

Child neglect and forensic entomology

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Abstract

Close co-operation between forensic scientists, medico-legal doctors, and police forces made it possible to estimate not only the post-mortem interval but also the time since a child was neglected. On the skin surface under the diaper (anal-genital area), third instar larvae of the false stable fly *Muscina stabulans* FALLÉN, and the lesser house fly *Fannia canicularis* L. were found. *F. canicularis* adults are attracted to both feces and urine. From the face, larvae of the bluebottle fly *Calliphora vomitoria* L. were collected. *C. vomitoria* maggots are typical early inhabitants of corpses. From the developmental times of the flies, it was estimated that the anal-genital area of the child had not been cleaned for about 14 days (7–21 day range), and that death occurred only 6–8 days prior to discovery of the body. This is the first report where an examination of the maggot fauna on a person illustrated neglect that had occurred prior to death. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

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1. Introduction

The investigation of arthropods associated with corpses can help to solve, or to produce additional information on, crimes and their circumstance. Until now insect evidence has been helpful in determining post-mortem intervals, to link a suspect to the scene of crime, to prove moving of the corpse to a different location, or to determine drug levels in a deceased person [1,2,6–10,13]. Blowfly larvae, and pupae, can also give information on how long a person was neglected [8]. The following report is the first to describe a case where the maggot fauna of a person was examined after its death caused by neglect. Older case reports dealt with the influence of cockroaches only. Cockroaches can feed on dead or weakened persons. This was generally known in earlier times [6,7] but is only seldom observed nowadays [4]. In a case from the 19th century, a father was acquitted of poisoning his child with sulphuric acid, where black marks near the mouth were proven to be caused by cockroaches feeding on the corpse post-mortem [7].

2. Case description

2.1. General description

On 10th July 2000, during an enforced eviction due to a lack of rent payments, a child was found dead near its bed in the apartment of a 20-year-old woman in a city in Central Germany. The child's body showed signs of greenish discoloration, and skin slippage (Figs. 1 and 2). When asked by the police, the mother did not remember when she had seen the child for the last time. For the last approximately 2 weeks, the mother had been living at her uncle's place. She told him that her child was living with the grandmother. She also asked him how long a human could survive without food.

The child's father had been arrested for theft 5 months previous. The mother was a heroin user, and worked as a street prostitute. Several months before, neighbours had repeatedly reported to a paediatric doctor and the social bureau (Jugendamt) that the child was crying, and left alone over long periods, with all the windows frequently shut. Social workers tried to visit the family, sometimes successfully, to offer help to the woman. At one point, the social worker reported that the apartment was "at least in an acceptable state", and that "the child's well being is not

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Fig. 1. Overall state of child's body. Black bar: 10 cm. Courtesy of the Institute of Legal Medicine, Leipzig University.

in danger". A photograph of the child that was taken in February 2000 shows a normal body development.

2.2. Crime scene

Police reported that at the crime scene, outer doors, and most windows of the flat were tightly closed ("the air did stand"). Windows in the child's room (where the corpse was found) were additionally closed with Venetian blinds. Some dirty dishes were present in the kitchen, and both the sink and bathtub were filled with used water. However, from an entomological point of view, the overall state of the flat would have to be judged as relatively in order compared to the general state of living areas of long time users of narcotic substances. The child's corpse was brought to the Institute

for Legal Medicine of the University of Leipzig within 1 h after the flat was declared a crime scene.

2.3. Autopsy report

At autopsy, the following findings were made:

1. Total body X-raying did not show any past, or recent fractures.
2. Signs of an extended post-mortem interval: general greenish discoloration, and partial mummification (Fig. 1). General autolysis of internal organs. Few maggots in eye sockets, and on the genitals (Figs. 2 and 3).
3. Signs of undernourishment with a weight of 6.74 kg, and a body length of 80 cm (the normal weight calculated



Fig. 2. State of the eyes: dried out but not infested with maggots. Courtesy of the Institute of Legal Medicine, Leipzig University.



Fig. 3. State of the genital area: fly larvae clearly visible. Note also egg patch on the left that was produced after child was found. Courtesy of the Institute of Legal Medicine, Leipzig University.

after weight at birth (3 kg) should have been 10–11 kg).

When the child was born, no signs of an influence of drugs on the child's development could be found.

4. No signs of illnesses or malformations that may have caused death.
5. No drugs present in the child's tissues. Blood alcohol 0.51‰.
6. Estimated post-mortem interval from forensic pathologist's point of view 7–10 days between death and autopsy.

2.4. Legal impact

During the legal proceedings, both the mother and two social workers were charged for duty of care violation. Therefore, the following questions became essential: (a) How long had the child been neglected? (b) When did the child die?

3. Material and methods for forensic entomology

Ca. 20 maggots per body location (daiper area face) were killed in hot water, and then transferred to 70% EtOH. Dissection of maggots was performed under a Carl Zeiss dissecting microscope (magnification max. 40×) using sharply pointed forceps. Maggot tissue was softened and brightened with 10% NaOH. Additional analysis was performed under a Leica MZ 12.5 dissecting microscope (magnification max. 100×). Determination, and interpretation was performed using the keys, and the information given in

[5,9,11–13], based on features of the mouth parts, and external body structures. Developmental times were determined following the information given in [13]. Additionally, a video that had immediately been taken at the crime scene, as well as high quality autopsy color photographs were handed over to the forensic entomologist. Post-mortem interval determination of the autopsy team was initially unknown to the forensic entomologist.

3.1. Forensic entomology observations

The child's body showed signs of malnourishment (Fig. 1). The eyes were slightly dried out but had clearly not been regularly infested by fly larvae (Fig. 2). The overall decompositional state of the body (late fresh, pre-bloat) showed greenish discoloration of the abdominal parts, with discoloration of the eyelids, nose and chin setting in, together with the beginnings of skin slippage. The summer had been cold in comparison to previous local summers. Mean outside temperature ranges had been (excerpt):

- 3–9 July 2000, $x = 16.6^{\circ}\text{C}$;
- 4–9 July 2000, $x = 16.0^{\circ}\text{C}$, S.D. 15%;
- 6–9 July 2000, $x = 15.0^{\circ}\text{C}$, S.D. 15%;
- 7 July, 9:30 to 10 July, 8:30 h, $x = 14.5^{\circ}\text{C}$, median 14.5°C .

The lowest temperature in the 7-day interval before the child was found was 11°C (08:30 h, 8 July 2000), the highest temperature was 24.1°C (17:30–18:30 h, 3 July 2000). The heating in the flat was turned off which is common during summer in Germany. Also, as in practically all German apartments, no air conditioning was present.

Maggots were collected separately from the anal-genital area, and the face, at the Institute for Legal Medicine, Leipzig University and placed into hot water. After a few minutes, these larvae were removed to 70% EtOH, and shipped to the forensic entomologist.

From the genital area, third instar larvae of *Muscina stabulans* ("false stable fly", length: 9 mm), and *Fannia canicularis* ("little house fly", length: 7 mm) were identified. From the face, maggots of *Calliphora vomitoria* ("bluebottle", length: 8 mm) were identified. No *Lucilia* (*Phaenicia*, "greenbottle") individuals were found.

4. Results and discussion

Both *Muscina stabulans*, and *Fannia canicularis* adults can often be found in local flats where they are attracted to decaying organic matter. From second instar onwards, *M. stabulans* larvae are also predacious upon other larvae. *F. canicularis* is strongly attracted to urine and feces, with an observed delay of initial colonization of 3–10 days post-mortem [13]. *M. stabulans* is strongly attracted to human feces but less so to corpses [3]. Since only few observations on the development of *M. stabulans* were available, we

compared our conditions to those reported by Nuorteva [9]. Conditions were found to be similar enough for an estimation of a post-mortem interval of between 7–21 days, most likely around 14 days (i.e. 27 June 2000). This very conservative estimate was due to the fact that it was unknown if a fly population may have been present inside of the flat since several month before. This once again stresses the importance that the forensic entomologist be at the scene of the crime to determine such factors.

Calliphora vomitoria, the third fly species, is a common early inhabitant of corpses [13]. Under the assumption that only few Calliphoridae were present and began feeding on the corpse, and from its known growth rates under the given temperatures, a colonization interval of the corpse between 6.5 and 7.2 days was calculated. An interval of 6–8 days (i.e. 3–5 July 2000) was later reported to take into account that temperatures inside of the flat had not been recorded directly.¹

The absence of *Lucilia (Phaenicia)* might have been due to the lack of access to the closed room. If true, one would have to assume that a certain fly population was already present, and that this population was dominated by the species that were later found on the corpse. It is, however, likely that the mother did open the windows once in a while which allowed flies to enter then. The mother may have closed the windows and doors before the child died so that only few *Calliphora* were in the flat to later deposit eggs on the corpse. *Muscina* and *Fannia*, however, may already have entered the flat at that point, at least in slightly higher numbers. *F. canicularis* is also known to prefer living indoors when conditions outside are cooler [13], as they were present over this summer period.

4.1. Legal proceedings

The trial was held in front of the Große Jugendstrafkammer (“main chamber for crimes performed by juveniles”) of the Landgericht (State Court). The mother was sentenced to 5 years in prison without probation for manslaughter (“Totschlag”; verdict legally binding). A psychiatric statement claimed reduced duty (German § 21 of the penal code). The judge was interested particularly in the time of neglect, and the time of agony. One line of legal proceedings against the social workers were stopped shortly before, further proceedings are still being dealt with.

5. Final remark

The questions that the forensic entomologist was asked in this case could be answered in a clearly restricted but still in *praxi* useful way. The entomological evidence recovered

from the body made it highly likely that the neglect set in earlier, maybe even much earlier, than the actual death. This would mean that the child may have been saved by legal action that was, in fact, not carried out. The practical applicability of insect evidence collected from separate locations of the body in this case should highly encourage police, and medico-legal doctors to apply this sampling method in future routine use.

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¹N.B.: A special request was later made by the parents concerning a fixed date of death to engrave in the tombstone.

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