

SCIENTIFIC NOTE

***Toxonevra muliebris* (Harris) (Diptera: Pallopteridae): a European fly new to North America**

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The Pallopteridae are acalypterate Diptera classified in the superfamily Tephritoidea along with families such as Piophilidae, Lonchaeidae, and Tephritidae (Woodley *et al.* 2009). They are usually called flutter flies, because the males of some species extend their wings and vibrate them (Marshall 2012; Rotheray 2014). Pallopterid flies are 3 to 6 mm long, with a presutural dorsocentral seta, and are usually grey or yellow with brown-patterned wings that are conspicuously longer than the abdomen (Fig. 1). The proboscis is short, and the ovipositor is prominent with a non-retractile sheath (McAlpine 1987).



Figure 1. *Toxonevra muliebris*, Victoria, BC, 23 August 2018. Photo: Thomas Barbin

There are 12 genera containing about 70 extant species of Pallopteridae worldwide (Pape *et al.* 2011), distributed in the northern temperate region, temperate South America, and New Zealand (Marshall 2012). In North America, three native genera and nine species are recorded (Shewell 1965; McAlpine 1987). British Columbia (BC) has at least six species, with more that are undescribed (Cannings and Scudder 2005).

Flutter fly larvae can apparently be saprophagous, phytophagous, or carnivorous (McAlpine 1987; Rotheray 2014). Some have been found in the flower buds and stems of plants in the aster and carrot families; others live under the bark of dead trees and prey on the larvae of long-horned and bark beetles (Rotheray 2014). On Vancouver Island, *Palloptera claripennis* Malloch has been reared from the cones of Douglas-fir, where the larvae fed on the larvae of *Contarinia* midges (Cecidomyiidae) (McAlpine 1987). Adults are usually found on flowers or on the lower branches of trees and shrubs (Teskey 1976; McAlpine 1987).

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Species of *Toxonevra* have been included in the genus *Palloptera* Fallén (e.g., Shewell 1965; Watson and Dallwitz 2003; Jones 2014) and the spelling *Toxoneura* Macquart has been commonly used (e.g., McAlpine 1987; Ozerov 1999, 2009). The correct spelling is *Toxonevra* (Marshall 2012; Pape and Thompson 2018).

This note reports the first records in North America of a European pallopterid, *Toxonevra muliebris* (Harris), in Victoria, BC, Canada. Morge (1984) states that this fly ranges in Europe from Spain and Italy to Great Britain, France, and Austria. It has also been recorded once in Turkey (Ozerov 2009) and sporadically in Ireland (Speight 1986; Wallace and O'Connor 1997), but it is not known to occur in western Russia (Ozerov 2009) or eastern Asia (Ozerov 1999). The wing pattern is distinctive (Fig. 1), making the species one of the easiest pallopterids to identify.

The first record is a photograph taken in Victoria on 2 June 2016 by Eriko Yamamoto and posted on BugGuide by Talmage Bachman (<https://bugguide.net/node/view/1544782>). Bachman and Yamamoto subsequently collected two specimens that are now deposited in the RBCM: one female (label data: Canada, BC, Victoria, 3946 Quadra St., indoors, 48°28'00"N, 123°21'46"W, 17.viii.2018, T. Bachman, E. Yamamoto, ENT018-004842) and one male (label data: Canada, BC, Victoria, 536 Herald St., indoors, 48°25'50"N, 123°22'05"W, 23.viii.2018, T. Bachman, E. Yamamoto, ENT018-004854). Andrew Simon and Lauren Magner reported a dead individual discovered in a house cupboard at 281 Highland Road, Galiano Island (48°52'8.5"N, 123°20'45"W), 9 September 2017 (<https://bugguide.net/node/view/1469157/bgimage>; <https://www.inaturalist.org/observations/18366976>). Two additional female specimens were collected on indoor windows; they are also housed in the RBCM. The label data read: Canada, British Columbia, Victoria, 1909 Shotbolt Road, at indoor window, urban garden, 48°24'52.3"N, 123°19'34.8"W, 31m asl, 3.ix.2017, Joan C. Kerik and Robert A. Cannings, ENT017-012001; *ibid.*, 18.x.2017, ENT017-012000. Thomas Barbin photographed a male in Victoria on the corner of Raynor Ave. and Catherine St., 48°26'12"N, 123°23'05"W on 23 August 2018 (<https://bugguide.net/node/view/1595875>) (Fig. 1). Finally, on 4 August 2019, Scott Gilmore collected two on a screen mesh on his house deck at 7494 Andrea Crescent, Lantzville (49°14'46"N, 124°05'31"W). These specimens are now in the RBCM: male, ENT019-003779; female, ENT019-003780.

Although *T. muliebris* occurs in outdoor habitats in Europe (where larvae are often found under tree bark, where they probably feed on beetle larvae and other insects), the fly is also reported indoors (Wallace and O'Connor 1997), where the larvae are thought to prey on carpet beetles (Coleoptera: Dermestidae) (Jones 2014). All but two of the BC specimens have been found inside buildings, where perhaps the fly has adopted the same behaviour. The two found outside (the Lantzville record) were captured on a house deck.

Toxonevra muliebris may already be widespread on southeastern Vancouver Island and the Gulf Islands, given the time frame of the records (2016 through 2019) and the six different locations. The Lantzville record is approximately 108 kilometres north of the southernmost Victoria site; the Galiano Island site is about 50 kilometres northeast of the same Victoria location. The species likely has the potential to spread over a much larger area and, if it establishes in North America as a predator of *Anthrenus* and other dermestid beetles, it might even help control those species that are household pests.

Although many historical alien insect introductions from Europe to the Pacific Coast of Canada came directly via shipping (Spence and Spence 1988), many later ones probably arrived indirectly via eastern North America (Copley and Cannings 2005; Cannings *et al.* 2007). Other recent introductions have come directly from eastern Asia in part because of the plentiful marine traffic between the two continents (e.g., Cannings 1989; Canadian Forest Service 1999; deWaard *et al.* 2010). It is most likely that the southwestern BC population of *Toxonevra muliebris* arrived directly from Europe because the fly is not known to be introduced anywhere else, and is distinctive enough that if it had it would likely have been noted. We speculate that the species may have arrived in household goods, such as clothing or luggage.

The discovery of *Toxonevra muliebris* in North America is an excellent example of citizen science and the value of online species identification and documentation sites such as BugGuide and iNaturalist. Postings of photographs of this fly on these sites by naturalists and other members of the public brought the records to the attention of entomologists who recognized the unusual nature of the observations.

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REFERENCES

- Canadian Forest Service, Natural Resources Canada. 1999. Alien forest pests: context for the Canadian Forest Service's Science Program (Science Program context paper). Available from http://www.cfs.nrcan.gc.ca/pubwarehouse/pdfs/10465_e.pdf.
- Cannings, R.A. 1989. An Asian Hornet, *Vespa simillima xanthoptera* (Hymenoptera: Vespidae) in North America. *Journal of the Entomological Society of British Columbia*, **86**: 91.
- Cannings, R.A., Miskelly, J.W., Schiffer, C.A.H., Lau, K.L.A., and Needham, K.M. 2007. *Meconema thalassinum* (Orthoptera: Tettigoniidae), a foreign katydid established in British Columbia. *Journal of the Entomological Society of British Columbia*, **104**: 91-92.
- Cannings, R.A. and Scudder, G.G.E. 2005. The true flies (Diptera) of British Columbia. In *E-Fauna BC: Electronic Atlas of the Fauna of British Columbia* [www.efauna.bc.ca]. Edited by B. Klinkenberg, 2018. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver, British Columbia, Canada.
- Copley, C. and Cannings, R.A. 2005. Notes on the status of the Eurasian moths *Noctua pronuba* and *N. comes* (Lepidoptera: Noctuidae): on Vancouver Island, British Columbia. *Journal of the Entomological Society of British Columbia*, **102**: 83-84.
- deWaard, J.R., Humble, L.M., and Schmidt, B.C. 2010. DNA barcoding identifies the first North American records of the Eurasian moth, *Eupithecia pusillata* (Lepidoptera: Geometridae). *Journal of the Entomological Society of British Columbia*, **107**: 25-32.
- Jones, R. 2014. The Womanly Bow-wing. <https://bugmanjones.com/tag/palloptera-muliebris/>
- Marshall, S.A. 2012. Flies: the natural history and diversity of Diptera. Firefly Books, Richmond Hill, Ontario, Canada.
- McAlpine, J.F. 1987. Pallopteridae [chapter 68]. In *Manual of Nearctic Diptera*. Vol. 2. Edited by J.F. McAlpine, B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood. Agriculture Canada Monograph 28. Pp. 839-843.
- Morge, G. 1984. Family Pallopteridae. In *Catalogue of Palearctic Diptera*. Edited by A. Soós and L. Papp. Akadémiai Kiadó, Budapest, Hungary. Pp. 242-246.
- Ozerov, A.L. 1999. Family Pallopteridae [chapter 73]. In *Key to the Insects of the Russian Far East*. Vol. VI. Diptera and Siphonaptera. Part 1. Edited by P.A. Lehr. Vladivostok. Dal'nauka. Pp. 531-534. (In Russian).
- Ozerov, A.L. 2009. Review of the family Pallopteridae (Diptera) of the fauna of Russia. *Russian Entomological Journal*, **8(2)**: 128-146. (In Russian).
- Pape, T., Blagoderov, V., and Mostovski, M.B. 2011. Order Diptera Linnaeus, 1758. In *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness*. Edited by Z.-Q. Zhang. *Zootaxa*, **3148**: 222-229.
- Pape, T. and Thompson, F.C., editors. 2018. Systema Dipteroorum (version 2.0, Jan 2011). In *Species 2000 & ITIS Catalogue of Life*, 30th October 2018. Edited by Y. Roskov *et al.* Digital resource available from www.catalogueoflife.org/col. Species 2000: Naturalis, Leiden, The Netherlands.
- Rotheray, G.E. 2014. Development sites, feeding modes and early stages of seven European *Palloptera* species (Diptera, Pallopteridae). *Zootaxa*, **3900**: 50-76.
- Shewell, G.E. 1965. Family Pallopteridae. In *A catalogue of the Diptera of North America north of Mexico*. Edited by A. Stone, C.W. Sabrosky, W.W. Wirth, R.H. Foote, and J.R. Coulson United States Department of Agriculture, Washington, DC, USA. Pp. 714-715.
- Speight, M.C.D. 1986. *Cheilosia argentifrons* (Diptera: Syrphidae) new to Ireland: *Donacia cinerea* (Coleoptera: Chrysomelidae) and *Palloptera muliebris* (Diptera: Pallopteridae), presence confirmed in Ireland. *Irish Naturalists' Journal*, **22**: 159-160.

- Spence, J. and Spence, D. 1988. Of ground beetles and men: introduced species and the synanthropic fauna of western Canada. *Memoirs of the Entomological Society of Canada*, **120 (S144)**: 151-168. doi:10.4039/entm120144151-1.
- Teskey, H.J. 1976. Diptera larvae associated with trees in North America. *Memoirs of the Entomological Society of Canada*, **100**: 1-83.
- Watson, L. and Dallwitz, M.J. 2003 onwards. *Insects of Britain and Ireland: the families of Diptera*. Version: 7 October 2018. Available from <http://www.delta-intkey.com/> [accessed 19 April 2019]
- Wallace, P.F. and O'Connor, J.P. 1997. *Palloptera muliebris* (Harris) (Dipt., Pallopteridae) discovered in Dublin City. *Entomologist's Monthly Magazine*, **133**: 114.
- Woodley, N.E., Borkent, A., and Wheeler, T.A. 2009. Phylogeny of Diptera. *In* *Manual of Central American Diptera: Volume 1*. Edited by B.V. Brown, A. Borkent, J.M. Cumming, D.M. Wood, N.E. Woodley, and M.A. Zumbado. NRC Research Press, Ottawa, Ontario, Canada. Pp. 79-94.