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Death-Watch and Spider Beetles of Wisconsin

Coleoptera: Ptinidae

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Abstract

Critical insights relating to the distribution, natural history, and abundance of Ptinidae sensu lato, in Wisconsin and North America have been overlooked in many faunistic surveys and taxonomic studies, in part due to the relative difficulty in working with the contractile nature of many species and complexity of certain taxonomic characters. Work by H.C. Fall, R.E. White, and T.K. Philips significantly aided in the understanding of this family, although numerous genera are still in need of major revision. This study is the first state-wide survey of Wisconsin Ptinidae. It provides a comprehensive list of all ptinid species documented from Wisconsin, with taxonomic keys for their identification. Profiles for each species were compiled, including a taxonomic overview, capsule description, species diagnosis, and overview of their natural history. Specimens were collected using a variety of methods during two field seasons; Lindgren funnel traps and flight intercept traps were particularly significant. Trap samples from previous faunistic surveys of other taxa and mounted specimens from private and public research collections were also examined. Seventy-eight Wisconsin pest control companies and the University of Wisconsin insect diagnostic laboratory were consulted for information regarding indoor pest species of Ptinidae. During this survey, 28 genera and 64 species of Ptinidae were documented from the state from 2,063 specimens. Of these, 14 genera and 46 species are considered new state records, a 72% increase from the number of species known previously.

Keywords: Ptininae, Eucradinae, Ernobiinae, Anobiinae, Ptilininae, Xyletininae, Dorcatominae, Mesocoelopodinae

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Contents

Abbreviations

Co.	County
GPS	Global Positioning System
Hg	Mercury
SEM	Scanning Electron Microscope
SNA	State Natural Area
SWA	State Wildlife Area
s.l.	sensu lato
TNC	The Nature Conservancy
WDNR	Wisconsin Department of Natural Resources
WI	Wisconsin

Collection Codes

JJDC	John J. Dorshorst Collection
RAAC	Rachel A. Arango Collection
IRCW	University of Wisconsin–Madison Insect Research Collection
MPMC	Milwaukee Public Museum Collection
FMNH	Chicago Field Museum of Natural History Collection
UWSP	University of Wisconsin–Stevens Point Collection
UWOC	University of Wisconsin–Oshkosh Collection
UWEC	University of Wisconsin–Eau Claire Collection
OSUC	Ohio State University Collection

Death-Watch and Spider Beetles of Wisconsin—Coleoptera: Ptinidae

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Introduction

Members of Ptinidae are known commonly as “death watch” or “spider beetles,” the former common name referring to the mating behavior of one particular species, *Xestobium rufovillosum* (De Geer). Adult beetles produce a tapping or clicking noise by hitting their frons on the substrate within their wooden galleries (Birch and Keenlyside 1991), causing a sound similar to the ticking of a clock, which was interpreted as an omen that a loved one would soon pass on (Belmain et al. 2000). This tapping behavior, now known to be a form of communication used in finding mates (Birch and Keenlyside 1991, Goulson et al. 1994), evoked fear of impending death especially during times of plague and sickness. In fact, classic horror fiction writer Edgar Allan Poe alluded to these beetles in his 1843 short story, “The Tell-Tale Heart,” in which, a murderer recounts the killing of an old man:

> I had my head in, and was about to open the lantern, when my thumb slipped upon the tin fastening, and the old man sprang up in bed, crying out—“Who’s there?” I kept quite still and said nothing. For a whole hour I did not move a muscle, and in the meantime I did not hear him lie down. He was still sitting up in the bed listening; —just as I have done, night after night, hearkening to the death watches in the wall.

After the murder, the body is dismembered and the old man’s body parts are hidden beneath the wooden floorboards of his quarters. The killer, confident that he has foiled the authorities, then begins to hear the man’s heart beating from beneath the floor, causing him/her to confess to the crime. The sound of the man’s heart beat is likely in reference to the aforementioned “death watches.”

At least two species of Ptinidae produce the tapping noise described above, even though numerous species are associated with wood products. More frequently these beetles are referred to as “powderpost beetles” because of their wood boring behavior, which causes numerous small holes in the infested wood upon emergence (Figs. 8 and 9). It is important to note that two families of beetles are referred to as powderpost beetles, with the Bostrichidae considered "true powderpost" beetles. Members of this family have substantially different nutritional food requirements than members of Ptinidae.

As it was in the mid-1800s, some ptinid species continue to be feared today, not as harbingers of death, but as a result of the economic cost associated with damage caused by their close association with stored food products and wooden materials. The economic significance of numerous ptinid species has been recognized for years by many sectors of the wood preservation industry, as well as by homeowners and pest control operators. Building project planners and developers discussing the preservation and renovation of historically significant structures, such as homes and wooden bridges, often cite problems with ptinids during their renovations. Homeowners may also encounter these beetles in common outdoor wooden structures, such as fence posts and wood decking, and indoors, most commonly within crawl spaces or emerging from antique furniture. Some of the most frequently infested buildings (especially in the Midwest) are older barns, where moisture levels tend to be higher and unfinished wood relatively abundant.

Although many ptinid species have some degree of economic significance, three are clearly the most well-known, cosmopolitan species. These include *Stegobium paniceum* Linnaeus, the “drugstore beetle,” which obtained its name from its ability to develop in pharmaceutical drugs among many other larval food materials; *Lasioderma serricorne* (Fabricius), the “cigarette beetle,” a well-known pest of tobacco and other stored products; and *Anobium punctatum* (DeGeer), the “furniture beetle,” a species that is often found emerging from in-home wood furnishings. These species have received a great deal of attention because they are nearly worldwide in distribution as a result of increased global commerce. Unfortunately, much of the past research focused exclusively on characteristics of these and other economically important species, with little attention given to the remainder of the family in terms of distribution and abundance. Significant differences undoubtedly exist between the species seen indoors and those that are most abundant in forested environments, but these differences are not well understood.

The aim of this study is to provide a means for recognizing all Wisconsin ptinid species regardless of economic significance and to offer needed figures and illustrations to aid in determinations, as these are typically lacking in previous publications. A comprehensive study of the diversity of this family will not only promote a better understanding of Wisconsin's natural areas as they affect the distribution and range of many of these species, but also provide insight into the abundance of economically significant species in the state and their potential to become problematic in the future as a result of climate change and/or other environmental factors.

Family Ptinidae

Distribution

Ptinidae is a widely distributed group with approximately 220 genera and more than 2,200 species known worldwide, with some 464 species occurring in Mexico, the United States, and Canada (Phillips 2002). The spider beetles (Ptininae) make up nearly 70 of the 220 genera known worldwide, with 69 of the 464 species occurring in Mexico, the United States, and Canada (Phillips 2002). White (1974) listed type species and general worldwide distributions of all ptinid genera, with the exception of Ptininae. Of the 10 Ptinidae subfamilies currently recognized in North America (Lawrence and Newton 1995), eight have been found to occur in Wisconsin. During this survey, 28 genera and 64 species were found from Wisconsin, a significant increase from the 16 genera and 18 species previously noted in literature to occur in the state.

Anatomy

Identification of many ptinids is difficult not only due to their small size and compact body structure, but also because of the obscure nature of certain diagnostic characters (White 1971a). Understanding the evolution of body form in this family will undoubtedly aid in comprehension of many of these potentially diagnostic and phylogenetically important characters. White (1971a) explained in detail the transition from the more elongate and less contracted members of Ptininae and Eucradinae to the highly compacted body forms of Dorcatominae and Mesocoelopodinae. The ability to recognize the various morphological adaptations, which allow many of these species to contract their appendages into cuticular grooves, is essential for taxonomic work in this family.

For Wisconsin fauna, the overall body form, antennae, shape of the prothorax, proximity of the mandibles to the metathoracic ventrite when the body is contracted, shape of the anterior margin of the metathoracic ventrite, and shape of the metathoracic coxae are the most useful characters in subfamilial classification. Ptininae, hypothesized to be the most primitive of all ptinid subfamilies (Philips 2000), exhibits a range of body forms in the Wisconsin fauna, but it is easily recognized by the long, filiform antennae with the antennal insertions close together between the eyes and separated by a narrow, longitudinal ridge (Fig. 84), as well as the shape of the pronotum and lack of prothoracic lateral margins (Figs. 99–118).

The closely related Eucradinae also lacks lateral prothoracic margins (Figs. 119–122) and has the metathoracic coxae not grooved to receive the metathoracic femora. Eucradines may be distinguished from Ptininae by the antennal insertions, which are further apart when viewed from the front, near the compound eyes. In Ernobiinae, prothoracic lateral margins are apparent (Figs. 124, 126, 128) and the prothoracic ventrite appears slightly inflated, causing the ventral surface to be convex to flat near the base of the head (Fig. 87). Members of Anobiinae, although not highly contractile, begin to show adaptations for reception of appendages into the ventral surface. The prothoracic ventrite is excavate ventrally, appearing concave and enclosing much of the head (Fig. 86). The prothoracic coxae are often separated by a prosternal process, allowing the antennae to lie between them when the body is contracted (Fig. 86). Another adaptation is the structure of the metathoracic ventrite, which may be deeply excavate anteriorly to receive the antennal club and prothoracic tarsi. Ptilininae is not significantly different from Anobiinae in body sculpture, except for the cylindrical body shape (Figs. 155–160), asperities on the pronotum (Figs. 92, 159, 160), and sexually dimorphic antennae (Figs. 36, 37, 156–160).

Xyletininae, Dorcatominae, and Mesocoelopodinae begin to show a distinct reduction of the pro- and mesosternum, which allows for greater contraction of the head so that the mandibles reach, or nearly reach, the metathoracic ventrite when the body is retracted (Figs.172, 174, 184, 188, 190, 196, 224, 228). Xyletininae may be distinguished from Dorcatominae and Mesocoelopodinae by the structure of the first abdominal ventrite, which is not grooved to receive the metathoracic legs (Fig. 164). Members of Dorcatominae are highly contractile, sometimes appearing seed-like, with the mandibles easily attaining the metathoracic ventrite during body retraction, and all appendages largely contained within excavations of the ventral surface (Fig. 188), including the first abdominal ventrite, which is grooved for reception of the metathoracic legs (Figs. 208, 218, 220). Mesocoelopodinae is similarly contractile except that the anterior margin of the metathoracic ventrite is not at all grooved for the mesothoracic tarsi but has the mesothoracic tarsi lying just above the metasternal process (Fig. 83).

Numerous ptinids are sexually dimorphic, especially in antennal formation (Figs. 21, 22, 24, 25), but also in body shape and size (Figs. 11–118), distance between and size of the compound eyes, vestiture, and shape of the last abdominal ventrite. In Ptininae, usually females but also males of some species are flightless, having the elytra fused.

Taxonomy

Supraspecific taxonomy of Ptinidae has undergone numerous nomenclatural shifts over the course of its history. Potentially the most significant has been the inclusion of Ptininae ("spider beetles") within the then Anobiidae by such authors as Melsheimer (1845), LeConte (1861, 1865), and Fall (1905). LeConte (1865) was first to organize genera based on the manner in which the body is contracted. Fall (1905) supported LeConte's classification, "the arrangement of genera proposed by him at that time appears to me to be on the whole distinctly more natural than any other that has been advanced either by earlier or later authors." Fall's monographic revision incorporated the two subfamilies under Ptinidae, and included keys and descriptions for 225 species, of which 132 species and 15 genera were described as new. Two genera, *Hedobia* and *Eucrada*, were transferred from Ptininae as intermediate forms between the two subfamilies into their own tribe, Hedobiini at the head of Anobiinae. Pic's (1912a) catalog treated the two subfamilies as distinct families, a classification continued by Crowson (1955), although their strong relationship to members of Bostrichidae was also noted. In 1981, however, Crowson reverted back to a taxonomic scheme similar to that of Melsheimer, LeConte, and Fall, which was repeated by Lawrence and Newton (1995). Although higher taxonomy of this family has varied significantly, the general arrangement of the genera within the family has not changed drastically since LeConte's (1865) and Fall's (1905) treatments of the group. The taxonomic classification presented by Lawrence and Newton (1995) has been followed throughout this survey, although the family name Ptinidae is chosen as the correct name (Lawrence and Newton 1995): "Ptinidae Latreille (1802: 112) has priority over Anobiidae if the two families are combined as done here." Ptinidae, including Ptininae, will be hereafter written as Ptinidae *sensu lato* (*s.l.*), Ptinidae, or ptinids. Ptinidae, excluding Ptininae, will continue to be referred to as Anobiidae *auctorum*, Anobiidae, or anobiid.

Recent studies of the phylogenetic relationships of the group have proposed Anobiinae and Ptininae as subfamilies within the monophyletic Bostrichidae by Philips (2000), who found Anobiidae to be monophyletic without inclusion of Ptininae, also determined to be a monophyletic grouping. Bostrichidae was determined to be paraphyletic without the inclusion of both taxa (Philips 2000). Ivie (1985) studied the relationships within the Bostrichiformia as part of his dissertation and supported placement of Ptinidae *s.l.* within the Bostrichidae, but his classification was not adopted by Lawrence and Newton (1995).

Surprisingly few taxonomists have focused on Ptinidae, and as a result numerous genera are in need of major revision. LeConte (1865) was first to provide a comprehensive overview of the organization of this family. Fall's 1905 publication represents the last, major, comprehensive review of this family in North America, drastically increasing understanding of the morphological attributes and distribution of this group. Fall's revision also provided a small number of illustrations, a feature that was nearly entirely absent in the majority of previous publications. White (1971a) elaborated on Fall's (1905) comprehensive key to genera (although excluding Ptininae) and described in detail the evolution of the various subfamilies by means of the manner in which the body is contracted. The generic taxonomic key including Ptininae, presented by Philips (2002), represents the most current treatment of this family as a whole.

Other significant publications and catalogues on North American Ptinidae include Melsheimer's (1845) descriptions of new Coleoptera species in the United States; a description of mature anobiid larvae by Böving (1954); Simeone's (1960) study of *Hemicoelus carinatus* (Say), with observations on other anobiid species; a survey of Ohio Anobiidae (White 1962a) and subsequent (White 1982) catalog of the Anobiidae of America north of Mexico; an overview of the beetles of the Pacific Northwest (Hatch 1961); and a study of Anobiidae associated with northern hardwood forests in central New York (Acciavatti 1972). Papp (1962) provided keys and descriptions for members of Ptininae.

Pellitteri and Boush (1983) noted a number of new ptinines from Wisconsin during a survey of stored products insects in Wisconsin's feed mills. Other ptinid researchers confined their focus to economically important species or taxa (e.g., Howe 1940, 1953, Hinton 1941, Halstead 1986, Spilman 1991). Additional useful catalogs or checklists to North American fauna include work by Hopkins (1893), Pic (1912a), Leng (1920), Arnett (1983), McNamara (1991), and Downie and Arnett (1996).

Natural History

Ptinid larvae are typically found in well-seasoned lumber (10+ years old) with low starch content, as well as in dry, dead standing trees, where they develop in the sapwood, and less frequently heartwood, of hardwoods and softwoods (Fig. 12) (Smith and Whitman 1992, Kyhl and Seybold 2002). The adult female lays eggs on or close to the surface of the wood, or other food material, in open cracks or pores (Smith and Whitman 1992). Once the larvae have eclosed, they burrow further into the wood to feed and eventually pupate; adult emergence usually occurs in the spring and summer months. Although old, dead trees and lumber are the most common preferred substrate for the group, larvae have also been shown to utilize bark, twigs, seeds, woody fruits, galls, fungi, and infrequently, the stems or shoots of young, growing trees (Phillips 2002). A wide variety of stored food products are also commonly infested, mostly by members of Ptininae, although this subfamily does include some wood-boring species (Philips 2002).

The development period for the life cycle of Ptinidae depends strongly on environmental conditions. According

to some sources, development may take up to 10 years or more if environmental conditions are unfavorable (i.e., low humidity and poor nutritional content of the wood) (Fisher 1940, Belmain et al. 2000). Some studies have indicated ptinid development occurs more rapidly outdoors, egg to pupa taking only 2–3 weeks, with complete development in 1 year, whereas indoors, development is thought to be slower, taking 2–3 years to complete larval and pupal development (Ebeling 1978). However, there are exceptions to this trend. The indoor pest species *L. serricorne* has been found to have a life cycle ranging from 42 to 70 days and has been reared in just 47 days (Powell 1931).

The success of this family developing within such a wide range of larval food materials is at least in part due to the endosymbiotic yeasts stored in mycetomes located at the anterior end of the larval mid-gut (although apparently lacking in Ptininae) (Crowson 1981). These symbionts have been shown to provide essential nutrients, especially steroids and vitamins in the B group, allowing larvae to develop not only in nutrient-poor food materials, but also at times in otherwise toxic substances (e.g., *L. serricorne* in tobacco) (Crowson 1981, Schwemmler 1989). In addition, because most ptinids are wood borers, they need cellulose-degrading enzymes, which may also be generated by these symbionts (Crowson 1981).

The ability to withstand xeric conditions is particularly well developed in this family. As with other members of the Bostrichiformia, ptinids have a modified cryptonephridic excretory system in which the Malpighian tubules are fused to the hindgut and rectum, allowing for efficient resorption of water (Grimaldi and Engel 2005). The evolution of flightlessness in many ptinines, causing the elytra to be fused, has also been shown to act as a means of preserving water in dry conditions. Benoit et al. (2005) compared water loss rates of *Mezium affine* Boieldieu and *Gibbium aequinoctiale* Boieldieu to the closely related, winged lesser grain borer, *Prostephanus truncatus* (Horn) (Family: Bostrichidae), showing five times lower water loss rates in the former two species. This was hypothesized to be at least in part due to the fused elytra and ability to enter into quiescence.

Materials and Methods

Material Examined

Specimens for this survey were obtained using a variety of collection techniques during two separate field seasons from April/May to August/September in 2006 and 2007. Trapping locations were chosen largely from site descriptions obtained from The Nature Conservancy (TNC) and the Wisconsin Department of Natural Resources (WDNR). Wooded areas with a variety of hardwoods, such as oaks and maples, were preferentially chosen, as well as areas of pine further north (Figs. 1–6, 15). Within the sites, and where possible, traps were set in areas of standing or leaning dead trees. Lindgren funnel and flight intercept traps were the primary sampling tools used because many Ptinidae are strong fliers and are therefore easily obtained using passive trapping techniques (personal communication, Tom Phillips and T. Keith Philips). Traps were maintained at 30 natural area sites across Wisconsin, 15 in central to southern Wisconsin in 2006, 14 in central to northern Wisconsin in 2007, and one both years. Traps were serviced every two to three weeks. Numerous additional sites were visited for hand collecting. Sorting through bulk trap samples obtained previously during related insect surveys or from other studies (e.g.,such as red pine pocket mortality) yielded a significant amount of material from additional locations.

Collections from various museums were examined for Wisconsin material, including University of Wisconsin–Insect Research Collection (IRCW), Milwaukee Public Museum Collection (MPMC), Chicago Field Museum of Natural History Collection (FMNH), University of Wisconsin–Stevens Point Collection (UWSP), University of Wisconsin–Oshkosh Collection (UWOC), and University of Wisconsin–Eau Claire Collection (UWEC). The Ohio State University C.A. Triplehorn Insect Museum (OSUC) was also visited for two days. Although the visit did not provide additional Wisconsin specimens, it was very useful in confirming identifications of species because two prominent ptinid workers, R.E. White and T.K. Philips, did much of their research and deposited many specimens in this location. In fact, the OSUC houses primary types for 28 ptinid species, many of which were described by R.E. White. IRCW specimens and loan material from OSUC and FMNH were heavily utilized for initial species determinations.

Given that a number Ptinidae are indoor pests of woody materials or stored products, 78 pest control companies from across the state were contacted via written letter or by phone not only to obtain specimens but also to determine which species they most frequently encountered as pests within structures. Similarly, specimens sent to the Insect Research Diagnostic laboratory at the University of Wisconsin–Madison also provided evidence for which species are most prevalent as pests of stored products or building materials.

Field Collection Methods

Lindgren funnel traps consisted of a series of (8, 12, or 16) black funnels suspended from the branch of a tree, and terminating in a small collection cup filled half way with a 50% propylene glycol/50% distilled water solution (Fig. 13). Baits are frequently used with these types of traps, but because no baits have been reported to be significant related to ptinid sampling, baiting was experimented with only to a minor degree in this study. One Lindgren trap was baited with 95% alcohol by filling a small 60-mL, narrow-mouth Nalgene bottle and inserting a cotton wick into the bottle so that the top was completely sealed by the cotton, reducing evaporation of the alcohol. The bottle was then

tied to the side of the Lindgren trap with a small string. The synthetic pheromone, serricornin was also used in conjunction with a number of Lindgren funnel traps (formulated as developed by Dr. Tom Phillips using 5 mg of powder serricornin diluted in 50% hexane). Ten microliters of the solution was applied to small rubber stoppers, which have been shown to provide a slow release of the pheromone over a 1–2 week time span. These rubber stoppers were attached inside the center funnel using metal wire.

Examination of bulk samples from previous Wisconsin beetle diversity studies provided some specimens from cantharidin-baited traps, or traps baited with either cantharidin, ipsdienol, or a combination, but no evidence suggests these chemicals are significant to attracting ptinids.

Flight intercept traps consisted of either a flat plastic garbage bag or a sheet of plexiglass (66 by 40.6 cm) secured between two trees so that the base of the bag ran along the midline of a colleting tray (Fig. 14). The 74.9- by 19.1-cm collecting tray with a filtered drain near the top was filled one quarter full with a 50% propylene glycol/50% distilled water solution.

Other collection techniques included Berlese funnel extraction, beating branches, use of a small, hanging flight intercept/ pane trap, rearing larvae, collecting at night using an ultraviolet (UV) or mercury vapor (Hg) lamp, and hand collecting specimens usually from dead trees or other woody materials. Infested wooden material and hard, woody fungi were placed in rearing chambers (Fig. 11) consisting of a 20-L bucket with a clear glass bottle attached to two sides to collect phototropic adults. A number of ptinines were hand-collected during site visits to various factories, food warehouses, and barns.

Specimen Preparation and Curation

Field trap samples were processed as soon as possible by separating all ptinid specimens into 70% alcohol until they could be point mounted. Once mounted, specimens were labeled using 100% cotton paper with locality data including county, specific site, and global positioning system (GPS) coordinates, where possible. The collection date, collector, and method of collection were also included on specimen labels. A number of specimens required re-hydration to expose certain morphological characters, which was done by immersing the specimen in near-boiling (88 °C) water for 3–5 min and using a minuten pin to extract the necessary structures. Characters needed for identification are noted in each individual subfamilial description.

For certain genera, male genitalia had to be extracted and examined to confirm species identifications. Due to the small size and compact nature of many Ptinidae, the entire abdomen was generally removed after the specimen was re-hydrated. The abdomen was then placed in a small beaker with approximately 30 mL of near-boiling (88 °C) water and three pellets of either potassium hydroxide or sodium hydroxide and left covered for 20–30 min. Genitalia were then carefully extracted with a minuten and stored in a glass genitalia vial with 300 µL of glycerin, capped by a small rubber stopper, and pinned beneath the specimen identification label. The disarticulated abdomen was attached to a glue board and pinned directly below the specimen.

Label data for all specimens, including those from museum loans, were assigned a unique specimen code and entered into a database using Biota™ software (Sinauer Associates, Inc., Sunderland, Massachusetts) (Colwell 1996). Specimens collected during this survey were deposited in the IRCW. Collection codes chosen for each specimen in Biota™ correlate with the acronyms listed for each of the various insect collections.

Methods for Diagnoses

A relatively comprehensive list of synonyms is given for each species. The type species for each genus was generally that reported by White (1974 or 1982) for Anobiidae. Type species for ptinine genera were those reported in Borowski and Zahradník (2007). Capsule descriptions are based entirely on Wisconsin specimens and therefore may be less variable than if considered for the entire species range. Lengths and widths given represent an average of five, large and small specimens (where possible). Specimen length was measured along the meson from the anterior pronotal margin to the elytral apices. Specimen width was measured at the widest part of the elytra, usually along the apical quarter of the elytra for anobiids. Ptinines were usually measured near the middle of the elytral disk. All measurements were made using a micrometer installed in the lens of a dissecting microscope. Perhaps one of the most difficult characters to distinguish was the punctation and sculpturing of the body surface. The use of a small, hand-held fluorescent light greatly improved surface sculpture visibility, especially on genera such as *Tricorynus*. A description of the male genitalia is provided for species where necessary.

Methods of collection and larval associations are provided under the “Natural History” section for each species treatment. Adult phenology is given in terms of early, mid-, or late periods of the months collected as many were obtained from trap samples and therefore do not have a specific collection date. Distributions are presented as general overviews of the occurrence of each species in North America, north of Mexico, indicating whether the species is a new state record, and/or range extension from the previously known distribution of the species. Distribution of each Wisconsin species is annotated in Appendix B.

Images and Illustrations

Line drawings were adapted from previous work (e.g., Fall 1905, White 1962a) or drawn from Wisconsin

specimens using Adobe® Illustrator® CS3 (Adobe Systems, Inc., San Jose, California). Habitus images were digitally created using an extended depth of field microscope with Auto-Montage 3-D imaging software (Syncroscopy™, Synoptics Inc., Frederick, Maryland) and edited in Adobe® Photoshop® CS3. All scale bars represent 1 mm where shown. Wisconsin county distribution maps were also created in Photoshop® CS3.

Family Ptinidae Latreille, 1802

Key to the Wisconsin Subfamilies of Adult Ptinidae

[Modified from White 1962a, 1971a, Philips 2002]

1 Antennal insertions close together between the eyes and separated by a ridge no wider than the length of the scape (Fig. 84); abdominal ventrites 1–3 mostly fused; metathoracic coxal plates absent ..... **Ptininae (p. 6)**

1’ Antennal insertions far apart just in front of each eye and separated by >0.5X the total width of the frons (Fig. 85); abdominal ventrites 1–2 mostly fused and metathoracic coxal plates nearly always present **2**

2 (1’) Pronotum without lateral margins (Figs. 120, 122); metathoracic coxae not grooved for reception of femora; frons without narrow ridge over bases of antennae ..... **Eucradinae (p. 17)**

2’ Pronotum with lateral margins (Fig. 130); metathoracic coxae grooved for reception of femora; frons usually with narrow ridge over bases of antennae **3**

3 (2’) Outer margin of each prothoracic tibia prolonged apically into a horizontal tooth, margin above finely toothed or rugose; pronotum asperate anteriorly (Figs. 92, 158–160) ..... **Ptilininae (p. 39)**

3’ Outer margin of each prothoracic tibia not as above; pronotum never asperate anteriorly **4**

4 (3’) Head in repose very strongly deflexed and extended posteriorly; mandibles reaching or nearly reaching metathoracic ventrite (Figs. 162, 188, 234) **5**

4’ Head in repose deflexed but not extended posteriorly; mandibles never reaching metathoracic ventrite (Figs. 124, 152) **7**

5 (4) Metathoracic ventrite and abdomen not excavate for reception of mesothoracic and metathoracic legs; head impressed or excavate beneath for reception of antennae ..... **Xyletininae (p. 43)**

5’ Metathoracic ventrite and abdomen grooved for reception of mesothoracic and metathoracic legs; head impressed beneath for reception of antenna or not impressed (Figs. 80–83) **6**

6 (5’) Metathoracic ventrite lacking tarsal grooves anteriorly (Fig. 83); hypomera never visible in body retraction ..... **Mesocoelopodinae (p. 77)**

6’ Metathoracic ventrite usually with tarsal grooves (note: the grooves are often most easily visible on each side of the metasternal process) (Figs. 80–82); a portion of hypomera often visible in body retraction ..... **Dorcatominae (p. 53)**

7 (4’) Prothoracic ventrite excavated beneath, hypomera distinctly concave, more or less enclosing head (Fig. 86); elytra striate (Figs. 129–154) ..... **Anobiinae (p. 22)**

7’ Prothoracic ventrite not excavated beneath, hypomera flat or convex, head free (Fig. 87); elytra never striate (Figs. 123–128) ..... **Ernobiinae (p. 18)**

Subfamily Ptininae

Ptininae was erected by Latreille (1802); its classification has varied considerably over its taxonomic history. Some of its species have previously been included as members of “Bruchidae” and Anobiidae (Papp 1962), or classified as an independent family, Ptinidae (such as Pic 1912a, Bellés 1994, Downie and Arnett 1996), as a subfamily within Anobiidae (such as Crowson 1981, Lawrence and Newton 1995, Philips 2002, Majka 2007a), as a tribe within the Bostrichidae (e.g., Ivie 1985), or as the family Ptinidae *s.l.*

(e.g., Fall 1905, Borowski and Zahradník 2007). Authors who have considered Ptininae to be a valid family, without the inclusion of the other anobiid subfamilies, typically divided its members into the subfamilies Gibbiinae and Ptininae, the latter being something of a catch-all for species not included in Gibbiinae (Philips 2000).

Recently, Philips (2000) conducted a phylogenetic analysis of New World Ptininae not only to determine its relationship to related subfamilies, but also to ascertain the placement of Ptinidae *s.l.* in higher classification, specifically as related to Bostrichidae. His analysis recovered Anobiidae and ptinines as sister taxa, suggesting both groups might be classified at the same hierarchical level. The Bostrichidae alone was found to be paraphyletic without the inclusion of Ptinidae *s.l.* Therefore, Philips (2000) suggested both Anobiidae *auctorum* and Ptininae might better be considered as subfamilies of Bostrichidae to maintain a monophyletic relationship, as had been previously suggested by Ivie (1985). Classification used in this work, however, follows that of Crowson (1981), Lawrence and Newton (1995), and Philips (2002), all of which retain Ptinidae *s.l.* as a valid family until further phylogenetic studies are completed.

Ptinines, also referred to as spider beetles, are so named because of their long legs, long filiform antennae, appearing as a fourth set of legs, and round or oval body shape causing the head to be hidden when viewed dorsally, giving the appearance of only two tagmata like spiders (Figs. 99–118). This subfamily, however, contains a wide variety of morphologies, including a number of myrmecophiles, such as *Coleoaethes* Philips and *Gnostus* Westwood, both considered to be basal within ptinine classification (Philips 2000). Numerous species are flightless in females only or in both sexes, a character thought to have evolved at least three times within the Ptininae (Philips 2000). Body forms of flightless individuals tend to be short and globular (e.g., *Gibbium* Scopoli and *Mezium* Curtis) (Figs. 99–102) as opposed to elongate and parallel sided (e.g., males of *Ptinus* Linnaeus) (Figs. 111, 112) (Philips 2000).

Elytral fusion is hypothesized to play an important role in water conservation in many flightless species (Benoit et al. 2005). *Mezium affine* Boieldieu and *Gibbium aequinoctiale* Boieldieu are said to show significant desiccation resistance, with *M. affine* surviving nearly 3 months with no food or free water and laboratory cultures of *G. aequinoctiale* persisting 7 years without water (Ark et al. 2005, Benoit et al. 2005). The ability to tolerate such xeric conditions and survive for long periods of time without food or water sets spider beetles apart from many other stored products insects (Benoit et al. 2005).

Ptinines are mainly scavengers on dry plant or animal matter, although some are known to be ant associates and one species is hypothesized to be a termitophile (Zayas 1988). Larvae may also be found as bird or mammal nest inquilines, as well as in nests of solitary bees, where they have been found to feed on pollen (Linsley and MacSwain 1942). Within structures, they tend to breed in damp areas such as crevices where food product has built up (VanRyckeghem 2004). In nature, ptinines may be found in caves, rotten wood, animal nests, or in damp or dry organic matter (Rees 2004). Other known food materials include grains or grain-based products, old rodent bait, animal feces, dead insects, feathers, bones, animal skin, almonds, cayenne pepper, beans, dried fruits, raisins, fish meal, and stored hops (VanRyckeghem 2004). As a result, this subfamily contains a number of economically important species in North America as well as worldwide, such as *Mezium americanum* (Castelnau), *M. affine*, *Gibbium psylloides* (Czenpinski), *G. aequinoctiale*, *Niptus hololeucus* (Faldermann), *Tipnus unicolor* (Piller & Mitterpacher), *Trigonogenius globulus* Solier, *Ptinus clavipes* Panzer, *Ptinus fur* (Linnaeus), *Ptinus villiger* (Reitter), *Pseudeurostus hilleri* (Reitter), and *Sphaericus gibboides* Boieldieu (Hinton 1941, Pellitteri 1977, Halstead 1986, Philips 2000), of which *M. affine*, *G. aequinoctiale*, *N. hololeucus*, *T. unicolor*, *P. hilleri*, and *S. gibboides* are thought to have been incidentally introduced into the New World (Philips 2000). Many ptinines are also known to be resistant to cold temperatures, allowing them to become problematic even in colder climates of northern North America (VanRyckeghem 2004).

Locating spider beetle infestations is sometimes difficult because many species are nocturnal (Rees 2004). Indoors, sticky traps may be used to monitor beetle populations (VanRyckeghem 2004), and traps made of cardboard or sacking materials in corners or crevices may also be used to locate spider beetles within structures (Rees 2004). Control efforts generally focus on removal of infested materials and thorough cleaning, which may involve locating and discarding old bags of feed and even rodent or other animal nests (VanRyckeghem 2004). Fumigation is used very rarely, and only in situations where the infestation is severe and cannot be controlled in any other manner (VanRyckeghem 2004).

Species recognition of many Ptininae has been obscured in the past in literature as well as in collections particularly with respect to species of *Mezium* and *Gibbium*, as well as various species of *Ptinus* (e.g., *Ptinus latro* Fabricius, *P. villiger*, *P. clavipes*, and *P. fur*). Species characterization is likely to be a problem for many species distributed through commerce (although also a problem with some native North American *Ptinus*) as isolated populations form, which may appear as the originating species, but begin to show variation as a result of genetic bottleneck, causing them to be considered two separate species (personal communication T.K. Philips). Some of these difficulties are discussed in the following generic diagnoses.

Ptininae contains 11 genera and 59 species in North America, north of Mexico (Philips 2002). Four genera and eight species are known from Wisconsin. Ptinines are easily distinguished from all other North American Ptinidae

by having the antennal insertions close together between the eyes, separated by a ridge less than or equal to the length of the antennal scape (Fig. 84) (extracted in part from Philips 2002). Special preparation of most Ptininae is unnecessary before mounting, although in certain cases, genitalia may need to be extracted and examined for positive identification.

Key to the Wisconsin Genera of Adult Ptininae

[Modified from Spilman 1991 and Philips 2002]

1 Elytra with appressed scales and/or rows of setae (Figs. 103–118); abdominal ventrites not significantly narrower than elytra when viewed ventrally (Fig. 71) **2**

1' Elytra smooth and shining with none to a few scattered erect setae (Figs. 99–102); abdominal ventrites 0.3–0.5X width of elytra when viewed ventrally (Fig. 72) **3**

2 (1) Each metathoracic trochanter long, its apex reaching the elytral margin when projected perpendicular to the length of the body (Fig. 70) ..... ***Pseudeurostus*** **(p. 10)**

2' Each metathoracic trochanter short, its apex not reaching the elytral margin (Fig. 71) ..... ***Ptinus*** **(p. 11)**

3 (1') Head and pronotum glabrous (Figs. 99, 100); abdomen with 4 ventrites ..... ***Gibbium*** **(p. 8)**

3' Head and pronotum densely setose (Figs. 101, 102); abdomen with 5 ventrites ..... ***Mezium*** **(p. 9)**

Genus *Gibbium* Scopoli

[Synonymy modified from Papp 1962]
Type Species: *Ptinus scotias* Fabricius 1781: 74.
Gibbium Scopoli 1777: 505.
Scotias Czenpinski 1778: 51.

Worldwide, three species of *Gibbium* are known to be associated with stored products: *G. aequinoctiale* Boeildieu, *Gibbium psylloides* (Czenpinski) and *Gibbium boieldieui* Levrat (Bellés and Halstead 1985). The former two species have frequently been confused in literature because the morphological characters separating them are obscure and difficult to interpret. Therefore, many publications and studies in North America regarding *G. aequinoctiale* are likely misidentified as *G. psylloides*. Bellés and Halstead (1985) clarified separation of these two species by examination of the male genitalia and concluded *G. psylloides* is largely Palaearctic, whereas *G. aequinoctiale* has the more cosmopolitan distribution, occurring mostly in warmer parts of the globe. *Gibbium aequinoctiale* is the only species likely to be found in North America, although *G. psylloides* is said to occur extremely rarely (Philips 2002).

Gibbium aequinoctiale Boieldieu

(Figs. 99, 100; Map 1)

[Synonymy modified from Borowski and Zahradník 2007]
Gibbium aequinoctiale Boieldieu 1854: 1xxxiv.
Gibbium chevrolatii Boieldieu 1854: 1xxxv.
Gibbium aegyptiacum Pic 1894: 203.
Gibbium einsteini Bellés 1980: 845.

Capsule Description **(Figs. 23, 99, 100)—Length:** 2.1–2.7 mm. **Width:** 1.4–1.8 mm. **Integument Color:** dorsal surface orangish to dark reddish, shining; maxillary and labial palpi yellowish-orange; head darker orange, reddish or appearing blackish; anterior pronotal margin similarly darker, posterior area of margin lined with darkly pigmented circular marks. **Body Form:** globular, spider-like, 1.5X longer than wide. **Vestiture:** antennae, legs, and ventral surface densely clothed in coarse, golden-yellowish pubescence obscuring surface sculpture; pronotal and elytral disks glabrous; head with sparse yellow setae above antennal insertions, longer and denser below. **Head:** terminal segment of each maxillary palpus elongate, apically pointed; antennae 11-segmented, nearly as long as body, filiform, separated on frons by a narrow, longitudinal ridge, terminal antennomere elongate, pointed; eyes very small, oval, flat, located just above antennal insertions; cranial surface striate laterally, smooth and sparsely punctate medially, between eyes. **Pronotum:** narrow; surface mostly glabrous, shining. **Elytra:** fused, concealing scutellum; disk globose, widely enclosing body, reducing size of ventral surface; surface glabrous, shining. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs. **Legs:** not received in ventral excavations; metathoracic coxae short; metathoracic trochanters very long, 0.6X length of the femora. **Abdomen:** with 4 ventrites (mostly obscured by pubescence); much narrower than elytra when viewed ventrally.

Diagnosis—*Gibbium aequinoctiale* is easily separated from all other North American Ptininae by the following combination of characters: antennal insertions close together between eyes; head, pronotum and elytra glabrous (Figs. 99,

100); abdomen with four ventrites; abdominal ventrites only about a third as wide as the elytra when viewed ventrally (Fig. 72) (extracted in part from Philips 2002). As previously mentioned, *G. aequinoctiale* is commonly confused with *G. psylloides* because the character historically used for their separation refers to the ambiguous prominence of the ridges beneath the eyes. The form of the median lobe of the male genitalia, as described by Bellés and Halstead (1985), is the most accurate means in separating these two species.

Natural History—*Gibbium* species are known to be detritivores, feeding on a variety of stored products (Ngamo et al. 2007). VanRyckeghem (2004) lists stored seeds, wheat, bran, stale bread, decaying animal and vegetable refuse, rat droppings, stored wheat, baby food, dog biscuits, cereals, woolens, towels, leather, paste, and tallow and opium cake as food material for *G. psylloides* from houses, hotels, warehouses, mills, granaries, bakeries, and latrines, although the species to which he is referring is likely *G. aequinoctiale*.

All Wisconsin specimens were collected from within structures, with none found outside an urban environment. Three individuals were taken by a pest control company from a milk drying plant, where they were found crawling on the floor in some food debris. A few were discovered in stored food in the University of Wisconsin (UW) Entomology Department. Another large infestation was found at a pet food warehouse, where the beetles were developing within a 100+-year-old brick wall in the center of the factory. The company had all other walls replaced, but could not remove the center, load-bearing wall. Pet food debris, flour, and powder had built up within the cracks of the wall, which is where the infestation is thought to have originated. Numerous spot treatments and monitoring using sticky traps for several years could not resolve the problem. Heat treatments and/or sealing the cracks in the old center wall were recommended as other potential remediation options.

From the latter infestation, approximately 15 live adults of *G. aequinoctiale* were collected on 26 April 2007 and maintained in a large fish tank with chicken feed (mostly grains) as a food source. As of January 2009, a few hundred individuals have emerged. No water source was ever provided, which did not appear to influence development, but did seem to affect behavior. *Gibbium aequinoctiale* adults are able to aestivate. This period of physical inactivity was also reported by Benoit et al. (2005), who suggested this behavior occurs as a result of water stress and fasting. The fused elytra and ability to aestivate significantly enhances survival in stored, old, dried materials (Benoit et al. 2005). Rees (2004) reported breeding conditions of *G. aequinoctiale* to be at 20–35 °C (68–95 °F) and 40–70% relative humidity, with the shortest development period occurring in 45 days at 33 °C (91.4 °F).

Phenology—Adult specimens of *G. aequinoctiale* were recorded from within structures in Wisconsin during mid-November, late December, mid-March, and late April.

Distribution—Because *G. aequinoctiale* is cosmopolitan, it may be found in stored products across North America (Bellés and Halstead 1985). Pellitteri and Boush (1983) recorded *G. psylloides* from Wisconsin, although these specimens were actually *G. aequinoctiale*. In this study, specimens were examined from four southern Wisconsin counties.

Wisconsin Records **(Map 1)**—The 40 specimens of *G. aequinoctiale* examined during this study were recorded from the following localities: **Crawford Co. (3):** Boscobel Milk Drying Plant; **Dane Co. (3):** UW Entomology Department; **Jefferson Co. (33):** Pet Food Warehouse; **Milwaukee Co. (1):** No other locality data.

Genus *Mezium* Curtis

[Synonymy modified from Borowski and Zahradník 2007]
Type Species: *Ptinus sulcatus* Fabricius 1781: 73.
Mezium Curtis 1828: 232.

Two species of *Mezium* occur in North America, north of Mexico: *M. affine* and *M. americanum*, the former being more commonly encountered (Philips 2002). Both species are, however, considered largely cosmopolitan (Papp 1962); they are generally found in stored food products. *Mezium* closely resembles *Gibbium* species, from which it is easily separated by the densely pubescent head and pronotum. The female, at least for *M. affine*, is similar in morphology to the male (Hinton 1941) and is therefore difficult to separate externally.

Mezium affine Boieldieu

(Figs. 101, 102; Map 2)

[Synonymy modified from Borowski and Zahradník 2007]
Mezium affine Boieldieu 1856: 674.
Mezium hirtipenne Reiche 1864: 241.

Capsule Description **(Figs. 101, 102)—Length:** 2.5–3.4 mm. **Width:** 1.4–1.8 mm. **Integument Color:** maxillary and labial palpi light yellowish to reddish-orange; antennae and appendages reddish-orange (note: only visible if setae is partially removed); elytra yellowish-orange to dark reddish or reddish-black. **Body Form:** globular, spider-like, 1.8X longer than wide. **Vestiture:** antennae, head, pronotum, legs, and ventral surface densely clothed in coarse, golden-yellowish scales and thick setae, obscuring surface sculpture; pronotum with two parallel tomentose rows of suberect to erect setae; elytra with a narrow tomentose basal collar, partially interrupted medially; long, erect setae sparsely distributed medially, posterial elytral collar; surface of metathoracic ventrite and abdomen completely concealed by yellowish scales and sparse erect setae. **Head:** terminal segment of each maxillary palpus elongate, apically pointed; antennae 11-segmented, nearly as long as body, filiform, narrowly separated on frons; terminal antennomere distinctly pointed apically; eyes small, convex, round, located above and lateral of antennal insertions; surface sculpture obscured by

pubescence. **Pronotum:** broad, nearly parallel-sided when viewed dorsally; disk dorsally and laterally adjacent to elytral disk; surface sculpture obscured by pubescence. **Elytra:** fused, concealing scutellum; disk globose, widely enclosing body, reducing size of ventral surface; surface glabrous, shining, except pubescent basal margin of disk. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs. **Legs:** not received in ventral excavations; metathoracic trochanter 0.3X length of the metathoracic femora. **Abdomen:** with 5 ventrites (difficult to count because of pubescence); much narrower than elytra when viewed ventrally.

Diagnosis—*Mezium affine* may be distinguished from all other North American Ptininae by a combination of the following characters: antennal insertions close together between eyes; head and pronotum densely setose; pronotum with basal collar entire on each side, only interrupted medially; pronotum with tomentum parallel on disk, not appearing convergent apically; abdomen with 5 ventrites; abdominal ventrites only about a third as wide as the elytra when viewed ventrally (e.g., Fig. 72) (extracted in part from Philips 2002). The form of the basal pronotal tomentose collar and shape of the pronotal disk will readily separate this species from the cosmopolitan *Mezium americanum* (Castelnau) (Spilman 1991).

Natural History—As with *G. aequinoctiale*, *M. affine* (known commonly as the shiny spider beetle or Northern spider beetle) is also known to survive extended periods without water (Benoit et al. 2005) and are therefore able to infest a variety of dry food products. Rees (2004) reported breeding conditions of *M. affine* to be at 20–33 °C (68–91.4 °F) and 30–70% relative humidity, with the shortest development period occurring in 62 days at 29–33 °C (84.2–91.4 °F). Howe (1953) found this species to be capable of a tenfold increase in population in three months. In Wisconsin, specimens were collected from inside the Milwaukee Public Museum library, "in store room," from "paper birch infested by *Agrilus anxius*," from a lab culture, and from inside a light fixture inside a home. It is likely that all records were from indoor collections, including the specimen recorded from paper birch, as it was collected during winter on 01 January 1941.

Phenology—Adults of *M. affine* were recorded from within Wisconsin structures nearly all months of the year.

Distribution—*Mezium affine* has a relatively cosmopolitan distribution and has been found from Europe, North Africa, southeastern Canada, and northeastern United States (Papp 1962).

In this study, specimens were examined from three Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 2)**—The 32 specimens of *M. affine* examined during this study were recorded from the following localities: **Crawford Co. (10):** Prairie Du Chien; **Dane Co. (19):** Madison; Madison Lab Culture; no other locality data; **Milwaukee Co. (3):** Milwaukee Public Museum Building.

Genus *Pseudeurostus* Heyden

[Synonymy modified from Borowski and Zahradník 2007]
Type Species: *Ptinus frigidus* Boieldieu 1854: 1xxxii.
Eurostus Mulsant & Rey 1868: 49 (not Dallas 1851 or Dumeril 1853).
Pseudeurostus Heyden 1906: 424.
Niptomimus Pic 1950: 10.
Niptinus Yang 1980: 26.

Aalbu and Andrews (1992), in agreement with Spilman (1975), suggested species of *Pseudeurostus* should be included under the genus *Niptus* because both species of *Pseudeurostus*, and all species of *Niptus* with the exception of *N. hololeucus*, have a strongly reduced fourth abdominal ventrite, which they considered a clear synapomorphy: "if *Pseudeurostus* is to be generically separated from *Niptus*, then *N. hololeucus*, the type species of *Niptus*, needs also to be separated from both groups, making it necessary for a new generic name for the eight 'wild' species of *Niptus*." In a more recent phylogenetic analysis (Philips 2000), *Niptus* + *Pseudeurostus* was recovered as a polyphyletic taxon containing three distinct monophyletic lineages, supporting the use of *Pseudeurostus* as a valid genus and "creation of a new genus for North and possibly South American *Niptus*."

Two species of *Pseudeurostus* occur in North America, *Pseudeurostus kelleri* Brown recorded from Utah to Montana, and *Pseudeurostus hilleri* (Reitter), from various locations across southern Canada (Brown 1959, Papp 1962, Philips 2002). The holotype and eight paratypes of *P. kelleri* were recorded "60 feet inside the entrance of Logan Cave" in Utah, while *P. hilleri* has been taken infrequently from inside warehouses (Brown 1959). To date, only *P. hilleri* has been found in Wisconsin.

Members of *Pseudeurostus* may be distinguished from all other Wisconsin Ptinidae by the following combination of characters: antennal insertions close together between the eyes; metathoracic trochanters long, exceeding the elytral margin when projected perpendicular to the body (Fig. 70); abdominal ventrites not significantly narrower than the elytra when viewed ventrally (extracted in part from Philips 2002).

Pseudeurostus hilleri (Reitter)

(Figs. 19, 70, 103, 104; Map 3)

[Synonymy modified from Brown 1959, Borowski and Zahradník 2007]
Niptus hilleri Reitter 1877: 378.
Eurostus sahoroensis Ohta 1930: 106.
Eurostus yezoensis Ohta 1930: 107.
Eurostus hilleri (Reitter); Howe 1940: 73.

Eurostus alienus Brown 1940: 116.
Niptus subelongatus Pic 1950: 10.
Pseudeurostus hilleri (Reitter); Philips 2000.

Capsule Description **(Figs. 19, 70, 103, 104)—Length:** 2.5–2.7 mm. **Width:** 1.3–1.6 mm. **Integument Color:** uniformly dark reddish-brown; maxillary and labial palpi yellowish-brown. **Body Form:** oval, 1.8X longer than wide. **Vestiture:** pubescence yellowish; head with fine, moderately dense, recumbent setae; pronotum with mostly bristling, suberect to decumbent, moderately sparse setae; elytral intervals with long, erect to recumbent setae; elytral strial setae reclinate to recumbent; ventral surface with vestiture of fine, moderately dense, recumbent setae. **Head:** eyes small, almond-shaped, widely separated on front; antennal insertions close together between eyes, separated by a narrow, longitudinal carina; antennae 11-segmented, filiform; frons medially with a short, longitudinal sulcus; surface densely granulate, punctate. **Pronotum:** widest diameter of pronotum 1.8X shorter than widest diameter of elytra; disk similar in shape to the elytra, constricted basally; lateral margins absent; surface densely granulate with large, shallow punctures. **Elytra:** fused, discal striae not to weakly impressed, surface shining, punctate, strial punctures deep, regularly spaced, separated by about 2X the diameter of a puncture; membranous metathoracic wings absent. **Metathoracic Ventrite:** narrow, not excavate for reception of mesothoracic legs; surface with large, crater-like punctures laterally and along entire anterior margin, granulate laterally, smooth and shining medially, between metathoracic coxae. **Legs:** not received in ventral excavations; prothoracic coxae narrowly separated by a prosternal process; mesothoracic coxae widely separated by a broad, quadrate mesosternal process; metathoracic coxae separated by 5X the separation of the mesothoracic coxae; metathoracic trochanters long, exceeding the elytral margin when projected perpendicular to the body. **Abdomen:** with 5 ventrites; 4th ventrite narrow, about 0.4X the width of 3rd ventrite; surface of ventrites 1–3 with large, crater-like punctures and smaller punctures; surface of ventrites 4–5 with smaller punctures only; abdomen with brush of long, erect setae arising from two, closely adjacent, large, shallow punctures on the apical region of the 5th ventrite (♀♀) or long, erect setae absent (♂♂).

Diagnosis—*Pseudeurostus hilleri* may be readily distinguished from the similar *Ptinus* species by having metathoracic trochanters long and exceeding the elytral margin when projected perpendicular to the body (Fig. 70). Males and females are easily separated by the long, erect setae on the fifth abdominal ventrite (Hinton 1941).

Natural History—*Pseudeurostus hilleri* is thought to have been introduced to both Canada and England (Papp 1962). Hinton (1941) reported this species from within warehouses and granaries, where it can become a pest of stored products, such as large quantities of cereals (Hatch 1961). This species has been reared on whole wheat flour and brewer's yeast and is said to feed on rat and mouse feces in England (Hatch 1961). Rees (2004) reported breeding conditions of *P. hilleri* to be at temperatures below 28 °C (82.4 °F) and 40–70% relative humidity, with the shortest development period from egg to adult to be 53 days at 20 °C (68 °F). The two Wisconsin specimens were collected from an animal food processing plant in a food trap set during a 1976 survey of stored products pests in southern Wisconsin feed mills (personal communication, Phil Pellitteri).

Phenology—Adults of *P. hilleri* were recorded in Wisconsin on August 9 and 17 of 1976.

Distribution—*Pseudeurostus hilleri*, described from Japan by Reitter (1877), was first recorded in North America from New England by Johnson (1921) (Papp 1962) and from inside warehouses in Canada in 1936 (Brown 1959). Within Canada, it is known from Quebec, New Brunswick, Ontario, Alberta, and British Columbia (Brown 1959, Philips 2002). This species is also said to be widely distributed in Scotland, where it is considered a pest of stored products, as well as from Great Britain (Hinton 1941). Pellitteri (1977) and Pellitteri and Boush (1983) encountered this species in Wisconsin during a survey of stored product insects found in southern Wisconsin feed mills, which provided the only specimens examined from the state.

Wisconsin Records **(Map 3)**—The two specimens of *P. hilleri* examined during this study were recorded from the following locality: **Dane Co. (2):** Madison.

Genus Ptinus Linnaeus

Type Species: *Cerambyx fur*
Linnaeus 1758: 393.
Ptinus Linnaeus 1767: 537.

Six subgenera are considered valid in *Ptinus* worldwide: *Bruchoptinus* Reitter, *Cyphoderes* Mulsant & Rey, *Gynopterus* Mulsant & Rey, *Pseudoptinus* Reitter, *Ptinus* Linnaeus, *Tectoptinus* Iablokoff-Khnzorian & Karapetyan (personal communication, T.K. Philips). Thirty-eight species of *Ptinus* are known to occur in North America, north of Mexico, as listed by Papp (1962), although the status of two nearly cosmopolitan species, *P. clavipes* and *Ptinus latro* Fabricius, is uncertain. In the catalogue of Palaearctic Coleoptera, Borowski and Zahradník (2007) considered *P. clavipes* to be a junior synonym of *P. latro*. Philips also questioned the validity of *P. latro*. However, the types of both species should be examined to determine their validity (personal communication Dr. T. Keith Philips).

Ptinus species are not commonly encountered except in stored products within an indoor environment. Outdoors, this species may be found in association with mammal and bird nests. Berlese samples of nests, especially old, abandon nests, and use of pitfall traps are often the most effective way to collect *Ptinus* specimens outside an urban setting.

Members of *Ptinus* can be distinguished from other North American Ptininae by having the metathoracic trochanters

short, with their apices not reaching the elytral margins, and the abdominal ventrites being subequal in width to the elytra when viewed ventrally (Fig. 71). Relative lengths and widths of both males and females of certain *Ptinus* species are provided where possible, as body size is strongly sexually dimorphic in a number of species. Other methods of separating males from females are also given for individual species if known.

Key to the Wisconsin Species of the Adult *Ptinus*

[Modified from Papp 1962 and Spilman 1991]

1 Elytra sub-parallel in males, oval in females, without black coloration; female apterous; 4th abdominal ventrite distinctly shorter than 5th (Fig. 71)..... **2**

1’ Elytra elongate in both sexes, largely black in areas (Figs. 105, 109); both sexes winged; 4th abdominal ventrite longer, subequal to slightly shorter than the 5th..... **3**

2 (1) Elytral interspaces with long, erect setae (Figs. 84, 115–118); longest erect elytral setae as long as or longer than last segment of metathoracic tarsus; elytra with many to at least a few recumbent scales..... ***Ptinus villiger*** **(Reitter) (p. 16)**

2’ Elytral interspaces and striae with setae equal or subequal in length; elytral setae usually shorter than last segment of metathoracic tarsus; recumbent elytral scales present or completely absent..... **3**

3 (2’) Pronotum usually with 2 dense rows of suberect yellowish setae, often joined posteriorly, forming a U or V (Figs. 111, 113); elytral intervals with erect setae subequal in length and usually uniformly angled to setae of strial punctures; subbasal and subapical patches of pale, whitish scales conspicuous, especially in female (Figs. 111–114)..... ***Ptinus fur*** **(Linnaeus) (p. 14)**

3’ Pronotum with erect or suberect, golden setae on either side of midline, at most forming 2 indistinct to moderately distinct rows, not forming a U or V; elytral intervals of erect setae usually more erect and slightly longer than those of strial punctures; subbasal and subapical spots of recumbent, whitish scales completely absent, represented in female by coarse, appressed, yellowish humeral setae (Figs. 107, 108)..... ***Ptinus clavipes*** **Panzer (p. 13)**

4 (1’) Each elytron with a broad, black area medially, widely interrupted at suture (Fig. 109)..... ***Ptinus concurrens*** **Fall (p. 14)**

4’ Broad, black area of the elytra, contiguous, not interrupted at suture (Fig. 105)..... ***Ptinus bimaculatus*** **Melsheimer (p. 12)**

Ptinus bimaculatus Melsheimer

(Figs. 20, 105, 106; Map 4)

[Synonymy modified from Fall 1905, Papp 1962]
Ptinus bimaculatus Melsheimer 1845: 308.
Ptinus frontalis Melsheimer 1845: 308.
Ptinus bimaculatus rubroapicatus Pic 1903: 183.
Ptinus bimacalatus Melsheimer; Papp 1962: 396 (*lapsus calami*).

Fall (1905) considered Melsheimer’s (1845) description of *P. frontalis* to be the male of *P. bimaculatus*. Similarly, Pic’s (1903) variation *rubroapicatus* was found by Papp (1962) to be the female of this species.

Capsule Description **(Figs. 20, 105, 106)—Length:** 2.1–2.5 mm. **Width:** 0.9–1.2 mm. **Integument Color:** maxillary and labial palpi light yellowish-brown; antennae and legs yellowish-brown to reddish-brown; head dark reddish-black; pronotum black, apical margin reddish-brown to black; elytra mostly black, humeri and apical 0.3 of elytral disk orange-brown to reddish-brown; ventral surface orange-brown, reddish-brown, or black. **Body Form:** elongate, length 2.2X width. **Vestiture:** yellowish pubescence of head and pronotum moderately sparse, erect to suberect; head usually with 2 small patches of white, recumbent, scale-like setae basally (note: may be hidden by pronotum); pronotal setae long, with few small patches of recumbent to decumbent white, scale-like setae; scutellum densely clothed

in white, scale-like setae; erect to suberect pubescence of elytra moderately sparse, yellowish to more or less blackish over the darker parts of elytral disk; each elytron with white, recumbent scale-like setae present in a large patch below humerus, partially extending into central, black area, forming a small round patch towards apical section of black elytral area; white scale-like setae forming a transverse band just below black elytral margin; ventral surface densely clothed in recumbent, yellowish to whitish setae. **Head:** terminal segment of each maxillary and labial palpus elongate, slightly rounded on lateral margins, apically pointed; antennae 11-segmented, filiform; antennae separated on frons by a narrow, longitudinal carina; surface densely granulate. **Pronotum:** disk rounded, distinctly constricted to form a basal collar; lateral margins absent; surface granulate-punctate, strongly tuberculate. **Elytra:** roughly parallel sided; humeri prominent; disk shallowly striate, with rows of punctures. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a parallel sided, moderately shallow, longitudinal sulcus; surface punctate, with both large and small punctures. **Legs:** not received in ventral excavations; metathoracic coxae short; prothoracic, mesothoracic and metathoracic femora club shaped, distinctly wider in apical half with inner margins partially grooved to receive the tibiae. **Abdomen:** with 5 ventrites; 4th ventrite subequal in length to the 5th.

Diagnosis—The black elytra, not interrupted at the elytral suture (Fig. 105), and the fourth abdominal ventrite subequal to the fifth will readily distinguish *P. bimaculatus* from all other Wisconsin *Ptinus* species.

Natural History—*Ptinus bimaculatus* is thought to breed in dry tree holes with accumulated dung material (personal communication T.K. Philips). In Wisconsin, all specimens of *P. bimaculatus* were collected in Lindgren funnel traps.

Phenology—Adult specimens of *P. bimaculatus* were recorded in Wisconsin from late May to mid-September.

Distribution—*Ptinus bimaculatus* is known from New York, Pennsylvania, Michigan, Mississippi, Missouri, Kansas, south into Florida, and west into Texas (Papp 1962). According to Fall (1905), this species is relatively rare in the northern States, although large numbers had been seen from Texas. In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 4)**—The six specimens of *P. bimaculatus* examined during this study were recorded from the following localities: **Adams Co. (3):** Quincy Bluff TNC; **Sauk Co. (3):** Hemlock Draw TNC.

Ptinus clavipes Panzer

(Figs. 107, 108; Map 5)

[Synonymy modified from Papp 1962, Borowski and Zahradník 2007]
Ptinus clavipes Panzer 1792: pls 24.
Ptinus testaceus Olivier 1790: 9 nec Thunberg 1784.
Ptinus brunneus Duftschmid 1825: 65.
Ptinus hirtellus Sturm 1837: 80.
Ptinus rufus Lucas 1846: 207.
Ptinus advena Wollaston 1854: 261.
Ptinus lucasii Boieldieu 1856: 636.

Ptinus testaceus Olivier is a junior primary homonym of *Ptinus testaceus* Thunberg, now considered a synonym of *Stegobium paniceum* Linnaeus, and is thus unavailable.

Capsule Description **(Figs. 107, 108)—Length:** 3.0–3.7 mm. **Width:** 1.4–1.7 mm (♂♂ and ♀♀). **Integument Color:** head, dorsal and ventral surfaces, antennae, and legs uniformly light yellowish-brown to dark reddish-brown; maxillary and labial palpi yellowish-brown. **Body Form:** elongate, subparallel, wider toward elytral apex (♂♂); ob-ovate (♀♀); average 2.1X longer than wide. **Vestiture:** pubescence yellowish; head, scutellum, and ventral surface with pale yellowish, moderately dense and mostly recumbent setae; head and ventral surface with few erect to suberect setae; pronotum with suberect to inclined setae usually forming 2 moderately distinct to indistinct longitudinal rows, each side of pronotal disk with circular patch of erect setae; suberect to decumbent setae of elytral intervals slightly longer than the mostly recumbent setae of strial punctures; elytral disk entirely without whitish, recumbent scales, humeral region with a dense to sparse patch of appressed, yellowish hairs to appressed hairs absent. **Head:** terminal segment of each maxillary and labial palpus elongate, slightly rounded on lateral margins, apically pointed; antennae 11-segmented, filiform; antennae separated on frons by a narrow, longitudinal carina; vertex with a fine, longitudinal sulcus medially; surface obscured by pubescence. **Pronotum:** disk mostly rounded, distinctly constricted to form a basal collar; lateral margins absent; surface strongly granulate-punctate, with raised tubercles. **Elytra:** humeri moderately distinct; disk shallowly striate, with rows of punctures. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; short, median longitudinal sulcus posteriorly on disk; surface with numerous large, elongate punctures. **Legs:** not received in ventral excavations; metathoracic coxae short; prothoracic, mesothoracic, and metathoracic femora clavate, distinctly wider in apical half with inner apical margins partially grooved to receive the tibiae. **Abdomen:** with 5 ventrites; 4th ventrite short, distinctly shorter than 5th.

Diagnosis—*Ptinus clavipes* may be separated from all other Wisconsin *Ptinus* by a combination of the following characters: pronotum with erect or anteriorly-directed, golden setae on either side of midline, at most forming indistinct rows, not forming a U or V; subbasal and subapical spots of whitish, recumbent scales completely absent; coarse,

appressed, yellowish setae present only in the humeral region or completely absent (Figs. 107, 108). *Ptinus clavipes* is most likely to be confused with the similar *P. fur*; both species have similar habits, appearance and microhabitats (VanRyckeghem 2004).

Natural History—*Ptinus clavipes*, also known as the brown spider beetle, is thought to be omnivorous and has been found to feed on books, skin, feathers, dried mushrooms, excrement of rats and other animals, powdered leaves of drugs such as senna and jaborandi, dried fruit, grains, and sugar (VanRyckeghem 2004). This species is said to require six to nine months to complete its life cycle, although larvae can remain in diapause for more than 10 months depending on conditions (Ebeling 1978). Wisconsin specimens of *P. clavipes* examined during this study had no additional bionomics data.

Phenology—Those adult specimens of *P. clavipes* with label data were recorded in Wisconsin during late March.

Distribution—*Ptinus clavipes* is described as nearly cosmopolitan, occurring in North America from New York, New Jersey, District of Columbia, North Carolina, Georgia, Ohio, Wisconsin, Indiana, Illinois, Missouri, Iowa, Kansas, New Mexico, Arizona, and California (Papp 1962). Pellitteri (1977) and Pellitteri and Boush (1983) reported this species in Wisconsin during surveys of stored product insects in southern Wisconsin feed mills. During this study, specimens were recorded from two Wisconsin counties.

***Wisconsin Records* (Map 5)**—The 10 specimens of *P. clavipes* examined during this study were recorded from the following localities: **State only (2)**; **Milwaukee Co. (4):** Milwaukee; **Rock Co. (4):** Janesville.

Ptinus concurrens Fall

(Figs. 109, 110; Map 6)

Ptinus concurrens Fall 1905: 125.

***Capsule Description* (Figs. 109, 110)—Length:** 1.9–2.7 mm. **Width:** 0.9–1.3 mm. **Integument Color:** maxillary and labial palpi light yellowish-brown; antennae and legs yellowish-brown to reddish-brown; head dark reddish-black; pronotum black; elytra mostly reddish-brown; middle of elytral disk to lateral margin black, broadly interrupted at elytral suture; apical region of elytra reddish to blackish; ventral surface reddish-black to black. **Body Form:** elongate, length 2.1X width. **Vestiture:** yellowish to brownish pubescence of head and pronotum long, thick, moderately dense, erect to suberect; head usually with 2 small patches of white to whitish-yellow, recumbent setae basally (note: may be hidden by pronotum); pronotal setae long, clumped in part, with few small patches of recumbent white, scale-like setae; scutellum and most of the reddish areas of elytra densely clothed in white setae, some patches extending into black areas of elytra; erect to suberect elytral pubescence moderately sparse, yellowish to whitish-yellow over reddish areas of elytral disk, mostly black over blackish areas of elytral disk; ventral surface densely clothed in recumbent, yellowish to whitish setae, partially obscuring surface sculpture. **Head:** terminal segment of each maxillary and labial palpus elongate slightly rounded on lateral margins, distinctly pointed apically; antennae 11-segmented, filiform; antennae separated on frons by a narrow, longitudinal carina; surface tuberculate. **Pronotum:** disk rounded, distinctly constricted to form a basal collar; lateral margins absent; surface strongly tuberculate. **Elytra:** roughly parallel sided; humeri prominent; disk shallowly striate, with rows of punctures. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a long, parallel sided, moderately shallow, longitudinal sulcus; surface punctate, with both large and small punctures. **Legs:** not received in ventral excavations; metathoracic coxae short; prothoracic, mesothoracic and metathoracic femora clavate, distinctly wider in apical half with inner margins partially grooved to receive the tibiae. **Abdomen:** with 5 ventrites; 4th ventrite subequal to slightly shorter than the 5th.

Diagnosis—The black elytral patches, broadly interrupted at the elytral suture (Fig. 109), and the fourth abdominal ventrite subequal to or slightly shorter than the fifth will readily separate *P. concurrens* from all other Wisconsin *Ptinus*.

Natural History—In Wisconsin, two specimens were collected at flight intercept traps in sandy oak barrens, one in a Lindgren funnel trap, and one in an unbaited Townes–Malaise trap in a dry lime prairie.

Phenology—Adult specimens of *P. concurrens* were recorded in Wisconsin from early May to early June and late September, early October.

Distribution—*Ptinus concurrens* was described by Fall (1905) from specimens collected in northern Illinois and Arkansas. In this study, specimens were examined from four Wisconsin counties; they constitute a **NEW STATE RECORD** and new northern range extension as Papp (1962) considered this species to be restricted to the above localities.

***Wisconsin Records* (Map 6)**—The four specimens of *P. concurrens* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Grant Co. (1):** Dewey Heights Prairie SNA–Nelson Dewey State Park; **Monroe Co. (1):** Fort McCoy SNA; **Sauk Co. (1):** Spring Green Preserve SNA.

Ptinus fur (Linnaeus)

(Figs. 21, 22, 71, 111–114; Map 7)

[Synonymy modified from Borowski and Zahradník 2007]
Cerambyx fur Linnaeus 1758: 393.
Ptinus rapax DeGeer 1774: 231.
Bruchus furunculus Müller 1776: 57.

Ptinus pulex Goeze 1776: 90.
Ptinus germanus Goeze 1777: 159.
Ptinus striatus Fabricius 1787: 40.
Ptinus longipes Rossi 1792: 20.
Ptinus humeralis Say 1835: 165.
Ptinus fur (Linnaeus); Linnaeus 1767: 566.

Capsule Description **(Figs. 21, 22, 71, 111–114)—Length:** 2.1–3.4 (♂♂); 2.7–4.0 (♀♀) mm. **Width:** 0.9–1.4 (♂♂); 1.2–1.8 (♀♀) mm. **Integument Color:** head, dorsal and ventral surfaces uniformly light yellowish-brown, reddish-brown, or reddish-black; maxillary and labial palpi yellowish-brown; antennae and legs similar in color to dorsal surface. **Body Form:** elongate, subparallel, wider toward elytral apex, 2.4X longer than wide (♂♂); ovate-oblong, 2.2X longer than wide (♀♀). **Vestiture:** pubescence yellowish; head, scutellum, and ventral surface with pale yellowish, moderately dense and mostly recumbent setae; head and ventral surface with few erect to suberect setae; pronotum with suberect to inclined setae usually posteriorly joined, forming a U or V, each side of pronotal disk with circular patch of erect setae; suberect to decumbent setae of elytral intervals subequal in length to mostly decumbent setae of strial punctures; appressed, scale-like, white setae moderately sparse to moderately dense, especially on female, forming two interrupted bands on basal and apical half of the elytra; 5th abdominal ventrite with moderately sparse, inclined setae. **Head:** terminal segment of each maxillary and labial palpus elongate, slightly rounded on lateral margins, apically pointed; antennae 11-segmented, filiform, 3rd antennomere nearly 2X longer than 2nd (♂♂) or 3rd antennomere slightly longer than or subequal to 2nd antennomere (♀♀); antennae separated on frons by a narrow, longitudinal carina; vertex with a fine, longitudinal sulcus medially; surface rugose-granulate. **Pronotum:** disk mostly rounded, distinctly constricted to form a basal collar; lateral margins absent; surface strongly granulate-punctate, with raised tubercles. **Elytra:** humeri distinct; disk shallowly striate, with rows of punctures. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; short, median longitudinal sulcus posteriorly on disk, slightly less obvious in females; surface with numerous large, elongate punctures. **Legs:** not received in ventral excavations; metathoracic coxae short; prothoracic, mesothoracic, and metathoracic femora clavate, distinctly wider in apical half with inner apical margins partially grooved to receive the tibiae. **Abdomen:** with 5 ventrites; 4th ventrite short, distinctly shorter than 5th.

Diagnosis—*Ptinus fur* may be separated from all other Wisconsin *Ptinus* by a combination of the following characters: dense, suberect to recumbent setae of pronotum generally forming a U or V (Figs. 111, 113); length of elytral interval setae subequal to those of strial punctures; appressed, white, elytral scales present; fourth abdominal ventrite shorter than the fifth (Fig. 71). Many specimens of *P. fur* possess the characteristic U or V shape on the pronotum, formed by two dense rows of setation, however, this character alone is not reliable for species determinations as it does not appear to be consistent. *Ptinus fur* is separated from the similar *P. clavipes* by the presence of at least some appressed, white scales on the elytra (Figs. 111–114), which are completely lacking in the latter species.

Natural History—Hatch (1961) stated *P. fur*, also known as the white-marked spider beetle, was introduced and common, found in houses, grain elevators, warehouses, sacked grain, and in cones of conifers. This species has also been reported as a pest in warehouses, granaries, museums, and libraries, feeding on feathers, animal skins, stuffed birds, herbarium specimens, stored seeds, ginger, cacao, dates, paprika, rye bread, flour, stored cereals, cottonseed in jute bags and insect specimens (VanRyckeghem 2004).

The majority of *P. fur* specimens from Wisconsin were hand collected (64%), with a large number of specimens collected crawling around in an old, unused barn, two were from a "jar of dead insects," one from a "dog's food dish," and six from a dog's water dish, near food, one from "in home," and one from a cement basement of a malt house that had grain dust present. Specimens were also collected from Lindgren funnel traps, one of which was baited with ethanol and alpha pinene, as well as one specimen collected in a "sand pit." An abandon bird's nest on an old, unheated building covered in spider webs and dead insects (Berlese sample) in Dane Co. also provided numerous specimens (17%).

Phenology—Adults of *P. fur* may be found during many months of the year, with the majority of Wisconsin specimens collected from January to June. A large number of adult specimens were also collected on the outside of the non-heated structure mentioned previously during mid- to late November and a few at this location during early January. A similar observation was noted by VanRyckeghem (2004), who stated that adults may be found on the walls of cellars and unheated structures during mid-winter months.

Distribution—The distribution of *P. fur* is simply described as cosmopolitan, commonly found infesting homes, granaries, warehouses, and museums (Papp 1962). Fall (1905) examined this species mostly from northeastern North America from Ontario, south into Massachusetts, Pennsylvania, and west into Illinois and Ohio as well as from California and Alaska. Pellitteri (1977) and Pellitteri and Boush (1983) encountered this species in Wisconsin during surveys of stored product insects in southern Wisconsin feed mills. During this study, specimens were recorded from 13 counties throughout Wisconsin.

Wisconsin Records **(Map 7)**—The 64 specimens of *P. fur* examined during this study were recorded from the following localities: **State only (2)**; **Dane Co. (42):** Private Property–Town of Blue Mounds; Sun Prairie; UW Lakeshore Nature Preserve–Picnic Point; **Dodge Co. (1):** Beaver Dam; **Door Co. (2):** No other locality data; **Jefferson Co.**

(1): Waterloo; **Manitowoc Co. (6):** Cleveland; **Marinette Co. (1):** Middle Inlet: E Hwy 141–E Trellis Lane; **Milwaukee Co. (2):** Milwaukee; **Portage Co. (1):** Stevens Point; **Sauk Co. (1):** Hemlock Draw TNC; **Shawano Co. (1):** 5 mi. S Bonduel; **Walworth Co. (1):** 1 mi. S Darien; **Waupaca Co. (1):** Waupaca; **Winnebago Co. (2):** Oshkosh.

Ptinus villiger (Reitter)

(Figs. 84, 115–118; Map 8)

[Synonymy modified from Borowski and Zahradník 2007]
Bruchus villiger Reitter 1884: 311.
Ptinus villiger (Reitter); Seidl 1891: 545.
Ptinus balticus Iablokoff-Khnzorian and Karapetyan 1991: 48.

Capsule Description **(Figs. 84, 115–118)—Length:** 2.2–3.1 (♂♂); 2.8–3.6 (♀♀) mm. **Width:** 1.0–1.2 (♂♂); 1.3–1.7 (♀♀) mm. **Integument Color:** head, dorsal and ventral surfaces uniformly light yellowish-brown, reddish-brown, or reddish-black; pronotum and elytral apex sometimes darker than remainder of dorsal surface; maxillary and labial palpi yellowish-brown; antennae and legs yellowish-brown to reddish-brown. **Body Form:** elongate, subparallel, 2.4X longer than wide (♂♂); ovate-oblong, 2.2X longer than wide (♀♀). **Vestiture:** pubescence yellowish; head, scutellum, and ventral surface with pale yellowish, moderately dense and mostly recumbent setae; pronotum with erect to inclinate setae forming indistinct parallel rows on either side of midline, each side of pronotal disk with circular patch of erect setae basally; long, erect hairs of elytral intervals alternating with decumbent to recumbent setae of strial punctures; appressed, scale-like, white setae sparse to moderately dense, forming two strongly interrupted bands on basal and apical halfs of the elytra; 5th abdominal ventrite with sparse, inclinate setae. **Head:** terminal maxillary palpomeres elongate, slightly rounded on lateral margins, apically pointed, terminal segment of each labial palpus similar; antennae 11-segmented, filiform, 3rd antennomere nearly 2X longer than 2nd (♂♂), or 2nd and 3rd antennomeres subequal in length (♀♀); antennae separated on frons by a narrow, longitudinal carina; surface granulate-punctate. **Pronotum:** disk rounded, distinctly constricted to form a collar basally; lateral margins absent; surface strongly granulate-punctate, with raised tubercles. **Elytra:** humeri distinct; disk shallowly striate, with rows of punctures. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; short, median longitudinal sulcus posteriorly on disk; surface with numerous large, elongate punctures. **Legs:** not received in ventral excavations; metathoracic coxae short; prothoracic, mesothoracic, and metathoracic femora clavate, distinctly wider on apical half with inner margins partially grooved to receive the tibiae. **Abdomen:** with 5 ventrites; 4th ventrite short, distinctly shorter than 5th.

Diagnosis—*Ptinus villiger* may be separated from other members of Wisconsin *Ptinus* by a combination of the following characters: long, erect setae of elytral intervals as long as or longer than the terminal segment of the metathoracic tarsus (Fig. 84); elytra with appressed, white scales present on the elytra (Figs. 115–118); fourth abdominal ventrite distinctly shorter than the fifth. The erect elytral setae will readily separate this species from both males and females of *P. fur*. Elytral setation of *P. villiger* may resemble that of *P. clavipes*, from which it may be distinguished by the presence of at least a few, but sometimes many appressed, white elytral scales.

Natural History—*Ptinus villiger*, also known as the hairy spider beetle (VanRyckeghem 2004), has been considered a serious pest of cereal products in Canada since 1915 (Hatch 1961) and has been known to infest flour, farina, corn meal, and wheat (VanRyckeghem 2004). Adults emerge in the spring, after which females lay eggs on or in food debris, with larvae pupating within three months (VanRyckeghem 2004). Control of *P. villiger* in warehouses may involve application of insecticides to floors and walls to kill insects before they are able to reach stored food products (VanRyckeghem 2004). Radinovsky (1957) examined the development of *P. villiger* given different larval food materials and maintained at various temperatures and relative humidity levels, and found temperature to have the most significant effect on development followed by food materials.

In Wisconsin, 38% of specimens were hand collected, the other 62% had no other collection data. Hand-collected specimens were from bags of old feed stored in a bin in an old, unused barn, on the window of the barn, or crawling on the barn wall. Four specimens were found in a "food packet," and one from inside a house.

Phenology—Adult specimens of *P. villiger* were recorded in Wisconsin from within heated/unheated structures during mid-April to early June. Other records, which do not specify if the specimen was found indoors or outdoors, were recorded from mid-March, mid- to late April, late June, late July, early September, and early November.

Distribution—In North America *P. villiger* is found in the northern parts of the United States and the southern parts of Canada, from Newfoundland to British Columbia (Papp 1962), south into Washington, Nebraska, and Pennsylvania (Fall 1905). This species is also thought to be common in Europe, east into Asia (Papp 1962). Fall (1905) recorded this species from Bayfield, Wisconsin, while Pellitteri (1977) and Pellitteri and Boush (1983) encountered it in Wisconsin during a survey of stored product insects in southern Wisconsin feed mills. During this study, specimens were recorded from seven Wisconsin counties.

Wisconsin Records **(Map 8)**—The 45 specimens of *P. villiger* examined during this study were recorded from the following localities: **State only (4)**; **Dane Co. (13):** Oregon; Private Property–town of Blue Mounds; **Dodge Co. (13):** Beaver Dam; **Eau Claire Co. (4):** Katt Rd– Fall

Creek; **Milwaukee Co. (1):** Milwaukee; **Shawano Co. (1):** 8 mi. SW Shawano; **Walworth Co. (4):** Waits Rest. (Restaurant?); **Winnebago Co. (5):** 1 mi. W Oshkosh; 2 mi. NW Oshkosh; 2 mi. W Oshkosh; 3 mi. N Oshkosh; Oshkosh.

Subfamily Eucradinae

Eucradinae has undergone numerous nomenclatural modifications since its inception. LeConte (1861) is credited with the subfamily name for placing the genus *Eucrada* in the tribe Eucradini under the subfamily Ptininae. LeConte and Horn had both included *Hedobia* and *Eucrada* as members of the Ptininae in their classification based on the proximate insertion of the antennae on the head (Fall 1905). Fall (1905) recognized that *Hedobia* and *Eucrada* deviated from typical ptinine morphology based on the palpal formation, apically bidentate mandibles, absence of a prosternal process separating the prothoracic coxae, non-clavate femora, stout tarsi with broadly triangular terminal tarsomere, metatarsus with with divaricate claws, and subequal abdominal segments. Therefore, he removed these genera from Ptininae and placed them in Anobiinae (Fall 1905). Subsequent authors included the members of this subfamily in the Hedobiinae, until this name was synonomyzed as a junior synonym of Eucradinae, which has priority if the genus *Eucrada* is included (Lawrence and Newton 1995). Currently, North American Eucradinae north of Mexico includes three genera and six species (Philips 2002). *Eucrada humeralis* (Melsheimer) is the only species found in Wisconsin as well as the sole representative of the subfamily for the state.

Eucradines closely approach the anatomy of certain Ptininae and are therefore thought to have evolved from a common ancestor (Crowson 1967, White 1971a). This is supported by the position of the antennal insertion between the eyes, the absence of prothoracic lateral margins (Figs. 120–122), and the elongate-cylindrical body form (White 1971a). The filiform antennae in both sexes in *Hedobia* also support this hypothesis (Fall 1905). In a recent study examining the phylogenetic relationships in Ptinidae *s.l.*, Philips (2000) evaluated the relationship between Ptininae and Eucradinae, proposing the Ptininae to be a sister taxon either to members of Eucradinae or to all other Ptinidae *auctorum*. His study also supports the possibility of Eucradinae as a sister group to the remaining Ptinidae *s.l.* subfamilies (Philips 2000).

Genera within Eucradinae are wood borers, with larvae known to tunnel between the bark and wood of mainly dead hardwood trees (Rozen 1957, White 1962a, 1982). *Quercus* species are most commonly listed as larval food (White 1982).

Species of Eucradinae can be distinguished from all other Ptinidae by a combination of the following characters: front of head without narrow ridge over base of antennae; pronotum laterally rounded, without even a partial margin (Figs. 120–122); metathoracic coxae not distinctly grooved for reception of femora (extracted in part from Philips 2002). Preparation of members of this subfamily for identification is rather straightforward, as they are not contractile and generally die with the necessary structures exposed.

Genus *Eucrada* LeConte

[Synonymy modified from Pic 1912a, White 1974, 1982]

Type Species: *Hedobia humeralis* Melsheimer 1845: 310 (by monotypy).
Eucrada LeConte 1861: 202.
Crichtonia Abdullah 1967: 26 (a fossil genus).
In North America, north of Mexico, *Eucrada* is comprised of two species: *Eucrada humeralis* (Melsheimer) and *Eucrada robusta* Van Dyke. *Eucrada humeralis* is widely distributed throughout much of the Eastern United States and is the only species found in Wisconsin.

Males and females of *Eucrada* may be easily separated based on their sexually dimorphic antennae. The males have pectinate antennae (Figs. 24, 119, 120), whereas the females have rather strongly serrate antennae (Figs. 25, 121, 122).

Eucrada humeralis (Melsheimer)

(Figs. 24, 25, 119–122; Map 9)

[Synonymy modified from White 1982]
Hedobia humeralis Melsheimer 1845: 310.
Eucrada humeralis (Melsheimer); LeConte 1861: 452.

This species was first described as *Hedobia humeralis*, but was later moved to *Eucrada* based on the sexually dimorphic antennal forms, which are not seen in *Hedobia* (LeConte 1861, Fall 1905).

Capsule Description **(Figs. 24, 25, 119–122)—Length:** 3.9–5.5 mm. **Width:** 1.5–2.2 mm. **Integument Color:** mostly dull black; mouthparts reddish-brown; antennae mainly dull black; head reddish-black; disk of pronotum orange except basal and apical margins; elytra dull black with elytral humeri orange; legs reddish-black; abdomen dull black. **Body Form:** robust, moderately elongate, 2.5X longer than wide. **Vestiture:** head with dense, more or less recumbent, light grey pubescence; pronotum densely covered with orange pubescence which becomes lighter laterally; elytra with strial margins conspicuously pubescent, humeral interval a little more conspicuously cinereously pubescent, appearing as a narrow longitudinal stripe; scutellum and abdomen densely clothed with a light grey pubescence. **Head:** antennae 11-segmented, pectinate (♂♂), strongly serrate (♀♀); eyes small, separated by nearly 3X their vertical diameter, highly convex, prominent, visible dorsally. **Pronotum:** laterally rounded, without even a partial margin at base; disk obtusely elevated; surface granulate. **Elytra:** rough; rows of punctures coarse and somewhat irregular, especially toward the suture; intervals narrow, feebly convex. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; with a narrow and shallow longitudinal sulcus posteriorly. **Legs:** metathoracic coxae not grooved

for reception of the femora; tibiae terminating in two spurs, those of the female comparable in size, in the male, the inner spur is enlarged and the smaller outer spur is in close approximation. **Abdomen:** with 5 ventrites.

Diagnosis—*Eucrada humeralis* may be separated from all other Wisconsin Ptinidae by the sexually dimorphic serrate (female) (Figs. 25, 121, 122) or pectinate (male) (Figs. 24, 119, 120) antennae, the pronotum and humeral region with orange coloration, and the dull black elytra (Figs. 119–122). The absence of lateral pronotal margins (Figs. 120–122) is also diagnostic for the genus and species in Wisconsin.

Natural History—Larvae bore in the bark or between bark and wood of dead or dying oak and beech trees (Champlain and Knull 1922, White 1962a, White 1982). Adults can also be found on the trunks or branches of these trees (White 1962a). Rozen (1957) published detailed biological notes on the life history of *E. humeralis*, in which he commented on the coexistence of pupae and mature and early stage larvae in one tree, suggesting that there may not be a definitive adult emergence period. Larval burrows averaged about four inches in length divided between the bark and the wood (Rozen 1957). Because the larvae were not found to burrow deeper into the wood, Rozen (1957) concluded this species would most likely not be of economic importance. The pupal casing differs from that of most other Ptinidae in that it is constructed of "threadlike strands of silk, presumably from anal secretions," rather than mainly from debris and fecal material (Rozen 1957). This is similar to the silken cocoon constructed by members of the subfamily Ptininae; however, debris and particles of food generally adhere to the outer surface of the casing (Ebeling 1978). A complete larval description is provided by Böving (1954).

During this survey larvae of *E. humeralis* were collected from beneath the bark of a dead standing *Quercus rubra* tree at the LWRSGA Avoca Unit in Iowa County, Wisconsin, on 30 April 2007. The tree maintained only half its bark, which was the only side shown to contain the beetles. Larvae were collected and kept in a small petri dish packed tightly with pieces of bark from the originating tree. Adult emergence was noted on the 14 May 2007. In Wisconsin, adults of *E. humeralis* were most frequently recovered from Lindgren funnel traps and flight intercept traps. One specimen was collected crawling on the trunk of a live tree in an area of both hardwoods and softwoods.

Phenology—Adult specimens of *E. humeralis* were recorded in Wisconsin from mid-May to late June.

Distribution—*Eucrada humeralis* has been recorded from much of the eastern United States from South Carolina, north into Kentucky, Ohio, Pennsylvania, Michigan and into Canada (Fall 1905, White 1982). In this study, specimens were examined from seven Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

***Wisconsin Records* (Map 9)**—The 36 specimens of *E. humeralis* examined during this study were recorded from the following localities: **Adams Co. (22):** Quincy Bluff TNC; **Columbia Co. (4):** Rocky Run SNA; **Iowa Co. (1):** LWRSGA Avoca Unit; **Jackson Co. (2):** Black River State Forest–Castle Mound Pine Forest; **Menominee Co. (1):** Private Property–Legend Lake–Spirit Island Road; **Monroe Co. (5):** Fort McCoy SNA; **Wood Co. (1):** Wood County State Wildlife Area.

Subfamily Ernobiinae

Pic (1912a) erected Ernobiinae for genera previously included in Fall's (1905) Dryophilini with the exception of *Paralobium* Fall. White (1962a, 1971a) maintained Fall's classification, elevating the tribe to subfamilial status. Later, White (1974) adopted a classification more closely resembling that of Pic (1912a), with 14 genera included in Ernobiinae, including all those assigned by Pic (1912a).

Larvae of Ernobiinae bore beneath bark or into the wood of dead or dying softwoods and hardwoods, and therefore may damage woodwork or structural wood in buildings (White 1982). Some species bore into cones of conifers (Ruckes 1957). *Ernobius bicolor* White was found to feed on old cones that remained on black spruce trees (*Picea mariana* (Miller)), thereby interfering with the tree's ability to reestablish especially after harvest or fire (White 1983a). Other larval food materials include weed stems, galls, dried flowers, and twigs of avocado (White 1982).

North American Ernobiinae north of Mexico contains eight genera and 50 species (Philips 2002), including *Ernobius youngi* Arango described in 2009 from the results of this study. *Xestobium* Motschulsky, *Utobium* Fall, and *Ernobius* Thomson may occur in Wisconsin, although during the course of this study only members of *Ernobius* were collected from the state. *Xestobium rufovillosum* (De Geer), known as the true "Deathwatch beetle," has been recorded from Illinois, and is therefore included in the key to genera due to its relatively cosmopolitan distribution. Likewise, *Utobium elegans* (Horn) may also be found in Wisconsin as it is generally distributed throughout much of the northern United States. The key presented below closely resembles that of Philips (2002) as adult specimens of *Xestobium* and *Utobium* were not obtained for examination during this survey.

Species of Ernobiinae are distinguished from all other Wisconsin Ptinidae by a combination of the following characters: elongate body shape; prothoracic ventrite inflated, causing the ventral surface to appear convex or flat (Fig. 87); legs not received in thoracic cavities (Fall 1905, White 1971a, Philips 2002). Curation of specimens of Ernobiinae prior to identification is generally unnecessary; however, the antennae should be brought out so as to be able to compare the lengths of the various antennal segments, and the prothoracic legs should be pulled away from the body, exposing the prothoracic coxae.

Key to the Wisconsin Genera of Adult Ernobiinae

[Modified from Philips 2002]

1 Prothoracic coxae, prominent, touching to narrowly separate..... **2**

1' Prothoracic coxae, less prominent, separated by a prosternal process **3**

2 (1) Prothoracic ventrite anterad coxae about 0.6X coxal diameter, prothoracic coxae very narrowly separated..... ***Xestobium* (in part)**

2' Prothoracic ventrite anterad coxae 0.3–0.5X coxal diameter, prothoracic coxae touching..... ***Ernobius* (p. 19)**

3 (1') Antennal segments 4–8 subequal in length; pubescence of dorsal surface predominantly golden, dull yellowish or whitish..... ***Xestobium* (in part)**

3' Antennal segments 4–8 unequal, segments 5 and 7 broader and distinctly longer than others; pubescence white, brown, black, and (frequently) orange..... ***Utobium***

Genus *Ernobius* Thomson

[Synonymy modified from White 1962a, 1974, 1982, Philips 2002]

Type Species: *Dermestes mollis* Linnaeus 1758: 355.
Ernobius Thomson 1859: 88.
Conophoribium Chevrolat 1861: 391.
Philoxylon LeConte 1861: 205.
Dryophilus LeConte 1861: 205.
Liozoum Mulsant and Rey 1863: 30, 31, 92.
Conopheribium Chevrolat; Chevrolat 1864: xvii (l*apsus calami*).
Liozum Mulsant and Rey; Mulsant and Rey 1864: 145 (l*apsus calami*).
Conoploribium Chevrolat; Pic 1912a: 80 (l*apsus calami*).
Liozuom Mulsant and Rey; Gardiner 1953: 3 (l*apsus calami*).

Fall (1905) listed 22 species in his key to *Ernobius*, 12 of which were newly described in his revision. Included in *Ernobius* were members of *Episernus*, a genus Fall synonomyzed as "doubtfully distinct from *Ernobius*." White (1969c) re-established *Episernus* based on the following characters: antennae 10-segmented, pronotum with distinct lateral margins only basally, prothoracic ventrite anterad the coxae 0.5–0.75X coxal diameter, and first tarsomere of metathoracic legs as long as the following three segments combined. *Episernus* contains two mostly western North American species, *Episernus champlaini* (Fisher) and *Episernus trapzoideus* (Fall), both of which were described in *Ernobius*.

Currently, 31 species of *Ernobius* are known from North America as listed by White (1982), with the exception of *Ernobius bicolor* White, which was described later from specimens collected throughout the island of Newfoundland (White 1983a, Philips 2002) and *E. youngi* described as a result of the present survey (Arango 2009). Three species of *Ernobius* have been collected in Wisconsin to date, although six species may occur and are therefore included in the key.

Specimens of *Ernobius* are uncommon in collections, and when found they are generally collected under bark or in conifer cones or at UV light (White 1982). Relatively few species of *Ernobius* in North America are considered economically significant on pine materials, although a few have been shown to be problematic. As mentioned above, *E. bicolor* affects the ability of *P. mariana* to re-establish (Schooley 1983, White 1983a). *Ernobius mollis*, also known as the "pine bark anobiid" or "pine knot borer," is a common European species thought to have been introduced into the eastern United States (Fall 1905, White 1962a). This species, although not considered a serious pest, can damage cut or fallen pine trees with their bark intact, thereby reducing the quality of lumber produced (Craighead 1950). In the United States, *E. mollis* has occasionally been found to damage pine and spruce flooring (Craighead 1950). *Ernobius punctulatus* (LeConte), known from western North America, has been found to destroy or weaken shoots of young pines (Ebeling 1978).

Ernobius species can be distinguished from all other Wisconsin Ptinidae by the following combination of characters: antennae 11-segmented with an elongate, three-segmented club (Fig. 26), lateral margins of pronotum complete, prothoracic ventrite convex to flat, not excavate (Fig. 87), prothoracic coxae contiguous and elytra without striae (Fig. 123–128) (extracted in part from Philips 2002). The antennal club and structure of the sixth abdominal ventrite are sexually dimorphic in *Ernobius*. On average, males have the last three antennal segments slightly more elongate than females, in addition to having the last abdominal ventrite emarginate, although this is not true for all *Ernobius* species (Fall 1905).

This genus is in need of major revision as no comprehensive key to North American species exists. Recent work on *Ernobius* includes a revision of the Iberian species (Español 1992) and a revision of the Palearctic species (Johnson 1975, Novoa and Baselga 2000). Fall's (1905) revision

represents the last major publication on North American *Ernobius* and is not without problems. Most couplets refer only to the comparative lengths of male antennal segments with no indication of how to determine female specimens, although certain species, such as *Ernobius opicus* Fall, were described from only females. In addition, dorsal surface sculpture and integument color are frequently used to separate species, both of which are difficult to distinguish if representative specimens are not available for comparison. Future work should involve genitalic dissections of males and comprehensive descriptions of both males and females.

Because members of this genus are uncommonly encountered, the following key includes three species that have not yet been found in Wisconsin but may occur in the State. *Ernobius mollis* was said to be relatively common from the coastal region of Maine to Virginia (White 1962a) and has been found as far northwest as Ontario, Canada (Fall 1905, White 1982). *Ernobius lacustris* Fall may occur in Wisconsin as it has been collected from Cook County, Minnesota, as well as from Marquette and Ann Arbor, Michigan. *Ernobius luteipennis* LeConte is also included in the key because it has been widely collected across much of the eastern United States.

Key to the Wisconsin Species of Adult *Ernobius*

[Modified from Fall 1905 and White 1962a]

1 Ninth antennomere shorter than three preceding antennomeres combined ..... ***mollis* Linnaeus**

1’ Ninth antennomere longer than three preceding antennomeres combined (Figs. 26, 123, 124, 126) **2**

2 (1’) Each elytron with a distinct, longitudinal carina running nearly 0.75X the length of the disk (Figs 127, 128) ..... ***youngi* Arango (p. 22)**

2’ Elytra without longitudinal carina **3**

3 (2’) Pronotum and elytra nearly uniformly brownish-yellow (Figs. 125, 126); pronotum usually with a fine, narrowlongitudinal line devoid of setae ..... ***granulatus* LeConte (p. 21)**

3’ Pronotum mostly dark brown or blackish, without narrow longitudinal line; elytral color variable **4**

4 (3’) Elytra and pronotum nearly uniformly dark brown to blackish; length 4.8–5.5 mm ..... ***lacustris* Fall**

4’ Elytra lighter, usually brownish-yellow; <4 mm in length **5**

5 (4’) Eyes small, separated by 2.0–2.75X the vertical diameter of the eye when viewed from the front ..... ***luteipennis* LeConte**

5’ Eyes large, separated by 1.2–1.7X the vertical diameter of the eye when viewed from the front ..... ***filicornis* LeConte (p. 20)**

Ernobius filicornis LeConte

(Figs. 26, 123, 124; Map 10)

Ernobius filicornis LeConte 1879: 517.

***Capsule Description* (Figs. 26, 123, 124)—Length:** 2.1–2.7 mm. **Width:** 0.8–1.0 mm. **Integument Color:** maxillary and labial palpi yellowish to reddish-yellow; antennae yellowish to brownish; head, pronotum, metathoracic ventrite, and abdomen dark reddish-brown to blackish; legs yellowish to reddish-yellow; elytra yellowish to dark reddish-brown. **Body Form:** elongate, 2.6X longer than wide. **Vestiture:** pubescence yellowish, fine, completely recumbent. **Head:** terminal segment of maxillary palpi elongate, nearly parallel-sided; eyes large, separated by 1.2–1.7X the vertical diameter of the eye when viewed from the front; antennae 11-segmented, clubbed, 9th antennomere longer than 3 preceding segments combined (♂♂ & ♀♀), about as long as 6 preceding segments combined (♂♂); surface finely granulate-rugose. **Pronotum:** moderately rounded dorsally; hypomera mostly flat to slightly convex ventrally, not at all excavate; lateral pronotal margins complete; dorsal surface finely granulate-rugose. **Elytra:** slightly wider than width of pronotum; surface irregularly punctate, not at all striate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; medially with a nearly parallel-sided, moderately shallow sulcus, 0.5–0.75X length of disk, terminating before anterior margin. **Legs:** not received in ventral excavations; prothoracic coxae contiguous; 1st tarsomere of all legs elongate; metathoracic coxae grooved to receive metathoracic legs. **Abdomen:** with 6 ventrites; 1st ventrite not at all grooved for metathoracic legs; 6th ventrite smaller.

Diagnosis—*Ernobius filicornis* may be distinguished from all known and potential species of Wisconsin *Ernobius* by the following combination of characters: eyes large,

separated on the front by slightly more than their vertical diameter, to slightly more than 1.5X their vertical diameter; ninth antennal segment of the male equal to the six preceding segments combined (Figs. 26, 123); head and pronotum generally darker when compared with the elytra (Fig. 123, 124); small, 2–3 mm size.

Ernobius filicornis is most likely to be confused with specimens of *E. luteipennis*, partially because both Fall (1905) and White (1962a) used integument color for species separation in their taxonomic keys. More specifically, specimens of *E. filicornis* and *E. lacustris* were separated from *E. granulatus* and *E. luteipennis* by the elytra being black or dark brown. Fall (1905) described *E. filicornis* as "piceous," *E. granulatus* as "rufotestaceous," and *E. luteipennis* as having the "head and prothorax black or piceous, the elytra testaceous in the male; head and prothorax usually a little darker than but sometimes con-colorous with the elytra in the female." However, specimens I examined from the Ohio State Insect Collection, likely determined by White, seem to be more variable in color than accounted for in both Fall's (1905) and White's (1962a) work. This may lead to misidentifications if teneral specimens are collected, or if there is no way to compare them with similar species. The distance between the compound eyes compared to their vertical diameter when viewed from the front proved useful in separating *E. filicornis* from *E. luteipennis* and was discovered to be the main character for their separation in this work.

Natural History—Little has been published on the biology of *E. filicornis*. In Wisconsin, four specimens were obtained from material collected during a study examining red pine pocket mortality. One specimen came from a Lindgren funnel and two from flight intercept traps. An additional specimen was collected at Hg/UV at night.

Phenology—Adults of Wisconsin *E. filicornis* were recorded from mid-June to late July.

Distribution—In North America, *E. filicornis* has been recorded from Massachusetts, Virginia, and Ohio (White 1982) as well as from the Maritime Provinces of Canada (Majka 2007b). During this study, specimens were examined from four Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension for the known distribution of this species.

***Wisconsin Records* (Map 10)**—The five specimens of *E. filicornis* examined during this study were recorded from the following localities: **Jackson Co. (1):** Black River Falls; **LaCrosse Co. (1):** West Salem; **Vilas Co. (1):** Northern Highland American Legion State Forest; **Waupaca Co. (2):** B. Schellpfeffer Property; J. Baker Property.

Ernobius granulatus LeConte

(Figs. 125, 126; Map 11)

Ernobius granulatus LeConte 1865: 225.

***Capsule Description* (Figs. 125, 126)—Length:** 2.7 mm. **Width:** 1.0 mm. **Integument Color:** brownish-yellow, shining throughout; maxillary and labial palpi, antennae, and legs light yellowish to yellowish-brown; ventral surface somewhat darker brown. **Body Form:** elongate, 2.6X longer than wide. **Vestiture:** pubescence yellowish, fine, completely recumbent. **Head:** terminal segment of maxillary palpus elongate; eyes large, separated by 1.6X the vertical diameter of the eye when viewed from the front; antennae 11-segmented, clubbed, 9th antennomere longer than 3 preceding segments combined (♂♂ & ♀♀); surface finely granulate-rugose. **Pronotum:** with a fine, narrow, longitudinal line devoid of setae medially; moderately rounded dorsally; hypomera mostly flat to slightly convex ventrally, not at all excavate; lateral pronotal margins complete; dorsal surface finely granulate-rugose. **Elytra:** equal in width to that of pronotum; surface irregularly punctate, not at all striate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; medially with a shallow sulcus 0.5X length of the disk. **Legs:** not received in ventral excavations; prothoracic coxae contiguous; metathoracic coxae grooved to receive metathoracic legs. **Abdomen:** with 6 ventrites; 1st ventrite not at all grooved for metathoracic legs; 6th ventrite smaller, slightly emarginate.

Diagnosis—*Ernobius granulatus* may be distinguished from all other Wisconsin *Ernobius* species by the ninth antennomere being longer than the combined length of antennomeres 6–8 and by the uniformly yellowish-brown to light reddish-brown color (Fig. 125, 126). Teneral specimens of other *Ernobius* species may accidentally be mistaken for *E. granulatus* because this species closely resembles other species in this genus and is only distinguished from them by integument color.

Natural History—Larvae were described by Böving (1954) for specimens determined as "probably *E. granulatus*" collected from *Pinus caribeae* and "in dying tip of *Pinus palustris*." It has also been recorded in conifer cones (White 1982) and infesting stored pine cones (Craighead 1950). Frost (1975) collected specimens of *E. granulatus* during a survey of insects taken at light traps from the Archbold Biological Station in Florida. Davis and Leng (1912) reported several specimens from a study of insects occurring on a recently felled long leaf pine tree (*P. palustris* Miller). In Wisconsin, the single specimen of *E. granulatus* collected had no natural history data.

Phenology—The adult specimen of *E. granulatus* was recorded in Wisconsin during late August.

Distribution—*Ernobius granulatus* is widely distributed in the eastern United States; northeast from Massachusetts, New York, and Pennsylvania, southeast into Florida and Georgia, and as far southwest as Texas (White 1982). This species has also been recorded from the Maritime Provinces of Canada (Majka 2007b). In this study, the single specimen collected constitutes a **NEW STATE RECORD** and new northwestern range extension for the known distribution of this species.

***Wisconsin Records* (Map 11)**—The only specimen of *E. granulatus* examined during this study was recorded from the following locality: **Waushara Co. (1):** Plainfield.

Ernobius youngi Arango

(Figs. 127, 128; Map 12)

Ernobius youngi Arango 2009: 353.

Ernobius youngi was described from a single female specimen in honor of Dr. Daniel K. Young, who has inspired many in the study of Coleoptera.

***Capsule Description* (Figs. 127, 128)—Length:** 3.3 mm. **Width:** 1.4 mm. **Integument Color:** light yellowish-brown to orange-brown throughout; maxillary and labial palpi yellowish; abdomen slightly darker; dorsal surface shining. **Body Form:** elongate; 2.3X longer than wide. **Vestiture:** pubescence yellowish, moderately dense, completely recumbent. **Head:** terminal segment of maxillary palpi elongate, 2.6X longer than wide; eyes small, separated by 2.0X the vertical diameter of the eye when viewed from the front; antennae 11-segmented, clubbed, 9th antennomere equal in length to 5 preceding antennomeres combined; surface punctate, margin of punctures raised. **Pronotum:** disk moderately rounded, 1.7X wider than long at widest diameter; lateral margins smooth, expanded and broadly reflexed; surface punctate with margins of punctures raised, partially incomplete posteriorly towards center of disk. **Elytra:** slightly narrower than pronotum at base; surface punctate, margin of punctures raised, not at all striate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; medially with a shallow, longitudinal and darkly pigmented sulcus extending less than 0.5X length of disk from posterior margin; surface mostly rugose, smoother medially along posterior margin. **Legs:** not received in ventral excavations; prothoracic coxae contiguous; metathoracic coxae shallowly grooved to receive metathoracic legs. **Abdomen:** with 6 ventrites; 1st ventrite not at all grooved for metathoracic legs; 6th ventrite smaller and weakly emarginated apically.

Diagnosis—*Ernobius youngi* is easily distinguished from all other *Ernobius* species by the elytron each with a distinct longitudinal carina running nearly 0.75X the length of the disk.

Natural History—Collection methods for this specimen were not noted.

Phenology—The single adult specimen of *E. youngi* was recorded in Wisconsin on 25 July 1947.

Distribution—During this study, specimens were recorded from a single Wisconsin county.

***Wisconsin Records* (Map 12)**—The single specimen of *E. youngi* examined during this study was recorded from the following locality: **Wood Co. (1):** Griffith State Nursery.

Subfamily Anobiinae

Anobiinae was erected by Fleming (1821) as Anobiumedæ for those genera differing from Ptininae (written Ptinusidæ) by having the antennae much shorter than the length of the body and the metathorax nearly equal in width to the abdomen. Subsequent works, such as LeConte (1861) and Fall (1905), maintained division of Ptinidae into two subfamilies: Ptininae and Anobiinae. In these publications, the Anobiinae was further divided into tribes, which would later be elevated to subfamilial status in Pic's (1912a) catalog. The genera included in Anobiinae have changed little since Fall's (1905) classification, with the exception of three genera: *Platybregmus* Fisher, *Falsogastrallus* Pic, and *Desmatogaster* Knutson, which were subsequently described within Anobiinae. Classification used in this work follows such recent publications as Lawrence and Newton's (1995) review of the higher taxonomy of Ptinidae as well as works by White (1982) and Philips (2002).

Anobiinae contains some of the most economically important ptinid species in North America including *Trichodesma gibbosa* (Say), *Nicobium castaneum* (Olivier), *Anobium punctatum* (De Geer), *Hemicoelus carinatus* (Say), *Hemicoelus gibbicollis* (LeConte), *Hemicoelus umbrosus* (Fall), *Hadrobregmus quadrulus* (LeConte), *Priobium punctatum* (LeConte), *Priobium sericeum* (Say), as well the stored product pest, *Stegobium paniceum* (Linnaeus). *Hemicoelus gibbicollis* was reported by Furniss (1939) as potentially the most destructive native powder-post beetle found in the Pacific Coast States (Simeone 1960). Linsley (1943) also reported *H. gibbicollis* as "the most serious pest among the powderpost beetles in the broad sense of the term" (Ebeling 1978). Although *H. gibbicollis* does not occur in Wisconsin, another species in the same genus, *H. carinatus*, is found frequently throughout the state and is considered the most common wood-damaging ptinid in eastern North America (White 1982). Böving (1954) described in detail the larvae of some of the more commonly encountered species within Anobiinae.

North American Anobiinae contains 19 genera and 68 species north of Mexico (White 1982, Philips 2002). Seven genera and 13 species are known from Wisconsin. Although unlikely to occur in Wisconsin, *Anobium* has been included in the generic key because it contains the cosmopolitan species *A. punctatum*, which may potentially become introduced.

Wisconsin Anobiinae may be distinguished by a combination of the following characters: head in repose with mandibles distant from metathoracic ventrite (Figs. 129–154); prothoracic ventrite concave ventrally (Fig. 86), with complete to partially interrupted lateral margins (Figs. 130, 132); elytra striate; pubescence distinct; and body elongate-cylindrical (extracted in part from Philips 2002). Although members of this subfamily are not highly contractile, certain

genera are adapted to receive either the antennae or the legs into grooves of the ventral surface. An important advantage to having the prothoracic coxae separated by a prosternal process is to allow the antennae to lie between them in tight spaces (e.g., *Hadrobregmus*, *Hemicoelus*, *Oligomerus sericans* (Melsheimer), *Priobium*). Another adaptation is in the structure of the metathoracic ventrite, which may be deeply excavate anteriorly to receive the antennal club and prothoracic tarsi (e.g., *Hadrobregmus* and *Priobium*). Proper curation of Anobiinae prior to identification involves pulling the antennae or the prothoracic legs away from these structures so that the prosternal intercoxal process and the prothoracic coxae are visible; the mesothoracic coxae should also be exposed.

Key to the Wisconsin Genera of Adult Anobiinae

[Modified from White 1971a and Philips 2002]

1 Prothoracic coxae touching or very narrowly separated; combined length of last 3 antennal segments nearly as long as, to much longer than all preceding segments combined (Fig. 27)..... ***Oligomerus*** **(in part) (p. 33)**

1' Prothoracic coxae distinctly to widely separated; length of last 3 antennal segments variable **2**

2 (1') Combined length of last 3 antennal segments not longer than combined length of preceding 5 segments (Fig. 28)..... ***Priobium*** **(p. 30)**

2' Combined length of last 3 antennal segments much longer than combined length of preceding 5 segments..... **3**

3 (2') Prosternal intercoxal process with sides converging posteriorly, more or less V-shaped; punctures of elytral striae obscure, elongate, and longitudinally closed spaces..... ***Stegobium*** **(p. 37)**

3' Prosternal intercoxal process parallel-sided (Fig. 86), apex truncate; punctures of elytral striae not as above..... **4**

4 (3') Tarsal claws each with a broad, basal tooth (Fig. 68)..... ***Trichodesma*** **(p. 32)**

4' Tarsal claws simple (Fig. 69)..... **5**

5 (4') Abdominal ventrites 2, 3, and 4 with sutures distinct laterally, weak to nearly absent medially (Fig. 79)..... ***Hadrobregmus*** **(p. 29)**

5' Abdominal ventrites 2, 3, and 4 with sutures distinct throughout..... **6**

6 (5') Metathoracic ventrite deeply excavate anteriorly..... ***Anobium***

6' Metathoracic ventrite not deeply excavate anteriorly..... **7**

7 (6') Abdominal ventrite 3, 1.5X length of ventrite 4 (Fig. 138); pronotum concave medially, produced laterally near base (Fig. 137)..... ***Microbregma*** **(p. 28)**

7' Abdominal ventrite 3 sub-equal in length to ventrite 4; pronotum convex to flat medially **8**

8 (7') Prothoracic coxae separated by 0.5X coxal diameter or less; elytral strial punctures without distinct margins or fine lines; pronotum stouter (Fig. 145–152) ..... ***Oligomerus*** **(in part) (p. 33)**

8' Prothoracic coxae separated by 0.5–1.0X coxal diameter; elytral strial punctures with more or less distinct margins; pronotum less stout (Fig. 129–136)..... ***Hemicoelus*** **(p. 23)**

Genus *Hemicoelus* LeConte

[Synonymy modified from White 1962a, 1982]

Type Species: *Anobium gibbicollis* LeConte 1859: 284 (designated by Knutson 1963: 187).
Hemicoelus LeConte 1861: 204.
Cacotemnus LeConte 1861: 204.
Hadrobregmus (of authors, not Thomson).
Hemicoelum LeConte; Español 1971: 22 (*lapsus calami*).

Knutson (1963) synonymized *Hadrobregmus* Thomson with *Coelostethus* LeConte. The North American species formerly placed in *Hadrobregmus* were assigned to *Hemicoelus* and *Cacotemnus* (both previously considered synonyms of *Hadrobregmus*). White (1965) noted the differences given for separation of *Hemicoelus* and *Cacotemnus*, specifically the slight gibbosity of the prothorax, the wing venation, and the structure of the lateral lobe in the male genitalia, are unreliable, thereby proposing *Cacotemnus* as a synonym of *Hemicoelus*.

Hemicoelus includes some of the most economically significant species in North America. *Hemicoelus gibbicollis* (LeConte), also known as the California deathwatch beetle, is a serious pest species in the Pacific coastal region (Ebeling 1978), and may be the most economically significant species of *Hemicoelus* for North America. This species has been found to cause extensive damage to well-seasoned flooring, joists, and supporting timbers of structures (Ebeling 1978). Suomi and Akre (1992) reported *Pseudotsuga menziesii* (Mirbel) Franco, *Thuja plicata* Donn ex D. Don, and *Tsuga heterophylla* (Rafinesque) Sargent as the most commonly infested building materials in structures in the Pacific Northwest. Seybold (2001) provided a complete list of wood material records utilized by *H. gibbicollis*. *Hemicoelus carinatus* is also of economic significance and is discussed further in the species description that follows.

Controlling infestations of *Hemicoelus* has often focused on removal of infested wood material in addition to lowering the moisture content of the wood by increasing ventilation to the area where the beetles occur (Simeone 1960). If possible, stains or paints are applied to the wood surface to prevent oviposition by females. Less frequently, borates or other insecticides may be applied, which will aide in preventing future infestation but will not kill insects already developing in the wood.

Species of *Hemicoelus* have been recorded in a variety of hardwood as well as softwood species, including *Acer*, *Carya*, *Fraxinus*, *Fagus*, *Tilia*, *Quercus*, *Ulmus*, *Betula*, *Tsuga*, *Picea*, and *Pinus* (White 1962a, Ebeling 1978). A more comprehensive list of larval food material for Wisconsin specimens is given for individual species below.

In North America, *Hemicoelus* includes seven species north of Mexico, four of which occur in Wisconsin (White 1982). Specimens of *Hemicoelus* have been collected at light, or in Lindgren, Townes–Malaise, and flight intercept traps, as well as by rearing infested wood material. Inspection of historic structures (e.g., churches and covered bridges), barns, and crawl spaces of older homes almost always yields specimens.

Members of *Hemicoelus* may be separated from all other Wisconsin Anobiinae by a combination of the following characters: antennae distinctly clubbed with the last three segments much longer than the preceding five (Figs. 33–35); prothoracic coxae distinctly separated by a parallel-sided intercoxal process (Fig. 86); pronotum not concave at center dorsally; elytral punctures with distinct margins (Fig. 76); elytral pubescence uniform in color; metathoracic ventrite without anterior excavation; abdominal ventrite sutures distinct throughout with third and fourth ventrites subequal in length (Figs. 73, 74) (extracted in part from Philips 2002).

Males and females of this genus may be separated based on their sexually dimorphic antennae in which the antennal club of males is more elongate and about one half longer than that of females (Figs. 33, 34). Females also tend to be larger than males, although this character is unreliable (Simeone 1960).

As has been noted for some species of *Oligomerus,* the number of antennal segments in species of *Hemicoelus* varies to some degree (Fall 1905, White 1962a). For example, *H. linearis*, a species synonomized with *H. carinatus*, has been shown to have either 9- or 10-segmented antennae (Fall 1905). Two *Hemicoelus* species, *H. carinatus* and *H. umbrosus*, are separated exclusively with respect to the number of antennal segments, although they are otherwise difficult to distinguish (see diagnosis for *H. umbrosus*). Acciavatti (1972) thought that phenology could help distinguish these two species because *H. umbrosus* occurs from early to late June and *H. carinatus* from late June to late July. In my opinion, however, the differences in seasonal occurrence are not separated enough to be useful. In this survey, *H. carinatus* and *H. umbrosus* are treated as separate species; genetic analysis, however, might provide further insight into their relationship.

Key to the Wisconsin Species of Adult *Hemicoelus*

[Modified in part from White 1962a and 1976b]

1 Lateral pronotal margin at least partially obliterated to weakly indicated by produced, discrete granules (Fig. 132)..... ***defectus* (Fall) (p. 26)**

1’ Lateral pronotal margin distinct and complete throughout (Figs. 130, 134, 136) **2**

2 (1’) Smaller, length 2.1–2.8 mm; second abdominal segment a little longer than fifth; first ventral suture broadly arcuate posteriorly at middle (Fig. 74)..... ***pusillus* (Fall) (p. 27)**

2’ Larger, length 3.1–5.8 mm; abdomen not as above **3**

3 (2’) Antennae 10-segmented; abdomen near middle finely punctate and shiny, with little to no indication of granules..... ***carinatus* (Say) (p. 25)**

3’ Antennae 11-segmented; abdomen near middle finely punctate and nearly always with distinct, fine granulation, less shiny..... ***umbrosus* (Fall) (p. 27)**

Hemicoelus carinatus (Say)

(Figs. 33, 34, 73, 129, 130; Map 13)

[Synonymy modified from Simeone 1960, Knutson 1963, White 1965, 1982]
Anobium carinatus Say 1823: 187.
Anobium errans Melsheimer 1846: 309.
Hadrobregmus linearis LeConte 1865: 232.
Hadrobregmus carinatus (Say); LeConte 1865: 232.
Cacotemnus carinatus (Say); Knutson 1963: 178.
Hemicoelus carinatus (Say); White 1965: 113.

***Capsule Description* (Figs. 33, 34, 73, 129, 130)—Length:** 3.4–6 mm. **Width:** 1.2–1.9 mm. **Integument Color:** light reddish-brown or orange-brown to dark reddish-brown; maxillary and labial palpi, and antennae generally lighter. **Body Form:** elongate, parallel, 2.9X longer than wide. **Vestiture:** pubescence yellowish, short, entirely recumbent on elytra and pronotum, slightly to moderately bristling on head. **Head:** antennae 10-segmented, clubbed, last 3 antennal segments longer than preceding segments combined; surface densely granulate. **Pronotum:** base subequal in width to the elytra; slightly gibbous; laterally rounded; lateral margins complete; moderately convergent toward apex; surface densely granulate. **Elytra:** parallel sided, converging apically; punctures moderately impressed; strongly and rather closely punctate striate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; with a moderately impressed, longitudinal sulcus posteriorly; surface granulate, densely punctate. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites; first ventrite suture straight; ventrite 2 subequal in length to 5.

Diagnosis—*Hemicoelus carinatus* may be separated from all other Wisconsin *Hemicoelus* by its larger size, 10-segmented antennae (Figs. 33, 34), the presence of a complete pronotal lateral margins, and abdominal ventrite two nearly equal in length to ventrite five (Fig. 73). This species closely resembles *Hemicoelus umbrosus* with the exception of the number of antennal segments. The relationship between the two species is discussed further in the diagnosis for *H. umbrosus*.

Natural History—*Hemicoelus carinatus*, the eastern deathwatch beetle, is a serious economic pest throughout eastern North America (Ebeling 1978). An extensive study of the ecology, life history, abundance, distribution, and control of *H. carinatus* was done by Simeone (1960) during his Ph.D. work. This species has been recorded from *Fraxinus*, *Tilia*, *Acer*, *Fagus*, and *Ulmus* (White 1962a, Ebeling 1978). Simeone (1960) listed 12 hardwoods and softwoods as larval food for *H. carinatus*, stating that hardwoods are preferred, but softwoods may be utilized in areas of higher humidity. He determined the life cycle of this species to be completed in about one year, which is relatively rapid compared with other Anobiidae. The success and relative abundance of this species is attributed in part to their shorter life cycle, the wide range of acceptable larval food material, and their ability to develop in both hardwoods and softwoods (Simeone 1960). Additionally, Smith and Whitman (1992) noted *H. carinatus* will attack old as well as newly cut wood, which suggests a range in tolerance to various starch contents in wood.

Larvae of *H. carinatus* were described, with some uncertainty, by Böving (1954) from decaying roots of a live *Tsuga* sp. Larvae of this species can cause significant damage, possibly resembling that caused by *Lyctus* spp. (Bostrichidae), to wood flooring as well as in sills, joists, and beams of buildings (Ebeling 1978). In Wisconsin, many old barns are likely to be infested, or have been infested, with this species, at times causing severe structural damage. Simeone (1960) inspected 720 farm and non-farm structures in New York State and reported at least 31% had at least some anobiid damage, which was likely from *H. carinatus*, although positive identification was not possible in all cases. The higher humidity and lack of adequate ventilation in many of these structures was thought to aide in the development of this species (Simeone 1960). Several control methods have been proposed to protect wooden structures from *H. carinatus*, the first of which involves constructing buildings so the wood remains ventilated and dry without accumulation of excessive humidity (<13% moisture content) (Simeone 1960). It is also thought that immature stages of *H. carinatus* require a period of cold for development, which is why they are not commonly seen in heated structural lumber (Simeone 1960). Therefore, the use of a space heater or other type of centralized heating system may also aide in the control of this species in normally unheated areas (Simeone 1960). The effectiveness of various parasitoids has also been investigated. Simeone (1960) and Cabrera et al. (2002) both recorded *Heterospilus flavicollis* (Ashmead), a braconid wasp, as a parasitoid of *H. carinatus*, although the effect of *H. flavicollis* in controlling large populations of *H. carinatus* is not well documented. Various chemical insecticides and fumigants are sometimes used (e.g.,borates); however, many of these products are not able to penetrate deeply enough into the wood to effect the most destructive larval stage of *H. carinatus* (Simeone 1960). Painting or staining the exposed wooden surface is also commonly known to deter oviposition by *H. carinatus* adult females.

Hemicoelus carinatus is perhaps the most frequently encountered wood-boring ptinid in Wisconsin structures. During this survey, five indoor infestations were visited in south-central Wisconsin. Three of the five occurred in old, unheated barns being used for storage, in which at least some of the structural wood was partially decayed. Live and dead adults were generally collected on or near the barns' window sills. In one particular barn in Sun Prairie, the infestation had been left unchecked for so long that *H. carinatus* was able to cause structural damage to some of the barn's main support beams. One specimen was collected hanging

from a blade of grass near a recently cut boxelder tree in the vicinity of one of the infested barns (Fig. 10). Another infestation occurred in a residence in which the homeowner cut down a dead hickory tree from his yard for firewood and stored the wood inside a porch closet. Adult beetles emerged nearly concurrently, filling the room with ptinids. A large fungal fruiting body was collected from the hickory stump and identified as *Phellinus gilvus* (Schwein.). The last infestation was inside a 115-year-old, one-room school house in Monticello (Fig. 7), in which the maple flooring was severely damaged by *H. carinatus* (Fig. 8). The floor also showed damage from decay fungi and excessive moisture.

Other Wisconsin specimens were obtained at Lindgren, flight intercept, Townes–Malaise, and light traps, as well as on sticky traps and using a mercury vapor lamp. The majority of specimens were hand collected from the various infestations or sent in from indoor infestations or from cut logs/lumber. A large series of *H. carinatus*, which had emerged from a birch tree cut one year earlier, were sent to the University Insect Diagnostic Laboratory for identification in early May. A number of IRCW specimens are labeled as follows: from "flooring," "from sawed lumber," "from *Acer saccharum*," "collected on air near" and "on apple tree," "under bark of large, recently fallen *Quercus* sp. tree limb," and "in basement of home."

Phenology—Adult specimens of *H. carinatus* were recorded outdoors in Wisconsin from early May to late July, appearing to be most prevalent during the month of June. This seasonality resembles closely the emergence periods reported from New York State by Simeone (1960). Records of indoor emergences in Wisconsin have been documented during March, June, August, and one from December, although the label of the last record does not directly specify that the specimen was collected indoors.

Distribution—*Hemicoelus carinatus* is widely distributed throughout eastern North America (Ebeling 1978), its range extending into the Midwestern states including Wisconsin (Simeone 1960). This species has been recorded as far northwest as Manitoba and Saskkatchewan and as far south as North Carolina (White 1982). Simeone (1960) reported examining museum specimens of *H. carinatus* from Oregon, Alaska, and Florida, although he stated that these records were most likely the result of transportation of infested materials. In this study, specimens were examined from 27 counties throughout Wisconsin.

***Wisconsin Records* (Map 13)**—The 189 specimens of *H. carinatus* examined during this study were recorded from the following localities: **State only (2)**; **Adams Co. (3):** Quincy Bluff TNC; **Barron Co. (3):** Rice Lake; **Buffalo Co. (2):** Engel Farm Property; **Burnett Co. (1):** Crex Meadows SWA; **Clark Co. (2):** Schmidt Maple Woods SNA; **Columbia Co. (1):** Rocky Run SNA; **Dane Co. (80):** DeForest; Madison; Nakoma Golf Course; Private Property–Town of Blue Mounds; Private Property–Deerfield; Private Property–Sun Prairie–Corner Town Hall & Bailey Rd; Private Property–Sun Prairie –Woodsend Ct; Swamp Lover's Inc.; No additional locality data; **Dodge Co. (6):** Beaver Dam; **Door Co. (1):** Sturgeon Bay; **Douglas Co. (1):** Brule River State Forest; **Eau Claire Co. (1):** Eau Claire County Forest; **Florence Co. (4):** Morgan Lake; Private Property; No additional data; **Fond du Lac Co. (1):** No other locality data; **Green Co. (7):** Monticello–Exetor Crossing Rd; Ward/Swartz Decatur Woods SNA; **Jackson Co. (3):** Black River State Forest–Castle Mound Pine Forest SNA; No other locality data; **Juneau Co. (1):** Lemonweir Bottomland Hardwood Forest SNA; **Lafayette Co. (4):** Wedel Property–~3 mi. north of Argyle; **Lincoln Co. (16):** Council Grounds State Park–Kruger Pines SNA; Merrill; **Marinette Co. (1):** Marinette County Beech Forest SNA; **Oconto Co. (8):** 4 mi. W. Soring; **Rock Co. (1):** Janesville; **Sauk Co. (17):** Hemlock Draw TNC; **Sheboygan Co. (6):** Kettle Moraine Red Oaks SNA; Sheboygan; **Vernon Co. (8):** Mt. Pisgah Hemlock–Hardwoods SNA; **Walworth Co. (7):** No other label data; **Waupaca Co. (1):** Waupaca; **Wood Co. (1):** Powers Bluff SNA.

Hemicoelus defectus (Fall)

(Figs. 131, 132; Map 14)

[Synonymy modified from White 1965, 1982]
Hadrobregmus defectus Fall 1905: 182.
Cacotemnus defectus (Fall); Knutson 1963: 178.
Hemicoelus defectus (Fall); White 1965: 113.
Hemicoelus defectus was described by Fall (1905) from a single female specimen.

***Capsule Description* (Figs. 131, 132)** —**Length:** 4.5 mm. **Width:** 1.7 mm. **Integument Color:** Dark brown to blackish; maxillary and labial palpi, antennae, and legs reddish-yellow to yellowish. **Body Form:** elongate, parallel, 2.7X longer than wide. **Vestiture:** pubescence yellowish, short, entirely recumbent. **Head:** antennae 10-segmented, clubbed; last 3 antennal segments much longer than preceding segments combined; surface granulate. **Pronotum:** base distinctly narrower than the elytra; compressed inward laterally toward apex; lateral margins incomplete, appearing partially granulate. **Elytra:** strongly and rather closely punctate-striate; punctures moderately impressed. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; with narrow longitudinal sulcus posteriorly. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites.

Diagnosis—*Hemicoelus defectus* is easily separated from all other Wisconsin *Hemicoelus* by having the lateral pronotal margins partially incomplete, appearing granulate (Fig. 132).

Natural History—Little is known of the natural history of this species. The specimen from which the original description was made is said to have been collected "on an oak stump in the woods" (Fall 1905). Knutson (1963) recorded *Pinus ponderosa* Lawson as a larval food for *H. defectus*. Of

the two male Wisconsin specimens collected, one specimen was recorded "from bread like fungus," while the other was obtained at UV light.

Phenology—Adult specimens of *H. defectus* were recorded in Wisconsin from mid- to late June.

Distribution—Scattered records of this species occur throughout the northern range of North America into Canada. In this study, specimens were examined from a single Wisconsin county; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 14)**—The two specimens of *H. defectus* examined during this study were recorded from the following localities: **Dane Co. (2):** DNR Goose Lake; Madison School Forest.

Hemicoelus pusillus (Fall)

(Figs. 35, 74, 133, 134; Map 15)

[Synonymy modified from Knutson 1963, White 1982]
Hadrobregmus pusillus Fall 1905: 183.
Hemicoelus pusillus (Fall); Knutson 1963: 178.

***Capsule Description* (Figs. 35, 74, 133, 134)—Length:** 2.1–2.8 mm. **Width:** 0.9–1.2 mm. **Integument Color:** orange-brown to reddish-brown; maxillary and labial palpi, and antennae generally lighter. **Body Form:** elongate, cylindrical, 2.5X longer than wide. **Vestiture:** pubescence yellowish, short, entirely recumbent. **Head:** antennae 10-segmented, clubbed, last 3 antennal segments longer than preceding segments combined; surface densely granulate. **Pronotum:** strongly crested posteriorly, sinuate laterally; lateral margins complete; surface densely granulate. **Elytra:** parallel sided, converging apically; closely punctate-striate; punctures rather weakly impressed. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; with narrow longitudinal sulcus posteriorly. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites; second abdominal segment longer than the fifth; first ventral suture feebly arcuate at middle.

Diagnosis—*Hemicoelus pusillus* may be distinguished from all other members of *Hemicoelus* by its small size as well and by the second abdominal ventrite being longer than the fifth (Fig. 74).

Natural History—This species is uncommonly collected as was noted by White (1962a). Much of its natural history, including larval food material, remains unknown. Wisconsin specimens were collected using both flight intercept and Lindgren funnel traps.

Phenology—Adult specimens of *H. pusillus* were recorded in Wisconsin from mid-June to early August.

Distribution—Fall (1905) had a specimen of *H. pusillus* from Dane County, Wisconsin, in his possession at the time of its description. In North America, this species occurs mainly in the northeastern United States (White 1982). It has been recorded as far south as Tennessee and North Carolina, and as far west as Wisconsin and Ontario (White 1982). During this study, specimens were recorded from four Wisconsin counties.

***Wisconsin Records* (Map 15)**—The four specimens of *H. pusillus* examined during this study were recorded from the following localities: **Eau Claire Co. (1):** Eau Claire County Forest; **Fond du Lac Co. (1):** Waupun Park Maple Forest SNA; **Menominee Co. (1):** Menominee Tribal Enterprises; **Milwaukee Co. (1):** Cudahy Woods SNA.

Hemicoelus umbrosus (Fall)

(Figs. 135, 136; Map 16)

[Synonymy modified from White 1965, 1982]
Hadrobregmus umbrosus Fall 1905: 184.
Cacotemnus umbrosus (Fall); Knutson 1963: 179.
Hemicoelus umbrosus (Fall); White 1965: 113.

***Capsule Description* (Figs. 135, 136)—Length:** 4.3–5.5 mm. **Width:** 1.4–2.0 mm. **Integument Color:** orangish-brown to dark reddish-brown; maxillary and labial palpi and antennae generally lighter. **Body Form:** elongate, parallel, 2.9X longer than wide. **Vestiture:** pubescence yellowish, short, entirely recumbent. **Head:** antennae 11-segmented, clubbed, last 3 antennal segments longer than preceding segments combined; surface densely granulate. **Pronotum:** base subequal in width to the elytra; slightly gibbous; laterally rounded; moderately convergent toward apex; lateral margins complete; surface densely granulate. **Elytra:** parallel sided, converging apically; punctures moderately impressed; strongly and rather closely punctate striate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; with a moderately impressed, longitudinal sulcus posteriorly; surface granulate punctate. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites.

Diagnosis—*Hemicoelus umbrosus* was described by Fall (1905) with some hesitation for a large, blackish form of *H. carinatus*, with 11-segmented antennae. In the description, Fall stated, "It is possible that in a large series the number of joints will be found to vary as in *Oligomerus obtusus*, and that *umbrosus* is only an extreme form of *carinatus*." White (1962a) examined a specimen in which the antennae had the fourth and fifth segments nearly fused, appearing as an intermediate form between 10 and 11 segments. From this he reiterated the statement made by Fall about this species possibly being a member of the variable *H. carinatus*, but maintained it as a separate species. In his revision of *Hadrobregmus*, Knutson (1963) included specimens having either 10- or 11-segmented antennae as *H. umbrosus*. Separation of *H. carinatus* from *H. umbrosus* was said to rely on color as well as on the structure of the male genitalia. *Hemicoelus umbrosus* was said to have the posterior part of the median lobe spatulate as opposed to straight in *H. carinatus*.

Wisconsin *H. umbrosus* are distinguished rather tentatively from *H. carinatus* based exclusively on having at least one 11-segmented antenna. Two of the *H. umbrosus* specimens examined in fact had one 11-segmented antenna and one 10-segmented antenna. The additional segment appears to arise from a constriction between the fourth and fifth segments. As in *Oligomerus*, it is possible that members of the same species demonstrate variation in the number of antennal segments, thereby giving further support for the potential synonymy of these two species. Combinations of 10–11 and 11–12 antennal segmentation were also observed by Knutson (1963), although he maintained separation of these two species based on the shape of the distal end of the median lobe. Since dissection of all *H. carinatus* and *H. umbrosus* males was not practical, four male specimens were selected for comparison: one *H. umbrosus* specimen with 10–11-segmented antennae, one dark brown specimen of *H. carinatus*, and two light reddish-brown specimen of *H. carinatus*. Examination of the distal end of the median lobe did not appear to be significantly different among the selected specimens, although it is difficult to assess without comparing the group to specimens identified by Knutson himself. It is possible that all Wisconsin *H. umbrosus* are actually variations of *H. carinatus*, and that once a "true" specimen of the former is seen, differences in the median lobe will become apparent. Additionally, none of the Wisconsin specimens of *H. carinatus* or *H. umbrosus* collected could be described as "blackish" in color, although a series of *H. carinatus* did show a wide range in color from lighter orange-brown to dark reddish-brown. All Wisconsin specimens determined as *H. umbrosus* were similar in color to *H. carinatus*, supporting the idea they may be the same species.

Natural History—*Hemicoelus umbrosus* is rather uncommon in North America as well as Wisconsin. This species is reported to use *Abies balsamea* (L.), *Betula occidentalis* (Hook), and *Fagus* sp. as larval food (Knutson 1963). *Hemicoelus umbrosus* is also known to be attracted to light (Knutson 1963). In Wisconsin, specimens were collected from Lindgren funnel and flight intercept traps; one specimen came to UV light.

Phenology—Adult specimens of *H. umbrosus* were recorded in Wisconsin from late May to late June.

Distribution—Scattered records of *H. umbrosus* have been found distributed throughout the United States, occurring from New York, New Hampshire, Michigan, and Ohio, south from Arkansas, and west from Nevada and California (White 1982). In this study, specimens were examined from five Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 16)**—The five specimens of *H. umbrosus* examined during this study were recorded from the following localities: **Dane Co. (1):** DNR Goose Lake; **Green Co. (1):** Abraham's Woods SNA; **Jackson Co. (1):** Black River State Forest; **Lafayette Co. (1):** Wedel Property– ~3 mi. north of Argyle; **Wood Co. (1):** Power's Bluff SNA.

Genus *Microbregma* Seidlitz

[Synonymy modified from White 1982, Philips 2002]
Type Species: *Anobium emarginatum* Duftschmid 1825: 54 (by monotypy).
Microbregma Seidlitz 1889: 501.
Microbregmum Seidlitz; Böving 1954: 21 (*lapsus calami*).

Microbregma was erected by Seidlitz (1889) as a subgenus of *Anobium* for the European species *Anobium emarginatum* Duftschmid, which was later found to be conspecific with the North American *Anobium foveatum* Kirby (Fall 1905). Fall (1905) elevated *Microbregma* to generic status to include *Microbregma emarginatum* (Duftschmid) and *Microbregma emarginatum granicollis* Fall.

Only a single species and two subspecies belong to this genus worldwide. In North America, *Microbregma e. granicolle* occurs in the west, and has been documented from Washington and California (White 1982). The distribution of *M. e. emarginatum* is noted below.

Microbregma emarginatum emarginatum (Duftschmid)

(Figs. 32, 137, 138; Map 17)

[Synonymy modified from White 1962a, 1982]
Anobium emarginatum Duftschmid 1825: 54.
Anobium foveatum Kirby 1837: 190.
Hadrobregmus foveatus (Kirby); LeConte 1865: 233.
Microbregma emarginatum (Duftschmid); Seidlitz 1889: 501.
Microbregma emarginatum emarginatum (Duftschmid); White 1962a: 13.

***Capsule Description* (Figs. 32, 137, 138)—Length:** 4.0 mm. **Width:** 1.5 mm. **Integument Color:** reddish-brown to dark reddish-brown throughout; maxillary and labial palpi yellowish. **Body Form:** elongate, 2.6X longer than wide. **Vestiture:** pubescence yellowish, completely recumbent. **Head:** antennae 11-segmented, clubbed, last 3 antennal segments longer than all preceding combined; surface granulate. **Pronotum:** lateral margins straight and nearly parallel, expanded laterally; disk prominently raised medially on either side surrounding a broad, concave depression. **Elytra:** striate-punctate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites; 3rd ventrite nearly 0.5X longer than ventrite 4; 5th ventrite with surface granulate.

Diagnosis—*Microbregma emarginatum* may be separated from all other Wisconsin Anobiinae by a combination of the following characters: combined length of last three antennal segments much longer than the preceding five segments (Fig. 32); prothoracic coxae separated by a parallel-sided

intercoxal process; pronotal disk depressed medially (Figs. 137, 138); metathoracic ventrite not deeply excavate anteriorly; tarsal claws without a broad basal tooth; abdominal sutures distinct at center; third abdominal ventrite one half longer than the fourth ventrite (extracted in part from Philips 2002).

Morphologically, this species most closely resembles members of *Hemicoelus* but may be easily separated by the straight pronotal lateral margins, the pronotum being prominently raised on either side, surrounding a broad, concave depression; the third abdominal ventrite being about one half longer than ventrite four (Fig. 138), and the first and second abdominal sutures curved anteriorly.

Natural History—Specimens of *M. emarginatum* have been collected in both hardwood- and softwood-dominated forests (Jacobs et al. 2007). Lindhe et al. (2005) reported collecting numerous specimens of *M. emarginatum* using "net-enclosure trapping" on a spruce tree stump, while Birch, Aspen, and Oak yielded no specimens using this method. Larvae purportedly feed in the outer bark of pine and hemlock as well as hickory (White 1962a, 1982). A paper by Jacobs et al. (2007) reported nearly 32% of *M. emarginatum* were collected from girdled aspen trees. The larvae were described by Böving (1954) from specimens collected within bark of *Picea* species.

Phenology—A single adult specimen of *Microbregma emarginatum* was recorded in Wisconsin during early April.

Distribution—*Microbregma emarginatum* is rather sporadically distributed in North America. It has been recorded from British Columbia, Colorado, Minnesota, Michigan, New Hampshire, and Massachusetts (White 1982). During this study, a single specimen was recorded in Wisconsin, representing a **NEW STATE RECORD**.

Wisconsin Records **(Map 17)**—One Wisconsin specimen was examined during this study from the following location: **Wood Co. (1):** Nekoosa.

Genus *Hadrobregmus* Thomson

[Synonymy modified from White 1974, 1982, Philips 2002]

Type Species: *Anobium denticollis* Creutzer in Panzer 1796: 8 (by original description and monotypy).
Hadrobregmus Thomson 1859: 89.
Coelostethus LeConte 1861: 204.
Dendrobium Mulsant and Rey 1864: 65 (as subgenus of *Anobium*).
Habrobregmus Thomson; De Leon 1952: 79 (*lapsus calami*).
Hadrobrogmus Thomson; Simeone 1962: 328 (*lapsus calami*).
Hadrobresmus Thomson; Simeone 1962: 330 (*lapsus calami*).
Hadrobegmus Thomson; Español 1970: 53 (*lapsus calami*).
Allobregmus Español 1970: 55 (as subgenus).
Megabregmus Español 1970: 56 (as subgenus).

Hadrobregmus was erected by Thomson (1859) for a single species, *Anobium denticollis* Creutzer. Around the same time, *Coelostethus* was proposed by LeConte (1861) for two species, *Anobium notatum* Say and *Anobium quadrulum* LeConte, with the connate abdominal ventrites being the most notable character uniting these species (Fall 1905). Fall's (1905) revision included seven species in *Hadrobregmus*, four of which were newly described at that time. In keeping with LeConte's classification, these species all lacked connate abdominal ventrites. Those with this character were assigned by Fall (1905) to *Coelostethus*. Later, two other species were described in the genus: *Hadrobregmus subconnatus* Fall and *Hadrobregmus destructor* Fisher. Knutson (1963) determined the nine North American species contained within *Hadrobregmus* of Fall and LeConte did not agree in morphology with the type species, most notably in regard to the connate abdominal segments, and proposed they be split into three separate genera: *Hadrobregmus*, *Hemicoelus*, and *Cacotemnus*, although the latter of the three was soon synonymized with *Hemicoelus* (White 1965). According to Knutson, *Hadrobregmus* should contain those species previously included in *Coelostethus*, making *Coelostethus* a junior synonym of *Hadrobregmus*. *Desmatogaster* was proposed for *H. subconnatus* Fall while *Hemicoelus* was revalidated by Knutson to include two species: *Hemicoelus gibbicollis* (LeConte) and *Hemicoelus pusillus* (Fall). The remaining species under *Hadrobregmus* were placed under *Cacotemnus* (Knutson 1963) until White's synonymy in 1965.

In North America, *Hadrobregmus* is composed of five species north of Mexico, with only a single species known to occur in Wisconsin (White 1982). Four species in this genus are known mainly from western North America, while *Hadrobregmus notatus* (Say) is found throughout eastern North America (White 1982). Specimens of *Hadrobregmus* have been recorded from both hardwoods and softwoods (White 1982). In Europe, members of *Hadrobregmus* are destructive pests of old wooden structures that are infested by decay fungi (Viitanen 2007), although their economic significance within the United States appears to be far less.

Members of this genus may be separated from all other Wisconsin Ptinidae by the combined length of last three antennal segments being much longer than the preceding five segments and the abdominal sutures distinct laterally and weak or absent medially.

Hadrobregmus notatus (Say)

(Figs. 31, 79, 139, 140; Map 18)

[Synonymy modified from White 1962a, 1982]
Anobium notatum Say 1825: 172.
Coelostethus notatus (Say); LeConte 1861: 204.
Hadrobregmus notatus (Say); Knutson 1963: 178.

Capsule Description **(Figs. 31, 79, 139, 140)—Length:** 3.3–4.3 mm. **Width:** 1.4–1.9 mm. **Integument Color:** reddish-brown to nearly blackish; maxillary and labial palpi, antennae, and legs somewhat lighter. **Body Form:** moderately elongate, subcylindrical, 2.4X longer than wide. **Vestiture:** pubescence dark brown to golden, patterned with yellowish to whitish pubescence as follows (or nearly so): dense at base of pronotum, sometimes extending laterally toward apex, present on humeri and scutellum, on elytra: longitudinally following suture nearly to center, medially with 4 short, longitudinal stripes, laterally with a spherical patch, lower half of elytra with distinct transverse band, divided at suture. **Head:** antennae 11-segmented, clubbed, combined length of last 3 antennal segments longer than all preceding combined; surface granulate. **Pronotum:** deeply excavate for reception of the head; base as wide as the elytra; longitudinally indented at center, with raised areas on either side of indentation; posterior angles deeply depressed; lateral margins curving upward, forming a wide U-shape; surface granulate. **Elytra:** punctate-striate; punctures deeply impressed, quadrate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a rather deep longitudinal sulcus terminating below a deep U-shaped excavation anteriorly, extending into mesothoracic ventrite. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites; sutures strongly impressed laterally, obscure to indistinct at center.

Diagnosis—*Hadrobregmus notatus* may be easily distinguished from all other Ptinidae by the variegated patterning of the dorsal pubescence (Fig. 139) and by having the abdominal sutures strongly impressed laterally but obscure to indistinct medially (Fig. 79). A few individuals examined during this study exhibit a reduction in the amount of patterned, dorsal pubescence. One particular specimen from Eau Claire Co. was almost entirely black, with the yellowish pubescence confined to the base of the pronotum and uppermost surface of the elytra (Fig. 140). Although this specimen is obviously aberrant from the typical *H. notatus*, it resembles this species in all other characters and is therefore most likely an uncommon variation of this species.

Natural History—In the United States, *H. notatus* does not appear to be of significant economic importance as there is little mention of it in pest control books and articles. In Wisconsin, it has not been encountered inhabiting urban structures but has been relatively abundant in forested environments. It is possible that the presence of decay fungi in the larval food material is required to facilitate development of this species, similar to what is thought to be true for members of *Priobium*. This then may restrict the ability of *H. notatus* to cause damage in the majority of urban structures.

Larvae of *H. notatus* were described by Böving (1954) from specimens collected in "rotten oak," "dry rotten pine," "ash, chestnut and oak," and "in pine-boards in cellar partitions." The majority of Wisconsin specimens were recovered from Lindgren funnel traps and flight intercept traps. One specimen was taken at UV light and one in a sweep net in border of a hardwood forest.

Phenology—Adult specimens of *H. notatus* were recorded in Wisconsin from early May to late September.

Distribution—*Hadrobregmus notatus* is known from eastern North America, south to Mississippi and North Carolina, northwest into Michigan, Ohio, and Ontario, northeast into Massachusetts and Maine (Simeone 1960, White 1982). In this study, specimens were examined from 17 Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 18)**—The 74 specimens of *H. notatus* examined during this study were recorded from the following localities: **State only (1)**; **Buffalo Co. (1):** Engel Farm Property; **Clark Co. (3):** Schmidt Maple Woods SNA; **Dane Co. (1):** Swamp Lover's Inc.; **Dodge Co. (1):** Private Property–Waterloo; **Eau Claire Co. (3):** Augusta State Wildlife Area; **Florence Co. (2):** Morgan Lake; **Grant Co. (4):** Blue River Bluffs SNA; Wyalusing State Park; No other label data; **Iowa Co. (1):** Tower Hill State Park; **Jackson Co. (4):** Black River State Forest–Castle Mound Pine Forest SNA; No other label data; **La Crosse Co. (1):** West Salem PC; **Lincoln Co. (1):** Council Grounds State Park–Kruger Pines SNA; **Marinette Co. (4):** Bloch Oxbow SNA; Dunbar Barrens SNA; **Marquette Co. (1):** Mecan River Public Fishing Area; **Menominee Co. (2):** Menominee Tribal Enterprises; **Sauk Co. (22):** Hemlock Draw TNC; Mirror Lake State Park–Echo Rock Trail; **Shawano Co. (17):** 1.3 mi. NE Wittenberg; Jung Hemlock-Beech Forest SNA; **Trempealeau Co. (1):** Perrot State Park; **Vernon Co. (4):** Mt. Pisgah Hemlock-Hardwoods SNA.

Genus *Priobium* Motschulsky

[Synonymy modified from White 1971a, 1974, 1982]

Type Species: *Anobium carpini* Herbst 1793: 58 (designated by I.C.Z.N., 1976: 31).
Priobium Motschulsky 1845: 35.
Trypopitys Redtenbacher 1849: 346.
Trypopithys Redtenbacher; Baudi di Selve 1873: 333 (*lapsus calami*).
Tripopitys Redtenbacher; Horn 1894: 389 (*lapsus calami*).
Tripopithys Pic 1931: 6 (*lapsus calami*).
Typopitys Redtenbacher; Brimley 1938: 196 (*lapsus calami*).
Prioblum Motschulsky; Zaitsev 1956: 72 (*lapsus calami*).

Priobium is a relatively small genus, represented by four species in North America, north of Mexico. *Priobium mexicanum* White, originally known only from Mexico, was first recorded in the United States by White in 1976 from Arizona (White 1982). The European *Priobium carpini* Herbst, was determined to be established in Maryland by Ford (1984); the likely source of entry was the Baltimore City harbor. Of the remaining two species, *Priobium*

punctatum (LeConte) is known from the western United States, while *Priobium sericeum* (Say) is widely distributed, mainly across eastern North America (White 1982).

Specimens of *Priobium* have been collected using a variety of techniques: rearing from infested wooden material, beating branches in wooded areas, from passive traps, and at UV light traps (Ford 1984). Members of this genus have been recorded from both hardwoods and softwoods, including oak and maple woodwork, as well as Monterey cypress, pine, and fir (Hatch 1961, Ford 1984). Larvae have been recorded from timber decayed by fungi (Böving 1954). Simeone (1960) in fact utilized fungi during his work on Ptinidae, noting other researchers (Becker 1951) had shown certain species, such as *P. carpini*, to require fungal-infested wood for larval development.

Species of *Priobium* may be separated from all other Wisconsin Anobiinae by a combination of the following characters: antennae somewhat serrate, with the last three segments not much longer than the preceding five segments (Fig. 28); prothoracic coxae widely separated; elytral punctures quadrate, forming distinct rows; abdominal sutures distinct at sides, weak or indistinct medially (extracted in part from Philips 2002). *Priobium* most closely resembles *Hadrobregmus*, from which it may be immediately separated by the form of the antennae, which are clubbed and elongate in the latter genus.

Priobium sericeum (Say)

(Figs. 28, 141, 142; Map 19)

[Synonymy modified from White 1962a, 1982]
Xyletinus sericeus Say 1825: 171.
Trypopitys sericeus (Say); LeConte 1865: 234.
Priobium sericeum (Say); White 1971a: 183.

It is likely that *P. sericeum* was first described in *Xyletinus* because of the serrate antennae (Fall 1905). Fall (1905) noted that the structure of the body resembled more closely that of *Hadrobregmus* except in the form of the antennae; he considered *Priobium* (as *Trypopitys*) to be allied with other Anobiini rather than Xyletinini.

Capsule Description **(Figs. 28, 141, 142)—Length:** 3.3–5.5 mm. **Width:** 1.3–2.3 mm. **Integument Color:** light reddish-brown to dark reddish-brown throughout; maxillary and labial palpi, antennae, and tarsi somewhat lighter. **Body Form:** robust, elongate, 2.4X longer than wide. **Vestiture:** pubescence yellowish, short, moderately dense, recumbent to reclinate; arranged in rows between elytral punctures. **Head:** antennae 11-segmented, last 3 antennal segments nearly as long preceding 5–6 segments, segments 3–7 serrate, 8–10 elongate-triangular, 11 narrow and elongate; surface strongly granulate. **Pronotum:** concave laterally; longitudinally grooved at middle, groove not reaching base of elytra; deeply excavate ventrally, enclosing head; lateral margins curving; surface densely granulate. **Elytra:** strongly punctate-striate; strial punctures deep, quadrate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; deeply excavate anteriorly for reception of last 3 antennal segments, sometimes holding the prothoracic tarsi; with shallow, longitudinal sulcus posteriorly; surface of numerous, large, ring-shaped punctures, which are raised and more shining than the surrounding area. **Legs:** not received in ventral excavations. **Abdomen:** with 5 ventrites; sutures distinct at sides, weak toward middle; surface with numerous, large, ring-shaped punctures, which are raised and more shining than the surrounding area.

Diagnosis—*Priobium sericeum* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: mandibles distant from metathoracic ventrite; antennae somewhat serrate, with the last three segments not longer than the preceding five segments (Fig. 28); pronotal lateral margins complete, disk deeply indented medially; pronotum lacking asperities; prothoracic coxae widely separated; elytral punctures square, forming distinct rows; abdominal sutures distinct at sides, weak or indistinct at center (similar to Fig. 79) (extracted in part from Philips 2002).

A single specimen of *P. sericeum* from Winnebago Co. has the dorsal surface pubescence atypical, somewhat approaching that of the western species, *P. punctatum*. Variation in pubescence was also seen by White (1975) in a specimen taken from Arizona:

A specimen of *Priobium* in the USNM from 5 miles west of Portal, Arizona is possibly distinct from *punctatum* (Lec.), *sericeum* (Say), and the species described below. I have labeled the specimen as "*Priobium* evidently distinct from *sericeum* & *punctatum*." The abdominal sculpture is as that of *punctatum*, but the pubescence of the dorsal surface is about midway between the conditions in *punctatum* and *sericeum*, namely, the hairs are in part raised and arcuate, with the apices of each about parallel with the elytral surface. The pubescence of the dorsal surface of *punctatum* is clearly bristling in part; the pubescence of *sericeum* is almost completely appressed, with some hairs only a little elevated. Until a series of this form is available, its status remains uncertain.

Although the specimen being described by White is geographically distant from the one encountered in Wisconsin, the variation in the form of the pubescence is clearly analogous. For the purpose of this survey, and until additional specimens are found, the Wisconsin specimen is considered to fall within the variation of *P. sericeum*.

Natural History—White (1962a, 1982) reported this species from dead oak branches, wild cherry, hickory, and holly, occasionally causing damage to flooring and furniture. *Priobium sericeum* has also been reared from dead mountain laurel (*Kalmia latifolia*) (White 1982). Larvae of *P. sericeum* collected from hickory and from a "fallen dead holly branch" were described by Böving (1954).

Although *P. sericeum* has been infrequently encountered within structures (Simeone 1960), it is not generally thought to be of economic significance. It is possible that *P. sericeum*, like *P. carpini*, requires some degree of fungal activity within a woody substrate before it may be utilized as a larval food source. If this is the case, it could explain why this species is not seen as commonly in an indoor environment.

The majority of Wisconsin specimens were collected using Lindgren funnel and flight intercept traps. Specimens were also obtained at light, in Townes–Malaise traps, as well as on sticky traps and, incidentally, at a cantharidin bait trap. One specimen was collected "from milkweed."

Phenology—Adults of *P. sericeum* were collected in Wisconsin from mid-June to late August.

Distribution—*Priobium sericeum* is generally known throughout much of eastern North America. This species occurs from Canada, west to Iowa and Wisconsin, southwest to Arizona,and southeast to Texas and Florida (Simeone 1960, White 1982). Pellitteri and Boush (1983) reported this species from southern Wisconsin feed mills. During this study, specimens were recorded from 28 counties throughout Wisconsin.

Wisconsin Records **(Map 19)**—The 96 specimens of *P. sericeum* examined during this study were recorded from the following localities: **State only (6)**; **Adams Co. (6):** Quincy Bluff TNC; **Barron Co. (1):** Kriska Residence; **Buffalo Co. (2):** Engel Farm Property; **Burnett Co. (1):** Burnett Co. Forest; **Columbia Co. (5):** Rocky Run SNA; **Dane Co. (5):** 7 mi. SW of UW Campus; Swamp Lover's Inc.; **Door Co. (3):** Sturgeon Bay; **Douglas Co. (1):** Brule River State Forest; **Grant Co. (1):** No additional data; **Iowa Co. (3):** LWRSGA Avoca Unit; No additional locality data; **Jackson Co. (2):** Black River State Forest–Castle Mound Pine Forest SNA; No other label data; **Jefferson Co. (4):** Kettle Moraine Oak Opening SNA; **Juneau Co. (2):** Lemonweir Bottomland Hardwood Forest SNA; **Lincoln Co. (1):** Council Grounds State Park–Kruger Pines SNA; **Marinette Co. (14):** Dunbar Barrens SNA; **Marquette Co. (2):** Fox River Wildlife Refuge; **Menominee Co. (4):** Menominee Tribal Enterprises; Private Property–Legend Lake–Spirit Island Road; **Milwaukee Co. (3):** No additional data; **Racine Co. (2):** Renak–Polak Maple–Beech Woods SNA; **Richland Co. (1):** LWRSWA Lone Rock Unit; **Rusk Co. (1):** Bruce; **Sauk Co. (8):** Hemlock Draw TNC; **Shawano Co. (4):** 1.3 mi. NE Wittenberg; Jung Hemlock-Beech Forest SNA; **Sheboygan Co. (1):** Kettle Moraine Red Oaks SNA; **Vernon Co. (1):** Mt. Pisgah Hemlock–Hardwoods SNA; **Waupaca Co. (2):** Hartman Creek; Mud Lake Bog SNA; **Winnebago Co. (1):** Menasha to B/L N. Shore Golf Course; **Wood Co. (9):** Griffith St. Nursery; Grand Rapids; Nekoosa Plant.

Genus *Trichodesma* LeConte

[Synonymy modified from White 1982, Philips 2002]

Type Species: *Anobium gibbosum* Say 1825: 171 (by original description).
Trichodesma LeConte 1861: 204.
Ptinodes LeConte 1861: 204.
Microtrichodesma Pic 1931: 2.
Trichedesma LeConte; Borror and DeLong 1954: 305 (*lapsus calami*).

LeConte (1861) described two genera, *Ptinodes* and *Trichodesma*, that were separated based on the structure of the mesosternum. Fall (1905) stated that "the two genera are separated on rather trifling differences and may yet have to be united," but retained them as separate genera based on the structure of the "palpi," antennae, legs, and abdomen (White 1974). White (1974) reevaluated the differences seen by Fall (1905) and concluded *Ptinodes* is synonymous with *Trichodesma*.

Ten species of *Trichodesma* are known from North America, north of Mexico, with species diversity greatest in the southwestern United States (White 1982). Various hardwood trees have been reported as hosts for many members of this genus (Philips 2002). In Wisconsin this genus is represented by a single species, *Trichodesma gibbosa* (Say).

Males and females of *Trichodesma* are not readily separated; however, as with most Ptinidae, the eyes of the male tend to be slightly larger and the last three antennal segments more elongate than in the female (Fall 1905).

Trichodesma gibbosa (Say)

(Figs. 30, 68, 143, 144; Map 20)

[Synonymy modified from White 1962a]
Anobium gibbosum Say 1825: 171.
Trichodesma gibbosa (Say); LeConte 1861: 204.

Capsule Description **(Figs. 30, 68, 143, 144)—Length:** 6.4–7.0 mm. **Width:** 3.0–3.3 mm. **Integument Color:** dark reddish-brown throughout. **Body Form:** cylindrical, robust, 2.1X longer than wide. **Vestiture:** of both recumbent and erect pubescence, obscuring surface sculpture in part; short, recumbent pubescence grayish-white to white, dense on lateral and apical pronotal surface, absent medially at base, forming a broad band on apical half of elytra, also present on humeral region and scutellum; basal area of elytra less pubescent; head, legs, and ventral surface densely clothed in short, grayish-white to white recumbent pubescence; erect white pubescence widely distributed on dorsal and ventral surface, head, and legs; pronotum with tufts of dark brown and golden brown setae medially on raised part of pronotal disk, also present on humeri and in patches above and below white pubescent band on elytra. **Head:** antennae 11-segmented; combined length of last 3 antennal segments slightly longer than all preceding combined; surface completely

concealed by pubescence. **Pronotum:** strongly raised at center of disk; narrowed and slightly expanded laterally; appearing divided medially; surface strongly, densely granulate. **Elytra:** with punctures arranged in rows, obscured by pubescence in part; surface strongly granulate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a somewhat deep, narrow, longitudinal sulcus; surface strongly granulate. **Legs:** not received in ventral excavations; tarsal claws with a broad, basal tooth. **Abdomen:** with 5 ventrites.

Diagnosis—*Trichodesma gibbosa* may be easily separated from all other Wisconsin Ptinidae by the dense elytral pubescence, which forms a white band across the apical half of the elytra (Fig. 143), and the tarsal claws, which possess a broad, basal tooth (Fig. 68).

Natural History—Böving (1954) described the larvae of this species from specimens collected in the "dead trunk of *Persea*." This description includes larvae of the morphologically similar *Trichodesma klagesi* Fall, collected in *Benzoin* sp. (Fever bush), which he stated are indiscernible from *T. gibbosa*. Specimens of *T. gibbosa* have also been recorded from hickory, elm sprouts, sour gum, tupelo (*Nyssa sylvatica*), and sweetgum joists and studding (Fall 1905, White 1982).

A single Wisconsin specimen was collected in a flight intercept trap baited with cantharidin, while a second specimen was found crawling on the outside of a cantharidin bait trap. Although both specimens were collected using cantharidin, there is no evidence to indicate that this chemical is an attractant for *T. gibbosa* as many other locations and traps using this compound did not yield specimens.

Phenology—Adult specimens of *T. gibbosa* were recorded in Wisconsin from mid- to late June.

Distribution—*Trichodesma gibbosa* occurs throughout much of the eastern and central United States (White 1982). This species has been found as far west as Kansas, Louisiana, and Iowa, south to Florida, and north into Michigan, New York, and Ontario (White 1982). In this study, specimens were examined from two southeastern Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 20)**—The two specimens of *T. gibbosa* examined during this study were recorded from the following localities: **Milwaukee Co. (1):** Cudahy Woods SNA; **Racine Co. (1):** Renak–Polak Maple–Beech Woods SNA.

Genus *Oligomerus* Redtenbacher

[Synonymy modified from White 1974, 1982]

Type Species: *Anobium brunneus* Olivier 1790: 8 (by monotypy).

Oligomerus Redtenbacher 1849: 347.
Oligomerinus Portevin 1931: 484.

Oligomerus was erected by Redtenbacher (1849). The number of species described in *Oligomerus* for North America has grown since its inception partially as a result of the revisionary work done by Fall (1905) and White (1976b). Fall (1905) described three species: *Oligomerus californicus* and *Oligomerus tenellus*, each from single specimens collected from California and Arizona, respectively; *Oligomerus brevipilis* was described from females ranging from the east coast into Michigan and was recorded from Wisconsin (White 1976b). While revising the North American species of *Oligomerus*, White (1976b) described six new species and confirmed strong generic similarities among them after examination of the male genitalia of all species, with the exception of *Oligomerus delicatulus* (Fall), *O. californicus*, and *O. brevipilis*.

Fourteen species of *Oligomerus* occur in North America, four of which are found in Wisconsin. Specimens of *Oligomerus* tend to be rather rarely collected in Wisconsin as well as across the country. Fall (1905) noted that few collections in North America contain more than a half a dozen specimens.

Members of *Oligomerus* can be distinguished from all other Anobiinae by the close approximation of the prothoracic coxae (except *Oligomerus sericans* (Melsheimer)), the more rounded pronotum, and the elytral striae being comprised of shallow punctures (extracted in part from Philips 2002). Species of *Oligomerus* most closely resemble those of *Hemicoelus* but can be immediately distinguished by their contiguous prothoracic coxae or by their shallow elytral punctures.

Species identifications in the genus can be difficult in part because of the variation in number of antennal segments observed within a single species. Fall (1905) documented a series of *Oligomerus obtusus* LeConte in which 10 specimens had 11-segmented antennae, 12 had 10-segmented antennae, and one had one of each. It was noted that this discrepancy could partially have resulted from a constriction on one of the antennal segments, which may appear as a division depending on the depth of the impression (Fall 1905). Although Fall (1905) thought this variation in number of antennal segments was not seen in species with nine-segmented antennae, nor in *O. sericans*, a specimen of *O. sericans* was collected in Wisconsin with one 9-segmented and one 10-segmented antenna. Therefore, the number of antennal segments cannot be used critically in making species level determinations despite the fact that White's (1962a) and Fall's (1905) keys both include this character.

Males and females may be easily separated based on antennal structure. The antennal club of males is nearly 1.5X the length of the club exhibited by females. Eyes of males also tend to be relatively larger and closer in proximity.

Key to the Wisconsin Species of Adult *Oligomerus*

[Modified from Fall 1905 and White 1976b]

1 Prothoracic coxae separated by about 0.5 transverse coxal diameter by a broadly triangular intercoxal process; pubescence of head and pronotum distinctly erect (Fig. 85); male genitalia (Fig. 95) ..... ***sericans* (Melsheimer) (p. 36)**

1' Prothoracic coxae contiguous to separated by not >0.33X transverse coxal diameter by a triangular intercoxal process which becomes laminate posteriorly; pubescence of head and pronotum recumbent to moderately erect **2**

2 (1') Pubescence of head and pronotum moderately erect (Fig. 148); male genitalia (Fig. 96) ..... ***brevipilis* Fall (p. 34)**

2' Pubescence of head recumbent to slightly erect, that of pronotum entirely recumbent **3**

3 (2') Sides of pronotum evenly rounded throughout (Figs. 149, 150); anterior metasternal process forming an obtuse angle; pubescence of head slightly or not erect; male genitalia (Fig. 97) ..... ***obtusus* LeConte (p. 35)**

3' Pronotum prominent, flared at base, appearing pinched medially (Fig. 145); anterior metasternal process forming an acute to right angle; pubescence of head completely recumbent; male genitalia (Fig. 98) ..... ***alternans* LeConte (p. 34)**

Oligomerus alternans LeConte

(Figs. 98, 145, 146; Map 21)

Oligomerus alternans LeConte 1865: 228.

***Capsule Description* (Figs. 98, 145, 146)—Length:** 4.0–4.6 mm. **Width:** 1.5–1.7 mm. **Integument Color:** Dark reddish-brown to black; maxillary and labial palpi, antennae, and tarsi reddish-yellow to yellowish. **Body Form:** elongate, cylindrical, 2.7X longer than wide. **Vestiture:** pubescence yellowish, entirely recumbent. **Head:** antennae 9-segmented, clubbed, combined length of last 3 antennal segments much longer than preceding segments combined; surface finely, thickly granulate. **Pronotum:** disk strongly elevated and compressed medially; surface finely, moderately granulate. **Elytra:** punctate-striate; elytral intervals convex; strial punctures without distinct margins. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; anterior metasternal intercoxal process forming a more or less acute angle; posteriorly with a shallow, longitudinal sulcus, devoid of setae. **Legs:** not received in ventral excavations; prothoracic coxae contiguous. **Abdomen:** with 5 ventrites. **Genitalia:** dorsum of basal piece with inner margins of distal lobes narrowly parallel along middle third, slightly expanded, vasiform basally.

Diagnosis—*Oligomerus alternans* may be confused with darker specimens of *O. obtusus* if the configuration of the metasternal intercoxal process is misinterpreted. In *O. alternans* the process extending between the mesothoracic coxae is acute (≤90° angle). In *O. obtusus* the angle is obtuse to arcuate. However, in some specimens of *O. obtusus*, the anterior portion of the process is raised and extended further between the mesothoracic coxae, giving the false impression that the angle is acute. To prevent misinterpretation, the angle should be evaluated before the raised portion of the process begins. Dissection of the male genitalia will easily separate this species from *O. obtusus* (Fig. 98).

Natural History—Little is known about the natural history of this species, as it is uncommonly encountered. In Wisconsin, one specimen was collected at UV light, one from a Lindgren funnel trap, and a third specimen lacked any natural history data.

Phenology—Adult specimens of *O. alternans* were recorded in Wisconsin from late June to mid-July.

Distribution—*Oligomerus alternans* is generally distributed throughout the eastern United States, extending west to Kansas and south to Mississippi (White 1982). This species is also recorded as far north as Canada (Fall 1905). In this study, specimens were examined from three Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 21)**—The three specimens of *O. alternans* examined during this study were recorded from the following localities: **Dane Co. (1):** No other label data; **Richland Co. (1):** No other locality data; **Sauk Co. (1):** Hemlock Draw TNC.

Oligomerus brevipilis Fall

(Figs. 96, 147, 148; Map 22)

Oligomerus brevipilis Fall 1905: 166.
Oligomerus brevipilis was described by Fall (1905) from only female specimens.

***Capsule Description* (Figs. 96, 147, 148)—Length:** 4.8–6.6 mm. **Width:** 1.8–2.4 mm. **Integument Color:** dark

reddish-brown to nearly black; maxillary and labial palpi, antennae, and legs reddish-yellow to reddish-brown. **Body Form:** elongate, cylindrical, 2.7X longer than wide. **Vestiture:** pubescence yellowish, head and usually pronotum with intermixed, erect setae among recumbent setae; erect setae sparser on elytra. **Head:** antennae 9-segmented, clubbed, combined length of last 3 antennal segments much longer than preceding segments combined; surface granulate. **Pronotum:** convex, stout; surface densely, minutely granulate, feebly shining. **Elytra:** punctate-striate; strial punctures without distinct margins; feebly impressed. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a shallow, narrow and distinctly shining longitudinal sulcus, mostly devoid of pubescence. **Legs:** not received in ventral excavations; prothoracic coxae contiguous. **Abdomen:** with 5 ventrites. **Genitalia:** dorsum of basal piece with inner margins of distal lobes widely subparallel through much of their length, slightly rounded basally.

Diagnosis—*Oligomerus brevipilis* may be separated from all other Wisconsin *Oligomerus*, including *Oligomerus alternans* LeConte, to which it is most closely related, by the contiguous prothoracic coxae, the erect pubescence of the head and pronotum (Fig. 148), and the structure of the male genitalia (Fig. 96). These characters, in addition to the elytral strial punctures lacking distinct margins (e.g., Fig. 77), will help distinguish this species from other Anobiinae.

Although a subset of *O. brevipilis* specimens examined during this study exhibit less distinctly erect pronotal pubescence, the erect cranial pubescence distinguishes them from *O. alternans*, with which they may be confused. The structure of the male genitalia of these specimens did seem to reveal an intermediate form between *O. brevipilis* and that of *O. alternans*, although with so few specimens (n = 19), it is not prudent to make any generalizations. The validity of both species is likely sound based on the condition of the pubescence in most specimens, but this small subset of *O. brevipilis* might provide good candidates for future genetic studies.

Variation in the number of antennal segments in this species was not observed as was previously seen in *O. sericans* and *O. obtusus*. However, this could be due to the small number of specimens collected from the state.

Natural History—Little is known about the natural history of this species as it tends to be rather uncommonly collected. In Wisconsin, UV light sampling provided the majority of specimens (42%), of which 88% were female. Specimens were also obtained using Lindgren funnel traps, flight intercept traps, and a Townes–Malaise trap. Three specimens were collected from underneath driftwood debris on a Lake Michigan beach in Sheboygan County. The majority of specimens were collected in areas dominated by hardwoods with a few specimens from hardwood cut sites.

Phenology—Adult specimens of *O. brevipilis* were recorded in Wisconsin from mid-June to late July.

Distribution—*Oligomerus brevipilis* is known throughout much of the northeastern United States (White 1982). It has been collected as far south as West Virginia and Washington D.C., and as far west as Wisconsin and Michigan (White 1976b, 1982). During this study, specimens were recorded from 10 Wisconsin counties.

Wisconsin Records **(Map 22)**—The 19 specimens of *O. brevipilis* examined during this study were recorded from the following localities: **Dane Co. (5):** DNR Goose Lake; Private Property–Cottage Grove; Private Property–Deerfield; No other locality data; **Dodge Co. (3):** Private Property–Waterloo; **Jefferson Co. (1):** No other label data; **Marquette Co. (1):** Fox River Wildlife Refuge; **Milwaukee Co. (1):** Sheridan Park; **Richland Co. (1):** No other locality data; **Rock Co. (1):** Private Property–1.7mi NW Janesville; **Sheboygan Co. (3):** Kohler–Andrae State Park; **Waupaca Co. (2):** Mud Lake Bog SNA; **Wood Co. (1):** Powers Bluff SNA.

Oligomerus obtusus LeConte

(Figs. 97, 149, 150; Map 23)

Oligomerus obtusus LeConte 1865: 228.

Capsule Description **(Figs. 97, 149, 150)—Length:** 4.6–5.2 mm. **Width:** 1.7–1.8 mm. **Integument Color:** dark reddish-brown to light reddish-brown. **Body Form:** elongate, cylindrical, 2.9X longer than wide. **Vestiture:** pubescence yellowish, entirely recumbent to slightly erect on head, especially just above mandibles. **Head:** antennae 9-, 10- or 11-segmented, clubbed, combined length of last 3 antennal segments much longer than preceding segments combined; surface granulate. **Pronotum:** moderately gibbous; surface granulate. **Elytra:** punctate-striate; strial punctures without distinct margins. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a distinctly shining, shallow and narrow longitudinal sulcus. **Legs:** not received in ventral excavations; prothoracic coxae contiguous. **Abdomen:** with 5 ventrites. **Genitalia:** dorsum of basal piece with inner margins of distal lobes widely subparallel along middle third, converging basally, acuminate.

Diagnosis—Separation of darker specimens of *O. obtusus* from *O. alternans*, with which it may be mistaken, is discussed in detail under the diagnosis for *O. alternans*. *Oligomerus obtusus* may also be confused with specimens of the genus *Hemicoelus*, especially those of *Hemicoelus carinatus* (Say), but are readily separated by the close approximation of the prothoracic coxae, the elytral strial punctures with less distinct margins (Figs. 76, 77), and the more cylindrical body form.

Natural History—Although Fall (1905) and White (1962a) stated this species is the most frequently collected member

of *Oligomerus*, only 11 specimens were collected from Wisconsin. Champlain and Knull (1922) reported *O. obtusus* reared from *Fagus americana*. Wisconsin specimens were collected using Lindgren funnel, Townes–Malaise and flight intercept traps, as well as a single specimen taken at a mercury vapor lamp. One specimen was collected "crawling on wet sand near the water's edge" of a Lake Michigan beach in the early afternoon. All specimens were collected in areas dominated by hardwoods; two were obtained at hardwood cut sites.

Phenology—Adult specimens of *O. obtusus* were recorded in Wisconsin from late June to early August.

Distribution—*Oligomerus obtusus* is known only from northeastern North America, extending northward into Canada (White 1982). Ohio and Washington D.C., represent the southern-most boundary of this species (White 1982), with Wisconsin likely representing the western-most boundary of its distributional range. In this study, specimens were examined from eight Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

***Wisconsin Records* (Map 23)**—The 11 specimens of *O. obtusus* examined during this study were recorded from the following localities: **Door Co. (1):** Sturgeon Bay; **Florence Co. (1):** Private Property; **Forest Co. (1):** Nicolet National Forest; **Racine Co. (1):** Renak–Polak Maple–Beech Woods SNA; **Sheboygan Co. (2):** Kettle Moraine Red Oaks SNA; Kohler–Andrae State Park; **Trempealeau Co. (1):** Perrot State Park; **Waupaca Co. (2):** Mud Lake Bog SNA; **Wood Co. (2):** Powers Bluff SNA.

Oligomerus sericans (Melsheimer)

(Figs. 27, 85, 93–95, 151, 152; Map 24)

[Synonymy modified from White 1962a, 1982]
Anobium sericans Melsheimer 1846: 309.
Oligomerus thoracicus LeConte 1861: 205.
Oligomerus sericans (Melsheimer); LeConte 1865: 228.

***Capsule Description* (Figs. 27, 85, 93–95, 151, 152)**—**Length:** 3.3–5.1 mm. **Width:** 1.4–1.9 mm. **Integument Color:** brownish-black to black; maxillary and labial palpi, antennae and legs yellowish-red to yellowish-brown. **Body Form:** elongate, cylindrical, 2.6X longer than wide. **Vestiture:** pubescence yellowish, recumbent, with intermixed erect setae, which are numerous on head and pronotum, infrequent on elytra. **Head:** antennae generally 10-segmented, clubbed, combined length of last 3 antennal segments much longer than preceding segments combined; surface somewhat shining, finely granulate. **Pronotum:** convex, stout; surface somewhat shining with small scattered granules. **Elytra:** slightly rough, punctate-striate; inner rows of punctures irregular and feebly impressed. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a shallow, narrow and distinctly shining longitudinal sulcus (sulcus infrequently indiscernible). **Legs:** not received in ventral excavations; prothoracic coxae separated about 0.5 transverse coxal diameter by a broadly triangular intercoxal process. **Abdomen:** dorsum of basal piece with inner margins of distal lobes narrowly subparallel along middle third, distinctly rounded basally.

Diagnosis—*Oligomerus sericans* is clearly aberrant with respect to all other Wisconsin *Oligomerus* species. The erect pubescence of the head and pronotum (Fig. 85), separation of the prothoracic coxae by a broadly triangular intercoxal process, as well as the structure of the male genitalia (Fig. 95) easily distinguish this species from most other Anobiinae.

As noted in the generic introduction, *Oligomerus* exhibits variation in the number of antennal segments even within a single specimen (Fall 1905). Cursory light microscopy examination of *O. sericans* from Wisconsin showed that whereas most specimens had 10-segmented antennae, a single individual was found to have antennae with 10 (left) and nine (right) antennal segments. To examine this more closely, the antennae of this individual were removed and examined using compound light as well as a scanning election microscopy (SEM). The fifth and sixth antennal segments of the left antenna are very nearly equal in size and appear nearly fused, but are distinctly separated (Fig. 93). The right antenna however showed no such division and is clearly nine-segmented (Fig. 94). Therefore, it may be concluded that the variation observed in the number of antennal segments among specimens as well as within individuals may itself constitute a generic character, as was suggested by Fall (1905).

Natural History—The natural history of *O. sericans* is not well known. Larvae of this species were described in detail by Böving (1954) from specimens reported from chestnut as well as from the end of an English walnut twig. Fall (1905) listed two specimens from the LeConte collection labeled as being from *Carya* (hickory) and white oak. The majority of Wisconsin specimens were collected using Lindgren funnel traps and flight intercept traps. Three specimens came from cantharidin-baited traps, although the association is likely incidental. Although the majority of specimens came from areas dominated by hardwoods, some specimens were from areas dominated by *Pinus* spp.

Phenology—Specimens of *O. sericans* were recorded in Wisconsin from mid-June to mid-August. A single specimen [IRCW] was collected on 17 November 1969 from a "roadside" in Dane County.

Distribution—*Oligomerus sericans* is widespread throughout much of the eastern United States and appears to be the most commonly collected species of *Oligomerus* in Wisconsin. According to White (1982), this species occurs as far west as Minnesota and as far south as Kentucky. Fall's (1905) revision included specimens from Canada. In this

study, specimens were examined from 14 Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 24)**—The 45 specimens of *O. sericans* examined during this study were recorded from the following localities: **State only (1)**; **Adams Co. (4):** Quincy Bluff TNC; **Barron Co. (1):** Kriska Residence; **Columbia Co. (5):** Rocky Run SNA; **Dane Co. (7):** Madison; Swamp Lover's Inc.; No other label data; **Eau Claire Co. (1):** UW Eau Claire Campus; **Grant Co. (3):** Wyalusing State Park; **Iowa Co. (2):** Ridgeway Pine Relict SNA; No other locality data; **Lafayette Co. (3):** Wedel Property–~3 mi. north of Argyle; **Marquette Co. (3):** Fox River Wildlife Refuge; **Milwaukee Co. (2):** No other label data; **Racine Co. (1):** Renak–Polak Maple–Beech Woods SNA; **Richland Co. (1):** LWRSWA Lone Rock Unit; **Sauk Co. (8):** Hemlock Draw TNC; **Sheboygan Co. (3):** Kettle Moraine Red Oaks SNA.

Genus *Stegobium* Motschulsky

[Synonymy modified from White 1974, 1982]
Type Species: *Dermestes paniceus* Linnaeus 1758: 357 (by monotypy).
Stegobium Motschulsky 1860: 154.
Sitodrepa Thomson 1863: 166.
Artobium Mulsant and Rey 1864: 67.
Autobium Mulsant and Rey; Reitter 1901: 23 (*lapsus calami*).
Litropeda Thomson; Stebbing 1914: 179 (*lapsus calami*).
Sidrotepa Thomson; Bosq 1934: 324 (*lapsus calami*).
Sitoprepa Thomson; Seabra 1939: 284 (*lapsus calami*).

Stegobium was erected by Motschulsky for *Dermestes paniceus* Linnaeus (White 1974). The generic name *Sitodrepa*, which is commonly used in earlier documents (notably Fall 1905 and Pic 1912a), was described by Thomson for the same species, *D. paniceus*, now considered an invalid synonym of *Stegobium* (White 1982). This genus consists of a single, nearly cosmopolitan species (White 1974).

Stegobium paniceum (Linnaeus)

(Figs. 29, 66, 67, 153, 154; Map 25)

[Synonymy modified from White 1962, 1982]
Dermestes paniceus Linnaeus 1758: 357.
Anobium ferrugineum Herbst 1783: 27.
Ptinus testaceum Thunberg 1784: 6.
Ptinus upsaliense Gmelin 1790: 1608.
Anobium minutum Fabricius 1792: 238.
Ptinus tenuicorne Marsham 1802: 84.
Ptinus rubellum Marsham 1802: 85.
Anobium pusillum Gyllenhal 1808: 294.
Anobium tenuistriatum Say 1825: 172.
Anobium ireos Villa and Villa 1833: 33.
Anobium obesum Melsheimer 1846: 309.
Anobium nanum Kuester 1849: 45.
Anobium panum Mulsant and Rey 1864: 114.
Sitodrepa panicea (Linnaeus); LeConte 1865: 229.
Stegobium paniceum (Linnaeus); Jacobson 1912: 358.

The worldwide distribution and economic significance of this species has led to its re-description numerous times throughout history.

***Capsule Description* (Figs. 29, 66, 67, 153, 154)—Length:** 1.9–3.1 mm. **Width:** 0.9–1.4 mm. **Integument Color:** yellowish-brown to reddish-brown; maxillary and labial palpi, antennae, and tarsi somewhat lighter, usually reddish-yellow to yellow. **Body Form:** moderately robust, 2.3X longer than wide. **Vestiture:** pubescence yellowish, mostly recumbent, bristling in part, dense, especially on head and dorsal surface. **Head:** antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than preceding segments combined; surface finely granulate. **Pronotum:** not strongly convex, rather flat medially; lateral margin somewhat serrate; surface finely granulate. **Elytra:** punctate-striate, punctures obscure, elongate, longitudinally closed spaces. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; with a narrow longitudinal sulcus on posterior half. **Legs:** not received in ventral excavations; prothoracic coxae separated by a V-shaped process; tibial spurs small and difficult to see. **Abdomen:** with 5 ventrites.

Diagnosis*—*Stegobium paniceum is readily distinguished from all other Wisconsin Anobiinae by a combination of the following characters: length of the last three antennal segments much longer than all preceding segments (Fig. 29); prothoracic coxae separated by a V-shaped to slightly truncate intercoxal process; elytral punctures obscure, elongate, longitudinally closed spaces (extracted in part from Philips 2002). In most specimens, the prothoracic coxal process is obviously V-shaped, although there are some examples where the tip of the process is slightly truncate, which may cause some confusion in the key to genera when one is not entirely familiar with the species. Males and females of *S. paniceum* may be separated by the shape of the tarsal claw (Halstead 1986) (Figs. 66, 67).

Natural History*—*Stegobium paniceum, named in reference to this beetle's habit of feeding on bread products (Hedges and Lacey 1996), is more commonly known as the drugstore beetle. As well-preserved breads were frequently presented as funeral offerings in ancient Egypt, infestations of *S. paniceum* tended to be rather common occurrences within ancient Egyptian tombs, including the antechamber of king Tut-ankh-amun (1333–1323 B.C.) (Levinson and Levinson 1994). This species is a serious economic pest of a variety of stored products (White 1982). As the common name suggests, *S. paniceum* has been found to infest almost any stored material, which includes prescription drugs, strychnine powder, and tin cans (Cabrera 2001, VanRyckeghem 2004). They are also known to chew through most food packaging, including aluminum foil and lead sheets (Hedges and Lacey 1996). Food products such as flour, dry

mixes, spices, chocolate, dried herbs, cookies, grains, seeds, cereal, dried fruits, and vegetables are also infested in addition to such non-food items as wool, leather, horns, hides, books, manuscripts, wood, and museum specimens (Smith and Whitman 1992, VanRyckeghem 2004). One technical bulletin relayed an anonymous quote that this species "eats anything but cast iron" (Cabrera 2001). Rees (2004) stated that outside of an urban environment, "*S. paniceum* has been found living in bee hives, feeding on pollen collected by bees." Woodroffe (1953) reported this species from nests of pigeons.

The ability of *S. paniceum* to develop on such a wide variety of food materials has been a topic of study for many years. Karawaiew (1899) first described the presence of a structure called a mycetom, located in the intestine, which was later found to contain intracellular, yeast-like symbionts that provide a source of nutrients for the host (Pant and Fraenkel 1954). These symbionts are able to produce vitamins of the B-complex, in addition to being a source of sterols that the insect needs for development (Pant and Fraenkel 1954). This type of symbiotic relationship is also seen in the ptinid *Lasioderma serricorne* Fabricius, which is known to develop on toxic tobacco leaves (Pant and Fraenkel 1954). This adaptation has no doubt given this species significant advantage throughout its evolutionary history.

The complete lifecycle of *S. paniceum* is thought to last approximately seven months (Smith and Whitman 1992). The adult female lays eggs in and around the food material, which hatch after only a few days. The larvae then go through four to six instars during a period of four to five months. Mature larvae pupate in a silken cocoon composed partially of food material, emerging after only 12–18 days (Smith and Whitman 1992). However, the duration of larval development depends strongly on the nutritional content of the food, as well as on temperature and humidity (Hedges and Lacey 1996, Rees 2004). Rees (2004) stated the optimal conditions for development of *S. paniceum* to be around 30 °C (85 °F) and 60–90% relative humidity for 40 days.

Infestations of *S. paniceum* are often controlled in an in-home environment by finding the source of the infestation and removing the affected material. Infestations within warehouses can be slightly more problematic. Kuwahara et al. (1975, 1978) examined the response of males to the female sex pheromone, 2,3-dihydro-2,3,5-trimethyl-6-(1-methyl-2-oxobutyl)-4H-pyran-4-one (known commonly as stegobinone). Their work suggested that this pheromone may be used as a monitoring tool to determine the extent of *S. paniceum* populations within warehouses where infestations may occur. Light traps have also been used alone or in conjunction with pheromones to monitor insect populations (VanRyckeghem 2004). Historically, fumigation has been effective in controlling *S. paniceum* infestations using aluminum phosphide, magnesium, phosphine, methyl bromide, or sulfuryl fluoride as fumigants (Gilberg 1989, VanRyckeghem 2004), although the latter is not suitable for fumigation of food products (Hedges and Lacey 1996). However, increasing environmental awareness has substantially reduced the use of many of these fumigants, particularly methyl bromide, as treatment options, prompting examination of the effects of carbon dioxide and other inert, low-oxygen gases as potential alternatives (Gilberg 1989, Gunasekaran and Rajendran 2005). The use of extreme temperatures is also sometimes used to treat severe infestations (VanRyckeghem 2004).

All Wisconsin specimens were collected from within homes or buildings. One particular infestation at a Manitowoc County home involved a kitchen and bathroom that were re-infested from the previous year. This was likely the result of improper removal of infested materials. The homeowner maintained that the drugstore beetles were biting their family cat, so it is possible that pet food was the source of the infestation, as is commonly observed, although there is no evidence to suggest that *S. paniceum* acts in this manner toward household pets.

A second infestation occurred at a food processing plant located in Owen, Wisconsin. Within the large plant, *S. paniceum* was found only in the area that processed imitation cheese by dumping bags of dry product into large vats. Since the air ducts are cleaned only every few years, a large build-up of dry product accumulated within the duct work. Samples showed countless specimens of *S. paniceum* developing on this material. In addition to the beetles, wingless parasitic bethylid wasps were also found on the walls near the infested product, presumably developing within the drugstore beetle larvae. The company resolved to routinely clean out the air ducts.

A number of other indoor infestations in Wisconsin originated from dog food or dog biscuits. Other infested food materials reported include a box of dry vermicelli, flour-based food products, as well as numerous specimens said to be from "furniture." One infestation occurred in the basement of a six-month old home wherein the previous owner brewed beer.

Phenology—Adult specimens of *S. paniceum* have been recorded throughout the year from within various structures in Wisconsin.

Distribution—*Stegobium paniceum* is widely distributed across North America as well as worldwide (White 1982), mostly through commerce (White 1962a). Pellitteri (1977) and Pellitteri and Boush (1983) reported this species from feed mills surveyed in southern Wisconsin. During this study, specimens were recorded from seven Wisconsin counties.

***Wisconsin Records* (Map 25)**—The 189 specimens of *S. paniceum* examined during this study were recorded from the following localities: **State only (1)**; **Dane Co. (94):** Eagle Heights, Madison; Madison; No other label

data; Verona; **Jefferson Co. (5):** No other locality data; **Manitowoc Co. (15):** Manitowoc/ Sent to Manitowoc County Health Department; **Milwaukee Co. (3):** Milwaukee; **Vernon Co. (2):** Hillsboro; **Waukesha Co. (66):** Oconomowoc; No other locality data; Waukesha; **Winnebago Co. (3):** Oshkosh.

Subfamily Ptilininae

Ptilininae was established by Shuckard (1840) to include six species contained within four genera: *Lasioderma* Stephens, *Ochina* Ziegler, *Xiletinus* Latreille (emended to *Xyletinus*), and *Ptilinus* Mueller. Classifications by LeConte (1861) and Fall (1905) considered Ptilininae (as Ptilinini) as monogeneric in North America, containing only the genus *Ptilinus*. Pic (1912a) also listed only *Ptilinus* for North American Ptilininae in addition to *Plumaria* Reitter and *Ptilineurus* Reitter, both said to occur outside North America. *Ptilineurus* was later recorded from Virginia and is currently the only genus representing Dryophilinae LeConte in North America (Philips 2002). Presently, North American Ptilininae, north of Mexico includes one genus and nine species (White 1982, Philips 2002). Specific curation of adult-mounted specimens of Ptilininae is usually not necessary as they are not highly contractile and generally die with the necessary structures exposed.

Ptilinus was first thought to be a transitional form between Anobiinae and Bostrichidae (LeConte 1861, Casey 1898) based on resemblance to certain bostrichid genera in terms of body form, sculpture, and the structure of the prothoracic tibiae (Fall 1905). This was later discredited by Fall (1905) who reported the resemblance as largely superficial and stated "there can be no doubt that *Ptilinus* is a true Anobiide, and it appears to me to be most closely allied to the central group—the Anobiini—from which it has diverged in about the same degree as have *Petalium* and *Eupactus*, and is equally hard to place." White (1971a) stated Ptilininae are "likely an offshoot of a *Euceratocerus*-like anobiid" and exhibit "little change in general form from members of the more primitive genera of Anobiinae." Thus, Ptilininae was placed between the Anobiinae and Xyletininae in North American fauna (Philips 2002).

Genus *Ptilinus* Mueller

Type Species: *Ptilinus fuscus* Geoffroy 1972: 64 (designated by Lucas 1920: 557).

Ptilinus Mueller 1764: xii.

Geoffroy (1762) established this genus for *Ptinus pectinicornis* Linnaeus, but his work was rejected by the International Commission on Zoological Nomenclature (ICZN) because he did not use the requisite binary system of nomenclature (Acciavatti 1972). Mueller (1764) was next to describe this genus, although no species were assigned to *Ptilinus*, his description validated the name (Acciavatti 1972).

The first major synopsis of the North American species of *Ptilinus* was compiled by Casey (1898) in which he described five new species: *Ptilinus acuminatus*, *Ptilinus flavipennis*, *Ptilinus lobatus*, *Ptilinus pruinosus*, and *Ptilinus ramicornis*, in addition to *Ptilinus ruficornis* Say and *Ptilinus basalis* LeConte. In 1905, Fall tentatively included *Tomicus thoracicus* Randall in *Ptilinus* (White 1982). Later, the European species, *P. pectinicornis* (Linnaeus), was recorded from New York State by Simeone (1961), bringing the total number of species known to occur in North America, north of Mexico, to nine (White 1982).

Two species have been found in Wisconsin, with one species that may eventually be collected. This includes *P. ruficornis*, the second most frequently encountered wood-feeding anobiid in the northeastern United States (White 1982). *Ptilinus pruinosus* has not yet been recorded from the state but is included in the key as it has been found in Ontario, Ohio, and Indiana, and may occur in Wisconsin. Males of this species were not available for examination during this study, so characters described in the key regarding antennal structures are taken from Fall's (1905) revision.

This genus is in need of revision as it has not been seriously treated taxonomically since Fall's work in 1905. The characters used in his key pertain almost exclusively to characteristics of the male antennae, with little to distinguish female specimens of *Ptilinus*, particularly *P. lobatus* from *P. pruinosus*. In addition, the couplet separating these two species in Fall's (1905) key contradicts the description of *P. pruinosus* given, by separating *P. pruinosus* from *P. lobatus* based on the prothorax being narrower than the elytra. However, in his description he characterized the prothorax as being "fully as wide as the elytra" for *P. pruinosus*. Casey (1898) differentiated females of these two species by the shape of the scutellum and form of the epipleurae, although these distinctions were not utilized or addressed by Fall (1905). In Casey's (1898) work, the scutellum of *P. lobatus* was said to be "elongate, finely and densely rugose" and the "epipleurae gradually wider at base," compared to *P. pruinosus* which was said to have the "scutellum quadrate, coarsely rugose," and the "epipleurae rapidly wider at base." Examination of female specimens of *P. lobatus* and *P. pruinosus* from the IRCW and FMNH did not seem to provide additional insight into these differences. To determine the potential usefulness of the female genitalia in species level determinations, three *P. ruficornis* females were dissected. Although females are known to oviposit in pores of hardwoods, the genitalia did not appear to be strongly sclerotized, and their potential for offering diagnostic characters was not further examined. Therefore, females of *P. lobatus* and *P. pruinosus* may not be separated unless collected with a male specimen, which is unfortunate because many of the *Ptilinus* specimens collected are ovipositing females. The structure of the female anterior pronotal asperities may eventually provide useful taxonomic characters, but this requires further study (see diagnosis for *P. lobatus*).

Larvae of *Ptilinus* develop in a variety of hardwoods (White 1982), whereas adults are commonly collected using flight intercept and Lindgren funnel traps. As stated above, large numbers of adult females may be collected on dead, standing hardwood trees, where they are commonly seen ovipositing on the same wood from which they emerged (Acciavatti 1972).

Males and females may be easily separated based on their sexually dimorphic antennae, which are strongly pectinate in males and serrate in females (Figs. 36, 37, 156–158). Males also tend to be smaller and less robust than females. The pronotal asperities appear to be sexually dimorphic as well; those of females strongly produced on the apical pronotal margin, which likely evolved to facilitate movement through tunnels in the wood created by the female during oviposition (Figs. 92, 159, 160). Anterior pronotal asperities in the males tend to be much less strongly developed (Figs. 157, 158).

Species of *Ptilinus* can be easily distinguished from all other Wisconsin Ptinidae by the following combination of characters: mandibles distant from metathoracic ventrite during body retraction (Figs. 156, 158, 160); antennae sexually dimorphic (Figs. 36, 37, 157–160); pronotum with asperities (Figs. 92, 159, 160); outer margin of prothoracic tibiae finely toothed, terminating in a large apical tooth (extracted in part from Philips 2002).

Key to the Wisconsin Species of Adult *Ptilinus*

[Modified from Casey 1898, Fall 1905, and White 1962a]

1 Lateral pronotal margins fine, but well defined and even throughout (Figs. 158, 160); subapical transverse carina of last ventrite distinct in both sexes (Fig. 78); antennal rami of male longer, that of the third segment about twice the length of the segment, that of the fourth antennomere six or seven times the length of the segment (Fig. 36) ..... ***ruficornis* Say (p. 41)**

1’ Lateral pronotal margins not well defined, comprised of granules (Fig. 156); subapical ventral transverse carina nearly or entirely absent in both sexes; antennae of male not as above **2**

2 (1’) Male with ramus of third antennomere not longer than the segment itself (Fig. 156); ramus of fourth antennomere 3–3.5X length of the segment..... ***lobatus* Casey (p. 40)**

2’ Males with ramus of the third antennomere 0.5X length of the segment itself; ramus of fourth antennomere nearly 5X the length of the segment..... ***pruinosus* Casey**

Ptilinus lobatus Casey

(Figs. 155, 156; Map 26)

[Synonymy modified from White 1982]
Ptilinus lobatus Casey 1898: 62.
Ptilinus serricollis Say 1823: 186 (White 1970).

Capsule Description **(Figs. 155, 156)—Length:** 3.0–3.3 mm. **Width:** 1.1–1.3 mm. **Integument Color:** dark reddish-brown to black; maxillary and labial palpi, and antennae yellowish-orange to yellowish-brown; pronotum sometimes darker than elytra; legs reddish-brown to reddish-black, tarsi yellowish. **Body Form:** cylindrical, robust, 2.6X longer than wide. **Vestiture:** pubescence yellowish; moderately dense, short, recumbent. **Head:** antennae 11-segmented, those of male strongly pectinate, 3rd antennomere with ramus equal to that of length of the segment, 4th antennomere about 3.5X the length of the segment, antennae of female strongly serrate; surface granulate. **Pronotum:** subequal in width to the elytra; appearing compressed toward anterior margin; surface with numerous asperities anteriorly, asperities decreasing in size laterally (less distinctive in male); lateral pronotal margins not well defined, composed of granules; pronotal base with a slightly raised and shining longitudinal carina. **Elytra:** parallel-sided; humeri discernible, not prominent; surface irregularly punctate, without striae; intervals slightly raised. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a deep longitudinal sulcus, terminating around middle of disk, sulcus mostly smooth and devoid of setae; surface densely punctate. **Legs:** not received in ventral excavations; margin of each prothoracic tibia finely toothed, terminating in a large apical tooth; metathoracic coxae grooved for metathoracic legs. **Abdomen:** with 5 ventrites; 5th ventrite with subapical transverse carina indistinct to lacking.

Diagnosis*—Ptilinus lobatus* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: mandibles distant from metathoracic ventrite during body retraction (Fig. 156); antennae of males strongly pectinate with ramus of third antennomere not longer than the length of the segment (Fig. 156), and the fourth antennomere about 3–3.5X the length of the segment, females with serrate antennae; pronotum with discal asperities; pronotal lateral margins not well defined, made up of granules (Fig. 156); outer margin of prothoracic tibiae finely toothed,

terminating in a large tooth at apex; last abdominal ventrite without a distinct transverse carina (extracted in part from White 1962a and Philips 2002).

Wisconsin adult males of *P. lobatus* are slightly different than those described by Fall in that the fourth antennomere is about three and a half times the length of the segment compared with "scarcely three times the length of the joint," as stated by Fall (1905). This could simply be the result of differences in measuring techniques and is not thought to be significant. Adult males of *P. pruinosus* have the fourth antennomere "nearly five times the length of the joint," thus, the Wisconsin specimens fall closer to *P. lobatus*.

As mentioned in the generic synopsis, females of *P. lobatus* are not readily distinguished from those of *P. pruinosus* unless accompanied by a male. Females of these two species may eventually be separated based on the form of the anterior asperities of the pronotum, as comparison of this structure on *P. ruficornis* and *P. lobatus* females did seem to show a significant difference in arrangement. In females of *P. ruficornis*, these asperities were fewer and closer together, compared to those of female specimens of *P. lobatus*, which were more numerous and spread apart, gradually decreasing in size laterally.

Natural History—Little has been reported pertaining to the natural history of this species. In a study of saproxylic insects associated with dead wood or woody fungi, Jacobs et al. (2007) reported *P. lobatus* to be a significant indicator species of a deciduous-dominated forest habitat, meaning they found a strong association between this species and certain deciduous trees. In Wisconsin, a male and a female specimen of *P. lobatus* were collected from a "termite log." The third male specimen examined had no specific collection data.

Phenology—Two adults of *P. lobatus* were recorded in Wisconsin during mid-May and one in mid-June.

Distribution—*Ptilinus lobatus* occurs mainly in south central North America from New Mexico and Colorado, and east into Nebraska, Kansas, and Missouri (White 1982). Majka (2007a) reported this species from Nova Scotia and Ontario. In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 26)**—The three specimens of *P. lobatus* examined during this study were recorded from the following localities: **Door Co. (1):** No other locality data; **Rock Co. (2):** Janesville.

Ptilinus ruficornis Say

(Figs. 9, 36, 37, 78, 92, 157–160; Map 27)

[Synonymy modified from White 1982]
Ptilinus ruficornis Say 1823: 186.
Ptilinus bicolor Melsheimer 1846: 308.

Capsule Description **(Figs. 9, 36, 37, 78, 92, 157–160)**—**Length:** 2.8–4.5 mm. **Width:** 1.1–1.7 mm. **Integument Color:** light or dark reddish-brown to black; maxillary and labial palpi and antennae yellowish-orange to yellowish-brown; pronotum sometimes darker than elytra; legs and tarsi reddish-brown to reddish-orange. **Body Form:** cylindrical, robust, 2.7X longer than wide. **Vestiture:** pubescence yellowish; moderately dense, short, recumbent. **Head:** antennae 11-segmented, that of male strongly pectinate, 3rd antennomere with ramus nearly 2X the length of the segment, antennae of female strongly serrate; surface granulate-punctate. **Pronotum:** as wide as, to slightly wider than elytra; appearing compressed toward anterior margin; surface with numerous asperities anteriorly, becoming smaller laterally (less distinctive in males); lateral margins complete and even throughout; base of pronotum with a slightly raised and shining longitudinal carina. **Elytra:** parallel sided; humeri discernible, not prominent; surface punctate, without striae; punctures forming indistinct rows. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; posteriorly with a deep longitudinal sulcus, terminating around middle of disk, sulcus mostly smooth and devoid of setae; surface densely punctate. **Legs:** not received in ventral excavations; outer margin of prothoracic tibiae finely toothed, terminating in a large apical tooth; metathoracic coxae grooved for reception of metathoracic legs. **Abdomen:** with 5 ventrites; 5th ventrite with a distinct subapical transverse carina.

Diagnosis—*Ptilinus ruficornis* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: mandibles distant from metathoracic ventrite during body retraction (Figs. 158, 160); antennae strongly pectinate with ramus of third antennomere twice the length of the segment (males) (Fig. 36) or serrate (females) (Fig. 37); pronotum with asperities (Figs. 92, 157–160); lateral pronotal margins fine, well defined and even throughout, not made up of granules (Figs. 158, 160); outer margin of prothoracic tibiae finely toothed, terminating in a large apical tooth; last abdominal ventrite with distinct transverse carina (Fig. 78) (extracted in part from Philips 2002).

Natural History—*Ptilinus ruficornis*, excluding Ptininae, is perhaps the "most abundant species of Anobiidae breeding in seasoned wood of American beech and sugar maple in Northern Hardwood Forests" (Acciavatti 1972). Both Simeone (1960) and Acciavatti (1972) examined the life history of this economically important species in the northeastern United States. Work by Acciavatii investigated viability of adult males and females, emergence factors, courtship behavior, flight ability, temporal activity, orientation of females to potential oviposition sites, pre-oviposition boring, effect of chilling on larval development, and parasitoids of *P. ruficornis* larvae. This work recorded the abundance of males and females during five different behaviors: emerging, walking on brood wood, flight, landing on un-infested

wood, and female boring. Acciavatti (1972) concluded *P. ruficornis* females are more abundant in all behavioral situations, with the exception of emergence, where numbers of males and females were nearly equal. He also determined females live longer on average than males, although mated females showed a reduction in viability compared to unmated females (Acciavatti 1972). These results suggested adults have the greatest flight ability within one day of emergence, with mating usually occurring at emergence when higher proportions of males are present (Acciavatti 1972).

Acciavatti (1972) examined the behavior of solitary males and females of *P. ruficornis* as well as sexual display behavior when they were combined. Females were observed to "raise and lower their abdomens periodically" and during these movements, "a glandular structure protruded from beneath the pygidium each time the abdomen was raised." When females were placed in a container with males, Acciavatti (1972) observed the following:

> Upon encountering a displaying female, a male responded with rapid body undulations for 1 to 2 seconds, extension of the aedeagus and excessive activity culminating in mating attempts. Antennal vibration over the female's prothorax while grasping her elytra with his legs accompanied these attempts. Displaying males attempted to mate with other males as well. Apparently, once males respond to a displaying female, the presence of other adults regardless of their sex is adequate to stimulate mating attempts.

After mating has occurred, the female may seek out suitable wooden material in which to lay her eggs, or oviposit on the same wood from which she emerged (Acciavatti 1972). Females were not shown to be attracted to infested wood, although Acciavatti's (1972) results suggested flight was arrested by chemical stimuli from the wood and other boring females once a female landed on a substrate. The ovipositor and sensory pits on antennomeres 4–10 are though to act as olfactory receptors for such chemicals (Acciavatti 1972). Both Simeone (1960) and Acciavatti (1972) observed females bore back into the wood to complete oviposition after emergence. Females create a hole along the wood grain by use of their mandibles (Fig. 9). After the hole is deep enough, the female turns around, backs into the hole so that her head is directed towards the entrance, and inserts her ovipositor deeply within the wood cells (Acciavatti 1972).

Larvae of this species were described by Böving (1954) for specimens collected from *Populus deltoides* Bartram, although this description also included three other species: *P. basalis*, *P. fuscus*, and *P. pectinicornis*. Specimens of *P. ruficornis* have been recorded only from hardwoods, including *Acer saccharum* Marshall, *Acer rubrum* Linnaeus, *Betula alleghaniensis* Britton, *Fagus grandifolia* Ehrhart., *Tilia americana* Linnaeus, and *Quercus* sp. (Harrington 1887, Runner 1919, Champlain and Knull 1922, Simeone 1960, Acciavatti 1972). Packard (1890) reported this species to be rather common, attacking both live and dead trees, and boring into exposed wood in which the bark has been partially stripped away. Other larval food materials include wild cultivated cherries, *Prunus* spp., eastern hophornbeam, *Ostrya virginiana* (Miller) K. Koch (Hopkins 1893); American sycamore, *Platanus occidentalis* Linnaeus, and mesquite *Prosopis* sp. (Craighead 1950); as well as "seaweed and dead beech" (Leng 1928, Acciavatti 1972). According to Acciavatti (1972), this species was reported from "dry, exposed wood of blazed, peeled and dead trees (Harrington 1887, 1897), sawlogs and cordwood (Packard 1890), flooring (Felt 1905), woodwork and stored wood (Craighead 1950) and structural timbers and furniture (Mallis 1960)." Within buildings, infested wood was found to have a relatively high average moisture content of 16.9% (Simeone 1960).

The tendency of *P. ruficornis* to utilize woody substrates causes it to be economically significant in wood and wood products (Simeone 1960). In fact, damage from this species is often referred to as "powder-posting" due to the frass exuded from emergence holes in the wood (Acciavatti 1972). Both larvae and to a lesser degree adults damage wooden materials that can increase over time from continuous reinfestation within the same wood material (Packard 1890, Acciavatti 1972). A rhipiphorid beetle, *Pelecotoma flavipes* Melsheimer, known to feed on wood-inhabiting insects, is a parasitoid of *P. ruficornis* larvae (Acciavatti 1972), although its numerical effects on *P. ruficornis* populations is not well understood.

Although *P. ruficornis* was found to be relatively common throughout Wisconsin, it was not found to be a significant pest of structures or stored wooden products in the state, possibly because of the higher moisture conditions required by this species. Of the 215 specimens collected, only about 3% were collected indoors, with no indication whether the beetle emerged from structural wood or from something brought into the home.

Approximately a third of specimens (36%) were hand-collected, either crawling on or boring into bare standing or fallen dead hardwoods, including *Acer* sp. and a box elder tree, *Acer negundo* Linnaeus, that had been cut down over the previous winter. A number of specimens were also collected boring into the heartwood of a dead, cut *Quercus* sp. log, although females appeared to bore into sapwood as well. Literature and collections indicate *P. ruficornis* occurs mainly in hard, dead, debarked hardwoods; however, one series was collected from a dead, standing *Quercus* tree that still retained some of its bark, although partially separated from the tree trunk. One specimen was swept from "vegetation along path opening," one was beaten from "vegetation

along R.R. tracks on Lake Superior," three were collected crawling "on trunk of maple," one from a "cut-site log pile at night," and one specimen was found on a leaf of a shrub. Adults of *P. ruficornis* were also readily obtained by trapping, including flight intercept, Lindgren funnel, and Townes–Malaise traps, some of which were baited with ipsdienol, cantharidin, or ethanol, although these did not appear to be significant attractants for the species. Finally, four specimens were taken at a Hg vapor lamp at night in a "one-year old hardwood cut site."

Phenology—Simeone (1960) found *P. ruficornis* to be univoltine with eggs generally laid in August, larval development until late May, pupation in June, and adult emergence from June to August. Emergence may, however, be delayed when conditions are not favorable (Acciavatti 1972). Emergence of the maximum number of adult *P. ruficornis* individuals was determined by Acciavatti (1972) to occur between the 25th and 30th of June, coinciding with maximum air temperature. Daily emergence number was said to "depend on present as well as on previous wood temperatures." Both studies were conducted in the northeastern part of the United States.

In Wisconsin, adults of *P. ruficornis* were recorded from mid-May to late July, with the majority of individuals occurring during June. A few specimens that emerged indoors were recorded from late March. Additional specimens were recorded from mid-February and late March, likely from indoors as well, although this was not directly stated on the label.

Distribution—*Ptilinus ruficornis* occurs widely across central and eastern North America, having been collected from Alberta and Ontario, Canada, and in the United States from Kansas, Iowa, and Wisconsin, east to New York and Massachusetts, and south to Kentucky and Alabama (White 1982). Larvae described by Böving (1954) included specimens obtained from Wisconsin. During the present study, specimens were recorded from 24 counties throughout the state.

Wisconsin Records **(Map 27)**—The 215 specimens of *P. ruficornis* examined during this study were recorded from the following localities: **State only (5)**; Watertown; **Ashland Co. (1):** Marina Peninsula Park; **Dane Co. (30):** Madison–U.S.G.S. National Wildlife Health Center; Picnic Point; Private Property–Town of Blue Mounds; Swamp Lover's Inc.; No other locality data; **Eau Claire Co. (2):** Eau Claire County Forest; **Florence Co. (5):** Private Property; **Forest Co. (24):** 10.4 mi. North of FR 2183 and HWY 55; **Grant Co. (1):** Wyalusing State Park; **Green Co. (47):** Abraham's Woods SNA; Browntown Oak Forest SNA; **Iowa Co. (1):** Ridgeway Pine Relict SNA; **Jackson Co. (1):** No additional label data; **Lafayette Co. (3):** Wedel property–~3 mi. North of Argyle; **Marathon Co. (3):** Big Eau Pleine Woods SNA–Big Eau Pleine County Park; **Marinette Co. (1):** Marinette County Beech Forest SNA; **Menominee Co. (2):** Menominee Tribal Enterprises; **Milwaukee Co. (13):** Cudahy Woods SNA; Whitefish Bay; No other locality data; **Ozaukee Co. (2):** Mequon–Riverlake Road Natural Area; **Racine Co. (12):** Renak–Polak Maple–Beech Woods SNA; **Richland Co. (3):** LWRSWA Lone Rock Unit; **Rock Co. (2):** Private Property–1.7 mi. NW Janesville; **Sauk Co. (22):** Spring Green–Bakken's Pond; Hemlock Draw TNC; **Shawano Co. (1):** 1.3 mi. NE Wittenberg; **Trempealeau Co. (18):** Perrot State Park; **Walworth Co. (1):** Kettle Moraine Oak Opening SNA; **Washburn Co. (13):** Berry Road–Near Nice Lake–4.5 mi. NW of Birchwood; **Wood Co. (2):** Powers Bluff SNA.

Subfamily Xyletininae

Xyletininae was proposed by Gistel (1856) according to Lawrence and Newton (1995), although Thomson (1859) is sometimes given credit for the subfamilial name (e.g., Español 1992). Within Xyletininae, taxonomy of species in Xyletinini has been particularly problematic. White (1985) stated, "it is surely evidence of difficult taxonomy when the history of a group of species shows much confusion in suprageneric and generic assignments." The genera to which he referred include *Xyletinus* Latreille, *Euvrilletta* Fall, and *Vrilletta* LeConte.

Fall's (1905) generic description indicated *Euvrilletta* was structurally similar to *Vrilletta*, but differentiated the two based on characters of the antennae and maxillary palpi. In 1985, White re-examined generic concepts of *Euvrilletta* and *Xyletinus*, placing elongate-bodied species with large eyes in *Euvrilletta* and stout-bodied species with smaller eyes in *Xyletinus*. Subsequent work limited *Vrilletta* to species with small eyes and antennal segments 4–10 strongly serrate to pectinate. This may lead them to be difficult to distinguish from other genera in Xyletininae. The relationships among the three genera should be re-evaluated so that species determinations can be made with a greater amount of certainty.

Xyletininae begin to show a distinct reduction of the pro- and mesosternum, allowing for greater contraction of the head and enabling the mandibles to reach, or nearly reach, the metathoracic ventrite in repose (less obvious in *Vrilletta* and *Euvrilletta*, compared to *Lasioderma* and most species of *Xyletinus*). This trend becomes still more defined in phylogenetically more derived subfamilies such as the Dorcatominae and Mesocoelopodinae. Xyletininae in North America north of Mexico currently includes six genera and 50 species (White 1985, Philips 2002). Four genera and seven species were confirmed from Wisconsin in the present study.

Larvae of most Xyletininae bore into dead hardwoods or softwoods and therefore may cause damage to woodwork and structural wood of buildings (White 1982). Xyletininae contains two well-known species of economic importance,

the first being the cosmopolitan species, *Lasioderma serricorne* (Fabricius), which breeds in a variety of stored products, most notably tobacco. Another economically significant species is *Euvrilletta peltata* (Harris), considered the most common anobiid in the southeastern United States (Ebeling 1978). Both *L. serricorne* and *E. peltata* are discussed further in the descriptions that follow.

Members of North American Xyletininae may be distinguished from most other Ptinidae by having the mandibles reach or nearly reach the metathoracic ventrite in repose and the first abdominal ventrite not grooved to receive the metathoracic legs (Fig. 162) (extracted in part from Philips 2002). However, in Mesocoelopodinae, the genus *Neosothes* White also exhibits these characters and is difficult to separate from the Xyletininae, except by its distribution, being known only as far north as Baja California (White 1975). Proper curation of specimens in this subfamily involves drawing out the antennae so that the length of various segments may be compared. Prothoracic and mesothoracic legs should also be pulled away from the body so that the metathoracic ventrite is visible. In certain cases, male genitalia may need to be extracted and examined.

The following key should be used with caution as it pertains quite specifically only to species possible for the Wisconsin genera presented.

Key to the Wisconsin Genera of Adult Xyletininae

[Modified from Philips 2002]

1 Metathoracic ventrite abruptly declivous and transversely carinate anteriorly ..... ***Lasioderma*** **(p. 51)**

1’ Metathoracic ventrite not abruptly declivous and transversely carinate anteriorly **2**

2 (1’) Combined length of last 3 antennal segments equal to or longer than all preceding combined (Fig. 39); elytral intervals strongly convex (Figs. 167, 168) ..... ***Vrilletta*** **(p. 47)**

2’ Combined length of last 3 antennal segments at most equal in length to preceding 4–7 segments; elytral intervals less convex **3**

3 (2’) Eyes large, separated by ≤3.5X their width when viewed from the front (Fig. 88)..... ***Euvrilletta*** **(p. 44)**

3’ Eyes small, separated by ≥4.0X their width when viewed from the front..... ***Xyletinus*** **(p. 48)**

Genus *Euvrilletta* Fall

[Synonymy modified from White 1982, 1985]
Type Species: *Euvrilletta xyletinoides* Fall 1905: 196 (by monotypy).
Oligomerodes Fall 1905: 161.
Euvrilletta Fall 1905: 196.
Oligomeroides Fall; Pic 1912a: 81 (*lapsus calami*).
Euvrilleta Fall; Van Dyke 1946: 85 (*lapsus calami*).

Euvrilletta was proposed by Fall (1905) for *E. xyletinoides*. In the same revision, he erected *Oligomerodes*, in Anobiini, for two species: *Oligomerodes occidentalis* and *Oligomerodes catalinae*, which were later synonymized as species of *Euvrilletta* by White (1976b).

Although White significantly improved the taxonomy of this genus, species determinations still remain problematic. The key to North American *Euvrilletta* (White 1985) relies on distribution and relative lengths of the antennal segments for determinations with few dissections of male genitalia. Because the length of the last three antennal segments in most Anobiidae *auctorum* tends to be sexually dimorphic, this character may lead to difficulties. In addition, given that collection of members of Xyletininae is rather uncommon, distributions are not well known, and should only be used in a key in conjunction with other characters. Unfortunately, it is not possible at this time to make significant changes to the existing keys. Further examination of male genitalia should be conducted to evaluate the extent of variation present in species otherwise difficult to separate by present means.

Euvrilletta may be distinguished from all other Wisconsin Xyletininae by a combination of the following characters: eyes large and separated by less than 3.5X their width when viewed from the front; metathoracic ventrite not abruptly declivous and without a transverse carina (extracted in part from White 1985, Philips 2002).

Fifteen species of *Euvrilletta* are known from North America, north of Mexico, three of which occur in Wisconsin. Specimens are most frequently taken using UV or Hg light, but they may also be collected using passive Lindgren or flight intercept traps.

Key to the Wisconsin Species of Adult *Euvrilletta*

[Modified from White 1985]

1 Last 3 antennomeres combined equal in length to preceding 6 segments; terminal antennomere nearly 3X longer than wide in both sexes (Figs. 40, 41).....***brevis* White (p. 45)**

1' Last 3 antennomeres combined equal in length to preceding 4–5 segments; terminal antennomere <3X as long as wide in both sexes **2**

2 (1) Lateral pronotal margin narrow and not reflexed; terminal maxillary palpomere elongate, >2X longer than wide, feebly triangular (Fig. 59).....***peltata* (Harris) (p. 46)**

2' Lateral pronotal margin broad and reflexed; terminal maxillary palpomere broadly triangular, about 1.5X longer than wide. (Fig. 60).....***harrisii* (Fall) (p. 46)**

Euvrilletta brevis White

(Figs. 40, 41, 161, 162; Map 28)

[Synonymy modified from White 1982]
Euvrilletta brevis White 1960: 235.
Xyletinus brevis (White); White 1969c: 254.

Euvrilletta brevis was described by White (1960) from three males collected in Adams Co., Ohio. White (1969c) briefly considered this species as a member of *Xyletinus* before his revision of the two genera (White 1977b, 1985).

Capsule Description **(Figs. 40, 41, 161, 162)—Length:** 3.7–4.0 mm. **Width:** 1.5–1.8 mm. **Integument Color:** light reddish-brown to dark reddish-brown throughout; pronotum and elytral base sometimes darker; maxillary and labial palpi, antennae, and tarsi reddish-yellow to reddish-brown. **Body Form:** elongate, robust, 2.3X longer than wide. **Vestiture:** body and appendages with moderately dense, short, yellowish, recumbent pubescence. **Head:** terminal segment of each maxillary palpus elongate, 2–3X longer than wide, inner lateral margin rounded; eyes moderately large, separated by <3.5X the width of the eye when viewed from the front; antennae 11-segmented, serrate, segments 3–8 similar in size and shape, 9th segment slightly shorter than combined length of 7 + 8, segments 9–11 elongate (moreso in male), about equal in length to the combined length of 3–8; terminal antennomere 3X longer than wide; surface finely, densely punctate. **Pronotum:** evenly convex; with short, feeble basal longitudinal carina; lateral margin narrowly reflexed; surface finely granulate, punctate. **Elytra:** each elytron with 10 complete to nearly complete striae, not appearing as rows of punctures; striae weakly impressed, intervals nearly flat. **Metathoracic Ventrite:** not excavate for reception of the mesothoracic legs; anterior raised margin of the intercoxal process arcuate; posteriorly with a darkly pigmented, longitudinal sulcus medially, extending 0.75X length of disk; surface finely, densely punctate. **Legs:** not received in ventral excavations; metathoracic coxae grooved to receive metathoracic legs. **Abdomen:** with 5 ventrites.

Diagnosis—*Euvrilletta brevis* may be separated from all other Wisconsin Xyletininae by a combination of the following characters: terminal segment of each maxillary palpus elongate, at least twice as long as wide; eyes large, separated by no more than 3.5 times the width of the eye when viewed from the front; antennomeres 9–11 elongate, equal in length to combined length of 3–8, terminal antennal segment nearly 3X longer than wide (Figs. 40, 41); metathoracic ventrite not declivous anteriorly (extracted in part from White 1985, Philips 2002).

In Wisconsin, specimens of *E. brevis* are most similar to those of *Euvrilletta peltata* (Harris) in the form of the terminal maxillary palpomere and shape of the pronotum. The combined length of antennomeres 9–11 is the only positive way to differentiate the two species, although this may also prove problematic in the future as more variation is discovered.

Natural History—The natural history of this species is unknown as few records have been published from North America. The majority of Wisconsin specimens were collected at light, either from a light trap or at a UV or Hg vapor lamp. The two specimens collected at a flight intercept trap baited with cantharidin were certainly incidental with respect to the bait.

Phenology—White (1965) recorded *E. brevis* adults from South Dakota during the months of June, July, and August, and specimens collected from Ohio in June (White 1962a). In Wisconsin, adults were collected from late June to mid-July.

Distribution—*Euvrilletta brevis* has been recorded from South Dakota, Ohio, and South Carolina (White 1982). This species has been previously published to occur in Wisconsin (White 1982). During this study, specimens were recorded from six Wisconsin counties.

***Wisconsin Records* (Map 28)**—The 12 specimens of *E. brevis* examined during this study were recorded from the following localities: **Dane Co. (6):** Private Property–Cottage Grove; Private Property–Deerfield; **Florence Co. (1):** No other locality data; **Milwaukee Co. (2):** Cudahy Woods SNA; **Richland Co. (1):** No other label data; **Sauk Co. (1):** Hemlock Draw TNC; **Wood Co. (1):** Griffith St. Nursery.

Euvrilletta harrisii (Fall)

(Figs. 42, 43, 60, 88, 163, 164; Map 29)

[Synonymy modified from White 1982, 1985]
Xyletinus harrisii Fall 1905: 201.
Euvrilletta harrisii (Fall); White 1985: 185.

Euvrilletta harrisii was described by Fall (1905) for specimens differing from the morphologically similar *E. peltata*. Therefore, collections of *E. peltata* determined prior to 1905 probably also contain specimens of *E. harrisii*.

***Capsule Description* (Figs. 42, 43, 60, 88, 163, 164)**—**Length:** 3.6–4.3 mm. **Width:** 1.6–1.9 mm. **Integument Color:** light reddish-brown to dark reddish-brown throughout; maxillary and labial palpi and antennae reddish-yellow to reddish-brown; legs orange-brown to reddish-brown. **Body Form:** elongate, robust, 2.2X longer than wide. **Vestiture:** body and appendages with short, yellowish, moderately dense, recumbent pubescence. **Head:** terminal segment of each maxillary palpus broadly triangular, about 1.5X as long as wide; eyes large, separated by <3.5X the width of the eye when viewed from the front; antennae 11-segmented, serrate, antennomeres 3–10 triangular, segment 3 elongate-triangular, segment 11 elongate, segments 9–11 equal in length to the 4–5 preceding combined; surface finely, densely punctate. **Pronotum:** strongly convex; lateral margin of pronotum broad and reflexed; surface granulate-punctate. **Elytra:** each elytron with 10 complete to nearly complete fine, and somewhat deep striae; intervals weakly convex. **Metathoracic Ventrite:** not excavate for reception of the mesothoracic legs; anterior raised margin of the intercoxal process broadly arcuate to flat; posteriorly with a darkly pigmented, longitudinal sulcus medially, extending 0.75X length of disk; surface finely, densely punctate. **Legs:** not received in ventral excavations; metathoracic coxae grooved to receive metathoracic legs. **Abdomen:** with 5 ventrites.

Diagnosis—*Euvrilletta harrisii* may be separated from all other Wisconsin Xyletininae by a combination of the following characters: terminal maxillary palpomere broadly triangular, length 1.5X width (Fig. 60); eyes large, separated by no more than 3.5X width of the eye when viewed from the front (Fig. 88); antennomeres 9–11 slightly enlarged, equal in length to the preceding 4–5 segments combined, terminal antennomere usually less than twice as long as wide (Figs. 42, 43); lateral margin of the pronotum broad and reflexed (extracted in part from White 1985, Philips 2002). Specimens of *E. harrisii* may be immediately distinguished from the other two Wisconsin species by the form of the terminal maxillary palpomere and lateral pronotal margin.

Natural History—Unlike *E. peltata*, *E. harrisii* is said to be uncommonly collected in North America and is therefore thought to be of little economic significance. Champlain and Knull (1922) reported specimens of *E. harrisii* reared from dead oak. In Wisconsin, specimens of *E. harrisii* were collected at Lindgren funnel and flight intercept traps as well as at a Hg vapor lamp. One specimen was found crawling on the outside of a hanging flight intercept trap.

Phenology—Adult specimens of *E. harrisii* were recorded in Wisconsin from mid-July to early August.

Distribution—*Euvrilletta harrisii* occurs throughout the northeastern United States from New Jersey, New York, Massachusetts, and New Hampshire, and west into Kentucky, Ohio, Pennsylvania, and Michigan (White 1982). In this study, specimens were examined from four Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

***Wisconsin Records* (Map 29)**—The eight specimens of *E. harrisii* examined during this study were recorded from the following localities: **Clark Co. (1):** Schmidt Maple Woods SNA; **Fond du Lac (1):** Waupun Park Maple Forest SNA; **Milwaukee Co. (4):** Cudahy Woods SNA; Sheridan Park; **Sauk Co. (2):** Hemlock Draw TNC.

Euvrilletta peltata (Harris)

(Figs. 59, 165, 166; Map 30)

[Synonymy modified from White 1962a, 1982, 1985]
Anobium peltatus Harris 1836: 75.
Xyletinus peltatus (Harris); LeConte 1865: 237.
Euvrilletta peltata (Harris); White 1985: 185.

***Capsule Description* (Figs. 59, 165, 166)—Length:** 3.7–4.6 mm. **Width:** 1.6–2.2 mm. **Integument Color:** yellowish-brown to dark reddish-brown throughout; maxillary and labial palpi and antennae reddish-yellow to reddish-orange; legs orange-brown to reddish-brown, tarsi lighter. **Body Form:** elongate, 2.2X longer than wide. **Vestiture:** body and appendages with short, yellowish, moderately dense, recumbent pubescence. **Head:** terminal segment of each maxillary palpus elongate, feebly expanded laterally, 2–2.5X as long as wide; eyes large, separated by <3.5X the width of the eye when viewed from the front; antennae 11-segmented, serrate, antennomeres 3–8 triangular, segment 3 elongate-triangular, segment 11 elongate, segments 9–11 equal in length to the 4–5 preceding combined; surface finely, densely punctate. **Pronotum:** strongly convex; lateral margin narrow, not reflexed; surface finely sparsely punctate-granulate. **Elytra:** each elytron with 10 complete to nearly complete striae, not appearing as rows of punctures; striae not deeply impressed, intervals weakly convex.

Metathoracic Ventrite: not excavate for reception of the mesothoracic legs; anterior raised margin of the intercoxal process broadly arcuate to flat; posteriorly with a darkly pigmented, longitudinal sulcus medially, extending 0.75X length of the disk; surface densely punctate. **Legs:** not received in ventral excavations; metathoracic coxae grooved to receive metathoracic legs. **Abdomen:** with 5 ventrites.

Diagnosis—*Euvrilletta peltata* may be separated from all other Wisconsin Xyletininae by a combination of the following characters: terminal maxillary palpomere elongate, feebly triangular, length ≥2X width (Fig. 59); eyes large, separated by not more than 3.5X the width of the eye when viewed from the front; last three antennal segments equal in length to the preceding four or five segments combined; lateral pronotal margins narrow, not reflexed (extracted in part from White 1985, Philips 2002). As mentioned in the diagnosis for the previous species, specimens of *E. peltata* are most easily confused with those of *E. brevis*.

Natural History—*Euvrilletta peltata* is thought to prefer high wood moisture content for development and may thrive on wood already degraded by certain fungi (Ebeling 1978). Damage from this species is sometimes compared to that of *Lyctus* spp. in that structural failure of wood may occur if the conditions are favorable (Baker 1972). Wooden joists and flooring in damp buildings tend to be particularly susceptible (White 1962a). In an unoccupied structure, Baker (1972) reported damage from re-infestation may become so severe that it could cause flooring to collapse. Older homes with crawl spaces are also heavily infested. Williams and Smythe (1978) estimated over 99% of 673 indoor crawl spaces inspected throughout 11 states in the southern United States were, or had been, infested with *E. peltata* (although the species identification was based on damage rather than on actual specimens).

Euvrilletta peltata may develop in both sapwood and heartwood of seasoned hardwoods and softwoods (Baker 1972, Moore 1979) but is thought to show a distinct preference for certain wood species (Ebeling 1978). Moore (1964, 1979) stated *E. peltata* is one of the most common species in southern yellow pine, although hardwoods are generally preferred. This is probably because southern pine timbers are used widely for wood-frame construction, especially in the South (Williams and Smythe 1978). Williams (1973) reported that within a barn infested with *E. peltata*, the yellow poplar boards were heavily infested, while the cypress and western pine were not. Further studies by Williams and Mauldin (1974) confirmed this preference for oviposition on yellow poplar over other wood species; they estimated the life cycle of *E. peltata* is at least two years in favorable wood species, whereas it may extend to 3–5 years in non-preferred wood species (Williams and Mauldin 1981). Within the wood, damage is usually confined to the spring wood of each annual ring (Baker 1972). Remediation may be achieved through fumigation or removal of infested material, especially if the infestation is localized. Extreme temperatures may also be an effective control method.

A complete description of the larva was provided by Böving (1954) for *E. peltata* (as *Xyletinus peltatus*) collected from pine wood, pine joists in a 40-year old house, and shop timbers of "swamp maple." This description also included larvae determined as "near *peltatus*," recorded from barn timbers, wood from a bookcase, and pine sills. In Wisconsin, but two specimens of *E. peltata* were seen during this study; one specimen was obtained at UV light and one with no collection information.

Phenology—Collections of adult *E. peltata* by Williams and Mauldin (1974) showed that a greater number of females than males were collected from the wood surface shortly after dusk (7–9 p.m.). Later in the evening (9–11 p.m.), both sexes were collected equally as this appears to be the time of peak mating activity. In their study, adults were collected 18 May to 02 June, 1970, with a greater proportion of females collected later in the emergence period (Williams and Mauldin 1974). In Wisconsin, adult specimens of *E. peltata* were collected during mid-July.

Distribution—*Euvrilletta peltata* is widely distributed in eastern North America with the greatest number of records from the southeastern states (Ebeling 1978). It occurs as far southwest as Texas, Louisiana, and Arkansas, southeast to Georgia and North Carolina, northeast along the east coast into New York, Maryland, and Massachusetts, and northwest to Pennsylvania, Kentucky, Ohio, Michigan, and Illinois (White 1982). Majka (2007a) reported this species from Ontario, Prince Edward Island, Quebec, and Rhode Island. In this study, specimens were examined from two southern Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 30)**—The two specimens of *E. peltata* examined during this study were recorded from the following localities: **Grant Co. (1):** Wyalusing State Park; **Richland Co. (1):** No other locality data.

Genus *Vrilletta* LeConte

[Synonymy modified from White 1974, 1982, Philips 2002]
Type Species: *Vrilletta murrayi* LeConte (designated by Lucas 1920: 668).
Vrilletta LeConte 1874: 64.
Pseudoxyletinus Pic 1903: 182; Pic 1912a: 45 (as subgenus).
Vrilleta LeConte; Pic 1905: 171 (*lapsus calami*).
Urilletta LeConte; Zoological Record 1924: 173 (*lapsus calami*).
Vriletta LeConte; Böving 1927: 57 (*lapsus calami*).

White (1980) re-examined this genus and described two new species from California: *Vrilletta bicolor* White and *Vrilletta pectinicornis* White. In this work, he also reviewed descriptions of *Vrilletta nigra* Pic and *Vrilletta fulvolineata* Pic and

suggested that *V. nigra* might be synonymous with *Vrilletta convexa* LeConte or *V. pectinicornis* and that *V. fulvolineata* might be synonymous with *Vrilletta decorata* VanDyke. Pic's type specimens were not examined during White's study because they could not be located; therefore, White regarded these taxa as *incertae sedis* until the types could be examined. White's (1980) review of *Vrilletta* represents the most recent work on the genus.

The 12 species known from North America, north of Mexico, including the two Pic species listed above, occur predominantly in the Pacific coastal states with the exception of *Vrilletta laurentina* Fall.

Vrilletta laurentina Fall

(Figs. 39, 167, 168; Map 31)

Vrilletta laurentina Fall 1905: 195.

This species was described by Fall (1905) from two females collected in Toronto, Canada. Later, White (1962a) examined a series of seven females from Mt. Alto, Pennsylvania.

Capsule Description **(Figs. 39, 167, 168)—Length:** 4.6 mm. **Width:** 2.0 mm. **Integument Color:** antennae and palpi yellowish-orange; pronotum and elytra dark reddish-brown; head and ventral surface blackish; legs reddish-brown. **Body Form:** robust, elongate, 2.3X longer than wide. **Vestiture:** pubescence yellowish, moderately dense, recumbent. **Head:** terminal segment of each maxillary palpus elongate, distinctly pointed apically; eyes small, separated by nearly 5.1X the width of the eye when viewed from the front; antennae 11-segmented, segments 4–8 strongly serrate and distinctly wider than long; combined length of last 3 antennal segments longer than all preceding segments combined, 11th segment elongate, about 3X longer than wide; surface finely, densely punctate. **Pronotum:** with a narrow, smooth line medially; surface with large punctures, becoming larger and shallower laterally; small punctures moderately dense. **Elytra:** striae sharply impressed, intervals convex; elytral apices not truncate. **Metathoracic Ventrite:** not excavate for reception of the mesothoracic legs; posteriorly with a moderately shallow longitudinal sulcus 0.5X length of the disk; surface punctate. **Legs:** not received in ventral excavations; prothoracic and mesothoracic tibiae conspicuously concave on outer margins; metathoracic coxae grooved to receive metathoracic femora. **Abdomen:** with 5 ventrites.

Diagnosis—*Vrilletta laurentina* may be separated from all other Wisconsin Xyletininae by a combination of the following characters: antennal segments 4–8 strongly serrate; combined length of the last three antennal segments longer than all preceding segments combined (Fig. 39); pronotum with a narrow, smooth median line; elytral intervals strongly convex (Figs. 167, 168).

Separation of *Vrilletta* from other North American Ptinidae using Philips (2002) key may not always be obvious based on the couplet (#7) referring to the approximation of the mandibles to the metathoracic ventrite. In the specimen examined, the mandibles are not as close to the metathoracic ventrite as they are in other members of Xyletininae. However, when compared with specimens having the mandibles distant from the metathoracic ventrite, it is apparent that *Vrilletta* specimens are in fact contracted in this manner.

Natural History—Little has been published on the natural history of *V. laurentina*. White (1962a) recorded this species from "dead twigs and partly decayed linden branches." The single Wisconsin specimen examined collected from a cantharidin bait trap was certainly an incidental recovery.

Phenology—The adult specimen of *V. laurentina* was recorded in Wisconsin from mid- to late April. It is possible that the earlier flight of this species is responsible for it being rather uncommonly collected.

Distribution—Unlike most other members of *Vrilletta*, *V. laurentina* appears to occur in eastern North America (Fall 1905). It has been recorded from Ontario, Quebec, and Pennsylvania and is thought to be rather rare in collections. In this study, one specimen was examined from a single Wisconsin county; it constitutes a **NEW STATE RECORD**.

Wisconsin Records **(Map 31)**—The single specimen of *V. laurentina* examined during this study was recorded from the following locality: **Racine Co. (1):** Renak–Polak Maple–Beech Woods SNA.

Genus *Xyletinus* Latreille

[Synonymy modified from White 1982, Philips 2002]
Type Species: *Ptilinus ater* Cruetzer, I.C.Z.N. 1971: 81 (proposed by White 1969b).
Xyletinus Latreille 1809: 376.
Xylotinus Latreille; Sturm 1826: 59 (*lapsus calami*).
Xiletinus Latreille; Stephens 1829: 12 (*lapsus calami*).
Xytelinus Latreille; Griffith and Pidgeon 1832: 350 (*lapsus calami*).
Calypterus Mulsant and Godart 1859: 181 (described as genus but listed as subgenus of *Xyletinus* by Pic 1912a).
Notiomimus Wollaston 1861: 6.
Xeronthobius Morawitz 1863: 164 (listed as subgenus of *Xyletinus* by Pic 1912a).
Sternoplus Mulsant and Rey 1864: 263.
Xyletomimus Reitter 1901: 28 (as subgenus of *Xyletinus*).
Ryletinus Latreille; Zaitsev 1956: 76 (*lapsus calami*).
Xylentinus Latreille; Santoro 1957: plate (*lapsus calami*).

Xyletinus was described by Latreille (1809), although no species were included in the genus (White 1969b). One year later, Latreille (1810) designated *Ptilinus laevis* Illiger as the type species of *Xyletinus*, a species later transferred to *Lasioderma* (White 1969b). Stephens (1829) added *X. ater* to *Xyletinus*, which White (1969b) later designated as the type species for the genus.

In North America, north of Mexico, *Xyletinus* is composed of 13 species, including *Xyletinus puberulus* Boheman, of uncertain status. Because a number of species previously placed in this genus were transferred into *Euvrilletta*, an updated list of North American *Xyletinus* has not yet been presented in existing literature. Therefore, the species considered to be found in North America (excluding Mexico) are as follows:

Xyletinus bicolor White
Xyletinus californicus White
Xyletinus carinatus White
Xyletinus confusus White
Xyletinus fasciatus White
Xyletinus fucatus LeConte
Xyletinus gracilipes Fall
Xyletinus lugubris LeConte
Xyletinus obsoletus White
Xyletinus parvus White
Xyletinus pubescens LeConte
Xyletinus rotundicollis White

Four *Xyletinus* species are hypothesized to occur in Wisconsin; two species have been collected to date. *Xyletinus bicolor* is included in the key as it has been recorded from Minnesota, as well as *X. lugubris*, which has been recorded from much of the northeastern and north-central regions of the United States (White 1982).

Species determinations in this genus are difficult at best. Specimens of *X. fucatus* are difficult to distinguish as they are determined based mostly on color (see diagnosis for *X. fucatus*). Also, separation of female *X. lugubris* from those of *X. confusus* or *X. bicolor* was not possible during this study as representative samples of each species were not obtained for examination. White (1977b) separated *X. lugubris* females from the other two species because it was said to have most antennomeres about twice as wide as long (compared to as wide, to a little wider than long, in both males and females of *X. confusus* and *X. bicolor*). Two females I examined fit the description for *X. lugubris*; however, I am hesitant to assign them to this species based on my examination of a male of *X. lugubris*. This specimen, determined by White, was easily distinguished using White's (1977b) key, which stated the antennal segments of the male are about three times as wide as long. A number of males from Wisconsin express an intermediate form between the two character states, having most antennal segments about twice as wide as long, which may lead them to be determined to *X. lugubris* females, if not dissected to prove them to be males. The genitalia of these males more closely resemble those of *X. confusus*, to which they were assigned, than the similar *X. bicolor*. Therefore, it may be possible that the female specimens mentioned above are actually *X. confusus*, and that there is greater variability in the relative lengths and widths of the antennal segments than previously documented.

Species of *Xyletinus* have been recorded from *Populus tremuloides* Michaux as well as "on *Ceanothus americanus*" Linnaeus (White 1982). Larvae of *X. parvus* have reportedly been collected in rabbit dung (White 1982). In Wisconsin, members of this genus appeared to be rather uncommonly collected.

Males and females are not easily separated; however, males tend to have the eyes larger, separated by about 4–4.5X the width of the eye when viewed from the front. Eyes of females are generally smaller and separated by 5–7 times the width of the eye when viewed from the front (White 1962b). For most *Xyletinus*, specimens may require dissection, which is the most accurate method of separating the sexes.

Key to the Wisconsin Species of Adult *Xyletinus*

[Modified from White 1977b]

1 Body uniformly orange-brown to reddish-brown throughout (Figs. 171, 172).....***fucatus* LeConte (p. 50)**

1' Body dark brown to black.....**2**

2 (1') Antennomeres 5–8 of male approximately 3X as wide as long.....***lugubris* LeConte**

2' Antennomeres 5–8 of males <2.5X as wide as long.....**3**

3 (2') Lateral pronotal punctures irregular with dorsal rim of each often obscure; male genitalia with lateral lobes narrow and arcuate.....***bicolor* White**

3' Lateral pronotal punctures irregular and running together with posterior rim of each often obscure; male genitalia with lateral lobes broader, less arcuate.....***confusus* White (p. 50)**

Xyletinus confusus White

(Figs. 44, 169, 170; Map 32)

Xyletinus confusus White 1977b: 528.

Capsule Description **(Figs. 44, 169, 170)—Length:** 2.5–3.7 mm. **Width:** 1.4–1.8 mm. **Integument Color:** dark-brown to black; mouthparts, antennae, and legs somewhat lighter; elytra orange-brown to blackish. **Body Form:** elongate, robust, 2.0X longer than wide. **Vestiture:** body and appendages with moderately dense, short, yellowish, recumbent pubescence. **Head:** terminal segment of each maxillary palpus elongate, approximately 2.5X longer than wide; eyes small, separated by 4–6X the width of the eye when viewed from the front; antennae 11-segmented, segments 3–10 serrate, 5–8 wider than long, segment 11 elongate; surface granulate-punctate. **Pronotum:** convex; slightly concave apically on each side; surface punctate, punctures laterally irregular, becoming confluent together. **Elytra:** humeri distinct, not prevalent; each elytron with 10 complete to nearly complete striae, not appearing as rows of punctures; intervals moderately convex; apex truncate. **Metathoracic Ventrite:** not excavate for reception of mesothoracic legs; medially with a shallow, longitudinal sulcus, running the length of the disk, posterior margin of sulcus with a round nitid patch; surface punctate. **Legs:** not received in ventral excavations; metathoracic coxae grooved to receive metathoracic legs. **Abdomen:** with 5 ventrites. **Genitalia:** lateral lobes mostly parallel, curving inward apically; internal process of median lobe with two sclerotized, wedge-shaped pieces.

Diagnosis—*Xyletinus confusus* may be distinguished from all other Wisconsin Xyletininae by a combination of the following characters: body dark brown to blackish (Figs. 169, 170); eyes small, separated by approximately four or more times their width when viewed from the front (e.g., Fig. 89); combined length of last three antennomeres shorter than all preceding segments combined, segments five through eight of males less than two and a half times as wide as long (Fig. 44); metathoracic ventrite not declivous anteriorly; male genitalia with lateral lobes mostly parallel, not strongly arched (extracted in part from White 1977b, Philips 2002). As mentioned above in the generic summary, only males of this species were positively identified.

Natural History—White (1982) reported *X. confusus* from Douglas-fir, *Pseudotsuga menziesii* (Mirbel). In Wisconsin, two specimens were collected at a Lindgren funnel trap, and one specimen was hand-collected "on exposed woody root at base of tree in forest" in the evening.

Phenology—Adult specimens of *X. confusus* were recorded in Wisconsin from early May to mid-June.

Distribution—*Xyletinus confusus* is known mostly from western North America, from British Columbia, Alberta, and the Northwest Territories in Canada, and from California, Wyoming, and South Dakota in the United States (White 1982). In this study, specimens were examined from three Wisconsin counties; they constitute a **NEW STATE RECORD** and new eastern range extension for the species.

Wisconsin Records **(Map 32)**—The four specimens of *X. confusus* examined during this study were recorded from the following localities: **Clark Co. (2):** Schmidt Maple Woods SNA; **Dane Co. (1):** No other locality data; **Taylor Co. (1):** Chequamegon National Forest–Kathryn Lake CG.

Xyletinus fucatus LeConte

(Figs. 89, 171, 172; Map 33)

Xyletinus fucatus LeConte 1865: 238.

Fall (1905) stated in his description of this species that the material before him was most likely composed of several similar species but did not separate them. White (1977b) confirmed this after examination of the male genitalia and regarded those specimens with orange-brown to reddish-brown integument as *X. fucatus*. However, he also noted that differences in male genitalia among species similar to *X. fucatus* were not always obvious and suggested that future work should involve numerous dissections to better clarify species hypothesis (White 1977b). The series before me is also questionable and likely composed of more than one species, as the color of these specimens ranges from light-orange to darker reddish-brown. The relatively larger size of the darker specimens and variation in the shape of the terminal maxillary palpomere also leads me to question their determination.

Capsule Description **(Figs. 89, 171, 172)—Length:** 3.0–5.2 mm. **Width:** 1.5–2.4 mm. **Integument Color:** orange-brown to reddish-brown throughout, nearly uniform in color; elytra infrequently darker than body; elytral striae usually brownish. **Body Form:** elongate, robust, about 2.0X longer than wide. **Vestiture:** body and appendages with short, yellowish, moderately dense, recumbent pubescence. **Head:** eyes small, separated by ≥4.0X the width of the eye when viewed from the front; antennomeres 3–10 serrate with the 11th segment elongate, segments 5–7 slightly wider in the male than in the female; terminal segment of each maxillary palpus elongate to subtriangular, about 2X as long as wide; surface finely, densely punctate. **Pronotum:** as wide to slightly wider than base of the elytra; evenly convex; shallowly concave at sides; lateral margin sharp, explanate and weakly recurved; surface finely, densely punctate-granulate. **Elytra:** each elytron with 10 complete to nearly complete, distinctly impressed striae, intervals moderately to distinctly convex; slightly truncate apically. **Metathoracic Ventrite:** not excavate for reception of the mesothoracic legs; intercoxal process of the mesothoracic coxae broadly arcuate, posteriorly with a shallow, darkly pigmented, longitudinal sulcus extending 0.5X the length of the disk. **Legs:** not received in ventral excavations; metathoracic coxae grooved

to receive metathoracic legs; prothoracic and mesothoracic tibiae concave on outer surface, metathoracic tibiae flat. **Abdomen:** with 5 ventrites.

Diagnosis—Most specimens of *X. fucatus* may be separated from all other Wisconsin Xyletininae by a combination of the following characters: body uniformly orange-brown to reddish-brown throughout; eyes small, separated by approximately ≥4X their width when viewed from the front (Fig. 89); combined length of last three antennomeres shorter than all preceding segments combined; metathoracic ventrite not declivous anteriorly (extracted in part from White 1977b, Philips 2002).

The uniformly lighter color of *X. fucatus* generally distinguishes this species from other members of Wisconsin *Xyletinus*, although I have included in this description specimens that are considerably larger and darker reddish-brown than the typical *X. fucatus*. The reddish dorsal surface and uniformly colored body leads these specimens more closely to *X. fucatus* than to the other *Xyletinus* species, which are, at least in part, dark brown to blackish. White (1977b) also noted the difficulty in separating this species from other closely related species, even after examination of the male genitalia. Therefore, the structure of the male genitalia was not examined during this study for *X. fucatus*, but should be addressed in future work on *Xyletinus*.

Natural History—A complete larval description was provided by Böving (1954) from specimens collected in "dead oak twigs." *Xyletinus fucatus* has also been reared from "dead American linden branches" (White 1982). In Wisconsin, specimens were collected using Lindgren funnel, flight intercept, Townes–Malaise, and cantharidin bait traps. One specimen was collected at a Lindgren funnel trap baited with ethanol, and a few were collected from flight intercept traps baited with cantharidin, although their uncommon attraction to either of these compounds is believed to be incidental. Regrettably, over 50% of specimens had no collection data recorded.

Phenology—Adults of *X. fucatus* were recorded in Wisconsin from early May to late August.

Distribution—*Xyletinus fucatus* is widely distributed in North America and has been recorded from British Columbia, Saskatchewan, Ontario, Quebec, and New Brunswick, Canada, and in the United States, from Washington and California, south into Texas, centrally from Illinois, Ohio, Michigan, and northeast to New Jersey (White 1977b, 1982). White (1977b) reported this species from Wisconsin. During this study, specimens were recorded from eight counties throughout Wisconsin.

***Wisconsin Records* (Map 33)**—The 25 specimens of *X. fucatus* examined during this study were recorded from the following localities: **State only (6)**; **Barron Co. (1):** Kriska Residence; **Dane Co. (8):** No other label data; **Milwaukee Co. (4):** Cudahy Woods SNA; Sheridan Park; **Racine Co. (1):** Renak–Polak Maple–Beech Woods SNA; **Sauk Co. (1):** Hemlock Draw TNC; **Shawano Co. (1):** Jung Hemlock–Beech Forest SNA; **Sheboygan Co. (1):** Kettle Moraine Red Oaks SNA; **Wood Co. (2):** Powers Bluff SNA.

Genus *Lasioderma* Stephens

[Synonymy modified from White 1962a, 1982, Philips 2002]
Type Species: *Ptinus serricornis* Fabricius 1792: 241.
Lasioderma Stephens 1835: 417.
Pseudochina Jacquelin du Val 1860: 143 (mis-spelled as *Pseudochinus* Zoological Record 1865: 398).
Hypora Mulsant and Rey 1864: 306 (as subgenus).
Tasioderma Stephens; Chenu 1884: 214 (*lapsus calami*).
Lasiderma Stephens; Schilsky 1899: 30 (*lapsus calami*).
Ladioderma Stephens; Löding 1945: 96 (*lapsus calami*).
Losioderma Stephens; Borror and DeLong 1964: 307 (*lapsus calami*).
Lassioderna Stephens; Mukerji 1954: 131 (*lapsus calami*).

Lasioderma was established by Stephens (1835) for *Lasioderma testaceum* Duftschmid, now considered a synonym of the cosmopolitan species, *L. serricorne* (White 1969b). Five species of *Lasioderma* are found in North America, compared to the over 50 species recognized worldwide (White 1990, Philips 2002). Four species are more or less generally distributed in eastern North America, whereas *Lasioderma haemorrhoidale* (Illiger) is currently known only from California, where it is thought to have been introduced (White 1990). To date, only *L. serricorne* has been recorded from Wisconsin, although *Lasioderma semirufum* Fall is included in the key because it is known from both Indiana and Ohio (White 1982). The characters used in the key for *L. semirufum* are taken from White (1990); specimens of this species were not examined during this study.

Work on *Lasioderma* has focused almost entirely on the economically important, cosmopolitan species *L. serricorne*, while surprisingly little is known about the biology of most other species (White 1990). Worldwide, thistles are thought to be the most frequent food plants of many species; they are also suspected to have been the original food of *L. serricorne* (White 1990).

Members of *Lasioderma* can be distinguished from other North American Xyletininae by the serrate antennae with the last three antennal segments not elongate (Fig. 38), the lack of elytral striae (Figs. 173, 174), and the abrupt anterior declivity of the metathoracic ventrite with a transverse carina. Males and females are not readily separated, although females are thought to be larger than males (Lefkovitch 1963). Dissection of the genitalia or treatment of the abdomen with alcohol so that the abdomen becomes transparent and sexual structures may be observed through the cuticle (methods described by Papadopoulou and Buchelos (2002) for *L. serricorne*) are the only reliable means of separating the sexes.

Key to the Wisconsin Species of Adult *Lasioderma*

[Modified from White 1990]

1 Body bicolored, elytra darker than remainder; metathoracic ventrite with 2 transverse carinae, a distinct one bordering anterior declivity, and a weaker one behind declivity which may be incomplete medially.....***semirufum* Fall**

1' Body color uniform throughout; metathoracic ventrite with a single transverse carina bordering anterior declivity.....***serricorne* (Fabricius) (p. 52)**

Lasioderma serricorne (Fabricius)

(Figs. 38, 173, 174; Map 34)

[Synonymy modified from Pic 1912a, White 1962a, 1982, Español 1992]
Ptinus serricornis Fabricius 1792: 240.
Ptilinus testaceus Duftschmid 1825: 46.
Lasioderma rufescens Sturm 1826: 206.
Lasioderma testaceum Stephens 1835: 417.
Xyletinus testaceus (Duftschmid); Sturm 1837: 89.
Lasioderma castaneum Melsheimer 1846: 308.
Xyletinus breve Wollaston 1861: 15.
Pseudochina (*Hypora*) *serricorne* (Fabricius); Mulsant & Rey 1864: 307.
Lasioderma serricorne (Fabricius); LeConte 1865: 238.
Lasioderma testacea (Duftschmid); Kiesenwetter 1877: 150.

The species currently known as the "cigarette beetle" or "tobacco beetle" was first described by Fabricius from North America in 1792 as *Ptinus serricornis* (Runner 1919). Mulsant and Rey (1864) removed the species to *Pseudochina* under the subgenus *Hypora*. LeConte (1965) recognized the species as a *Lasioderma*, transferring it to the genus where it currently resides. The name *Lasioderma castaneum* frequently appears in historical literature but should be regarded as *L. serricorne* as it was synonomyzed by White in 1971 (White 1971b).The numerous synonyms associated with this species are most likely a result of its nearly worldwide distribution.

***Capsule Description* (Figs. 38, 173, 174)—Length:** 1.8–2.8 mm. **Width:** 1.1–1.6 mm. **Integument Color:** uniformly orange-brown, reddish-yellow or reddish-brown. **Body Form:** oval, moderately convex, 1.6X as long as wide. **Vestiture:** pubescence short, subrecumbent, moderately dense, yellowish. **Head:** eyes small, widely separated, not prominent; antennae 11-segmented, serrate, narrow, segments 4–10 similar, 11 oval and pointed, slightly longer than 10th; surface with numerous small punctures. **Pronotum:** hypomera deeply excavated ventrally; surface punctate, with fine, uniform, moderately dense punctures. **Elytra:** not striate; surface punctate, punctures similar to those of pronotum. **Metathoracic Ventrite:** abruptly declivous anteriorly; with a single distinct transverse carina; surface finely, densely punctate. **Legs:** not received in ventral excavations; prothoracic tibiae distinctly widened and compressed apically; prothoracic and mesothoracic legs retractable into the declivent region of the metathoracic ventrite; metathoracic coxae grooved to receive the metathoracic legs. **Abdomen:** with 5 ventrites.

Diagnosis—*Lasioderma serricorne* differs from other Wisconsin Xyletininae by its serrate antennae with the last three segments not at all elongate (Fig. 38) and the metathoracic ventrite abruptly declivous anteriorly, with a single distinct transverse carina (extracted in part from Philips 2002).

Although diagnostic, integument color has been shown to vary. Coffelt and Vick (1973) noted the occurrence of a black body color form in a laboratory colony maintained for several years. While dark color forms appear rather infrequently, these variations are important to note because integument color is referred to taxonomically. Similar variations have been described in depth for other stored products Coleoptera as well, but are by no means limited to stored product insects (Coffelt and Vick 1973).

Natural History—As the common name "cigarette beetle" or "tobacco beetle" suggests, *L. serricorne* is the most widespread and destructive pest of harvested and manufactured tobacco (Runner 1919). Damage and economic losses from *L. serricorne* infestations were estimated by the USDA (1971) to be 0.7% of the total warehoused tobacco commodity in 1971. Few insects actually utilize tobacco as a food source because of its low nutritional value and nicotine toxicity (Farnham et al. 2007). In a recent study by Farnham et al. (2007), the ability of *L. serricorne* to develop in the presence of nicotine was examined in order to determine if the nicotine was assimilated, sequestered, metabolized, and/or excreted. Their results indicated nicotine is not metabolized but rather excreted unmodified. Although rapid excretion is a mechanism utilized by some insects to rid themselves of toxins, *L. serricorne* was shown to take four days to excrete all the waste from their system, suggesting a different mechanism of nicotine toxicity resistance (Perry and Buckner 1959, Farnham et al. 2007). Additionally, *L. serricorne* does not need external vitamins such as thiamin, pyridoxine, riboflavin, and nicotinic acid to develop, which may explain its successful growth on manufactured tobacco (Ashworth 1993). Intracellular yeast-like endosymbionts are thought to produce several substances allowing it to survive without these otherwise important nutrients (Ashworth 1993). This symbiotic relationship is comparable to that seen in termites,

which require symbiotic protozoa in order to digest cellulose (Pant and Fraenkel 1954).

Larvae (and less frequently adults) may also damage a variety of dried stored products in addition to tobacco, including seeds, grains, rice, pasta, beans, cacao, spices, dried fruits, vegetables, and yeast. This species also breeds in animal materials such as wools, silks, leather, dried insects, dried fish, fishmeal, meat meal, and wax (Howe 1957, White 1990, Ashworth 1993, Blanc et al. 2006). *Lasioderma serricorne* has even been recorded developing on insecticides containing pyrethrum (Ebeling 1978). In the home, paprika and dog food are the most commonly infested commodity (Ebeling 1978).

Historically, fumigation using hydrocyanic acid gas, carbon disulphide, ethylene oxide, methyl bromide, or phosphine were used to control infestations of the tobacco beetle in warehouses (Runner 1919, Powell 1931). However, concerns over environmental toxicity and observed resistance to certain fumigants in *L. serricorne* populations have forced a re-examination of control methods (Imai and Harada 2006). Currently, trapping techniques with pheromone attractants (anhydroserricornin and serricornin) or light traps, as well as application of either chemical or botanical insecticides/repellants have been used as alternatives (Levinson et al. 1981, Hori 2004, Mahroof and Phillips 2008). Exposing tobacco to extreme heat or cold for an extended period of time has also been used as a non-chemical form of treatment, as pesticide applications for tobacco products carry heavy restrictions (Runner 1919, Swingle 1938, Imai and Harada 2006). Treatment of residential infestations is generally through good sanitation techniques, proper storage of food products, and removal of infested materials.

The absence of specimens collected outside an urban/warehouse environment is likely the result of climate conditions in Wisconsin. According to Powell (1931), the optimal temperature for development of *L. serricorne* is 32 °C (89.6 °F) and 75% humidity, while a temperature below 4–5 °C (39.2–41 °F) for 21 consecutive days appears to be fatal to larvae. *Lasioderma serricorne* is thought to be able to survive at temperatures between 2 °C (35.6 °F) and 36 °C (96.8 °F), and all life stages may survive temperatures below 2 °C, but only for a short time (Powell 1931, Ashworth 1993). In Wisconsin, temperatures may remain below 2 °C for extended periods, thereby rendering development of this species unlikely outside a heated structure. This is supported by Rees (2004): "*L. serricorne* is not cold hardy and survives in temperate areas only in heated buildings," and by the lack of specimens obtained outside urban environments in Wisconsin despite the use of the synthetic pheromone, serricornin, in the field.

Wisconsin specimens of *L. serricorne* examined during this study were all likely collected indoors, although the exact location of collection was not always stated on specimen labels. Food materials listed for Wisconsin specimens include paprika, dried tobacco, Venezuelan cigars, and Jamaican ginger. A number of specimens were obtained from laboratory culture.

Phenology—As Runner (1919) noted, the term phenology or seasonality is difficult to apply to this species as it is an indoor, stored products pest, and generations tend to vary depending on factors such as temperature and humidity. Wisconsin specimens are likely to be found indoors at all times of year; thus far, they have been recorded in January, March, July, August, September, October, November, and December.

Distribution—*Lasioderma serricorne* is distributed throughout the United States and southern Canada (Ebeling 1978). In this study, specimens were examined from five Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 34)**—The 59 specimens of *L. serricorne* examined during this study were recorded from the following localities: **State only (9):** Wisc. Exp. Sta.; **Dane Co. (31):** Madison; Madison Experimental Station; Madison–Eagle Heights; Madison–Russell Laboratory; 346 Russell Fire Cabinet (Russell Laboratory?); UW Madison Campus; No other label data; **Milwaukee Co. (6):** No other locality data; Wixon–Milwaukee Spice Corp.; **Monroe Co. (6):** Sparta; **Waukesha Co. (2):** Brookfield; **Winnebago Co. (5):** Oshkosh.

Subfamily Dorcatominae

Dorcatominae was erected by Thomson (1859) for two genera, *Dorcatoma* Herbst and *Caenocara* Thomson. A subsequent classification (LeConte 1878) included *Byrrhodes* LeConte within this subfamily, but refrained from placing *Petalium* LeConte, *Theca* Mulsant and Rey (now *Stagetus* Wollaston), and *Eupactus* LeConte (now *Calymmaderus* Solier) in this group because of the manner whereby the body is contracted: mandibles not lying in as close proximity to the metathoracic ventrite as *Dorcatoma*, *Caenocara*, and *Byrrhodes* (Fall 1905). Fall (1905) chose to include the former three genera in his Dorcatomini, noting "the possession of metasternal and ventral pits," which receive the mesothoracic and metathoracic tarsi in repose, as the most important character uniting the subfamily. Eight genera were therefore added to the Dorcatominae, three of which were newly described in Fall's revision, dramatically improving the organization and taxonomy of the subfamily, although not without some hesitation. White (1966b) described a new genus, *Cryptoramorphus*, in Dorcatominae. White's subsequent subfamilial classification closely resembled that of Fall (1905) until 1971 (White 1971d), when he transferred *Mesocoelopus* Jacquelin du Val, *Cryptorama* Fall, and *Tricorynus* Waterhouse from Dorcatominae and placed them in the newly erected subfamily Tricoryninae (now Mesocoelopodinae Mulsant and Rey). This division was partially inspired by Fall's (1905) initial observation that the three genera he placed at the top of his Dorcatomini (*Petalium*, *Stagetus*, and *Calymmaderus*) constituted "an obvious interruption to an orderly sequence of genera, *Lasioderma* and

Megorama of the Xyletinini forming a natural transition to *Catorama* and *Cryptorama* of the Dorcatomini." The supportive characters Fall (1905) used were the "elongate form, feebly elevated disk of the prothorax, internally widened posterior coxal plates, and the less deeply excavated first ventral segment of *Petalium*," characters relating them more closely with Anobiini than Xyletinini (Fall 1905). This suggested to White (1971d) a possible diphyletic origin of the genera in Fall's Dorcatomini, encouraging the formation of Tricoryninae, which allowed for a more natural progression of development in body form (White 1971d). Classification used in this work follows such recent publications as Lawrence and Newton's (1995) review of the higher taxonomy of Ptinidae as well as works by White (1982) and Philips (2002).

Members of Dorcatominae are known to utilize woody fungi, mushrooms, and puffballs as well as wood, dead branches, twigs, and vines as larval food material (White 1982). The larvae of a number of dorcatomine species were described by Böving (1954) within the genera *Protheca* LeConte, *Petalium*, *Byrrhodes* (as *Eutylistus* Fall), *Dorcatoma*, and *Caenocara*.

Currently, North American Dorcatominae contains 11 genera and 69 species north of Mexico (Philips 2002). Nine genera and 23 species from this subfamily are known from Wisconsin.

Members of North American Dorcatominae can be distinguished by a combination of the following characters: antennae clubbed with last three segments longer than all preceding (Figs. 45–57); head reflexed with mandibles near or attaining metathoracic ventrite when body is contracted; metathoracic ventrite excavate anteriorly for reception of mesothoracic tarsi (Figs. 80–82) (note: the grooves are often most easily visible on each side of the metasternal process; much less obvious in *Striatheca* White); first abdominal ventrite depressed or grooved to receive the metathoracic legs (Fig. 82, 218); body with most appendages contained within grooves of the ventral surface (extracted in part from Philips 2002).

Dorcatominae is one of the largest and taxonomically most difficult of the ptinid subfamilies (White 1979). Members of this subfamily have greatly contractile appendages; often specimens need to be relaxed and the head raised so the antennae and palpi are visible before they may be critically examined. Specimens of *Dorcatoma* and *Byrrhodes* require having the head and prothoracic ventrite elevated from the body to expose the form of the posterior portion of the prothoracic ventrite. However, pulling the legs away from the body is not necessary, and was considered by Ford (1998) and others to be more destructive than useful.

Key to the Wisconsin Genera of Adult Dorcatominae

[Modified from White 1971a and Philips 2002]

1 Prothoracic coxae visible ventrally when body is retracted.....**2**

1' Prothoracic coxae concealed ventrally when body is retracted **4**

2 (1) Metathoracic ventrite produced anteriorly into a broad rounded lobe, concealing the mandibles when body is retracted (Fig. 82); second abdominal ventrite subequal to combined length of ventrites 3–5 (Fig. 208).....***Petalium*** **(p. 68)**

2' Metathoracic ventrite and second abdominal ventrite not as above **3**

3 (2') Pubescence moderately dense, bristling; elytra with distinct, strongly impressed striae throughout (Figs. 217, 218) .....***Stagetus*** **(p. 75)**

3' Pubescence somewhat dense to sparse, never bristling; elytra laterally striate only or not striate throughout (Figs. 176, 178).....***Calymmaderus*** **(p. 55)**

4 (1') Eyes, incised or notched to or beyond middle when viewed from the front (Fig. 192); body nearly spherical .....***Caenocara*** **(p. 60)**

4' Eyes not as deeply incised; body usually broadly to narrowly oval **5**

5 (4') Each elytron with 10 complete striae, not appearing as rows of punctures (Fig. 219).....***Striatheca*** **(p. 76)**

5 Elytra not striate as above or lacking striae **6**

6 (5') Elytra notched laterally for metathoracic legs **7**

6' Elytra not notched laterally for metathoracic legs **8**

(Key to the Wisconsin Genera of Adult Dorcatominae continued)

7 (6) Antennae 11-segmented (Fig. 53); pubescence of elytra and pronotal disc changing in direction, appearing as darker spots on the elytra (Figs. 213, 214) ..... ***Protheca*** **(p. 74)**

7' Antennae 9-segmented (Fig. 54); pubescence of elytra and pronotal disc not or slightly changing in direction, never appearing as darker spots on the elytra (Figs. 215, 216)..... ***Sculptotheca*** **(p. 74)**

8 (6') Prothoracic ventrite produced posteriorly into 2, slender, parallel-sided processes behind the prothoracic coxae and attaining or nearly attaining coxal apex (Fig. 64) (Note: this character is only visible when the head and prothoracic ventrite are pulled away from the body) ..... ***Dorcatoma*** **(p. 65)**

8' Prothoracic ventrite simple, produced into 2 broad, triangular processes up to 0.5X coxal length (Fig. 65)..... ***Byrrhodes*** **(p. 57)**

Genus *Calymmaderus* Solier

[Synonymy modified from Pic 1912a, White 1962a, 1974, 1982, Philips 2002]
Type Species: *Calymmaderus capucinus* Solier 1849: 473 (designated by Pic 1912b: 48).
Calymmaderus Solier 1849: 472.
Eupactus LeConte 1861: 203.
Calymmoderus Solier; Gemminger and Harold 1869: 1785 (*lapsus calami*).
Phoberus Kirsch 1873: 400 (but, see White 1974: 444).
Eutheca Kiesenwetter 1877: 155.
Lioolius Gorham 1883: 203.
Thaptor Gorham 1883: 205.
Byrrhocerus Brethes 1919: 26.
Calymaderus Solier; Pic 1923: 7 (*lapsus calami*).
Nevermannia Fisher 1927: 49.
Nevermannus Fisher 1927: 116.
Colymmaderus Solier; Van Dyke 1936: 178 (*lapsus calami*).
Thapter Gorham; Arnett 1962: 574 (*lapsus calami*).
Eupactidius Español 1969: 106 (as subgenus).

Calymmaderus is most diverse in the Americas, with a large number of species occurring from Central and South America (Fall 1905, White 1982, 1983b, Arnett 1983). Seven species, including one of uncertain status, are found in North America, north of Mexico, the majority of which are found throughout the southern-most states (White 1982, Arnett 1983). Two of the seven species, *Calymmaderus obsoletus* (Fall) and *Calymmaderus nitidus* (LeConte), have a more northern distribution (White 1982); both have been collected from Wisconsin.

As with most Ptinidae, members of *Calymmaderus* appear to be of less economic significance in North America than in other parts of the world. However, one species, *Calymmaderus punctulatus* (LeConte), found in the south to southeastern United States has been identified as a pest in historical art pieces (Ramírez et al. 2005).

Members of *Calymmaderus* may be easily distinguished from all other Wisconsin Ptinidae by the form of the antennae, which have the last two segments of the antennal club closely united (Fig. 47), by having the prothoracic coxae exposed ventrally while the body is contracted, and by the double third and fourth abdominal sutures.

Key to the Wisconsin Species of Adult *Calymmaderus*

[Modified from White 1962a]

1 Elytra laterally with two complete striae (Fig. 178); finely pubescent; surface rather dull (Fig. 177)..... ***obsoletus*** **(Fall)(p. 56)**

1' Elytra laterally without striae (Fig. 176); pubescence nearly obsolete; surface distinctly shining (Fig. 175)..... ***nitidus*** **(LeConte)(p. 55)**

Calymmaderus nitidus (LeConte)

(Figs. 175, 176; Map 35)

[Synonymy modified from White 1962a]
Eupactus nitidus LeConte 1865: 236.
Calymmaderus nitidus (LeConte); Pic 1912a: 65.

Capsule Description **(Figs. 175, 176)—Length:** 2.5–3.0 mm. **Width:** 1.3–1.7 mm. **Integument Color:** dark reddish-black to black; surface shining; maxillary and labial palpi, antennae, and tarsi reddish-yellow to yellowish. **Body Form:** robust, oval, 1.9X longer than wide. **Vestiture:** pubescence yellowish, exceedingly short and sparse, completely recumbent. **Head:** 11-segmented antennae, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, 9th antennal segment exceedingly large and rectangular, 10th and 11th segments nearly equal in size and closely united, 9th antennal segment sometimes appearing notched laterally; surface punctate. **Pronotum:** deeply excavate ventrally to receive the head; disk not at all raised dorsally; lateral margins

rounded; surface densely punctate. **Elytra:** without lateral striae; disk slightly grooved at sides for the prothoracic and mesothoracic legs; surface punctate, not arranged in rows. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced into an emarginate, U-shaped process that receives the last 2 antennal segments in repose; surface punctate, punctures absent to less numerous medially and posteriorly. **Legs:** received in ventral excavations; prothoracic coxae exposed ventrally during body retraction, narrowly separating mandibles from metathoracic ventrite. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; ventrite 3 slightly wider than ventrite 4; double 3rd and 4th sutures; 5th ventrite indented along posterior margin.

Diagnosis—The form of the antennae (e.g., Fig. 47), absence of lateral elytral striae (Fig. 176), and exceedingly short pubescence will separate *C. nitidus* from all other Wisconsin Ptinidae.

Natural History—Ferro et al. (2007), from Louisiana State University, reported collection of *C. nitidus* during a study of beetles inhabiting oak twigs. Quinn (2000) documented this species from beating and sweeping oaks, elms, and junipers in Texas. In Wisconsin, specimens were collected using Lindgren funnel traps as well as UV light. One specimen was "swept from vegetation on edge of small woods near Helena Marsh."

Phenology—Adults of *C. nitidus* were recorded in Wisconsin from late June to mid-August.

Distribution—*Calymmaderus nitidus* is widely distributed in the United States, occurring from Arizona and Texas, southeast to Florida, northeast to Massachusetts, New Jersey, D.C., and Pennsylvania, west into Ohio, Kentucky, Illinois, Missouri, and Kansas (White 1982). In this study, specimens were examined from seven Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 35)**—The 11 specimens of *C. nitidus* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Dane Co. (3):** Swamp Lover's Inc.; **Fond du Lac Co. (1):** No additional label data; **Grant Co. (1):** No other locality data; **Iowa Co. (1):** LWRSWA Helena Unit; **Milwaukee Co. (1):** Milwaukee; **Richland Co. (3):** No other locality data.

Calymmaderus obsoletus (Fall)

(Figs. 47, 177, 178; Map 36)

[Synonymy modified from White 1962a]
Eupactus obsoletus Fall 1905: 220.
Calymmaderus obsoletus (Fall); Pic 1912a: 65.

Calymmaderus obsoletus was described by Fall (1905) as one of three new species having the two elytral striae present on the lateral margins.

Capsule Description **(Figs. 47, 177, 178)—Length:** 1.9–3.0 mm. **Width:** 0.9–1.3 mm. **Integument Color:** reddish-brown throughout; maxillary and labial palpi yellowish. **Body Form:** oval, 2.2X longer than wide. **Vestiture:** pubescence yellowish, dense, slightly more so on dorsal surface, pubescence short, completely recumbent. **Head:** antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, 9th antennal segment exceedingly large and rectangular, 10th and 11th segments nearly equal in size and closely united; surface densely punctate. **Pronotum:** deeply excavate ventrally to receive the head; disk not at all raised dorsally; with a strongly impressed sulcus anteriorly along the lateral margins; surface densely punctate. **Elytra:** with 2 complete lateral striae; short, inner 3rd striae comprised of mainly punctures; disk faintly appearing striate dorsally; grooved at sides for the prothoracic, mesothoracic, and metathoracic legs; surface densely punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced into an emarginate, slightly V-shaped process that receives the last 2 antennal segments in repose; posteriorly with a short, deep excavation; surface punctate. **Legs:** received in ventral excavations; prothoracic coxae exposed ventrally during body retraction, narrowly separating mandibles from metathoracic ventrite. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; double 3rd and 4th sutures; ventrite 4 nearly 0.5 as wide as ventrites 2 or 3.

Diagnosis—The form of the antennae (Fig. 47) as well as the two complete lateral elytral striae (Fig. 178) separate *C. obsoletus* from all other Wisconsin Ptindae. The above description, however, differs somewhat from that of White (1962a) with respect to pubescence and form of the dorsal punctures. In his work, White stated the pubescence was short and sparse, whereas it is clearly rather dense compared to that of *C. nitidus* in the Wisconsin specimens examined. Additionally, White stated the punctures were exceedingly small, just visible on all surfaces, while punctation of the aforementioned specimens tended to be relatively large.

Natural History—Little has been reported of the life history of *C. obsoletus*. In Wisconsin, all specimens were collected using Lindgren funnel and flight intercept traps, with the majority obtained from the front yard of a suburban residence. Although this site provided numerous specimens of this species, the source of the beetles could not be identified. It is possible that the ptinids were emerging from a ~60-ft-tall dead tree located across the street in a small patch of preserved wetlands, although this was not confirmed.

Phenology—Adult specimens of *C. obsoletus* were recorded in Wisconsin from early July to mid-August.

Distribution—White (1962a, 1982) reported *C. obsoletus* from Texas, Louisiana, Missouri, Ohio, and Indiana. Wisconsin currently represents the northern-most extension of the range of this species. In this study, specimens were examined from two Wisconsin counties; they constitute a

NEW STATE RECORD.

***Wisconsin Records* (Map 36)**—The 53 specimens of *C. obsoletus* examined during this study were recorded from the following localities: **Racine Co. (52):** Private Property—Arango Residence—Greenbriar Rd.; **Sauk Co. (1):** Spring Green Preserve SNA.

Genus *Byrrhodes* LeConte

[Synonymy modified from White 1974, 1982, Philips 2002]
Type Species: *Byrrhodes setosus* LeConte 1878: 413 (by monotypy).
Byrrhodes LeConte 1878: 412.
Priotoma Gorham 1886: 350.
Eutylistus Fall 1905: 264.
Fachus Lucas 1920: 294.
Notiotheca Brethes 1923: 458.
Eutylistes Fall; Böving 1927: 57 (*lapsus calami*).
Byrrhoides LeConte; White 1966: 959 (*lapsus calami*).

Byrrhodes was established by LeConte (1878) for the species *B. setosus*. Fall (1905) retained *Byrrhodes* as monotypic but separated three species out of *Dorcatoma*, which lacked the prosternal horn-like processes, for those with the prothoracic ventrite forming two broadly, triangular processes (Fig. 65). *Dorcatoma granus* LeConte, *Dorcatoma incomptus* LeConte, and *Dorcatoma tristriatus* LeConte, then formed Fall's (1905) new genus *Eutylistus*, along with *Caenocara intermedius* LeConte, as well as four newly described species. *Eutylistus* was distinguished from *Byrrhodes* based on elytral striation present in *Byrrhodes* and absent in *Eutylistus* (Fall 1905). White (1971a) re-examined the type species of *Eutylistus* and determined the genus to be a synonym of *Priotoma*. Subsequently, White (1971c) synonymized *Priotoma* with *Byrrhodes*, after concluding that the elytral striation described by Fall (1905) was not generically significant, as he found "nearly continuous intermediate conditions between the smooth elytral lines between bands of punctures to be found in *Priotoma incompta* (Lec.) and *P. tristriata* (Lec.) and the impressed striae of *B. setosus* Lec."

Byrrhodes consists of 12 species in North America, north of Mexico (White 1981, 1982, Ford 1998). Five of the 12 species were described by LeConte (1865, 1878), four by Fall (1905), two by White (1973, 1981), and one by Ford (1998). Species richness appears to be greatest in eastern North America, with only a few species occurring southwest into Texas, Arizona, and California (White 1982). Members of this genus are also thought to develop within fungi (Böving 1954).

Specimens of *Byrrhodes* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: clubbed antennae with last three segments much longer than all preceding segments (Figs. 56, 57); eyes distinctly notched, but not to or past center of eye; prothoracic ventrite produced posteriorly into two broadly triangular processes (Fig. 65); prothoracic coxae concealed ventrally during body retraction; head strongly deflexed with mandibles reaching the metathoracic ventrite (Figs. 180, 182, 184); metathoracic ventrite produced anteriorly into a broad lobe with distinct tarsal grooves, visible in repose; elytra not notched at sides for metathoracic legs; appendages highly contractile and received in ventral excavations; first abdominal ventrite grooved for metathoracic legs (extracted in part from Philips 2002). Members of *Byrrhodes* are most easily confused with those of *Dorcatoma*, from which they may be readily distinguished by the form of the process on the prothoracic ventrite.

Male and female *Byrrhodes* may be separated by the length and shape of the antennal club, which is said to be enlarged in the male (Fall 1905, White 1962a). In all three Wisconsin species examined, the first segment of the antennal club is more produced laterally and more deeply emarginate apically in the males (Fig. 56) than in the females (Fig. 57). These differences are obvious in *B. tristriatus* and *B. incomptus*, but appear to be less so in *B. intermedius*.

Key to the Wisconsin Species of Adult *Byrrhodes*

[Modified from White 1973]

1 Elytra with 2 distinct lateral striae, lowest lateral elytral stria deeply impressed anteriorly and attaining elytral fovea for mesothoracic legs (Fig. 182) ..... ***intermedius* (LeConte) (p. 58)**

1' Lowest lateral elytral stria distinct only to level of metathoracic coxae or metathoracic ventrite, not attaining fovea for mesothoracic legs (Figs. 180, 184) **2**

2 (1') Upper 3rd stria nearly to just as strong as lower striae (Fig. 184) ..... ***tristriatus* (LeConte) (p. 59)**

2' Upper 3rd stria not well-defined (Fig. 180) ..... ***incomptus* (LeConte) (p. 57)**

Byrrhodes incomptus (LeConte)

(Figs. 56, 179, 180; Map 37)

[Synonymy modified from White 1962a, 1971c]
Dorcatoma incomptum LeConte 1865: 243.
Eutylistus incomptus (LeConte); Fall 1905: 265.
Priotoma incomptus (LeConte); White 1971a: 183.
Byrrhodes incomptus (LeConte); White 1971c: 342.

***Capsule Description* (Figs. 56, 179, 180)—Length:** 1.8–2.4 mm. **Width:** 1.1–1.5 mm. **Integument Color:** black

to reddish-brown; some with pronotum reddish-brown and elytra black; ventral surface reddish, sometimes clouded with black; maxillary and labial palpi reddish-yellow to yellowish; antennae yellowish to yellowish-orange; legs reddish; tarsi reddish to yellowish; surface shining. **Body Form:** moderately elongate, oval, 1.6X longer than wide. **Vestiture:** pubescence yellowish; erect to suberect on dorsal surface and head, suberect to recumbent on ventral surface; short, slightly more dense on head and pronotum. **Head:** antennae 9- or 10-segmented (see diagnosis below), clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined; surface shining, punctate. **Pronotum:** spherical; surface shining, densely punctate, punctures slightly less strongly indented than those of elytra. **Elytra:** convex; humeri prominent; punctures of elytral disk grouped and forming longitudinal rows separated by narrower, smooth lines (note: best seen using indirect lighting); lowest lateral stria distinct only to level of metathoracic coxae or metathoracic ventrite, not attaining fovea for mesothoracic legs; upper 3rd striae not apparent to just slightly visible, never as strong as lowest lateral striae; surface shining. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; with a shallow, longitudinal sulcus forming an elongate fovea anteriorly, constricted posteriorly; produced in a broadly, flat lobe anteriorly. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; ventrite sutures slightly to distinctly curving upward medially.

Diagnosis—*Byrrhodes incomptus* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes distinctly notched, but not to or past center of eye; prothoracic ventrite produced posteriorly into two broadly triangular processes (Fig. 65); prothoracic coxae concealed ventrally in repose; metathoracic ventrite produced anteriorly into a broad lobe with distinct tarsal grooves, visible in repose; lowest lateral stria distinct only to level of metathoracic coxae or metathoracic ventrite, not attaining fovea for mesothoracic legs (Fig. 180); upper third stria not well defined; elytra not notched at sides for metathoracic legs (extracted in part from White 1973, Philips 2002).

A single specimen collected from Wisconsin appears to have only 9-segmented antennae instead of the typical 10-segmented antennae. This specimen also differs from all others of this species in the form of the metathoracic fovea. In this specimen, the fovea is more deeply impressed, elongate, and not at all constricted posteriorly. Although the number of antennal segments has been known to vary within certain genera and species, the form of the metasternal fovea may potentially signify a new species or variation of *B. incomptus*. The color variation as described above under the diagnosis for *B. tristriatus* is also true of a number of specimens of *B. incomptus* seen during this survey.

Natural History—Literature to date provides no information as to the food requirements of this species. In Wisconsin, specimens were collected at flight intercept and Lindgren funnel traps, as well as two specimens obtained at UV light. One specimen was reported from the IRCW as having been reared from a "brown fungus," collected on 22 November 1998, with adult emergence occurring on 13 January 1999.

Phenology—Adult specimens of *B. incomptus* were recorded in Wisconsin from mid-May to late August. It is probable that the specimen reared from fungus described above emerged as a result of being brought indoors and is not likely an extension of its phenology. This species was recorded from Ohio in June and July (White 1965).

Distribution—*Byrrhodes incomptus* is known from much the northeastern United States, although it has been recorded from South Carolina and Florida (White 1982). It has also been collected north from Pennsylvania and Massachusetts, west to Ohio, Michigan, and Illinois (White 1982). In this study, specimens were examined from 12 Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 37)**—The 29 specimens of *B. incomptus* examined during this study were recorded from the following localities: **Adams Co. (3):** Quincy Bluff TNC; **Clark Co. (1):** Schmidt Maple Woods SNA; **Columbia Co. (2):** Rocky Run SNA; **Dane Co. (4):** Madison–Elver Park; Swamp Lover's Inc.; **Grant Co. (2):** Wyalusing State Park; **Iowa Co. (1):** Arena Pines–Sand Barrens SNA; **Juneau Co. (1):** Lemonweir Bottomland Hardwood Forest SNA; **Lafayette Co. (3):** Wedel Property– ~3 mi. north of Argyle; **Marinette Co. (1):** Bloch Oxbow SNA; **Monroe Co. (7):** Fort McCoy SNA; **Racine Co. (2):** Private Property–Arango Residence–Greenbriar Rd.; **Sauk Co. (2):** Spring Green Preserve SNA.

Byrrhodes intermedius (LeConte)

(Figs. 181, 182; Map 38)

[Synonymy modified from White 1962a, 1971c]
Caenocara intermedia LeConte 1878: 411.
Eutylistus intermedius (LeConte); Fall 1905: 265.
Priotoma intermedius (LeConte); White 1971a: 183.
Byrrhodes intermedius (LeConte); White 1971c: 342.

Capsule Description **(Figs. 181, 182)—Length:** 1.6–2.1 mm. **Width:** 1.1–1.3 mm. **Integument Color:** black; maxillary and labial palpi reddish-yellow to yellowish; antennae yellowish-orange; legs reddish; tarsi reddish-yellow to yellowish; surface shining. **Body Form:** spherical to broadly oval, 1.5X longer than wide. **Vestiture:** pubescence yellowish, erect to suberect on dorsal surface and head, suberect to recumbent on ventral surface, rather sparse, slightly more dense on head and pronotum. **Head:** antennae 8-segmented, clubbed, combined length of last 3 antennal

segments much longer than all preceding segments combined; surface shining, punctate, slightly less densely punctate than pronotum. **Pronotum:** spherical; surface shining, densely punctate, punctures slightly less strongly indented than those of elytra. **Elytra:** convex; humeri prominent; laterally with 2 distinct striae, lowest lateral elytral stria deeply impressed anteriorly, attaining elytral fovea for mesothoracic legs; disk punctate, punctures in irregular rows, or completely confused; surface shining. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; with a shallow, longitudinal sulcus, obsolete posteriorly, anteriorly forming an elongate fovea; produced as a broad, flat lobe anteriorly; surface punctate. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for, and nearly concealed by, metathoracic legs.

Diagnosis—*Byrrhodes intermedius* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes distinctly notched, but not to or past center of eye; prothoracic ventrite produced posteriorly into two broadly triangular processes (Fig. 65); prothoracic coxae concealed ventrally in repose; metathoracic ventrite produced anteriorly into a broad lobe with distinct tarsal grooves, visible in repose; elytra with two distinct lateral striae; lowest lateral elytral stria deeply impressed anteriorly and attaining elytral fovea for mesothoracic legs (Fig. 182); elytra not notched at sides for metathoracic legs (extracted in part from White 1973, Philips 2002).

Natural History—Larvae of *B. intermedius* were described by Böving (1954) from specimens collected from *Fomes fomentarius*, *Fomes* sp., and "in fungus." Quinn (2000) documented this species from beating and sweeping oaks, elms, and junipers in Texas. In Wisconsin, specimens were obtained at flight intercept and Townes–Malaise traps. Specimens were also collected at Lindgren funnel traps, including one baited with ethanol. One specimen was hand collected from "shelf fungus on dead *Betula papyrifera*." Another specimen was found in the large series of *D. pallicornis* reared from the shelf fungus *G. applanatum* (see natural history for *D. pallicornis,* p. 67).

Phenology—Adult specimens of *B. intermedius* were recorded in Wisconsin from mid-April to late August.

Distribution—Although thought to be uncommonly collected (White 1962a), *B. intermedius* occurs throughout eastern North America, from Florida, north into Massachusetts, and west to Ohio, Michigan, and Illinois (Böving 1954, White 1982). Majka (2007a) recorded this species from Nova Scotia and Quebec. In this study, specimens were examined from seven Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 38)**—The 15 specimens of *B. intermedius* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Buffalo Co. (1):** Engel Farm Property; **Dane Co. (3):** Private Property–Madison–501 Hammersley Dr.; Swamp Lover's Inc.; **Jackson Co. (1):** No additional label data; **Milwaukee Co. (6):** Cudahy Woods SNA; **Sauk Co. (1):** Hemlock Draw TNC; **Shawano Co. (2):** Jung Hemlock–Beech Forest SNA.

Byrrhodes tristriatus (LeConte)

(Figs. 57, 183, 184; Map 39)

[Synonymy modified from White 1962a, 1971c]
Dorcatoma tristriatum LeConte 1878: 411.
Eutylistus tristriatus (LeConte); Fall 1905: 266.
Priotoma tristriatus (LeConte); White 1971a: 183.
Byrrhodes tristriatus (LeConte); White 1971c: 342.
Byrrhodes tristiatus (LeConte); White 1982: 27 (*lapsus calami*).

***Capsule Description* (Figs. 57, 183, 184)—Length:** 1.8–2.4 mm. **Width:** 1.2–1.5 mm. **Integument Color:** black to reddish-brown; some with pronotum reddish-brown and elytra black; ventral surface reddish, sometimes clouded with black; maxillary and labial palpi reddish-yellow to yellowish; antennae yellowish to yellowish-orange; legs reddish; tarsi reddish to yellowish; surface shining. **Body Form:** robust, broadly oval, 1.6X longer than wide. **Vestiture:** pubescence yellowish to grayish, erect to suberect on dorsal surface and head, suberect to recumbent on ventral surface, short, slightly more dense on head and pronotum. **Head:** antennae 10-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined; surface shining, punctate. **Pronotum:** spherical; surface shining, densely punctate, punctures slightly less strongly indented than those of elytra. **Elytra:** convex; humeri prominent; punctures of elytral disk grouped and forming longitudinal rows separated by narrower, smooth lines (note: best seen using indirect or filtered lighting); lowest lateral stria distinct only to level of metathoracic coxae or metathoracic ventrite, not attaining fovea for mesothoracic legs; upper 3rd stria nearly or just as strong as lower stria; surface shining. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; with a shallow, longitudinal sulcus forming an elongate fovea anteriorly; produced in a broadly, flat lobe anteriorly. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for, and nearly concealed by, metathoracic legs; ventrite sutures distinctly curving upward medially.

Diagnosis—*Byrrhodes tristriatus* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes distinctly notched, but not to or past center of eye; prothoracic ventrite produced posteriorly into two broadly triangular processes (Fig. 65); prothoracic coxae concealed ventrally in repose; metathoracic ventrite produced anteriorly into a broad lobe with distinct tarsal grooves, visible in repose; lowest lateral stria distinct only to level of metathoracic coxae or metathoracic ventrite, not attaining fovea for mesothoracic legs; upper third stria

nearly to just as strong as lower stria (Fig. 184); elytra not notched at sides for metathoracic legs (extracted in part from White 1973, Philips 2002).

The highly contractile nature of *Byrrhodes* makes counting the number of antennal segments difficult. In *B. tristriatus*, the segments of the antennal funicle are so tightly compacted that it is difficult to determine if the antennae are 10- or 11-segmented. Also, the color variation observed within the current set of specimens is aberrant from what has been described for this species. It is likely that the lighter reddish-brown specimens are teneral; however, the specimen with a reddish pronotum and black elytra may represent a new color variation of *B. tristriatus*.

Natural History—*Byrrhodes tristriatus* has been recorded from *Polyporus cuticularis* Bulliard (Weiss and West 1922, White 1982). In Wisconsin, specimens were collected at flight intercept, Lindgren funnel, and Townes–Malaise traps, many of these from a single location in an oak savanna next to a sandy prairie.

Phenology—Adult specimens of *B. tristriatus* were recorded in Wisconsin from early June to mid-August.

Distribution—*Byrrhodes tristriatus* has been recorded from Texas, Louisiana, Mississippi, Georgia, and Florida, north into Pennsylvania, Massachusetts, and Maryland (White 1982). In this study, specimens were examined from eight Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 39)**—The 16 specimens of *B. tristriatus* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Dane Co. (2):** Swamp Lover's Inc.; **Grant Co. (2):** Blue River Sand Barrens SNA; **Juneau Co. (1):** Lemonweir Bottomland Hardwood Forest SNA; **Lafayette Co. (1):** Wedel Property– ~3 mi. north of Argyle; **Monroe Co. (6):** Fort McCoy SNA; **Sheboygan Co. (1):** Kettle Moraine Red Oaks SNA; **Wood Co. (2):** Griffith St. Nursery.

Genus *Caenocara* Thomson

[Synonymy modified from Pic 1912a, White 1974, 1982, Philips 2002]
Type Species: *Dorcatoma bovistae* Hoffmann 1803: 100 (by original designation and monotypy).
Caenocara Thomson 1859: 90.
Tylistus LeConte 1861: 203.
Enneatoma Mulsant and Rey 1864: 328.
Coenocara Thomson; LeConte 1865: 242 (*lapsus calami*).
Cyphanobium Broun 1893: 1149.

Caenocara consists of 14 species in North America, north of Mexico, including one of uncertain status (White 1982, Philips 2002). Five of these species have been collected in Wisconsin. According to White (1962a), "most if not all members of this genus pass the larval stage in puffballs (*Lycoperdon*)." Adult specimens have also been recorded from "beating oak foliage" (Fall 1905). It may be interesting to note that a large majority of specimens collected from Wisconsin were obtained at Townes–Malaise traps as opposed to Lindgren funnel or flight intercept traps.

Members of *Caenocara* most closely resemble those of *Byrrhodes* and *Dorcatoma*, from which they may be easily distinguished by the deeply emarginate to nearly divided compound eyes. Species identifications, however, are questionable at best. In fact, White (1962a) stated, "In most cases determination to species is only possible if the specimen is relaxed and head raised so that antennae and palpi are visible; even with this done, determinations are often doubtful."

Caenocara is in need of taxonomic attention as it has not been adequately revised since Fall (1905). The form and size of the maxillary palpi, antennae, and distance between the eyes are relied on heavily in previous keys. In some specimens, characters utilized in differentiating species appear to be clear and discontinuous, while in others any distinctions are subtle, at best. For example, both *C. inepta* and *C. oculata* are said to have the terminal maxillary palpomere 1.3X longer than wide or less; however, in many specimens examined, this measurement was not found to be constant. This may be at least partially due to the insect drying and the palpus curling slightly, making exact measurement difficult. Also, because these insects are so small, the angle at which the specimen is held while measuring will cause some inconsistency. Therefore, the shape of the maxillary palpus is given greater consideration in specific determinations rather than its relative length and width, although these measurements were found to be useful in other species, such as *C. tenuipalpa* and to a lesser extent, *C. blanchardi*. Difficulties in determinations are elaborated on further in the species capsule descriptions that follow.

Male and female *Caenocara* may be separated by the form of the first segment of the antennal club (Fall 1905), which is more strongly produced laterally in the males (Fig. 50) and forming a transverse isosceles triangle in the females (Fig. 51) (Fall 1905). The eyes also tend to be larger and less deeply emarginate in the males than females, although this is not true for all *Caenocara* species (Fall 1905). Species identification in both Fall's (1905) and White's (1962a) keys rely on sexual dimorphism for species determinations, making identification of a female specimen alone impossible when not collected with a male. In certain species, identification of females was possible using other characters; in the cases of both *C. inepta* and *C. oculata*, many females were left undetermined unless they were part of a collecting event including males.

Caenocara sycmnoides LeConte, although thought to be relatively uncommon, is included in the key as it has been found widely across the northern United States (White 1962a).

Key to the Wisconsin Species of Adult *Caenocara*

[Modified from Fall 1905 and White 1962a]

1 Elytral pubescence relatively short, much inclined and nearly uniform in direction; antennal club in male blackish, paler in female ..... ***sycmnoides* LeConte**

1' Elytral pubescence long, erect, and alternating in direction; antennae pale in both sexes **2**

2 (1') Terminal maxillary palpomere narrow, subparallel, 2.5–3X longer than wide (Fig. 63); terminal antennal segment not arched; eyes cleft, emargination equal to 0.5 diameter in male, nearly divided in female ..... ***tenuipalpa* Fall (p. 64)**

2' Terminal maxillary palpomere wider, usually <2X longer than wide; terminal antennal segment and eyes variable **3**

3 (2') Terminal antennal segment in male slightly arched with the tip acutely pointed (Fig. 48); eyes of male larger than those of female, area between eyes equal to or narrower than the vertical diameter of the eye (♂♂); eye cleft, emargination equal to 0.5 diameter in male, nearly divided in female head and pronotum red to reddish brown ..... ***bicolor* (Germar) (p. 61)**

3' Terminal antennal segment without acutely pointed tip; eyes and color variable **4**

4 (3') Terminal maxillary palpomere less broadly triangular, apex obliquely truncate (Fig. 61) ..... ***blanchardi* Fall (p. 62)**

4' Terminal maxillary palpomere broadly triangular, apex squarely truncate **5**

5 (4') Eyes of male distinctly larger than those of female, area between nearly equal to or narrower than the vertical diameter of the eye in male, 1.3–2X wider than the vertical diameter of eye in female; eyes cleft, emargination equal to 0.75 diameter in male, nearly divided in female ..... ***inepta* Fall (p. 63)**

5' Eyes of male slightly larger than those of female, area between wider, nearly 1.3–2X wider than the vertical diameter of the eye, eyes nearly divided in both sexes ..... ***oculata* (Say) (p. 64)**

Caenocara bicolor (Germar)

(Figs. 48, 185, 186; Map 40)

[Synonymy modified from White 1962a]
Dorcatoma bicolor Germar 1824: 79.
Caenocara bicolor (Germar); Fall 1905: 275.

***Capsule Description* (Figs. 48, 185, 186)—Length:** 1.8 mm. **Width:** 1.3 mm. **Integument Color:** reddish-brown throughout; maxillary and labial palpi, antennae, and tarsi yellowish-orange. **Body Form:** spherical, 1.4X longer than wide. **Vestiture:** pubescence yellowish, erect to suberect, sparse, alternating in direction. **Head:** terminal maxillary palpomere narrowly truncate, nearly 2.1X longer than wide; eyes large, cleft, emargination equal to 0.5 the diameter of the eye, eyes separated in front by a little less than their vertical diameter (♂♂); antennae 9-segmented, clubbed, 7th segment transversely triangular (♂♂), 9th segment slightly curved and distinctly pointed apically, combined length of last 3 antennal segments much longer than preceding segments combined; surface shining, punctate. **Pronotum:** convex; wider at base, curving posteriorly at center towards scutellum, constricted apically; surface shining, punctate. **Elytra:** humeri prominent; with 2 complete lateral striae from base to apex, shorter 3rd upper striae terminating before level of metathoracic legs; surface shining, punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced in a flat, T-shaped lobe; posteriorly with a slightly raised, darkly pigmented, longitudinal carina, terminating anteriorly in an oval-shaped puncture; surface punctate, with large punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; 5th ventrite nearly 1.5X longer than ventrites 3 and 4 combined.

Diagnosis—*Caenocara bicolor* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: eyes deeply emarginate; eyes of male larger than those of female, separated in front by a distance less than the longest vertical diameter of the eye; terminal antennal segment of male curved and pointed at tip (said to be curved and somewhat pointed in female (White 1962a)) (Fig. 48); prothoracic coxae concealed ventrally in repose; elytral pubescence long and erect; pronotum and head red to reddish-brown; body with mandibles reaching the metathoracic ventrite (extracted in part from White 1962a, Philips 2002).

The black elytra contrasting with the red head and pronotum are thought to be diagnostic for this species and were noted to differ very little between specimens according to Fall (1905). However, the Wisconsin specimens examined clearly exhibit the typical reddish-brown head and pronotum, yet the elytra are not any darker than the pronotum. It is possible that these specimens represent a variation of the color seen in *C. bicolor*, or that they are simply teneral adults.

Natural History—In Wisconsin, only two male specimens were examined during the present study; one reported from a Townes–Malaise trap and the other using an unknown method. The former specimen was taken from a trap sample containing mostly *C. oculata* specimens.

Phenology—The only adult specimen of *C. bicolor* with a date recorded was found in Wisconsin during an early to mid-August sampling interval.

Distribution—*Caenocara bicolor* has been recorded from much of the central and eastern United States, northeast from Massachusetts and Michigan, southeast into Virginia and Kentucky, and west to Nebraska, Kansas, and Texas (White 1982). In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

***Wisconsin Records* (Map 40)**—The two specimens of *C. bicolor* examined during this study were recorded from the following localities: **Milwaukee Co. (1):** Milwaukee; **Dane Co. (1):** Swamp Lover's Inc.

Caenocara blanchardi Fall

(Figs. 49, 61, 187, 188; Map 41)

Caenocara blanchardi Fall 1905: 273.

Fall (1905) described *C. blanchardi* from a series of five specimens taken in Massachusetts by Blanchard, for whom the species was dedicated.

***Capsule Description* (Figs. 49, 61, 187, 188)—Length:** 1.6–2.2 mm. **Width:** 1.2–1.6 mm. **Integument Color:** reddish-black to black; maxillary and labial palpi, antennae, and tarsi yellowish to yellowish-orange; head reddish; pronotum red, reddish-black, or black; elytra reddish-black to black; ventral surface blackish; legs reddish-black. **Body Form:** spherical, 1.3X longer than wide. **Vestiture:** pubescence yellowish, erect to suberect, sparse, alternating in direction. **Head:** terminal maxillary palpomere oblique, 1.5–2.0X longer than wide; eyes nearly divided and separated by nearly 1.5X their vertical diameter (♀♀); antennae 9-segmented, clubbed, 7th segment broadly triangular (♀♀), 9th segment slightly curved, apically rounded, combined length of last 3 antennal segments much longer than preceding segments combined; surface shining, punctate. **Pronotum:** convex; wider at base, curving posteriorly at center towards scutellum, constricted apically; surface shining, punctate. **Elytra:** humeri prominent; with 2 complete lateral striae from base to apex, shorter 3rd upper stria terminating before level of metathoracic legs; surface shining, punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced in a flat, T-shaped lobe, shallowly grooved along outer margin; posteriorly with a slight to indiscernible longitudinal depression, oval-shaped puncture barely evident; surface shining, punctate, with large punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; 5th ventrite nearly 1.5X longer than combined length of ventrites 3 and 4.

Diagnosis—*Caenocara blanchardi* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: terminal maxillary palpomere strongly oblique laterally (Fig. 61); eyes deeply emarginate, those of male subequal in size to those of female; terminal antennal segment only slightly curved, tip somewhat pointed (Fig. 49); prothoracic coxae concealed ventrally in repose; elytral pubescence long and erect; body with mandibles reaching the metathoracic ventrite (Figs. 187, 188) (extracted in part from White 1962a, Philips 2002).

Wisconsin specimens of *C. blanchardi* may be separated with some trepidation from those of *C. tenuipalpa* by having the terminal maxillary palpomere distinctly wider at the apex than at the base of the segment. This character is unfortunately comparative in nature and requires examination of specimens of both species in order to make accurate comparisons. However, the relative lengths and widths of this segment do seem to be useful, although the specimens examined during this survey differ slightly from that reported by Fall (1905). In his description, Fall stated the terminal maxillary palpomere is 0.5X longer than wide in *C. blanchardi*, compared to 2.5X longer than wide in *C. tenuipalpa*. In the Wisconsin specimens examined during this survey, the terminal maxillary palpomere is 1.5–2X longer than wide in *C. blanchardi* and 2.5–3X longer than wide in *C. tenuipalpa*. In addition, the color of Wisconsin *C. blanchardi* specimens differs from previous descriptions. White (1962a) stated specimens of *C. blanchardi* are completely black, a character utilized in his key to species. However, specimens identified by him from the OSUC as well as specimens collected from Wisconsin, are distinctly reddish-black to black.

Natural History—In Wisconsin, only female specimens of *C. blanchardi* were collected: two from a flight intercept trap, two from a Townes–Malaise trap, and one at a "backyard barrier trap." The majority of specimens were found crawling on the outer surface of a giant puffball mushroom growing on the grassy path of a dry prairie. It was at this location I experienced the defense mechanism commonly used by other species in this genus (notably *C. oculata*; Weiss 1922). Their nearly perfectly cylindrical body shape and their ability to fold all appendages within grooves of the

ventral surface allows them to quickly retract and drop to the ground when disturbed, making it exceedingly difficult to find them again.

Phenology—Adult specimens of *C. blanchardi* were recorded in Wisconsin from mid-April to mid-September, although no specimens were collected during the months of June or July.

Distribution—*Caenocara blanchardi* has been recorded from Oregon, Michigan, Ohio, and Massachusetts (White 1982). In this study, specimens were examined from four Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 41)**—The 11 specimens of *C. blanchardi* examined during this study were recorded from the following localities: **Dane Co. (1):** Madison; **Green Co. (6):** Muralt Bluff Prairie SNA; **Oneida Co. (2):** No other label data; **Rock Co. (2):** Private Property–1.7 mi. NW Janesville.

Caenocara inepta Fall

(Figs. 189, 190; Map 42)

Caenocara inepta Fall 1905: 276.

***Capsule Description* (Figs. 189, 190)—Length:** 1.9–2.4 mm. **Width:** 1.5–1.7 mm. **Integument Color:** dark reddish-brown to black; maxillary and labial palpi, antennae, and tarsi yellowish to yellowish-orange. **Body Form:** spherical, 1.4X longer than wide. **Vestiture:** pubescence yellowish, erect to suberect, sparse, alternating in direction. **Head:** terminal maxillary palpomere broadly triangular, apically truncate, nearly 1.3X longer than wide; eyes cleft, emargination equal to 0.5–0.75 the diameter of the eye (♂♂), to nearly divided (♀♀); each eye separated in front by a little less or equal to its vertical diameter (♂♂) to 1.3–2X its vertical diameter (♀♀); antennae 9-segmented, clubbed, 7th segment transversely triangular (♂♂) to triangular (♀♀), 9th segment curved, apically rounded, combined length of last 3 antennal segments much longer than preceding segments combined; surface somewhat shining, punctate. **Pronotum:** convex; wider at base, curving posteriorly at center towards scutellum, constricted apically; surface shining, punctate. **Elytra:** humeri prominent; with 2 complete lateral striae from base to apex, shorter 3rd upper striae terminating before level of metathoracic legs; surface somewhat shining, punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced in a flat, T-shaped lobe, grooved along outer margin; posteriorly without or with a less distinct, darkly pigmented, longitudinal depression, terminating anteriorly in an oval-shaped puncture; surface punctate, with large punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; 5th ventrite nearly 1.5X longer than ventrites 3 and 4 combined.

Diagnosis—*Caenocara inepta* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: terminal maxillary palpomere broadly triangular, apically truncate; eyes deeply emarginate; eyes of male larger than those of female, separated in front by a distance equal to the longest vertical diameter of the eye; terminal antennal segment with rounded tip; prothoracic coxae concealed ventrally in repose; elytral pubescence long and erect; body with mandibles reaching the metathoracic ventrite (Figs. 189, 190) (extracted in part from White 1962a, Philips 2002).

Caenocara inepta so closely resembles *Caenocara oculata* (Say) that they may only be separated by the sexually dimorphic eyes. Males of *C. inepta* have the eyes much larger than those of females, whereas in *C. oculata*, the eyes of males and females are similar in size. For this reason, *C. inepta* females may not be determined unless they are within a larger series containing male specimens.

Some male specimens of *C. inepta* examined during this study have the eyes separated by slightly more than the vertical diameter of the eye, thus possibly causing them to be determined as *Caenocara similis* (Say) according to Fall's (1905) key. However, because many of these specimens are contained in a larger series of specimens that are distinctly *C. inepta*, it is unlikely that this slight difference in width between the eyes is significant in the specimens collected.

Natural History—Although this species is thought to be uncommon, a relatively large number of specimens were recorded from Wisconsin, many of which were obtained during different collecting years at the Spring Green Preserve. Interestingly, the majority of *C. inepta* specimens collected were males, even within large series, with the exception of a series of adults reared from fungus in which seven of the eight specimens were females. Other Wisconsin specimens were collected at Townes–Malaise, flight intercept, and Lindgren funnel traps. Two specimens were collected in a "human dung/malt/molasses" baited pitfall trap.

Phenology—Adults of *C. inepta* were recorded in Wisconsin from early June to mid-October.

Distribution—*Caenocara inepta* has been recorded from New Jersey, Tennessee, Florida, and Texas (White 1982). In this study, specimens were examined from six Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

***Wisconsin Records* (Map 42)**—The 122 specimens of *C. inepta* examined during this study were recorded from the following localities: **Columbia Co. (2):** Rocky Run SNA; **Iowa Co. (8):** No additional label data; **Monroe Co. (1):** Fort McCoy SNA; **Sauk Co. (101):** Spring Green Preserve SNA; **Waukesha Co. (9):** Kettle Moraine Southern Unit; **Wood Co. (1):** Powers Bluff SNA.

Caenocara oculata (Say)

(Figs. 50, 51, 62, 191, 192; Map 43)

[Synonymy modified from White 1962a]
Dorcatoma oculata Say 1824: 273.
Caenocara oculata (Say); LeConte 1865: 243.

Capsule Description **(Figs. 50, 51, 62, 191, 192)—Length:** 1.8–2.1 mm. **Width:** 1.3–1.4 mm. **Integument Color:** mostly black; humeri, legs, and head (in part) reddish; pronotum black to reddish; maxillary and labial palpi, antennae, and tarsi yellowish to yellowish-orange. **Body Form:** spherical, 1.3X longer than wide. **Vestiture:** pubescence yellowish, erect to suberect, sparse, alternating in direction. **Head:** terminal maxillary palpomere broadly triangular, apically truncate, nearly 1.3X longer than wide; eyes nearly divided and separated by 1.3–2X their vertical diameter in both sexes; antennae 9-segmented, clubbed, 7th segment transversely triangular (♂♂) to triangular (♀♀), 9th segment curved, apically rounded, combined length of last 3 antennal segments much longer than preceding segments combined; surface shining, punctate. **Pronotum:** convex; widest basally, curving posteriorly at center towards scutellum, constricted apically; surface shining, punctate. **Elytra:** humeri prominent; with 2 complete lateral elytral striae from base to apex, shorter 3rd upper striae terminating before level of metathoracic legs; surface shining, punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced in a flat, T-shaped lobe, grooved along outer margin; posteriorly with a slight longitudinal depression, terminating anteriorly in an oval-shaped puncture; surface punctate, with large punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; 5th ventrite nearly 1.5X longer than ventrites 3 and 4 combined.

Diagnosis—*Caenocara oculata* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: terminal maxillary palpomere broadly triangular, apically truncate (Fig. 62); eyes deeply emarginate; eyes of male subequal in size to those of female, separated in front by a distance 1.3–2X the vertical diameter of the eye; terminal antennal segment with rounded tip (Figs. 50, 51); prothoracic coxae concealed ventrally in repose; elytral pubescence long and erect; body with mandibles reaching the metathoracic ventrite (Figs. 191, 192) (extracted in part from White 1962a, Philips 2002). As mentioned previously in the diagnosis for *C. inepta*, females of *C. oculata* were not determined unless contained within a series including males.

Males are not always easily separated from females because they may have the seventh antennal segment strongly to slightly produced laterally, which nearly approaches the condition observed in females (Figs. 50, 51).

Natural History—*Caenocara oculata*, commonly known as the puffball beetle, has been recorded from puffball mushrooms in the genera *Lycoperdon* and *Scleroderma* (Weiss 1922). Larvae of this species were described by Böving (1954) from specimens all reported from puffballs. Weiss (1922) described in detail the larval, pupal, and adult stages of this species and its life history within puffballs. In this work, he noted what was observed in Wisconsin: when disturbed, *C. blanchardi* adults immediately fold in the appendages and fall off the surface of the mushroom. In Wisconsin, specimens were collected using Townes–Malaise, flight intercept, and Lindgren funnel traps.

Phenology—Adult specimens of *C. oculata* were recorded in Wisconsin from mid-April to late August.

Distribution—*Caenocara oculata* is said to be the most widely distributed species in this genus (White 1962a) and has been recorded from Vermont, Maine, and New Hampshire, south to North Carolina, southwest into Louisiana, Texas, and Arizona, and north from Kansas and Missouri, into Wisconsin and Michigan (White 1982). During this study, specimens were recorded from 15 Wisconsin counties.

Wisconsin Records **(Map 43)**—The 82 specimens of *C. oculata* examined during this study were recorded from the following localities: **State only (4)**; **Columbia Co. (1):** Rocky Run SNA; **Dane Co. (31):** Madison; Swamp Lover's Inc.; **Dodge Co. (2):** Beaver Dam; **Fond du Lac Co. (1):** No other locality data; **Grant Co. (11):** Wyalusing State Park; No additional locality data; **Iowa Co. (2):** No additional label data; **Jackson Co. (18):** No additional locality data; **Oneida Co. (1):** No additional label data; **Racine Co. (3):** Renak–Polak Maple–Beech Woods SNA; **Richland Co. (1):** LWRSWA Lone Rock Unit; **Rock Co. (2):** Private Property—1.7 mi. NW Janesville; No additional label data; **Sauk Co. (1):** Spring Green Preserve SNA; **Shawano Co. (2):** 1.3 mi. NE Wittenberg; Jung Hemlock–Beech Forest SNA; **Walworth Co. (1):** Kettle Moraine Oak Opening SNA; **Waukesha Co. (1):** Kettle Moraine Southern Unit.

Caenocara tenuipalpa Fall

(Figs. 52, 63, 193, 194; Map 44)

Caenocara tenuipalpa Fall 1905: 275.

Capsule Description **(Figs. 52, 63, 193, 194)—Length:** 1.5–1.8 mm. **Width:** 1.1–1.5 mm. **Integument Color:** dark reddish-brown to black; maxillary and labial palpi, antennae, and tarsi yellowish to yellowish-orange. **Body Form:** spherical, 1.3X longer than wide. **Vestiture:** pubescence yellowish, erect to suberect, sparse, alternating in direction. **Head:** terminal maxillary palpomere elongate, narrow, 2.5–3X longer than wide; eyes cleft, emargination equal to 0.5 its length (♂♂) to nearly divided (♀♀), eyes separated in front by a little less than their vertical diameter (♂♂) to distinctly more than their vertical diameter (♀♀); antennae 9-segmented, clubbed, 7th segment transversely triangular (♂♂) to triangular (♀♀), 9th segment not at all curved,

similar in form in both sexes, slightly longer than wide in males, combined length of last 3 antennal segments much longer than preceding segments combined; surface shining, punctate. **Pronotum:** convex; wider at base, curving posteriorly at center towards scutellum, constricted apically; surface shining, punctate. **Elytra:** humeri prominent; with 2 complete lateral striae from base to apex, shorter 3rd upper stria terminating before level of metathoracic legs; surface shining, punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced in a flat, T-shaped lobe, shallowly grooved along outer margin; posteriorly with slightly pigmented, shallow, longitudinal depression, terminating anteriorly in a round to oval-shaped puncture; surface punctate, with large punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; 5th ventrite nearly 1.5X longer than ventrites 3 and 4 combined.

Diagnosis—*Caenocara tenuipalpa* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: terminal maxillary palpomere slender, subparallel, nearly 2.5X as long as wide (Fig. 63); eyes deeply emarginate; eyes of male larger than those of female, separated in front by a distance less than the longest vertical diameter of the eye; terminal antennal segment not curved, similar in form in males as in females (Fig. 52); prothoracic coxae concealed ventrally in repose; elytral pubescence long and erect; body with mandibles reaching the metathoracic ventrite (Figs. 193, 194) (extracted in part from White 1962a, Philips 2002). *Caenocara tenuipalpa* also tends to be much smaller than the more commonly seen *C. oculata* or *C. inepta*.

Identification of female *C. tenuipalpa* was possible based on the form of the maxillary palpi, which are unlike those of any other Wisconsin *Caenocara* species.

Natural History—In Wisconsin, most specimens of *C. tenuipalpa* were collected using flight intercept, Townes–Malaise, and Lindgren funnel traps. One specimen was obtained at UV light and another was swept "from forest understory vegetation" in a hardwood forest.

Phenology—Adult specimens of *C. tenuipalpa* were recorded in Wisconsin from late May to early September.

Distribution—*Caenocara tenuipalpa* has been recorded north from Massachusetts, Michigan, Ohio, Illinois, south into North Carolina and Tennessee, and west to Texas (White 1982).

In this study, specimens were examined from 12 Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 44)**—The 22 specimens of *C. tenuipalpa* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Dane Co. (1):** Swamp Lover's Inc.; **Eau Claire Co. (1):** Eau Claire County Forest; **Grant Co. (4):** Blue River Sand Barrens SNA; No additional label data; **Green Co. (1):** Abraham's Woods SNA; **Iowa Co. (1):** No additional label data; **Jackson Co. (4):** No other locality data; **Monroe Co. (1):** Fort McCoy SNA; **Racine Co. (2):** Private Property – Arango Residence – Greenbriar Road; Renak-Polak Maple-Beech Woods SNA; **Rock Co. (1):** No other locality data; **Sauk Co. (2):** Spring Green Preserve SNA; **Wood Co. (3):** Power's Bluff SNA.

Genus *Dorcatoma* Herbst

[Synonymy modified from White 1962a, 1974, 1982]
Type Species: *Dorcatoma dresdensis* Herbst 1792: 103 (by monotypy).
Dorkatoma Herbst 1792: 103.
Dorcatoma Herbst; Paykull 1798: 319 (justified emendation).
Serrocerus Kugelann 1792: 486.
Dorcatorna Herbst; Westwood 1838: 273 (*lapsus calami*).
Dorcotoma Herbst; Lea 1924: 44 (*lapsus calami*).
Nerrocerus Kugelann; Wu 1937: 548 (*lapsus calami*).
Doratoma Herbst; Hayashi 1951: 4 (*lapsus calami*).
Dorcadoma Herbst; Horion 1961: 248 (*lapsus calami*).

Dorkatoma Herbst (1792) was emended as *Dorcatoma* by Paykull (1798) as a justified spelling correction (White 1974). Five *Dorcatoma* species are known from North America, north of Mexico (White 1982, Philips 2002), three of which have been found in Wisconsin.

Specimens of *Dorcatoma* strongly resemble those of *Byrrhodes*, with which they have been frequently confused. In 1905, Fall clarified *Dorcatoma* to include those species in which "the prosternum is produced behind into two long slender horn-like processes," an important character that cannot be seen unless the head and prothoracic ventrite are pulled away from the body (Fig. 64) (Philips 2002). Although this structure was adequately described by LeConte during his work on the genus, Fall (1905) found more than half the species included by LeConte in *Dorcatoma* lacked this structure, while others expressing this character were erroneously placed in other genera such as *Caenocara* and *Catorama* (now *Tricorynus*) (Fall 1905). Those species lacking the prosternal horn-like processes were removed by Fall (1905) and placed into his new genus *Eutylistus*, which was later synonymized under *Byrrhodes* (White 1971a, c).

Dorcatoma larvae are fungivores, developing within more or less woody fungi (White 1962a) generally found growing on dead or dying trees. The ability of *Dorcatoma* spp. to colonize wood-decay fungi was researched in Sweden by Jonsell et al. (1999), who studied the effect of distance and patch size on dispersal abilities of several beetles known to inhabit fungi. Their results showed members of *Dorcatoma* to be highly dispersive, and they hypothesized that with this

ability to colonize distant patches, the beetles were able to avoid competition for resources from other fungivores as well as escape parasitism (Jonsell et al. 1999). This is especially important because larvae are thought to take more than one year to complete development (Jonsell et al. 1999).

The efficiency with which *Dorcatoma* spp. find mates has also been recently studied. Jonsson et al. (2003) discovered only females are attracted to the odor of various fruiting bodies, after which they attract males to the fungal site with a sex pheromone. The pheromone method of locating mates was suggested by the authors to be a successful strategy even in areas of higher habitat fragmentation when compared with other fungivores where both sexes are attracted to the fungus (Jonsson et al. 2003).

Members of *Dorcatoma* may be separated from all other Wisconsin Ptinidae by a combination of the following characters: eyes not, or slightly, notched; antennae clubbed, with last three segments much longer than all preceding segments (Fig. 55); prothoracic ventrite produced posteriorly into two slender, parallel-sided processes (Fig. 64); prothoracic coxae concealed ventrally during body retraction; head strongly deflexed so that the mandibles reach the metathoracic ventrite (Fig. 196); metathoracic ventrite produced anteriorly into a broad lobe with distinct tarsal grooves (Figs. 80, 81); elytra not notched at sides for metathoracic legs; appendages highly contractile and received in ventral excavations (Figs. 196, 198, 200); first abdominal ventrite grooved for metathoracic legs (extracted in part from Philips 2002). The form of the prosternal parallel-sided process (Fig. 64) alone may differentiate this genus from all other Wisconsin Ptinidae, although there are a few genera for which this character has not yet been assessed.

Males and females of *Dorcatoma* may be separated based on their sexually dimorphic antennae. In the males, the 8th and 9th antennal segments are more strongly produced laterally; nearly appearing branched in *Dorcatoma pallicornis* LeConte and *Dorcatoma falli* White. The females of these two species have the 8th and 9th antennal segments produced laterally into a broadly, emarginate triangle. In *Dorcatoma setulosa* LeConte, the difference is more subtle with the males having the 8th and 9th antennal segments produced laterally into a more broadly, emarginate triangle and the females with these segments scarcely produced laterally and only slightly emarginate.

Key to the Wisconsin Species of Adult *Dorcatoma*

[Modified from White 1966a]

1 Pubescence of dorsal surface erect (Figs. 199, 200) ..... ***setulosa* LeConte (p. 68)**

1’ Pubescence of dorsal surface recumbent (Figs. 195–198) **2**

2 (1’) Metasternal fovea large and circular (Fig. 81) ..... ***pallicornis* LeConte (p. 67)**

2’ Metasternal fovea narrow and slit-like (Fig. 80) ..... ***falli* White (p. 66)**

Dorcatoma falli White

(Figs. 55, 80, 195, 196; Map 45)

[Synonymy modified from White 1982]
Dorcatoma dresdensis sensu Fall 1905: 262.
Dorcatoma falli White 1965: 114.

White (1965) described *D. falli* from specimens erroneously thought to be *D. dresdensis* Herbst (Fall 1905) (see *D. pallicornis* section).

Capsule Description **(Figs. 55, 80, 195, 196)—Length:** 2.1–3.0 mm. **Width:** 1.3–1.8 mm. **Integument Color:** dark reddish-brown to black; maxillary and labial palpi yellowish to reddish-black; antennae and tarsi yellowish to reddish-yellow; legs reddish black to black; surface distinctly shining. **Body Form:** elongate, oval, 1.6X longer than wide. **Vestiture:** pubescence yellowish to whitish; short, somewhat sparse, completely recumbent. **Head:** antennae 10-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, segments 8 and 9 moderately produced laterally (♀♀) to appearing branched (♂♂), 10th segment elongate; surface shining, densely punctate. **Pronotum:** short; deeply excavate ventrally to receive head; ventrally produced posteriorly into two slender, parallel-sided processes; surface shining, densely punctate. **Elytra:** humeri prominent; laterally with 2 strongly impressed striae, upper 3rd striae sometimes visible basally; surface densely punctate, not arranged in rows. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; deeply, longitudinally sulcate throughout most of its length; produced in a broadly flat lobe anteriorly. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for, and nearly concealed by, metathoracic legs.

Diagnosis*—Dorcatoma falli* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes not, or slightly, notched; prothoracic coxae concealed ventrally during body retraction;

prothoracic ventrite produced posteriorly into two slender, parallel-sided processes (Fig. 64); pubescence of dorsal surface recumbent; elytra with two or three striae (Figs. 195, 196); elytra laterally not notched for metathoracic legs; fovea of metathoracic ventrite narrow and slit-like (Fig. 80) (extracted in part from Philips 2002).

Natural History—The larvae of *D. dresdensis* were described by Böving (1954) for specimens collected both in Europe as well as in North America. Therefore, it is likely that this description is actually a combination of both *D. falli* and *D. dresdensis*. The North American specimens examined, including some from Wisconsin, were said to have been collected in a "woody fungus." During this survey, Wisconsin specimens were collected using Lindgren funnel, flight intercept, and Townes–Malaise traps.

Phenology—Adult specimens of *D. falli* were recorded in Wisconsin from mid-May to early August.

Distribution—*Dorcatoma falli* occurs widely across the northern United States and Canada (Fall 1905). Specimens have been recorded west from Montana, east to Maryland, and south to Missouri, Virginia, and South Carolina (Fall 1905, White 1982). Böving (1954) reported this species from Wisconsin. During this study, specimens were recorded from nine counties in Wisconsin.

***Wisconsin Records* (Map 45)**—The 10 specimens of *D. falli* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Green Co. (1):** Abraham's Woods SNA; **Marathon Co. (1):** Big Eau Pleine Woods SNA–Big Eau Pleine County Park; **Milwaukee Co. (1):** Milwaukee; **Monroe Co. (1):** Fort McCoy SNA; **Racine Co. (1):** Renak–Polak Maple–Beech Woods SNA; **Sauk Co. (2):** Hemlock Draw TNC; Sauk County Forest AC; **Shawano Co. (1):** Jung Hemlock–Beech Forest SNA; **Wood Co. (1):** Powers Bluff SNA.

Dorcatoma pallicornis LeConte

(Figs. 81, 197, 198; Map 46)

[Synonymy modified from White 1962a, 1982]
Dorcatoma pallicornis LeConte 1874: 274.
Dorcatoma foveatum White 1960: 238.

Dorcatoma pallicornis was described by LeConte (1874). During his revision of North American fauna, Fall (1905) synonymized *D. pallicornis* with the European species, *Dorcatoma dresdensis* Herbst. Later, White (1965) determined that *D. dresdensis sensu* Fall was not conspecific with *D. dresdensis* based on the structure of the metathoracic ventrite. Thus, Fall's description was actually for an unnamed species White described as *Dorcatoma falli* White in Fall's honor. In this work, White (1965) resurrected to specific status *D. pallicornis*, stating "*D. dresdensis* Herbst resembles *D. pallicornis* LeConte in the metasternal characters, but the male of the latter bears branched 8th and 9th antennal segments similar to those of *falli*." White (1962a) later synonymized *Dorcatoma foveatum* White, stating "examination of LeConte's female type showed it to be distinct from *dresdensis* and identical with *foveatum*."

***Capsule Description* (Figs. 81, 197, 198)—Length:** 2.1–3.1 mm. **Width:** 1.2–1.8 mm. **Integument Color:** dark reddish-brown to black; maxillary and labial palpi, antennae, and tarsi yellowish to reddish-yellow; legs yellowish-black to black; surface distinctly shining. **Body Form:** robust, elongate, oval, 1.7X longer than wide. **Vestiture:** pubescence yellowish, short, somewhat sparse, completely recumbent. **Head:** antennae 10-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, segments 8 and 9 moderately produced laterally (♀♀) to appearing branched (♂♂), 10th segment elongate; surface shining, with numerous small punctures. **Pronotum:** short, deeply excavate ventrally to receive head, ventrally produced posteriorly into two slender, parallel-sided processes; surface shining, with numerous small punctures. **Elytra:** humeri prominent; laterally with 2 strongly impressed striae, upper 3rd striae sometimes visible basally; punctures of disk not arranged in rows. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; with a longitudinal sulcus terminating in a deep fovea towards anterior margin; produced in a broadly flat lobe anteriorly. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for, and nearly concealed by, metathoracic legs.

Diagnosis—*Dorcatoma pallicornis* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes not, or slightly, notched; prothoracic coxae concealed ventrally during body retraction; prothoracic ventrite produced posteriorly into two slender, parallel-sided processes (Fig. 64); pubescence of dorsal surface recumbent; elytra with two or three striae (Figs. 197, 198); elytra laterally not notched for metathoracic legs; fovea of metathoracic ventrite large and circular (Fig. 81) (extracted in part from Philips 2002).

Natural History—In Wisconsin, the majority of specimens were collected from a single site in Madison, WI. A large shelf fungus, determined as *Ganoderma applanatum* (Pers.) Pat., was collected on 03 April 2007 from the side of a dead elm tree in the yard of an apartment complex. The fungus was placed in a bucket rearing chamber (Fig. 11); adults emerged on 17 April 2007, filling the glass jars on the sides of the chamber. A few more adults emerged over the next several days, but in fewer numbers. Three other specimens from Wisconsin were collected, "on shelf like fungus growing on tree snag," and an additional five specimens were obtained in flight intercept traps.

Phenology—Adult specimens of *D. pallicornis* were recorded in Wisconsin from early April to mid-August.

Distribution—*Dorcatoma pallicornis* is known mainly from northeastern North America, from Ontario, Maine, New Hampshire, and New York, west to Ohio and

Wisconsin (White 1982). During this study, specimens were recorded from five Wisconsin counties.

Wisconsin Records **(Map 46)**—The 53 specimens of *D. pallicornis* examined during this study were recorded from the following localities: **Dane Co. (45):** Private Property–Madison–4501 Hammersley Dr.; **Eau Claire Co. (1):** Eau Claire County Forest; **Marinette Co. (1):** Dunbar Barrens SNA; **Menominee Co. (4):** Menominee Tribal Enterprises; **Waupaca Co. (2):** Mud Lake Bog SNA.

Dorcatoma setulosa LeConte

(Figs. 199, 200; Map 47)

Dorcatoma setulosa LeConte 1865: 242.

Capsule Description **(Figs. 199, 200)—Length:** 1.6–2.1 mm. **Width:** 1.0–1.2 mm. **Integument Color:** black; sometimes dark reddish-black along pronotal and elytral margins; maxillary and labial palpi yellowish to reddish-yellow; antennae and tarsi yellowish; legs reddish-yellow to reddish-black; surface distinctly shining. **Body Form:** elongate, oval, 1.6X longer than wide. **Vestiture:** pubescence yellowish, short, sparse, erect on dorsal and ventral surface. **Head:** antennae 10-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, segments 8 and 9 scarcely produced laterally and only slightly emarginate (♀♀) to broadly triangular and obviously emarginate (♂♂), 10th segment elongate; surface shining, with numerous small punctures. **Pronotum:** short; deeply excavate ventrally to receive head; ventrally produced posteriorly into two slender, parallel-sided processes; surface shining, with numerous small punctures. **Elytra:** humeri prominent; laterally with 2 strongly impressed striae, upper, 3rd striae sometimes visible basally; punctures of disk forming more or less regular rows, punctures atx appearing arranged in pairs. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; with a deeply impressed longitudinal sulcus; produced anteriorly in a broadly flat lobe. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs.

Diagnosis—*Dorcatoma setulosa* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes not, or slightly, notched; prothoracic coxae concealed ventrally during body retraction; prothoracic ventrite produced posteriorly into two slender, parallel-sided processes (Fig. 64); pubescence of dorsal surface erect; elytra with two or three striae (Figs. 199, 200); elytra laterally not notched for metathoracic legs (extracted in part from Philips 2002).

Natural History—Specimens of *D. setulosa* are known to develop in the fungus, *Polyporus cuticularis* Fr. (Weiss and West 1922, White 1962a, 1982). In Wisconsin, specimens were collected using Lindgren funnel, flight intercept and Townes–Malaise traps.

Phenology—Adult specimens of *D. setulosa* were recorded in Wisconsin from late June to mid-August.

Distribution—*Dorcatoma setulosa* is known from much of eastern North America, occurring from New Hampshire, New York, Pennsylvania, south into Georgia and Louisiana, southwest to Kansas, and northwest into Illinois, Michigan, and Ohio (White 1982). In this study, specimens were examined from 11 Wisconsin counties; they constitute a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 47)**—The 23 specimens of *D. setulosa* examined during this study were recorded from the following localities: **Adams Co. (3):** Quincy Bluff TNC; **Dane Co. (2):** Swamp Lover's Inc.; **Iron Co. (1):** Frog Lake and Pines SNA; **Juneau Co. (1):** Lemonweir Bottomland Hardwood Forest SNA; **Lafayette Co. (1):** Wedel Property–~3 mi. north of Argyle; **Marinette Co. (1):** Dunbar Barrens SNA; **Milwaukee Co. (9):** Cudahy Woods SNA; **Rock Co. (1):** Private Property–1.7 mi. NW Janesville; **Sauk Co. (1):** Hemlock Draw TNC; **Shawano Co. (1):** Jung Hemlock–Beech Forest SNA; **Wood Co. (2):** Power's Bluff SNA.

Genus *Petalium* LeConte

[Synonymy modified from White 1982]
Type Species: *Anobium bistriatum* Say 1825: 172 (by original description).
Petalium LeConte 1861: 204.
Rhadine Baudi di Selve 1873: 331.
Synanobium Schilsky 1898: 22.
Radine Baudi di Selve; Schilsky 1899: 36c (*lapsus calami*).
Fossanobium Pic 1903: 172 (as subgenus).
Rahdine Baudi di Selve; White 1962a: 20 (*lapsus calami*).
Metapetalium Español 1970: 2 (as subgenus).

Petalium was established by LeConte (1861) and redefined by LeConte (1865) based on the first known New World species, which Say (1825) described as *Anobium bistriatum* Say (Ford 1973). Pic (1903, 1912a, respectively) synonymized *Rhadine* as well as *Synanobium* with *Petalium.* *Fossanobium* and *Metapetalium* were both described as subgenera but are currently recognized as synonyms of *Petalium* (White 1982). Fall (1905) described four new species and three subspecies in his revision of the genus, the most complete reference to *Petalium* until 1973, when the genus was revised by Ford. Ford's work described 17 new species and elevated Fall's (1905) three subspecies to specific status. During Ford's examination of the type series of *Petalium seriatum* Fall, he discovered a mix of what he determined to be three different species: *P. seriatum* Fall, *Petalium whitei* Ford, and *Petalium incisum* Ford. This discovery helped clarify some of the confusion over determinations of this species (e.g., White 1962a). Classification of *Petalium* as presented here is modified from the revisionary work completed by Ford (1973).

Petalium is composed of 23 North American species north of Mexico, with species richness greatest in southwestern

North America and along the east coast, diminishing northward. Six *Petalium* species have been collected in Wisconsin. Members of this genus have been recorded from several species of hardwoods, including *Juglans nigra* Linnaeus, *Juglans* sp., *Robinia pseudoacacia* Linnaeus, *Robinia* sp., *Quercus ilicifolia* Wangenheim, *Quercus velutina* Lamarck, as well as from the softwood genus *Pinus*, two lianas, *Celastrus scandens* Linnaeus and *Rhus toxicodendron* Linnaeus, and the shrub/tree *Forestiera acuminata* Poir. (Ford 1973). According to the literature, hand-collected specimens were generally obtained from the outer layers of dry, pithy, woody tissues, rather than from material that was wet, fungus ridden, or infested with other insects (Ford 1973). Species of *Petalium* have also been collected at UV light.

The generic name *Petalium* refers to the petal-like expansion of the anterior area of the metathoracic ventrite, which conceals the mandibles and prothoracic tarsi during body retraction (Fig. 82) (Ford 1973). The shape of the terminal maxillary palpomere (Fig. 91), the expansion of the metathoracic ventrite as well as the shape of the second abdominal ventrite (Fig. 208), which is elongate and generally as long as ventrites 3–5 combined, serve to distinguish this genus from all other Wisconsin ptinid genera. The perforations on the sides of the pronotum (Figs. 202, 204, 206, 208, 210, 212) are also unique to this genus and are hypothesized to represent adaptations whereby the cuticle has inverted to provide more efficient muscle attachments for movement of the head (Ford 1973).

Although members of *Petalium* are readily distinguished from other ptinid genera, species determinations are often difficult as they share many characteristics and show some variation in color and size between the sexes and throughout their geographic ranges. For example, Ford (1973) stated that "specimens of *seriatum*, *bistriatum*, and *whitei* are usually darker and smaller in the south than those collected further north." He also noted that males are generally smaller than females. However, the key presented in his revision does not consider this variation in size. In addition, the degree and distance of punctures on the elytral disk, characters used extensively in Ford's (1973) work, also proved problematic, as examination of material determined by Ford did not always agree with the description given in the key. For the purpose of this survey, other characters have been chosen to separate Wisconsin species. It should be noted that previously known distributions as defined by Ford (1973) and White (1982) as well as loaned material for comparison were relied on heavily to differentiate species. This genus is one of the most difficult groups to determine to species with any degree of certainty and is therefore in need of further revision to account for possible variations within the species. Future revisionary work should compare species over a broad geographic range. Analysis via molecular techniques may also prove insightful.

Males and females of *Petalium* are not easily separated, although the eyes tend to be larger and less widely separated in males.

Key to the Wisconsin Species of Adult *Petalium*

[Modified from Fall 1905 and Ford 1973]

1 Pronotum with anterior recurved carina strongly raised and obviously incised or emarginate medially (Figs. 90, 207); pronotal medial hump prominent (Figs. 207–208) ..... ***incisum* Ford (p. 71)**

1' Pronotum with anterior recurved carina not incised medially; pronotal medial hump variable **2**

2 (1') Pronotal medial hump prominent; 7th antennal segment swollen, 2–3X broader than segments 6 or 8 (Fig. 46); lateral pronotal margins with two perforations usually connected by a shallow sulcus, not extending beyond perforations (Fig. 210) ..... ***seriatum* Fall (p. 72)**

2' Pronotal medial hump not to moderately raised; antennae not as above; lateral pronotal margins variable **3**

3 (2') Body dark reddish-brown to blackish **4**

3' Body generally lighter reddish-brown to castaneous, never blackish **5**

4 (3) Body blackish; pronotum reddish or black, coarsely wrinkled; elytral disk shining with short, yellowish, recumbent setae, not distinctly arranged in rows (Fig. 203) ..... ***bistriatum* (Say) (p. 70)**

4' Body dark reddish-brown to blackish; elytral disk covered with golden pubescence, arranged in alternating broad and narrow rows (Fig. 201) (note: rows best viewed using diffuse lighting) ..... ***alternatum* Ford (p. 70)**

5 (3') Larger, 1.8–2.1 mm long; lateral pronotal margins with two perforations connected by deep, crescent-shaped sulcus extending beyond perforations (Fig. 212) ..... ***whitei* Ford (p. 73)**

5' Smaller, <1.8 mm; lateral pronotal margins with two perforations connected by a short, deep sulcus, not extending beyond perforations (Fig. 206) ..... ***debile* Fall (p. 71)**

Petalium alternatum Ford

(Figs. 201, 202; Map 48)

Petalium alternatum Ford 1973: 24.

Capsule Description **(Figs. 201, 202)—Length:** 2.0–2.4 mm. **Width:** 0.9–1.1 mm. **Integument Color:** reddish-black to black; maxillary and labial palpi, antennae, and tarsi yellowish to reddish-yellow; head black; ventral surface sometimes lighter. **Body Form:** moderately elongate, subcylindrical, 2.3X longer than wide. **Vestiture:** pubescence yellowish, recumbent; dense and arranged in rows on elytra (note: best seen using diffuse lighting); short and sparse on metathoracic ventrite and abdomen. **Head:** maxillary palpi with terminal segment emarginate apically; antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, pedicel large and spherical, segment 3 projecting laterally, appearing more or less triangular, segment 5 with a finger-like projection that exceeds the width of segment 3; surface wrinkled, granulate. **Pronotum:** moderately gibbous; medial hump distinct, but not strongly raised; perforations of lateral surface connected by a deep, crescent-shaped sulcus; surface wrinkled, granulate. **Elytra:** rather strongly convex; notched at sides for prothoracic, mesothoracic, and metathoracic legs. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly with a petal-like expansion concealing the mandibles during body retraction; posteriorly with a shallow, longitudinal sulcus. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; 2nd ventrite elongate, subquadrate, as long as ventrites 3–5 combined.

Diagnosis—*Petalium alternatum* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: metathoracic ventrite with petal-like expansion (e.g., Fig. 82); second abdominal ventrite elongate; body dark reddish-brown to blackish; elytral disk vested with rows of golden pubescence, which is arranged in rows (Fig. 201). Ford (1973) stated that this species could be confused with darker specimens of *P. seriatum* but may be distinguished from them by the unusual form of the antennae, which was said to have "segments 3, 5, and 7 strongly produced inward, 5 with fingerlike projection exceeding width of 3 or 7, 7 longer than 3." Ford illustrated the antennal forms of most species, but an illustration of the antennae of *P. alternatum* was not provided. Specimens collected from Wisconsin do not clearly follow Ford's description of the antennae, nor did a specimen from the FMNH determined by Ford. Wisconsin specimens of these two similar species are therefore separated based on elytral pubescence: dense and arranged in distinct rows in *P. alternatum*; less dense, and not arranged in rows in *P. seriatum*.

Natural History—The holotype of this species was collected using a light trap (Ford 1973). Other specimens have been reported from *Forestiera acuminata* (Ford 1973). In Wisconsin, specimens were collected using Lindgren funnel and flight intercept traps.

Phenology—Adult specimens of *P. alternatum* were collected in Wisconsin from early June to late August.

Distribution—This species has been recorded from Mississippi, Texas, and Indiana (Ford 1973, White 1982). In this study, specimens were examined from three Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 48)**—The four specimens of *P. alternatum* examined during this study were recorded from the following localities: **Dane Co. (2):** Swamp Lover's Inc.; **Grant Co. (1):** Dewey Heights Prairie SNA–Nelson Dewey State Park; **Trempealeau Co. (1):** Perrot State Park.

Petalium bistriatum (Say)

(Figs. 45, 203, 204; Map 49)

[Synonymy modified from White 1962a, Ford 1973]
Anobium bistriatum Say 1825: 235.
Petalium bistriatum (Say); LeConte 1865: 235.
Petalium bistriatum bistriatum (Say); White 1962a: 21.

Capsule Description **(Figs. 45, 203, 204)—Length:** 1.5–1.9 mm. **Width:** 0.6–0.8 mm. **Integument Color:** reddish-black to black; maxillary and labial palpi, antennae, and tarsi generally yellowish to reddish-yellow; pronotum red, reddish-black, or black; elytra blackish; metathoracic ventrite reddish, reddish-black, or blackish; abdomen usually reddish. **Body Form:** moderately elongate, subcylindrical, 2.4X longer than wide. **Vestiture:** pubescence whitish to yellowish, recumbent, short. **Head:** maxillary palpi with terminal segment emarginate apically; antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, pedicel large and spherical, segments 3 and 5 projecting laterally, appearing finger-like; surface wrinkled, granulate. **Pronotum:** gibbous; medial hump not strongly raised; perforations of lateral surface connected by a deep, crescent-shaped sulcus; surface wrinkled, granulate. **Elytra:** notched at sides for prothoracic, mesothoracic, and metathoracic legs; punctures smaller and more widely spaced, becoming nearly obsolete on the apical half; surface shining. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly with a petal-like expansion concealing the mandibles during body retraction; posteriorly with a shallow, longitudinal sulcus. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; 2nd ventrite elongate, subquadrate, as long as ventrites 3-5 combined.

Diagnosis—*Petalium bistriatum* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: metathoracic ventrite with petal-like expansion (e.g., Fig. 82); second abdominal ventrite elongate; elytra blackish, shiny, usually contrasting to the reddish,

roughly granulate pronotum (Fig. 203); elytral pubescence short and not arranged in rows. Ford (1973) stated teneral specimens of *P. bistriatum* could be confused with *P. whitei*, but may be distinguished from them by the pronotum being moderately gibbous in *P. bistriatum* and not at all gibbous in *P. whitei*. The punctures of the elytral disk will also aide in separation of these two species. In *P. bistriatum*, the elytral punctures become smaller and more widely spaced apically, nearly obsolete on the apical half, whereas the elytral punctures of *P. whitei* are more or less distinct from base to apex (Ford 1973).

Natural History—*Quercus ilicifolia* and *Q. velutina* have been reported as hosts for *P. bistriatum* (White 1982). White (1962a) stated that this species is frequently swept from low vegetation. In Wisconsin, specimens were collected using Lindgren funnel, Townes–Malaise, and flight intercept traps.

Phenology—Adult specimens of *P. bistriatum* were collected in Wisconsin from early July to mid-August.

Distribution—*Petalium bistriatum* is widely distributed throughout eastern North America, with its range extending from New England, south to Florida and as far west as Texas, Louisiana, Arkansas, and Missouri (Ford 1973, White 1982). In this study, specimens were examined from four Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 49)**—The nine specimens of *P. bistriatum* examined during this study were recorded from the following localities: **Columbia Co. (1):** Rocky Run SNA; **Dane Co. (4):** Swamp Lover's Inc.; **Juneau Co. (3):** Lemonweir Bottomland Hardwood Forest SNA; **Sauk Co. (1):** Spring Green Preserve SNA.

Petalium debile Fall

(Figs. 205, 206; Map 50)

[Synonymy modified from Ford 1973, White 1982]
Petalium bistriatum debile Fall 1905: 217.
Petalium debile Fall; Ford 1973: 32 (new status).

***Capsule Description* (Figs. 205, 206)—Length:** 1.8 mm. **Width:** 0.7–0.8 mm. **Integument Color:** reddish-brown to brown; maxillary and labial palpi, antennae, and tarsi yellowish to reddish-yellow. **Body Form:** moderately elongate, subcylindrical, 2.5X longer than wide. **Vestiture:** pubescence yellowish, recumbent, sparsely covering elytra, short and sparse on metathoracic ventrite and abdomen. **Head:** maxillary palpi with terminal segment emarginate apically; antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, pedicel large and spherical, segment 3 broadly triangular, segment 5 projecting laterally, appearing finger-like; surface wrinkled, granulate. **Pronotum:** feebly gibbous; medial hump not evident; perforations of lateral surface connected by a short, sometimes interrupted, deep sulcus not extending beyond perforations; surface wrinkled, granulate. **Elytra:** notched at sides for prothoracic, mesothoracic, and metathoracic legs; punctures small and shallow. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly with a petal-like expansion concealing the mandibles during body retraction; posteriorly with a shallow, longitudinal sulcus. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; 2nd ventrite elongate, subquadrate, as long as ventrites 3–5 combined.

Diagnosis—As noted in the diagnosis for *P. whitei*, specimens of *P. debile* may be easily confused with those of *P. whitei*. The Wisconsin specimens examined so closely resembles the latter species that they are determined to *P. debile* with some reservation. However, the smaller size of the specimens as well as the perforations of the pronotum connected by a short, deep sulcus that does not extend beyond the perforation to form a crescent shape (Fig. 206) support this determination. It is possible, however, that further comparison and genetic studies of these two species may eventually lead to their synonomy. In fact, two of the three *P. debile* specimens known from Wisconsin were obtained during the collecting event described under the diagnosis for *P. whitei*, supporting this hypothesis.

Natural History—Ford (1973) examined a specimen of *P. debile* found on *M. borealis*. In Wisconsin, two specimens were collected at UV light and one from a Townes–Malaise trap.

Phenology—Adults of *P. debile* were collected in Wisconsin from late July to late August.

Distribution—*Petalium debile* is known mostly from the southeastern United States (Ford 1973, White 1982). Ford (1973) recorded this species from Florida, Texas, Georgia, and New Jersey. One specimen from Indiana was examined during this survey from the FMNH. In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 50)**—The three specimens of *P. debile* examined during this study were recorded from the following localities: **Dane Co. (1):** Madison Nevin Hatchery; **Racine Co. (2):** Private Property–Arango Residence–Greenbriar Road.

Petalium incisum Ford

(Figs. 82, 90, 207, 208; Map 51)

Petalium incisum Ford 1973: 9.

***Capsule Description* (Figs. 82, 90, 207, 208)**

Length: 2.1–2.2 mm. **Width:** 0.8–0.9 mm. **Integument Color:** reddish-brown to dark reddish-brown; maxillary and labial palpi, antennae, and tarsi yellowish to reddish-yellow. **Body Form:** moderately elongate, subcylindrical, 2.4X longer than wide. **Vestiture:** pubescence yellowish, recumbent; short and sparse on abdomen and metathoracic ventrite,

slightly longer dorsally. **Head:** maxillary palpi with terminal segment emarginate apically; antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, pedicel large and spherical, segments 3 and 5 projecting laterally, appearing finger-like; surface wrinkled, granulate. **Pronotum:** gibbous; with a prominent medial hump; anterior recurved carina strongly raised and incised to weakly emarginate medially; perforations of lateral surface connected by a rather deep sulcus that may extend past the perforation; surface wrinkled, granulate. **Elytra:** notched at sides for prothoracic, mesothoracic, and metathoracic legs; surface punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly with a petal-like expansion concealing the mandibles during body retraction; posteriorly with a shallow, longitudinal sulcus. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; 2nd ventrite elongate, subquadrate, as long as ventrites 3–5 combined.

Diagnosis—*Petalium incisum* is readily distinguished from all other Wisconsin Ptinidae by a combination of the following characters: anterior recurved carina of pronotum strongly raised and obviously incised or emarginate medially (Fig. 90); metathoracic ventrite with petal-like expansion (Fig. 82); second abdominal ventrite elongate. The extent of pronotal emargination appears to vary, from strongly incised to weakly emarginate.

Natural History—The holotype of this species was reared from *Rhus toxicodendron* by Ford. *Petalium incisum* has also been recorded from *Robinia pseudacacia* and *Celastrus scandens* (Ford 1973). In Wisconsin, specimens were collected using Lindgren funnel, Townes–Malaise, cantharidin-baited flight intercept, and unbaited flight intercept traps.

Phenology—Adult specimens of *P. incisum* were collected in Wisconsin from early July to mid-September. The majority of records for this species from eastern North American collections occurred in June and July (Ford 1973).

Distribution—*Petalium incisum* occurs widely across eastern North America, with its range extending as far west as Texas and Missouri and as far south as Florida (Ford 1973, White 1982). This species has been found as far north as New York, Maryland, and Pennsylvania (Ford 1973, White 1982). In this study, specimens were examined from seven Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 51)**—The 35 specimens of *P. incisum* examined during this study were recorded from the following localities: **Dane Co. (21):** Swamp Lover's Inc.; **Grant Co. (1):** No other locality data; **Green Co. (1):** Browntown Oak Forest SNA; **Jefferson Co. (4):** Kettle Moraine Oak Opening SNA; **Ozaukee Co. (1):** UW–Milwaukee Field Station; **Racine Co. (2):** Private Property–Arango Residence–Greenbriar Road.; **Rock Co. (5):** Private Property–1.7 mi. NW Janesville.

Petalium seriatum Fall

(Figs. 46, 209, 210; Map 52)

Petalium seriatum Fall 1905: 215.

Fall's (1905) original type series consisted of three species, which he initially considered variations of *P. seriatum* (Ford 1973). Ford (1973) clarified Fall's description by separating out and describing two new species from the type series.

***Capsule Description* (Figs. 46, 209, 210)—Length:** 1.6–1.8 mm. **Width:** 0.7–0.8 mm. **Integument Color:** reddish-brown; maxillary and labial palpi, antennae, and tarsi yellowish to reddish-yellow. **Body Form:** moderately elongate, subcylindrical, 2.3X longer than wide. **Vestiture:** pubescence yellowish, recumbent, somewhat dense and arranged in indistinct rows on elytra; short and sparse on metathoracic ventrite and abdomen. **Head:** maxillary palpi with terminal segment emarginate apically; antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, pedicel large and spherical, segment 3 broadly triangular, segment 5 projecting laterally, appearing finger-like, segment 7 swollen 2–3X larger than segments 6 or 8; surface wrinkled, granulate. **Pronotum:** moderately gibbous; medial hump distinct, but not strongly raised; perforations of lateral surface connected by a shallow sulcus; surface wrinkled, granulate. **Elytra:** notched at sides for prothoracic, mesothoracic, and metathoracic legs; strial punctures usually strong and closer together, distinct beyond middle of elytral disk. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly with a petal-like expansion concealing the mandibles during body retraction; posteriorly with a shallow, longitudinal sulcus. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; 2nd ventrite elongate, subquadrate, as long as ventrites 3–5 combined.

Diagnosis—*Petalium seriatum* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: seventh antennal segment swollen and about twice as large as segments six or eight (Fig. 46); metathoracic ventrite with petal-like expansion (e.g., Fig. 82); second abdominal ventrite elongate; body reddish-brown. Ford (1973) described this species as having the pronotal medial hump "large and flanked each side by oblique depressions." The Wisconsin specimens examined, however, show a far less distinctly raised medial hump. Specimens of *P. seriatum* may be confused with those of *P. whitei*; however, the latter species does not have the seventh antennal segment swollen (Ford 1973).

Natural History—Larvae of *P. seriatum* were described by Böving (1954) from specimens reared from *Juglans* sp. as well as from a "small dead branch." Other known associations include *Juglans nigra* Linnaeus and *Pinus* sp. (White 1982). *Petalium seriatum* has also been collected on

Mimosa borealis Gray (Ford 1973). Wisconsin specimens were collected using flight intercept, Lindgren funnel, and Townes–Malaise traps.

Phenology—Adult specimens of *P. seriatum* were collected in Wisconsin from late May to mid-August.

Distribution—*Petalium seriatum* is widely distributed throughout eastern North America. This species occurs from Florida, west to Louisiana, Texas, Kansas, and Missouri, and North into Indiana, Ohio, Pennsylvania, Maryland, and Ontario, Canada (Ford 1973, White 1982). In this study, specimens were examined from four Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 52)**—The 10 specimens of *P. seriatum* examined during this study were recorded from the following localities: **State only (1)**; **Burnett Co. (1):** Crex Meadows SWN; **Dane Co. (6):** Madison; Swamp Lover's Inc.; No additional data; **Grant Co. (1):** Dewey Heights Prairie SNA–Nelson Dewey State Park; **Polk Co. (1):** Governor Knowles State Forest.

Petalium whitei Ford

(Figs. 91, 211, 212; Map 53)

Petalium whitei Ford 1973: 31.

Petalium whitei was named by Ford (1973) in recognition of the substantial amount of work done by Dr. Richard E. White on this family of beetles.

Capsule Description **(Figs. 91, 211, 212)—Length:** 1.8–2.1 mm. **Width:** 0.7–0.8 mm. **Integument Color:** reddish-brown; maxillary and labial palpi, antennae, and tarsi yellowish to reddish-yellow. **Body Form:** moderately elongate, subcylindrical, 2.5X longer than wide. **Vestiture:** pubescence yellowish, recumbent, sparsely covering elytra, short and sparse on metathoracic ventrite and abdomen. **Head:** maxillary palpi with terminal segment emarginate apically; antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined, pedicel large and spherical, segment 3 broadly triangular, segment 5 projecting laterally, appearing finger-like; surface wrinkled, granulate. **Pronotum:** feebly gibbous; medial hump evident, but not strongly raised; perforations of lateral surface connected by a deep to shallow, crescent-shaped sulcus that extends beyond perforations; surface wrinkled, granulate. **Elytra:** notched at sides for prothoracic, mesothoracic, and metathoracic legs; punctures distinct from base to apex, closer together on anterior third. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly with a petal-like expansion concealing the mandibles during body retraction; posteriorly with a shallow, longitudinal sulcus. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs; 2nd ventrite elongate, subquadrate, as long as ventrites 3–5 combined.

Diagnosis—*Petalium whitei* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: petal-like expansion of the metathoracic ventrite (e.g.,Fig. 82); elongate second abdominal ventrite; reddish-brown body; seventh antennal segment not swollen; perforations of lateral surface connected by a deeper to shallower, crescent-shaped sulcus that extends beyond perforations (Fig. 212).

Some specimens of *P. whitei* closely resemble those of *Petalium debile* Fall, from which they are separated in Ford's (1973) key by size. However, the couplet that separates them contains overlapping size ranges, which may cause smaller specimens of *P. whitei* to key out as *P. debile*. As the latter species is less common with a more southeastern distribution, it is likely that many of the Wisconsin specimens collected are smaller examples of *P. whitei*.

The form of the lateral pronotal perforations in Wisconsin specimens generally supported their determination; however, a single collection event at UV light demonstrated variation in this character. Of the specimens collected, half had the typical deep, crescent-shaped sulcus connecting the two perforations, whereas the other half had the perforations connected by an exceedingly shallow sulcus. Some members of the latter group had the sulcus extending slightly past the more interior perforation, appearing partially crescent shaped. This type of variation was not observed by Ford (1973): "large series of species bred from the same host plant show very little variation, or large series of a species collected at light on the same night display hardly any differences." Brief examination of the male genitalia of one specimen from each group, however, did not reveal any inherent differences, thus supporting their identity as *P. whitei*.

Natural History—The holotype of *P. whitei* was collected using a UV light trap (Ford 1973). In Wisconsin, most specimens were collected at UV light. Specimens were also obtained using Lindgren funnel and flight intercept traps.

Phenology—Adult specimens of *P. whitei* were collected in Wisconsin from early June to early August.

Distribution—*Petalium whitei* is widely distributed throughout eastern North America. It has been recorded as far west as Texas, and south from Florida, Georgia, and Mississippi, north to Massachusetts, Pennsylvania, and New York (Ford 1973, White 1982). In this study, specimens were examined from five Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 53)**—The 17 specimens of *P. whitei* examined during this study were recorded from the following localities: **Adams Co. (1):** Quincy Bluff TNC; **Iowa Co. (1):** Arena Pines–Sand Barrens SNA; **Lafayette Co. (1):** Wedel Property– ~3 mi. north of Argyle; **Racine Co. (12):** Private Property–Arango Residence–Greenbriar Road; **Sauk Co. (2):** Bakken's Pond; Gatshall AC.

Genus *Protheca* LeConte

[Synonymy modified from White 1979, 1982, Philips 2002]
Type Species: *Protheca hispida* LeConte 1865: 241 (designated by Lucas 1920: 541).
Protheca LeConte 1865: 241.
Picatoma Lepesme 1947: 224.

Photheca LeConte; Español 1972: 75 (*lapsus calami*).

Protheca was proposed by LeConte (1865) to include two North American species: *Protheca hispida* LeConte and *Protheca puberula* LeConte, the latter of which was subsequently transferred to *Sculptotheca* (White 1979). Species of *Protheca* are found exclusively in the Americas (White 1979), with one species occurring in North America north of Mexico. Members of *Protheca* are largely unknown, however. White (1979) provided a complete revision of the genus for worldwide fauna in which he gave descriptions for 20 new species, 11 of which were described from a single specimen.

Members of *Protheca* may be distinguished from all other North American Dorcatominae by a combination of the following characters: eyes entire, not incised; antennae 11-segmented; prothoracic coxae concealed ventrally during body retraction; elytra faintly punctate-striate; elytra at sides notched for metathoracic legs; pubescence bristling; metathoracic ventrite with distinct tarsal grooves; first ventrite grooved for reception of the metathoracic legs.

As with many species of *Protheca*, the only certain method of separating males from females is by genitalic examination (White 1979).

Protheca hispida LeConte

(Figs. 53, 213, 214; Map 54)

Protheca hispida LeConte 1865: 241.

Capsule Description **(Figs. 53, 213, 214)—Length:** 1.6 mm. **Width:** 1.0 mm. **Integument Color:** reddish-brown to castaneous; maxillary and labial palpi, antennae, and tarsi reddish-yellow to yellowish. **Body Form:** oblong, oval, 1.7X longer than wide. **Vestiture:** pubescence yellowish to whitish; body covered in semi-recumbent to erect, dense, bristling setae, changing in direction, appearing as darker spots on the elytra. **Head:** antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined; surface with both large and small punctures. **Pronotum:** elongate, laterally compressed; surface with both large and small punctures. **Elytra:** grooved at side for mesothoracic and metathoracic legs; surface distinctly, densely punctate. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; deeply, longitudinally sulcate at center from base to apex, wider mesally; produced anteriorly into a rounded lobe terminating in a somewhat hooked knob; surface with both large and small punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by metathoracic legs; ventrite sutures curving upward medially.

Diagnosis—This species most closely resembles *S. puberula* but may be immediately distinguished from it by the 11-segmented antennae (Fig. 53) and pubescence of the dorsal surface changing in direction, which appears as darker spots on the elytra (Figs. 213, 214).

Natural History—Remarkably little is known of the natural history of *P. hispida*. White (1979) reported one specimen "from a tulip tree." Larvae of *P. hispida* were described by Böving (1954) from specimens collected "in *Liriodendron*" from a "single, imperfect larval skin." The Wisconsin specimen collected was obtained using a flight intercept trap baited with cantharidin (although the chemical bait is considered incidental).

Phenology—The single adult specimen of *P. hispida* was recorded in Wisconsin during a mid- to late July trap sampling interval.

Distribution—*Protheca hispida* is widely distributed throughout eastern North America, having been recorded from New York and Ohio, south to Florida and Texas. In this study, one specimen was examined from a single Wisconsin county; it constitutes a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 54)**—A single specimen was examined during this study from the following location: **Milwaukee Co. (1):** Cudahy Woods SNA.

Genus *Sculptotheca* Schilsky

[Synonymy modified from White 1982]
Type Species: *Stagetus hilleri* Schilsky (by monotypy).
Sculptotheca Schilsky 1900: 16 (as subgenus).

This genus contains one species in North America, north of Mexico. Members of *Sculptotheca* may be distinguished from all other North American Dorcatominae by a combination of the following characters: eyes entire, not incised; antennae nine-segmented; prothoracic coxae concealed ventrally during body retraction; elytra punctate-striate; elytra at sides notched for metathoracic legs; pubescence bristling; metathoracic ventrite with distinct tarsal grooves; first ventrite grooved for reception of the metathoracic legs.

Males and females are not readily separable; however, Fall (1905) stated that the abdomen of males is distinctly flattened to slightly concave medially.

Sculptotheca puberula (LeConte)

(Figs. 54, 215, 216; Map 55)

[Synonymy modified from White 1979, 1982]

Protheca puberula Leconte 1865: 241.
Sculptotheca puberula (LeConte); Español 1973: 62-63.

This species was transferred from *Protheca* by Español (1973) on the basis of its nine-segmented antennae and lateral lobes of the male genitalia without "palplike objects" (White 1979).

Capsule Description **(Figs. 54, 215, 216)—Length:** 1.5–2.2 mm. **Width:** 0.9–1.1 mm. **Integument Color:** dark reddish-brown to dark brown throughout; maxillary and labial palpi, antennae, and tarsi reddish to reddish-yellow. **Body Form:** oblong, oval, 1.8X longer than wide. **Vestiture:** pubescence yellowish; body covered in semi-recumbent to erect, bristling setae; not, to slightly changing in direction dorsally. **Head:** antennae 9-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined; with cup-like excavation beneath for reception of the antennae; surface with both large and small punctures. **Pronotum:** elongate; laterally compressed; surface with both large and small punctures. **Elytra:** grooved at sides for mesothoracic and metathoracic legs; surface distinctly punctate-striate, arranged in rows. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; deeply, longitudinally sulcate at center from base to apex; produced anteriorly in a rounded lobe; surface with both large and small punctures. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for and nearly concealed by the metathoracic legs; slightly flattened to concave medially.

Diagnosis—This species resembles the morphologically similar *P. hispida* but is readily separated from it by the nine-segmented antennae (Fig. 54) and pubescence of dorsal surface not, or only slightly changing in direction (Figs. 215, 216).

Natural History—White (1969a) recorded three specimens of *S. puberula* in Virginia from low foliage in the evenings between late June and early July. In Wisconsin forests, *S. puberula* is the most frequently collected ptinid using passive trapping techniques. The majority of Wisconsin specimens of *S. puberula* were collected using Lindgren funnel, flight intercept, and Townes–Malaise traps. A small number of specimens were recovered from pitfall traps, at light, and in cantharidin-baited traps. One specimen was collected by beating oak and maple branches. Two others are reported from *Ulmus americana* Linnaeus and "non-wilting *Quercus*." Specimens were obtained at traps utilizing ipsdienol, cantharidin, or synthetic serricornin, although it is not clear as to whether any of these compounds had any effect on attracting *S. puberula* as this species is so commonly collected.

Phenology—Adult specimens of *S. puberula* were collected in Wisconsin from mid-June to early September.

Distribution—*Sculptotheca puberula* is widely distributed throughout eastern North America, as far north as Maryland, Michigan, Wisconsin, and Pennsylvania, extending south into Florida (White 1982). Wisconsin currently represents the western-most boundary of this species. During this study, specimens were recorded from 29 counties throughout Wisconsin.

Wisconsin Records **(Map 55)**—The 261 specimens of *S. puberula* examined during this study were recorded from the following localities: **State only (2)**; **Adams Co. (25):** Quincy Bluff TNC; **Barron Co. (1):** Kriska Residence; **Buffalo Co. (2):** Engel Farm Property; **Clark Co. (3):** Schmidt Maple Woods SNA; **Columbia Co. (7):** Rocky Run SNA; **Dane Co. (34):** Swamp Lover's Inc.; **Douglas Co. (1):** Brule River State Forest; **Eau Claire Co. (5):** Augusta State Wildlife Area; UW Eau Claire Campus; **Grant Co. (7):** No additional label data; Wyalusing State Park; **Green Co. (7):** Abraham's Woods SNA; **Iowa Co. (6):** LWRSGA Avoca Unit; Ridgeway Pine Relict SNA; Tower Hill State Park; No other locality data; **Jackson Co. (16):** Black River State Forest; Black River State Forest–Castle Mound Pine Forest SNA; No additional locality data; **La Crosse Co. (2):** West Salem PC; **Lafayette Co. (37):** Wedel Property– ~3 mi. north of Argyle; **Marathon Co. (1):** Big Eau Pleine Woods SNA–Big Eau Pleine County Park; **Marinette Co. (6):** Bloch Oxbow SNA; Dunbar Barrens SNA; **Marquette Co. (2):** Fox River Wildlife Refuge; **Menominee Co. (3):** Menominee Tribal Enterprises; Private Property–Legend Lake–Spirit Island Road; **Milwaukee Co. (6):** Cudahy Woods SNA; **Racine Co. (3):** Renak–Polak Maple–Beech Woods SNA; **Richland Co. (2):** Gotham Jack Pine Barrens; No other locality data; **Rock Co. (2):** Private Property–1.7 mi. NW Janesville; **Sauk Co. (58):** Bakken's Pond; Hemlock Draw TNC; Just north of Spring Green–Spring Green Preserve TNC; Mirror Lake State Park–Echo Rock Trail; **Sheboygan Co. (13):** Kettle Moraine Red Oaks SNA; **Trempealeau Co. (2):** Perrot State Park; **Walworth Co. (2):** Kettle Moraine Oak Opening SNA; **Waukesha Co. (1):** Kettle Moraine State Forest; **Waushara Co. (1):** D. Balliet Property; **Wood Co. (4):** Griffith St. Nursery; Powers Bluff SNA.

Genus *Stagetus* Wollaston

[Synonymy modified from White 1982, Philips 2002]
Type Species: *Stagetus hirtulus* Wollaston 1861: 12 (designated by White 1974: 450).
Theca Mulsant and Rey 1860: 293.
Stagetus Wollaston 1861: 1.
Anomotheca Schilsky 1899: 40a.
Thecha Mulsant and Rey; Español 1968: 103 (*lapsus calami*).
Anotheca Schilsky; Español 1969: 109 (*lapsus calami*).

This genus contains two species in North America, north of Mexico: *Stagetus profundus* (LeConte) and *Stagetus grossus* White. *Stagetus profundus* is the only species that occurs

in Wisconsin. Members of this genus may be distinguished from all other North American Dorcatominae by a combination of the following characters: prothoracic coxae visible during body retraction; anterior metasternal process not concealing mandibles; elytra with distinctly impressed striae throughout from base to apex; pubescence dense and bristling; first ventrite grooved for reception of the metathoracic legs.

Stagetus profundus (LeConte)

(Figs. 217, 218; Map 56)

[Synonymy modified from White 1962a, 1982]
Theca profundus LeConte 1865: 235.
Theca striatopunctatus LeConte 1884: 22.
Stagetus profundus (LeConte); Leng 1920: 243.

Capsule Description **(Figs. 217, 218)—Length:** 3.0 mm. **Width:** 1.4 mm. **Integument Color:** dark reddish-black to black throughout; maxillary and labial palpi, and antennae yellowish-orange. **Body Form:** elongate, robust, 2.2X longer than wide. **Vestiture:** pubescence whitish to dull yellowish, moderately dense, slightly obscuring surface sculpture, erect on dorsal surface and head, mostly recumbent with intermixed erect setae on ventral surface. **Head:** antennae 11-segmented, clubbed, combined length of last 3 antennal segments much longer than all preceding segments combined; surface rather densely punctate, with both large and small punctures. **Pronotum:** widest at base, narrowing toward apex; slightly concave laterally; lateral margins nearly straight; surface with both large and small punctures, large punctures at side with puncture rim obsolete toward anterior margin. **Elytra:** each with 10 complete striae; humeri distinct; notched at sides for metathoracic legs. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; deeply, longitudinally grooved at center; with larger punctures laterally and on anterior 0.5, smaller punctures medially to posterior margin. **Legs:** received in ventral excavations; prothoracic and mesothoracic coxae visible during body retraction, separated by a diamond/cross-shaped, metasternal process, which is distinctly rounded apically (often held between mandibles during body retraction). **Abdomen:** with 5 ventrites; 1st ventrite grooved for, and largely concealed by, the metathoracic legs.

Diagnosis—Specimens of *S. profundus* may be distinguished from all other North American Dorcatominae by a combination of the following characters: prothoracic coxae visible during body retraction; anterior metasternal process diamond shaped, rounded apically, not concealing the mandibles; each elytron with 10 complete striae (Fig. 217); pubescence dense and bristling (Figs. 217, 218); first ventrite grooved for reception of the metathoracic legs (Fig. 218); length less than 3.0 mm.

Although the Wisconsin specimen of *S. profundus* collected during this survey is the first member of the genus I have ever encountered, the descriptions given by Fall (1905) and White (1962a) leave little doubt as to its determination with the exception of the punctation on the head. *Stagetus profundus* is said to have the head "sparsely not coarsely punctate" (Fall 1905), made up of smaller punctures (White 1976a). However, the head of the Wisconsin specimen is clearly more densely punctate with both larger and smaller punctures. Both Fall (1905) and White (1975) discussed specimens they examined that differed slightly from the known species in either punctation or elytral striae, but were hesitant to describe them as new species or assign them to an already described species until a greater number of specimens was obtained. Until additional specimens and species in this genus can be examined, the Wisconsin specimen will be considered to represent *S. profundus*.

Natural History—Literature to date provides no information as to the hosts or larval food requirements of this species. The only Wisconsin specimen collected during this survey was taken from a Lindgren funnel trap in a recently burned forest dominated by *Pinus strobus* Linnaeus and *Pinus resinosa* Aiton.

Phenology—The adult specimen of *S. profundus* was collected in Wisconsin during a late April–early May sampling interval.

Distribution—The distribution of this species is rather diffuse, from the northwestern states of Washington, Oregon, and California, to the northeast from New Jersey, Pennsylvania, and Maryland, and into Indiana (White 1982, Philips 2002, Majka 2007a). *Stagetus profundus* has also been recorded in Canada from British Columbia, Ontario, Québec (McNamara 1991), and Nova Scotia (Majka 2007a). Although specimens of *S. profundus* have been collected most commonly in the northeastern states, in general they appear to be rather infrequently encountered (White 1962a). The single Wisconsin specimen examined during this study represents a **NEW STATE RECORD**.

Wisconsin Records **(Map 56)**—The only specimen of *S. profundus* examined during this study was recorded from **Adams Co. (1)**: Quincy Bluff TNC.

Genus *Striatheca* White

Type Species: *Striatheca lineata* White 1973: 49 (by original description and monotypy).
Striatheca White 1973: 48.

Striatheca was established by White (1973): "*Striatheca* is a neo-Latin name of feminine gender formed by taking the termination -theca and combining with it stria-, which refers to the strongly developed elytral striae." This genus is said to be most closely related to *Protheca* LeConte, although this was prior to the separation of *Sculptotheca* from *Protheca*. The characters given for their separation are the form of the elytral striae, which are composed of punctures in

Protheca and *Sculptotheca* but consist of deeply impressed lines in *Striatheca*, and the form of the anterior process of the metathoracic ventrite, which forms a broad lobe in *Protheca* and *Sculptotheca* and a hook-like process in *Striatheca*. The single species, *Striatheca lineata*, is found in North America, north of Mexico.

The anterior excavation of the metathoracic ventrite, which receives the mesothoracic legs in repose, is far less obvious than in other Dorcatominae, so that specimens of *Striatheca* may potentially be confused with those of *Tricorynus*. This is complicated further by the metathoracic ventrite being produced into a narrow, hook-like process in both genera. However, careful examination of the ventral surface will reveal the metathoracic ventrite to be excavate for the mesothoracic tarsi, especially toward the metasternal process. The elytral striation also readily separates these two genera in Wisconsin.

Male and female *Striatheca* are not thought to be easily separated. White (1973) stated that there were no external sexual characters upon which to separate the sexes.

Striatheca lineata White

(Figs. 219, 220; Map 57)

Striatheca lineata White 1973: 49.

Capsule Description **(Figs. 219, 220)—Length:** 2.1 mm. **Width:** 1.1 mm. **Integument Color:** maxillary and labial palpi reddish-yellow; antennae orangish; head mostly black, suffused with red above mandibles; dorsal surface black; scutellum and basal margin of pronotum reddish; margins of elytra suffused with red; ventral surface dull reddish, suffused with black; tarsi yellowish-orange; surface shining. **Body Form:** elongate, oval, 1.8X longer than wide. **Vestiture:** pubescence yellowish, somewhat sparse, slightly denser on pronotal disk, erect on dorsal surface, erect to inclined on ventral surface; forming regular rows on either side of elytral striae. **Head:** antennae 10-segmented, clubbed, last 3 segments as long as all preceding, segments 8 and 9 broadly triangular, 10th segment oval; surface shining with deep, scattered, small to somewhat irregular punctures. **Pronotum:** subspherical; laterally concave; surface shining, punctate, punctures somewhat irregular in size and density; laterally crenulate. **Elytra:** humeri prominent; lateral margins notched for metathoracic legs; with 10 deeply impressed striae on each elytron; striae distinct from base to apex, not appearing as rows of punctures; surface shining. **Metathoracic Ventrite:** excavate for reception of mesothoracic legs; anteriorly produced in a narrow, hook-like process, concealed by mandibles during body retraction; with a moderately impressed, longitudinal sulcus arising from anterior carina and extending to apex. **Legs:** received in ventral excavations. **Abdomen:** with 5 ventrites; 1st ventrite grooved for the metathoracic legs.

Diagnosis—*Striatheca lineata* may be distinguished from all other Wisconsin Dorcatominae by a combination of the following characters: eyes not incised; prothoracic coxae concealed ventrally during body retraction; each elytron with 10 distinct striae from base to apex, not appearing as rows of punctures (Figs. 219, 220); anterior process of the metathoracic ventrite narrow and hook-like; first abdominal ventrite grooved for reception of the metathoracic legs (extracted in part from Philips 2002).

Natural History—Little has been published on the natural history of *S. lineata*. This species was described from five specimens, taken at various localities at light/UV light (White 1973). In Wisconsin, a single specimen was collected in a Lindgren funnel trap baited with ethanol.

Phenology—The single adult specimen of *S. lineata* was recorded from Wisconsin during mid-July.

Distribution—In North America, *S. lineata* is known only from Mississippi, Georgia, and Florida (White 1982). In this study, a single specimen was examined from one Wisconsin county; it constitutes a **NEW STATE RECORD** and new northwestern range extension of the known distribution for the species.

Wisconsin Records **(Map 57)**—A single specimen was examined during this study from the following location: **Shawano Co. (1):** Jung Hemlock–Beech Forest SNA.

Subfamily Mesocoelopodinae

Genera now comprising Mesocoelopodinae were once considered members of Dorcatominae (Fall 1905). White (1971d) realized Fall's classification in fact represented two separate lineages and proposed the subfamily Tricoryninae for *Tricorynus* Waterhouse, *Cryptorama* Fall, and *Mesocoelopus* Jacquelin duVal. He considered Tricoryninae to be allied more closely with Xyletininae, whereas Dorcatominae was closer to Anobiinae. However, Mesocoelopodinae *sensu* Mulsant and Rey (1864) has priority over White's Tricoryninae (Lawrence and Newton 1995).

Larvae of a number of species in Mesocoelopodinae develop in seeds (White 1982). Other larval food materials include dead wood or branches, plant or vine stems, galls, as well as a species from apple bark and one from dry kelp (White 1982). North American Mesocoelopodinae, north of Mexico, includes three genera and 95 species (White 1982, 1984, Philips 2002), of which only *Tricorynus* has been recorded from Wisconsin to date.

Members of North American Mesocoelopodinae can be distinguished by having the prothoracic coxae concealed when the body is retracted and the metathoracic ventrite without tarsal grooves anteriorly on either side of the metasternal process (extracted in part from Philips 2002). Species identifications in Mesocoelopodinae can be difficult not only

due to their small size and compact body structure, but also because of the subtle characters used to separate species. White (1965, 1984) described species of *Tricorynus* and *Cryptorama*, both exceedingly specious genera, as markedly similar in terms of external morphology. Specimen preparation should ensure that the surface is clear of debris so as to expose the surface structure of the cuticle, although even when this is done, determinations are often difficult.

Genus *Tricorynus* Waterhouse

[Synonymy modified from White 1965, 1982, Philips 2002]
Type Species: *Tricorynus zeae* Waterhouse 1849: 68 (by monotypy).
Tricorynus Waterhouse 1849: 1xviii.
Catorama Guérin-Méneville 1850: 431.
Hemiptychus LeConte 1865: 239.
Cathorama Gemminger and Harold 1869: 1784 (emendation).
Xylotheca Reitter 1897: 204.
Hemitychus LeConte; Böving 1954: 297 (*lapsus calami*).

Tricorynus was described by Waterhouse (1849) for the new species, *Tricorynus zeae* Waterhouse, collected from Barbados Islands (White 1965). The following year, Guérin-Méneville (1850) described the genus *Catorama*, for *Catorama tabaci* Guérin-Méneville (White 1982). LeConte (1865) described five species in the new genus *Hemiptychus*, transferring two previously described species, *Dorcatoma grave* LeConte and *Dorcatoma pusillum* LeConte, to this genus. LeConte and Horn (1883) published a key separating *Catorama* from *Hemiptychus* based on the excavation of the first ventral segment. Reitter (1897) described *Xylotheca* for one species, *Xylotheca meieri* Reitter, later synonymized with *Catorama* by Pic (1912a) (White 1965). Fall (1905) synonymized *Hemiptychus* with *Catorama* and stated that members of the genus could be recognized by the 10-segmented antennae and intercoxal hook (Fig. 83) separating the mesothoracic coxae. *Catorama* was finally synonymized with *Tricorynus* by White (1965).

Tricorynus is easily the largest North American genus of Ptinidae (White 1974), with 84 species and five subspecies in North America, north of Mexico (White 1982). (*Tricorynus cryptoglyptus* Ford and *Tricorynus dudleyae* White are described later.) This genus is interesting because nearly all known species are from the Americas (White 1974).

Although *Tricorynus* is a rather large genus, natural history of many species is not well known. Most species are known to feed in plant seeds, with a few reared from galls (White 1982, Philips et al. 1998). Other larval food materials include dead limbs and twigs as well as fungi (White 1965). One species, *Tricorynus herbarius* (Gorham), known as the Mexican book beetle, is considered the most economically significant member of the genus (White 1963), having been found to damage historical books, leather, stored foods, furniture, and wood (White 1965).

Members of *Tricorynus* may be distinguished from all other Wisconsin Ptinidae by a combination of the following characters: antennae 10-segmented (Fig. 58); prothoracic tibiae nearly always striate (Fig. 75); metathoracic ventrite without apical, tarsal grooves, and produced into a hook, which the beetle is able to grasp between its mandibles when the body is contracted (Fig. 83) (extracted in part from Philips 2002).

White's (1965) revision of *Tricorynus*, the last major work on this genus in North America, significantly increased our understanding of this difficult genus, although he stated, "the marked similarities and often minute differences between species are such that any key constructed for their separation will require considerable study and effort for effective use." Punctation of the pronotal and elytral surfaces is frequently used in separation of species, a character which is impossible to interpret without the proper magnification and lighting. The use of a small, hand-held fluorescent light significantly enhanced visibility of this feature. Additionally, material borrowed from the OSUC, where many of White's type specimens were deposited, was essential for species comparisons. Unfortunately, determinations may still be uncertain because it is possible there is more variability within species than stated by White (1965). The minute differences used by White (1965) for species determinations may actually represent population variation or sibling speciation (personal communication T.K. Philips). In fact, one specimen of *Tricorynus* from Wisconsin was not identified during this study because it was unrecognizable to White in 1971, even after his work on this genus. This alone suggests future work is needed on *Tricorynus* to evaluate the variability of the morphological features; such an analysis would likely benefit from molecular analyses.

The following key includes four species that may be found in Wisconsin as they have been recorded from Illinois (White 1965). The southwestern species, *Tricorynus estriatus* (Horn) is also included in the key as four specimens were deposited in the IRCW as being collected from Dane County, Wisconsin, although as White stated on the determination label, "either label in error or introduced," and are therefore not described further. Many couplets, referring to the size and distance between the compound eyes were taken directly from White's (1965) work as there were insufficient Wisconsin specimens available for accurate measurements. Characteristics of the male genitalia, specifically internal processes of the median lobe, were said to be diagnostic for species determinations (White 1965) although, these characters were not used during this study as separation of males and females based on external morphology is generally not possible.

Key to the Wisconsin Species of Adult *Tricorynus*

[Modified from White 1962a and 1965]

1 Elytra without distinctly impressed lateral striae on apical half ..... ***estriatus* (Horn)**

1' Elytra with 2 distinctly impressed lateral striae on apical half (Figs. 222, 224, 226, 228, 230, 232, 234) **2**

2 (1') Metathoracic ventrite medially with a distinct longitudinal carina (Fig. 83) ..... ***punctatus* (LeConte)(p. 82)**

2' Metathoracic ventrite without longitudinal carina medially **3**

3 (2') Prothoracic tibiae each with only one stria on outer surface ..... ***ventralis* (LeConte)**

3' Prothoracic tibiae bisulcate on outer surface (Fig. 75) **4**

4 (3') Mesothoracic tibiae grooved along posterior margin (Fig. 75) **5**

4' Mesothoracic tibiae not grooved along posterior margin **11**

5 (4) Pronotum laterally with small punctures only **6**

5' Pronotum laterally with both large and small punctures **7**

6 (5) Eyes large to moderate, separated by 1.6–2.3X their vertical diameter; lateral raised pronotal margins evident ..... ***dichrous* (Fall)(p. 81)**

6' Eyes very small, separated by 3.1–4.0X their vertical diameter; pronotum lacking lateral raised margin ..... ***densus* (Fall)**

7 (5') Large and small pronotal punctures indistinct and sparse; body not gibbous in form; length 1.8–2.0 mm ..... ***parvus* (Fall)(in part)**

7' Large and small pronotal punctures usually distinct, never sparse; form and size variable **8**

8 (7') Eyes large to moderate in size, separated by 1.2–2.2X their vertical diameter ..... ***similis* (LeConte)(p. 83)**

8' Eyes moderate to small in size, separated by 2.3–2.7X their vertical diameter **9**

9 (8') Large pronotal punctures laterally larger and distinct; surface distinctly shining ..... ***nigritulus* (LeConte) (p. 82)**

9' Large pronotal punctures laterally smaller, less distinct; surface rather feebly shining **10**

10 (9') Body light reddish-brown; pronotum laterally flat from front to back ..... ***parvus* (Fall)(in part)**

10' Body usually nearly black, sometimes light reddish-brown; pronotum laterally evenly rounded front to back ..... ***obscurus* White**

11 (4') Pubescence of dorsal surface short and sparse, elytral setae separated by more than their length (Figs. 223, 224) ..... ***castaneus* (Hamilton)(p. 80)**

11' Pubescence of dorsal surface normal, elytral setae separated by much less than their length **12**

12(11') Pronotum laterally with small punctures only, large punctures absent ..... ***borealis* (LeConte)(p. 79)**

12' Pronotum laterally with both large and small punctures distinct ..... ***confusus* (Fall)(p. 81)**

Tricorynus borealis (LeConte)

(Figs. 221, 222; Map 58)

[Synonymy modified from White 1965]
Hemiptychus borealis LeConte 1865: 240.
Catorama borealis (LeConte); Fall 1905: 249.
Tricorynus borealis (LeConte); White 1965: 306.

***Capsule Description* (Figs. 221, 222)—Length:** 2.4–3.0 mm. **Width:** 0.9–1.8 mm. **Integument Color:** orange-brown to dark reddish-brown throughout; maxillary and labial palpi and antennae yellowish-orange to brownish-orange. **Body Form:** elongate, robust, 2.0X longer than wide. **Vestiture:** pubescence whitish to yellowish, moderately dense and mostly recumbent over entire surface. **Head:** terminal segment of each maxillary palpus elongate; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface moderately, densely punctate

with small punctures only. **Pronotum:** weakly rounded; surface densely punctate, with small punctures only. **Elytra:** humeri distinct; scutellum small; laterally with 2 distinctly impressed striae on apical half, terminating near or before level of metathoracic legs; surface moderately, densely punctate. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi, anteriorly produced into a hook-like process (held between mandibles in repose); anterior margin at each side with usually 1 narrow, elongate fovea; surface moderately, densely punctate with larger punctures sometimes sparser than small punctures. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae without sulcus along posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus borealis* may be distinguished from all other Wisconsin *Tricorynus* by the pubescence of dorsal surface being not short and sparse (Fig. 221), the pronotum laterally with small punctures only, and each mesothoracic tibia not grooved along its posterior margin.

Natural History—Little has been published on the natural history of this species. In Wisconsin, one specimen was collected in a Lindgren funnel trap. The other two specimens had no additional collection data.

Phenology—Adults of *T. borealis* were recorded in Wisconsin from early to mid-July.

Distribution—Sporadic records of *T. borealis* are reported from Manitoba and Ontario, Canada; in the United States from Michigan and Wyoming (White 1982). In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 58)**—The three specimens of *T. borealis* examined during this study were recorded from the following localities: **Dane Co. (1):** Swamp Lover's Inc.; **Wood Co. (2):** Griffith St. Nursery.

Tricorynus castaneus (Hamilton)

(Figs. 223, 224; Map 59)

[Synonymy modified from White 1965]
Hemiptychus castaneus Hamilton 1893: 307.
Catorama castaneum (Hamilton); Fall 1905: 247.
Tricorynus castaneus (Hamilton); White 1965: 308.

***Capsule Description* (Figs. 223, 224)—Length:** 1.5–1.9 mm. **Width:** 1.0–1.2 mm. **Integument Color:** light yellowish-brown to reddish-brown throughout; maxillary and labial palpi and antennae yellowish-orange to brownish-orange; surface distinctly shining. **Body Form:** elongate, oval, 1.6X longer than wide. **Vestiture:** pubescence whitish to yellowish, exceedingly short and sparse on dorsal surface, with setae separated by more than their length on elytra and pronotum; setae of legs, metathoracic ventrite, and abdomen longer and more dense. **Head:** terminal segment of each maxillary palpus elongate, pointed apically; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface sparsely punctate, with small punctures only. **Pronotum:** mostly rounded; surface sparsely punctate with small punctures dorsally on disk; large, moderately, dense punctures occurring on lateral margins. **Elytra:** humeri moderately distinct; scutellum very small; laterally with 2 distinctly impressed striae on apical half, continued to base by shallow, punctate grooves; surface moderately, sparsely punctate. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi; anteriorly produced into a hook-like process (held between the mandibles in repose); anterior margin at each side with a narrow, elongate fovea; surface moderately, densely punctate with both large and small punctures; large punctures sparse to absent laterally on disk. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae without sulcus on posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus castaneus* may be distinguished from all other members of *Tricorynus* by the lack of a sulcus on the posterior mesothoracic tibial margin and pubescence of dorsal surface exceedingly short and sparse, with elytral setae separated by more than the length of a seta (Figs. 223, 224).

Natural History—White (1965) reared specimens of *T. castaneus* from "bullet oak galls formed by the cynipid *Disholcaspis quercus globulus* (Fitch) on white oak, *Quercus alba* (L.)." Specimens have also been reported from "in Virginia creeper with Scolytus," "sweeping grass," "from oak gall," "beating turkey oak at night," and "on *Vaccinium* and other low bushes" (White 1965, 1982). In Wisconsin, most specimens were recorded from "gall on oak." One specimen was "from non-wilting *Q. macrocarpa*."

Phenology—Adult specimens of *T. castaneus* were recorded in Wisconsin from mid-July to early August.

Distribution—*Tricorynus castaneus* is mostly known from the eastern United States, northeast from Massachusetts, west to Indiana and Wisconsin, southeast from Florida, southwest as far as Mississippi, Arkansas, and Texas (White 1977a, 1982). During this study, specimens were recorded from two southern Wisconsin counties.

***Wisconsin Records* (Map 59)**—The 12 specimens of *T. castaneus* examined during this study were recorded from the following localities: **Kenosha Co. (11):** Kenosha; **Waukesha Co. (1):** no additional locality data.

Tricorynus confusus (Fall)

(Figs. 58, 225, 226; Map 60)

[Synonymy modified from White 1965]
Catorama confusum Fall 1905: 252.
Tricorynus confusus (Fall); White 1965: 310.

Capsule Description **(Figs. 58, 225, 226)—Length:** 2.2–2.4 mm. **Width:** 1.3–1.4 mm. **Integument Color:** light to dark reddish-brown throughout; maxillary and labial palpi and antennae yellowish-orange to brownish-orange. **Body Form:** elongate, oval, 1.8X longer than wide. **Vestiture:** pubescence whitish to yellowish, moderately dense and mostly recumbent over entire surface. **Head:** terminal segment of each maxillary palpus elongate; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface moderately, densely punctate with both large and small punctures. **Pronotum:** distinctly rounded, slightly bulging laterally; surface moderately densely punctate, with both large and small punctures laterally on disk. **Elytra:** humeri distinct; scutellum small; laterally with 2 distinctly impressed striae on apical half, terminating near or before level of metathoracic legs; surface moderately, densely punctate with both large and small punctures. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi; anteriorly produced into a hook-like process (held between mandibles in repose); anterior margin at each side with 2 circular foveae; surface moderately, densely punctate with larger punctures absent laterally on disk. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae without sulcus along posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus confusus* may be separated from all other Wisconsin *Tricorynus* by the pubescence of dorsal surface being not short and sparse (Fig. 225), the pronotum laterally with both large and small punctures, and each mesothoracic tibia not grooved along its posterior margin. White (1965) described this species with two elongate foveae anteriorly on the metathoracic ventrite, although the Wisconsin specimens examined have two circular, as opposed to elongate foveae aneriorly on the disk.

Natural History—White (1982) reported this species, "on tree buds and twigs, oak galls, oak, pecan leaves, under apple bark, on *Quercus imbricaria*." In Wisconsin, one specimen was obtained at a Hg vapor lamp and black light at night and the other in a Townes–Malaise trap.

Phenology—Adult specimens of *T. confusus* were recorded in Wisconsin from early July to early August.

Distribution—*Tricorynus confusus* is one of the most widely distributed species in North America (White 1965) and has been recorded from the majority of eastern United States west to Iowa, Kansas, Oklahoma, and Texas. In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 60)**—The two specimens of *T. confusus* examined during this study were recorded from the following localities: **Dane Co. (1):** Swamp Lover's Inc.; **Sauk Co. (1):** Spring Green Preserve SNA.

Tricorynus dichrous (Fall)

(Figs. 227, 228; Map 61)

[Synonymy modified from White 1965]
Catorama dichroum Fall 1905: 240.
Tricorynus dichrous (Fall); White 1965: 314.

Capsule Description **(Figs. 227, 228)—Length:** 2.1–2.4 mm. **Width:** 1.1–1.2 mm. **Integument Color:** ventral surface, head, and pronotum orange-brown; metathoracic ventrite orange-brown to reddish-brown; elytra darker than remainder, reddish-brown to reddish-black; maxillary and labial palpi and antennae yellowish-orange to brownish-orange. **Body Form:** elongate, oval, 1.9X longer than wide. **Vestiture:** pubescence yellowish; moderately dense and mostly recumbent over entire surface. **Head:** terminal segment of each maxillary palpus elongate; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface moderately, densely punctate. **Pronotum:** mostly rounded; surface moderately, densely punctate, laterally with small punctures only. **Elytra:** humeri distinct; scutellum small; laterally with 2 distinctly impressed striae on apical half, terminating near or before level of metathoracic legs; surface moderately, densely punctate, with small punctures only. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi; anteriorly produced into a hook-like process (held between mandibles in repose); surface moderately, densely punctate. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae with sulcus along posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus dichrous* may be distinguished from all other Wisconsin *Tricorynus* by the larger compound eyes, separated by 1.6–2.3X their vertical diameter; pronotum with small punctures only; elytra with two distinctly impressed lateral striae on the apical half (Fig. 228); each mesothoracic tibiae with a posterior groove (e.g., Fig. 75).

Natural History—White (1965) examined specimens recorded as "reared form [*sic*] elm," and "in tanglefoot on w. oak." White (1969a) mentioned collecting adults during the evenings of June 19, 21, and July 8. In Wisconsin, three specimens were collected at Lindgren funnel traps and one

at a flight intercept trap baited with cantharidin (presumably incidental and not an attractant).

Phenology—Adult specimens of *T. dichrous* were recorded in Wisconsin from late June to late July.

Distribution—*Tricorynus dichrous* has been reported from much of the eastern United States, from Massachusetts, and New York, southeast to South Carolina and Georgia, southwest to Mississippi, and northwest into Illinois (White 1982). In this study, specimens were examined from two Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 61)**—The four specimens of *T. dichrous* examined during this study were recorded from the following localities: **Adams Co. (3):** Quincy Bluff TNC; **Walworth Co. (1):** Kettle Moraine Oak Opening SNA.

Tricorynus nigritulus (LeConte)

(Figs. 229, 230; Map 62)

[Synonymy modified from White 1965]
Hemiptychus nigritulus LeConte 1865: 240.
Catorama nigritulum (LeConte); Fall 1905: 241.
Tricorynus nigritulus (LeConte); White 1965: 332.

***Capsule Description* (Figs. 229, 230)—Length:** 1.8–2.2 mm. **Width:** 1.1–1.2 mm. **Integument Color:** maxillary and labial palpi and antennae yellowish-orange to brownish-orange; head, pronotum, and ventral surface black, reddish-black, or reddish; elytra black to black with slight evidence of reddish; surface distinctly shining. **Body Form:** elongate, oval, 1.8X longer than wide. **Vestiture:** pubescence whitish to yellowish, moderately dense and mostly recumbent over entire surface. **Head:** terminal segment of each maxillary palpus elongate, somewhat pointed apically; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface moderately, densely punctate. **Pronotum:** mostly rounded; surface moderately, densely punctate, with both large and small punctures laterally. **Elytra:** humeri distinct; scutellum small; laterally with 2 distinctly impressed striae on apical half, terminating near or before level of metathoracic legs; surface moderately, densely punctate. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi; anteriorly produced into a hook-like process (held between mandibles in repose); anterior margin at each side with 1–2 narrow, elongate foveae; surface moderately, densely punctate with both large and small punctures; large punctures not smaller, or more sparse laterally on disk. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae with sulcus along posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus nigritulus* may be distinguished from all other Wisconsin *Tricorynus* by the following combination of characters: eyes moderate to small in size, separated by 2.3–2.7X their vertical diameter; pronotum laterally with both large and small punctures; elytra with two distinctly impressed lateral striae on apical half (Fig. 230); prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae grooved posteriorly (e.g., Fig. 75); metathoracic ventrite without a longitudinal carina; metathoracic ventrite and metepisternum with anterior foveae; entire surface distinctly shining. This species most closely resembles *T. similis* (for separation, see diagnosis for *T. similis*).

Natural History—White (1965) examined specimens "reared from elm." Other biological records include specimens from vacineae and other low bushes (Hamilton 1893), dead wisteria (White 1982), and larvae from the outer wood of a debarked elm stump (Hoffman 1940). Böving (1954) described larvae of *T. nigritulus* from specimens collected "in wood of *Ulmus americana* L.," "ex dead Wisteria," and "in dead Elm branch." In Wisconsin, most specimens were collected using Lindgren funnel traps, two were obtained at Townes–Malaise traps, and one from a flight intercept trap. Cantharidin was used as bait on one of the Lindgren traps, but the association is presummed incidental and the compound is not considered significant in attracting members of *Tricorynus*.

Phenology—Adult specimens of *T. nigritulus* were recorded in Wisconsin from mid-June to mid-August.

Distribution—*Tricorynus nigritulus* has been recorded from much of the eastern United States, northeast from New York and Massachusetts, southeast from North Carolina, southwest to Mississippi and Oklahoma, and northwest into Iowa (White 1982). In this study, specimens were examined from seven Wisconsin counties; they constitute a **NEW STATE RECORD**.

***Wisconsin Records* (Map 62)**—The 13 specimens of *T. nigritulus* examined during this study were recorded from the following localities: **Dane Co. (6):** Swamp Lover's Inc.; **Fond du Lac Co. (1):** Waupun Park Maple Forest SNA; **Iowa Co. (1):** no other locality data; **Lafayette Co. (1):** Wedel Property– ~3 mi. north of Argyle; **Racine Co. (2):** Private Property–Arango Residence–Greenbriar Road; Renak–Polak Maple–Beech Woods SNA; **Rock Co: (1):** Private Property–1.7 mi. NW Janesville; **Sauk Co. (1):** Hemlock Draw TNC.

Tricorynus punctatus (LeConte)

(Figs. 75, 83, 231, 232; Map 63)

[Synonymy modified from White 1965]
Hemiptychus punctatus LeConte 1865: 240.
Catorama punctatum (LeConte); Fall 1905: 239.
Tricorynus punctatus (LeConte); White 1965: 340.

Capsule Description **(Figs. 75, 83, 231, 232)—Length:** 2.1–2.5 mm. **Width:** 1.1–1.5 mm. **Integument Color:** uniformly orange-brown to dark reddish-brown; maxillary and labial palpi and antennae yellowish-orange to orange-brown. **Body Form:** elongate, oval, 1.8X longer than wide. **Vestiture:** pubescence yellowish; moderately dense and mostly recumbent over entire surface. **Head:** terminal segment of each maxillary palpus elongate, distinctly pointed apically; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface moderately, densely punctate. **Pronotum:** mostly rounded, slightly inflated laterally; surface moderately, densely punctate, with both large and small punctures laterally. **Elytra:** humeri distinct; laterally with 2 distinctly impressed striae on apical half, terminating near or before level of metathoracic legs; surface moderately densely punctate. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi; anteriorly produced into a hook-like process (held between mandibles in repose); medially with a distinct longitudinal carina; surface moderately, densely punctate with both large and small punctures, large punctures not significantly smaller laterally. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae with sulcus along posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus punctatus* may be distinguished from all other Wisconsin *Tricorynus* by the bisulcate prothoracic tibiae (Fig. 75) and distinct carina of the metathoracic ventrite (Fig. 83). The sulcus on the posterior margin of the mesothoracic tibia is distinct in all but one specimen, causing it to be determined as another species in White's (1965) taxonomic key. As only two species are known to have a carina on the metathoracic ventrite, both of which are said to have the mesothoracic tibiae sulcate posteriorly, it is clear that this specimen is in fact *T. punctatus* by the bisulcate prothoracic tibiae.

Natural History—White (1965) examined specimens from an "old dead sycamore log." Larvae were described by Böving (1954) from specimens collected "in grape vine." In Wisconsin, single specimens were obtained at a UV light and from a Townes–Malaise trap. Five specimens were recorded from flight intercept traps, one of which was baited with cantharidin (presumably incidental and not an attractant) and two from Lindgren funnel traps.

Phenology—Adults of *T. punctatus* were recorded in Wisconsin from early June to late July.

Distribution—*Tricorynus punctatus* is widely distributed in the eastern United States, northeast from New York, southeast to Florida, southwest to Arizona, and northwest to Iowa (White 1965, 1982). In this study, specimens were examined from six Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 63)**—The 10 specimens of *T. punctatus* examined during this study were recorded from the following localities: **Dane Co. (1):** No additional locality data; Swamp Lover's Inc.; **Dodge Co. (1):** W12286 Hwy 89; **Grant Co. (1):** Blue River Sand Barrens SNA; **Green Co. (1):** Abraham's Woods SNA; **Lafayette Co. (2):** Hardscrabble Prairie SNA; Wedel Property– ~3 mi. north of Argyle; **Rock Co. (1):** Private Property–1.7 mi. NW Janesville.

Tricorynus similis (LeConte)

(Figs. 233, 234; Map 64)

[Synonymy modified from White 1965]
Hemiptychus similis LeConte 1878: 408.
Catorama simile (LeConte); Fall 1905: 250.
Catorama vexatum Fall 1905: 245.
Tricorynus similis (LeConte); White 1965: 343.

Capsule Description **(Figs. 233, 234)—Length:** 2.1–2.7 mm. **Width:** 1.2–1.4 mm. **Integument Color:** mostly reddish-brown; ventral surface orange-brown to reddish-brown; maxillary and labial palpi and antennae yellowish-orange to brownish-orange. **Body Form:** elongate, oval, 1.8X longer than wide. **Vestiture:** pubescence whitish to yellowish, moderately dense and mostly recumbent over entire surface. **Head:** terminal segment of each maxillary palpus elongate; antennae 10-segmented with 3-segmented club; combined length of last 3 antennomeres much longer than length of all preceding combined; surface moderately, densely punctate. **Pronotum:** mostly rounded; surface moderately, densely punctate, with both large and small punctures laterally. **Elytra:** humeri distinct; scutellum small; laterally with 2 distinctly impressed striae on apical half, terminating near or before level of metathoracic legs; surface moderately, densely punctate, with both large and small punctures. **Mesothoracic Scutellum:** small. **Metathoracic Ventrite:** not grooved anteriorly to receive the mesothoracic tarsi; anteriorly produced into a hook-like process (held between mandibles in repose); anterior margin at each side with 1 narrow, elongate fovea and 1–2 circular foveae. **Legs:** mostly received in ventral excavations; prothoracic tibiae bisulcate on outer surface; mesothoracic tibiae with sulcus along posterior margin of outer surface; metathoracic coxae excavate for metathoracic femora. **Abdomen:** with 5 ventrites (appearing as 4); 1st ventrite excavate for and mostly concealed by metathoracic legs.

Diagnosis—*Tricorynus similis* may be distinguished from all other Wisconsin *Tricorynus* by the following combination of characters: eyes large to moderate in size, separated by 1.2–2.2X their vertical diameter; pronotum with both large and small punctures; elytra with two distinctly impressed lateral striae on apical half (Fig. 234); mesothoracic tibiae grooved posteriorly (e.g., Fig. 75); metathoracic

ventrite without a longitudinal carina; metathoracic ventrite and metepisternum with anterior foveae.

Relative to the Wisconsin fauna, this species is most similar to *T. nigritulus*, from which it is separated based on the size of the compound eyes. White (1965), however, stated this to be a seemingly variable character, and determined a number of specimens as "nr. *nigritulus*" based on their larger eyes, but did not account for this variation in his key. Based on White's (1965) descriptions, the form of the posterior mesothoracic tibial sulcus may potentially be diagnostic as it is thought to be more or less complete in *T. nigritulus* and absent on posterior third in *T. similis*. The two Wisconsin specimens of *T. similis* examined during this study have the apparently larger eyes, but also appear to have a complete sulcus on the mesothoracic tibia, and may therefore be more similar to what White (1965) considered as "nr. *nigritulus*."

Natural History—White (1965) examined specimens of *T. similis* collected "beating oak." In Wisconsin, one specimen was collected at a Lindgren funnel trap and one in a Townes–Malaise trap.

Phenology—Adult specimens of *T. similis* were recorded in Wisconsin from late May to late July.

Distribution—*Tricorynus similis* is widely distributed in the eastern United States northeast from New York, southeast to Florida, southwest to Texas and Oklahoma, and northwest into Missouri and Illinois (White 1982). In this study, specimens were examined from two, mostly southern Wisconsin counties; they constitute a **NEW STATE RECORD**.

Wisconsin Records **(Map 64)**—The two specimens of *T. similis* examined during this study were recorded from the following localities: **Dane Co. (1):** Swamp Lover's Inc.; **Grant Co. (1):** Dewey Heights Prairie SNA–Nelson Dewey State Park.

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Appendix A—Checklist of Wisconsin Ptinidae

[Species in bold are new state records]

PTININAE

- *Gibbium*
  - *aequinoctiale* Boieldieu
- *Mezium*
  - ***affine* Boieldieu**
- *Pseudeurostus*
  - *hilleri* (Reitter)
- *Ptinus*
  - ***bimaculatus* Melsheimer**
  - *clavipes* Panzer
  - ***concurrens* Fall**
  - *fur* (Linnaeus)
  - *villiger* (Reitter)

EUCRADINAE

- *Eucrada*
  - ***humeralis* (Melsheimer)**

ERNOBIINAE

- *Ernobius*
  - ***filicornis* LeConte**
  - ***granulatus* LeConte**
  - ***youngi* Arango**

ANOBIINAE

- *Hemicoelus*
  - *carinatus* (Say)
  - ***defectus* (Fall)**
  - *pusillus* (Fall)
  - ***umbrosus* (Fall)**
- *Microbregma*
  - ***emarginatum*** (Duftschmid)
- *Hadrobregmus*
  - ***notatus* (Say)**
- *Priobium*
  - *sericeum* (Say)
- *Trichodesma*
  - ***gibbosa* (Say)**
- *Oligomerus*
  - ***alternans* LeConte**
  - *brevipilis* (Fall)
  - ***obtusus* LeConte**
  - ***sericans* (Melsheimer)**
- *Stegobium*
  - *paniceum* (Linnaeus)

PTILININAE

- *Ptilinus*
  - ***lobatus* Casey**
  - *ruficornis* Say

XYLETININAE

- *Euvrilletta*
  - *brevis* White
  - ***harrisii* (Fall)**
  - ***peltata* (Harris)**
- *Vrilletta*
  - ***laurentina* Fall**
- *Xyletinus*
  - ***confusus* White**
  - *fucatus* LeConte
- *Lasioderma*
  - ***serricorne* (Fabricius)**

DORCATOMINAE

- *Calymmaderus* Solier
  - ***nitidus* (LeConte)**
  - ***obsoletus* (Fall)**
- *Byrrhodes*
  - ***incomptus* (LeConte)**
  - ***intermedius* (LeConte)**
  - ***tristriatus* (LeConte)**
- *Caenocara*
  - ***bicolor* (Germar)**
  - ***blanchardi* Fall**
  - ***inepta* LeConte**
  - *oculata* (Say)
  - ***tenuipalpa* Fall**
- *Dorcatoma*
  - *falli* White
  - *pallicornis* LeConte
  - ***setulosa* LeConte**
- *Petalium*
  - ***alternatum* Ford**
  - ***bistriatum* (Say)**
  - ***debile* Fall**
  - ***incisum* Ford**
  - ***seriatum* Fall**
  - ***whitei* Ford**
- *Protheca*
  - ***hispida* LeConte**
- *Sculptotheca*
  - *puberula* (LeConte)
- *Stagetus*
  - ***profundus* (LeConte)**
- *Striatheca*
  - ***lineata* White**

MESOCOELOPODINAE

- *Tricorynus*
  - ***borealis* (LeConte)**
  - *castaneus* (Hamilton)
  - ***confusus* (Fall)**
  - ***dichrous* (Fall)**
  - ***nigritulus* (LeConte)**
  - ***punctatus* (LeConte)**
  - ***similis* (LeConte)**

Appendix B—Wisconsin Distribution Maps

Map 1. *Gibbium aequinoctiale* Boieldieu

Map 3. *Pseudeurostus hilleri* (Reitter)

Map 2. *Mezium affine* Boieldieu

Map 4. *Ptinus bimaculatus* Melsheimer

Map 5. *Ptinus clavipes* Panzer

Map 7. *Ptinus fur* (Linnaeus)

Map 6. *Ptinus concurrens* Fall

Map 8. *Ptinus villiger* (Reitter)

Map 9. *Eurada humeralis* (Melsheimer)

Map 11. *Ernobius granulatus* LeConte

Map 10. *Ernobius filicornis* LeConte

Map 12. *Ernobius youngi* Arango

Map 13. *Hemicoelus carinatus* (Say)

Map 15. *Hemicoelus pusillus* (Fall)

Map 14. *Hemicoelus defectus* (Fall)

Map 16. *Hemicoelus umbrosus* (Fall)

Map 17. *Microbregma emarginatum* (Duftschmid)

Map 18. *Hadrobregmus notatus* (Say)

Map 19. *Priobium sericeum* (Say)

Map 20. *Trichodesma gibbosa* (Say)

Map 21. *Oligomerus alternans* LeConte

Map 23. *Oligomerus obtusus* LeConte

Map 22. *Oligomerus brevipilis* (Fall)

Map 24. *Oligomerus sericans* (Melsheimer)

Map 25. *Stegobium paniceum* (Linnaeus)

Map 27. *Ptilinus ruficornis* Say

Map 26. *Ptilinus lobatus* Casey

Map 28. *Euvrilletta brevis* White

Map 29. *Euvrilletta harrisii* (Fall)

Map 30. *Euvrilletta peltata* (Harris)

Map 31. *Vrilletta laurentina* Fall

Map 32. *Xyletinus confusus* White

Map 33. *Xyletinus fucatus* LeConte

Map 35. *Calymmaderus nitidus* (LeConte)

Map 34. *Lasioderma serricorne* (Fabricius)

Map 36. *Calymmaderus obsoletus* (Fall)

Map 37. *Byrrhodes incomptus* (LeConte)

Map 39. *Byrrhodes tristriatus* (LeConte)

Map 38. *Byrrhodes intermedius* (LeConte)

Map 40. *Caenocara bicolor* (Germar)

Map 41. *Caenocara blanchardi* Fall

Map 43. *Caenocara oculata* (Say)

Map 42. *Caenocara inepta* LeConte

Map 44. *Caenocara tenuipalpa* Fall

Map 45. *Dorcatoma falli* White

Map 46. *Dorcatoma pallicornis* LeConte

Map 47. *Dorcatoma setulosa* LeConte

Map 48. *Petalium alternatum* Ford

Map 49. *Petalium bistriatum* (Say)

Map 51. *Petalium incisum* Ford

Map 50. *Petalium debile* Fall

Map 52. *Petalium seriatum* Fall

Map 53. *Petalium whitei* Ford

Map 55. *Sculptotheca puberula* (LeConte)

Map 54. *Protheca hispida* LeConte

Map 56. *Stagetus profundus* (LeConte)

Map 57. *Striatheca lineata* White

Map 59. *Tricorynus castaneus* (Hamilton)

Map 58. *Tricorynus borealis* (LeConte)

Map 60. *Tricorynus confusus* (Fall)

Map 61. *Tricorynus dichrous* (Fall)

Map 63. *Tricorunus punctatus* (LeConte)

Map 62. *Tricorynus nigritulus* (LeConte)

Map 64. *Tricorynus similis* (LeConte)

Figure 1: Crex Meadows Wildlife Area

Figure 4: Black River State Forest

Figure 2: Schmidt Maple Woods

Figure 5: Jung Hemlock–Beech Forest

Figure 3: Augusta State Wildlife Area

Figure 6: Kettle Moraine Red Oaks

Figure 7: 115+-year-old one-room school house

Figure 8: Ptinid damage to school house flooring

Figure 9: *Ptilinus ruficornis* female boring into cut *Acer negundo*; pre-oviposition

Figure 10: *Hemicoelus carinatus* on grass near cut *Acer negundo*

Figure 11: Rearing chamber

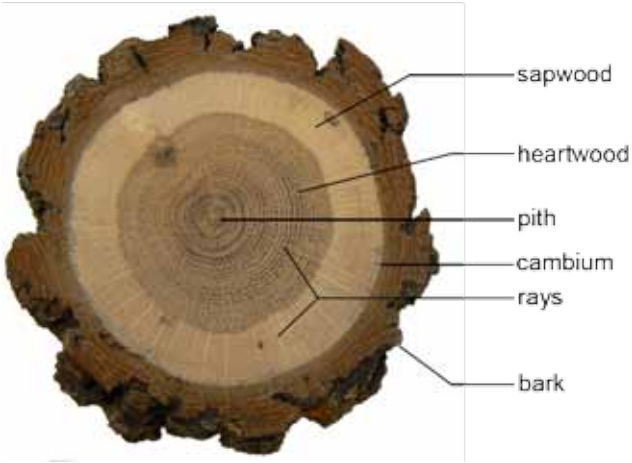

Figure 12: Wood structure

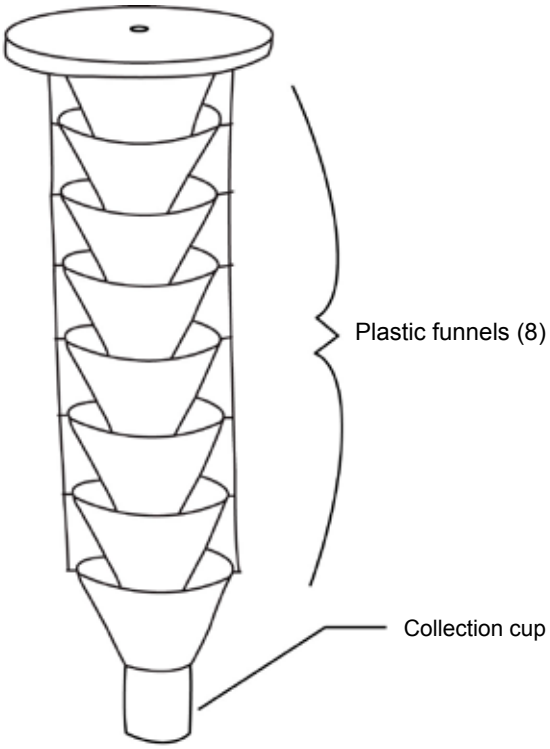

Figure 13: Lindgren funnel trap

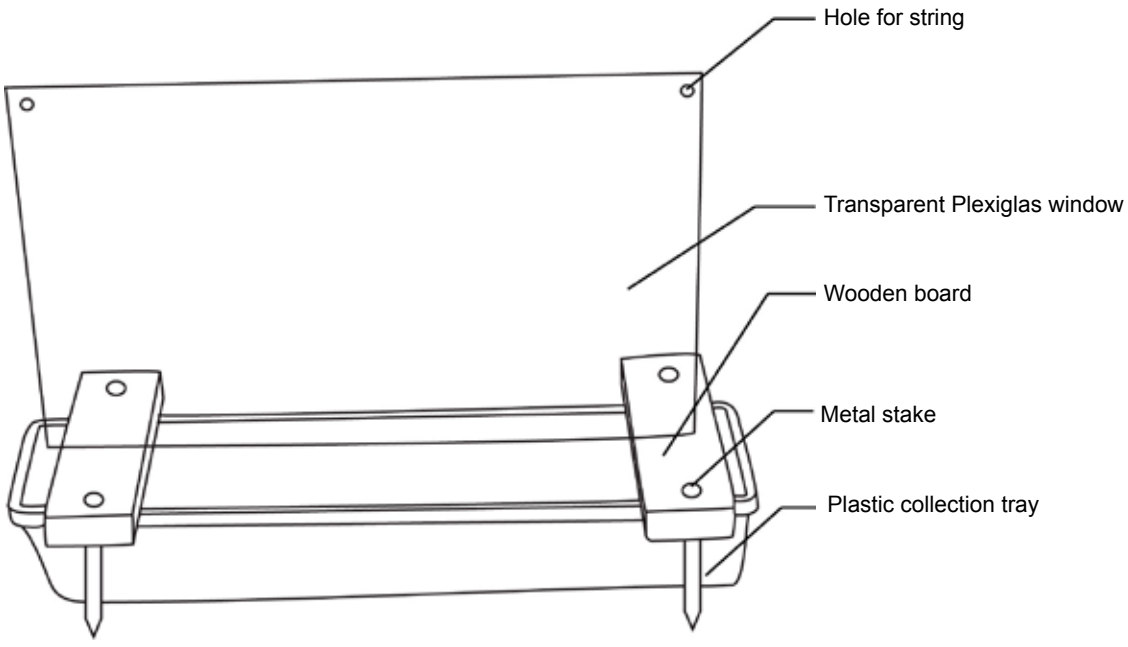

Figure 14: Flight intercept trap

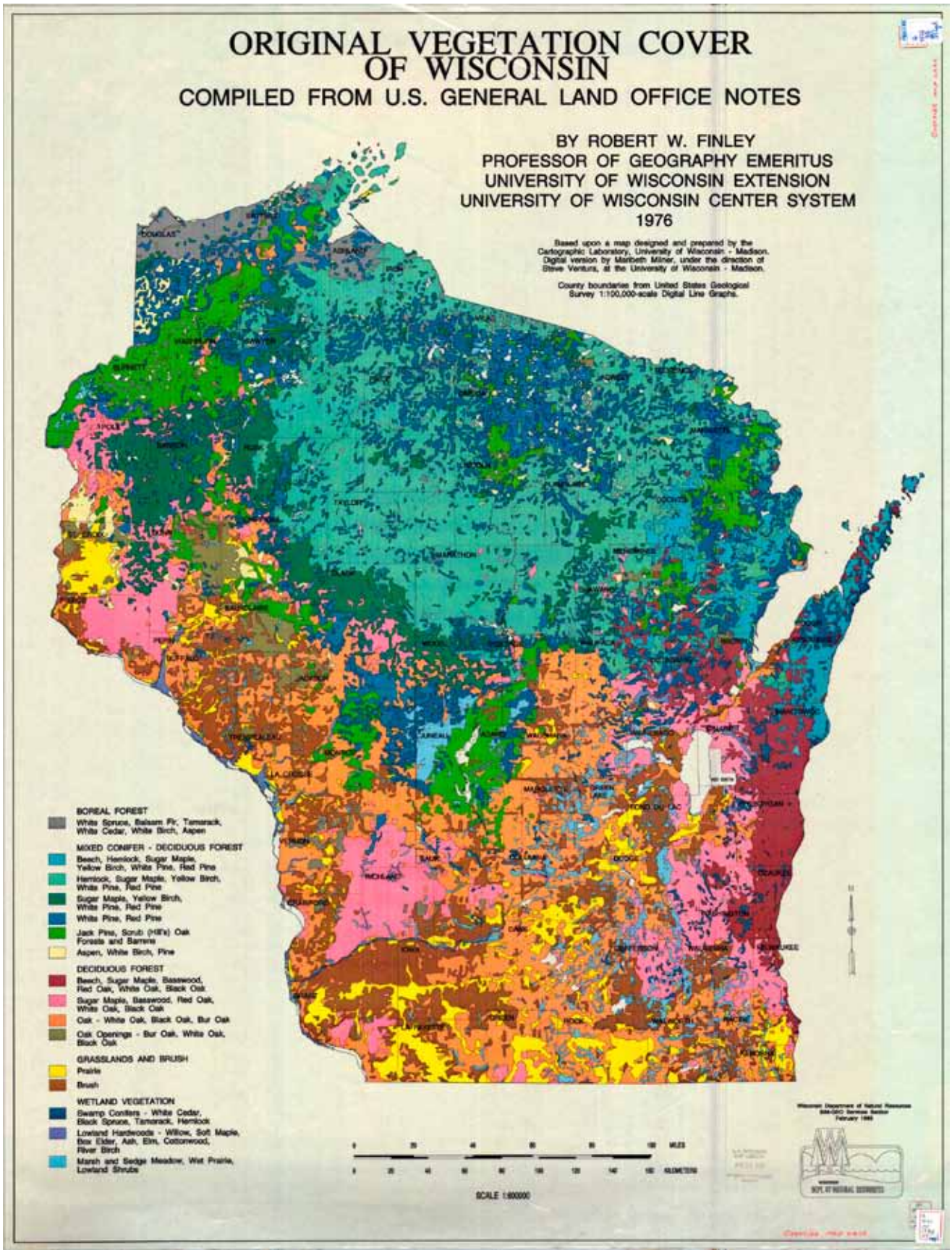

Figure 15: Wisconsin vegetation map (scanned); from Robert W. Finley 1976, USDA Forest Service, North Central Forest Experiment Station.

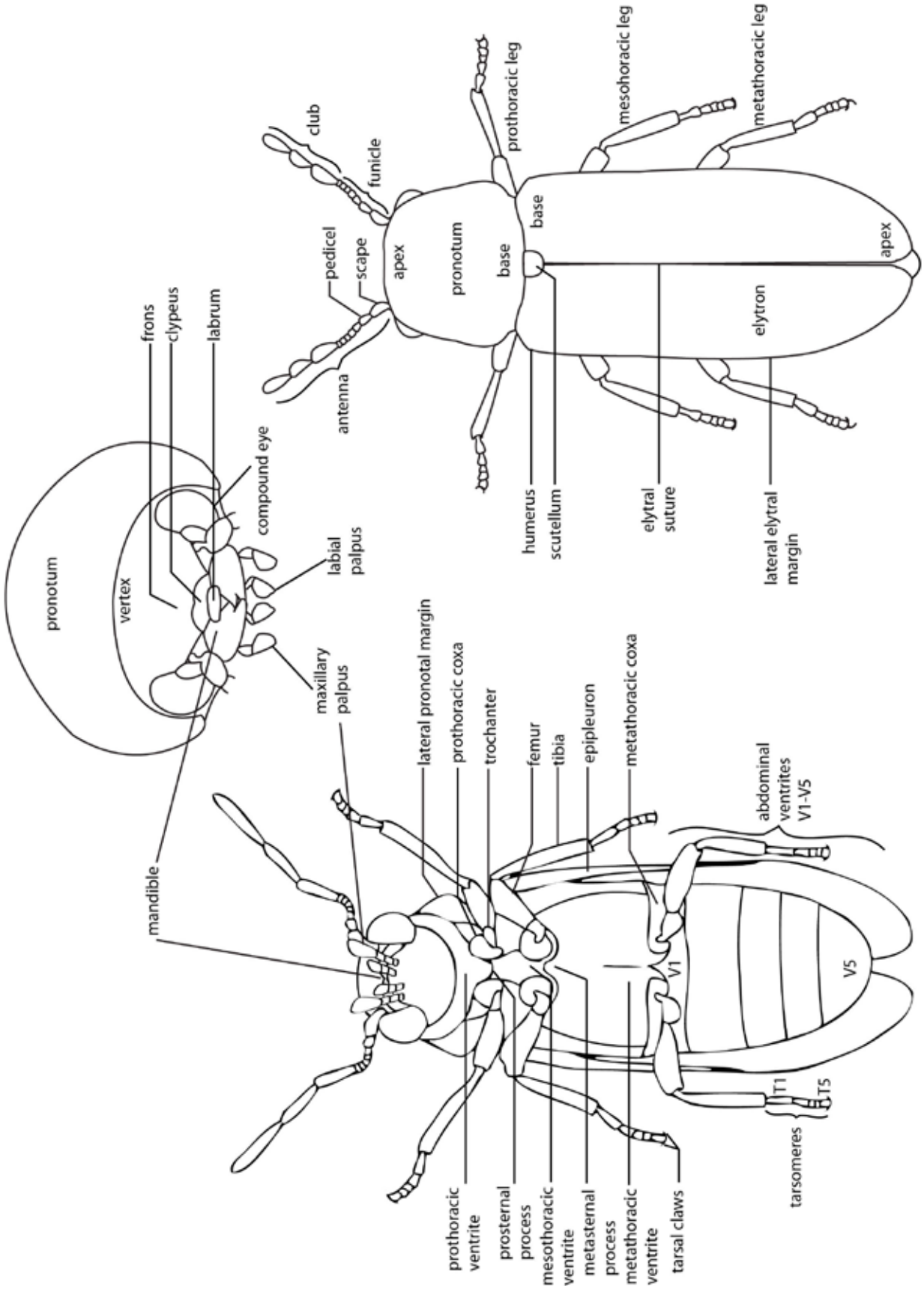

Figure 17: Generalized ptinid body form

Figure 18: Generalized ptinid body form

Figure 16: Generalized ptinid body form

Figure 19: *Pseudeurostus hilleri* (Reitter), antennae

Figure 20: *Ptinus bimaculatus* Melsheimer, antennae

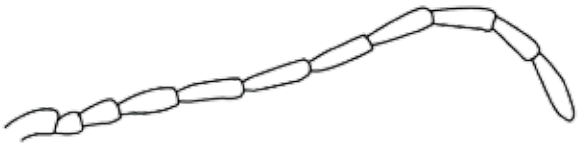

Figure 21: *Ptinus fur* (Linnaeus), antennae, male

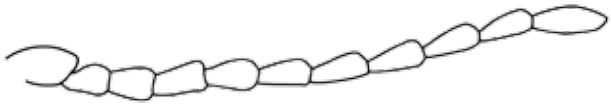

Figure 22: *Ptinus fur* (Linnaeus), antennae, female

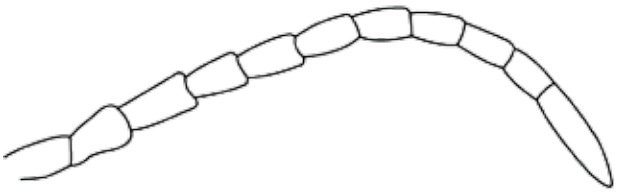

Figure 23: *Gibbium aequinoctiale* Boieldieu, antennae

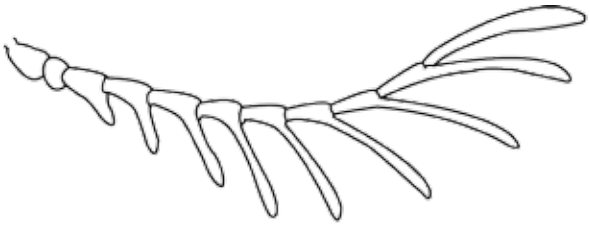

Figure 24: *Eucrada humeralis* (Melsheimer), antennae, male

Figure 25: *Eucrada humeralis* (Melsheimer), antennae, female

Figure 26: *Ernobius filicornis* LeConte, antennae, male

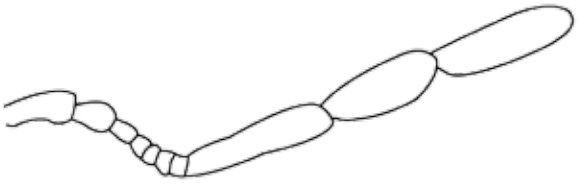

Figure 27: *Oligomerus sericans* (Melsheimer), antennae, male

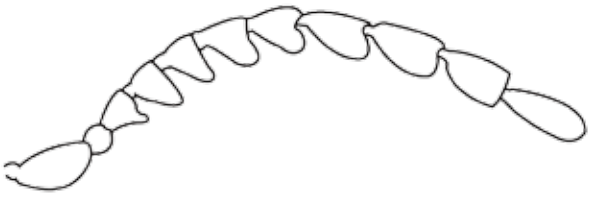

Figure 28: *Priobium sericeum* (Say), antennae

Figure 29: *Stegobium paniceum* (Linnaeus), antennae

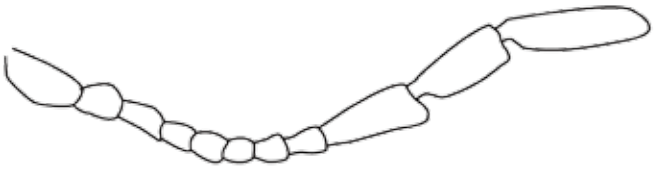

Figure 30: *Trichodesma gibbosa* (Say), antennae

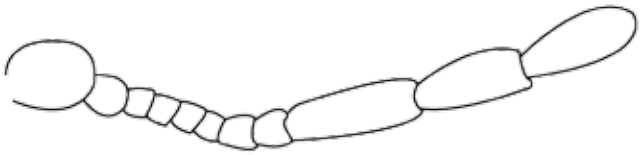

Figure 31: *Hadrobregmus notatus* (Say), antennae

Figure 32: *Microbregma emarginata* (Duftschmid), antennae

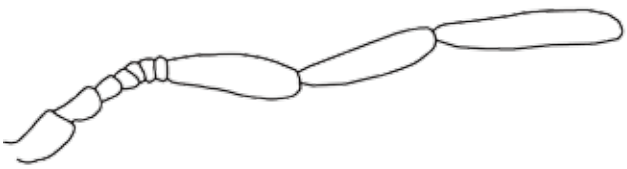

Figure 33: *Hemicoelus carinatus* (Say), antennae, male

Figure 34: *Hemicoelus carinatus* (Say), antennae, female

Figure 35: *Hemicoelus pusillus* (Fall), antennae, male

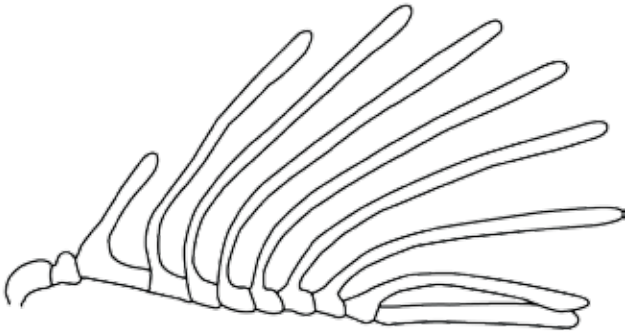

Figure 36: *Ptilinus ruficornis* Say, antennae, male

Figure 37: *Ptilinus ruficornis* Say, antennae, female

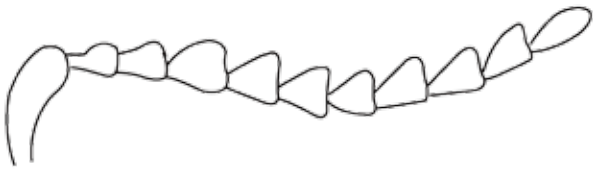

Figure 38: *Lasioderma serricorne* (Fabricius), antennae; adapted from Philips 2002

Figure 39: *Vrilletta laurentina* Fall, antennae

Figure 40: *Euvrilletta brevis* White, antennae, male; adapted from White 1985

Figure 41: *Euvrilletta brevis* White, antennae, female; adapted from White 1985

Figure 42: *Euvrilletta harrisii* (Fall), antennae, male; adapted from White 1985

Figure 43: *Euvrilletta harrisii* (Fall), antennae, female; adapted from White 1985

Figure 44: *Xyletinus confusus* White, antennae, male

Figure 45: *Petalium bistriatum* (Say), antennae

Figure 46: *Petalium seriatum* Fall, antennae

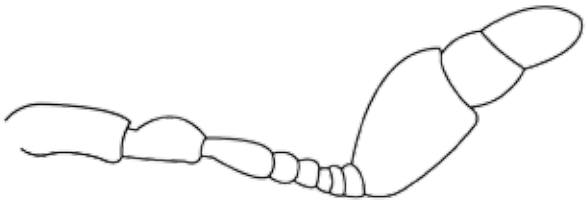

Figure 47: *Calymmaderus obsoletus* (Fall), antennae

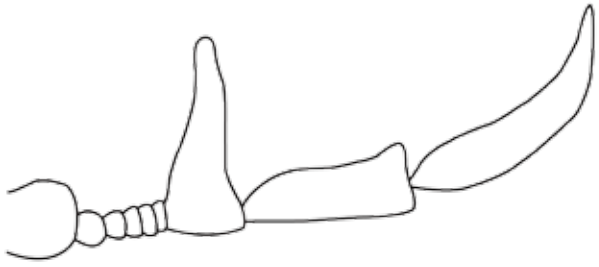

Figure 48: *Caenocara bicolor* (Germar), antennae, male; adapted from Fall 1905

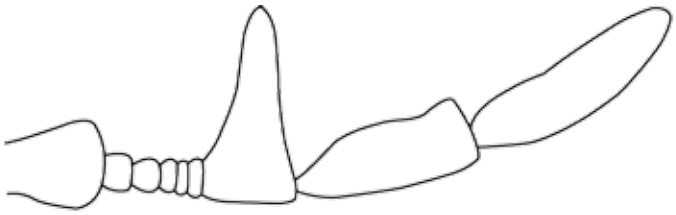

Figure 49: *Caenocara blanchardi* Fall, antennae, male; adapted from Fall 1905

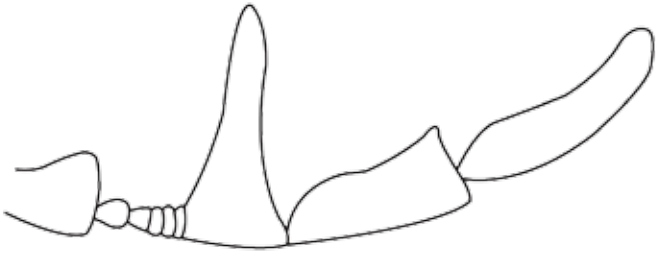

Figure 50: *Caenocara oculata* (Say), antennae, male; adapted from Fall 1905

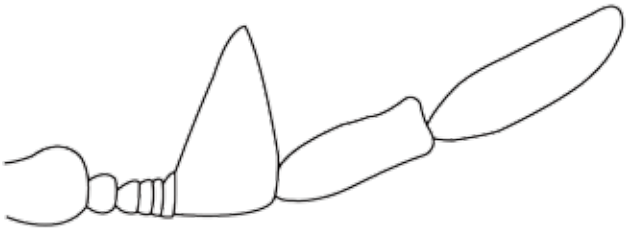

Figure 51: *Caenocara oculata* (Say), antennae, female; adapted from Fall 1905

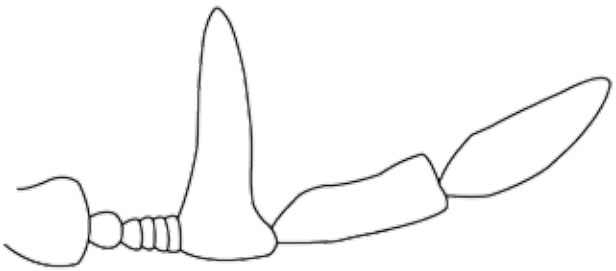

Figure 52: *Caenocara tenuipalpa* Fall, antennae, male; adapted from Fall 1905

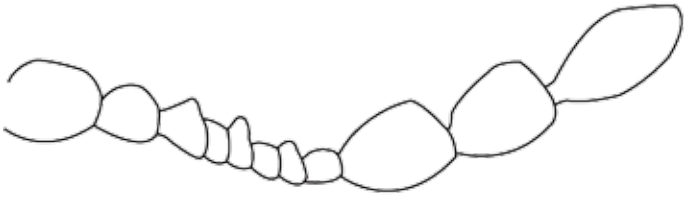

Figure 53: *Protheca hispida* LeConte, antennae

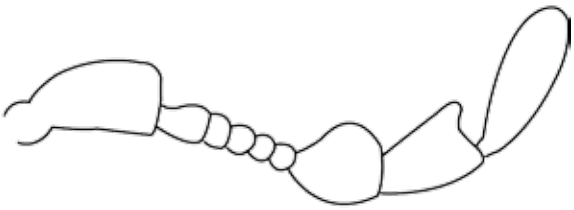

Figure 54: *Sculptotheca puberula* (LeConte), antennae

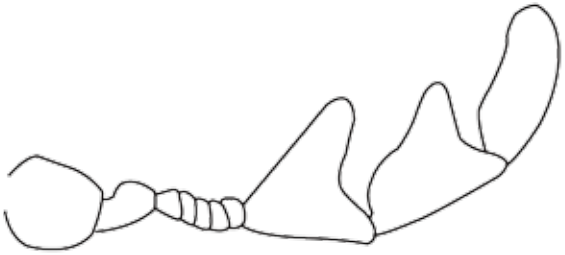

Figure 55: *Dorcatoma falli* White, antennae

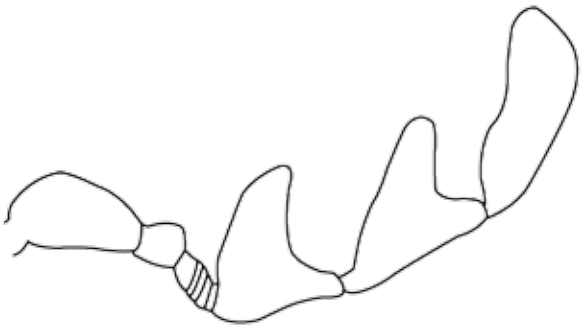

Figure 56: *Byrrhodes incomptus* (LeConte), antennae, male

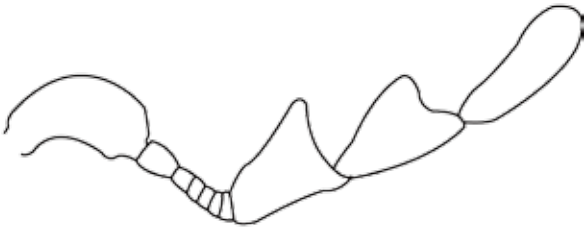

Figure 57: *Byrrhodes tristriatus* LeConte, antennae, female

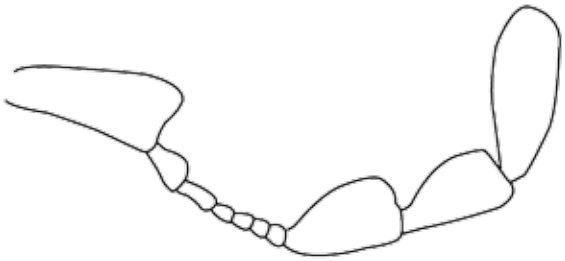

Figure 58: *Tricorynus confusus* (Fall), antennae; adapted from White 1963

Figure 59: *Euvrilletta peltata* (Harris), terminal maxillary palpomere

Figure 60: *Euvrilletta harrisii* (Fall), terminal maxillary palpomere

Figure 61: *Caenocara blanchardi* Fall, terminal maxillary palpomere; adapted from Fall 1905

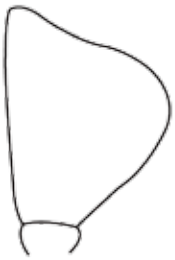

Figure 62: *Caenocara oculata* (Say), terminal maxillary palpomere; adapted from Fall 1905

Figure 63: *Caenocara tenuipalpa* Fall, terminal maxillary palpomere; adapted from Fall 1905

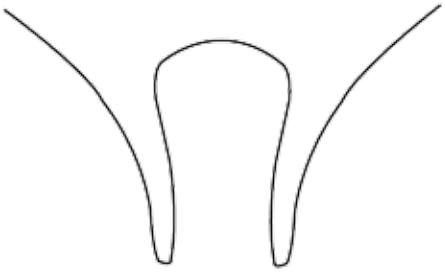

Figure 64: *Dorcatoma* sp., prosternal process

Figure 65: *Byrrhodes* sp., prosternal process

Figure 66: *Stegobium paniceum* (Linnaeus), tarsal claw, male; adapted from Halstead 1986

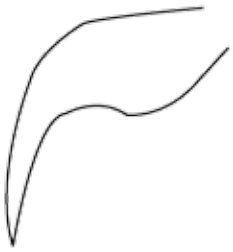

Figure 67: *Stegobium paniceum* (Linnaeus), tarsal claw, female; adapted from Halstead1986

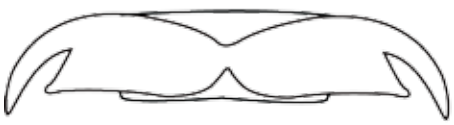

Figure 68: *Trichodesma gibbosa* (Say), tarsal claw

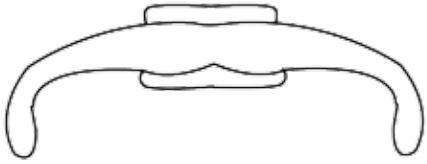

Figure 69: *Hemicoelus* sp., tarsal claw

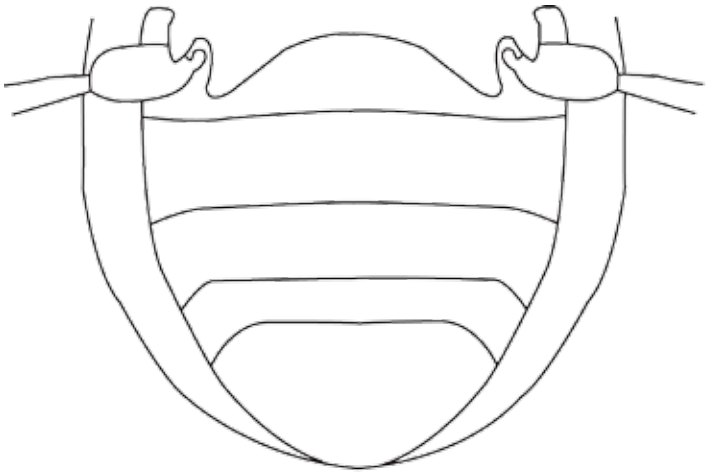

Figure 70: *Pseudeurostus hilleri* (Reitter), abdomen; adapted from Spilman 1991

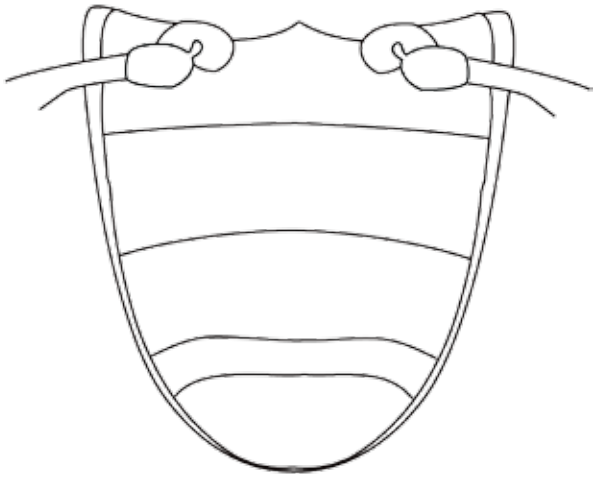

Figure 71: *Ptinus fur* (Linnaeus), abdomen

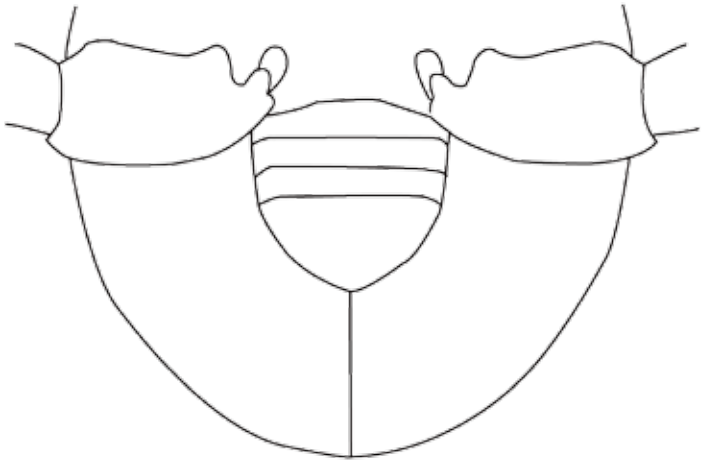

Figure 72: *Gibbium* sp., abdomen; adapted from Spilman 1991

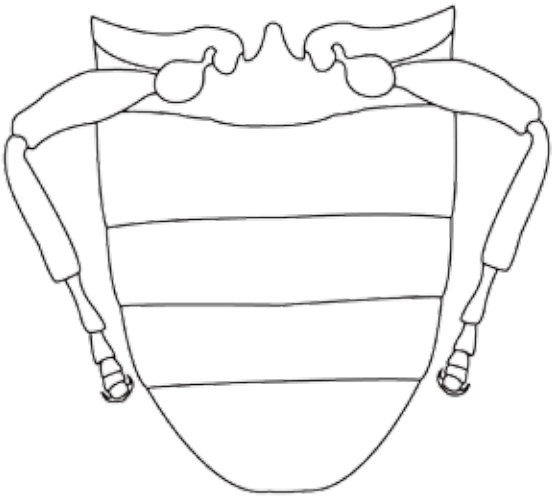

Figure 73: *Hemicoelus carinatus* (Say), abdomen

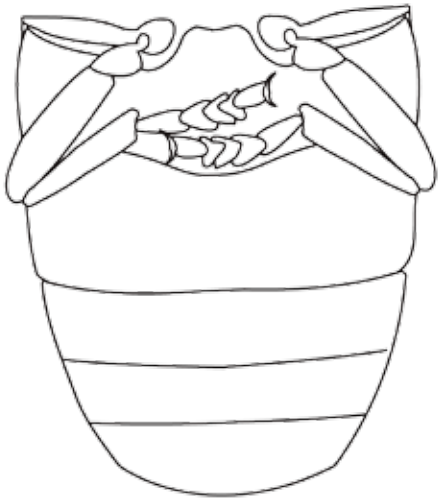

Figure 74: *Hemicoelus pusillus* (Fall), abdomen

Figure 75: *Tricorynus punctatus* (LeConte), pro- and mesothoracic legs

Figure 76: *Hemicoelus* sp., elytral punctures

Figure 77: *Oligomerus* sp., elytral punctures

Figure 78: *Ptilinus ruficornis* Say, abdomen, female

Figure 79: *Hadrobregmus notatus* (Say), abdomen

Figure 80: *Dorcatoma falli* White, metathoracic ventrite

Figure 82: *Petalium incisum* Ford, metathoracic ventrite

Figure 81: *Dorcatoma pallicornis* LeConte, metathoracic ventrite

Figure 83: *Tricorynus punctatus* (LeConte), metathoracic ventrite

Figure 84: *Ptinus villiger* (Reitter), frons

Figure 85: *Oligomerus sericans* (Melsheimer), frons

Figure 86: *Hemicoelus carinatus* (Say), prothorax, ventral

Figure 87: *Ernobius* sp., prothorax, ventral

Figure 88: *Euvrilletta harrisii* (Fall), frons

Figure 89: *Xyletinus fucatus* LeConte, frons

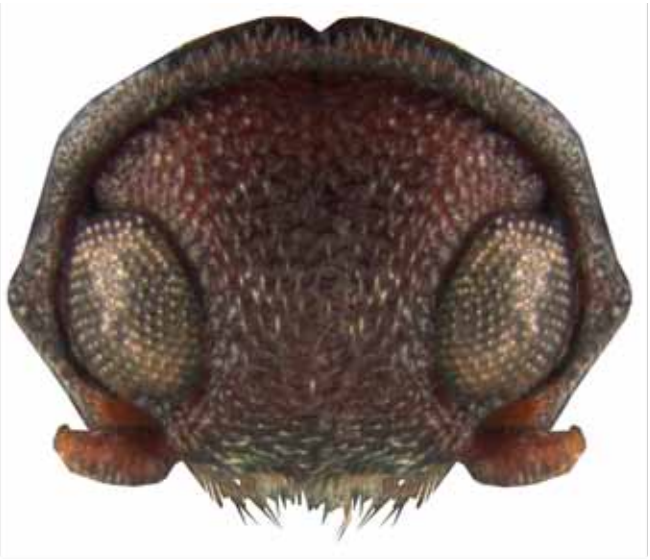

Figure 90: *Petalium incisum* Ford, pronotal notch

Figure 91: *Petalium whitei* Ford, pronotum without notch

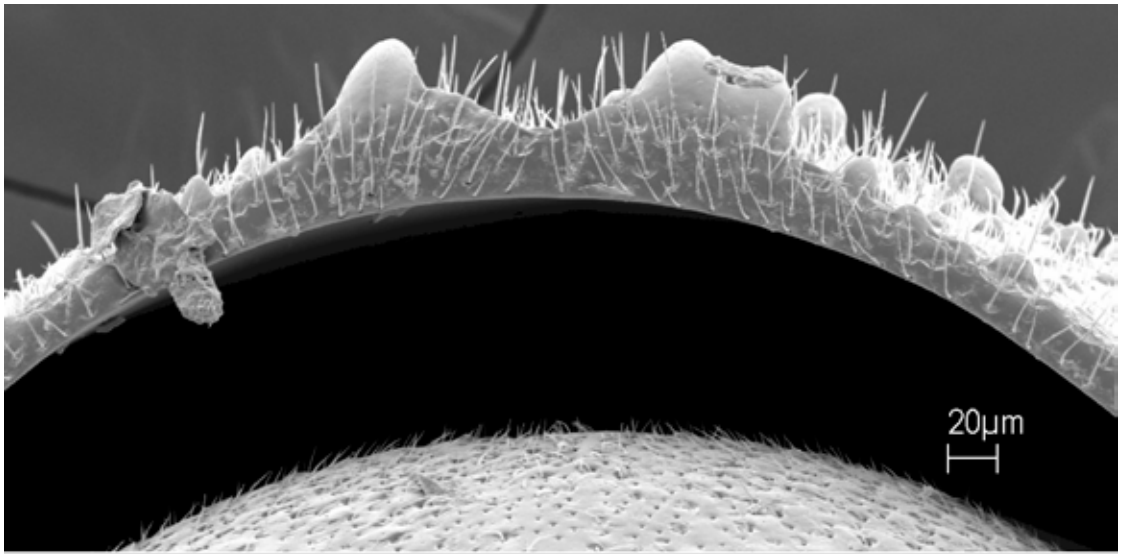

Figure 92: *Ptilinus ruficornis* Say, pronotal apex with asperities, female

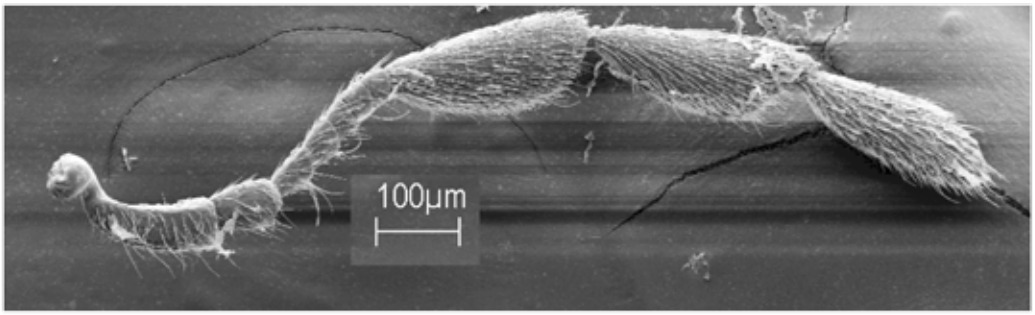

Figure 93: *Oligomerus sericans* (Melsheimer), left antenna

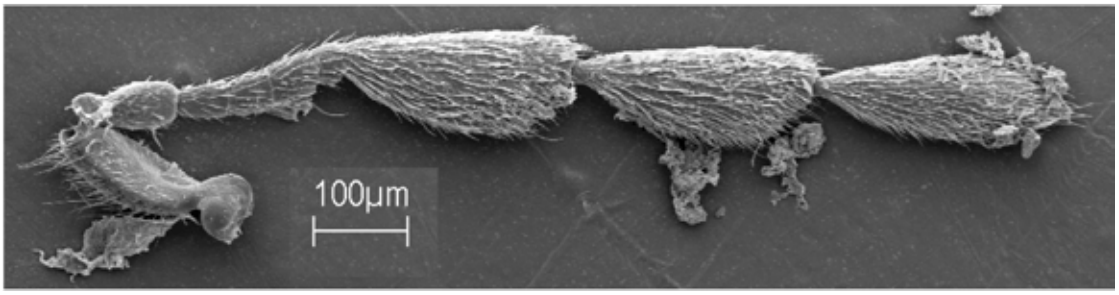

Figure 94: *Oligomerus sericans* (Melsheimer), right antenna. (SEM images taken by Tom Kuster)

Figure 95: *Oligomerus sericans* (Melsheimer), genitalia, dorsal, male

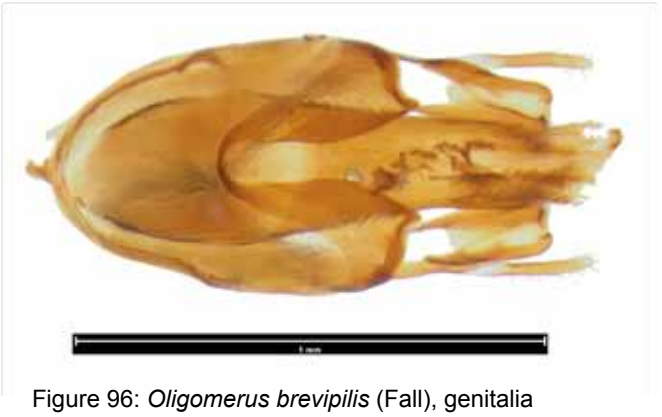

Figure 96: *Oligomerus brevipilis* (Fall), genitalia dorsal, male

Figure 97: *Oligomerus obtusus* LeConte, genitalia dorsal, male

Figure 98: *Oligomerus alternans* LeConte, genitalia dorsal, male

Figure 99: *Gibbium aequinoctiale* Boieldieu, dorsal

Figure 100: *Gibbium aequinoctiale* Boieldieu, lateral

Figure 101: *Mezium affine* Boieldieu, dorsal

Figure 102: *Mezium affine* Boieldieu, lateral

Figure 103: *Pseudeurostus hilleri* (Reitter), dorsal

Figure 105: *Ptinus bimaculatus* Melsheimer, dorsal

Figure 104: *Pseudeurostus hilleri* (Reitter), lateral

Figure 106: *Ptinus bimaculatus* Melsheimer, lateral

Figure 107: *Ptinus clavipes* Panzer, dorsal

Figure 108: *Ptinus clavipes* Panzer, lateral

Figure 109: *Ptinus concurrens* Fall, dorsal

Figure 110: *Ptinus concurrens* Fall, lateral

Figure 111: *Ptinus fur* (Linnaeus), dorsal, male

Figure 113: *Ptinus fur* (Linnaeus), dorsal, female

Figure 112: *Ptinus fur* (Linnaeus), lateral, male

Figure 114: *Ptinus fur* (Linnaeus), lateral, female

Figure 115: *Ptinus villiger* (Reitter), dorsal, male

Figure 116: *Ptinus villiger* (Reitter), lateral, male

Figure 117: *Ptinus villiger* (Reitter), dorsal, female

Figure 118: *Ptinus villiger* (Reitter), lateral, female

Figure 119: *Eucrada humeralis* (Melsheimer), dorsal, male

Figure 120: *Eucrada humeralis* (Melsheimer), lateral, male

Figure 121: *Eucrada humeralis* (Melsheimer), dorsal, female

Figure 122: *Eucrada humeralis* (Melsheimer), lateral, female

Figure 123: *Ernobius filicornis* LeConte, dorsal, male

Figure 125: *Ernobius granulatus* LeConte, dorsal, male

Figure 124: *Ernobius filicornis* LeConte, lateral, male

Figure 126: *Ernobius granulatus* LeConte, lateral, male

Figure 127: *Ernobius youngi* Arango, dorsal, female (Holotype)

Figure 129: *Hemicoelus carinatus* (Say), dorsal, female

Figure 128: *Ernobius youngi* Arango, lateral, female (Holotype)

Figure 130: *Hemicoelus carinatus* (Say), lateral, female

Figure 131: *Hemicoelus defectus* (Fall), dorsal

Figure 133: *Hemicoelus pusillus* (Fall), dorsal

Figure 132: *Hemicoelus defectus* (Fall), lateral

Figure 134: *Hemicoelus pusillus* (Fall), lateral

Figure 135: *Hemicoelus umbrosus* (Fall), dorsal

Figure 137: *Microbregma emarginatum emarginatum* (Duftschmid), dorsal

Figure 136: *Hemicoelus umbrosus* (Fall), lateral

Figure 138: *Microbregma emarginatum emarginatum* (Duftschmid), lateral

Figure 139: *Hadrobregmus notatus* (Say), dorsal

Figure 141: *Priobium sericeum* (Say), dorsal

Figure 140: *Hadrobregmus notatus* (Say), lateral

Figure 142: *Priobium sericeum* (Say), lateral

Figure 143: *Trichodesma gibbosa* (Say), dorsal

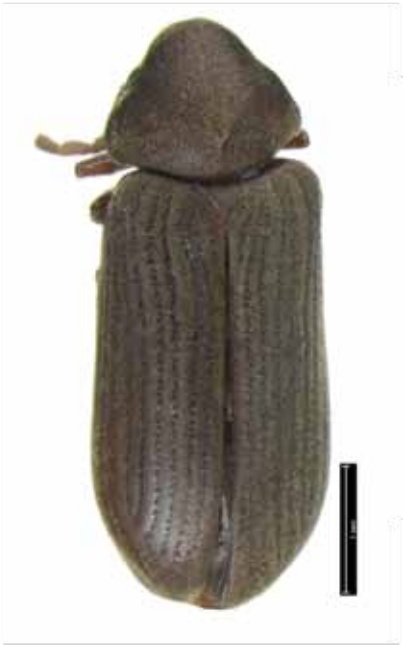

Figure 145: *Oligomerus alternans* LeConte, dorsal

Figure 144: *Trichodesma gibbosa* (Say), lateral

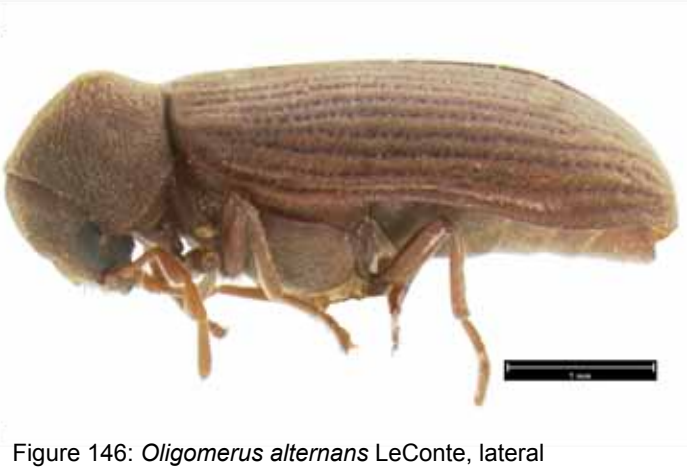

Figure 146: *Oligomerus alternans* LeConte, lateral

Figure 147: *Oligomerus brevipilis* Fall, dorsal

Figure 148: *Oligomerus brevipilis* Fall, lateral

Figure 149: *Oligomerus obtusus* LeConte, dorsal, male

Figure 150: *Oligomerus obtusus* LeConte, lateral, male

Figure 151: *Oligomerus sericans* (Melsheimer), dorsal, male

Figure 153: *Stegobium paniceum* (Linnaeus), dorsal

Figure 152: *Oligomerus sericans* (Melsheimer), lateral, male

Figure 154: *Stegobium paniceum* (Linnaeus), lateral

Figure 155: *Ptilinus lobatus* Casey, dorsal, male

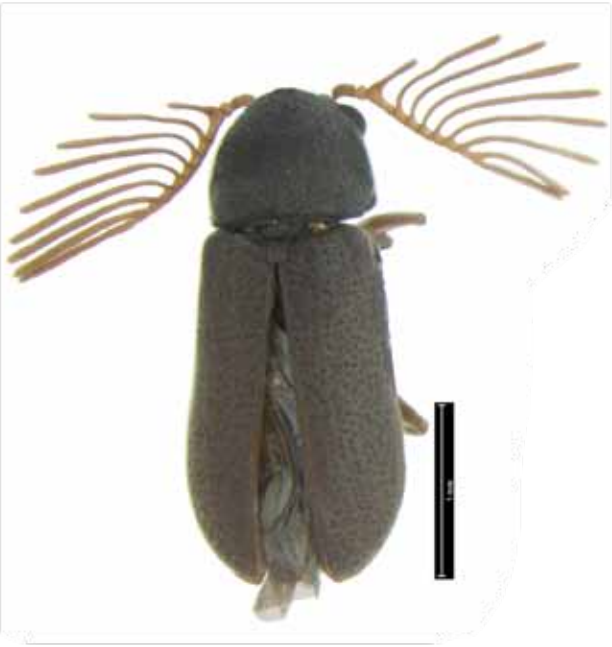

Figure 157: *Ptilinus ruficornis* Say, dorsal, male

Figure 156: *Ptilinus lobatus* Casey, lateral, male

Figure 158: *Ptilinus ruficornis* Say, lateral, male

Figure 159: *Ptilinus ruficornis* Say, dorsal, female

Figure 161: *Euvrilletta brevis* White, dorsal

Figure 160: *Ptilinus ruficornis* Say, lateral, female

Figure 162: *Euvrilletta brevis* White, lateral

Figure 163: *Euvrilletta harrisii* (Fall), dorsal

Figure 165: *Euvrilletta peltata* (Harris), dorsal

Figure 164: *Euvrilletta harrisii* (Fall), lateral

Figure 166: *Euvrilletta peltata* (Harris), lateral

Figure 167: *Vrilletta laurentina* Fall, dorsal

Figure 169: *Xyletinus confusus* White, dorsal, male

Figure 168: *Vrilletta laurentina* Fall, lateral

Figure 170: *Xyletinus confusus* White, lateral, male

Figure 171: *Xyletinus fucatus* LeConte, dorsal

Figure 172: *Xyletinus fucatus* LeConte, lateral

Figure 173: *Lasioderma serricorne* (Fabricius), dorsal

Figure 174: *Lasioderma serricorne* (Fabricius), lateral

Figure 175: *Calymmaderus nitidus* (LeConte), dorsal

Figure 177: *Calymmaderus obsoletus* (Fall), dorsal

Figure 176: *Calymmaderus nitidus* (LeConte), lateral

Figure 178: *Calymmaderus obsoletus* (Fall), lateral

Figure 179: *Byrrhodes incomptus* (LeConte), dorsal

Figure 180: *Byrrhodes incomptus* (LeConte), lateral

Figure 181: *Byrrhodes intermedius* (LeConte), dorsal

Figure 182: *Byrrhodes intermedius* (LeConte), lateral

Figure 183: *Byrrhodes tristriatus* (LeConte), dorsal

Figure 185: *Caenocara bicolor* (Germar), dorsal

Figure 184: *Byrrhodes tristriatus* (LeConte), lateral

Figure 186: *Caenocara bicolor* (Germar), lateral

Figure 187: *Caenocara blanchardi* Fall, dorsal, female

Figure 189: *Caenocara inepta* LeConte, dorsal

Figure 188: *Caenocara blanchardi* Fall, lateral, female

Figure 190: *Caenocara inepta* LeConte, lateral

Figure 191: *Caenocara oculata* (Say), dorsal, male

Figure 193: *Caenocara tenuipalpa* Fall, dorsal

Figure 192: *Caenocara oculata* (Say), lateral, male

Figure 194: *Caenocara tenuipalpa* Fall, lateral

Figure 195: *Dorcatoma falli* White, dorsal

Figure 197: *Dorcatoma pallicornis* LeConte, dorsal

Figure 196: *Dorcatoma falli* White, lateral

Figure 198: *Dorcatoma pallicornis* LeConte, lateral

Figure 199: *Dorcatoma setulosa* LeConte, dorsal

Figure 201: *Petalium alternatum* Ford, dorsal

Figure 200: *Dorcatoma setulosa* LeConte, lateral

Figure 202: *Petalium alternatum* Ford, lateral

Figure 203: *Petalium bistriatum* (Say), dorsal

Figure 205: *Petalium debile* Fall, dorsal

Figure 204: *Petalium bistriatum* (Say), lateral

Figure 206: *Petalium debile* Fall, lateral

Figure 207: *Petalium incisum* Ford, dorsal

Figure 209: *Petalium seriatum* Fall, dorsal

Figure 208: *Petalium incisum* Ford, lateral

Figure 210: *Petalium seriatum* Fall, lateral

Figure 211: *Petalium whitei* Ford, dorsal

Figure 213: *Protheca hispida* LeConte, dorsal

Figure 212: *Petalium whitei* Ford, lateral

Figure 214: *Protheca hispida* LeConte, lateral

Figure 215: *Sculptotheca puberula* (LeConte), dorsal

Figure 217: *Stagetus profundus* (LeConte), dorsal

Figure 216: *Sculptotheca puberula* (LeConte), lateral

Figure 218: *Stagetus profundus* (LeConte), lateral

Figure 219: *Striatheca lineata* White, dorsal

Figure 220: *Striatheca lineata* White, lateral

Figure 221: *Tricorynus borealis* (LeConte), dorsal

Figure 222: *Tricorynus borealis* (LeConte), lateral

Figure 223: *Tricorynus castaneus* (Hamilton), dorsal

Figure 225: *Tricorynus confusus* (Fall), dorsal

Figure 224: *Tricorynus castaneus* (Hamilton), lateral

Figure 226: *Tricorynus confusus* (Fall), lateral

Figure 227: *Tricorynus dichrous* (Fall), dorsal

Figure 229: *Tricorynus nigritulus* (LeConte), dorsal

Figure 228: *Tricorynus dichrous* (Fall), lateral

Figure 230: *Tricorynus nigritulus* (LeConte), lateral

Figure 231: *Tricorynus punctatus* (LeConte), dorsal

Figure 233: *Tricorynus similis* (LeConte), dorsal

Figure 232: *Tricorynus punctatus* (LeConte), lateral

Figure 234: *Tricorynus similis* (LeConte), lateral