

FOUR MANITOBA SPECIES OF *CENTROPTILUM* EATON
(EPHEMEROPTERA: BAETIDAE)
WITH REMARKS ON THE GENUS

Robert G. Lowen and John F. Flannagan

Freshwater Institute, 501 University Crescent,
Winnipeg, Manitoba, R3T 2N6, Canada

ABSTRACT

Various life stages of *Centroptilum album* McDunnough, *C. bifurcatum* McDunnough, *C. conturbatum* McDunnough, and *C. victoriae* McDunnough are described or redescribed from Manitoba specimens. First descriptions are given for nymphs of *C. bifurcatum*, *C. conturbatum*, and *C. victoriae*, and for female imagines of *C. bifurcatum* and *C. victoriae*. Manitoba species are retained in the genus *Centroptilum* based on the shared characteristic of a conical shaped styliger plate with a finger-like appendix between the bases of the forceps. The Manitoba species may be considered a species group because of the following nymphal similarities: canines of left mandible partially fused, profusion of pore-like spots on abdominal terga, and a projection of the posterior edge of tergum IX.

INTRODUCTION

Keffermüller and Sowa (1984) examined central European species that had been assigned to the genus *Centroptilum*. Using Kazlauskas (1969) they redefined the genus to include only the type species *C. luteolum*, and two unnamed species. All other European species they placed with *P. motasi* in the genus *Pseudocentroptilum*. Examination of western Canadian species formerly assigned to *Centroptilum* has revealed four species that have closer affinities with *C. luteolum* than with *P. motasi*. A wider definition of *Centroptilum* is proposed that includes the Nearctic species.

METHODS

Specimen handling and preservation procedures are described in Lowen (1989). Museums that loaned specimens for this study are as follows: Canadian National Insect Collection, Ottawa. Florida State Collection of Arthropods, Gainesville. Freshwater Institute, Winnipeg. J. B. Wallis Museum of Entomology, University of Manitoba, Winnipeg. Royal Ontario Museum, Toronto. Université de Montréal, Montréal. University of Windsor,

Windsor. Zoologische Staatssammlung, München.

RESULTS

Centroptilum Eaton

Centroptilum Eaton, 1869. Ent. Monthly Mag. 6: 131-132. Kazlauskas, 1969. Proc. XIIIth Int. Congr. Ent. III: 337-338. Keffermüller, and Sowa, 1984. Pol. Pismo Ent. 54: 309-340.

Type Species: Centroptilum luteolum (Müller) by original designation.

Imago: Distal end of hind wings with variable shape. Male genital forceps with long terminal segment, and inner margins of basal segments irregular or forming a distinct process. Styliger plate variable, with distal margin semi-circular to conical or with distal margin deflected dorsally and appearing concave. Pointed process between forceps, secondarily lost in one species.

Nymph: Maxillary palpomere III subequal to palpomere II. Canines of right mandible divided to base. Prosthema of both mandibles thin, often needle-like. Labial palpomere III with distal margin concave and inwardly expanded. Unilamellate gills slightly asymmetrical with rounded ends to symmetrical with pointed ends, early instars with narrower and more pointed gills. Abdominal lateral spines absent or small in size. Manitoba species further distinguished by canines of left mandible partially fused, numerous pore-like spots on abdominal terga, and tergum IX with mid-dorsal posterior projection.

Species Included: *Centroptilum luteolum* (Müller), *C. album* McDunnough, *C. bifurcatum* McDunnough, *C. conturbatum* McDunnough, *C. victoriae* McDunnough.

Centroptilum bifurcatum McDunnough

Centroptilum bifurcatum McDunnough 1924, Can. Ent. 56: 96. McDunnough 1929, Can. Ent. 61: 171 (Male imago redescribed).

Imago: Lengths: body 5.5-6.5 mm, fore wings 5.1-6.4 mm (Fig. 1), hind wings 0.9-1.4 mm (Fig. 5), male cerci 8.7-11.2 mm, female cerci 7.7-8.4 mm. Colouration: Male adequately described by McDunnough (1924, 1929). Female with antennae light brown basally. Head and thorax light brown, with white on pronotum, laterally on mesonotum, anteriorly on metanotum. Thoracic and abdominal sterna hyaline. Coxae opaque white. Legs semi-hyaline tan. Abdominal terga I to VII light brown, paler on anterior edges. Terga I to VI with purple spiracular blotches. Terga and sterna VIII hyaline with white speckling, terga and sterna IX and X opaque white. Cerci semi-hyaline. Male genitalia with posterior edge of styliger plate bent dorsally, appearing concave (Fig. 9).

Nymph: Lengths: body 5.5-6.9 mm, antennae 1.6-2.1 mm, terminal filament 2.3-2.6 mm, and cerci 2.3-2.7 mm. Colour pattern as in Fig. 13.

Mouthparts: As in Figs. 17-20. Femora with small dorsal brown area near tibiae. Femora with short row of setae distally along dorsal margin. Tibiae with arc of setae across dorsal margin near femoral joint. Abdominal terga with numerous semi-circular hollows. Mid-dorsal posterior edge of tergum IX produced posteriorly as rounded hump lacking spines. Paired mid-dorsal pore-like spots on pronotum, metanotum, and abdominal terga I-IV, and VI. Additional pairs of more lateral pores on tergum V. Posterior abdominal tergal spines narrow and long, evenly spaced and with small gap between spines, only occasional small spines in between. Lateral spines small, indistinct but numerous (Table 1). Gills as in Fig. 21. Caudal filaments darkened near tip.

Specimens Examined: Holotype, Waterton Lakes, Alberta, Canada, 49°06'N 113°54'W, coll. J. McDunnough (no. 677 CNIC): 23/VII/1923, male imago. Others, 62 nymphs, 207 male imagines and subimagines, and 137 female imagines and subimagines.

Distribution: Alberta, British Columbia, Idaho, Manitoba, and Wyoming.

Centroptilum victoriae McDunnough

Centroptilum victoriae McDunnough 1938, Can. Ent. 70: 27.

Imago: Lengths: body 3.4-5.5 mm, fore wings 3.7-4.5 mm (Fig. 2), hind wings 0.6-0.9 mm, male cerci 6.1-7.5 mm, female cerci 4.3-7.5 mm. Hind wings variable, thicker and rounder wings have a short third vein (Fig. 6). Colouration: Male adequately described by McDunnough (1938). Female with head and base of antennae light yellow-tan. Pronotum yellow-tan, with brown posterior edge. Mesonotum white dorsally, light tan dorsolaterally. Metanotum white anterior and dark brown posterior. Thoracic sterna white with hyaline spots ventrad to coxae. Abdomen semi-hyaline to hyaline. Brown on posterior 2/3 of terga I to VI. Terga VII to X and sternum IX with red wash. Broken black spiracular line on segments II to VIII. Male genitalia with posterior edge of styliger plate bent dorsally, appearing concave (Fig. 10).

Nymph: Lengths: body 4.2-5.6 mm, antennae 1.2-1.6 mm, terminal filament 1.5-2.0 mm, and cerci 1.6-2.3 mm. Colour pattern as in Fig. 14. Mouthparts: As in Figs. 25-28. Small pore-like spot near each compound eye at narrowest point between eyes. Legs light tan with dark brown spots on either side of femoral/tibial joint. Distal end of femora with few scattered setae in a short row on dorsal margin. Paired mid-dorsal pore-like spots on pronotum, mesonotum, and metanotum. Abdominal terga with few scattered semi-circular hollows. Tergum IX produced posteriorly as mid-dorsal round hump lacking posterior spines. Paired mid-dorsal pore-like spots on terga I-IV, and X. Second pair of more lateral pores on terga II-VI, and IX. Posterior tergal spines very long and narrow, evenly spaced and with gaps and only occasional small spines in between. Lateral spines small and inconspicuous (Table 1). Gills as in Fig. 22. Caudal filaments with terminal segments darkened.

Specimens examined: Holotype, Inhabitants River, at Victoria Highway, Cape Breton Island, Nova Scotia, Canada, 45°46'N 61°20'W, coll. J. McDunnough (no. 4288 CNIC), 19/VI/1936, male imago. Paratypes, 3 male imagines, same data. Others, 206 nymphs, 19 male imagines and subimagines, and 9 female imagines and subimagines.

Distribution: Manitoba, Nova Scotia, and Ontario.

Centroptilum album McDunnough

Centroptilum album McDunnough 1926, Can. Ent. 58: 189. McDunnough 1930, Can. Ent. 62: 58-59. (described nymph). McDunnough 1932, Can. Ent. 64: 80.

Imago: Lengths: body 4.0-5.5 mm, fore wings 4.1-5.4 mm (Fig. 3), hind wings 0.5-0.8 mm (Fig. 7), cerci 6.9-8.7 mm. Colouration: Male and female adequately described by McDunnough (1926) except the mentioned red-brown V-shaped mark is not present in all females. Male genitalia as in Fig. 11. Tubercle between bases of forceps probably not fully sclerotized as boiling in KOH solution destroys traces of it.

Nymph: Lengths: body 4.6-5.8 mm, antennae 1.4-1.7 mm, cerci 1.8-2.0 mm, terminal filament 1.6-2.0 mm. Dorsal colour pattern described by McDunnough (1930, and 1932)(Fig. 15). Mouthparts: As in Figs. 29-32. Distal end of femora with scattered hairs in a short row along dorsal edge. Tibiae with distinct sub-proximal arc of setae across dorsal edge. Abdominal terga with few scattered semi-circular hollows. Tergum IX lacking posterior tergal spines mid-dorsally and in some individuals this area projects posteriorly. Pore-like spots present near eyes and mid-dorsally on thoracic and abdominal terga I-IV, and VII-IX. Additional lateral pores occur on terga VII, VIII, and X. Dark markings on sterna VII to IX. Paired mid-ventral pores also found on sterna II, VIII, and IX. Sternum VIII with two additional pairs of pores more laterally. Posterior tergal spines short, wide, rounded and with little to no gap between spines. Some individuals lacking lateral spines but most with numerous very small spines (Table 1). Gills as in Fig. 23. Caudal filaments with dark brown band of segments in middle and at distal end.

Specimens Examined: Holotype, Silver Creek, Orillia, Ontario, Canada, 44°37'N 79°25'W, coll. C.H. Curran (no. 1790 CNIC): 13/VI/1925, male imago. Allotype, Same location, coll. J. McDunnough, 11/VI/1925, female imago. Paratypes, Same location, 11/VI/1925-13/VI/1925, 9 male imagines and 14 female imagines, coll. C.H. Curran and J. McDunnough. Others, 153 nymphs, 107 male imagines and subimagines, 46 female imagines and subimagines.

Distribution: British Columbia, Manitoba, New Brunswick, North Carolina, Ontario, and Quebec.

Centroptilum conturbatum McDunnough

Centroptilum conturbatum McDunnough 1929, Can. Ent. 61: 171-173.

Imago: Lengths: body 4.1-6.3 mm, fore wings 4.2-6.2 mm (Fig. 4), hind wings 0.6-1.0 mm (Fig. 8), cerci 6.1-10.1 mm. Hind wings of females with costal process more erect than males and in most specimens not curved. Colouration: Male and female adequately described by McDunnough (1929) except: female antennae hyaline brown distally and opaque tan basally, and sterna opaque white mid-ventrally, clear hyaline laterally. Fore wings of female with occasional black markings in pterostigmal area. Both sexes with long fore wing veins, especially intercalaries (Fig. 4). Male genitalia as in Fig. 12. Irregularities along inner margins common and may look like tubercles.

Nymph: Lengths: body 4.4-6.2 mm, antennae 1.5-2.0 mm, terminal filament 1.9-2.4 mm, cerci 2.1-2.7 mm. Colouration: As in Fig. 16. Mouthparts: As in Figs. 33-36. Pore-like spot located near eye and on each thoracic segment on either side of mid-dorsal line. Coxae dark brown on prothorax, lighter meso- and metathorax. Femora with dark brown patches just proximal to tibial joint and distal to coxae. Tibiae with brown patch along mid-length. Distal end of femora with a few scattered setae in short row along dorsal edge. Tibiae with distinct sub-proximal arc of setae across dorsal edge. Abdominal terga with few scattered semi-circular hollows. Posterior edge of tergum IX produced posteriorly into rounded hump lacking spines. Paired mid-dorsal pore-like spots found on terga I to VI and tergum VIII. Second pair of more lateral pores on terga II to VIII. Sterna III-V, and VII with sub-lateral brown patches. Sterna V-VII with two pale brown patches along anterior edge. Posterior tergal spines very long and narrow, evenly spaced with occasional small spines in spaces. Lateral spines small, indistinct and variable in number (Table 1). Gills as in Fig. 24. Caudal filaments hyaline brown with darker apical segments in some specimens.

Specimens Examined: Holotype, Cameron Lake, Waterton Lakes, Alberta, Canada, 49°06'N 113°54'W, coll. J. McDunnough (no. 2985 CNIC): 20/VIII/1928, male imago. Allotype, female imago, same data. Paratypes-6 male imagines, 5 female imagines, same data. Others, 192 nymphs, 56 male imagines and subimagines reared from nymphs, and 61 female imagines and subimagines reared from nymphs.

Distribution: Alberta, British Columbia, California, and Manitoba.

DISCUSSION

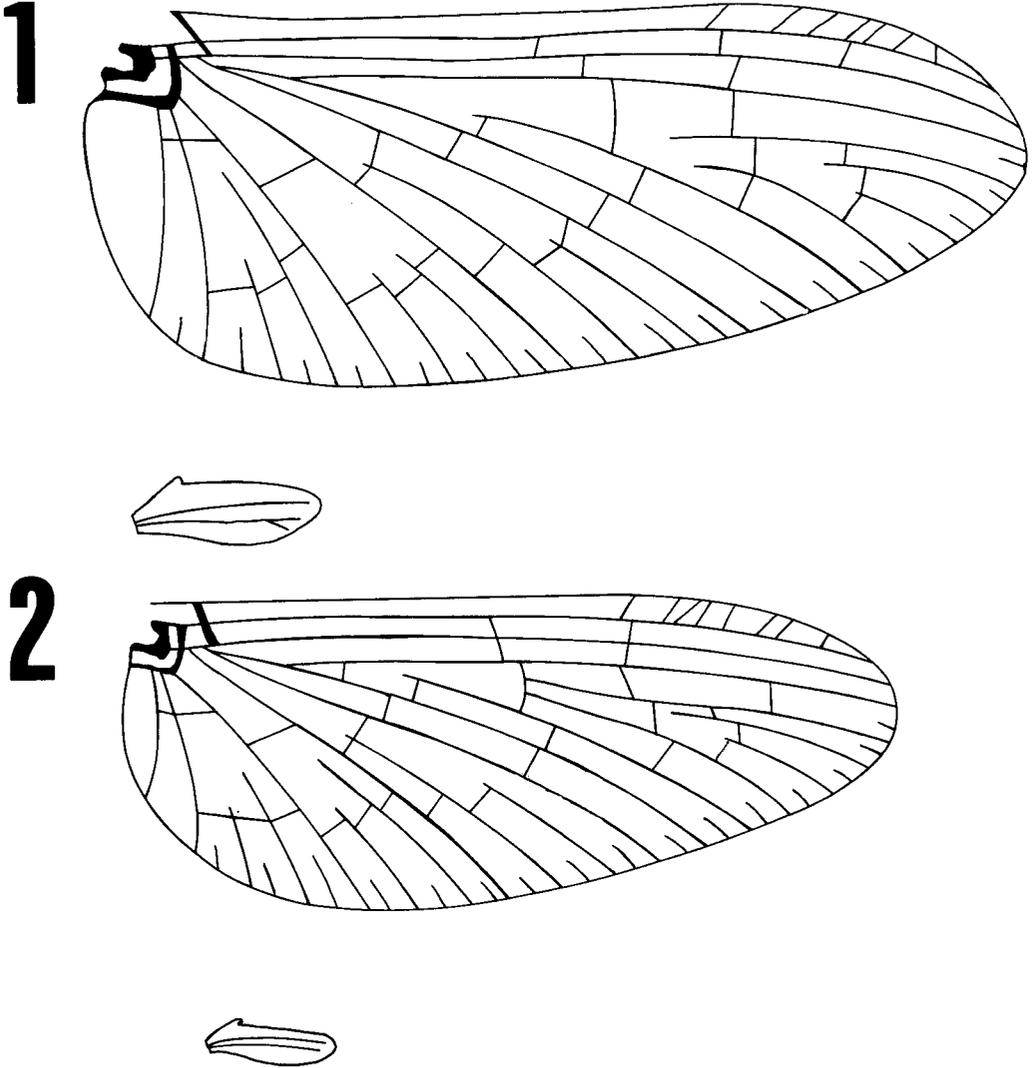
Manitoba species resemble *Centroptilum luteolum* in that the imagines have a conical shaped styliiger plate (in some species distal margin secondarily tilted upwards and giving the appearance of being concave), usually with a finger-like process between the bases of the forceps. The male forceps have a relatively long terminal segment, segment I and the basal segments tend to be strongly tuberculate or at least project inwards to some degree. The nymphs have nearly symmetrical, unilamellate gills. Maxillary palpomeres II

and III are of sub-equal length. Right mandible has unfused canines and very thin prosthema. Lateral spines are very small or absent. Derived character states among this list, *eg.* conical shaped styliger plate with a pointed process between the male genital forceps, support the idea that the Manitoba species belong in the genus *Centroptilum* as defined by Kazlauskas (1969) and Keffermüller and Sowa (1984). In addition *C. luteolum* has further derived states of some characters found in the Manitoba species, *eg.* a very narrow hind wing which comes to a sharp point and symmetrical gills that come to sharp points.

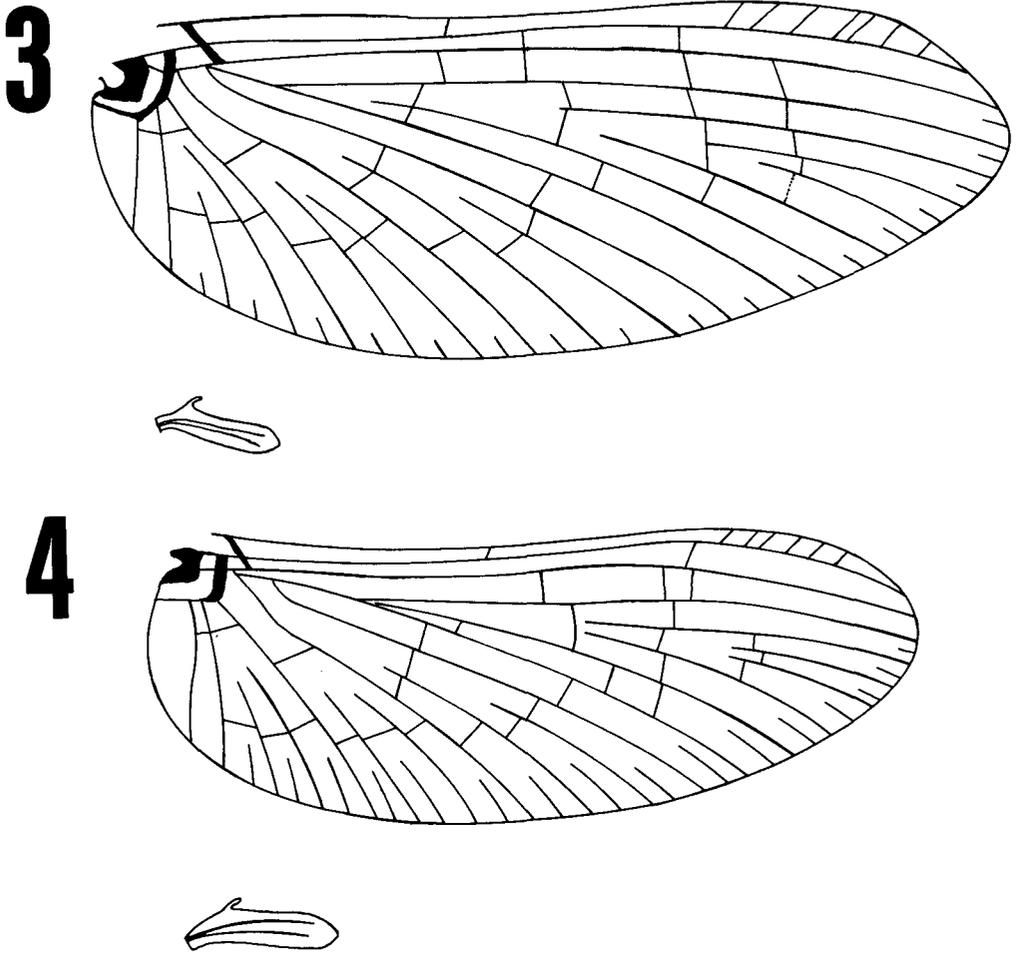
Western Canadian species have the following derived character states that *C. luteolum* does not possess: canines of left mandible at least partially fused, multitude of pore-like spots on nymphal terga, anterior margins of gills serrate, and mid-dorsal posterior margin of nymphal tergum IX lacking spines and produced posteriorly. Since these characteristics are all restricted to the nymphal stage, the authors do not consider them sufficient to warrant establishing a new genus. The Manitoba species are therefore conserved in the genus *Centroptilum*.

LITERATURE CITED

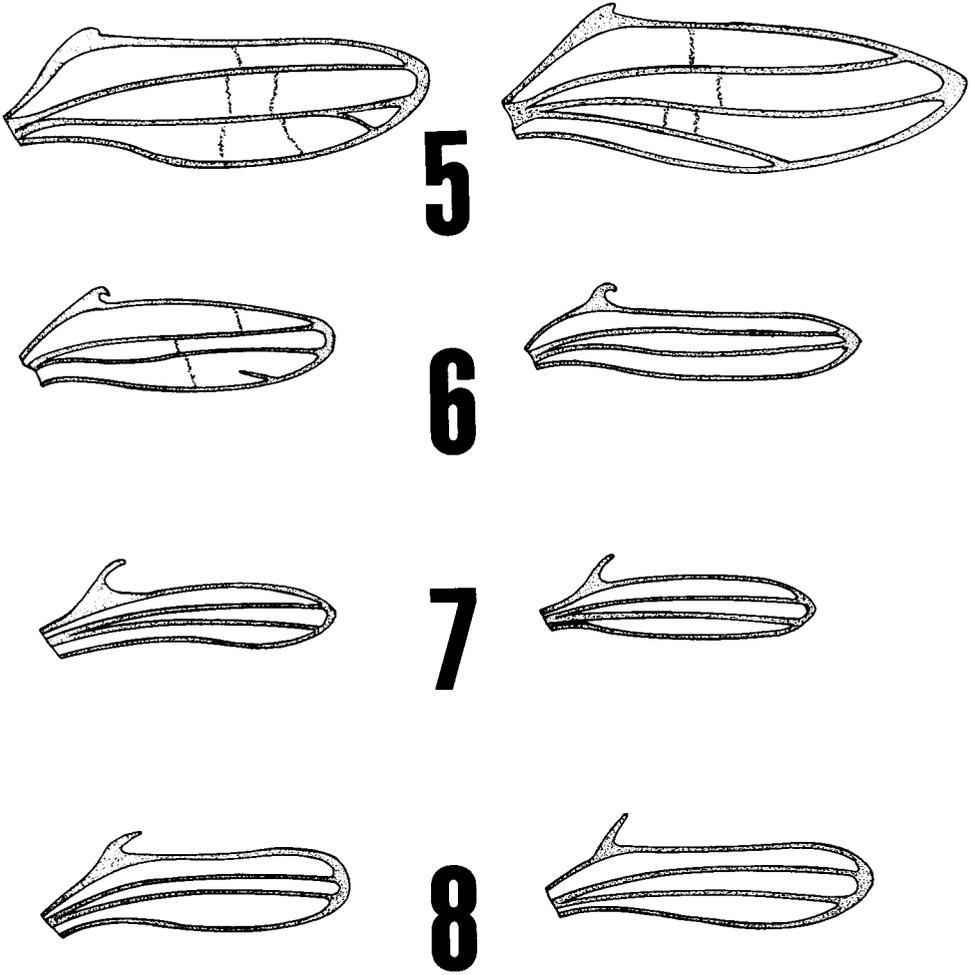
- Eaton, A.E. (1869): On *Centroptilum*, a new genus of the Ephemeridae. Ent. Monthly Mag. 6:131-132.
- Kazlauskas, R.S. (1969): Neues über das System der Eintagsfliegen der Familie Baetidae (Ephemeroptera). Proc. XIIIth Int. Congr. Ent., III: 337-338.
- Keffermüller, M., and R. Sowa (1984): Survey of Central European species of the genera *Centroptilum* Eaton and *Pseudocentroptilum* Bogoescu (Ephemeroptera, Baetidae). Polskie Pismo Entomol. 54:309-340.
- Lowen, R.G. (1989): *Centroptilum* Eaton and *Pseudocentroptilum* Bogoescu of Manitoba (Ephemeroptera; Baetidae): Classification, species groups and post-glacial dispersal. M.Sc. Thesis, University of Manitoba.
- McDunnough, J. (1924): New Canadian Ephemeridae with notes, II. Can. Ent. 56:90-98.
- McDunnough, J. (1926): Notes on North American Ephemeroptera with descriptions of new species. Can. Ent. 58:184-196.
- McDunnough, J. (1929): Notes on North American Ephemeroptera with descriptions of new species, II. Can. Ent. 61:169-180.
- McDunnough, J. (1930): The Ephemeroptera of the North shore of the Gulf of St. Lawrence. Can. Ent. 62:54-62.
- McDunnough, J. (1932): Further notes on the Ephemeroptera of the North shore of the Gulf of St. Lawrence. Can. Ent. 64:78-81.
- McDunnough, J. (1938): New species of North American Ephemeroptera with critical notes. Can. Ent. 70:23-35.



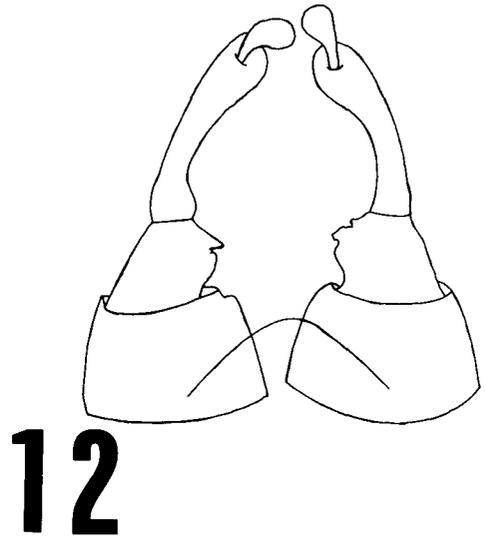
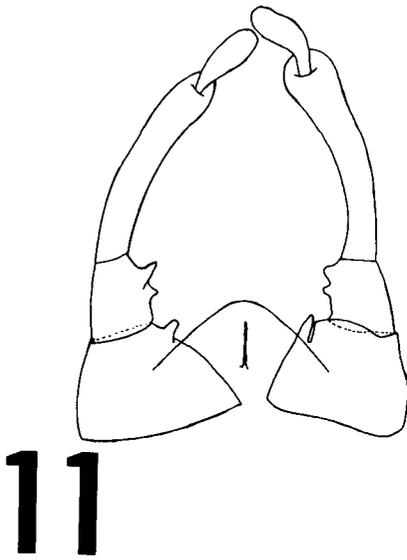
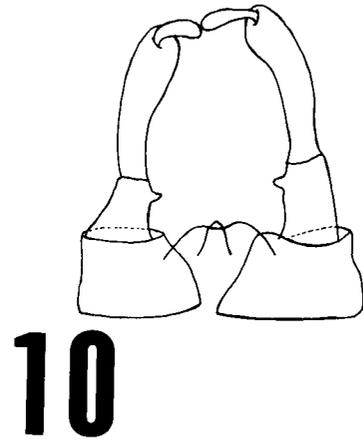
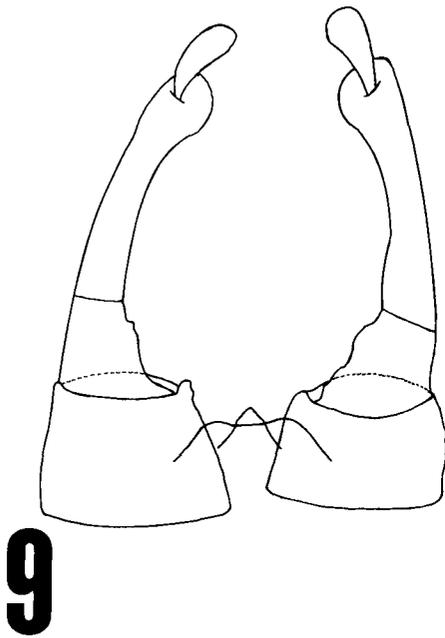
Figures 1-2. Meso- and metathoracic wings of *Centroptilum* imagines. 1) *C. bifurcatum* 2) *C. victoriae*.



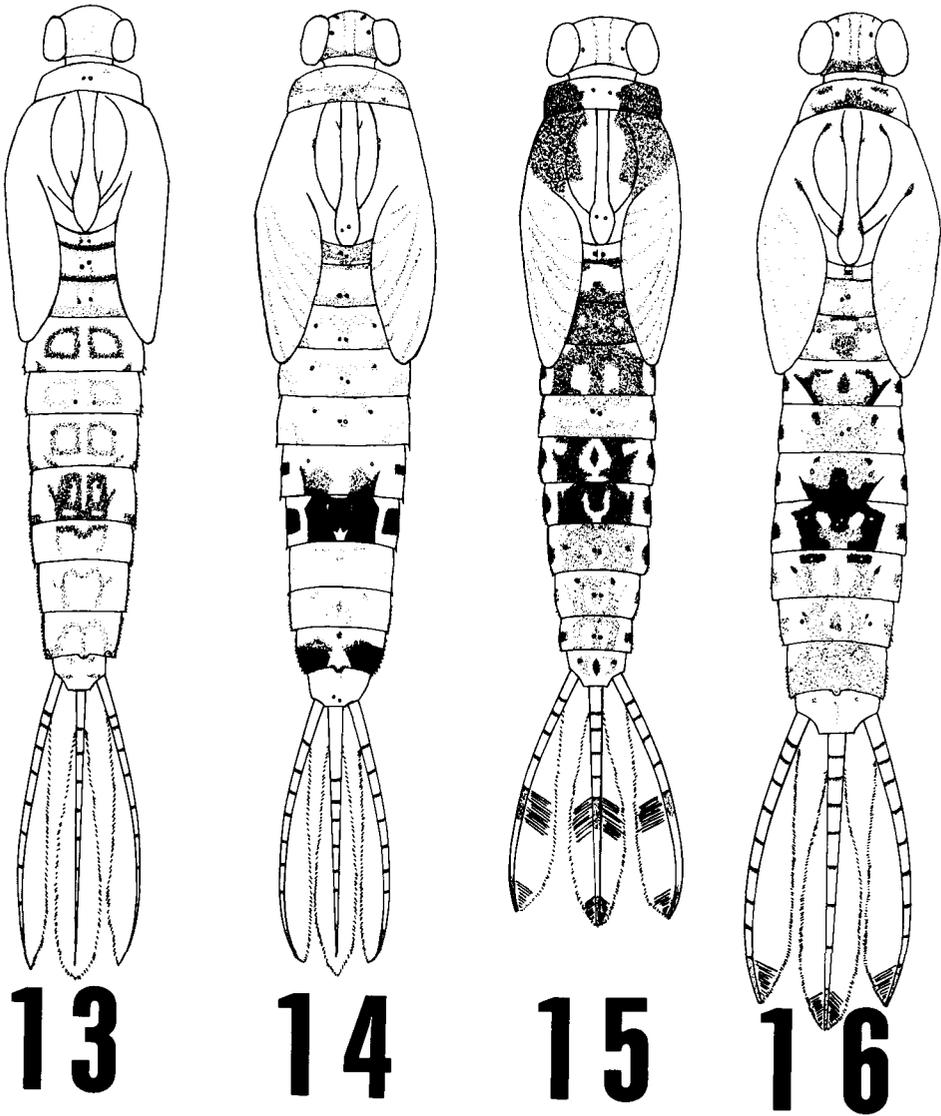
Figures 3-4. Meso- and metathoracic wings of *Centroptilum* imagines. 3) *C. album* 4) *C. conturbatum*.



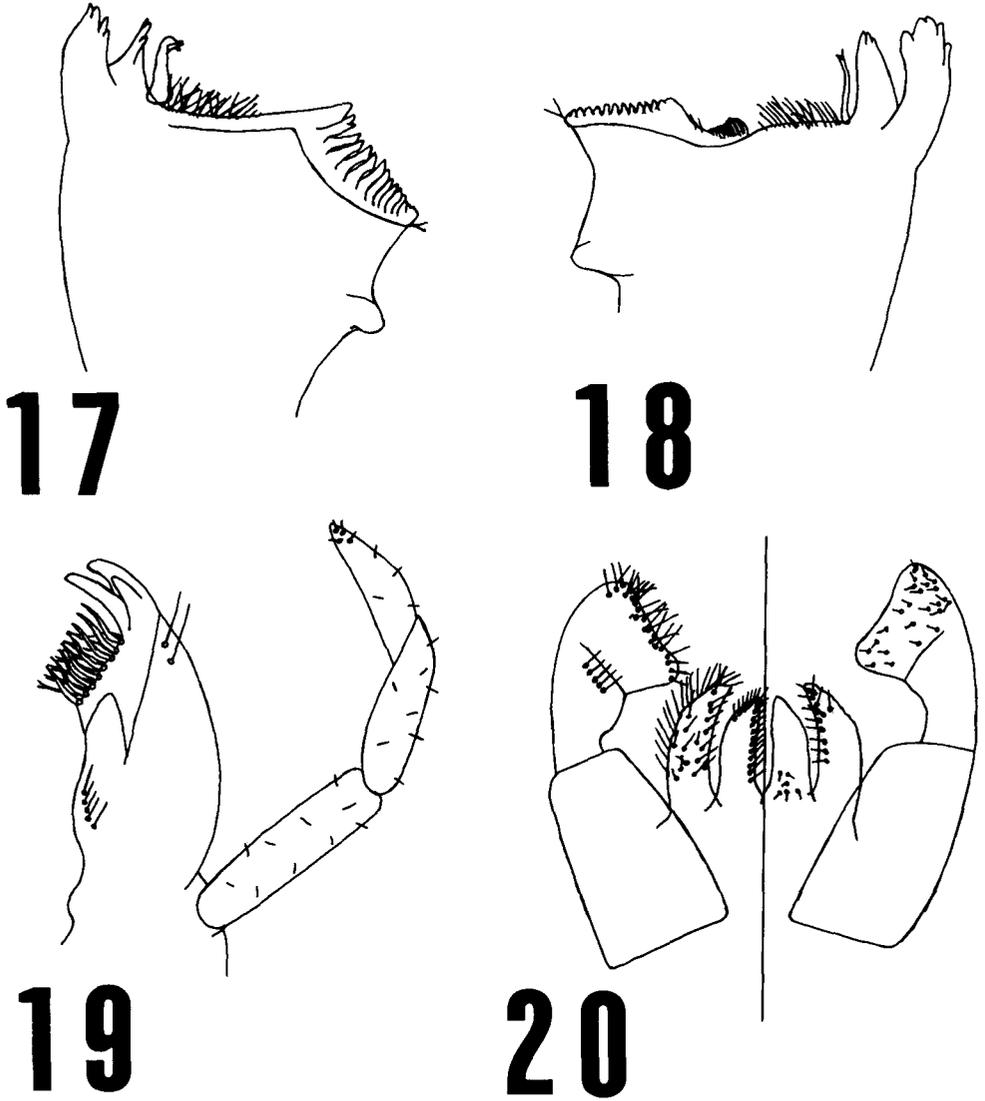
Figures 5-8. Detail of *Centroptilum* metathoracic wings showing range of variation observed. 5a,b) *C. bifurcatum* 6a,b) *C. victoriae* 7a,b) *C. album* 8a,b) *C. conturbatum*.



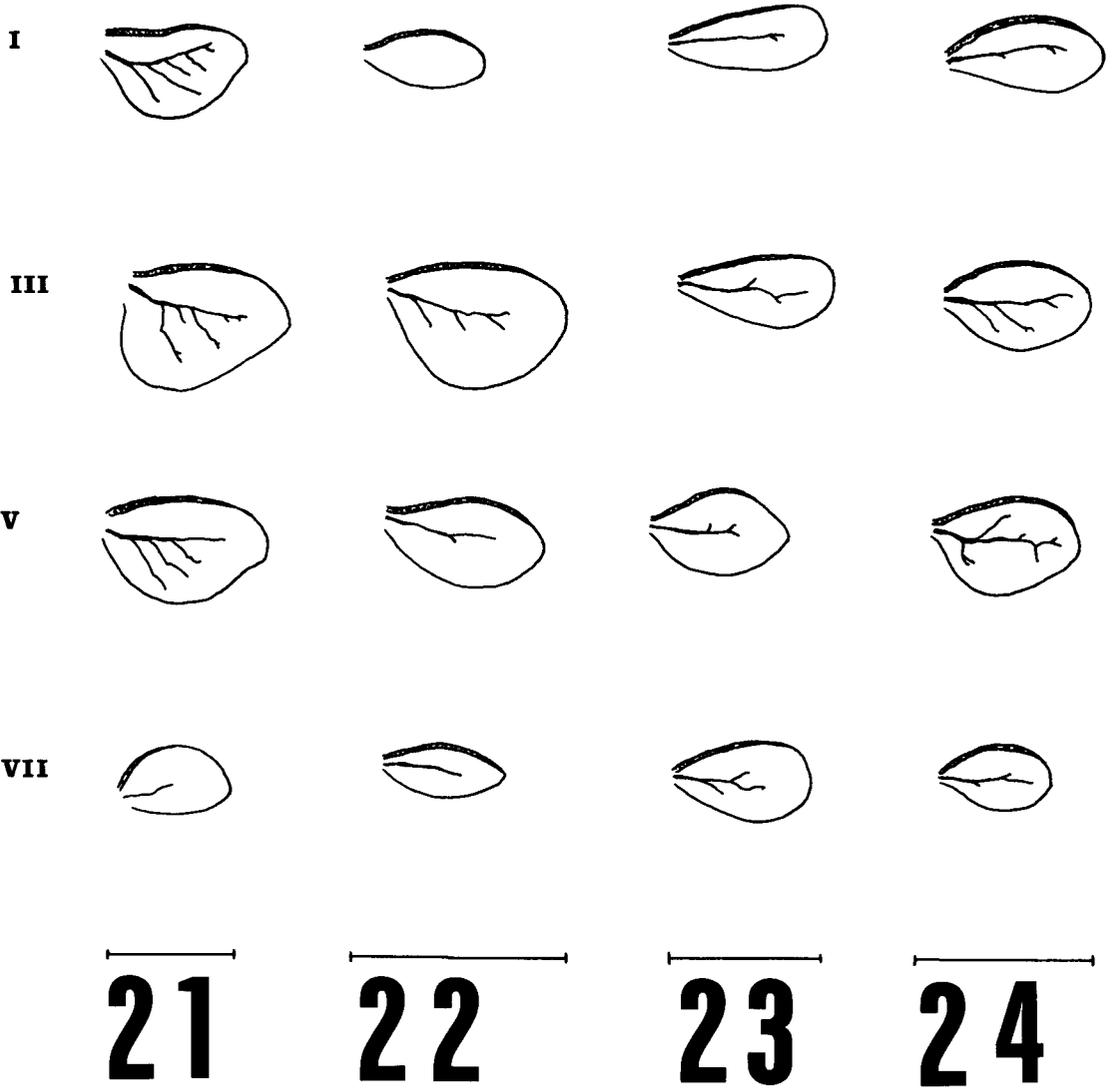
Figures 9-12. Dorsal view of *Centropitulum* male genitalia. 9) *C. bifurcatum*
10) *C. victoriae* 11) *C. album* 12) *C. conturbatum*.



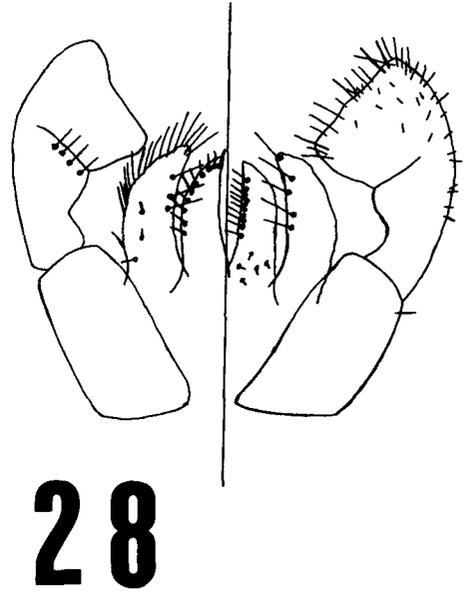
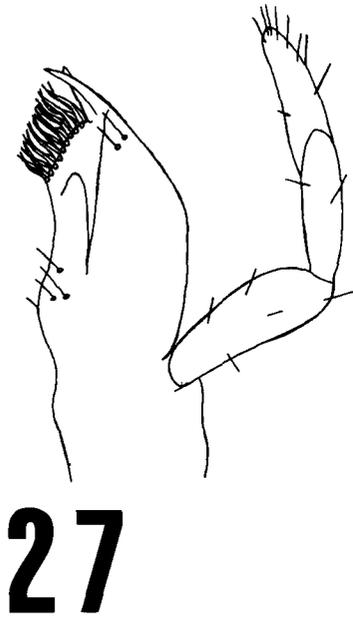
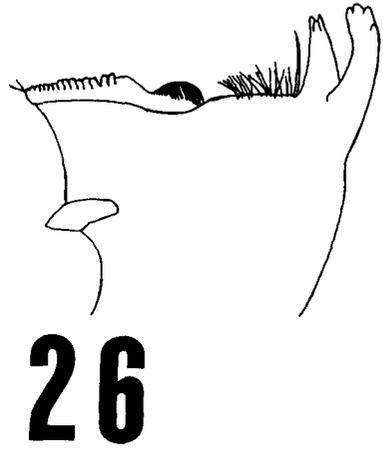
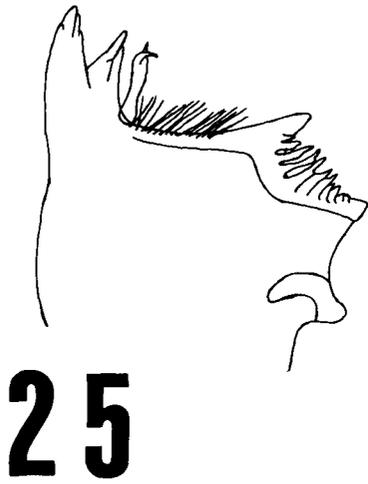
Figures 13-16. Dorsal colour pattern of mature *Centropilum* nymphs. 13)*C. bifurcatum* 14)*C. victoriae* 15)*C. album* 16)*C. conturbatum*.



Figures 17-20. Nymphal mouthparts of *C. bifurcatum* 17)left mandible. 18)right mandible. 19)maxilla. 20)labium (left half dorsal, right half ventral).



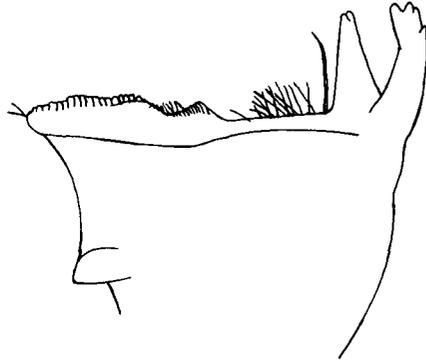
Figures 21-24. Gills from abdominal segments I,III,V, and VII of mature *Centroptilum* nymphs. 21)*C. bifurcatum* 22)*C. victoriae* 23)*C. album* 24)*C. conturbatum*.



Figures 25-28. Nymphal mouthparts of *C. victoriae* 25)left mandible. 26)right mandible. 27)maxilla. 28)labium (left half dorsal, right half ventral).



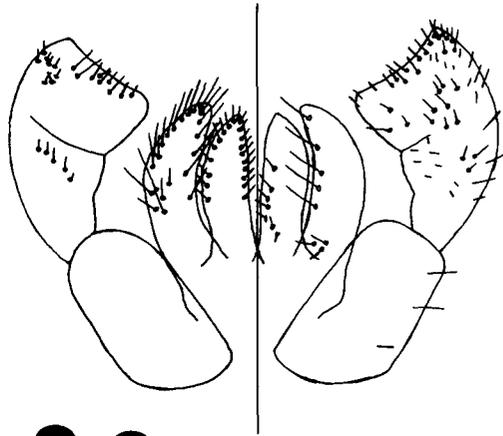
29



30

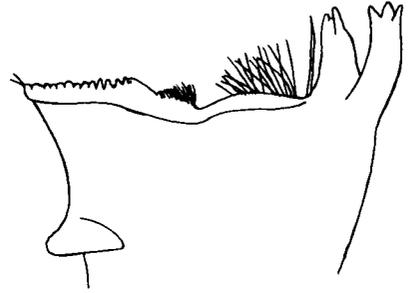
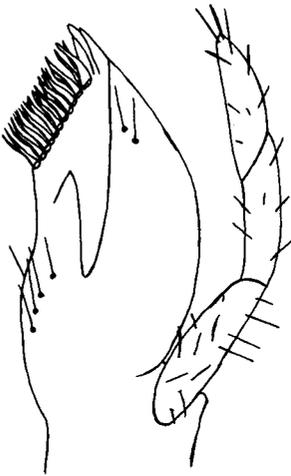
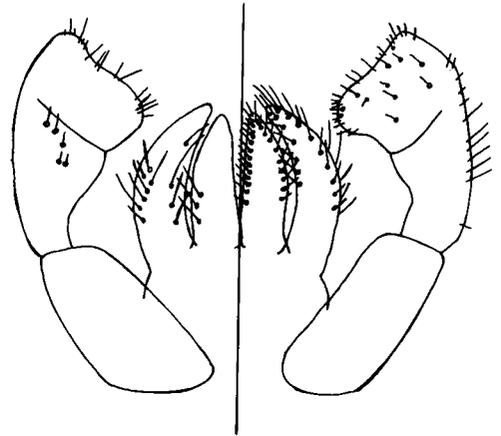


31



32

Figures 29-32. Nymphal mouthparts of *C. album* 29)left mandible. 30)right mandible. 31)maxilla. 32)labium (left half dorsal, right half ventral).

**33****34****35****36**

Figures 33-36. Nymphal mouthparts of *C. conturbatum* 33)left mandible. 34)right mandible. 35)maxilla. 36)labium (left half dorsal, right half ventral).

Table 1. Number of lateral spines observed on abdominal segments of mature nymphs.

ABDOMINAL SEGMENT	SPECIES			
	C. BIFURCATUM	C. VICTORIA	C. ALBUM	C. CONTURBATUM
I	0	0	0	0
II	0	0	0	0
III	0-1	0	0	0
IV	0-3	0	0	0
V	5-10	0	0-trace	0
VI	6-14	0	0-trace	0
VII	7-16	0	0-3	0
VIII	9-19	6-14	0-4	0-3
IX	10-17	8-14	0-3	0-8
X	0	0	0	0