

Rediscovery of *Cerceris fumipennis* (Hymenoptera: Crabronidae) in British Columbia, Canada, with notes on geographic variation and nesting habits

Troy Kimoto,¹ Matthias Buck

Abstract—Within Canada, *Cerceris fumipennis* Say (Hymenoptera: Crabronidae) is known to occur in Ontario and Québec but there is also one historic record from 1935 of two female specimens captured in Lytton, British Columbia. No other records have been recorded for the last 77 years. In 2012 and 2013, one male and four females were captured in a sweep net adjacent to a gravel parking lot in Merritt, British Columbia. Although there are differences in size and colouration between the British Columbia and eastern species, the variation between the populations does not warrant assigning a new name to this geographical race.

Résumé—Au Canada, *Cerceris fumipennis* Say (Hymenoptera: Crabronidae) est connu pour être présent en Ontario et au Québec, mais un relevé historique datant de 1935 rapporte deux femelles capturées à Lytton, Colombie-Britannique. Aucun autre relevé n'a été enregistré au cours des 77 dernières années. En 2012 et 2013, un mâle et quatre femelles ont été capturés dans un filet fauchoir adjacent à un stationnement en gravier à Merritt, Colombie-Britannique. Même s'il y a des différences au niveau de la taille et de la coloration entre les espèces de la Colombie-Britannique et celles de l'est, la variation entre les populations ne justifie pas l'attribution d'un nouveau nom à cette race géographique.

Cerceris fumipennis Say (Hymenoptera: Crabronidae) is a solitary, ground-nesting wasp occurring east of the Rockies in the United States of America (Scullen 1965). Within Canada, it is widely distributed throughout southern Ontario, and colonies have also been found in western Québec (Buck 2004; Marshall *et al.* 2005; Careless *et al.* 2009; Careless 2010). There is one historical record from Lytton, British Columbia (two females collected by R.H. Beamer on 3 August 1935; University of Kansas Natural History Museum, Lawrence, Kansas, United States of America), but since then no other specimens had been collected in western North America (except for one from Wyoming, United States of America locality, see below). Female wasps dig individual burrows up to 20 cm beneath the surface with cells originating from the

central tunnel. Females provision each cell with paralysed buprestid beetles (Coleoptera: Buprestidae) upon which larval wasps will develop (Hook and Evans 1991; Marshall *et al.* 2005). As *C. fumipennis* provisions its nest with a wide variety of buprestid beetles, including several species of *Agrilus* Curtis, it has been used in Canada and the United States of America as a biosurveillance tool to detect the emerald ash borer, *Agrilus planipennis* Fairmaire, a non-indigenous beetle from Asia that is killing millions of ash (*Fraxinus* Linnaeus, Oleaceae) trees in eastern North America (Careless *et al.* 2009; Nalepa *et al.* 2012; Careless *et al.* 2014). In the United States of America, citizen scientists are deployed to “adopt” and monitor *C. fumipennis* colonies for emerald ash borer and other non-indigenous buprestid beetles (Rutledge *et al.* 2013).

Received 17 March 2014. Accepted 10 July 2014. First published online 9 October 2014.

T. Kimoto,¹ Canadian Food Inspection Agency, 4321 Still Creek Drive, Burnaby, British Columbia, Canada, V5C 6S7

M. Buck, Royal Alberta Museum, 12845-102nd Avenue, Edmonton, Alberta, Canada, T5N 0M6

¹Corresponding author (e-mail: troy.kimoto@inspection.gc.ca).

Subject editor: Chris Schmidt

doi:10.4039/tce.2014.66

Fig. 1. Location of *Cerceris fumipennis* nests (red circle), Central Park, Merritt, British Columbia, Canada (50.11875°N, 120.78348°W).



Cerceris fumipennis can easily be recognised even by non-experts (Careless 2010) because of its distinctive colouration (dark, black or blackish brown stigma; ivory instead of yellow markings on head and body; only tergum 2 with a wide ivory band, bands reduced or absent on other terga), its morphology (female clypeus without prominent process), and relatively large size (6.0–13.5 mm, usually at least 8.5 mm).

The very differently coloured *Cerceris californica* Cresson is the western equivalent of *C. fumipennis*, preying upon buprestid beetles in British Columbia and the western United States of America (Scullen 1965). In 2012, various locations near Merritt, British Columbia were initially examined for *C. californica* nests with the intention of using it as a biosurveillance tool. A single female *Cerceris* was captured in a sweep net on 3 August 2012 to the west of the parking lot at Central Park, located at Vogt Street and Burgess Avenue (Fig. 1), and sent to M.B. The specimen was identified as *C. fumipennis*,

but it differs slightly from eastern specimens (see below).

On 7 July 2013 one male and three females were captured using a sweep net at the exact same location and determined by M.B. as *C. fumipennis*. A paralysed buprestid (possibly *Chrysobothris* species) lay next to the entrance hole of one of the nests (Fig. 2). The nesting area is essentially an extension of the parking lot and is exposed to full sun throughout the day. It is comprised of hard, compact, sandy soil with some sparsely distributed low lying vegetation. The nesting area occurs in an area with a lot of foot and vehicle traffic. However, unlike the parking lot, the nesting area does not have a top layer of gravel. Some moderately sized (10–35 cm diameter at breast height) trees (*Acer* Linnaeus, Sapindaceae; *Fraxinus*; *Quercus* Linnaeus, Fagaceae; and *Sorbus* Linnaeus, Rosaceae) as well as shrubs are planted as ornamentals at this park. *Ponderosa* pine (*Pinus ponderosa* Douglas ex Lawson and Lawson, Pinaceae) occurs naturally along the

Fig. 2. *Chrysobothris* species at nest entrance, Central Park, Merritt, British Columbia, Canada.



Fig. 3. Female *Cerceris fumipennis* habitus (Merritt, British Columbia, Canada). Wings hardly infuscated except fore wing anteriorly. Ivory markings absent on pronotum, more developed on terga 3–5 (see diagnosis).



Fig. 4. Female *Cerceris fumipennis* habitus (Ontario, Canada). Wings strongly infuscated. Ivory markings present on pronotum, usually absent on terga 3–5 (see diagnosis).



park's border and throughout the city. Merritt (elevation: 595 m) occurs within the Bunchgrass biogeoclimatic zone, which is characterised by warm to hot, dry summers, and moderately cold winters (Anonymous 2014a). Merritt has an annual mean rainfall of 189.3 mm with an average maximum July temperature of 26.2 °C and an

average minimum January temperature of –10.8 °C (Anonymous 2014b). The five specimens collected in 2012 and 2013 are deposited at the Royal Alberta Museum (Edmonton, Alberta, Canada).

During the last week of July 2013, other potential nesting sites in the region were also searched, including baseball diamonds, campsites, dirt walking paths, school yards, and dirt running ovals in Cache Creek, Ashcroft, Spence's Bridge,

Fig. 5. Female *Cerceris fumipennis* head (Merritt, British Columbia, Canada). Flagellum brown beneath, ivory markings more extensive (see diagnosis). This specimen with only minute ivory spots on scape, supraclypeal area and interantennal carina (these spots distinct in two other females but smaller than in male, see Fig. 7).



Fig. 6. Female *Cerceris fumipennis* head (Ontario, Canada). Flagellum black beneath, ivory markings more restricted.



Skihyst Provincial Park, Lytton, Boston Bar, West Kelowna, and Vernon. No other specimens were collected or observed flying.

The specimens from British Columbia (Figs. 3, 5, 7) differ from eastern (Figs. 4, 6, 8) *C. fumipennis* as follows: Except for the apparently smaller size (wing length ♀:9.5–10.5 mm [$n = 6$], ♂:8.5 mm [$n = 1$]; eastern *C. fumipennis* ♀:9.5–13.5 mm [$n = 75$], ♂:6.0–11.5 mm [$n = 55$], specimens examined from Canada: Ontario and United States of America: Delaware, Florida, Georgia, Kentucky, Maryland, Massachusetts, Minnesota, Nebraska, North Carolina, Pennsylvania, Texas, West Virginia; deposited at University of

Fig. 7. Male *Cerceris fumipennis* head (Merritt, British Columbia, Canada). Flagellum brown beneath, ivory markings more extensive (see diagnosis).



Fig. 8. Male *Cerceris fumipennis* head (Ontario, Canada). Flagellum black beneath, ivory markings restricted.



Guelph, Guelph, Ontario, Canada, and Royal Alberta Museum), the specimens from British Columbia differ from eastern populations only in colouration. Ivory markings of head more extensive (especially males), including mark on supraclypeal area and often scape or interantennal carina (all absent in eastern *C. fumipennis*, except for spot on scape which is present in 5% of males). The only male from British Columbia with large ivory clypeal spot (spot absent in 75% of eastern males, spot large in only 7% of males). Female with well-developed ivory spot on lateral portions of clypeus, small in one specimen (usually absent in eastern *C. fumipennis*, rarely with a small spot). Flagellum brown to yellowish brown beneath, especially in basal half (dark brown to black in eastern *C. fumipennis*, except for flagellar apex of male, which is usually pale). Ivory spots on

pronotum small or absent (well developed in eastern *C. fumipennis*). Ivory fascia on tergum 2 narrow and broadly emarginate medially (wide and usually not emarginate in eastern *C. fumipennis*). Ivory markings on terga 3–5 of female more developed than in eastern *C. fumipennis*, including markings on tergum 3 that are as wide or almost as wide laterally as fascia on tergum 2, forming a complete or interrupted apical band (reduced to small lateral spots or absent in eastern *C. fumipennis*, laterally at most one third of width of fascia of tergum 2). Profemur often with posteroventral ivory stripe near apex, rarely also on mesofemur (absent in eastern *C. fumipennis*). Wings noticeably less infuscated than in eastern *C. fumipennis*, tinted faintly greyish-brown except for marginal cell, submarginal cells, distal part of radial cell, and areas distad of these on fore wing, which are more substantially infuscated.

These differences amount to a clear geographic differentiation of the British Columbia population, which contrasts with the fairly uniform pattern of eastern *C. fumipennis*, despite the extensive latitudinal range of the latter (spanning from southern Canada to Florida and Texas). Undoubtedly, the geographic isolation of the British Columbia population has contributed to its distinctness, with the closest known eastern populations ~1000 km to the southeast (near Old Faithful, Yellowstone National Park, Wyoming, United States of America) and separated by high mountain ranges. The two Wyoming specimens (a male and a female, collected 13 July 1966, Florida State Collection of Arthropods, Gainesville, Florida, United States of America) indeed belong to the eastern colour form of *C. fumipennis*, as was confirmed to us by Kevin Williams (Florida State Collection of Arthropods; personal communication). In the absence of further data (structural characters or genetic evidence) we see no merit in assigning a new name to this geographic race, since geographic colour variation in widespread crabronid species is common place and such forms are not usually named.

Acknowledgements

The authors thank Philip Careless, Steven Paiero, and Morgan Jackson (University of Guelph) for sharing their knowledge and experience in locating

C. fumipennis nests, and for taking images of *C. fumipennis* from British Columbia (S. Paiero) and Ontario (P. Careless). Michael Engel (University of Kansas Natural History Museum) and Steve Marshall (University of Guelph) are thanked for the opportunity to study specimens under their care. Kevin Williams (Florida State Collection of Arthropods) kindly confirmed the identity of *C. fumipennis* specimens from Wyoming. Robert Favrin and Wendy Laviolette (Canadian Food Inspection Agency) provided support to conduct this survey.

References

- Anonymous 2014a. Biogeoclimatic ecosystem classification program. British Columbia Ministry of Forest and Range, Research Branch, Victoria, British Columbia, Canada. Available from <http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/subzones/index.html> [accessed 2 May 2014].
- Anonymous 2014b. City of Merritt. Available from <http://www.merritt.ca/discover-merritt/local-climate> [accessed 2 May 2014].
- Buck, M. 2004. An annotated checklist of the spheciform wasps of Ontario (Hymenoptera: Ampulicidae, Sphecidae and Crabronidae). *Journal of the Entomological Society of Ontario*, **134** (2003): 19–84.
- Careless, P.D. 2010. Working with *Cerceris fumipennis* [online]. Available from <http://www.cerceris.info> [accessed 2 October 2013].
- Careless, P.D., Marshall, S.A., Gill, B.D., Appleton, E., Favrin, R., and Kimoto, T. 2009. *Cerceris fumipennis* – a biosurveillance tool for emerald ash borer. Canadian Food Inspection Agency, Ottawa, Ontario, Canada.
- Careless, P., Marshall, S.A., and Gill, B.D. 2014. The use of *Cerceris fumipennis* (Hymenoptera: Crabronidae) for surveying and monitoring emerald ash borer (Coleoptera: Buprestidae) infestations in eastern North America. *The Canadian Entomologist*, **146**: 90–105.
- Hook, A.W. and Evans, H.E. 1991. Prey and parasites of *Cerceris fumipennis* (Hymenoptera: Sphecidae) from central Texas, with description of the larva of *Dasymutilla scaevola* (Hymenoptera: Mutillidae). *Journal of the Kansas Entomological Society*, **64**: 257–264.
- Marshall, S.A., Paiero, S.M., and Buck, M. 2005. Buprestid sampling at nests of *Cerceris fumipennis* (Hymenoptera: Crabronidae) in southern Ontario: the first Canadian records of three buprestids (Coleoptera: Buprestidae). *The Canadian Entomologist*, **137**: 416–419.
- Nalepa, C.A., Teerling, C., Rutledge, C.E., Swink, W., and Arellano, C. 2012. Ball diamonds as habitat for nests of *Cerceris fumipennis* (Hymenoptera: Crabronidae): comparisons among three states. *Journal of the Kansas Entomological Society*, **85**: 219–225.

- Rutledge, C.E., Fierke, M.K., Careless, P.D., and Worthley, T. 2013. First detection of *Agrilus planipennis* in Connecticut made by monitoring *Cerceris fumipennis* (Crabronidae) colonies. *Journal of Hymenoptera Research*, **32**: 75–81.
- Scullen, H.A. 1965. Review of the genus *Cerceris* in America north of Mexico (Hymenoptera: Sphecidae). *Proceedings of the United States National Museum*, **116**: 333–548.