

BIOLOGICAL NOTES AND RANGE EXPANSION OF THE NON-BITING MIDGE *ODONTOMESA FULVA* (KIEFFER) (DIPTERA: CHIRONOMIDAE)

Iain D. Phillips^{1,2,3}, Dale Parker⁴, Brittney M. Hoemsen^{2,3}, Aaron J. Bell³, and Douglas P. Chivers²

ABSTRACT.—During research on brook trout (*Salvelinus fontinalis* [Mitchill]), we collected larval and pupal specimens of the midge *Odontomesa fulva* (Kieffer) (Diptera: Chironomidae) from Pine Cree Creek, in the Cypress Hills area of the Northern Great Plains of Saskatchewan, Canada. This record is the first observation of *O. fulva* from the province. The larvae of the population of *O. fulva* in this study prefer shallow pools in this first-order, cold water stream. The species displays a univoltine emergence phenology. This range extension of *O. fulva* highlights and reinforces the importance of the Cypress Hills to the unique aquatic faunal biodiversity and ecology of Saskatchewan and the Northern Great Plains.

RESUMEN.—Durante investigaciones sobre la trucha de manantial (*Salvelinus fontinalis* [Mitchill]), colectamos especímenes en estadios larvario y crisálida de *Odontomesa fulva* (Kieffer), (Diptera: Chironomidae) de Pine Cree Creek, en el área de Cypress Hills de las Grandes Llanuras del norte en Saskatchewan, Canadá. Este registro constituye la primera observación de *O. fulva* en la provincia. Las larvas de la población de *O. fulva* en este estudio prefieren pozas de poca profundidad en arroyos de agua fría y presentan una fenología de emergencia univoltina. Esta extensión biogeográfica de *O. fulva* hace que se destaquen y se refuercen la biodiversidad única de fauna acuática y la ecología de Cypress Hills en Saskatchewan y en las Grandes Llanuras del norte en general.

There have been few published accounts of the range of the freshwater midge genus *Odontomesa* Pagast in North America, and life history studies are even rarer. *Odontomesa* has a Holarctic distribution. A taxonomic review by Sæther (1985) revealed that the genus consists of at least 3 species. Two species, *O. lutosopra* (Garrett) and *O. ferringtoni* Sæther appear restricted to the Nearctic (Garrett 1925, Sæther 1985). *Odontomesa lutosopra* has only been found in British Columbia (Sæther 1985, Oliver et al. 1990), while *O. ferringtoni* is reported from British Columbia, Colorado, and Ohio (Sæther 1985, Oliver et al. 1990, Bolton 1992, Epler 2001, Canadian National Collection [CNC]). The third species, *O. fulva* (Kieffer) is Holarctic. In North America, it has been reported from Ontario and the Yukon, and it is distributed widely from Montana south to New Mexico, in Illinois, and from Pennsylvania to Mississippi (Pagast 1947, Roback 1957, Oliver et al. 1990, Epler 2001, CNC). Mason et al. (1991) and Mason and Parker (1994) do not record the genus as occurring in their surveys of Saskatchewan Chironomidae.

Some confusion has occurred in earlier distribution accounts. Oliver (1981) lists only *O. lutosopra* as occurring in British Columbia, Alberta, Colorado, Wisconsin, Ontario, and Quebec, while Oliver and Roussel (1983) report the genus as occurring in Alberta and Ontario. However a later publication (Oliver et al. 1990) restricts *O. lutosopra* to British Columbia and does not include any Canadian occurrence of *O. fulva*. Specimens at the CNC collected by D.R. Oliver in 1990 record *O. fulva* from Frankford, Kintor, and Trout creeks in southern Ontario, and a single specimen was collected in 1976 by K. Dance near Waterloo, Ontario.

We discovered larval and pupal specimens of *O. fulva* in Pine Cree Creek, Saskatchewan, Canada (49°61'64.3", -108°76'95.2"), while sampling with a 500 µm mesh Hess sampler and drift nets, as part of a larger study on food-web dynamics and brook trout (*Salvelinus fontinalis* [Mitchill]) diet in this stream. During summer 2012, we sampled Pine Cree Creek monthly starting at the beginning of May and finishing in late September, for a

¹Water Quality Services, Integrated Water Services, Water Security Agency of Saskatchewan, #101–108 Research Drive, Saskatoon, Saskatchewan, Canada S7N 2R3. E-mail: iain.phillips@wsask.ca

²Department of Biology, University of Saskatchewan, #112 Science Place, Saskatoon, Saskatchewan, Canada S7N 5E2.

³Troutreach Saskatchewan, Saskatchewan Wildlife Federation, #9 Lancaster Road, Moose Jaw, Saskatchewan, Canada S7J 1M8.

⁴AquaTax Consulting, #1204 Main Street, Saskatoon, Saskatchewan, Canada S7H 0L2.



Fig. 1. Map showing location of study site, Pine Cree Regional Park (star).

total of 5 collection dates or periods. We identified our specimens of *O. fulva* by applying the keys of Sæther (1983, 1985, 1986) and Epler (2001) to larval specimens collected on 5 May, 7 June, and 6 July 2012. *Odontomesa fulva* pupal exuviae were collected in 500 μm mesh drift nets in our early May sampling, and pupae again in the Hess samples from 7 June. We found most larvae in the pools. Larval density was highest in May (mean density ~ 2700 individuals $\cdot \text{m}^{-2}$, $n = 3$), then declined in the June collection (mean density ~ 1500 individuals $\cdot \text{m}^{-2}$, $n = 2$) and were lowest in July (mean density ~ 850 individuals $\cdot \text{m}^{-2}$, $n = 3$). We recovered no *O. fulva* specimens in later sampling. Representative voucher specimens are deposited at the CNC, the Water Security Agency of Saskatchewan, and the Royal Saskatchewan Museum, Regina, Saskatchewan.

Pine Cree Creek is a first-order, spring-fed headwater stream in the Cypress Hills ecoregion of Saskatchewan—an anomalous elevated region in the Northern Great Plains with high-relief streams (Fig. 1). This creek in particular is surrounded by mixed wood forest of white spruce, lodgepole pine, trembling aspen, and balsam poplar. The aquatic environment itself

is characterized by a mean annual specific conductivity of $638 \mu\text{S}$ ($\pm 38 \mu\text{S}$), mean pH of 7.02 (± 0.80), maximum temperature of 16.4°C , and mean summer temperature of 4.5°C (May–September).

In our study stream, *O. fulva* appears restricted to the slow-moving pool habitats dominated by loose fine sediment, with no appreciable macrophyte growth. Sæther (1983) reports the species as living in slightly silted sand in slow lotic habitats and littoral regions of lakes; however, *Odontomesa* is listed in Ferrington et al. (2008) as occurring in lotic erosional habitats, exhibiting sprawling habit and functioning as a collector-gatherer (see Monakov 1972) in their communities. Gut contents of our larval specimens revealed a predominance of diatoms with lesser amounts of fine particulate material. Studies by Shilova (1966) describe the feeding of *O. fulva* as a form of filtering, whereby the larvae swallow water and force it back out by a strong contraction of the intestine, trapping food particles in bristles through the mouth apparatus (Shilova 1966). Shilova (1966) speculates that this method of feeding focuses *O. fulva* diet on algae.

We have sampled the pool, run, and riffle habitats of Pine Cree Creek in triplicate once

each fall (between September and November) and each spring (March to mid-April) from 2007 to 2011, yet we have never before produced any *O. fulva* specimens, suggesting the larvae are in either an egg form or too early an instar to be captured in our 500 µm mesh nets. As most chironomids overwinter in the ultimate (4th-instar) or penultimate instar, another possibility is that the larvae use the hyporheic zone of the creek to overwinter. Our first collections of *O. fulva* are in early May as larvae and pupal exuviae. Based on the pupae and pupal exuviae collections of *O. fulva* through the ice-free season of 2012, and considering the short duration of most chironomid pupae and the floatation period of pupal exuviae, we hypothesize a univoltine life cycle with emergence from early May through to mid-July. Specimens of *O. fulva* in the CNC from southern Ontario are represented by adult specimens collected in late May and pupae collected in August, suggesting a more prolonged emergence than we find at Pine Cree Creek.

The chironomid faunas of the Cypress Hills and area have been largely ignored to date. Our observations of *O. fulva*'s range extension into Pine Cree Creek and the Cypress Hills is one of the first chironomid investigations for the area. Undoubtedly, as more records are established for the species, a clearer picture of its distribution and postglacial origins will be determined. Previous research in the Cypress Hills reveals that the region supports distinctive communities of Trichoptera (Smith 1984), Plecoptera (Doddall and Lehmkuhl 1979), and Ephemeroptera (Webb 2002), which include assemblages of prairie and boreal species but also species with affinities to the montane regions to the west and the southwestern glacial refuges. Our findings highlight and reinforce the importance of the Cypress Hills to the biodiversity of Saskatchewan and the Northern Great Plains. Further research on the chironomids and other aquatic groups will most certainly contribute to our understanding of the ecology and aquatic community biodiversity present in these unique stream habitats.

We are grateful to Joan Hodgins at the Pine Cree Creek Regional Park for her support in our studies there, as well as the Saskatchewan Wildlife Federation, Saskatchewan Student Works Program, Natural Science and Engineering

Research Council of Canada (NSERC), and EcoAction Fund for funding the research that made these observations possible. Further, we appreciate J. Cumming at the Canadian National Collection for providing us with access to the *O. fulva* material deposited therein.

LITERATURE CITED

- BOLTON, M.J. 1992. Chironomidae (Diptera) of Cedar Bog, Champaign County, Ohio. *Ohio Journal of Science* 92(5):147–152.
- DOSDALL, L.M., AND D.M. LEHMKUHL. 1979. Stoneflies (Plecoptera) of Saskatchewan. *Questiones Entomologicae* 15:3–116.
- EPLER, J.H. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina: a guide to the taxonomy of the midges of the southeastern United States, including Florida. Version 1.0. John H. Epler, PhD, 461 Tiger Hammock Rd., Crawfordville, FL; [cited 9 October 2012]. 532 pp. Available from: <http://home.comcast.net/~johneppler3/SEMidges.pdf>
- FERRINGTON, L.C., JR., AND W.P. COFFMAN. 2008. Chapter 26: Chironomidae. In: R.W. Merritt, K.W. Cummins, and M.B. Berg, editors, *An introduction to the aquatic insects of North America*. 4th edition. Kendall/Hunt Publishing Co., Dubuque, IA.
- GARRETT, C.B.D. 1925. Seventy new Diptera. Key to Pseudoleria, Helomyzidae, Tipulidae, Chironomidae, Dixinae, Orphnephilidae, Mycetophilidae. Cranbrook, British Columbia, Canada.
- MASON, P.G., AND D.W. PARKER. 1994. Additions and corrections to the list of non-biting midges in Saskatchewan. *Blue Jay* 52:200–203.
- MASON, P.G., D.W. PARKER, AND P. MORRILL. 1991. An amateur naturalist's guide to non-biting midges in Saskatchewan. *Blue Jay* 49:174–182.
- MONAKOV, A.V. 1972. Review of studies on feeding of aquatic invertebrates conducted at the Institute of Biology of Inland Waters, Academy of Sciences, USSR. *Journal of the Fisheries Research Board of Canada* 29:363–383.
- OLIVER, D.R. 1981. Chironomidae. Pages 423–458 in J.F. McAlpine, B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood, coordinators, *Manual of Nearctic Diptera*. Volume 1. Agriculture Canada Monograph No. 27. 674 pp.
- OLIVER D.R., M.E. DILLON, AND P.S. CRANSTON. 1990. A catalog of Nearctic Chironomidae. Publication 1857/B, Research Branch, Agriculture Canada, Ottawa, Ontario, Canada. 89 pp.
- OLIVER, D.R., AND M.E. ROUSSEL. 1983. The genera of larval midges of Canada, Diptera: Chironomidae. The insects and arachnids of Canada, Part 11. Publication 1746, Research Branch, Agriculture Canada, Ottawa, Ontario, Canada. 263 pp.
- PAGAST, F. 1947. Systematik und Verbreitung der um die Gattung *Diamesa* gruppierten Chironomiden. *Archiv für Hydrobiologie* 41:435–596.
- ROBACK, S.S. 1957. The immature tendipedids of the Philadelphia area. Monographs of the Academy of Natural Sciences Philadelphia 9:1–152. 28 plates.
- SETH, O.A. 1983. 8. The larvae of Prodiamesinae (Diptera: Chironomidae) of the Holarctic region—keys

- and diagnoses. *Entomologica Scandinavica Supplement* 19:141–147.
- _____. 1985. A review of *Odontomesa* Pagast, 1947. *Spixiana Supplement* 11:15–29.
- _____. 1986. 8. The pupae of Prodiamesinae (Diptera: Chironomidae) of the Holarctic region—keys and diagnoses. *Entomologica Scandinavica Supplement* 28:139–145.
- SHILOVA, A.I. 1966. The larvae of *Odontomesa fulva* Kieff. (Diptera, Chironomidae, Orthocladiinae). *Trud Institute of Biology Vodokhran* 12:239–250. Fisheries Research Board of Canada Translation Series 1012, 1968; [cited 24 September 2012]. Available from: <http://waves-vagues.dfo-mpo.gc.ca/waves-vagues/search-recherche/display-afficher/137839>
- SMITH, D.H. 1984. Systematics of Saskatchewan Trichoptera larvae with emphasis on species from boreal streams. Doctoral dissertation, University of Saskatchewan, Saskatoon, Saskatchewan, Canada. 1302 pp.
- WEBB, J.M. 2002. The mayflies of Saskatchewan. Master's thesis, University of Saskatchewan, Saskatoon, Saskatchewan, Canada. 430 pp.

Received 13 October 2012
Accepted 13 February 2013