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December 2002

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## Parajulid milliped studies V. The genera *Pseudojulus* Bollman and *Arvechambus* Causey (Parajulinae: Aniulini)

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**Abstract.** The parajulid milliped genus *Pseudojulus* Bollman comprises four species: *P. obtectus* (Bollman), *P. paynei* (Hoffman), n. comb., and *P. carolinensis* and *P. coastalis*, new species; *Arvechambus* Causey comprises two species, *A. hummi* and *A. weemsi*, both by Causey. *Georgiulus* Hoffman is placed in synonymy under *Pseudojulus*; *G. hubrichti* Hoffman is placed under *P. paynei*; and *A. australis* Causey is placed under *A. hummi*. The genera are sympatric in north Florida and southern Georgia, but *Pseudojulus* extends northward to coastal South Carolina and southcentral North Carolina, and westward to Alabama west of Mobile Bay. Both genera belong to the Aniulini and possess unique features; in *Pseudojulus* the anterior gonopod coxae are fused into a "shelf" on the dorsal surface of the complex that extends ventrad along the caudal margin and possesses a pair of posterior median syncoxal lobes or laminae of varying lengths and configurations. *Arvechambus* exhibits a suite of apomorphies and is sister to the rest of the tribe collectively: the 8th sternum possesses elevated lateral lobes that overhang the sides of the gonopodal aperture; the 7th pleurotergite possesses lobes that also overlie the sides of the aperture; the anterior gonopods lack lateral syncoxal processes, the coxal lobes, much larger than in other tribal genera, arise laterad and obscure part of the telopodite in anterior view, and the telopodite is elongate rather than clavate; and the 2nd pleurotergite in females possesses lobes that overhang and effectively close the cyphopodal aperture.

### Introduction

The parajulid milliped tribe Aniulini covers much of the eastern 2/3 of North America; revisionary studies show that it comprises widely-ranging (*Aniulus*, *Hakiulus*, and *Oriulus*, all authored by Chamberlin) and restricted (*Gyniulus* Loomis) genus-group taxa (Shelley 2000a, b; 2001a; 2002). This contribution addresses two endemic southeastern components that are most common in northern Florida and southern Georgia — *Pseudojulus* Bollman and *Arvechambus* Causey. The latter has never been assigned to the Aniulini, as it was omitted by Hoffman (1992) from the list of components that he compiled because Causey (1974) did not do so when she proposed this and ten other tribes in the subfamily Parajulinae. Hoffman (1992) proposed a tenth component, *Georgiulus*, that he related to *Pseudojulus*, and the recent discovery of two new species north of the Savannah River prompts a reassessment of the taxa and the three established species. As it occurs sympatrically along the Florida/Georgia border, *Arvechambus* is conveniently treated simultaneously.

The task in revising *Pseudojulus* is complicated by the variability of the genitalia in both sexes. It is difficult to distinguish boundaries between species, and material from collecting gaps in the Florida panhandle may unite those in western Florida/Ala-

bama and eastern Florida/Georgia; at present I believe there are at most two species in these states. North of the Savannah River, I propose two new species, one from each of the Carolinas, to bring the generic composition to four species. I also believe that *Georgiulus* cannot be maintained as a separate genus because the anatomical gaps on which it was established are bridged by the new species and by newly discovered material from Florida and Georgia. *Arvechambus* is less complex, and I recognize two species, one represented only by the holotype. In the interests of brevity, I provide expanded diagnoses rather than full descriptions, which were provided by Causey (1963) and Hoffman (1992). Acronyms of sources of preserved material are as follows:

**FSCA** - Florida State Collection of Arthropods, Gainesville.

**NCSM** - North Carolina State Museum of Natural Sciences, Raleigh.

**NMNH** - National Museum of Natural History, Smithsonian Institution, Washington, DC.

**SMNH** - Schiele Museum of Natural History, Gastonia, North Carolina.

**VMNH** - Virginia Museum of Natural History, Martinsville.

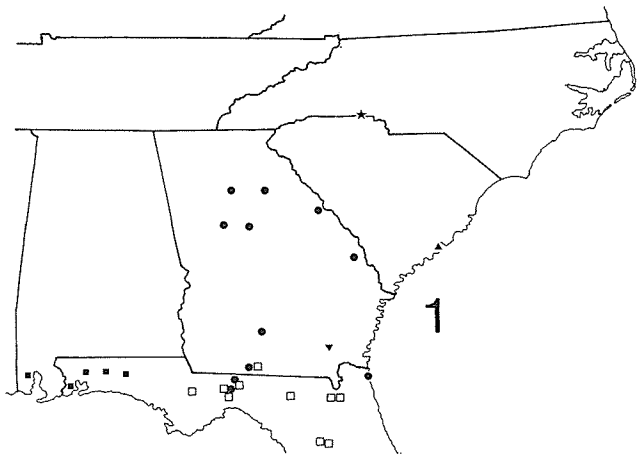


Figure 1. Distributions of *Pseudojulus* and *Arvechambus*. Solid squares, *P. obtectus*; dots, *P. paynei*; star, *P. carolinensis*; upright triangle, *P. costalis*; open squares, *A. hummi*; inverted triangle, *A. weemsi*.

### Genus *Pseudojulus* Bollman

*Parajulus* (*Pseudojulus*) Bollman, 1887a:227; 1887b:38.

*Pseudoiulus*: Cook, 1895:6. Silvestri, 1896: 138, 177.

*Pseudojulus*: Chamberlin and Hoffman, 1958:141. Jeekel, 1971:174. Hoffman, 1980:108; 1992:14-16; 1999:161-162. Shelley, 2001b:243.

*Georgiulus* Hoffman, 1992:9; 1999:154. Shelley *et al.*, 2000:46. Shelley, 2001b: 243. **New Synonymy.**

**Type species.** *Parajulus* (*Pseudojulus*) *obtectus* Bollman, 1887a, by subsequent designation of Bollman (1887b).

**Diagnosis.** A genus of moderate-size to large-bodied Aniulini (ca. 18-40 mm long, 1.6-2.8 mm wide), generally mottled brown in color, with ca. 50-60 segments in adults, caudal segments lightly hirsute; epiproct prominent and spiniform, usually overhanging and extending well beyond level of paraprocts; sternum of segment 8 extending dorsad well into body cavity, with low but distinct medial ridge, not enlarged into a lobe, and ventral lobes anterior to 10th legs (Figs. 2, 10, 20). Anterior gonopod coxae fused into plate-like dorsal "shelf," extending ventrad caudally for varying distances with a pair of discrete posterior syncoxal lobes or laminae that are partly or

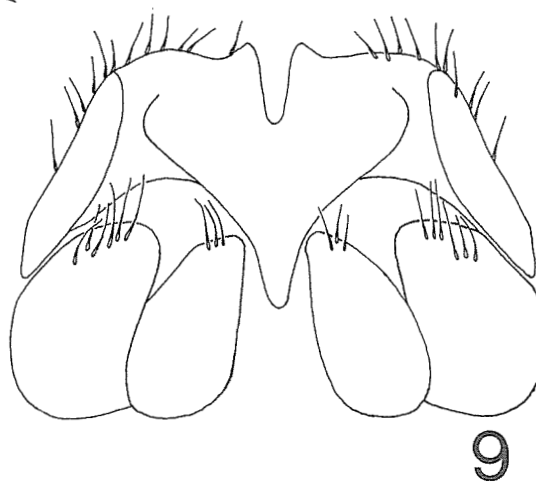
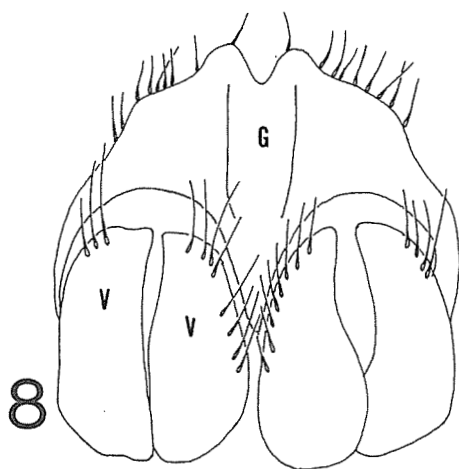
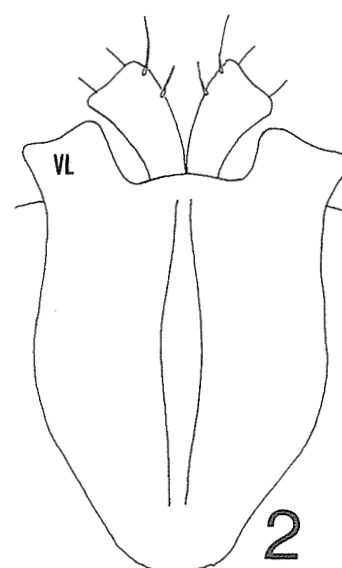
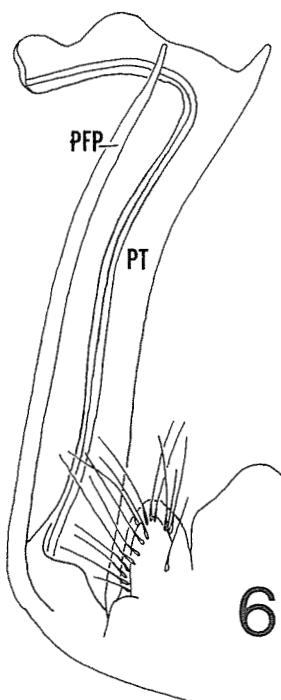
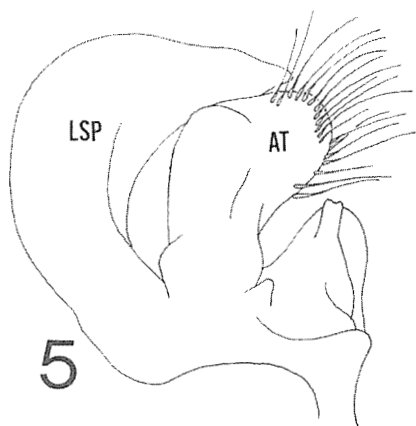
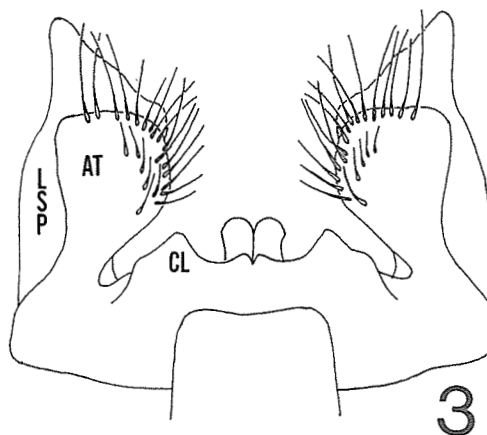
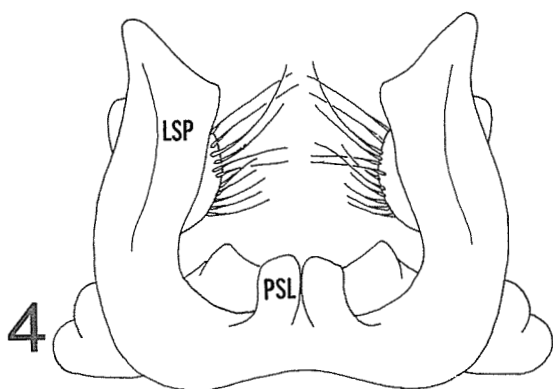
completely fused with ventral extension of shelf, also with variable coxal lobes, lateral syncoxal processes narrowing variably distad, curving anteroventrad over apices of telopodites, falcate in lateral view; telopodite usually with subcaudal lobe, not entirely clavate (Figs. 3-5, 11-13, 16-17, 21-23, 26-27). Posterior gonopods *in situ* located "behind" (caudal to) ventral extension of anterior gonopod coxal "shelf," not positioned between telopodites; prefemoral process long and slender, arising anterior or caudal to telopodite, overlapping it apically; telopodite flared variably distad, overall configuration also variable, either leaning or curving anteriad or upright and bent abruptly anteriad distad, distal zone with or without marginal teeth, occasionally sigmoidally reflexed (Figs. 6, 14, 18, 24, 28). Gynaspis of cyphopods extending to varying degrees below ventral segmental margin, distal configuration variable (Figs. 8-9, 15, 19, 25).

**Distribution.** Southern Coastal Alabama and the panhandle and northern tier of counties in peninsular Florida to coastal South Carolina and the southern fringe of Gaston County, North Carolina, in the southcentral Piedmont Plateau (Fig. 1), an area of ca. 328 mi (525 km), north-south, and 401 mi (642 km), east-west.

**Species.** Four.

**Note on synonymy.** *Georgiulus* was erected on the basis of a shorter posterior gonopod telopodite, subequal to the prefemoral process and not sigmoidally reflexed, and a longer gynaspis of the cyphopods. This seemed like a meaningful basis at the time, but the gonopods and cyphopods of additional specimens from Florida and Georgia plus the new species from the Carolinas bridge the anatomical gaps between *Pseudojulus* and *Georgiulus*, and I consider the distal bend in the posterior gonopod telopodite of *obtectus* to be a species-level character. The only criterion that I see on which *Georgiulus* could be maintained is the origin of the posterior gonopod prefemoral process, which arises on the anterior side of the telopodite in *obtectus*, in western Florida and Alabama, and the caudal side in males from the rest of the distribution. This seems a more fundamental difference and potentially worthy of taxonomic recognition, but the position of the

Figures 2-9. *Pseudojulus obtectus*. 2) process of the 8th sternum of a male from Escambia County, Florida, anterior view. 3) anterior gonopods of the same, anterior view. 4) the same, caudal view. 5) left anterior gonopod of the same, lateral view. 6) left posterior gonopod of the same, medial view. 7) distal extremity of the left posterior gonopod of a male from Santa Rosa County, Florida, medial view. 8) cyphopods of the female from Mobile County, Alabama, caudal view. 9) the same of a female from Walton County, Florida, caudal view. AT, anterior gonopod telopodite; CL, coxal lobe; G, gynaspis; LSP, lateral syncoxal process; PFP, posterior gonopod prefemoral process; PSL, posterior syncoxal lobe; PT, posterior gonopod telopodite; S, sternum; V, valve; VL, ventral lobe of 8th sternum. Scale line = 1.00 mm for figs. 2-6, 8-9; 2.00 mm for fig. 7.



prefemoral process relative to the telopodite is known to vary in *Aniulus* and *Hakiulus* (Shelley 2000a, 2001a). As this is not a generic-level feature elsewhere in the Aniulini, I do not think it should be accorded such value here.

**Relationships.** Hoffman (1992) cited the hypertrophied 8th sternum of males (misstated as the 7th sternum) as a distinguishing feature of *Pseudojulus* and *Georgiulus* together. There are two lobes that project ventrad anterior to the 10th legs (anterior legs on segment 8) and a dorsal extension that goes to or beyond the center of the body cavity. In previous studies on the Aniulini (Shelley 2000a, b; 2001a; 2002), I neglected to check for a sternal extension, so I reexamined species of *Aniulus*, *Hakiulus*, *Oriulus*, and *Gyniulus* and found that the first three have it. In fact, the anterior lobe of the 8th sternum that projects between the posterior gonopods in *Aniulus* and *Hakiulus* and both pairs of gonopods in *Oriulus* is merely the enlarged medial ridge of this extension. *Pseudojulus* possesses the ridge, which is low, rounded, and does not extend appreciably anteriad. Because of this shared feature, I believe that *Pseudojulus* is most closely related to *Aniulus*, *Hakiulus*, and *Oriulus*, and it is the ventral lobes of this sternum, not the dorsal extension, that are diagnostic for *Pseudojulus*. This genus also is distinct in having a "shelf" on the dorsal surface of the anterior gonopods ("beneath them") that extends ventrad, so the posterior gonopods are positioned caudal to this structure instead of lying between the anterior gonopod telopodites and lateral syncoxal processes. In *Gyniulus*, the 8th sternum does not extend dorsad, and the anterior gonopod coxae are not fused, so the posterior gonopods are also situated between the anterior gonopods. An analysis of relationships in the Aniulini will be feasible after alpha taxonomic studies have been completed: *Ethojulus* Chamberlin and *Aliulus*, *Illius*, and *Okliulus*, all authored by Causey, have not been revised.

**Remarks.** Past authors have not mentioned the "shelf" on the dorsal surface of the anterior gonopods, a diagnostic trait for *Pseudojulus*. I have not encountered such a feature on any of the aniulinine genera that I have studied (Shelley 2000a, b; 2001a, 2002).

As noted by Hoffman (1992), *Pseudojulus* is the second oldest genus-group name in the Parajulidae after *Parajulus* Humbert & DeSaussure, 1869.

The subgenus, *Pseudojulus*, and the species, *Parajulus (Pseudojulus) obtectus*, were described as new by Bollman twice in 1887, the first work (Bollman

1887a) being published in March and the second (Bollman 1887b) being published in June. Two species were placed in *Pseudojulus* each time, *P. (P.) varius* Bollman, 1887, from California, in addition to *obtectus*. No type species was mentioned in the first paper, but Bollman (1887b) specifically designated *obtectus*, making it the type species by subsequent, rather than original, designation. *Pseudojulus* was elevated to full generic status by Cook (1895) and considered such by Silvestri (1896), Chamberlin and Hoffman (1958), and Hoffman (1980, 1992, 1999). The other species, *varius*, remains in *Parajulus* as a species of uncertain generic position (Hoffman 1999); Chamberlin and Hoffman (1958) suggested that it was referable to a Pacific Coastal genus, possibly *Bollmaniulus* Verhoeff or *Codiulus* Chamberlin.

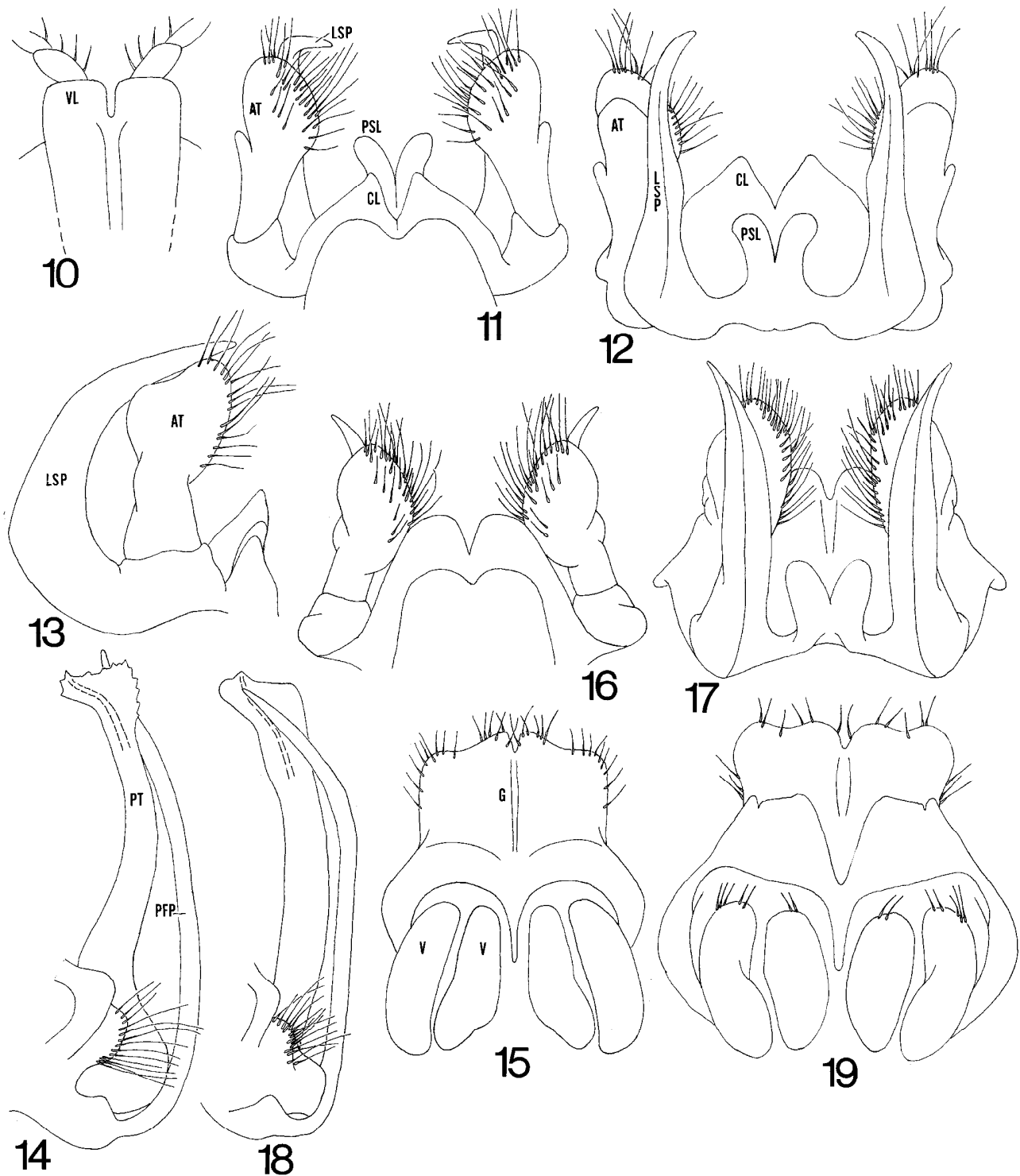
With the discovery of *P. carolinensis* in Gaston County, *Pseudojulus* becomes the second southeastern milliped genus known to range northward into the southern fringe of this county of North Carolina and reach its northern limit there. The other is *Pachydesmus* Cook (Polydesmida: Xystodesmidae), whose terminus is the Kings-Crowders Mountain area in the adjoining corners of Gaston and Cleveland counties (Shelley and Filka 1979; Filka and Shelley 1980).

### *Pseudojulus obtectus* (Bollman) Figs. 2-9

*Parajulus (Pseudojulus) obtectus* Bollman, 1887a: 227; 1887b: 38.

*Pseudojulus obtectus*: Chamberlin and Hoffman, 1958:141. Hoffman, 1992:16-18, figs. 15-21; 1999:162. Shelley, 2001b:243.

**Type specimens.** The types were cited by Hoffman (1992, 1999) as lost; Chamberlin and Hoffman (1958) stated "if extant, probably at the U. S. Nat. Mus." (NMNH) and restricted the type locality to Pensacola, Escambia County, Florida, although they did not designate a lectotype, as noted by Hoffman (1999). The types now exist at the NMNH, and there are three vials of specimens inside a larger vial stating "*Paraiulus obtectus* lectotype"; there is also a separate, loose, hand-written label stating "LECTOTYPE." One of the three smaller vials lacks a label and contains one immature specimen. The other two vials have hand-written labels by Bollman without dates stating "*Paraiulus obtectus* type," so all the specimens are considered syntypes; one vial is from "Pensacola, Fla." and contains eight highly fragmented juvenile females, and the other is from "Bloomington, Ind." and contains one fragmented adult female and three



Figures 10-19. *Pseudojulus paynei*. 10) process of the 8th sternum of a male from Thomas County, Georgia, anterior view. 11) anterior gonopods of the holotype, anterior view. 12) the same, caudal view. 13) left anterior gonopod of the same, lateral view. 14) left posterior gonopod of the same, medial view. 15) cyphopods of a female paratype, caudal view. 16) anterior gonopods of a male from Columbia County, Georgia, anterior view. 17) the same, caudal view. 18) left posterior gonopod of the same, medial view. 19) cyphopods of a female from Columbia County, Georgia, caudal view. Abbreviations as for figs. 2-9. Scale line = 1.00 mm for figs. 10-14, 16-17; 1.50 mm for figs. 15, 18-19.

fragmented juveniles. In accordance with the action of Chamberlin and Hoffman (1958), I have placed the lectotype label with the Pensacola juveniles, which appear to be *P. obtectus* because they possess prolonged epiprocts. The structure is extended and spiniform in five specimens, though shorter than in adults, and it is short, blunt, and broken in three individuals.

**Diagnosis.** A large-bodied species ca. 30-36 mm long, 2.3-3.3 mm wide. Anterior gonopods with coxal lobes relatively short and subtriangular, posterior syncoxal lobes short and distinct, caudal margin of coxal process moderately broad, lateral syncoxal processes broad for most of length and, in lateral view, narrowing only apically. Telopodite of posterior gonopod generally upright and bent abruptly anteriorly distad, distal zone either sublinear with scalloped outer margin or sigmoidally reflexed, margins without teeth; prefemoral process arising anterior to telopodite. Gynaspis moderately long, apically narrow or broad and somewhat linear (Figs. 2-9).

**Variation.** The most notable variation involves the configuration of the distal zone of the posterior gonopod telopodites, which is either sublinear with a scalloped outer margin or sigmoid (Figs. 6-7). The posterior syncoxal lobes are also broader and shorter in the males from Santa Rosa County. The gynaspis varies distad, being short and narrowing in females from Escambia and Mobile counties but broader in ones from Okaloosa and Walton counties (Figs. 8-9); also, the epiproct also does not overhang the paraprocts in the Okaloosa female. As a male is available from Okaloosa County, I assign this female to *P. obtectus*.

**Ecology.** Nothing is known about the habitat preferences of this species.

**Distribution.** The Gulf Coast of Alabama and the western panhandle of Florida. The known range is one county wide and extends for a distance of ca. 110 mi (176 km). In addition to the types, specimens were examined as follows: ALABAMA: *Mobile Co.*, Mobile, Spring Hill College, female, April 1954, C. E. Valentine (FSCA). FLORIDA: *Okaloosa Co.*, Crestview, male, 16 October 1914, A. J. M. (FSCA); and Valparai-

so, female, Fall 1943, Edwards (FSCA). *Santa Rosa Co.*, Boy Scout camp, males, females, 3 October 1958, N. B. Causey (FSCA). *Walton Co.*, 8.5 mi (13.6 km) W DeFuniak Springs, female, date and collector unknown (FSCA).

***Pseudojulus paynei* (Hoffman)  
new combination  
Figs. 10-19**

*Georgiulus paynei* Hoffman, 1992:9-12, figs. 1-11; 1999:154. Shelley, 2001b:243.

*Georgiulus hubrichti* Hoffman, 1992:14, figs. 12-14; 1999:154. **New Synonymy.**

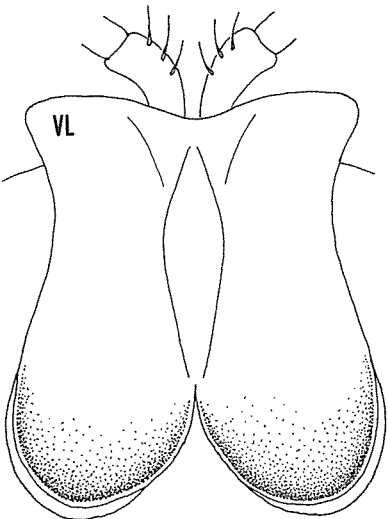
**Type specimens.** Male holotype and two male and one female paratypes of *G. paynei* (VMNH) collected by J. A. Payne, 27 January 1968, at Tifton, Tift County, Georgia; 19 male and female paratypes taken at same locality by same collector on 12 and 29 October and 18-24 November 1967 and 13 January 1968 (VMNH).

Male holotype and two male and two female paratypes of *G. hubrichti* (VMNH) collected by L. Hubricht, 24 October 1954, from a roadside dump ca. 4 mi (6.4 km) N Evans, Columbia County, Georgia.

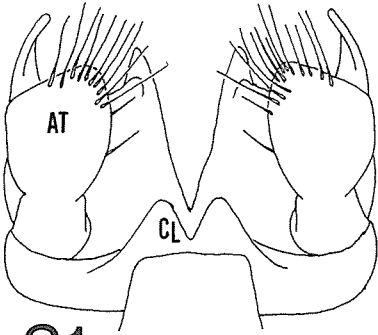
**Diagnosis.** A large-bodied species ca. 30-40 mm long, 2.8 mm wide. Anterior gonopods with coxal lobes relatively long, distally narrow and subtriangular or broadly rounded, posterior syncoxal lobes short and distinct, caudal margin of coxal process relatively narrow, lateral syncoxal processes relatively narrow in lateral view, tapering for most of length, curving gently laterad or mediad apically. Telopodite of posterior gonopod leaning or curving gently anteriorly, apically flared to varying degrees, usually with varying numbers of teeth distad along inner, apical, and/or outer margins; prefemoral process arising caudal to telopodite, varying from shorter than to slightly longer than latter. Gynaspis relatively long, inner margins of lobes sometimes prolonged (Figs. 10-19).

**Variation.** *Pseudojulus paynei* is highly variable with apparent character gradients, and having examined all the available material, I see no reason to recognize more than one species in Georgia and northern peninsular Florida; I therefore place *G.*

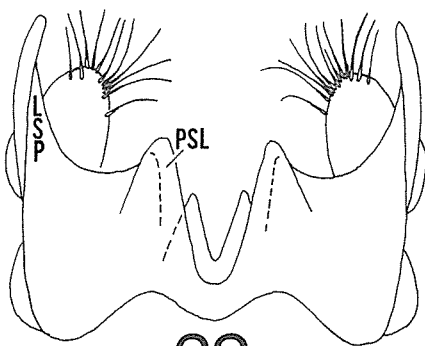
Figures 20-25. *Pseudojulus carolinensis*. 20) process of the 8th sternum of the holotype, anterior view. 21) anterior gonopods of the same, anterior view. 22) the same, caudal view. 23) left anterior gonopod of the same, lateral view. 24) left posterior gonopod of the same, medial view. 25) cyphopods of the female paratype, caudal view. Figs. 26-28. *Pseudojulus coastalensis* holotype. 26, left anterior gonopod, anterior view. 27, the same, caudal view. 28, left posterior gonopod, medial view. Abbreviations as for figs. 2-9. Scale line = 1.00 mm for figs. 21-28, 0.75 mm for fig. 20.



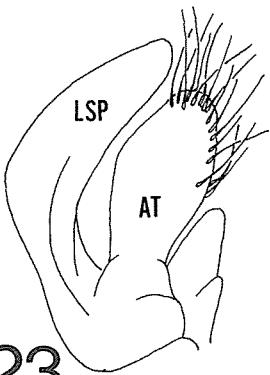
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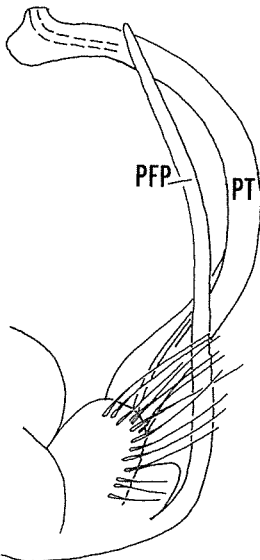
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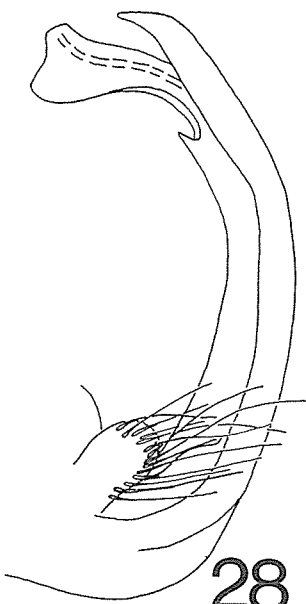
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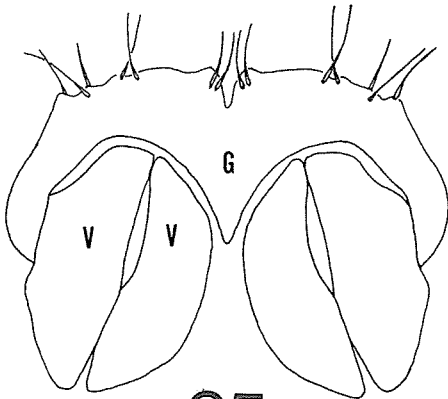
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*hubrichti* in synonymy. The coxal lobes of the anterior gonopods are larger and apically broader in specimens from northern Georgia, as opposed to Florida males in which they are more rounded and discreet, and the posterior syncoxal lobes are longer in the latter and extend for nearly the length of the telopodite in anterior view. The posterior gonopod telopodite varies from leaning anteriorly to gently curved or bowed, and the prefemoral process is directed similarly, being separated from the telopodite basally and overlapping it apically. The telopodite flares distad to varying degrees and usually possesses varying numbers and sizes of teeth on the inner, apical, and/or outer margins. In the Nassau County male, the teeth are minute, located on the outer margin at the base of the flare, and extend a short distance down the stem; in the Leon County male, the teeth are slightly more distinct and located only along the outer margin; however, the teeth are distinct and occur on all three margins in the holotype (Figs. 14, 18). The prefemoral process is slightly longer than the telopodite in the holotype (Fig. 14) and slightly shorter in the Leon County male, terminating beside the distal part of the flare; in the Nassau County male, the structure is shorter still, extending only to the base of the flare.

**Ecology.** As noted by Hoffman (1992), *P. paynei* is the undescribed species and genus at Tifton, Georgia, that was feeding on fleshy skulls of game animals set out to be cleaned by weathering (Hoffman and Payne 1969). The species appears to be more common in cool weather, as all samples were taken from October to April. The range has been well sampled from spring to fall and I have collected there myself, but no specimens of *P. paynei* have been taken then, when most collecting occurs. Habitat notations on vial labels include: "pitfall traps," "under a pine branch," "under rocks on a quarry floor," and in a "malt trap."

**Distribution.** From the vicinity of Atlanta and the Savannah River in Georgia south to the northern tier of counties in peninsular Florida and the eastern extremity of the panhandle, an area of approximately 240 mi (384 km), north-south, and 160 mi (256 km), east-west. In addition to the types, specimens were examined as follows: GEORGIA: *Clarke Co.*, Athens, female, 5 October 1948, E. P. Odum (FSCA). *DeKalb Co.*, Stone Mountain, 3 male, 5 female, 20 October 1940, collector unknown (FSCA) and 2 male, female, 6 April 1947, collector unknown (FSCA). *Houston Co.*, Perry, 2 male, 26-28 December 1982, J. A. Payne (VMNH). *Screven Co.*, 8 mi (12.8 km) S Sylva, female, 5 December 1960, R. E. Woodruff (FSCA).

*Taylor Co.*, Butler, along Rambullet Cr., female, 19 October 1945, collector unknown (FSCA). *Thomas Co.*, Bar M Ranch near Boston, male, female, April 1968, W. Sedgwick (VMNH). FLORIDA: *Leon Co.*, Tallahassee, female, 1 November 1959, G. W. Deckla (FSCA); and Tall Timbers Res. Sta., 3 male, female, 15 November 1971 - 10 December 1973, D. Harris, W. Riess (FSCA). *Nassau Co.*, Amelia I., public beach access area off FL hwy. A1A ca. 3 mi (4.8 km) N south end of island, male, 1 December 1995, R. M. Shelley (NCSM).

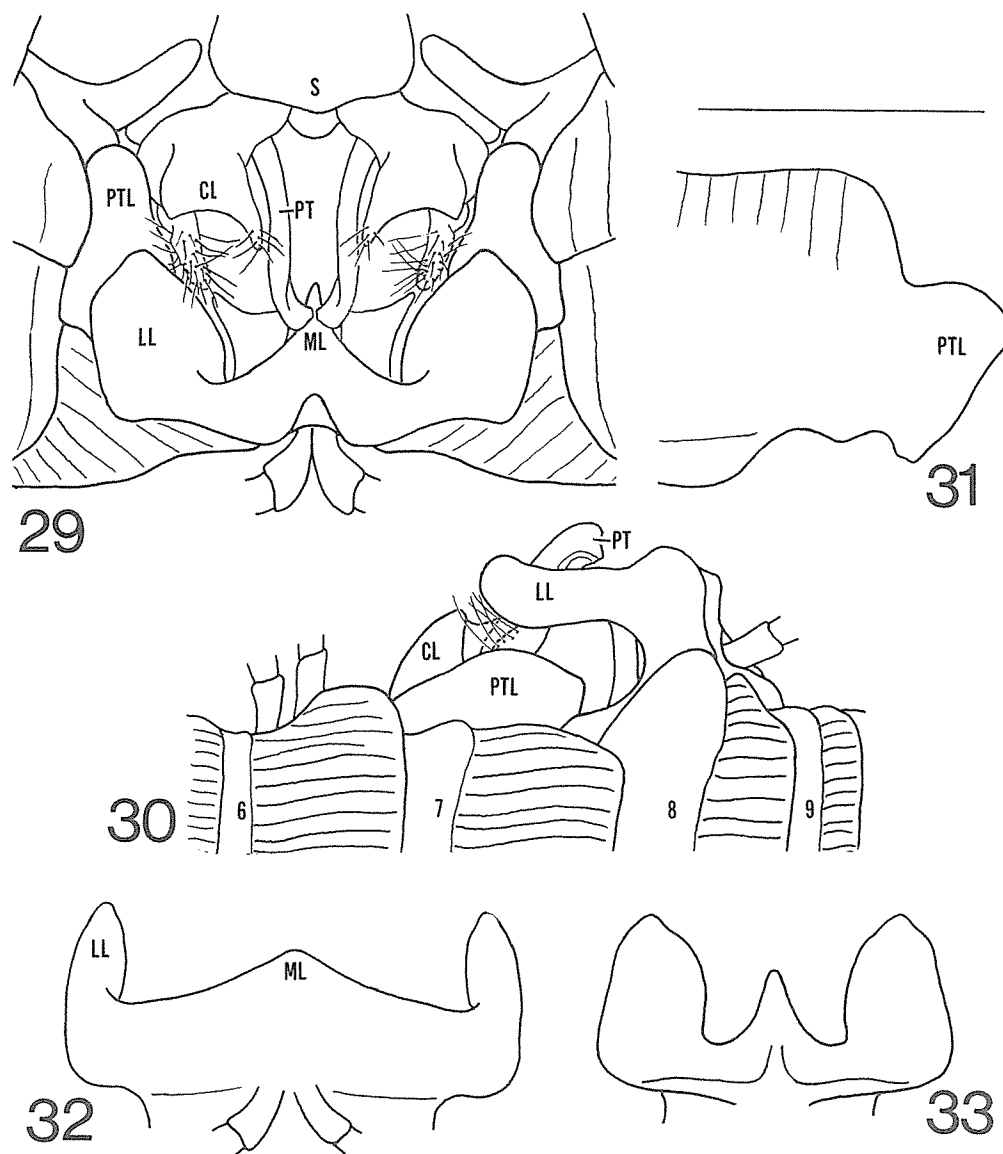
***Pseudojulus carolinensis* Shelley**  
**new species**  
**Figs. 20-25**

**Type specimen.** Male holotype and female paratype (NCSM) and adult and immature male paratypes (SMNH) collected by D. Flynn, 6.5 mi (10.4 km) S Gastonia, along SR 1108 ca. 1.2 mi (1.9 km) SW jct. US hwy. 321, Gaston County, North Carolina; the holotype and adult male paratype were taken on 21 May 1999, the juvenile male paratype on 24 May 1999, and the female paratype on 1 June 1999. This site is approximately 1.2 mi (1.9 km) north of the South Carolina state line.

**Diagnosis.** A moderate-size species ca. 30 mm long and 2.3 mm wide. Anterior gonopods with coxal lobes short and subtriangular, posterior syncoxal lobes appearing as prolonged, triangular inner corners of elevated, laminate, caudal margin, fused for most of length with latter, lateral syncoxal processes moderately broad, tapering distad. Telopodite of posterior gonopod relatively narrow, curving broadly anteriorly, flared apically, without marginal teeth; prefemoral process relatively narrow, arising caudal to, and separated from, telopodite, extending just beyond outer margin of latter. Gynaspis short and broad, barely elevated above segmental margin, edge slightly irregular (Figs. 20-25).

**Variation.** The male paratype agrees closely with the holotype.

**Ecology.** The holotype and female paratype were collected in a pitfall trap in entangled briars and poison ivy beneath an isolated winged elm tree (*Ulmus alata* Michaux) in an open, broom sedge meadow, 100 yards or more from other trees. The adult male paratype was taken in a pitfall trap under a Virginia Pine (*Pinus virginiana* Mill.) on the border between the meadow and a narrow pine woods, and the imma-



Figures 29-33. *Arvechambus hummi*. 29) segments 7-8, ventral view of male from Alachua County. 30) segments 6-9 of the same, lateral view. 31) left side of 7th pleurotergite of paratype, ventral view. 32) 8th sternum of the same, ventral view. 33) the same of male from Alachua County, ventral view. Abbreviations as for figs. 2-9; LL, lateral lobe of 8th sternum; ML, medial lobe of 8th sternum; PTL, pleurotergal lobe. Scale line = 0.67 mm for figs. 29-30, 1.00 mm for figs. 31-33.

ture male paratype was recovered from a trap in honeysuckle on the edge of the meadow within 10-30 ft. of other winged elms. I visited this site with Dr. Flynn and other Schiele Museum researchers during a drought in May 2001 and was astounded by the environment. With its general lack of shelter, absence of water, the nearest creek (McGill Branch of Crowders Creek) being hundreds of yards away, and a thin layer of litter that is mostly Virginia Pine needles and narrow deciduous leaves, the site appears inhospita-

ble. It is a most unlikely habitat in which to find any milliped, much less an undescribed species.

**Distribution.** Known only from the type locality, located in the Piedmont Plateau in the southern fringe of southcentral North Carolina. The species undoubtedly also occurs in piedmont South Carolina, less than 2 mi (3.2 km) away, hence the specific name.

**Remarks.** With the discovery of *P. carolinensis* in Gaston County, 51 genera and 119 species and subspe-

cies are known from North Carolina (Shelley 2000c, 2001b).

***Pseudojulus coastalis* Shelley**  
**new species**  
**Figs. 26-28**

**Type specimen.** Male holotype (NCSM) collected by C. L. Whitney on 28 November 1993 along the Stono River in the Dill Refuge near James Island County Park, James Island, Charleston County, South Carolina.

**Diagnosis.** A small-bodied species ca. 22 mm long and 1.6 mm wide. Anterior gonopods with coxal lobes long and prominent, prolonged mediad, posterior syncoxal lobes indetectable, wholly fused with elevated, laminate caudal margin, lateral syncoxal processes tapering distad. Telopodite of posterior gonopod relatively broad, relatively upright basally and curving anteriad distad, flared apically and without marginal teeth, with strong spur on inner margin at 2/3 length; prefemoral process relatively broad, arising mediad to telopodite and overlapping anterior margin of latter for most of length, extending well beyond outer telopodal margin and tapering apically (Figs. 26-28). Females unknown.

**Ecology.** The holotype was collected in moist soil in a wooded area.

**Distribution.** Known only from the type locality.

**Remarks.** *Pseudojulus coastalis* shares with *P. carolinensis* the elevated, laminate, caudal margin of the anterior gonopod coxal processes. Though fused for most of their lengths with the lamina, the posterior syncoxal lobes are moderately distinct and visible in the latter species, whereas they are completely fused in *P. coastalis* and are not detectable as discreet structures.

**Genus *Arvechambus* Causey**

*Arvechambus* Causey, 1963:66-69. Hoffman, 1980:108; 1999:149. Shelley *et al.*, 2000: 44. Shelley, 2001:243.

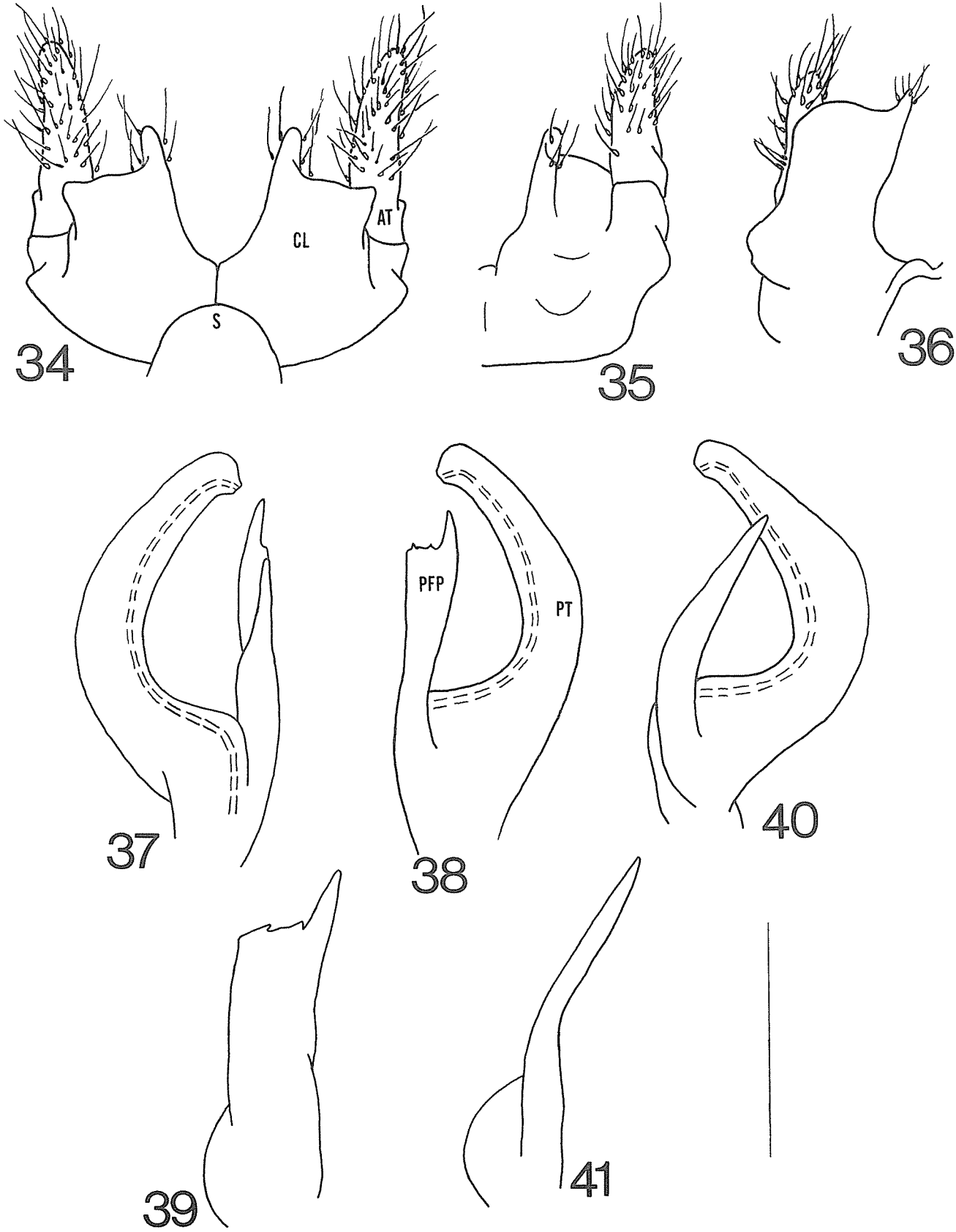
**Type species.** *Arvechambus hummi* Causey, 1963, by original designation.

**Diagnosis.** A genus of large-bodied Aniulini (ca. 34-44 mm long, 3-4 mm wide), generally light mottled brown in color with lightly reddish bands along caudal pleurotergal margins, with 56-62 segments in adults, caudal segments glabrous; epiproct prominent and spiniform, overhanging and extending well beyond level of paraprocts; 7th pleurotergite with distinct lobes, demarcated by indentations and strongly narrowed, overhanging sides of gonopodal aperture (Figs. 29-31); sternum of segment 8 extending moderately dorsad into body cavity, with moderate-size medial ridge projecting anteriad as narrow lobe, sides of sterna elevated and enlarged into prominent, anteriorly-directed lobes, extending over 7th pleurotergal lobes and margins of aperture (Figs. 29-30, 32-33). Anterior gonopod coxae with strong coxal lobes arising anterior to telopodites, extending ventrad for at least one third of lengths of latter and overlapping and partly obscuring them in anterior view, medial corners prolonged into narrow lobes, lateral syncoxal processes absent; telopodites elongate, not clavate (Figs. 34-36). Posterior gonopods *in situ* leaning anteriad between anterior gonopod telopodites and positioned "behind" (caudal to) coxal lobes; prefemoral process arising caudolaterad to telopodite, either narrow or broad with distolateral corner prolonged into subacuminate lobe; telopodite curving variably caudad, either extending to level of tip of prefemoral process or overhanging it (Figs. 37-40, 45-46). Females with 2nd pleurotergite prolonged into narrow lobes extending nearly to level of gynaspis, overlapping and effectively closing cyphopodal aperture; gynaspis variably prolonged and extending well below ventral segmental margin, usually indented apically to varying degrees (Figs. 41-44).

**Species.** Two.

**Distribution.** The southernmost counties of Georgia and the eastern panhandle and northern peninsula of Florida east of the Apalachicola River. The area encompasses around 115 mi (184 km), north/south, and 170 mi (272 km), east/west.

Figures 34-39. *Arvechambus hummi*. 34) anterior gonopods of holotype, anterior view. 35) right anterior gonopod of the same, caudal view. 36) left anterior gonopod of male from Alachua County, anterior view. 37) left posterior gonopod of holotype, medial view. 38) the same, lateral view. 39) left posterior gonopod prefemoral process, caudal view. 40-41, *A. weemsi* holotype. 40, left posterior gonopod, lateral view. 41, prefemoral process of the same, caudal view. Abbreviations as for figs. 2-9, 29-33. Scale line = 1.00 mm for all figs.



**Relationships.** With a suite of apomorphies that distinguish it from all other genera in the tribe, *Arvechambus* is clearly the sister group to the rest of the tribe collectively. The apomorphies include the lobes on the 7th pleurotergites of males and the 2nd of females, the lateral lobes on the 8th sterna in males, the lateral origins of the anterior gonopod coxal lobes that partly obscure the telopodites in anterior view, the absence of lateral syncoxal processes, and the elongate, non-clavate telopodites.

**Remarks.** Individuals of *Arvechambus* are the largest aniulinines and the largest parajulids occurring east of the Mississippi River except for some representatives of *Uroblaniulus* Attems, which occurs in north Georgia around Atlanta. The anterior gonopod coxal lobes are also broader than those of other tribal genera, where they arise medial to the telopodites and do not overlap them. In addition to their large size, the lateral lobes of the 8th sternum are also elevated; they overhang the sides of the gonopodal aperture but are raised considerably above it (Fig. 30). *Arvechambus* is one of the few parajulid genera that can be accurately identified from females, because of the pleurotergal lobes that overhang the cyphopodal aperture.

Causey (1963) reported juvenile specimens from Columbia, Dixie, Duval, Franklin, Lafayette, Suwannee, and Wakulla counties, Florida, with the "facies" of *Arvechambus*. I cannot interpret the word, "facies," in this context and these samples are not available, so I delete these records pending confirmation with adults. I do assign a sample of juveniles from Hamilton County to *A. hummi* because they are larger than any other parajulid that would be expected in this part of Florida.

***Arvechambus hummi* Causey**  
**Figs. 29-43**

*Arvechambus hummi* Causey, 1963:69-70, figs. 1-3, 9.  
Hoffman, 1999:149. Shelley, 2001:243.

*Arvechambus australis* Causey, 1963:71, figs. 4-6. Hoffman, 1999:149. Shelley, 2001:243. **New Synonymy.**

**Type specimens.** Male holotype (NMNH) and two male and one female paratypes of *A. hummi* (FSCA, NMNH) collected by H. J. Humm on an unknown date in October or November 1952 at Tallahassee, Leon County, Florida. The original description gives the collector's name as H. H. Humm, but the initials on the vial label are H. J. Other paratypes as follows: one male and four females (FSCA) collected in Tallahassee in November-December 1952 by "Ecology Class"; one male (NMNH) collected by R. McFarland on 26 October 1958, 4 mi (6.4 km) S of Tallahassee, Leon County.

Male holotype of *A. australis* (NMNH) collected by H. V. Weems, Jr., on 20 December 1959, in Gainesville, Alachua County, Florida. Paratypes, all from Gainesville, as follows: one male (FSCA) and one female (NMNH) taken by W. J. Platt on 28 October and 22 November 1959, respectively, "on floor in house"; one female (FSCA) taken by same collector on 17 October 1959 "on top of ground in creek ravine area."

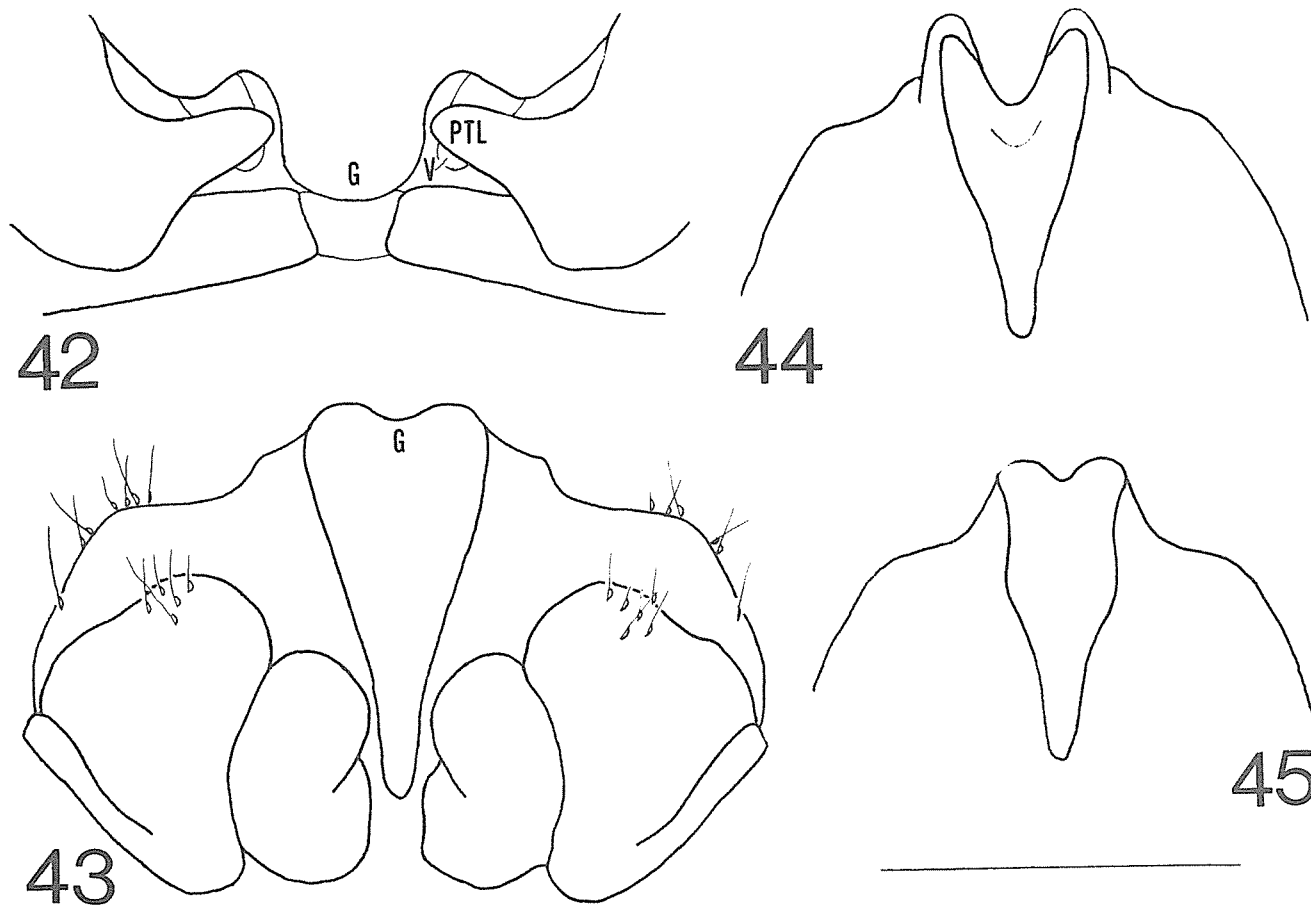
**Diagnosis.** Posterior gonopod prefemoral process broad, distolateral corner prolonged into subacuminate lobe, upright for most or all of length, bending anteriorly only distad if at all, directed toward tip of telopodite, in lateral profile, expanding distal to midlength (Figs. 37-39).

**Variation.** *Arvechambus hummi* is a highly variable species. In Alachua County males, the lateral lobes of the 8th sterna are broader and the medial lobe is more sharply defined and more clearly demarcated from the lateral ones (Figs. 32-33). The distal breadth of the posterior gonopod prefemoral process varies as does the length of the distolateral prolongation, but the most obvious variation involves the size of the anterior gonopod coxal lobes relative to the telopodites. In Alachua County males they arise farther laterad and extend for about 7/8 of the length of the telopodite, largely obscuring it in anterior view, as opposed to origins near midwidths of the telopodites and extensions for only about one third of their lengths elsewhere (Figs. 34-36). This difference is caused by a reduction in telopodal length in southern males coupled with enlargement of the coxal lobes in both length and breadth. While acknowledging that the variants may intergrade and be conspecific, Causey (1963) nevertheless treated them as full species and assigned the name, *australis*, to the southern form.

I do not think they are reproductively isolated and synonymize this name; the difference involves relative sizes and hence is subjective, as opposed to a totally different configuration, as in the posterior gonopod prefemoral processes in *A. hummi* and *weemsi*. In females, the gynaspis varies in length and the degree of apical indentation, which ranges from a slight impression to a distinct invagination (Figs. 41-43).

**Ecology.** Habitat notations on labels with the samples include "in rotting log," "in leaf litter," "in malt traps," "under rotting oak log," and "along dry but still moist lake."

**Distribution.** Straddling the border between Georgia and Florida and extending, north/south, from Thomas County, Georgia, to Alachua County, Florida, a distance of ca. 110 mi (176 km), and, east/west,



Figures 42-45. *Arvechambus hummi*. 42) segments 2-3 of female from Leon County, ventral view. 43) cyphopods of female paratype, caudal view. 44-45) gynaspises of female paratypes, caudal views. Abbreviations as for figs. 2-9, 29-33. Scale line = 1.00 mm for figs. 42-43, 0.67 mm for figs. 44-45.

from Baker to Liberty counties, a distance of ca. 170 mi (272 km) (Fig. 1). In addition to the types, the following specimens were examined: FLORIDA: *Alachua Co.*, Gainesville, 2 females, 26 January 1962 and 23 September 1963, W. J. Platt (FSCA); and ca. 5 mi (8 km) E Gainesville, nr. Newnan's Lake, 2 male, female, 10 April 1963, R. E. Woodruff (FSCA). *Baker Co.*, Glen St. Mary, 3 female, 2 juvs., 16 March and 21 December 1960, E. W. Holder (FSCA) and female, 10 January 1961, R. E. Woodruff (FSCA); and MacClenney, female, 5-9 December 1960, R. E. Woodruff, E. W. Holder (FSCA). *Hamilton Co.*, White Springs, 8 juvs., 29 May 1958, N. B. Causey (FSCA). *Leon Co.*, 4 mi (6.4 km) S Tallahassee, 5 males, females, juvs., 26 October 1958, R. McFarland (FSCA); and 4 mi (6.4 km) S Tall Timbers Res. Sta., female, 26 October 1958, I. Bolick (FSCA). *Liberty Co.*, nr. Bristol, male, 3 juvs., 4 July 1959, collector unknown (FSCA). GEORGIA: *Thomas Co.*, Bar M Ranch nr. Boston, male, April 1968, W. Sedgwick (VMNH).

**Remarks.** *Arvechambus hummi* occurs sympatrically with *P. paynei* in Thomas County, Georgia, and Leon County, Florida.

***Arvechambus weemsi* Causey  
Figs. 44-45**

*Arvechambus weemsi* Causey, 1963:71-72, figs. 7-8. Hoffman, 1999:149.

**Type specimens.** Male holotype (NMNH) collected by D. Culbreth in March 1962 at Waycross, Ware County, Georgia.

**Diagnosis.** Posterior gonopod prefemoral process narrow, elongate, and of subequal breadth throughout most of length, tapering slightly distad, leaning anteriad and directed toward telopodite at about 3/4 length (Figs. 44-45).

**Ecology.** Nothing is known about the habitat at the type locality.

**Distribution.** Known only from the type locality.

**Remarks.** This species is known only from the holotype, and I agree with Causey (1963) that the subuniformly narrow, elongate posterior gonopod prefemoral process justifies recognition at the specific level. There is no evidence of intergradation with the expanded condition found in *A. hummi*.

#### Acknowledgments

I thank Duane Flynn and other researchers at the SMNH, for discovering *P. carolinensis* while conducting an arthropod inventory of Gaston County that was funded by the State of North Carolina Grassroots Science Initiative; I also thank Carl Whitney, for collecting the holotype of *P. coastalis*. J. Coddington (NMNH) lent the types of *P. obtectus* and the holotypes and paratypes of *A. hummi*, *australis*, and *weemsi*; G. B. Edwards lent paratypes of *A. hummi* and *australis* and non-typical material from the FSCA; and R. L. Hoffman lent the types of *G. paynei* and *hubrichti* and non-typical samples from the VMNH.

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