

Cambridge University Press

978-0-521-80915-3 - Entomology and the Law: Flies as Forensic Indicators

Bernard Greenberg and John Charles Kunich

Excerpt

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PART 1

“Who saw him die? I, said the fly,
with my little eye, I saw him die.”

Anonymous

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Preface to Part 1

Plautus, one of the most popular dramatists in ancient Rome, put it best: “This man is a fly, my father, nothing can be concealed from him, whether secret or public, he is presently there and knows all the matter”. Even today, we still wish to be “the fly on the wall” at some secret meeting or momentous event. Not even Plautus could have dreamed that one day the intrusive fly would tell its story in court and help tip the scales of justice. For a good part of the 50 years that I studied flies as vectors of disease I had never associated flies with homicides. Few entomologists had during those years, and the name of Mégnin, the founder of medicolegal entomology, was buried in the 100-year-old literature. It all changed in 1976 with my first case – a double murder – in which there weren’t even specimens, just photographs taken two years before. Since then, forensic entomology has become a ‘growth industry’ in countries around the world. Although still viewed by the public as something of an oddity, insect evidence is recognized by the courts and increasingly introduced in cases involving accidents, homicides, and suspicious deaths, especially where time of death is a key issue.

We focus on carrion flies as forensic indicators. Blowflies particularly are usually the first insects at a body, sometimes before the police arrive. As the initial colonizers they may arrive in minutes and lay eggs within a few hours. Their first generation provides a biological clock that more precisely measures the time of death for two or more weeks, than the medical examiner’s estimate which is limited to about a day or two. If the discovery of a body is delayed beyond the first generation of flies, the succeeding colonizers – various species of beetles and flies with more variable schedules of arrivals – will still provide a useful but less precise time of death.

The stakes are usually high when a forensic entomologist is hired. Sound science must be applied to the available evidence no matter the charge. In the courts, a healthy skepticism is replacing the acceptance of science on blind faith. To cite an example: that venerable icon of identification, fingerprinting, was never based on good scientific proof and has just fallen from its pedestal in one of the Federal courts. The entomology chapters provide a wealth of useful information on fly biology in a context relevant to entomologists everywhere, and hopefully, clear enough for lawyers to follow. It is a sad fact that science, on its way from laboratory to court, is sometimes transmuted under adversarial heat into pseudoscience. Given the limitations of our knowledge and experience, we have tried to expose the shoals and quicksands of the weaker side of

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forensic entomology as guides through the litigation process and for future research.

The fly is a magic carpet that has taken me from home base at the University of Illinois at Chicago to Mexico, Peru, Brazil, and Italy to unravel a few of its mysteries. I am deeply indebted to many colleagues and collaborators along the way. I am especially indebted to Hiromu Kurahashi of Japan, František Gregor of the Czech Republic, Juan Carlos Mariluis of Argentina, Baharudin Omar of Malaysia, and James F. Wallman of Australia for providing keys to the flies of forensic importance in their region. Others, after a stint in my laboratory, have returned to their home countries to establish forensic entomology. John Kunich became a Professor of Law. He and my family pried me from semi-retirement to write the entomology portion of this book. Now I am grateful that they did this and it is my sincere hope that the reader will be too.

I am grateful to Lon Kaufman, my Department Head, for his encouragement and essential logistical support, and to Matt Dean for his computer skills.

Bernard Greenberg

January, 2002



(Illustration by Janice Rajecki.)

1

A History of Flies

Travelling back in time we are reminded of the intimate, if disagreeable, association between man and flies, traceable almost to the dawn of recorded history. A 5000-year-old cylinder seal from Mesopotamia depicts a fly above two ibexes and a reclining gazelle (Fig. 1.1). They are carefully and skillfully carved in stone, understandably so in the case of the graceful mammals. But why a fly?

The mounting piles of garbage as human settlements grew, and the carnage of war, generated exploding legions of flies. They could not be ignored by the living and in death, whether king or slave, all carrion was equal. Some time during the 10-year siege of Troy, Achilles worries over the dead body of his dear friend, Patrokliis, “that flies might get into his wounds beaten by bronze in his body and breed worms in them, and there make foul the body . . .” His mother, the goddess Thetis answers: “I shall endeavour to drive from him the swarming and fierce things, those flies, which feed upon the bodies of men who have perished . . .” (Homer, *The Iliad*, Book 19).

The first clear reference to blowflies was “published” more than 3600 years ago in the *Ḫar-ra-Ḫubulla*, a collection of cuneiform writings on clay. Tablet XIV is a systematic inventory of wild terrestrial animals that dates from the time of Hammurabi and is based on even more ancient Sumerian lists. It is the oldest known book in zoology. In it are 396 names of animals inscribed in Akkadian cuneiform on clay tablets, of which about 10 are flies. Here is the first mention of the “green” fly (probably *Phaenicia sericata* or *Chrysomya albiceps*) and the “blue” fly (possibly a *Calliphora*). These lists may be the source for the passage in Genesis where God “formed every beast of the field and every fowl of the air and brought them unto the man . . . And the man gave names to all cattle, and to the fowl of the air, and to every beast of the field” (Genesis 3:19,20).

Given the human propensity to name things, it is reasonable to inquire about the origin of the word ‘fly’. There are probably almost as many names as there are cultures but we will only deal with two. The English word ‘fly’ originated in northwestern Europe where the insect is epitomized by the restless flight of the common housefly *Musca domestica*. In this part of the world, the insect is not so much attracted to us as it is to objects around us, especially food. The word has evolved relatively little in a millennium. In Old English it is *fleoge*; in Middle English, *flie*; in Swedish, *fluga*; Norwegian, *flue* or *fluge*; Danish, *flue*; and in German, *Fliege*.

More widespread is the root that traces back to the Old World tropics. In Sanskrit, the word for fly is *maksika*, pronounced *mukshika*. If one slurs the

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Fig. 1.1. Mesopotamian cylinder seal with fly, c. 3000 BCE. (© The British Museum.)

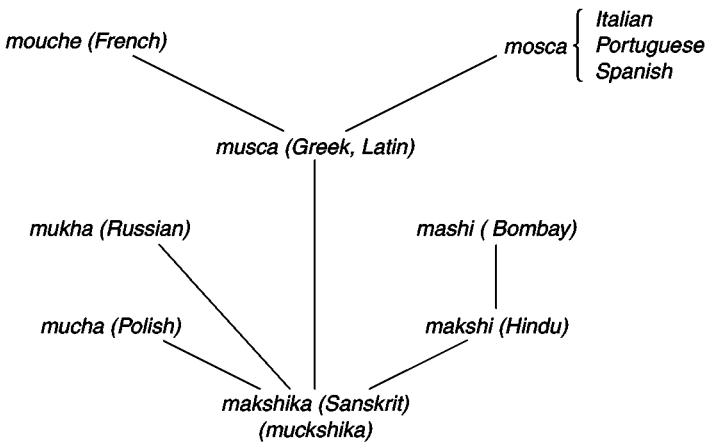


Fig. 1.2. A suggested 'genealogy' for the genus name *Musca*.

pronunciation a bit how easily this becomes *mushka* and then *musca*. The root '*muk*' means face or mouth in Hindi and this strongly suggests a link to the eye fly, *Musca sorbens*. Unlike the northern housefly, this fly is relentless in its appetite for the secretions of the eyes and mouth, best described as "in your face." This behavior suggests the nomenclature and the source of the scientific name as set out in Fig. 1.2.

In our time familiarity may breed contempt but among the ancients the fly appears to have bred a kind of reverence. A cylinder seal, dating from the Old Babylonian or early Kassite period (c. 1700 to 1400 BCE) depicts an oversized fly with the god Nergal holding a scimitar (Fig. 1.3). Other small creatures such as grasshoppers and frogs were depicted in these early Kassite seals (Porada, 1948; J. Brinkman, pers. comm.), but flies were deified. The Assyriologist, Elizabeth van Buren (1936–7, 1939), writes: "comparisons with flies carry no

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Fig. 1.3. Cylinder seal with fly and the god Nergal holding scimitar. Old Babylonian or early Kassite, c. 1700–1400 BCE. (Courtesy the Pierpont Morgan Library, New York. Seal impression #571.)

stigma, and the gods themselves are compared to these pestilential insects. In the Epic of Gilgamesh (Tab. IX, 162) we are told that the gods gathered like flies around Utnapistim when he offered sacrifice.” Another passage relates: “The gods of strong-walled Uruk are changed into flies and buzz around the streets”. It is interesting to note that in the Epic of Gilgamesh (Tablet XI), after the flood has receded, Belitili/Aruru, the mother goddess, lifts up a necklace with carved lapis lazuli fly heads representing her dead offspring and vows: “You gods, as surely as I shall not forget this lapis lazuli around my neck, may I be mindful of these days [days of the flood] and never forget them” (Kovacs, 1985). Kilmer (1987) believes that the necklace suggests the iridescence of blowfly wings that are like the rainbow that brings peace and an end to the flood. She is supported by a passage in Genesis where the flood has receded and God makes a covenant with Noah: “I have set my bow in the cloud and it shall be for a token of a covenant between Me and the earth. And it shall come to pass, when I bring clouds over the earth, and the bow is seen in the cloud, that I will remember my covenant which is between Me and you and every living creature of all flesh; and the waters shall no longer become a flood to destroy all flesh” (Genesis, 8–17). But Homer’s view of rainbows is less rosy: “As when in the sky Zeus strings for mortals the shimmering rainbow, to be a portent and sign of war or of wintry storm . . .” (*The Iliad*, Book 17).

From the royal tombs of Queen Puobi at Ur, dating from 2600 to 2500 BCE, comes an exquisite string of beads with flies of gold and lapis lazuli (Plate 1).

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The work might have been done in different workshops because the technology of fashioning gold and carving stone is quite different and so is the rendering of the flies. The ones in lapis lazuli are literal, with typical head, thorax, abdomen and wings, as in Figs. 1.1 and 1.3. Those in gold are highly stylized and abstract. Never before had the lowly fly attained such esthetic glory.

In the Chaldean, Philistine, and Phoenician pantheon, flies were deified as Baalzebub, Lord of Flies. Appearing as a fly, he could ward off plagues of the insect or send his winged legions as punishment. He would reappear thousands of years later as Beelzebub, First Lieutenant of Satan, in the witchcraft atmosphere of Colonial New England.

The Greek god, Apollo, had many duties – as pasture god and protector of herds, the function of Myiagros, or fly-chaser, belonged to him, because the hordes of flies could lead to plagues (Noury, 1932). Sometimes Zeus, himself, insisted on chasing away the flies, and he saved Hercules when the latter was almost vanquished by these insects. Such was the mythic power of flies.

The Egyptians, too, were obsessed with flies. They wore carved amulets of flies to ward off evil, and burial beads to avert the destruction of the body (Plate 2). Fly whisks were a more practical defense (Fig. 1.4) and even today they are used in widely separate cultures in Africa and the Pacific islands as symbols of rank (Riegel, 1979). In ancient Egypt the fly also symbolized impudence, persistence and courage, and a necklace of flies of purest gold was awarded to soldiers who distinguished themselves in battle – a kind of Congressional Medal of Honor or Victoria Cross (Plate 3). No fly in that region epitomized persistence more than *M. sorbens*, the eye fly, whose avidity for eyes and mouth still torments people on that continent.

When death occurred, could flies be far behind? In Egypt, carrion flies may have even assisted in the embalming process. The late Bruce Ralston (pers. comm.), a neurosurgeon, considered excerebration by mechanical and chemical means insufficient for the task of removing the brain although this method has been accepted as dogma since Herodotus, some 2500 years ago. Herodotus wrote: “First they draw the brain through the nostrils with an iron hook, taking part of it out this way, the rest by pouring in drugs”. In fact the ancients, including Aristotle, considered the heart, not the brain, the seat of intelligence, so the brain was not worth saving. According to Ralston, telltale scratch marks made by an instrument inserted into the skull to remove the brain and the more resistant dura mater are absent and “no chemical has been found to this day which will remove all tissues from the bone without damaging it” (Babin *et al.*, 1990). A recent simulation of the embalming process faithfully follows the ancient practice but overlooks this issue in the following description of the entry into the cranium: “We inserted a long bronze instrument, shaped like a miniature harpoon, inside the nasal passage and hammered it through the cribiform plate into the cranium with a wooden block” (Brier, 2001). Leek (1969) successfully removed a sheep brain by this method and in an appendix

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Fig. 1.4. Defeating flies might be as difficult as vanquishing lions in this drawing by Francesco del Toppo, Aesop, *Vita et Fabulae*, Naples, 1485. (Courtesy The Pierpont Morgan Library, PML, 15404.)

to the same paper, Sudhoff and Patterson reported success on human bodies. There is no mention in these papers that the procedure removed the dura mater.

Professor Arthur Aufderheide, University of Minnesota Medical School, (pers. comm.), has examined 49 Roman period mummies excavated from the Kellis-1 cemetery at Ismant el Kharab in the Dakhelh Oasis, Egypt. Of these, 35 were sufficiently preserved to permit reconstruction of their mummification process. "In only five of the twelve anthropogenically mummified bodies did resin gain access to the cranial cavity and, in two of these, multiple insects

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(some of which were identifiable as mature dermestids) were found mired in the hardened resin. Dura mater was not identifiable in the cranial cavities of any of either anthropogenically or spontaneously [desiccated] mummified bodies" (A. Aufderheide, pers. comm.).

Maspero (1904) has calculated the number of bodies undergoing a 60- to 80-day embalming procedure in ancient Thebes as a minimum of about 1200 to 1500 at one time. Hamilton-Paterson and Andrews (1979) mention black swarms of flies in the charnel houses. If such conditions existed, and it is hard to believe otherwise, carrion flies would have had a picnic cleaning out the brain, exiting the skull as postfeeding larvae, and leaving the remnants of drier tissue to dermestid and other beetles and piophilid flies (Pettigrew 1834; Curry 1979; Babin et al. 1990). In homicide cases the brain is often the first organ attacked and destroyed by flies, given their predilection for eyes, mouth, and nose as sites for oviposition. Furthermore, according to Tapp (1984), "the ancient Egyptians tended to leave the brain to liquefy for a few days before attempting to remove it . . ." (see also Isherwood *et al.*, 1979). Under these conditions it would have been extremely difficult to exclude flies. The intervention of flies would have reduced the process of decerebration to just a few days, given the warmth of the charnel house and the metabolic heat produced by the actively feeding maggots. David and Tapp (1984, p. 73) describe an endoscopic examination of the Asru mummy skull, which revealed several intact larval skins lying free within the skull that were removed and identified as *Chrysomyia*. The species is probably *albiceps*, a common fly in the region (see also Cockburn *et al.*, 1975).

Whether fly eggs or larvae were ever deliberately introduced into the head by the embalmers is not known. With or without encouragement, flies could have done the job.

Since the brain was considered an unimportant organ, the object of embalming was to protect all organs except the brain from the ravages of insects and time. This concern was expressed in the Book of the Dead, Chapter 154: "That my body will not become prey to maggots" (Huchet, 1995). At death, the guardian spirit, or Ka, remained with, or periodically returned to, the body. A horde of maggots leaving the body and possibly taking the Ka with them would have defeated the purpose of the sacred ritual. A slip of paper found in the mouth of a mummy contains the inscription: "The maggots will not turn into flies within you" (Papyrus Gizeh no. 18026:4:14) – a recognition of the metamorphosis of flies, and what might have been a widespread worry that the body's destruction by maggots might thwart the Ka's return. A similar exhortation is in the Book of the Dead, Chapter 154. Kritsky (1985) mentions a belief that still persists in parts of rural Egypt: "shiny, metallic calliphorid flies found inside houses represent the spirit of a deceased individual who once lived there. That association is enough to keep some people from killing flies for fear they might harm an ancestor." It suggests the persistence of the ancient, ambivalence toward flies as both sacred and a scourge.

The Greek demon of decay Eurynomos, appears both as a vulture and as a fly. In the Persian book *Vendidad*, it is written that as soon as a person dies the demon of death throws himself upon the corpse in the form of a fly.

The ubiquity of flies remained unabated down to early modern times. Here is the personal account of the famed military surgeon, Amboise Paré, following “The Battel of S. Quintin, 1557,” in a contemporary translation: “We saw more than halfe a league about us the earth covered with dead bodyes; neither could we abide long there, for the cadaverous scents which did arise from the dead bodyes, as well of men, as of dead horses. And I think we were the cause, that so great a number of flyes, arose from the dead bodees, which were procreated by their humidity and the heate of the Sunne, having their tayles greene and blew; that being up in the ayre made a shadow in the Sunne. We heard them buzze, or humme, which was much meruaile to us. And I think it was enough to cause the Plague, where they alighted”.

During the Renaissance, death and the devil were personified by the fly, depicted in two paintings by Carlo Crivelli, a fifteenth-century Venetian painter. In Plate 4, the insect, probably a bluebottle, rests on a human skull next to a vase of flowers – a metaphor of life and death. In Plate 5, the Christ child clutches a bird, a symbol of resurrection, while recoiling from a fly, a symbol of Satan and death. The same attitudes were prevalent in Northern Europe as shown in Plates 6, 7, and 8. Dr. Marcel Dicke of Wageningen University, The Netherlands, has supplied the following observation of Jan de Kok of the Rijksmuseum. In the sixteenth century the fly on the white cap of the woman was often added to the painting after she had died (Plates 6 and 8; Dicke, 2000). For superb reproductions of Renaissance paintings depicting flies and other insects the reader is referred to Chastel (1984).

Given the ancient and enduring intimacy with flies it is surprising that in the West, murder was never associated with the triad – flies, death and decay – until the mid-nineteenth century. Not so in China. We are indebted to Professor Fang Jianming of the Shanghai Institute of Entomology, Academia Sinica, for the following case and translation. The crime is set sometime between 907 and 960 and is described by Cheng (1890).

An officer of the court suddenly heard a woman endlessly weep and wail. The officer asked her what had happened. The woman said that her husband was killed by fire, but the officer discovered many flies clustered on the head of the corpse. At autopsy, there was a snag in the head of the corpse. The woman confessed that she and another man had put a snag in the head of her husband.

In 1247, Sung Tz’u, a high-ranking judicial administrator, published *The Washing Away of Wrongs*, a training manual for death scene investigators. In it he relates a murder investigation in a rural, agricultural village. A man was found dead in the road with numerous slash wounds in his head that appeared to have been made by a sickle. An investigator assembled the men of the village