

***PYRRHOCORIS APTERUS* L. (HEMIPTERA:
PYRRHOCORIDAE), A NEWLY INTRODUCED FAMILY,
GENUS, AND SPECIES TO ONTARIO AND CANADA**

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Scientific Note

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The family Pyrrhocoridae (Hemiptera: Pentatomomorpha) has a widespread range, having its greatest diversity in the tropics yet also containing members endemic to the Holarctic region (Schuh and Slater 1995), although none are native to Canada. *Dysdercus* Guérin-Ménéville (Hemiptera: Pyrrhocoridae), which includes the economically important cotton stainers, is the only pyrrhocorid genus with members native to the New World, but is chiefly tropical and more diverse in the Old World (Schaefer 2015). One species has been recorded from as far north as South Carolina and Georgia, USA (Henry 1988a). *Pyrrhocoris apterus* L. (Hemiptera: Pyrrhocoridae), commonly known as the European firebug, linden bug, or red soldier bug, is found natively throughout Europe and neighbouring regions of Asia. *Pyrrhocoris apterus* has also been recorded historically from Costa Rica (Distant 1880–1893) and reported in New Jersey, USA in 1896 (Barber 1911; Henry 1988a), though it was not considered established in North America until it was found in Utah, USA in 2008 (Hodgson 2008). This paper will describe the first account of *P. apterus*, and the family Pyrrhocoridae, in Canada, with evidence that the species has become locally established.

The first author first noticed *P. apterus* in a backyard in Etobicoke, Ontario near the intersection of Martin Grove Road and The Westway (43°41'N 79°34'W) in August 2017. An adult was photographed on 13 August 2017 (Fig. 1) and a nymph was photographed on 30 August 2017 (Fig. 2). While they were identified as *P. apterus* at that time, their importance was not noted until early 2018, when these photographs were submitted to the citizen science project iNaturalist (<https://www.inaturalist.org/>). It was then realized that these records would be the first in Canada.

To determine whether the population had established in the area, the leaf litter surrounding potential host plants on the property was searched for overwintering adults (Hodek 1968). Several live specimens were collected on 3 March 2018 and 5 March 2018 under leaf litter near perennial roses of Sharon (*Hibiscus syriacus* L., Malvaceae), and under leaf litter where an annual mallow (*Malva sylvestris* L., Malvaceae) grew the previous year. Overwintering adults were photographed on 23 March 2018 (Fig. 3), and a more thorough

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search through the leaf litter (within 10 m of the aforementioned host plants) on 25 March 2018 yielded dozens of adults, roughly equal numbers of males and females. Several mating pairs were also observed at this time. A series of *P. apterus* specimens were deposited at the University of Guelph Insect Collection (DEBU; accession numbers debu00398100–145, debu00398146–153). Separate observations of *P. apterus* were made in the Etobicoke area in July 2018 (A. Guidotti, pers. comm., Royal Ontario Museum).

How the species was introduced to Ontario is unknown, but it likely arrived along with imported plant material or soil. The reported locality is less than 3 kilometres east of Lester B. Pearson International Airport—a possible introductory route. The species was likely attracted to the neighbourhood due to an abundance of mallow plants, and it can be noted that both *H. syriacus* and *M. sylvestris* are introduced ornamentals from Europe and known host plants of *P. apterus* (Kristenová et al. 2011). Linden seeds (including *Tilia cordata* Mill. and *Tilia platyphyllos* Scop.), which also belong to the family Malvaceae, are one of their primary food sources in Central Europe (Kristenová et al. 2011), and this may enable them to feed on related Ontario species such as basswood (*Tilia americana* L.). Additionally, *P. apterus* is known to adapt to other seed diets even outside of Malvaceae, allowing it to easily colonize new areas (Kristenová et al. 2011).

The host versatility of *P. apterus* makes them easy to rear, which has facilitated their use in research. In fact, the species has been implicated in the discovery of sex chromosomes (Henking 1891), as well as “paper factor” (Sláma and Williams 1965), the first plant-based juvenile hormone analog discovered (Williams 1970). Studies involving *P. apterus* span morphology, physiology, and genetics; hence, its habits and biology are well known (Socha 1993). So prominent is its use in research in its home range that it is depicted on the cover of the *European Journal of Entomology*. Arguably, its importance in entomological research is underappreciated outside of Europe.

Pyrrhocoris apterus is a distinctive hemipteran, typically having short red



FIGURES 1–3. *Pyrrhocoris apterus* individuals found *in situ*. 1. Adult male, 13 August 2017, (iNaturalist observation at <https://www.inaturalist.org/observations/9958761>); 2. Nymph on rose of Sharon (*H. syriacus*), 30 August 2017, (iNaturalist observation at <https://www.inaturalist.org/observations/9860910>); 3. Overwintering group of adults beneath leaf litter at the base of rose of Sharon (*H. syriacus*), 23 March 2018, (iNaturalist observation at <https://www.inaturalist.org/observations/12519880>).

wings with striking black markings (Fig. 4). While most individuals are brachypterous, a macropterous morph (Fig. 5) may develop under certain conditions, though neither morph is thought to fly (Socha 1993; Honěk 1995). *Pyrrhocoris apterus* (Fig. 6) is superficially similar to several species of Ontario Lygaeidae (such as the small milkweed bug, *Lygaeus kalmii* Stål (Fig. 7), and large milkweed bug, *Oncopeltus fasciatus* (Dallas)) and Rhopalidae (such as the box elder bug, *Boisea trivittata* (Say)), though Pyrrhocoroidea, including *P. apterus*, can be differentiated from most other Pentatomomorpha by the absence of ocelli (Henry 1997). Largidae, the sister group of Pyrrhocoridae, has yet to be recorded from Ontario, but has been recorded in northeastern USA (Henry 1988b). These two families can be differentiated by the lateral margins of the pronotum, being flattened and beveled in Pyrrhocoridae (Fig. 6) but rounded in Largidae (Fig. 8) (Schuh and Slater 1995). Within



FIGURES 4–5. *Pyrrhocoris apterus* adults with typical markings, dorsal views, 4. Brachypterous male, 5. Macropterous female.



FIGURES 6–8. Select examples of North American Hemiptera, 6. *Pyrrhocoris apterus*, a member of Pyrrhocoridae, lacking ocelli and having a marginated pronotum, 7. *Lygaeus kalmii*, a member of Lygaeidae, with ocelli, 8. *Largus succinctus* (L.), a member of Largidae, lacking ocelli and having a pronotum with rounded edges.

Pyrrhocoridae, *P. apterus* may be confused with the visually similar *Scantius aegyptius* (L.), another Palearctic species that has been recently introduced to North America, though it has only been recorded in the state of California, USA (Bryant 2009). *Scantius aegyptius* is a winged pyrrhocorid with a more slender body shape, and may be definitively distinguished from *P. apterus* via the first segment of its rostrum, which is only about half the length of the head in *S. aegyptius* and about as long as the head in *P. apterus* (Pluot 1978). The lack of a black marking anterior to the large black spot on the hemelytron in *S. aegyptius* can also help differentiate it from *P. apterus*. The genus *Dysdercus*, the only lineage of Pyrrhocoridae native to the New World, is restricted to tropical and subtropical climes, and adults are easily differentiated from *Pyrrhocoris* by their dorsal colour patterning and parallel-sided abdomen. Nymphs can be more difficult to distinguish, but the gregariousness of *P. apterus* means nymphs can often be found in the vicinity of adults. *Pyrrhocoris apterus* nymphs are red with black wing buds and three black spots along the dorsal midline (Fig. 2).

As a Palearctic species, *P. apterus* has adaptations that allow it to survive cold winters like those that occur in southern Ontario. Adults are freeze-intolerant and can supercool their tissues to survive freezing temperatures, particularly under leaf litter (Košťál and Šimek 2000). Individuals enter diapause in the fall until they emerge in the spring, dependent on the photoperiod (Hodek 1968). Although the species is normally considered univoltine, warm temperatures can be conducive to a second brood in the summer of the same year (Hodek 1968; Saulich and Musolin 1996), yet individuals may prevent multiple generations by seeking out microhabitats that do not exceed 24°C, thereby restricting developmental rate (Honěk and Šrámková 1976). Nonetheless, as nymphs were observed in late August, the climate of southern Ontario is probably warm enough to allow for multivoltinism.

The impact of the introduction of *P. apterus* is currently unknown. *Pyrrhocoris apterus* could become a nuisance pest, as personal observations suggest that it can be extremely prolific locally, and their gregarious nature makes them difficult to ignore. Its dietary preference for seeds of mallows could have an impact on popular ornamental plants such as rose of Sharon (*H. syriacus*), but its potential impact on native *Hibiscus* species such as the swamp rose-mallow (*Hibiscus moscheutos* L.), recognized by the Species at Risk Act (SARA) and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of special concern (COSEWIC 2004), makes further study of *P. apterus* in Ontario important.

Considering the species' versatility and hardiness, it is unsurprising that it has become established in Ontario. Its flightlessness may limit its spread, but individuals may be transported unwittingly along with ornamental plants, soil, or even leaf litter. Nevertheless, they are conspicuous insects that can be easily noticed by the keen gardener, and with tools such as iNaturalist, amateur naturalists can assist in keeping track of their range and natural history.

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