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## Two New Species and the Redescription of Another Species of the Cleptoparasitic Bee Genus *Triepeolus* with Notes on Their Immature Stages (Anthophoridae: Nomadinae)

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### ABSTRACT

Two epeoline cuckoo bees belonging to the genus *Triepeolus* from the deserts of North America are named and described, and *Triepeolus grandis* (= *Epeolus grandis* Friese, 1916, new combination), heretofore known only from the type, is redescribed on the basis of numerous specimens from the United States and Mexico. Past published references to the mature larvae and biologies of *gran-*

*dis* and *kathrynae*, new species, are cited. The third species, *loomisorum*, new species, is associated with the eucerine *Xenoglossodes eriocarpi* (Cockerell) (a new host record for *Triepeolus*), and the egg of *T. loomisorum* is described as is the nest of its host. The description of the pupa of *T. grandis* is the first for the genus.

### INTRODUCTION

This paper names one large and one small species of the cuckoo bee genus *Triepeolus*, and redescribes a third species, *T. grandis* (Friese), a large-bodied form heretofore known only by its type specimen. Mature larvae of the two large species (*grandis* and *kathrynae*) were described (but not named) more than 20 years ago in a larva-based phylogenetic analysis of the diverse cleptoparasitic

bee subfamily Nomadinae (Rozen, 1966), and the same two species have been cited subsequently in literature pertaining to their hosts. Both were thought to be unnamed until the present paper was undertaken. *Triepeolus kathrynae* is described now and *T. grandis* is redescribed, both in conjunction with the appropriate references to avoid possible confusion. The small species (*loomisorum*) is

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named because it was collected in association with a nest (described below) of *Xenoglossodes eriocarpi* (Cockerell), a new host for *Triepeolus*. The egg of *T. loomisorum* and the pupa of *T. grandis* are described herein, and the highly modified first instars of both species are treated morphologically and taxonomically in a separate paper (Rozen, 1989).

The distribution and structure of the special setae on the pseudopygidial areas of female *Triepeolus* are particularly useful in distinguishing the species in this genus (and in other groups of Nomadinae as well). For that reason females have been selected as holotypes of the two species named here.

#### ACKNOWLEDGMENTS

Before his death, Paul D. Hurd, Jr., of the Smithsonian Institution had intended to revise *Triepeolus*. To that end he had sorted to species many of the large, unidentified specimens in the collections of the Smithsonian Institution, the American Museum of Natural History, and University of California, Berkeley. In the process he recognized *T. grandis* and *T. kathrynae* although he thought both to be unnamed. His preliminary work in sorting and identification substantially aided the initial steps leading to this paper.

I thank the following persons who have loaned or allowed me to examine adult specimens in their charge: Mont A. Cazier, Arizona State University, Tempe, Arizona; Saul I. Frommer, University of California, Riverside; Ronald J. McGinley, National Museum of Natural History, Washington, D.C.; Charles D. Michener and Arturo Roig A., University of Kansas, Lawrence; Jerry A. Powell, University of California, Berkeley; and Wojciech J. Pulawski, California Academy of Sciences, San Francisco. The type of *Triepeolus grandis* was kindly loaned by Dr. Frank Koch, Museum für Naturkunde der Humboldt-Universität, Berlin, DDR.

I extend my appreciation to the following specialists for carefully reviewing the manuscript and for their thoughtful comments on it: Wallace E. LaBerge, E. Gorton Linsley, Charles D. Michener, Arturo Roig A., and Philip F. Torchio. I am especially grateful to Arturo Roig who suggested that the speci-

mens here referred to *Triepeolus grandis* might indeed be that species.

#### ADULTS OF *TRIEPEOLUS GRANDIS* (FRIESE), NEW COMBINATION Figures 1–6, 10–17

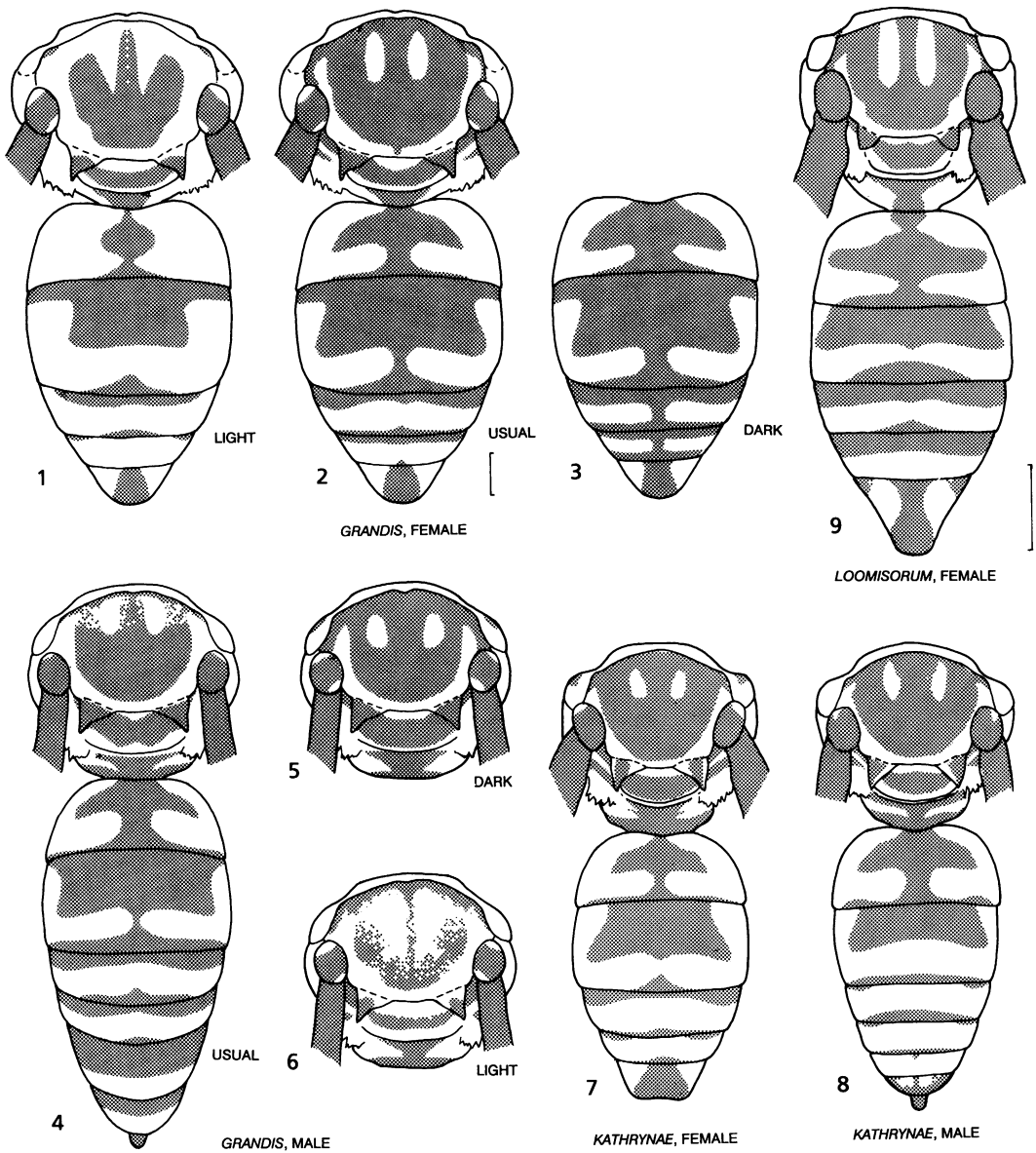
*Epeolus grandis* Friese, 1916: 338.

This species has been firmly associated with *Ptiloglossa jonesi* and *arizonensis* as revealed in the listing of host-associated specimens and in immatures recorded from the nests of the two *Ptiloglossa*. The mature larva was described and termed *Triepeolus* species A (Rozen, 1966), and its biology was addressed by Rozen (1984) as *Triepeolus* species b. Hurd and Linsley (1976) referred to this species, not by name, but as a *Triepeolus* associated with *P. jonesi*.

**DIAGNOSIS:** The large body size, strong black-and-pale (nearly white) hair pattern, and red legs of this species will distinguish both sexes from any other *Triepeolus*. In addition, the following features, described below in detail, appear to be diagnostic for females: shape and sculpturing of clypeus and supraclypeal area, sharp median preoccipital ridge, dense punctation of lower lateral mesepisternum (figs. 12, 13), characteristic pseudopygidial area (fig. 10), and unmodified metasomal sternum V (fig. 17). Males also exhibit a sharp median preoccipital ridge and dense punctation on the lower lateral mesepisternum. Features of the pygidial plate, genitalia, and sterna VII and VIII described below distinguish males of this species from those of *Triepeolus kathrynae* and other large-bodied species from the southwestern United States and adjoining northern Mexico and may well be more broadly diagnostic.

**FEMALE:** Body length 10–17 mm; length of forewing from distal end of costal sclerite to apex 8.9–12.2 mm.

**Integumental Coloration:** Vertex and frons black; supraclypeal area and clypeus usually black to very dark brown but clypeus becoming reddish along lower edge; mandibular bases and labrum red; scape, pedicel, first flagellomere, and proximal part of second flagellomere red on most specimens; on some specimens these areas more or less suffused with dark pigment but never as dark as dark-

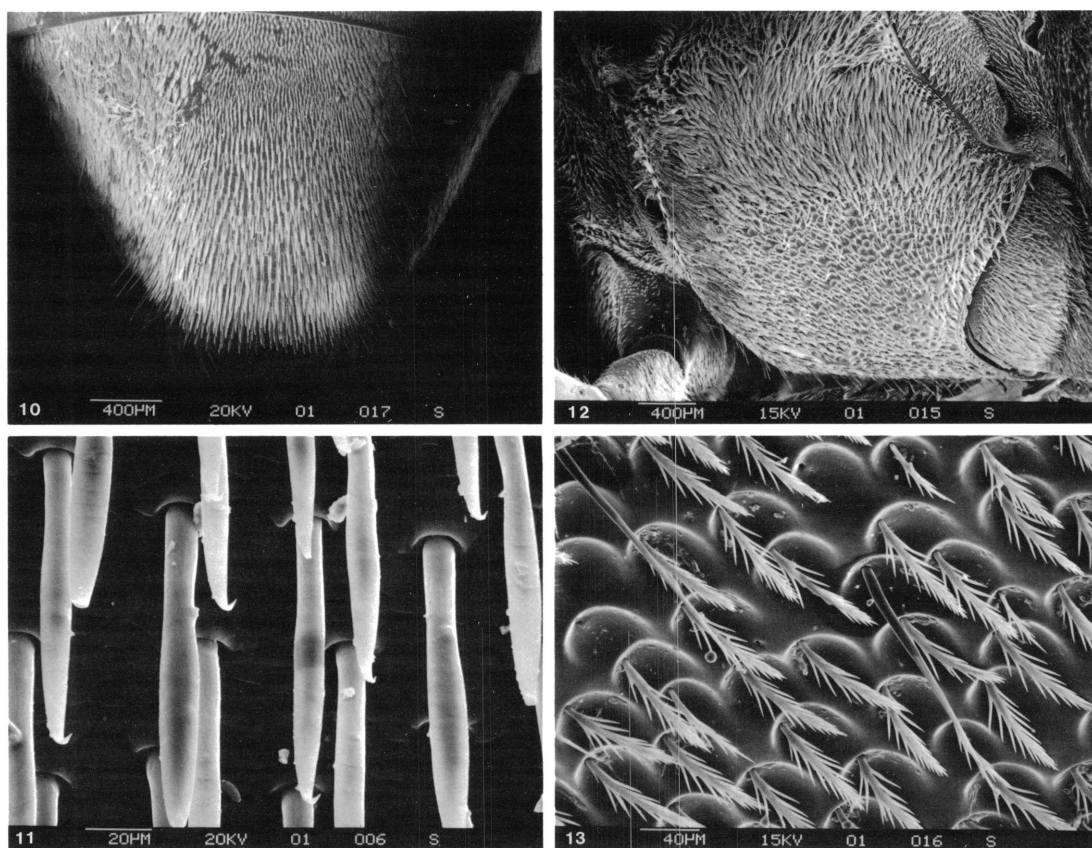


Figs. 1-9. Dorsal hair patterns of mesosoma and metasoma of three species of *Triepeolus*. Scales equal 1.0 mm and refer to figures 1-8 and to 9, respectively.

est part of flagellum; on other specimens reddish areas of flagellum more extensive especially on proximal part. Mesosoma very dark reddish brown to black. Tegulae of most specimens translucent red, concolorous with red of legs, but on some specimens tegulae opaque dark brown to almost black; wings evenly, moderately infuscated; legs red except coxae on some specimens dark; middle

and hind tibial spurs dark brown, distinctly darker than red of legs. Metasomal tergal color black to very dark brown; pseudopygidial area tending to be very dark brown; sterna very dark reddish brown to almost black but generally paler than terga.

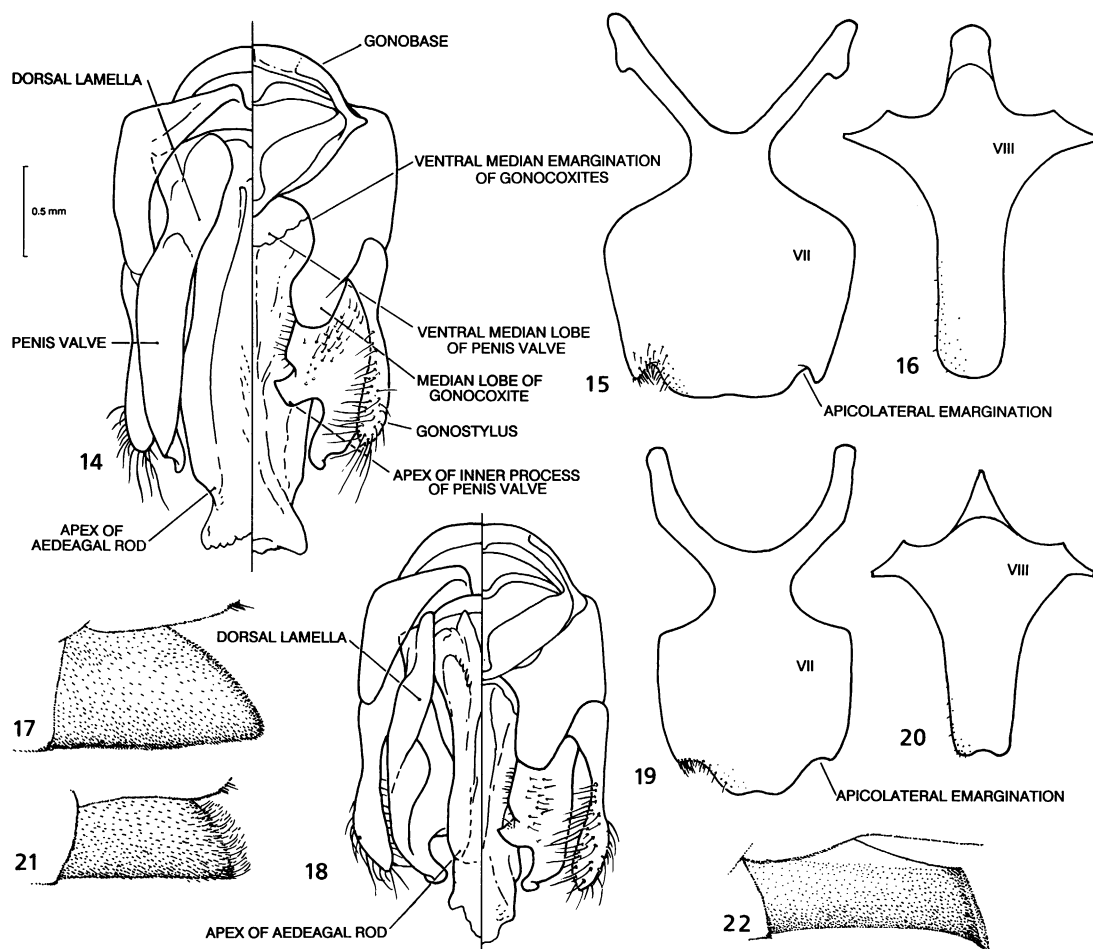
*Pubescence:* Setae in vicinity of median part of preoccipital ridge long, erect, pale cream color; those on lateral extensions of ridge



Figs. 10–13. Scanning electron micrographs of *Triepeolus grandis*, female. 10. Metasomal tergum V showing pseudopygidial area, dorsal view. 11. Close-up of special setae of pseudopygidial area to immediate right of midline, dorsal view. 12. Mesepisternum, lateral view, midcoxa to right. 13. Close-up of integument of mesepisternum in front of midcoxa, lateral view.

tending to become tan; setae of vertex sparse, dark, and therefore inconspicuous except for clump of cream-colored setae immediately behind median ocellus; setae on frons pale cream color to almost white, erect above antennae but becoming denser and recumbent at level of antennae so as to cover integument nearly completely; setae of paraocular areas recumbent, dense, and usually pale, but on many specimens variable-size triangular patch of dark setae next to eye at level of anterior tentorial pits; clypeal setae often worn away but on fresh specimens consisting of mixture of brown and pale, recumbent, plumose setae; clypeus also with sparse vestiture of fine, erect, nonplumose, brown setae; setae of genal area recumbent, those of upper part pale cream color and forming conspicuous

light spot, those of lower area dark brown and therefore inconspicuous against dark integument. Posterior margin of pronotum and margins of pronotal lobes covered with dense recumbent pale setae forming conspicuous pale band which is only very rarely interrupted medially; mesoscutum of most specimens (fig. 2) with similar band of pale setae on lateral and posterior margins extending to anterior margin of mesoscutellum and bases of axillary spines; mesoscutal disk usually with nearly black recumbent setae except for two paramedian oval spots of pale dense recumbent setae (fig. 2); this patterning variable, however, so that on some specimens pale setae appear on anterior margin of mesoscutum and often unite with paramedian spots (fig. 1); mesoscutellum with setae black except for



Figs. 14–22. 14. *Triepeolus grandis*, male genitalia, dorsal (left) and ventral (right) views. 15. Same, sternum VII of male, ventral view. 16. Same, sternum VIII of male, ventral view. 17. Same, sternum V of female, lateral view. 18. *Triepeolus kathrynae*, male genitalia, dorsal (left) and ventral (right) views. 19. Same, sternum VII of male, ventral view. 20. Same, sternum VIII of male, ventral view. 21. Same, female, sternum V, lateral view, showing long upcurved setae apically. 22. *Triepeolus loomisorum*, sternum V of female, lateral view showing downcurving of ventral profile. Scale refers to 14–16, 18–20.

those on anterior and posterior margins; axillae with setae black above except at extreme base; setae on underside of spine sometimes pale but not visible from above; hence black setae of mesoscutellum and axillae forming continuous dark, transverse band (figs. 1, 2); only rarely, few pale setae between axillae and mesoscutellum; metanotum obscured by short, pale, recumbent setae; setae of dorsolateral notal areas elongate, pale, erect; propodeum with very dense patch of recumbent, nearly white setae mesad of each spiracle; these patches becoming less dense as they extend toward midline; elsewhere propo-

deum with sparse, dark, inconspicuous setae. Setae above scrobal suture tending to be worn away but, when present, pale, semierect, and sparse; setae immediately below suture pale, recumbent, and dense so as to obscure integument; mesepisternal setae in front of mid-coxa usually black and inconspicuous so that sides of mesepisternum appear nearly white above and black below; on some specimens pale setae appear just posterior to anterior face of mesepisternum; ventral surface of mesepisternum with setae usually dark but sometimes with pale setae or mixture of both. Tegulae with sparse recumbent setae that are

pale at anterior and posterior edges but dark elsewhere. Ventral surface of front femur usually with patch of white, recumbent setae which may be more or less worn away; patch not as conspicuous and dense as that found on *Triepeolus kathrynae*; setae arising from spines on anterodorsal surface of hind tibia normally short and pale, nearly concolorous with recumbent plumose setae in same region in contrast to elongate, amber-colored simple setae arising from spines of *T. kathrynae*; recumbent setae at apical anterior flange of hind tibia mostly simple and much denser than recumbent setae elsewhere on tibia, completely obscuring integument. Pale hair pattern of metasomal terga variable as in figures 1–3; pale hairs of terga pale cream color; pale tergal bands usually briefly interrupted medially on terga I, II, and sometimes on following segments; sternal pattern of recumbent hairs variable but patterns not sharply defined although pale banding usually more or less evident marginally on sterna II–IV. Setae of pseudopygidial area described below. Setae on apical margin of sternum V extremely short (fig. 17), not much longer than other setae on sternum.

*Structure:* Preoccipital ridge behind vertex sharply acute, not rounded, at highest elevation of head; behind eye, ridge distinctly carinate; interantennal carina normally projecting, clearly exceeding eyes in lateral view; supraclypeal area also normally projecting and convex, not forming flat, shiny plane continuous with similarly modified clypeus; supraclypeal area and clypeus finely, densely, nearly contiguously punctate although on some specimens clypeus faintly shiny; alveoli of nonplumose, erect clypeal setae more or less evident; midline of clypeus usually indistinguishable from rest of clypeus, i.e., midline not normally raised and impunctate although, on a few specimens, dorsal part of midline less punctate though not raised. Axillae strongly produced, with sharp apices, well-separated from scutellum (figs. 1, 2); apices reaching well beyond transverse midline of scutellum when viewed in dorsal aspect. Mesepisternum laterad of subpleural signum densely punctate, so that shiny interspaces generally not meeting, hence few in number and irregular in shape; propodeal triangle finely tessellate, duller than in *Triepeolus*

*kathrynae*. Pseudopygidial area about as broad as long, usually oval although in some specimens somewhat triangular, consisting of moderately dense special setae, all uniformly directed posteriorly, showing little patterning with respect to size (fig. 10); these setae (fig. 11) nonplumose, moderately long, and curved upward apically; posterior margin of pseudopygidial area curved to nearly straight but never emarginate. Metasomal sternum V normally short; apex not turned down, so that in lateral view it is continuous with rest of sternum (fig. 17); surface evenly curved from side to side, i.e., without longitudinal depression creating ridge on each side.

*MALE:* Body length 11–18 mm; that of holotype 14.4 mm; length of forewing from distal end of costal sclerite to apex 8.8–12.1 mm; that of holotype 11.2 mm.

*Integumental Coloration:* Similar to that of female except red areas usually reduced; hence on some specimens mandibular bases brown to black; labrum red to reddish brown; scape, pedicel, first flagellomere occasionally red but more often scape dark brown with vague reddish areas to nearly black (dark reddish brown in holotype); first flagellomere usually red with some darkish areas, rarely if ever completely dark (in holotype mostly dark reddish brown, somewhat paler below). Mesosoma very dark reddish brown to black. Tegulae usually dark translucent red but on some specimens opaque dark brown to almost black; wings evenly, moderately infuscated; legs generally red although coxae and tarsi often darker; mid and hind tibial spurs dark brown. Metasomal tergal color black to very dark brown; sterna black to very dark reddish brown.

*Pubescence:* Setae on upper part of head as described for female; lower part of frons, paraocular areas, supraclypeal area, and clypeus covered by dense, silvery pale cream-colored pubescence obscuring most of integument on fresh specimens; gena with sparser pale recumbent pubescence although on some specimens setae brown on lower part of gena. Pronotal setae as described for female; setal color pattern of dorsum of mesosoma as described for female except most specimens with pale setae on anterior part of scutum fusing with paramedian oval spots as in figure 4; rarely paramedian oval spots (fig. 5) com-

pletely surrounded by black as is usual in female; on some specimens pale setae extending over most of scutum (fig. 6). Mesepisternum usually entirely covered with pale recumbent setae; on some specimens, however, patches of dark recumbent setae present ventrally behind fore coxae and in front of midcoxae; on very few specimens entire ventral area of mesepisternum and lower part of lower lateral mesepisternum covered with dark recumbent setae so that color pattern appears to be similar to that of most females. Vestiture of tegula and fore femur as described for female. Middle and hind coxae covered with abundant white setae; outer surfaces of all tibiae moderately sparsely covered with recumbent pale setae, less so than in males of *Triepeolus kathrynae*. Pale hair pattern of metasomal terga somewhat variable but generally as in figure 4; pale hairs pale cream color, not as yellow as those of *T. kathrynae*; sternum II with pale setae short and abundant along posterior margin and extending variable distance anteriorly; in allotype these setae occupy much of sternum; apical part of sternum III covered with recumbent white setae; on most specimens setae on apical edge elongate so as to completely obscure edge of sternum in which case these setae are curved, brushlike, and similar to apical fringe of following two sterna; on some specimens apical setae of sternum III no longer than those on rest of sternum; on still other specimens apical setae intermediate in length between these extremes; sterna IV and V with apical fringe of elongate, undulate setae varying in color from nearly white to tan to brown.

**Structure:** Head and mesosoma as described for female although punctation of clypeus and mesepisternum obscured by recumbent setae. Pygidial plate with rim low, usually unnotched apically though faintly notched on some specimens; plate with basal transverse ridge, posterior to which integument uneven, bearing scattered setae, and anterior to which integument clothed in long recumbent setae which hide surface. Metasomal sternum VII (fig. 15) with anterior margin V-shaped; basal constriction wide; apical plate broad by comparison with length; apicolateral emarginations deep in contrast to those of *Triepeolus kathrynae*; sternum VIII (fig. 16) with median apical process rounded

as seen in ventral view; dorsal lamellae at base of penis valves covering much of sclerotized portion of base of aedeagal rods (fig. 14) which extend posteriorly beyond apices of penis valves; apex of inner process of penis valve acute as seen in ventral view (fig. 14); ventral median emargination of gonocoxites much wider than distance between median lobes of gonocoxites; base of penis with semi-membranous ventral median lobe (fig. 14).

**HOST-ASSOCIATED SPECIMENS:** One female, Portal, Cochise Co., Arizona, August 31, 1982 (J. G. Rozen), collected at nest site of *Ptiloglossa arizonensis*; 1 male, 2 females, same except collected from nests of *P. arizonensis* as larvae in August 1982, emerged in laboratory, May 1983 (one pupated on May 22, 1983); 1 female, same except July 27, 1964 (J. H. Puckle, M. A. Mortenson, M. A. Cazier), collected "after being in nest no. 75" of *Ptiloglossa jonesi*; 1 female, same except collected "after being in nest no. 70 of *P. jonesi*."

**OTHER SPECIMENS:** 583 females and 560 males as follows: **ARIZONA:** *Cochise Co.:* Apache, 5 mi SW, 13 mi SW, 14 mi SW, and 22 mi SW Apache, Barfoot Park (Chiricahua Mts.), Bernardino, Carr Canyon Rd. (Huachuca Mts.), Cave Creek Ranch (Portal, Chiricahua Mts.), entrance Chiricahua National Monument, Cochise, 2 mi N Cochise, Douglas, 1 mi N, 1 mi E, 5 mi E, 6 mi NE, 7 mi NE, 14 mi NE, 16 mi NE Douglas, 15 mi N Ft. Huachuca, Huachuca Canyon, Paradise (Chiricahua Mts.), 2 mi E Paradise, Portal, 1 mi N, 1.5 mi NE, 2 mi N, 2 mi NE, 2 mi E, 5 mi E, 2.5 mi NE, 2.9 mi NE, 4 mi SW, 5 mi NE, 7 mi NE, 10–13 mi W Portal, Rustler Park to Flys Peak (8400–9000 ft, Chiricahua Mts.), San Simon Road mouth Keating Canyon, Skeleton Canyon, SWRS (5 mi W Portal, Chiricahua Mts.), 7 mi W SWRS (Chiricahua Mts.), Tombstone, Texas Canyon (Chiricahua Mts.), 6 mi SE Willcox; *Coconino Co.:* Oak Creek Canyon (6000 ft); *Pima Co.:* Madera Canyon (Santa Rita Mts.), Tucson; *Santa Cruz Co.:* 4.5 mi N Harshaw (4200 ft), Peña Blanca Lake, 3 mi N, 10 mi E Sonoita, Sonoita River (Patagonia); *Yavapai Co.:* Bridgeport, 4 mi N Chino Valley. **NEW MEXICO:** *De Baca Co.:* 7 mi S Ft. Sumner; *Eddy Co.:* Carlsbad; *Hidalgo Co.:* 8 mi E, 19 mi S, 21 mi S, 22 mi S, 23 mi S, 24 mi S, 29

mi S Animas, Antelope Pass (5 mi W Animas), Cienega Lake, Granite Pass, Rodeo, 1 mi N, 1 mi W, 1 mi S, 1.5 mi S, 2 mi N, 2 mi NW; *Luna Co.*: Deming; *Sierra Co.*: Elephant Butte.

MEXICO: CHIHUAHUA: 42 mi SW Camargo (4900 ft), Delicias, 18 mi W Jimenez, 6 mi NE Meoqui, 5 mi W Parrita (Santa Clara Cyn.), Santa Barbara. DURANGO: 8 mi S Canutillo, 12 mi SW Durango, Encino, 34 mi NW La Zarca (5800 ft), Nombre de Dios, San Juan del Rio, Villa Madero (6700 ft), Yerbanis (Cuencame Dist.). JALISCO: 6 mi NE Jalastitlan (6000 ft), 15 mi NE Lagos de Moreno (6600 ft). NAYARIT: Jesus Maria. TAMAULIPAS: 15 mi NE Juamava (2500 ft). ZACATECAS: 5 mi S Fresnillo, Sain Alto (7000 ft), 15 km E Sombrerete.

Collectors: W. F. Barr, S. Beshers, D. J. Brothers, C. Cazier, M. A. Cazier, J. A. Chemsak, J. H. Davidson, J. M. Davidson, J. Doyen, H. E. Evans, M. Favreau, W. J. Gertsch, S. A. Gorodenski, S. J. Hessel, P. D. Hurd, W. W. Jones, D. Kolner, M. A. Kolner, G. Krueger, R. L. Langton, E. G. Linsley, J. M. Linsley, C. D. MacNeill, J. W. MacSwain, B. Malkin, R. McGinley, C. D. Michener, D. R. Michener, A. Michelbacher, M. Michelbacher, M. A. Mortenson, E. Ordway, J. Powell, J. H. Puckle, V. Roth, B. L. Rozen, J. G. Rozen, K. C. Rozen, R. Schrammel, R. F. Smith, F. H. Snow, H. Spieth, M. Statham, P. H. Timberlake, H. Townes, C. Vaurie, P. Vaurie, J. A. Woods, and R. Zweifel.

Dates of Collection: June 18 to September 19; see table 1.

Host Plants: *Cleome jonesii*, *Eysenhardtia polystachya*, *Melilotus alba*, *Ceanothus* sp., *Euphorbia albomarginata*, *Kallstroemia grandiflora*, *Larrea tridentata*, *Asclepias subverticillata*, *Monarda pectinata*, *Baccharis glutinosa*, *Gaillardia pulchella*, *Helianthus annuus*, *Senecio douglasii*, *Verbesina encelioides*.

REMARKS: The type of *Triepeolus grandis*, a male (Jacubaya, Mexico, 1900, Barrett [collector]), differs from most males by having reduced reddish markings on the antennae and having the pale paramedian oval spots on the mesoscutum reduced so that they are completely surrounded by black. However,

these features seem typical for other males collected in Chihuahua and Durango, and females associated with these males are clearly conspecific with other females treated here.

The many specimens collected in and near Portal, Arizona, tend to be larger and have more extensive pale pubescent areas compared with samples from elsewhere. However, I can identify no structural differences between this local population and others. A number of specimens of *Triepeolus* structurally similar to *T. grandis* have been collected along the west coast of Mexico but have not been included in the above description. Differing primarily by their black legs, they may be *T. grandis*, but, until the genus is revised, their status remains uncertain.

Most species of *Triepeolus* from the Southwest and northern Mexico have a similar, striking black-and-white color pattern in conjunction with red legs. E. Gorton Linsley, upon reading this manuscript, suggested that this is probably a case of Müllerian mimicry rather than of Batesian mimicry because there is no obvious model and, for that matter, the bees are quite capable of stinging.

Collection records indicate that this species is most abundant in July, August, and the first half of September and that males and females appear synchronously (table 1).

First Paul D. Hurd, Jr., and then I (before I learned that the species had already been described) had intended to name this *Triepeolus* in honor of Dr. Mont A. Cazier, the founder of the Southwestern Research Station. The existence of the station has added substantially to our knowledge of the ecology, behavior, and systematics of many groups of organisms in the Southwest. Melittology has especially benefited from this facility because of the rich bee fauna of the region. Dr. Cazier himself has contributed to these studies. As a case in point, he was the first to associate any *Triepeolus* (this species, as it turned out) with *Ptiloglossa* and with *Protoxaea* (*T. kathrynae*), and his collecting larvae of *T. grandis* and *kathrynae* from their hosts' nests permitted me to describe and compare them with other Nomadinae more than 20 years ago (Rozen, 1966). However, Friese provided a name for the species more than 70 years earlier, and certainly the name *grandis* is appropriate for this large, handsome species.



PUPA OF *TRIEPEOLUS GRANDIS* (FRIESE)  
Figures 23, 24

The following is the first description of a pupa of the Epeolini, although pupae of *Odyneropsis* and *Epeolus* were referred to in a key (Rozen and McGinley, 1974).

DIAGNOSIS: The pupa of *Triepeolus grandis* runs to *Epeolus* in the key to pupal Nomadinae in Rozen and McGinley (1974). Specimens of *Triepeolus grandis* and *Epeolus pusillus* Cresson are nearly identical, the differences being in body size and the relative sizes of the sharp-pointed, spine-tipped, usually apically pigmented tubercles. These are referred to as sharp-pointed tubercles in the following description. The patterning of these tubercles is nearly identical in the two representatives.

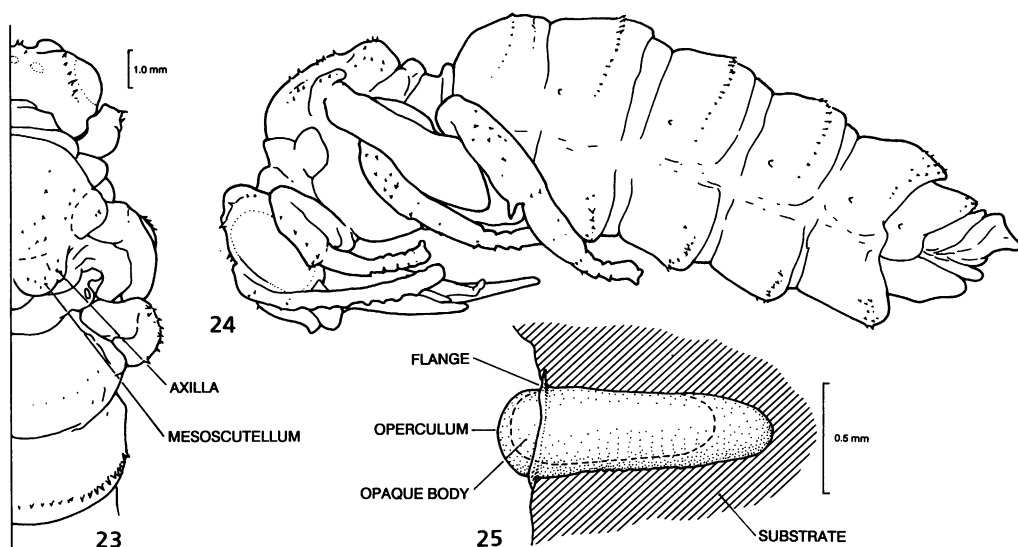
HEAD: Integument without setae. Vertex with linear series of variably sized but small, sharp-pointed tubercles; frons with similar tubercles, especially medially; clypeus with scattered similar tubercles; scape with very small sharp-pointed tubercles especially near apex; basal flagellomere with several very small, sharp-pointed tubercles; genal tubercles absent; apicolateral angles of clypeus without downward-directed, rounded tubercles (characteristic of the Ammobatini); mandible nontuberculate.

MESOSOMA: Setae absent. Outer angles and posterior lobes of pronotum moderately produced. Mesepisternum without tubercles; mesoscutum without large rounded tubercles but with numerous variably sized but small, sharp-pointed tubercles; axilla moderately produced, with scattered sharp-pointed tubercles; mesoscutellum bilobed, with each lobe bearing scattered sharp-pointed tubercles; neither metanotum nor propodeum produced. Tegula without rounded tubercle but with several very small sharp-pointed tubercles; wings without tubercles or swellings. All coxae, trochanters, and femora without tubercles; all tibiae bearing scattered sharp-pointed tubercles on outer aspects, especially toward apices; basitarsi and some other tarsal segments with scattered sharp-pointed tubercles.

METASOMA: Tergum I with submarginal row of sharp-pointed tubercles which are appreciably smaller than those of following seg-

TABLE 1  
Dates of Capture of *Triepeolus grandis*, *kathrynae*, and *loomisorum*, by Sex

	June	July	August	September	
<i>grandis</i>					+
male	•	•	•	•	
female	•	•	•	•	
<i>kathrynae</i>					
male		•	•	•	
female	•	•	•	•	
<i>loomisorum</i>					
female			•	•	+



Figs. 23–25. 23, 24. *Triepeolus grandis*, female pupa, dorsal and lateral views, respectively. 25. *Triepeolus loomisorum*, lateral view of egg embedded in substrate, drawn live. Two scales refer respectively to figures 23 and 24 and to 25.

ment; terga II–IV (female) and II–VI (male) each with submarginal row of sharp-pointed tubercles; tergum V of female with tubercles more apical and not arranged in distinct row; tergum VI of female with apical tubercles but not medially; tergum VII of male with apical tubercles not arranged in distinct row; sterna II–V with apical tubercles mostly arranged in rows; these tubercles especially well developed toward sides of sterna II–IV; sterna II–VI of male with apical rows of sharp-pointed tubercles. Apex of metasoma rounded, without distinct terminal spine.

**MATERIAL STUDIED:** 1 female pupa, Portal, Cochise Co., Arizona, collected as larva August–September 1982, preserved as pupa May 26, 1983 (J. G. Rozen) from nest of *Ptiloglossa arizonensis*; 1 male pupa, same except preserved as pupa July 11, 1983; 1 female pupa, same except preserved as pupa July 18, 1983.

ADULTS OF *TRIEPEOLUS KATHRYNAE*,  
NEW SPECIES

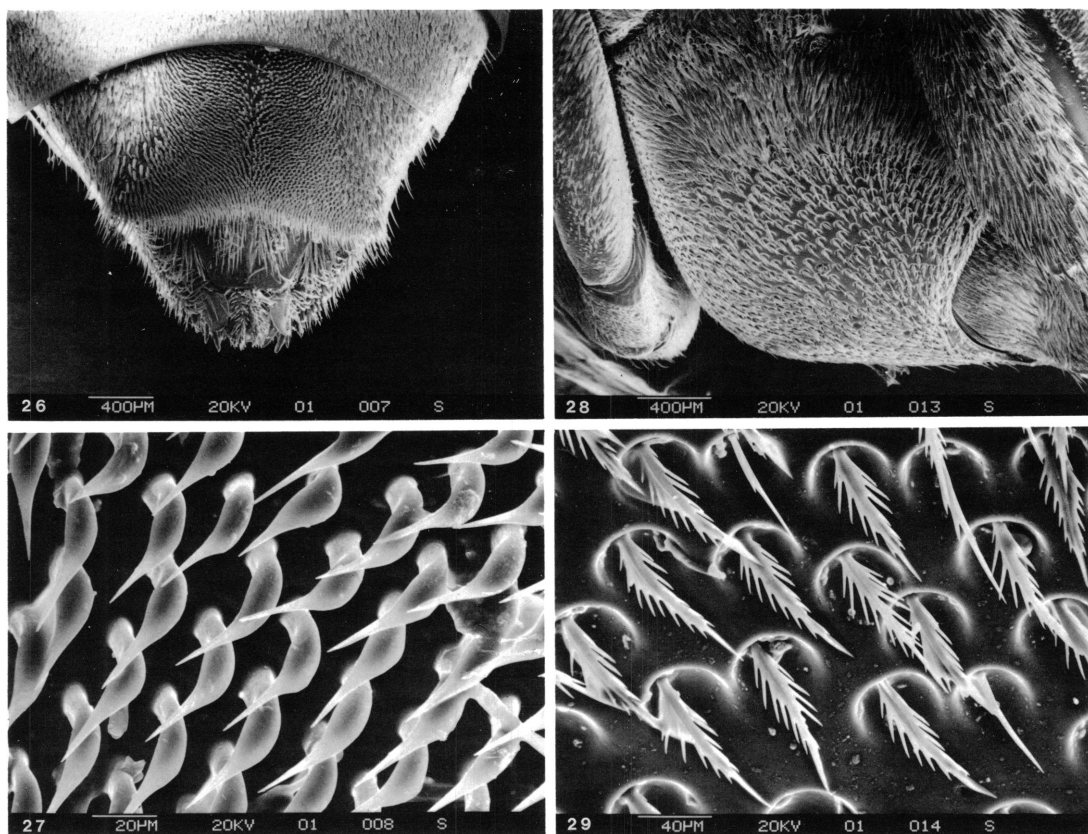
Figures 7, 8, 18–21, 25–32

This species is believed to be the one whose mature larva was described as *Triepeolus* species B by Rozen (1966) and whose host association with *Protoxaea* was discussed by Hurd and Linsley (1976), all because of a

single voucher specimen (host associate paratype) recorded below.

**DIAGNOSIS:** This species, though large, is generally smaller than *Triepeolus grandis* with which it shares a similar, but not identical, color pattern including red legs. However, the tergal bands tend to be slightly yellower and thicker in *T. kathrynae*. The shiny, continuous interpuncture surface of the lower part of the sides of the mesepisternum of *T. kathrynae* (fig. 28) is diagnostic for distinguishing it from *T. grandis* (fig. 12). Although the patterning of the dark and light hairs of the mesosoma is similar, male and female *T. kathrynae* characteristically have pale setae on the sides of the axillary spines (figs. 7, 8), whereas the axillae of *T. grandis* (figs. 1, 2) appear totally dark when viewed from above. The females of *T. kathrynae* (fig. 21) have a distinctive long fringe of brown, upcurving setae on the apical margin of sternum V, a feature uncommon if not unique for the genus. Males can be further distinguished from those of *T. grandis* by features of the pygidial plate, the subgenital sterna, and genitalia described below.

**FEMALE:** Body length 11–14 mm; that of holotype 12 mm; length of forewing from distal end of costal sclerite to apex 9.7–10.8 mm; that of holotype 9.9 mm.

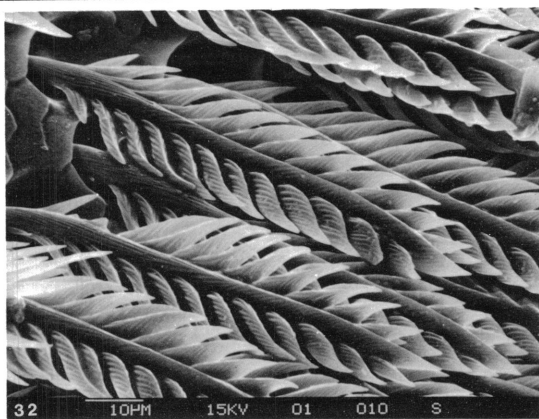
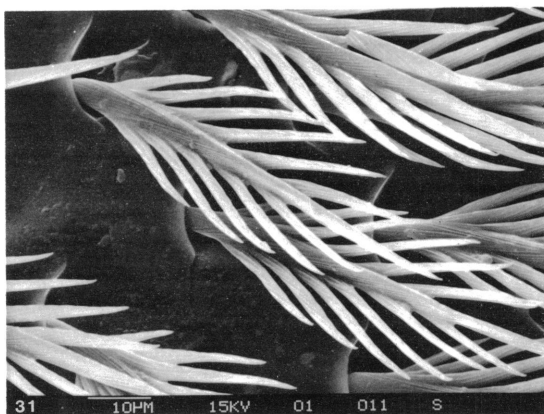
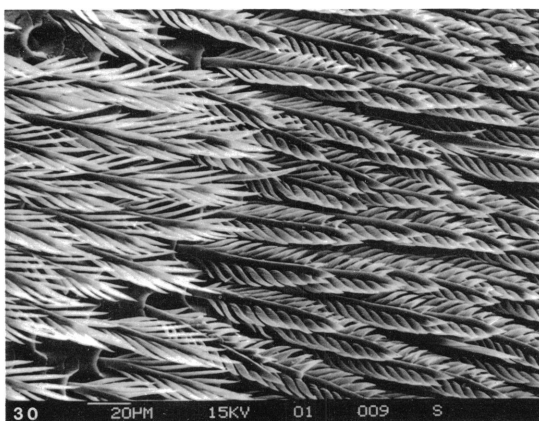


Figs. 26–29. Scanning electron micrographs of *Triepeolus kathrynae*, female. 26. Metasomal tergum V, showing pseudopygidial area and specialized setae, dorsal view. 27. Close-up of special setae to immediate right of midline, dorsal view. 28. Mesepisternum, lateral view, midcoxa lower right. 29. Close-up, integument of mesepisternum in front of midcoxa, lateral view.

**Integumental Coloration:** Vertex, frons, supraclypeal area, and clypeus black; lower margin of clypeus sometimes very dark brown; mandibular bases and labrum usually dark reddish, often with labrum blackish at base; occasionally, as in holotype, these areas very dark reddish brown; scape, pedicel, first flagellomere, and basal part of second flagellomere red and reddish coloring extending along one side of rest of flagellum; only in specimen from Texas scape, pedicel, and first flagellomere suffused with brown. Mesosoma black or nearly so. Tegulae translucent reddish brown, essentially concolorous with legs; wings evenly, moderately infuscated; legs mostly red except on specimen from Texas legs darker so that hind femur and tibia medium reddish brown; middle and hind tibial spurs dark brown. Metasomal terga black to

very dark brown; pseudopygidial area very dark brown to black; sterna very dark reddish brown to almost black.

**Pubescence:** Setae on head very much as described for *Triepeolus grandis* except: setae tending to be shorter, setae of supraclypeal area dark on some specimens, a few setae immediately adjacent to inner orbits often brown, and recumbent setae of clypeus often dark. Pronotum with pale setae forming conspicuous transverse band similar to, but not as dense or thick as, that of *T. grandis*; mesoscutum with band of pale setae on lateral and posterior margins similar to, but somewhat thinner than, that of *T. grandis*; this band extending to anterior margin of mesoscutellum and bases of axillary spines; mesoscutal disk with dark recumbent setae that are very dark brown, sometimes reflecting reddish;



Figs. 30–32. Scanning electron micrographs of *Triepeolus kathrynae*, female, setae of dorsum of metasoma. 30. Micrograph showing dark setae (appearing lighter) to left and pale setae (appearing darker) to right. 31. Microstructure of dark setae. 32. Microstructure of pale setae.

anterior part of disk with pair of paramedian, narrowly oval spots of pale setae; these spots well defined (fig. 7) and not extending to anterior margin of scutum in contrast to some specimens of *T. grandis*; axillae with dark setae above but both inner and outer sides of each spine outlined with pale setae that extend to apex of spine as seen from above (fig. 7); hence dark areas of axillae and mesoscutellum not forming continuous transverse dark band; metanotum obscured by short, recumbent pale setae; setae of dorsolateral notal areas elongate, pale; propodeal setae as described for *T. grandis*. Setae above scrobal suture pale, semierect, and moderately sparse, immediately below suture pale, recumbent, and dense so as to obscure integument; mesepisternal setae in front of midcoxae inconspicuous, dark against black background;

hence sides of mesepisternum light above, dark below. Ventral surface of front femur with dense patch of white, recumbent setae, more conspicuous than that of *T. grandis*; setae arising from spines on anterodorsal surface of hind tibia elongate, semierect, amber-colored, hence quite different in appearance from recumbent plumose setae in same region; recumbent setae on apical anterior flange of hind tibia mostly plumose, not much denser than setae elsewhere on leg and not obscuring flange. Pale hair pattern on metasomal terga (fig. 7) approximately same as that typical of *T. grandis* except hair band of tergum II rarely interrupted medially; pale hairs of terga cream color, slightly more yellow than those of *T. grandis*; setae on margins of sterna II–IV recumbent, pale. Setae of pseudopygidial area described below. Setae on apical

margin of sternum V (fig. 21) brown, elongate, two or three times longer than setae on rest of sternum, forming dense, upcurving fringe; hence this species quite different from *T. grandis* which lacks such fringe.

**Structure:** Head as described for *Triepeolus grandis* except that supraclypeal area and clypeus more heavily punctate so that alveoli of nonplumose setae less evident than in *T. grandis*. Axillae sharp-pointed, as described for *T. grandis*. Mesepisternum laterad of subpleural signum less densely punctate than in *T. grandis* so that shiny interspaces generally meeting; propodeal triangle very finely tessellate, shinier than in *T. grandis*. Pseudopygidial area about as broad as long, distinctly triangular, consisting of dense special setae that are directed toward the midline (fig. 26); these setae (fig. 27) nonplumose, very short, and markedly curved toward the midline; apical edge of pseudopygidial area with shallow, broad, inverted V-shaped median emargination. Metasomal sternum V (fig. 21) as described for *T. grandis* (exclusive of setae, see above).

**MALE:** Body length 12–13 mm; that of allotype 12.5 mm; length of forewing from distal end of costal sclerite to apex 9.2–11.3 mm; that of allotype 11.2 mm.

**Integumental Coloration:** Head as described for female except generally darker so that bases of mandibles and labrum usually blackish; scape, pedicel, and first flagellomere brownish although often paler than rest of flagellum. Mesosoma black or nearly so. Tegulae translucent brownish but darker at base; wings as in female; legs mostly reddish brown although upper surfaces of tibiae somewhat darker; occasionally legs almost brown in which case they tend to be concolorous with apical spurs. Metasomal tergal color black to very dark brown; sterna dark reddish brown to dark brown.

**Pubescence:** Setae on head as described for *Triepeolus grandis*. Pattern of dorsal setae of mesosoma (fig. 8) as described for female; hence males not easily confused with those of *T. grandis* in which paramedian oval spots fusing with pale marginal setae (figs. 4, 6). Mesepisternum covered with recumbent setae; those immediately below scrobal suture nearly white and dense so as to obscure integument; setae in front of midcoxa short,

sparse so as not to obscure integument, and pale on some specimens, brown on others, and mixed on still others; setae on ventral part of mesepisternum mostly brown. Vestiture on legs as described for female except recumbent pale setae more conspicuous owing to generally darker integumental color; outer surface of all tibiae moderately densely covered with recumbent pale setae, distinctly more dense than in males of *T. grandis*. Pale hair pattern of metasomal terga as in figure 8; pale hairs cream color, yellower than those of *T. grandis*; pale hair pattern of metasomal terga approximately same as that of *T. grandis* except marginal band of terga II never interrupted medially; sternum II with most of posterior half covered with pale, short, recumbent setae; exposed parts of sterna III and IV covered with pale setae; only sterna IV and V with apical fringe of long, curved, and nearly white setae.

**Structure:** Head and mesosoma as described for female. Pygidial plate with pronounced, apically unnotched rim; plate without transverse basal ridge; integument toward apex more finely and regularly pitted than in *Triepeolus grandis*; integument of basal part covered with small contiguous pits and bearing fine setae that do not obscure integument. Metasomal sternum VII (fig. 19) with anterior margin U-shaped, broadly rounded; basal constriction wide, even wider than that of *Triepeolus grandis*; apical plate only moderately broad in comparison with length, narrower than that of *T. grandis*; apicolateral emarginations shallow in contrast to those of *T. grandis*; sternum VIII (fig. 20) with median apical process subtruncate and with shallow median indentation; dorsal lamellae at base of penis valves (fig. 18) reduced, not covering much of base of aedeagal rods; aedeagal rods (fig. 18) ending well before apices of penis valves; apex of inner process of penis valve obtuse as seen in ventral view (fig. 18); ventral median emargination of gonocoxites about as wide as distance between median lobes of gonocoxites; base of penis (fig. 18) with reduced (or without) ventral median lobe.

**TYPES:** Holotype, female, 11 mi N Rodeo, Hidalgo Co., New Mexico, August 19, 1968 (J. G. Rozen, M. Favreau); allotype, Southwestern Research Station, 5 mi W Portal,

Cochise Co., Arizona, 5400 ft, August 15, 1956 (E. Ordway); in the collection of the American Museum of Natural History. Host-associated paratypes: 1 female, 1 mi N Rodeo, Hidalgo Co., New Mexico, August 23, 1963, 1:48 p.m. (M. A. Cazier, M. Mortenson) taken at *Protoxaea* #10 burrow as it investigated entrance.

OTHER PARATYPES: 28 female, 24 male paratypes as follows: ARIZONA: *Cochise Co.*: 1 mi E Douglas, 7 mi N Elfrida, 1.5 mi NE Portal (4600 ft), 2 mi E, 2 mi NE, 5 mi W Portal; *Pima Co.*: Madera Canyon (Santa Rita Mts.); *Santa Cruz Co.*: Tumacacori. NEW MEXICO: *Eddy Co.*: 5 mi N Carlsbad; *Hidalgo Co.*: 1 mi N, 2 mi NW, 4.5 mi N, 11 mi N Rodeo. TEXAS: *Culberson Co.*: 17 mi S Kent; *Dimmit Co.*: Carrizo Springs.

MEXICO: BAJA CALIFORNIA SUR: 11 km W Santiago (Cañon de la Zorra, 285 m). CHIHUAHUA: 18 mi W Jimenez. DURANGO: 8 mi S Canutillo, San Juan del Rio. GUERRERO: Mexcala. MORELOS: 4.3 mi W Yautepec (4000 ft). NUEVO LEON: Vallecillo. SONORA: 10 mi W Alamos.

COLLECTORS: Bradts, C. Cazier, M. A. Cazier, J. H. Davidson, J. M. Davidson, L. Draper, H. E. Evans, M. Favreau, E. Fisher, W. J. Gertsch, P. D. Hurd, E. G. Linsley, J. M. Linsley, J. W. MacSwain, Marston, C. D. Michener, M. A. Mortenson, E. Ordway, J. H. Puckle, B. L. Rozen, J. G. Rozen, R. Schrammel, M. Statham, C. Vaurie, P. Vaurie, R. Westcott.

DATES OF COLLECTION: June 4 to September 21.

HOST PLANTS: *Melilotus alba*, *Kallstroemia grandiflora*, *Asclepias subverticillata*, *Baccharis* sp., *Verbesina encelioides*.

ETYMOLOGY: This species is named in celebration of Kathryn Gail Rozen-Gagnon.

REMARKS: Although essentially sympatric with *Tripeolus grandis*, this species is apparently far less abundant. In southeastern Arizona and southwestern New Mexico, it has been collected only from July 24 to the end of August. However, a single female was captured on June 10, 1948, at Carrizo Springs, Dimmit Co., Texas; a male, on July 3, 1963, at 17 mi south of Kent, Culberson Co., Texas; and a female, on September 21, 1956, 5 mi north of Carlsbad, Eddy Co., New Mexico.

An examination of the dorsal recumbent

setae of the metasoma (figs. 30–32) (i.e., the setae that account for the strong visual pattern of the metasoma) of this species through a scanning electron microscope (SEM) revealed that the pale setae are structurally different from the dark ones. Although both types of setae have a central shaft (rachis), the plumosities (barbs) on the light hairs are shorter, more uniform in length, thicker at their bases, and more distinctly striate (fig. 32). In contrast, dark setae have long basal barbs but short apical ones, and the striations are distinct but less obvious (fig. 31). These dissimilarities in structure may affect the tone value of the setae to some extent, but examination under a light microscope showed that the dark setae were distinctly pigmented whereas the pale ones were not. Through the SEM the dark setae appear lighter in value than the pale setae (fig. 30) for some unknown reason.

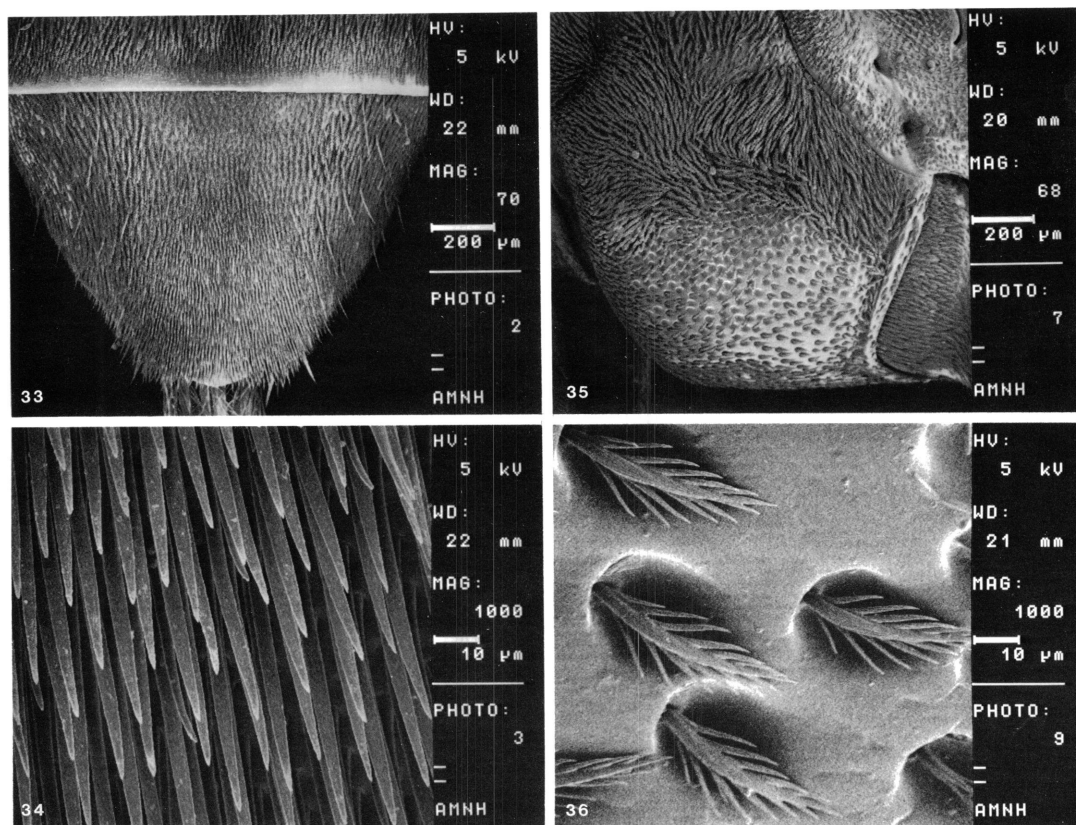
The dorsal metasomal setae of the other two species described in this paper are basically similar to those of *Tripeolus kathrynae*. However, the mesepisternal recumbent setae in front of the midcoxae of females show some variation of taxonomic significance. In *T. kathrynae* (fig. 29), the rachis of these setae bears few barbs toward the apex compared with the dense brush of apical barbs found on *T. grandis* (fig. 13). In *T. loomisorum* (fig. 36), these setae resemble those of *T. kathrynae* except the rachis is far less attenuate.

#### ADULTS OF *TRIEPEOLUS LOOMISORUM*, NEW SPECIES

Figures 9, 22, 33–36

In southeastern Arizona and southwestern New Mexico, the known range of this species, there are at least eight small species of *Tripeolus* (probably mostly undescribed), the females of which are distinctive because of sex-limited features of the apexes of their metasomas. Males of these species are similar to one another, and large series of both sexes of a single species from one locality have not been collected. Hence association of the sexes is uncertain. For that reason *T. loomisorum* is described on the basis of the female alone.

DIAGNOSIS: Because of its much smaller size, this species will not be confused with



Figs. 33–36. Scanning electron micrographs of *Triepeolus loomisorum*, female. 33. Tergum V, showing very fine, dense setae of pseudopygidial area, dorsal view. 34. Close-up of special setae of pseudopygidial area to immediate right of midline, dorsal view. 35. Mesepisternum, lateral view, midcoxa to right. 36. Close-up of integument of mesepisternum in front of midcoxa, lateral view.

*Triepeolus grandis* or *T. kathrynae* in spite of the fact that they exhibit remarkably similar, bold color patterns of pale markings against a black body and red legs, a pattern that is repeated among numerous species from the Southwest (and undoubtedly northern Mexico). From the many species of similar size (as well as from *T. grandis* and *kathrynae*), it can be distinguished by its elongate velvety pseudopygidial area (fig. 33) composed of fine, parallel setae (finer than any other species of similar size from the Southwest) and by its downcurved sternum V (fig. 22), as seen in lateral view.

**FEMALE:** Body length 6.5–9 mm; that of holotype 7.2 mm; length of forewing from distal end of costal sclerite to apex 4.5–5.2 mm; that of holotype 5.1 mm.

**Integumental Coloration:** Vertex and frons black; supraclypeal area black; clypeus very

dark brown to brown except apical margin reddish; mandibular bases and labrum red; scape, most or all of pedicel, and part of first flagellomere red; other flagellomeres brown above fading to reddish below. Mesosoma black above, except for pronotal tubercles which are reddish (though partly obscured by setae), and brownish on sides. Tegulae translucent red, concolorous with red of legs; wings only faintly infuscated; legs red except coxae on some specimens darker; middle and hind tibial spurs dark brown. Metasomal tergal color black to very dark brown except apically reddish brown, especially on pseudopygidial area; sterna dark reddish brown to reddish brown, generally paler than terga.

**Pubescence:** Setae in vicinity of median part of preoccipital ridge short, recumbent, usually pale cream color but on some specimens (including holotype) with admixture of tan



setae; setae of vertex tan, moderately dense, recumbent, plumose, hence moderately conspicuous; these setae become denser and paler so that in vicinity of antennae nearly white and obscuring integument; setae on supra-clypeal area, lower corners of paraocular areas, and clypeus recumbent and moderately sparse so that integument visible even on unworn specimens; nonplumose, fine setae of clypeus suberect, short, brown, scarcely noticeable; setae of genal area short, plumose, moderately sparse, recumbent, pale. Posterior margin of pronotum and margin of pronotal lobes covered with dense, pale recumbent setae which form pale transverse band that is occasionally briefly interrupted medially and usually interrupted on each side between lateral lobe and posterior margin of pronotum; mesoscutum (fig. 9) with narrow lateral patch of pale setae in front of tegula (this patch not reaching prothorax); these setae extending around tegular emargination on most (but not all) specimens, becoming conspicuous white spot mesad of posterior part of tegula, and then forming narrow pale band running along posterior margin of scutum; pale setae also on anterior margin of mesoscutellum and perhaps extreme base of axilla; mesoscutal disk with nearly black recumbent setae except for two paramedian elongate oval pale setal spots which on some specimens reach or nearly reach prothorax; these spots always sharply defined, never uniting or broadly fusing with pale of prothorax; mesoscutellum black except for narrow band along anterior margin and somewhat wider band along posterior margin which becomes even wider laterally so as to silhouette dark axillae as seen from above; metanotum obscured by short, recumbent, nearly white setae; setae of dorsolateral notal areas elongate, pale, erect; propodeum usually densely covered with nearly white recumbent setae mesad of each spiracle to or nearly to propodeal triangle so that triangle usually well defined except ventrally; setae on side of propodeum recumbent, very short, and pale. Mesepisternum with setae above and immediately below scrobal suture pale, recumbent, and dense so as to obscure integument; mesepisternal setae in front of midcoxae usually dark, always short, sparse, often worn away; ventral surface of mesepisternum with setae mostly pale, recumbent, and moderate in density, so that integument

visible. Tegulae with setae obscure. Ventral surface of front femur with recumbent setae not forming distinct patch; setae arising from spines on anterodorsal surface of hind tibia normally short and pale, nearly concolorous with recumbent setae in same region; recumbent setae on apical anterior flange of hind tibia apparently mostly plumose (but branches of more apical setae very short), sufficiently dense only apically to obscure integument. Pale hair pattern of metasoma as in figure 9; tergal pale hairs pale cream color; marginal hair bands briefly interrupted medially on tergum I, sometimes very briefly interrupted medially on tergum II, and rarely if ever interrupted on III; sternal pattern of recumbent hairs not sharply defined although pale recumbent setae most evident on apical parts of sterna II-IV; sternum V covered with very short recumbent reddish setae similar to background color; setae at apical edge of sternum tending to be nearly black, erect, and about as long as other setae on sternum.

*Structure:* Preoccipital area behind vertex rounded so that preoccipital ridge appears as indistinct fine line, lower than maximum height of vertex; behind upper part of compound eye, ridge not evident; behind lower part of eye, ridge expressed merely as obtuse angle of integument although acute faint carina sometimes evident below; interantennal carina projecting normally, exceeding eyes in lateral view; supra-clypeal area normally projecting and normally convex; supra-clypeal area and clypeus finely, densely punctate but punctures generally not contiguous so that clypeus, when not obscured by recumbent setae, faintly shiny as result of reflections from interpuncture areas; alveoli of nonplumose suberect clypeal setae more or less evident; unelevated, impunctate midline usually discernible on upper part of clypeus. Axillae acute but weakly produced and not sharp-pointed; apices scarcely if at all reaching transverse midline of scutellum when viewed in dorsal aspect. Mesepisternum (fig. 35) laterad of subpleural signum moderately densely, finely punctate so that shiny interspaces expressed on most specimens; propodeal triangle shagreened but still somewhat shiny. Pseudopygidial area as defined by special setae somewhat longer than broad, with widest part subapical; pseudopygidial surface (fig. 37) gently, anteroposteriorly curved, covered with



very fine, very dense, uniform special setae (fig. 34), all directed posteriorly and with apices slightly curved upward; hence these setae similar to but denser, finer, and straighter than those of *T. grandis*; this vestiture velvetlike; posterior edge of pseudopygidial area gently curved. Metasomal sternum V slightly elongate; apex turned down so that in lateral view (fig. 22) lower profile distinctly curved; surface evenly curved from side to side, i.e., without longitudinal depressions creating ridge on each side.

MALE: Unknown.

TYPES: Holotype female, 13 mi SW Apache, Cochise Co., Arizona, September 1, 1988 (E. Quinter); in the collection of the American Museum of Natural History. Host-associated paratype (pinned with female of *Xenoglossodes eriocarpi* (Cockerell),<sup>2</sup> both specimens taken together at nest entrance) same data as holotype except August 30, 1988 (J. G. Rozen and E. Quinter).

OTHER PARATYPES: 42 female paratypes as follows: ARIZONA: *Cochise Co.*: Apache, 2 mi E, 11 mi S, 13 mi SW, 17.5 mi SW Apache, 8 mi NE, 16 mi NE Douglas, 4 mi SW Rodeo (Hidalgo Co., N. M.), Skeleton Canyon (Peloncillo Mts.). NEW MEXICO: *Hidalgo Co.*: Rodeo, 1 mi N Rodeo. TEXAS: *Jeff Davis Co.*: 41 mi NE Ft. Davis (4500 ft).

COLLECTORS: Baker, E. Brewster, M. A. Cazier, M. Favreau, T. M. Favreau, J. Hessel, Kamm, M. A. Mortenson, J. H. Puckle, E. Quinter, A. Roig Alsina, B. L. Rozen, J. G. Rozen, K. C. Rozen, M. Statham.

DATES OF COLLECTION: August 21 to September 15; see table 1.

HOST PLANT: *Pectis papposa*.

ETYMOLOGY: I take pleasure in naming this species for Mr. and Mrs. Alfred Lee Loomis, Jr., in recognition of their interest in and concern for entomological field research and the American Museum of Natural History.

BIOLOGY: Females of *Xenoglossodes eriocarpi* and *Triepeolus loomisorum* were moderately abundant on August 30 and 31, 1988, at 13 mi southwest of Apache, Cochise County, Arizona. I identified *X. eriocarpi* as the host of *T. loomisorum* when I saw a returning, pollen-laden female of *Xenoglossodes* unable to locate her nest entrance because I

had accidentally covered it with a rock. The female of *Triepeolus loomisorum* hovered about the *Xenoglossodes* female as she made numerous attempts to enter the ground over a period of five minutes after I had removed the rock. The persistent relationship of the two females at this particular spot of ground strongly indicated a nest entrance. Both females were netted and the nest entrance subsequently uncovered.

The entrance was in a rock-strewn slope at the base of an abandoned railroad bed where there was no shade. Rocky on the surface, the soil below was moist and composed of fine, sticky decomposed lava with some pebbles and a few dead roots. The entrance apparently had been open, and the burrow (4.00–4.25 mm in diameter) descended vertically with only slight bending for the first 20 cm. Two centimeters below the surface, a blind side tunnel descended downward at a 45° angle for about 4 cm. Below 20 cm, the open main tunnel bent and descended at about 45° for 9 cm and then abruptly turned 90° horizontally and continued to descend at about 45° for another 9 cm. At this bend (about 25 cm below the surface) a filled tunnel continued in line with the first 9 cm section. Although this filled section could not be fully traced, it obviously led to one or more vacated cells from a previous generation and one unopened cocoon containing moldy remains. At the end of the second 9 cm section of main tunnel another mostly filled section of tunnel led downward to a number of vacated or moldy cells also representing a previous generation. Below this section (at approximately 30 cm below the surface) the open main burrow became horizontal but then curved downward (with another side tunnel from a previous generation branching off) until it reached the 35 cm level. Here it opened into a partly provisioned, fresh cell containing a live *Triepeolus* egg (described below) inserted nearly perpendicularly into the cell wall, as is characteristic of eggs of *T. rufithorax* Graenicher (Rozen, 1964), *T. remigatus* (Fabricius) (Bohart, 1966), and *T. dacotensis* (Stevens) (Torchio, 1986). A closed cell had been constructed several centimeters away, and contained a first instar of *Triepeolus* on top of the provisions.

Several old cells were oriented at about 45° from horizontal with the closure end highest,

<sup>2</sup> Identification kindly confirmed by Wallace E. LaBerge, Illinois Natural History Survey.

but other cells (including the two freshly constructed cells) seemed vertical. Cell surfaces were of typical eucerine shape with evenly rounded bottoms and parallel-sided walls. Two cells measured 5.0 and 5.1 mm in maximum diameter and one about 8.5 mm long. One was 3.1 mm in diameter at the closure, which was formed by four very distinct coils and was somewhat concave on the inside. Whereas the tunnel wall was moderately smooth, the cell wall was very smooth and lined with a coating easily detected by placing a piece of cell wall in water which caused the lining to curl from the very fine soil that fell away.

The lower 5.0 mm of the completed cell contained moist orange pollen apparently with a layer of liquid on top that leaked into the substrate as the cell was broken open. The pollen was sufficiently solid so that it did not lose its shape even when part of the cell wall had been removed. The cell emitted a sour odor but did not have the sour milk odor of cells of some anthophorids.

Only a single female *Xenoglossodes* was associated with this nest. However, the collection of the American Museum of Natural History contains a series of nine females of *X. eriocarpi*, identified by the late P. H. Timberlake, all captured from a single nest and bearing the following data: 22 mi south of Animas, Hidalgo Co., New Mexico, August 25, 1973 (J. G. Rozen, K. C. Rozen, R. McGinley), indicating that this species does nest communally.

The *Triepeolus loomisorum* egg (fig. 25), 1.3 mm long and 0.4 mm in maximum diameter near the flange, was completely buried in the substrate except for the operculum and flange. The chorion was opaque, dull white when observed dry. When submerged in water it was transparent and encased a somewhat smaller, slightly curved elongate opaque body within. The area between this body and the chorion was clear. The operculum was bulbous, almost hemispherical, and not nearly as flat as apparently is the case in *T. remigatus* (Bohart, 1966) and *T. dacotensis* (Torchio, 1986). The flange was thin in side view, unlike that of *T. dacotensis* (Torchio, 1986), and unpigmented. Annulations, apparently characteristic of *T. remigatus* (Bohart, 1966), *T. pectoralis* (Robertson) (Alexander and Ro-

zen, 1987), and *T. helianthi* (Robertson), but not of *T. dacotensis* (Torchio, 1986), were faint and may not have completely circumscribed the egg (fig. 25). The posterior end of the egg was narrowly rounded.

The linear first instar (described and figured in Rozen, 1989) with elongate, curved mandibles was crawling on the wet surface of the provisions when it was uncovered.

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