

TECHNICAL NOTE

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Chrysomya rufifacies (Macquart) (Diptera: Calliphoridae) Established in the Vicinity of Knoxville, Tennessee, USA*

REFERENCE: Shahid SA, Hall RD, Haskell NH, Merritt RW. *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae) established in the vicinity of Knoxville, Tennessee, USA. *J Forensic Sci* 2000;45(4):896–897.

ABSTRACT: The hairy maggot blow fly, *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae) was collected in large numbers as both adults and immatures in the Knoxville, Tennessee, area during 1998 and is likely established there. The distribution of this species in the Old World, isothermal data, and its collection from mid-Michigan during 1998 suggest that it will eventually occupy most of the U.S. The forensic importance of *C. rufifacies* makes it probable that it will factor into an increasing number of medicolegal cases, but the expanding distribution of this species decreases its utility as a geographic indicator when postmortem movement of decedents is suspected.

KEYWORDS: forensic science, forensic pathology, *Chrysomya rufifacies*, blow fly, hairy maggot blow fly, forensic entomology, distribution

The hairy maggot blow fly, *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae), is an Old World species native to the Australasian Region. Whereas first instars feed on decaying tissue, second and third instar larvae can exist also as facultative predators of other necrophilous fly larvae (1,2), and thus may have significant ecological impact on native species (3). Further, *C. rufifacies* can be important forensically when fly evidence is used to gage postmortem interval or situs of death (4). In brief, the known thermal developmental profiles of fly species encountered on a decedent are applied to retrospective weather records modified as appropriate by external information, and a minimum postmortem interval is calculated by working backward in time from the point at which such fly specimens were preserved at the body-recovery scene or at autopsy (see 5). Further, inferences of postmortem movement of

decedents can be made when collections include species whose known distribution does not encompass the area where the body was found. Such an instance suggests that the corpse was colonized, and thus located at that time, in a geographic area inhabited by the fly in question and moved subsequently to the site where found.

Flies in the genus *Chrysomya* can be distinguished as adults from other Calliphoridae by the following combination of characters (6): remigium ciliate posteriorly, metacoxae bare posteriorly, and lower squamae pilose above. Adult *C. rufifacies* and *C. albiceps* (Wiedemann) can be separated by the presence of a proepisternal (stigmatal) bristle on the former (7), although the reliability of the latter character has been questioned (8). Both species are characterized by “hairy” larvae exhibiting a median row of distinctive fleshy tubercles on each segment, and although easily distinguished from other blow fly maggots by this highly recognizable character are separated from one another with difficulty (8,9). Of the two aforementioned *Chrysomya* species, only *C. rufifacies* is currently recorded from the continental U.S. (10).

Chrysomya rufifacies was first reported from the New World in the late ‘70’s (11), when it was collected in Costa Rica. It was subsequently collected from other locations in the Americas (12,13). The presence of *C. rufifacies* in the U.S. was first reported from Texas (14), and it has since been noted in Arizona (15), California (16), Florida (17), Louisiana (18), and Arkansas (19). Similar collections have been reported for Colorado (20), Nebraska (21), Michigan (R. W. Merritt, unpubl. data), and Kentucky (N. Haskell, unpubl. data), although established populations of this species have been documented heretofore only in southern areas ranging from Florida to California.

Chrysomya rufifacies has been the subject of a recent review (22) which provides a summary of the species’ taxonomy, biology, ecological role, medical, and medicolegal importance. This species produces unisexual immatures where all offspring of any one female are the same sex (23). It is regarded in its native range as a summer species rare during the cold season with cold-resistant stage(s) unidentified to date (see 22). This historical distribution has thus far been compatible with the areas occupied by *C. rufifacies* in North America.

In the early summer of 1998, a study was initiated in Knoxville, Tennessee, and proximate areas to evaluate rates of decomposition

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* Supported in part by National Institute of Justice research grant number 97-IJ-CX-0046, through Dr. Richard Rau, and in part by Project MO-152. It is published as a Contribution of the Missouri Agricultural Experiment Station, Journal Series No. 12,876.

Received 10 May 1999; and in revised form 3 Sept. 1999; accepted 7 Sept. 1999.

and arthropod colonization patterns on swine, *Sus scrofa* L. Three pig carcasses of similar mass (ca. 25 kg each) were placed within the Anthropological Research Facility (ARF), University of Tennessee (UT), and three carcasses each of similar size were placed at a forested site ca. 1 km east, at the UT Agricultural Experiment Station ca. 3.2 km east, and at a forested site ca. 32 km north. Larvae of *C. rufifacies* were first discovered on June 24, 1998, at the ARF and larval and adult specimens were subsequently collected from all swine carcasses employed in this study.

In July, 1998, an additional four swine carcasses with masses ranging from ca. 22 to 135 kg plus the corpses of two human adults were exposed at the ARF. As populations of necrophilous arthropods were studied, *C. rufifacies* immatures and adults were collected from all carcasses and corpses in the trial. The large numbers of *C. rufifacies* present and the consistency of such collections during June and July, 1998, suggest that this species is established in the Knoxville, Tennessee, area. Because the dispersal rate of this species has been measured to be between 0.77 and 3.2 km/day (24), it can spread rapidly under favorable conditions. The hairy maggot blow fly has been regarded as "very common all over the Oriental and Australian regions" (2), and it is not unreasonable to expect its eventual northward distribution in North America to mirror its Old World limits as they have evolved. In this context, *C. rufifacies* is reported to be distributed in Japan as far north as the southern Tokyo region (H. Kurahashi, personal communication). A map of July isothermal data (25) shows that the 24°C isotherm approximates this northernmost reported range of *C. rufifacies* in Asia. The theory is supported by the aforementioned collection of *C. rufifacies* adults and immatures on pig carcasses and human corpses in several locations in the vicinity of East Lansing, Michigan, during the 1998 summer season. Although insufficient to postulate a firmly established population, the latter constitute the northernmost records for this species in the New World and with North American isothermal data suggest that it will eventually occupy most of the U.S. Because of its potential use in determinations of postmortem interval and place of death, especially in homicides, it will probably factor into an increasing number of North American criminal and civil cases. Importantly, the documented northward expansion of its range beyond the southern U.S. obviously decreases the value of *C. rufifacies* in estimating place of death, in that it is no longer exclusive to southern regions.

Acknowledgments

We thank UT-ARF personnel, especially Dr. William Bass, Dr. John Hodges, and many volunteer entomologists, criminologists, and law enforcement officers for their assistance during these studies.

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