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AQUATIC AND SEMIAQUATIC HETEROPTERA OF THE GRAND CANYON (INSECTA: HEMIPTERA)

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Abstract.— The aquatic and semiaquatic Hemiptera from 12 localities in Marble Canyon and Grand Canyon are reported, along with those from 1 locality in the Escalante Canyon. Fourteen species are recorded and compared to the water-bug fauna of the southwestern United States and western Mexico. *Ochterus rotundus* n. sp. is described from the Grand Canyon and the mountains of western Mexico.

The aquatic and semiaquatic Heteroptera of the Grand Canyon are not well known. This fact, coupled with the discovery that an undescribed ochterid inhabited both the Grand Canyon and the mountainous regions of western Mexico prompted an expedition to sample this fauna in late May and June 1972. Collecting permits were granted by the U.S. Park Service, and we obtained the splendid cooperation of the late Dr. Aaron Ross of Ogden, Utah, who provided raft transportation, advice on a variety of different ecological situations that could be sampled, and logistic support to help reach collecting locations.

In this paper, we treat Marble Canyon and the Grand Canyon as one. The starting point was Lee's Ferry and the stopping point was the pull-out north of Peach Springs, Arizona. Later in 1972 the first author sampled a spring location in Davis Gulch on the Escalante and the data is included for comparison.

The 13 collection locations are described so that ecologists can make use of the data presented here. Following the species tabulations, a discussion of the affinities of the fauna is given. All material is held in the collections of the University of Colorado Museum (CU) and the United States Museum of National History (USNM).

In addition to those mentioned previously, we are indebted to Dr. Peter Robinson (CU) and Dr. Jon Herring (USNM) for making available material for study.

Description of Collection Locations

CL557. Lake Powell. Davis Gulch on the Escalante River.

This gulch has intermittent water in the sandy stream bed, with some permanent seep springs. The collection was made at the side of a small waterfall. The damp soil was overgrown with vegetation which had to be pulled away to disturb the soil clinging to cracks in the rock before the bugs could be seen. There were many trees, grasses, and other plants in this canyon. October 2, 1972.

CL545. Vasey's Paradise. Marble Canyon.

This is a well-known spring leaping from a sheer wall. Adjacent to the spring are many seeps with abundant vegetation, and wet rock faces with and without vegetation; the collections were taken from these seep areas. May 28, 1972.

CL546. Buckfarm Canyon. Mile 41, Marble Canyon.

Buckfarm is dry at the Colorado River confluence, but abundant seeps occur on a low wall about ½ mile upstream. A great deal of vegetation grows on this wall, preventing the moist earth from eroding. May 28, 1972.

CL547. Clear Creek. Mile 84.

The permanent stream has swift, clear water and a pebbly bottom without large boulders. Collections were made along the stream and at pools near a waterfall about a mile from the mouth. May 30, 1972.

CL548. Confluence of Colorado and Little Colorado.

The latter river is milky blue since most of the flow originates in large springs some distance upstream. The pebbles and rocks in the riffles are covered and stuck together with travertine; the fauna is depauperate. May 29, 1972.

CL549. Shinomu Creek. Mile 109.

This is a good-sized stream with a stony and gravel bottom. The water is

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clear and warm. Collections were from long, deep pools, a waterfall near the mouth, and a mile of stream above the falls where the valley widens and trees, grasses, and sandy banks are prevalent. May 31, 1972.

CL550. Elves Chasm.

The very narrow canyon prevents sunlight from entering except for short periods, so this chasm is the coolest we visited. A series of grottos, falls, and seeps on the walls provide numerous habitats, but most species were still immature, indicating late maturation at this locality. The water is crystal clear, with abundant algae in the pools. May 31, 1972.

CL551. Stone Creek. Mile 132.

This stream has a fairly wide valley in places where springs arise on benches and feed small saw-grass marshes. Some seeps occurred on rock walls. The main stream has sandy banks, clear water, and a bottom of gravel and small stones. Collections were made for several miles upstream from the mouth. May 31, 1972.

CL552. Thunder Spring.

Thunder River issues in a torrent from this spring, situated high on a cliff about four miles from the Colorado. The stream has an extremely steep gradient to its confluence with Tapeats Creek, so collecting was restricted to the spring region where the cold water encouraged a lush growth of watercress. June 1, 1972.

CL553. Deer Creek.

Lower Deer Creek is hidden in an extremely narrow deep gorge, so no collecting was possible. The upper stream is swift and clear, flowing through a relatively broad valley with dense vegetation and many trees. Occasional gravel bars occurred where collections were made. June 1, 1972.

CL554. The Ledges.

Shelves of limestone adjacent to the river give this locality its name. Several seeps and shallow spring pools provided limited collecting. June 1, 1972.

CL555. Havasu Creek.

Compared to the other canyons visited, Havasu ranks as a large canyon. The large, swift stream is milky blue, indicating heavy mineralization. Many travertine dams form large pools, and while these were largely sterile, some side pools had good growths of vegetation providing habitats for aquatic insects. June 2, 1972.

CL560. Lava Falls.

On the south bank along these rapids there is a rather sizable saw-grass marsh. The spring water from the marsh has deposited travertine on the steep banks of the river which is overgrown with vegetation in many places, being kept constantly moist. Collections were made along these steep to overhanging banks. June 3, 1972.

List of Species Found

Only the collection location numbers are given here. Refer to the location descriptions for full data.

Gerridae

Gerris remigis Say. CL546, 1♂, 4♀♀ apterous, 2 nymphs; CL547, 1♂ apterous, 1♂, 1♀ alate; CL549, 2 ♂♂ alate.

Macroveliidae

Macrovelia hornii Uhler. CL552, 1♂, 1♀, brachypterous; CL557, 1♂, 5♀♀, brachypterous.

Veliidae

Microvelia beameri McKinstry. CL547, 2♂♂, 3♀♀ alate; CL551, 1♂, 2♀♀ alate; CL555, 1♂ apterous, 1♀ alate.

Microvelia torquata Champion. CL545, 3♂♂, 5♀♀ apterous; CL546, 6♂♂, 5♀♀ apterous; CL547, 3♂♂, 12♀♀ apterous, 2♀♀ alate; CL549, 3♂♂, 4♀♀ apterous, 4♀♀ alate; CL550, 2♂♂ apterous; CL551, 4♂♂, 1♀ apterous; CL552, 7♂♂, 2♀♀ apterous, 1 nymph; CL554, 2♂♂, 7♀♀ apterous, 1 nymph; CL555, 5♂♂, 6♀♀ apterous, 1♂, 1♀ alate; CL557, 3♂♂, 5♀♀ apterous.

Rhagovelia distincta Champion. CL547, 1♂, 3♀♀ apterous, 2♂♂ alate; CL548, 1♂, 3♀♀ apterous, 2♂♂ alate; CL549, 5♂♂, 3 ♀♀ apterous, 4♂♂ alate, 4 nymphs; CL551, 3♂♂, 5♀♀ apterous, 1♀ alate, 3 nymphs.

Hebridae

Hebrus hubbardi Porter. CL557, 4♂♂, 7♀♀ alate; CL546, 7♀♀ alate; CL550, 1♂ alate; CL551, 1♀ alate; CL553, 1♀ alate; CL554, 2♀♀ alate.

Hebrus obscura Polhemus and Chapman. CL550, 1♂, 1♀ micropterous.

Saldidae

Saldula pexa Drake. CL549, 2♂♂, 2♀♀; CL550, 1♂♂, 4♀♀; CL553, 2♂♂, 2♀♀; CL555, 2♂♂, 3♀♀.

Saldula pallipes (Fabricius). CL545, 3♂♂, 1♀; CL546, 5♂♂, 3♀♀; CL549, 4♂♂, 1♀; CL550, 2♀♀; CL555, 2♀♀.

Ochteridae

Ochterus barberi Schell. CL551, 3♂♂, 1♀.

Ochterus rotundus Polhemus and Polhemus, n.sp. CL546, 2♂♂, 2♀♀, 5 nymphs; CL550, 3 nymphs; CL551, 1♀, 1 nymph; CL554, 1 nymph (?).

Gelastocoridae

Gelastocoris oculatus (Fabricius). CL557, 4♂♂; CL549, 1 nymph (?); CL551, 1♀, 1 nymph.

Corixidae

Graptocorixa serrulata (Uhler). CL550, 1♂; CL555, 9♂♂, 8♀♀, 1 nymph.

Notonectidae

Notonecta lobata Hungerford. CL547, 2♀♀; CL550, 1♂; CL551, 1 nymph; CL554, 2♂♂, 2♀♀; CL555, 6♂♂, 4♀♀.

Ochterus rotundus n. sp.

Large, ovate, widest across middle of hemelytra. Color: Ground color blackish brown, with greenish cast over most of dorsum; lateral and posterior margins of pronotum, margins of hemelytra brown; elongate spot on explanate margins of pronotum, apex of clavus yellow or yellow brown; dorsum covered with tiny golden pubescence. With usual silvery grey spots on pronotum and hemelytra; on pronotum at anterolateral angles next to collar, at anterolateral angle of posterior lobe just behind tubercle, and each side of center; on clavus scattered over basal half; on hemelytra, a large spot at base of membrane, five irregular spots along margin plus a small spot at suture.

Underpart of thorax frosted with grey; of abdomen, deep brown. Legs, rostrum, labrum, yellowish to yellow brown.

Frons brilliant green to blackish green. Structure: Eyes prominent, slightly higher than vertex in side view; even with frons in top view (Fig. 1f). Frons rugose, faintly carinate on midline. Width of eye/interocular space, 8/13 (viewed from top).

Pronotum with lateral tubercles on disc, lateral margins straight or very slightly curved; hind margin sinuate; posterolateral angles as in Fig. 1d; length/width, 55/142.

Hemelytra with membrane not prominent, cells indistinct. Scutellum length/width, 47/76; somewhat tumid. Mesoxyphus acute (Fig. 1e).

Antennal formula I: II: III: IV; 7: 9: 19: 20

Male genital capsule and right paramere as in Figure 1a, b, and c.

Measurements.— Male: Length 4.5 mm, width 2.8 mm. Female: Length 5.5 mm, width 3.5 mm.

Material.— MEXICO: *Durango*: holotype, male, and 2♂♂ paratypes, 7 mi W Los Bancos, km 175, on top of divide, IV-26-1974, M. S. Polhemus (JTP). Additional paratypes as follows: MEXICO: *Durango*: 6♂♂, 7♀♀, 7 mi W Los Bancos, CL1017, 20 April 1964, J. T. and M. S. Polhemus (CU); 2♂♂, 2♀♀, 16 nymphs (nymphs not paratypes), E Santa Lucia, IV-26-1964, M. S. Polhemus (JTP). *Michoacan*: 1♂, 1♀, E Morelia, El Salto, CL751, VI-15-1975, J. T. Polhemus (JTP); 5♂♂, 12♀♀, 3 nymphs, Uruapan, CL747, VI-14-1975, J. T. Polhemus (JTP). *Sinaloa*: 1♂, 2♀♀, 1 nymph, 4 mi E La Palmita, CL722, VI-6-1975, J. T. Polhemus (JTP); *Sonora*: 10♂♂, 3♀♀, 5 nymphs, Rancho Los Banos, Canyon, NE Nacazori, CL709, VI-3-1975, J. T. Polhemus (JTP). USA: *Arizona*: 1♀, Grand Canyon, Stone Creek, mile 132, CL551 V-31-1972, J. T. and M. S. Polhemus (JTP): 2♂♂, 2♀♀, (5 nymphs, not paratypes). Marble Canyon, Buckfarm Canyon, mile 41, seeps ½ mi from Colorado River, CL546 V-28-1972. J. T. and M. S. Polhemus (JTP); 1♀, Grand Canyon (USNM).

Also the following, not considered paratypes: MEXICO: *Jalisco*: 3♀♀, S Mismaloya, CL734, VI-9-1975, J. T. Polhemus (JTP). *Nayarit*; 3♀♀, W Compostela, CL730, VI-8-1975, J. T. Polhemus (JTP).

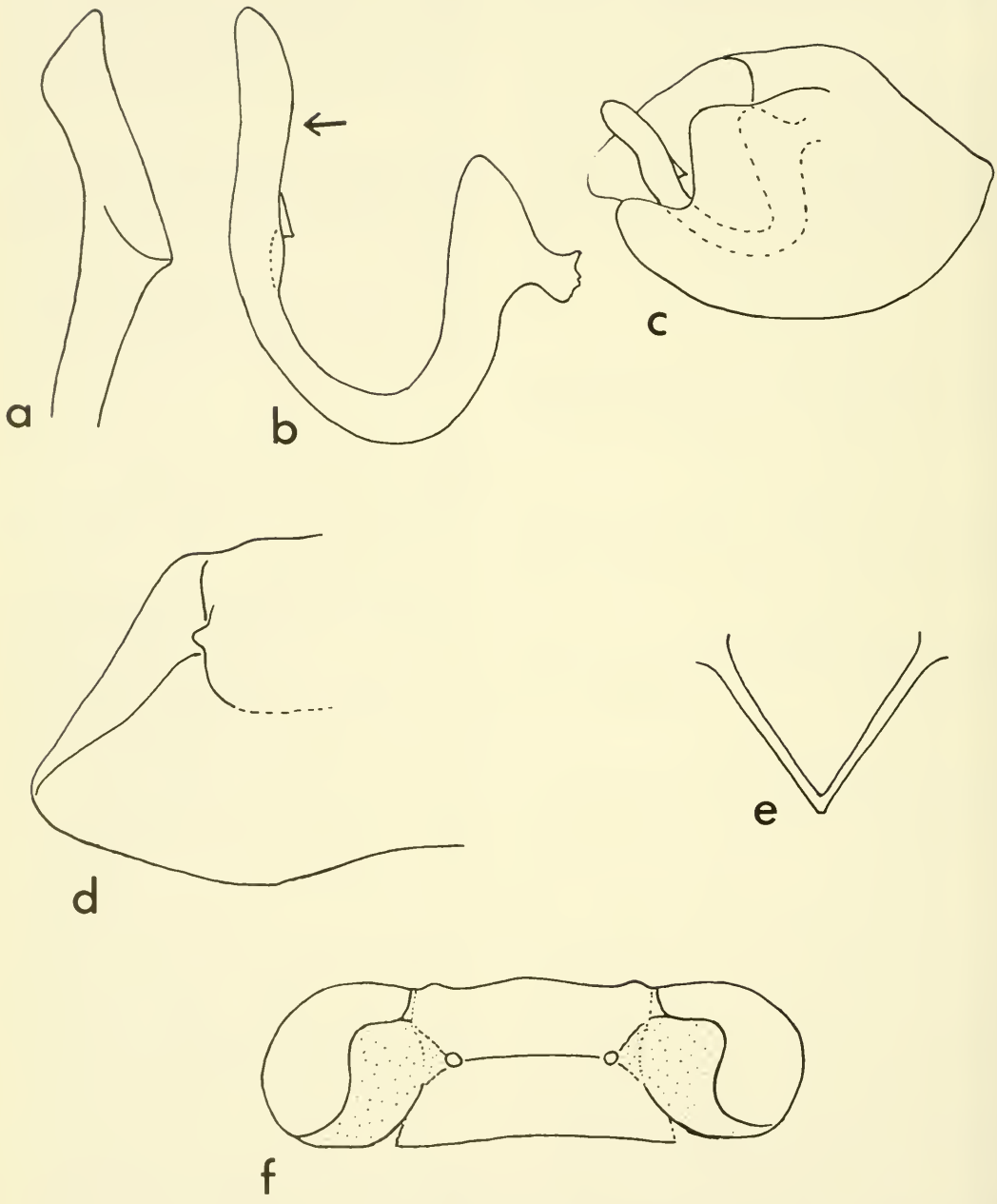

Fig. 1 *Ochlurus rotundus* n. sp.: (a) right male paramere, tip, seen as in arrow of b; (b) right male paramere; (c) male genital capsule; (d) pronotum, dorsal view; (e) mesoxyphus; (f) head, dorsal view.

Discussion.— This species is quite distinct due to its large size, ovate shape, and greenish color. A specimen of *rotundus* from the Grand Canyon (USMN) was determined by Schell (1943) as *O. viridifrons* Champ, but *rotundus* has little in common with the latter.

The specimens collected by the authors were taken from seeping rock faces at various localities in western Mexico and

from vegetated areas on steep rock faces in the Grand Canyon.

Zoogeography

When we began this expedition, we had no preview as to the affinities of the aquatic Hemiptera fauna of the Grand Canyon gorge except one undescribed ochterid specimen (USNM) that tied the fauna to the Sierra Madre of western Mexico. We had expected to find other evidence of a northward extension of the Mexican fauna, as such evidence existed for sites further south in Arizona (Polhemus 1966), but this expectation was not fulfilled. As can be seen in Table 1, 9 of the 14 species taken on this expedition occur in western Mexico, but *Ochterus rotundus* is the only one of these species that is not also widespread through the southwestern United States. *Notonecta lobata* has its range centered in southern Arizona, being uncommon elsewhere in the state, and can be considered an isolate in the Grand Canyon. Beyond these two species, the fauna is typically southwestern but is depauperate.

Certain species and genera were expected but not found, including *Buenoa* and other species of *Notonecta* (Notonectidae), *Abedus* (Belostomatidae), *Velia* (Veliidae), *Gelastocoris rotundatus* Champion, other corixids, other *Gerris* species (Gerridae), *Mesovelia* (Mesoveliidae) and additional species of Saldidae.

Intensive collecting in locations having the diversity of habitat and topography encountered in the Grand Canyon gorge and the side canyons we explored would yield a substantially larger number of species elsewhere in Arizona at the same elevations. For instance, if a transect from Bisbee to Tucson further south was chosen, a quick review of the species found in and around Sabino Canyon, the Santa Rita Mountains, and the Huachuca Mountains on such a transect shows a faunal list (not intended to be exhaustive) of 11 families, 25 genera, and 44 species.

The 7,000-foot landmass seems to have effectively blocked the northward dispersal of species such as *Saldula dewsi*, Hodgden, *Martarega mexicana* Truxal, and *Velia summersi* Drake, which occur scarcely 80 miles south in Oak Creek Canyon. The first two species are typically Mexican and may be rather recent invaders (see Menke and Truxal 1966).

There are two species, *Abedus herberti* Hidalgo and *Ambrysus woodburyi* Usinger, which should be found in side streams in the Grand Canyon as it bisects their ranges. They occur at Sedona to the south and in the Virgin River system to

Table 1. Distribution of species found in the Grand Canyon.

Species found in Grand Canyon	Collection localities: Escalante R.	Vasey's Paradise	Buckfarm	Clear Creek	Little Colorado	Shinumu Creek	Elves Chasm	Stone Creek	Thunder Creek	Deer Creek	The Ledges	Havasu Creek	Lava Falls	Southern Arizona	Sierra Madre Western Mexico	Southwest U.S.	Western U.S.
Gerris remigis			X	X		X						X		X	X	X	X
Macrovelia hornii	X								X							X	X
Microvelia beameri				X				X				X		X	X	X	
Microvelia torquata	X	X	X	X		X	X	X	X		X	X		X	X	X	
Rhagovelia distincta				X	X	X		X				X		X	X	X	X
Hebrus hubbardi	X		X				X	X		X	X			X	X	X	
Hebrus obscurus							X							X		X	
Saldula peza						X	X			X		X		X	X	X	
Saldula pallipes		X	X			X	X					X		X	X	X	X
Ochterus barberi								X					X	X		X	
Ochterus rotundus			X				X	X			?				X		
Gelastocoris oculatus	X					?		X						X		X	X
Graptocoriza serrulata							X					X		X	X	X	
Notonecta lobata				X			X	X			X	X		X		X	

the north; the latter has headwaters in the Hurricane Cliffs only a few miles from Tapeats Creek, the latter a feeder of the Colorado.

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