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CARABIDAE (Ground Beetles)

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ABSTRACT

This report contains keys and descriptions of the Carabidae (ground beetles) known to occur on the Pawnee Site. The tiger beetles are included as subfamily Cicindelinae. The paper is designed to be used in conjunction with a synoptic set in the site reference collection and is intended for the use of workers who are not trained taxonomists. Technical terminology is kept at a minimum. The family is divided into tribes. The dominant tribe, Harpalini, is discussed first, and the remaining ones follow in alphabetical order. Within the tribes, the arrangement in the key is not phylogenetic, but is based on the most easily observed reliable characteristics. The descriptions are arranged in alphabetic order and emphasize comparisons with the species most likely to be confused with the one under consideration. There are 81 species in the family recorded from the Pawnee Site.

CARABIDAE (Ground Beetles)

Note: The tiger beetles are included in this key, though they are often considered to be a separate family, Cicindelidae.

RECOGNITION

The Carabidae are easily distinguished from all other terrestrial beetles by the fact that the prothorax has distinct lateral sclerites (episterna). This feature is shared with Dytiscidae and two other families of aquatic beetles. In all other beetles the prothorax consists of only two sclerites, the pronotum and prosternum, or is fused into one solid sclerite. Two further features are shared with the Dytiscidae and their relatives: the hind coxae form large, scarcely movable plates, which appear to interrupt the first abdominal sternite, dividing it into a small triangular median portion and two lateral portions; and the hind trochanter appears to be "out of line," i.e., the distal part of it forms a lobe projecting parallel to the femur, while only a small basal portion lies between the coxa and femur where one would normally expect a trochanter. The characters listed above are typical of the Suborder Adephaga, of which the Carabidae are the only terrestrial representatives. All other local beetles belong to the Suborder Polyphaga.

Carabidae have 11-segmented filiform antennae (flattened in *Helluomor-phoides*). The antennae are never clubbed, serrate, or enlarged distally. In all genera (locally) except *Calosoma* and *Cicindela* there is a characteristic structure, the antenna-cleaner, on the anterior tibia. This consists of a comb of hairs located in a notch on the inner margin of the front tibia. Usually the tibial spurs are displaced so that one of them lies above, and

one below the antenna-cleaner. *Trachypachus* is exceptional in having both spurs distal to the antenna-cleaner. The outer segments of the antenna are cleaned by being pulled across the comb of the antenna-cleaner.

The tarsi of all legs have five segments. Except for the Scaritini and certain genera of Harpalini, all Carabidae exhibit sexual dimorphism in the structure of the front tarsi. In the female they resemble those of the other legs, while in the male they are dilated and are provided with adhesive hairs on the ventral surface. In some species the middle tarsi are similarly modified.

Carabidae have enlarged specialized hairs called *tactile setae*. These form organs of touch and are relatively constant in location and numbers. They are not quite diagnostic of Carabidae, since similar hairs occur in members of a few other families. Tactile setae are larger than the ordinary body hairs and project further. Each one arises from a definite puncture. When a seta has broken off, its location can still be found by locating the setiferous puncture. When setae are hard to see, the best method is to view the specimen at right angles, light it from the side, and view it against a dark background. The setae most used in classification are as follows:

1. *preocular*--above the anterior margin of the eye.
2. *postocular*--above the posterior margin of the eye.
3. *clypeal*--one or two on either side of the clypeus.
4. *lateral* (of pronotum)--one or more at or near the margin of the pronotum. This does not include the one at the hind angle.
5. *angular*--at or near the posterior corner of the pronotum.
6. *ocellate* or *striolar*--at the base of the elytron near the striae, a short stria near the scutellum.

7. *dorsals*--on the elytron, on the second or third stria or on the interval between them. In some species, additional dorsals occur more laterally, on the fifth and seventh striae, or near them.
8. *marginals*--along the lateral margin of the elytron.
9. *ambulatory setae*--on the abdominal sternites.

Carabidae are quite variable in size, shape, and color. The most common colors are black and brown, but green, bronzed, spotted, and striped forms also occur. Most species are terrestrial and are found beneath cover (often cow dung) during the day. Some seek shelter in mammal burrows and are almost impossible to catch except at night. Many species abound on the wet mud near waterholes. Most of these are diurnal. A few species are burrowers, and a few others climb on plants. Most textbooks convey the impression that Carabidae are strictly carnivorous. However, the two groups best represented on the open prairie (Harpalini and Amarini) are known to be largely herbivorous. Most Carabidae have a pair of anal scent glands. These are used in repelling enemies. The repellent fluid varies in chemical composition, and many species have highly distinctive odors.

OTHER FAMILIES WHICH MAY BE MISTAKEN FOR CARABIDAE

1. *Tenebrionidae*: Common in the same habitats as carabids. Differ in having small eyes which are vertically elongate (or divided into a dorsal and a ventral eye in one genus), the antennae broadened distally, the anterior margin of the head thickened, and the hind tarsus with only four segments.
2. *Anthicidae* are very small beetles with a superficial similarity to certain Carabidae. They differ in having only four segments to the hind

tarsi and in having the head constricted to a narrow neck. (Not true of any local carabid.)

3. *Cerambycidae* (Longhorn beetles). *Prionus* and *Moneilema* may be found under cover on the ground and might be mistaken for large ground beetles. They differ in having the tarsi apparently four-segmented (the third segment is deeply bilobed while the true fourth segment is minute and hidden between the lobes).

4. *Chrysomelidae* (Leaf Beetles). The carabid genus *Lebia* contains species which are mimics of certain leaf beetles, which they resemble in size, shape, and coloring. In addition to the suborder characters, they are easily distinguished by the structure of the tarsus. The Chrysomelidae have the type of foot described above for the Cerambycidae, while in *Lebia* it is the *fourth* segment which is bilobed, and the tarsus is clearly five-segmented.

CLASSIFICATION

The family is too well represented on the Site to be treated as a single unit. Unfortunately, the classification of Carabidae is in a state of flux, and no two specialists recognize the same subfamilies. The next lower taxonomic category, the tribe, is much more standardized and easily recognized. Accordingly, the Carabidae will be treated by tribes.

KEY TO TRIBES OF CARABIDAE ON THE PAWNEE SITE

- 1a. Both spurs of anterior tibia at or near the apex; antenna-cleaner either absent or else entirely proximal to tibial spurs. 2

- 1b. One of the apical spurs of the anterior tibia displaced proximally (at least one-sixth of length of tibia) or else entirely absent (*Lebia*); antenna-cleaner well developed, lying between the tibial spurs, if both are present. 4
- 2a. Antenna-cleaner well developed, proximad to both tibial spurs; antennal segments 4 to 11 smooth and shining, without hairs (except for a few tactile setae); length 3.8-5.8 mm; an oval bronzed species. Trachypachini
- 2b. Antenna-cleaner not developed; antennal segments 4 to 11 with a coating of dense hair in addition to the tactile setae; length more than 6.0 mm. 3
- 3a. Labrum and clypeus extending laterad to bases of antennae; jaws very long, with serrate inner margins. Cicindelini
- 3b. Labrum and clypeus entirely mesad to bases of antennae; inner edge of jaw not serrate. Carabini
- 4a. Edge of head extending anteriorly laterad to clypeus, forming plate above base of antenna; anterior tibia with a long tooth at apex, extending distad to attachment of tarsus; mesothorax narrow, appearing to form a "stalk" connecting pronotum to elytra. Scaritini
- 4b. Edge of head not forming plate above base of antenna; anterior femur usually without an apical tooth (except in *Euryderus*); mesothorax not or scarcely stalklike. 5
- 5a. Last segment of maxillary palpus very small and narrow, usually less than one-fifth as long as second-last segment; the latter enlarged and clublike; small to minute species, mostly found near waterholes. Bembidiini

- 5b. Last segment of maxillary palpus well developed, usually wider than and nearly as long as second-last, which is not clublike. 6
- 6a. Eyes very large; width across eyes greater than width of pronotum; elytra without striae, but with raised rings surrounding circular depressions; on bare mud near waterholes. Elaphrini
- 6b. Eyes less large; elytra without large circular depressions. 7
- 7a. Elytra truncate at tip, leaving last abdominal tergite exposed. 8
- 7b. Elytra not truncate at tip, but fitted to abdomen, usually covering last tergite (part of tergite may be exposed in gravid or bloated specimens). 10
- 8a. Antennal segments strongly flattened; anterior tibia strongly flattened; brown; elytra bluish-black except at base; length 13.0-18.0 mm. Helluonini
- 8b. Antennal segments normal, only slightly flattened; anterior tibia only slightly flattened; size smaller. 9
- 9a. Abdomen with seven or eight visible sternites; dorsal surface hairy; head and pronotum orange; elytra blue. Brachinini
- 9b. Abdomen with only six visible sternites; color varying (if orange with blue elytra, then the dorsal surface is not hairy). Lebiini
- 10a. Labrum strongly emarginate at middle and asymmetrical (left and right lobes unequal); clypeus emarginate anteriorly; one black species with black legs, 9.0-12.0 mm long. Licinini
- 10b. Labrum at most weakly emarginate, symmetrical. 11

- 11a. Mandibles short, curved, very thick, tips blunt; clypeus with base much wider than apex (clypeal margin usually at more than 45° angles to long axis of body. 12
- 11b. Mandibles elongate, tips pointed, thin; clypeus not so broad at base, lateral margins at less than 45° angles to long axis. 13
- 12a. Preocular seta absent; angular seta usually absent. . . . Harpalini
- 12b. Preocular and angular setae present. Amarini
- 13a. Dorsal surface hairy; preocular seta absent; green or bronzed above. Chlaeniini
- 13b. Dorsal surface glabrous; preocular seta present; color varying. Pterostichini

A. THE PHYTOPHAGOUS TRIBES

Most of the Carabidae of the Pawnee Site belong to the tribes Harpalini and Amarini. These two groups are largely herbivorous in diet, although most species are thought to take some animal food. Although they are not closely related, the two tribes look much alike. Compared to other Carabidae, they have short, heavy, curved mandibles and a short clypeus which is strongly trapezoidal, the anterior width being much narrower than the posterior width. The tribes are easily distinguished: the Harpalini lack the preocular seta and almost always lack the angular seta of the pronotum, as well, while both of these setae are present in the Amarini. The only local Harpalini which possesses an angular seta is *Trichocellus cognatus*, which is easily distinguished from any Amarini by its hairy eyes, variegated color pattern, and lack of a preocular seta.

TRIBE 1. HARPALINI

Over one-third of the species of Carabidae on the Pawnee Site belong to this tribe. In the open prairie, away from the waterholes, probably 80% of the individuals are Harpalini. The tribe is easily recognized by the absence of the preocular seta. The only other tribes in which the preocular is absent are the Chlaeniini, which are green or bronzed above and densely hairy, and the Brachinini, which are orange with blue elytra.

Some of the Harpalini are very difficult to separate. The six common species should be learned and used as a basis of comparison. These are: *Harpalus desertus*, *Harpalus opacipennis*, *Cratacanthus dubius*, *Piosoma setosum*, *Selenophorus planipennis*, and *Stenolophus conjunctus*.

Key to Species

- 1a. Anterior tibia strongly modified for burrowing; length 10.0-17.0 mm.
 2
- 1b. Anterior tibia not modified for burrowing; size varying. 3
- 2a. Anterior tibia with heavy, outward-directed tooth at tip; pronotum with many marginal setae; a dark-brown, broadly oval species.
 *Euryderus grossus*
- 2b. Anterior tibia with semicircular projecting lobe at tip; pronotum with one marginal seta; pale yellowish-brown, body stout, head very large.
 *Geopinus incrassatus*
- 3a. Eyes, dorsal surface of head, lateral margins of pronotum, and outer elytral intervals with numerous very short hairs; angular seta of pronotum present; length 3.5-5.2 mm. *Trichocellus cognatus*
- 3b. Eyes not at all hairy; angular seta absent. 4

- 4a. Head, pronotum, elytral intervals with long setae; 7.0-12.0 mm.
..... *Pisoboma setosum*
- 4b. Dorsal surface with only the usual tactile setae. 5
- 5a. Margin of head with prominent tooth above base of antenna; 7.5-11.5 mm.
..... *Cratacanthus dubius*
- 5b. No such tooth above base of antenna. 6
- 6a. Apical spur of anterior tibia trifid; body broadly oval; length
8.8-11.0 mm; black with black legs. *Anisodactylus rusticus*
- 6b. Apical spur of anterior tibia not trifid. 7
- 7a. Elytron with series of dorsal setae in second, fifth, and seventh
striae; length 4.3-7.5 mm. 8
- 7b. Elytron with one or (rarely) two dorsal setae at or near the second
stria, or else entirely without dorsal setae. 9
- 8a. Striae deep; scutellar striole deep, distinct; dorsal surface not
metallic; length 6.0-7.5 mm. *Discoderus parallelus*
- 8b. Striae fine; scutellar striole reduced, often nearly absent; dorsal
surface with dull bronzed tint; length 4.3-5.7 mm.
..... *Selenophorus planipennis*
- 9a. Scutellar striole entirely absent; a minute, narrow, brown beetle;
3.9-4.8 mm. *Bradycellus congener*
- 9b. Striole present, usually well developed. 10
- 10a. Head black, contrastingly darker than pronotum, which is brown, length
less than 8.0 mm. 11
- 10b. Head not contrastingly darker than pronotum; length 7.0 mm or more.
..... 14
- 11a. Length less than 4.3 mm. 12

- 11b. Length greater than 5.0 mm. 13
- 12a. Pronotum distinctly wider than long; basal impressions not punctured; 3.2-4.3 mm. *Stenolophus conjunctus*
- 12b. Pronotum distinctly longer than wide; basal impressions punctured; length 2.9-3.4 mm. *Acupalpus pauperculus*
- 13a. Each elytron with a well defined black stripe occupying intervals two to five (not reaching base or apex); elytra not iridescent; first segment of hind tarsus short, about equal to second. *Stenolophus comma*
- 13b. Elytra iridescent, without distinct black marks (though vaguely darker near suture); first segment of hind tarsus twice as long as second segment. *Stenolophus sp.*
- 14a. Hind angles of pronotum entirely rounded; elytra with metallic purplish or greenish tint; all abdominal sternites (including last one) with very short hairs in addition to ambulatory setae. *Harpalus amputatus*
- 14b. Hind angles less rounded (though very blunt in some species); elytra without any trace of metallic coloration; last sternite without hairs other than ambulatory setae. 15
- 15a. Legs light brown or yellowish, contrastingly lighter than body. . . 16
- 15b. Legs (at least femora) black or nearly so (tibiae sometimes lighter than femora). 20
- 16a. Elytra without dorsal punctures; length 10.0-15.0 mm. 17
- 16b. Each elytron with one dorsal puncture in third interval or in second stria; length 11.0 mm or less. 18

- 17a. Pronotum with lateral margins distinctly depressed, becoming more broadly so posteriorly; raised basal margin of pronotum usually becoming indistinct laterally. *Harpalus pennsylvanicus*
- 17b. Pronotum with lateral margins not distinctly depressed; raised basal margin complete. *Harpalus paratus*
- 18a. Abdominal sternites four and five with many setae in addition to ambulatory setae; seventh elytral interval with two or three setiferous punctures near apex; no punctures at base of pronotum. *Harpalus desertus*
- 18b. Abdominal sternites four and five each with only the one pair of ambulatory setae; seventh interval with one puncture near apex; base of pronotum punctate, both in and lateral to basal impressions. 19
- 19a. Humeral tooth of elytron very small; female with spinose projection on tip of elytron next to suture; length 7.5-9.5 mm. *Harpalus somnulentus*
- 19b. Humeral tooth larger; female elytron without sutural spine; length 8.2-11.0 mm. *Harpalus uteanus*
- 20a. Elytron without a dorsal puncture; length 18.0-26.0 mm. *Harpalus caliginosus*
- 20b. Dorsal puncture and seta present in third elytral interval or second stria. 21
- 21a. First segment of hind tarsus elongate, about twice as long as second segment; two clypeal setae on either side. . . *Anisodactylus harrisi*
- 21b. First segment of hind tarsus short, about equal to second segment; normally with one clypeal seta on either side. 22

- 22a. Abdominal sternites four and five with several long setae lateral to ambulatory setae; dorsal surface shining; length 10.0 mm or more. *Harpalus funerarius*
- 22b. Abdominal sternites four and five with only the single pair of ambulatory setae; size usually smaller; dorsal surface opaque. 23
- 23a. Apical spur of anterior tibia stout; head broad; humeral tooth of elytron stout, blunt. *Harpalus carbonatus*
- 23b. Apical spur of front tibia slender; head small; shoulder tooth small, sharp. *Harpalus opacipennis*

Species Descriptions

1. *Acupalpus pauperculus* Dej. 2.9-3.4 mm. Scarce, at waterholes. A minute, elongate beetle with black head and reddish-brown pronotum and legs. The elytra are largely black, but the margins, including the suture, are usually rufous. The pronotum appears to be as long as wide (this is actually an optical illusion). It is narrowed posteriorly, so that the base is distinctly narrower than the apex. The hind angles are completely rounded. The basal impression contains a small number of coarse punctures. The scutellar striole is usually distinct, though very short. Distinguished from *Bradycellus congener* by the sharper color contrast between head and pronotum, the punctures in the basal impressions, the shining dorsal surface, and the usual presence of the scutellar striole. Easily distinguished from *Stenolophus conjunctus* by the less-transverse pronotum, which is distinctly narrower at base than at apex.
2. *Anisodactylus harmisi* Lec. 10.0-13.0 mm. Rare, taken once on the open prairie, possibly a stray from cultivated ground. A medium-sized black

species with black legs. Unique among local species in having two clypeal setae on either side. The pronotum is strongly depressed along the lateral margins, becoming more broadly so posteriorly (much as in *Harpalus pennsylvanicus*). This species and the next differ from all *Harpalus* in the elongate basal segment of the hind tarsus and in the vestiture of the male front and middle tarsi. In *Anisodactylus* this consists of many rows of minute hairs, while in *Harpalus* there are two rows of enlarged scales.

3. *Anisodactylus rusticus* Say. 8.8-11.0 mm. A rather dull black, broadly oval species. The pronotum is widest near the base, and is strongly narrowed anteriorly. The trifid apical spur is unique among species so far taken at Pawnee. This species lacks a humeral tooth on the elytron. Another, larger species, *A. merula* Germ., is very similar, but has a distinct humeral tooth. It has not so far been taken at the Pawnee Site. One specimen, probably a stray, of *A. rusticus* has been taken at the Site.
4. *Bradycellus congener* Lec. 3.9-4.8 mm. Scarce, usually near waterholes, but sometimes away from them, especially in the spring. Often lingers among mud cracks after a temporary pond has dried. A small, narrow brown beetle. The color is rather variable. The head is rarely contrastingly darker than the pronotum. The elytra are usually dark brown with the margins (including suture) indefinitely paler. Hind angles of pronotum rounded; basal impressions punctured. The elytra are dull and have strong microsculpture. Likely to be mistaken only for *Acupalpus carus* Lec., which has shining elytra without microsculpture, a contrastingly black head and usually a distinct scutellar striole.

5. *Cratacanthus dubius* Beauv. 7.5-11.5 mm. Common on the open prairie. It looks like a medium-sized *Harpalus* with an oversized head. Easily recognized by the tooth above the base of the antenna. The pronotum is strongly sinuate anterior to the hind angles, unlike any local *Harpalus*. The male has the front tarsi scarcely dilated (though the two rows of scales are present on the ventral surface). It is easily recognized by the presence of a projecting shelf on the right mandible, as well as by the head more enlarged than in the female. *Piosoma setosum* is superficially similar to *Cratacanthus*, but is easily recognized by the numerous long setae on the dorsal surface.
6. *Discoderus parallelus* Hald. 6.0-7.5 mm. Rare, on the open prairie. Like a large version of *Selenophorus planipennis*, but with deep stria and a well developed striole. The pronotum is broadly rounded laterally, with both base and apex narrowed. The hind angles are almost completely rounded. The pronotum is larger and the head smaller than in *S. planipennis*. The dorsal surface is pure black, without the bronzing seen in the latter species. The male secondary sexual characters are unusual: the anterior tarsi are not dilated, but the middle tibia is strongly curved and bears a row of tubercles on the inner margin.
7. *Euryderus grossus* Euryd. 10.5-15.8 mm. Rare, a burrower found in sandy soil. Taken once near Owl Creek. Easily recognized by the tooth on the front tibia (resembling that of Scaritini). It is an oval, dark-brown, very broad species. Like *Piosoma* it has extra setae on the pronotum and elytra. It differs from the latter species in lacking additional setae on the head and in having the pronotum not at all narrowed at the base.

8. *Geopinus incrassatus* Dej. 13.0-17.0 mm. Rare, or at least rarely caught. A burrowing species probably restricted to sandy terraces along Owl Creek. One specimen was found dead in the bed of Owl Creek, and two were found alive in one of the headquarters buildings (collected by John Leetham). The latter two were probably attracted to light at night. This species is easily recognized by its pale-brown coloring, large head, and modified anterior tibia. The mandibles are very long for a Harpaline, but are thick and blunt as usual in the tribe. The large head, pale color, and small but prominent eyes give it a superficial resemblance to a Jerusalem cricket.
9. *Harpalus amputatus* Say. 8.5-12.0 mm. Scarce, on the open prairie. Usually recognizable by the distinct metallic tint (purple or green) of the elytra. Some individuals are almost completely black. They differ from other medium-sized Harpalini in the almost complete rounding of the hind angles of the pronotum. The species is always recognizable by the abundant short hairs on all the abdominal sternites, including the last one.
10. *Harpalus caliginosus* F. 18.0-26.0 mm. Scarce, in the lowland prairies only (near Owl Creek); elsewhere, a common beetle of dry cultivated lands. Easily recognized by the large size, the lack of dorsal punctures, and the black legs.
11. *Harpalus carbonatus* Lec. 8.0-11.5 mm (usually over 10.0 mm). Rare, taken in the prairie once near Cottonwood Pond. A small stout *Harpalus* with the legs largely black. The apical spur of the anterior tibia is stout and is dilated at about one-third of its length. This feature is unique among local *Harpalus*, but is seen in more exaggerated form

- in *A. harrisi*. *Harpalus carbonatus* is most similar to the common *H. opacipennis*, but is somewhat larger and has a much bigger head.
12. *Harpalus desertus* Lec. 6.5-8.0 mm. Common on the open prairie, especially in early summer. The common small *Harpalus* with pale legs. Two features separate it from all other *Harpalus* so far taken on the Site: it is the only species with two or more punctures near the apex of the seventh interval (other species have one, at most); and it is the only pale-legged species with accessory ambulatory setae on the abdomen. It shares these features with *H. furtivus* Lec., a species so far not found at the Site. The latter species is larger (about 10.0 mm), broader, and flatter, with finer elytral striae and flatter intervals.
13. *Harpalus funerarius* Cki. 10.5-13.0 mm. Rare, caught once in a pit trap on the open prairie. This is a rather large, black-legged species with accessory ambulatory setae on the abdomen. The hind angle of the pronotum is rather sharp. The dorsal surface of the body is shining in both sexes. The front tarsi of the male are scarcely broader than those of the female. The female lacks a sutural spine on the elytron. Other black-legged species with extra abdominal setae occur in the area, though not, so far, at the Site. They differ from *H. funerarius* in having well dilated front tarsi in the male, and dull elytra with well developed microsculpture and sutural spines in the female.
14. *Harpalus opacipennis* Hald. 7.5-9.3 mm. Very common on the open prairie. The common, small, dark-legged *Harpalus*. The head is smaller, and the pronotum is more narrowed anteriorly than in *H. desertus*, giving the body a more oval outline. The basal impressions are impunctate or nearly so; the lateral margins are usually narrowly depressed behind

the middle. There are no accessory ambulatory setae. The elytron has a small but sharp humeral tooth. The species most likely to be confused with it is *H. carbonatus*, which is larger, has a larger head, and has an enlarged, dilated anterior tibial spur. In Canada there is a pale-legged form of *H. opacipennis*. This is not known to occur in Colorado. If it did appear, it would trace to *H. sommulentus* or *H. uteanus* in the key, but would differ from those species in the small head, oval shape, and virtual lack of punctation on the base of the pronotum.

15. *Harpalus paratus* Csy. 10.0-14.0 mm. Scarce, apparently limited to lowland prairie near Owl Creek. A large species with orange legs, and without a dorsal puncture. The pronotum is distinctly narrowed at the base, and the lateral margins are not depressed near the base. The raised basal margin is complete and well defined. These characters are sufficient to separate it from *H. pennsylvanicus*, the only similar local species. *Harpalus bicolor* F, and several other species of similar appearance, may be expected at Pawnee. They differ from *H. paratus* in having well developed minute punctures in the outer elytral intervals, and in having conspicuous setae on the dorsal surface of all segments of the hind tarsus. (In *H. paratus* the outer intervals are virtually without punctures, and the setae of the hind tarsi are limited to the first and fifth segments.)
16. *Harpalus pennsylvanicus* De G. 10.0-15.0 mm. Scarce, taken in the lowland prairie near Owl Creek and Cottonwood Pond. Elsewhere, one of the commonest beetles of dry cultivated land in most of North America. Like *H. paratus*, it is a large species with orange legs and without a dorsal puncture. The pronotum has a much broader base than in the latter

- species, while the lateral margins are distinctly depressed behind the middle. The raised basal margin becomes indistinct laterally. The outer elytral intervals are minutely punctate, and all segments of the hind tarsus bear dorsal setae.
17. *Harpalus somnulentus* Dej. 7.5-9.5 mm. Rare, three specimens, all newly transformed, from the open prairie. (This identification is provisional.) A small, pale-legged *Harpalus*, superficially like *H. desertus*, but with only one puncture in the apex of the seventh interval and without accessory ambulatory setae on the abdomen. The female has a distinct sutural tooth at the apex of the elytron. The base of the pronotum is finely but distinctly punctate, both in the lateral to the basal impressions. The most similar species is the next one.
18. *Harpalus uteanus* Csy. 8.2-11.0 mm. Rare, taken once in the dry bed of a temporary pond southeast of Cottonwood Pond. This species is said to be partial to saline localities. It is closest to the preceding species, but is usually larger and lacks the sutural spine on the female elytron. The humeral tooth is larger.
19. *Pisoboma setosum* Lec. 7.8-11.7 mm. Common on the open prairie. Similar in size and shape to *C. dubius*, from which it differs in having numerous long setae on the pronotum, a transverse row on the head and a row in each elytral interval. The male anterior tarsi are not broadened (a similarity to *Cratacanthus*), but the male mandibles are not modified. *Pisoboma* differs from any *Harpalus* in having the pronotum strongly sinuate anterior to the hind angles, which are rectangular. One specimen was observed climbing on buffalo grass on a cool day in late May.

20. *Selenophorus planipennis* Lec. 4.3-5.7 mm. Abundant in the open prairie, especially in the spring. A very small, bronzed Harpaline with many dorsal punctures along the second, fifth, and seventh striae. In cool weather, seen running rapidly over the soil. In hot weather, usually found beneath cow dung. The only similar species is *D. parallelus*, which is larger, not bronzed, and which has deep striae and a well developed striole. (For further differences, see *Discoderus*.)
21. *Stenolophus comma* F. (formerly known as *Agonoderus comma*). 5.5-7.7 mm. Abundant in the wet mud near waterholes, where it burrows. Known to economic entomologists as the "corn seed beetle" because it sometimes damages sprouting corn in very wet soil. The general color is reddish-brown, with the head and the elytral stripe black. The pronotum also may have a central black spot. The elytral black stripe occupies the second to fourth intervals. It fails to reach either the base or the apex and is usually squarely truncate anteriorly. The only similar species is the undescribed *Stenolophus* discussed below (*q.v.*).
22. *Stenolophus conjunctus* Say. 3.2-4.3 mm. Common in the open prairie, especially in summer. Head black; pronotum dark reddish-brown; elytra very dark brown to black, but with margins, including the suture, pale. The pronotum is distinctive. It is strongly transverse, with completely rounded sides and without punctures in the basal impression. The scutellar striole is well developed. The most similar species is *A. pauperculus*, which has the pronotum scarcely wider than long and the basal impressions punctate.
23. *Stenolophus* sp. 5.0-6.0 mm. Scarce on wet mud near waterholes. This apparently undescribed *Stenolophus* is superficially very similar to

S. comma, but lacks the black stripe on elytral intervals two to four. The head is black. The pronotum and elytra are reddish-brown. The latter become vaguely darker near the suture. In contrast to *S. comma*, the elytra are strongly iridescent. The basal segment of the hind tarsus is about twice as long as the second segment, and both segments are carinate on the outer surface. In *S. comma*, the first segment is short, about equalling the second segment, while neither segment is carinate. This species is found along with *S. comma*, but is not a burrower.

24. *Trichocellus cognatus* Gyll. 3.5-5.2 mm. Rare, represented by one specimen, possibly a winged stray from the alpine zone on the mountains, where it is commoner. Differs from all other local Carabidae in having numerous short fine hairs on the surface of the eye. These are most easily seen in profile view. The number of outer intervals which are hairy is quite variable. The color pattern is also rather variable. In general, both pronotum and head are black near the midline, becoming reddish-brown laterally. The elytra are reddish-brown except for a large black discal spot. The first interval is reddish-brown, so that the spots on the two elytra do not make contact with one another. The lack of sharp color contrast between head and pronotum will separate this species from *S. conjunctus* and *A. pauperculus*. The most similar species is *B. congener*, which lacks hairs on the eyes, pronotum, and outer elytral intervals.

TRIBE 2. AMARINI

Most species look like small oval Harpalini with relatively small heads. The exception in the local fauna is *Amara carinata*, which looks like a medium-sized, elongate Harpaline with strongly carinate hind angles. (No medium-sized local Harpaline has carinate hind angles.) In addition to feeding on seeds and flower parts, some Amarini are known to feed on the eggs of other insects.

Key to Species

- 1a. Pronotum broadest near middle, distinctly narrowed at base; sides distinctly sinuate before hind angles; 11.0-14.0 mm.
 *Amara carinata*
- 1b. Pronotum broadest near base, sides not sinuate; body oval; length 9.5 mm or less. 2
- 2a. Dorsal surface brown to almost black, not metallic; antenna entirely pale. 3
- 2b. Dorsal surface black with bronzed tint; antennal segments 4 to 11, black. 4
- 3a. Head of normal size; pronotum widest near middle, very slightly narrowed to base; basal impressions strongly punctate; elytra of female opaque, with distinct microsculpture of transverse meshes more or less in transverse rows. *Amara idahoana*
- 3b. Head very small; pronotum widest at base, strongly narrowed anteriorly; basal impressions (in local specimens) scarcely punctate; elytra shining in both sexes; microsculpture isodiametric, but scarcely evident.
 *Amara musculus*

- 4a. Antenna with only the first (or rarely the second) segments pale; elytron with blunt, strongly projecting humeral tooth. *Amara foveata*
- 4b. Antenna with segments one to three pale; humeral tooth very small or absent. 5
- 5a. Elytron with ocellate puncture present; outer basal impression of pronotum usually less definite than inner one. . . . *Amara littoralis*
- 5b. Elytron without ocellate puncture near striole; outer basal impression of pronotum as deep as inner one, oblique. *Amara convexa*

Species Descriptions

1. *Amara carinata* Lec. 11.0-14.5 mm. Scarce, on the open prairie. A dark brown species, with paler legs. Very different from other local *Amara* in appearance, but with some similarity to *H. paratus*, from which it is easily separated by the strongly carinate hind angles and sinuate pronotal sides. The middle tibia of the male has a strong tooth on its inner margin at about the middle. Two similar species may eventually be found at the Site. One (*A. thoracica* Hayw.) has the pronotum much more strongly narrowed at the base, so that the latter is much narrower than the apex. The other (*A. pennsylvanica* Hayw.) is shorter and stouter than *A. carinata*, with a coarser raised lateral rim and with the lateral margin of the elytron evenly rounded at the posterior end of the epipleura. (The margin of the elytron appears "twisted" at this point.) In *A. carinata*, the epipleura is angulate just anterior to the "twist."
2. *Amara convexa* Lec. 5.3-8.0 mm. Common on the open prairie, often gregarious (20 or more individuals may occur beneath the same piece of cow dung). Smaller and narrower than similar species. Easily recognized

by the well developed outer basal impression, which points diagonally toward the hind angle. Differ from *A. farcta* in having the third antennal segment pale and from *A. littoralis* in lacking the ocellate elytral puncture.

3. *Amara farcta* Lec. 6.5-9.0 mm. Rare, taken once on the open prairie in the spring (common in the foothills). A bronzed species much like *A. convexa*, but with the third (and usually the second) antennal segment black and with a blunt, strongly projecting humeral tooth on the elytron. The male differs from that of other small bronzed species in lacking dense pubescence on the inner edge of the hind tibia.
4. *Amara idahoana* Csy. 5.0-6.5 mm. Common on the open prairie in the spring, disappearing later. A small brown species, easily separated from *A. convexa* by the lack of metallic coloring. This species becomes very dark brown or almost black when fully mature in the fall. Mature specimens are almost impossible to find on the Site, however. In June, when the species is common, the beetles are newly transformed and are various shades of brown. This species is unusually slow in assuming the final color pattern. The only similar species is the relatively rare *A. musculus* (q.v.).
5. *Amara littoralis* Mnh. 6.2-9.3 mm. Scarce, on lowland prairie near Cottonwood Pond. A metallic species, much like *A. convexa*, but larger and broader and with the outer basal impression obsolete. Unlike *A. convexa*, it has an ocellate puncture near the scutellar striole. A very few specimens from other regions are reported to lack the ocellate puncture on both elytra. If such a specimen occurred here, it could still be separated from *A. convexa* by the reduced outer basal impression.

6. *Amara musculus* Say. 4.5 mm. (local specimens). Rare, one pair taken beneath cow dung in early June. These are only provisionally identified as *A. musculus*; they are too immature for certain identification. They are smaller than *A. idahoana*, with a much smaller head. The pronotum is widest at the base. The basal impressions are scarcely punctate (this is not true of *A. musculus* in other regions). The microsculpture of the elytra is much less prominent in the female of this species than in *A. idahoana* and shows no tendency to alignment in transverse rows. The two specimens are pale brown, as is always true of newly transformed beetles. The true adult color is probably piceous black. Confirmation of the identity of this species will have to await the capture of more-mature specimens.

B. THE CARNIVOROUS TRIBES

Although the carnivorous Carabidae are represented by 10 tribes and over 40 species, most of them are limited to the vicinity of waterholes and few are common on the open prairie. The only species which are really abundant away from water are *Pasimachus elongatus* (Scaritini), *Cicindela punctulata* (Cicindelini), and *Evarthrus constrictus* (Pterostichini). Only a few of the Carabidae (particularly *Cicindela* and *Calosoma*) are entirely limited to animal food; the others eat some vegetable matter.

TRIBE 3. BEMBIDIINI

Members of this tribe are medium to small Carabidae with two dorsal punctures on the elytron and with a characteristic type of palpus. The last segment is very small (usually only about 10% as long as the preceding

segment), while the next-to-last segment is enlarged and clublike. Most species inhabit shorelines and are diurnal. Only two local species occur on the open prairie, *Bembidion nitidum* and *Bembidion quadrimaculatum*, and neither of these is abundant. Most species are metallic in color, and many have elytral spots.

Key to Species

- 1a. Only the innermost elytral stria well developed, its tip recurving at the elytral apex (forming a "recurrent stria"); scutellar striole absent; length less than 3 mm; dorsal surface brown, shining, humeral and apical regions of elytra paler. *Tachys anceps*
- 1b. At least five elytral striae well developed; the innermost stria not recurving at apex; scutellar striole present. 2
- 2a. Raised lateral rim of elytron forming sharp angle at its anterior end (at humerus); dorsal surface bronzed; elytra not spotted. 3
- 2b. Raised lateral rim of pronotum not angulate anteriorly; elytra with pale marks of some sort. 4
- 3a. Dorsal setae of elytra located in large pits along third stria; pronotum cordate, with base as narrow as apex; 6.8-7.7 mm. *Bembidion bifossulatum*
- 3b. Dorsal setae in ordinary punctures located in third interval (though usually near the stria); 4.1-5.3 mm. *Bembidion nitidum*
- 4a. Dorsal punctures on the third stria. 5
- 4b. Dorsal punctures in the third interval. 7
- 5a. Elytron largely dark, but with large isolated orange spot near apex; head with group of punctures mesad to eye on dorsal surface. *Bembidion scopulinum*

- 5b. Elytra largely pale, usually with diamond-shaped dark-brown spot in middle (spreading laterally from suture); without coarse punctures mesad to eye. 6
- 6a. Length 3.9-5.1 mm; pronotum narrower, with its sides less rounded and greatest width nearer to middle. *Bembidion obscurellum*
- 6b. Length 5.5-7.2 mm; pronotum broader, its sides more curved, and greatest width at about anterior third. *Bembidion sejunctum*
- 7a. Frontal grooves convergent, at least anteriorly, where they are prolonged upon the clypeus; length 3.7 mm or less. 8
- 7b. Frontal grooves parallel, not extending onto clypeus; size often larger. 10
- 8a. Elytra (together) with four yellow spots. *Bembidion quadrimaculatum oppositum*
- 8b. Elytra with more complex pattern of light and dark spots ("mosaic pattern"). 9
- 9a. Frontal grooves markedly convergent only on clypeus. *Bembidion timidum*
- 9b. Frontal grooves strongly convergent throughout their length, becoming closely approximate anteriorly. *Bembidion sp.*
- 10a. Pronotum strongly cordate, the base distinctly narrower than the apex. 11
- 10b. Pronotum not distinctly cordate, base of pronotum as wide as or wider than apex (measured across hind angles and front angles, respectively). 12
- 11a. Length 5.0-6.5 mm; head and pronotum with metallic green tint; elytra with mosaic pattern. *Bembidion cordatum*

- 11b. Length 3.5-4.0 mm; dorsal surface dark brown, not at all metallic; each elytron with a distinct pale spot near apex.
..... *Bembidion nudipenne*
- 12a. Pronotum slightly constricted posteriorly, so that base is about equal to apex; pale marks of elytra restricted to apical half.
..... *Bembidion rapidum*
- 12b. Pronotum not constricted, the base wider than the apex. 13
- 13a. Legs largely or entirely dark; only the first antennal segment pale (sometimes partly dark). *Bembidion nigripes*
- 13b. Legs pale; second, third antennal segments pale, at least ventrally.
..... 14
- 14a. Pronotum very broad; dark parts of elytra brown.
..... *Bembidion aeneicolle*
- 14b. Pronotum narrower; dark marks on elytra black.
..... *Bembidion intermedium*

Species Descriptions

1. *Bembidion aeneicolle* Lec. 3.6-4.7 mm. Scarce, few were caught near drying waterholes. Said to be partial to saline areas and might be expected to occur in numbers around Lynn Lake when the latter contains water. This is one of several species with a complete "mosaic" pattern of elytral spots, i.e., with many small light spots which are arranged so as to form interrupted or broken bands. This species is unique among such forms in having a very broad pronotum and in having the dark areas deep brown rather than black.

2. *Bembidion bifossulatum* Lec. 6.8-7.7 mm. Common on wet mud by waterholes. A large bronzed *Bembidion* with a strongly cordate pronotum and without pale spots. The two dorsal punctures are diagnostic. They are situated in foveate depressions in the third stria.
3. *Bembidion cordatum* Lec. 5.5-6.5 mm. Scarce, in wet mud by water, especially where there is emerging vegetation (e.g., Cottonwood Pond). The largest local species with the mosaic spot pattern on the elytra. The strongly cordate pronotum will separate it from other mosaic-patterned species. *Bembidion rapidum* is the only other mosaic-patterned species with a somewhat cordate pronotum. It is smaller, and the pale spots on the elytra are much reduced, being distinct only near the apex. *Bembidion cordatum* often has the dark areas of the elytra brown, rather than black as in *B. aeneicolle*, but is easily distinguished from the latter species by the totally different shape of the pronotum.
4. *Bembidion intermedium* Kby. 3.6-4.4 mm. Scarce, muddy shores of Cottonwood Pond and along the semipermanent parts of Owl Creek. A species with a mosaic pattern on the elytra, like *B. aeneicolle*, but with a narrower pronotum, and with the dark parts of the elytra pure black. The pale marks are relatively extensive and include the entire humeral region. This will distinguish it from several species not yet taken at Pawnee (particularly *B. patrule* Dej.), as well as from *B. nigripes*. The latter species also differs in having the legs largely dark.
5. *Bembidion nigripes* Kby. 3.0-4.2 mm. Common on bare muddy shores (including trampled waterholes where *B. intermedium* is apparently lacking). Another mosaic-patterned species, differing from other such forms in having the legs darkened. In occasional individuals, the legs are

partly pale, but at least the hind tibia is always very dark brown or black. The pale marks are more restricted than in *B. intermedium*. The actual humerus of the elytron is contained in a black spot, but there is a pale spot just medial to it. The presence of this spot distinguishes it from *B. coloradense* Hayw., a larger (3.9-5.6 mm), but otherwise similar species which may be found here in the future.

6. *Bembidion nitidum* Kby. 4.1-5.6 mm. Scarce, found on bare soil away from water. Apparently rare or absent on the open upland prairie, but occurring in the valley of Owl Creek. It is an oval, bronzed, very shiny species with a very broad base to the pronotum. It is unlikely to be taken for a *Trachypachus* or a small *Amara*. It differs from both these genera in having the typical Bembidiine palpi. In addition, *Trachypachus* has an unusual type of antenna-cleaner and has rows of punctures rather than normal elytral striae, while the oval metallic *Amaras* lack a carina at the hind angle of the pronotum. The carina is well developed in *B. nitidum*.
7. *Bembidion nudipenne* Lth. 3.5-4.0 mm. Rare, two specimens taken in June in the dry bed of a small temporary pool near Watershed 2, where they were found hiding in mud cracks. It is uncertain whether this is the usual habitat of the species. Otherwise, it is known only from the Canadian prairies. It is a small brown species with a strongly cordate pronotum and a single spot near the apex of each elytron. The only other *Bembidion* with a similar pattern is *B. scopulinum*, which is larger and has a metallic blue or green lustre.
8. *Bembidion obscurellum* Mtsch. 3.0-5.1 mm. Common on mud around water-holes and along Owl Creek. It is a powerful flyer and was taken in

numbers in a blacklight trap at the headquarters building. Stray specimens can be anywhere in the prairie. Around 1965, this species made a spectacular irruption to the east, extending its range all the way from Lake Superior to the Coast of Maine, apparently in a single year. The elytra are almost white. Each one has a brown spot along the suture, together forming a diamond-shaped or triangular area. The only similar species is *B. sejunctum*, which is a much larger insect (5.5-7.2 mm), with a somewhat differently shaped pronotum. The latter is broader, with more-rounded sides and with the greatest width closer to the anterior end than in *B. obscurellum*.

9. *Bembidion quadrimaculatum oppositum* Say. 2.8-3.7 mm. Scarce, a species of bare soils which is very abundant in most parts of North America; at the site, however, it seems to be limited to the valleys (like *N. nitidum*). A small black species with a large head and a strongly cordate pronotum. Each elytron has two large, sharply defined yellow spots, one near the humerus and the other near the apex. No other local *Bembidion* has such a color pattern.
10. *Bembidion rapidum* Lec. 3.8-4.4 mm. Abundant on wet mud near waterholes. A medium-sized species with a reduced version of the mosaic pattern, which is developed only near the elytral apex. The pronotum is narrowed posteriorly, so that its shape is somewhat cordate. This distinguishes it from *B. aeneicolle*, *B. intermedium*, and *B. nigripes*. It is less cordate than in *B. cordatum*, which is also a bigger insect with a well developed mosaic pattern in the basal part of the elytron.
11. *Bembidion scopulinum* Kby. 4.1-5.3 mm. Scarce, in sand along the semi-permanent part of Owl Creek. A rather elongate species with a metallic

bluish-black dorsal surface and with a large orange spot near the tip of each elytron. The only species with a similar arrangement of spots is *B. nudipenne*. In the latter species, the general color is dark brown without a hint of metallic color, and the dorsal punctures are in the third elytral intervals, rather than in the third striae. A feature which is peculiar to *B. scopulinum* is the presence of a group of coarse punctures near the postocular seta.

12. *Bembidion sejunctum* Csy. 5.5-7.2 mm. Scarce, in sand along the semi-permanent part of Owl Creek. This is a large species with largely pale elytra. It is similar to *B. obscurellum*, which it does not overlap in size. For differences in the pronotum, see the latter species. In the specimens so far taken there is less color contrast between the dark central spot and the pale areas of the elytra than is usual in *B. obscurellum*.
13. *Bembidion* sp. (subgenus *Furcacampa*). 2.5-3.2 mm. Common on wet mud by waterholes. This undescribed species is a very small form with a well developed mosaic pattern on the elytra. It differs from all other local species in having deep, strongly converging frontal furrows which are prolonged to the anterior margin of the clypeus. Otherwise, it is very similar to the next species.
14. *Bembidion timidum* Lec. 2.6-3.3 mm. Abundant on wet mud by waterholes. Like the preceding species, it is a small beetle with a well developed mosaic pattern. The two are easily distinguished by the form of the frontal furrows. In *B. timidum*, they are nearly parallel on the frons, but become convergent on the clypeus where, however, they are shallow, and become obsolete before reaching the anterior margin. Other, larger

mosaic-patterned species do not have the frontal furrows prolonged upon the clypeus at all. *Bembidion timidum* has a narrower pronotum which is strongly sinuate anterior to the hind angles. This is not true of any of the larger mosaic-patterned species except for *B. cordatum*, which is so much larger that it would not be confused with *B. timidum*.

15. *Tachys anceps* Lec. 2.2-2.7 mm. Common on wet mud at waterholes. A minute, shining, reddish-brown carabid with the humeral and apical areas of the elytra becoming yellowish (though not forming distinct spots). Only the innermost elytral stria is well developed, though the second one is faintly suggested. The tip of the first stria continues around the elytral apex, paralleling the margin at first, then moving away from it. The body is oval and very stout. The pronotum is relatively broad at its base and is slightly sinuate just anterior to the hind angles. No other carabid under 3 mm long has the stout form and reduced striation seen in this species.

TRIBE 4. BRACHININI (Bombardier beetles)

The members of this tribe have a hairy dorsal surface and a striking color pattern. The head and pronotum are orange, while the elytra are blue or blue-black. The elytra are truncate and lack distinct striae (though the intervals may be represented by low-raised costae). No members of any other tribe with a similar color pattern have yet been taken at the Site. One Lebiine, however, *Lebia grandis* Hentz, may be expected, since it is a parasite on the Colorado potato beetle, which does occur there. It is colored like a bombardier beetle and has truncate elytra. It differs in having definite striae on the elytra and in not being hairy dorsally.

The bombardier beetles are so named because the repellent fluid in the anal scent glands is highly volatile and is released with an audible "pop." It can be directed accurately to a distance of several centimeters. It has recently been demonstrated that the temperature of the fluid is 100°C at the time of release. The larvae of bombardier beetles are parasitoids, feeding on the pupae of water beetles.

1. *Brachinus* sp. 10.0 mm. Rare, one specimen at Cottonwood Pond. Its specific identity has not been settled yet.

TRIBE 5. CARABINI

Medium-to-large carabids which are usually black in color. The anterior tibia does not exhibit an antenna-cleaner of the normal type. Both spurs are apical or nearly so (though the posterior one may be raised slightly above the level of the anterior spur). There is an inconspicuous longitudinal groove on the *inner* face of the tibia which probably functions as an antenna-cleaner, but there is no notch with pectinate hairs, as in other Carabidae. The elytral striae are more numerous than in other tribes (usually 16 on each elytron), and the intervals in both local species have characteristic transverse grooves which give the elytra a "scaly" appearance. The labrum is short and broad and is emarginate at the middle. The preocular seta is absent. The front tibia has the outer apical angle drawn out into a short tooth, as described for *Euryderus grossus* (Harpalini), though less developed.

The "extra" striation, the scaly intervals, and the poorly developed antenna-cleaner will distinguish the Carabini from other large black Carabidae. All species are believed to be exclusively predaceous. They do not swallow

solid food, but digest it extraorally and ingest only the fluids. They are probably more abundant than our collecting indicates, as they seldom shelter under superficial cover, but hide instead in mammal burrows or in deep crevices where these are available.

Key to Species

- 1a. Elytral margin not serrate near humerus; elytra oval, the humeri completely rounded. *Calosoma luxatum*
- 1b. Elytral margin serrate just posterior to humerus; elytra more elongate, the humeri distinct. *Calosoma obsoletum*

Species Descriptions

- 1. *Calosoma luxatum* Say. 13.0-22.0 mm. Rare, taken once beneath a large piece of sod in the bed of Owl Creek. This species has a very short, almost circular elytra without distinct humeri. Dorsal punctures are very inconspicuous or absent. The head and prothorax are proportionally much bigger than in *C. obsoletum*. The hind wings are reduced to minute scales.
- 2. *Calosoma obsoletum* Say. 17.0-24.0 mm. Rare, taken once beneath cow dung in the upland prairie. Unlike the preceding species, this one has well developed hind wings and is a powerful flyer. Probably not really rare, but hard to find, and perhaps adult for a limited time only (in June). This species has elytra with distinct humeri. The head and pronotum are of normal proportions for Carabidae, not greatly enlarged as in *C. luxatum*. The 5th, 9th, and 13th elytral intervals each bear a row of dorsal setae. Each dorsal seta is situated in a

small depression (usually less than the width of the interval), and there is a slight tinge of metallic blue or green in the depression. Two other species of *Calosoma* which might turn up have similar, but much larger, pits which are colored red or gold.

TRIBE 6. CHLAENIINI

Medium-sized carabids in which the dorsal surface is metallic in coloration and is densely hairy. No other brightly colored Carabidae are densely hairy above. The preocular seta is absent. The repellent fluid of the anal glands has the odor of creosote.

Key to Species

- 1a. Dorsal surface of head hairy. 2
- 1b. Dorsal surface of head without hairs and impunctate; color green.
. *Chlaenius nebraskensis*
- 2a. Dorsal surface bright green; pronotum widest at middle.
. *Chlaenius sericeus*
- 2b. Dorsal surface dull coppery or bronzed; pronotum widest at base.
. *Chlaenius tomentosus*

Species Descriptions

- 1. *Chlaenius nebraskensis* Lec. 10.0-12.0. Scarce, under cover near waterholes. This is a green species, superficially similar to *C. sericeus*, but smaller and with a glabrous, impunctate head.
- 2. *Chlaenius sericeus* Forst. 11.0-16.0 mm. Abundant, under cover near waterholes. A moderately large, usually bright green species. The

elytra are occasionally tinted with blue, especially in newly emerged specimens. Liable to be confused only with the preceding species, from which it is easily separated by the punctate frons.

3. *Chlaenius tomentosus* Say. 12.0-18.0 mm. Rare, represented by one pair from the Pawnee Site in the CSU collection and by one larva taken in a pit trap. It is a species typical of dry, open areas and is rarely taken under superficial cover except in cool weather. It probably shelters by day in mammal burrows and may be more common than it seems. It is a large, bronzed, oval species with a rather small head. It has somewhat the appearance of an oversized *Amara*, but differs from that genus in having a densely hairy dorsal surface. The pronotum has four or five marginal setae on each side.

TRIBE 7. CICINDELINI (Tiger beetles)

Medium to large Carabidae without a distinct antenna-cleaner. (The anterior tibia is as described for Carabini except that both spurs are completely apical.) The prothorax is narrow and more or less cylindrical. The clypeus and labrum extend laterally, entirely covering the bases of the mandibles in dorsal view. The bases of the antennae are medial to the mandibular bases and the margins of the clypeus, rather than lateral as in other Carabidae. Consequently, the antennae are often said to arise from the "frons." The outer half of each mandible forms a long, slightly curved sickle, with several large teeth on its inner margin.

Two radically different genera represent this tribe in the Great Plains. *Amblycheila* is a huge (up to 38 mm) dark brown or black beetle with inflated elytra, each with three carinae. It is a nocturnal form with small eyes.

It has not yet been taken at Pawnee, but is almost certainly present, as it is notoriously difficult to collect. It is reported to be active at night during electrical storms. It probably shelters in mammal burrows during the daytime. If live specimens are captured, an effort should be made to determine their feeding habits. Like other members of the tribe, they are no doubt completely carnivorous. There would seem to be a scarcity of insects which are large enough to be suitable prey. Large Tenebrionidae and small vertebrates seem to be the most probable choices.

The other genus, *Cicindela*, contains diurnal species with greatly enlarged eyes. (The width across the eyes is much greater than that of the prothorax.) The legs are very long. The elytra are nearly flat and are completely without any trace of striation. They often bear white marks. When complete, these spots form a characteristic pattern. They consist of a *humeral lunule*, a curved spot at the shoulder; a *middle band*, a transverse mark with a J-shaped recurved portion at its inner end, and an *apical lunule*, a C-shaped spot which touches the suture at the apex. The ventral surface of local species is covered with very long erect white hairs. Tiger beetles hunt actively by daylight and can be seen to catch ants and other small insects. Unlike most other Carabidae, they use flight to escape. They can be caught by careful stalking with a net, or can be taken in a pit trap. They are far more numerous than they appear, since they usually see a would-be collector before he sees them. The only local carabid likely to be taken for a *Cicindela* is *Elaphrus* (Tribe Elaphrini), which has similarly enlarged eyes. However, the latter genus has large circular pits, each surrounded by a raised ring on the elytra. Furthermore, it has ordinary carabid mouthparts, a well-developed antenna-cleaner, and only moderately long legs. It does not fly to escape pursuit.

Key to Species of *Cicindela*

- 1a. Frons (space between eyes on dorsal surface of head) entirely bare (except for tactile setae). 2
- 1b. Frons hairy, at least at sides near eye. 3
- 2a. Each elytron with a row of green pits; elytra black to bright metallic green. *Cicindela punctulata*
- 2b. Elytron without green pits; dorsal surface black. *Cicindela obsoleta*
- 3a. Frons hairy at the sides, bald in the middle; elytral spots absent; color brilliantly metallic. *Cicindela scutellaris*
- 3b. Frons entirely hairy; white spots developed to a varying degree. 4
- 4a. Humeral lunule of elytron reduced to dots or absent; middle band not reaching margin. *Cicindela purpurea*
- 4b. Humeral lunule well developed. 5
- 5a. Posterior half of humeral prolonged obliquely; ground color coppery. *Cicindela lengi*
- 5b. Humeral lunule C-shaped (the posterior end transverse to the body axis); ground color dull brownish. *Cicindela repanda*

Species Descriptions

- 1. *Cicindela lengi* W. Horn. About 16.0 mm. Scarce, areas of sand or sandy soil, especially outcrops of poorly consolidated sandstone along Owl Creek. A species with well-developed white marks and a coppery ground color on the elytra. The head and pronotum are often tinged with green. The enlarged humeral lunule is diagonally prolonged almost

to the inner part of the middle band. All the white marks are usually narrowly joined together along the margin. This will help to distinguish it from several species of possible occurrence, which have the marks broadly connected laterally.

2. *Cicindela obsoleta* Say. About 18.0 mm. Rare, caught once in a pit trap near Little Owl Creek. This species is a very wary insect and a powerful flyer, so that its rarity may be more apparent than real. It is said to be typical of the open prairie. It is a large, stout *Cicindela* without any frontal hairs. There is a reduced pattern of white spots in the specimen from Pawnee, without a humeral lunule, with the apical lunule reduced to two dots and with the middle band relatively complete, but failing to reach the elytral margin. The dorsal surface is dull black. This species is easily distinguished from *C. punctulata* by the large size and the lack of green pits. The species most similar in appearance is *C. purpurea*. The latter species has well developed hairs on the frons.
3. *Cicindela punctulata* Oliv. 11.0-14.0 mm. Abundant, especially on drying mud by waterholes; but also found on the open prairie. A small narrow species with the white marks reduced to small dots. Two subspecies intergrade in the Pawnee Grassland, and local specimens can resemble either parent race or can be intermediate in appearance. The subspecies *C. punctulata punctulata* s. str. is blackish above, with little trace of metallic coloration except for the elytral pits. The subspecies *C. punctulata chihuahua* Bates has brilliantly metallic green elytra and somewhat bronzed head and pronotum. Intermediate specimens show varying degrees of metallic coloration on the elytra. Even though

many individuals resemble one of the parent races, the population as a whole is a hybrid one and should be known as *C. punctulata* × *chihuahua*. The species is easily identified by a row of pits on each elytron, paralleling the suture. These pits are bright metallic green in color and are very conspicuous in the blackish specimens. They are easily overlooked in the *C. punctulata chihuahua* color pattern because of the bright green elytra. The bare frons will separate this species from all others except for *C. obsoleta*, which is a much larger, stouter species. The repellent fluid from the anal glands of *C. punctulata* has the odor of apples.

4. *Cicindela purpurea* Oliv. 13.0-15.0 mm. Rare, usually taken on bare, level clay. A species with a hairy frons and incomplete markings. The local subspecies is *C. purpurea auduboni* Lec. It occurs in two color phases with a green or a black ground color, respectively. The middle band is distinctive; the outer, transverse part is missing, so that it consists entirely of an oblique mark. This pattern is most closely duplicated in *C. obsoleta*, a larger, more robust species with a bare frons.
5. *Cicindela repanda* Dej. 11.0-13.0 mm. Scarce, in sandy or gravel areas along Owl Creek. Possibly it will be found more abundantly in spring and fall. It is a species with a hairy frons, a rather dull brownish or olive ground color and well developed white marks. The humeral lunule is C-shaped, with its posterior end transverse to the body axis. The middle band is prolonged in either direction along the margin. Anteriorly it often makes narrow contact with the humeral lunule, but posteriorly it is well separated from the apical lunule. The only

other species so far taken at Pawnee which has equally well developed markings is *C. lengi*. It is easily separated by the red ground color and the oblique humeral lunule. Two other species which are more similar to *C. repanda* have a good chance of being taken at Pawnee: *C. hirticollis* Say is a stouter species in which the posterior end of the humeral lunule is bent anteriorly (so that it looks more like a capital G than a C); while *C. duodecimguttata* Dej. has the white marks constricted or more or less broken up into separate dots. The former species is characteristic of sand areas, and the latter is restricted to clay.

6. *Cicindela scutellaris scutellaris* Say. 12.0-14.0 mm. Rare, usually on dry sand; taken once near the headquarters building by Lee Rogers. A brilliantly metallic species without any white spots. The head and pronotum are usually blue or green, while the elytral surface is more finely punctate and more shiny than in any other local species. The frons is bare at the center, but hairy laterally (near the eyes). No other local species has the frons partly hairy.

TRIBE 8. ELAPHRINI

Diurnal Carabidae with huge eyes. Among local forms, they could only be mistaken for small tiger beetles (*Cicindela*). They differ conspicuously from the latter in the form of the elytra. Each elytron has three rows of dorsal punctures, each situated in the middle of a large, round depression. The areas between the depressions are more or less elevated, particularly the inner ones, some of which are smooth and shining. The local species are otherwise very densely and coarsely punctured on the dorsal surface.

They differ from tiger beetles in having a well developed antenna-cleaner and in having the mouthparts of the usual carabid type, with the mandibles much shorter and more triangular than in a tiger beetle. They also differ conspicuously in that they do not attempt to fly to escape.

1. *Elaphrus californicus* Mnh. is the only species collected so far. It is 6.3-8.0 mm long. The hind femur has a group of white hairs on its dorsal face near the tip. The color is dull bronzed. This species is abundant on bare wet mud near waterholes. A second species, *E. lecontei* Crotch, may be expected around playa lakes when they contain water. It is larger (7.5-10.0 mm), lacks the white hairs on the hind femur, and has the lateral margin of the pronotum incomplete both at base and at apex. The marginal rim of the elytron continues around the humerus onto the lateral part of the base (while in *E. californicus* it ends at the humerus).

TRIBE 9. HELLUONINI

This tribe contains one local species, *Helluomorphoides praeustus* Dej. It is a large (13.0-18.0 mm), rather short-legged carabid with truncate elytra and short, strongly flattened antennae. The head, pronotum, and extreme base of the elytra are brown, while the remainder of the elytra are black with a slightly bluish tinge. The head is abruptly constricted posterior to the eyes. The elytral striae are broad and shallow, so that the intervals form low costae. This species is unlikely to be mistaken for any other. The hairy dorsal surface, truncate elytra, and general color pattern give it a slight resemblance to *Cymindis planipennis* (Tribe Lebiini). The latter species is much smaller (less than 10.0 mm) and has ordinary elongate

cylindrical antennae. *Helluomorphoides praeustus* is rare; one pair in the CSU collection is labelled as coming from the Pawnee Site. The true habitat of this species is unknown.

TRIBE 10. LEBIINI

Lebiini is a varied tribe of medium to small Carabidae with truncate elytra. Most species have a row of small teeth on the lower margin of each tarsal claw. These are entirely absent only in *Apristus*. The fourth tarsal segment is usually broadened and bilobed or emarginate. (This is not true of *Apristus*, *Microlestes*, and *Axinopalpus*.) Both of these tarsal modifications are adaptations for climbing on vegetation, and their reduction or loss is associated with a return to terrestrial life. Lebiini are liable to be mistaken only for the other tribes with truncate elytra. Helluonini are much larger and have peculiar flattened antennae. Brachinini resemble certain species of *Lebia* in size and color, particularly *L. grandis* Hentz, a species not yet found at the Site, but undoubtedly occurring there. The latter species as a larva is a parasitoid on the pupae of the Colorado Potato Beetle (*Leptinotarsa decimlineata* Say), which has been taken at Pawnee. *Lebia grandis* has the same color pattern as *Brachinus*, an orange head and pronotum, and blue elytra. It differs from the latter in being glabrous (without hairs) above, in having only six abdominal sternites, in having distinct elytral striae, and in having tarsi with toothed claws and bilobed fourth segments. *Lebia grandis* is probably a mimic of *Brachinus*.

Key to Species

- 1a. Entire dorsal surface densely hairy; length 7.5-10.0 mm.
..... *Cymindis planipennis*
- 1b. Dorsal surface not hairy; usually smaller. 2
- 2a. Dorsal surface of a single color, without contrasting pattern. . . 3
- 2b. Dorsal surface with a contrasting color pattern. 7
- 3a. Fourth tarsal segment broader than others, emarginate or bilobed;
color usually bright green or blue; length 4.5 mm or more. 4
- 3b. Fourth tarsal segment neither broadened nor emarginate; dorsal surface
black, sometimes with bronzed luster; length 2.8-4.2 mm. 5
- 4a. Pronotum as long as wide; fourth tarsal segment merely emarginate;
length 6.3-9.1 mm. *Calleida viridis*
- 4b. Pronotum much wider than long; fourth tarsal segment deeply bilobed.
..... *Lebia viridis*
- 5a. Dorsal surface bronzed; apex of elytron transversely truncate in outer
half, but becoming oblique near suture. *Apristus latens*
- 5b. Dorsal surface black; elytra squarely truncate. 6
- 6a. Basal margin of pronotum oblique just mesad to hind angles, thus only
moderately sinuate between hind angles and mesothorax; elytra dimor-
phic, either elongate, parallel-sided (fully winged individuals), or
short and becoming broad behind middle (individuals with vestigial
hind wings). *Microlestes linearis*
- 6b. Basal margin of pronotum transverse mesad to hind angles, then
abruptly sinuate, defining a median lobe which borders mesothorax;
elytra short, broadening posteriorly. . . . *Microlestes curtipennis*

- 7a. Dorsal surface dark brown to black except for a large yellow humeral spot which is prolonged obliquely toward middle of elytron.
..... *Axinopalpus biplagiatus*
- 7b. Head, pronotum, and abdomen reddish; elytra each with two longitudinal black stripes on yellow background. *Lebia vittata*

Species Descriptions

1. *Apristus latens* Lec. 3.0-4.2 mm. Abundant in its limited habitat, which is barren gravel in the dry bed of Owl Creek. A small bronzed species, very reminiscent of an unspotted *Bembidion*, but differing from that genus in the different palpi and the truncate elytra. Among local *Lebiini* it is most similar to the two species of *Microlestes*. It has the pronotum strongly sinuate anterior to the hind angles and only slightly sinuate mesad to them. In *Microlestes*, the reverse is true. In *Apristus*, the elytra are oblique near the suture, while in *Microlestes* they are squarely truncate. *Apristus* has tarsal claws which are entirely smooth, while in *Microlestes* the claws are finely toothed below. *Microlestes* also differs in being pure black, without bronzed reflections.
2. *Axinopalpus biplagiatus* Dej. 3.0-3.5 mm. Scarce, on the open prairie; usually seen running on bare ground, but also sometimes found on flowers. Easily recognized by its color pattern, entirely dark brown or black except for a large humeral yellow mark on each elytron. The spot is prolonged obliquely backwards (much like the humeral lunule of *Cicindela lengi*). Otherwise, it is much like a *Microlestes*, except that the last segment of the labial palpis is greatly enlarged and very broadly triangular.

3. *Calleida viridis* Dej. 6.3-9.1 mm. Seemingly rare, but perhaps merely hard to find; an inhabitant of the open prairie. One specimen was seen climbing on grass leaves on an overcast day in June. A metallic species, commonly blue, but sometimes green, and sometimes rather faintly metallic so that it looks almost black. An elongate Lebiine with small, almost flat eyes and long narrow elytra. The fourth tarsal segment is broadened, but is only shallowly emarginate at its apex, rather than being deeply bilobed as in *Lebia*. *Lebia viridis* is the only species in the tribe which resembles it in color. The latter species has a very transverse pronotum and much shorter and broader elytra. In addition, it is smaller and has prominent eyes.
4. *Cymindis planipennis* Lec. 7.5-10.0 mm. Scarce, on the open prairie, sometimes beneath cattle dung; not becoming adult until midsummer. A relatively large Lebiine with a densely punctate and hairy dorsal surface. The head and pronotum are reddish-brown. The elytra are black with more-or-less-distinct metallic blue reflections (which may appear quite bright when the insect is in alcohol). Each elytron has a reddish-brown humeral patch, which has rather indistinct boundaries (unlike the shoulder spot of *Axinopalpus*). The color pattern and the incomplete basal margin to the elytra will distinguish it from other species of *Cymindis* which might occur at the Pawnee Site.
5. *Lebia viridis* Dej. 4.7-6.6 mm. Rare, a strong flier which is commonly attracted to lights. The larva is a parasitoid on the pupae of green flea beetles (Chrysomelidae) of the genus *Altica*, of which the adult *Lebia* is a mimic. Usually bright green, rarely nearly black. The head is large with big, protruding eyes, while the pronotum is very small and strongly transverse, with the margins somewhat reflexed.

The elytra are broad and are squarely truncate. The claws are strongly pectinate, and the fourth tarsal segment is deeply bilobed. Unique among local Carabidae, the tibial spur above the antenna-cleaner has been lost in this genus. The only similarly colored local species, *Calleida viridis*, is much longer and narrower and has the fourth tarsal segment merely emarginate.

6. *Lebia vittata* F. 5.6-8.0 mm. Abundant near willows along Owl Creek; occasional in pit traps on the prairie. The larva is a parasitoid on the pupae of the flea beetle (Chrysomelidae), *Disonycha alternata* Ill, of which the adult is a mimic. A strikingly colored species with the body reddish-brown and the elytra with longitudinal yellow and black stripes. This species differs from similarly colored *Lebia* which might occur here in having largely black legs and in having the inner black elytral stripes separated by a yellow sutural stripe which narrows gradually posteriorly.
7. *Microlestes curtipennis* Csy. 3.1-3.5 mm. Rare, associated with *M. linearis*. It resembles the short-winged form of the latter species in the shape of the elytra, but differs in having the base of the pronotum much more strongly sinuate mesad to the hind angles. This species is dimorphic for the development of the hind wings, but unlike *M. linearis* the wing status is not correlated with the body shape.
8. *Microlestes linearis* Lec. 3.0-3.8 mm. Common on bare soil on the open prairie; especially noticeable in the fine sand that collects in the concrete gutters of the watersheds. A very small, very fast terrestrial black Lebiine. It is much like *Apristus latens*, which is bronzed, and which occurs in a different habitat (the gravel of stream beds).

Microlestes linearis, like many Carabidae, is dimorphic for the development of the hind wings. This species is unusual in that the two wing forms differ in body shape and look like two different species. The fully winged form has elongate, parallel-sided elytra, while the individuals with vestigial wings have short elytra whose lateral margins diverge posteriorly. The latter form is very similar to *M. curtipennis* except in the shape of the pronotum. In *M. linearis* the basal margin of the pronotum is distinctly oblique mesad to the hind angles, so that the base is only slightly sinuate. In *M. curtipennis* the margin is transverse mesad to the hind angles, then becoming abruptly oblique, so that the basal margin is strongly sinuate. In addition, the anterior angles are somewhat protruding in *M. curtipennis*, and the basal margin is incomplete at the center (complete though very fine in *M. linearis*).

TRIBE 11. LICININI

This tribe is easily recognized by the peculiar form of the clypeus and labrum, which give a characteristic appearance to the head. The clypeus is very short, and its anterior margin is strongly curved, so that at the midline it is actually posterior to the condyles of the jaws. The labrum is very small and is strongly emarginate at the midline and somewhat asymmetrical. The shortening of the clypeus and labrum exposes the dorsal side of the mandibles much more fully than in other Carabidae. The mandibles are thick and are rather short. They differ from Harpalini in being more pointed and in having the outer margin much less curved.

Species Description

1. *Diplocheila obtusa* Lec. 9.7-11.7 mm. Rare, taken once in open lowland prairie about one-half mile southeast of Cottonwood Pond. All Licinini which have been investigated have been found to feed on snails. The peculiar mouthparts are adapted to crush the shells. It is hard to believe that this species feeds on snails, since it is found in dry open prairie. *Diplocheila obtusa* is a moderately stout black carabid with black legs. The hind angles of the pronotum are obtusely rounded. Superficially it resembles the medium-sized black-legged Harpalini, from which it differs in the presence of the preorbital seta, as well as in the form of the mouthparts.

TRIBE 12. PTEROSTICHINI

A rather varied group of medium-sized, rather "normal"-looking carabids, with eight or nine striae on each elytron and with the preorbital and angular setae present. The last two characters will distinguish them from the Harpalini. In addition, the mandibles are longer and more pointed than in the latter tribe. The tip of the elytron is somewhat sinuate in certain species, but it is never transversely truncate as in the Lebiini. In addition, local species do not have pectinate claws (as do most Lebiini). The most similar tribe is actually Amarini, which differs in having a broader head and shorter, much stouter mandibles. Pterostichini are mostly nocturnal species which are found beneath cover in the daytime. They are largely carnivorous, but some of them, at least, eat some plant material.

Key to Species

- 1a. Color black or brown without metallic reflections. 2
- 1b. Dorsal surface with metallic green or blue reflections (inconspicuous in one species). 4
- 2a. Pronotum strongly cordate, the sides parallel anterior to hind angles; color shining black. *Evarthrus constrictus*
- 2b. Pronotum not as strongly cordate, the lateral margins not parallel anterior to hind angles; color usually brown. 3
- 3a. Elytra rounded, the humeri obliterated; length 9.0-11.5 mm. *Agonum lindrothi*
- 3b. Elytra more or less parallel-sided, the humeri distinct; length 5.5-7.0 mm. *Agonum ferruginosum*
- 4a. Pronotum with two distinct deep basal impressions at either side, with a raised ridge (carina) between outer basal impression and hind angle; third elytral interval with two dorsal punctures (and setae) located behind middle. *Pterostichus scitulus*
- 4b. Basal impressions not double; hind angles not carinate; third interval with three to six dorsal punctures, at least one of them anterior to middle. 5
- 5a. Legs black; hind angles of pronotum entirely rounded. 6
- 5b. Legs yellow or reddish; hind angles obtuse, but distinct. 7
- 6a. Dorsal surface shining, bright green; three to four dorsal punctures on elytron. *Agonum subsericeum*
- 6b. Dorsal surface dull, black with inconspicuous blue-green reflections; four to seven dorsal punctures. *Agonum placidum*

- 7a. Elytron with three dorsal punctures; striae punctured.
..... *Agonum errans*
- 7b. Elytron with five to six dorsal punctures; striae not punctured.
..... *Agonum extensicolle*

Species Descriptions

1. *Agonum errans* Say. 7.0-9.3 mm. Scarce, under cover near waterholes. This is a bright metallic green species with orange legs. The striae are evidently punctured (though it may take good magnification to see it). There are three dorsal punctures. The most similar species is *Agonum extensicolle*, which is duller green, has a narrower pronotum, impunctate striae, and more dorsal punctures. *Agonum errans* might be mistaken for *Chlaenius nebraskensis*, which occurs in the same habitat. The latter species is larger and has hairy elytra.
2. *Agonum extensicolle* Say. 6.9-10.4 mm. Rare, in gravel along the permanent part of Owl Creek. Superficially like the preceding species, but with a longer, narrower pronotum (at least as long as wide), duller surface, impunctate striae, and five or six dorsal punctures.
3. *Agonum ferruginosum* Dej. 5.5-7.0 mm. Common in its limited habitat, among cattails (*Typha*) at Cottonwood Pond. It hides among the leaf-sheathes on old stalks. A small, slender species, rather like *A. extensicolle* in shape, but entirely unmetallic. The head is always black, while the pronotum and elytra are usually brown (or less commonly the pronotum is black, while the elytra are brown, or both are black). The legs vary from pale to dark brown. There are four to six dorsal punctures in the third interval; in addition, there may be one or more in the fifth interval.

4. *Agonum lindrothi* Barr. 9.0-11.5 mm. Rarely caught; a subterranean species which inhabits mammal burrows and earth cracks where it evidently forages. Occasional specimens are captured in pit traps; such individuals are probably moving from one burrow system to another. A slender, elongate, reddish-brown beetle with very long legs and antennae. The elytra are small, flat, and oval, without distinct humeri. There are four dorsal punctures. The head is constricted posterior to the eyes. The pronotum has distinct hind angles, and its sides are oblique anterior to them. No other medium-sized carabid resembles it in shape and color.
5. *Agonum placidum* Say. 6.8-8.8 mm. Rare, taken once in the open prairie in June. This is a common beetle of cultivated lands and pastures in most of the U.S. It is a strong flier; perhaps the Pawnee specimen is a stray migrant from cultivated land. The dorsal surface is superficially dull black, but shows faint blue-green reflections. The pronotum is almost circular, with scarcely any trace of hind angles. The lateral margins are reflexed posteriorly. There are four to six dorsal punctures. No other local *Agonum* is black with a circular pronotum. Several such species occur in the mountains and might stray into the Pawnee. All these other species differ from *A. placidum* in having shining elytra and in lacking the bluish reflections. Most of them have only three dorsal punctures.
6. *Agonum subsericeum* Lec. 9.0-11.0 mm. Scarce, under cover near dried temporary ponds in the upland prairie in June. Elsewhere reported to live along rivers. This is a brilliantly metallic green species with fine, impunctate striae. There are three or four dorsal punctures. In contrast to other green *Agonum*, the legs are black. The pronotum is

nearly circular, as in *A. placidum*. The marginal rim of the pronotum is narrow and well defined. It extends posterior to the angular seta, but fades out before reaching the midline. No other bright green carabid with black legs has a circular pronotum without distinct hind angles.

7. *Evarthrus constrictus* Say. 9.5-13.0 mm. Common on the open prairie. A shining black species with dark legs. The elytra are rather short and have only one dorsal puncture. The head is proportionally very large. The shape of the pronotum is distinctive. The apex is much wider than the base. The lateral margins are strongly curved, except near the base where they become parallel. The hind angles are rectangular and carinate. The body form is somewhat similar to *Pasimachus elongatus*, but the latter species is much larger, lacks elytral striae, and has teeth on the anterior tibia. Another species of *Evarthrus*, *E. substriatus* Lec., occurs in the area, but has not yet been taken at the Site. It differs from *E. constrictus* in having a well developed knob on the last sternite on either side. This knob is adapted to fit under the elytron. In addition, the outer margin of the elytron near the apex is more strongly sinuate than in *E. constrictus*. The striae are always well developed in *E. constrictus*, while in *E. substriatus* they vary from well developed to almost absent. Some authorities put both these species in the Genus *Pterostichus*.
8. *Pterostichus scitulus* Lec. 8.5-11.5 mm. Scarce, in the open prairie in June. The dorsal surface is shining black with green, blue, or violet reflections. The legs are black. There are two dorsal punctures on each elytron, both situated behind the middle. The pronotum is relatively broad. The lateral margins are sinuate just anterior to the rectangular

hind angles. The pronotum has two basal impressions on each side. The inner ones are linear and relatively long, while the outer ones are much shorter and somewhat oblique. The area between the outer impression and the hind angle forms a carina. The species most similar in size and color is *Harpalus amputatus*. In addition to the tribal characters, it differs in having rounded hind angles.

TRIBE 13. SCARITINI

This tribe is easily recognized by the possession of three features, all adaptations for burrowing: (i) The base of the antenna is hidden in dorsal view by a shelf extending anteriorly from the side of the head laterad to the clypeus. (ii) The mesothorax is elongate and forms a narrow "waist" between the prothorax and elytra. (iii) The anterior tibia has a long apical tooth projecting parallel to the tarsus and the apical spur. This tooth is on the outer margin, which often bears additional teeth above it. The only species approaching Scaritini are certain burrowing Harpalini, particularly *Geopinus* and *Euryderus*. These genera lack the shelf above the antenna. *Geopinus* has the narrow waist, and the tibia has a semicircular lobe at the apex rather than a tooth. *Euryderus* has an apical tooth, but the waist is not narrowed.

Key to Species

- 1a. Length 21.0-28.0 mm; elytra without striae; elytral margins metallic blue or green. *Pasimachus elongatus*
- 1b. Length 7.0 mm or less; elytra usually distinctly striate. 2
- 2a. Pronotum not globular, with sides more or less straight anterior to hind angles; color reddish-brown. 3

- 2b. Pronotum globular, its sides completely curved; dark brown to black, shining. 4
- 3a. Frons smooth except for a conspicuous median pit; length 5.9-7.0 mm. *Clivina impressifrons*
- 3b. Frons with six parallel longitudinal ridges; length 3.8-4.1 mm. *Schizogenius depressus*
- 4a. Apical spur of anterior tibia much larger than the proximal one and about equal to apical tooth. 5
- 4b. Apical spur approximately equal to proximal one and only about half as long as apical tooth. *Dyschirius tenuispinus*
- 5a. Third elytral interval with only two (or rarely one) dorsal punctures, dorsal surface distinctly bronzed; length 4.2-5.2 mm. *Dyschirius sphaericollis*
- 5b. Third elytral interval with three dorsal punctures; dorsal surface black, shining, not metallic; length 2.6-4.2 mm. 6
- 6a. Legs black; middle of clypeus prolonged on frons as a keel or ridge. *Dyschirius integer*
- 6b. Legs reddish or yellowish; center of frons not keeled. *Dyschirius globulosus*

Species Descriptions

1. *Clivina impressifrons* Lec. 5.9-7.0 mm. Scarce, burrows in wet mud by waterholes. Dark reddish-brown. Third interval with four dorsal punctures. The frons is smooth except for a median pit. The only carabid that resembles it in form and color is *Schizogenius depressus*, which is much smaller, has many more dorsal punctures, and has a longitudinally striate frons.

2. *Dyschirius globulosus* Say. 2.6-3.2 mm. Rare, two specimens taken near a dried temporary pond on the upland prairie on July 15, 1970. A very small *Dyschirius* with three dorsal punctures and with well-developed lateral teeth on the front tibia. Easily distinguished from *D. integer*, the other small species, by the pale legs.
3. *Dyschirius integer* Lec. 2.7-4.2 mm. Scarce, burrows in wet mud near waterholes. It is similar to the preceding species except in having black legs. The middle of the clypeus is prolonged backwards onto the frons as a median ridge. In rare individuals this structure fails to develop. This species can be distinguished from *D. globulosus* by the black legs and by the complete elytral striae. (The outer striae are effaced near the apex in *D. globulosus*.)
4. *Dyschirius sphaericollis* Say. 4.2-5.2 mm. Scarce, in wet mud by waterholes. This species is associated with *Bledius* (Coleoptera, Staphylinidae) and *Heterocerus* (Coleoptera, Heteroceridae). The nature of the relationships among these burrowing beetles is poorly understood. This species differs from the two preceding ones in being larger, in having the lateral teeth of the anterior tibia very much reduced or absent, and in lacking one or sometimes two of the dorsal punctures. It is the anterior puncture which is constantly lacking. The surface is bronzed, and the legs are at least partly reddish. The elytral striae are complete at the apex.
5. *Dyschirius tenuispinus* Lth. 3.7-4.0 mm. Rare, on the open prairie, often found in tunnels in dry cow dung; sometimes in pit traps. This species differs from all other members of the genus in having the apical spur not enlarged and adapted for digging. The apical tooth is well

developed, but the lateral teeth are reduced, as in the preceding species. There are only two dorsal punctures, but, in contrast to *D. sphaericollis*, it is the middle one which is missing. *Dyschinus tenuispinus* is longer and more slender than other species. The dorsal surface is very dark brown without metallic reflections. The legs are yellowish. The outer striae are incomplete.

6. *Pasimachus elongatus* Lec. 21.0-28.0 mm. Abundant in the open prairie; often found beneath cow dung. This species is common in pit traps and evidently forages on the open prairie at night. It is less of a burrower than other members of the tribe, but it will often bury itself in loose soil during the daytime. This is an unmistakable species with very thick, almost smooth elytra which are completely fused together. The head is very large. The mandibles are long and sickle-shaped. The inner margin of the mandible is toothed. When handled, the beetle spreads its mandibles in a threatening attitude. It will bite vigorously if given the opportunity. The lateral margins of the pronotum and elytra are bordered with metallic blue (rarely green or purple). Otherwise the beetle is shining black. The elytra are usually entirely smooth except for a sharp carina extending posteriorly from the humerus. Occasionally there are vague traces of striae on the central part of the elytron. Another species, *Pasimachus obsoletus* Lec., has been found in sand prairie near the Platte River and might occur in sandier areas of the Pawnee Grassland. It has a second carina on the elytron, lateral to the humeral one. The elytra almost constantly have distinct traces of striation. There is no metallic coloring along the margins of the pronotum and elytra.

7. *Schizogenius depressus* Lec. 3.8-4.1 mm. Rare, in wet sand near the permanent part of Owl Creek. A small, strongly flattened reddish-brown Scaritine, resembling a small *Clivina impressifrons*, but easily distinguished by the peculiar sculpture of the frons, which has six parallel ridges. The dorsal punctures are much more numerous than in other Scaritini, there being about six along the third, fifth, and seventh striae.

TRIBE 14. TRACHYPACHINI

This tribe differs from all other local Carabidae in having both tibial spurs entirely distal to a well developed antenna-cleaner. Two other features are diagnostic: The hind coxae are very large and border the elytron (in other Carabidae the pleural sclerites separate the two); and the outer antennal segments bear only tactile setae (in other Carabidae these segments are densely hairy). Only one species is found in Colorado.

1. *Trachypachus holmbergi* Mnh. 3.8-5.8 mm. Rare, only one specimen was taken in the lowland prairie near Owl Creek. It is perhaps a stray from the upper montane zone where the species is common, though hard to collect except just at the time the snow melts. It is a small, oval, dark bronzed species, superficially much like *Bembidion nitidum*, but easily distinguished from the latter by the much smaller eyes and by the fact that the elytra have rows of punctures rather than impressed striae. The latter feature will separate it from the smaller metallic *Amara*, which it also resembles.