

# Denopelopia atria, a new genus and species of Pentaneurini (Diptera: Chironomidae: Tanypodinae) from Florida

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## Abstract

The larva, pupa and ♂ and ♀ adults of a new genus of Pentaneurini, *Denopelopia* n. gen. and *Denopelopia atria* n. sp. are described from Florida. Comparison is made with the genera *Pentaneurella*, *Monopelopia*, *Telmatopelopia*, *Krenopelopia*, *Xenopelopia*, and *Zavreliomyia*. To date, this species is known only from the type locality, a *Typha* sp. – choked drainage ditch in southwest Florida. The larvae are tolerant of extended periods of low dissolved oxygen and relatively high iron concentrations, and consume chironomid larvae, naidid worms, ploimate rotifers and diatoms.

## Introduction

The new genus and species herein described were collected and reared by Mr. Rutter from a small ditch near the Florida Department of Environmental regulation (FDER) laboratory in Punta Gorda, Florida. The specimens listed are in the collections of the Academy of Natural Sciences of Philadelphia. Additional material is in the Punta Gorda FDER laboratory. Most of the specimens are slide mounted, those in ethanol are indicated by (Alc.) under *specimens examined*.

## Abbreviations and Terminology

The following abbreviations and terminology are used in the descriptions, figures and tables. With some exceptions they follow SAETHER (1980). The ♀ genitalic terminology is after SAETHER (1977). The adult wing venation and pupal abdominal setae follow FITTKAU (1962), the pupal thoracic setae follow COFFMAN (1983) and the ventral head setae, KOWALYK (1985). The measurements of the ligula and the ratio of the inner and mesal teeth to the outer teeth are illustrated in ROBACK (1985, Fig. 86). L and W are used to indicate length and width.

### Adult

A, I–X, abdominal segments  
AR, antennal ratio  
Ce, cerci  
Csa, coxosternapodeme A. IX, ♀ genitalia  
F, femur  
Gc, gonocoxite, ♂ genitalia  
GCa, gonocoxapodeme VIII, ♀ genitalia  
Gp, gonapophysis A. VIII, ♀ genitalia  
Gs, gonostylus, ♂ genitalia  
HR, hypopygium ratio Gc/Gs  
LR, leg ratio Ta<sub>1</sub>/Ti  
NO, notum, ♀ genitalia  
R, rami, ♀ genitalia  
SCa, seminal capsules, ♀ genitalia  
SDu, spermathecal duct, ♀ genitalia

Ta<sub>1–5</sub>, tarsal segments

Ti, tibia

I–II, pro, meso-, metathoracic legs

### Pupa

A, I–VIII, abdominal segments  
Aet, aeropyle tube of respiratory organ  
AL, anal lobes  
ANi, apical nipple, respiratory organ  
D<sub>1–5</sub>, dorsal abdominal setae  
Dcs 1, 2, 4, dorsocentral thoracic setae  
L<sub>1,2</sub> lateral abdominal setae  
LS<sub>1–5</sub>, lateral filaments, abdomen, AL  
GS, genital sacs  
O<sub>d</sub>, O<sub>v</sub>, anterior setae, abdomen  
V<sub>1,2</sub> ventral abdominal setae

Larva

a-e, apical palpal sensillae  
 aa, antaxial seta of lacinia  
 A<sub>1-4</sub>, antennal segments  
 AB1, accessory blade  
 AeT, aeropyle tube  
 ANi, apical nipple  
 AR, antennal ratio A<sub>1</sub>/A<sub>2-4</sub>  
 Bl, blade  
 BR, basal ring of Bl  
 CS, campaniform sensillum  
 IC, head ratio <sup>w</sup>/L

Lc, lacinia  
 LCh, lacinial chaeta  
 Li, ligula  
 pa, paraxial seta of lacinia  
 Pl, paraligula  
 PH, pecten hypopharyngis  
 S<sub>1-3</sub>, lateroventral mandibular setae  
 S<sub>9-10</sub>, genal setae  
 SP<sub>2</sub>, sensory pegs A<sub>2</sub>  
 SSm, setae submenti  
 VP, ventral pore

**Denopelopia gen. nov.**

Type species, *Denopelopia atria* spec. nov., by present designation

Diagnosis

Adult - AR 1.6-1.7; ♂ antenna with 14 flagellomeres, ♀ with 11; verticals and orbital setae in simple row (Fig. 9); wing densely haired with slight pattern in both sexes (Figs. 11, 12); costa not extended beyond R<sub>4+5</sub> (Figs 11-13) ends between apices of M and CU<sub>1</sub> (Figs. 11, 12); m-cu close to r-m (Fig. 14); tibial spurs with elongate apical tooth (Figs. 1-3) more than half the length of the

Table 1. Comparison of some characters of *Denopelopia* (D) with those of *Pentaneurella* (P), *Monopelopia* (M), *Krenopelopia* (K), *Xenopelopia* (X), *Telmatopelopia* (T) and *Zavrelimyia* (Z). C = concave, E = even, I = inner, OU = outer, + = present, - = absent.

	P	M	K	X	T	D	Z
<u>Adult</u>							
AR	1.0	1.0	1.4	1.5-1.8	1.6	1.6-1.7	2.0
Produced Costa	?	-	+	-	+	-	+
end of Costa	?	Cu <sub>1</sub> <> M	> M	Cu <sub>1</sub> <>M	= M	Cu <sub>1</sub> <>M	= M
T.IX setae	-	+	+	-	+	+	+
Gc, basidorsal lobes	-	-	-	+	+	-	-
<u>Pupa</u>							
RO L/W	3.0	5.2	3.0	5.0	5.0	11.0	4.0-5.0
distinct ANi	-	-	-	-	-	+	-
long Aet	-	-	-	-	-	+	-
no. LS.VII	4	4	3	4	4	3	4
♂GS/AL	0.66	>1.00	0.75	0.80	0.66	0.52	1.00±
AL spines	I-OU	OU	-	OU	OU	OU	I-OU
Sticky sheath LS,							
AL	-	-	-	+	-	+	+
<u>Larva</u>							
SP <sub>2</sub> sessile	+	+	+	+	+	+	-
CS, A <sub>1</sub> position	<0.5	0.5-0.6	0.6-0.7	0.5	0.5	0.6	0.6
apices of Li Teeth	C	C	C	E	E	E	E
no. PI teeth	2	2	2	2	2	3	2
no. PH teeth	15	7	11	10	9	11	15

entire spur in length; claws sharp; ♂ genitalia simple (Fig. 18); tergite A. IX with transverse row of setae; anal point conical; hypopygium ratio about 1.6; goncoxite without internal lobes; L/W >2.00; ♀ genitalia (Figs. 15, 16); anterior end of notum slightly expanded; notum/rami 1.4; coxosternapodeme 1X curved, broadened mesally; gonocoxapodeme VIII very poorly developed; gonapophysis VIII rounded somewhat triangular; labia bare.

**Pupa** – Wholly brown; respiratory organ elongate with apical nipple (Figs. 20–22) and small plas-tron plate; respiratory atrium with constrictions, about 11 times as long as greatest width; distinct thoracic comb present (Fig. 32) Dcs 1 very short with apparent apical points (Fig. 25); scar A. I distinct, pigmented in shape of inverted T; shagreen of abdomen, short scattered spinules (4 μm); venter, A. II with arcs of combs (Fig. 28); D setae appear shaped as in Fig. 24; A. VII with three LS filaments, A. VIII with five (Fig. 29); anal lobes elongate-triangular (Fig. 29) with a row of spinules on outer margin only (Fig. 30); ♂ genital sacs about half as long as anal lobes (Fig. 29); LS filaments of anal lobes with sticky sheaths (Fig. 29).

**Larva** – Body of instar IV red, instar III more orange; head IC ratio about 0.50; lauterborn organs (SP<sub>2</sub>) on A<sub>2</sub> sessile (Figs. 35, 36); ligula with all teeth fairly even in length (Fig. 41); paraligula trifid (Fig. 41); posterior prolegs with two smaller claws with large inner spurs (Fig. 39) and some outer pectination; medium claws (Fig. 39) with a single small inner spine; all claws (14) pale; anal tubules (Fig. 45) shorter than posterior prolegs.

## Discussion

On the basis of its overall characters *Denopelopia* appears most closely related to *Telmatopelopia* Fittkau and *Zavrelimyia* Fittkau. The adult head and thoracic chaetotaxy (Figs. 6, 9) closely resemble that of *T. nemorum* (Goetg.) as figured in FITTKAU (1962) Figs. 218, 219, 220. The tibial spurs (Figs. 1–3) are also close to those of *T. nemorum* as are the ♂ genitalia (Fig. 18). The wing macrotrichial pattern (Fig. 11) is similar to that of *Z. signatipennis* (Kieffer) as figured (Fig. 240) by FITTKAU (1962). The pupa is very close to that of *T. nemorum* in the form of the Dcs setae (Figs. 25–27) the form of the D setae (Fig. 24) and the form and setae of the AL (Figs. 29, 30). The shape of the unusual RO of *Denopelopia* (Fig. 20) can be possibly derived by elongating the RO of *T. nemorum* (FITTKAU 1962, Fig. 226) with its suggestion of an ANi. The pupa of *Denopelopia* differs in having a distinct thoracic comb (Fig. 32) and only three LS on A. VII (Fig. 29). The larval Li (Fig. 41) is close to that of *Zavrelimyia* and *Telmatopelopia* but the trifid Pl is distinct from either of those genera. The two claws of the PP with large inner spurs (Fig. 39) resemble those of *Zavrelimyia*. The latter genus has none to only one claw of that form. *Telmatopelopia* possesses several pectinate claws on the PP.

The sessile SP<sub>2</sub> (Fig. 36) would superficially appear to relate *Denopelopia* to *Pentaneurella* Fittkau & Murray, *Monopelopia*, Fittkau, *Krenopelopia* Fittkau, *Xenopelopia* Fittkau, and *Telmatopelopia* Fittkau. However, as noted above, the only one of those genera to which it appears more clearly related on the basis of other characters is *Telmatopelopia*. *Zavrelimyia* lacks the sessile SP<sub>2</sub>. Table 1 compares some of the characters of all those genera with those of *Denopelopia* and will serve to help differentiate them.

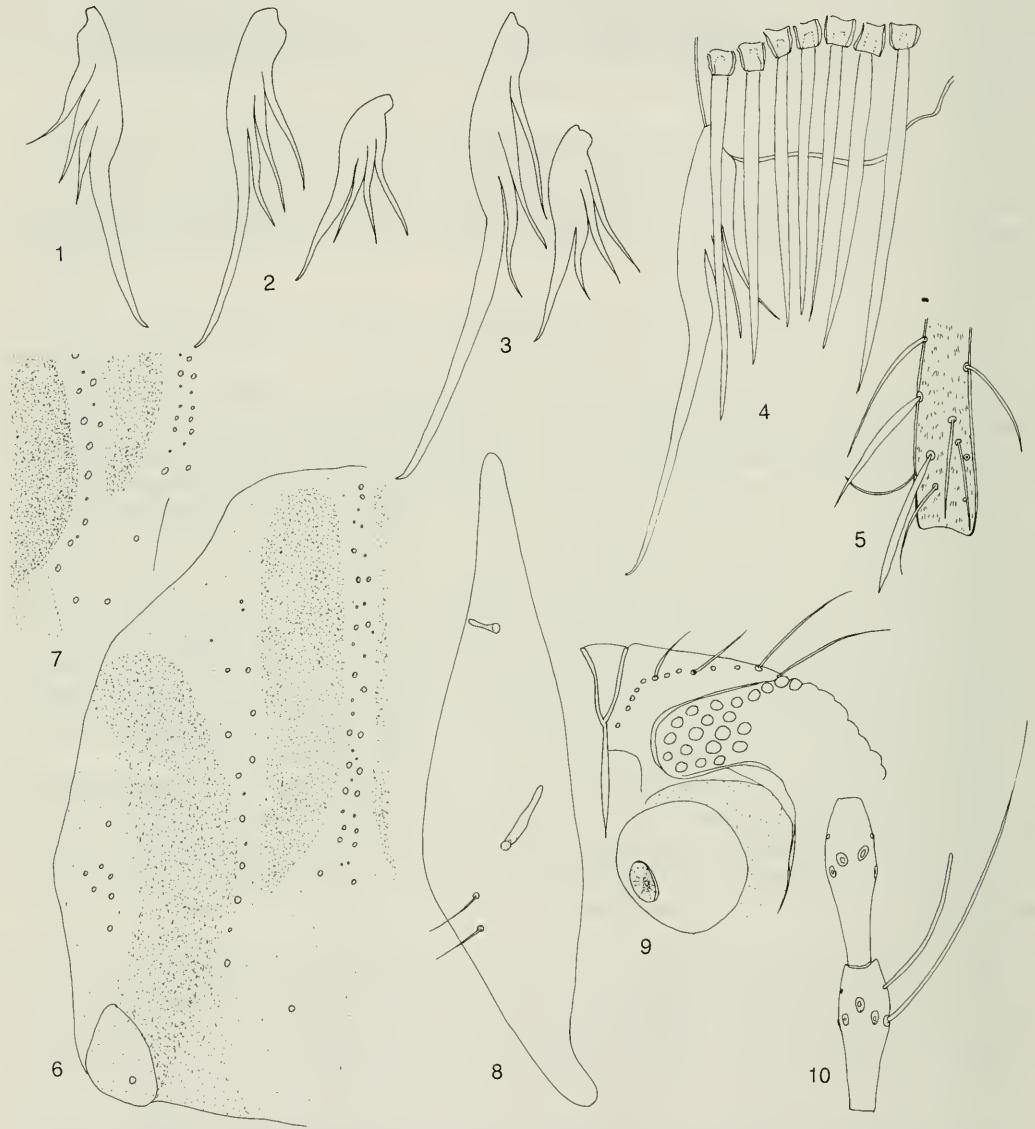
The ♀ genitalia of *Denopelopia* (Figs. 15–17) will key to *Zavrelimyia* in SAETHER (1977), differing in the slightly expanded anterior end of NO and the broader R of Gp IX. The other characters in Saether's description of the *Zavrelimyia* ♀ genitalia fit *Denopelopia* closely. The ♀ genitalia of *Telmatopelopia* as described by RODOVA (1971) and cited by SAETHER (1977) possess only two seminal capsules.

Geographically *Denopelopia* poses somewhat of a problem. *Telmatopelopia* has not been to-date recorded from either the Nearctic or Neotropical Regions. The presence of *Denopelopia* in southern Florida would suggest a Neotropical derivation. This is possible, inasmuch as the Neotropical fauna is still very poorly known. *T. nemorum* has been found only in the western Palaearctic.

*Denopelopia atria* spec. nov.

In the following descriptions, unless otherwise indicated, the  $n$  for  $th \bar{x}$  in the ♂ adult = 4 and for the pupa and larva = 5.

Adult ♂ – head brown; eyes bare; outer verticals 107  $\mu\text{m}$  long, uniseriate; orbitals uniseriate extend to center of dorsal eye extension (Fig. 9), 63  $\mu\text{m}$  long; pedicel with five setae, 141  $\mu\text{m}$  diameter (Fig. 9), pedicel 1.41 $\times$  interocular space; AR 1.63–1.71 ( $\bar{x}$  1.683); flagellomere 14, 80  $\mu\text{m}$  long with

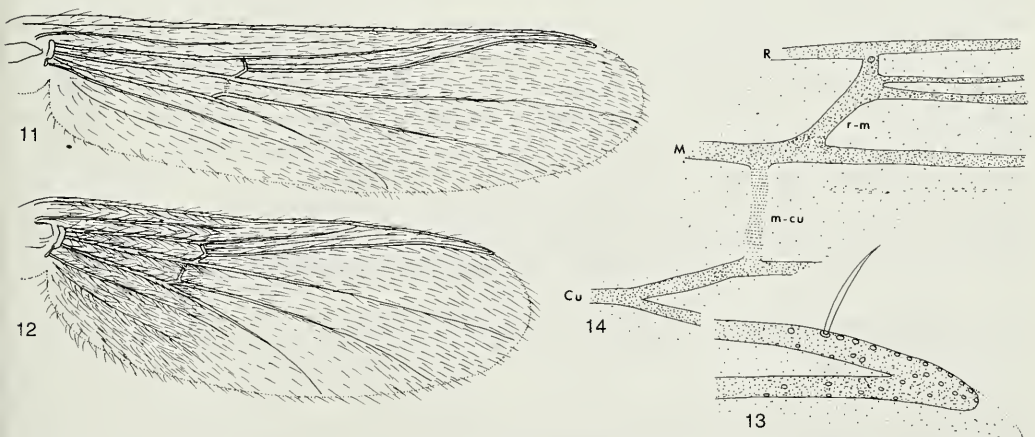


Figs 1–10. Adult. 1. spur, tibia I; 2. spurs, tibia II; 3. spurs, tibia III; 4. comb, tibia III; 5. apex of  $Ta_2$  II; 6. scutum, male, dorsal view; 7. apices of dorsocentrals and acrostichals, female; 8. antepronotum, lateral view; 9. anterior view of male dorsal eye extensions and head setae; 10. flagellomeres 8 and 9, female antenna.

Table 2. The range of and  $\bar{x}$  of the leg segment measurements  $\mu\text{m}$  and LR for adult ♂ and ♀ *Denopelopia atria*,  $\bar{x}$  in parentheses, n = 3.

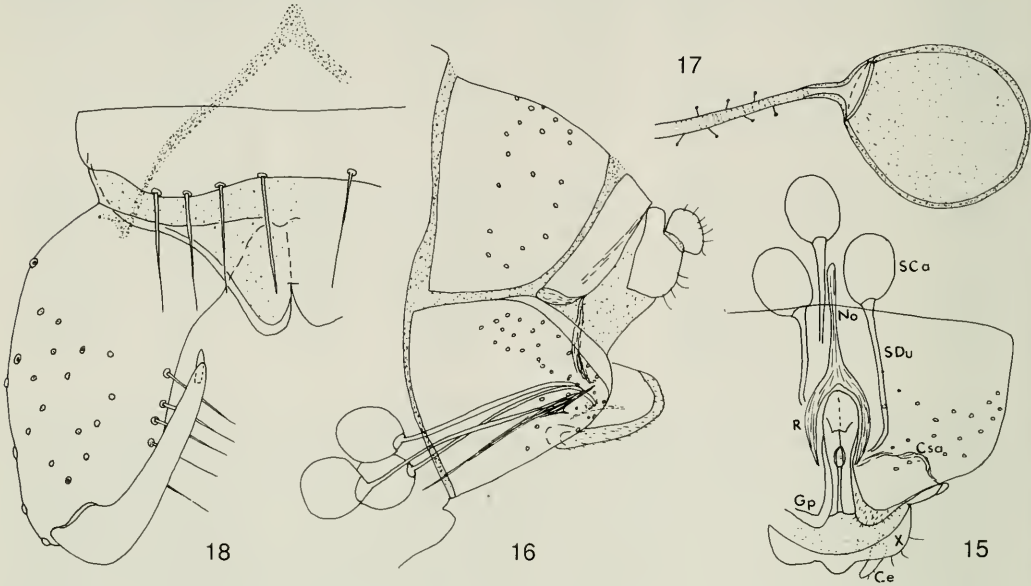
♂	F	Ti	Ta <sub>1</sub>	Ta <sub>2</sub>	Ta <sub>3</sub>	Ta <sub>4</sub>	Ta <sub>5</sub>	LR
P <sub>1</sub>	636-722 (673.3)	677-833 (762.2)	592-707 (661.3)	318-370 (351.3)	266-322 (299.7)	181-204 (192.3)	89-107 (96.3)	0.85-0.88 (0.867)
P <sub>2</sub>	699-792 (698.0)	629-751 (701.7)	496-555 (534.0)	237-278 (261.7)	162-222 (192.0)	103-130 (117.0)	78-89 (82.7)	0.74-0.79 (0.763)
P <sub>3</sub>	629-722 (674.7)	803-940 (879.3)	666-755 (715.3)	352-407 (386.3)	248-300 (281.3)	148-181 (169.0)	78-104 (91.7)	0.80-0.83 (0.813)
♀	F	Ti	Ta <sub>1</sub>	Ta <sub>2</sub>	Ta <sub>3</sub>	Ta <sub>4</sub>	Ta <sub>5</sub>	LR
P <sub>1</sub>	592-622 (608.3)	703-777 (734.0)	570-599 (581.0)	307-315 (312.3)	233-252 (244.3)	155-167 (167.7)	93-100 (96.3)	0.77-0.82 (0.793)
P <sub>2</sub>	685-770 (725.7)	681-740 (713.0)	459-496 (477.3)	241-266 (249.3)	163-167 (165.7)	107-118 (112.0)	89-93 (90.3)	0.66-0.67 (0.667)
P <sub>3</sub>	629-692 (655.0)	870-932 (909.0)	629-648 (640.3)	333-370 (354.0)	241-274 (260.3)	148-167 (159.3)	89-100 (94.0)	0.70-0.72 (0.707)

preapical seta 61  $\mu\text{m}$  L; clypeus with 22 long setae; palpus segments in ratio 26, 78, 141, 170, 301  $\mu\text{m}$ ; campaniform sensillum ventral on segment 3; antepnotum (Fig. 8) with 2-3 antepnotals and an upper (15  $\mu\text{m}$  L) and lower (32  $\mu\text{m}$  long) membranous projections; scutum (Fig. 6) pale brown; vittae, episterna, postnotum, bare, dark brown; scutellum paler brown; 9-12 setae on disc + 15 anterior smaller setae; three humerals; dorsocentrals irregularly uniseriate (Fig. 6); acrostichals biseriate, extend to caudal end of median vittae; a single seta mesal and behind dorsocentrals; six-nine prealars and one supra-alar; wing (Fig. 11) with overall hair pattern, slightly paler mesally; length 1.6-1.7 mm; costa not produced (Fig. 13) ends between M and Cu<sub>1</sub>; R<sub>2</sub> not present; m-cu 0.30 arculus to wing tip; crossvein area of wing as in Fig. 14; legs pale, unmarked; leg measurements and ratios in Table 2; ratio of longest hairs of Ti, Ta<sub>1,2</sub> to mesal segment width in Table 3; slight beard present on Ta<sub>2,3</sub> I; hairs on Ti, Ta<sub>1</sub> II, III longer than on I; spur Ti I 48-54  $\mu\text{m}$  L with three lateral teeth (Fig. 1); spurs Ti II



Figs. 11-14. Adult. 11. male wing; 12. female wing; 13. detail of apex of costa, female wing; 14. detail base of radial sector and r-m, m-cu crossveins.

57–58 and 31–35  $\mu\text{m}$  long with three lateral teeth (Fig. 2); spurs Ti III 73–77 and 34–35  $\mu\text{m}$  long with three lateral teeth; comb Ti III (Fig. 4) of seven setae; pseudospurs on Ta<sub>1</sub>, Ta<sub>2</sub> (Fig. 5) and Ta<sub>3,4</sub> II; none could be discerned on leg III; abdomen with A. I–III pale; basal third of A. IV brown; A. V–VIII wholly brown; A. IX with 8–10 setae; A. X conical, membranous; genitalia as in Fig. 18, pale; Gc 118–126  $\mu\text{m}$  L ( $\bar{x}$  124.0); Gc length/width 2.00–2.27 ( $\bar{x}$  2.133); Gs 74–81  $\mu\text{m}$  L ( $\bar{x}$  77.8); HR 1.45–1.70 ( $\bar{x}$  1.598); megaseta of Gs, 11  $\mu\text{m}$  L; only strut 3 clearly discernible (Fig. 18).



Figs. 15–18. Adult genitalia. 15. female, ventral view; 16. female, lateral view; 17. detail of seminal capsule and duct; 18. male, dorsal view.

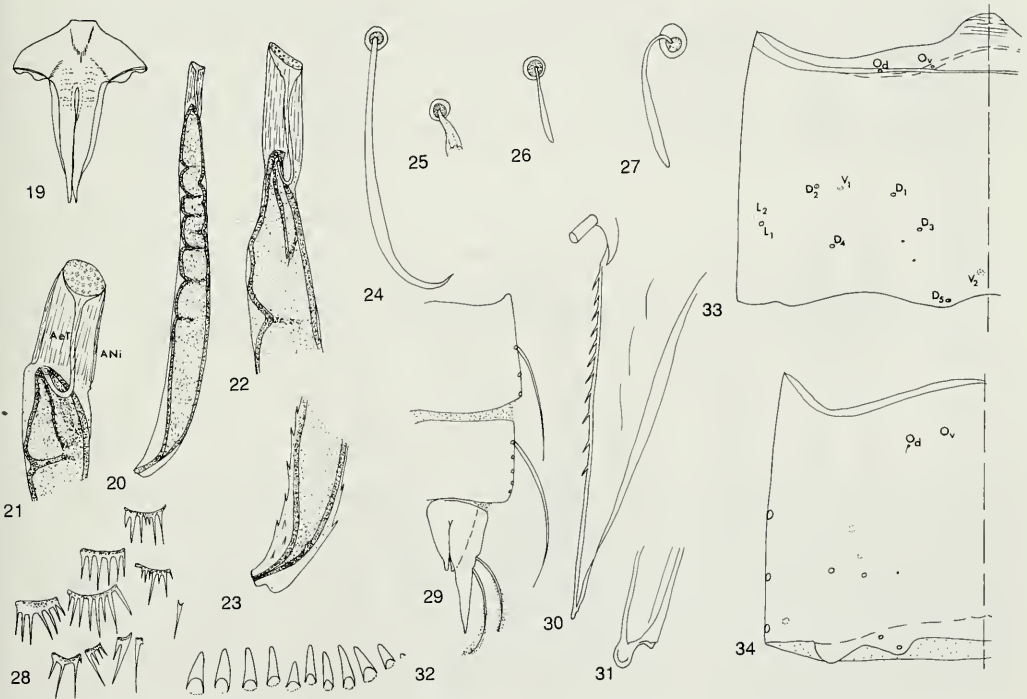
Adult ♀ – Head verticals and orbitals as in ♂; pedicel with 6–7 setae; scape with 4–6 setae; pedicel 81  $\mu\text{m}$  diameter, equal to interocular space; antenna with 11 flagellomeres; flagellomere 1 73–76  $\mu\text{m}$  L; flagellomeres 2–4, 44–51  $\mu\text{m}$  long; flagellomeres 5–8, 55–61  $\mu\text{m}$  L; flagellomeres 9–10, 64–70  $\mu\text{m}$  long; flagellomere 11 145–146  $\mu\text{m}$  L with 115  $\mu\text{m}$  preapical seta; flagellomeres 8, 9 as in Fig. 10; basiconic sensillum 73  $\mu\text{m}$  long; clypeus and palpus as in ♂; antepnotum and scutum marked as in ♂; 8–11 humerals; 8–12 prealars; dorsocentrals extended caudad as are acrostichals (Fig. 7); 10 scutellars across disc; postnotum as in ♂; wing 1.30–1.33 mm; wing venation as in ♂; hairs in basal third of wing denser and darker (Fig. 12); apex of C and R<sub>4+5</sub> (Fig. 13); legs as in ♂, unmarked; tibial spurs and comb III as in ♂; leg measurements and ratios in Table 2; longest hairs on Ta<sub>2,3</sub> I not longer than those on II and III (Table 3); hairs on Ti and Ta<sub>1</sub> II, III longer than those on Ti, Ta<sub>1</sub> I as in ♂ (Table 3); abdomen wholly brown; genitalia as in Figs. 15, 16; SCa (Fig. 17) pale

Table 3. Ratio of longest hairs/mesal segment width for ♂ and ♀ Ti, and Ta<sub>1–3</sub>, all legs, *Denopelopia atria*.

♂	Ti	Ta <sub>1</sub>	Ta <sub>2</sub>	Ta <sub>3</sub>	♀	Ti	Ta <sub>1</sub>	Ta <sub>2</sub>	Ta <sub>3</sub>
P <sub>1</sub>	4.40	4.62	7.33	6.50	P <sub>1</sub>	3.75	3.71	3.43	2.85
P <sub>2</sub>	6.00	5.29	4.50	3.83	P <sub>2</sub>	6.00	5.00	3.14	2.71
P <sub>3</sub>	8.00	7.69	3.83	6.00	P <sub>3</sub>	6.67	6.00	5.43	3.57

brown,  $63 \times 55 \mu\text{m}$ ; L/W 2.25; SDu (Fig. 17) thin walled with special secretory cells; NO  $108 \mu\text{m}$  L, slightly widened anteriorly; R  $77 \mu\text{m}$  (Fig. 15); NO/R 1.40; Gca VIII poorly developed; Csa IX curved, slightly broadened mesally (Figs. 15, 16); gonocoxite IX small; gonotergite IX well developed, bare, appears transversely striate; Gp VIII apically rounded, somewhat triangular (Fig. 15) labia bare; X with three-four setae on each side (Figs. 15, 16), Ce (Figs. 15, 16)  $63 \times 55 \mu\text{m}$ ; L/W 1.15; Sca/Ce 1.40; Sca/NO 0.58.

**Pupa** – Exuviae including wing pads medium to dark brown; frontal apotome as in Fig. 19; respiratory organ (Fig. 20) elongate, narrow with a distinct apical nipple (Figs. 21, 22); overall length of respiratory organ  $480\text{--}533 \mu\text{m}$  ( $\bar{x}$  508.0); respiratory atrium with variable constrictions;  $432\text{--}480 \mu\text{m}$  long ( $\bar{x}$  460.8); L/W  $10.7\text{--}11.5$  ( $\bar{x}$  11.14); greatest width of respiratory atrium 0.37 from its base; apical nipple, lightly sclerotized,  $66\text{--}76 \mu\text{m}$  L ( $\bar{x}$  70.0); L/W  $2.22\text{--}3.46$  ( $\bar{x}$  2.586); apopyle tube with bend toward base (Figs. 21, 22); overall  $61\text{--}67 \mu\text{m}$  L ( $\bar{x}$  64.2); plastron plate (Fig. 21) ovoid,  $15\text{--}16 \mu\text{m}$  L ( $\bar{x}$  15.3,  $n = 4$ ); L/W  $0.53\text{--}0.79$  ( $\bar{x}$  0.643,  $n = 4$ ); base of respiratory organ with small surface spines (Fig. 23); a distinct thoracic comb of 10–11 short conical tubercles present (Fig. 32); precorneal setae not clearly discernible; dorsocentral setae in Figs. 25–27, Dcs1, short with 3,4 points,  $9 \mu\text{m}$  L (Fig. 25); Dcs2 (Fig. 26)  $20 \mu\text{m}$  L; Dcs4 (= Sas)  $27 \mu\text{m}$  L (Fig. 27); scar A. I distinct, pigmented in the form of an inverted T; abdominal shagreen of scattered fine spinules about  $4 \mu\text{m}$  L; venter of A. II with arcs of spinule combs,  $5\text{--}12 \mu\text{m}$  L (Fig. 28); A. I with three D setae; A. II and A. VII (Fig. 34) with four D setae; A. III–VI (Fig. 33) with five D setae;  $L_1$  appears present on A. I–VI;  $L_2$  on A. I–VII;  $V_{1,2}$  on A. III–VII; almost aligned and close together on A. VII (Fig. 34); arrangement of D, L, V setae of A. V shown in Fig. 33; D setae appear shaped as in Fig. 24; most D setae distorted in mounting; on



Figs. 19–34. Pupa. 19. frontal apotome; 20. respiratory organ; 21. detail of apex of respiratory organ, dorsal; 22. detail of apex of respiratory organ, lateral; 23. detail of base of respiratory organ; 24. seta  $D_3$ , A. IV; 25. seta Dcs1; 26. seta Dcs2; 27. seta Dcs4 (= Sas); 28. ventral combs of A. II; 29. A. VII, VIII and anal lobes; 30 detail of anal lobe; 31. detail apex of anal lobe; 32. thoracic comb; 33. setal pattern of A. V; 34. setal pattern of A. VII.

A. V  $D_2$   $73 \mu\text{m L}$ ;  $D_3$  (Fig. 24)  $51 \mu\text{m L}$ ;  $D_5$   $24 \mu\text{m L}$ ;  $O_D$  and  $O_V$  in anterior segment margins (Fig. 33); on A. VII (Fig. 34)  $O_D$ ,  $O_V$  distinctly caudad of anterior margins; anterior of A. III–V produced strap-like (Fig. 33) with transverse grooves; A. VII with three LS filaments about  $348 \mu\text{m L}$  (Fig. 29); filaments placed at 0.47, 0.74, 0.94 from base to apex of segment; A. VIII with five LS filaments about  $481 \mu\text{m L}$  (Fig. 29); filaments placed at 0.28, 0.54, 0.72, 0.87; 0.98 from base to apex of segment; on some specimens  $L_1$  of A. VI is enlarged into filament  $222 \mu\text{m L}$ ; anal fins elongate. triangular (Fig. 29) with row of 9–13 spinules (Fig. 30) on outer margin; spinules  $8\text{--}9 \mu\text{m L}$ ; anal lobes  $344\text{--}418 \mu\text{m L}$  ( $\bar{x}$   $387.8$ );  $L/W$   $3.21\text{--}3.64$  ( $\bar{x}$   $3.492$ ); lateral filaments of anal lobes with sticky sheaths (Fig. 29);  $LS_1$  about  $222 \mu\text{m L}$  placed at  $0.39\text{--}0.42$  ( $\bar{x}$   $0.408$ ) from base to apex of anal lobes;  $LS_2$  about  $259 \mu\text{m L}$  placed at  $0.49\text{--}0.52$  ( $\bar{x}$   $0.506$ ) base to apex of anal lobes; apex of anal lobes knob-like (Fig. 31); ♂ genital sacs, slightly narrowed apically;  $0.49\text{--}0.55$  ( $\bar{x}$   $0.523$ ,  $n = 3$ ) length of anal lobes; ♀ genital sacs  $0.26$  ( $\bar{x}$   $0.275$ ,  $n = 2$ ) length of anal lobes.



Figs. 35–45. Larva. 35. apical antennal segments; 36. detail of apex of  $A_2$ ; 37. maxillary palpus and apical sensillae; 38. detail of lacinia of maxilla; 39. smaller claws of posterior prolegs; 40. mentum; 41. ligula, paraligula and pecten hypopharyngis; 42. ventral head setal pattern; 43. detail of lateroventral mandibular setae; 44. detail of apex of mandible; 45. anal tubules, lateral view.



Larva – Head pale brown; length 739–749; IC 0.51; depth/length 0.52; labrum similar to *Ablabesmyia* (Roback, 1985, Figs. 11, 12);  $S_9, S_{10}$ , SSm and VP (Fig. 42) similar to *Monopelopia* (KOWALYK, 1985);  $A_1$  300–318  $\mu\text{m}$  ( $\bar{x}$  307.8); CS,  $A_1$  0.55–0.61 ( $\bar{x}$  0.570) from base;  $A_2$  94–100  $\mu\text{m}$  (Fig. 35) ( $\bar{x}$  96.7,  $n = 3$ ); L/W  $A_2$  about 12;  $A_3$  4  $\mu\text{m}$ ;  $A_4$  4–5  $\mu\text{m}$ ; AR 2.75–2.91 ( $\bar{x}$  2.846); Bl and ABl (Fig. 35) subequal in length to  $A_{2-4}$ ; Bl/ $A_{2-4}$  0.95–0.98 ( $\bar{x}$  0.963,  $n = 4$ ); Bl 100–111  $\mu\text{m}$  ( $\bar{x}$  104.8,  $n = 4$ ); ABl 102–111  $\mu\text{m}$  ( $\bar{x}$  105.8,  $n = 4$ ); basal ring (BR) 24  $\mu\text{m}$  L;  $L/W$  3.00 (Fig. 35); sensory pegs (Lauterborn organs) of  $A_2$  4–5  $\mu\text{m}$  L; sessile on apex of  $A_2$  (Figs. 35, 36); blade of  $A_2$  (Fig. 35) about 7  $\mu\text{m}$  L; mandible 107–122  $\mu\text{m}$ ; lateroventral setae ( $S_{1-3}$ ) as in Fig. 43;  $S_1$  short and peg-like; inner teeth and seta subdentalis (Fig. 44); apical tooth of mandible about 0.30 length of mandible and 2.75 as long as width at base;  $A_1$ /mandible 2.57–2.80 ( $\bar{x}$  2.656); palpus (Fig. 37) 44–47  $\mu\text{m}$  L ( $\bar{x}$  45.0);  $L/W$  4.43–5.17 ( $\bar{x}$  4.758); CS of palpus 0.64–0.71 from base ( $\bar{x}$  0.690); apical segments of palpus (b) and sensillae (a, c, d, e, f) shown in Fig. 37; lacinia as in Fig. 38 with border of LCh; antiaxial seta and paraxial setae on membranous projections, simple (Fig. 38);  $A_1$ /palpus 6.45–7.07 ( $\bar{x}$  6.848); ligula (Fig. 41) 77–78  $\mu\text{m}$  ( $\bar{x}$  81.8); inner and mesal teeth appear slightly paler; inner teeth and mesal tooth 1.00–1.02 length of outer tooth ( $\bar{x}$  1.012); paralingula trifold (Fig. 41); 44–45  $\mu\text{m}$  L ( $\bar{x}$  44.4); first inner tooth apex at about 0.75 base to apex; second inner tooth apex 0.65 base to apex; pecten hypopharyngis with 11–12 teeth (Fig. 41); mentum as in Fig. 40; pseudoradula slightly broadened basally, pustules random; M appendage and ventromentum clearly separated, laterally separation appears partially sclerotized with alveoli (Fig. 40); two dorsomental teeth present; body red in fourth instar, more orange in third; anterior prolegs about 469  $\mu\text{m}$  L, fork about 0.76 of their length from base; claws 29–58  $\mu\text{m}$  L, simple; those under 29  $\mu\text{m}$  with 1–3 fine inner spines; procercus 159–170  $\mu\text{m}$  ( $\bar{x}$  163.8,  $n = 4$ ); L/W 4.74–5.38 ( $\bar{x}$  5.000,  $n = 4$ ); with seven apical elongate setae; two lateral setae below procercus; upper simple, 38  $\mu\text{m}$ ; lower multibranched, 92  $\mu\text{m}$ ; supraanal setae about 350  $\mu\text{m}$  L; three lateral setae below supraanal seta, upper bifid 114  $\mu\text{m}$ ; mesal seta simple 27  $\mu\text{m}$ ; lower bifid 54  $\mu\text{m}$ ; subbasal seta of posterior prolegs simple, about 230  $\mu\text{m}$  L; claws of posterior prolegs pale brown; two shortest claws (Fig. 39) with strong inner teeth and some spinules on outer margins, three slightly larger claws with one small internal spine (Fig. 39); nine longer teeth narrow, finely pectinate; anal tubules as in Fig. 45; upper about 192  $\mu\text{m}$  L; lower 155  $\mu\text{m}$ ; both slightly more than 4 times as long as greatest width.

#### Specimens examined

Holotype – ♂ pupal exuviae-adult, shallow ditch near FDER laboratory, Punta Gorda FL, VII-1986, coll. Rutter.

Allotype – ♀ pupal exuviae – adult, same data

Paratypes – 5 ♂♂, 3 ♀♀ pupal exuviae – adult, same data; 3 ♀♀ pupal exuviae – adult, same data (Alc.)

Non-types – 12 larvae; 4 ♂♂, 3 ♀♀ pupae, same data; 19 larvae; 2 ♂♂, 3 ♀♀ pupae, same data: (Alc.).

### Habitat, Ecology and Rearing

To date this midge is known only from the type locality, a shallow drainage ditch surrounding the Punta Gorda Branch Office of the Florida Department of Environmental Regulation (FDER) in Charlotte County. Charlotte County lies in the transition zone between the humid subtropical climate that prevails over much of the southeastern United States and the quasi-tropical climate of southernmost Florida. Freezing temperatures are rare. Rainfall averages between 127 and 140 cm per year. Although some rainfall normally occurs every month, there is a distinct rainy season extending from May through September and a low rainfall season from October through April. About 60 to 65 percent of the annual rainfall occurs during the late spring-summer rainy season (FERNALD & PATTON 1984, p. 179).

The 3 m wide ditch, at least 12 years old, was constructed to aid in stormwater drainage but has water yearround due to groundwater seepage. Ditchbank vegetation includes cinnamon fern (*Osmunda*

*cinnamomea*), royal fern (*O. regalis* var. *spectabilis*), water primrose (*Ludwigia* sp.), wax myrtle (*Myrica cerifera*), exotic Brazilian pepper (*Schinus terebinthifolius*), swamp willow (*Salix caroliniana*), southern fox grape (*Vitis munsoniana*), and south Florida slash pine (*Pinus elliottii* var. *densa*). Emergent species are cattail (*Typha* sp.), present throughout the ditch, duck-potato (*Sagittaria lancifolia*) and pickerelweed (*Pontederia lanceolata*). Overstory canopy is restricted to the shoreline, but the dense growth *Typha* sp. effectively shades much of the open water areas.

The pupae and adults were reared from fourth instar larvae collected in mid-July and early August 1986. A D-frame aquatic dip net was pulled swiftly backward along the bottom among the cattails producing currents which suspended the surficial detritus, then the direction was rapidly reversed and the mouth of the net bag was pushed forward through the incoming water. In this manner about 24 larvae were collected with a minimum of debris from an area of approximately 3 m<sup>2</sup>.

Water depth in the area where *D. atria* larvae were collected was 613 cm and water movement was barely perceptible. The bottom was 34 cm of accumulated leaf and needlefall from riparian and emergent vegetation, overlain by an orange floc. Values for selected physicochemical parameters measured at this location at a depth of 4 cm on 14 July 1986 were: temperature 27.5°C, specific conductance 370  $\mu$ mhos/cm, pH 7.1, dissolved oxygen 0.3 mg/l, Fe 1.2 mg/l. On 19 December 1986 values were: 21.5°C, 345  $\mu$ mhos/cm, 7.1, 0.6 mg/l and 2.8 mg/l, respectively. An iron concentration of 108 mg/l was recorded for a floc sample collected from the bottom on 22 December 1986.

Midges coexisting with *D. atria* in August were *Chironomus* sp., *Goeldichironomus holoprasinus* (Goeldi) and *Zavreliella varipennis* (Coquillett); in December were *Chironomus* sp., *Einfeldia austini* Beck & Beck and *Tanytus carinatus* Sublette. Larvae of the phantom crane fly, *Bittacomorpha* sp., were also present in both months. Gut contents of 15 slide-mounted *D. atria* larvae included *Chironomus* sp. larvae, naidid worm setae, unidentified arthropod parts, the ploimate rotifer *Lecane* sp., a variety of pennate diatoms (*Achnanthes* sp., *Cymbella* sp., *Gomphonema* sp., *Navicula* spp., *Nitzschia* spp., *Pinnularia* sp.) and undifferentiated detritus.

Fourth instar larvae were held communally in a 5.0×8.5 cm clear glass container filled with 75 ml of ditchwater, several detrital willow leaves and floc. In the rearing container larvae clung either to the underside of the willow leaves or to the small irregular clumps of floc/fine detritus. The larvae readily pupated and each pupa was placed in to a 17×60 mm 2 dram clear glass vial containing 4 ml (depth 25 mm) of ditchwater and either a toothpick or willow leaf extending through the air/water interface. Pupae typically assumed a "C" configuration against the submerged portion of the leaf or stick, and often times were observed with the respiratory organs against the water surface. When prodded they were strong swimmers. However, all pupae died within 36H, some in the process of eclosion. Subsequently all but 3 mm of water was drained from the vials and some willow leaf fragments were placed on the bottom. This worked nicely and several adults emerged successfully. It appears that the pupa of this species may leave the water partially or entirely at some time prior to eclosion.

A multitude of habitats and water quality conditions in southwest Florida rivers, streams, canals, lakes and ponds have been sampled for benthic macroinvertebrates since 1980 as part of the FDER water quality monitoring program, but not a single specimen of *D. atria* has been collected. This suggests restrictive ecological requirements for the species, most likely the larval stage. FDER sampling in ditches is rare, but such habitats are not uncommon in southwest Florida. Ditching to improve drainage for pastureland, cropland and residential developments has been and still is extensively employed. Southwest Florida has an extensive surficial aquifer system (FERNALD PATTON 1984, p. 36), and in Charlotte County the water table may be at or above land surface for months in poorly drained areas. Many wells that tap this aquifer in the central portion of the county produce water with more than 2 mg/l of iron (SUTCLIFFE 1975). According to WOLANSKY (1978) a significant but unknown amount of discharge from this unconfined aquifer is into canals and drainage ditches. Further collecting in ironrich groundwater seeps may reveal additional populations of *Denopelopia atria*.

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