



## A new species of *Dicrotendipes* (Diptera: Chironomidae) from Florida

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### Abstract

A new species of *Dicrotendipes* is described in all life stages from Florida. Adults of this new species are nearly identical to *D. modestus* (Say); pupae are similar to *D. modestus*, *D. neomodestus* (Malloch) and *D. tritonus* (Kieffer); while the larvae are unique and were keyed by Epler (1992, 1995, 2001) as *Dicrotendipes* sp. A. The taxonomic status of *D. modestus* and *D. pulsus* (Walker) is discussed.

**Key words:** Diptera, Chironomidae

### Introduction

After revising the Nearctic (Epler 1987a) and world (Epler 1988) species of *Dicrotendipes* Kieffer, I was surprised in the early 1990's to find an undescribed species of this genus living essentially at my doorstep in Florida. Adults of this new species are nearly identical morphologically to *D. modestus* (Say); pupae are similar to *D. modestus*, *D. neomodestus* (Malloch) and *D. tritonus* (Kieffer); while the larvae are unique and were keyed by Epler (1992, 1995, 2001) as *Dicrotendipes* sp. A. This new species is described below.

### Methods

Morphological terms and abbreviations used follow Sæther (1980), Epler (1988), Langton (1994) and Cranston (2013). Measurement methods follow Epler (1987a, 1988) and consist of the range followed by the mean (if four or more specimens are included) and, in parentheses, the number of specimens utilized if different from the number (n) cited at the beginning of the description. Unless otherwise stated, measurements are in  $\mu\text{m}$ . Note that in several of my earlier papers (Epler 1987a, 1987b; 1988), the VR was calculated incorrectly; it should be the inverse of the values stated in those publications (see Epler 1996). Material used in the description consisted of two males with associated pupal and larval exuviae, 3 pharate male pupae with associated larval exuviae, two pharate female pupae with associated larval exuviae, and material from a light trap collection. These specimens constitute the type series; other non-type material was also examined but not measured for use in the descriptions.

Other abbreviations used

FDEP	Florida Department of Environmental Protection
FSCA	Florida State Collection of Arthropods (Chironomidae collection housed at Florida A&M University, Tallahassee, Florida)
JHE	J.H. Epler collection, Crawfordville, Florida
Pex	pupal exuviae
Lex	larval exuviae
USNM	National Museum of Natural History, Washington, D.C.

## Systematics

### *Dicrotendipes hulberti* Epler, sp. n.

*Dicrotendipes* sp. A Epler 1992: 7.43, 7.47; 1995: 7.43, 7.47; 2001: 8.60, 8.64 (larva in key)

**Adult male** (n=10). *Coloration*. In life pale green to light brown; in alcohol stramineous/light brown, sometimes with light brown anal point and base; some species with abdomen almost completely pale brown, others with light brown band on posterior margin of tergites I–IV; others with abdomen entirely stramineous; thoracic vittae light brown/orange, preepisternum light brown, postnotum brown. Wings unmarked, with pale veins.

*General dimensions*. Thorax 857–925, 770 (8); abdomen 1.97–2.84, 2.36 mm (9); total 2.52–3.73, 3.08 mm (7); wing 1.22–1.48, 1.32 mm long (5), 360–440, 406 wide (5).

*Head*. Temporal setae 13–22, 18 (4); clypeal setae 9–12, 11 (6); cibarial sensilla 3–12, 10 (6). AR 1.87–2.18, 2.06 (5). Frontal tubercles L 2.5–15, 10 (4); W 2.5–10, 6.3 (4). Maxillary palp with 5 palpomeres; lengths of palpomeres (3): 27–30; 28–30; 63–70; 80–92; 90–128.

*Thorax*. Setae: acrostichals 8–11, 9 (5); dorsocentrals 5–10, 7; scutellars 1–9, 5(8); prealars 2–5, 4 (8); 1 specimen with a single supraalar seta.

*Wing*. Wing length 1.22–1.48, 1.32 mm (5), width 360–440, 406 (5). Wing setae: squama 2–7, 4 (9); R 12–16 (3), R<sub>1</sub> 6–10 (3), R<sub>4+5</sub> 2–13, 7 (5). VR 1.12–1.11, 1.18 (5).

*Legs*. Lengths and ratios in Table 1. Fore tarsi without beard. Metatarsus of middle leg with 4–12, 8 (6) palmate sensilla chaetica.

**TABLE 1.** Leg measurements (µm) and ratios for male *Dicrotendipes hulberti*.

(n=6)	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p1	530–710 602	420–540 475	660–850 746 (5)	330–375 349 (5)	260–340 285 (5)	170–260 202 (5)	80–120 98 (5)	1.56–1.77 1.61 (5)	1.76–2.04 1.92 (5)	1.27–1.44 1.40 (5)
p2	480–620 557	430–550 502	200–320 250	130–170 149	90–120 103	50–70 58	50–60 58	0.45–0.58 0.49	3.35–3.84 3.54	3.63–4.67 4.30
p3	530–690 610	590–750 670	360–500 438 (5)	210–260 233 (5)	150–220 185 (5)	80–120 96 (5)	60–80 70 (5)	0.58–0.68 0.64 (5)	2.90–3.08 3.00 (5)	2.82–3.28 3.02 (5)

*Abdomen*. S VI with (0?)1–5, 1 (6) ventral accessory setae.

*Hypopygium* (Fig. 1). Phallapodeme length 63–98, 83. Gonostylus normal (not inflated), moderately curved, with 6–8, 7 larger setae apicomediaally, apical seta about ½ length of preceding setae; setae sometimes with bifid or fimbriate apex. Superior volsella pediform (Fig. 2); length 40–63, 54 (7); width 35–45, 39 (7); with 6–8, 7 (9) large ventral setae, volsella mostly covered with microtrichia, with small bare area posteriorly. Inferior volsella with apex of club slightly expanded, slightly indented apically; club dorsally with 2–3 longitudinal rows of 2–11, 6 large setae, setae sometimes with bifid/fimbriate apex. Anal point bare, pyriform, moderately deflexed apically; with 3–9, 5 (7) dorsal basal setae.

**Adult female** (n=2). Only pharate material available; most counts/measurements not possible.

*Coloration*. Apparently as in male.

*Thorax*. Setae: dorsocentrals 10–12; scutellars 5–9; prealars 4.

*Wing*. Squama with 5–7 setae.

*Genitalia*. Typical for Nearctic members of the genus, as figured in Epler (1988: Figs. 4A, 4B), apodeme lobe weakly sclerotized (Fig. 3). Each side of S VIII with 11–17 setae; T IX with 34–48 setae; T X with 2–3 setae. Cercus 88–98 long.

**Pupa** (n = 9). Typical *Dicrotendipes* pupa, very similar to *D. modestus*.

*Coloration*. Exuviae light brown.

*General dimensions*. Cephalothorax 1.14–1.24 mm (2); abdomen 2.27–3.02, 2.79 mm (8); total length 3.90–4.26 mm (2).

*Cephalothorax*. With weak to moderate dorsal pebbling. Cephalic tubercles conical, 48–63, 56 (5) long; frontal setae 28–48 (3) long. With typical 4 dorsocentral setae; Dc1 33–45, 38 (5); Dc2 not measurable; Dc3 48 (1); Dc4 33–35 (2). Scutal tubercle absent.

*Abdomen.* T II with posterior transverse row of 55–70, 65 hooklets. T I without shagreen; T II–IV with median subquadrate shagreen area, shagreen points small, subequal; T V and VI with narrower median subquadrate shagreen area, shagreen points larger, especially in center of patch. T VII with pair of weak ovoid shagreen areas anteriorly, points small; T VIII with pair of weak longitudinal shagreen areas, points small. Most sternites without shagreen, sometimes with small oval/circular areas of fine points anteriorly; S I with posterior transverse row of 30–72, 60 (7) fine, clear spinules >5 µm long. S II with anterior transverse row of 39–132, 84 (8) fine, clear spinules >5 µm long; with posterior transverse row of 39–97, 64 (8) fine, clear spinules >5 µm long. S III without anterior or posterior transverse rows of clear spinules >5 µm long. Each side of T VIII with single caudolateral spur, thorn-like to mostly straight to slightly curved (Figs. 4, 5). Anal lobe with uniserial fringe of 31–38, 35 taeniae. Disc ratio 1.94–2.69, 2.40.

**Fourth instar larva** (n = 8).

*Coloration.* Head capsule light brown.

*General dimensions.* Medium sized larvae, total length about 6 mm.

*Head.* Frons with anterior margin mostly smooth, with 2–4 crenations on each anterolateral projection, with uvula-like medial frontal pit (Fig. 7); clypeal sclerite smooth posterodorsally. Postmentum length 198–235, 214. Antenna (Fig. 8) with 5 antennomeres, lengths (1–5):53–60, 58; 18–20, 19; 10–13, 11; 10–15, 13; 5. AR 1.03–1.33, 1.17. Antennal blade 45–58, 50, extending to middle or apex of 4<sup>th</sup> antennomere. Premandible 95–108, 100 long, with 2 apical teeth. Mandible (Fig. 9) 145–170, 155 (5) long; outer margin mostly smooth to crenulate/furrowed; with pale dorsal tooth, dark apical tooth and 3 dark inner teeth; proximal inner tooth directed medially to slightly posteriorly; seta subdentalis length 20–24, 22 (6); pecten mandibularis with 9–11, 10 setae. Mentum (Fig. 6) 113–130, 124 (6) long; with 13 teeth, 2<sup>nd</sup> lateral tooth fused/appressed to 1<sup>st</sup>, 6<sup>th</sup> lateral tooth rounded and fused/appressed to 5<sup>th</sup>. Ventromental plates with finely crenulate anterior margin, 88–98, 91 wide, 38–48, 44 long; with 24–30, 26 full-length strial ridges; interplate distance 48–50, 49 (6).

*Body.* Ventral and lateral tubules absent. Procerci 15–25, 18 long; longest anal seta 700–840, 759 long; supraanal seta 250–288 (2) long. Posterior parapods with simple claws.

**Type material. Holotype**, male with associated pupal and larval exuviae, U.S.A.: FLORIDA: Palm Beach County; Lake Okeechobee nr Kramer Island; 3-ix-1991; leg. J.H. Epler, L.M. Epler. Slide mounted in Canada balsam. Holotype in FSCA. **Paratypes**: 1 male/Pex/Lex, 1 pharate male pupa/Lex; same data as holotype; [JHE]; 3 pharate male pupae/Lex, 2 pharate female pupae/Lex, FL: Palm Beach County; Lake Okeechobee nr Winnie's Cove; 4-ix-1991; leg. J.H. Epler, L.M. Epler, D. Strom [FSCA, JHE]; 54 males (4 slide mounted), FL: Marion Co., Buck Pond near Moss Bluff, 4-viii-2003, UV, leg. D.R. Denson [JHE]. Slide mounted in Canada balsam or Euparal.

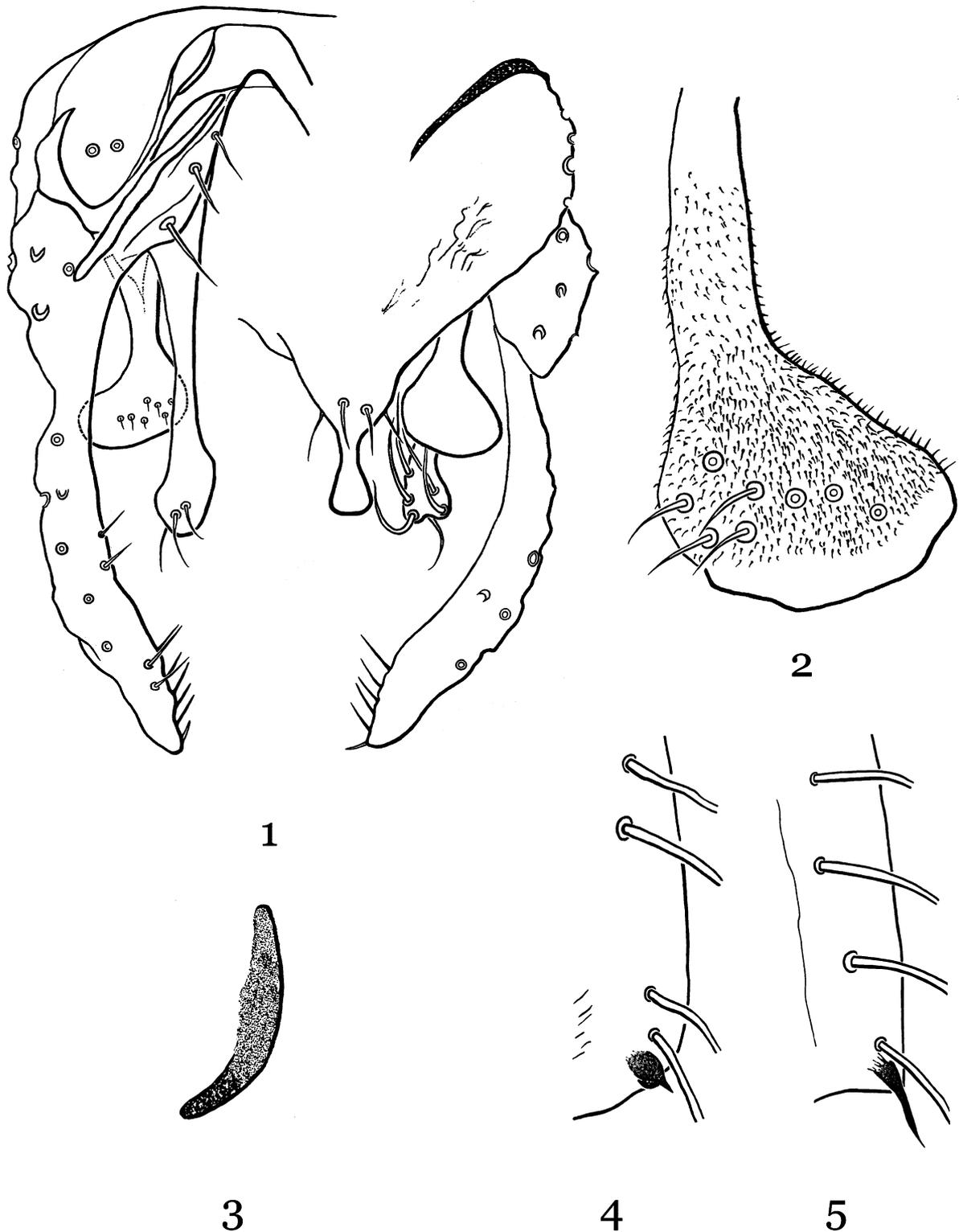
Other, non-type, material examined: 1 male, FL: Levy Co, Manatee Springs State Park, 3-v-1989, leg. C.A. Bennett, ex “adult emerge in jars with *Najas guadalupensis*”; 1 male, same locality, xi-xii-1990, Gainesville DPI quarantine, ex *Hydrellia* rearing jars with *Hydrilla verticillata* [JHE]; 1 male, FL: Osceola Co., Kissimmee, Lake Tohopekaliga, 28.24136N, 81.40636W, 17-ix-2010, leg. K. Stratman [JHE]; 1 male, PANAMA: Canal Zone, Gamboa, Rio Agua Salud, July 1967, W.W. Wirth, light trap [USNM]. I've also seen larvae from the following locations in Florida: Alachua Co., Santa Fe River at Hwy 21 nr Worthington Springs, 4-vi-2004; Gilchrist Co., Santa Fe River at US 129, 13-iii-1996; Gilchrist Co., Suwannee River at SR 340 nr Rock Bluff, 14-vi-1995; Washington Co., Cypress Spring spring run, 25-vii-2007.

**Distribution.** Known from the Panhandle of Florida south to Lake Okeechobee; I've seen a single male assignable to this species from Panama.

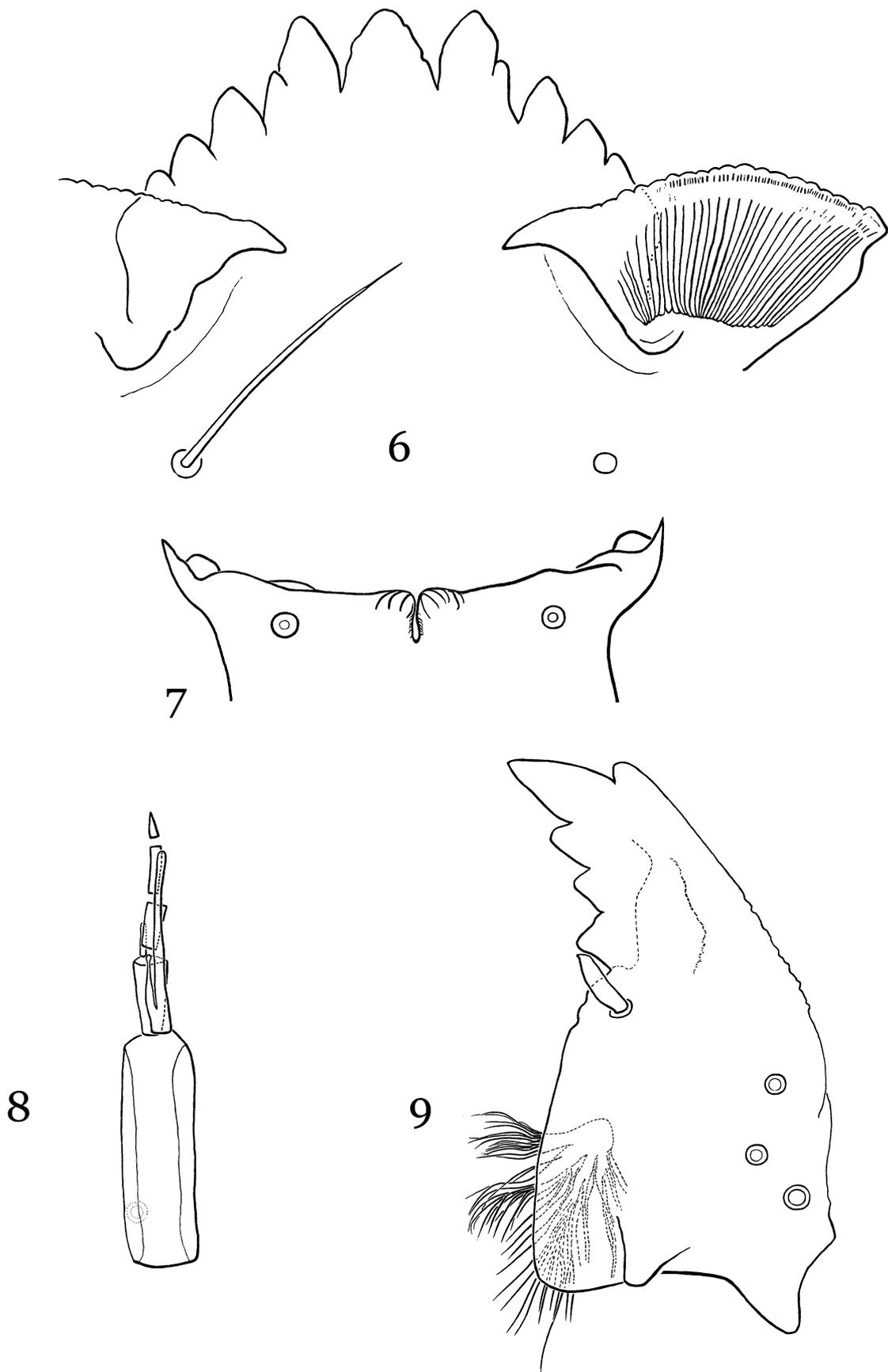
**Etymology.** I am honored to name this species for my friend and colleague Jim Hulbert, formerly a biologist with the Florida Department of Environmental Protection. Jim's foresight and knowledge of the state bureaucracy made the first of my larval midge identification manuals (Epler 1992) possible. This began the series of identification manuals for Florida's aquatic macroinvertebrates that today covers the majority of freshwater and some inshore marine taxa.

**Comments.** Adults are extremely similar to *D. modestus*; genitalia of the two species are indistinguishable from each other. Adult males will key to *D. modestus* in Epler (1988) but may be separated by the lower counts of dorsocentral and squamal setae in *D. hulberti*, which has 5–10, mean of 7, dorsocentrals and 2–7, mean of 4, squamal setae. In *D. modestus* these numbers are 12–44, mean of 26, dorsocentrals; and 7–21, mean of 13, squamal setae (Epler 1987a: 70). In alcohol *D. hulberti* may usually be separated from *D. modestus* by their slightly more

delicate habitus and the more restricted pigmentation of the anal point; at higher power it is possible to count the reduced setae of the squama and thorax.



**PLATE 1.** Fig. 1. *Dicotendipes hulberti* male, genitalia. Fig. 2. *Dicotendipes hulberti* male, superior volsella, ventral. Fig. 3. *Dicotendipes hulberti* female, apodeme lobe. Figs. 4, 5. *Dicotendipes hulberti* pupa, variation of caudolateral spur on tergite VIII.



**PLATE 2.** Fig. 6. *Dicrotendipes hulberti* larva, mentum and ventromental plate. Fig. 7. *Dicrotendipes hulberti* larva, frons, anterior margin. Fig. 8. *Dicrotendipes hulberti* larva, antenna. fig. 9. *Dicrotendipes hulberti* larva, mandible (setae of pecten mandibularis not shown).

On two males, R<sub>4+5</sub> had only 2 setae, near the apex of the wing.

Pupae may be impossible to separate from those of some *D. tritomus* (Kieffer) with a single T VIII caudolateral spur. Pupae are also similar to those of *D. modestus* and *D. neomodestus* (Malloch), but those species usually possess a sinuate caudolateral spur on T VIII; that of *D. hulberti* is mostly straight.

Larvae are keyed as *Dicrotendipes* sp. A in Epler (1992, 1995, 2001). They are distinguished by having the second lateral teeth of the mentum closely appressed/fused to the first lateral teeth and the 6<sup>th</sup> lateral teeth are reduced or fused to the 5<sup>th</sup> lateral teeth. In addition, the proximal inner mandibular tooth is directed mediad, rather than slanting forward as the other inner teeth do.

I have found larvae of *D. hulberti* and *D. modestus* in the same sample. Little is known of the biology of this new species. Larvae have been associated with aquatic plants such as *Najas guadalupensis* (Spreng.) Magnus (family Najadaceae) and *Hydrilla verticillata* (L.f.) Royale (family Hydrocharitaceae); they've been collected from lakes, rivers and spring runs.

*Dicrotendipes hulberti* is a member of a group of species (the “*Dicrotendipes modestus* group”) that share similar morphology in the adult, pupal and larval stages. As adult males *D. hulberti*, *D. modestus*, *D. neomodestus*, and “*D. pulsus* (Walker)” are the most similar, but in the Nearctic the group also includes *D. adnilus* Epler, *D. californicus* (Johannsen), *D. crypticus* Epler and *D. thanatogratus* Epler based on genitalia similarities (all have a pediform superior volsella). Pupae of all of these species share the character of one to two horizontal bands of fine, clear spinules on sternites I–II, and sometimes III. Note that this pupal character is also found in at least two other species, *D. tritomus* and *D. lobiger* (Kieffer); *D. tritomus* is closely related but lacks the pediform superior volsella; *D. lobiger* belongs to a different clade within the genus (see Epler 1988).

*Dicrotendipes pulsus*, as *D. modestus*, was last described in the adult male, pupa and larva stages by Contreras-Lichtenberg (1986); she used information from Epler (1983) and placed *D. pulsus* as a junior synonym of *D. modestus*. However, Epler (1983) is an unpublished Master's thesis; this information was eventually published as Epler (1987a), thus the date of synonymy of the two species is 1986.

Langton & Visser (2003) used the name *D. objectans* (Walker) instead of *D. modestus* for this taxon in their key for West Palearctic pupal exuviae, with no explanation of synonymy. In his previous key, upon which the key in Langton & Visser (2003) is based, Langton (1991) used “*D. modestus*” in a similar couplet. Note that later Spies & Sæther (2004) pointed out that the name “*objectans*” was incorrect and that “*pulsus*” should be used.

Apparently Langton & Visser (2003) based their synonymy on a couplet in an unpublished manuscript key for Nearctic pupal exuviae by “Langton, Coffman & Oliver” that has been available in one form or another for many years. There is a note on the front page that states “Publication expected in 1996”, but this key has yet to be published. In the manuscript's Chironominae chapter, under couplet 81 it was stated:

“*D. pulsus* has been synonymized with modestus by Epler, but the pupae are consistently different in the size of the cephalic tubercle, which is over twice the size in pulsus. D. pulsus is also a much less variable taxon. The median point patches usually nearly reach D<sub>2</sub> on IV and V, whereas in modestus they never (?) extend that far. The specimens recorded below accord well with Palearctic pulsus.”

Lake. May. [WPC M48.97, M51.55]”

The last numbers refer to specimens in Coffman's collection; material was from Somerset and Warren Counties in Pennsylvania (Carlos de la Rosa, pers. comm. 5-x-2016). Thus, the authors considered both *D. modestus* and *D. pulsus* to occur in the Nearctic.

Epler (1987a) did not include measurements for pupal cephalic tubercles. I have re-examined some of the material used in the revision, from Colorado, Florida and Pennsylvania in the USA and Manitoba, Canada, plus additional more recent material. Utilizing only associated male/Pex/Lex material (n=6), I found a range of 63–193, mean 115 µm for *D. modestus* cephalic tubercle length. Contreras-Lichtenberg (1986) gave measurements of 157–223 µm for pupal cephalic tubercles in *D. modestus* (= “*pulsus*”).

The extent of the “median point patches” on IV and V was also investigated. The majority of specimens had the median point patches extending to the level of D<sub>2</sub>, even as far as D<sub>1</sub>; the patches also often contained the D<sub>2</sub> seta within the area of the point patch.

Epler (1987a) had examined “*pulsus*” material from Great Britain (the holotype of *pulsus*), West Germany and Italy, which included some associated material. I also re-examined 3 males of “*D. pulsus*” from Germany's Bodensee; they do not differ from *D. modestus* as defined by Epler (1987a) (i.e., they had numerous thoracic dorsocentral setae and squamal setae). Note that Contreras-Lichtenberg (1996) did not include adult thoracic setal counts or squamal setal counts.

Epler (1987a) recognized significant variation in *D. modestus*, based on the study of over 80 associated specimens from much of the United States and Canada, in addition to hundreds of adults.

Thus, if *D. modestus* is as variable as Epler (1987a) stated, the characters given in the Langton, Coffman & Oliver manuscript key do not separate *D. modestus* from *D. pulsus*. With no published criteria to justify splitting the species, especially with no inclusion of characters from other life stages, I consider the synonymy proposed by Epler (1987a) to remain valid.

No doubt more cryptic species may occur within the *D. modestus* group. In over 35 years of studying *Dicrotendipes*, I have found that pupae offer the most ambiguous characters for species discrimination within the genus—here is just too much overlap of counts, measurements and shagreen patterns between some species, especially in the *D. modestus* group. This paper demonstrates that by using at least two life stages, in the instance of *Dicrotendipes* the adult and larva, it may be possible to delimit new species within the group. An in-depth study of these taxa throughout the Holarctic would be necessary, a project beyond the scope of this paper.

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