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A NEW SPECIES OF FLIGHTLESS, WINTER-ACTIVE DUNG BEETLE, *STENOTOTHORAX WOODLEYI* (COLEOPTERA: SCARABAEIDAE), ASSOCIATED WITH SHRUB-STEPPE HABITAT IN WASHINGTON STATE

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Abstract.—A **new species** of flightless beetle (Scarabaeidae), ***Stenotothorax woodleyi* Gordon,** is described from the Hanford Nuclear Site located in south central Washington State. *Stenotothorax* is a former subgenus of *Aphodius*. *Stenotothorax woodleyi* is separated from the related species *S. washtucna* (Robinson). Notes on habitat and phenology are presented.

Key Words: Scarabaeidae, *Aphodius, Stenotothorax,* new species, Hanford, Washington State, flightless beetle

Numerous species of *Aphoodius,* and related genera, commonly referred to as dung beetles, are found throughout eastern Washington State. Many species can be collected from the dung of domestic and wild animals. Adults of several species are winter-active (Hatch 1971, Robinson 1938, Saylor 1940); these winter active species are thought to be detritovores and usually are not found in association with dung (Gordon, unpublished data).

Beginning in 1995 and continuing through 2003, RSZ and CNL conducted an extensive entomological survey of the Hanford Nuclear Site that is situated in the semi-arid Columbia Plateau Basin of south central Washington State. For the purposes of the study discussed in this paper, pitfall traps were used and maintained from March 1998 through June 2000 and again from April 2002 through April 2003 to sample sites.

The 1,450 km^2 of the Hanford Nuclear Site were closed to the general public in 1943. Originally acquired by the United States government as a site for the production of plutonium to be used in weapons production, Hanford is currently administered by the Department of Energy for nuclear waste management, environmental restoration, and research and development. Placing such a large tract of land virtually off limits to the public for over half a century has preserved a shrub-steppe ecosystem that has otherwise changed radically throughout the remainder of the Columbia Plateau and presents a rare chance to study native insect communities.

The Hanford Site consists of a steeply rising, northeastern facing slope (Rattlesnake Ridge—1,150 m) and extensive flats that slope gently from 500 to 150 m before they reach the Columbia River. Vegetation is primarily a sagebrush-bitterbrush/Sandberg's bluegrass-cheatgrass type; the general habitat is referred to as shrub-steppe (Daubenmire 1970). Several small, permanent springs and associated riparian areas are found in the southeastern portion of the Site; this area is referred to as the Fitzner-

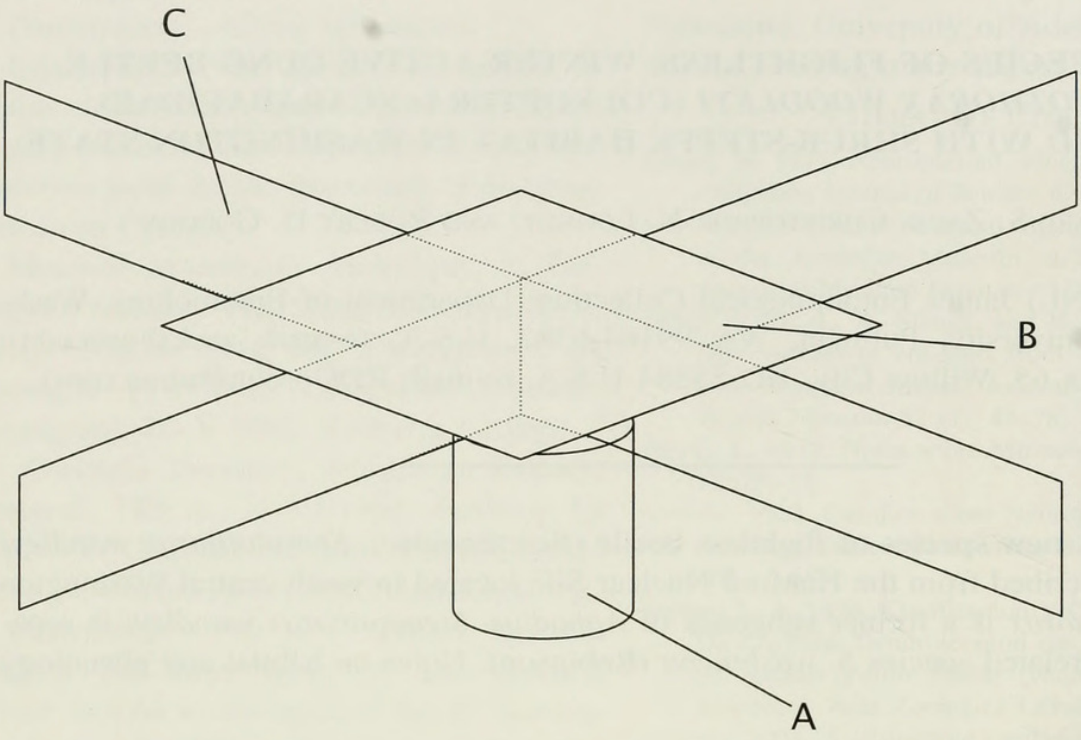

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Fig. 1. Schematic of pitfall trap. A, Trap receptacle. B, Cover. C, Baffles.

Eberhardt Arid Lands Ecology Area (ALE). For a discussion of the plants of Hanford, including all sites examined in these studies, see Sackschewsky et al. (1992) and Downs et al. (1993). Climate at Hanford is best characterized as semi-arid with hot and dry summers and cold winters. Precipitation ranges from 30–35 cm at the crest of Rattlesnake Ridge to less than 12 cm in central Hanford and along the Columbia River. Temperatures range from an average of 3°C in January to 33°C in July; temperatures of 32°C or above occur an average of 56 days per year (ERDA 1975).

Materials and Methods

Pitfall traps.—Traps consisted of "one-pound" plastic deli cups with an 11.5 cm open top diameter and a depth of 8.25 cm. Cups were buried flush with the soil. Each trap was covered with an x-shaped set of runners with a span of 46 cm from the center of the trap; runners were 7.5 cm high. A 30.5 cm square lid was placed over the runners and was centered on the center of the cup (Fig. 1). Runners and lids were cut from sheet metal. Cups were filled to a depth of 2.5 cm with propylene glycol (Sierra Brand®) diluted 1:1 with water. Traps were collected on an irregular basis depending on time of season (Table 1). A GPS reading for each site was taken at a trap located in the approximate center of the trap line.

Pitfall sites.—Beetles were collected in four of six survey sites established on that portion of the Hanford Site south of the Columbia River. Depending on site, traps were maintained for one to two years.

The ENE slope of Gable Mountain (46°35.745′N, 119°26.384′W—130 to 185 m) is a north-facing slope dominated by big sagebrush (*Artemisia tridentata* Nutt.), cheatgrass (*Bromus tectorum* L.) and bunchgrasses in sandy soil. A series of 15 pit traps was placed 10 m apart running from an elevation of 130 m, which was approximately 20 m higher than the base of the Mountain, to 185 m in elevation. The area is typical shrub-steppe.

The Rattlesnake Spring system (46°30.447′N, 119°41.887′W—210 m) is situated in the northeast corner of ALE on the flat of Cold Creek Valley. This is the

most prominent, permanent spring on the Hanford Site and flows approximately 3 km, beginning from ground seepage and being fed by a number of smaller springs along its course. The area surrounding the spring is typical shrub-steppe, the soil being very sandy. Five pit traps were placed at various locations adjacent to the creek and in the riparian zone.

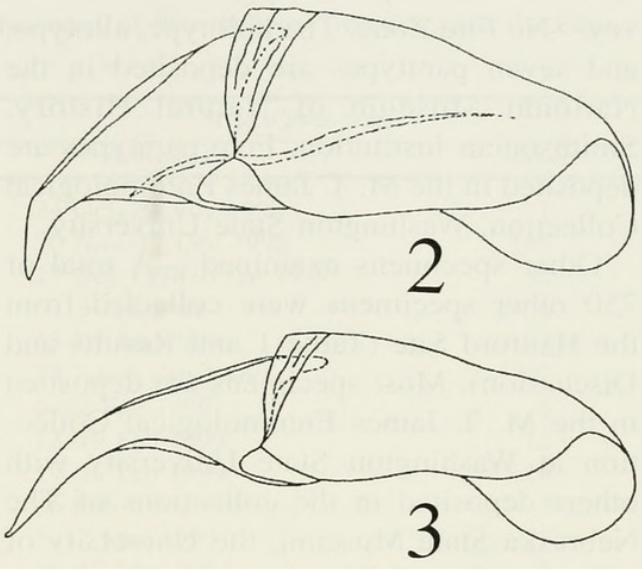
A large area of sand dunes (46°31.369′N, 119°21.192′W—150 m) exists along the western margin of the Columbia River and several km inland. A series of 15 pitfall traps was established in a T-shaped formation through the dunes habitat. Traps were placed 10 m apart with the transect running through areas of dune with little to no vegetation and through a draw that contained varying amounts of bitterbrush (*Purshia tridentata* (Pursh) DC), sagebrush (*Artemisia* spp.) and rabbitbrush (*Chrysothamnus* spp.) along with varying numbers of low-growing plants.

Two sites were established at the eastern end of the Fitzner-Eberhardt Arid Lands Ecology Research area (ALE); these were in undisturbed shrub-steppe and in a disturbed shrub-steppe habitat that had become significantly invaded by cheatgrass (46°22.757′N, 119°31.073′W—360 m). The adjacent sagebrush/Sandberg's bunchgrass and cheatgrass communities were divided by a one-lane road (15 m wide) that led to the summit of Rattlesnake Ridge. Ten pitfall traps were placed in each habitat. Transects were begun 30 m from the road with 10 m of spacing between each trap.

Stenotothorax woodleyi Gordon, new species

(Fig. 2)

Description.—*Male:* Length 8.60 mm, width 4.25 mm. Form oval, widest behind middle of elytra, bases of pronotum and elytra strongly constricted. Color dark reddish brown to black throughout. Clypeus granulate, anterior angle subangulate. Head with frons and vertex densely, finely punctate. Pronotum with lateral margin explanate from anterior to posterior angle, particularly strong explanate in apical ½; base with marginal line lacking; surface with fine punctures separated by less than 3 times a diameter except lacking in basal $\frac{1}{10}$. Elytron with striae feebly impressed, strial punctures nearly invisible; interval with some scattered, fine punctures; humerous not dentate. Metasternum short, wing not developed. Anterior tibial spur thickened, bent inward in apical ⅓; inferior mesotibial spur short, curved inward in apical ⅓. Paramere as in Fig. 2.



Figs. 2–3. Parameres. 2, *Stenotothorax woodleyi*. 3, *S. washtucna*.

Female: As for male except anterior tibial spur slender, inferior mesotibial spur straight.

Variation.—Length 7.25 to 9 mm, width 3.7 to 4.3 mm.

Type material.—Holotype: Washington, ALE Site, Snively Basin, upper oldfield, Hanford (AEC) Res., 10 mi. NW Richland, 3-XII-1975, pit trap collection, Woodley Collection. Allotype: Same data as holotype except date 10–26–1973, Lee Rogers Collector. Paratypes: 12; with same data as holotype except dates 10-26-1973, and 20-X-1975, Lee Rogers Collector; Washington, Benton Co., Richland, 14 Dec. 1981, on snow; Wash., Benton Co., Hanford Site, ALE, rd up to Rattlesnake Mtn., 46°22.751′N 119°31.073′W pitfall trap sur-

vey—No Fire Zone. The holotype, allotype, and seven paratypes are deposited in the National Museum of Natural History, Smithsonian Institution. Five paratypes are deposited in the M. T. James Entomological Collection, Washington State University.

Other specimens examined.—A total of 750 other specimens were collected from the Hanford Site (Table 1 and Results and Discussion). Most specimens are deposited in the M. T. James Entomological Collection at Washington State University with others deposited in the collections of The Nebraska State Museum, the University of Missouri, The California Academy of Sciences, and several private collections.

Distribution.—Known only from the Hanford Site of south central Washington State.

Etymology.—The species is named for our friend and colleague, Norman Woodley, currently with the USDA, ARS, Systematic Entomology Laboratory, at the Smithsonian Institution. Norm collected the first known specimens during studies at the Hanford Site in the 1970s.

Biology.—Virtually unknown, but species of this genus are suspected detritovores. *Stenotothorax washtucna* (Robinson), a closely related species, was taken from the nests of the sagebrush vole (label data). See additional remarks under Results and Discussion.

Remarks.—This species most closely resembles *S. washtucna* and will key to couplet 15 in Saylor (1940) but has an entirely explanate lateral pronotal margin and completely smooth pronotal base with no trace of a basal marginal line. *Stenotothorax washtucna* has the lateral pronotal margin not or only feebly explanate in the apical ½ and pronotum with a basal marginal line at least at middle of base. Male genitalia differ principally in the parameral shape. The paramers are bent downward apically in *S. woodleyi* (Fig. 2) but are gently and evenly curved in *S. washtucna* (Fig. 3).

The group of species to which *S. woodleyi* and *S. washtucna* belong has been referred to as the *cadaverinus* group of the genus *Aphodius* by American authors including Saylor (1940) in his synopsis of the group. Schmidt (1913) proposed the formal subgeneric name *Stenotothorax* for this group along with subgeneric names for nearly all units formerly known as groups. This subgeneric classification was mostly ignored by authors dealing with American species until relatively recently. Marco Dellacasa (1988) and G. Dellacasa and Gordon (1994) used *Stenotothorax* in the subgeneric sense. Giovanni Dellacasa et al. (2001) elevated *Stenotothorax* to generic status, which is the classification followed here.

Results and Discussion

Stenotothorax woodleyi was taken from four sites at Hanford but was only collected in significant numbers at the ALE shrub-steppe and cheatgrass locations. Our findings indicate that *S. woodleyi* may not be sensitive to habitat changes typified by the cheatgrass and sagebrush collecting sites. In fact, *S. woodleyi* was found in most of the habitats that we sampled from the riparian zones of permanent springs to sand dunes, albeit in small numbers.

Table 1 lists dates and numbers of specimens taken during pitfall trapping in both the cheatgrass and sagebrush shrub-steppe sites on ALE. Between the period 24 Oct and 17 Dec 1998, 302 of the 743 specimens collected were taken. Aside from this time period, scattered specimens were collected until the first week of May and, beginning again, in late Oct. No beetles were taken during the late spring or summer. Little is known concerning the dispersal abilities of these flightless beetles or their normal population levels; however, information presented in Table 1 would indicate that the beetles are sensitive to trapping, and numbers collected throughout the over two years of continuous sampling may not be a true representation of the temporal distribution of this species. However, it is also possible that this odd capture pattern simply represents the normal population density and variability

Table 1. Collection dates and number of captured specimens of *Stenotothorax woodleyi* from the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE).

Cheatgrass		Typical Shrub-Steppe	
Collection Date	Number	Collection Date	Number
28 Mar–4 Apr 1998	1	24 Oct–20 Nov 1998	1
4–18 Apr 1998	1	20 Nov–17 Dec 1998	145
25 Apr–1 May 1998	1	17 Dec 1998–6 Jan 1999	32
24 Oct–20 Nov 1998	86	6–15 Jan 1999	6
20 Nov–17 Dec 1998	71	15–29 Jan 1999	24
17 Dec 1998–6 Jan 1999	45	29 Jan–6 Feb 1999	2
6–15 Jan 1999	12	6–12 Feb 1999	6
15–29 Jan 1999	16	12–19 Feb 1999	12
29 Jan–6 Feb 1999	12	19–26 Feb 1999	14
6–12 Feb 1999	2	26 Feb–5 Mar 1999	7
12–19 Feb 1999	11	5–13 Mar 1999	3
19–26 Feb 1999	17	13–19 Mar 1999	1
26 Feb–5 Mar 1999	12	26 Mar–2 Apr 1999	1
5–13 Mar 1999	4	7–14 May 1999	1
13–19 Mar 1999	5	24 Oct–2 Nov 1999	1
19–26 Mar 1999	2	2–9 Nov 1999	2
26 Mar–2 Apr 1999	2	9–18 Nov 1999	1
2–9 Apr 1999	3	18–25 Nov 1999	10
9–16 Apr 1999	1	25 Nov 1999	23
24 Oct–2 Nov 1999	2	25 Nov–3 Dec 1999	13
2–9 Nov 1999	8	9–16 Dec 1999	15
9–18 Nov 1999	5	16–23 Dec 1999	4
18–25 Nov 1999	10	23–30 Dec 1999	2
25 Nov–3 Dec 1999	14	30 Dec 1999–6 Jan 2000	12
3–9 Dec 1999	5	13–20 Jan 2000	3
9–16 Dec 1999	6	20–27 Jan 2000	2
16–23 Dec 1999	2	27 Jan–3 Feb 2000	1
23–30 Dec 1999	1	3–10 Feb 2000	3
30 Dec 1999–6 Jan 2000	4	10–17 Feb 2000	1
6–13 Jan 2000	1	17–24 Feb 2000	1
13–20 Jan 2000	4	24 Feb–2 Mar 2000	6
20–27 Jan 2000	4	2–9 Mar 2000	4
3–10 Feb 2000	3	9–16 Mar 2000	3
10–17 Feb 2000	1	16–23 Mar 2000	1
24 Feb–2 Mar 2000	2	23–30 Mar 2000	2
16–23 Mar 2000	2		

over the two years. Capture/recapture studies, as well as a more thorough investigation into this beetle's natural history, would begin to answer these questions.

Other Hanford sites at which the beetle was collected include:

ENE slope of Gable Mountain.—A total of seven beetles were collected on the slope of Gable Mountain. Collection dates and numbers of beetles are as follows (1998–99); 24 Oct–25 Nov (1); 17 Dec–6 Jan (2); 6 Jan–15 Jan (2); 15–29 Jan (1); 6–12 Feb (1).

Rattlesnake Springs.—A total of three beetles were collected at Rattlesnake springs. Collection dates and numbers of beetles are as follows (1999): 19–26 Feb (1); 26 Feb–5 Mar (2).

Sand dunes.—A total of two beetles were collected at the sand dunes. Collection dates and numbers of beetles are as follows (1998–99): 24 Oct–25 Nov (1); 13–19 Mar (1).

Beginning in 2002, three survey sites were established in the newly created Han-

ford Reach National Monument, which is primarily that portion of the Hanford Site located north of the Columbia River and includes the Wahluke and Saddle Mountain Wildlife Refuges. These sites were sampled from April 2002 through April 2003. No *S. woodleyi* were collected in these traps during the period of study.

Why no *S. woodleyi* were found during studies on the Hanford Reach National Monument is problematic. The overall habitat is very much like that shrub-steppe found on the opposite side of the Columbia River. In fact, at least one of the areas collected on the Monument is in sight of an area where a small number of beetles was taken, a distance of approximately 8 km in direct line. It is interesting to speculate that the river has hindered the dispersal of the beetle and has kept it from moving north of the river, at least in this general area. Our collections and some earlier Hanford Site collections conducted south of the river represent the only available specimens of *S. woodleyi.* Several other species of *Stenatothorax* (the *cadaverinus* group of *Aphodius*) are found in eastern Washington but none are known to be sympatric on the Hanford Site with *S. woodleyi.*

During the period of this study, we examined large amounts of coyote, elk, and mule deer dung, both during the summer and winter months, without ever finding specimens of *S. woodleyi.* A member of the *cadaverinus* species group, *S. woodleyi* is probably a burrow-inhabiting detritovore and does not occur in dung. At two different times, a total of six specimens were found at the entrances to animal burrows at the ALE sagebrush site. Specimens were found at the entrances to burrows in the undisturbed shrub-steppe, two at the entrance to one burrow and four at the entrance to another in early-December 1998.

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