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GROUND BEETLES FROM A REMNANT OAK-MAPLE-BEECH FOREST AND ITS SURROUNDINGS IN NORTHEASTERN OHIO (COLEOPTERA: CARABIDAE)[1]

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ABSTRACT

We report 66 ground beetle species in 14 tribes from a natural preserve in northeastern Ohio (Stark County). Six species are new state records. Data from pitfall trap transects across adjoining habitats suggest narrow habitat preferences in some species and broad tolerances in others.

Trends toward flightlessness in forest species and macroptery in the fauna of disturbed agricultural sites are apparent.

Ground beetles (Coleoptera: Carabidae) are well represented in North America and can comprise an important invertebrate component of terrestrial communities in a wide range of habitats (e.g., Boiteau 1983, Thiele 1977). The family's dramatic adaptive radiation often reflects a fine-grained pattern of habitat preference which has led to several studies focused on niche partitioning (Liebherr 1988, Loreau 1988, McKee 1986, Wallin 1986). By sampling across sharply distinctive adjoining habitats we expected to find evidence that the carabid fauna is segregated on the basis of such habitat characteristics as local plant assemblages and stability of moisture and temperature regimes. We had an opportunity to sample carabids at a site where an old-growth upland forest representing a stable environment abutted highly disturbed agricultural areas.

Darlington (1943, 1970) analyzed carabid brachyptery in relation to island habitats and montane refugia. While he presented a very complex discussion of the interaction of invader species, geographical latitude, habitat size, etc., he concluded that flightlessness is an evolutionary outcome of resource predictability. We hypothesized that the relatively stable conditions in the old-growth forest would favor a flightless fauna by reducing the importance of vagility.

COLLECTING SITE

Stark County is located in NE Ohio on the Appalachian Plateau. We collected at The Wilderness Center, Wilmot in Sugar Creek township in the SW corner of the county. This

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site was entirely glaciated, although it lies only a few km N of the terminal moraine of the final Wisconsin glaciation (Delong and White 1963). The soil association at the Center is predominantly Canfield-Wooster: well drained and formed on till deposited upon Pennsylvanian (Pottsville) sandstone (Christman et al. 1971). Annual precipitation is ca. 91 cm (National Weather Service, Akron-Canton Airport 30 yr average).

Upland forest co-dominants at the collecting site are red and white oaks, sugar maple, and beech (*Quercus rubra, Q. alba, Acer saccharum,* and *Fagus grandifolia,* respectively). This forest fragment contains large, overmature trees, and although grazed by cattle and lumbered occasionally over the years, it is most likely a credible remnant of the original pre-Columbian forest (G. Maupin pers. comm.). Co-dominant trees on less well drained areas include pin oak, shagbark hickory, red maple, American elm, and white ash (*Q. palustris, Carya ovata, A. rubrum, Ulmus americana,* and *Fraxinus americana,* respectively). In addition to forested areas, the preserve includes small impoundments, rills, old field habitat, and adjacent agricultural zones.

MATERIALS AND METHODS

We sampled with pitfall traps using a 1:1 mixture of water and ethylene glycol. During each trapping period in 1987 and 1988, traps were spaced 10 m apart along four parallel linear transects in both upland and lowland forest, through a hay meadow into corn (1987), or from lowland forest directly into corn and oats (1988). We trapped for 72 h on three occasions in the 1987 season and twice in 1988. For each trapping bout we used a total of 80 traps along the same four transects.

In addition to carabids from our pitfall trapping, we have added hand-capture records obtained by us and Richard M. Ritter (whose collection is housed at the preserve site in Stark County). Our records are represented by voucher specimens in our collections at the Ohio Agricultural Research and Development Center, Wooster, Ohio.

We have followed Lindroth's (1961–1969) classification, with minor adaptations (Erwin et al. 1977) and revisions and additions evident in Shrock's (1985) checklist of Indiana Carabidae. The Ritter collection and ours include a few undetermined species of *Lebia,* species in the Amarini, and Bembidiini that are not included in this paper.

RESULTS AND DISCUSSION

We collected 66 carabid beetle species in 14 tribes from the preserve collection site (Table 1); six species are new state records, confirmed by checking the compilation of North and Central American species by Erwin et al. (1977), Dury (1902), Wright and Whitehouse (1941), Everly's (1927) list of Columbus, Ohio carabids, and reports by Brust et al. (1986a, 1986b).

Table 1.—Carabidae from The Wilderness Center, Wilmot, Ohio with collection date; RMR = Ritter collection.

Cicindelini	
Cicindela sexguttata (F.) 3-V-81 RMR	
Cicindela punctulata Olivier 18-VII-88	
Cychrini	
Sphaeroderus stenostomus Weber 12-IX-88	
Sphaeroderus lecontei Dejean 12-VI-87	
Nebriini	
Nebria pallipes Say 9-IX-82 RMR	
Notiophilini	
Notiophilus aeneus Herbst 18-XII-77 RMR	state record

Notiophilus novemstriatus LeConte 18-XI-79 RMR
Notiophilus semistriatus Say 9-IX-88

Elaphrini

Elaphrus ruscarius Say 10-V-84 RMR

Scaritini

Clivina bipustulata (F.) 24-V-88
Clivina impressifrons LeConte 6-VI-80 RMR
Scarites substriatus Haldeman 18-VII-88
Scarites subterraneus F. 12-VII-83 RMR

Patrobini

Patrobus longicornis Say 24-V-88

Pterostichini

Myas coracinus Say 18-VII-88
Pterostichus adoxus (Say) 18-VII-88
Pterostichus chalcites Say 18-VII-88
Pterostichus coracinus Newman 9-IX-88
Pterostichus femoralis Kirby 29-IX-82 RMR
Pterostichus honestus Say 12-IX-88
Pterostichus lucublandus Say 9-IX-88
Pterostichus mutus Say 12-IX-88
Pterostichus ohionis Csiki 24-V-88
Pterostichus stygicus Say 18-VII-88
Cyclotrachelus sodalis (LeConte) 18-VII-88
Abacidus hamiltoni Horn 18-VII-88
Abacidus permundus (Say) 18-VII-88
Calathus gregarius Say 18-VII-88
Synuchus impunctatus (Say) 18-VII-88 — state record
Agonum crenistriatum (LeConte) 18-VII-88
Agonum cupripenne (Say) 12-VI-87
Agonum placidum (Say) 18-XII-77 RMR
Agonum puncticeps Casey 18-VII-88 — state record
Agonum punctiforme (Say) 18-VII-88
Platynus decentis Say 24-V-88
Platynus hypolithos (Say) 18-VII-88

Harpalini

Harpalus bicolor (F.) 18-VII-88
Harpalus caliginosus (F.) 18-VII-88
Harpalus pensylvanicus DeGeer 18-VII-88
Trichotichnus vulpeculus (Say) 12-X-88
Anisodactylus discoideus Dejean 12-VII-83 RMR
Anisodactylus harrisi LeConte 18-VII-88
Anisodactylus nigrita Dejean 9-IX-82 RMR — state record
Anisodactylus rusticus Say 24-V-88
Anisodactylus sanctaecrucis F. 18-VII-88
Amphasia interstitialis (Say) 18-VII-88
Amphasia sericea (Harris) 19-VI-81 RMR
Xestonotus lugubris (Dejean) 23-XI-80 RMR
Notiobia nitidipennis (LeConte) 9-IX-88
Bradycellus atrimedeus (Say) 24-V-88
Bradycellus badipennis (Haldeman) 13-IV-80 RMR
Bradycellus rupestris Say 31-VIII-79 RMR
Stenolophus comma F. 18-VII-88 — state record
Stenolophus ochropezus (Say) 12-VII-83 RMR
Acupalpus pauperculus (Dejean) 8-VI-82 RMR — state record

(continued)

Licini
Dicaelus elongatus Bonelli 24-V-88
Dicaelus teter Bonelli 18-VII-88
Chlaeniini
Chlaenius aestivus Say 14-VII-87
Chlaenius brevilabris LeConte 26-VII-75 RMR
Chlaenius emarginatus Say 23-XI-80 RMR
Chlaenius pusillus (Say) 18-VII-88
Chlaenius sericeus Forster 24-V-88
Chlaenius tricolor Dejean 18-VII-88
Ctenodactylini
Leptotrachelus dorsalis F. 6-VI-80 RMR
Odacanthini
Colliuris pensylvanica (L.) 4-IV-88
Lebiini
Callida punctata LeConte 13-VI-82 RMR

Table 2.—Carabid pitfall trap captures on 2 dates in 1988 (The Wilderness Center, Wilmot, Ohio) showing correlations between wing condition and habitat preference in 19 species.[2]

	FOREST SITE CAPTURES			AGRICULTURAL SITE CAPTURES			HABITAT PREFERENCE	WINGS/ FLIGHT Macropterous +
CARABID SPECIES	18 July	9 Sept	Total	18 July	9 Sept	Total	Cornfield: C Forest: F	Micropterous − Dimorphic ±
Cicindela punctulata				45	33	78	C	flies
Scarites substriatus				2	2	4	C	flies
Patrobus longicornis	4	3	7		17	17	Both	±
Myas coracinus	6	3	9		1	1	F	−
Pterostichus chalcites				18	34	52	C	flies
Pterostichus coracinus	5		5				F	−
Pterostichus lucublandus	7	6	13	32	43	75	Both	+
Pterostichus stygicus	19	9	28		6	6	Both	−
Cyclotrachelus sodalis	33		33	28	26	54	Both	−
Abacidus hamiltoni	11	4	15		1	1	F	−
Abacidus permundus	55	26	81	31	200	231	Both	−
Calathus gregarius	4	19	23		4	4	Both	−
Synuchus impunctatus	3	5	8				F	±
Platynus hypolithos	9	2	11	3	24	27	Both	−
Harpalus bicolor				4	3	7	C	flies
Harpalus pensylvanicus	10		10	44	157	201	C	flies
Anisodactylus sanctaecrucis				15	2	17	C	flies
Amphasia interstitialis	4		4				F	+
Stenolophus comma				6	2	8	C	flies

*Microptery precludes flight; macropterous forms may or may not fly (flight is confirmed in some cases, here noted); dimorphic forms present locally variable wing conditon; *P. lucublandus* has "probably non-functional" wings (Lindroth 1961–1969).
[2]Flight capability and wing condition data from Blatchley (1910), Lindroth (1961–1969), and from our records.

The relation of brachyptery to habitat choice for the 19 carabids most abundant in our samples is shown in Table 2, with capture data from mid- and late summer trapping periods. We identified seven agricultural-site species, all of which are macropterous, and five forest-site species of which three are wingless, one is dimorphic and one is macropterous (although there is no record that it can fly). The remaining seven species were captured regularly in both habitats and are predominantly flightless. Assignment of carabid species to habitat type was made on the basis of capture frequency (90% or more trapped in one habitat defined ''preference''). Our data support Darlington's (1970) observation that environmental stability favors winglessness, and that a disturbed environment selects for flight capability. We see compelling evidence for both trends in the carabid fauna we collected.

Severe drought at the site in 1988 sharpened habitat distinctions during the first trapping period, but rains eventually reduced the atypical water stress prior to the second trapping bout in early September. Effects of this habitat amelioration are suggested by comparing July and September captures of the micropterous eurytopic species *Abacidus permundus*, *Cyclotrachelus sodalis*, and *Platynus hypolithos*. These species colonized the agricultural zone after the drought had been broken.

We captured a few other species (Table 1) that tend to support the notion of a flightless stable-zone fauna and a winged disturbed-zone fauna. For example, the flightless species, *Dicaelus teter* and *D. elongatus* appear to be strict forest carabids and are flightless (our data, Lindroth 1961–1969). *Agonum crenistriatum*, *A. punctiforme*, and *Chlaenius pusillus* can fly and appear to represent principally disturbed-habitat species (our data, Brust et al. 1986a, Lindroth 1961–1969). Whether the carabid fauna of the stable tall-grass prairie habitat (remnants of which persist in NE Ohio) reflects the brachyptery we noted in carabids of stable old-growth forest, or whether it is more like the macropterous fauna of more open, disturbed habitats invites inquiry. While interactions of niche attributes and brachyptery in carabids are certainly quite complex, we predict that further study at sites with sharply contrasting adjacent habitats will generate more evidence to support the trends we have noted.

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LITERATURE CITED

Blatchley, W. S. 1910. An illustrated descriptive catalogue of the Coleoptera or beetles known to occur in Indiana. Bull. Ind. Dept. Geol. Nat. Resources, 1. 1386 pp.

Boiteau, G. 1983. Activity and distribution of Carabidae, Arachnida, and Staphylinidae in New Brunswick potato fields. Can. Entomol. 115:1023–1030.

Brust, G. E., B. R. Stinner, and D. A. McCartney. 1986a. Predation by soil inhabiting arthropods in intercropped and monoculture agroecosystems. Agric. Ecosystems Environ. 18:145–154.

Brust, G. E., B. R. Stinner, and D. A. McCartney. 1986b. Predator activity and predation in corn agroecosystems. Environ. Entomol. 15:1017–1021.

Christman, R. L., D. D. Waters, and J. R. Bauder. 1971. Soil survey of Stark County, Ohio. Government Printing Office, Washington, D.C. 157 pp.

Darlington, P. J., Jr. 1943. Carabidae of mountains and islands: data on the evolution of isolated faunas, and on atrophy of wings. Ecol. Monogr. 13:37–61.

Darlington, P. J., Jr. 1970. Carabidae on tropical islands, especially the West Indies. Biotropica 2:7–15.

Delong, R. M. and G. W. White. 1963. Geology of Stark County. Bull. Div. Geol. Surv., Ohio Dept. Nat. Resources, 61. 209 pp.

Dury, C. 1902. A revised list of the Coleoptera observed near Cincinnati, Ohio, with notes on localities, bibliographic references, and description of new species. J. Cincinnati Soc. Nat. Hist. 20:107–196.

Erwin, T., D. R. Whitehead, and G. E. Ball. 1977. Family 4. Carabidae, the ground beetles. *In:* Checklist of the beetles of North and Central America and the West Indies. Biol. Res. Inst. Am.; World Digest Publ., Kinderhook, New York. 68 pp.

Everly, R. T. 1927. A check list of the Carabidae of Columbus, Ohio, and vicinity. Ohio J. Sci. 27:155–156.

Liebherr, J. K. 1988. Gene flow in ground beetles (Coleoptera: Carabidae) of differing habitat preference and flight-wing development. Evolution 42:129–137.

Lindroth, C. H. 1961–1969. The ground-beetles (Carabidae excl. Cicindelinae) of Canada and Alaska, Pt. 1–6. Opusc. Entomol., Suppl. 20, 24, 29, 33, 34, 35, Lund. 1192 pp.

Loreau, M. 1988. Determinants of the seasonal pattern in the niche structure of a forest carabid community. Pedobiologia 31:75–87.

McKee, J. 1986. The Carabidae (Col.) of Unst, Shetland. Entomol. Mon. Mag. 122:243–248.

Schrock, J. R. 1985. Checklist of adult carabid beetles known from Indiana. Proc. Ind. Acad. Sci. 94:341–356.

Thiele, H. -U. 1977. Carabid beetles in their environments: a study on habitat selection by adaptations in physiology and behaviour. Zoophysiol. Ecol. 10:1–369.

Wallin, H. 1986. Habitat choice of some field-inhabiting carabid beetles (Coleoptera: Carabidae) studied by recapture of marked individuals. Ecol. Entomol. 11:457–466.

Wright, J. F. and J. Whitehouse. 1941. Additions to the list of Cincinnati Coleoptera. Bull. Brooklyn Entomol. Soc. 36:69–73.