

A New Species of *Monopelopia* (Diptera: Chironomidae) from Phytotelmata in Jamaica, with Preliminary Ecological Notes

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ABSTRACT: The chironomid component of the aquatic community found in Jamaican bromeliad phytotelmata consisted of *Chironomus anonymus* Williston, a *Metriocnemus* sp., *Polypedilum* cf. *tritum* (Walker) and two species of *Monopelopia*. The fourth instar larva, pupa, and adult male and female of *Monopelopia mikeschwartzi* n. sp. are described from material collected from these phytotelmata. The new species is very similar to *M. tillandsia* Beck and Beck, another New World *Monopelopia* species also known from bromeliad phytotelmata. Characters are given that separate these two species in all life stages, as well as from other Nearctic species of the genus. Water temperature, pH and conductivity values and additional ecological data are given for the phytotelmata in which the new species was found.

Phytotelmata are small water bodies impounded by plants or plant structures (Fish, 1983) that can be regarded as aquatic microcosms (Maguire, 1971), inhabited by a variety of organisms. Among these, dipteran larvae, especially Chironomidae, Culicidae and Syrphidae, are highly successful in colonizing phytotelmata. Reviewing the published literature, Frank (1983) listed *Ablabesmyia costarricensis* (Picado), *A. ignobilis* (= *Paramerina ignobilis* (Johannsen)), *Chirocladius pedipalpus* Picado, *Chironomus*, *Cryptochironomus*, *Metriocnemus abdominoflavatus* Picado, *Monopelopia tillandsia* Beck and Beck, *Orthocladius*, *Pentaneura* and *Tanytarsus* sp. nr. *confusus* Malloch as Chironomidae having larval stages known to occur in bromeliad phytotelmata. Epler (1988, 1995) reported larvae of *Dicrotendipes leucoscelis* (Townes), *Monopelopia tillandsia* and two species of *Metriocnemus* from bromeliad phytotelmata in Florida. Laessle (1961) noted the presence of *Chironomus* sp. and *Cryptochironomus* sp. in Jamaican bromeliad phytotelmata. Due to taxonomic changes and the general difficulty involved in identifying Chironomidae, many of the preceding names from Frank (1983) and Laessle (1961) must be viewed with skepticism until the material is re-examined. For example, *Chirocladius pedipalpus* is almost certainly a *Polypedilum*, but its true identity will not be clear until type material, if it exists, is examined. The widely used (especially in older literature) generic names *Chironomus*, *Cryptochironomus*, *Orthocladius* and *Pentaneura* are almost meaningless without modern examination of reference material. Cranston and Judd (1987) and Cranston and Kitching (1995) provide additional (and taxonomically correct, at least in this moment in time) information on phytotelmatic chironomids.

During a study conducted by the junior author in Jamaica, larvae of *Polypedilum* cf. *tritum* (Walker), *Metriocnemus* sp., *Chironomus anonymus* Williston and two different species of *Monopelopia* were found. One of the latter was successfully reared to the adult stage and is described here by the senior author, along with preliminary notes on its ecology.

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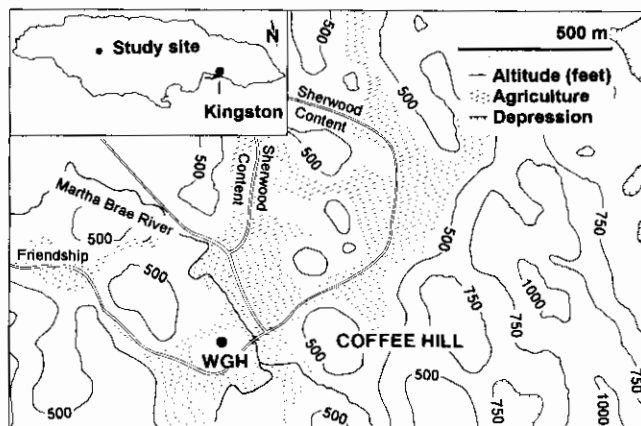


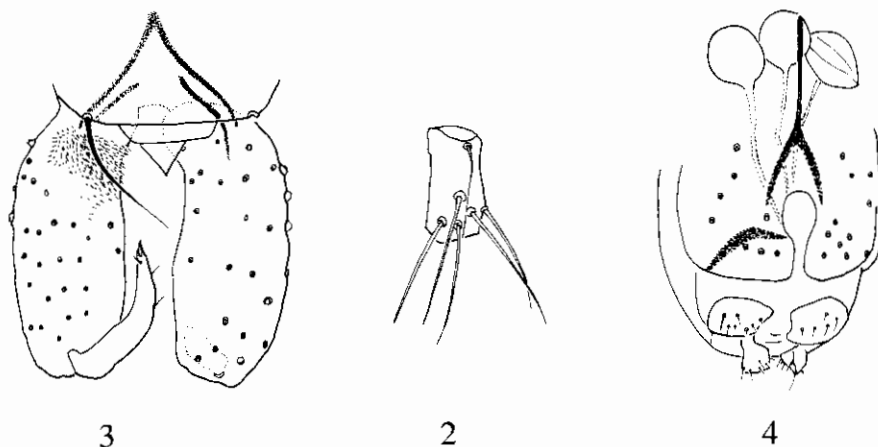
Fig. 1. Map of study area (Inset: Jamaica; WGH = Windsor Green House field station; Friendship and Sherwood Content are nearby villages).

The study was conducted near Windsor, Trelawny Parish, at the northern rim of the Jamaican Cockpit Country, a karst landscape reaching 700 m elevation at its highest part (Fig. 1); part of the study was performed on Coffee Hill (77°41'15"W, 18°21'10"N, elevation approximately 198 m). The mean annual rainfall of 1900–3000 mm fosters tropical wet to moist rainforest, described by Asprey and Robbins (1953) as "Wet Limestone Forest". Terrestrial tank bromeliads (Bromeliaceae) such as *Hohenbergia inermis* Mez and *Aechmea paniculigera* (Swartz) Grisebach are a typical feature of the understory. Among these bromeliads, *A. paniculigera* is especially suitable to funnel rainwater and leaf litter derived from the canopy into its leaf axils, where a temporary or even permanent pool is formed (Janetzky and Vareschi, 1993).

Methods

Temperature and pH values were measured by means of a temperature-compensated pH meter (WTW pH 320) and a temperature-compensated conductivity meter (WTW LF 92). Before samples were taken, accumulated leaf litter derived from the canopy was removed after being washed down in the phytotelmata. Water and remaining small detritus were sucked out of the bromeliads' leaf axils using a 100 ml syringe on which a hose was fitted, to reach the bottom of leaf axils. Empty leaf axils were rinsed with water for complete sampling. In a few cases, bromeliads were cut from the ground, dissected, and water from different leaf axils was collected separately. Samples were filtered with a net (mesh size 108 μm), and fixed with formalin (final concentration 5%). In the laboratory samples were sorted using a light microscope (WILD M8) and preserved in 70% ethanol.

For rearing experiments, in April 1995 samples were taken from phytotelmata in *Aechmea paniculigera* growing on Coffee Hill and sorted. Larvae of *Monopelopia* sp. were transferred into Petri dishes. Detritus was added, after checking for further animals to avoid contamination. The dishes were covered with nets to prevent the contamination of samples and to retain emergent adults. The dishes were checked daily for developmental stages; larvae, pupae and adults were fixed in 70% ethanol. Material was mounted on microscope slides in Canada balsam or Euparal. Mor-



Figs. 2–4. *Monopelopia mikeschwartzi*, adult: 2. Male palpomere 2; 3. Male hypopygium: dorsal on left, ventral on right; 4. Female terminalia, ventral.

phological terminology and abbreviations follow Sæther (1980), Kowalyk (1985) and Epler (1988, 1996); the term “taenia” is used for lateral filamentous or lamellate (flattened) pupal setae (Langton, 1994). Measurements are given in μm unless otherwise noted.

Description

Monopelopia mikeschwartzi Epler, n. sp.

Type locality: JAMAICA: Trelawny Parish, Coffee Hill near Windsor.

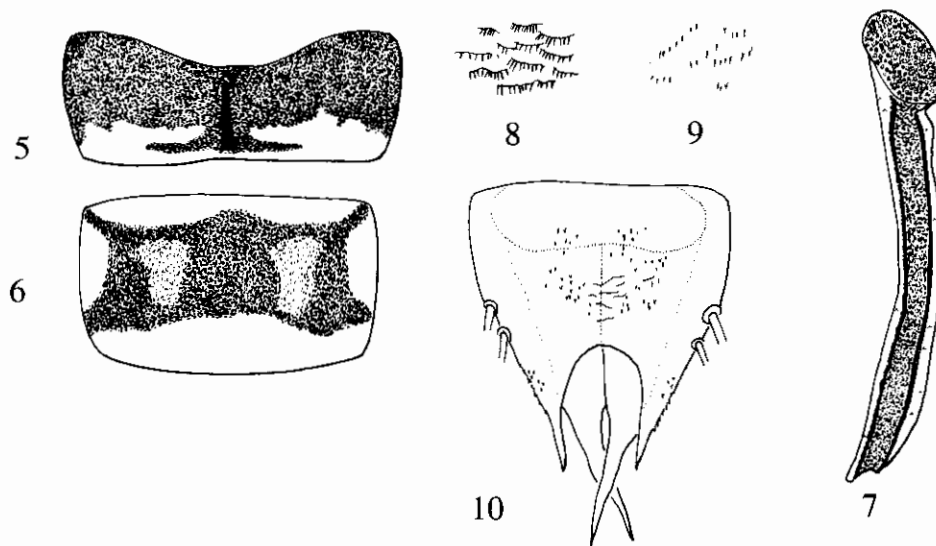
Type material: Holotype male, JAMAICA Trelawny Parish, Coffee Hill near Windsor ($77^{\circ}41'15''\text{W}$, $18^{\circ}21'10''\text{N}$), elevation about 198 m, from phytotelmata in bromeliad *Aechmea paniculigera*, April 1995, leg. W. Janetzky. Allotype, female, same collection data. Paratypes: 2 males, one female, 4 pupal exuviae, 6 fourth instar larvae, same collection data. Holotype and allotype deposited in Florida State Collection of Arthropods housed at Florida A&M University, Tallahassee, Florida, USA; paratypes in same collection, the Zoologische Staatssammlung, München, Germany, and the senior author's collection.

Etymology: The new species is dedicated to Mr. Mike Schwartz, Windsor Great House, Jamaica, for his hospitality and friendship during the junior author's stay in Jamaica.

Diagnosis: Adult males are distinguished by the long, pale preapical setae on palpomere 2; abdominal tergites II–VI with broad basal brown band, T VII mostly brown with narrow pale apical band and T VIII pale; and gonostylus $<100\ \mu\text{m}$ long. Pupae are distinguished by the brown, patterned exuviae, thoracic horn with rounded apex and T VII usually with 2 lateral setae and 2 taeniae on each side. Larvae are distinguished by the pale claws of the posterior parapods, with at least two small claws with 7–9 large inner teeth and the lack of a small dark claw, and AR 2.22–2.53.

Male imago ($n = 3$; holotype and two paratypes).

Color: Head, dorsum of thorax and postnotum light brown, with light brown spot on anterior anepisternum and median anepisternum; scutellum pale; wings clothed with pale brown macrotrichia; legs pale yellow-brown, with fore femora and tarsi light brown; abdomen with tergite I pale, T II–V each with light brown band on basal



Figs. 5-10. *Monopelopia mikeschwartzi*, pupa: 5. T I; 6. T IV; 7. Thoracic horn; 8. Shagreen spinule groups on T II; 9. Shagreen spinule groups on T VIII; 10. Anal lobe and male genital sac.

half; T VI-VII mostly light brown with narrow apical pale band. T VIII pale, genitalia light brown.

Lengths: Total 2.08-2.54 mm; thorax 0.63-0.74 mm; abdomen 1.45-1.80 mm.

Head: Setae—temporals 8-10, uniserial; clypeals 15-17; antennal pedicel 3-4. Cibarial sensillae about 13 ($n = 1$). Lengths of palpomeres 1-5: 50-53; 55-65; 120-145; 120-130; 155-200. Palpomere 2 with 5-6 long, pale, preapical setae (Fig. 2). AR 1.20-1.49. Dorsal eye extension 3 ommatidia wide.

Thorax: Setae—antepnotals 3-4; acrostichals 26-33, biserial; dorsocentrals 15-22, biserial anteriorly; prealars 5-6; scutellars 6-8, partially biserial; supraalar 1.

Wing: Length 1.18-1.33 mm; width 0.35-0.45 mm. Brachiolum with 1 large seta near base and 2 smaller distal setae. VR 0.96-1.00.

Legs: Weak tarsal beard on mid and hind legs; with preapical tarsal pseudospurs present on tarsomeres 1-3 on all legs; palmate sensilla chaetica not present, but numerous blunt-tipped setae (sensilla chaetica?) present on all tarsomeres. Tibial spur lengths: fore 30-35; mid 43-50; hind 50. Hind tibia with weak comb of 5 setae. Lengths and proportions of legs ($n = 1$):

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR	BV	SV
P ₁	600	640	480	330	230	150	90	0.75	2.15	2.58
P ₂	690	590	616	340	200	135	80	1.04	2.51	2.08
P ₃	570	690	—	—	—	—	—	—	—	—

Hypopygium (Fig. 3): T IX with one large seta on each side. Anal point conical, pointed. Length of gonocoxite 138-155; length of gonostylus 85-93; HR 1.48-1.82.

Female imago ($n = 2$; allotype and paratype).

Color: Head, dorsum of thorax and postnotum light brown, with light brown spot on anterior anepisternum and median anepisternum; scutellum pale; wings clothed

with pale brown macrotrichia; legs pale yellow-brown, with fore femora and tarsi light brown; abdomen with tergite I pale, T II–V each with brown band on basal half, T VI and T VII mostly brown, remaining tergites pale; seminal capsules pale brown.

Lengths: Total 1.55–1.68 mm; thorax 0.65–0.75 mm; abdomen 0.90–0.93 mm.

Head: Setae—temporals 10–12, uniserial; clypeals 15–22; antennal pedicel 8–9. Cibarial sensillae not observable. Lengths of palpomeres 1–5: 60 ($n = 1$); 60–68; 138–158; 123–155; 170–220. Palpomere 2 with 5–7 long, pale, preapical setae. Antenna with 11 flagellomeres; AR 4.71–4.88. Dorsal eye extension 3 ommatidia wide.

Thorax: Setae—anteprenotals 3; acrostichals 32, biserial; dorsocentrals 28, multiserial anteriorly; prealars 8–12; scutellars 8–11, biserial; supraalar 1.

Wing: Length 1.15–1.33 mm; width 0.41–0.45 mm. Brachiolium with 1 large seta near base and 3 smaller distal setae. VR 0.95–0.97.

Legs: Preapical tarsal pseudospurs present on tarsomeres 1–4 on mid and hind legs (foretarsi missing); palmate sensilla chaetica not present, but numerous blunt-tipped setae (sensilla chaetica?) present on all tarsomeres. Tibial spur lengths ($n = 1$): fore 30; mid 45; hind 48. Hind tibia with weak comb of 5 setae. Lengths and proportions of legs ($n = 1$):

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR	BV	SV
P ₁	560	590	—	—	—	—	—	—	—	—
P ₂	660	590	560	280	190	110	80	0.95	2.74	2.23
P ₃	560	700	520	320	240	150	80	0.74	2.25	2.42

Abdomen (Fig. 4); Notum length (from bifurcation forward) 85–97; seminal capsules spherical, 33–38 in diameter; cerci very small, not measurable.

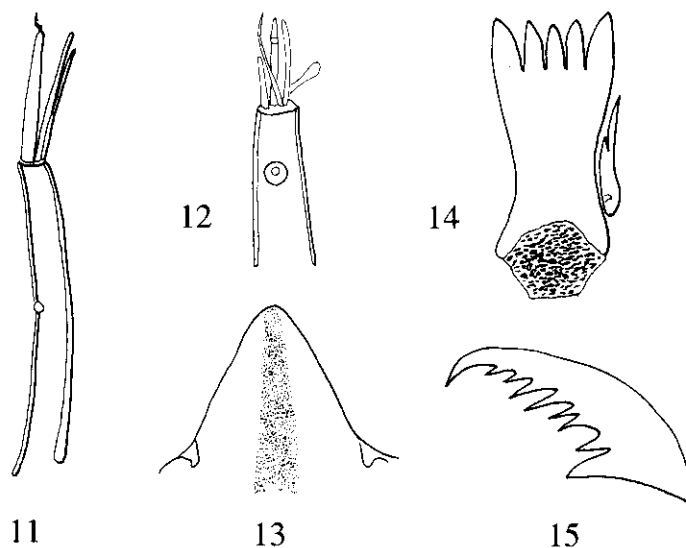
Pupa ($n = 4$ paratypes)

Color: Exuviae mostly brown, with lighter areas. T I with brown pattern as in Fig. 5; T II, T VIII and anal lobes mostly brown, T III–VII brown with lighter areas as in Fig. 6.

Lengths: Total 2.76–3.50 mm; cephalothorax 0.76–1.05 mm; abdomen 2.00–2.45 mm.

Cephalothorax: Dc₁, Dc₂ and Sa setae simple. Thoracic horn (Fig. 7) tubular with rounded apex, 260–365 long, 25–40 wide at middle; surface of horn with scattered, moderately broad-based spinules (spinules very weak on some specimens).

Abdomen: Most dorsal and ventral setae simple (one bifurcate dorsal abdominal seta observed amongst all paratype exuviae). Tergite I without shagreen spinules; shagreen heaviest on T II, with numerous transverse rows of small (about 5 μ m long) spinule groups (Fig. 8), then progressively smaller and fewer on succeeding tergites until only ungrouped spinules present on T VII–VIII (Fig. 9). Sternite I with scattered weak spinules anteromedially; S II with shagreen of well-defined transverse rows of spinules; spinules becoming progressively weaker and fewer in number on S III–S VIII. Anal lobe (Fig. 10) with small dorsal spinules on disc, in some specimens also extending down anal points; some small, fine spinules around outer margin of anal points; without ventral shagreen; male genitalia sac extends beyond anal lobe points, sac with pointed apices. Segments I–VI with one ventrolateral and one dorsolateral seta/side; VII with 2 lateral setae and 2 taeniae per side (one specimen with 3 lateral setae and one taenia per side); VIII with 5 taeniae; anal lobe with 2 taeniae.



Figs. 11–15. *Monopelopia mikeschwartzi*, larva: 11. Antenna; 12. Maxillary palp; 13. Pseudoradula; 14. Ligula and paraligula; 15. Smaller claw of posterior parapod.

Fourth Instar Larva ($n = 3\text{--}5$ paratypes).

Color: Head capsule pale yellow; antennae with pale yellow first segment, second segment pale yellow-brown in one specimen, pale yellow in other material; apical third of ligula light brown, apices of teeth paler; apex of mandible light yellow-brown; claws of anterior parapod pale yellow-brown; claws of posterior parapod colorless to pale yellow-brown.

Head: Head capsule length 0.51–0.53 mm; width 0.29 mm ($n = 2$). Antenna (Fig. 11) with segment 1 180–190 long, ring organ 0.61–0.65 from base; segment 2 63–72 long; antennal blade 65–73 long; AR 2.22–2.43. Maxillary palp (Fig. 12) length 30–32, width 9–11; length of antennal segment 2/length of the maxillary palp 1.97–2.33. Mandible length 78–83. Pseudoradula (Fig. 13) slightly broadened basally. Ligula (Fig. 14) 63–70 long, 28–30 maximum width; paraligula 29–32 long. Pecten hypopharyngis with 7–8 teeth/side. Dorsal head capsule setae are arranged similarly to those of *M. boliekae* as figured by Kowalyk (1985: fig. 117); ventral chaetotaxy is similar to that of *M. boliekae* in Kowalyk's fig. 116, except that SS_M , VP and S10 lie in a straight line at a right angle to the longitudinal axis of the head capsule, with VP placed directly caudad of S9.

Body: Proceri 57–60 long, 20 wide. Anal tubules 75–108 long, 15–25 wide. Posterior parapod with large claws with fine inner and outer teeth; two smaller claws with 7–9 large inner teeth (Fig. 15).

Discussion

Roback (1986) provided the most recent review of *Monopelopia* for the New World; *M. mikeschwartzi* belongs to his *M. tenuicalcar* group. *Monopelopia mikeschwartzi* is very similar to *M. tillandsia* Beck and Beck morphologically and in choice of habitats; both are denizens of phytotelmata. *Monopelopia mikeschwartzi*

is a rather typical member of the genus, and with the few exceptions noted below, fits the diagnoses found in Fittkau and Roback (1983), Fittkau and Murray (1986) and Murray and Fittkau (1989).

The adult of *M. mikeschwartzi* will key to couplet 3 in Roback (1986:353); it can be separated from *M. tillandsia* and *M. tenuicalcar* (Kieffer) by the pale T VIII (brown on the other two species).

The pupae of *M. mikeschwartzi* and *M. tillandsia* deviate from the diagnosis for the genus given in Fittkau and Murray (1986) by bearing simple Dc₁, Dc₂ and Sa setae on the cephalothorax and having all or most dorsal and ventral abdominal setae simple. The color pattern of the abdominal tergites of *M. mikeschwartzi* is similar to that of *M. boliekae* Beck and Beck as figured in Roback (1986: figs. 38–40); however, the distinctive apically pointed thoracic horn of *M. boliekae* easily separates the two species. The pupa of *M. mikeschwartzi* will key to couplet 4 in Roback (1986:355); it can be separated from *M. tillandsia* and *M. tenuicalcar* by its distinctively patterned brown exuviae.

Larvae will key to *M. tillandsia* in couplet 1 in Roback (1986:355) and Epler (1995:3.47); larvae of *M. mikeschwartzi* can be separated from *M. tillandsia* by the presence of at least two smaller claws with seven to nine large inner teeth (only three to four small teeth in *M. tillandsia*; see Epler (1995:3.46) and Roback (1987:2)) and the lower AR (2.22–2.43 in *M. mikeschwartzi*; 3.28–3.80 in *M. tillandsia* (Beck and Beck, 1966:337) and Roback (1987:2)). Ventral chaetotaxy will also separate the two taxa: in *M. mikeschwartzi*, SS_M, VP and S10 lie in a straight line at a right angle to the longitudinal axis of the head capsule; in *M. tillandsia* SS_M lies farther caudad than VP and S10. Note that based on material the senior author has collected in Florida, the antennae of *M. tillandsia* can be pale yellow, as in *M. mikeschwartzi*, in addition to the "somewhat brown" color in the description by Beck and Beck (1966:337) and in Roback's (1986:355) key.

Larvae of a second species of *Monopelopia* were also encountered in the Coffee Hill bromeliad phytotelmata. These larvae appeared to be similar to *M. tillandsia* in that the claws of the posterior parapod were clear to pale yellow-brown and the smaller claws had only a few small inner teeth. These larvae had a lower AR, 2.47–2.78. Only a few were collected and none were associated with other life stages; one can only speculate on their exact identity. As noted by Roback (1986), the paucity of specimens of the genus *Monopelopia* makes it difficult to appreciate the amount of variation that may be present in populations of the different species. All of the known material of *M. tillandsia* is limited to the type material, two larvae examined by Roback (1987) and material collected and reared by the senior author.

Based on many larvae and one reared female examined by the senior author, at least one additional, apparently undescribed, species of *Monopelopia* occurs on the U.S. Southeast Coastal Plain in Florida and Georgia. This species is not keyed in Epler (1995), but will key to *M. tillandsia* in that key and in Roback (1986). The larva of the undescribed species lacks any dark claws on the posterior parapod; instead they are pale yellow to light yellow-brown and several of the smaller claws bear numerous inner teeth, similar to those of *M. mikeschwartzi*. This undescribed species is larger than *M. mikeschwartzi* (head capsule length about 0.70 mm compared to 0.51–0.53 mm for *M. mikeschwartzi*); has a higher AR (2.88–3.25 compared to 2.22–2.43 for *M. mikeschwartzi*); and has a lower ratio for the length of an-

tennal segment 2 divided by the length of the maxillary palp (1.58–1.63 compared to 1.97–2.33 for *M. mikeschwartzi*). Note that all these measurements are based on very small series of specimens. The pupa of the undescribed species is pale and is similar to the pupa of *M. tenuicalcar* as described by Roback (1986); the color pattern of the pupa of *M. mikeschwartzi* is darker and similar to that of *M. boliekae*. *Monopelopia mikeschwartzi* is known only from Jamaican phytotelmata; the undescribed U.S. species has been collected from ponds and streams in northern Florida and southern Georgia.

Ecology

The fauna associated with *Aechmea paniculigera* shown in Table 1 was dominated by cyclopoid copepods. The chironomid component of the aquatic community found in phytotelmata consisted of *Chironomus anonymus*, a *Metriocnemus* sp., *Polypedilum* cf. *tritum* and two species of *Monopelopia* (Table 1). *Monopelopia* occurred in 11 out of 12 phytotelmata with a mean individual number of seven specimens per phytotelmata; for *Metriocnemus*, occurring in six phytotelmata, 15 specimens; and for *Ch. anonymus*, occurring in 11 phytotelmata, 18 individuals. Exceptionally high individual numbers for *Ch. anonymus* (90 specimens) were observed in the central reservoir, where the water body was covered with accumulated leaf litter.

Identification of chironomids was hindered by the fact that only larval stages, especially early larval stages, could be observed (Table 1). In most cases only generic level identifications were possible with larval *Monopelopia* because the claws of the posterior parapods, necessary for accurate species identification, were missing.

The water held in the phytotelmata of *Aechmea paniculigera* shown in Table 1 had a mean temperature of 25.1°C (25.0–25.2°C). The mean pH value was 5.6 (5.4–5.8) and mean electrical conductivity was 27.2 µS/cm (23.6–32.9 µS). The only exception was the central reservoir with a reading of 99.2 µS/cm, reflecting the fact that leaf litter had accumulated. No correlation could be observed between *M. mikeschwartzi* and the amount of leaf litter accumulated, nor to pH values or conductivity measured for the water bodies. In additional samples taken on top of Coffee Hill, the species occurred in phytotelmata with a water temperature of 24.8°C (23.1–26.1°C), pH 5.8 (4.4–6.4) and conductivity of 56.6 µS/cm (12.1–223 µS/cm).

Monopelopia larvae were observed feeding on *Chironomus* sp. larvae in three instances. Laessle (1961) found that *Chironomus* sp. was most abundant in plants, especially in the inner reservoir, when direct insolation fostered growth of algae. Laessle suggested that *Chironomus* sp. was a principal consumer of algae, principally *Trachelomonas* sp., but no proportional correlation between algal densities and individual numbers of *Chironomus* sp. could be observed. In contrast to the inner reservoir, *Chironomus* sp. was less abundant in outer leaf axils, which might have been due to the fact that these phytotelmata contained less algae and small amounts of detritus (Laessle, 1961). We found that most *Ch. anonymus* occurred in phytotelmata with higher amounts of accumulated leaf litter. Laessle (1961) stated that densities of *Chironomus* sp. were influenced by predators such as larvae of "*Pentanaeura*" sp. (perhaps a *Monopelopia*) and dragonflies. In our study no or only a few *Ch. anonymus* or other chironomids were found when the libellulid dragonfly *Erythrodiplax* sp. was present in epiphytic bromeliads that also contained algal mats.

Table 1. Faunal assemblages in different phytotelmata of one *Aechmea paniculigera* bromeliad by individual numbers: central—central reservoir formed by new leaves, no. 1–11—outer reservoirs in lateral leaf axils.

Fauna	Lateral leaf axil number											
	1	2	3	4	5	6	7	8	9	10	11	
Crustacea: Ostracoda												
<i>Pseudocardona</i> cf. <i>antilliana</i>	1	*	*	2	*	*	*	*	14	10	5	
Copepoda												
<i>Ectocyclops phaleratus</i>	1	*	1	2	5	6	1	*	3	2	8	
<i>Tropocyclops jamaicensis</i>	137	147	289	203	631	348	159	115	363	78	412	
Decapoda												
<i>Metapaulias depressus</i>	*	*	1	*	*	*	*	1	4	*	*	
Insecta: Odonata												
<i>Diceratobasis macrogaster</i>	1	1	1	2	3	*	1	1	2	*	*	
Coleoptera												
<i>Cyphon</i> sp.	2	*	*	*	1	4	1	3	*	*	4	
Diptera												
<i>Aedes grabhami</i>	4	*	7	3	2	29	1	17	43	*	*	
<i>Chironomus anonyms</i>	90	1	4	26	10	11	4	26	*	3	22	
<i>Metricnemus</i> sp.	19	*	2	44	3	*	*	12	8	*	*	
<i>Monopelopia mikeschwartzi</i>	*	*	*	*	*	*	5	*	*	3	*	
<i>Monopelopia</i> sp.	7	6	4	13	7	7	*	13	12	3	5	
<i>Polypeditum</i> cf. <i>tritum</i>	*	*	*	*	*	*	*	*	36	*	6	

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