

**A REVIEW OF GROUND BEETLE SPECIES (COLEOPTERA: CARABIDAE)  
OF MINNESOTA, UNITED STATES: NEW RECORDS AND  
RANGE EXTENSIONS**

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*Abstract.*—We report new Minnesota records for 13 genera and 100 species of ground beetles (Coleoptera: Carabidae), reflecting 21% and 31% increases, respectively, over records in the literature. There are now 76 genera and 433 carabid species recorded from Minnesota. New material was collected from sub-boreal forest study sites in northeastern and central Minnesota. We also surveyed 16 museum collections and private collections in the United States with an emphasis on collections in the north central region and those likely to contain Minnesota records. New generic records for Minnesota from the museum collections include *Paratachys* Casey, *Nomius* Laporte, *Platypatrobus* Darlington, *Gastrellarius* Casey, *Lophoglossus* LeConte, *Pseudamara* Lindroth, *Panagaeus* Latreille, *Dicheirotichus* Jacquelin du Val, *Discoderus* LeConte, *Leptotrachelus* Latreille, *Tetragonoderus* Dejean, *Apenes* LeConte, and *Axinopalpus* LeConte. New species records from the field surveys in northeastern and central Minnesota include *Notiophilus aquaticus* (Linnaeus), *Sphaeroderus nitidicollis brevoorti* LeConte, *Trechus crassiscapus* Lindroth, *Bembidion mutatum* Gemminger & Harold, *Bembidion wingatei* Bland, *Patrobus foveocollis* (Eschscholtz), *Patrobus septentrionis* Dejean, *Pterostichus melanarius* (Illiger), *Amara coelebs* Hayward, *Pseudamara arenaria* (LeConte), *Bradycellus semipubesceus* Lindroth, *Harpalus ventralis* LeConte, *Agonum affine* Kirby, and *Agonum trigeminum* Lindroth. In addition, we highlight the special role of *P. melanarius* as an invasive beetle. Since many of the new records were based on specimens stored in research entomological collections, we recognize the significance of institutional holdings as a source of information for studies of native biodiversity.

*Key Words:* biodiversity, Carabidae, ground beetles, Minnesota, museum collections,

species distributions, sub-boreal forest, invasive species, *Pterostichus melanarius*, threatened species, local extinctions, *Calosoma scrutator*

Ground beetles (Coleoptera: Carabidae) are relatively abundant and diverse in the forests and grasslands of Minnesota. Minnesota is unique among neighboring US states and Canadian provinces because it occurs at a transition point where three biomes meet: sub-boreal coniferous/deciduous forests, central deciduous forests, and tall grass prairies (Tester 1995, Minnesota Department of Natural Resources 2004) (Fig. 1). This habitat diversity leads to corresponding biodiversity of the Carabidae in the state. In a literature and museum (excluding the University of Minnesota Insect Collection) survey of America north of Mexico, Bousquet and Larochelle (1993) reported 63 genera and 323 species of carabids inhabiting Minnesota. In a survey of northeastern North America, Downie and Arnett (1996) documented 28 genera and 94 species of ground beetles in Minnesota. Three species records in the latter work were unique, bringing the total in the state to 63 genera and 326 species.

Since the late 1800s, ground beetles have been collected by numerous professional and amateur entomologists in Minnesota, with the earliest collections dating from 1888 when the Division of Entomology and Botany was established at the University of Minnesota (Department of Entomology, University of Minnesota 2004). Otto Luger, a faculty entomologist, developed the first insect collection, which is housed at the University of Minnesota Insect Collection in St. Paul (UMIC). O.W. Oestlund, an entomologist with the Minnesota Geological and Natural History Survey and a professor in the Department of Animal Biology at the University of Minnesota, also collected a large number of carabids in the state. The carabid collection was further enhanced in the late 1800s and early 1900s by C.N. Ainslie, a professor in the Department

of Zoology, who collected almost entirely in Olmsted County. In the early to mid-1900's, C.E. Mickel, a professor in the Department of Entomology, D.G. Denning, a student at the UMIC, W.E. Stehr, a curator at the UMIC, M.H. Hatch, an instructor at the University of Minnesota (1926–1927), and A.A. Granovsky, a professor in the Department of Entomology (1930–1956), all were avid Minnesota insect collectors who contributed carabid specimens to the UMIC. Between the mid-1960's and the early 1990's, J.R. Powers, a biology professor at Concordia College in Moorhead, Minnesota, and his students, made extensive collections of carabids from the western counties. Many of these specimens were deposited in the Essig Museum, University of California, Berkeley.

During the last twenty years, carabid surveys have focused on specific geographic areas and habitat types in the state (Fig. 2).

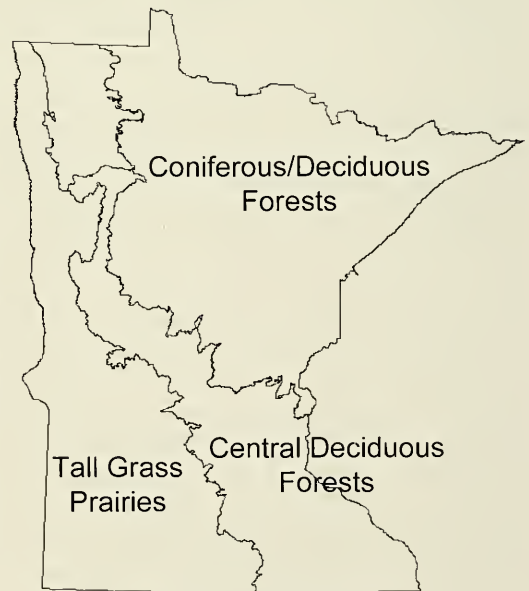


Fig. 1. Map of Minnesota showing the three major ecological biomes present in the state.

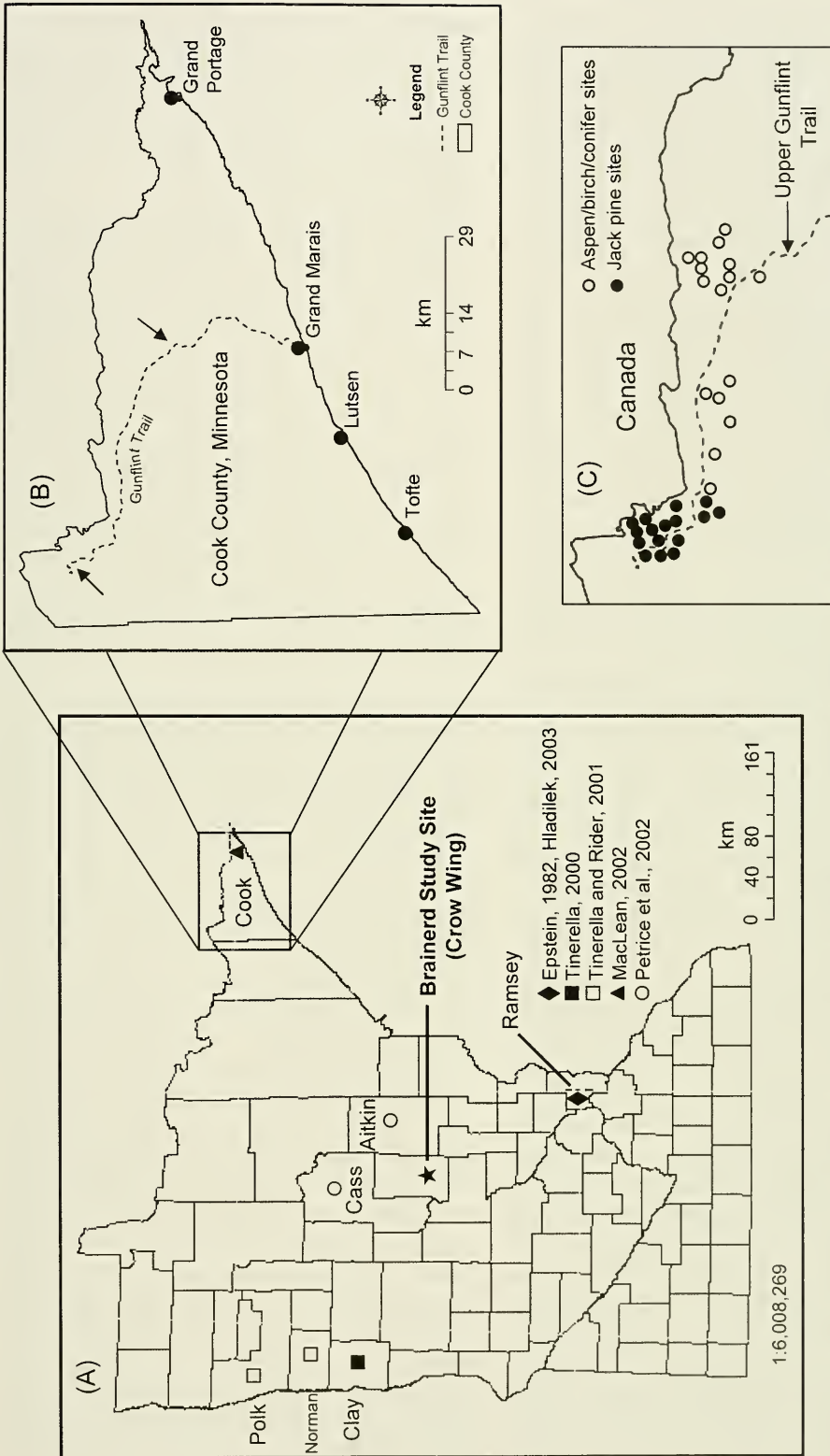


Fig. 2. Map of Minnesota showing collection sites by Epstein (1982), Epstein and Kulman (1984, 1990), and Hladilek (2003) (Ramsey County) (◆); Tinerella (2000) (Clay County) (■), and Tinerella and Rider (2001) (Norman and Polk Counties) (□); MacLean (2002) (Cook County) (▲); and Petrice et al. (2002) (Aitkin and Cass Counties) (○). The map also shows our study sites in Crow Wing (★) and Cook Counties (A). Map of Cook County showing the location of Gunflint Trail (B). Arrows depict the range of sub-boreal study sites along the Gunflint Trail. Magnified area of the upper Gunflint Trail (Superior National Forest) showing the location of 32 study sites (C).

For example, Epstein (1982) and Epstein and Kulman (1984, 1990) studied carabids in oak and cottonwood forests, and grassy fields in east-central Minnesota. These sites are being re-sampled in 2005 by the first author and M.E. Epstein to document long-term changes in ground beetle assemblages in Minnesota. More recently, Tinerella (2000) and Tinerella and Rider (2001) studied carabids in the tallgrass prairie region of western Minnesota, and reported six new state records. MacLean (2002) studied sub-boreal forest stands and wetlands in the Grand Portage National Monument in extreme northeastern Minnesota, and reported five new state records. Gilmore et al. (2002) outlined a research project in the sub-boreal forests of northeastern Minnesota and first reported the presence of *Pterostichus melanarius* (Illiger), a European invasive species, in Minnesota. Subsequently, Petrice et al. (2002) confirmed the presence of *P. melanarius* in Minnesota and established eight additional records of carabid species in hardwood vernal pond habitats in north-central Minnesota. Hladilek (2003) conducted an ecological study of the interaction of ground beetles with detrital food webs in a wheat field on the University of Minnesota campus in east-central Minnesota (Ramsey County), but reported no new state species records.

During the summer of 2000, we initiated a study of ground beetles in the sub-boreal forested region of northeastern Minnesota including the Boundary Waters Canoe Area Wilderness. A catastrophic windstorm event occurred on the 4<sup>th</sup> of July, 1999, and resulted in windthrow of trees on more than 193,035 hectares of forestland in the Superior National Forest (USDA 2000). This study focused on the influences of this large-scale wind-disturbance event and post-wind-disturbance silvicultural treatments (e.g., salvage-logging and prescribe-burning) on the abundance and diversity of forest Coleoptera (Gilmore et al. 2002, 2005). During the summer of 2002, we initiated a separate study to assess the im-

mediate responses of ground beetles to a severe wildfire in a *Pinus banksiana* Lamb. forest near Brainerd in central Minnesota. Results from a disturbance ecology perspective from both of these field studies will be reported elsewhere.

Our field studies on carabids in Minnesota have revealed a number of species occurrences that were previously unrecorded in the state. In addition, we surveyed the UMIC and 15 other insect collections, housed in academic and research institutions or in private hands, for new state records. In this paper, we list and discuss these new records and include information on sample locations, collection dates, name of the collector, and number of adults collected in each series. We also provide the current distributions and known habitat associations of the species that represent new state records from our studies in northeastern and central Minnesota.

#### MATERIALS AND METHODS

**Study sites.**—In northeastern Minnesota, ground beetles were sampled from research sites along the Gunflint Trail and in the Boundary Waters Canoe Area Wilderness in the Superior National Forest in Cook County (Fig. 2). The forest is composed of paper birch, *Betula papyrifera* Marsh., trembling aspen, *Populus tremuloides* Michx., northern white cedar, *Thuja occidentalis* L., jack pine, *Pinus banksiana*, eastern white pine, *P. strobus* L., red pine, *P. resinosa* Ait., black spruce, *Picea mariana* (Mill.) B.S.P., white spruce, *P. glauca* (Moench) Voss, balsam fir, *Abies balsamea* (L.) Mill., and tamarack, *Larix laricina* (Du Roi) K. Koch. We sampled carabids from *P. tremuloides*/*B. papyrifera*/conifer-, and *P. banksiana*-dominated forests in undisturbed, severely wind-disturbed (67–100% tree mortality), wind-disturbed-salvage-logged, and wind-disturbed-prescribe-burned stands (Gilmore et al. 2002, 2005). The burned stands were moderately salvage-logged prior to burning, and thus had been subjected to three disturbance factors.

During 2000, we sampled two sites (replicates) for each of three treatment types (undisturbed, severely wind-disturbed, and wind-disturbed-salvage-logged) in each of the two (*P. tremuloides*/B. papyrifera/conifer and *P. banksiana*) forest cover types for a total of 12 sites. During 2001–2003, we sampled four sites (replicates) for each of the four treatment types (undisturbed, severely wind-disturbed, wind-disturbed-salvage-logged, and wind-disturbed-prescribed-burned) in each of the two (*P. tremuloides*/B. papyrifera/conifer and *P. banksiana*) forest cover types for a total of 32 sites

In central Minnesota, ground beetles were sampled near the town of Barrows, located ten km southwest of Brainerd in Crow Wing County (Fig. 2). The forest is composed primarily of oak, *Quercus* spp., and jack pine, *P. banksiana*, growing on sandy soils. On 31 May 2002, a lightning strike started a wildfire between Brainerd and Barrows, and it quickly consumed over 285 hectares of this forest type. We sampled carabids from unburned and severely-burned (100% tree mortality) *P. banksiana*-dominated forest stands. During 2002 and 2003, we sampled four sites in each of the two treatment types (unburned and burned) for a total of eight sites.

Field surveys.—Adult ground beetles were collected with standard pitfall traps consisting of an outer 1 L and an inner 500 mL plastic cup filled with 2–3 cm of propylene glycol as a preserving agent (Spence and Niemelä 1994). Each trap was covered with a 100 cm<sup>2</sup> plywood roof to protect the collecting cup from small mammal disturbances and flooding during rain. During 2000 in northeastern Minnesota, six unbaited pitfall traps were placed in each of the 12 sites for a total of 72 traps. During 2001–2003, six unbaited pitfall traps were placed in each of the 32 sites for a total of 192 traps. In addition, we collected carabid beetles from pitfall traps that were baited with various combinations of  $\alpha$ - or  $\beta$ -pinene that were used to attract rhizophagous beetles. During 2000, three

replicates of each of four bait-types were placed in each of the 12 sites for a total of 144 traps. During 2001–2003, only *P. banksiana* sites were sampled with baited pitfall traps, and five of these traps (including an unbaited control trap) were placed in 16 sites for a total of 80 traps. In northeastern Minnesota, all traps were spaced by 20 m, operated from late-May to early October, and emptied every 15–20 days. In the central Minnesota study area, four unbaited pitfall traps spaced by 50 m were placed in each of the eight sites for a total of 32 traps. These traps were operated from mid-June to mid-September and emptied every 15–20 days.

Adult beetles were identified by the authors K. J. K. Gandhi and G. E. Ball using taxonomic keys provided by Lindroth (1961–69), Downie and Arnett (1996), Liebherr and Will (1996), and Ball and Bousquet (2001). Distribution records of the species were cross-checked with Bousquet and Larochelle (1993), Downie and Arnett (1996), and other specific references noted above. Nomenclature and phylogenetic concepts in this paper generally follow that of Noonan (1991) and Bousquet and Larochelle (1993). Voucher specimens from our sub-boreal forest studies in northeastern and central Minnesota have been deposited at the UMIC.

Museum survey.—We searched systematically for new records of carabids amongst the specimens in major collections. At the UMIC, we surveyed the identified and unidentified material in the family Carabidae. For the identified beetles, we focused on adult carabids collected from all counties in Minnesota. Because of the large number of unidentified material at UMIC, we focused primarily on unidentified carabids collected from Aitkin, Beltrami, Carlton, Cook, Itasca, Kittson, Koochiching, Lake, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, Roseau, and St. Louis counties of Minnesota. We chose specimens from these counties reasoning that they would include all boreal species

that might overlap with our own biodiversity surveys. We searched the database of the Insect Collection at the California Academy of Sciences (San Francisco, CAS) for new Minnesota records amongst the identified carabid beetles, and searched the complete holdings of the California Collection of Arthropods at the Plant Pest Diagnostic Center (Sacramento, CDFA), the Environmental Division of the Grand Portage Band (Grand Portage, Minnesota, GPB), Iowa State University (Ames, ISU), the Milwaukee Public Museum (MPM), North Dakota State University (Fargo, NDSIRC), the Smithsonian Institution (Washington, D.C., NMNH), South Dakota State University (Brookings, SDSU), University of California, Berkeley (UCB), University of California, Davis (UCD), Illinois Natural History Survey (Champaign, INHSIC), University of Wisconsin (Madison, UWM), and University of Wyoming (Laramie, UW). Furthermore, we searched the private ground beetle collections of K.J. Larsen, Luther College (Decorah, Iowa, KJL) and K.W. Will, University of California (Berkeley, KWW) for new records.

Collection data for each specimen included county and specific locality, any habitat information, collector, collection date, and number of specimens in the series (indicated parenthetically at the end of the record). Some information about the museum specimens may be incomplete because of the limited locality and habitat data recorded on specimen labels. If the specimen was only labeled "Minn." or "MN," then this is listed as unknown county and unknown collector in our results. The records are presented in chronological order to reflect the historical precedence of the collections, and when dates were not present on the labels, we have placed them in the chronology based on our knowledge of when various collectors were active. Unless indicated by a specific collection acronym, the record is from the UMIC.

## RESULTS

### Tribe Notiophilini

*Notiophilus aquaticus* (Linnaeus).—Otter Tail Co., O. Lugger (1). Lake Co., Two Harbors, M.H. Hatch, VI.28.1927 (1). Crow Wing Co., C.E. Mickel, V.14.1928 (1). Cook Co., Superior National Forest, baited pitfall trap, K.J.K. Gandhi, 48°07'31"N 90°50'30"W, *P. banksiana* wind-disturbed-prescribe-burned forest, VII.30-VIII.11.2003 (1). We collected a total of one adult.

*Notiophilus aquaticus* is a transcontinental species that ranges from Newfoundland to Alaska and south to Arizona (Bousquet and Laroche 1993: 50). This species is associated with open areas (Lindroth 1961–69: 95).

### Tribe Carabini

*Calosoma affine* Chaudoir.—Olmsted Co., C.N. Ainslie (1, ISU). Martin Co., Truman, J.H. Patchin, VII.20.1936 (1).

*Calosoma externum* (Say).—Olmsted Co., C.N. Ainslie (1, ISU). Ramsey Co., St. Paul, Como Park lights, W.E. Hoffman, VII.6.1921 (1). Houston Co., unknown collector, V.26.1940 (1).

*Calosoma obsoletum* Say.—Olmsted Co., C.N. Ainslie (1, ISU). Cass Co., Cass Lake, K.F. Ziegler, VI.27.1934 (1). Rock Co., Luverne, A.E. Pritchard, IX.13–14.1935 (1); P. Nicholson, VI.8.1938, VI.14.1938, VI.11.1938, VI.22.1938 (7). Big Stone Co., Odessa Township, W. Stehr, VIII.24.1935 (2, CAS), (1, NMNH). Polk Co., D.G. Denning, VIII.13.1936 (1). Mille Lacs Co., R. Handford, V.28.1937 (1). Ramsey Co., R.H. Handford, V.28.1937 (1). Beltrami Co., D.G. Denning, VI.22.1937 (1). Kittson Co., Hallock, D.G. Denning, VII.8.1937 (1); A.W. Buzicky, VIII.12.1939 (1). Nobles Co., C.E. Mickel, VI.2.1938 (3). Pipestone Co., C.E. Mickel, VI.3.1938 (3). Lincoln Co., C.E. Mickel, VI.4.1938 (3).

*Calosoma scrutator* (Fabricius).—Hennepin Co., Minneapolis, O.W. Oestlund (1); Lake Minnetonka, G. Swanson, VI.10.1933

(1). Fillmore Co., Entomology Class, V.25.1936 (1). Houston Co., H.C. Ma, V.22.1937 (1). Ramsey Co., E. Thomas, IX.15.1937 (1).

*Carabus sylvosus* Say.—Olmsted Co., C.N. Ainslie (1, ISU). Itasca Co., Itasca Park, L.W. Orr, VII.2.1928, VIII.22.1931 (2). Anoka/Isanti Co., Cedar Creek Bog, H.L. Gunderson, VIII.24.1948 (1). Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, M. Davis, VII.26.2000, IX.13.2000 (2, KJL).

*Carabus vinctus* (Weber).—Olmsted Co., C.N. Ainslie (1, ISU).

### Tribe Cychrini

*Scaphinotus fissicollis* (LeConte).—Olmsted Co., C.N. Ainslie (10, ISU). Houston Co., Jellison, V.25.1940 (1).

*Sphaeroderus nitidicollis brevoorti* LeConte.—Cook Co., Superior National Forest, baited and unbaited pitfall traps, K.J.K. Gandhi, 48°02'35"N 90°22'30"W, 48°02'42"N 90°21'58"W, 48°02'26"N 90°23'37"W, *P. tremuloides*/*B. papyriferal* conifer wind-disturbed forests, VIII.10-IX.29.2000, V.21-VI.11.2001, VI.27-VII.10.2001, VIII.20-X.13.2001, V.31-VII.12.2002, VIII.9-IX.21.2002, V.30-IX.15.2003 (36); 48°02'11"N 90°23'01"W, 48°01'46"N 90°23'53"W, *P. tremuloides*/*B. papyriferal* conifer wind-disturbed-salvage-logged forests, VIII.21–26.2000, VI.7–27.2001, VI.26-VII.20.2001, VIII.20-X.13.2001, V.28-VI.17.2002, VIII.9-IX.21.2002, VIII.5-IX.14.2003 (21); 48°01'56"N 90°23'55"W, 48°01'56"N 90°23'56"W, 48°02'42"N 90°21'58"W, *P. tremuloides*/*B. papyriferal* conifer undisturbed forests, VI.7–26.2001, VII.9-X.13.2001, V.31-VI.27.2002, VIII.9-IX.21.2002, V.30-IX.15.2003 (81); and 48°00'33"N 90°25'15"W, *P. tremuloides*/*B. papyriferal* conifer wind-disturbed-prescribed burned forest, VI.11–25.2001, VIII.20-IX.8.2001, VI.27-VII.12.2002, VIII.9–23.2002, VIII.18-IX.14.2003 (10). We collected a total of 148 adults.

Our collection of *S. n. brevoorti* is a new

regional record for the north central United States. This species had been collected in the northeastern United States as far west as New York, and in Canada from Nova Scotia, through Ontario, Manitoba, and as far west as Saskatchewan (Bousquet and Laroche 1993: 78). It is a forest species associated with moist habitats such as moss and litter (Lindroth 1961–69: 30, Pearce et al. 2003: 347). In agreement with Pearce et al. (2003), we caught *S. n. brevoorti* exclusively in the *P. tremuloides*/*B. papyriferal* conifer forest cover-type, which suggests that this species may be dependent upon micro-habitats typical of deciduous forests.

### Tribe Elaphrini

*Elaphrus lecontei* Crotch.—Itasca Co., Itasca Park, Bohall Lake, D.G. Denning, V.31.1935 (1). Clay Co., Bluestem State Natural Area, mesic prairie, D. Rider and G. Fauske, VII.27.1995 (1, NDSIRC).

### Tribe Clivinini

*Clivina americana* Dejean.—Ramsey Co., Gray Cloud Island, H.H. Knight, V.23.1920 (1). Wilkin Co., D.G. Denning, VII.11.1937 (1). Houston Co., R. Anderson, V.20.1938 (1).

*Clivina bipustulata* (Fabricius).—Hennepin Co., Minneapolis, E. Vaughn, IV.23.1942 (1). Houston Co., C.E. Mickel, IV.23.1942 (1). Aitkin Co., Bluff, C.E. Mickel, VI.1.1942 (1).

*Clivina impressifrons* LeConte.—Wright Co., Buffalo, S.I. Parfin, VII.29.1947, VIII.3.1947 (2, NMNH).

*Dyschirius aeneolus* LeConte.—Lake Co., Two Harbors, at beach, M.H. Hatch (1).

*Dyschirius erythrocerus* LeConte.—Unknown Co., A. Bolter (1, INHSIC). Olmsted Co., C.N. Ainslie (2); Rochester, C.N. Ainslie (1). Nicollet Co., St. Peter, Fish Hatchery, S. Kepperley, VIII.11.1925 (1). Polk Co., Crookston, Red Lake River, at light, D.G. Denning, VII.18.1935 (3).

*Dyschirius globulosus* (Say).—Ramsey Co., O. Luggar (4). Unknown County, O.

Lugger (1). Olmsted Co., C.N. Ainslie (5). Lake Co., Two Harbors, roots of grass, beach-drift, beach, M.H. Hatch, VI.23.1927, VI.30.1927, VII.1.1927 (3). Goodhue Co., Frontenac, W.C. Stehr, V.29.1930 (2). Winona Co., A.W. Buzicky, V.20.1938 (1). Mille Lacs Co., Mille Lacs, H.E. Milliron, V.18.1940 (1). Clay Co., Trust Lands, six miles east of Felton, hayed prairie, unmanaged prairie, C. Locken and G. Fauske, VI.7.1996, VI.21.1996, VII.28.1996 (4, NDSIRC); Bluestem State Natural Area, unmanaged prairie, dry prairie, hayed prairie, L. DeCock, J. Albertson and K. Urlacker, VI.27.1996, VII.10.1996, VIII.5.1996 (4, NDSIRC); Bicentennial Prairie, J. Albertson and L. DeCock, VII.3.1996 (1, NDSIRC); and Blazingstar Prairie, J. Albertson and L. DeCock, VII.3.1996, (2, NDSIRC). Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VII.6.2000, VIII.16.2000, (2, KJL).

*Dyschirius haemorrhoidalis* (Dejean).—Mille Lacs Co., Mille Lacs, H.G. Rodeck, X.21.1928 (1).

*Dyschirius longulus* LeConte.—Polk Co., Crookston, light trap, D.G. Denning, VII.9.1935 (1).

*Dyschirius pumilus* (Dejean).—Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VII.6.2000, VIII.29.2000 (2, KJL).

*Dyschirius sellatus* LeConte.—Ramsey Co., Gray Cloud Island, W.E. Hoffman, VII.12.1921 (1).

*Schizogenus lineolatus* (Say).—Olmsted Co., C.N. Ainslie (2).

#### Tribe Trechini

*Trechus crassiscapus* Lindroth.—Cook Co., Superior National Forest, unbaited pit-fall trap, K.J.K. Gandhi, 48°03'30"N 90°32'40"W, *P. tremuloides*/*B. papyrifera*l conifer wind-disturbed forest, V.30-VI.18.2003 (1). We collected a total of one adult.

*Trechus crassiscapus* is primarily an eastern species, and our collection reflects a major westward extension of this species

in the United States. It ranges from Newfoundland to Ontario and south to Massachusetts (Bousquet and Laroche 1993: 120), and is a hygrophilous species associated with swamps in forested areas (Lindroth 1961–69: 200).

#### Tribe Bembidiini

*Bembidion coloradense* Hayward.—Wilkin Co., light trap, D.G. Denning, VII.11.1937 (1). Itasca Co., Itasca Park, light trap, C.E. Mickel, VII.8.1939 (1). Polk Co., Crookston, unknown collector, VII.28–29.1959 (1).

*Bembidion coxendix* Say.—Benton Co., O.W. Oestlund (1). Ramsey Co., Gray Cloud Island, W.E. Hoffman, VII.12.1921 (1). Le Sueur Co., Ottawa, W.E. Hoffman, VII.18.1922 (2).

*Bembidion dorsale* Say.—Olmsted Co., C.N. Ainslie (2).

*Bembidion fortetrium* (Motschulsky).—Itasca Co., Little Winnibigoshish Lake, K. Cooper, VI.10–11.1935 (1, NMNH). Wright Co., Buffalo, S.I. Parfin, VIII.3.1947 (1, NMNH). Roseau Co., bluegrass, A.G. Peterson, V.22.1968 (1).

*Bembidion inaequale* Say.—St. Louis Co., Duluth, unknown collector (Chth?) (1, NMNH). Hennepin Co., Minneapolis, at light, A.T. Hertig, VII.13.1922 (1). Red Lake Co., Plummer, from mud near river, off sand near river, D.G. Denning, V.16.1933, V.23.1933 (2). Houston Co., Southeast tip of county, H.R. Dodge, V.24.1936 (1). Unknown Co. (probably Ramsey), Gray Cloud, C.E. Mickel, IV.21.1939 (1). Washington Co., Afton, Entomology Class, V.3.1947 (1). Houston Co., Winnebago Creek Valley, 3–4 m NE Eitzen, A. Raske, V.30.1960 (1, NMNH). Clay Co., Buffalo River State Park, S.J. Vick, IX.15.1980 (1, UCB).

*Bembidion mutatum* Gemminger & Harold.—Clay Co., Clay County Trust Lands, hayed mesic prairie, P. Tinerella, A. Abbott, and G. Fauske, VI.24.1997, VII.9.1997, VII.28.1997, VIII.13.1997, IX.22.1997 (46, NDSIRC); unmanaged prairie, P. Tinerella,



and A. Abbott, VII.28.1997 (10, NDSRIC); and grazed mesic prairie, P. Tinerella, and A. Abbott, VII.9.1997 (1, NDSRIC). Cook Co., Superior National Forest, unbaited and baited pitfall traps, K.J.K. Gandhi, 48°07'21"N 90°51'25"W, *P. banksiana* wind-disturbed-salvage logged forest, VIII.26-IX.30.2000 (1); 48°05'12"N 90°47'35"W, *P. banksiana* wind-disturbed-prescribe-burned forest, VII.6-VIII.4.2001 (1); and 48°00'30"N 90°25'15"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed-prescribe-burned forest, IX.8-29.2001 (1). We collected a total of three adults.

*Bembidion mutatum* is transcontinental from Newfoundland to Alaska extending south in eastern North America to New York and south in the Rocky Mountains to New Mexico (Bousquet and Larochelle 1993: 146, Purrington et al. 2000: 202). This species is generally caught in open habitats with sparse vegetation (Lindroth 1961-69: 387).

*Bembidion pedicellatum* LeConte.—Hennepin Co., O.W. Oestlund (1). Winona Co., Dresback, W.S. Lund, VII.12.1920 (1).

*Bembidion postremum* Say.—Olmsted Co., C.N. Ainslie (1). Itasca Co., Itasca Park, light trap, C.E. Mickel, VII.8.1939 (1).

*Bembidion texanum* Chaudoir.—Hennepin Co., O.W. Oestlund (1). Ramsey Co., O.W. Oestlund (1). Olmsted Co., C.N. Ainslie (10). Le Sueur Co., Fish Hatcheries, at light, W.E. Hoffman, VII.23.1922 (1).

*Bembidion transversale* Dejean.—Unknown Co., A. Bolter (3, INHSIC). St. Louis Co., Duluth, A. Bolter (1, INHSIC). Cook Co., Grand Portage, Susie Island, Lake Superior, unbaited fence trap, gravel beach of Lake Superior, C. Garry and D. Schwert, VII.1.1991 (10).

*Bembidion wingatei* Bland.—Cook Co., Superior National Forest, baited and unbaited pitfall traps, K.J.K. Gandhi, 48°02'42"N 90°21'58"W, *P. tremuloides*/B. *papyrifera*/conifer undisturbed forest, VII.7-VIII.3.2000 (1); 48°07'51"N 90°51'30"W, *P. banksiana*

undisturbed forest, VIII.6-VIII.30.2001 (2); and 48°07'21"N 90°51'25"W, *P. banksiana* wind-disturbed-salvage-logged forest, VI.6-VI.21.2001 (1). We collected a total of four adults.

*Bembidion wingatei* ranges from Newfoundland and St. Pierre and Miquelon south to North Carolina, and west to Wyoming (Bousquet and Larochelle 1993: 149). It also has been reported by Petrice et al. (2002: 9) in Aitkin and Cass counties of Minnesota. This species inhabits subterranean habitats beneath rocks in grasslands and deciduous litter in forest stands (Lindroth 1961-69: 406).

*Paratachys scitulus* (LeConte).—Ramsey Co., St. Paul, Battle Creek, W.E. Hoffman, V.20.1922 (1); St. Paul, University Farm, at light, A.A. Granovsky, VI.26.1936 (1). LeSueur Co., Fish Hatcheries, W.E. Hoffman, VII.20-30-1922 (1). Hennepin Co., G. Kohls, V.1.1937 (1).

#### Tribe Psydrini

*Nomius pygmaeus* (Dejean).—St. Louis Co., Duluth, O. Lugger (6). Unknown Co., O. Lugger (2). Unknown Co., unknown collector and A. Bolter (2, INHSIC). Koochiching Co., International Falls, J.P. Kelly, VII.30.1921 (3). Koochiching Co., Little Fork, C.N. Cantwell, VII.18.1922 (1); Cook Co., Schroeder, unknown collector, VIII.20.1970 (2).

#### Tribe Patrobini

*Patrobus foveocollis* (Eschscholtz).—Koochiching Co., T160N, R26W, S33, H.M. Kulman, VI.30-VII.10.1971 (1). Cook Co., Superior National Forest, baited and unbaited pitfall traps, K.J.K. Gandhi, 48°03'30"N 90°32'40"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed forest, VIII.3-IX.29.2000 (1); 48°00'30"N 90°25'15"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed-prescribe burned forest, VI.25-VII.9.2001 (1); and 48°08'12"N 90°51'25"W, *P. banksiana* wind-disturbed-salvage-logged forest,

VII.12–25.2002 (1). We collected a total of three adults.

*Patrobis foveocollis* is a holarctic species, ranging in North America from Alaska and British Columbia southward in the Rocky Mountains to Colorado, and from Newfoundland to Vermont in eastern North America (Bousquet and Laroche 1993: 159). It is generally found under fallen dead leaves and shaded places (Lindroth 1961–69: 186).

*Patrobis septentrionis* Dejean.—Kooch-iching Co., T71B, R24W, S10, H.M. Kulman, V.25–VI.6.1971 (1). Cook Co., Superior National Forest, unbaited pitfall trap, K.J.K. Gandhi, 48°03'30"N 90°32'40"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed forest, VII.9–20.2001 (1). We collected a total of one adult.

*Patrobis septentrionis* is also a holarctic species, ranging from Alaska and Washington southward in the Rocky Mountains to Colorado, and from Newfoundland to New Hampshire in eastern North America. It has also been reported by Petrice et al. (2002: 9) in Aitkin and Cass Counties of Minnesota. This species is associated with vegetation in riparian areas along lakes, ponds, and streams (Lindroth 1961–69: 184–185).

*Platypatrobis lacustris* Darlington.—Cook Co., Grand Portage Reservation, unknown collector, VII.5.2000 (2, GPB).

#### Tribe Pterostichini

*Cyclotrachelus sodalis colossus* (LeConte).—Olmsted Co., six miles east Chatfield, J.R. Powers, V.17.1967 (1, UCB). Wabasha Co., Lake City, J.R. Powers, VI.4.1970 (1, UCB).

*Cyclotrachelus torvus torvus* LeConte.—Rock Co., Luverne, C.E. Mickel, VI.26.1925 (1).

*Gastrellarius honestus* (Say).—Otter Tail Co., O. Luggen (1).

*Lophoglossus scrutator* (LeConte).—Olmsted Co., C.N. Ainslie (1).

*Poecilus corvus* (LeConte).—Norman Co., A.A. Nichol, V.20.1923 (1). Unknown County, swept from sweet clover, B.A.

Haws, VII.23.1956, VIII.11.1956 (6). Polk Co., Crookston, A.E. Grable, VII.17.1960 (1). Clay Co., Buffalo River State Park, J. Allen, IX.19.1980 (1, UCB); Moorhead, J. Allen, IX.15.1980 (1, UCB). Wilkin Co., potato, R. Johnston, VII.19.1982 (3). We also found three specimens of *P. corvus* in the NDSIRC from Clay and Norman Cos. (Bluestem and Agassiz Dunes State Natural Areas) that had been collected between VI.27 and IX.24.1996 (Tinerella and Rider 2001).

*Poecilus scitulus* (LeConte).—Polk Co., Crookston, swept from sweet clover, unknown collector, VII.21.1952 (1).

*Pterostichus ebeninus* (Dejean).—Unknown Co., unknown collector (1, NMNH).

*Pterostichus melanarius* (Illiger).—Wright Co., Monticello, unknown collector, VIII.26.1990 (1). Aitkin Co., 1.4 miles west of Willow River, D.E. Hansen, 46.334°N 03.096°W, IV.22.1994 (1). Clay Co., Trust Lands, hayed prairie, D. Rider and G. Fauske, VIII.12.1995 (1, NDSIRC); Bluestem Prairie, grazed prairie, wet prairie, reclaimed prairie, mesic prairie, P. Tinerella, C. Jordan and C. Davis, IX.4.1997, VIII.5.1999 (5, NDSIRC); and Blazingstar Prairie, C. Jordan and C. Davis, VIII.30.1999 (1, NDSIRC). Ramsey Co., St. Paul, pitfall trap, 70% ethanol, wheat, E.E. Hladilek, VI.29.2000, VI.30.2000 (5). Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VII.6.2000, VII.19.2000 (2, KJL). Cook Co., Superior National Forest, baited and unbaited pitfall traps, K.J.K. Gandhi, 48°03'42"N 90°33'55"W, 48°02'42"N 90°21'58"W, *P. tremuloides*/B. *papyrifera*/conifer undisturbed forests, VII.6–VIII.27.2000, VIII.3–X.5.2000, VIII.21–X.5.2000 (20); 48°03'30"N 90°32'40"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed forest, VIII.3–IX.29.2000 (3); 48°03'48"N 90°32'40"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed-salvage-logged forest, VII.6–IX.30.2000, VIII.3–IX.30.2000 (86); 48°07'51"N 90°51'30"W, 48°07'31"N

Table 1. Habitat, locality, and seasonal data on *Pterostichus melanarius* caught in baited and unbaited pitfall traps in *Populus tremuloides/Betula papyrifera/conifer* and *Pinus banksiana* sites in Cook Co., Minnesota during 2001–2003.

| Forest Cover-type                    | Silvicultural Treatment             | Latitude/Longitude    | Trapping Period  | Number of Adults |
|--------------------------------------|-------------------------------------|-----------------------|--|------------------|
| <i>P. trem./B. pap./<br/>Conifer</i> | Undisturbed                         | 48°01'56"N 90°23'56"W | V.21–VI.25.2001  | 3                |
|                                      |                                     | 48°03'42"N 90°33'55"W | VII.9–VII.7.2001   | 4                |
|                                      |                                     | 48°02'42"N 90°21'58"W | VIII.20–X.13.2001  | 3                |
|                                      |                                     | 48°01'56"N 90°23'55"W | VI.1–IX.21.2002<br>V.29–IX.14.2003                           | 442*             |
|                                      | Wind-disturbed                      | 48°01'50"N 90°24'20"W | VI.7–VI.27.2001  | 2                |
|                                      |                                     | 48°03'30"N 90°32'40"W | VI.25–VII.9.2001   | 2                |
|                                      |                                     | 48°02'26"N 90°23'37"W | VIII.20–IX.8.2001  | 17               |
|                                      |                                     | 48°01'50"N 90°24'20"W | VI.27–VIII.3.2002<br>V.30–VIII.5.2003                        | 32*              |
|                                      | Wind-disturbed-<br>salvage logged   | 48°01'45"N 90°24'18"W | V.30–IX.29.2001  | 659              |
|                                      |                                     | 48°03'48"N 90°32'40"W | V.28–IX.21.2002  |                  |
|                                      |                                     | 48°01'46"N 90°23'53"W | VI.19–IX.15.2003   |                  |
|                                      |                                     | 48°02'11"N 90°23'01"W |  |                  |
|                                      | Wind-disturbed-<br>prescribe burned | 48°00'30"N 90°25'15"W | V.29–IX.29.2001  | 2,622            |
|                                      |                                     | 48°05'01"N 90°46'52"W | V.28–IX.21.2002  |                  |
|                                      |                                     | 48°05'05"N 90°49'17"W | V.29–IX.14.2003  |                  |
|                                      |                                     | 48°03'30"N 90°35'00"W |  |                  |
| <i>Pinus banksiana</i>               | Undisturbed                         | 48°07'31"N 90°51'50"W | V1.6–IX.22.2001  | 211              |
|                                      |                                     | 48°07'38"N 90°51'36"W | V.29–IX.14.2002  |                  |
|                                      |                                     | 48°07'51"N 90°51'24"W | VI.4–IX.10.2003  |                  |
|                                      |                                     | 48°07'29"N 90°51'40"W |  |                  |
|                                      | Wind-disturbed                      | 48°07'12"N 90°50'50"W | V1.6–VII.5.2001<br>VII.13–VII.27.2002<br>VII.28–VIII.11.2003 | 10               |
|                                      |                                     | 48°07'21"N 90°51'25"W | V1.6–IX.22.2001  | 794              |
|                                      |                                     | 48°07'40"N 90°50'00"W | VI.13–IX.14.2002   |                  |
|                                      | Wind-disturbed-<br>salvage logged   | 48°07'27"N 90°51'00"W | VII.9–IX.10.2003   | 5,561            |
|                                      |                                     | 48°05'00"N 90°48'12"W | V.31–IX.22.2001  |                  |
|                                      |                                     | 48°05'12"N 90°47'35"W | V.29–IX.14.2002  |                  |
|                                      | Wind-disturbed-<br>prescribe burned | 48°07'51"N 90°51'30"W | VI.4–IX.11.2003  | 10,362           |
|                                      |                                     | 48°07'31"N 90°50'30"W |  |                  |
| Total Number of Adults               |                                     |                       |  | 10,362           |

\* Includes number of adults from both 2002 and 2003.

90°51'50"W, *P. banksiana* undisturbed forests, VIII.3–VIII.27.2000, VIII.4–X.5.2000, VIII.20–X.1.2000 (13); 48°07'12"N 90°50'50"W, *P. banksiana* wind-disturbed forest, VIII.28–X.5.2000 (1); and 48°07'21"N 90°51'25"W, 48°07'27"N 90°51'00"W, *P. banksiana* wind-disturbed salvage-logged forests, VIII.3–IX.30.2000, VIII.4–IX.30.2000, VIII.20–IX.30.2000 (38). We also collected 10,362 specimens of *P. melanarius* in our northeastern Minnesota study site dur-

ing the summers of 2001–2003 in baited and unbaited pitfall traps (Table 1). we collected a total of 10,523 adults. Anoka Co., Carlos Avery Wildlife Management Area, Old Game Farm Road, A.K. Ambourn, 45°19'N 93°07'W, VII.21.2002 (1). Crow Wing Co., Barrows, south of Brainerd, near Hwy. 371, unbaited pitfall trap, K.J.K. Gandhi, 46°24'N 94°08'W, *P. banksiana* forest, VII.25–VIII.8.2002 (1).

*Pterostichus melanarius* is an introduced species from western Europe, and has

achieved a transcontinental distribution in North America (Lindroth 1961–69: 491, Bousquet and Laroche 1993: 174, Will et al. 1995: 66, Purrington et al. 2000: 201). This beetle is associated with disturbed and open habitats such as cultivated agricultural lands and managed forest landscapes (Lindroth 1961–69: 492). It is a generalist predator of economically important pests (Lee 1998), but it also known to feed on conifer seeds (Lindroth 1961–69: 1116). In Minnesota, this species has been reported from Aitkin and Cass Counties (Petrice et al. 2002). Three records in the UMIC (Wright, Aitkin and Ramsey Counties), three records from the NDSIRC (Clay County), one record from KJL (Anoka County), and our collections from Cook County pre-date the report by Petrice et al. (2002). *Pterostichus melanarius* is known to aggressively colonize new habitats. In Minnesota, it has rapidly established populations even in the remote areas of the Superior National Forest, although it was absent in similar forest-types in Ontario (Pearce et al. 2003). We collected 10,523 adults in 2000–2003 indicating the abundance of this species in northeastern Minnesota. It was the most abundant carabid in our survey there. We trapped only one specimen of *P. melanarius* in our survey in central Minnesota.

*Pterostichus permundus* (Say).—Wabasha Co., Lake City, J.R. Powers, IX.3.1961, VIII.20.1962 (3, UCB); Dumfries, J.R. Powers, VI.23.1991 (2, UCB). Clay Co., Moorhead, R.A. Woehl, IX.11.1972 (1, UCB). Redwood Co., Redwood Falls, A.C. Rustand, IX.18.1993 (1, UCB).

#### Tribe Zabrinii

*Amara basillaris* (Say).—Unknown County, O. Lugger (1). Olmsted Co., C.N. Ainslie (1).

*Amara chalcea* Dejean.—Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VII.6.2000, VII.19.2000, (2, KJL).

*Amara coelebs* Hayward.—Big Stone Co., O. Lugger, VII.19.1910 (1). Unknown

Co., unknown collector (1, INHSIC), (7, NMNH). Hennepin Co., O.W. Oestlund (2). Olmsted Co., C.N. Ainslie, May (3); C.N. Ainslie (9). Unknown Co., A. Fenyes (2, CAS). Ramsey Co., W.E. Hoffman, III.21.1922 (1); St. Anthony Park, O. Lugger, H.H. Knight, D. Murray, W.D. Buchanan, and W.E. Hoffman, III.4.1922, III.26.1922, III.28.1920, III.29.1920, V.5.1920, III.23.1937 (18); St. Paul University Farm, W.E. Hoffman and C.E. Mickel, III.27.1922, V.19.1922 (3). Clearwater Co., Lake Itasca, S.A. Graham, VI.7.1923 (1). Lake Co., Two Harbors, M.H. Hatch, VI.29.1927 (1). Hennepin Co., Entomology Class, IV.30.1938 (1). Pope Co., one mile south Sedan, J. Hafsted, IV.29.1961 (1, UCB). Clay Co., Moorhead, B. Wermager, V.3.1961 (2, UCB). Lyon Co., J.T. Bush, IV-13-1963, female specimen, unable to verify species status completely (1, ISU). Traverse Co., two miles north Browns Valley, Lake Traverse, B. Tollefson, VI.20.1974 (1, UCB). Cook Co., Superior National Forest, baited and unbaited pitfall traps, K.J.K. Gandhi, 48°03'30"N 90°32'40"W, *P. tremuloides*/*B. papyrifera* conifer wind-disturbed forest, VI.25-VII.9.2001 (1); 48°03'48"N 90°32'40"W, 48°01'46"N 90°23'53"W, 48°01'45"N 90°24'18"W, *P. tremuloides*/*B. papyrifera* conifer wind-disturbed-salvage-logged forests, VI.7–25.2001, V.28-VII.12.2002 (5); 48°00'30"N 90°25'15"W, 48°05'01"N 90°46'52"W, 48°05'05"N 90°49'17"W, *P. tremuloides*/*B. papyrifera* conifer wind-disturbed-prescribe-burned forests, VI.7-VII.9.2001, V.28-VI.17.2002, V.29-VI.18.2003, VII.14-VIII.18.2003 (10); 48°07'21"N 90°51'25"W, 48°07'27"N 90°51'00"W, *P. banksiana* wind-disturbed-salvage-logged forests, VII.5-VIII.16.2001, VI.27-VII.13.2002, VI.23-VII.9.2003 (5); and 48°05'00"N 90°48'12"W, 48°07'31"N 90°50'30"W, 48°05'12"N 90°47'35"W, 48°04'59"N 90°47'35"W, *P. banksiana* wind-disturbed-prescribe-burned forests, V.31-VI.6.2001, V.29-VIII.12.2002, VI.4-

VIII.27.2003 (23). We collected a total of 44 adults.

*Amara coelebs* ranges from Wisconsin to British Columbia, and south to Colorado (Bousquet and Laroche 1993: 195). It is a prairie species occurring on dry, grassy and sandy areas (Lindroth 1961–69: 725). In our study, it was caught only in the disturbed forest stands.

*Amara crassispina* LeConte.—Hubbard Co., unknown collector, IX.10.1980 (1, KWW).

*Amara ellipsis* (Casey).—Clay Co., Moorhead, J. Allen, IX.15.1980 (1, UCB).

*Amara pallipes* Kirby.—Kanabec Co., Mora, C.R. Yeager, VI.24–30.1934 (1). Anoka Co., Cedar Creek Natural History Area, burned, K.J. Larsen, M. Davis, VII.27.2000 (1, KJL).

*Amara pennsylvanica* Hayward.—Ramsey Co., St. Paul, University Farm lights, S. Kepperley, VII.23.1924 (1). Rock Co., Luverne, C.E. Mickel, IX.13–14.1935 (2). Houston Co., unknown collector, V.23–24.1936 (1).

*Amara torrida* (Panzer).—Otter Tail Co., O. Luggner (3). Martin Co., S.S. Easter, VIII.13.1926 (1). Pope Co., Sedan, D.G. Denning, VII.19.1929 (1). Polk Co., Crookston, light trap, D.G. Denning, VII.19.1935 (1). Ramsey Co., St. Paul, University Golf Course, light trap, A.A. Granovsky, VII.20.1936 (1). Roseau Co., Winaska, on Timothy grass, unknown collector, VIII.13.1982 (5).

*Pseudamara arenaria* (LeConte).—Koochiching Co., emergence trap, L.C. Thompson, VI.14.1972 (1). Cook Co., Superior National Forest, unbaited pitfall trap, K.J.K. Gandhi, 4803'48"N 90°32'40"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed-salvage-logged forest, V.29–VI.18.2003 (1). We collected a total of one adult.

*Pseudamara arenaria* is primarily a northeastern species ranging from New Brunswick to Ontario in the north and West Virginia to Illinois in the south (Bousquet and Laroche 1992:190). It is reported to

be an open-habitat, riparian, and cavernicolous species (Lindroth 1961–69:650).

#### Tribe Pangaeini

*Panagaeus fasciatus* Say.—Hennepin Co., O. Luggner (1). Ramsey Co., St. Anthony Park, O. Luggner (3). Olmsted Co., C.N. Ainslie (2). Clay Co., Bicentennial Prairie, burned dry prairie, P. Tinerella and C. Davis, VII.27.2000 (1, NDSIRC).

#### Tribe Chlaeniini

*Chlaenius erythropus* Germar.—Unknown County, O. Luggner (1). Olmsted Co., C.N. Ainslie (4). Ramsey Co., A.T. Herty, IX.2.1921 (2). Anoka Co., K.S. Liu, V.8.1937 (1). Houston Co., H.E. Milliron, P.M. Schroeder, H.S. Telford, D.G. Denning, C.E. Mickel, M.T. Jen, C. Kohls, E. Thomas, M. Gotschall, H.C. Ma, I. Tarshis, and R.H. Daggy, V.13.1937, V.21.1937, V.22–23.1937, V.24.1937, V.26.1937, V.20.1938 (18). Goodhue Co., unknown collector, V.21.1937 (1). Wabasha Co., H.E. Gustafson, V.21.1937 (1).

*Chlaenius prasinus* Dejean.—Unknown Co., Cliff, (Lake Co., Cliff Lake?) W.E. Hoffman, V.30.1922 (2).

*Chlaenius purpuricollis purpuricollis* Randall.—Red Lake Co., Plummer, off sand near river, D.G. Denning, V.23.1933 (1). We also found 113 specimens of *C. purpuricollis* in the NDSIRC from Clay and Polk Cos. (Bluestem, Blazingstar, and Agassiz Dunes State Natural Areas, Clay County Trust Lands, and Bicentennial Prairie) that had been collected between VII.27.1995 and IX.17.1999 (Tinerella and Rider 2001).

*Chlaenius pusillus* Say.—Olmsted Co., C.N. Ainslie (2).

#### Tribe Licinini

*Badister ocellaris* Casey.—Traverse Co., O.W. Oestlund (1). Ramsey Co., St. Paul, Minnesota Farm, A.A. Granovsky, V.29.1936 (1).

*Dicaelus furvus carinatus* Dejean.—Ramsey Co., St. Anthony Park, O. Luggner

(4). Olmsted Co., May, June, C.N. Ainslie  
(3). Fillmore Co., G. Kohls, IV.24.1927 (1).  
Goodhue Co., Frontenac, W.C. Stehr,  
V.29.1930 (1). Fillmore Co., Preston, S.I.  
Parfin, V.8.1948 (1, NMNH).

#### Tribe Harpalini

*Acupalpus partiaris* (Say).—Lake Co.,  
Two Harbors, beach, M.H. Hatch,  
VI.28.1927 (1). Houston Co., R.H. Daggy,  
V.22.1937 (1). Mille Lacs Co., C.E. Mickel,  
and H.E. Milliron, VI.2.1937, V.10.1970  
(2). Crow Wing Co., C.E. Mickel,  
V.14.1938 (1).

*Anisodactylus agricola* (Say).—Wabasha  
Co., seven miles southwest Wabasha, J.R.  
Powers, V.6.1972 (1, UCB).

*Anisodactylus carbonarius* (Say).—Ram-  
sey Co., St. Anthony Park, O. Lugger (1).  
Olmsted Co., C.N. Ainslie (2).

*Anisodactylus melanopus* (Haldeman).—  
Wabasha Co., Lake City, W.O. Powers,  
V.25.1967 (1, UCB).

*Bradycellus atrimedeus* (Say).—Lac Qui  
Parle Co., Lac Qui Parle Park, E.U. Bals-  
baugh, Jr., IV.16.1967 (2, SDSU).

*Bradycellus badipennis* (Haldeman).—  
Koochiching Co., T160, NR26, WS33, pit-  
fall trap, H.M. Kulman, IX.25-X.13.1971  
(1).

*Bradycellus insulsus* (Casey).—Polk Co.,  
Crookston, Red Lake River, at light and  
malaise trap, unknown collector, VIII.20–  
21.1959, IX.27.1973 (2).

*Bradycellus neglectus* (LeConte).—Kitt-  
son Co., Hallock, N.P. Nichelson,  
VII.15.1941 (1). Polk Co., Crookston, B.A.  
Haws, VII.20.1956 (1). Roseau Co., Roo-  
sevelt, A.G. Peterson, V.15.1969 (1).

*Bradycellus semipubescens* Lindroth.—  
Washington Co., H.E. Milliron, V.7.1938  
(1). Crow Wing Co., Mille Lacs, C.E.  
Mickel, V.8.1940 (1). Koochiching Co.,  
T70N, R24W, S14, H.M. Kulman, VIII.11–  
22.1971 (1). Cook Co., Superior National  
Forest, baited pitfall trap, K.J.K. Gandhi,  
48°07'21"N 90°51'25"W, *P. banksiana*  
wind-disturbed-salvage-logged forest,

VI.5–23.2003 (1). We collected a total of  
one adult.

*Bradycellus semipubescens* ranges from  
Newfoundland to Alberta and southward to  
New York and Michigan (Bousquet and  
Laroche 1993:226). The ecology of this  
species was previously unknown (Lindroth  
1961–69:899), but in recent years it is re-  
ported to be an inhabitant of marsh and  
boggy areas (Liebherr and Song 2002:134).  
In our study sites, it was caught in a sea-  
sonally flooded, wind-disturbed-salvage-  
logged conifer forest.

*Dicheirotichus cognatus* (Gyllenhal).—  
Ramsey Co., St. Paul, University Farm,  
C.T. Schmidt, VIII.27.1926 (1). Lake Co.,  
roots of grass, M.H. Hatch, VI.23.1927 (1).  
Polk Co., Crookston, light trap, D.G. Den-  
ning, IX.23.1936 (1). Itasca Co., Grand  
Rapids, North Central Experimental Re-  
search Station, malaise trap, unknown col-  
lector, V.8.1973 (1). Cook Co., malaise trap,  
F.S. Hovland, IX.28.1973 (1). Clay Co.,  
Moorhead, T.L. Wanless, VI.1.1997 (1,  
UCB).

*Discoderus parallelus* (Haldeman).—  
Jackson Co., Wm. S. Marshall, June 1896  
(2, UWM). Crow Wing Co., Garrison, D.G.  
Denning, VI.8.1935 (16); Garrison, on  
beach, B. Armstrong, VI.8.1935 (1); C.E.  
Mickel, VI.3.1938 (2). Rock Co., Luverne,  
A.E. Pritchard, IX.13–14.1935 (1). Mille  
Lacs Co., C.E. Mickel, VI.2.1937 (1); Mille  
Lacs Lake, R.H. Daggy, VI.2.1935 (3);  
Mille Lacs, unknown collector, VI.2.1935  
(1). Traverse Co., Lake Traverse, six miles  
NE Browns Valley, B. Tollefson,  
VI.10.1974 (1, UCB). Anoka Co., Cedar  
Creek Natural History Area, K.J. Larsen,  
VII.28.2000, VIII.29.2000 (2, KJL).

*Harpalus desertus* LeConte.—Traverse  
Co., Lake Traverse, two miles north of  
Browns Valley, J.R. Powers, VI.10.1974 (1,  
UCB).

*Harpalus ellipsis* LeConte.—Itasca Co.,  
T57, R24, S26, D.E. Rau, VI.1–30.1973  
(1). Carlton Co., Cloquet Forestry Center, 5  
km west of Cloquet, 46°42'25"N,

92°31'35"W, UMN Silviculture Class, VI.01.01 (1).

*Harpalus erythropus* Dejean.—Hennepin Co., O.W. Oestlund (2). Olmsted Co., C.N. Ainslie (3). Unknown Co., unknown collector (1, NMNH). Washington Co., Marine, St. Croix River, unknown collector, V.14.1922 (1). Carver Co., W.E. Hoffman, VII.16.1922 (3). Ramsey Co., St. Paul, at light, S. Kepperley, VII.11.1925 (2); St. Paul, University Farm, C.T. Schmidt, VIII.16.1926 (1). Goodhue Co., Frontenac, W.C. Stehr, V.29.1930 (1). Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VIII.1.2000, VIII.29.2000 (2, KJL).

*Harpalus paratus* Casey.—Big Stone Co., O. Lugger, VII.20.1910 (1). Hennepin Co., O.W. Oestlund (1). Washington Co., Marine, St. Croix River, unknown collector, V.14.1922 (2). Ramsey Co., St. Paul, at light, S. Kepperley, VII.11.1925 (1). Hennepin Co., Fort Snelling, Flood Plain Forest, C.T. Schmidt, V.10.1928 (1); Goodhue Co., C.T. Schmidt, V.29.1930 (1).

*Harpalus ventralis* LeConte.—Crow Wing Co., Barrows, south of Brainerd, near Hwy. 371, unbaited pitfall trap, K.J.K. Gandhi, 46°24'N 94°08'W, *P. banksiana* naturally burned forest, VII.9–18.2002 (1).

*Harpalus ventralis* ranges from North Dakota to Utah and New Mexico (Bousquet and Laroche 1993: 234). It is generally associated with prairie habitats on sandy soils (Lindroth 1961–69: 781–782).

*Selenophorus ellipticus* Dejean.—Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VI.20.2000 (1, KJL).

*Selenophorus hylacis* (Say).—Ramsey Co., St. Paul, A.A. Granovsky, VI.25.1934 (1).

*Stenolophus infuscatus* (Dejean).—Olmsted Co., C.N. Ainslie (1).

*Stenolophus rotundicollis* (Haldeman).—Ramsey Co., Ammunition plant, old field, pitfall trap, M.E. Epstein, VII.29–VIII.5.1980 (1).

#### Tribe Platynini

*Agonum aeruginosum* Dejean.—Unknown Co., O. Lugger (2). Ramsey Co.,

Golf Ponds, W.E. Hoffman, VII.28.1921 (1). Houston Co., unknown collector, V.22.1937 (1).

*Agonum affine* Kirby.—Unknown Co., A. Bolter (2, INHSIC). Ramsey Co., O.W. Oestlund (1); St. Anthony Park, at light, W.E. Hoffman, VI.25.1921 (1); St. Paul, Indian Mounds Park, W.E. Hoffman, V.7.1922 (1); University Farm lights, W.E. Hoffman, VI.10.1922 (1); St. Paul, University Farm lights, W.E. Hoffman, VI.12–13.1922 (1). Hennepin Co., Oak Grove, A.A. Nichol, V.13.1922 (1). Fairbault Co., A. Hertig, W.E. Hoffman, VI.19–20.1922 (2). Nicollet Co., St. Peter, H.H. Holland, VIII.6.1922 (1). Polk Co., Crookston, light trap, D.G. Denning, VI.23.1931 (1). Itasca Co., Itasca Park, at light, C.E. Mickel, VII.4.1939 (1). Cook Co., Superior National Forest, unbaited pitfall trap, K.J.K. Gandhi, 48°08'15"N 90°51'36"W, *P. banksiana* wind-disturbed-salvage logged forest, VII.6–VIII.3.2000 (1). We collected a total of one adult.

*Agonum affine* ranges throughout North America (Bousquet and Laroche 1993: 255). It is a hygrophilous species, associated with vegetation at the margins of standing water (Lindroth 1961–69: 605).

*Agonum moerens* Dejean.—Ramsey Co., St. Paul, University Farm lights, W.E. Hoffman, V.25.1922 (1).

*Agonum nigriceps* LeConte.—Lake Co., Two Harbors, M.H. Hatch, V.30.1927 (1).

*Agonum nutans* (Say).—Ramsey Co., St. Paul, University Golf Course, A.A. Granovsky, VI.26.1936 (1). We also found 31 specimens of *A. nutans* in the NDSIRC from Clay Co. (Bluestem State Natural Area) that had been collected between VI.3.1996 and IX.4.1997 (Tinerella and Rider 2001).

*Agonum trigeminum* Lindroth.—Chisago Co., Center City, H.M. Kulman, VII.21.1972 (1). Chisago Co., Wyoming City, H.M. Kulman, VIII.5.1972 (1). Koochiching Co., H.M. Kulman, T69N R25W S17, VIII.10.1972, IX.12.1972 (15); T70N R25W S14, VIII.10.1972 (3); T70N

R25W S32, VIII.10.1972 (1); T70N R25W S33, VIII.10.1972 (1); T70N R24W S14, VI.20-VII.1.1971, VII.14.1972, VII.28.1972 (4); T70N R24W S14, VII.14.1972, VII.28.1972 (16); T69N R25W S17, VII.14.1972 (2); T70N R25W S32, VII.14.1972 (3); T70N R25W S33, VII.14.1972 (1); T70N R24W S14, VI.30.1972 (21); T70N R25W S33, VI.30.1972 (6); T69N R25W S17, VI.30.1972 (4); and T69N R23W S26, VI.30.1972 (6). Cook Co., Superior National Forest, baited and unbaited pitfall traps, K.J.K. Gandhi, 48°01'45"N 90°24'18"W, *P. tremuloides*/B. *papyrifera*/conifer wind-disturbed-salvage-logged forest, VI.7-VII.26.2001, VIII.19-IX.15.2003 (6); 48°06'29"N 90°50'12"W, *P. banksiana* wind-disturbed forest, X.5.2000 (1); and 48°07'21"N 90°51'25"W, 48°08'12"N 90°50'25"W, 48°07'21"N 90°51'25"W, *P. banksiana* wind-disturbed-salvage-logged forests, V.25-VI.6.2001, VII.5-VIII.2.2001, VII.25-VIII.12.2002, VIII.27-IX.14.2002, VIII.27-IX.10.2003 (5). We collected a total of twelve adults.

*Agonum trigeminum* is an eastern species that ranges from New Brunswick and North Carolina west to Michigan and Wisconsin (Bousquet and Larochelle 1993: 258). In Minnesota, this species has also been reported in Aitkin and Cass counties (Petrice et al. 2002: 9), and Cook county (MacLean 2002). *Agonum trigeminum* is generally associated with vegetation growing at the margins of bodies of water (Lindroth 1961-69: 601).

*Platynus cincticollis* (Say).—Wabasha Co., Lake City, J.R. Powers, VI.4.1970 (1, UCB).

#### Tribe Ctenodactylini

*Leptotrachelus dorsalis* (Fabricius).—Houston Co., C.E. Mickel, V.20.1938 (2).

#### Tribe Cyclosomini

*Tetragonoderus fasciatus* (Haldeman).—Unknown Co., O. Luggar (20). Unknown Co., unknown collector (2, SDSU). Kandi-

yohi Co., O.W. Oestlund (1). Olmstead Co., C.N. Ainslie (4). Ramsey Co., University Farm, St. Paul, at light, A.A. Granovsky, VI.26.1936 (1) and H. Knutsen, IX.2.1937 (2). Goodhue Co., C.E. Mickel, V.27.1939 (1).

#### Tribe Lebiini

*Apenes lucidulus* (Dejean).—Olmsted Co., C.N. Ainslie (1).

*Apristus subsulcatus* (Dejean).—Jackson Co., Wm. S. Marshall (1, UWM). Olmsted Co., C.N. Ainslie (2). Itasca Co., Itasca Park, DeSoto Lake, C.E. Mickel, VI.2.1937 (1). Mille Lacs Co., C.E. Mickel, VI.2.1937 (2).

*Axinopalpus biplagiatus* (Dejean).—Washington Co., Newport, Bailey's Nursery, under apple bark, R.H. Daggy, II.2.1935 (1). Ramsey Co., St. Paul, University Golf Course, light trap, A.A. Granovsky, VII.20.1936 (1). Mille Lacs Co., Mille Lacs Lake, R.H. Daggy, VI.2.1937 (1).

*Calleida purpurea* (Say).—Ramsey Co., St. Anthony Park, O. Luggar (2). Unknown County, O. Luggar (1). Traverse Co., O.W. Oestlund (1). Unknown Co., Stromberg (1, INHSIC). We also found 33 specimens of *C. purpurea* in the NDSIRC from Clay Co. (Clay Co. Trust Lands and Bicentennial Prairie) that had been collected between VIII.15.1996 and VII.30.1999 (Tinerella 2000).

*Cymindis interior* Lindroth.—Anoka Co., Cedar Creek Natural History Area, K.J. Larsen, VIII.1.2000, VIII.16.2000 (2, KJL).

*Cymindis planipennis* LeConte.—St. Louis Co., Duluth, unknown collector (1, INHSIC). Hennepin Co., O.W. Oestlund (1). Traverse Co., O.W. Oestlund (1). Polk Co., D.G. Denning, VII.6.1936 (1). Anoka Co., C.E. Mickel, V.6.1939 (1).

*Cymindis platicollis* (Say).—Olmsted Co., C.N. Ainslie, V.30.1905 (2). Nicollet Co., St. Peter, H.H. Holland, VIII.26.1922 (1). We also found two specimens of *C. platicollis* in the NDSIRC from Norman Co. (Agassiz Dunes State Natural Area) col-



lected on X.13.1997 (Tinerella and Rider 2001).

### Tribe Galeritini

*Galerita bicolor* (Drury).—Goodhue Co., Cannon Falls, on sawdust, W.C. Stehr, IX.28.1929 (1). Houston Co., A.G. Peterson, T. Knigin, I. Tarshis, E. Ivy, O. Elster, C. Reif, P.M. Schroeder, H.E. Milliron, R.H. Daggy, and C.E. Mickel, R. Cottrell, V.22.1936, V.23.1936, V.22.1937, V.20.1938, V.25–26.1940, V.26.1940 (24). Wabasha Co., H.E. Gustafson, V.21.1937 (1). Winona Co., I. Tarshis, V.25.1940 (1).

### DISCUSSION

We present new state records for 100 carabid species from Minnesota collected by us or revealed in our survey of 12 institutional or personal collections (Table 2). We found no new state records and in some cases no specimens from Minnesota at the CDFA, MPM, UCD, and UW. The species that are new state records represent 20 tribes and 43 genera, are reported to inhabit sub-boreal to prairie landscapes (Lindroth 1961–69), and reflect the diversity of landscapes and habitats present within Minnesota (Tester 1995). In our field survey we collected 14 species that have never been reported before from Minnesota in the peer-reviewed literature. Nine of these species had been collected earlier and deposited in museum collections by other workers; four of those nine had also been recently reported in non-peer-reviewed literature (MacLean 2002, Petrice et al. 2002). Thirteen of twenty new records reported by Tinerella (2000), Tinerella and Rider (2001), MacLean (2002), and Petrice et al. (2002) were present in the museum collections surveyed by us or were already reported in the literature. When our results (100 species) are combined with those in monographic works by Bousquet and Laroche (1993) and Downie and Arnett (1996) (326 species), and with the unique collection data from the recent reports noted above (7 spe-

cies), there are now 76 genera and 433 carabid species recorded from Minnesota.

About half (45%) of the new state records from the museum survey represent specimens that have not been collected again since 1950 (Table 2). This may reflect historical differences in collecting intensity in Minnesota vs. other states and provinces. For example, in a recent large-scale study in Iowa, Larsen et al. (2003) reported the collection of small numbers of four species (*Clivina impressifrons*, *Bembidion postremum*, *Chlaenius pusillus*, and *Apenes lucidulus*), which since 1950 have not been collected in Minnesota and deposited in collections. *Chlaenius pusillus* was also recently collected in Wisconsin (Purrington et al. 2000). Alternatively, the long duration since the last collection of certain species may be a consequence of local extinctions resulting from habitat alteration by humans. For example, the large distinctive ground beetle, *Calosoma scrutator*, has not been added to museum collections since 1937, 1939, and 1956, in Minnesota, Wisconsin and South Dakota, respectively, and a live specimen has not been seen in recent years in these areas (G. Noonan, MPM, personal communication). *Calosoma scrutator* is known to be associated with open hardwood forests (Lindroth 1961–69: 46), which have become scarce within the historic range of this beetle in southern Minnesota (Fillmore, Hennepin, Houston, and Ramsey Counties). Local extinctions may have especially occurred for other ground beetle species associated with undisturbed, native habitats such as late-successional forests with large eastern white pines, *Pinus strobus*, or various wetland habitats that are threatened throughout Minnesota (Minnesota Department of Natural Resources 2005).

A number of our newly reported carabid species such as *Carabus sylvosus*, *Elaphrus lecontei*, *Bembidion dorsale*, *B. mutatum*, *B. postremum*, *B. wingatei*, *Poecilus scitulus*, *Amara torrida*, *Bradycellus semipubes-cens*, *Harpalus ventralis*, *Stenoloplus ro-*

Table 2. Summary data for new Minnesota records of ground beetles (Carabidae) representing 100 species, 43 genera, and 20 tribes.

| Tribe                    | Species   | Number of Specimens | Number of Collectors <sup>1</sup> | Number of Counties <sup>1</sup> | Date of First Record <sup>2</sup> | Collections <sup>3</sup> |
|--------------------------|---|---------------------|-----------------------------------|---------------------------------|-----------------------------------|--------------------------|
| Notiophilini<br>Carabini | <i>Notiophilus aquaticus</i> (Linnaeus)             | 4                   | 4                                 | 4                               | V1.28.1927                        | a                        |
|                          | <i>Calosoma affine</i> Chaudoir                     | 2                   | 2                                 | 2                               | VII.20.1936 <sup>4</sup>          | a, d                     |
|                          | <i>Calosoma externum</i> (Say)                      | 3                   | 3                                 | 3                               | VII.6.1921                        | a, d                     |
|                          | <i>Calosoma obsoletum</i> Say                       | 28                  | 9                                 | 12                              | V1.27.1934 <sup>4</sup>           | a, b, f, d               |
|                          | <i>Calosoma scrutator</i> (Fabricius)               | 5                   | 5                                 | 4                               | V1.10.1933 <sup>4</sup>           | a                        |
|                          | <i>Carabus sylvosus</i> Say                         | 6                   | 5                                 | 4                               | VII.2.1928                        | a, d, k                  |
|                          | <i>Carabus vinctus</i> (Weber)                      | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | d                        |
|                          | <i>Scaphinotus fuscicollis</i> (LeConte)            | 11                  | 2                                 | 2                               | V.25.1940 <sup>4</sup>            | a, d                     |
|                          | <i>Sphaeroderus nitidicollis brevoortii</i> LeConte | 148                 | 1                                 | 1                               | VIII.10-IX.29.2000                | a                        |
|                          | <i>Elaphrus lecontei</i> Crotch                     | 2                   | 3                                 | 2                               | V.31.1935                         | a, e                     |
| Elaphrini<br>Clivini     | <i>Clivina americana</i> Dejean                     | 3                   | 3                                 | 3                               | V.23.1920 <sup>4</sup>            | a                        |
|                          | <i>Clivina bipustulata</i> (Fabricius)              | 3                   | 2                                 | 3                               | IV.23.1942 <sup>4</sup>           | a                        |
|                          | <i>Clivina impressifrons</i> LeConte                | 2                   | 1                                 | 1                               | VII.9.1947 <sup>4</sup>           | f                        |
|                          | <i>Dyschirius aeneolus</i> LeConte                  | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|                          | <i>Dyschirius erythrocerus</i> LeConte              | 8                   | 4                                 | 3                               | VIII.11.1925 <sup>4</sup>         | a, i                     |
|                          | <i>Dyschirius frigidus</i> LeConte                  | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|                          | <i>Dyschirius globulosus</i> (Say)                  | 30                  | 12                                | 8                               | V1.23.1927                        | a, e, k                  |
|                          | <i>Dyschirius haemorrhoidalis</i> (Dejean)          | 1                   | 1                                 | 1                               | X.21.1928 <sup>4</sup>            | a                        |
|                          | <i>Dyschirius longulus</i> Dejean                   | 1                   | 1                                 | 1                               | VII.9.1935 <sup>4</sup>           | a                        |
|                          | <i>Dyschirius pumilus</i> (Dejean)                  | 2                   | 1                                 | 1                               | VII.6.2000                        | k                        |
| Trechini<br>Bembidiini   | <i>Dyschirius sellatus</i> LeConte                  | 1                   | 1                                 | 1                               | VII.12.1921 <sup>4</sup>          | a                        |
|                          | <i>Schizogenus lineolatus</i> (Say)                 | 2                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|                          | <i>Trechus crassiscapus</i> Lindroth                | 1                   | 1                                 | 1                               | V.30-VI.18.2003                   | a                        |
|                          | <i>Bembidion coloradense</i> Hayward                | 3                   | 2                                 | 3                               | VII.11.1937                       | a                        |
|                          | <i>Bembidion coxendix</i> Say                       | 4                   | 3                                 | 3                               | VII.12.1921 <sup>4</sup>          | a                        |
|                          | <i>Bembidion dorsale</i> Say                        | 2                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|                          | <i>Bembidion fortestratum</i> (Motschulsky)         | 3                   | 3                                 | 3                               | V1.10-11.1935                     | a, f                     |
|                          | <i>Bembidion inaequale</i> Say                      | 9                   | 7                                 | 6                               | VII.13.1922                       | a, f, h                  |
|                          | <i>Bembidion mutatum</i> Gemminger & Harold         | 60                  | 4                                 | 2                               | V1.24.1997                        | a, e                     |
|                          | <i>Bembidion pedicellatum</i> LeConte               | 2                   | 2                                 | 2                               | VII.12.1920 <sup>4</sup>          | a                        |
| Bembidionini             | <i>Bembidion postremum</i> Say                      | 2                   | 2                                 | 2                               | VII.8.1939 <sup>4</sup>           | a                        |
|                          | <i>Bembidion texanum</i> Chaudoir                   | 13                  | 3                                 | 4                               | VII.23.1922 <sup>4</sup>          | a                        |
|                          | <i>Bembidion transversale</i> Dejean                | 14                  | 3                                 | 2                               | VII.1.1991                        | a, i                     |
|                          | <i>Bembidion wingatei</i> Bland                     | 4                   | 1                                 | 1                               | VII.7-VII.3.2000                  | a                        |

Table 2. Continued.

| Tribe         | Species  | Number of Specimens | Number of Collectors <sup>1</sup> | Number of Counties <sup>1</sup> | Date of First Record <sup>2</sup> | Collections <sup>3</sup> |
|---------------|--|---------------------|-----------------------------------|---------------------------------|-----------------------------------|--------------------------|
| Psydrini      | <i>Paratachys scitulus</i> (LeConte)                 | 4                   | 3                                 | 3                               | V.20.1922 <sup>4</sup>            | a                        |
|               | <i>Nomius pygmaeus</i> (Dejean)                      | 16                  | 4                                 | 3                               | VII.30.1921                       | a, i                     |
|               | <i>Patrobis foveocollis</i> (Eschscholtz)            | 4                   | 2                                 | 2                               | VI.30–VII.10.1971                 | a                        |
|               | <i>Patrobis septentrionis</i> Dejean                 | 2                   | 2                                 | 2                               | V.25–VI.6.1971                    | a                        |
|               | <i>Platypatrobis lacustris</i> Darlington            | 1                   | 1                                 | 1                               | VII.5.2000                        | c                        |
|               | <i>Cyclotrachelus sodalis colossus</i> (LeConte)     | 2                   | 1                                 | 2                               | V.17.1967                         | h                        |
|               | <i>Cyclotrachelus torvus torvus</i> LeConte          | 1                   | 1                                 | 1                               | VI.26.1925 <sup>4</sup>           | a                        |
|               | <i>Gastrellarius lutesus</i> (Say)                   | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|               | <i>Lophoglossus scrutator</i> (LeConte)              | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|               | <i>Poecilus corvus</i> (LeConte)                     | 16                  | 7                                 | 4                               | V.20.1923                         | a, e, h                  |
| Pterostichini | <i>Poecilus scitulus</i> (LeConte)                   | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|               | <i>Pterostichus ebeninus</i> (Dejean)                | 1                   | 1                                 | 1                               | VII.21.1952                       | a                        |
|               | <i>Pterostichus melanarius</i> (Illiger)             | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | f                        |
|               | <i>Pterostichus pennundus</i> (Say)                  | 10,541              | 10                                | 7                               | VIII.26.1990                      | a, e, k                  |
|               | <i>Amara basillaris</i> (Say)                        | 7                   | 3                                 | 3                               | IX.3.1961                         | h                        |
|               | <i>Amara chalconea</i> Dejean                        | 2                   | 2                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|               | <i>Amara coelebs</i> Hayward                         | 2                   | 1                                 | 1                               | VIII.6.2000                       | k                        |
|               | <i>Amara crassispina</i> LeConte                     | 99                  | 17                                | 11                              | VII.19.1910                       | a, b, d, f, h, i         |
|               | <i>Amara ellipsis</i> (Casey)                        | 1                   | 1                                 | 1                               | IX.10.1980                        | l                        |
|               | <i>Amara pallipes</i> Kirby                          | 1                   | 1                                 | 1                               | IX.15.1980                        | h                        |
| Pangaeini     | <i>Amara pennsylvanica</i> Hayward                   | 2                   | 3                                 | 2                               | VI.24–30.1934                     | a, k                     |
|               | <i>Amara torrida</i> (Panzer)                        | 4                   | 2                                 | 3                               | VII.23.1924 <sup>4</sup>          | a                        |
|               | <i>Pseudamara arenaria</i> (LeConte)                 | 12                  | 4                                 | 6                               | VIII.13.1926                      | a                        |
|               | <i>Pangaea fasciatus</i> Say                         | 2                   | 2                                 | 2                               | VI.14.1972                        | a                        |
|               | <i>Chlaenius erythropus</i> Germar                   | 7                   | 4                                 | 4                               | VII.27.2000                       | a, e                     |
|               | <i>Chlaenius prasinus</i> Dejean                     | 28                  | 17                                | 6                               | IX.2.1921 <sup>4</sup>            | a                        |
|               | <i>Chlaenius pusillus</i> Say                        | 2                   | 1                                 | 1                               | V.30.1922 <sup>4</sup>            | a                        |
|               | <i>Chlaenius purpuricollis purpuricollis</i> Randall | 114                 | 3                                 | 3                               | V.23.1933                         | a, e                     |
|               | <i>Badister ocellaris</i> Casey                      | 2                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|               | <i>Dicaelus furvus carinatus</i> Dejean              | 2                   | 2                                 | 2                               | V.29.1936 <sup>5</sup>            | a                        |
| Harpalini     | <i>Acupalpus partitarius</i> (Say)                   | 10                  | 5                                 | 4                               | IV.24.1927 <sup>4</sup>           | a, f                     |
|               | <i>Anisodactylus agricolae</i> (Say)                 | 5                   | 4                                 | 4                               | VI.28.1927 <sup>4</sup>           | a                        |
|               | <i>Anisodactylus carbonarius</i> (Say)               | 1                   | 1                                 | 1                               | V.6.1972                          | h                        |
|               | <i>Anisodactylus melanopus</i> (Haldeman)            | 3                   | 2                                 | 2                               | Unknown <sup>4</sup>              | a                        |
|               | <i>Brachycellus atrinoides</i> (Say)                 | 1                   | 1                                 | 1                               | V.25.1967                         | h                        |
|               | <i>Brachycellus badipennis</i> (Haldeman)            | 2                   | 1                                 | 1                               | IV.16.1967                        | g                        |
|               | <i>Brachycellus badipennis</i> (Haldeman)            | 1                   | 1                                 | 1                               | IX.25–X.13.1971                   | a                        |

Table 2. Continued.

| Tribe          | Species                                      | Number of Specimens | Number of Collectors <sup>1</sup> | Number of Counties <sup>1</sup> | Date of First Record <sup>2</sup> | Collections <sup>3</sup> |
|----------------|--|---------------------|-----------------------------------|---------------------------------|-----------------------------------|--------------------------|
|                | <i>Bradycellus insulsus</i> (Casey)          | 2                   | 1                                 | 1                               | VIII.20-21.1959                   | a                        |
|                | <i>Bradycellus neglectus</i> (LeConte)       | 3                   | 3                                 | 3                               | VII.15.1941                       | a                        |
|                | <i>Bradycellus semipubescentis</i> Lindroth  | 4                   | 4                                 | 4                               | V.7.1938                          | a                        |
|                | <i>Dicheirotichus cognatus</i> (Cyllenbal)   | 6                   | 5                                 | 6                               | VIII.27.1926                      | a, h                     |
|                | <i>Discoderus parallelus</i> (Haldeman)      | 30                  | 8                                 | 6                               | June, 1986                        | a, h, j, k               |
|                | <i>Harpalus desertus</i> LeConte             | 1                   | 1                                 | 1                               | VI.10.1974                        | h                        |
|                | <i>Harpalus ellipsis</i> LeConte             | 2                   | 2                                 | 2                               | VI.1-30.1973                      | a                        |
|                | <i>Harpalus erythropus</i> Dejean            | 16                  | 7                                 | 7                               | V.14.1922                         | a, f, k                  |
|                | <i>Harpalus parvus</i> Casey                 | 7                   | 4                                 | 5                               | VII.20.1910 <sup>4</sup>          | a                        |
|                | <i>Harpalus ventralis</i> LeConte            | 1                   | 1                                 | 1                               | VII.9-18.2002                     | a                        |
|                | <i>Selenophorus ellipticus</i> Dejean        | 1                   | 1                                 | 1                               | VI.20.2000                        | k                        |
|                | <i>Selenophorus hylacis</i> (Say)            | 1                   | 1                                 | 1                               | VI.25.1934 <sup>4</sup>           | a                        |
|                | <i>Stenolophus infuscatus</i> (Dejean)       | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|                | <i>Stenolophus rotundicollis</i> (Halderman) | 1                   | 1                                 | 1                               | VII.29-VIII.5.1980                | a                        |
| Platynini      | <i>Agonum aeruginosum</i> Dejean             | 4                   | 2                                 | 2                               | VII.28.1921 <sup>4</sup>          | a                        |
|                | <i>Agonum affine</i> Kirby                   | 14                  | 9                                 | 7                               | VI.25.1921                        | a, i                     |
|                | <i>Agonum moerens</i> Dejean                 | 1                   | 1                                 | 1                               | V.25.1922 <sup>4</sup>            | a                        |
|                | <i>Agonum nigriceps</i> LeConte              | 1                   | 1                                 | 1                               | V.20.1927 <sup>4</sup>            | a                        |
|                | <i>Agonum nitans</i> (Say)                   | 32                  | 3                                 | 2                               | VI.26.1936                        | a, e                     |
|                | <i>Agonum trigeminum</i> Lindroth            | 97                  | 2                                 | 3                               | VII.21.1972                       | a                        |
|                | <i>Platynus cincticollis</i> (Say)           | 1                   | 1                                 | 1                               | VI.4.1970                         | h                        |
| Ctenodactylini | <i>Leptotrachelus dorsalis</i> (Fabricius)   | 2                   | 1                                 | 1                               | V.20.1938 <sup>4</sup>            | a                        |
| Cyclosomini    | <i>Tetragonoderus fasciatus</i> (Haldeman)   | 31                  | 6                                 | 4                               | VI.26.1936 <sup>4</sup>           | a, g                     |
| Lebiini        | <i>Aprenes lucidulus</i> (Dejean)            | 1                   | 1                                 | 1                               | Unknown <sup>4</sup>              | a                        |
|                | <i>Apristus subsulcatus</i> (Dejean)         | 6                   | 3                                 | 4                               | VI.2.1937 <sup>4</sup>            | a, j                     |
|                | <i>Axinopalpus bipagiatus</i> (Dejean)       | 3                   | 2                                 | 3                               | II.2.1935 <sup>4</sup>            | a                        |
|                | <i>Calleida purpurea</i> (Say)               | 38                  | 4                                 | 3                               | VIII.15.1996                      | a, e, i                  |
|                | <i>Cymindis interior</i> Lindroth            | 2                   | 1                                 | 1                               | VIII.1.2000                       | k                        |
|                | <i>Cymindis planipennis</i> LeConte          | 5                   | 3                                 | 5                               | VII.6.1936                        | a, i                     |
|                | <i>Cymindis platicollis</i> (Say)            | 5                   | 4                                 | 3                               | V.30.1905                         | a, e                     |
| Galeritini     | <i>Galerita bicolor</i> (Drury)              | 27                  | 13                                | 4                               | IX.28.1929 <sup>4</sup>           | a                        |

<sup>1</sup> Records where either the collector or the county was unknown are not included in these columns.

<sup>2</sup> If the only specimen record had an unknown date, this information is included in the date of first record column as 'Unknown'. Based on our historical knowledge of the collectors, these specimens with unknown dates were all likely collected prior to 1940. If other specimens with known dates were discovered during our survey, any records with unknown dates were omitted from the date of first record column.

<sup>3</sup> a: UMIC, b: CAS, c: GPB, d: ISU, e: NDSIRC, f: NMNH, g: SDSU, h: UCB, i: INHSIC, j: UWM, k: KJL, l: KWW

<sup>4</sup> There are no collection records of these 45 ground beetle species after 1950.

*tundicollis*, *Agonum trigeminum*, and *Cymindis planipennis* have been documented in the literature from states and provinces adjacent to Minnesota such as Iowa, North Dakota, Ontario, South Dakota, and Wisconsin (Bousquet and Laroche 1993, Purrington and Larsen 1997, Purrington and Maxwell 1998, Purrington et al. 2000, Werner and Raffa 2000, Larsen et al. 2003). A number of other newly reported species for Minnesota such as *Notiophilus aquaticus*, *Bembidion inaequale*, *B. mutatum*, *Patrobus foveocollis*, *P. septentrionis*, *Dicheirotrichus cognatus*, and *Agonum affine* have transcontinental distributions. Hence, it is not surprising that species such as these were eventually found in Minnesota. This likely also reflects an historically uneven effort in the collection of ground beetles among states.

Our collecting in the sub-boreal forests of northern Minnesota has extended considerably the ranges of *Sphaeroderus nitidicollis brevoorti* and *Trechus crassiscapus* within the United States, and also has extended the ranges of *Bembidion wingatei*, *Patrobus septentrionis*, *Pterostichus melanarius*, and *Agonum trigeminum* within the state. Previously, these latter four species were collected by others from southern and central Minnesota (records in UMIC, Petrice et al. 2002). Hence, it appears that these species are associated with both the central deciduous and northern coniferous/deciduous forest biomes.

From our museum survey, *Pterostichus melanarius* has been present in Minnesota at least since 1990. It was recorded in 1993 in Iowa (Winneshiek Co.) (Purrington and Larsen, 1997), in 1990 in southern Minnesota (Wright Co., UMIC), and in 1995 in western Minnesota (Clay Co., NDSIRC). We suspect that it appeared in Minnesota even earlier because it had been documented in adjacent states in the upper Midwest and in Ontario and Manitoba (Lindroth 1961–69, Bousquet and Laroche 1993, Will et al. 1995). For example, *P. melanarius* was collected as early as 1948 in Fort

William in western Ontario (Lindroth 1961–69), 1956 in Winnipeg in Manitoba (Lindroth 1961–69), and 1980 in Milwaukee, Washington, and Waushara Counties in Wisconsin (records from MPM). In Michigan, the species had become evident in urban and agricultural habitats to the extent that it was noted in the extension literature as a generalist predator of economically important pests (Lee 1998). In a 1996–1997 study on the Michigan-Wisconsin border, *P. melanarius* was the fourth most abundant of the 59 species of Carabidae collected in mixed northern hardwood forest sites (Werner and Raffa 2000). Hladilek (2003) reported that in 2000 it occurred at approx. 5% of all ground beetles trapped in pitfall traps placed in a wheat field in east-central Minnesota. Furthermore, we have trapped *P. melanarius* in extremely high numbers in the Superior National Forest, suggesting that a long enough time interval had transpired to allow it to colonize a relatively remote and northern portion of Minnesota.

In 2001–2003, *Pterostichus melanarius* was most active in northern Minnesota between mid-July and mid-August (Table 1 and Gandhi et al. unpublished data). This seasonal activity pattern is similar to that reported for populations of *P. melanarius* in a wheat field in east-central Minnesota (peaked in late June) (Hladilek 2003), the boreal-prairie transition forests in Canada (Cárcamo et al. 1995, Niemelä et al. 1997), and hemlock-northern hardwood forests in Michigan and Wisconsin (peaked in late July to mid-August) (Werner and Raffa 2003). In northern Minnesota, *P. melanarius* was most prevalent in prescribed-burned forest sites that had experienced previous wind disturbance and salvage logging (Table 1). This suggests that recently disturbed areas in the sub-boreal forests may be colonized aggressively by exotic species. We do not know if the response of *P. melanarius* was dictated simply by the burning that occurred at these sites or by the combination of the three disturbances (wind, salvage logging, burning). We also do not

know whether *P. melanarius* will displace other native species, e.g., the congener *P. coracinus* Newman, within this sub-boreal forest habitat (Werner and Raffa 2003).

Our trapping and museum survey have increased the generic and species records of carabids in Minnesota by 21% and 31%, respectively. This underscores how little known the local historical and current distributions of Carabidae are in some areas of North America. Purrington et al. (2000) summarized increases in known state carabid fauna of 4% (Illinois), 4% (Wisconsin), and 7% (Iowa). Furthermore, Werner and Raffa (2000) reported only one new state record for both Michigan and Wisconsin in a collection of 47,590 adult carabid beetles. In Minnesota, we have documented an increase in the species list that is almost an order of magnitude greater than that of Purrington et al. (2000) and Werner and Raffa (2000), and this emphasizes the need for both further field collections and careful examination of museum collections on a regional basis.

We find it significant that a number of these genera and species, although collected, identified, and deposited in museums in the earlier part of the last century, remained undocumented in literature. *Patrobus septentrionis*, *Poecilus corvus*, *Amara crassipina*, *Chlaenius purpuricollis purpuricollis*, *Harpalus paratus*, *Agonum nutans*, *Platynus cincticollis*, *Calleida purpurea*, and *Cymindis platicollis* (all collected between 1905 and 1980 and present in our museum survey) were recently reported to be new state records by Tinerella (2000: 193), Tinerella and Rider (2001: 319), MacLean (2002: 6), and Petrice et al. (2002: 9). *Pterostichus tenuis* (Casey), another new record reported by Petrice et al. (2002: 9), actually had been previously documented in Minnesota by Downie and Arnett (1996: 149), and was also collected in our field study in northeastern Minnesota. Since these museum specimens were collected and deposited much earlier than when these studies were conducted, we stress the importance of ac-

cessing the identified and unidentified material at local and regional museums prior to reporting new state species records. This approach will ensure an enhanced and more accurate understanding of species distributions for future workers. In addition, the time and effort expended in collection and curation by previous workers will be recognized.

#### CONCLUSIONS

We document the occurrence of 13 previously unreported genera and 100 previously unreported species of Carabidae in Minnesota, and report a major range extension for one species in the United States and for four species within Minnesota. Further, we describe the seasonal activity and numerical dominance of *P. melanarius* in remote sub-boreal forest sites in northern Minnesota, suggesting that newly disturbed areas in these forests may be colonized by invasive species. The results of our field and museum surveys should stimulate and provide the basis for future biodiversity studies of carabids in Minnesota. Our study underscores the significant benefits of academic insect collections that act as repositories of distributional, ecological, and taxonomic information about species present in native landscapes. In the future, we hope that researchers will take greater advantage of such insect collections, and that the universities and other institutions will receive greater funding and resources to improve and maintain their collections for studies such as ours.

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