 1863

Diagnostic Description.

This species differs from other North American *Oxyporus* spp. by having a strongly convex carina at each basal angle of the pronotum (Fig. 9). Color yellow to reddish-yellow; head black except for gula and median dorsal spot; pronotum with a large, black, longitudinal vitta near each side; elytra yellow with large, circular, piceous sutural spot and black outer apical angles; abdomen with middle of basal two tergites and all of apical three segments black; antennae piceous with basal four antennomeres and apical antennomere distinctly lighter in color; palpi and labrum reddish-yellow. Overall length 5.5-8.0 mm (Fig. 14).

Males with right mandible abruptly curved medially near middle, usually with apical third broadly expanded, apex shallowly emarginate; left mandible slightly curved medially from base to apex, inner surface often slightly widened just before apex, apex acute (Fig. 11); basal ventral groove of left mandible ending abruptly near center of mandible in form of a notch; frons with two distinct longitudinal impressions between eyes. Sides of pronotum usually deeply excavate under carina. Females differ from males by the well developed outer ventral tooth of the left mandible; longitudinal depressions of frons shallow or absent; basal angles of the pronotal carina not raised above pronotal disc, sides only slightly excavate under carina.

National Distribution.

Primarily distributed in northeastern North America, ranging from Nova Scotia and southeastern Québec south to North Carolina and Georgia, and west to Illinois and the upper peninsula of Michigan (Map 3).

Illinois Distribution.

Known in Illinois only from the Rocky Branch Nature Preserve, Clark County (Map 3). This collection represents the first record from Illinois and the most western record of this species.

Habitat/Fungal Hosts.

The most commonly recorded fungal host of adults of O. quinquemaculatus is Pluteus cervinus (Table 3). All Illinois specimens were collected from P. cervinus. No host records have been published for larvae of O. quinquemaculatus.

Seasonal Occurrence.

All Illinois specimens were collected in early June (Table 1).

Remarks.

Like other species of Oxyporus, this species tends to be gregarious. I collected a series of 23 specimens from one mushroom and examined 9 other series composed of 3 or more specimens. An interesting behavior noted is the tendency for adults to fall to the substrate when their fungal host is disturbed, apparently death feigning. After about a minute, the beetles right themselves and return to

the mushroom.

Due to limited collection data, additional distributional, seasonal and host information for O. quinquemaculatus would be welcome. The immatures of this species have not been described.

Material Examined.

I have examined 91 specimens, 28 of which were from Illinois.

Subgenus Oxyporus Fabricius 1775

This subgenus differs from the subgenus Pseudoxyporus by having antennae with antennomeres VI-X strongly flattened, broad, and with each antennomere at least 2.0 times as wide as long. The apical seven antennomeres broadly glabrous and shining along the longitudinal axis (Fig. 5). The terminal segment of the labial palpi is well developed and strongly cresent-shaped (Fig. 2). The labrum is usually narrowly emarginate at the center of anterior margin, often narrowly split from the apex of emargination to the base of the labrum.

Males of each species have temples rounded, width subequal to slightly less than the distance between outer margins of eyes; length of the mandibles usually subequal to the length of the head. Females of each species generally differ from males by having the temples broadly rounded, width subequal to or greater than the width of the pronotum; and mandibles smaller and broader, shorter than length of

head.

The subgenus Oxyporus includes 16 New World species. Six of these species, O. femoralis femoralis, O. stygicus, O. rufipennis, O. major, O. vittatus, and O. lepidus have been collected in Illinois.

Oxyporus femoralis femoralis Gravenhorst 1802

Diagnostic Description.

This species differs from other North American species of Oxyporus by the coarsely rugose outer apical angles of the elytra (Fig. 9); finely alutaceous head and pronotum, black legs, and yellow elytra with suture and outer apical angles black. Color piceous to black; elytra yellow with suture, outer and posterior margins black (including rugose portion); labrum and labial palpi yellow; femora black; tibia yellow with base, apex, and inner side piceous; tarsi yellow. Mandibles subequal in length. Overall length 6.6-9.9 mm (Fig. 15).

Males with width of head (including eyes) broad, greater than width of pronotum; left mandible often irregularly widened on inner side; left mandible with basal ventral groove ending abruptly near center of mandible as a small acute tooth; frons with a shallow median impression between eyes.

Females differ from males as follows: head smaller, width (including eyes) no greater than width of pronotum; apices of mandibles acute; frons with very slight median

impression between eyes.

National Distribution.

Eastern Canada and United States, ranging from southern Québec south to North Carolina, and west to Wisconsin, Iowa, Missouri, Oklahoma and Mississippi (Map 4).

Illinois Distribution.

Known in Illinois only from Ogle County (Map 4). Of the 9 Illinois specimens examined, only one has a specific collection location, another is labelled "central Ill." and the remainder have no specific collection data. Based on national distribution, this species may be more widely distributed in Illinois than these records indicate.

Habitat/Fungal Hosts.

The primary fungal hosts of O. femoralis femoralis are Grifola frondosa and Naematoloma fasciculare (see Table 4 for complete list of hosts). Leschen and Allen (1988) reared 30 larvae to adults from Naematoloma fasciculare. No fungal hosts records are attached to the 9 Illinois specimens.

Seasonal Occurrence.

Of the 9 Illinois specimens examined, only one had a collection date; 8 July 1905. In Arkansas, specimens have been collected from May through October, with most specimens being collected in September. In Michigan, specimens have been collected from July through October, with most specimens being collected in July.

Remarks.

Campbell (1969) reduced Oxyporus austrinus Horn to a subspecies of O. femoralis. It differs from O. femoralis femoralis in having the legs almost completely yellow and the abdomen usually partially or completely reddish-yellow, but is identical in all other aspects. Oxyporus femoralis austrinus is restricted to the southeastern United States ranging from South Carolina to Florida, west to Louisiana and Texas. This subspecies does not occur in Illinois (Map 4).

Oxyporus femoralis femoralis appears to be uncommon in Illinois, but quite common in other parts of its range. Any additional distributional, seasonal and host information would be welcome. Leschen and Allen (1988) described the immature stages of O. femoralis femoralis.

Material Examined.

I have examined 342 specimens, 9 of which were from Illinois.

Oxyporus stygicus Say 1834

Diagnostic Description.

This species differs from other North American species of Oxyporus in having a uniformly black body and elytra. Body smooth and shiny throughout; labrum and tarsi light reddish-yellow to brown; apices of maxillary and labial palpi and sides of antennomeres V-XI light reddish-brown to piceous. Mandibles subequal in length (Fig. 10). Overall

length 5.7-12.5 mm (Figs. 1 and 16).

Males with width of head (including eyes) distinctly greater than width of pronotum; frons broadly, irregularly impressed between eyes, often with distinct groove on each side of middle; fifth and sixth abdominal sternites densely punctate in apical two-thirds.

Females differ from males as follows: head smaller, width (including eyes) subequal to width of pronotum; temples not as rounded, each approximately one and one-half times as long as eye; mandibles shorter than head; frons with median impressed areas very shallow, indistinct; fifth and sixth abdominal sternites more shallowly and sparsely punctate.

National Distribution.

Eastern North America, ranging from Maine south to Virginia and North Carolina, and west to Nebraska, Kansas and Arkansas (Map 5).

Illinois Distribution.

Widespread throughout Illinois (Map 5). Oxyporus stygicus is the most frequently collected species of Oxyporus in Illinois.

Habitat/Fungal Hosts.

Hanley and Goodrich (1993) reported seven fungal hosts for O. stygicus (Table 5). The largest series of adults were found on Pleurotus ostreatus, Omphalotus illudens, Grifola frondosa and Polyporus squamosus. Hanley and Goodrich (1993) reared 49 O. stygicus eggs and larvae to

adults from Pholiota aurivella. Additional large series of immatures were also collected from Pholiota aurivella and Omphalotus illudens. Adult specimens of O. stygicus were most often collected when the host mushroom was at full maturity. Specimens were not as frequently encountered when the host mushroom was immature or old and beginning to degrade.

Seasonal Occurrence.

Specimens have been collected in Illinois from April through November, with the majority of specimens being taken in October (Table 1). Adults of O. stygicus tend to be collected more often in the spring and fall months than in the summer months.

Remarks.

Adults of O. stygicus have been collected in association with other species of Oxyporus as follows: with O. occipitalis in Grifola frondosa; with O. vittatus in Grifola frondosa and Armillaria gallica; and with O. rufipennis in Omphalotus illudens and Pleurotus ostreatus. One joint collection record is of particular interest. Both adult and larval specimens of O. stygicus and adult specimens of O. rufipennis were collected from Omphalotus illudens in southwest Michigan by A. Newton and M. Thayer. All immatures from this collection are third instar larvae which I identified as O. stygicus. This collection would suggest partitioning of the larval environment by O. stygicus and O. rufipennis larvae. This partitioning may be

temporal or the result of larval host specificity. Large numbers of adult Triplax thoracica Say and T. flavicollis Lacordaire (Coleoptera: Erotylidae) are also frequently collected with specimens of O. stygicus from the fungal host Pleurotus ostreatus. Hanley and Goodrich (1993) described the immatures of O. stygicus.

Material Examined.

I have examined 718 specimens, 414 of which were from Illinois.

Oxyporus rufipennis LeConte 1863

Diagnostic Description.

This species differs from other North American species of Oxyporus by the distinctive coloration and large size. Color black with yellow to orange-red elytra; outer apical angles of elytra and area adjacent to scutellum black; labrum and tarsi reddish yellow. Mandibles subequal in length. Overall length 8.7-14.4 mm (Fig. 17).

Males and females very similar. Temples of males with width subequal to distance between outer margins of eyes, each approximately 1.5-2.0 times as long as eyes. Temples of females with width subequal to or less than distance between outer margins of eyes, each approximately subequal to or slightly less than length of eye.

National Distribution.

Northeastern and northcentral North America, ranging from Québec south to Maryland, and west to Minnesota,

Nebraska, and Kansas (Map 6). One specimen reported by Campbell (1969) with a North Carolina state label should be regarded as questionable until verified by further collecting.

Illinois Distribution.

Primarily distributed in the northern half of the state (Map 6).

Habitat/Fungal Hosts.

Only a limited number of host records are available for this beetle. Campbell (1969) reported O. rufipennis from Pholiota aurivella (Cortinariaceae) and Pleurotus ostreatus (Tricholomataceae). Newton (1984) reported 4 adults from Pleurotus ostreatus, 1 adult from Polyporus squamosus (Polyporaceae), and 1 adult and 20 larvae from an undetermined member of the Agaricales. I have additional records of O. rufipennis collected from Omphalotus illudens (Tricholomataceae) in Michigan and from Pleurotus ostreatus in Michigan, Maryland, and Indiana.

Seasonal Occurrence.

Specimens have been collected in Illinois from May through October, with an equal number of specimens being taken in July and October (Table 1).

Remarks.

Adult specimens of O. rufipennis have been collected in association with O. stygicus in Pleurotus ostreatus (O. stygicus adults only) and Omphalotus illudens (O. stygicus adults and larvae). The immatures of this species have not

been described.

Material Examined.

I have examined 181 specimens, 22 of which were from Illinois.

Oxyporus major Gravenhorst 1806

Diagnostic Description.

This very distinctive species differs from other North American species of Oxyporus by the presence of one or two distinct, ivory-colored, longitudinal vittae on each elytron. Color black; each elytron usually with two longitudinal vittae; the inner vitta extending from base to apex, often reduced or obsolete; the outer vitta extending from humeral angles posterior to middle of elytron. Mandibles subequal in length. Overall length 8.4-13.7 mm (Fig. 18).

Males with pronotum wider than long, sides narrowed from apex to base; a weak transverse impression just posterior to apex and another across the middle.

Females with width of pronotum subequal to length, sides not distinctly narrowed from apex to base, impressions on pronotum absent.

National Distribution.

Generally distributed in the eastern United States from Vermont and New Hampshire south to South Carolina and Georgia, and west to Missouri and Arkansas (Map 7).

Illinois Distribution.

Known in Illinois from 8 counties in the southern half of the state (Map 7).

Habitat/Fungal Hosts.

The primary fungal hosts for O. major are Lepiota acutaesquamosa and Stropharia hardii (see Table 6 for complete list of hosts).

Seasonal Occurrence.

Specimens have been collected in Illinois from August through October, with most specimens being taken in October (Table 1).

Remarks.

Three or more specimens of O. major are rarely taken from the same fruiting body. Typically, one male and one female are collected from a single fruiting body, with females rarely taken alone. When disturbed, adult specimens tend to fly readily from the fungal host. Adults are frequently collected in Malaise and flight traps.

Adult specimens of O. major have been collected in association with other species of Oxyporus as follows: with O. vittatus in Armillaria gallica; with O. occipitalis in Armillaria gallica; and with O. femoralis femoralis in an undetermined mushroom. The immatures of this species have not been described.

Material Examined.

I have examined 131 specimens, 56 of which were from Illinois.

Oxyporus vittatus Gravenhorst 1802

Diagnostic Description.

This species differs from other North American Oxyporus spp. by the elytral color pattern, shiny smooth surface, small size, and pale legs. Color highly variable; head from black to completely pale dorsally, pronotum from black to pale dorsally, with at least anterior and posterior margins black; elytra from completely black to pale with a narrow, black, sutural vitta; elytra from completely black to pale, with suture, outer, and posterior margins black; abdominal tergites ranging from completely black to completely pale; legs always pale; surface smooth and shiny. Mandibles subequal in length. Overall length 5.2-7.5 mm (Fig. 19).

Males with width of head (including eyes) subequal to or slightly less than width of pronotum; mandibles distinctly shorter than head; apical two abdominal sternites covered with long, coarse setae.

Females differ from males as follows: width of head (including eyes) distinctly less than width of pronotum; mandibles significantly shorter than head; apical two abdominal sternites more sparsely covered with coarse setae.

National Distribution.

Eastern North America ranging from southern Québec south to northern Florida, and west to Manitoba, Minnesota, Missouri and Oklahoma (Map 8).

Illinois Distribution.

Known in Illinois from 4 counties near the eastern edge of the state (Map 8), although it probably has a wider distribution within the state.

Habitat/Fungal Hosts.

The primary fungal hosts of O. vittatus are Cortinarius sp., Boletus sp., Armillaria mellea, Armillaria gallica, and Grifola frondosa (see Table 7 for complete list of hosts). Leschen and Allen (1988) reared 8 larvae to adults from Cortinarius sp.

Seasonal Occurrence.

Specimens have been collected in Illinois from August through October, with most specimens being taken in October (Table 1).

Remarks.

Campbell (1969) recognized O. bicolor Fauvel 1864 as a subspecies of O. vittatus on the basis of color pattern. The 174 specimens identified as O. vittatus bicolor that Campbell examined are from the eastern United States from New Jersey south to northern Florida, and west to Tennessee, Kentucky, and southern Illinois. My data show that the color pattern for bicolor is not restricted to the area described by Campbell. In addition, specimens with the typical vittatus color pattern have been collected within and south of the range of bicolor reported by Campbell. In addition, I have examined large series from several localities which include both color forms as well as

intermediates not described by Campbell. Therefore, I conclude that bicolor represents only a color morph of vittatus and is not deserving of subspecific status.

Adult specimens of O. vittatus have been collected in association with other species of Oxyporus: with O. major in Armillaria gallica; with O. stygicus in Armillaria gallica, Grifola frondosa, and Pholiota sp.; and with O. occipitalis in Armillaria gallica, Armillaria mellea, and Grifola frondosa.

Adult specimens are also collected in Malaise traps and window traps. Oxyporus vittatus is the most frequently collected species of Oxyporus in North America. Leschen and Allen (1988) described the immature stages.

Material Examined.

I have examined 515 specimens, 90 of which were from Illinois.

Oxyporus lepidus LeConte 1877

Diagnostic Description.

This species differs from other North American species of Oxyporus by the entirely reddish-yellow pronotum. Color reddish-yellow; black on anterior three-fourths or more of head, outer apical angles of elytra, elytral suture, apical two segments of abdomen, and posterior three-fourths of metepisterna and metepimera; surface smooth and shiny. Mandibles subequal in length. Overall body length 5.7-7.5 mm (Fig. 20).

Males with apical two abdominal segments covered with dense setae. Females with setae on last two abdominal segments sparse.

National Distribution.

Distributed in the eastern and central United States, ranging from New York south to South Carolina and Georgia, and west to Iowa and Nebraska (Map 9).

Illinois Distribution.

Known in Illinois from 4 counties in the southern half of the state (Map 9).

Habitat/Fungal Hosts.

Newton (1984) reported 2 adults and 25 larvae from Pholiota sp. (Cortinariaceae). The only fungal host record for Illinois is one specimen from Pholiota sp. from the Rocky Branch Nature Preserve (Clark Co.).

Seasonal Occurrence.

Specimens have been collected in Illinois from June through October, with most specimens being taken in October (Table 1).

Remarks.

This is the rarest species of Oxyporus in eastern North America. Campbell (1969) examined only 44 specimens in his revisionary treatment of the subfamily. Despite extensive field collecting in east central Illinois over the past two years, only one specimen was collected in its fungal host. In the same time period however, four specimens were collected in Malaise traps. The immatures of O. lepidus

have not been described.

Material Examined.

I have examined 41 specimens, 22 of which were from Illinois.

DISCUSSION

Of the fourteen species of Oxyporus known to occur in America north of Mexico, nine species occur in Illinois. The five species that do not occur within the state include two uncommon species from the eastern United States with very small ranges (O. ashei and O. kiteleyi), one from eastern Texas and Louisiana (O. elegans), and two neotropical species that are found in Mexico, Arizona and New Mexico (O. mexicanus and O. neomexicanus) (Campbell 1969, 1974, 1978). Illinois, therefore, has a large proportion of the North American species of Oxyporus.

Many staphylinids are known to visit mature mushrooms and may be collected on them in great numbers. The majority of these staphylinids appear to be attracted to mushrooms after they have begun to decay and probably prey on other insects. Mycophagy in the Staphylinidae is relatively uncommon and is thought to be a highly derived condition (Ashe 1984a, 1984b). Among the mycophagous staphylinids, it is often unclear if the beetles are obligately or facultatively mycophagous.

Two groups of staphylinids are thought to be obligately associated with mature mushrooms. The first group are members of the subtribe Gyrophaenina. Adults and larvae of this subtribe feed exclusively on the hymenium (spore producing layer) of the mushroom. This adaptation has allowed members of the Gyrophaenina to avoid many of the interspecific competitive interactions with species that

feed on the tissue of the pileus and stipe (Ashe 1984a, 1984b). The second group of obligate mycophagous staphylinids are members of the Oxyporinae, the subjects of this research.

The Mushroom as a Habitat.

Since members of the Oxyporinae are thought to be obligately mycophagous, the general features of mushrooms as a habitat and food source are important to understanding the relationships that exist between the Oxyporinae and their fungal hosts.

Mushrooms tend to be highly ephemeral. The fruiting bodies of many gilled mushrooms may occur for only a few days before they begin to decay whereas the fruiting bodies of other species may occur for a much longer period of time. Gilled mushrooms generally have shorter durational stability than polypores. Richardson (1970) reported variation in the stability of gilled mushrooms ranging from 4 to 19 days whereas the stability of polypores often last from several weeks to several years.

Mushrooms also tend to be fairly predictable, but irregular in occurrence in time and space. The vegetative mycelium of many mushroom species may remain associated to the same tree for several years and produce basidiocarps in approximately the same location annually (Bruns 1984, pers. observ.). On the other hand, areas that seem to be suitable for fungal growth may never produce sporocarps. Most species have very specific moisture and temperature

requirements which govern their growth. Slight differences in environmental conditions may alter the occurrence and distribution of a mushroom even within a limited area. Many species are so severely governed by environmental conditions that they take years to store up enough glycogen and lipids to produce reproductive fruiting bodies.

Mushrooms are also extremely heterogeneous in physical properties. Large sporocarps, for example, may provide several microhabitats for fungivorous insects (Hanski 1989). Members of the staphylinid subtribe Gyrophaenina are known to graze exclusively on spores, while one species of the Anthomyiidae (Diptera) feeds exclusively on stipe tissue and still other species feed exclusively on the pileus or cap tissue.

Mushrooms also vary in chemical properties. For example, unrelated genera may contain the same mycotoxin i. e. Amanita and Galerina containing amanitoxin (Bresinsky and Besl 1990). Poisonous and non-poisonous species can also be found within a single genus (Amanita rubescens Pers., non-poisonous; Amanita phalloides (Fr.) Link, poisonous) (Phillips 1991).

These factors create great variation in the occurrence and distribution of fungi in a given area. For members of the Oxyporinae to exploit such a habitat, many structural and behavioral specializations are necessary.

Structural Adaptations to the Mushroom Habitat.

The principle structural adaptations of the Oxyporinae to the mushroom habitat has involved modifications of the mandibles and labial palpi. The general features of the oxyporine mandibles include the following. Both mandibles are very large and highly prognathous. The ventral surface of each mandible has a shallow median groove extending from the apex to the middle, and a large, pubescent groove extending from the base to the middle. The left mandible has a notch-like structure on the outer ventral margin to receive the right mandible when at rest. The labial palpi are characterized by being three-segmented with the apical segment strongly compressed laterally and semicircular to cresent-shaped.

Oxyporines feed by slicing off bits of host fungi and saturating the fungal chunks with preoral digestion fluid (Newton 1984, Leschen and Allen 1988, pers. observ.). Newton (1984) speculated that oxyporines might preorally digest host fungi. Leschen and Allen (1988) postulated that two characters are adaptations to preoral digestion in the Oxyporinae. First, the mandibles, when closed, form a container which aids in the manipulation of preoral juices and the extended clypeus functions in a similar manner when the mandibles are open. Secondly, the ventral basal area of the mandibles has a denticulate anterior region and brush-like structure on the posterior region which serve to increase the surface area of the fungal bits for exposure to

digestive enzymes. The notch-like structure on the left mandible (Fig. 3) apparently serves to protect the inner cutting surface of the mandibles from damage and to keep the mandibles correctly aligned when not in use.

The widened apical segments of the labial palpi (Fig. 2) possess many chemoreceptors and almost certainly have an important sensory function. It is likely that the labial palpi aid in the recognition of host fungi when in contact with the surface of the sporocarp or evaluate the quality of tissue available within a particular mushroom.

Structures that appear to be analogous to the oxyporine labial palpi are the cresent-shaped maxillary palpi of the obligate mycophagous Triplacinae (Coleoptera: Erotylidae), especially species of Triplax (Boyle 1956; Goodrich and Skelley 1991, 1993). Within the genus Triplax, members of the species group macra are associated exclusively with members of the polypore genus Inonotus, whereas members of the species group thoracica are primarily associated with the gilled mushroom genus Pleurotus (Skelley, Goodrich and Leschen 1991, Goodrich and Skelley 1993). The structure of the maxillary palpi of species of Triplax likely aids in this host specificity, although the specific function is unknown.

Behavioral Adaptations to the Mushroom Habitat.

In the Oxyporinae, adults feed, court, mate, and oviposit on mushrooms (Newton 1984, Leschen and Allen 1988, Hanley and Goodrich 1993). In a few days the eggs hatch and

the larvae begin to tunnel through the mushroom feeding on the tertiary mycelia, pileus, and stipe tissue. After passing through three larval instars, each about one day in duration, the larvae crawl out and pupate in the surrounding soil. Adults emerge approximately 8 days later. The entire life cycle takes about 17 days at 22°C in O. stygicus (Hanley and Goodrich 1993) and O. vittatus (Leschen and Allen 1988). These life cycles are quite similar to life cycles described by Lacy (1984) for mycophagous drosophilids. The short duration of the Oxyporus life cycles serves as a key adaptation to the ephemeral nature of the host fungi.

Primitive parental care (subsociality) might be expected to evolve among those organisms that occupy ephemeral, but nutritionally rich resources, such as fleshy mushrooms (Wilson 1971, 1975; Tallamy 1984; Ashe 1986; Tallamy and Wood 1986). Such parental care would be a key behavioral adaptation to the fungal habitat as a whole. Wilson (1971) identified two major environmental factors that create the conditions favorable for the evolution of parental care. First, a highly stable or structured environment that is unusually favorable, and second, a physically stressful environment that is unusually harsh. Intermediate or "ordinary" environments were noted to not especially promote the evolution of subsocial behavior. Fleshy mushrooms fit into the category of scattered, ephemeral and nutritionally rich resources. As such, fungal

habitats would be expected to promote the evolution of subsocial behavior in mushroom inhabiting insects.

Subsocial behavior is characterized by the building of elaborate nests, nest guarding and grooming, transport of food to brood cells, and the transport of young (Wilson 1971). Members of the obligate mycophagous staphylinid subtribe Gyrophaenina have been observed to exhibit such subsocial behavior (Ashe 1987).

Many subsocial species are known that utilize various food sources that are rich but scattered and ephemeral, for example, dung (Platystethus: Scarabaeidae), dead wood (Passalidae, Platypodidae and Scolytidae), and carrion (Necrophorus: Silphidae). Wilson (1971) called the exploitation of these habitats the "bonanza strategy" and described it as a strategy in which individuals "strike it rich" and are assured of a more than sufficient food supply for the rearing of young. However, those individuals must exclude all others which are seeking to utilize the same "bonanza".

Subsocial behavior can also be expected to eliminate the threat of egg dumping or deliberate substitution of an alien brood for the resident brood by intruding conspecific females. These types of behaviors (cleptoparasitism and brood parasitism) have been noted most commonly in birds (Weller 1959, Weatherhead and Robertson 1978, Yom-Tov 1980, Dhindsa 1981), but have also been noted in insects, for example, in Gargaphia solani (Hemiptera: Tingidae) (Tallamy

1985, 1986), and in Curanigus and Scolytoproctus (Coleoptera: Curculionidae) (Wilson 1971).

It may be assumed that subsocial behavior maximizes the benefits and minimizes the costs associated with the exploitation of a resource (Tallamy and Wood 1986). Within the scattered, ephemeral and nutritionally rich mushroom habitat, subsocial behavior would increase the overall fitness and success of the immatures. Possible functional explanations for this behavior include: parental protection of fungal microhabitat from conspecifics, parental protection of eggs and juveniles from predation and/or parasitism, trophic exchange or grooming behavior between parent and young, insurance that young are kept within a favorable microclimate, and insurance that young are placed together for reciprocal benefits to each other.

Subsocial behavior has not been documented for members of the Oxyporinae. However, if subsocial behavior is shown to exist in members of the Oxyporinae then its functional cause would be of great interest. One could hypothesize that with the very short developmental time of members of the Oxyporinae, subsocial behavior is unnecessary for the success of the young as in mycophagous drosophilids. I do not hold such a view because Oxyporinae larvae can grow to great relative size compared to drosophilid larvae and would thus be much more inviting to potential predators and/or parasites.

Patterns of Beetle-Host Relationships.

Due to the ephemeral and predictable, but irregular occurrence of mushrooms, obligate mycophagous insects can be expected to exhibit a life history strategy that would: (1) be specialized in host choices while being short-lived with the beetle's seasonal occurrence somewhat matching the occurrence of the hosts; or (2) be specialized in host choices while being long-lived and aestivating during periods of food shortage; or (3) be unselective in host choices while being relatively long-lived and not aestivating during times of food shortage; or (4) be unselective in host choices while being short-lived, feeding on the available fungi present during the beetle's occurrence.

Lacy (1984) speculated that there are conflicting selective pressures on mycophagous insects: on the one hand, toward specialization for specific groups of fungi, and on the other, toward generalization on a variety of fungal hosts. Lacy suggested that obligate mycophagous insects would be expected to restrict their host choices to relatively similar mushrooms to avoid any noxious compounds which they are not adapted to ingest. Specialization, however, can only occur if the fungal hosts are sufficiently long lasting and/or available during the feeding stages of the beetle's life cycle. Conversely, due to the ephemeral and irregular occurrence of some species of mushrooms, obligate mycophagous insects might be expected to be

unselective in host choices.

Hanski (1989) concluded that generalized fungus-feeding is selected for against specific fungus-feeding. Two hypotheses were given to support this conclusion. First, the quantity hypothesis (Jaenike 1978) which states that the ephemeral and somewhat unpredictable occurrence of mushrooms selects for generalized fungus-feeding. Second, the quality hypothesis states that there are only minor differences in the quality of host species making widening of host selection favorable by mycophagous insects. Leschen (1990) pointed out that this hypothesis makes the assumption that all mushrooms can serve as potential hosts and are equally edible to fungivorous insects. Mushrooms, however, vary widely in their quality to mycophagous insects. For example, the presence of aflotoxin B_1 in mushrooms inhibits feeding by most mycophagous insects, except Carpophilus hemipterus (L.) (Coleoptera: Nitidulidae) which is apparently unaffected (Dowd 1992).

In some groups, specific fungus-feeding may be selected for against generalized fungus-feeding. Goodrich and Skelley (1991, 1993) have argued that in the Erotylidae (Coleoptera), generalized fungus feeding is a characteristic of the more primitive subfamily Dacninae, which possess unmodified maxillary palps. In contrast, in the more derived subfamily Triplicinae, which possess highly modified maxillary palps, members tend to be more host specific.

Patterns of Oxyporinae-mushroom host relationships become apparent only after large numbers of host records were obtained. Three patterns of host utilization for the members of the Oxyporinae are postulated (no pattern is assigned to O. lepidus due to limited host records).

Pattern 1.

Adults are found on a wide variety of fungi, typically many genera from distantly related families. For example, over 150 specimens of Oxyporus vittatus Gravenhorst have been collected from 16 genera in 7 families of fungi (Table 6). Oxyporus occipitalis also exhibits this pattern.

Pattern 2.

Adults are consistently found only on a few genera of fungi and less commonly on other genera. For example, over 140 specimens of O. femoralis femoralis have been collected from 8 genera in 4 families of fungi. Over 100 of those specimens were taken from only two genera (Table 3). Other Oxyporus species to exhibit this pattern include O. lateralis, O. stygicus, O. major and O. rufipennis.

Pattern 3.

Adults are found on a variety of fungi but the great majority are found on only one genus. For example, over 34 specimens of O. quinquemaculatus LeConte have been collected from 5 genera in 3 families of fungi. Thirty of those specimens were collected from the genus Pluteus (Table 2).

Ashe (1984b) documented similar patterns of host utilization for members of the Gyrophaenina. The patterns

of Oxyporinae-mushroom host relationships are complex and require additional adult and immature host records for a more complete interpretation.

It remains unclear what role competition plays in Oxyporinae-mushroom host relationship patterns. Both interspecific and intraspecific competition probably occur with members of the Oxyporinae, but is very difficult to observe and document. For example, the collections of O. stygicus and O. rufipennis from Omphalotus illudens noted previously (see O. stygicus species description) is composed of both adults of O. stygicus and O. rufipennis and larvae of O. stygicus. As noted previously, this collection would suggest partitioning of the larval environment by O. stygicus and O. rufipennis. It is unknown whether this partitioning is temporal or the result of larval host specificity.

At present, members of the Oxyporinae appear to be r-selected species. The theory of the r-K selection continuum (MacArthur and Wilson 1967, Pianka 1970) states that there is a continuum of life history strategies that surround r-selected species at one end and K-selected species at the other. r-selected species are those that have poor competitive abilities, but have a high rate of per-capita population growth. K-selected species are good competitors, but have slow rate of per-capita population growth up to the carrying capacity of the environment. In r-selected species, natural selection favors rapid development, a high

reproductive rate, early reproduction, small body size, and single reproductions. Members of the Oxyporinae appear to fit that description. However if subsocial behavior (a more K-selected trait) is shown to exist, then members of the Oxyporinae would probably be somewhere in the middle on the r-K selection continuum.

There are groups of fungi which produce fruiting bodies on which members of the Oxyporinae are never found. These include the chanterelles (Cantherellales), the coral fungi (Clavariales), the tooth fungi (Hydnaceae), the resupinate fungi (Corticiales), the puffballs (Lycoperdales and Tulostomatales), the earth stars (Geastrales), the stinkhorns (Phallales), the bird's-nest fungi (Nidulariales), and the jelly fungi (Phragmobasidiomycetes). In addition, members of the Oxyporinae are never found on members of the Ascomycota. The reasons for the absence of these beetles from these groups fungi are unknown.

Future Trends in Research Within the Oxyporinae.

Study of the Oxyporinae has yielded many new insights into the relationships between these beetles and their fleshy fungal hosts. At present, the fungal host lists for all species are still incomplete and would benefit from further collecting and accurate host identification.

Subsocial behavior has not yet been shown in members of the Oxyporinae, however, I believe that with further study, subsocial behavior may be confirmed. Advances in mushroom rearing may allow future experiments on subsocial behavior

to be feasible.

Summary

The patterns of host relationships of the Oxyporinae appear to be quite complex. They are adapted for the exploitation of an ephemeral, heterogeneous, and fairly predictable, but irregularly occurring habitat. The Oxyporinae have evolved structural modifications in the mandibles and labial palpi to exploit this habitat. Members of the Oxyporinae also exhibit a very short developmental time as an adaptation to the emphemeral nature of the host fungi. The Oxyporinae may exhibit primitive parental care (subsociality) as a key adaptation to possible larval predation and/or parasitism and to increase survival of the larvae. Three patterns of Oxyporinae-mushroom host relationships are noted: (1) adults found on a wide variety of fungi, typically many genera from many distantly related families; (2) adults predictably and consistently found only on a few genera of fungi and less commonly on other genera; or (3) adults found on a variety of fungi but the great majority on only one genus of fungi.

Table 1. Occurrence of the Oxyporinae in Illinois, and total number of collection records for each species (n).

Species	n	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Oxyporus lateralis	38					▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	
O. occipitalis	67									▓▓▓	▓▓▓	▓▓▓	
O. quinquemaculatus	28						▓▓▓						
O. femoralis femoralis	9							▓▓▓					
O. stygicus	414				▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	
O. rufipennis	22					▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓		
O. major	56								▓▓▓	▓▓▓	▓▓▓		
O. vittatus	90								▓▓▓	▓▓▓	▓▓▓		
O. lepidus	22						▓▓▓	▓▓▓	▓▓▓	▓▓▓	▓▓▓		

Table 2. Known fungal hosts of Oxyporus occipitalis Fauvel.

Host	Number of collections	Number of specimens taken
COPRINACEAE		
Coprinus sp.	1	1
CORTINARIACEAE		
[1]Cortinarius sp.	---	---
[1]Crepidotus sp.	---	---
[1]Hebeloma sp.	---	---
[1]Inocybe sp.	---	---
HYGROPHORACEAE		
[2]Hygrophorus russula (Fr.) Quél.	6	*27
PLUTEACEAE		
Pluteus cervinus (Schaeff. ex Fr.) Kummer	1	1
POLYPORACEAE		
Grifola frondosa (Dickson ex Fr.) S. F. Gray	2	13
RUSSULACEAE		
[3]Lactarius sp.	2	3
Russula sp.	1	14
TRICHOLOMATACEAE		
Armillaria gallica Marxüller & Romagnesi	3	20
[4]Armillaria mellea (Fr.) Quél. (sensu lato)	2	10

* Includes adult and immature specimens.
1 Reported by Leschen and Allen (1988) from personal communication from J. S. Ashe (no numbers given).
2 Two records reported by Leschen and Allen (1988).
3 One record reported by Newton (1984).
4 One record reported by Moennich (1944).

Table 3. Known fungal hosts of *Oxyporus quinquemaculatus* LeConte.

Host	Number of collections	Number of specimens taken
PLUTEACEAE		
Pluteus cervinus (Schaeff. Fr.) Kummer	2	27
Pluteus sp.	3	3
STROPHARIACEAE		
[1]*Naematoloma sublateritium* (Fr.) Karsten	---	---
[2]*Psilocybe* sp.	---	---
TRICHOLOMATACEAE		
[2]*Laccaria amethystina* Murr.	---	---
Tricholomopsis platyphylla (Pers. ex Fr.) Sing.	1	3

[1] Reported by Weiss and West (1921) (no numbers given).
[2] Reported by Weiss and West (1920) (no numbers given).

Table 4. Known fungal hosts of Oxyporus femoralis femoralis Gravenhorst.

Host	Number of collections	Number of specimens taken
AMANITACEAE		
Amanita sp.	3	3
PLUTEACEAE		
Pluteus cervinus (Schaeff. ex Fr.) Kummer	2	4
Pluteus sp.	1	1
POLYPORACEAE		
Grifola frondosa (Dickson ex Fr.) S. F. Gray	2	64
Laetiporus sulphureus (Bull. ex Fr.) Murr.	1	1
Polyporus sp.	2	6
TRICHOLOMATACEAE		
[1]Armillaria mellea (Fr.) Quel. (sensu lato)	3	3
Armillaria sp.	1	1
Marasmius sp.	1	1
Naematoloma fasciculare (Huds. ex Fr.) Karst.	5	*52
[2]Naematoloma sublateritium (Fr.) Karsten	---	---
Naematoloma sp.	3	4

* Includes adults and immatures.
[1] Four records reported by Leschen and Allen (1988).
[2] Reported by Campbell (1969) (no numbers given).

Table 5. Known fungal hosts of Oxyporus stygicus Say.

Host	Number of collections	Number of specimens taken
CORTINARIACEAE		
[1]Pholiota aurivella (Fr.) Kummer	4	*223
[2]Pholiota sp.	4	*48
POLYPORACEAE		
Grifola frondosa (Dickson ex Fr.) S. F. Gray	4	42
Polyporus squamosus Micheli ex Fr.	3	16
TRICHOLOMATACEAE		
Armillaria gallica Marxmüller & Romagnesi	1	1
Omphalotus illudens (Schw.) Bigelow	2	*56
[3]Pleurotus ostreatus (Jacq. ex Fr.) Kummer	25	167

* Includes adults and immatures.
1 Larvae sucessfully reared to adults.
2 One record reported by Newton (1984)
3 One record reported by Weiss and West (1920).

Table 6. Known fungal hosts of Oxyporus major Gravenhorst.

Host	Number of collections	Number of specimens taken
BOLETACEAE		
[1]Boletus sp.	1	1
CORTINARIACEAE		
Pholiota sp.	1	1
LEPIOTACEAE		
Lepiota acutaesquamosa (Weinm.) Kummer	7	15
RUSSULACEAE		
[2]Lactarius sp.	---	---
Russula sp.	3	3
STROPHARIACEAE		
Stropharia hardii Atkinson	7	10
TRICHOLOMATACEAE		
Armillaria gallica Marxüller & Romagnesi	2	2
Armillaria mellea (Fr.) Quel. (sensu lato)	1	1
Armillaria tabescens (Vahl ex Fr.) Karsten	1	1

[1] Reported by Newton (1984).
[2] Reported by Campbell (1969) (no numbers given).

Table 7. Known fungal hosts of Oxyporus vittatus Gravenhorst.

Host	Number of collections	Number of specimens taken
AMANITIACEAE		
Amanita sp.	3	5
BOLBITIACEAE		
Agrocybe semiorbicularis (Bull. ex St. Amans) Fayod	1	2
BOLETACEAE		
[1]Boletus sp.	6	22
Leccinum sp. (section scabra)	1	3
Suillus granulatus (L. ex Fr.) Kuntze	1	2
[2]Suillus sp.	4	4
CORTINARIACEAE		
Cortinarius subargentarius Orton	1	1
[3]Cortinarius sp.	1	*43
Pholiota sp.	2	2
POLYPORACEAE		
Grifola frondosa (Dickson ex Fr.) S. F. Gray	2	18
STROPHARIACEAE		
Naematoloma sublateritium (Fr.) Karsten	3	9

Table 7 (cont.). Known fungal hosts of Oxyporus vittatus Gravenhorst.

Host	Number of collections	Number of specimens taken
TRICHOLOMATACEAE		
Armillaria gallica Marxmüller & Romagnesi	6	19
Armillaria mellea (Fr.) Quel. (sensu lato)	10	20
[4]Laccaria amethystea (Bull. ex Mérat) Murr.	---	---
Marasmius sp.	2	3
Melanoleuca brevipes (Bull ex Fr.) Pat.	1	1
[4]Pleurotus ostreatus (Jacq. ex Fr.) Kummer	---	---
[3]Tricholomopsis platyphylla (Pers. ex Fr.)	---	---
Tricholomopsis sp.	1	1

* Includes both adults and immatures.
[1] One record reported each by Bruns (1984) and Newton (1984).
[2] One record reported each by Campbell (1969) and Bruns (1984).
[3] Reported by Leschen and Allen (1988) (no numbers given).
[4] Reported by Weiss and West (1920) (no numbers given).

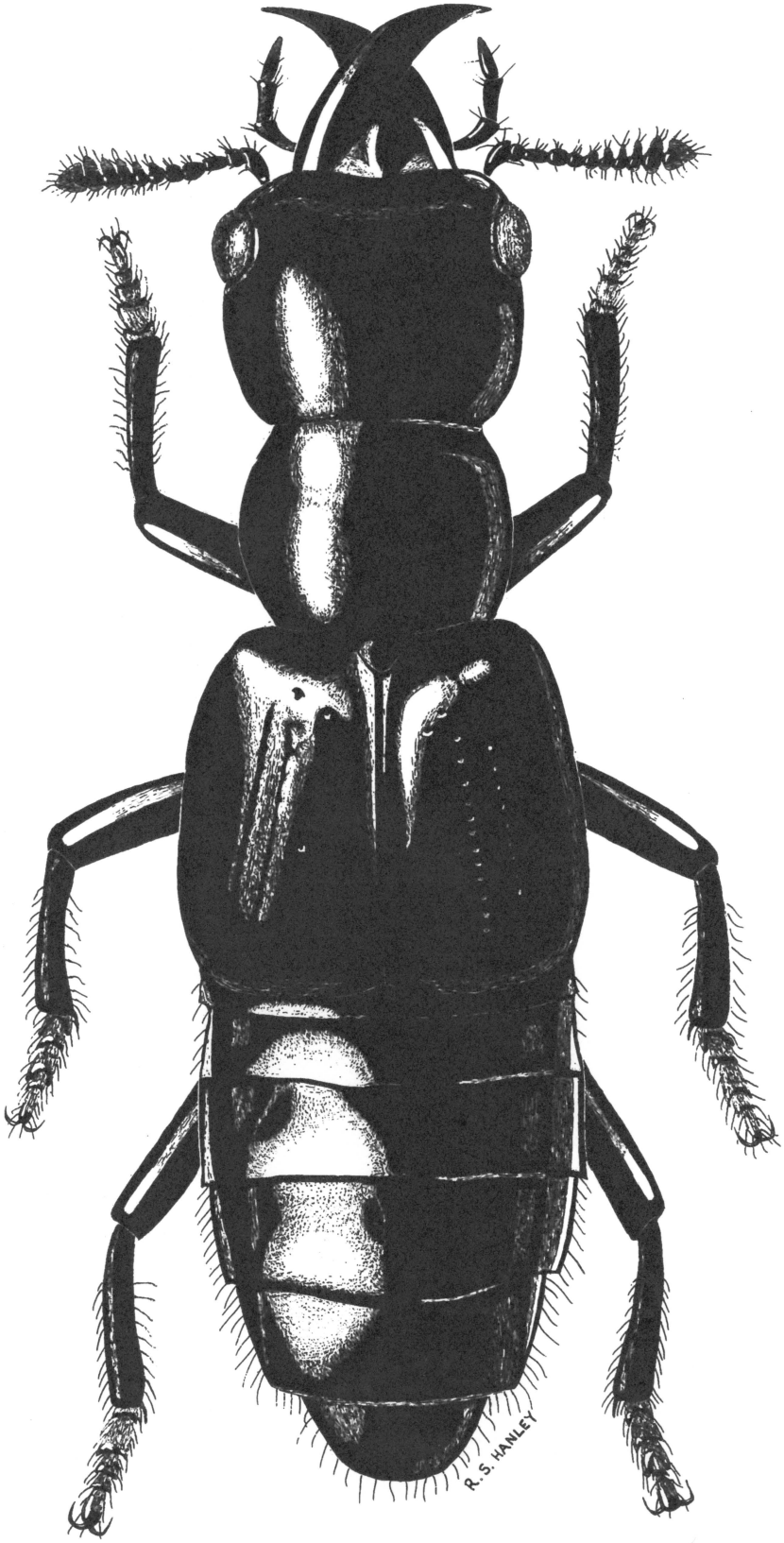


Figure 1. Dorsal habitus of Oxyporus stygicus Say.

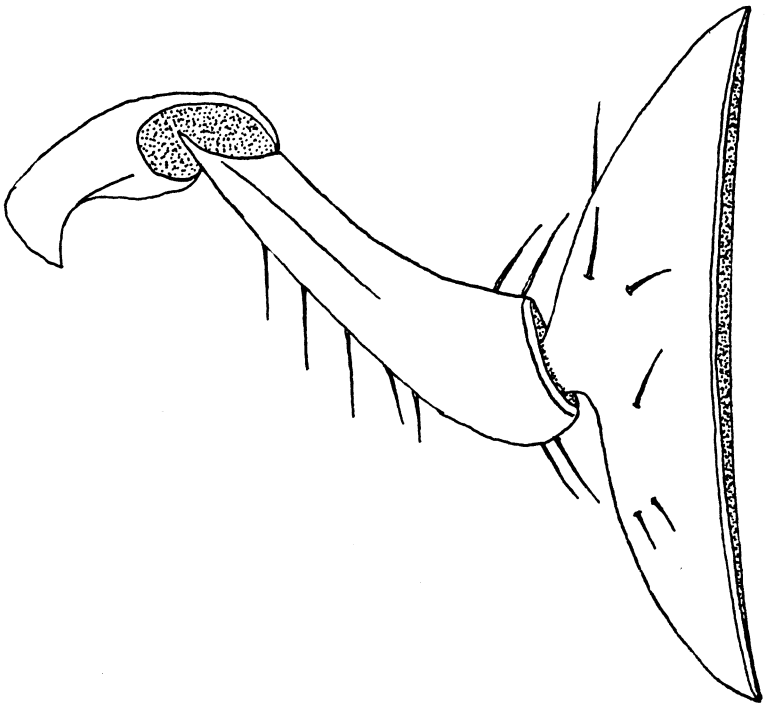


Figure 2. Labial palpus of Oxyporus stygicus Say.

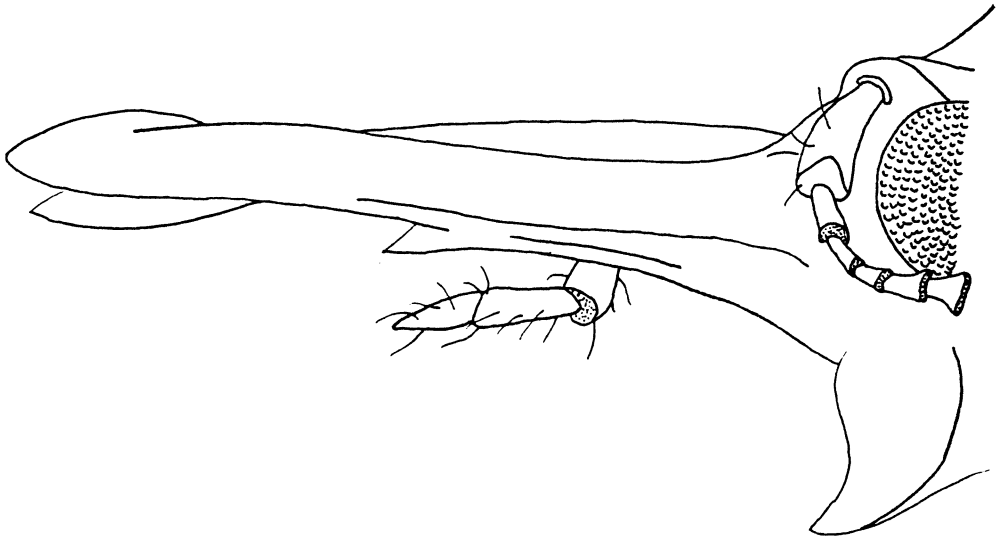
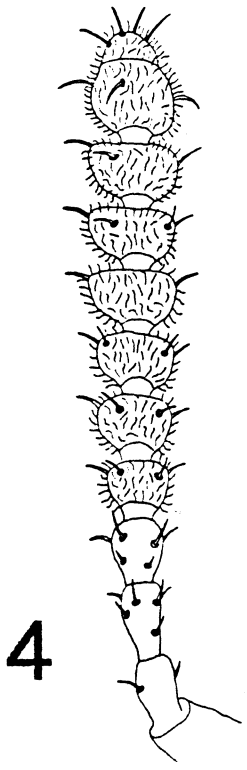
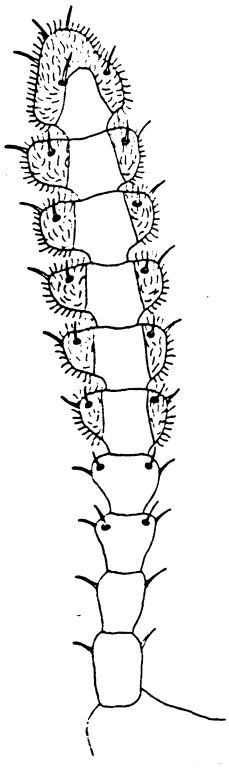
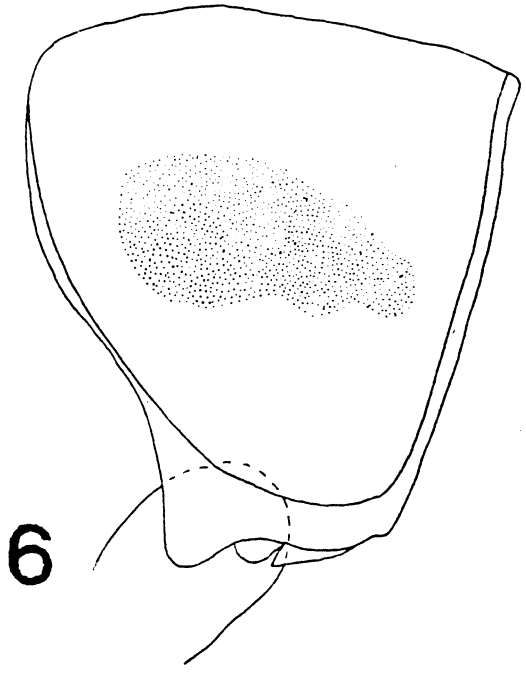


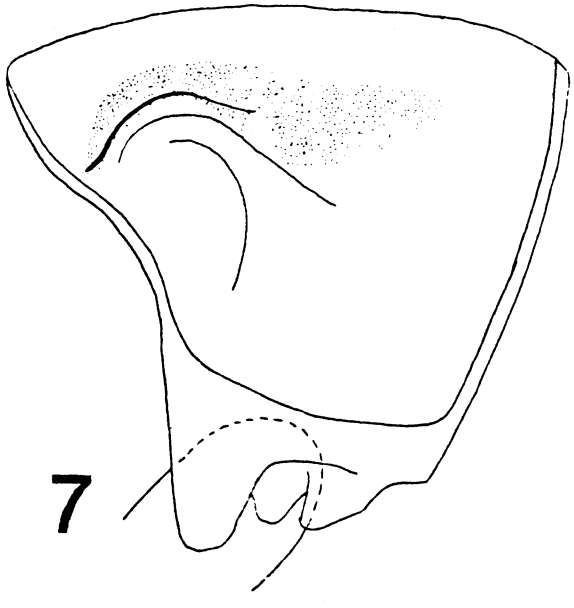
Figure 3. Lateral aspect of left mandible of Oxyporus major Gravenhorst.



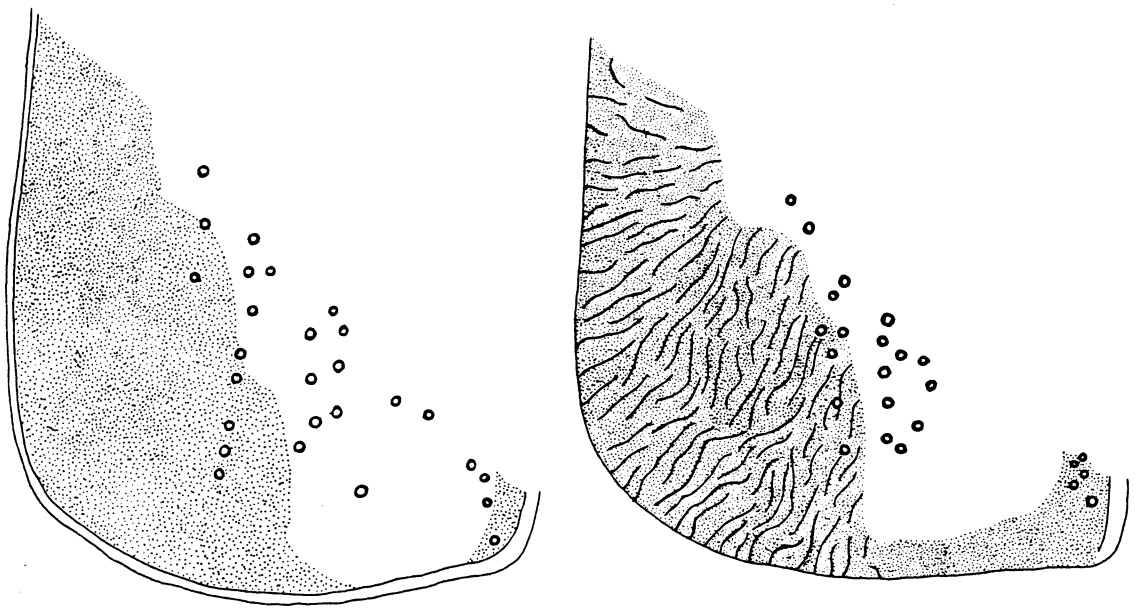


Figures 4-5. Left antenna of species of Oxyporus. 4. O. occipitalis Fauvel (subgenus Pseudoxyporus). 5. O. femoralis femoralis Gravenhorst (subgenus Oxyporus).

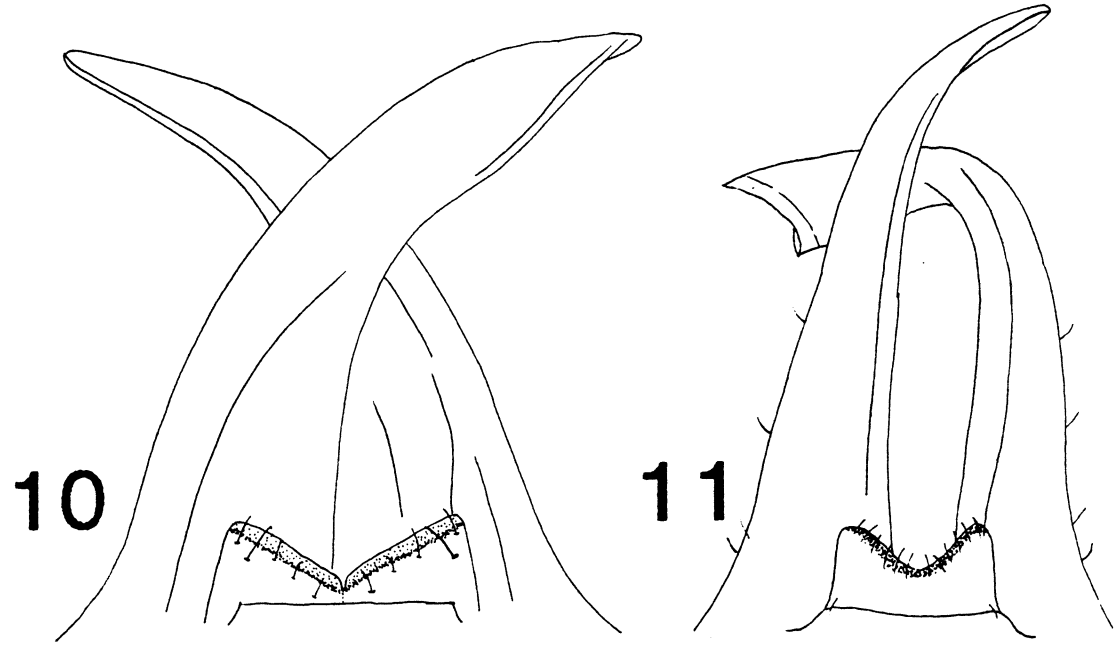




Figures 6-7. Right dorsoventral aspect of pronotum of species Oxyporus. 6. O. occipitalis Fauvel. 7. O. quinquemaculatus LeConte.



Figures 8-9. Outer apical angle, left elytron of species of Oxyporus. 8. O. occipitalis Fauvel. 9. O. femoralis femoralis Gravenhorst.



Figures 10-11. Dorsal aspect of male mandibles of species of Oxyporus. 10. O. stygicus Say. 11. O. quinquemaculatus LeConte.

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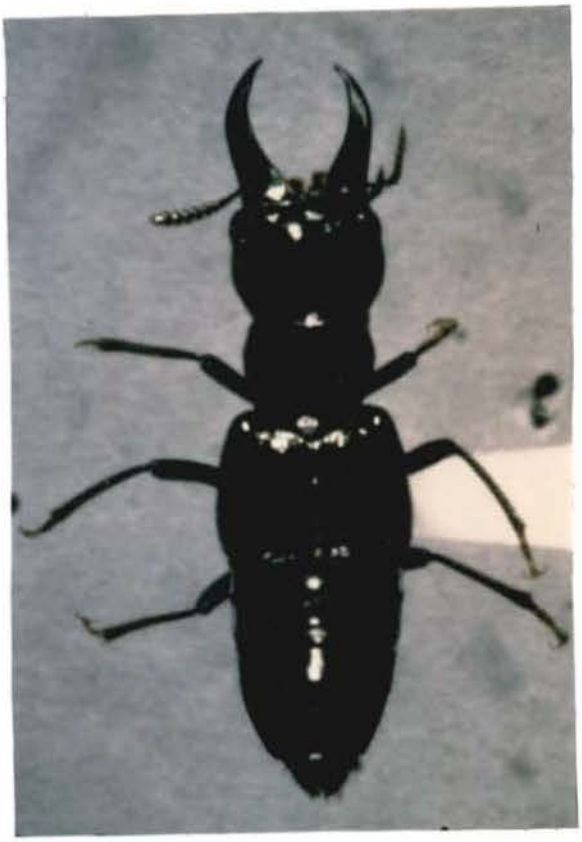
Figures 12-14. Dorsal aspect of species of subgenus Pseudoxyporus. 12. Oxyporus lateralis Gravenhorst. 13. O. occipitalis Fauvel. 14. O. quinquemaculatus LeConte.

15



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Figures 15-17. Dorsal aspect of species of subgenus Oxyporus. 15. Oxyporus femoralis femoralis Gravenhorst. 16. O. stygicus Say. 17. O. rufipennis LeConte.

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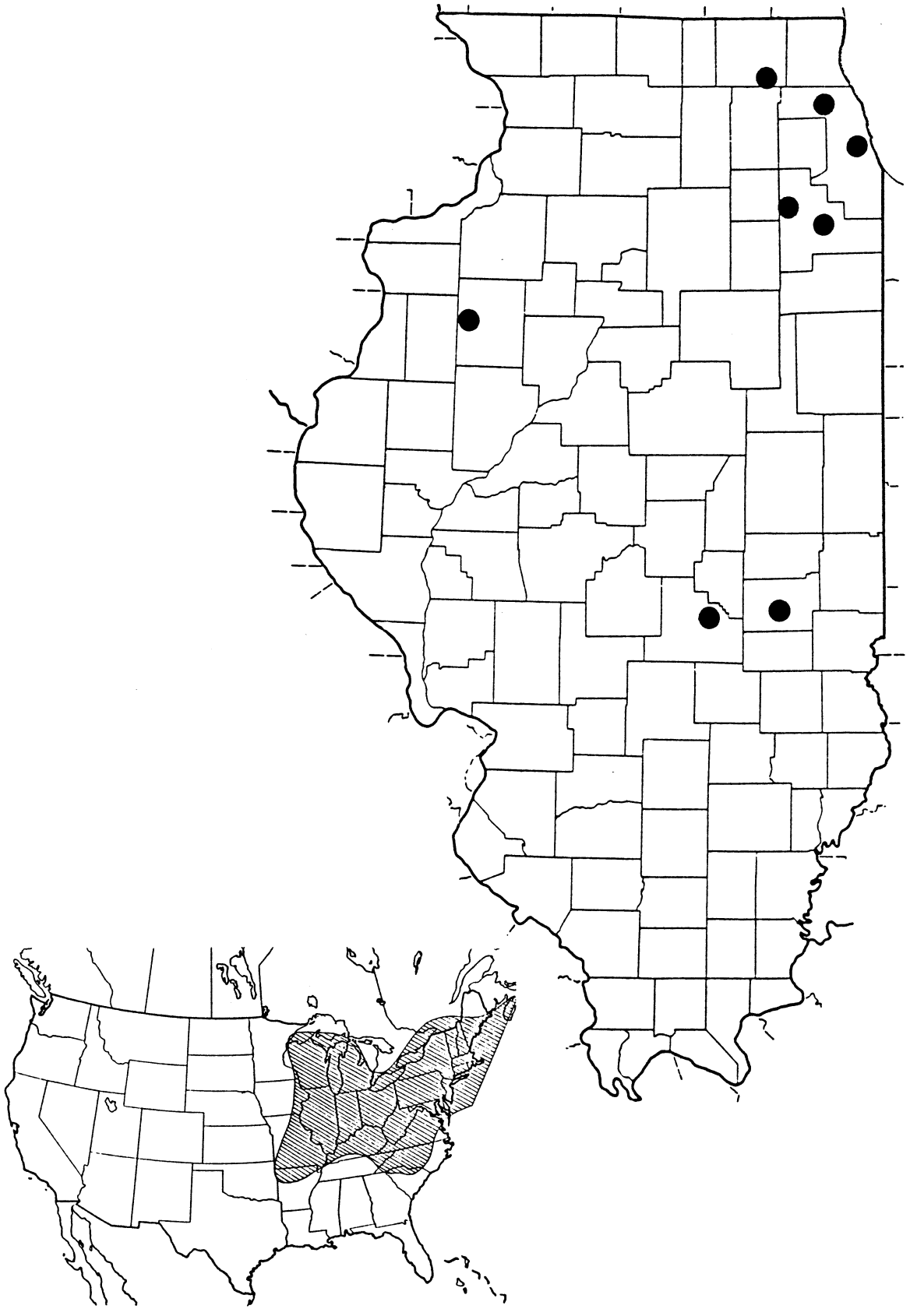
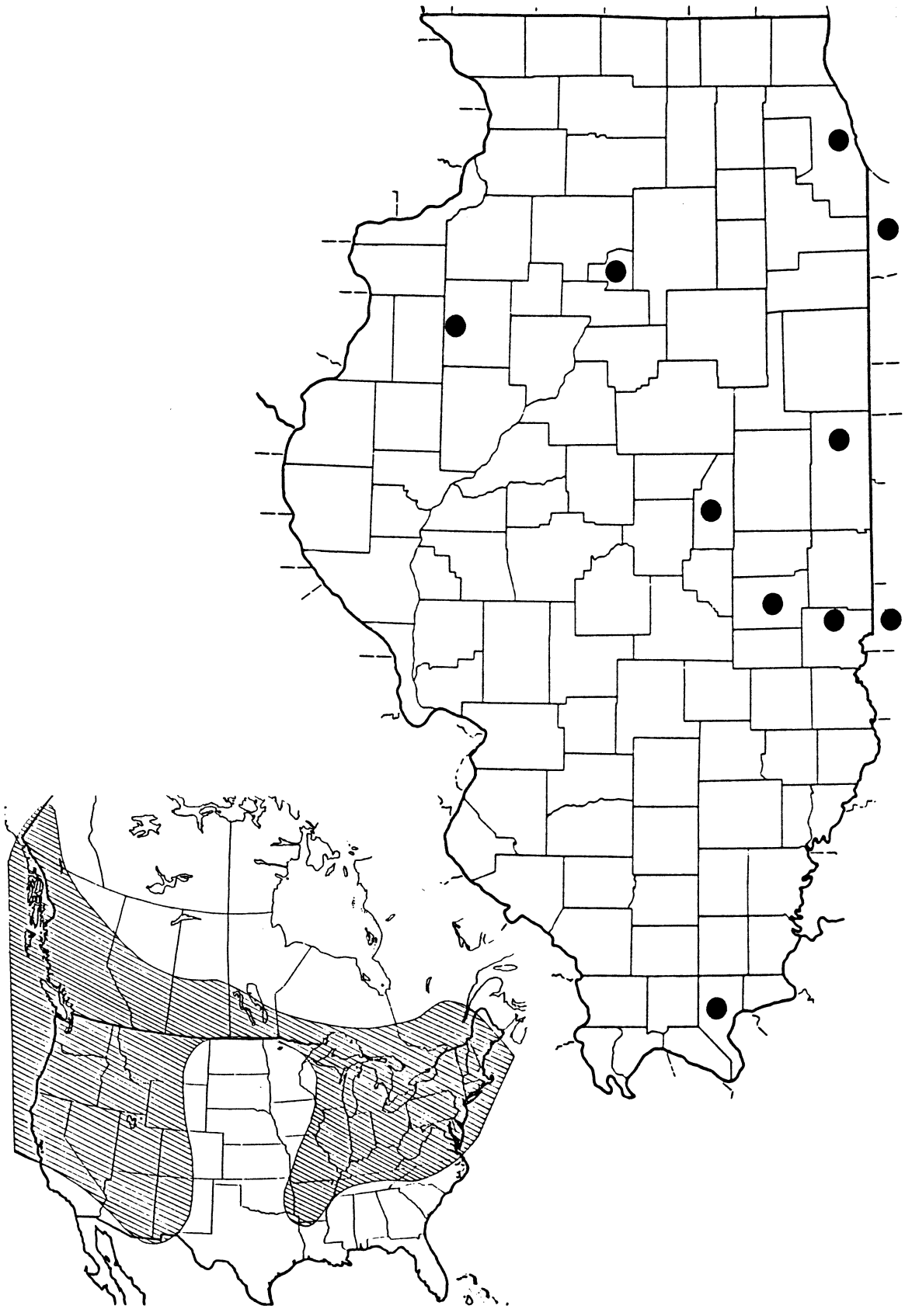
Figures 18-20. Dorsal aspect of species of subgenus Oxyporus. 18. Oxyporus major Gravenhorst. 19. O. vittatus Gravenhorst. 20. O. lepidus LeConte.



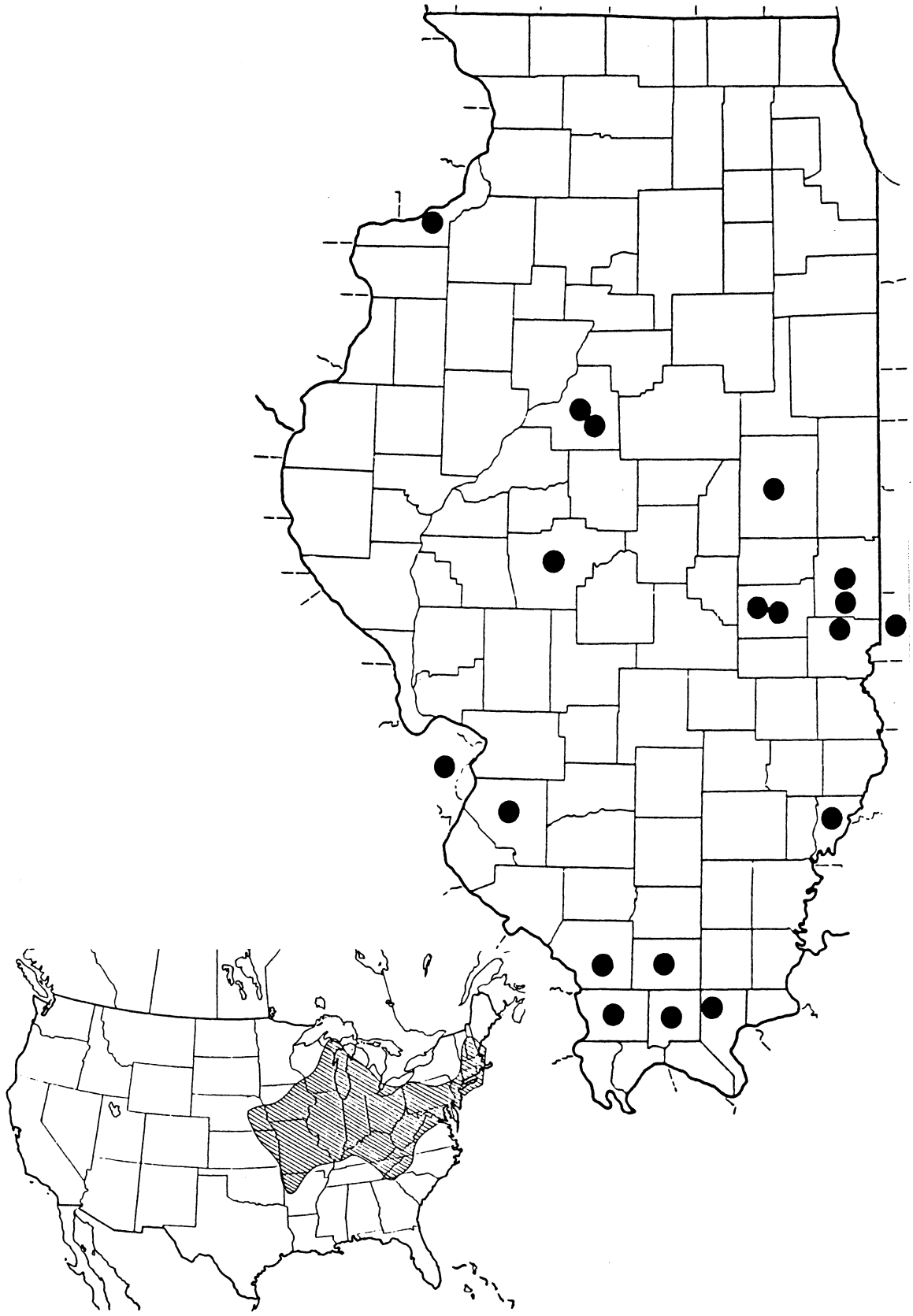
Map 1. Distribution of Oxyporus lateralis Gravenhorst.



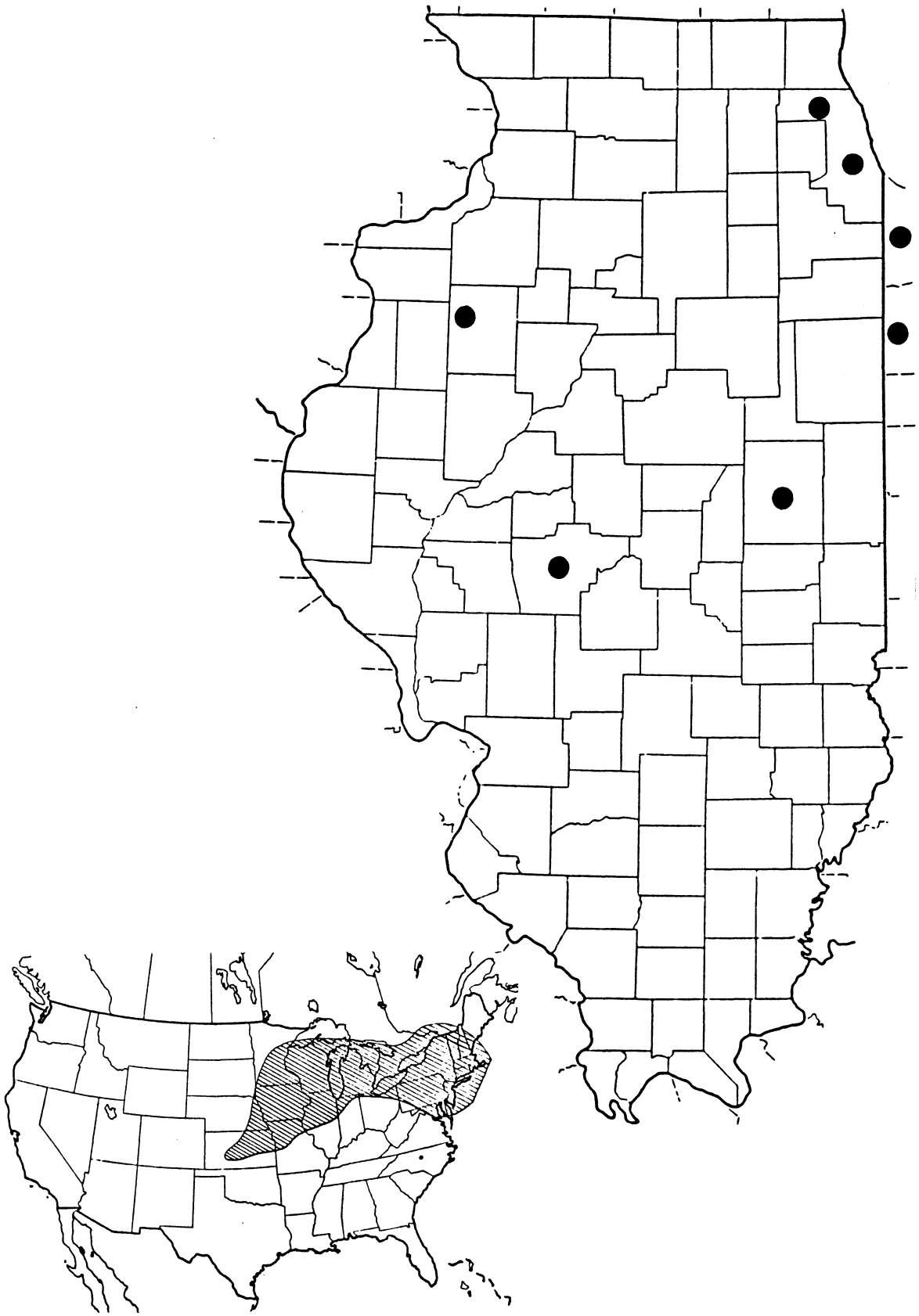
Map 2. Distribution of Oxyporus occipitalis Fauvel.

Map 3. Distribution of Oxyporus quinquemaculatus LeConte.

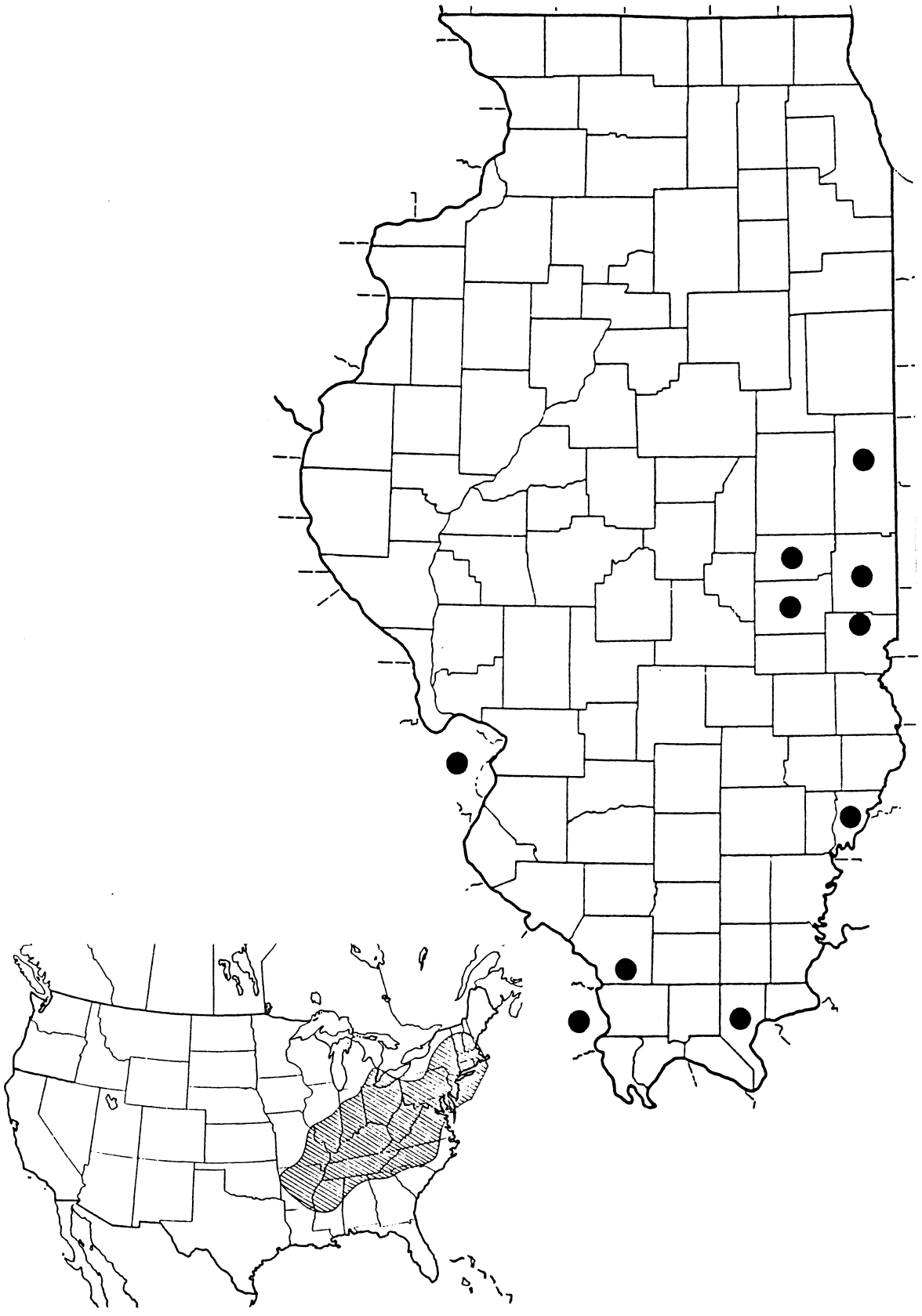
Map 4. Distribution of subspecies of Oxyporus femoralis Gravenhorst: O. femoralis femoralis Gravenhorst (northern), O. femoralis austrinus Horn (southern).



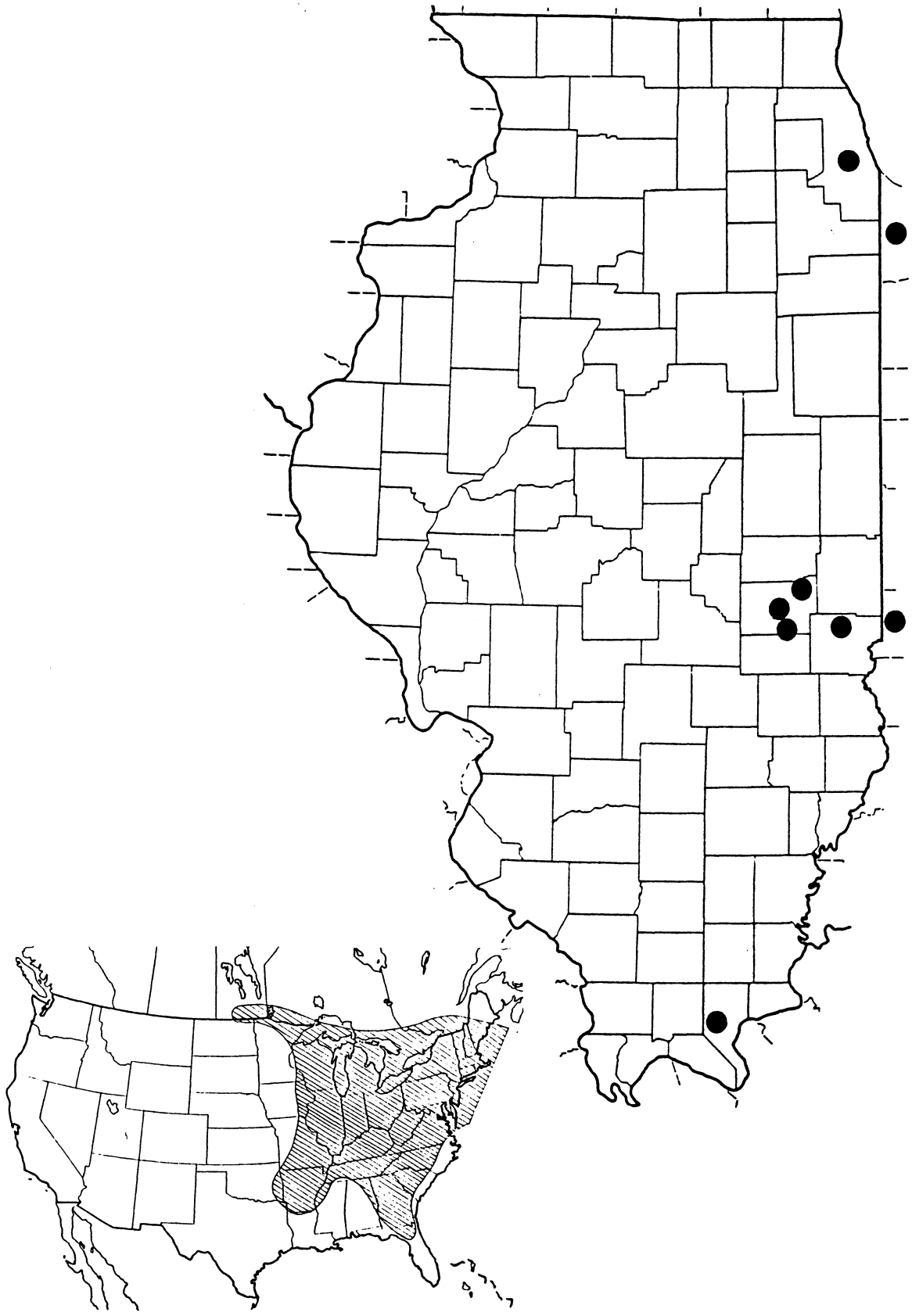
Map 5. Distribution of Oxyporus stygicus Say.



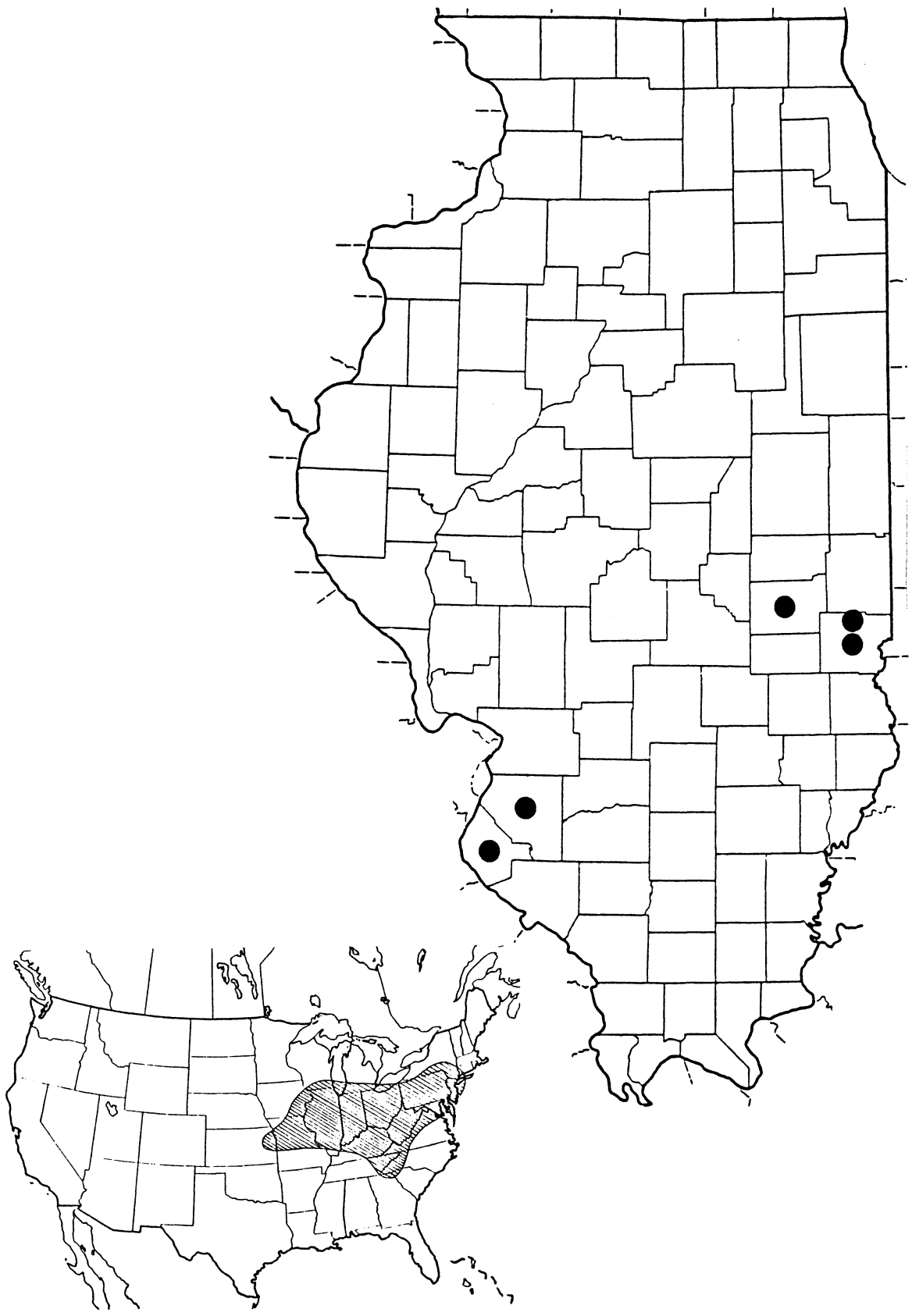
Map 6. Distribution of Oxyporus rufipennis LeConte.



Map 7. Distribution of Oxyporus major Gravenhorst.



Map 8. Distribution of Oxyporus vittatus Gravenhorst.



Map 9. Distribution of Oxyporus lepidus LeConte.

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APPENDIX

Locality Data for the Illinois Oxyporinae from North America

Discussions of the geographical and temporal distributions and fungal host preferences of the Oxyporinae of Illinois, presented in the preceeding text, are based, in part, on data from specimens listed here. For each species, distributional data is grouped by country, state or province and specific locality. The collection date, total number of specimens for each series and depositories for the specimens are also provided.

Oxyporus lateralis Gravenhorst

CANADA

Canada, 2 Oct 1917 (1 SEM); Oakville, Sep (1 UMI)

Quebec:
Montreal, 2 Oct 1919 (5 UMO); Montreal Is., 2 Oct 1900 (4 UWI)

UNITED STATES

Arkansas:
Washington Co., Lake Weddington, 12 mi. W. Fayetteville, 26 Oct 1986 (2 UOA), 26 Oct 1986 (4 RABL)

District of Columbia:
DC (11 CMNH)

Illinois:
IL (1 FMNH), (1 INHS), (1 INHS), (1 INHS), (4 CMNH), (4 INHS), Northern IL (2 INHS), (2 SEM); Coles Co., Charleston, 20 May (1 EIU); Cook Co., Sep (3 UWI); Carle Woods, Des Plains, 14 Oct 1961 (1 FMNH); Palos Park, 24 July 1904, (1 UMI), 30 Sep 1923 (1 UMI); McHenry Co., Algonquin (1 INHS), (1 INHS), (1 INHS), MCZ); Shelby Co., Rdg. Lakewood, Shelbyville, 8 Sep 1936 (9 EIU); Will Co., Bonfield, 15 Nov 1944 (1 FMNH); Pilcher Park Joliet (1 FMNH)

Indiana:
Hessville, 7 Oct 1906 (3 FMNH); Tremont, 8 Oct 1933 (1 FMNH); Porter Co., Beverly Shrs., 8 Oct 1933 (1 FMNH); Putnam Co., 4 Nov 1902 (1 PU); Tippecanoe Co., 10 Oct 1933 (1 PU), 7 Oct 1906 (2 PU), Oct 1935 (3 PU)

Kentucky:
KY (3 INHS)

Maine:
Cumberland Co., Scarsboro, 11 June 1967 (1 USNM)

Massachusetts:
MA (1 INHS), (3 SEM); Dartmouth, 12 Oct 1906 (1 MCZ); Dover, 13 Oct 1907 (2 MCZ); Fall River, 12 Oct 1913 (1 MCZ), 31 Oct 1937 (1 MCZ); Hopkinton (1 INHS); Natick, 28 Sep 1912 (1 UMI)

Michigan:
MI (1 FMNH); Detroit, 19 Aug 1905 (1 MCZ), 19 Aug 1905 (4 UMO), 4 Oct 1904 (1 UMI), 4 Oct 1909 (2 MCZ), 9 Aug 1905 (3 UMO); Alger Co., Onota TWP., 28 July 1916 (1 UMI); Berrien Co., Lakeside, 2 June 1935 (2 FMNH), 4 June 1935 (3 UMI), 4 June 1935 (4 UMO); Charlevoix Co., Beaver Island, 21-23 Sep 1920 (1 UMI); Gratiot Co., Ithaca, 16 Sep 1950 (3 UMI), 27 Oct 1957 (3 UMI); Marquette Co., Huron Mts., 12 July 1920 (2 UMI); Oakland Co., Bloomfield, 10 Oct 1916 (1 UMI); Coopers, 28 Sep 1913 (1 UMI); Schoolcraft Co., 10 Sep 1923 (8 UMI); Wayne Co., 5 Oct 1913 (1 UMI)

Minnesota:
Beaver Bay, 25 Aug 1952 (1 SEM)

North Carolina:
NC (2 INHS); Morrison (1 INHS)

New Hampshire:
Durham, 8 June 1907 (1 INHS)

New Jersey:
NJ (5 UMO); Newfoundland, 17 Oct 1915 (2 UMI); Union Co., Newark (2 CMNH), 10 July (4 CMNH)

New York:
NY (3 INHS); Elbridge, 7 June 1941 (1 UMI); Pike, 31 May 1901 (8 UMO); Powder Hills, 26 Sep 1933 (2 INHS); Greene Co., Oct (1 CMNH)

Ohio:
OH (4 CMNH); Crawford Co., Plankton (2 CASC)

Pennsylvania:
Easton, 2 Oct 1917 (1 SEM), 20 Sep 1934 (2 SEM); Indiana (1 UMO); Allegheny Co. (3 CMNH), 4 (CMNH); Pittsburgh (4 CMNH), 2 July (3 CMNH), 6 July (1 CMNH), Aug 1901 (4 CMNH), June (2 CMNH), Nov 1921 (1 CMNH), Oct 1922 (4 CMNH), Sep 1921 (9 CMNH); Washington Co., Canonsburg, Mt. Blain, 21-23 Sep 1920 (1 UMI); Westmoreland Co., Jeannette (1 CMNH), (1 CMNH), 10 Aug (4 CMNH), 14 Sep (2 CMNH), 2 Aug (1 CMNH), 22 Oct (2 CMNH), 3 July (5 CMNH), 7 July (1 CMNH), 9 July (3 CMNH)

Tennessee:
Great Smokey Mts. N. P., 14 June 1944 (1 FMNH)

Utah:
San Juan Co., Monticello, 30 July 1933 (1 MCZ)

Vermont:
Underhill Nebraska Notch, 14 Sep 1985 (2 UVT)

Virginia:
VA (1 INHS), (2 INHS)

Wisconsin:
Beaver Dam, 21 June 1944 (1 FMNH); Dane Co., 12 Nov 1917 (1 UWI)

Oxyporus occipitalis Fauvel

CANADA

Banff. Alta, 27 Aug 1932 (1 SEM); Cypress Hills Alta, 26 Aug 1932 (1 SEM)

Alberta:
9 Sep 1961 (1 SEM); Canada, 1 mi. E. Bauff, 1 Aug 1950 (1 INHS); Edmonton, S. Bank, N. Sask. River, 10 June 1976 (1 SEM); Sibbald Flats Rec. Area, 14-28 Aug 1981 (4 SEM), 18-19 Aug 1981 (1 SEM), 18-19 Aug 1981 (3 SEM), Thickwood Hills Look Out, 18.5 km E. Jackpine Forest, 26 Sep 1978 (1 SEM)

Ontario:
Nepigon, June (1 FMNH)

Quebec:
Mistassini Prov. Lake, 18-22 Aug 1970 (2 SEM); Mistassini, 18-22 Aug 1970 (2 NCSU)

UNITED STATES

Arkansas:
Washington Co., Lake Wellington; 12mi. W. Fayetteville, 4 Oct 1986 (4 RABL)

Arizona:
Cochise Co., Chiracahua Mts.; W. Turkey Creek, 17 Aug 1989 (3 PESC); Coronado Nat. Forest, Chiricahua Wildlife Area, 26 Sep 1975 (1 SEM); Rustler Park, Chiricahua Mts., 15 Sep 1952 (1 FMNH)

California:
CA (1 CMNH), (2 CMNH); El Dorado Co., Lake Tahoe (1 CMNH); Santa Clara Co., 15 Oct 1961 (1 NCSU)

Colorado:
CO (1 CMNH)

District of Columbia:
DC (4 CMNH)

Idaho:
Custer Co., Red Fish Lake, 14 May 1959 (1 UOI); Fremont Co., Targhee Pass, 6 July 1966 (1 UOI); Kootenai Co., Chilco, 21 May 1958 (1 UOI); Latah Co., Deary, 28 May 1949 (1 UOI); Tomer's Butte, 10 June 1953 (1 UOI); Lemhi Co., Bannock Pass, 23 July 1966 (1 UOI)

Illinois:
Clark Co., Rocky Branch Nature Preserve, 12 Oct 1884 (5 PESC), 13 Sep 1989 (1 EIU), 16 Sep 1991 (9 EIU); Coles Co., 18 Sep 1970 (1 EIU), 4 Nov 1984 (1 PESC); 3 mi. S. Charleston, 22 Sep 1989 (7 EIU); Charleston, 22 Sep 1949 (1 EIU); Fox Ridge S. P., 11 Oct 1992 (17 EIU), 12 Oct 1992 (3 EIU), 23 Oct 1992 (2 EIU), 26 Oct 1992 (1 EIU), 29 Sept 1992 (3 EIU); Cook Co., Riverside, 20 Oct 1913 (1 UMI); Piatt Co., 5 Oct 1989 (1 EIU); Polk Co., Bell Smith Springs, 23 Oct 1982 (10 SEM); Putnam Co., 25 Nov 1943 (1 INHS); Vermilion Co., Forest Glen Nature Preserve, 27 Sept 1992 (3 EIU)

Indiana:
Lake Co., 7 Oct 1908 (1 PU); Marion Co., 14 Oct 1900 (1 PU); Parke Co., Shades S. P., 22 Sept 1981 (4 FSCA), 9 Sep 1977 (3 PU); Vigo Co., 20 Oct 1894 (3 PU)

Kentucky:
Bernheim Forest, 2 June 1952 (1 PU)

Louisiana:
LA (3 CMNH)

Massachusetts:
MA (1 SEM); Lowell (2 SEM); Melrose (1 MCZ)

Maryland:
MD (1 CMNH)

Michigan:
MI (2 FMNH); Bloomfield, 3 Sep 1911 (1 UMI); Melville Lake, 12 Oct 1915 (1 UMI); Presqu. Isle, 18 Sep 1921 (1 UMI); Wyandanch Lake, 10 Oct 1915 (1 UMI); Crawford Co., Higgins Lake, summer 1932 (1 UMI); Gratiot Co., Ithaca, 14 Oct 1949 (1 UMI), 16 Oct 1949 (2 UMI), 18 May 1948 (2 UMI), 19 Sep 1947 (1 UMI), 7 May 1948 (1 UMI); Livingston Co., E. S. George Reserve, 10 Sep 1989 (1 UMI); Oakland Co., 8 Oct 1920 (1 UMI)

Missouri:
Koeltztown, 6 Oct 1934 (7 UMO); Kofferton, 14 Oct 1919 (2 UMO);

Montana:
Beaver Creek, Aug 1913 (8 SEM)

North Carolina:
Rockingham Co., Reidsville, 30 Oct 1975 (14 SEM); Wake Co., Hemlock Bluff, 4 mi. E Apex, 6 Oct 1976 (2 NCSU)

New Mexico:
NM (1 CMNH)

Oklahoma:
Latimer Co., Dec 1986 (1 KSC), Dec 1987 (1 KSC), Nov 1987 (1 KSC), Oct 1987 (2 KSC), Oct 1988 (3 KSC), Oct 1989 (2 KSC), Oct 1992 (2 KSC), Sep 1989 (1 KSC)

Oregon:
Crater Lake National Park, 4 July 1945 (1 INHS); Pine Creek, 10 mi. NW Baker, 27 June 1952 (2 FMNH); Unity, 4 July 1933 (1 UOI); Grant Co., Prairie City Blue Mts., 8 July 1928 (2 MCZ)

Pennsylvania:
6 Oct 1917 (1 SEM); Allegheny Co. (2 CMNH); Westmoreland Co., Jeannette, 2 July (2 CMNH), 29 July (1 CMNH), 4 July (1 CMNH)

Utah:
LaSal Mts., 24 July 1923 (1 INHS)

Wisconsin:
Loon Lake, 16 May 1924 (2 FMNH); Adams Co., Friendship, 22 Oct 1958 (9 FMNH)

Washington Territory(?):
(1 CMNH)

Wyoming:
WY (2 CMNH); National Park, 9.8 (1 CMNH)

Oxyporus quinquemaculatus LeConte

CANADA

Quebec:
Mont Albert Parc, Gaspie, 20-21 July 1972 (1 SEM)

UNITED STATES

Connecticut:
Fairfield Co., Weston, 21 June 1976 (7 FMNH)

District of Columbia:
DC (2 CMNH)

Illinois:
Clark Co., Rocky Branch Nature Preserve, 3 June 1992 (23 EIU); 9 June 1992 (4 EIU); 14-16 Jun 1992 (1 EIU)

Maryland:
Bowie, 26 May 1969 (1 USNM); Oakland, 31 May 1942 (1 USNM); Patuxent Wildlife Refuge nr. Laurel 2 May 1967 (1 USNM); Ann Arundel Co., 9 June 1969 (1 USNM); Montgomery Co., Widewater(?), 29 Apr 1968 (1 USNM)

Maine:
Cumberland Co., Raymond, 2 July 1991 (3 UVT)

Michigan:
Alger Co., Onota, 27 July 1916 (1 UMI)

North Carolina:
Great Smokey Mts. N. P., 13 June 1986 (1 PESC)

New Hampshire:
Coos Co., 0.3 mi. S. Jefferson Notch, 14-31 July 1982 (1 FMNH); 14-31 July 1982 (1 FMNH)

New Jersey:
Monmouth (1 INHS)

New York:
West Point (1 INHS); West Point, 15 June 1912 (3 UMI); Tompkins Co., 16 June 1979 (2 PU); Tompkins Co., Ridgewood Preserve, 14 May 1981 (1 SEM)

Ohio:
Hocking Co., 2 mi. S. Gibsonville, 4 June 1977 (1 CMNH); Summit Co., 24 June 1937 (1 INHS)

Pennsylvania:
St. Vinc. (1 CMNH); Allegheny Co. (2 CMNH); Allegheny Co., Pittsburgh, 4 July 1924 (6 CMNH); Allegheny Co., Wall, 4 July 1924 (4 CMNH); Westmoreland Co., Jeannette, 21 June (1 CMNH), 27 Aug (1 CMNH), 29 July (1 CMNH), 4 July (1 CMNH)

Tennessee:
Great Smokey Mts. N. P., 10 June 1940 (1 FMNH); Great Smokey Mts. N. P., Chimneys Campground, 7 June 1954 (3 SEM)

Vermont:
Bennington Co., Mt. Equinox, 28 June 1965 (2 UVT)

Virginia:
VA (7 CMNH)

Oxyporus femoralis femoralis Gravenhorst

CANADA

Quebec:
Montreal Is., 3 Sep 1900 (2 UWI); Ste-Foy, 1 Aug 1962 (1 SEM); LaTrappe, 28 June 1935 (1 UMI)

UNITED STATES

Arkansas:
AR (4 UOArk); Garland Co., Camp Clear Fork, 3 mi. W. Crystal Springs, 15 June 1986 (1 PESC), 27 Sep 1986 (1 RABL), 28 Sep 1986 (1 RABL); Logan Co., Cove Lake, 3 June 1986 (1 RABL), 3 June 1986 (2 UOArk), 8 Sep 1986 (1 RABL); Mt. Magazine, 26 Aug 1986 (1 RABL), 28 Aug 1986 (1 RABL), 26 Aug 1986 (2 UOArk), 17 Aug 1986 (1 RABL), 17 Aug 1986 (1 UOArk); Polk Co., Shady Lake Rec. Area, 13 Oct 1974 (1 UOArk); Washington Co., Lake Weddington, 5 Sep 1986 (1 UOArk), 5 Sep 1986 (2 RABL), 5 Sep 1986 (2 UOArk)

District of Columbia:
DC (5 CMNH)

Illinois:
IL (1 CMNH), (1 INHS), (2 INHS), (3 INHS); central IL (1 INHS); Ogle Co., Oregon, 8 July 1905 (1 UMI)

Indiana:
Tremont (1 FMNH), (4 FMNH)

Massachusetts:
MA (1 FMNH); Farmingham, 30 July 1945 (1 INHS); Monterey, 1 Aug 1920 (1 UMI); Natick, 22 June 1941 (4 UMI); Sherborn (2 UMI); Bristol Co., Fall River, 4 July 1908 (1 MCZ); Dukes Co., Marthas Vineyard, North Tisbury, 20 July 1935 (2 MCZ);

Maryland:
MD (1 INHS); Ellicott, 15 Sep 1940 (2 USNM)

Michigan:
MI (1 FMNH); Detroit, 12 Sep 1909 (1 UMI), 14 Aug 1908 (1 UMO), 14 Aug 1908 (3 UMO), 4 Oct 1909 (1 UMI); Galesburg (2 SEM); Melville, 12 July 1915 (1 UMI); University of Michigan Bio. Stat., Douglas Lake, 21 July 1961 (1 MCZ); Alger Co., Onota TWP., 25 July 1916 (1 UMI), 28 July 1916 (2 UMI; Berrien Co., Harbert Dunes, 25 July 1917 (1 UMI); Cheboygan Co., 23 July 1942 (1 SEM), 27 July 1945 (2 INHS); Chippewa Co., Whitefish Point, 2 July 1913 (2 UMI), 28 July 1914 (2 UMI); Marquette Co., Huron Mts. (1 UMI); Oakland Co., 2 Oct 1921 (4 UMI), 8 Oct 1920 (1 UMI)

Mississippi:
Picayune, 24 Aug 1899 (1 UMO); Attala Co., 2 mi. E. Kosciusko, Hurricane Creek, 21 Aug 1982 (1 FMNH)

North Carolina:
Boone, 23 Sep 1972 (1 SEM), 25 Aug 1972 (2 SEM); Flat Rock, 25 Aug 1940 (1 USNM); Raleigh, 1 Nov 1964 (1 SEM), 1 Nov 1964 (5 SEM); Haywood Co., Crestmont, 30 July 1922 (3 UMI); McDowell Co., Marion, Feb 1929 (1 NCSU); Moore Co., Southern Pines, 8 Sep 1911 (1 INHS); Rockingham Co., Reidsville, 23 Aug 1974 (6 SEM), 25 Oct 1975 (52 SEM); Wake Co., Raleigh, 18 Oct 1988 (12 NCSU); Watanga Co., Blue Ridge Parkway, Prica Park, 27 Aug 1974 (1 SEM)

New Jersey:
Newfoundland, 17 Oct 1915 (2 UMI); Princeton, 6 Sep 1911 (1 USNM)

New York:
NY (2 CMNH); 12 July 1899 (2 UMO); Newport (1 UMO); Pike, 6 Aug 1901 (4 UMO); Powder Mills, 26 Sep 1933 (1 INHS); West Point, 15 Sep 1912 (2 UMI)

Ohio:
OH (1 CMNH); Summit Co., 19 June 1937 (1 INHS)

Oklahoma:
Latimer Co., June 1986 (1 UOI), May 1986 (1 KSC), Oct 1983 (6 KSC), Oct 1984 (11 KSC), Oct 1986 (1 KSC), Oct 1987 (1 UOI), Oct 1988 (2 KSC), Oct 1991 (1 KSC), Oct 1992 (6 KSC), Sep 1988 (8 SEM); 5 mi. W. Red Oak, Oct 1980 (3 FSCA)

Pennsylvania:
PA (3 CMNH); Easton, 17 Sep 1928 (3 UMO); Wilmerding (1 FMNH); Allegheny Co. (4 SEM), (3 CMNH); Pittsburgh (3 FMNH), (4 CMNH); Pittsburgh, 4 July 1924 (7 CMNH), July 1912 (3 CMNH), June (1 CMNH), June 1910 (7 CMNH), Sep 1924 (14 CMNH), Sep 1926 (1 CMNH); Lebanon Co., Mt. Gretna, 12 Sept 1910 (2 INHS); Monroe Co., 18 Sep 1926 (1 USNM); Washington Co., Aug (1 CMNH); Westmoreland Co., Jeannette, 10 Sep (1 CMNH), 16 Oct (2 CMNH), 2 Oct (6 CMNH), 22 Oct (1 CMNH), 27 June (1 CMNH), 7 July (1 CMNH), Aug (2 CMNH), July 1924 (2 CMNH), June 1927 (2 CMNH)

South Carolina:
Clemson College, 30 July 1933 (1 INHS); Merideth, 16 June 1927 (4 INHS);

Virginia:
VA (2 CMNH); Cape Henry, 12 Sep 1965 (3 USNM); Giles Co., Mt. Lake Biol. Stat., 18 Aug 1945 (1 UMI), Stat. 3 Aug 1945 (6 UMI)

Vermont:
Underhill, Nebraska Notch, 14 Sep 1985 (2 UVT)

Wisconsin:
Bayfield Co., Lake Namekagoa, July 1922 (2 UWI); Dane Co., 10 Sep 1917 (1 UWI); Door Co., 30 June 1929 (1 UWI); Sauk Co., 29 Sep 1952 (1 UWI)

West Virginia:
W. Sulphur, 10 July 1910 (1 UMI)

Oxyporus stygicus Say

Arkansas:
Logan Co., Mt. Magazine, 13 May 1986 (1 RABL)

District of Columbia:
Washington, D. C. (2 USNM)

Illinois:

Champaign Co., Brownfield Woods, 14-15 June 1966 (1 UOA); Urbana, 15 Oct 1911 (3 INHS), 22 Oct 1932 (4 FMNH); Clark Co., Rocky Branch Nature Preserve, 6 May 1987 (4 PESC), 9 May 1987 (1 PESC), 10 May 1989 (3 EIU), 17 May 1989 (1 HC), 24 May 1989 (2 E.I.U.), 4 June 1990 (5 EIU), 2 July 1990 (1 EIU), 5 Oct 1990 (3 EIU), 30 Sep 1991 (4 EIU), 11 Oct 1991 (1 EIU), 21 Oct 1991 (5 EIU), 21 May 1992 (2 EIU), 3 June 1992 (5 EIU), 9 June 1992 (4 EIU); 16 June 1992 (11 EIU), 4 Oct 1992 (2 EIU), 8 Oct 1992 (11 EIU), 8 Oct 1992 (87 EIU), 19 Oct 1992 (6 EIU), 19 Oct 1992 (93 EIU); Coles Co., 2 Oct 1965 (1 EIU), 9 June 1966 (1 EIU); 10 June 1966 (2 EIU), 23 Sep 1966 (2 EIU), 22 Sep 1984 (1 PESC), 5 Oct 1984 (2 PESC); 18 Oct 1984 (2 PESC); 2 mi. NE of Rardin, 18 Sept 1989 (1 EIU); Burgner Acres Nature Preserve, 5 June 1992 (2 EIU), 6 Nov 1992 (36 EIU); Fox Ridge S. P., 23 Sep 1988 (7 EIU), 12 Oct 1991 (6 EIU), 2 May 1992 (10 EIU), 1 June 1992 (2 EIU), 8 June 1992 (2 EIU); 13 July 1992 (3 EIU), 29 Sep 1992 (18 EIU), 5 Oct 1992 (3 EIU), 12 Oct 1992 (11 EIU), 19 Oct 1992 (4 EIU), 23 Oct 1992 (1 EIU); Edgar Co., Baber's Woods Nature Preserve, 29 Oct 1990 (6 EIU); Foley's Woods, 2 Nov 1992 (1 EIU); Jackson Co., Carbondale, 1 Nov 1979 (1 SIU); Johnson Co., Heron Pond, 21 Apr 1989 (1 EIU), 6 Oct 1990 (1 EIU); Polk Co., Bell Smith Springs, 23 Oct 1982, (12 SEM); Pope Co., 1-3 May 1970 (1 EIU); Sangamon Co., Sangamon River, 16 May 1941 (3 ISM); St. Clair Co., 1 Oct 1910 (1 UMO); Tazewell Co., Hopedale, 2 Oct 1917 (1 INHS), Union Co., Pine Hill nr. McCann Springs, 6 May 1976 (1 SEM), Pine Hills, 29 Oct 1974 (1 SIU); Wabash Co., Beall Woods S. P., 30 Oct 1988 (2 EIU), 4 Oct 1992 (5 EIU); Williamson Co., Crab Orchard Lake, 8 May 1960 (1 SIU)

Indiana:

Brown Co., 27 May 1988 (2 FSCA); Fountain Co., West Point, 15 Sep 1984 (4 PU); Frande Co., 11 June 1907 (1 PU); Johnson Co., Smith Valley, 28 Oct 1936 (1 FMNH); Marion Co., 11 Sep 1897 (1 PU); Parke Co., Shades S. P., 11 Oct 1983 (1 PU); 9 Sep 1977 (3 PU); Porter Co., Davis Woods, 18 Oct 1941 (1 FMNH); Vigo Co., 9 Sep 1893 (3 PU), 6 Oct 1894 (1 PU)

Kansas:

Auburn, 8 Sep 1933 (1 FMNH)

Kentucky:

KY (1 SEM), (2 INHS), (3 CMNH)

Maryland:
Baltimore, 27 Oct 1939 (1 USNM); 21 May 1940 (1 USNM), 18 Nov 1940 (1 USNM), ; Blandensburg, 27 May (3 USNM); Patapsco, 30 Sep 1962 (3 USNM); Montgomery Co., 1 June 1902 (1 USNM), 19 Sep 1919 (1 USNM); Bethesda, 23 May 1970 (5 USNM), 27 May 1972 (2 USNM); Washington Co., Harper's Ferry, 25 May 1964 (1 USNM)

Michigan:
Detroit, 30 May 1909 (1 UMI); Berrien Co., Lakeside, 2 June 1935 (1 FMNH), 4 June 1935 (1 UMI), 4 June 1935 (3 UMO), Warren Woods, 19 June 1920 (1 INHS), 3 June 1990 (2 FMNH), 3 June 1990 (2 FMNH), 3 June 1990 (54 FMNH), 5 Oct 1968 (3 FMNH), 9 June 1990 (76 FMNH), 6 Oct 1982 (8 SEM), 7 June 1989 (7 SEM), 1 June 1986 (11 SEM), Livingston Co., Edwin S. George Reserve, 14 May 1933 (1 UMI); Oakland Co., 20 Sep 1926 (3 UMI), 27 Sep 1931 (3 UMI); Proud Lake Rec. Area, 15 Oct 1983 (16 UMI); Washtenaw Co., Ann Arbor, 5 June 1901 (1 UMI)

Missouri:
Neeley's Landing, 22 Sept 1946 (1 FMNH); Boone Co., Columbia (1 UMO); Shannon Co., Eminence, 10 Oct 1937 (10 INHS); St. Louis Co., Creve Coeur, 2 May 1905 (2 UMO), 20 Sep 1896 (1 UMO)

North Carolina:
Henderson Co., Fletcher, 10 Aug 1969 (1 FSCA)

Ohio:
OH (1 CMNH), (1 INHS); Ashland Co., 26 June 1974 (1 FMNH), 27 June 1974 (1 FMNH); Ashtabula Co., Jefferson (2 USNM); Crawford Co., Plankton (2 CASC); Hamilton Co., Cincinnati, 3 June 1901 (2 UMI); Summit Co., 25 July 1934 (4 INHS)

Pennsylvania:
PA (1 CMNH); Honey Creek, 20 May 1961 (2 EIU); Allegheny Co. (4 CMNH); All'y, 22 June 1890 (1 SEM); Pittsburgh (1 CMNH), 11 Oct (1 CMNH), 25 June (1 CMNH), 30 July (2 CMNH); Wall, 19 June 1921 (3 CMNH), 20 July 1921 (2 CMNH), 26 July 1921 (1 CMNH); Wilmerding, 3 Oct 1920 (2 CMNH); Westmoreland Co., Jeannette, 17 Aug (1 CMNH), 2 June (2 CMNH), 6 Aug (1 CMNH)

Tennessee:
Sevier Co., Great Smoky Mts. N. P., Trail to Ramsey, 13 May 1986 (3 PESC)

Virginia:
VA (2 CMNH); Chain Bridge, 23 May (1 MCZ); Fairfax Co., Gt. Falls, 19 Sep 1915 (1 USNM)

Oxyporus rufipennis LeConte

CANADA

Canada (1 SEM)

Ontario:
North Bay Ontario, 1-8 Sep 1896 (2 MCZ)

UNITED STATES

Connecticut:
Mansfield, 25 May 1960 (1 MCZ)

Iowa:
Story Co., Ames, 29 Oct 1933 (1 FMNH)

Illinois:
IL (1 CMNH), (1 INHS), (1 INHS), 2 (INHS), (5 CMNH), June (1 INHS); N. Ill. (1 CMNH), (1 INHS); Champaign Co., Urbana, 15 Oct 1911 (1 INHS), 22 Oct 1932 (2 FMNH); Cook Co., Willow Springs, 8 July 1917 (4 UMI); DuPage Co., Des Plaines, 11 Oct 1958 (1 FMNH); Sangamon Co., Sangamon River, 16 May 1941 (1 ISM)

Indiana:
Kankakee River Woods, State Line, 2 Sep 1922 (1 UMI); LaSalle Fish & Game Refuge, nr. Schneider, 8 Sep 1975 (2 FMNH); Porter Co., Smith Davis Woods, 18 Oct 1941 (1 FMNH)

Kentucky:
Douglas Co. (1 SEM)

Kansas:
Edwards Co., Kinsley, 23 Sep 1926 (6 UMI)

Maryland:
Takoma Park, 2 Oct 1950 (9 UMO); Upper Marlboro, 12 May 1971 (1 USNM); Caroline Co., Ridgely, 10 Oct 1966 (1 NCSU)

Michigan:
Detroit, 21 Oct 1905 (1 UMO), 29 Aug 1905 (1 UMO), 29 May 1906 (1 UMI), 4 Oct 1909 (1 UMI); Alger Co., Onota TWP., 17 July 1916 (1 UMI), 24 July 1916 (1 UMI), 27 July 1916 (1 UMI); Berrien Co., Harbert Dunes, 3 Aug 1917 (1 UMI); Lakeside, 2 June 1935 (1 FMNH), 4 June 1935 (2 INHS); Warren Woods, 3 June 1990 (6 FMNH), 9 June 1990 (31 FMNH), 5 Oct 1968 (1 FMNH), 7 June 1989 (1 SEM), 1 June 1986 (3 SEM); Chippawa Co., Whitefish Point, 28 July 1914 (2 UMI); Marquette Co., Huron Mts., 12 July 1920 (1 UMI); Oakland Co., 20 Sep 1926, (4

Michigan (cont.)
UMI); Bloomfield, 10 Oct 1916 (1 UMI); Proud Lake Rec. Area, 26 May 1946 (7 UMI); Schoolcraft Co., 10 Sep 1923 (4 UMI), 20 Aug 1923 (9 UMI); Floodwood, 25 July 1915 (1 UMI); Washtesaw, 6 June 1916 (1 UMI); Wayne Co., 2 mi. SW. Plymouth, 26 May 1946 (2 UMI)

Minnesota:
Brainerd, 9 June 1965 (2 SEM); Hennipin, 8 Sep 1956 (1 FMNH)

Missouri:
Johnson Co., Warrensburg, 19 May 1946 (1 FMNH)

New Hampshire:
Coos Co., 5 mi. N. Jefferson Notch, 14-31 June 1982 (1 FMNH)

New York:
NY (1 INHS); Elbridge, 10 Oct 1941 (4 UMI); Pike, 28 Oct 1901 (3 UWI)

Pennsylvania:
Allegheny Co., Pittsburgh, July (1 CMNH); Westmoreland Co., Jeannette, 16 Aug (1 CMNH)

Vermont:
VT (1 CMNH); Bolton Gleason Brook, 24 June 1973 (1 UVT), 26 Aug 1973 (1 UVT); Clarendon nr. Chippenhook Cave, 20 June 1985, (1 UVT); Fairfax Goose Pond Road, 17 Sep 1985 (1 UVT); Shelborne LaPlatte River, 13 Sep 1985 (2 UVT); Underhill Nebraska Notch, 15 Sep 1986 (2 UVT); W. Elmore, 15-18 Aug 1966 (3 UVT); Chittenden Co., 3 mi. S. Jonesville Branforth Ridge, 16 Sep 1984 (2 UVT)

Wisconsin:
Florence Co., 18 Sep 1958 (3 UWI); T,39N.16ES.21, 10 Sep 1958 (7 PU); Sauk Co., 13 Sep 1952 (3 UWI)

Oxyporus major Gravenhorst

CANADA

Newfoundland:
15 Sep 1940 (1 FMNH)

UNITED STATES

Arkansas:
Crawford Co., Ozark Nat. Forest, 1.5 mi. S. Lee Creek, 31 Aug 1986 (1 RABL), 31 Aug 1986 (1 UOA); Garland Co., Camp Clear Fork, 3 mi. W. Crystal Springs, 15 June 1986 (1 RABL); Logan Co., Cove Lake, 8 Sep 1986 (1 RABL); Stone Co., Gunner Pool, 20 July 1988 (1 RABL); White Co., Virginia Fall, 5 mi. S. Bon Air, 22 July 1986 (1 RABL)

District of Columbia:
DC (5 CMNH); 30 Aug 195(?) (1 INHS)

Delaware:
Delaware, Sep 1879 (2 MCZ)

Georgia:
Blood Mt., 9 Sep 1944 (1 INHS); Fort Mt., 12 Sep 1937 (3 INHS)

Illinois:
IL (1 INHS); S. Ill. (1 UMO); Clark Co., Rocky Branch Nature Preserve, 4 Aug 1988 (1 EIU), 8-19 Aug 1991 (2 EIU), 9 Sep 1991 (2 EIU), 13 Sep 1989 (1 EIU), 13-20 Oct 1992 (1 EIU), 16-23 Aug 1992 (2 EIU), 17 Sep 1992 (1 EIU), 17 Sep 1992 (1 EIU), 19-23 Aug 1992 (1 EIU), 19-26 Aug 1991 (4 EIU), 21 Oct 1991 (1 EIU), 21 Sep 1992 (1 EIU), 23 Sep 1988 (2 EIU), 23-27 Aug 1992 (1 EIU), 25 Sep 1989 (1 EIU), 26 Aug 1991 (1 EIU), 26 Aug-2 Sep 1991 (4 EIU); Coles Co., 27 Sep 1965 (1 EIU), 5 Oct 1984 (1 PESC); Fox Ridge S. P., 10 Oct 1992 (3 EIU), 23 Oct 1992 (1 EIU), 27 Oct 1992 (1 EIU); Douglas Co., 30 Sep 1970 (1 EIU); Edgar Co., Foley's Woods, 12 Sep 1988 (1 EIU); Jackson Co., Carbondale, 22 Sep 1984 (1 SIU); Pope Co., Shawnee Nat. Park, 1 Oct 1982 (1 EIU); Vermilion Co., Forest Glen Nature Preserve, 27 Sep 1992 (1 EIU); Wabash Co., Beall Woods S. P., 4 Oct 1992 (15 EIU)

Indiana:
Turkey Run S. P., 22 Sep 1989 (2 EIU); Clark Co., State Forest, 28 July 1937 (2 PU); Tippecanoe Co., McCormick's Woods, 23 July 1986 (1 FSCA)

Kentucky:
KY (1 PU), (6 INHS)

Louisiana:
LA (2 CMNH)

Maryland:
Hebbville, 6 Sep 1968 (1 USNM)

Michigan:
Detroit, 15 Oct 1905 (1 UMI); Oakland Co., 26 Sep 1926 (1 UMI)

Missouri:
Cape Girardeau Co., Cape Girardeau, 26 Oct 1968 (1 SEM); St. Louis Co., Mosley Park, St. Louis, 22 June 1986 (1 UOA)

North Carolina:
Black Mts., Sep-Oct (2 FMNH); Reedy Creek S.P., 2 Aug 1964 (1 NCSU); Mecklenburg Co., Charolette, 4 July 1961 (1 NCSU)

New York:
NY (1 CMNH); 6-Mile Creek, Ithaca, 30 June 1937 (1 INHS)

Ohio:
OH (1 SEM); Franklin Co., Columbus, 13 Sep 1975 (2 FMNH)

Pennsylvania:
Indiana (1 UMO); Allegheny Co. (2 SEM), (4 CMNH); Pittsburgh, July, (2 CMNH), June (1 CMNH), May 1900 (1 CMNH), Sep (1 CMNH); Fayette Co., Ohiopyle, July 1914 (1 CMNH); Lancaster Co., 29 July 1937 (1 SEM); Lebanon Co., Mt. Gretna, 23 July 1986 (1 INHS); Westmoreland Co., Jeannette, 16 Aug (1 CMNH), 16 June (1 CMNH), 17 Aug (1 CMNH), 18 Aug (1 CMNH), 19 Aug (1 CMNH), 20 Aug (1 CMNH), 22 Aug (1 CMNH), 30 Aug (1 CMNH)

Tennessee:
TN (1 CMNH)

Virginia:
Giles Co., Mt. Lake Bio. Stat., 9 Aug 1967 (1 SEM)

Oxyporus vittatus Gravenhorst

CANADA

Quebec:
Belle-Riviere Parc des Laurentides, 9 Aug 1970 (2 SEM); Gatineau Pk., Ramsey Lake, 23 May 1971 (1 SEM); Ste. Catherine, 8 July 1959 (2 NCSU); Val Morin, 16 Aug 1902 (3 UMO), Aug 1902 (2 UMO), Aug. (4 SEM)

UNITED STATES

Arkansas:
Garland Co., Camp Clear Fork, 3 mi. W. Crystal Springs,

Arkansas (cont.)
14 Sep 1986 (1 RABL), 15 June 1986 (2 RABL), 15 Sep 1986 (1 RABL), 27 Sep 1986 (1 UOArk), 28 Sep 1986 (1 UOArk), 28 Sep 1986 (2 RABL); LeFlore Co., Horse Thief Springs, 14 Sep 1986 (3 RABL); Logan Co., Mt. Magazine, E. slope, 17 Aug 1986 (1 UOArk), 26 May 1986 (2 UOArk), 26 May 1986 (1 RABL); Washington Co., Lake Weddington, 12 mi. W. Fayetteville, 17 Oct 1986 (5 UOArk), 26 Oct 1986 (5 RABL)

District of Columbia:
DC (2 INHS), (29 CMNH), 14 June 1908 (4 USNM)

Florida:
Alachua Co., 2.5 mi. SW. of Archer, 27-31 Dec 1987 (1 PESC); 3.8 mi. SW. of Archer, 11-18 Jan 1988 (1 PESC); Gainesville, 11 Jan 1987 (3 PESC), 13-16 Feb 1987 (2 PESC), 20-23 Feb 1987 (1 PESC), 25 Dec 1987 (1 PESC), 9-13 Mar 1987 (2 PESC); Monteocha, 12 Dec 1977 (1 FSCA); Newman's Lake, 27 Dec 1924 (1 FSCA)

Georgia:
Blood Mt., 20 Sept 1945 (2 INHS), 9 Sept 1944 (3 INHS); Dallas, 7 Oct 1945 (1 INHS); Stone Mt., 2 Nov 1928 (3 INHS)

Illinois:
IL (1 CMNH), (1 INHS), (1 INHS), (1 INHS), (6 INHS); N. Ill (2 CMNH), S. Ill., 14 Sep 1890 (2 UMO); Utica (5 UVT); Clark Co., Rocky Branch Nature Preserve, 11 Oct 1991 (1 EIU), 13 Sep 1989 (3 EIU), 16 Sep 1991 (2 EIU), 19 Oct-4 Nov 1990 (1 EIU), 21 Oct 1991 (1 EIU), 21 Oct 1991 (1 EIU), 25 Sep 1989 (4 EIU), 26 Sep 1988 (2 EIU), 29 Sep-8 Oct 1992 (1 EIU), 8 Oct 1992 (1 EIU), 9-16 Sep 1991 (1 EIU); Coles Co., 18 Oct 1984 (1 PESC), 5 Oct 1984 (3 PESC); 2 mi. NE. Rardin, 18 Sep 1989 (1 EIU); 3 mi. S. Charleston, 22 Sep 1989 (1 EIU); Fox Ridge S. P., 11 Oct 1992 (2 EIU), 12 Oct 1992 (2 EIU), 19 Oct 1992 (1 EIU), 23 Oct 1992 (1 EIU), 23 Oct 1992 (7 EIU), 26 Oct 1992 (4 EIU), 26 Oct 1992 (4 EIU), 29 Sep 1992 (2 EIU), 3 Aug 1992 (1 EIU), 3 Oct 1992 (2 EIU); vcty. Lake Charleston, 11 Oct 1992 (1 EIU); Cook Co., Sep (3 UWI); Willow Springs, 18 Sep 1905 (1 UMI); Polk Co., Bell Smith Springs, 23 Oct 1982 (16 SEM)

Indiana:
IN (1 FMNH); Hessville, 7 Oct 1906 (4 FMNH); Tremont (2 FMNH), 25 Sep 1921 (1 UMI); Lake Co., 7 Oct 1906 (4 PU); Porter Co., Ogden Dunes, 23 Sep 1928 (1 FMNH); Vigo Co., 2 July 1894 (2 PU), 20 Oct 1894 (1 PU), 9 Oct 1894 (1 PU)

Kentucky:
KY (1 INHS)

Louisiana:
LA (3 CMNH)

Massachusetts:
MA (1 INHS), (2 INHS), (4 SEM); Falls River, 29 Aug. (1 SEM), Aug 1904 (1 MCZ); Farmingham, 9 Aug 1908 (1 UMI), 9 Aug 1908 (1 UMI); Holland, 20 Sep 1967 (1 NCSU); Melrose (1 MCZ), (1 MCZ), (1 UMI); Natick, 18 Aug 1923 (1 INHS); Northboro, 16 Aug 1946 (1 INHS); Springfield, 9 Aug 1914 (1 USNM); Stoneham, 20 Apr (1 FMNH); Sunderland Co., Mt. Toby, 23 Sep 1917 (1 CASC)

Maryland:
MD (7 CMNH); Ellicott, 15 Sep 1940 (5 USNM); Montgomery Co., 19 Sep 1911 (5 USNM); Cabin John Bridge, 19 Sep 1919 (1 SEM)

Michigan:
MI (1 INHS), (2 FMNH); Cheboygan, 10 Aug 1928 (5 UMI); Crystal Valley, 9 Sep 1926 (2 FMNH); Detroit, 20 Aug 1909 (1 UMI); Galesburg (2 SEM); Anoka Co., Cedar Creek National Historical Area, 1 Sep 1981 (3 UMI); Charlevoix Co., Beaver Island, 20 Sep 1923 (1 UMI); Cheboygan Co., 18 July 1949 (1 NCSU), 31 Aug 1940 (1 UMI), 5 Aug 1937 (1 FMNH); Crawford Co., 16 Sep 1935 (7 SEM); Giles Co., Mt. Lake Bio. Stat., 3 Aug 1945 (4 UMI); Gratiot Co., 14 Sep 1946 (1 UMI); Ithaca, 13 Sep 1957 (1 UMI), 2 Oct 1958 (1 UMI); Lake Co., Loon Lake, 23 Aug 1932 (6 UMI); Livingston Co., Brighton TWP., 5 Sep 1921 (2 UMI); Mackinae Co., St. Ignace, 17 Sep 1926 (2 UMI); Manistee Co., 5 Sep 1938 (1 UMI); Midland Co., 15 Sep 1940 (1 UMI), 21 Aug 1945 (1 UMO), 7 Aug 1945 (5 UMO); Oakland Co., 20 Oct 1926 (2 UMI); Highland, 3 Sep 1921 (1 UMI); Milford, 27 Aug 1921 (2 UMI); Schoolcraft Co., Floodwood, 23 July 1915 (1 UMI), 28 July 1915 (1 UMI);

Missouri:
Callaway Co., Reform, 13 Oct 1974 (11 UMO); Crawford Co., 14 Oct 1899 (4 UWI), 14 Oct 1919 (8 UMO)

North Carolina:
NC (1 INHS), (1 INHS), (2 INHS); Great Smokey Mts. N. P., Bone Valley Creek, 21-24 Aug 1964 (1 NCSU); Hanging Rock S. P., 20 mi. N. Winston-Salem, 6-8 Sep 1967 (1 SEM), 8-10 Sep 1967 (1 FMNH); Morrison (1 INHS), (1 INHS); Reedy Creek S. P., 2 Aug 1964 (1 NCSU); Southern Pines, 12 Oct 1918 (3 USNM); Umstead S. P., nr. Raleigh, 6-8 Sep 1967 (2 SEM); Grahm Co., 22 Oct 1972 (1 SEM); Rockingham Co., Reidsville, 25 Aug 1974 (1

North Carolina (cont.)
SEM); Wake Co., Raleigh, 11 Oct 1992 (1 NCSU); Watuaga Co., 24 Aug 1970 (6 SEM); Blue Ridge Parkway, 27 Aug 1974 (9 SEM); Boone, 16 Sep 1972 (2 SEM); Boone, 16 Sep 1972 (2 SEM)

New Hampshire:
Barnstand, 6 Sep 1928 (1 CASC); Pelham, 31 Aug 1905 (1 INHS)

New Jersey:
NJ (1 CMNH); Ocean Co., 1 Oct 1989 (1 EIU)

New York:
NY (1 INHS), (2 CMNH), (4 INHS); Flushing (2 FMNH)

Ohio:
OH (2 CMNH)

Oklahoma:
Latimer Co., Oct 1983 (4 KSC), Oct 1984 (1 KSC), Oct 1987 (4 KSC), Oct 1988 (1 KSC), Oct 1988 (6 SEM), Oct 1989 (2 KSC), Oct 1992 (5 KSC), Sep 1987 (1 KSC); 5 mi. W. Red Oak, Oct 1980 (1 UOI), Oct 1980 (4 KSC), 14 Nov 1976 (1 KSC), 14 Nov 1976 (1 UOI), 15 Oct 1976 (1 KSC), 3 Oct 1976 (4 KSC), 9 Oct 1976 (1 KSC); LeFlore Co., 14 Sep 1986, (2 UOArk)

Pennsylvania:
Allegheny Co. (3 CMNH); Pittsburgh, 4 Aug (1 CMNH), July (3 CMNH); Lebanon Co., Mt. Gretna, 12 Sept 1910 (4 INHS); Westmoreland Co., Jeannette, 1 Aug (1 CMNH), 1 July (4 CMNH), 10 Sep (5 CMNH), 27 June (1 CMNH), 7 Sep (2 CMNH)

South Carolina:
SC, 2 Oct 1947 (3 USNM)

Tennessee:
TN (2 CMNH); Smokey Mts. N. P., Chimneys Campground, 7 June 1954 (3 SEM); Cocke Co., Great Smokey Mts N. P., 19 June 1977 (7 UOArk); Sevier Co., Gatlinburg, Aug 1948 (1 FMNH)

Utah:
UT (1 INHS)

Virginia:
VA (2 CMNH); Falls Church, 15 Oct (3 MCZ), 4 July (1 MCZ); Henry Co., Figsboro, 7 June 1981 (1 MCZ)

Vermont:
NW Vermont, Sep 1969 (1 UVT); S. Burlington, E. Woods, 19 Sep 1985 (1 UVT); W. Elmore, Worcester Ridge, 24 Aug 1966 (3 UVT)

Wisconsin:
WI (1 FMNH); Madison, 12 Oct 1940 (1 FMNH), 12 Oct 1940 (4 FSCA), 12 Oct 1940 (4 UWI); Plum Lake, 21 Aug 1924 (3 FMNH); Sayner, 18 Sep 1926 (10 FMNH); Bayfield Co., 6 Aug 1972 (3 FMNH); Oneida Co., Minocqua, 8 Sep 1934 (1 FMNH); 8 Sep 1934 (3 FMNH); Sauk Co., 13 Sep 1952 (1 UWI)

Oxyporus lepidus LeConte

Georgia:
Panther Creek, 5 mi. S. Tallulah Falls, 3 Sep 1967 (1 SEM)

Iowa:
IA (1 SEM)

Illinois:
IL (1 CMNH), (1 INHS), (1 INHS), (2 CMNH), (3 FMNH); Clark Co., 30 Oct 1965 (1 EIU); Rocky Branch Nature Preserve, 16-23 Aug 1992 (1 EIU), 21 Oct 1991 (1 EIU), 28 June-5 July 1992 (1 EIU), 30 Aug-6 Sep 1993 (1 EIU), 5-12 July 1992 (1 EIU); Coles Co., Oct 1965 (7 EIU); St. Clair Co., 30 Sep 1919 (1 UMO)

Maryland:
MD (1 UWI), (7 CMNH)

Michigan:
MI (1 FMNH)

New York:
NY (2 CMNH)

Pennsylvania:
Allegheny Co. (1 CMNH); Westmoreland Co., Jeannette, 20 Aug (1 CMNH), 21 Aug (1 CMNH), 6 Sep (3 CMNH)