Cicindela

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NOTICE: The mailing date for Vol. 33 (1-2), containing the description of *Cicindela waynei* Leffler, was 3 Aug 2001.

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Cicindela limbalis limbalis Klug. Photographed at Sussex, Waukesha County, Wisconsin, by Matt Brust, March 1998.

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Manuscripts dealing with any aspect of the study of Cicindelidae will be considered from any author. All manuscripts should be submitted on diskette [see *CICINDELA* 26(3-4):47-48 for conventions and format] with an accompanying hard-copy. Papers dealing with areas other than the Nearctic are especially solicited but should be in English. Translations are also very welcome. All manuscripts will be acknowledged upon receipt. Proofs-for-correction will be sent to authors for quality control. Illustrations, charts, graphs, *etc.*, are encouraged. Authors that have institutional or other funds available for publication purposes are importuned to arrange for at least partial payment of publication costs. Current page charges are shown inside the back cover. Separates, without cover, may be available at cost, *if ordered in advance*. Separates ordered after-the-fact cannot be honored. Current prices for separates are listed inside the back cover.

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NATURAL HISTORY OF THE TIGER BEETLES OF NORTH AMERICA NORTH OF MEXICO

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ABSTRACT. A summary of the ecology, biology, dispersal power, and conservation status is presented for the 215 tiger beetle taxa (Carabidae: Cicindelini) from North America north of Mexico.

INTRODUCTION

Among the beetle groups, the Cicindelini is one of the best-known geographically in North America north of Mexico (Boyd and Associates 1982; Bousquet and Larochelle 1993; Pearson *et al.* 1997; Freitag 1999). Although a vast amount of data has been gathered on the natural history of this group, it has only been partially published (Wickham 1899; Leng 1902; Willis 1967; Pearson 1988; Knisley and Schultz 1997; Leonard and Bell 1998; Freitag 1999). An increasing demand for more precise information on tiger beetle biodiversity prompted the authors to present a more comprehensive overview of the ecology, biology, dispersal power, and conservation status of all North American cicindeline taxa (5 *Amblycheila* taxa; 4 *Megacephala* taxa; 8 *Omus* taxa; 198 *Cicindela* taxa).

This natural history is dedicated to the past and actual editors of the *CICINDELA* journal: R.L. Huber, R.C. Graves, H.L. Willis, and R. Freitag. Their exceptional dedication to this quarterly has consecrated it as the main source of information on Nearctic tiger beetles.

METHODS

The present work is a summary of field data collected by the senior author since 1968 and, more recently, by the junior author, together with information from the scientific literature, insect collections, and communications by colleagues. Information is presented in a manner similar to that of previous authors (*e.g.*, Lindroth 1945, Koch 1989, Knisley and Schultz 1997).

The section on ecology comprises the following: ecological trends, adult habitat, larval habitat, diel activity, thermoregulatory behavior, sociability, and species association.

Although all cicindelid larvae appear to be fossorial, the indication "fossorial" has been applied only to cases for which the burrow is known.

The section dealing with biology gives details on seasonality, life patterns, mating, oviposition, larval life, pupation, tenerality, overwintering, feeding, predation, parasitism, defense mechanism, and teratology.

The section on dispersal power is concerned with wing condition and general locomotion.

Finally, the conservation status of threatened or rare taxa is indicated.

Tiger beetles are here considered a tribe within the Carabidae following Bousquet and Larochelle (1993). Readers are, however, referred to Freitag (1999) for the taxonomic status of most taxa, also to Kritsky and Horner (1998), for the following taxonomic changes: *C. tranquebarica moapana*, *C. tranquebarica lassenica* and *C. tranquebarica inyo* are junior synonyms of *C. tranquebarica parallelonota*; *C. tranquebarica roguensis* and *C. tranquebarica borealis* are junior synonyms of *C. tranquebarica vibex*; *C. arida* is a valid species distinct from *C. tranquebarica*; *C. cibecuei* Duncan is a subspecies of *C. tranquebarica*.

Table I. Two-letter abbreviations of geographic entities covered in this paper.

AB	Alberta
AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
BC	British Columbia
CA	California
CO	Colorado
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
LB	Labrador
MA	Massachusetts
MB	Manitoba
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
NB	New Brunswick
NC	North Carolina
ND	North Dakota
NE	Nebraska
NF	Newfoundland
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NS	Nova Scotia
NT	Northwest Territories
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma
ON	Ontario
OR	Oregon
PA	Pennsylvania
PE	Prince Edward Island
PM	St. Pierre and Miquelon
QU	Quebec
RI	Rhode Island
SC	South Carolina
SD	South Dakota
SK	Saskatchewan
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming
YT	Yukon Territory

Taxa are listed alphabetically to provide quicker access to information. Unless otherwise stated, all data refer to the adult stage. Abbreviations for States, Provinces or Territories covered in this paper, are presented in Table I. A selection of the major papers dealing with the natural history of North American tiger beetles and a glossary of technical terms are also provided.

NATURAL HISTORY

Amblycheila baroni Rivers, 1890

Ecology. Stenotopic, saxicolous, xerophilous, pholeophilous, crepuscular, epigean-fossorial (adult); fossorial (larva). Woodland (juniper, oak) canyons and craggy montane peaks: base of cliffs and boulders. Somewhat shaded ground; dry rocky soil. Larval habitat: A woodland canyon. Crepuscular; hides during the day in self-constructed burrows, rodent burrows, rarely under large stones or logs. Gregarious.

Biology. Seasonality: June, July (mostly), September. Third-instar larvae: July. Adult food, in the laboratory: tenebrionid adults and larvae, drosophilid flies, and other insects. Larval food, in the laboratory: tenebrionid larvae. Larval parasites: bombyliid flies. Defense mechanism: Retreating to deep rocky fissures when disturbed. Best collected by bait trapping or pitfall trapping.

Dispersal power. Subapterous. Slow runner.

Amblycheila cylindriformis (Say, 1823)

Ecology. Eurytopic, steppicolous, xerophilous, pholeophilous, myrmecophilous, crepuscular, epigean-fossorial (adult); fossorial (larva). Banks, cliffs, gullies, ravines, ditches, and river bluffs situated in hilly prairies, grasslands, cultivated lands, and pastures. Open

ground; sloping, well-drained, dry, clayey (rarely sandy or rocky), bare or sparsely vegetated soil. Adults tend to walk at night in the vicinity of animal burrows or mesquite clumps, near the bases of or along the sides of clay banks. Larval habitat: Dry, clay banks and cliffs, often near mammal burrows; larval burrows (35-97.5 cm deep) nearly vertical for about 45 cm, turning to a subhorizontal position in their lower part; each larval colony limited to a 25 cm radius and usually consisting of 2 to 11 individuals. Nocturnal, mostly crepuscular; occasionally active on warm cloudy afternoons; usually hiding in the daytime and on cold days in self-constructed burrows, rodent burrows (gopher, kangaroo rat, badger), rattlesnake burrows, ant mounds, sometimes in yucca clumps and under stones or other objects; larva coming near the soil surface after sundown or earlier on cloudy days. Associated species: *Pasimachus* (carabids) and *Eleodes* (tenebrionids).

Biology. Seasonality: May-September; in KS, mostly June. Summer species. Mating: May. Oviposition: Groups of one to two dozen eggs deposited near the soil surface. Third-instar larvae: May and August. Omnivorous, predaceous, necrophagous. Adult food, in the field: caterpillars, acridid nymphs, cerambycids, scarabaeids, tenebrionids, ants, spiders, dead insects, carrion, and dried yucca petals. Noise of individuals shredding yucca petals can be heard at quite a distance. Adults sometimes cannibalistic. Adult food, in the laboratory: caterpillars, locusts, other insects, and fresh meat. Larval food, in the field: Ants and other insects (*e.g.*, an adult *Cicindela*). Sight very poor. Predators: skunks, birds, and spiders. Defense mechanism: immediately retreating underground when emerging from its burrow and seeing movement; making no attempt to escape when disturbed outside of its burrow; sometimes delivering a painful bite when captured. Best collected with a flashlight in the earliest part of a warm, calm evening or by barrier pitfall trapping. Not shy.

Dispersal power. Subapterous. Slow runner. When on the move, raising body very high and keeping the antennae in constant motion.

Note. Before it was known to be nocturnal, the species was considered a rarity and commonly valued at 15 to 20 dollars each; for instance, the type of the beetle was sold for $300 by Thomas Say, and the second specimen, captured about 20 years later, was purchased for $50. By trading several hundreds specimens of this valuable tiger beetle as high as 25 dollars each, the well-known Professor F.H. Snow of the University of Kansas at Lawrence, the discoverer of its favorite haunt, was able both to consolidate an important general beetle collection at his university, and provide his collecting students a substantial amount of money to cover their university expenses for a whole year. As soon as the nocturnal habits of this species became known to the public, the price immediately went down to 50 cents per specimen.

Amblycheila hoversoni Gage, 1991

Ecology. Stenotopic, silvicolous, psammophilous, pholeophilous, nocturnal, epigean-fossorial (adult). Mostly scrublands; also rangelands. Mostly shaded ground; well-drained, moist or dry, sandy soil mixed with silt and clay. Nocturnal; active after midnight; hiding during the day in animal burrows and leaf litter.

Biology. Seasonality: April-November, except June. Predaceous. Adult food, in the field: adult and larvae of camel crickets, spiders, and other arthropods. Adult food, in the laboratory: caterpillars, crickets, beetles, millipedes, and centipedes. Predators: various birds.

Dispersal power. Subapterous. Slow runner.

Amblycheila picolominii Reiche, 1839

Ecology. Stenotopic, xerophilous, saxicolous, epigean. Rocky areas. Open ground; bare, dry, rocky soil. Nocturnal; seen active at dusk.

Biology. Seasonality: April-July.

Dispersal power. Subapterous. Slow runner.

Amblycheila schwarzi W. Horn, 1903

Ecology. Stenotopic, deserticolous, xerophilous, nocturnal, epigean (adult); fossorial (larva). Desert mountains, canyons, and bases of hills. Open ground; well-drained, dry, sandy, rocky or stony soil with sparse vegetation. Nocturnal; also seen foraging at dusk; especially active the night following midafternoon rains; hiding during the day under flat sandstone rocks. Solitary.

Biology. Seasonality: March-September. Two peaks of activity: March-May, August (CA). Duration of life cycle: 6 years. Predaceous. Adult food, in the laboratory: tenebrionids. Very poor sight.

Dispersal power. Subapterous. Slow runner.

Cicindela abdominalis Fabricius, 1801

Ecology. Stenotopic, silvicolous, xerophilous, psammophilous, thermophobous, epigean (adult); thermophobous, fossorial (larva). Pine barrens, sand hills, and scrublands: roads, paths, openings, and edges. Shaded or half-shaded ground; well-drained, dry, sparsely vegetated, white sandy soil often blackened by dead lichens, small twigs, pine needles, bud scales or by fires. Adults tend to occur close to low grass or lichens. Larval habitat: along a roadside; burrows (about 62.5 cm deep) dug into hard-packed soil. Nocturnal; remaining active during the day when raining; often hiding on hot days in shaded areas grown with lichens. Larva closes its burrow in response to increased temperature. Solitary or occurring in small groups. Associated species: *C. gratiosa* and *C. punctulata punctulata*.

Biology. Seasonality: March-November, mostly July; in SC, May-October. Summer species. Oviposition: August. Duration of larval life: Possibly 1 year. Predators: asilid flies. Defense mechanism: cryptic coloration - body color and size blending perfectly with the mosaic formed by blackened areas of dead lichens, pieces of fallen wood, cryptogamic soil or charcoal lying on white sand; flash

coloration - exposing its orange abdomen when flying to deter predators; flying only short distances, usually 5 to 10 m, when disturbed; producing defensive secretions and a strong scent when seized.

Dispersal power. Macropterous. Weak flier. Attracted to artificial lights at night. Fast runner. A colonizer of disturbed areas.

Conservation status. Sometimes threatened by the destruction of its preferred habitat, *e.g.*, the disappearance of open areas in pine barrens due to fire suppression which favors the regeneration of the ground vegetation.

Cicindela amargosae amargosae Dahl, 1939

Ecology. Stenotopic, hygrophilous, halophilous, epigean. Salt flats and vicinity of natural springs. Open ground; moist, dark, muddy, saline, grassy soil. Diurnal; active even on very windy days.

Biology. Seasonality: April (mostly), May-June. Mating: May.

Dispersal power. Macropterous. Fast runner.

Conservation status. Rare species.

Cicindela amargosae nyensis Rumpp, 1956

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Edges of small rivulets; mud flats along rivers; river beds and vicinity of lake shores. Open ground; mostly wet, muddy, alkaline soil. Adults tend to occur among patches of short grasses. Diurnal. Gregarious.

Biology. Seasonality: April-August. Defense mechanism: Flying only a short distance when disturbed. Rather wary.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela ancocisconensis T.W. Harris, 1852

Ecology. Stenotopic, riparian, psammophilous, thermophobous, epigean (adult); fossorial (larva). Banks and bars of rivers (mostly) and brooks, preferably with clear, clean running water. Usually close to the water's edge, but sometimes within 60 m of it on upper banks

and adjoining roads, paths, and fields. Open ground; moist or dry sand, sometimes mixed with silt, clayey or loamy, often with a few scattered stones, bare or sparsely vegetated with tall grass. Larval habitat: burrows usually dug into sandy-loamy soil, often far from the water's edge. Adult and larva able to survive high water floods. Diurnal; shuttling between the water's edge and the dry upper banks during the hottest part of the day; sheltering in late afternoon for the night on upper banks in self-constructed burrows dug among grass; hiding on cloudy days on brook banks, under stones, boards, and twigs. Semi-gregarious. Associated species: *C. repanda repanda* and *C. duodecimguttata*.

Biology. Seasonality: April-September, mostly May-June, with a 3-week gap in midsummer when the adult disappears. Spring-fall species. Duration of life cycle: Possibly 2-3 years. Mating: April-June; coitus lasting 3 min. Oviposition: "Spring" (WV). Tenerals: August (NH, QU). Overwintering both in the adult and larval stages. Predaceous. Adult food, in the laboratory: ants, carabids, wasps, and earthworms. Defense mechanism: cryptic coloration - body color blending perfectly with the surrounding moist sand; running among the tall grass when alarmed; flying readily when pursued, usually rather low and 1 to 2 m away from starting point. Wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Conservation status. Threatened species (OH).

Cicindela arenicola Rumpp, 1967

Ecology. Stenotopic, xerophilous, psammophilous, thermophilous, heliophilous, epigean (adult); thermophobous, fossorial (larva). Sand dunes. Open ground; well-drained, dry, sandy soil, bare or sparsely vegetated. Larval habitat: flattened, bowled-shaped portions of sand dunes; burrows (42 cm deep on average) usually dug into bare, sandy soil; larva active from April to June and September to November; burrows usually closed between July-September, i.e., during the hot, dry months. Diurnal; active on sunny, warm

(19-45°C) days; hiding on windy, cloudy or rainy days.

Biology. Seasonality: April-June, August-November. Spring-fall species. Duration of life cycle: 2-4 years. Mating: April. Oviposition: April. Pupation: August. Tenerals: August-September. Overwintering both in the adult and larval stages, in burrows dug into the sand. Predaceous. Larval food, in the laboratory: Mealworms. Very wary. Hard to capture when the sand gets hot.

Dispersal power. Wing condition unknown. Fast runner.

Conservation status. Rare species, threatened by habitat loss and grazing by cattle, which has a significant effect on larval mortality.

Cicindela arida A.C. Davis, 1928

Ecology. Stenotopic, riparian, hygrophilous, epigean. Stream margins. Open ground; moist, muddy, grassy soil. Adult tending to occur mostly near the green grass. Diurnal; seen foraging in midmorning. Gregarious. Associated species: *C. nevadica nevadica*, *C. hemorrhagica hemorrhagica*, and *C. tenuisignata*.

Biology. Seasonality: March, August, October. Spring-fall species. Defense mechanism: flying only short distances, then immediately returning to the water's edge when pursued. Not very wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela belfragei (Sallé, 1877)

Ecology. Eurytopic, steppicolous, heliophilous, epigean. Grasslands, sodded fields, hilltops, slopes, vacant lots, roadside ditches, roadsides, river and brook banks. Adult seasonally changing its habitat, from hilltops in early season to watercourses in August. Open ground; moist or dry, sandy or loamy, sparsely vegetated or bare soil. Adult tending to occur among weeds. Diurnal; active at all hours, but mostly between 2:00 P.M. and 5:00 P.M., on both sunny and cloudy days,

Biology. Seasonality: May-August.

Dispersal power. Subapterous. Fast runner. Long-distance disperser.

Cicindela bellissima bellissima Leng, 1902

Ecology. Stenotopic, coastal, xerophilous, psammophilous, epigean (adult); fossorial (larva). Sand dunes, mostly along the sea shore. Open ground; shifting, rather dry, sandy soil sparsely vegetated or bare. Larval habitat: Same as the adult; burrow mouth becoming filled with drifting sand. Diurnal; active between 10:00 A.M. and 3:00 P.M., preferably between 24 and 27°C. Larva being nocturnal, mostly crepuscular. Solitary. Associated species: *C. oregona oregona*.

Biology. Seasonality: April-September, with emergence peak in late summer-early fall. Mating: May. Tenerals: June-July. Defense mechanism: Reluctant to fly unless disturbed, then flying nearly straight upward 30 to 60 cm from its starting point.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela bellissima frechini Leffler, 1979

Ecology. Stenotopic, xerophilous, psammophilous, epigean (adult); fossorial (larva). Coastal foredunes and deflation plains. Open ground; rather dry, sandy, bare or sparsely vegetated soil. Larval habitat: Burrows (second and third instars) ranging from 12.7 to 20 cm in depth. Diurnal. Solitary.

Biology. Seasonality: September. Tenerals: September.

Dispersal power. Macropterous. Fast runner.

Cicindela blanda Dejean, 1831

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, epigean. Banks and bars along large blackwater rivers (mostly) and brooks. Open ground; wet, white, mostly sandy, sometimes clayey or muddy, bare soil; moving to higher adjoining trails when stream banks become flooded . Diurnal; active even when raining. Gregarious,

swarming by the hundreds. Associated species: *C. wapleri, C. repanda repanda,* and *C. hirticollis hirticollis*.

Biology. Seasonality: May-September, mostly June-July. Summer species. Mating: July, even in the rain. Tenerals: July. Defense mechanism: cryptic coloration - body color, with its extended white maculations, blending perfectly with the white sand; flying farther and harder to capture than *C. wapleri* when pursued. Quite wary.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela californica mojavi Cazier, 1937

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, epigean. Tidal marshes and adjacent beaches, shores of saline lakes and playas; muddy salt flats. Open ground; wet, sandy or muddy, saline soil. Both diurnal and crepuscular. Gregarious, occurring in large numbers.

Biology. Seasonality: July, September-October. Mating: May. Defense mechanism: When pursued, escaping by short flights.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela californica pseudoerronea Rumpp, 1958

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Salt flats and alkali flats along river beds and natural spring streamlets. Open ground; moist or wet, muddy soil. Diurnal and crepuscular.

Biology. Seasonality: April-June.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela cazieri Vogt, 1949

Ecology. Stenotopic, silvicolous, xerophilous, epigean. Limestone scrub woodlands; edges and dirt sides of a highway. Open ground; dry soil consisting of limestone. Diurnal. Associated species: *C. schauppii.*

Biology. Seasonality: October. Very wary.

Dispersal power. Wing condition unknown. Fast runner.

Conservation status. Rare species.

Cicindela celeripes LeConte, 1848

Ecology. Eurytopic, steppicolous, xerophilous, epigean. Grasslands, prairie hillsides, clay hilltops, sand hills, prairie bluffs, gullies, sides of railroad embarkments, forest paths, and vicinity of streams. Open ground; dry, usually consisting of clayey or sandy loam, sometimes sand, bare or vegetated with short grass or scattered grass clumps. Diurnal. Solitary.

Biology. Seasonality: May-August, mostly July. Summer species. Mating: July. Defense mechanism: When pursued, skillfully escaping capture by running through the vegetation and hiding under grass clumps; when captured, producing defensive secretions. Quite wary. Very difficult to approach.

Dispersal power. Subapterous. Fast runner, moving like a large ant.

Cicindela chlorocephala smythi E.D. Harris, 1913

Ecology. Stenotopic, coastal, psammophilous, epigean. Sea beaches. Open ground; wet sandy soil. Diurnal. Associated species: *C. dorsalis venusta.*

Biology. Seasonality: June.

Dispersal power. Macropterous. Fast runner.

Conservation status. Rare subspecies.

Cicindela circumpicta circumpicta LaFerté-Sénectère, 1841

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophobous, epigean. Sea beaches, tidal flats, estuarine flats, margins of ocean inlets, lagoons edges, salt flats along lake shores,

alkali flats along streams, ponds, and lakes; edges of drainage ditches. Open or shaded ground; wet, muddy, often saline, bare soil. Both diurnal and crepuscular; hiding under cover in hot sunshine. Associated species: *C. severa severa*, *C. togata togata*, *C. hamata monti*, *C. ocellata rectilatera*, and *C. pamphila*.

Biology. Seasonality: May-October; in NE, mostly June-July. Summer species. Predaceous. Adult food, in the field: acridids.

Dispersal power. Macropterous. Good flier. Often attracted to artificial lights at night. Fast runner.

Cicindela circumpicta johnsonii Fitch, 1857

Ecology. Eurytopic, hygrophilous, halophilous, thermophobous, heliophilous, epigean (adult); fossorial (larva). Salt flats, tidal flats, salt marshes; saline banks of rivers, brooks, alkaline drainage ditches, roadside ditches, small salty spots in fields and pastures; alkaline flats of river banks and lake shores; small alkaline grassy areas in prairies. Preferably close to the water's edge. Open ground; mostly wet, occasionaly dry, saline, often muddy soil more or less mixed with clay or sand, with bare spots surrounded by clumps of vegetation. Adult tending to occur in bare areas close to grass fringes. Larval habitat: Sloping brook banks, in the vicinity of hummocks among low vegetation, and margins of small flats; burrows (third instar) vertical, ranging from 11 to 29.5 cm in depth. Both diurnal and nocturnal, often crepuscular; hiding during the hottest part of the day and on cool days under dried cow chips and in the shade of grass clumps; inactive at about 36°C. Gregarious. Associated species: *C.fulgida fulgida*, C. *nigrocoerulea nigrocoerulea*, *C. nevadica knausii* and *C. togata globicollis*.

Biology. Seasonality: June-September, mostly June-July. Summer species. Duration of life cycle: 2 years. Mating: June (NE), often at night. Oviposition: In a saline pool; female depositing a single egg in each ovipositional hole. Pupation: Lasting 18-22 days. Predaceous. Adult food, in the laboratory: house fly larvae.

Predators: Kestrels. Larval parasites: trombidiid mite larvae.

Dispersal power. Macropterous. Often attracted to artificial lights at night. Fast runner.

Cicindela circumpicta pembina Johnson, 1993

Ecology. Epigean. A small salt flat. Open ground; dark saline soil. Diurnal.

Biology. Seasonality: June-August, mostly July. Defense mechanism: Body color blending with dark surroundings; escape by flying but returning to open areas after a while when disturbed.

Dispersal power. Macropterous. Good flier. Fast runner.

Conservation status. Rare species.

Cicindela columbica Hatch, 1938

Ecology. Stenotopic, psammophilous, thermophilous, epigean. Bars, beaches, and sand dunes along big rivers. Open ground; moist or dry sandy soil. Diurnal; quite active in hot weather. Gregarious. Associated species: *C. hirticollis couleensis*, *C. oregona oregona*, *C. repanda repanda*, and C. *hemorrhagica hemorrhagica*.

Biology. Seasonality: April-October, except July. Spring-fall species. Tenerals: August. Extremely wary.

Dispersal power. Macropterous. Fast runner.

Conservation status. Species threatened by the construction of dams along the Columbia River.

Cicindela cuprascens LeConte, 1852

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, epigean (adult); fossorial (larva). Beaches, bars, and flats along rivers and brooks. Usually close to the water's edge, but sometimes up to 6 m away from it. Open ground; moist or wet bare soil usually consisting of sand, but occasionally of mud or loam. Larval habitat: In burrows which are ragged at their edges or with crater-like entrances. Both diurnal and nocturnal. Gregarious. Associated species: *C. hirticollis*

shelfordi, *C. nevadica knausii*, *C. cursitans*, *C. macra macra*, and *C. repanda repanda*.

Biology. Seasonality: May-October, mostly July. Summer species. Duration of life cycle: 2 years. Mating: June-July. Oviposition: July; female digging many ovipositional holes in the sand, then depositing a few eggs in each. Larva migrating to a moister, cooler place when the soil gets too dry. Pupation: May. Overwintering in the larval (second and third instars) stage. Predaceous. Adult food, in the field: carabids, heterocerids, and dipterous larvae. Adult and larval food, in the laboratory: Lean meat. Defense mechanism: Cryptic coloration - body color blending with the background. Best captured in the daytime, even without a net, or at night, with a light trap or a flashlight. Not wary.

Dispersal power. Macropterous. Often attracted to artificial lights after dark. Fast runner.

Cicindela cursitans LeConte, 1857

Ecology. Eurytopic, riparian, hygrophilous, halophilous, epigean. Vicinity of rivers and streams, at 0.7 m to 50 m from the water's edge; also salt flats and roadside ditches. Open or slightly shaded ground; moist or wet, clayey, loamy or sandy (yellow sand), sometimes saline, sparsely vegetated soil. Diurnal. Solitary. Associated species: *C. duodecimguttata*, *C. terricola terricola*, *C. cuprascens*, and *C. macra macra*.

Biology. Seasonality: June-August, mostly June-July. Summer species. Mating: Lasting 5-15 min. (9-10 min. on average). Oviposition: Female digging many holes (about 4-6 mm deep) in the ground, then depositing a single egg in each hole. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: drosophilid flies, ants, leafhoppers, and tenebrionids. Defense mechanism: Escape by running. Wary. Difficult to approach.

Dispersal power. Flightless. Fast runner, moving like an ant.

Cicindela debilis Bates, 1890

Ecology. Stenotopic, steppicolous, psammophilous, epigean. Grasslands; hollows in pastures; sandy fields. Open ground; half-moist or dry, often sandy soil densely vegetated with grass. Larval habitat: grasslands; burrows dug into loamy or clayey soil. Diurnal; foraging and shuttling to shade at 30.2°C and 32.3°C respectively (AZ); active about 7 hours per day. Gregarious. Associated species: *C. hornii hornii*, *C. lemniscata lemniscata*, and *C. sedecimpunctata sedecimpunctata*.

Biology. Seasonality: July-November. Predaceous. Adult food, in the laboratory: adult and larval tenebrionids, flies, and other insects. Predators: lizards. Defense mechanism: either hiding at the base of grass clumps or escaping by short erratic flights less than 1 m long when pursued.

Dispersal power. Macropterous. Weak flier. Fast runner.

Conservation status. Threatened species (AZ); rapidly decreasing in grasslands.

Cicindela decemnotata Say, 1817

Ecology. Eurytopic, steppicolous, xerophilous, thermophilous, heliophilous, epigean. Roadsides, roadcuts, dirt paths, and cow paths. Open ground; dry, clayey, sandy, gravelly or silty soil with sparse grass or sagebrush clumps. Diurnal; usually sunning on warm soil. Solitary. Associated species: *C. longilabris laurentii*, C. *purpurea audubonii,* and *C. nebraskana.*

Biology. Seasonality: March-July, September-October. Spring-fall species. Mating: May-June; copulation lasting a brief period. Overwintering at least as in the adult stage. Defense mechanism: generally seeking cover through the vegetation rather than alighting again in the open. Adults being quite aggressive to each other in the laboratory. Very wary. Difficult to approach.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela denikei Brown, 1934

Ecology. Stenotopic, silvicolous, epigean (adult); fossorial (larva). Coniferous forests: along openings and roads. Open ground; soil consisting of sandy-silty till, more or less covered with mossy patches. Larval habitat: burrows (third instar, 10-20 cm deep) opening directly under rocks or stones in silty-sandy till with a good amount of gravel and stones. Diurnal; hiding during cloudy days under moss.

Biology. Seasonality: May-September, mostly June-July. Oviposition: each female lays 3.7 eggs per day on average. Tenerals: August. Pupation: August. Predaceous. Adult and larval food, in the laboratory: tenebrionid adults and larvae. Defense mechanism: Escape by flight.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela denverensis Casey, 1897

Ecology. Stenotopic, steppicolous, epigean. Sloping banks, eroded banks, sloped banks, eroded gullies, and roadcuts in short-grass prairies. Open or partly shaded ground; sloping, dry or moist, clayish, sparsely vegetated soil. Diurnal. Gregarious. Associated species: *C. scutellaris scutellaris* and *C. splendida.*

Biology. Seasonality: February-June, September-November, but mostly April-May. Spring-fall species. Mating: May. Interspecific copulation observed with *C. splendida*. Tenerals: late fall. Adult food, in the laboratory: mealworms, other insects, and small earthworms. Defense mechanism: escape by strong flight. Very wary. Difficult to approach.

Dispersal power. Macropterous. Excellent flier. Fast runner.

Cicindela depressula depressula Casey, 1897

Ecology. Eurytopic, hygrophilous, epigean. Grasslands, meadows, forest

clearings, roads, roadcuts, trails, and parking lots. Open ground; wet, bare or sparsely vegetated soil consisting of loam, clay, gravel or sandy pumice. Diurnal. Gregarious. Associated species: *C. longilabris perviridis.*

Biology. Seasonality: May-October. Defense mechanism: produces defensive secretions to deter predators.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela depressula eureka Fall, 1901

Ecology. Stenotopic, coastal, riparian, hygrophilous, psammophilous, epigean. River banks and bars. Open ground; moist, sandy soil. Diurnal. Associated species: *C. oregona oregona.*

Biology. Seasonality: April-July, September.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela dorsalis dorsalis Say, 1817

Ecology. Stenotopic, coastal, hygrophilous, psammophilous, halophilous, thermophobous, epigean (adult); fossorial (larva). Intertidal zone of sea beaches and barrier islands. Close to the water's edge. Open ground; wet, sandy, bare soil. Larval habitat: Mid-intertidal zone to several meters above the strand line, in an area ranging from 3 to 8 m in width; burrows (third instar, 20-30 cm deep) straight and highly aggregated. Diurnal (mostly) and nocturnal; less active on windy, cool or rainy days; tending to occur in early morning on dry sand of back beach, then moving to wet areas near the water's edge to stilt and sunface to avoid excessive heat. Extensive pale elytral maculations reduce excess body heat. Larva closes its burrow when the temperature increases, when the sand dries or when the rising tide approaches the burrow level; larval burrow staying open at night, except at high tide. Gregarious, occurring in great swarms.

Biology. Seasonality: April-October, mostly July. Summer species. Duration of life cycle: 1-2 years. Mating: mostly in late afternoon and during the night, lasting 6.1 min. on average; contact guarding

often exhibited by the male after copulation. Oviposition: in the upper intertidal zone, in self-constructed burrows (5-8 cm deep) dug at night. Duration of larval life: 1-2 years. Pupation: June. Tenerals: June. Overwintering in the larval (second or third instars) stage. Predaceous, necrophagous. Adult food, in the field: small amphipods, insects, dead fish, crabs, and other carrion. Adult food, in the laboratory: tenebrionid adults and larvae, meat, and pieces of apple. Larval food, in the field: Small amphipods. Predators: asilid flies and lycosid spiders. Parasites: tiphiid wasps (on larvae); also mites found associated with adult body. A larval population was substantially diminished by flooding and erosion caused by a storm (MD). Defense mechanism: cryptic coloration - body color, with its extended white maculations blending perfectly with the wet, white sand or the shell debris on beaches; when disturbed, runs about one meter, then stops, and so alternately; when pursued, flies for short distances, alights in the surf and then returns in the foam to the shore, and then usually escapes. Extremely wary. Best captured with a flashlight at night. Elytral markings disappear under the wearing action of the sand as the season moves forward, hence individuals become immaculate late in the season.

Dispersal power. Macropterous. Good flier. Often attracted to artificial lights at night. Fast runner. Long-distance disperser; able to move up to 10-15 miles from its breeding site.

Conservation status. Threatened subspecies, almost entirely extinct from the Northeast; dramatically declining due to truck and dune-buggy traffic, stabilization of beaches, housing developments, camping, and oil-slicks.

Cicindela dorsalis media LeConte, 1857

Ecology. Stenotopic, coastal, hygrophilous, psammophilous, halophilous, epigean (adult); fossorial (larva). Sea beaches. Open ground; wet, sandy, bare soil. Adults tend to occur between the lower and middle beach areas. Larval habitat: burrows (30-45 cm deep) dug into clean sand, outside of shrubs; probably inundated by the highest tides. Both diurnal and nocturnal; becoming active at 9:00 A.M. and being everywhere at 9:30 A.M. (SC). Gregarious, although less than *C. dorsalis dorsalis*; sometimes swarming by the hundreds. Associated species: *C. marginata.*

Biology. April-October, mostly July. Summer species. Duration of life cycle: Possibly 1 year. Duration of copulation: 6.2 min. on average. Tenerals: May-July. Adult food, in the laboratory: tenebrionids and meat. Defense mechanism: cryptic coloration - body color darker than *C. dorsalis dorsalis* and blending perfectly with the dark backsoil consisting of abundant shell debris; escape by flying when pursued. Mimics the tabanid fly, *Aegialomyia psammophila;* same resting position, wing color markings, body size, and habitat. Wary. Difficult to approach.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Conservation status. Threatened subspecies extirpated at both the southern and the northern limits of its geographic distribution due to heavy vehicular and pedestrian traffic.

Cicindela dorsalis saulcyi Guérin-Méneville, 1840

Ecology. Stenotopic, coastal, hygrophilous, psammophilous, halophilous, epigean (adult); fossorial (larva). Sea beaches. Open ground; wet, bare soil consisting of fine white sand. Diurnal. Larval habitat: burrows dug into moist sandy beaches. Gregarious, occurring in swarms.

Biology. Seasonality: April, June-August, October, but mostly July-August. Escape by flying. Moderately wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela dorsalis venusta LaFerté-Sénectère, 1841

Ecology. Stenotopic, coastal, hygrophilous, psammophilous, halophilous, epigean (adult); fossorial (larva). Sea beaches. Close to the

water's edge. Open ground; wet, sandy, bare soil. Larval habitat: burrows (30-45 cm deep) dug in clean, moist sand, outside of shrubs, and seemingly inundated by the highest tides. Diurnal. Solitary or semi-gregarious.

Biology. Seasonality: April-September. Defense mechanism: escape by flying long distances, sometimes often 50 m long.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela duodecimguttata Dejean, 1825

Ecology. Eurytopic, riparian, psammophilous, hygrophilous, halotolerant, thermophobous, heliophilous, epigean (adult) fossorial (larva). Banks and bars along slow-moving rivers and brooks; edges of pools and ponds; lake shores, roadside ditches; sand pits and gravel pits even with temporary waters; roads, paths, openings, and wet spots situated in marshes, sloughs, bogs, and wet meadows; alkali flats and mud flats. Open ground; horizontal to steep, dark, wet, sometimes alkaline, bare or almost bare soil consisting of sand (often mixed with humus), clay, mud or, more rarely, fine gravel. Larval habitat: vertical slopes of stream banks; highly aggregated burrows (third-instar, 6-10 cm deep) dug into humus, clay or sand; larva leaves its burrow when the soil gets too dry, in search of sufficiently moist situations. Mostly diurnal; tends to occur on dry upper banks in early morning, then moves to moist areas of stream edges during the hottest part of the day; hides for the night and on cloudy days in self-constructed burrows or under dead leaves. Gregarious, though less than *C. repanda repanda* with which it occurs.

Biology. Seasonality: March-October, with stragglers in midsummer. Spring-fall species. Duration of life cycle: 2 years. Mating: May-July; copulation lasting 2.8 min.; interspecific copulation observed with *C. repanda repanda* and *C. oregona oregona*. Oviposition: in clayey areas of stream edges. Pupation: August.Tenerals: July-August. Overwinters both in the adult and larval stages, in burrows

situated 1 to 4 m from the water's edge; adult burrows (15-50 cm deep) dug into stream or pond banks consisting of dry sand, clay, gravel or humus; larval burrows (15-30 cm deep) dug in similar habitat. Predaceous, necrophagous. Adult food, in the field: dead insects, small flies, and pygmy mole crickets. Adult food, in the laboratory: mealworms, flies, an ant, and lean meat. Larval food, in the laboratory: lean meat. Predators: flycatchers and asilid flies. Hibernating larvae and adults sometimes dying from habitat flooding. Defense mechanism: cryptic coloration - elytral color blends with the wet sand or sand covered with mud; produces a musky scent when captured; escapes by flying and running when pursued; flies on average within 2.16 m, at the slightest disturbance. Wary. Difficult to approach.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner. Seen swimming several times across small pools. Early to colonize new construction sites.

Cicindela fera Chevrolat, 1834

Ecology. Stenotopic, riparian, psammophilous, hygrophilous, halotolerant, epigean. River banks and sand bars, sea beaches, and drainage ditches. Open ground; wet, sandy (mostly) or muddy, sometimes saline soil. Diurnal.

Biology. Seasonality: August.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela formosa formosa Say, 1817

Ecology. Stenotopic, xerophilous, psammophilous, thermophilous, heliophilous, epigean (adult); fossorial (larva). Sand dunes, sand hills, blowouts, flats, banks, ditches, roads, and forested dunes (cottonwood). Open ground; well-drained, dry, sandy soil sparsely vegetated with grass or weeds. Adults tend to occur at the edges of sand dunes and blowouts, among the vegetation close to fringing bare areas or near the stems of sparse vegetation. Larval habitat:

Sand dunes; burrows (about 33 cm deep) vertical, with a pit similar to that of *C. formosa generosa,* also used for trapping small insects. Diurnal; becoming active at 15-20°C; usually very active, hunting and flying in the hot sunshine, between 9:30 A.M. and 12:20 P.M.; lighter morph with more extensive pale maculations, spends less time digging to escape the heat than dark morph. Gregarious, occurring in large numbers. Associated species: *C. scutellaris scutellaris* and *C. lengi lengi.*

Biology. Seasonality: March-October. Generally a spring-fall species with a gap in August, a summer species in NE. Mating: April-June. Coitus lasts 7-10 min.; interspecific copulation with *C. scutellaris rugata*. Larva closes its burrow in the summer. Pupation: August (TX). Overwinters in burrows (adult, 10-30 cm deep; larva, up to 3 m deep) dug into the sides of sand dunes. Adult sometimes slow to emerge in the spring due to the slow heating of deeper sand. Predaceous. Adult food, in the field: ants, acridids, carabids, and other insects. Predators: asilid flies. Defense mechanism: escapes by flying, usually not very far (6.44 m on average) and soon returns to its plant cover. Very wary; takes alarm easily.

Dispersal power. Macropterous. Regular, strong flier; when flying, it produces a loud buzz like that of a bumblebee. Fast runner. Agile.

Cicindela formosa generosa Dejean, 1831

Ecology. Stenotopic, xerophilous, psammophilous, thermophobous, heliophobous, epigean (adults); fossorial (larva). Sand dunes, sand hills, blowouts, swales, old sand pits, fields, little-used roads, and open paths; trails, paths, roads, open spots, and clearings through scrublands and forests (pine, oak); larger sand-bar deposits and terraces along rivers. Open ground; soil consisting of well-drained, dry, loose sand and with sparse vegetation. Species tends to occur in sandy situations just commencing to stabilize with scant vegetation. Larval habitat: sand dunes near bunch grass or trees, in well-drained, loose sand; burrows (30-197.5 cm deep) mostly vertical, but about 2

cm below the soil surface, opening horizontally into a small cup-like pit. Diurnal; active at 18°C; escapes from high temperatures by burrowing into the sand; extensive elytral maculations reduces body heat. Gregarious, sometimes swarming by the hundreds. Associated species: *C. scutellaris lecontei.*

Biology. Seasonality: April-October, with stragglers in summer; in NJ, mostly May and September. Spring-fall species. Duration of life cycle: 2-3 years. Mating: May-July. Oviposition: May-July, in slightly shifting, fresh sand. Duration of larval life: 12-24 months. Pupation: June-July, in a cavity dug obliquely from the burrow at about 10 cm below the soil surface. Tenerals: August-September; sexual maturity of individuals reared in the laboratory was reached in April-May, after hibernation in pupal chambers. Overwintering both in the adult and larval (third instar) stages, in burrows (10-120 cm and 30-200 cm deep respectively) dug into the sand in rather sheltered ground, *e.g.*, south slopes of sand hills. Larva closes its burrow in late September - early October for hibernation. Duration of adult life: 10-12 months. Predaceous. Adult food, in the field: ants, carabids, and chrysomelids. Adult food, in the laboratory: carabids, cicindelines, cantharids, cerambycids, scarabaeids, staphilinids, mealworms, flies, earthworms, mollusks, and lean meat. Larval food, in the field: ants. Larval food, in the laboratory: lean meat. Predators: asilids. Defense mechanism: cryptic coloration - dark brown elytra blending with the brown sandstone pebbles and leaf debris lying on the surface of sand dunes; flying out of sight, sometimes up to100 m at a stretch, when pursued; emitting a musky scent or causing a painful bite when captured. Very wary. Difficult to approach. Captured in malaise traps.

Dispersal power. Macropterous. Strong flier. Odd habit of tumbling when it lands. Fast runner.

Cicindela formosa gibsoni Brown, 1940

Ecology. Stenotopic, steppicolous, xerophilous, psammophilous,

thermophilous, epigean. Sand hills, sand dunes, blowouts, and roadcuts. Open ground; well-drained, dry, sparsely vegetated soil consisting of loose shifting sand. Diurnal; active for longer periods in the heat but basking longer in cool weather, due to its extensive light elytral maculations. Gregarious, occurring in large numbers. Associated species: *C. lengi lengi*, *C. limbata nympha*, and *C. scutellaris yampae*.

Biology. Seasonality: May-August; in CO, mostly June. Spring-fall species. Predaceous. Adult food, in the field: ants and a sphecid wasp. Defense mechanism: cryptic coloration - body color and wide pale elytral maculations blend with the pale sand; escapes by flight when pursued; flies upward when netted.

Dispersal power. Macropterous. Strong flier. Fast runner. Agile.

Cicindela formosa pigmentosignata W. Horn, 1930

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Sand dunes, fields, and roads, even those passing through pine forests. Open ground; well-drained, dry, bare or sparsely vegetated soil consisting of pure whitish sand peppered with fragments of sandstone. Diurnal.

Biology. Seasonality: April and September. Defense mechanism: cryptic coloration - body color blending with fragments of red-purple sandstone lying on the white sand.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela formosa rutilovirescens Rumpp, 1986

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Sand dunes and blowouts from low sand hills covered with short scrub oak. Open ground; well-drained, light, dry, bare sand. Diurnal.

Biology. Seasonality: May and September.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela fulgida fulgida Say, 1823

Ecology. Eurytopic, steppicolous, xerophilous, heliophilous, halophilous, epigean (adult); fossorial (larva). Alkali flats, salt flats, salt marshes, alkaline ditches, small alkaline spots in prairies, saline spots in pastures, fields, and along roadsides; alkaline banks and shores of streams, lakes, ponds, and sloughs; coulees and badlands. Open ground; often hard, usually dry (sometimes wet), muddy (sometimes sandy), saline soil covered with short sparse vegetation. Adults tend to occur at the fringe of vegetation, often consisting of grass clumps and shrubs. Larval habitat: among the vegetation in the vicinity of hummocks, at the margin of small flats, and along sloping stream banks; burrows (second instar) about 13 cm deep. Diurnal; active from early morning; on rainy days, either staying motionless and then easily captured by hand or hiding in round holes in the ground. Gregarious. Associated species: *C. circumpicta johnsonii*, *C. marutha*, and *C. nevadica knausii*.

Biology. Seasonality: April-October, mostly June-July. Spring-fall species. Overwintering at least in the adult stage. Predaceous. Adult food, in the field: ants, acridids, other insects, and spiders. Defense mechanism: prefers to run rapidly through the vegetation instead of flying when pursued; if escaping by flight, it takes short erratic flights in the open and then hurries back to the vicinity of grass and small shrubs. Not particularly wary.

Dispersal power. Macropterous. Good flier. Fast runner. Very active.

Cicindela fulgida pseudowillistoni W. Horn, 1938

Ecology. Stenotopic, halophilous, epigean. Mud flats bordering a lake. Open ground; soft, almost dry, muddy, alkaline soil vegetated with short grass. Adults tend to occur at the grassy border of gypsum flats. Diurnal; active around midday. Gregarious.

Biology. Seasonality: May - June, September. Spring-fall species. Defense mechanism: when it senses danger, it squats down close to the ground before it runs or flies; otherwise it sits motionless in the grass; prefers to scurry rather than fly; takes flight in a clumsy manner. Not particularly wary.

Dispersal power. Macropterous. Good flier. Fast runner. Very active.

Cicindela fulgida rumppi Knudsen, 1985

Ecology. Stenotopic, halophilous, psammophilous, heliophilous, epigean. Alkaline situations. Open ground; sandy, alkaline, crusty soil covered with low vegetation. Diurnal; hides during cloudy days under alkaline crusts elevated on vegetation.

Biology. Seasonality: Unknown. Defense mechanism: cryptic coloration - body color, with its wide maculations, blends with the surrounding white sand.

Dispersal power. Macropterous. Fast runner.

Cicindela fulgida westbournei Calder, 1922

Ecology. Stenotopic, steppicolous, halophilous, epigean. Alkali flats. Open ground; alkaline, soil with bare areas surrounded by grass or sparsely vegetated. Diurnal. Associated species: *C. tranquebarica tranquebarica.*

Biology. Seasonality: June-August. Mating: July. Defense mechanism: when disturbed, flies a certain distance and, after a while, comes back to its starting point; or else flies from one bare spot to another.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela fulgida williamlarsi Knudsen, 1985

Ecology. Stenotopic, hygrophilous, halophilous, paludicolous, epigean. Salt marshes and alkaline situations along a river. Open ground; moist, alkaline soil. Diurnal.

Biology. Seasonality: May-June, September-October.

Dispersal power. Macropterous. Fast runner.

Cicindela fulgida winonae Knudsen, 1985

Ecology. Stenotopic, hygrophilous, halophilous, paludicolous, epigean.

Salt marshes along a river. Open ground; moist, saline soil. Diurnal.

Biology. Seasonality: unknown.

Dispersal power. Macropterous. Fast runner.

Cicindela fulgoris albilata Acciavatti, 1980

Ecology. Stenotopic, hygrophilous, halophilous, epigean. Salt flats and pond margins. Open ground; moist, saline soil. Both diurnal and nocturnal.

Biology. Seasonality: June, August-October.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela fulgoris erronea Vaurie, 1951

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Flats bordering ponds and lakes. Open ground; wet, muddy (usually) or sandy, saline soil. Both diurnal and nocturnal. Associated species: *C. nigrocoerulea nigrocoerulea*, *C. sedecimpunctata sedecimpunctata*, *C. pimeriana*, *C. obsoleta santaclarae* and *C. marutha.*

Biology. Seasonality: July-September.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela fulgoris fulgoris Casey, 1913

Ecology. Eurytopic, halophilous, epigean (adult); fossorial (larva). Salt flats and alkali flats along lakes, permanent and temporary ponds, marshes, drainage ditches, and moist fields. Open ground; moist or dry, muddy or sandy, saline, bare or sparsely vegetated soil. Larval habitat: edges and flats of a playa; burrows (third-instar larva) range from 18 to 23.2 cm in depth (21.1 cm on average). Both diurnal and nocturnal; active from 8:00 A.M., peaking at 1:00 P.M.; forages and stilts at 30.2°C and 37.9°C respectively (AZ). Mean minimum thoracic temperature for coordinated walking, in the laboratory: 16.5°C. Associated species: *C. willistoni sulfontis* and *C. marutha.*

Biology. Seasonality: June-September. Duration of life cycle: 2-3 years. Predaceous. Larval food, in the laboratory: springtails, adult and larval tenebrionids, and drosophilid flies. Larval parasites: bombyliid flies. Pyemotid mites associated with both adult and larval body. Defense mechanism: quickly runs in a zigzag manner instead of flying. Very wary.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela gabbii G.H. Horn, 1866

Ecology. Stenotopic, coastal, hygrophilous, halophilous, epigean. Alkali flats, salt flats in estuarine areas, tidal flats, mud flats, salt marshes; also sea beaches. Open ground; wet (occasionally dry), saline soil consisting of dark-colored mud. Adults tend to occur among grass. Both diurnal and nocturnal.

Biology. Seasonality: July-September. Defense mechanism: Escaping by quick flights; darting ahead and often seen floating backwards upon the ocean water near its shore habitat. Moderately wary.

Dispersal power. Macropterous. Good flyer. Attracted to artificial lights at night. Fast runner.

Conservation status. Threatened species, extinct over much of its former geographic distribution; endangered by off-road vehicles.

Cicindela gratiosa Guérin-Méneville, 1840

Ecology. Stenotopic, silvicolous, xerophilous, psammophilous, epigean (adult); thermophobous, fossorial (larva). Paths, roads, fire lanes, openings, sand hills, and gullies situated in pine barrens (pine, oak); forest edges and adjoining fields; dry stream beds. Not associated with water. Open ground; sparsely vegetated soil consisting of dry, often gleaming white sand. Larval habitat: vertical burrows (55-110 cm deep) dug into dry sandy places mixed with clay. Diurnal. Extensive pale elytral maculations reduce excess body heat. Larva closing its burrow in response to increasing temperature. Associated

species: *C. abdominalis*.

Biology. Seasonality: March-October, mostly June-July; in SC, May-September. Summer species. Defense mechanism: cryptic coloration - body color and white elytral maculations blend with the surrounding sand.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela hamata lacerata Chaudoir, 1854

Ecology. Stenotopic, coastal, hygrophilous, halophilous, epigean. Sea beaches and salt flats. Close to the water's edge. Open ground; usually saline, bare or sparsely vegetated soil consisting of wet mud (mostly) or coarse sand, sometimes covered with seashells. Both diurnal and nocturnal.

Biology. Seasonality: April-November, mostly June.

Dispersal power. Macropterous. Often attracted to artificial lights at night. Fast runner.

Cicindela hamata monti Vaurie, 1951

Ecology. Stenotopic, coastal, hygrophilous, halophilous, epigean. Salt flats, bases of high areas in salt marshes, mud flats, tidal flats, muddy shores, lagoon edges, margins of tidal pools, creek shores, and sandy beaches. Open ground; usually saline, bare or sparsely grassed soil consisting of dark, wet mud (mostly) or of coarse sand. Diurnal. Gregarious. Associated species: *C. severa severa*, *C. pamphila*, *C. togata togata*, *C. trifasciata ascendens*, and *C. ocellata rectilatera*.

Biology. Seasonality: April-October, mostly June. Defense mechanism: escapes by running or by flying, only a meter or two when pursued.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela hemorrhagica arizonae Wickham, 1899

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, epigean.

Openings and paths along streams. Open ground; moist, sandy soil. Both diurnal and nocturnal.

Biology. Seasonality: May-August. Defense mechanism: escapes by flight. Not especially wary.

Dispersal power. Macropterous. Strong flier. Fast runner.

Note. The original spelling of the species name is *hemorrhagica*, not *haemorrhagica* as suggested by the more recent literature.

Cicindela hemorrhagica hemorrhagica LeConte, 1851

Ecology. Eurytopic, riparian, hygrophilous, halophilous, epigean (adult); fossorial (larva). Edges of ponds, lakes, reservoirs, rivers, springs and irrigation ditches, salt flats, alkali flats, sea beaches, sandy estuary beaches, and tidal flats; sandstone cliffs (occasionally). Near or at a certain distance from water. Open ground; dark, moist or wet (rarely dry), generally saline, bare or sparsely vegetated soil usually consisting of mud, sometimes of sand or of dry sandstone (*pacifica* morph). Larval habitat: Highly aggregated burrows (third-instar, 12.2-22.5 cm deep, 16.5 cm on average) dug into moist sandy clay at the edges of ponds. Both diurnal (mostly) and nocturnal; active early in the morning; the number of active individuals being relatively constant throughout the day; hiding for the night in cliff crevices bordering the ocean; basking, foraging, stilting, and shuttling to shade at 33°C, 37.2°C, 37.7°C, and 37.3°C respectively (AZ). Mean minimum thoracic temperature for coordinated walking, in the laboratory: 21.2°C . Gregarious. Associated species: *C. nevadica nevadica.*

Biology. Seasonality: April-October, mostly June. Spring-fall species. Duration of life cycle: one year. Pupation: December-January, lasting 17 days. Tenerals: June. Predaceous. Adult food, in the field: halictid bees, ants, and small flies. Adult food, in the laboratory: insects. Larval food, in the field: halictid bees. Larval food, in the laboratory: springtails, tenebrionid larvae or drosophilid flies. Predators: theridiid spiders. Parasites: bombyliid flies (parasitizing

larvae) and erythraeid mites (parasitizing adults). Defense mechanism: flash coloration - exposing its orange abdomen in flight; producing defensive secretions to deter predators (*nigroides* morph). Wary. Not easily taken on uneven surfaces.

Dispersal power. Macropterous. Strong flier. Attracted to artificial lights at night. Fast runner. Observed running in the water which was 3 mm deep. Quite active.

Conservation status. *Pacifica* morph is threatened.

Cicindela hemorrhagica woodgatei Casey, 1913

Ecology. Stenotopic, riparian, hygrophilous, epigean. Flats and edges of ponds, lakes, pastures, and roadside ditches. Close to the water's edge. Open ground; wet dark soil. Diurnal.

Biology. Seasonality: July. Tenerals: July.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela highlandensis Choate, 1984

Ecology. Stenotopic, psammophilous, xerophilous, epigean. Scrub pine flatwoods, sandy ridges, and fossil sand dunes. Adults tend to occur along the vegetated edges. Open ground; well-drained, dry, sandy soil. Larval habitat: deep burrows. Diurnal; active from early morning.

Biology. Seasonality: July. Duration of life cycle: 1 year. Larva stay active all year.

Dispersal power. Macropterous. Fast runner.

Conservation status. Rare species.

Cicindela hirticollis abrupta Casey, 1913

Ecology. Riparian, epigean. River banks.

Biology. Unknown.

Dispersal power. Macropterous. Fast runner.

Conservation status. Subspecies threatened by real estate development, expansion of the citrus industry and agriculture, insecticide spraying,

and fire suppression, which prevents the creation of natural open habitats.

Cicindela hirticollis athabascensis Graves, 1988

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, epigean. Lake shores, sand dunes, and sandy fields often situated far from the water's edge. Open ground; moist, sandy soil. Diurnal.

Biology. Seasonality: July (mostly), August.

Dispersal power. Macropterous. Fast runner.

Cicindela hirticollis coloradula Graves, 1988

Ecology. Habitat unknown.

Biology. Seasonality: June-August.

Dispersal power. Macropterous. Fast runner.

Cicindela hirticollis corpuscula Rumpp, 1962

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, halophilous, epigean. Sand bars and banks along rivers; shores of saline lakes. Open ground; moist, sometimes saline soil consisting of sand or sandstone. Diurnal. Gregarious. Associated species: *C. oregona guttifera* and *C. repanda tanneri*.

Biology. Seasonality: March-November. Defense mechanism: cryptic coloration - coppery red body blends with the sandstone deposits of stream beds.

Dispersal power. Macropterous. Fast runner.

Cicindela hirticollis couleensis Graves, 1988

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, epigean (adult); fossorial (larva). River sand deposits. Open ground; moist sandy soil. Diurnal. Larval habitat: a river bank; burrows (second instar, 13.5 cm deep) dug into fine sand.

Biology. Seasonality: May, June (mostly), August-September.

Dispersal power. Macropterous. Fast runner.

Cicindela hirticollis gravida LeConte, 1851

Ecology. Stenotopic, coastal, hygrophilous, psammophilous, halophilous, epigean. Beaches along the sea, bays, and barrier islands; sand bars at the mouth of rivers and brooks; salt marshes. Open ground; moist, sometimes dry, saline soil consisting of clean, light-colored sand. Diurnal.

Biology. Seasonality: February, April, August.

Dispersal power. Macropterous. Fast runner.

Conservation status. Threatened subspecies, extinct over most of its former distribution.

Cicindela hirticollis hirticollis Say, 1817

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophilous, heliophilous, psammophilous, epigean (adult); fossorial (larva). Sea beaches; shores of barrier islands, large rivers, and lakes; river sand bars, and moist pans in dune fields. Open ground; wet (mostly) or moist, often dark, slightly sandy, bare soil (often saline). Larval habitat: lake beaches, in well-drained, usually moist or wet, rarely dry sand, without humus or almost so; intertidal zone of beaches; vertical banks; edges of puddles or backwaters not disturbed by waves; straight, vertical burrows (15-20 cm in depth); larva leaving its burrow for a moister place when the soil gets too dry or for the tops of sand dunes and upper beaches after heavy rains and storms. Mostly diurnal; basking in the hottest sunshine; active only in sunny, warm weather; hiding in self-constructed burrows in the dry upper beach for the night, in late afternoon, and on rainy, cloudy or cool days. Gregarious, occurring in swarms. Associated species: *C. cuprascens*, *C. macra macra*, *C. repanda repanda*, *C. wapleri*, *C. blanda* and *C. dorsalis dorsalis*.

Biology. Seasonality: February-November; in MD, mostly July-August. Spring-fall species. Duration of life cycle: 1-2 years. Mating: Spring

(WV). Oviposition: in low areas of sea beaches beyond the reach of regular waves and on lake beaches; eggs laid on level, wet, white sand, in small vertical burrows, in June-July. Duration of larval life: approximately 4 months. Pupation: July-August. Tenerals: July-August. Overwinters both in the adult and larval (third instar) stages; larva closes its burrow from October to April for overwintering. Predaceous. Adult food, in the field: small amphipods and small insects. Larval food, in the field: small amphipods. Adult and larval food, in the laboratory: lean meat. Predators: Robins, frogs, and asilid flies. Larval parasites: bombyliid flies and tiphiid wasps. A pseudoscorpion observed on the body of an adult. Defense mechanism: cryptic coloration - body color blending perfectly with the dark, grayish luster of the wet sand; quickly escaping by flight, sometimes in swarms, which distracts the pursuer; emits a defensive secretion when captured. Very wary. Difficult to approach.

Dispersal power. Macropterous. Strong flier. Attracted to artificial lights at night. Fast runner. Often wades through 3-4 mm deep puddles. Quite active.

Conservation status. Subspecies sometimes threatened by building construction along shorelines, human recreational activities, and pesticide spraying; endangered in OH.

Cicindela hirticollis rhodensis Calder, 1916

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, heliophilous, psammophilous, epigean (adult); fossorial (larva). Sea beaches; shores of large rivers and lakes; sand dunes. Open ground; usually moist (rarely dry), sandy (sometimes muddy), often saline, bare or almost bare soil. Larval habitat: Lake beaches, sand dunes, and river sand bars; vertical burrows (12.5-20 cm deep) dug into wet sand; some burrows wetted at high tides. Diurnal; hiding on cloudy days. Gregarious.

Biology. Seasonality: March-September. Spring-fall species. Mating: June-July. Tenerals: July-August. Predaceous, necrophagous. Adult

food, in the field: adult and larval beetles; insects washed up as beach drift. Adult food, in the laboratory: ants, worms, and flies. Defense mechanism: cryptic coloration - body color and reduced elytral maculations blend with surface of dark intertidal beaches and mud flats. Defense mechanism: escapes by quick flight. Very wary. Difficult to approach.

Dispersal power. Macropterous. Strong flier. Fast runner. Very active.

Conservation status. Threatened subspecies, extinct over much of its former distribution in New England.

Cicindela hirticollis shelfordi Graves, 1988

Ecology. Eurytopic, riparian, hygrophilous, halotolerant, heliophilous, psammophilous, epigean. Banks and sand bars along rivers and brooks; shores of reservoirs; edges of pools; moist places in sand pits and at the bottom of blowouts; edges of wells; sand dunes, flooded fields, and saline areas. Open ground; moist or wet, sandy, sometimes alkaline, bare soil. Diurnal; hides among the sparse vegetation or close to logs and other debris on cloudy mornings or during sudden rains. Gregarious. Associated species: *C. cuprascens*, *C. nevadica knausii*, and *C. repanda repanda*.

Biology. Seasonality: April-November. Spring-fall species (NE, NM). Summer species (KS). Mating: July. Tenerals: August. Predaceous. Adult food, in the field: carabids, heterocerids, flies, and other insects. Predators: gulls and asilid flies. Defense mechanism: escapes by flying so rapidly and so far at the slightest disturbance, that the pursuer has to walk in large circles around an individual to drive it through the low vegetation where it can be caught; producing defensive secretions to deter predators. Very wary. Difficult to approach.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela hirticollis siuslawensis Graves, 1988

Ecology. Stenotopic, coastal, riparian, hygrophilous, halophilous,

psammophilous, epigean. Mouths of rivers flowing into the sea. Open ground; moist or wet, often saline, sandy soil. Diurnal.

Biology. Seasonality: May-September.

Dispersal power. Macropterous. Fast runner.

Cicindela hirtilabris LeConte, 1875

Ecology. Eurytopic, silvicolous, xerophilous, psammophilous, thermophilous, epigean (adult); fossorial (larva). Mostly pine forests, pine barrens and scrub flatwoods (roads, roadcuts, trails, lanes, paths, roadside ditches, and clearings); also meadow roads, eroded sand hills, and base of sand dunes. Not associated with water. Open ground; level, dry, sparsely vegetated soil consisting of white sand, slightly mixed with humus. Larval habitat: burrows dug into habitat similar to adult. Both diurnal (mostly) and nocturnal; basks in the early morning to elevate its body temperature; quite active in the hottest part of the day; extensive white elytral maculations reduces excess body heat. Solitary. Associated species: *C. abdominalis, C. gratiosa, C. highlandensis,* and *C. scabrosa.*

Biology. Seasonality: May-November, mostly June-July. Summer species. Duration of life cycle: 1-2 years. Oviposition: in same habitat as adult; female digs a shallow ovipositional hole. Larva stay active all year. Defense mechanism: cryptic coloration - body color (extensive white elytral maculations and brown surface of elytra) blends with the bright white sand, humus, and seeds lying on the sand surface; when disturbed, doesn't move until almost stepped on; runs away, sometimes quickly flies a short distance for cover, when pursued. Difficult to see when motionless or when flying.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela hornii hornii Schaupp, 1884

Ecology. Eurytopic, steppicolous, epigean (adult); fossorial (larva). Grasslands, grassy pastures, upland meadows, grassy marshlands, wet spots, broad flats of bottomlands, mountain slopes, mesas, and

rocky hillsides. Open ground; dry or slightly moist, sometimes wet, clayey, loamy, occasionally rocky or gravelly soil with sparse low vegetation or grass clumps. Larval habitat: burrows dug into grasslands. Diurnal; prefers to rest in the shade of low vegetation, e.g., under grass clumps; basking, foraging, stilting, and shuttling to shade at 34.9°C, 36.1°C, 37.6°C, and 36.4°C respectively (AZ); active for about 6 hours each day. Associated species: *C. lemniscata lemniscata* and *C. sedecimpunctata sedecimpunctata.*

Biology. Seasonality: June-September. Oviposition: females dig large numbers of ovipositional holes. Predaceous. Adult food, in the laboratory: beetles and flies. Defense mechanism: when pursued, takes wing vertically with a steady, long (up to 30 m) flight; sometimes carried off by powerful winds. Quite wary. Difficult to approach.

Dispersal power. Macropterous. Usually a weak flier, but a good flier if necessary. Fast runner.

Cicindela latesignata latesignata LeConte, 1851

Ecology. Eurytopic, coastal, hygrophilous, psammophilous, halophilous, epigean (adult); fossorial (larva). Sea beaches, ocean bays, estuaries, salt marshes, salt meadows, alkali flats near sloughs. Open ground; moist, sandy (mostly) or muddy, saline soil. Larval habitat: Tidal flats just above high tide, in mud or sand covered with mud; burrows (3.75-7.5 cm deep) often curved to an almost horizontal plane at the bottom. Diurnal. Gregarious, occurring in swarms.

Biology. Seasonality: May-October, mostly midsummer. Predaceous. Adult food, in the field: small crustaceans. Defense mechanism: escapes by flying just above the tide line.

Dispersal power. Macropterous. Good flier. Fast runner.Quite active.

Conservation status. Threatened subspecies, extinct over much of its former geographic distribution.

Cicindela lemniscata lemniscata LeConte, 1854

Ecology. Eurytopic, steppicolous, hygrophilous, halotolerant, thermophilous, epigean (adult); fossorial (larva). Grasslands, pastures, saltbush flats; roadsides; dry lake beds; beds of small rain-brooks; vicinity of pools, ponds, lakes and streams; dry uplands (in September-October). Open ground; moist, clayey, muddy or sandy, sometimes saline, sparsely vegetated soil. Larval habitat: grasslands and saltbush flats; burrows (third instar, 12.8-19.1 cm deep, 15.8 cm deep on average) dug into hard-packed, white, silty clay-loam, away from sparse vegetation; burrows being utilized for nest-provisioning by eumenid wasps. Both diurnal and nocturnal; active about 7 hours per day, occasionally up to 12 hours; frequently running and flying in hot sunshine; basking, foraging, stilting, and stilting at 30.5°C, 34.8°C, 37.1°C, and 37°C respectively (AZ). Associated species: *C. pulchra pulchra*, *C. hornii hornii*, and *C. sedecimpunctata sedecimpunctata*.

Biology. Seasonality: May-October, mostly midsummer. Duration of life cycle: 1-2 years. Predaceous. Adult food, in the laboratory: beetles and flies. Larval food, in the laboratory: springtails, tenebrionid larvae or drosophilid flies. Predators: flycatchers and lizards. Larval parasites: bombyliid flies. Defense mechanism: flies readily, normally short distances, sometimes in long erratic flights, when pursued.

Dispersal power. Macropterous. Good flier. Often attracted in great numbers to artificial lights, especially on warm, cloudy nights. Fast runner.

Cicindela lemniscata rebaptisata Vaurie, 1951

Ecology. Eurytopic, halophilous, epigean. Large alkali flats, desert areas, roadside ditches; dry areas, e.g., washes and flats; vicinity of brooks, rivers, and ponds; dry creek beds. Not necessarily associated with water. Open ground; moist or dry, gravelly or rocky, saline soil. Both diurnal and nocturnal.

Biology. Seasonality: July-October. Defense mechanism: escape by flight.

Dispersal power. Macropterous. Good flier. Often attracted to artificial lights at night. Fast runner.

Cicindela lengi jordai Rotger, 1874

Ecology. Stenotopic, riparian, xerophilous, psammophilous, epigean. Sandy banks of dry washes often lying along canyon beds. Open ground; dry, sandy soil. Diurnal.

Biology. Seasonality: May-June.

Dispersal power. Macropterous. Fast runner.

Cicindela lengi lengi W. Horn, 1908

Ecology. Stenotopic, steppicolous, xerophilous, psammophilous, thermophobous, epigean. Margins of sand dunes and sand hills; ravines, blowouts, eroded banks, barren flats, roadsides; vicinity of pools at the bottom of blowouts; sand bars along rivers. Open ground; well drained, dry, sandy, sparsely vegetated or bare soil often consisting of pure whitish sand, sometimes mixed with clay. Diurnal; hides during hot sunshine in the shade of low vegetation. Gregarious. Associated species: *C. scutellaris scutellaris* and *C. formosa formosa*.

Biology. Seasonality: April-October, mostly May-June. Spring-fall species. Tenerals: August-September. Defense mechanism: raises the anterior part of its body when disturbed; flies only a short distance when pursued.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela lengi versuta Casey, 1913

Ecology. Stenotopic, steppicolous, xerophilous, psammophilous, epigean (adult); fossorial (larva). Sand dunes, sand hills, barrens, blowouts, sandy washes; grassland margins, roads, and tracks adjacent to sand dunes; sand ridges through open coniferous forests.

Open ground; well-drained, dry, sparsely vegetated soil, sometimes consisting of reddish sand. Larval habitat: burrows 112.5 cm in depth on average. Diurnal. Gregarious. Associated species: *C. formosa formosa* and *C. decemnotata.*

Biology. Seasonality: April-October, mostly June-July with stragglers in September-October. Spring-fall species. Mating: June. Larva closes its burrow from June to August for the summer. Duration of larval life: 3 years. Pupation: July. Tenerals: August. Overwinters both in the adult and larval stages, in burrows (30-80 cm and 70-137 cm deep, respectively) dug into sandy soil. Predaceous. Adult food, in the field: ants. Predators: asilid flies. Defense mechanism: cryptic coloration - body color blends perfectly with the reddish sand; flies about 5 m in a straight line to alight on a sandy area when pursued .

Dispersal power. Macropterous. Good flier. Fast runner. Rather inactive.

Cicindela lepida Dejean, 1831

Ecology. Stenotopic, xerophilous, psammophilous, halotolerant, thermophobous, heliophilous, epigean (adult), fossorial (larva). Sand dunes, sand hills, dune fields, blowouts, barren flats, and sand pits; margins of grasslands adjacent to sand dunes; roadside banks; upper banks of rivers, stream sand bars, dried river beds, and vicinity of salt licks; sandy areas along the sea shore. Adults tend to occur on wind-swept dune crests; preferring the sloping sides of blowouts to their bottom. Not necessarily associated with water. Open ground; well-drained, horizontal or steep, bare or sparsely vegetated, dry soil consisting of loose, shifting white sand. Larval habitat: sheltered bowl areas of sand dunes or bank sides exposed to the wind; burrows (62.5-3 m deep) dug into pure drifting sand. Both diurnal and nocturnal; becoming active at 18°C; active from 8:00 A.M. to 8:00 P.M., mostly in the morning and at dusk; basks during the midmorning to elevate its body temperature, but hides in a burrow (3-6 cm deep) dug into the sand, beneath tufts of long grass, during

the hot midday temperature or during cloudy, cool or rainy weather; larva also dig in during the heat of the day. Extensive pale elytral maculations reduce excess body heat. Gregarious. Associated species: *C. formosa generosa*, *C. scutellaris lecontei*, *C. limbata hyperborea*, and *C. marutha.*

Biology. Seasonality: March-October, mostly June-July. Summer species. Two-brooded species, adults of each brood emerging in alternate years. Duration of life cycle: 2 years. Mating: June-August, in self-constructed burrows dug into the sand. Oviposition: in sandy areas, e.g., on tops of dunes, in slightly shifting soil, in June-July. Duration of larval stage: 22 months. Pupation: in long, curved pupal cells, in May-June. Tenerals: June-July; sexual maturity requiring about 2-3 weeks. Duration of adult life: 1-2 months. Overwinters in the larval (second and third instars) stage, in burrows dug 175 cm deep on average. Predaceous. Adult food, in the field: insects. Adult food, in the laboratory: carabids, house flies, spiders, and lean meat. Larval food, in the laboratory: lean meat. Adult parasites: protozoans. Defense mechanism: cryptic coloration - extensive pale elytral maculations blend perfectly with the white sand; usually stays motionless instead of flying when pursued, apparently aware of the protective color of the white sand, otherwise runs a short distance (1.98 m on average) or flies directly up over one's head, and alights in a moment behind one's back; often lets itself be transported by the wind when escaping by flight; emits a feeble scent when captured. Very wary, particularly in windy weather or when being forced to retreat on dark ground.

Dispersal power. Macropterous. Normally a weak flier, but occasionally a long-distance disperser, sometimes found many kilometers from its breeding habitat. Often attracted to artificial lights at night. Fast runner. Easy to collect with a flashlight at night.

Conservation status. Threatened species, extinct over much of its former distribution due to insecticide spraying, off-road vehicles, sand excavation, building construction, land development and

stabilization of sand dunes.

Cicindela limbalis Klug, 1834

Ecology. Stenotopic, hygrophilous, heliophilous, epigean (adult); fossorial (larva). Eroded banks, stream banks, embarkments, ditches, roadsides, little-used roads, dirt roads, roadcuts, paths, steep gullies, bluffs, cliffs, small canyons, clay pits, hillsides, hilltops, pocket-gopher hills; openings in meadows, fields, and forests. Often close to bodies of water. Open ground; sloping hard-packed, usually moist or wet (occasionally dry), clayey, bare or very sparsely vegetated soil. Larval habitat: Steep, moist clayey banks of lakes, old pocket-gopher hills, and open moist areas in fields; not usually more than 2 m from the water's edge; burrows (7-15 cm deep) usually with a chimney-like structure (about 6 mm high) at their entrance which opens perpendicularly to the soil surface, curving into an almost horizontal plane at their inner end. Diurnal. Solitary or occurring in pairs. Associated species: *C. purpurea purpurea* and *C. splendida*.

Biology. Seasonality: February-October, with stragglers in midsummer; in NH, April-June, August-September. Spring-fall species. Duration of life cycle: 2-3 years. Mating: April-July; copulation lasting 2.13-3.10 min.; interspecific copulation observed with *C. splendida* and *C. sexguttata*. Oviposition: in steep, clayey slopes, in May-June. Duration of larval stage: 14-26 months. Pupation: lasting 2 weeks-1 month, in July-August. Tenerals: August; sexual maturity reached in June, after hibernation. Overwinters both in the adult and larval (second and third instars) stages; adults prefer higher ground, hiding in burrows (5-47.5 cm deep) dug into clay or sand; larvae sheltered in burrows (5-20 cm deep) dug into clay; third-instar larva often closes its burrow in mid-July. Duration of adult life: 9-11 months. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: ants, carabids, woodborer larvae, other insects, mealworms, and small earthworms. Larval food, in the field: araneid spiders, libellulid dragonflies, and moths. Larval food, in the laboratory: lean meat. Predators: ants (able to drag larvae from their burrows). Larval parasites: bombyliid flies and eulophid wasps. Many larvae die during winter or in spring inundations. Defense mechanism: cryptic coloration - body color blends with banks of red clay; escapes by swift flight. Rather easy to capture by making it fly and netting it when it lands.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela limbata albissima Rumpp, 1962

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Crests and flats of sand dunes. Open ground; well-drained, dry, sandy, bare soil, away from any vegetation. Diurnal. Solitary.

Biology. Seasonality: May, August-September. Tenerals: September. Defense mechanism: flies readily when disturbed.

Dispersal power. Macropterous. Good flier. Fast runner.

Conservation status. Rare subspecies (or species ?).

Cicindela limbata hyperborea LeConte, 1863

Ecology. Stenotopic, silvicolous, xerophilous, psammophilous, epigean. Coniferous forests (jack pine): open spots, blowouts, and roadsides. Open ground; dry, bare sandy soil. Diurnal. Gregarious. Associated species:*C. tranquebarica tranquebarica* and *C. longilabris longilabris*.

Biology. Seasonality: Unknown. Defense mechanism: escape by flight.

Dispersal power. Macropterous. Flier. Fast runner.

Cicindela limbata labradorensis Johnson, 1990

Ecology. Stenotopic, psammophilous, xerophilous, epigean. Trails, roads, sand pits, and edges of drainage ditches. Open ground; bare dry soil consisting of yellowish sand. Diurnal.

Biology. Seasonality: July-August.

Dispersal power. Macropterous. Fast runner.

Conservation status. Rare subspecies.

Cicindela limbata limbata Say, 1823

Ecology. Stenotopic, xerophilous, psammophilous, epigean (adult); fossorial (larva). Sand dunes, sand hills, hillsides, blowouts, ditches, barren flats, and river banks. Not associated with water. Open ground; well-drained, dry, sandy, bare or sparsely vegetated soil. Adults tend to occur in the open, less often running among sparse vegetation or at its border. Both diurnal and crepuscular; hides for the night in self-constructed burrows dug into blowouts; becomes active at 9:00 A.M.. Larval habitat: blowouts; burrows (25-35 cm deep) aggregated, straight or slightly spiralled, dug into bare white sand. Both diurnal and crepuscular. Gregarious. Associated species: *C. formosa formosa* and *C. scutellaris scutellaris*.

Biology. Seasonality: April-October, mostly May-June, September. Spring-fall species. Mating: June. Larva closes its burrow in June-August. Tenerals: September. Defense mechanism: cryptic coloration - body color blends with surrounding environment; when disturbed, does not fly or run as readily as many other sand-frequenting species. Best captured with a flashlight at night.

Dispersal power. Macropterous. Not a strong flier. Attracted to artificial lights at night. Fast runner. Very active.

Cicindela limbata nympha Casey, 1913

Ecology. Stenotopic, steppicolous, xerophilous, psammophilous, thermophilous, epigean (adult); fossorial (larva). Sand dunes, sand hills, blowouts, roadsides, and roadcuts. Open ground; well-drained, dry, bare or sparsely vegetated soil consisting of white shifting sand. Adults tend to occur at the vegetation border and in bare areas. Larval habitat: middle of blowouts somewhat sheltered from the wind; aggregated burrows dug into moist, drifting white sand close to grass or weeds. Both diurnal and nocturnal; extensive pale elytral maculations reduce body heat; after high winds, sometimes occurs in large numbers in hollows and on the opposite side from which the

wind is blowing. Larva more cold-tolerant than adult. Gregarious, swarms by the hundreds.

Biology. Seasonality: April-October. Spring-fall species. Duration of life cycle: 3 years. Mating: June-July; copulating pairs often observed partially buried in the sand, with only their heads visible. Duration of larval life: about 2 years. Larva inactive during the summer, but becoming active in the fall until late October. Pupation: August-September. Tenerals: August. Duration of adult life: 1 year. Overwinters both in the adult and larval stages, in burrows (17.5 - 42.5 cm deep) dug at the margin of small, dark blowouts, in the soft, sandy slopes preferably facing the sun at midday; larva more cold-tolerant than adult. Defense mechanism: cryptic coloration - body color blends with the surrounding sand; looks like a big white spider skimming over the sandy background; when disturbed, escapes by flight; produces defensive secretions to deter predators.

Dispersal power. Macropterous. Not a strong flier. Fast runner, if necessary. Very active.

Cicindela longilabris laurentii Schaupp, 1884

Ecology. Eurytopic, silvicolous, xerophilous, epigean. Forests: openings, clearings, meadows, edges of gopher holes, paths, roadsides, and edges. Open ground; dry, often darkened, stony, gravelly, sandy or clayish loamy, bare or almost bare soil characterized as luvisol, brunisol, or podzol. Both diurnal and nocturnal. Usually solitary. Associated species: *C. lengi lengi* and *C. terricola cinctipennis*.

Biology. Seasonality: April-September, mostly August-September. At higher elevations, emerges in late summer (CO). Spring-fall species. Predators: frogs and asilid flies. Defense mechanism: cryptic coloration - dark body with reduced elytral maculations blends with surrounding soil; when pursued, prefers to run rather than fly, but if flying, then flight is slow and heavy; emits a strong musky scent when captured. Quite wary; very nervous on very windy days. Difficult to approach.

Dispersal power. Macropterous. Weak flier. Attracted to artificial lights at night. Fast runner.

Cicindela longilabris longilabris Say, 1824

Ecology. Eurytopic, silvicolous, xerophilous, psammophilous, heliophilous, epigean. Coniferous and mixed forests (preferably jack pine, spruce, and trembling aspen): Little-used roads, logging roads, paths, and trails; roadsides, sparsely grassed spots and flats, clearings, sand pits, gravel pits, edges of gopher holes, ridges, blowouts in or outside forests, open farmland, stony banks, mountain ledges; roads above the tree line, alpine and arctic meadows. Open ground; often dark, dry, sandy, bare or sparsely vegetated soil characterized as podzol (east), luvisol, brunisol and podzol (west). Often associated with blueberries (*Vaccinium*), reindeer moss (*Cladonia*), lichens, grass, and wild strawberries (*Fragaria*). Adults tend to occur on or near sandy soil darkened by decaying vegetation; adult observed on dust piles. Not associated with water or moist situations. Diurnal; even active at temperatures as low as 8.5°C; either active or hiding under dead leaves and pieces of wood on cloudy or rainy days; refuses to shelter, stays motionless and easily collected by hand during sudden rain. Gregarious.

Biology. Seasonality: May-September, with stragglers in midsummer. Males more numerous than females early in the season, but females more abundant than males later in the season. Spring-fall species. Duration of life cycle: 3 years. Mating: June-July; copulation lasting about 6 min. Oviposition: May-June. Pupation: June-July. Tenerals: August-September. Overwinters both in the adult and larval (two winters) stages. Duration of adult life: 3 months. Predaceous. Adult food, in the field: ants, scolytids, and an hemipteran. Predators: toads and asilid flies. Defense mechanism: cryptic coloration - dark body with reduced elytral maculations blends with the surrounding soil; when pursued, either takes refuge in herbage or escapes by a steady, slow, rather high and long (up to 20 m long) flight; emits a musky

scent when captured. Not wary. Best collected with a net or pitfall traps.

Dispersal power. Macropterous. Excellent flier; flying higher and for longer distances than is usual for this genus. Fast runner.

Cicindela longilabris perviridis Schaupp, 1884

Ecology. Eurytopic, silvicolous, xerophilous, epigean. Coniferous forests: paths, trails, and clearings; regenerating forests, sagebrush areas, pocket-gopher mounds, eroded areas, and alpine grasslands. Open ground; dry, clayey, sandy or gravelly, bare or sparsely vegetated soil. Adults tend to occur in bare areas. Diurnal. Solitary. Associated species: *C. nebraskana*.

Biology. Seasonality: June-October. Spring-fall species. Adults emerge in late summer, become sexually mature the next spring, after hibernation. Mating: interspecific copulation observed with *C. nebraskana*. Overwinters at least in the adult stage. Predators: owls. Defense mechanism: escapes by flight.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela macra ampliata Vaurie, 1951

Ecology. Stenotopic, riparian, hygrophilous, epigean. River banks and beaches. Open ground; wet, dark tan or reddish soil. Diurnal. Gregarious.

Biology. Seasonality: June-July.

Dispersal power. Macropterous. Fast runner.

Cicindela macra fluviatilis Vaurie, 1951

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, epigean. River banks. Open ground; wet, sandy soil. Larval habitat: sandy, sparsely vegetated areas at a short distance behind the shoreline; burrows ranging from 22.5 to 25 cm in depth. Both diurnal (mostly)

and nocturnal. Gregarious.

Biology. Seasonality: June-August.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela macra macra LeConte, 1857

Ecology. Eurytopic, riparian, hygrophilous, psammophilous, halotolerant, thermophobous, epigean (adult); fossorial (larva). Mostly sand bars, banks, and flats along large rivers; also brook banks, pond and lake shores, pool edges, salt flats and salt marshes; occasionally on roads in July-August. Close to the water's edge. Open ground; moist, sandy, sometimes saline, bare soil occasionally mixed with mud or silt. Larval habitat: lake shore, in well-drained, moist sand with little or no humus; shallow burrows smooth at their edges, similar to those of *C. hirticollis hirticollis*. Both diurnal and nocturnal; hides from the hot sunshine in the shade of stones, sticks, and in soil fissures; observed at night resting on beach debris and on herbaceous vegetation at the base of foredunes. Gregarious. Associated species: *C. cuprascens*.

Biology. Seasonality: May-October, mostly July. Summer species. Mating: July. Adult food, in the field: small insects. Defense mechanism: cryptic coloration - dark body with its pale maculations blends perfectly with the fine sand and bits of driftwood or pebbles lying on bare ground; usually escapes by running instead of flying, but if flying, only for short distances, then easily taken by hand; produces defensive secretions when captured. Not wary. Best collected by hand with a flashlight at night.

Dispersal power. Macropterous. Good flier. Often attracted to artificial lights at night. Moderate runner.

Cicindela marginata Fabricius, 1775

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophilous, epigean. Muddy habitats: tidal flats, lagoon edges, mud

flats over sandy beaches, flats of stream mouths, margins of ponds near the sea, shores of salt marshes, roads crossing salt marshes, salt meadows. Sandy habitats: ocean beaches, spots between creeks and dunes, upper regions of beaches with coarse sand, hills close to the sea, shores of barrier islands. Rocky shoreline. Close to the water's edge. Open ground; wet, saline, bare or sparsely vegetated dark soil usually consisting of mud, sand-mixed mud or organic debris, pure black sand (sometimes) or, more rarely, rock, and sometimes covered with a dense layer of darkened washed-up vegetation. Adults tend to occur on bare mud flats on beaches. Larval habitat: a sea beach, a short distance back from the shoreline; burrows (22.5-25 cm deep) dug into open, sandy, sparsely vegetated soil. Both diurnal (mostly) and nocturnal; quite active and abundant during the hottest part of the day. Solitary or occurring in small numbers. Associated species: *C. hirticollis hirticollis*, *C. dorsalis dorsalis*, *C. dorsalis media*, and *C. trifasciata ascendens*.

Biology. Seasonality: February-September, mostly June-July; in SC, May-September . Summer species. Mating: July. Oviposition, in the laboratory: in the mud, about 3 mm below the ground surface, in July. Tenerals: June. Predaceous. Adult food, in the field: a tabanid fly. Larval food, in the laboratory: small ants. Larval parasites: bombyliid flies. Defense mechanism: cryptic coloration - body color pattern blends perfectly with the darkest parts of its surroundings; takes wing readily when pursued, even from a distance of 5 m, flies not so rapidly, sometimes out over the water before landing again on the bare, wet sand further up the shore or hiding in the high or thick grass (e.g., *Spartina*) where it sometimes climbs. Very wary. Very difficult to approach in the daytime. Best captured with a flashlight at night.

Dispersal power. Macropterous. Strong flier. Attracted to artificial lights at night. Fast runner.

Conservation status. Threatened species, almost extinct from its original distribution (*e.g.*, in New England) because of coastal

development, recreational land-use, and perhaps pesticide spraying to control mosquitoes in salt marshes.

Cicindela marginipennis Dejean, 1831

Ecology. Stenotopic, riparian, epigean (adult); fossorial (larva). River islands: cobblestone beaches, gravel bars, gravel spits; sometimes sandy bars and sandy river banks. Closely associated with turbulent water. Open ground; soil consisting of cobblestones, pebbles or coarse gravel, sometimes with small patches of sand, bare or sparsely vegetated. Adults tend to occur on the median area of island shorelines, on stones surrounded by sparse vegetation. Larval habitat: near the interior of a cobblestone island; burrows dug into the sand between cobblestones. Adult and larva able to survive spring flooding. Diurnal; active at least between 1:00 P.M. and 4:00 P.M.. Gregarious, occurs in swarms, sometimes by the hundreds.

Biology. Adult seasonality: May-September; mostly July (NJ). Summer species. Tenerals: July. Mating: August. Defense mechanism: cryptic coloration - body color pattern blends perfectly with its surroundings; takes wing readily when disturbed; when netted, escapes easily by crawling under the rim of the net, taking advantage of the uneven surface of the cobblestone beach. Wary. Difficult to approach.

Dispersal power. Macropterous. Good flier. Fast runner.

Conservation status. Threatened species, extinct from many historic localities due to pollution and dam construction.

Cicindela marutha Dow, 1911

Ecology. Eurytopic, riparian, hygrophilous, halotolerant, thermophilous, epigean (adult); thermophobous, fossorial (larva). Edges of temporary or permanent ponds, reservoirs, alkaline lakes, shallow streams, drainage ditches; seepages from springs and cattle watering tanks; salt flats, wet spots near rivers, marshy grasslands, alkaline flats, and dirt roads near irrigated fields. Sometimes occurring

several hundred meters from the water's edge, for example in sandy ridges and sand dunes. Adults tend to occur on beaches or salt flats. Open ground; wet, muddy, sometimes sandy, saline soil with bare areas or vegetated with grass. Larval habitat: hot sandy ridges and sand dunes; burrows (third-instar, 18.8-45 cm deep, 31.5 cm on average) scattered or aggregated, dug into hot, dry, fine sand, through sparse, low vegetation. Both diurnal and nocturnal; mostly active in summer in early morning (10:00-11:00 A.M.) and late afternoon (3:00-4:00 P.M.); foraging, stilting, and shuttling to shade at 31.1°C, 37°C, and 37.2°C respectively (AZ); oviposition done at night; larva active most of the time, but closes its burrow on summer days, then becomes active only at night. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 14.4°C. Gregarious. Associated species: *C. nigrocoerulea nigrocoerulea*, *C. sedecimpunctata sedecimpunctata*, *C. pimeriana*, *C. obsoleta santaclarae*, *C. praetextata erronea*, *C. fulgida fulgida*, and *C. nevadica knausii*.

Biology. Seasonality: June-September; mostly July. Adult emergence at the beginning of summer rains. Summer species. Duration of life cycle: 2-4 years. Mating: during courtship, a riding male may often be attacked by a single larger male attempting to displace it; contact-guarding by male quite common. Oviposition: in sand dunes, sometimes at a distance of more than 1 km from pond edges. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: beetles or drosophilid flies. Larval food, in the laboratory: springtails, tenebrionid larvae or drosophilid flies. Predators: spiders. Larval parasites: bombyliid flies and tiphiid wasps. Defense mechanism: escapes by a quick, erratic flight. Quite wary. Difficult to approach. Best captured with a flashlight at night.

Dispersal power. Macropterous. Excellent flier. Long-distance disperser. Often attracted to artificial lights at night. Fast runner.

Cicindela nebraskana Casey, 1909

Ecology. Eurytopic, halotolerant, epigean (adult); fossorial (larva). Grassland-forest transitions and parklands (ponderosa pine-bunchgrass): small openings, trails, paths, dirt roads, roadside ditches, bank areas, hillsides, fields, and alkali flats; also short-grass plains. Open ground; heavy, clayey, sometimes alkaline soil. Adults tend to occur in bare areas between clumps of grass and earth mounds built by ground squirrels. Larval habitat: Burrows short, each with a funnel-like opening. Diurnal; quite active between 9:00 A.M. and 3:00 P.M. Associated species: *C. purpurea audubonii*, *C. tranquebarica tranquebarica*, *C. longilabris perviridis*, and *C. decemnotata*.

Biology. Seasonality: March-September. Spring-fall species (CO, AB). Summer species (NE). Mating: July-August. Tenerals: September; sexual maturity reached the following spring, after hibernation. Mating: interspecific copulation observed with *C. longilabris perviridis*. Defense mechanism: cryptic coloration - blackish body with reduced pale elytral maculations blends with surrounding dark soil; when pursued, moves through the grass or escapes by slowly flying, vertically at first and then horizontally to a distance of 3 to 10 m from its starting point. Moderately wary. Easy to capture.

Dispersal power. Macropterous. Good flier. Fast runner. Quite active.

Cicindela nevadica citata Rumpp, 1977

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, halophilous, epigean. Salt flats and beaches: along ponds, lakes, and playas. Open ground; wet, sandy, saline soil. Both diurnal and nocturnal.

Biology. Seasonality: July-September, less common in September.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Conservation status. Rare subspecies.

Cicindela nevadica knausii Leng, 1902

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean (adult); fossorial (larva). Edges of temporary or permanent ponds, lakes, pools, rivers, brooks, and ditches; sand bars, salt flats, salt marshes; small salty spots in pastures and fields. Close to the water's edge. Open ground; moist or wet, muddy (mostly) or sandy, often saline, bare or sparsely vegetated soil. Adults prefer open, sparsely vegetated spots on beaches and salt flats. Larval habitat: among the vegetation in the vicinity of hummocks; margins of small flats; sloping brook banks; burrows (third instar, 22-35 cm deep) dug into saline soil. Both diurnal and nocturnal; in the daytime, once observed going in and out of the cracks of mud cakes along a pool edge (MT). Gregarious, occurs in large numbers. Associated species: *C. circumpicta johnsonii*, *C. fulgida fulgida*, *C. nigrocoerulea nigrocoerulea*, and *C. togata globicollis*.

Biology. Seasonality: June-August. Summer species. Mating: July-August. Defense mechanism: cryptic coloration - body color blends with its surroundings; escapes by short flights when pursued. Easy to capture with a net. Teratology: An individual (OK) with the left antenna divided in two from the fourth segment onward. Best collected with a black light or a flashlight.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner. Observed wading through shallow water.

Cicindela nevadica lincolniana Casey, 1916

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Shores of brook and lakes, edges of drainage ditches, roadside ditches, and remnant salt marshes. Open ground; moist or wet, muddy (mostly) or sandy, saline soil. Diurnal; seen active in early morning.

Biology. Seasonality: May-July. Summer species, mostly in early summer. Mating: June. Tenerals: June. Adults often stop to drink water on hot days.

Dispersal power. Macropterous. Fast runner.

Conservation status. Subspecies threatened by the draining and filling of salt marshes.

Cicindela nevadica nevadica LeConte, 1875

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Banks and flats along stream and drainage ditches. Close to the water's edge. Open ground; moist or wet, muddy, saline soil. Both diurnal and nocturnal. Associated species: *C. hemorrhagica hemorrhagica*.

Biology. Seasonality: April-August, rare in June. Defense mechanism: when pursued, escapes by frequent short flights from one side of a stream to the other. Very wary. Difficult to approach.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela nevadica olmosa Vaurie, 1951

Ecology. Eurytopic, riparian, hygrophilous, halophilous, epigean. Alkali flats, salt flats, tidal flats; edges of ponds, lakes, and brooks. Close to the water's edge. Open ground; wet, whitish or grayish, alkaline, bare or sparsely vegetated soil consisting of fine sand, silt or clay. Both diurnal and nocturnal. Associated species: *C. circumpicta circumpicta*, *C. togata togata*, *C. ocellata rectilatera*, *C. pamphila*, and *C. hamata monti*.

Biology. Seasonality: June-October; less common in September-October. Best captured with a black light or a flashlight.

Dispersal power. Macropterous. Attracted to artificial lights at night.

Conservation status. Rare subspecies.

Cicindela nevadica tubensis Cazier, 1939

Ecology. Stenotopic, riparian, hygrophilous, epigean. Stream banks; shores of lakes and reservoirs. Close to the water's edge. Open ground; moist soil consisting of mud or sandstone. Diurnal.

Biology. Seasonality: June-August. Defense mechanism: cryptic coloration - coppery red body blends with the sandstone deposits of stream beds; usually takes wing when approached, but easily captured if approached carefully.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela nigrior Schaupp, 1884

Ecology. Stenotopic, psammophilous, epigean (adult); fossorial (larva). Upland situations. Open ground; dry, sparsely vegetated soil consisting of well-packed sand, containing much clay. Larval habitat: Burrows. Diurnal. Gregarious.

Biology. Seasonality: June, September-October. Fall species. Mating and Oviposition: in the fall. Duration of larval stages: apparently 1 year. Defense mechanism: escapes by flight and lands near or among the vegetation where it tends to shelter; reluctant to fly and often collected by hand. Not wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela nigrocoerulea bowditchi Leng, 1902

Ecology. Stenotopic, hygrophilous, halophilous, epigean. Salt flats and alkali flats. Open ground; wet, muddy, often saline soil. Adults tend to occur in bare areas or among grass bordering flats. Diurnal; seen active between 9:00 A.M. and noon. Associated species: *C. terricola cinctipennis*.

Biology. Seasonality: July-October, mostly July. Summer species. Defense mechanism: escapes by a quick flight and then lands to hide in the shade of the low vegetation when pursued.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela nigrocoerulea nigrocoerulea LeConte, 1848

Ecology. Eurytopic, steppicolous, hygrophilous, halophilous, epigean (adult); fossorial (larva). Grasslands, pastures, cultivated fields (alfalfa, sugar beet), mountain slopes, roads, roadside ditches, irrigation ditches, pond and reservoir edges, grassy marshlands,

small wet spots, muddy spots, desert areas, salt flats, playas, and open places in forests. Adult tending to occur in grasslands, along the edge of the vegetation. Open ground; moist or wet (rarely dry), muddy, often alkaline, bare or sparsely vegetated (grass or weeds) soil. Larval habitat: burrows dug into grasslands. Both diurnal and nocturnal; daily foraging lasts about 7 hours; basking, foraging, stilting, and shuttling to shade at 29.1°C, 35.6°C, 36.4°C, and 38.4°C respectively in AZ. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 17.8°C. Numerous individuals found in late morning under dried cow patties (AZ). Gregarious, occurs in swarms. Associated species: *C. punctulata punctulata*, *C. praetextata erronea*, *C.pimeriana*, *C. obsoleta santaclarae*, *C. sedecimpunctata sedecimpunctata*, *C. marutha*, *C. fulgida fulgida*, *C. nevadica knausii*, *C. obsoleta obsoleta*, and *C. togata globicollis*.

Biology. Seasonality: June-October, mostly July-August. Summer species. Mating: July. Predaceous. Adult food, in the laboratory: beetles and flies; able to survive about 30 days without food. Defense mechanism: often flies readily or runs into the grass when pursued, hence extremely difficult to approach; emits a fruity scent when captured.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela nigrocoerulea subtropica Vogt, 1949

Ecology. Stenotopic, hygrophilous, epigean. Mesquite grasslands-forestlands: grassy fields, clearings, little-used roadways; edge of a plowed field; a citrus grove. Well adapted to disturbed areas. Open ground; moist soil. Adults tend to occur on bare areas surrounded by short grass. Diurnal.

Biology. Seasonality: September-November, rare in November.

Dispersal power. Macropterous. Fast runner.

Conservation status. Rare subspecies.

Cicindela obsoleta neojuvenilis Vogt, 1949

Ecology. Stenotopic, epigean. Mesquite grasslands-forestlands: little-used roadways, edges of cultivated fields, and clearings. Diurnal.

Biology. Seasonality: October-January. Apparently a fall-winter species.

Dispersal power. Macropterous. Flier. Fast runner.

Conservation status. Rare subspecies.

Cicindela obsoleta obsoleta Say, 1823

Ecology. Eurytopic, steppicolous, epigean (adult); fossorial (larva). Grasslands, prairies, meadows, rangelands, hillsides, arid tablelands, roads, moist ditches, pastures near bays, parks near bayous; dried-up beds of pools and lakes; sometimes edges of springs, streams, ponds, and reservoirs. Not necessarily associated with water. Open ground; dry or moist, sometimes wet, sandy, loamy or clayey soil with small bare areas surrounded by grass clumps. Adults tend to occur in bare areas surrounded by clumps of grass or among the short vegetation. Larval habitat: prairies, in adobe or slightly gravelly soil; slightly spiralled burrows (12.5 to17.5 cm deep) dug into bare ground spots between grass tufts. Diurnal. Gregarious, occurring in small numbers. Associated species: *C. pulchra pulchra*, *C. schauppii*, and *C. punctulata punctulata*.

Biology. Seasonality: June-October, mostly July-August. Emergence after summer rains (CO). Predators: asilid flies. Larval parasites: bombyliid flies and tiphiid wasps. Defense mechanism: when disturbed, usually flies about 65 m before alighting in the grass. Very wary. Difficult to approach.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela obsoleta santaclarae Bates, 1890

Ecology. Stenotopic, steppicolous, xerophilous, thermophilous, epigean (adult); fossorial (larva). Grasslands, grassy pastures, meadows, and

well-drained, grassy alluvial slopes and hillsides. Not associated with water. Open ground; often hot, dry soil consisting of clay-loam, with small bare areas surrounded by grass clumps. Adults tend to occur under grass clumps. Larval habitat: base of a grassland slope; burrows (6.1-11.1 cm deep, 9.1 cm on average) dug into open patches of clay-loam soil with moderate vegetation. Diurnal; basking, foraging, stilting, and shuttling to shade at 31.7°C, 36.4°C, 38.1°C, and 38.6°C respectively in AZ; active for about 6 hours each day. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 15.6°C. Gregarious. Associated species: *C. nigrocoerulea nigrocoerulea* (mostly), *C. praetextata erronea*, *C. sedecimpunctata sedecimpunctata*, *C. pimeriana*, *C. marutha*, *C. pulchra dorothea*, *C. hornii hornii*, *C. debilis* and C. *lemniscata lemniscata*.

Biology. Seasonality: June-September, mostly July-August. Summer species. Duration of life cycle: 2 (mostly)-3 years. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: crickets, beetles, and flies. Larval food, in the laboratory: springtails, drosophilid flies, and tenebrionid larvae. Adult able to survive 50 days without food. Predators: shrikes and kestrels. Larval parasites: tiphiid wasps. Defense mechanism: when disturbed, flies quickly and steadily, often very high and over long distances (sometimes more than 100 m). Quite wary. Difficult to approach.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela obsoleta vulturina LeConte, 1853

Ecology. Eurytopic, steppicolous, xerophilous, psammophilous, epigean. Prairies, pastures, fields, roadside ditches, bare sandy or rocky flats; openings, roads, and paths through forests. Open ground; often dry, sandy, rarely rocky soil, bare or vegetated with short grass or clumps of bunch grass. Adults tend to occur close to grass clumps. Diurnal. Solitary or occurring in small numbers.

Biology. Seasonality: June-November. Defense mechanism: when

disturbed, flies rapidly and steadily high above the ground for distances up to 400 m. Wary, readily alarmed.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela ocellata ocellata Klug, 1834

Ecology. Eurytopic, riparian, hygrophilous, halophilous, epigean (adult); fossorial (larva). Edges of permanent ponds (mostly), irrigation ditches, stream banks, irrigated fields, moist pastures, cattle watering reservoirs, and flats. Open ground; moist or wet, rarely dry, sandy or muddy, sometimes alkaline soil. Larval habitat: ditches, drainage areas, and pond edges; burrows (third-instar larva, 12-18.8 cm deep, 15.6 cm on average) dug into wet, loamy sand. Both diurnal and nocturnal; number of active individuals stays relatively constant throughout the day; basking, foraging, and stilting at 32°C, 35.9°C, and 37.8°C respectively in AZ. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 20.1°C. Gregarious.

Biology. Seasonality: June-October, mostly July-August. Duration of life cycle: 1 year. Predaceous. Adult food, in the field: ants, other insects, marine fleas, and young fiddler crabs. Adult food, in the laboratory: beetles and flies. Larval food, in the laboratory: springtails, drosophilid flies, and tenebrionid larvae. Predators: lizards. Larval parasites: bombyliid flies and tiphiid wasps. Defense mechanism: flash coloration - deters predators by exposing its orange abdomen in flight; emits defensive secretions and a fruity scent similar to, but weaker than that of *C. punctulata punctulata*.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela ocellata rectilatera Chaudoir, 1843

Ecology. Eurytopic, riparian, hygrophilous, halophilous, thermophobous, epigean (adult); fossorial (larva). Edges of ponds, salt lakes, rivers (and their bars), brooks, springs, irrigation ditches, roadside ditches, cattle holes, road pools, and rain puddles; alkali

flats, salt flats, salt marshes, tidal flats, and sea beaches. Sometimes found a few kilometers from bodies of water. Open ground; wet, often sandy, sometimes muddy or clayey, often saline soil, bare or vegetated with grass or weeds. Larval habitat: aggregated burrows (20-25 cm deep) curved nearly to a horizontal plane at the bottom and dug into heavy, clayey soil at a distance of 300-400 m from the adult habitat. Both diurnal and nocturnal; during the hottest part of the day, hides among the vegetation on which it can climb up to 1.5 m above the ground. Gregarious, occurs in swarms.

Biology. Seasonality: April-September, December. Mating: lasts 1 min.; male runs rapidly after mating to escape the female counter-attack. Oviposition: female flies some distance, sometimes up to 400 m, from the adult habitat to deposit eggs singly at intervals of 2.5 to 15 cm. Omnivorous. Adult food, in the field: ants, other insects, marine fleas, young fiddler crabs, dead fish and rabbit, algae and fine green moss. Predators: flycatchers. Defense mechanism: when alarmed, runs by spurts and readily flies a distance of 2.8 m on average; produces defensive secretions to deter predators. Quite easily captured.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner. Very active.

Cicindela ohlone Freitag and Kavanaugh, 1993

Ecology. Stenotopic, coastal, epigean. Remnant stands of native grasslands: along trails and trampled areas. Open ground; poorly-drained soil consisting of clay or sandy clay over bedrock and covered by low sparse vegetation. Diurnal.

Biology. Seasonality: January-April, mostly February-March. Defense mechanism: often flies to areas of denser grass, when disturbed.

Dispersal power. Macropterous. Good flier. Fast runner.

Conservation status. Rare species.

Cicindela olivacea Chaudoir, 1854

Ecology. Stenotopic, coastal, saxicolous, epigean. Island shorelines. Close to the water's edge. Open ground; rocky soil of coral reef type, covered with coarse sand, coral, and broken shells. Adult tending to occur on a rock or a rocky area. Both diurnal and nocturnal.

Biology. Seasonality: June-August. Defense mechanism: cryptic coloration - body color blends with its background; when disturbed, escapes by flying in a quick and erratic manner, occasionally alighting on sandy areas, but soon returning to the rocks. Difficult to capture because of the uneven rocky surface of its habitat.

Dispersal power. Macropterous. Strong flier. Attracted to artificial light at night. Fast runner.

Cicindela oregona guttifera LeConte, 1857

Ecology. Eurytopic, riparian, hygrophilous, heliophilous, epigean. River and brook banks. Open ground; wet, sandy, muddy, rarely rocky, bare or sparsely vegetated soil. Diurnal; flying in the sunshine. Gregarious, often occurs in large numbers. Associated species: *C. repanda tanneri*, *C. repanda repanda*, *C. hirticollis corpuscula*, and *C. tranquebarica kirbyi.*

Biology. Seasonality: May-June, August. Spring-fall species. Defense mechanism: cryptic coloration - body color blends perfectly with its surroundings; readily escapes by flying a short distance (less than 3 m) at the slightest disturbance. Very wary.

Dispersal power. Macropterous. Good flier. Fast runner. Quite active.

Cicindela oregona maricopa Leng, 1902

Ecology. Stenotopic, riparian, hygrophilous, epigean (adult); fossorial (larva). Banks and sand bars along semipermanent streams. Open ground; moist, sandy or muddy soil. Larval habitat: closer to the water's edge than the adult; burrows preferably dug into the fine moist sand. Diurnal.

Biology. Seasonality: March-April, September-October. Spring-fall species. Predaceous. Adult food, in the laboratory: small crickets. Defense mechanism: cryptic coloration - light violet or green lustre of blackish elytra blends with the predominant basalt stones of the habitat.

Dispersal power. Macropterous. Fast runner.

Conservation status. Subspecies threatened by off-road vehicle traffic.

Cicindela oregona navajoensis Van Dyke, 1947

Ecology. Stenotopic, riparian, hygrophilous, epigean. Stream banks. Open ground: moist soil. Diurnal. Gregarious.

Biology. Seasonality: June-July. Spring-fall species. Predaceous. Adult food, in the laboratory: small crickets. Defense mechanism: cryptic coloration - coppery red color blends with the sandstone deposits of stream beds.

Dispersal power. Macropterous. Fast runner.

Cicindela oregona oregona LeConte, 1857

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophobous, epigean (adult); fossorial (larva). Sea beaches, estuarine beaches; tidal flats, alkali flats; banks and bars along rivers; edges of small desert springs, lakes, ponds, and livestock reservoirs; salt marshes. Close to the water's edge. Open ground; moist or wet, rarely dry, sometimes saline soil consisting of dark sand, gravel, mud, clay or stones, bare, sparsely vegetated or with open patches of vegetation. Larval habitat: sloping, moist, sandy or clayish banks; burrows (12.5-30.0 cm deep) generally vertical in orientation, but horizontal if dug into vertical banks, open from March to October. Diurnal; becoming active at 15°C. Gregarious, occurring in swarms. Associated species: *C. repanda repanda*, *C. duodecimguttata,* and *C. hirticollis shelfordi.*

Biology. Seasonality: March-November; one major peak of activity in June-July and a smaller one in September-October; females more

numerous than males early in the season, but males more abundant than females late in the season. Spring-fall species. Mating: May, July; interspecific copulation observed with *C. duodecimguttata, C. repanda repanda* and *C. willistoni pseudosenilis*. Oviposition: May-July. Tenerals: August-September. Overwinters both in the adult and larval (second-instar) stages; larval burrows closed during the winter. Adult food, in the field: small arthropods. Larval food, in the field: ants, tabanid flies, and a coccinellid; larvae cannibalistic when coming into contact. Predators: frogs and gnaphosid spiders. Larval parasites: bombyliid flies. Defense mechanism: cryptic coloration - dark elytra with pale maculations blend perfectly with the surrounding black sand containing little flecks of white; body coloration turns to black with age; escapes by slow flights when pursued, then easily caught by hand; produces defensive secretions to deter predators; when netted, burying itself just under the sand, then difficult to see and often escaping. Quite wary.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela pamphila LeConte, 1873

Ecology. Stenotopic, coastal, hygrophilous, halophilous, epigean. Sea beaches, lagoon edges, sea inlets, salt flats, mud flats, tidal flats near bays, creek shores, salt marshes opening to the sea, and edges of saline pools. Open ground; bare, muddy, saline soil. Diurnal; seen active in early morning. Associated species: *C. severa severa, C. ocellata rectilatera,* and *C. hamata monti.*

Biology. Seasonality: June-October. Defense mechanism: escape by a short flight and easily caught.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela parowana parowana Wickham, 1905

Ecology. Eurytopic, riparian, hygrophilous, halophilous, heliophilous, epigean. Shores of lakes, reservoirs, springs, and irrigation ditches; alkali flats and small bare spots. Normally close to the water's edge,

but sometimes up to one kilometer from it. Open ground; moist or wet, sandy or muddy, mostly alkaline soil with bare spots or sparsely vegetated with grass or weeds. Diurnal; running and flying in the sunshine.

Biology. Seasonality: March-April, July-September. Spring-fall species. Defense mechanism: escapes by flight. Quite wary.

Dispersal power. Macropterous. Flier. Fast runner.

Cicindela parowana platti Cazier, 1937

Ecology. Stenotopic, xerophilous, halophilous, epigean. Hill slopes at about 30-50 m from rivers. Open ground; dry, powdery, sometimes alkaline soil vegetated with grass stubble. Diurnal. Gregarious.

Biology. Seasonality: July-September.

Dispersal power. Macropterous. Fast runner.

Cicindela parowana remittens Casey, 1924

Ecology, Biology and **Dispersal power**: Unknown.

Cicindela parowana wallisi Calder, 1922

Ecology. Stenotopic, halophilous, epigean. Alkali flats and paths. Open ground; alkaline soil. Diurnal. Associated species: *C. hemorrhagica hemorrhagica*, *C. oregona oregona,* and *C. terricola imperfecta.*

Biology. Seasonality: March-June, August-September, mostly April-May. Spring-fall species.

Dispersal power. Macropterous. Fast runner.

Cicindela patruela consentanea Dejean, 1825

Ecology. Stenotopic, silvicolous, psammophilous, epigean. Coniferous forests (pine) and pine barrens: sandy paths, trails, little-used roads, roadsides, small sandy spots, clearings, edges, and gravelly bluffs. Open ground; mostly sandy soil blackened by decaying vegetation, sometimes, on small slopes, with scattered small stones and pebbles. Diurnal; hiding during the hottest part of the day under low vegetation; most active from mid- to late afternoon.

Biology. Seasonality: March-October (*e.g.*, April-June, September in NJ). Spring-fall species with stragglers in midsummer. Defense mechanism: cryptic coloration - dark body color blends perfectly with the mosaic formed by blackened areas of dead lichens, cryptogamic soil, and charcoal lying on sand; when disturbed, often flies into the forest undergrowth where it becomes very hard to see. Very wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela patruela patruela Dejean, 1825

Ecology. Eurytopic, silvicolous, psammophilous, thermophilous, heliophilous, epigean (adult); fossorial (larva). Mostly hills and mountains. Mixed forests (mostly dominated by jack-pine, sometimes oak or aspen): little-used roads, fire lanes, paths, trails, clearings, eroded slopes, and edges of abandoned sand quarries adjoining grassy hillsides, and fields near tree-trunks or patches of plum brush. Open or partly-shaded ground; dry soil, bare or sparsely vegetated with grass, moss and lichens, and consisting mostly of sand, which may be coarse, sometimes of sandstone, clay or rock. Adult preferring the grassy growth in and along the edges of open areas. Larval habitat: Burrows. Diurnal; sometimes found under leaves during the day; not active before 9:00-10:00 A.M.; basks to elevate its body temperature to about 34°C; stilts and shuttles to shade to maintain this temperature. Gregarious, not usually occurring in large numbers. Associated species: *C. longilabris longilabris* and *C. sexguttata.*

Biology. Seasonality: April-November (e.g., April-June, August-September in NH). Spring-fall species, with stragglers in midsummer. Duration of life cycle: 2 years (1 year in captivity). Mating: May-July. Oviposition: in shaded, barren areas, above a trail, among lichens and moss, in June.Tenerals: September. Overwinters at least in the adult stage, but possibly also in the pupal

stage. Defense mechanism: cryptic coloration - body color blends with the surrounding green vegetation; flies frequently into the shade of the forest when disturbed, usually for short distances and returning to its starting point after a while; emits a chemical liquid when captured. Not very wary.

Dispersal power. Macropterous. Good flier. Fast runner. Taken in malaise traps.

Conservation status. Almost extinct in parts of MD.

Cicindela pilatei (Guérin-Méneville, 1845)

Ecology. Eurytopic, coastal, epigean. Vicinity of bayous; edges of drying salt marshes; forests near lakes; little-used paths; fields, under haycocks; corn fields, on dry loam. Close to the water's edge. Open ground; sparsely vegetated soil. Mostly nocturnal, tending to be crepuscular; appears on roads about 4:00 P.M.; also active early in the morning, just after dawn. Solitary.

Biology. Seasonality: May-July. Defense mechanism: escape by quickly running and hiding in the vegetation, then easily captured by hand.

Dispersal power. Subapterous; flightless. Attracted to artificial lights at night. Fast runner.

Cicindela pimeriana LeConte, 1866

Ecology. Eurytopic, steppicolous, halophilous, epigean (adult); fossorial (larva). Edges of ponds, lakes, and artesian wells in grasslands; dry flats close to the water's edge; dry grassland areas. Open ground; wet to dry, clayey or sandy, saline, bare or sparsely vegetated soil. Larval habitat: burrows dug into saltbush flats. Diurnal; basking, foraging, stilting, and shuttling to shade at 30.9°C, 33.2°C, 38.8°C, and 39.1°C respectively in AZ. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 17.5°C. Gregarious. Associated species: *C. nigrocoerulea nigrocoerulea*, *C. sedecimpuncta sedecimpunctata*, *C. marutha*, *C. praetextata erronea*,

and *C. obsoleta santaclarae*.

Biology. Seasonality: July-November, mostly in late summer and September-November. Spring individuals which survive until fall become dull black. Predaceous. Adult food, in the laboratory: beetles and flies. Predators: asilid flies. Mites occurring on adult body. Defense mechanism: escapes by long, regular flights between long rest periods, possibly as self-defense against asilid flies.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela plutonica leachi Cazier, 1936

Ecology. Eurytopic, xerophilous, halophilous, epigean. Semi-alkaline and alkaline areas, desert sand dunes, scab-rock flats, foothill brushlands and pasturelands, and open exposed slopes at higher altitudes. Open ground; dry, sandy or rocky, alkaline soil, bare or sparsely vegetated with grass or forbes. Diurnal. Associated species: *C. purpurea audubonii* and *C. oregona oregona*.

Biology. Seasonality: March-April, June-July, September-October. Defense mechanism: escapes by flight for some distance.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela plutonica plutonica Casey, 1897

Ecology. Eurytopic, xerophilous, heliophilous, epigean. Rocky hillsides about snow pools and snow fields; sagebrush areas and adjoining roads and washes. Open ground; dry, rocky or sandy soil sparsely vegetated with sagebrush and grass. Diurnal; inactive on overcast days, almost inactive on windy days. Associated species: *C. purpurea audubonii* and *C. tranquebarica tranquebarica*.

Biology. Seasonality: January, June-July; mostly June. Mating: June. Defense mechanism: cryptic coloration - dark body color blends with the black soil; escapes by flying quickly for some distance.

Dispersal power. Macropterous. Strong flier. Fast runner.

Cicindela politula barbaraannae Sumlin, 1976

Ecology. Stenotopic, silvicolous, xerophilous, epigean. Limestone scrub woodlands. Open ground; dry, bare soil consisting of limestone. Adults tend to occur on large ledges of higher elevations. Diurnal; seen active in the afternoon.

Biology. Seasonality: August-September.

Dispersal power. Wing condition unknown. Fast runner.

Conservation status. Rare subspecies.

Cicindela politula petrophila Sumlin, 1985

Ecology. Stenotopic, silvicolous, xerophilous, saxicolous, epigean. Limestone scrub woodlands. Open ground; dry, rocky, bare soil consisting of limestone. Adults tend to occur on stones or boulders. Diurnal.

Biology. Seasonality: July-August.

Dispersal power. Wing condition unknown. Fast runner.

Conservation status. Rare subspecies.

Cicindela politula politula LeConte, 1875

Ecology. Stenotopic, xerophilous, epigean. Limestone scrub woodlands, open hillsides, and dirt roads and trails. Open ground; dry soil consisting of limestone or calcareous clay, and bare or sparsely vegetated with herbs, grass, junipers, and dwarf oaks. Adult tending to occur on large limestone blocks, stones or bare clay. Diurnal.

Biology. Seasonality: August-November, more rare in October. Defense mechanism: Not attempting to fly when pursued.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela politula viridimonticola Gage, 1988

Ecology. Epigean. Unknown.

Biology. Seasonality: August.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela praetextata pallidofemora Acciavatti, 1980

Ecology. Stenotopic, riparian, hygrophilous, epigean. River flats. Open ground; wet, muddy soil. Both diurnal and nocturnal.

Biology. Seasonality: June-August, mostly August.

Dispersal power. Wing condition unknown. Attracted to artificial light at night. Fast runner.

Cicindela praetextata praetextata LeConte, 1854

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Mostly pond edges; also river mud flats and sand bars. Open ground; wet, sandy or muddy, often alkaline soil. Adults tend to occur in the grass or in bare areas. Both diurnal and nocturnal. Gregarious, occurs in large numbers.

Biology. Seasonality: May-August. Mating: May.

Dispersal power. Wing condition unknown. Attracted to artificial light at night. Fast runner.

Cicindela pruinina (Casey, 1897)

Ecology. Eurytopic, psammophilous, epigean. Disturbed habitats: meadows, cultivated fields (corn, hay), lawns, parks, roads, forest paths and clearings. Open ground; sandy, more or less vegetated soil. Mostly crepuscular; active after 4:00 P.M.; when inactive, hides under haycocks.

Biology. Seasonality: June-August, mostly July. Defense mechanism: runs through the vegetation when pursued. Easily captured by hand.

Dispersal power. Flightless. Fast runner.

Cicindela pugetana **Casey, 1914**

Ecology. Stenotopic, epigean. Sagebrush tracts. Open ground; loamy, more or less vegetated soil. Diurnal.

Biology. Seasonality: April-June, September-October.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela pulchra dorothea Rumpp, 1977

Ecology. Stenotopic, xerophilous, steppicolous, epigean. Grassland and grassy flatlands. Not associated with water. Open ground; dry soil with bare spots surrounded by grass clumps. Adults tend to occur in the shade of grass clumps. Diurnal; not seen foraging after 11:00 A.M.

Biology. Seasonality: May, July-September, mostly August. Defense mechanism: when flushed from grass clumps, escapes by one flight and/or rapidly runs to the nearest clump.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela pulchra pulchra Say, 1823

Ecology. Eurytopic, steppicolous, psammophilous, epigean (adult); fossorial (larva). Eroded grasslands, arid tablelands, rangelands, tops of clay bluffs and hills: bare clay flats, barren spots, small openings, dirt roads and little-used roads; also clayey washes near chalk outcroppings. Open ground; dry soil, bare or vegetated with grass clumps and usually consisting of clay or loam, sometimes sand or gravel. Adults tend to move rapidly between grass clumps. Larval habitat: grasslands, saltbush and mesquite flats, and arroyos; scattered vertical burrows (third instar, 6.5-15.3 cm deep, 12.6 cm on average) dug into bare, hard-packed, silty clay-loam or moist adobe. Diurnal; basking, foraging, stilting, and shuttling to shade at 32.2°C, 36.4°C, 37°C, and 39°C respectively in AZ; active for about 5 hours each day. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 17.8°C. Solitary (CO) or gregarious (KS). Associated species: *C. obsoleta obsoleta*, *C. punctulata punctulata*, and *C. lemniscata lemniscata*.

Biology: Seasonality: February, April-October. Either spring-fall (CO, KS) or summer species (NE). Duration of life cycle: 2 years. Tenerals: September. Predaceous. Adult food, in the field: acridids. Adult food, in the laboratory: beetles and flies. Larval food, in the laboratory: springtails, drosophilid flies or tenebrionid larvae. Predators: asilid flies. Larval parasites: bombyliid flies and tiphiid wasps. Defense mechanism: escapes by swift and very long flights (up to 10 m in high winds). Bright red color of body and behavior makes it look similar to female mutillid wasps (*Dasymutilla* spp.) found in the same habitat. Quite wary. Very difficult to approach.

Dispersal power. Macropterous. Strong flier. Fast runner. Very agile.

Cicindela punctulata chihuahuae Bates, 1890

Ecology. Eurytopic, hygrophilous, halotolerant, epigean. Mostly edges of rivers, brooks, lakes, ponds, marshes, waterholes, irrigation ditches, roadside ditches, and sand dunes; alkali flats in grasslands, prairies and pastures; rocky hillsides. Open ground; usually wet, sometimes moist or dry, muddy, occasionally rocky or dusty, alkaline soil sparsely vegetated with grass or weeds. Adults tend to hide at the border of the low vegetation. Diurnal; hiding during the late afternoon heat. Solitary or occurring in small numbers. Associated species: *C. ocellata ocellata*.

Biology. Seasonality: June-September, rarely in June. Defense mechanism: escapes by flight.

Dispersal power. Macropterous. Good flier. Occasionally attracted to artificial lights at night. Fast runner.

Cicindela punctulata punctulata Olivier, 1790

Ecology. Eurytopic, xerophilous, psammophilous, epigean (adult); fossorial (larva). Both disturbed and undisturbed habitats: roads (sometimes dusty), paved roads, roadcuts, old trails, dusty paths, cow paths, roadsides, roadside ditches, eroded banks, eroded gullies, rocky hillsides, mountain tops, railroad embarkments, strip mine sites, sand dunes, blowouts, sand pits, sand bars, old excavations, yards, city lawns and parks, garden paths, prairies, grasslands, pastures, cultivated fields (soybean, cotton, corn, wheat, tobacco, clover, alfalfa, asparagus, small grains), plowed fields, city vacant

lots, field edges; city parking lots, streets, sidewalks, and vicinity of dwellings; orchards (apple), clearings, flats and pathways through forests. Open ground; hard-packed, preferably dry, bare or sparsely vegetated soil consisting of sand or sandy loam (sometimes pure loam, clay or, more rarely, gravel or rock). Adults tend to occur at the grassy edge of the habitat. Larval habitat: vacant lots containing bare areas surrounded with grass clumps; dry mossy situations between grass clumps; moist adobe soil; among willow and cottonwood seedlings; among grass and weeds; vertical burrows (third instar) ranging from 30 to 40 cm in depth, usually dug in hard-packed sand, clay or loam. Both diurnal and nocturnal; sheltering in the shade of vegetation, sticks and stones or in mud cracks during the hottest part of the day; hides under pieces of wood on cloudy or cool days; basking, foraging, stilting, and shuttling to shade at 33.4°C, 37.1°C, 37.2°C, and 37.7°C respectively in AZ; inactive in the field at 38-39°C in KS. Mean minimum thoracic temperature for coordinated walking, in the laboratory: 17.2°C. Gregarious, in small to moderate numbers.

Biology: Seasonality: April-November, mostly July. Summer species. Duration of life cycle: 1 year. Mating: late June-September; coitus lasting 60 min.; interspecific copulation observed with *C. sexguttata*. Oviposition: June-July; in vacant lots, in rather hard-packed, dry soil, generally in humus or in soil cracks in bare areas surrounded by grass clumps. Duration of larval life: 10 months; larval burrow usually closed in October for overwintering. Pupation: lasting 10 days to 2 weeks; in an oval cell, in May-June. Tenerals: May-July; sexual maturity requiring about 3 weeks. Duration of adult life: 2 months. Overwinters in the larval (third instar) stage, in burrows ranging from 45 to 65 cm in depth. Predaceous. Adult food, in the field: ants, nymphal lygaeids, acridids, chrysomelids, carabids, and worms. Adult food, in the laboratory: ants, carabids, flies, and lean meat. Larval food, in the field: small arthropods. Larval food, in the laboratory: cricket nymphs, house flies, and lean meat. Food

restriction is the principal cause of larval mortality. Predators: toads, frogs, bluebirds, crows, grackles, starlings, kestrels, flycatchers, robins, skunks, and asilid flies. Larval parasites: bombyliid flies and tiphiid wasps. Seemingly resistant to pesticides. Defense mechanism: cryptic coloration - body color blends with the loamy soil; when alarmed, hides beneath vegetation or climbs up grass stalks or low bushes; escapes by a quick flight when pursued; emits a strong, fruity apple-like scent when captured. Wary. Difficult to approach in the daytime, but easily collected with a flashlight at night. Teratology: one individual (QU) with the sixth segment of the left antenna bifurcate. Captured in malaise traps.

Dispersal power. Macropterous. Good flier. Often attracted in great numbers to artificial lights at night, particularly in cities. Fast runner. Excellent climber.

Cicindela puritana G.H. Horn, 1871

Ecology. Stenotopic, riparian, hygrophilous psammophilous, halotolerant, epigean (adult); fossorial (larva). Narrow beaches of coastal rivers and brooks; adults move to the base of sand-clay cliffs when beaches become flooded at high tide (MD). Open ground; often soft, sandy, sometimes saline soil. Both diurnal (mostly) and nocturnal. Larval habitat: burrows (30-70 cm deep on average) dug into the sand in the upper zone of beaches or at the base of cliffs. Gregarious, swarms by the hundreds. Associated species: *C. hirticollis hirticollis*, *C. marginata*, and *C. repanda repanda*.

Biology. Seasonality: June-September, mostly July. Summer species. Duration of life cycle: 1 (rarely) - 2 years. Mating: lasts 39 min. on average; contact-guarding often displayed by the male after copulation. Oviposition sites: cliff faces, in soft sand. Larva able to survive flooding of its habitat. Pupation: May. Tenerals: June. Overwinters in the larval (second or third instar) stage. Predaceous, necrophagous. Adult food, in the field: small flies, beetles, and small dead animals. Adult food, in the laboratory: tenebrionids and small

bits of ground beef. Predators: asilid flies and salticid spiders. Larval parasites: tiphiid wasps. Defense mechanism: cryptic coloration - body color blends with surroundings; when disturbed, escapes by short spurts and easily captured. Quite shy.

Dispersal power. Macropterous. Excellent flier. Attracted to artificial lights at night. Fast runner. Long-distance disperser; found at about 45 km from its breeding habitat.

Conservation status. Threatened species; endangered by dam construction, shore stabilization, flood control, recreational land-use, and general urbanization; numbers drastically decreasing in New England.

Cicindela purpurea audubonii LeConte, 1845

Ecology. Eurytopic, xerophilous, halotolerant, epigean (adult); fossorial (larva). Eroded clay banks, clay roads, red sandy roads, red sandstone roadcuts, paths, red clay roadsides, ditches, railroad embarkments, blowouts, small openings, clay pits, clay gullies, clay bottoms of ravines, steep clay hills, grassy slopes, clay bottoms near chalk washes; bare, sandy spots in prairies; sandy barrens, sandy banks of streams, salt flats, and alkali flats. Open ground: dry, clayey, sometimes sandy, saline, often sloping soil, bare, sparsely vegetated or with small bare areas between grass clumps. Larval habitat: Blowouts vegetated with bunchgrass; burrows (third instar) dug into clayey soil. Diurnal; becoming active at about 18°C. Solitary. Associated species: *C. splendida.*

Biology. Seasonality: February-October (*e.g.*, April-May, September-October in WA); becomes active just after snowmelt. Spring-fall species. Mating: March, June. Tenerals: August. Overwinters both in the adult and larval (third-instar) stages. Predaceous. Adult food, in the field: scarabaeids. Predators: of adult in the field, bluebirds and asilid flies; in the laboratory, a *Pasimachus* (carabid). Defense mechanism: cryptic coloration - black body and reduced elytral maculations of individuals living on dark soil blend with their

surroundings; flies in small spurts like a small grasshopper or readily hides in grass clumps when disturbed. Quite wary.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela purpurea cimarrona LeConte, 1868

Ecology. Eurytopic, steppicolous, epigean. Grasslands, meadows, fields, and open forests: openings, roads, roadsides, and paths. Open ground; clayey or sandy soil, either bare or with small open areas surrounded by grass clumps. Diurnal; active from early morning until the evening. Solitary or semi-gregarious. Associated species: *C. longilabris laurentii.*

Biology. Seasonality: April-August. Spring-fall species. Defense mechanism: hides in grassy edges or in grass clumps when pursued.

Dispersal power. Macropterous. Fast runner.

Cicindela purpurea hatchi Leffler, 1980

Ecology. Eurytopic, steppicolous, epigean (adult); fossorial (larva). Grasslands, glacial outwash prairies, mixed pine and chaparral areas, and sandy beaches. Open ground; soil mostly vegetated with short grass. Larval habitat: a short-grass prairie; burrows (third instar, 5 cm deep) dug into black, stony-loamy soil. Diurnal.

Biology. Seasonality: April-May, July, September.

Dispersal power. Macropterous. Fast runner.

Cicindela purpurea lauta Casey, 1897

Ecology. Stenotopic, epigean. South-facing slopes. Open ground; soil sparsely vegetated with herbs. Diurnal.

Biology. Seasonality: April, July-October.

Dispersal power. Macropterous. Fast runner.

Cicindela purpurea purpurea Olivier, 1790

Ecology. Eurytopic, xerophilous, thermophilous, heliophilous, epigean (adult); hygrophilous, fossorial (larva). Mostly roadways cutting

grassy meadows. Grassy roads, roadsides, paths, lanes, little-used sandy trails, powerline cuts, openings, south-facing slopes, meadows, prairies, pastures, swards, old fields, vacant lots, hillsides, grassy hills, sand dunes, and open forests. Not associated with water. Open ground; dry, level or sloping soil generally consisting of reddish clay standing over sand and humus, but in the western United States, usually consisting of a mixture of sand and gravel or gravel and loam; soil bare, sparsely vegetated or sometimes covered with small patches of decaying vegetation. Adults tend to occur in bare areas. Larval habitat: similar to the adult, in bare areas; scattered burrows ranging from 10 to 15 cm in depth. Diurnal; very active in early spring until late in the evening, especially on hot days; hides under pieces of wood, under stones or in small burrows dug at the base of clayey banks, during the night and on cloudy or cool days. Larva able to survive flooding for as long as 3 weeks. Solitary or occurring in pairs, occasionally in small groups. Associated species: *C. limbalis*.

Biology. Seasonality: February-December, mostly April-May (in MD, March-June, August-October); active early in the spring after snowmelt. Spring-fall species, with stragglers in midsummer. Duration of life cycle: 2 years. Mating: in April; male able to maintain the mounted position for a long time before coitus; interspecific copulation observed with *C. sexguttata* and *C. tranquebarica tranquebarica*. Oviposition: along cow paths in grassy ravines and in little-used areas near streams; ovipositional holes (7-9 mm deep) dug into moderately moist, black soil in April-June, and remaining uncovered; a female reported to have laid about 50 eggs. Duration of larval life: 12-13 months. Pupation: July. Tenerals: August-September. Sexual maturity of individuals reared in the laboratory reached in April, after overwintering. Duration of adult life: 10 months. Overwinters both in the adult and the larval (third instar) stages; adults pass the winter either in self-constructed holes (10-12 cm deep) dug into the loamy humus of a bank, in the hole of some other insect or, more rarely, under debris (*e.g.*, bricks); larva closes its burrow in August-September for overwintering; an hibernating adult became active as soon as it was taken into a warm room. Predaceous. Adult food, in the field: acridids. Adult food, in the laboratory: ants, scarabaeids, flies, other soft-bodied insects, and meat. Adult able to locate an ant from a distance of 10-13 cm. Larval food, in the laboratory: lean meat. Food restriction is the principal cause of larval mortality. Predators: crows, grackles, flycatchers, and starlings. Defense mechanism: cryptic coloration - greenish body blends with the surrounding vegetation; squats immediately and remains motionless when disturbed; escapes by running in and out of the grass and shelters under a grass tuft when pursued over a relatively well-vegetated area; reluctant to fly, but if flying, usually only a few meters away; easily confused with a green grasshopper when in flight. Wary. Difficult to approach.

Dispersal power. Macropterous, although some flightless specimens were seen that had fused elytra (NY). Good flier. Fast runner.

Cicindela repanda novascotiae Vaurie, 1951

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, psammophilous, epigean. Sea beaches, pond edges, lake shores; road ditches and sandy roads, sheltered sides of sand dunes. Never far from the water's edge. Open ground; wet, sandy, rarely clayey, often saline, bare or sparsely vegetated soil. Diurnal; active at temperatures as low as 8.5°C. Gregarious.

Biology. Seasonality: May-September. Tenerals: Late July-August. Defense mechanism: Escaping by flight. Wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela repanda repanda Dejean, 1825

Ecology. Eurytopic, riparian, hygrophilous, halotolerant, psammophilous, heliophilous, epigean (adult); fossorial (larva). Banks and

sand bars along brooks and rivers; river islands; beaches of ponds, lakes, and bogs; margins of water holes and irrigation ditches, bottoms of dry pools, sea beaches, barrier baches; dark roads and paths (sandy or clayey) near streams, wet roadsides; sand pits, sand dunes, gravel pits, and strip mines with permanent or temporary depressions of water or near streams; dirt roads, roadcuts, railway cuts, muddy roadways, and sandhills close to water; moist or wet fields (including cultivated fields, *e.g.*, corn, tall grains), irrigated fields, small ditches through lowland pastures, mud holes, and mud flats. Associated with water, living either closely or at some distance from it. Open ground; moist or wet, usually sandy, sometimes saline, bare or sparsely vegetated dark soil which is sometimes mixed with silt or clay, or occasionally made up of pure gravel, clay, mud or rock. Larval habitat: burrows ranging from 7.5 to 15 cm in depth, dug at right angle to sloping surfaces and oblique to horizontal surfaces into habitat similar to the adult (*e.g.*, edges of streams, ponds and lakes), but on higher ground, even among grass and willows, in sloping, moist or wet soil which usually consists of sand (sometimes of mud, clay) or is sometimes mixed with humus; larva leaves its burrow for a moister place when the sand gets too dry. Both diurnal (mostly) and crepuscular; mostly active on bright sunny days, from 8:00 A.M. to 7:00 P.M., especially between 26.7°C and 30.9°C; sunning, not running about at 15°C; becoming inactive at about 38-39°C; shuttles during the day from moist to dry areas depending on the ambient temperature; hides on the dry, sandy upper banks of streams, a short distance from the water's edge during the night and on rainy, cloudy or cool days, usually in self-constructed holes (about 1.2-2.5 cm deep) dug close to the edge of a stone or a small block of wood, or sometimes shelters under dead leaves; digs into the sand or hurries into the grass at the approach of a storm or at the disappearance of the sun. Gregarious, sometimes swarming by the hundreds. Associated species: *C. duodecimguttata*, *C. hirticollis hirticollis*, *C. oregona oregona*, and *C. ancocisconensis*.

Biology. Seasonality: January-November, with stragglers in summer; in SC, January-June, August-October; becomes active on the first sunny days of spring. Spring-fall species. Duration of life cycle: 1-2 years. Mating: May-July; copulation lasts 2.8-3.17 min.; male sometimes tries to mate with another male; interspecific copulation observed with *C. duodecimguttata, C. oregona oregona*, and *C. sexguttata*. Oviposition: in moist, firm, preferably sandy, sloping soil; eggs laid in May-June, in holes about 10 cm deep. Tenerals: July-October; sexual maturity of individuals reared in the laboratory reached in the following spring (*e.g.*, in May), after hibernation. Overwinters both in the adult and the larval (third instar) stages; adults pass the winter in burrows (5-55 cm deep, about 30 cm on average) dug into sloping, sparsely vegetated sand, clay or loamy humus, on higher ground, *e.g.*, banks, hillsides, bluffs, and beaches; adults sometimes congregate in large numbers and overwinter up to 1 km from their breeding habitat; found hibernating in the same hole with both *C. duodecimguttata* and *C. tranquebarica tranquebarica*; hibernating adult and larva both able to survive flooding for several days. Omnivorous, predaceous, necrophagous. Adult food, in the field: ants, carabids, staphylinids, weevils, other beetles, dead or dying halictid bees, acridids, caterpillars, sarcophagids flies, tipulid flies, springtails, other insects, worms, spiders, sassafras and pokeweed fruits. Adult food, in the laboratory: ants, carabids, chrysomelids, muscid flies, soft larvae, worms, crushed snails, a tadpole, dead fish, lean meat, and fruit. Adult able to detect an ant from a distance of 8 to 13 cm. Adult feeding much more on dead insects than on live ones; cannibalistic (in captivity). Larval food, in the field: acridids. Larval food, in the laboratory: lean meat. Larva able to discriminate a moving target from its background. Predators: toads, frogs, bluebirds, gulls, kestrels, owls, flycatchers, starlings, moles, asilid flies, aeshnid dragonflies, lycosid spiders, and sundews (*Drosera*). Larval parasites: bombyliid flies and tiphiid wasps. Defense mechanism: cryptic coloration - brown body blends

perfectly with the fine, moist sand; when disturbed, runs a certain distance and returns to its starting point after a while; when pursued, escapes by a short (1.98 m on average), weak, erratic flight, lands on wet, brown sand, and, after a while, comes back to about its starting point; often escapes in swarms, thus distracting the pursuer from individual targets; produces defensive secretions when captured. Quite wary.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner. Always on the move, running for a distance of 2.5 to 7.5 cm, stopping for one or several seconds, then starting again, busily chasing small insects or seeking a congener. Early to colonize disturbed sites.

Cicindela repanda tanneri Knaus, 1929

Ecology. Stenotopic, riparian, psammophilous, hygrophilous, halophilous, epigean. River banks; alkali flats and sedge meadows near rivers. Close to the water's edge. Open ground; moist or wet, sandy (mostly) or muddy, often alkaline, bare or sparsely vegetated soil. Diurnal; seen foraging from early morning until 4:00 P.M. Gregarious. Associated species: *C. oregona guttifera* and *C. hirticollis corpuscula.*

Biology. Seasonality: June-July.

Dispersal power. Macropterous. Fast runner.

Cicindela rufiventris cumatilis LeConte, 1851

Ecology. Eurytopic, xerophilous, epigean. Roads and bare areas in the vicinity of streams; beds of intermittent streams (*e.g.*, creeks); places (*e.g.*, roads) in forests. Diurnal. Open or partially shaded ground; dry, bare, sandy or muddy soil.

Biology. Seasonality: June-September, mostly July. Defense mechanism: escapes by flight when closely approached. Not wary. May be captured by hand.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela rufiventris heutzii Dejean, 1831

Ecology. Stenotopic, xerophilous, saxicolous, epigean (adult); fossorial (larva). Hilly outcrops, rocks, and ledges. Open ground; dry rocky (granitic), bare soil with patches of moss and lichen. Larval habitat: patches of moss and lichen either in large rock crevices mostly filled with sand and loose stones or in the soil between rocky spurs; burrows dug straight down for 7.5 to 10 cm, then at a right angle for their remaining length. Diurnal; basks on rocky surfaces for thermoregulation; hides in a burrow dug into a path of moss and lichens growing in rocky crevices when inactive.

Biology. Seasonality: June-September, mostly July. Summer species. Defense mechanism: flies readily and quickly between rocks or ledges when disturbed; flash coloration - exposing its crimson, almost transparent abdomen (like a drop of blood suspended to its apex) to deter predators. Adaptation to a specific habitat like granitic outcrops, is thought to be important for predator avoidance. Wary.

Dispersal power. Macropterous. Good flier. Fast runner.

Note. The original spelling of the subspecific name is *heutzii*, not *hentzii* as suggested in the more recent literature.

Cicindela rufiventris rufiventris Dejean, 1825

Ecology. Eurytopic, silvicolous, xerophilous, thermophobous, epigean (adult); fossorial (larva). Upland forests and their vicinity: small sparsely vegetated clearings, little-used dirt roads, paths and trails, roadcuts, roadsides, eroded or railway embankments, barren slopes, clay banks, eroded gullies, bare flats and spots in fields, overgrown gravel pits, sandy or gravelly blowouts, rocky outcrops or ledges, flat boulders, strip mines, rock quarries, beds of loose rocks, crushed granite, basalt or sandstone. Open or partially shaded ground; bare or sparsely vegetated, dry soil usually consisting of red or yellow clay (sometimes mixed with fine sand or gravel), rock or, less often, pure sand or gravel. Larval habitat: a gravel pit; burrows (a few

"inches" deep) dug into yellow clay soil mixed with sand. Diurnal (mostly) and nocturnal; mostly active in the morning and in late afternoon; either sunfacing or shuttling to partial shade (*e.g.*, at the edge of clearings or under tree branches) to avoid the excessive midday heat. Preferred temperatures, in the laboratory: 27.4-33.5°C. Solitary or occurring in small numbers. Associated taxa: *C. punctulata punctulata* and the Timber Rattlesnake (*Crotalus horridus*).

Biology. Seasonality: May-September, mostly July-August. Summer species. Duration of life cycle: 1 year. Tenerals: June-July. Predaceous. Adult food, in the field: elaterids. Adult food, in the laboratory: adult and larval tenebrionids or drosophilid flies. Larval food, in the laboratory: mealworms. Predators: asilid flies and spiders. Defense mechanism: cryptic coloration - body color blends with surrounding dark stones or detritus; flash coloration - exposes its orange abdomen in flight to deter predators; not flying until closely approached, then flies in short spurts; when pursued, often flies from one rock to another and returns to its starting point after a while; produces a strong scent, when captured. Not especially wary. Easier to capture either in partial shade or in the morning and evening, with or without a net; sometimes flushed out only after much backtracking or kicking the low vegetation.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela scabrosa Schaupp, 1884

Ecology. Stenotopic, silvicolous, xerophilous, psammophilous, epigean. Pine forests, scrublands, flatwoods, and tree plantations: small openings, clearings, roads, paths, trails, edges, adjoining dunes and ridges. Open or half-shaded ground; dry, sandy soil, bare or sparsely vegetated with grass and reindeer moss. Adults tend to occur along the vegetated edges. Diurnal; scarce in the early morning, more active between 3:30 P.M. and 5:00 P.M.. Associated species: *Cicindela scutellaris unicolor* and C. *punctulata punctulata*.

Biology. Seasonality: May-September, November; rare in May and

November. Mating: July. Defense mechanism: when pursued, flies only a short distance (about 2-3 m). Very wary.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela schauppii G.H. Horn, 1876

Ecology. Eurytopic, xerophilous, halotolerant, epigean (adult); fossorial (larva). Limestone outcroppings, little-used roads through mesquite forestlands, dirt roadsides, pastures, baseball diamonds in parks, and dry or moist ditches. Open ground; usually dry, rarely moist, sometimes saline, bare or sparsely vegetated soil consisting of limestone, gravel or sand. Larval habitat: burrows dug in large numbers in an open and weedy vacant lot. Both diurnal and nocturnal.

Biology. Seasonality: August-October. Predators: flycatchers. Defense mechanism: flash coloration - exposes its orange abdomen in flight; produces defensive secretions to deter predators. Not wary. Easy to capture.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner, when necessary.

Cicindela scutellaris flavoviridis Vaurie, 1950

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Dry washes through fields; upper beach of a river. Open ground; dry, sandy soil. Adults tend to occur in and around the bordering low vegetation. Diurnal. Gregarious.

Biology. Seasonality: March-April. Mating: April.

Dispersal power. Macropterous. Fast runner.

Cicindela scutellaris lecontei Haldeman, 1853

Ecology. Stenotopic, xerophilous, psammmophilous, thermophilous, heliophilous, epigean (adult); fossorial (larva). Sand dunes, sand

hills, blowouts, old sand pits, gravel pits, sandy roads and paths, roadcuts, roadsides, abandoned fields, sand flats, sandy spots, sandy washes, and forest openings (mostly pine, also oak or poplar); high, dry sand bars deposited by streams. Not associated with water. Open ground; well-drained, dry soil consisting of lightly colored, loose, drifting, sparsely vegetated sand. Adults often run through the sparse vegetation. Larval habitat: dry, sandy, sparsely vegetated areas (*e.g.*, abandoned fields); soil sometimes containing a little humus; vertical burrows ranging from 25 to 45 cm in depth. Diurnal; extremely active during the hottest part of the day; hides under cover during cloudy conditions; inactive during cold east winds. Gregarious. Associated species: *C. formosa generosa.*

Biology. Seasonality: April-October, with stragglers in midsummer; in OH, April-June, September-October. Spring-fall species. Duration of life cycle: 2 years. Mating: April-July; copulation lasts 1-15 min. (4 min. on average). Interspecific copulation observed with *C. sex-guttata* and *C. tranquebarica tranquebarica;* intersubspecific copulation observed with *C. scutellaris rugifrons*. Oviposition: May-June; in dry sand containing a little humus. Larva closes its burrow in the summer. Duration of larval life: 12-13 months. Pupation: August; in a chamber (2.5 to 5 cm in deep) branching off from the main burrow; pupal development inhibited by extreme heat or drought. Tenerals: August-September. Overwinters both in the adult and the larval (third instar) stages at the edge of bushes bordering abandoned fields and in small sandy openings surrounded by weeds; adult and larval burrows ranging from 25 to 65 cm and 25 to 70 cm in depth respectively. Overwintering adult reaching maturity in the following spring. Predaceous, necrophagous. Adult food, in the field: ants, cutworms, acridids, and carabid larvae. Adult food, in the laboratory: carabids, caterpillars, and dead fish. Larval food, in the field: carabid larvae, gomphid and libellulid dragonflies. Predators: catbirds, grouse, and spiders. Larval parasites: bombyliid flies. Defense mechanism: when disturbed, hides in the vegetation; when

pursued, takes fast, long, looping flights (3.26 m on average); when netted, either digs into the sand or runs to the edge of the net; when captured, emits a strong, fruity scent. Wary. Difficult to approach. Teratology: one individual (IN) with the ninth segment of the right antenna trifurcate.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela scutellaris rugata Vaurie, 1950

Ecology. Stenotopic, psammophilous, epigean. Roads, openings and flats in fields; roads in open pine forests. Open ground; bare or sparsely vegetated soil consisting of white sand. Diurnal.

Biology. Seasonality: March-June, October-November, mostly April. Spring-fall species. Mating: in March; copulation lasts 7-10 min. Interspecific copulation observed with *C. formosa formosa*. Adults hibernate in burrows (5-7 cm deep) dug into the sand. Necrophagous. Adult food, in the field: a dead lizard.

Dispersal power. Macropterous. Fast runner.

Cicindela scutellaris rugifrons Dejean, 1825

Ecology. Stenotopic, silvicolous, xerophilous, psammophilous, epigean (adult); fossorial (larva). Coniferous forests (pine) and pine barrens: little-used roads, trails, paths, clearings, small openings, and edges; adjoining sandy spots, dunes, sand hills, sand pits, old quarries, sandy fields, and meadows. Larval habitat: sand dunes, in burrows. Open or semi-open ground; well-drained, dry soil consisting of white sand, and bare or sparsely vegetated with grass, lichens, and moss. Diurnal; hides for the night in little self-constructed holes ranging in depth from 5 to 7.5 cm. Adult gradually loses its brassy colors with age.

Biology. Seasonality: April-October, with stragglers in summer; in NJ, April-early July, late August-October. Spring-fall species. Mating: May. Intersubspecific copulation observed with *C. scutellaris lecontei*; copulation also observed with the *modesta* morph.

Overwinters at least in the adult stage. Larval parasites: bombyliid flies. Defense mechanism: cryptic coloration - black body of *modesta* morph blends perfectly with the blackened mosaic formed by areas of dead lichens, cryptogamic soil or charcoal lying on the sand; often buries itself in the sand when netted. Not difficult to approach on sunny, warm, spring days. Rather wary in summer.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela scutellaris scutellaris Say, 1823

Ecology. Stenotopic, steppicolous, xerophilous, psammophilous, halotolerant, heliophilous, epigean. Sand dunes, sand hills, sandy barrens, blowouts, sandy flats, dirt and sandy roads, roadsides, eroded banks, sandy ravines, rangelands, grasslands adjoining sand dunes, sandy fields, open mixed forests, and edges of sandy salt flats. Adults tend to occur in older, stabilized sandy situations (*e.g.*, the margin of dunes and hills) and prefer short, sparse vegetation to bare sand. Open ground; well-drained, dry soil consisting of drifting white sand, rarely bare and usually covered with sparse vegetation. Diurnal; active between 10:00 A.M. and 4:00 P.M.; hiding in slit holes in grassy sand areas on cloudy days. Gregarious. Associated species: *C. formosa generosa*, *C. lengi lengi*, and *C. limbata nympha*.

Biology. Seasonality: March-October, with stragglers in summer; in KS, March-July, September-October. Spring-fall species. Mating: April, June. Overwinters at least in the adult stage. Predaceous. Adult food, in the field: acridids. Larval food, in the laboratory: tenebrionid larvae. Predators: crows. Defense mechanism: cryptic coloration - iridescent green and red color pattern of body mimics the toxic blister beetle, *Lytta nuttalli* Say; flies quickly, sometimes climbs on grass stalks, much as *C. punctulata punctulata* does, when disturbed. Wary. Difficult to approach.

Dispersal power. Macropterous. Good flier. Fast runner. Very agile.

Cicindela scutellaris unicolor Dejean, 1825

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Sand dunes, blowouts, sand pits, roads, roadcuts, paths, pastures, and dry runs; clearings, open patches, fire lanes, and edges through coniferous forests (pine) and scrublands. Open or half-shaded ground; soil consisting of well-drained, loose, whitish, dry sand covered with a sparse vegetation of weeds. Adults tend to occur in open areas. Diurnal. Gregarious, occurring in large numbers.

Biology. Seasonality: February-June, September-December; in MS, March-May, September-November. Spring-fall species. Mating: March. Overwinters at least in the adult stage. Defense mechanism: when disturbed, escapes by flying and landing in open areas. Wary. Difficult to approach.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela scutellaris yampae Rumpp, 1986

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Sand hills. Open ground; well-drained, dry, sandy, sparsely vegetated soil. Adult preferring older, stabilized areas. Diurnal. Gregarious. Associated species: *C. formosa gibsoni*, and *C. tranquebarica kirbyi*.

Biology. Seasonality: April, June-July, September. Defense mechanism: quick to fly within a distance of 3 m when disturbed.

Dispersal power. Macropterous. Good flier. Fast runner. Very agile.

Cicindela sedecimpunctata sedecimpunctata Klug, 1834

Ecology. Eurytopic, riparian, hygrophilous, halotolerant, thermophobous, epigean. Edges of permanent small ponds, lakes, cattle holes, streams, springs, irrigation canals, roadside ditches, grassy marshlands; very wet spots, mud flats, and alkali flats. Open ground; wet (sometimes dry), muddy (mostly) or clayey, sometimes alkaline soil with sparse low vegetation. Both diurnal (mostly) and nocturnal; number of active individuals stays relatively constant during the day; adults shelter in the shade of short sand ledges during hot sunshine;

basking, foraging, and stilting at 32.3°C, 35.8°C, and 38.8°C respectively in AZ. Gregarious, sometimes swarms by the thousands. Associated species: *C. nigrocoerulea nigrocoerulea*, *C. obsoleta santaclarae*, *C. praetextata erronea*, *C. marutha*, and *C. pimeriana.*

Biology. Seasonality: June-September, mostly August. Summer species. Predaceous. Adult food, in the laboratory: beetles and flies. Predators: flycatchers and spiders. Defense mechanism: flash coloration - exposes its orange abdomen in flight; produces defensive secretions to deter predators. Quite wary.

Dispersal power. Macropterous. Good flier. Flies in the daytime; attracted to artificial lights at night. Fast runner. Long-distance disperser, making seasonal altitudinal movements.

Cicindela senilis G.H. Horn, 1866

Ecology. Stenotopic, coastal, riparian, hygrophilous, halophilous, epigean. Tidal salt flats, salt marshes, and alkali flats away from the seashore. Open ground; wet, muddy or sandy, saline soil. Gregarious.

Biology. Seasonality: March-June, August-October. Spring-fall species. Mating: February-April. Adults found overwintering in a salt marsh in galleries no more than 7.5 cm deep, dug under flat rocks and sheltering one or two individuals. Predators: lizards.

Dispersal power. Wing condition unknown. Fast runner.

Conservation status. *Frosti* morph threatened, extinct over much of its former distribution.

Cicindela severa severa LaFerté-Sénectère, 1841

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophilous, epigean. Salt marshes, salt flats, mud flats, tidal flats, sea beaches, lagoon edges, and drying areas of lake beds. Open ground; moist or wet, muddy (mostly) or sandy, rarely rocky, saline soil with sparse, low vegetation. Adults tend to occur close to the grass. Both

diurnal and nocturnal; more active in the morning and in the evening; spontaneously flying in the hottest sunshine. Associated species: *C. togata togata* and *C. pamphila.*

Biology. Seasonality: June-September; in LA and MS, June and August. Defense mechamism: cryptic coloration - body color blends perfectly with a rocky background; flies swiftly and strongly (up to 50 m) when disturbed; produces defensive secretions when captured. Very wary. Very difficult to approach. Best collected with a flashlight or a light trap at night.

Dispersal power. Macropterous. Strong flier. Attracted to artificial lights at night. Fast runner. Quite active.

Conservation status. Threatened by insecticides and the destruction of its habitat.

Cicindela sexguttata Fabricius, 1775

Ecology. Eurytopic, silvicolous, hygrophilous, thermophilous, heliophilous, epigean (adults); fossorial (larva). Forests (mostly deciduous, *e.g.*, oak-hickory; also mixed forests and pine plantations): paths, trails, roads, sunny spots, clearings, brook and river banks, dry brook beds, small sandbars along streams, and forest edges; recently lumbered areas; adjoining old fields, vacant lots, cultivated fields (cotton), meadows, pastures, sparsely grassed fields, ditches, clay banks, sandy gullies, sandy roads, petroleum and gas drill sites, and rocky ravines; vicinity of thickets and hedges situated in fields; city gardens and cement sidewalks with trees and shrubs; alpine meadows. Not particularly associated with water. Open or partially shaded ground; warm, moist, mostly loamy, sometimes sandy, gravelly or rocky, often grass-grown or sometimes bare soil. Larval habitat: shaded level areas or slight slopes, *e.g.*, along trails and dry brook beds; burrows dug into sand, loam or clay, sometimes containing humus; each burrow usually with a visible round opening, sometimes dug close to fallen leaves or logs, and usually perpendicular to the soil surface. Diurnal. Preferred body

temperature: 31-35°C. Basks and forages with little locomotion, shuttles to shade, and changes posture to regulate its body temperature; often suns on logs, stones, rocks, or sometimes up to one meter high on standing tree trunks, wayside shrubs, fences, stone walls; hides for the night and on cool, cloudy or rainy days, under the loose bark of logs, fallen trees and tree trunks, under stones, boards, fallen branches, cardboard, plant rosettes (*Verbascum*), and even in the deserted burrows of borers. Adapted to the low ambient temperature of the forest. Basically solitary, but sometimes occurring in large aggregations. Gregarious mostly in winter and early spring.

Biology. Seasonality: March-November, mostly May-June, with stragglers in midsummer. Spring-fall species; active almost only in the spring in the northern part of its range, the new adult emerging in the fall but staying in its pupal chamber until the following spring. Duration of life cycle: 2 years. Mating: May-June; interspecific copulation observed with *C. punctulata punctulata*, *C. purpurea purpurea, C. repanda repanda, C. scutellaris lecontei*, *C. limbalis*, and *C. unipunctata*. Duration of coitus: 3.5 min. Oviposition: June-July; in shaded, clayey or sandy soil mixed with a little humus, *e.g.*, along sunlit trails and upper stream banks, preferably under loose dead leaves, sometimes under twigs; each female laying 7.7 eggs per day on average. Pupation: July and September. Tenerals: August-May. Overwinters in the adult, teneral, larval (mostly third instar, rarely second instar), and pupal stages; adult and teneral hibernate within the pupal chamber under stones and under the loose bark of stumps, fallen trees and logs throughout the forest, at its edge, in clearings, and on gravel banks overlaid with sandy loam. Predaceous. Adult food, in the field: ants, springtails, acridids, scarabaeids, other beetles, caterpillars, flies, an hymenopteran, spiders, worms, and gastropods. One individual observed walking and running on lily pads, searching for insects, about 50-100 m away from a pond shore. Adult food, in the laboratory: ants, carabids, staphylinids, earthworms, mealworms, and lean meat. Adult

cannibalistic (in captivity). Larval food, in the field: small arthropods. Larval food, in the laboratory: lean meat. Predators: toads, frogs, crows, flycatchers, jays, thrushes, pheasants, sparrows, foxes, raccoons, ground squirrels, asilid flies, and salticid spiders. Phoretic uropodid mites found attached to adult body. Victim of malaise traps. Defense mechanism: cryptic coloration - body color blends perfectly with the greenness of surrounding trees, shrubs and grass which makes it difficult to see in flight or even when resting on an isolated log; displays abrupt changes from bright metallic green to dark green when flying into the shade to avoid predators; when pursued, makes a hasty disorganized retreat either by running to hide under debris or by making quick, low flights (5.46 m on average), undulating from side to side through the vegetation or in the shade, or, landing on tree trunks and rocks; emits a defensive secretion or a fragrant scent similar to that of an enraged bee when captured. Quite wary. Difficult to approach, even with a long-handled net. Body size apparently greater in northern areas. Old cabinet specimens turning blue with age.

Dispersal power. Macropterous. Strong flier. Fast runner. Very active. A good seasonal disperser: overwinters in the forest, but returns to sunlit areas when the canopy closes in spring.

Cicindela sperata inquisitor Casey, 1897

Ecology. Stenotopic, riparian, hygrophilous, epigean. Banks of rivers, brooks, and bodies of standing water. Open ground; wet muddy soil.

Biology. Seasonality: June-August.

Dispersal power. Macropterous. Fast runner.

Cicindela sperata sperata LeConte, 1857

Ecology. Stenotopic, riparian, hygrophilous, halophilous, thermophilous, epigean. Banks and bars along brooks and rivers; salt marshes often crossed by streams; meadows and paths close to streams. Open ground; wet, muddy (mostly) or sandy, sometimes saline, bare or

sparsely vegetated soil. Both diurnal and nocturnal; very active over the hot steaming mud during the hottest part of the day; forages until late afternoon. Gregarious, occurring in swarms.

Biology. Seasonality: May-September. Summer species. Adult food, in the laboratory: caterpillars. Not very difficult to approach.

Dispersal power. Macropterous. Good flier. Often attracted to artificial lights at night in cities. Fast runner.

Cicindela splendida Hentz, 1830

Ecology. Stenotopic, hygrophilous, thermophilous, heliophilous, epigean (adult); fossorial (larva). Eroded banks, stream banks, slopes, roads, roadsides, railroad embankments, ditches, roadcuts with sparse to dense grass, trails, clay pits, cliffs, gullies, canyons, powerline cuts, fields, hills, sand dunes, and open sandy forests; edges of small duck ponds. Open or partially shaded ground; sloping, moist (sometimes dry), sparsely to densely vegetated soil consisting of red clay (rarely of pure red sand or sandstone). A lover of sloping reddish clay banks. Larval habitat: burrows (9-15 cm deep) abundant in the hard-packed soil of steep clay banks. Diurnal; foraging between 10:00 A.M. and 3:30 P.M.; either highly active or sunning itself on sloping banks, *e.g.*, in midmorning. Usually solitary, but sometimes occurring in numbers. Associated species: *C. limbalis*, *C. purpurea purpurea*, and *C. denverensis*.

Biology. Seasonality: January-July, September-November; in NE, March-April, September. Early to emerge in the spring, particularly in the southern United States. Spring-fall species. Duration of life cycle: 2-3 years. Mating: May; interspecific copulation observed with *C. limbalis* and *C. denverensis*. Pupation: July. Tenerals: September; requiring 2-3 days to acquire the typical red and green colors. Overwinters both in the adult and larval (second and third instars) stages, in burrows. Predaceous. Adult food, in the field: lygaeid bugs. Adult food, in the laboratory: mealworms, other insects, and small earthwworms. Larval food, in the field: young

locusts. Larval food, in the laboratory: tenebrionid adults and larvae. Defense mechanism: cryptic coloration - body color blends with the surrounding red clay; quickly takes wing when it sees its pursuer, even from 3 m away. Quite wary. Difficult to approach because of its swiftness and the unevenness of its habitat.

Dispersal power. Macropterous. Good flier. Fast runner. Very active.

Cicindela striga LeConte, 1875

Ecology. Stenotopic, coastal, riparian, hygrophilous, halophilous, crepuscular, epigean. Salt marsh areas, salt mud flats of river mouths, and a meadow-like opening in a pine forest close to a bay. Open ground; wet, saline, muddy, bare soil. Diurnal, crepuscular, and nocturnal; apparently more abundant during twilight; shelters under dead leaves beneath small bushes during rain. Associated species: *C. severa severa*.

Biology. Seasonality: April-August, mostly June-August. Summer species. Predaceous. Adult food, in the field: small insects. Defense mechanism: escapes by flight. Best collected by light trapping.

Dispersal power. Macropterous. Good flier. Attracted in large numbers to artificial lights at night, especially during or after rain. Fast runner.

Cicindela tenuicincta Schaupp, 1884

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Large salt flats and beaches along lakes and ponds; edges of pools and streams. Close to the water's edge. Open ground; moist, saline soil. Both diurnal and nocturnal. Male more active than female. Associated species: *C. arida*.

Biology. Seasonality: May-September. Predaceous. Adult food, in the field: small flies. Defense mechanism: escapes by flight. Not very shy.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela tenuisignata LeConte, 1851

Ecology. Eurytopic, riparian, hygrophilous, halophilous, epigean (adult); fossorial (larva). Edges of permanent ponds, lakes, and pools; beaches and bars along rivers and brooks; margins of estuaries; edges of irrigation ditches; grassy marshlands and very wet spots; alkali flats and mud flats. Open ground; wet, muddy or sandy, saline soil. Larval habitat: burrows dug into pond edges. Both diurnal (mostly) and diurnal. Solitary. Associated species: *C. ocellata rectilatera* and *C. sperata sperata.*

Biology. Seasonality May-November. Summer species. Predaceous. Adult food, in the laboratory: beetles and flies.

Dispersal power. Wing condition unknown. Attracted to artificial lights at night. Fast runner.

Cicindela terricola cinctipennis LeConte, 1848

Ecology. Eurytopic, steppicolous, hygrophilous, halophilous, thermophobous, epigean. Grasslands, prairies, grassy meadows, grassy or thinly wooded fields, roads, roadsides, outwashes, dry creek beds, edges of alkali ponds, rivers, creeks, springs and irrigation ditches. Open ground; wet, sometimes dry, usually clayey or muddy, sometimes sandy, often saline soil with short sparse vegetation. Adults tend to occur close to the grass. Diurnal; remains active until 7:00 P.M.; hides beneath plants during the hottest part of the day. Gregarious. Associated species: *C. fulgida fulgida*, *C. longilabris laurentii*, *C. nigrocoerulea nigrocoerulea*, and *C. nigrocoerulea bowditchi*.

Biology. Seasonality: April-September; in CO, mostly July-August. Summer species. Defense mechanism: when disturbed, escapes by running or flying. When captured, gets out easily from under a net.

Dispersal power. Macropterous, capable of flight. Fast runner.

Cicindela terricola imperfecta LeConte, 1851

Ecology. Eurytopic, steppicolous, hygrophilous, thermophobous, halophilous, epigean. Banks and bars along rivers and brooks; alkali flats bordering ponds, lakes, and springs; dirt roads, roadsides, and sagebrush areas. Open ground; usually wet soil consisting of sandy clay (AB), but in the western United States, consisting of mud, rarely of sand, and often alkaline with sparse vegetation. Diurnal; hides in the grass during the heat of the late afternoon. Solitary.

Biology. Seasonality: May (rarely)-August. Predaceous. Adult food, in the field: weevils and halictid wasps.

Dispersal power. Macropterous, capable of flight. Fast runner.

Cicindela terricola kaibabensis Johnson, 1990

Ecology. Epigean. Grassy meadows. Adults tend to occur among the grasses. Diurnal. Solitary.

Biology. Seasonality: July (mostly)-August. Defense mechanism: difficult to see among the grass. Flies 2 to 5 m in open areas and then comes back to the grass when pursued.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela terricola lunalonga Schaupp, 1884

Ecology. Eurytopic, riparian, halophilous, epigean. River and brook banks, alkali sites near water, meadows, and shaded paths. Open or shaded ground; moist or dry, sandy, often alkaline, vegetated soil. Diurnal. Solitary.

Biology. Seasonality: May-July.

Dispersal power. Macropterous, capable of flight. Fast runner.

Cicindela terricola terricola Say, 1824

Ecology. Eurytopic, hygrophilous, steppicolous, halophilous, epigean. Grasslands, cultivated fields (corn, oat), roadside ditches, saline spots along roads, grass-grown gravel pits; muddy or gravelly river

banks; shores of alkali lakes and sloughs, and alkali flats. Adults tend to occur in or near the vegetation. Open ground; moist, often alkaline soil consisting of clay, dark loam or mud, sometimes sand or gravel, without vegetation, with sparse vegetation, or with bare areas surrounded with grass or low plants. Diurnal; active up to 7:00 P.M. Solitary.

Biology. Seasonality: June-August. Defense mechanism: does not attempt to fly, but runs quickly in the grass when pursued.

Dispersal power. Macropterous, capable of flight. Very fast runner.

Cicindela theatina Rotger, 1944

Ecology. Stenotopic, xerophilous, psammophilous, epigean. Sand dunes; swales between dunes. Well-drained, shifting, loose, dry, sandy, bare or sparsely vegetated soil. Adults tend to occur in or near sparsely vegetated edges. Diurnal; still foraging at 5:00 P.M.; burrows into the sand during the day in very strong winds; hides for the night in a burrow with slightly cemented walls at its opening.

Biology. Seasonality: May-September. Spring-fall species, with stragglers in midsummer. Tenerals: August. Predaceous. Adult food, in the field: ichneumonid wasps. Wary.

Dispersal power. Wing condition unknown. Fast runner.

Cicindela togata fascinans Casey, 1914

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Alkali flats bordering ponds and lakes. Open ground; moist saline soil. Both diurnal and nocturnal.

Biology. Seasonality: July-September, rarely July. Defense mechanism: extensive white maculations blend perfectly with patches of crystallized salt in its habitat. Best collected with a flashlight at night.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Cicindela togata globicollis Casey, 1913

Ecology. Eurytopic, hygrophilous, halophilous, thermophilous, epigean (adult); fossorial (larva). Salt flats and alkali flats (mostly); salt marshes, saline ditches, roadside ditches; small salty spots in pastures and fields; banks and sand bars along brooks and rivers; shores of lakes and ponds Open ground; wet or moist (sometimes dry), sandy or muddy, saline, bare (mostly) or partially grassed soil. Adults tend to occur at or near vegetation edges. Larval habitat: salt flats with moist or dry bare soil, among the vegetation in the vicinity of hummocks, and on a sloping creek bank; burrows (third instar) ranging from 10 to 18 cm in depth. Diurnal; seen foraging from early morning until 6:00 P.M.; becomes inactive at about 38-39°C; able to stand high temperatures better than other species of saline habitats. Gregarious. Associated species: *C. circumpicta johnsonii*, *C. fulgida fulgida*, *C. nevadica knausii*, and *C. nigrocoerulea nigrocoerulea.*

Biology. Seasonality: April-October, mostly June. Summer species. Duration of life cycle: 2 years, sometimes 3. Mating: June. Oviposition: female digs oviposition holes in the soil, lays one egg in each hole, and then fills it with loose soil. Tenerals: June. Defense mechanism: cryptic coloration - red body color and extensive white elytral maculations blend pefectly with the red soil and the patches of crystallized salt of salt flats; quickly escapes by flight when pursued. Best collected with a flashlight or a light trap at night.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night and running crazily in the illuminated areas. Short-distance disperser. Fast runner. Agile.

Cicindela togata togata LaFerté-Sénectère, 1841

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophilous, epigean. Salt flats (mostly) and alkali flats along sea beaches, lagoons, ocean inlets, estuaries, marshes (high areas), rivers, creeks, lakes, ponds, pools, and abandoned oil wells. Open ground; wet, muddy (mostly) or sandy, saline, bare (mostly) or

sparsely grassed soil. Adults tend to occur in open areas away from vegetation. Both diurnal and nocturnal; forages in early morning; active throughout the day; able to endure hot temperatures; sluggish and unable to fly at 22°C. Gregarious, occasionally in large numbers.

Biology. Seasonality: April-August, October; in SC, May-August. Summer species. Mating: June. Predaceous. Adult food, in the field: hemipteran bugs and spiders. Adults cannibalistic. Predators: kestrels and asilid flies. Defense mechanism: cryptic coloration - highly reflective dull green body and extensive pale elytral maculations blend with the sand and algae in the drier parts of salt flats; hardly visible against its background when motionless; when pursued, prefers to run instead of flying unless persistently chased, then flies quickly. Very wary. Difficult to approach. Best collected with a light trap at night.

Dispersal power. Macropterous. Good flier. Attracted to artificial lights at night. Fast runner.

Cicindela tranquebarica cibecuei Duncan, 1958

Ecology. Riparian, hygrophilous, epigean. Creek banks.

Biology. Seasonality: April.

Dispersal power. Macropterous. Fast runner.

Cicindela tranquebarica diffracta Casey, 1909

Ecology. Stenotopic, riparian, hygrophilous, epigean. Banks and flats along rivers and brooks. Open ground; moist or wet, muddy (mostly) or sandy, bare or sparsely vegetated soil. Diurnal; seen foraging from 11:30 A.M. until early afternoon. Gregarious.

Biology. Seasonality: July. Predaceous. Adult food, in the laboratory: small crickets. Defense mechanism: cryptic coloration - coppery red body blends perfectly with the sandstone deposits of stream beds.

Dispersal power. Macropterous. Fast runner.

Cicindela tranquebarica kirbyi LeConte, 1866

Ecology. Eurytopic, halotolerant, thermophobous, epigean. Alkali mud flats, high beaches, upper zone of creek beds, blowouts, prairie grasslands, and forest trails. Open ground; muddy or sandy, sometimes alkaline soil with sparse vegetation. Diurnal; hides on high beaches, away from the water's edge, during the hottest parts of the day.

Biology. Seasonality: March-June, September. Overwinters at least in the adult stage. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: small crickets.

Dispersal power. Macropterous. Fast runner. Early to colonize disturbed areas.

Cicindela tranquebarica parallelonota Casey, 1914

Ecology. Eurytopic, riparian, hygrophilous, halophilous, epigean. Edges of small alkaline pools; mud flats bordering lakes; river banks. Open ground; wet, often alkaline soil consisting of sand or mud, sometimes mixed with gravel or covered with basalt stones. Larval habitat: edges of small alkaline pools. Diurnal; seen foraging at midday and in late afternoon. Either solitary or gregarious.

Biology. Seasonality: April-July. Spring-fall species. Defense mechanism: cryptic coloration - slight violet or green lustre of blackish elytra blends with surrounding basalt stones. Not wary. Individuals darkening in color with age.

Dispersal power. Macropterous. Fast runner.

Cicindela tranquebarica sierra Leng, 1902

Ecology. Stenotopic, riparian, hygrophilous, epigean. Stream banks. Open ground; moist soil vegetated with grass. Diurnal.

Biology. Seasonality: July. Predaceous. Adult food, in the field: flies.

Dispersal power. Macropterous. Fast runner.

Cicindela tranquebarica tranquebarica Herbst, 1806

Ecology. Eurytopic, psammophilous, halotolerant, thermophilous, heliophilous, epigean; fossorial (larva). Beaches of oceans, lakes, rivers and brooks; stream sand bars, dry stream beds, alkali flats, salt flats, sandy or mud flats, bare spots, sand dunes, sand hills, blowouts, old fields, stubble fields, pastures, prairies, sagebrush areas, blueberry barrens, little-used sandy roads, trails and paths, roads with fine gravel, roadsides, roadside ditches, alkali ditches, railroad cuts, powerline cuts, cement sidewalks, sandy patches, eroded slopes, borrow pits, sand pits, gravel pits, dumps, sand traps on golf courses, strip mines, alpine meadows; open spots, clearings, and roads in forests. Occasionally alights on old rail fences and stumps at the edge of forests. Not particularly associated with water. Open ground; dry or moist, occasionally saline, bare or sparsely vegetated (fine grass or weeds) soil preferably consisting of sand, but also commonly made up of dark fine gravel, mud or clay. Larval habitat: similar to adult, *e.g.*, sandy spots and roadsides; burrows, sometimes aggregated, straight, ranging from 22 to 50 cm in depth; a larval colony may comprise hundreds of individuals. Larva very sensitive to approaching movement, a single shadow will send it to the bottom of its burrow. Both diurnal (mostly) and nocturnal; becomes active at 9:00 A.M., but mostly active between noon and 2:00 P.M., during the hottest part of the day; forages, basks, stilts, and shuttles from moist to dry areas or in the shade of small plants to regulate its body temperature between 33°C and 38°C; flies spontaneously and frequently in the sunshine; hides for the night and on cloudy, cool or rainy days in self-constructed holes dug into small sandy mounds, paths and river banks, exceptionally under stones and pieces of wood; stays motionless, as if being paralyzed during sudden rain just after sunshine. Solitary, semi-gregarious or gregarious. Associated species: *C. repanda repanda.*

Biology. Seasonality: January-November, with stragglers in the summer; in OH, April-May, September-October. Early to appear in the spring.

Females more numerous than males in the spring, but males much more numerous than females in the fall. Spring-fall species. Duration of life cycle: 2 years. Mating: May-July, mostly on sunny days, but sometimes on humid, cloudy days; copulation lasts 4.1-15 min. Interspecific copulation observed with *C. purpurea purpurea* and *C. scutellaris lecontei.* Oviposition: in April-May, on humid, cloudy days; in a variety of habitats with the water table near the soil surface; eggs preferably laid into moist, sandy, sparsely vegetated soil containing some humus. Duration of larval life: 12-13 months. Pupation: July-August. Tenerals: July-September; in the laboratory, sexual maturity reached the following spring, after overwintering. Duration of adult life: 10-11 months. Overwinters both in the adult and larval (third instar) stages; in burrows (adult, 15-100 cm deep) dug into sandy or clayish soil, *e.g.*, river banks. Adult sometimes found in the same hibernation hole with *C. duodecimguttata* and *C. limbalis*. Predaceous. Adult food, in the field: ants, acridids, cutworms, aphids, bees, small beetles, and other small insects. Adult food, in the laboratory: ants, bees, carabids, chrysomelids, tenebrionid larvae, house flies, other insects, small earthworms, and lean meat. When put in a small container, adults quickly grasp one another with their mandibles. Larval food, in the field: ants, libellulid dragonflies, other dragonflies, carabids, weevils, an elaterid, and a wasp. Larval food, in the laboratory: caterpillars, cricket nymphs, drosophilid flies, muscid flies, ants, and lean meat. Food restriction is the principal cause of larval mortality. Predators: toads, crows, woodpeckers, flycatchers, and theridiid spiders. Larval parasites: bombyliid flies. Defense mechanism: cryptic coloration - body color blends perfectly with the sand, small stones, dead lichens or other debris lying on the ground; rarely flies in the sunshine unless alarmed, then takes wing readily and frequently performs an irregular, low, sustained flight (3-10 m long on average), undulating from side to side, occasionally hovering a moment, and upon landing, bounces and walks quickly away from the point of impact;

produces defensive secretions and a sweet honey-like scent when captured. Quite wary. Rather difficult to approach.

Dispersal power. Macropterous. Strong flier. Attracted to artificial lights at night. Fast runner.

Cicindela tranquebarica vibex G.H. Horn, 1866

Ecology. Eurytopic, coastal, hygrophilous, halophilous, epigean (adult); fossorial (larva). Sea beaches, alkali flats (mostly) and salt flats along lakes, ponds, streams, and in irrigated pastures; dry lakes, roads near a lake, and forest openings. Larval habitat: burrows dug in saltgrass areas along ditches. Open ground; dry, moist or wet, sometimes hard-packed, saline, bare or sparsely vegetated soil. Diurnal; hides under dried cow chips for the night. Gregarious.

Biology. Seasonality: April-October. Defense mechanism: escapes by slowly flying at a distance of 3 to 5 m, and always turns to face its pursuer at the last moment when it lands. Easily captured.

Dispersal power. Macropterous. Good flier. Fast runner.

Cicindela tranquebarica viridissima Fall, 1910

Ecology. Unknown.

Biology. Seasonality: March, October-November.

Dispersal power. Macropterous. Fast runner.

Conservation status. Rare subspecies, restricted to the Santa Ana River basin (CA). Endangered by human encroachment of its habitat.

Cicindela trifasciata ascendens LeConte, 1851

Ecology. Eurytopic, coastal, riparian, hygrophilous, halophilous, thermophilous, epigean (adult); fossorial (larva). Sandy beaches and mud flats along the sea shore; estuaries, lagoons, marshes, rivers, brooks, creeks, lakes, ponds, islands, and inlets; stream sand bars, edges of small pools bordering highways, drying beds of salt lakes, moist sandy places in hummocks, narrow sandy paths through meadows, and muddy cultivated fields (rice). Open ground; wet, often saline,

bare or sparsely vegetated soil usually consisting of dark sand or mud, rarely of rock. Larval habitat: burrows. Both diurnal and nocturnal; remains active and flies in the sunshine during the hottest part of the day. Usually gregarious, occasionally solitary.

Biology. Seasonality: January-December; in LA and MS, April-December, mostly June-August. Summer species, usually emerges in late May-early June, but remains active until early fall; possibly active throughout the year in FL. Predaceous. Adult food, in the field: ants. Defense mechanism: cryptic coloration - body color blends perfectly with the wet ground of mud flats covered with algae; escape by flying normally less than 1-2 m when pursued. Very wary. Difficult to approach. Best captured with a light trap at night.

Dispersal power. Macropterous. A regular, although weak flier. Exceptionally a long-distance disperser, *e.g.*, caught on offshore platforms at about 160 km from Galveston (TX). Often attracted to artificial lights at night. Fast runner.

Cicindela trifasciata sigmoidea LeConte, 1851

Ecology. Stenotopic, coastal, hygrophilous, halophilous, epigean (adult); fossorial (larva). Sea beaches: sand flats and mud flats; sandy banks of estuaries. Open ground; moist or wet, bare soil usually consisting of dark sand or mud. Larval habitat: Tidal flats, just above the high tide line; burrows (3.7-7.5 cm deep) dug either in sand covered with mud or in pure sand. Adults tend to occur on the ground, intertidal rocks or boulders during the day. Both diurnal and nocturnal. Gregarious, swarms by the thousands.

Biology. April-August, mostly May-June. Predaceous. Adult food, in the field: isopods.

Dispersal power. Macropterous. Often attracted in considerable numbers to artificial lights at night. Fast runner.

Conservation status. Rare subspecies. Threatened by housing development and recreational land-use.

Cicindela unipunctata Fabricius, 1775

Ecology. Stenotopic, silvicolous, crepuscular, epigean (adult); fossorial (larva). Forests (*e.g.*, oak, pine): shaded areas, open spots, roads, paths, trails, and powerline cuts. Shaded (usually) or open ground; often dark or blackish, sandy, gravelly or earthy soil, preferably covered with a thick layer of dead, deciduous leaves and twigs or sometimes bare. Larval habitat: a steep, sparsely forested hillside with rocky, bare soil; burrows perpendicular for the first 7.5-10 cm, then curving to an horizontal plane. Active from midday, but generally crepuscular; usually forages in late afternoon and early evening; normally active in the shade of dead fallen leaves during the day or, more rarely, hides in ground holes with its head alone being visible; observed running along roadways on cloudy days. Body temperature maintained more from the conduction of heat from the soil than from the solar radiation. Solitary or occurring in pairs.

Biology. Seasonality: April-September; mostly June-July. Summer species. Mating: August; interspecific copulation observed with *C. sexguttata*. Adult food, in the field: small ants. Predators: crows. Defense mechanism: cryptic coloration - body color and shape, especially its flat brown elytra, blend perfectly with dead leaves lying on the ground; stays motionless for up to 10 min. or runs rapidly to hide under dead leaves (usually), twigs, stones or other debris when disturbed; rarely flies, if so, less than 2 m away; emits a strong scent or feigns death for about 2 min. When collected by hand, feigns death until put into a killing bottle. Best collected by pitfall trapping.

Dispersal power. Macropterous. Weak flier. Fast runner.

Cicindela velutinigrens (Johnson, 1992)

Ecology. Eurytopic, psammophilous, halotolerant, heliophobous, epigean. Roads, paths and grassy areas through semi-forested areas; gulf prairies, clay dunes, coastal salt flats, and salt marshes. Open

ground; moist, sandy or clayey, sometimes saline soil vegetated with grass or forbes. Diurnal; adults tend to shelter in the grass away from bright sunlight.

Biology. Seasonality: May.

Dispersal power. Flightless. Fast runner.

Cicindela viridisticta arizonensis Bates, 1884

Ecology. Stenotopic, riparian, hygrophilous, epigean (adult); fossorial (larva). Edges of permanent ponds, river beds, irrigation ditches in cultivated fields, roadside ditches, shaded trails, and paths near streams. Open ground; sometimes sloping, moist, clayey soil sparsely to densely grassed. Adults tend to occur among the vegetation. Larval habitat: similar to adult (*e.g.*, ditch edges), in burrows. Both diurnal and nocturnal. Associated species: *C. hemorrhagica hemorrhagica* and *C. ocellata ocellata.*

Biology. Seasonality: July-October. Duration of life cycle: 1 year. Oviposition: female digs large numbers of ovipositional holes. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: adult and larval tenebrionids, flies, and other insects. Acarid mites associated with larval body. Defense mechanism: prefers to run in the grass instead of flying when disturbed; escapes by an erratic, short flight (about 60 cm long) when pursued. Best captured by placing a net edge on the ground and herding the beetle into it with the hand.

Dispersal power. Macropterous. Weak flier. Attracted to artificial lights at night in cities. Slow runner.

Cicindela wapleri LeConte, 1875

Ecology. Stenotopic, riparian, hygrophilous, psammophilous, thermophobous, epigean. Banks and sand bars along blackwater rivers and brooks. Close to the water's edge. Open or half-shaded ground (*e.g.*, under pine-trees); moist soil consisting of pure white sand, that makes a squeaking sound when trampled. Diurnal; basks in dry

sandy areas in the morning, and moves closer to the water's edge as the temperature increases. Solitary. Associated species: *C. blanda* and *C. repanda repanda.*

Biology. Seasonality: May-October, mostly June-July. Summer species. Predators: oxyopid spiders. Defense mechanism: cryptic coloration - brown body color and white elytral maculations blend respectively with small debris or mud amassed on the white sand; when pursued, darts around towards the shade of the steep upper bank rather than towards the water's edge. Less wary than *C. blanda,* easier to approach.

Dispersal power. Macropterous. Good flier, but with flight shorter than *C. blanda.* Fast runner.

Cicindela wickhami W. Horn, 1903

Ecology. Eurytopic, riparian, hygrophilous, epigean. Edges of streams, ditches, and ponds; in Mexico, unused roads in forested areas. Open ground; moist, bare soil.

Biology. Seasonality: June-August.

Dispersal power. Wing condition unknown. Attracted to artificial lights at night. Fast runner.

Cicindela willistoni echo Casey, 1897

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Salt flats and beaches along lakes, reservoirs, streams, springs, and irrigation ditches. Open ground; often whitish, moist or wet, muddy, saline, bare or sparsely vegetated soil. Adults tend to occur in or near the bordering grasses. Diurnal. Associated species: *C. tenuicincta*, *C. hemorrhagica hemorrhagica*, and *C. fulgida fulgida.*

Biology. Seasonality: April-August. Predators: Spiders. Defense mechanism: Escapes by quickly flying for a long distance. Wary.

Dispersal power. Macropterous. Strong flier. Fast runner. Observed entering shallow water (2.5 cm deep) and running about in it to catch a prey. Quite active.

Cicindela willistoni estancia Rumpp, 1962

Ecology. Stenotopic, riparian, hygrophilous, halophilous, heliophilous, epigean. Alkali flats and salt flats bordering ponds, lakes, and playas. Open ground; wet, muddy, mostly alkaline soil, bare or vegetated with short grass. Adults tend to occur among grass. Diurnal; seen foraging in midmorning; hides on cloudy days in small burrows dug beneath alkali encrustations, head faces burrow opening.

Biology. Seasonality: May-September. Tenerals: September.

Dispersal power. Macropterous. Fast runner.

Cicindela willistoni funaroi Rotger, 1972

Ecology. Stenotopic, epigean. A saline meadow with water originating from mineral springs; hides in small burrows on a very windy day.

Biology. Seasonality: April.

Dispersal power. Macropterous. Fast runner.

Cicindela willistoni hirtifrons Willis, 1967

Ecology. Stenotopic, riparian, hygrophilous, halophilous, heliophilous, epigean (adult); fossorial (larva). Salt flats in marshes or borders of ponds and reservoirs; alkaline mud flat of a lake. Open ground; wet, muddy (rarely sandy-loamy), saline, bare or sparsely vegetated soil. Adults tend to occur on the bare areas of salt flats. Larval habitat: dry or moist, bare salt flats; burrows (third instar, 16-35 cm deep) with a chimney-like turret (up to 5.5 cm high) at their entrance. Diurnal; becomes active at 18-19°C; hides in burrows on cloudy days and during the night.

Biology. Seasonality: May-June, September. Spring-fall species. A larva observed closing its burrow for 7 days in order to molt from the first to the second instar (KS). Quite wary.

Dispersal power. Macropterous. Fast runner.

Cicindela willistoni praedicta Rumpp, 1956

Ecology. Stenotopic, hygrophilous, halophilous, epigean. Desert salt pans and river beds. Open ground; white, wet, alkaline soil vegetated with grass clumps. Diurnal. Gregarious.

Biology. Seasonality: March-May.

Dispersal power. Macropterous. Fast runner.

Cicindela willistoni pseudosenilis W. Horn, 1900

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean. Beaches and flats bordering lakes; desert salt pans. Open ground; wet, white, muddy alkaline soil. Diurnal. Gregarious.

Biology. Seasonality: May-July, November. Mating: interspecific copulation observed with *C. oregona oregona.*

Dispersal power. Macropterous. Fast runner.

Cicindela willistoni sulfontis Rumpp, 1977

Ecology. Stenotopic, riparian, hygrophilous, halophilous, epigean (adult); thermophobous, fossorial (larva). Usually salt flats and alkali flats bordering playas and lakes; salty muds of semi-dry river beds, marshy areas, and pond edges. Open ground; wet or occasionally dry (May-June), muddy, saline soil. Larval habitat: edges, flats, and a roadside ditch along a playa; edge of a man-made reservoir; burrows (third instar, 14.1-22 cm deep, 18.5 cm deep on average) rather widely scattered, dug into wet, saline soil; each burrow with a chimney-like turret (1-4 cm high) at its entrance, used both for lowering the burrow's surface temperature and for attacking its prey. Diurnal; larva active throughout the day. Associated species: *C. fulgoris fulgoris.*

Biology. Seasonality: May-August. Duration of life cycle: 2 years. Predaceous. Adult food, in the laboratory: adult and larval tenebrionids, flies, and other insects. Larval food, in the laboratory: springtails, drosophilid flies or tenebrionid larvae. Larval parasites: bombyliid flies. Pyemotid mites associated with larval body. Defense mechanism: when alarmed, escapes by frequent flights (up to 10 m).

Dispersal power. Macropterous. Strong flier. Fast runner.

Conservation status. Rare subspecies.

Cicindela willistoni willistoni LeConte, 1879

Ecology. Stenotopic, riparian, hygrophilous, halophilous, thermophilous, epigean (adult); fossorial (larva). Alkali flats (mostly), salt flats, salt pans, and beaches of lakes and playas, reservoirs, streams, and seepages. Sometimes as far as 25 m from the water's edge. Adults tend to occur either in bare areas or among grass clumps. Larval habitat: a mud flat bordering a lake; burrows dug near grassy edges. Open ground; usually moist or wet (occasionally dry), muddy, saline, bare or sparsely vegetated soil. Diurnal; forages from 8:00 A.M. until sunset; very active in warm weather. Gregarious.

Biology. Seasonality: June. Predaceous. Adult food, in the field: ants and a salticid spider. Predators: undetermined bird species. Defense mechanism: usually stays motionless on the ground; escapes by slow short flights (3-4 m long) when pursued. Best captured with a net.

Dispersal power. Macropterous. Weak flier. Slow runner.

Megacephala affinis angustata Chevrolat, 1841

Ecology. Stenotopic, riparian, epigean. River banks. Nocturnal.

Biology. Seasonality: May-September.

Dispersal power. Macropterous. Often attracted to artificial lights at night. Fast runner.

Megacephala carolina carolina (Linné, 1767)

Ecology. Eurytopic, riparian, hygrophilous, halotolerant, crepuscular, epigean (adult); fossorial (larva). A lover of stream mud flats.

Mostly edges and bars of rivers, brooks, and edges of pools; also, fresh-water marshes, salt marshes, mud flats, salt flats, roadsides, cultivated fields (soybean, cotton, corn), plowed fields, old fields, pastures, city gardens, lawns and streets, orchards (citrus), and sand dunes. Often associated with water. Open ground; moist or wet, preferably muddy, sometimes clayish or sandy, saline soil, bare or sparsely vegetated. Larval habitat: vacant lots, beaches, and flats; on open ground with hard-packed or loose, moist, usually muddy or clayey (sometimes sandy, gravelly or stony), bare or sparsely vegetated soil; burrow (third instar, 20-45 mm deep) wide, straight or slightly sloping. Nocturnal, mostly crepuscular, sometimes also active in late afternoon, especially on cloudy days; male usually hides during the day under logs, boards, driftwood, stones, soapstone rocks, clods of earth, wheat shocks, trash piles, dead leaves, bunches of grass or in the cracks of dried mud; female usually digs a burrow for herself to spend the day, concealing its opening with a the leaf of a weed or a grass blade; after getting out of shelter in the evening, adult first goes to the water's edge, then thrusts its mandibles deep into the moisture and takes a long drink before searching for food. Gregarious.

Biology. Seasonality: March-November, mostly August; in SC, June-October. Summer species. Mating: lasts about 2 min. Oviposition: in burrows (6 to 12 mm deep) dug into well-drained spots close to water. Predaceous. Adult food, in the field: caterpillars (mostly), coccinellids, and toadlets. Larva waiting for its prey at the entrance of its burrow, similarly to a *Cicindela* larva. Adult body sometimes covered with algae or protozoans. Defense mechanism: when disturbed, runs about with great rapidity and seeks shelter, instead of flying, or even plunges readily into the water to hide under a stone for a long time; if flying, always crawls up on something (*e.g.*, a stick) to initiate a flight; produces defensive secretions when captured. Very shy. Best captured in the daytime by pouring water down the soil cracks and jumping on the mud, and, at night, around

artificial lights or by pitfall trapping.

Dispersal power. Macropterous. Excellent flier at night, but unwilling to fly during the day. Often attracted in large numbers to artificial lights in cities at night. Fast runner.

Megacephala carolina floridana (Leng and Mutchler, 1916)

Ecology. A salt marsh. Nocturnal.

Biology. Seasonality: June.

Dispersal power. Macropterous. Attracted to artificial lights at night. Fast runner.

Megacephala virginica (Linné, 1767)

Ecology. Eurytopic, hygrophilous, halotolerant, crepuscular, epigean (adult); fossorial (larva). Edges of rivers, brooks, ponds, marshes, and sloughs; grasslands, prairies, pastures, old fields, vacant lots, cultivated fields (soybean, cotton, corn, tobacco), city lawns and gardens, roadsides, roadcuts, sand pits, city streets and sidewalks, orchards (citrus), and open forests. Less closely associated with water than *M. carolina carolina.* Open ground; wet, moist or slightly dry, muddy, clayey or sandy, sometimes saline soil with bare spots or sparse vegetation. Larval habitat: lawns and little-used paths with more or less moist, clayey, sandy or gravelly soil; burrows (20-30 mm deep) straight or slightly sloping from the vertical; larva waits for its prey at the burrow entrance. Crepuscular (mostly) and nocturnal; sometimes active in the daytime after a rain or when cloudy; hides during the day in mud cracks, under cakes of dried mud, leaf litter, boards, stones, logs, dried cow chips, hay piles, clods of earth, pieces of paper, camping rubbish, and fence rails. Gregarious.

Biology. Seasonality: April-November; in NE, mostly August-September. Summer species. Predaceous. Adult food, in the field: caterpillars, mole crickets, coccinellids, chrysomelid eggs and larvae,

a dytiscid, other insects, and earthworms. Adult observed hunting prey on city sidewalks in the deeper shade adjoining brightly illuminated areas. A major enemy and potential biocontrol agent of several species of South American mole crickets introduced into the southeastern United States, which have become major pests of pasture and turf grass. Larval food, in the field: chrysomelid larvae, other insects, and earthworms. Predators: toads and crows. Often falls and drowns in moderate numbers in swimming pools. Defense mechanism: when pursued, prefers to run rapidly and hide instead of flying; produces defensive secretions to deter predators. Best collected by barrier pitfall trapping or light trapping.

Dispersal power. Macropterous. Excellent flier at night. Often attracted to artificial lights at night. Fast runner.

Omus audouini Reiche, 1838

Ecology. Eurytopic, silvicolous, nocturnal, thermophilous, epigean (adult); fossorial (larva). Coniferous forests, forest-meadow transitions, coastal bluffs and beaches. Open or shaded ground; often hard-packed, moist or dry soil consisting of clay or loamy sand and covered with needles or vegetated with grass. Larval habitat: half-inclined slopes; burrows (20-35 cm deep) dug into hard-packed soil. Both nocturnal (mostly) and diurnal; much less active at low temperatures; often hides under logs, stones, dead leaves, sometimes under plastic, tar paper, and automobile tires during the day. Associated species: *Omus dejeanii*.

Biology. Seasonality: March-September, mostly June. Mating: April-June; mostly under pieces of wood; copulating pairs separate rapidly if disturbed. Larva closes its burrow for the winter. Predaceous. Adult food, in the field: ants. Adult food, in the laboratory: centipedes. Predators: shrews. Larval parasites: fungi.

Dispersal power. Subapterous. Moderate runner; moves like a spider.

Omus californicus angustocylindricus W. Horn, 1913

Ecology. Stenotopic, silvicolous, nocturnal, epigean. Coniferous forests (pine). Shaded ground; soil covered with needles. Mostly nocturnal.

Biology. Seasonality: April-May. Oviposition: female lays about 9 eggs on average.

Dispersal power. Subapterous. Moderate runner.

Omus californicus californicus Eschscholtz, 1829

Ecology. Stenotopic, silvicolous, nocturnal, epigean (adult); fossorial (larva). Coniferous forests (Douglas-fir, pine, sequoia), sometimes along streams; edges of meadows. Shaded or open ground; moist or dry soil. Mostly nocturnal; hides under dead leaves, stones, fallen trees, and boards during the day. Larval habitat: burrows dug abundantly in clayey soil.

Biology. Seasonality: January-August, mostly May-June. Oviposition: female lays about 9 eggs on average. Predaceous. Adult food, in the field: flies. Larval parasites: tiphiid wasps.

Dispersal power. Subapterous. Moderate runner.

Omus californicus intermedius Leng, 1902

Ecology. Stenotopic, silvicolous, crepuscular, epigean. Coniferous forests (sequoia); chaparral belt. Shaded ground; soil covered with needles. Crepuscular; hides under stones during the day. Best collected by hand.

Biology. Seasonality: April-June, mostly June.

Dispersal power. Subapterous. Moderate runner.

Omus californicus subcylindricus Nunenmacher, 1940

Ecology. Unknown.

Biology. Seasonality: April.

Dispersal power. Subapterous. Moderate runner.

Omus cazieri van den Berghe, 1994

Ecology. Stenotopic, silvicolous, nocturnal, epigean. Coniferous forests (pine) and neighboring slopes. Open ground; soil covered with needles. Nocturnal.

Biology. Seasonality: February-June.

Dispersal power. Subapterous. Moderate runner.

Omus dejeanii Reiche, 1838

Ecology. Stenotopic, silvicolous, hygrophilous, nocturnal, thermophilous, epigean (adult); fossorial (larva). Coniferous forests, mixed forests, and forest-meadow transitions; their slopes, trails, roads, roadsides, and logged areas. Shaded (mostly) and semi-shaded ground; hard-packed, often sloping, moist, clayish soil covered with a large amount of wood debris. Larval habitat: trails, roads, roadsides, and cutbanks; horizontally oriented, aggregated burrows (15-20.5 cm deep) dug into hard-packed, sandy-clayey soil under overhanging vegetation; larva either active throughout the year or inactive during winter rains, then reopening its burrow in March-April. Both nocturnal (mostly) and diurnal; less active at low temperatures; often hides during the day under logs, fallen trees, and dead leaves, or, in rotten logs, fallen trees, and other debris. Gregarious. Associated taxa: *Omus audouini* and millipedes.

Biology. Seasonality: March-October, mostly May. Mating: May-July; copulation lasts up to 16 hours. Oviposition: June, in a sloping, sandy road bank. Pupation: May and September; in a chamber (25.5-30.5 cm deep). Tenerals: March and September. Predaceous. Adult food, in the field: millipedes. Larval food, in the laboratory: earthworms. Predators: shrews and skunks. Occasionally killed by automobiles. Defense mechanism: bites strongly when captured. Best collected using meat-baited traps.

Dispersal power. Subapterous. Moderate runner; moves like a spider.

Omus submetallicus G.H. Horn, 1868

Ecology. Stenotopic, silvicolous, hygrophilous, nocturnal, epigean (adult); fossorial (larva). Mixed forests and poison oak thickets, often along creeks. Shaded or half-shaded ground; moist soil rich in dead leaves. Larval habitat: burrows dug in a forested area near a creek. Mostly nocturnal. Semi-gregarious. Best collected by hand.

Biology. Seasonality: March-June, September; mostly May.

Dispersal power. Subapterous. Moderate runner.

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GLOSSARY

alkaline - containing a soluble salt or a mixture of salts, with a pH of more than 7.
arroyo - a stream located in an arid region.
barren - a tract of sterile land.
basking - warming by exposure to heat in order to elevate body temperature.

blowout - section of a sand dune that has been eroded by the wind and mostly stabilized by vegetation.
campicolous - living in fields.
contact guarding - the male post-mating mounting of the female to prevent copulation with other males.
crepuscular - active at dusk.
cryptic coloration - color pattern imitating the environmental background which conceals an organism from detection.
cryptogamic soil - soil grown with lichens or moss.
deserticolous - living in deserts.
diel activity - activity during the twenty-four hours of each day.
dispersal power - capacity of dispersal.
epigean - living on the surface of the ground.
eurytopic - with a wide range of ecological tolerance; occurring in many various or heterogeneous biotopes.
flash coloration - hidden color or pattern suddenly exposed to deter predators.
foraging - searching for food.
fossorial - digging burrows or holes.
halophilous - living in areas with salt, i.e. in saline or alkaline soils.
halotolerant - tolerating areas with salt or alkali.
heliophilous - active in the sunshine, but hiding during cloudy days.
heliophobous - inactive in the sunshine.
hygrophilous - living in moist or wet areas.
macropterous - having long or full membraneous wings.
mesa - a flat-topped elevation with steeply sloping sides.
mesophilous - living in areas with a moderate degree of soil moisture.
myrmecophilous - associated with ants.
necrophagous- an animal eating the carrion or the body of an animal not killed by itself.
omnivorous - feeding on both animal and plant matter.
paludicolous - living in marshes
pholeophilous - living in animal burrows.

phoretic - utilizing the body of a larger organism for transport.
playa - an intermittent lake in an undrained desert basin.
psammophilous - living in sandy areas.
riparian - living at the border of streams, lakes, and ponds.
saline - containing salt.
saxicolous - living on rocks or rocky soil.
seasonality - seasonal activity.
shuttling - moving back and forth frequently.
silvicolous - living in forests or woods.
spring-fall species - a species with a two adult abundance peaks in the same year, *i.e.*, the first one in spring, the second in fall.
stenotopic - with a narrow range of ecological tolerance; occurring only in definite, similar or homogeneous biotopes.
steppicolous - living in steppes, prairies or grasslands.
stilting - extending legs and elevating the body above the ground in order to increase convective cooling.
subapterous - nearly without membranous wings.
summer species - a species with a single adult peak abundance in the same year, *i.e.*, in summer.
sunfacing - stilting with the pale labrum directed toward the sun.
teneral - a new or young adult, recently emerged, sexually immature, with softer or paler exoskeleton.
thermophilous - loving the heat or the hottest part of the day.
thermophobous - avoiding hot sunshine.
thermoregulation - the maintenance of a constant body temperature.
xerophilous - living in dry areas.

ANNOUNCEMENT

The U.S. Fish & Wildlife Service announced on October 3, 2001 that the Ohlone Tiger Beetle (*Cicindela ohlone* Freitag & Kavanaugh) is being listed as endangered under the Endangered Species Act. To date, this species is known only from Santa Cruz County, California.

Researchers discovered the beetle in 1987. The species currently exists in remnant stands of native grassland on coastal terraces in four small geographic areas near or within the cities of Santa Cruz, Scotts Valley and Soquel, all in Santa Cruz County. The beetles inhabit less than 20 acres on a combination of private land, and lands owned by the University of California at Santa Cruz, the City of Santa Cruz, and California State Parks.

"The tiger beetle inhabits some of the last remaining patches of a coastal prairie ecosystem that once spanned coastal Santa Cruz County and extended into San Mateo County and Monterey County," said Steve Thomson, acting manager of the Fish & Wildlife Service's California/Nevada operations office. "We are already working with developers and land managers to plan for the conservation of this rare species."

The Service was petitioned by a private citizen in 1997 to list the Ohlone Tiger Beetle. Based upon additional scientific research and evaluation, the Service had originally proposed to list it as Endangered on February 11, 2000.

However, the final listing was delayed when the Service announced in November, 2000 that it would be unable to list any additional species in Fiscal Year 2001 because virtually its entire listing budget was being used to comply with court orders and settlement agreements requiring designation of critical habitat for species that had already been listed under the Act.

This news release, and others, can be seen in their entirety at the Service's Pacific Regional home page at: **www.rl.fws.gov**; else the National home page at: **www.fws.gov/r9extaff/renews.html**.