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## **Hidden in Plain View: The Range Expansion of *Carabus granulatus* L. (Coleoptera: Carabidae) and New Provincial Record for Saskatchewan, Canada**

Author(s): Aaron J. Bell, Erik J. Boyes, Alix T. Schmidt and Iain D. Phillips

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SCIENTIFIC NOTE

**HIDDEN IN PLAIN VIEW: THE RANGE EXPANSION OF *CARABUS GRANULATUS* L.  
(COLEOPTERA: CARABIDAE) AND NEW PROVINCIAL RECORD  
FOR SASKATCHEWAN, CANADA**

AARON J. BELL

TRoutreach Saskatchewan, Saskatchewan Wildlife Federation  
#9 Lancaster Road, Moose Jaw, Saskatchewan, CANADA, S7J 1M8  
Department of Renewable Resources, University of Alberta, 751 General Services Building  
Edmonton, AB, CANADA T6G 2H1

ERIK J. BOYES, ALIX T. SCHMIDT

TRoutreach Saskatchewan, Saskatchewan Wildlife Federation  
#9 Lancaster Road, Moose Jaw, Saskatchewan, CANADA, S7J 1M8

AND

IAIN D. PHILLIPS

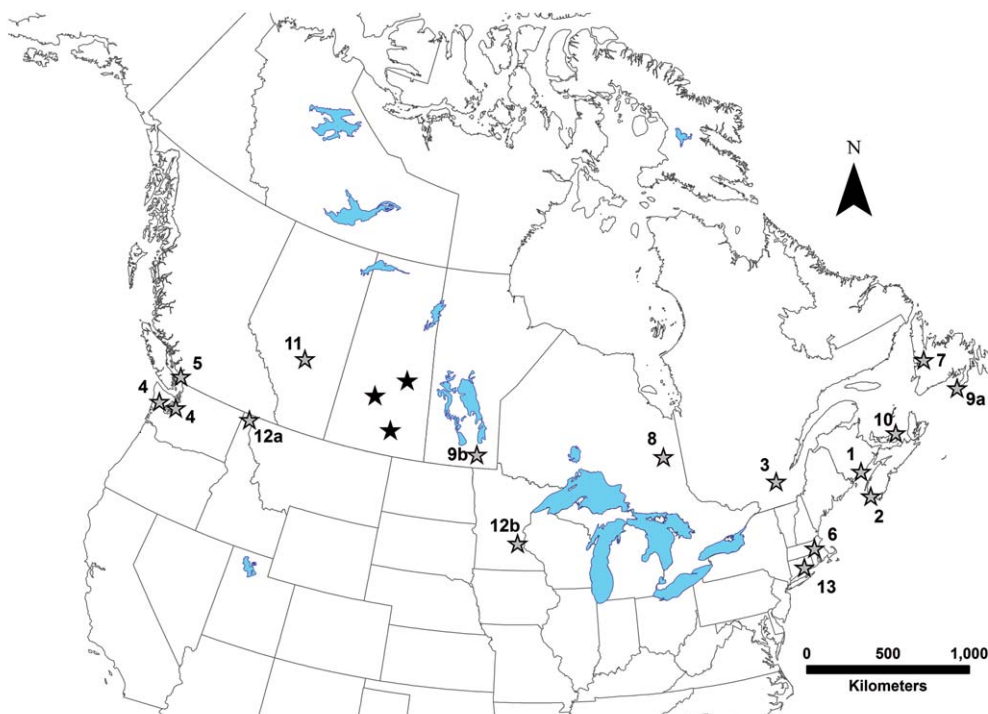
TRoutreach Saskatchewan, Saskatchewan Wildlife Federation  
#9 Lancaster Road, Moose Jaw, Saskatchewan, CANADA, S7J 1M8  
Department of Biology, University of Saskatchewan  
#112 Science Place, Saskatoon, Saskatchewan, CANADA, S7N 5E2  
Water Quality Services, Integrated Water Services, Water Security Agency of Saskatchewan  
#101-108 Research Drive, Saskatoon, Saskatchewan, CANADA, S7N 3R3

Fewer beetle species have been recorded in Saskatchewan (2,353) compared to its neighboring provinces, Alberta (2,863) and Manitoba (2,679; Bousquet *et al.* 2013). However, in the years following the previous Canadian checklist (Bousquet 1991), the number of Coleoptera recorded in Saskatchewan has increased by 683 species compared to only 400 and 328 in Alberta and Manitoba, respectively (Bousquet *et al.* 2013). These numbers suggest that, until recently, the Coleoptera of Saskatchewan were underrepresented in our knowledge of the Canadian beetle fauna and raises the question of whether the fauna of Saskatchewan is truly less diverse than in neighboring provinces or simply less well studied.

To explore this question, we compiled a list of Carabidae co-occurring in Alberta and Manitoba but absent from Saskatchewan from a spreadsheet provided by D. Shpeley, P. Bouchard, and Y. Bousquet. The purpose of this list was to identify carabids that might occur in Saskatchewan based on their habitat preferences and collection locations in neighboring provinces, but that had not previously been recorded in Saskatchewan. *Carabus granulatus* L., 1758 was a possible candidate, having dispersed across most of Canada

(Bousquet and Larochelle 1993; Bousquet *et al.* 2013), being synanthropic (Lindroth 1961; Larochelle and Laraivière 2003), and found in cultivated soils (Lindroth 1961). *Carabus granulatus* was collected in May 2014 in pitfall traps near the Water Security Agency, Saskatoon, Saskatchewan (52°8'35" N, 106°37'52" W), **new province record**. Additional specimens were collected in subsequent weeks throughout the city and nearby residences. In addition, two unidentified specimens collected by I. Phillips in an urban garden in Regina, Saskatchewan (50°26'32" N, 104°37'16" W) in May 2010 and by A. Bell near the roadside in Nipawin, Saskatchewan (not specific, but around 53°21' N, 104°0' W) in July 2012 were later identified as *C. granulatus*.

*Carabus granulatus* is a European species first detected in the Maritime Provinces in 1890 (Brown 1940) and the Pacific Northwest in 1924 (Hatch 1953), whereupon it expanded its range inland (Fig. 1). The occurrence of *C. granulatus* in Saskatchewan completes its trans-Canadian distribution, having previously been collected in Edmonton, Alberta in 1989 (specimens collected by J. L. and B. F. Carr in the Canadian National Collection, Y. Bousquet personal communication) and Winnipeg, Manitoba in 1983 (Roughley *et al.* 2010). This expansion took place over 120 years and illustrates the



**Fig. 1.** Location and first-collection dates of *Carabus granulatus* in North America. Black stars are locations reported in the present paper. Numbered gray stars represent the timeline of first detection records of *C. granulatus* for provinces and states: 1-1890 (Brown 1940); 2-1910 (Brown 1940); 3-1913 (Klimaszewski *et al.* 2012); 4-1924 (Hatch 1933, 1953); 5-1926 (Lindroth 1961); 6-1931 (Brown 1940); 7-1981 (Larson and Langor 1982); 8-1982 (Canadian National Collection); 9a-1983 (Roux 1984); 9b-1983 (Roughley *et al.* 2010); 10-1987 (Majka *et al.* 2006); 11-1989 (Canadian National Collection); 12a-2005 (Hatten *et al.* 2009); 12b-2005 (Gandhi *et al.* 2011); 13-2012 (Bousquet 2012).

spread of an adventive species across the continent. Furthermore, North American specimens of *C. granulatus* are brachypterous (Lindroth 1961) which means dispersal must take place on the ground and/or with the assistance of humans (Larochelle and Larivière 2003). It is unclear whether the Saskatchewan populations originated from the east or west; however, the dates of first detection in each jurisdiction offer insight into the introduction and dispersal of *C. granulatus* in North America (Fig. 1).

There have been at least three, possibly four, independent introductions of *C. granulatus* to North America (Fig. 1). The introduction to the Atlantic Provinces (Brown 1940) likely occurred via ships bringing supplies from Europe (Lindroth 1961), while the Québec record (Klimaszewski *et al.* 2012) may have been a separate introduction or originated from New Brunswick as it moved westwards. The West Coast introduction originated in Washington (Hatch 1933, 1953) and then moved east, and the New England introduction

has so far remained isolated to Massachusetts (Brown 1940) and Connecticut (Bousquet 2012). These proposed introductions are based solely on first detection and have limitations, such as the failure to detect dispersers, large movements facilitated by humans, and additional independent introductions of *C. granulatus*. Future work using molecular techniques could provide insight into the origin of the Saskatchewan populations of *C. granulatus*, as well as the introduction and subsequent dispersal of *C. granulatus* across North America.

The new provincial record reported here highlights and reinforces the importance of biological checklists in documenting biodiversity, species distributions, and the introduction and spread of exotic species.

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