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### Cover Page Footnote

The authors wish to thank the biology department at Valparaiso University, Birky Family Farms, and the members of Team Maggot who helped with the research (Shelby Leucata, Monique LeDonne and Lauren Smith).

## First Record of the Hairy Maggot Blow Fly, *Chrysomya rufifacies* (Diptera: Calliphoridae) in Indiana

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### Abstract

The hairy maggot blow fly, *Chrysomya rufifacies* (Macquart 1844; Diptera: Calliphoridae) is native to Australia but has been spreading to a worldwide distribution and has become established in the United States. This paper presents the first documentation of the species in Indiana, specifically in Valparaiso, Indiana. The species was found in September 2017 and again in October 2019. Its presence is variable in Northwest Indiana, but it seems to be found in the fall when the temperatures are at least 30°C prior to collection.

**Key Words:** Hairy maggot, *Chrysomya rufifacies*, Indiana

The hairy maggot blow fly, *Chrysomya rufifacies* (Macquart 1844) is native to Australia but has spread worldwide (Baumgartner 1993). It was first introduced to the Western Hemisphere in Costa Rica in 1978 (Baumgartner and Greenberg 1984). Since then, it has spread into North America and has been documented in: Arizona (Baumgartner 1986), Arkansas (Meek et al. 1998), California (Greenberg 1988), Colorado (DeJong and Chadwick 1997), Florida (Mertins 1991), Illinois (Shahid et al. 2000), Louisiana (Martin et al. 1996), Michigan (Shahid et al. 2000), Nebraska (Figarola and Skoda 1998), New Mexico (Shahid et al. 2000), Oklahoma (Ahadzadeh et al. 2014), Ontario (Rosati and VanLaerhoven 2007), Tennessee (Shahid et al. 2000), Texas (Richard and Aherns 1993), West Virginia (Joy and D'Avanzo 2007) and Wisconsin (Marche 2013). Theoretical distributions of *C. rufifacies* include Indiana (Whitworth 2006, Rosati and VanLaerhoven 2007, Jones et al. 2019), but were not actually documented. Only one other *Chrysomya* species is known in Indiana: Picard (2013) documented one female adult *Chrysomya megacephala* (Fabricius 1794), on chicken liver. This was the first record of a species of *Chrysomya* in the state, being collected in Indianapolis, Indiana, approximately 240 km south of Valparaiso, Indiana. The authors corresponded with Purdue Entomological Research Collection (PERC) personnel to ensure that there are no *C. rufifacies* voucher specimens from the state, and there are none. This paper presents the first documented *C. rufifacies* in Indiana.

The field site where the collections occurred is located on Valparaiso Universi-

ty's campus in Valparaiso, Indiana (approximate coordinates, 41° 27' 37.9" N, 87° 03' 03.3" W). It has been used for decomposition studies using pigs as a carrion model, consistently in the summer and fall months since 2012. It is located in the clearing of a shady, wooded area in a remote part of campus. Research is conducted inside a metal dog kennel measuring 6.1 m × 36.1 m × 31.8 m to prevent predation.

Third instar larvae of *C. rufifacies* were collected on 26 September 2017. During the time of year, it was unseasonably warm, with temperatures reaching up to 37 °C and with average temperatures of 26.55 °C. Average humidity ranged from 60–78%, and there was no precipitation during the period of corpse exposure. Other larval species of Calliphoridae collected in the same trial include *Lucilia coeruleiviridis* Macquart (1855), *Lucilia sericata* (Meigen 1826), *Phormia regina* (Meigen 1826), *Calliphora vicina* Robineau-Desvoidy (1830), and *Calliphora vomitoria* (Linnaeus 1758).

Identifications were made in the laboratory by Kristi Bugajski using Sukontason et al. (2008). The most distinguishing feature of *C. rufifacies* is a “hairy” appearance from distinct, elongated tubercles (Sukontason et al. 2008) (Fig. 1–2). This feature will help differentiate between *C. rufifacies* and *C. megacephala*. In addition to the tubercles, *C. rufifacies* has an incomplete and heavily pigmented peritreme with the middle slit being slightly bent (Sukontason et al. 2008). Adults of the two congeners can be separated using Whitworth's (2006) key.

The species was collected for a second time on 5 October 2019. Third instar larvae

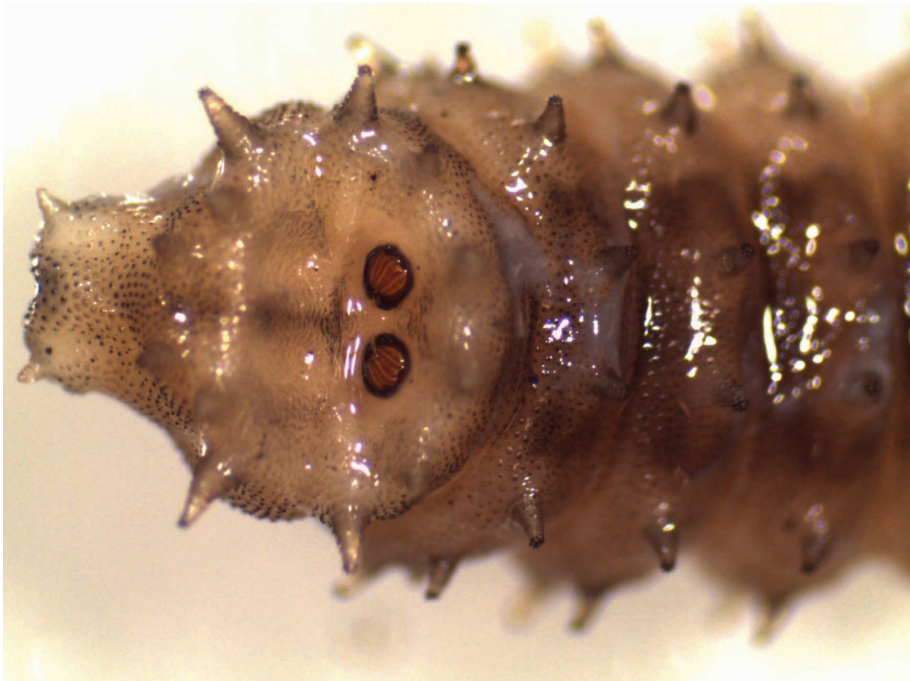


**Figure 1.** Three third instar *Chrysomya rufifacies* collected from Valparaiso, Indiana on 26 September 2017.

were found on one of six pigs that were placed in the field on 1 October 2019. At the start of the trial, temperatures were above average, reaching 31.5 °C on the day of placement, which is consistent with when the species was previously found. Despite higher temperatures of up to 34 °C in September 2018, no specimens were found. They were also not found in 2019 prior to October.

The timing of the first collections of *Chrysomya* species, as reported in the literature, looks consistent in the Midwestern states and Canada. *Chrysomya rufifacies* were collected in Wisconsin on 2–3 October 2012 by Marche (2013). Rosati and VanLaerhoven (2007) found *C. rufifacies* in Windsor, Ontario on 7 October 2004. Likewise, Picard (2013) found the congener *C. megacephala* in Indiana on 24 September 2012.

One of the concerns about the non-native *C. rufifacies* is that it will outcompete native calliphorids, in particular *Cochliomyia macellaria* (Fabricius 1775) (Baumgartner 1993). However, if the current trend of only seeing *C. rufifacies* in the fall months continues, this will not have a large impact on the species composition in northwestern Indiana because *C. macellaria* is a warm-weather species that is not typically found in the fall. In eight years of research, *C. macellaria* has



**Figure 2.** Close up of the posterior end of a third instar *Chrysomya rufifacies* collected from Valparaiso, Indiana on 26 September 2017.

never been found in the fall months at this field site.

*Chrysomya* are warm-weather species, and it is probable that these distribution records are from migrating populations that are established in the southern states (Rosati and VanLaerhoven 2007). Rosati and VanLaerhoven (2007) provided maps with a projected range for *C. rufifacies* based on climate change trends that included most of the United States. This paper confirms their predictions that the species would be found in Indiana. This paper documents the first confirmation of *C. rufifacies* in the state, specifically Northwest Indiana. The authors suspect that it is present in other parts of the state if the conditions are adequate.

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