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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 *Zavrelimyia.* 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 thoraic 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_1/Ti
NO, notum, ♀ genitalia
R, rami, ♀ genitalia
SCa, seminal capsules, ♀ genitalia
SDu, spermathecal duct, ♀ genitalia
Ta_{1-5}, tarsal segments
Ti, tibia
I–II, pro, meso-, metathoraic legs

Pupa

A. I–VIII, abdominal segments
Aet, aeropyle tube of respiratory organ
AL, anal lobes
ANi, apical nipple, respiratory organ
D_{1-5}, dorsal abdominal setae
Dcs 1, 2, 4, dorsocentral thoracic setae
$L_{1,2}$ lateral abdominal setae
LS_{1-5}, lateral filaments, abdomen, AL
GS, genital sacs
O_d, O_v, anterior setae, abdomen
$V_{1,2}$ ventral abdominal setae

Larva

a–e, apical palpal sensillae
aa, antaxial seta of lacinia
A_{1-4}, antennal segments
ABl, accessory blade
AeT, aeropyle tube
ANi, apical nipple
AR, antennal ratio A_1/A_{2-4}
Bl, blade
BR, basal ring of Bl
CS, campaniform sensillum
IC, head ratio $^{W}/L$
Lc, lacinia
LCh, lacinial chaeta
Li, ligula
pa, paraxial seta of lacinia
Pl, paraligula
PH, pecten hypopharyngis
S_{1-3}, lateroventral mandibular setae
S_{9-10}, genal setae
SP_2, sensory pegs A_2
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_{4+5} (Figs 11–13) ends between apices of M and CU_1 (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
Adult							
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_1<> M	> M	Cu_1<>M	= M	Cu_1<>M	= M
T.IX setae	-	+	+	-	+	+	+
Gc, basidorsal lobes	-	-	-	+	+	_	-
Pupa							
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	-	-	-	+	-	+	+
Larva							
SP_2 sessile	+	+	+	+	+	+	-
CS,A_1 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 plastron 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_2) on A_2 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_2 (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_2. Table 1 compares some of the characters of all those genera with those of *Denopelopia* and will serve to help differentiate them.

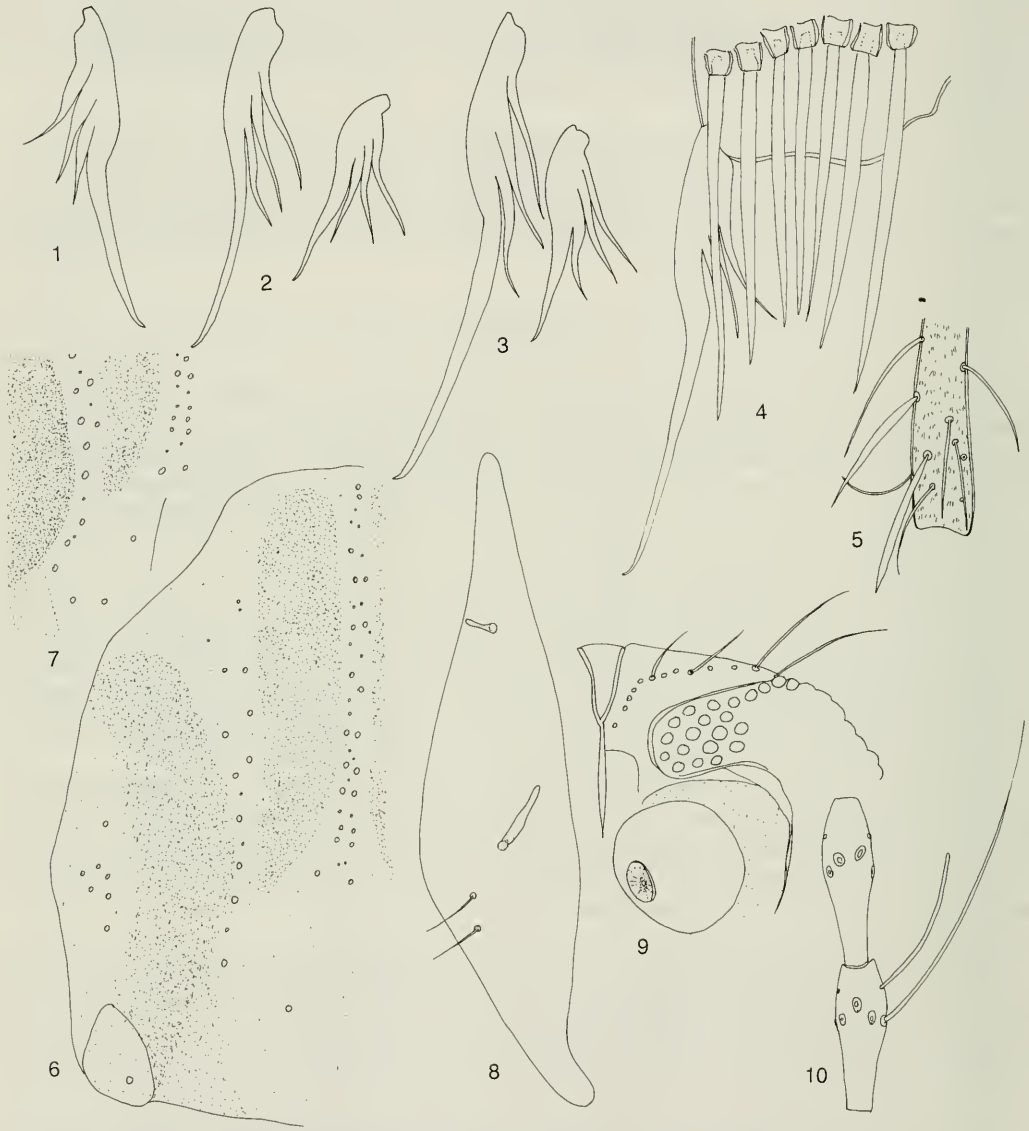
The ♀ genitalia of *Denopelopia* (Figs. 15–17) will key to *Zavrelimyia* in Saether (1977), differing in the slightly expanded anterior end of NO and the broader R of Gp IX. The other characters in Saether's description of the *Zavrelimyia* ♀ genitalia fit *Denopelopia* closely. The ♀ genitalia of *Telmatopelopia* 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 μm long, uniseriate; orbitals uniseriate extend to center of dorsal eye extension (Fig. 9), 63 μm long; pedicel with five setae, 141 μm diameter (Fig. 9), pedicel 1.41× interocular space; AR 1.63–1.71 ($\bar{x}$ 1.683); flagellomere 14, 80 μm long with



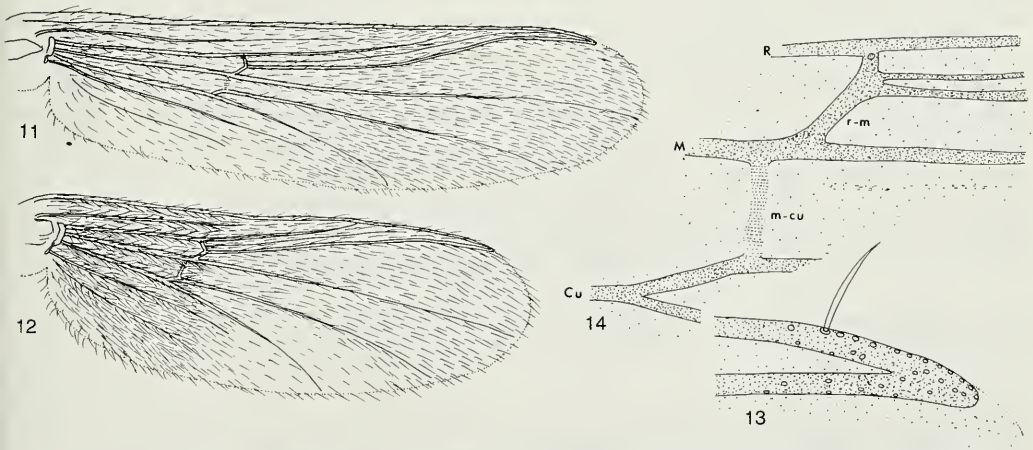
Figs 1–10. Adult. 1. spur, tibia I; 2. spurs, tibia II; 3. spurs, tibia III; 4. comb, tibia III; 5. apex of Ta_2 II; 6. scutum, male, dorsal view; 7. apices of dorsocentrals and acrostichals, female; 8. antepronotum, lateral view; 9. anterior view of male dorsal eye extensions and head setae; 10. flagellomeres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

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

♂	F	Ti	Ta_1	Ta_2	Ta_3	Ta_4	Ta_5	LR
P_1	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_2	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_3	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)

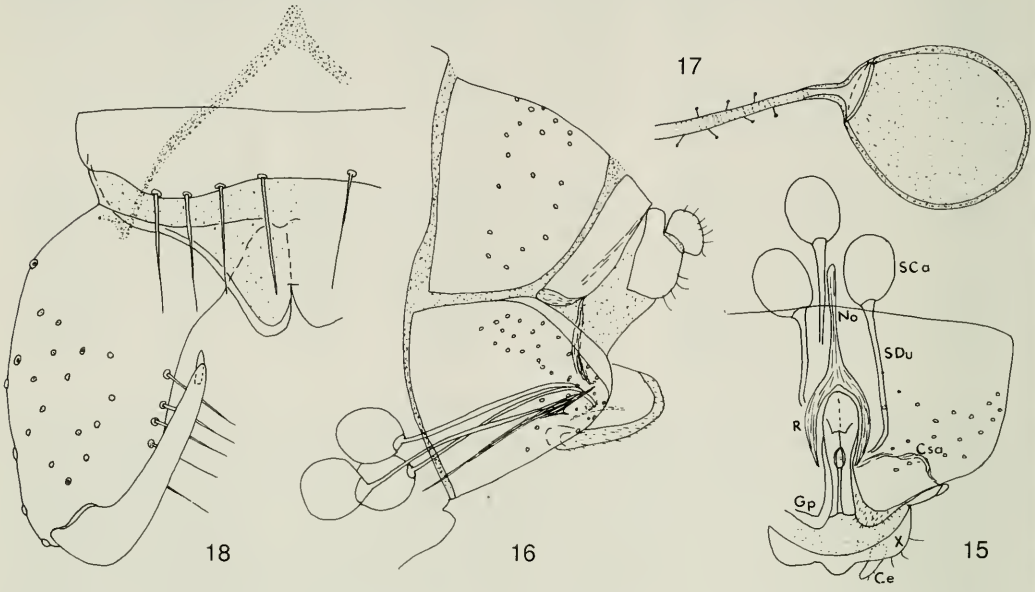
♀	F	Ti	Ta_1	Ta_2	Ta_3	Ta_4	Ta_5	LR
P_1	592-622 (608.3)	703-777 (734.0)	570-599 (581.0)	307-315 (312.3)	233-252 (244.3)	155-167 (167.7)	93-100 (96.3)	0.77-0.82 (0.793)
P_2	685-770 (725.7)	681-740 (713.0)	459-496 (477.3)	241-266 (249.3)	163-167 (165.7)	107-118 (112.0)	89-93 (90.3)	0.66-0.67 (0.667)
P_3	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 μm L; clypeus with 22 long setae; palpus segments in ratio 26, 78, 141, 170, 301 μm; campaniform sensillum ventral on segment 3; antepronotum (Fig. 8) with 2–3 antepronotals and an upper (15 μm L) and lower (32 μm 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_1; R_2 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, $Ta_{1,2}$ to mesal segment width in Table 3; slight beard present on $Ta_{2,3}$ I; hairs on Ti, Ta_1 II, III longer than on I; spur Ti I 48–54 μm 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 μm long with three lateral teeth (Fig. 2); spurs Ti III 73–77 and 34–35 μm long with three lateral teeth; comb Ti III (Fig. 4) of seven setae; pseudospurs on Ta_1, Ta_2 (Fig. 5) and $Ta_{3,4}$ 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 μm L ($\bar{x}$ 124.0); Gc length/width 2.00–2.27 ($\bar{x}$ 2.133); Gs 74–81 μm L ($\bar{x}$ 77.8); HR 1.45–1.70 ($\bar{x}$ 1.598); megaseta of Gs, 11 μm 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.

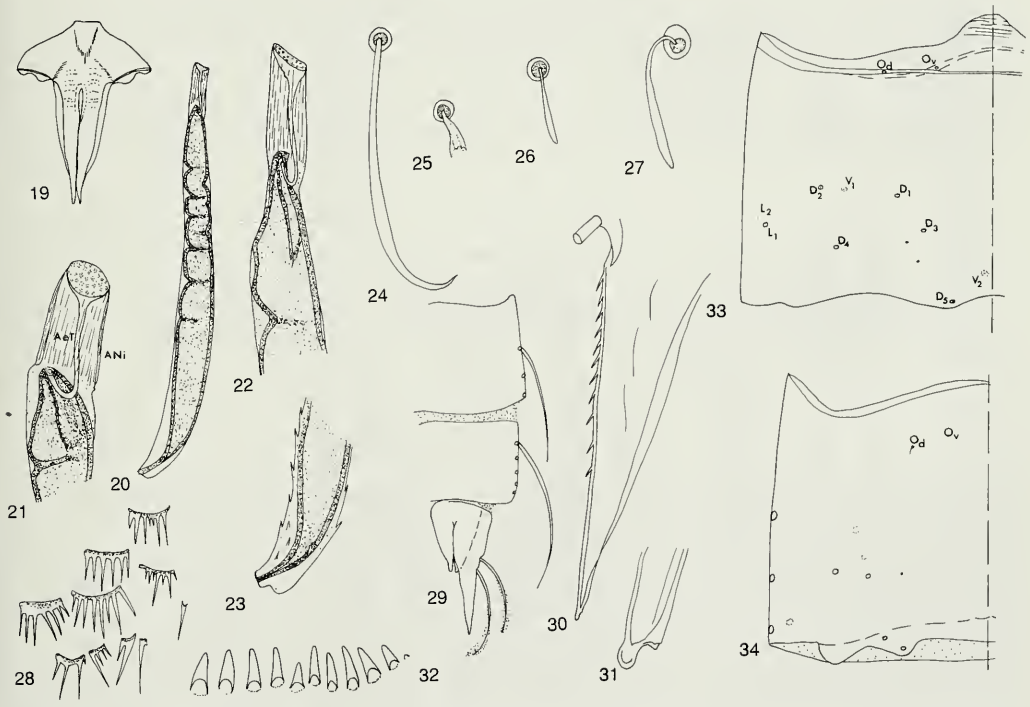
Adult ♀ – Head verticals and orbitals as in ♂; pedicel with 6–7 setae; scape with 4–6 setae; pedicel 81 μm diameter, equal to interocular space; antenna with 11 flagellomeres; flagellomere 1 73–76 μm L; flagellomeres 2–4, 44–51 μm long; flagellomeres 5–8, 55–61 μm L; flagellomeres 9–10, 64–70 μm long; flagellomere 11 145–146 μm L with 115 μm preapical seta; flagellomeres 8, 9 as in Fig. 10; basiconic sensillum 73 μm long; clypeus and palpus as in ♂; antepronotum 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_{4+5} (Fig. 13); legs as in ♂, unmarked; tibial spurs and comb III as in ♂; leg measurements and ratios in Table 2; longest hairs on $Ta_{2,3}$ I not longer than those on II and III (Table 3); hairs on Ti and Ta_1 II, III longer than those on Ti, Ta_1 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_{1-3}, all legs, *Denopelopia atria*.

♂	Ti	Ta_1	Ta_2	Ta_3	♀	Ti	Ta_1	Ta_2	Ta_3
P_1	4.40	4.62	7.33	6.50	P_1	3.75	3.71	3.43	2.85
P_2	6.00	5.29	4.50	3.83	P_2	6.00	5.00	3.14	2.71
P_3	8.00	7.69	3.83	6.00	P_3	6.67	6.00	5.43	3.57

brown, 63×55 μm; L/W 2.25; SDu (Fig. 17) thin walled with special secretory cells; NO 108 μm L, slightly widened anteriorly; R 77 μm (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) 63×55 μm; 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 480–533 μm ($\bar{x}$ 508.0); respiratory atrium with variable constrictions; 432–480 μm long ($\bar{x}$ 460.8); L/W 10.7–11.5 ($\bar{x}$ 11.14); greatest width of respiratory atrium 0.37 from its base; apical nipple, lightly sclerotized, 66–76 μm L ($\bar{x}$ 70.0); L/W 2.22–3.46 ($\bar{x}$ 2.586); aeropyle tube with bend toward base (Figs. 21, 22); overall 61–67 μm L ($\bar{x}$ 64.2); plastron plate (Fig. 21) ovoid, 15–16 μm L ($\bar{x}$ 15.3, n = 4); L/W 0.53–0.79 ($\bar{x}$ 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, Dcsl, short with 3,4 points, 9 μm L (Fig. 25); Dcs2 (Fig. 26) 20 μm L; Dcs4 (= Sas) 27 μm L (Fig. 27); scar A. I distinct, pigmented in the form of an inverted T; abdominal shagreen of scattered fine spinules about 4 μm L; venter of A. II with arcs of spinule combs, 5–12 μm 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 Dcsl; 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 μm L; D_3 (Fig. 24) 51 μm L; D_5 24 μm 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 μm 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 μm 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 μm L; anal fins elongate. triangular (Fig. 29) with row of 9–13 spinules (Fig. 30) on outer margin; spinules 8–9 μm L; anal lobes 344–418 μm L ($\bar{x}$ 387.8); L/W 3.21–3.64 ($\bar{x}$ 3.492); lateral filaments of anal lobes with sticky sheaths (Fig. 29); LS_1 about 222 μm L placed at 0.39–0.42 ($\bar{x}$ 0.408) from base to apex of anal lobes; LS_2 about 259 μm L placed at 0.49–0.52 ($\bar{x}$ 0.506) base to apex of anal lobes; apex of anal lobes knob-like (Fig. 31); ♂ genital sacs, slightly narrowed apically; 0.49–0.55 ($\bar{x}$ 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 μm (x̄ 307.8); CS, A_1 0.55–0.61 (x̄ 0.570) from base; A_2 94–100 μm (Fig. 35) (x̄ 96.7, n = 3); L/W A_2 about 12; A_3 4 μm; A_4 4–5μm; AR 2.75–2.91 (x̄ 2.846); Bl and ABl (Fig. 35) subequal in length to A_{2-4}; Bl/A_{2-4} 0.95–0.98 (x̄ 0.963, n = 4); Bl 100–111 μm (x̄ 104.8, n = 4); ABl 102–111 μm (x̄ 105.8, n = 4); basal ring (BR) 24 μm L; ^{L}/W 3.00 (Fig. 35); sensory pegs (Lauterborn organs) of A_2 4–5 μm L; sessile on apex of A_2 (Figs. 35, 36); blade of A_2 (Fig. 35) about 7 μm L; mandible 107–122 μm; 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 (x̄ 2.656); palpus (Fig. 37) 44–47 μm L (x̄ 45.0); ^{L}/W 4.43–5.17 (x̄ 4.758); CS of palpus 0.64–0.71 from base (x̄ 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; antaxial seta and paraxial setae on membranous projections, simple (Fig. 38); A_1/palpus 6.45–7.07 (x̄ 6.848); ligula (Fig. 41) 77–78 μm (x̄ 81.8); inner and mesal teeth appear slightly paler; inner teeth and mesal tooth 1.00–1.02 length of outer tooth (x̄ 1.012); paraligula trifid (Fig. 41); 44–45 μm L (x̄ 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 μm L, fork about 0.76 of their length from base; claws 29–58 μm L, simple; those under 29 μm with 1–3 fine inner spines; procercus 159–170 μm (x̄ 163.8, n = 4); L/W 4.74–5.38 (x̄ 5.000, n = 4); with seven apical elongate setae; two lateral setae below procercus; upper simple, 38 μm; lower multibranched, 92 μm; supraanal setae about 350 μm L; three lateral setae below supraanal seta, upper bifid 114 μm; mesal seta simple 27 μm; lower bifid 54 μm; subbasal seta of posterior prolegs simple, about 230 μm 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 μm L; lower 155 μm; 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^2.

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, overalain 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 27.5C, specific conductance 370 μmhos/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 μmhos/cm, 7.1, 0.6 mg/1 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 *Tanypus carinatus* Sublette. Larvae of the phantom cranefly, *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., *Nitzchia* 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 2dram 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 ecolosion.

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 rate, 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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