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A New Freshwater Gammarus (Crustacea:
Amphipoda) from Western Texas¹

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ABSTRACT: *Gammarus pecos*, a new species of amphipod crustacean, is described from a spring and springbrook within the drainage basin of the Pecos River in western Texas. The new form, similar to both *G. (Rivulogammarus) bousfieldi* Cole & Minckley and *G. (Gammarus) fasciatus* Say, is of uncertain subgeneric status.

INTRODUCTION

On various occasions from 1964-1968, representatives of an undescribed species of *Gammarus* were collected from a spring system near Fort Stockton, Pecos Co., Texas. W. L. Minckley of Arizona State University first called our attention to these amphipods and made many of the collections.

Willbank Spring, a subcircular limnocrene 30 m in diameter and 6 m deep, lies about 880 m above sea level, 13.6 km N, 5.6 km W of the center of Fort Stockton. The spring is the source of Leon Creek, a tributary of the Pecos River, and is about 265 km upstream from the confluence of the Pecos and Rio Grande. Amphipods are abundant under stones at the immediate outlet of Willbank Spring and, in addition, have been collected several times from *Chara* and grasses in Leon Creek where it is bridged by Highway 18. This is 863 m above sea level and 16.3 km N of Fort Stockton.

Willbank Spring water temperature is usually about 20 C. Temperature of Leon Creek at the highway crossing fluctuates seasonally; it was 28 C on 6 August 1967 and 4-5 C on 26 December 1966. Complete chemical analysis has not been performed on the spring water, but it is highly mineralized with a filtrable residue of 6.65 g/liter.

It is the purpose of this report to describe the new gammarid from the Pecos River drainage.

Gammarus pecos n. sp.
(Figs. 1-24)

Diagnosis.—A conspicuously banded species with reddish or greenish coloration, of uncertain subgeneric affinity, related to *G. (Rivulogammarus) bousfieldi* Cole and Minckley, but superficially similar to the *Gammarus fasciatus* Say - *G. tigrinus* Sexton complex of the subgenus *Gammarus*. The species has the following characteristics: eye elongate-reniform; antenna 1 with elongate flagellum; antenna 2 richly setose but lacking calceoli in mature male; mandibular palp segment

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3 medially broad; coxal plates 1 and 2 with several long anteroventral setae; 2 spines grouped dorsolaterally on urosome segments 1 and 2; abdominal side plates 2-3 with several posterior marginal setae; peraeopods 3-5 generally armed with dense clusters of simple setae as well as spine groups.

Description.—Male, 12-14.9 mm (Figs. 1-7, 9-11, 13-24). Inter-antennal lobe strong, lower margin evenly rounded, upper angle sharply rounded, not broadly and obtusely as in typical *Rivulogammarus*. Eye elongate-reniform, set back from anterior head margin by about half its width.

Antenna 1 about 1.3 to 1.5 times the length of antenna 2; peduncular segment 1, posterior margin with single median seta and two stout apical spines, segment 2 with 2-4 (usually 3) posterior groups of setae, segment 3 with 1-2 seta clusters; flagellum with up to 40 segments; accessory flagellum 4-5 segmented.

Antenna 2, peduncle scarcely longer than the flagellum; ultimate segment slightly longer than penultimate, its posterior margin with about seven clusters of long setae; penultimate segment with 4-5 such clusters; flagellum with 12-15 richly setose segments, lacking calceoli in specimens examined.

Mandible, right incisor relatively narrow with 4 teeth; lacinia mobilis elongate, formed with two sharp principal teeth and up to 10 smaller teeth; spine row composed of 8-11 plumose setae and 3-5 strong pectinate spines. Left incisor broad with 4-5 teeth; lacinia mobilis relatively broad with 4-5 blunt teeth arranged in step-like fashion; spine row with 8-11 plumose setae and 4-6 pectinate spines weaker than those of the right mandible. Palp, segment 3 broadest medially, outer face with two groups of setae, inner face with one group of 3-5 setae; inner margin slimmer distally with 23-36 stout pectinate setae and 4-6 long terminal setae; penultimate segment slightly longer with submarginal distal row of 4-6 long setae and marginal row of four shorter setae, 5-9 setae located more proximally.

Maxilla 1, inner plate with 15-17 plumose marginal setae; outer plate with 11 apical spine-teeth, bluntly or finely pectinate; right palp with 4-6 terminal conical teeth and one outer subterminal tooth and seta; left palp with 6-8 terminal spines, a subapical row of setae and one subterminal spine.

Maxilla 2, inner plate with facial row of 10-14 plumose setae inserted diagonally and 11-15 marginal setae.

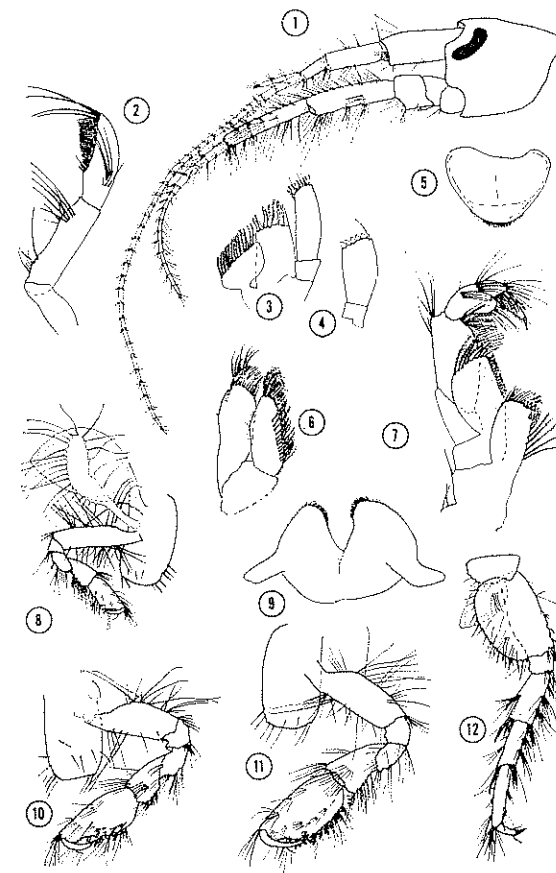
Maxilliped strong; inner plate narrow, reaching distal end of palp segment 1, truncate apex with three conical spine-teeth and one inner subterminal tooth and a subapical row of 12 curved plumose setae, inner margin with 8-13 long heavy plumose setae; outer plate broader, short, inner margin with slender spine-teeth continuing around apex as stout pectinate setae; palp segment 3 slender, with one outer marginal group of setae and distal obtuse row of strong pectinate blades; dactyl strong, shorter than segment 3.

Upper lip, apex bluntly rounded, very finely hirsute. Lower lip,

inner lobes vestigial; shoulders of outer lobes relatively strongly hirsute.

Coxal plates 1 and 2, with 4-7 anteroventral and 1-2 posteroventral setae, facial setae sparse.

Gnathopod 1, propodus narrowing distally, palmar margin very oblique, concave, with one stout truncate spine-tooth near the middle, and 7-10 mostly smaller spines near posterior angle; posterior margin with 4-5 groups of marginal setae; inner face with three superior lateral rows of setae and 6-8 inferior lateral rows.

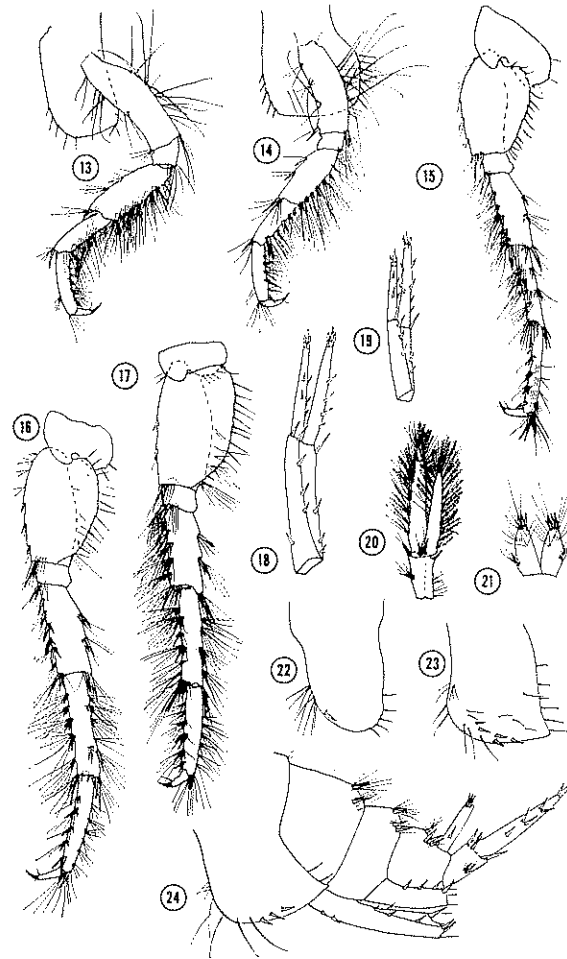


Figs. 1-12.—Fig. 1, male paratype, 13.1 mm; figs. 2-7, 9-11, male paratype, 14.4 mm; figs. 8, 12, female paratype, ovigerous, 9.4 mm. 1.—Head and antennae. 2.—Mandibular palp, outer aspect. 3.—Maxilla 1, right. 4.—Maxilla 1, left. 5.—Upper lip. 6.—Maxilla 2. 7.—Maxilliped. 8.—Gnathopod 2, female. 9.—Lower lip. 10.—Gnathopod 1, male. 11.—Gnathopod 2, male. 12.—Peracopod 5, female

Gnathopod 2, propodus relatively slender, length nearly twice its width; palmar margin oblique, medially concave, bearing one truncate spine-tooth, and 6-7 shorter spines at posterior angle; posterior margin with 7-9 groups of marginal setae; inner face with 2-4 superior lateral rows of setae and 6-8 inferior lateral rows.

Peraeopod 1, posterior margins of segments 4, 5 and 6 with about 9, 8, and 5 clusters of long slender setae, respectively.

Peraeopod 2 slightly smaller than peraeopod 1, posterior margins



Figs. 13-24.—male paratype, 13.1 mm. 13.—Peraeopod 1. 14.—Peraeopod 2. 15.—Peraeopod 3. 16.—Peraeopod 4. 17.—Peraeopod 5. 18.—Uropod 1. 19.—Uropod 2. 20.—Uropod 3. 21.—Telson. 22.—Epimeron 1. 23.—Epimeron 2. 24.—Epimeron 3 and urosome.

of segments 4, 5 and 6 with about 8, 6 and 5 clusters of long setae, respectively.

Peraeopods 3-5, posterior margins of segments 4-6 with relatively sparse groups of slender setae; anterior margins of segments 4 & 5 with 5-9 clusters of spines and long setae; segment 6 with three anterior spine groups and few setae. Posterior margin of basos of peraeopods 3-5 gently convex proximally, lined with 16-18 moderately long slender setae; basos of peraeopod 3 with conspicuous free distal lobe, unarmed; basos of peraeopods 4 & 5 with very narrow distal free margin almost coalescing with segment proper, angle sometimes armed with a short spine; angle at base of segment proper armed with cluster of 2-3 slender stiff setae, not spines.

Coxal gills simple, laminate, of medium size, decreasing in size posteriorly, although gill 2 sometimes largest. Gill of peraeopod 5 arises at junction with basos.

Abdominal side plates 2 & 3, posteroventral angles somewhat produced; side plate 2 with about 6 lower submarginal spines and setae and about 5 subparallel facial spines and setae; posterior margin bearing 6 short setae; side plate 3, lower margin with 1-2 setae and 3-7 stout spines, posterior margin lined with 2-6 fine setae.

Pleopods strongly natatory; pleopod 3 slightly shorter than the first two; protopodite 1 least setose, protopodite 3 most setose; inner rami of pleopods 1, 2 and 3 averaging 19, 18 and 17 complete segments, respectively, fused basal segments with 1 or 2 proximal simple setae and 3-7 split-tipped setae, most on the inner ramus of pleopod 1; outer rami averaging 22, 21 and 19 complete segments, respectively, fused basal segments with 5-11 plumose setae, most on outer ramus of pleopod 1; protopodites with coupling spines consisting of two curved nodose split-tipped spines and two distal setae.

Uropod 1, rami subequal, shorter than peduncle, tips slightly extending beyond uropod 2. Posterior margins of peduncle strongly spinose, inner distal angle with single long spine and outer distal angle with two unequal curved spines; anterior margin with single proximal spine. Inner ramus, inner margin with 3-5 spines, outer margin smooth or with 1-3 short spines; outer ramus, both margins with 2-4 short spines.

Uropod 2, inner ramus distinctly longer than outer and with 2-3 spines on inner and outer margins; outer ramus with 2-3 spines on inner margin and 2 spines on outer. Peduncle about equal to inner ramus, posterior margins strongly spinose.

Uropod 3, inner ramus 80-87% length of outer, inner margin with 19-26 sparse groups of setae including smooth and plumose types, some groups include spines; outer margin with 9-13 groups of setae and no spines; terminates in 1-2 spines and up to 15 setae including plumose and smooth types. Outer ramus, inner margin with 19-27 groups of 1-4 setae of two types, rarely spines in the proximal 1 or 2 groups; outer margin with 11-14 groups, spines present in 2-4 groups and plumose setae almost never associated with the spines, smooth

setae are commoner on the outer margin than on the inner; first segment of the ramus terminates in 1-4 spines and 14-15 setae of smooth and plumose types. Terminal segment of outer ramus has up to nine terminal setae of two types and rarely a spine, rarely 1 or 2 setae inserted on inner margin.

Urosome not dorsally humped; all segments with two middorsal spines and with a few setae in cluster; segments 1 & 2 with 1-2 lateral spines and segment 3 with 2-4 lateral spines.

Telson cleft to base, each apex with 2-4 spines and 6-9 slender setae; outer margin with two groups of spines and/or setae, inner margin of each lobe with one spine group.

Female, 9-11 mm (Figs. 8, 12). The female is typically smaller and more compact, with relatively short, weaker and less setose antenna 2, weakly developed gnathopod propods, shorter peraeopods, shorter uropod 3, and less elongate eye.

Gnathopods 1 & 2, propodus subrectangular, palm oblique (more so in 1), margin nearly straight, dactyl tip (when closed) exceeding spines at palmar angle. Peraeopods 3-5, basos relatively broader, posterior margin more strongly convex than in male. Brood plates present on pereonite segments 2-5, decreasing in size posteriorly; plates are more slender than in *G. fasciatus*, but not linear; marginal setae are elongate, simple.

Material Examined and Disposition of Types.—Specimens collected 26 Dec 1966, 6 Aug 1967 and 26 June 1968 were examined for this report. The holotype, a male 14.3 mm (U.S.N.M. 123821), and a representative ovigerous female paratype, 11 mm (U.S.N.M. 123822), are deposited in the U.S. National Museum. Additional series of paratypes have been deposited with the U.S. National Museum and the National Museum of Canada.

Remarks.—The affinities of this remarkable new species are puzzling. In many features *G. pecos* is clearly related to *G. bousfieldi* Cole & Minckley 1961, presently known only from one stream in Kentucky. Among these similar features can be specified: the shape of the interantennal head lobe; presence of two distal spines on peduncular segment 1 of antenna 1; elongate antennal flagellum; shape and armature of mandibular palp; type of maxilliped; deeply concave palmar margin of gnathopod 2; distally narrow free lobes of basos of peraeopods 4 & 5; excessively setose antenna 2 and peraeopods; shape and armature of abdominal side plates 2 & 3; and armature of the telson. *Gammarus pecos* is, however, clearly distinct from *G. bousfieldi* by the strongly setose coxal plates, by the lack of antennal calceoli in the male, and by the dorsally unhumped urosome and spinose lower margin of epimeron 3. These two species are quite distinct from North American members of the *Rivulogammarus* complex (see Bousfield, 1958) in which: the interantennal head lobe is broadly and smoothly rounded above; the gnathopod propodus is much broader and without a deeply concave palmar margin; and the posterodistal angle of the basos of peraeopods 4 & 5 forms a distinct free lobe, lacking spines or strong setae. The apparent absence of antennal calceoli is not subgenerically diagnostic, because mature males of *Gammarus* (*Rivulogam-*

marus) *minus* Say, in some drainage basins, lack calceoli during the reproductive period (Cole and Minckley, 1961; Minckley and Cole, 1963).

Gammarus pecos is also similar to *Gammarus fasciatus* and *G. tigrinus*, species occurring mainly in large rivers and estuaries, respectively, in American Atlantic coastal regions. Five specific similarities are: setose, noncalceolate antenna 2; strongly setose anteroventral angles of coxal plates; posterior margins of basos of peraeopods 4 and 5 armed with long setae; narrow free lobes and spines at distal angle of peraeopods 4 & 5; strongly setose peraeopods. The elongate antenna 1, however, and overall structure of the mouthparts, especially of the mandibular palp, are less like these features in the *G. tigrinus* complex (see Nijssen & Stock, 1966). The spinose submarginal armature of abdominal side plates 2 & 3 is more like that of *G. tigrinus* than the setose situation in *G. fasciatus*.

In view of the several important features in which subgeneric affinities cannot presently be clearly established, and in the knowledge that other, undescribed species of gammarids related to *G. pecos* occur in the Pecos River drainage system, it seems advisable to defer to a later study a thorough assessment of the taxonomic affinities and phylogeny of the *G. pecos*-*G. bousfieldi* complex. However, the suggestion by Cole and Minckley (1961) that this complex (represented, at that time, by *G. bousfieldi*) might link the subgenera *Gammarus* and *Rivulogammarus* is reinforced by the present findings.

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