

CASE REPORT

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Presence of Fecal Material in Diapers as a Potential Source of Error in Estimations of Postmortem Interval Using Arthropod Development Rates

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ABSTRACT: Second instar larvae of the fly *Chrysomya megacephala* (Diptera, Calliphoridae) were recovered from the diapers of a 16-month-old child abandoned by her mother on Oahu, Hawaii. The development of these larvae indicated a minimum period of 23.5 h of exposure prior to discovery of the child. Larvae of this species of fly are not normally associated with living tissues in Hawaii, but rather with feces and remains during the early stages of decomposition. Had the child in this case died and data not been provided detailing the site of infestation, the postmortem interval estimated would have been significantly longer than was actually the case, because of the development of the larvae inside the diapers of the living child. The need for caution in cases involving deaths of infants, the elderly, and individuals not capable of caring for themselves is stressed.

KEYWORDS: pathology and biology, insects, myiasis, postmortem interval, larvae, Diptera, flies

In providing an estimate of postmortem interval when using techniques of forensic entomology, the basis for the estimate is generally that the most mature larva of insect species demonstrating the longest period of association with the remains is the indicator of the minimum postmortem interval [1,2]. Factors such as the presence of drugs in the tissues [3,4] may serve to distort the picture by significantly altering the rate of larval development of insects feeding on the remains. The case study presented below demonstrates another antemortem event which may serve to introduce error into the estimate and illustrates the importance of appropriate collection techniques for sampling arthropods associated with decomposing remains.

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Case Study

A female child, approximately 16 months of age, was found by a passerby in heavy vegetation near the edge of Lake Wilson, Oahu, Hawaii. The child was suffering from dehydration, bruising, and numerous mosquito bites. The initial assessment was that the child had been exposed for approximately 2 days. Consultation with a pediatrician suggested a longer period of exposure, based on the observed state of dehydration. It was also revealed that the child would probably have died within the next 24-h period. The child was clothed in a sweatshirt, tee shirt, and pair of pants with disposable diapers underneath. On the front of the pants, from the waistband to a point below the knees, there were numerous egg masses of a species of Calliphoridae fly (Fig. 1). Inside the diapers were numerous first instar larvae (3 to 4 mm in total length) and fewer second instar larvae (5 mm in total length) of the calliphorid *Chrysomya megacephala* (Fig. 2). Additional larvae of this species had invaded the rectal and vaginal regions of the child and appeared to be feeding on those tissues. Developmental data for this fly species reared in controlled environmental chambers in the Forensic Entomology Laboratory of the University of Hawaii at Manoa, Honolulu, Hawaii, indicated that the most mature larvae would have required 39 h to reach that stage of development at 26.0°C and 36 h at 28.0°C. As the rate of development for fly larvae is directly related to temperature within normal functional limits, it is possible to extrapolate using the formula $ADH = T(^{\circ}C) \times T$, where ADH = accumulated degree hours, T = time in hours, and $^{\circ}C$ = the temperature in degrees Celsius. Using this method and adjusting to normal body temperature conditions, it was determined that the minimum time of 23.5 h would be required for the larvae to reach that stage of development in the child's diapers.

While the estimated time period indicated by the stage of development of the larvae in this instance is not an accurate estimate of the actual period of exposure, there are



FIG. 1—Front of the pants worn by the child, showing egg masses of *Chrysomya megacephala*.

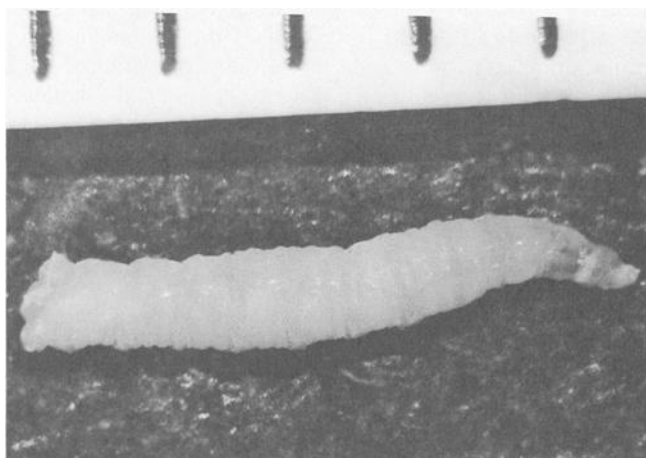


FIG. 2.—*Second instar larva of Chrysomya megacephala.*

several factors of possible significance to other cases involving deaths of infants, the elderly, or individuals not capable of adequately caring for themselves. The fly species involved, *Chrysomya megacephala*, is a common species associated with decomposing remains on the island of Oahu [1]. It is among the first species of insects to arrive at remains, frequently within 10 min after death. It is also a species commonly associated with human and animal feces in the islands and is encountered in a wide variety of different outdoor habitats. It is not, however, a species commonly found invading living tissues (myiasis) [5], although there are records of such involvement in other areas of the world. Feces are strongly attractive to this species both for feeding and for oviposition. This was undoubtedly the initial attractant for the flies in this case. Under normal conditions, this species will not oviposit on a moving object (Goff, unpublished observations). The fact that oviposition occurred indicates that the child was relatively motionless for a period of time. The developmental stages of the fly present suggest that this occurred a minimum of 23.5 h prior to the child's being discovered, although the period of time may have been longer. *Chrysomya megacephala* also seeks out dark areas for oviposition, frequently on the undersurface of the medium [6]. The presence of the egg masses on the front of the child's pants indicates that the child was lying face-down at the time of oviposition by the flies.

Of potentially greater significance to future cases is the potential for misinterpretation of the postmortem interval because of larval activity prior to the death, as evidenced in this case. Had the child died and collections of larvae been made which did not include data on the sites of infestation, the estimate would have been made on the basis of the most mature larvae indicating the minimum postmortem interval. In this case, that estimate would have been at least 23.5 h longer than the actual interval, and, lacking compensation for temperature, could have been as much as 39 h longer. Examination of the remains by an entomologist would serve to minimize the possibility of this type of error. Should such an examination not be possible, it would be essential that collections of arthropods from different parts of the remains be kept separate and these collections clearly labeled to indicate the sites represented. These data will allow a more accurate analysis of the fauna by the entomologist. The normal pattern for colonization of remains by insects is for the natural body openings of the head to be the first areas invaded. The genitals and anus are secondary sites for invasion under normal circumstances. Data

indicating that larvae associated with the genitals or anus are significantly older than those associated with the head should serve to alert the entomologist to an abnormal pattern of decomposition and to the need for further evaluation of the circumstances surrounding the death prior to producing a postmortem interval estimate.

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