

THE PROBLEM OF INTESTINAL MYIASIS IN HUMANS

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The term 'myiasis' indicates the infestation of humans and vertebrate animals with diptera (fly) larvae, which for a certain period feed on the host's dead or living tissues, liquid body-substances, or ingested food.

The important criterion of this definition is that the dipterous larvae complete or continue, at least for some time, their normal development on or in the vertebrate body. They act as obligatory or facultative parasites.

This interpretation normally poses no difficulties with regard to cases of traumatic myiasis in the dermal and subdermal tissues. The African tumbu fly (*Cordylobia anthropophaga*), for instance, develops in skin boils of man and various animals, and has been for some years a common pest in humans and dogs in South Africa. The first instar larvae invade the skin and complete their whole development in the boils; the mature larvae actively leave the host and pupate in the soil. This fly can develop only in live vertebrates and is therefore an obligatory parasite.¹

Another quite common occurrence in Africa and other parts of the world is the infestation of pre-existing contaminated traumatic lesions with blow-fly larvae—in humans mostly those of the green bottle fly (*Lucilia sericata*). These flies normally develop in carcasses or other decomposing organic matter, but the mother flies are also attracted to odorous wounds, and may deposit their eggs into such 'a piece of carcass' of the living body. The larvae then complete their development in the wound, feeding on the dead cells, or in some species they may also attack the living tissue. After reaching maturity, they drop from the wound and undergo pupation outside the body. In these cases, the normally free-living maggots have become facultative parasites.

LARVAE IN THE INTESTINE

Cases of so-called 'intestinal myiasis' recorded from humans are very often problematical and wrongly interpreted, and present pitfalls to the practitioner who has not a sound entomological knowledge.

The clinical findings in cases of infestations of the alimentary tract consist of the presence of fly larvae in the stool or the vomit. These findings may be restricted to a single event, or they may be made repeatedly over a period of several days or even weeks. Especially where there is a continued appearance of larvae in stools or vomit it is normally concluded that the maggots developed in the alimentary tract, as the above-quoted blow-fly larvae do in wounds.

There are many records in the literature of such assumed

cases of intestinal myiasis in humans, some of them unbelievable to the trained entomologist. When checking the scientific names of the flies said to have been involved in human cases, one group is not represented, namely the obligatory parasites. There are some fly species, the larvae of which are known to develop as obligatory parasites in the alimentary tract of animals; for instance *Gasterophilus* in equids, *Gyrostigma* in rhinoceroses and *Cobboldiinae* in elephants. These species, however, are strictly host-specific and do not develop in man. On the other hand, humans have no specific intestinal parasites belonging to the diptera or any other group of insects.

All diptera accused of causing intestinal myiasis in humans belong to species which normally develop in excrement, other decomposing organic matter, or in food-stuff. Were these species under certain circumstances able to develop in the human alimentary tract they would be regarded as facultative parasites. But is there such a facultative intestinal myiasis in man?

Contamination after Defaecation

From our own laboratory experience, it can be said that the majority of cases concerning maggots found in stools are due to subsequent contamination, mainly by the faeces-breeding red-tailed flesh fly *Sarcophaga haemorrhoidalis* (Fig. 1). Most physicians are unaware that these

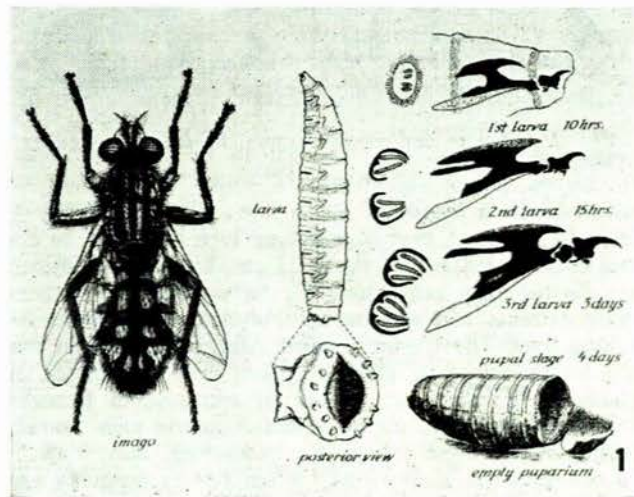


Fig. 1. Life cycle and larval features of the red-tailed flesh fly, *Sarcophaga haemorrhoidalis* (after Zumpt).

big flies, frequently found in houses, give birth to very mobile larvae of about 3 mm. body-length. These flies

are not egg-laying like house- and blowflies. Furthermore, the maggots may be deposited even while the patient is in the act of defaecation, or very shortly afterwards, so that the inspecting physician or nurse is quite convinced that the maggots were passed with the faeces. If the stool is inspected even a few hours later, or the next morning (as is usually done), then the maggots may already have reached a size of 1 cm. or more. It is rarely known by a layman that these *Sarcophaga* maggots in summer, at room-temperature, reach the 3rd larval stage within 24 hours.

The presence of the larvae of egg-laying flies can also be explained in this way, because in some groups the incubation period of the egg is only a few hours. In some cases the fly maggots may even be present in the slop jar before use, especially if it is not properly cleaned, or is kept under insanitary conditions. In this connection, Hall and Muir² mentioned that a physician saw 'a slop jar kept in a privy during the day and only brought in for use at night, with a larva of *Eristalis* hanging over it, just ready to drop, while it was in the privy. Had the larva fallen unobserved and been found at the appropriate time, it would have been ample evidence to most persons that it had been passed into the jar by the person using it'. The larvae of *Eristalis tenax*, the drone fly, have been recorded several times as intestinal parasites of humans, and in a few cases with justification, as discussed below.

Swallowed Larvae

Fly maggots, however, may actually be excreted with the faeces after being swallowed with food, and such cases are certainly more common than is realized. A well-known pest of cheese and cured meat like bacon and ham is the cheese skipper (*Piophilidae casei*), the larvae of which invade the foodstuff deeply, and are therefore often overlooked by the consumer. The mature larvae (Fig. 2),

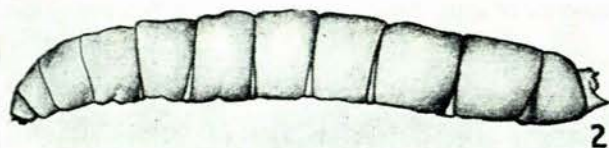


Fig. 2. Larva of the cheese skipper, *Piophilidae casei* (after Hennig).

which reach a length of 8-10 mm., have the ability to leap. In this way, they may get up to a height of 20 cm. and cover a distance of up to 23 cm. The cheese skippers are furthermore very tough fly larvae and may survive quite extreme and unusual environmental conditions for a long time. The Italian scientist Alessandrini³ found that the larvae remained alive in petrol for 40 minutes, in glacial acetic acid for 1 hour 35 minutes, in formalin for about 50 hours, and in artificial gastric juice for 120 hours. When these larvae are swallowed, they may be passed alive *via anum*—as foreign bodies normally are. Alessandrini fed a great number of these maggots to dogs, and found that they were excreted, a high percentage of them alive, up to the third day after ingestion. Many of these larvae even pupated afterwards. The larvae caused intestinal lesions, damage to the mucous membrane and

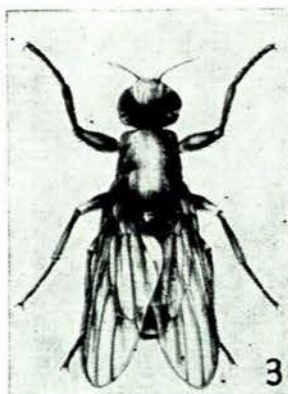


Fig. 3. Adult fly of the cheese skipper, *Piophilidae casei* (after Simmons).

Cases with a prolonged excretion of the larvae of *Piophilidae casei* may be explained by a continuous intake of polluted food, which may easily happen when people are provided every day with slices of bacon or ham from the same infested source.

Much less tough are the larvae of the common housefly (*Musca domestica*) and of blowflies (*Calliphoridae*), which commonly deposit their eggs on human food, cooked or raw. The swallowed maggots are usually killed quickly by the gastric secretions, but their skins, consisting mainly of chitin, are very resistant and may therefore reappear apparently undamaged in the faeces. Should the digestive process be disturbed, for instance by bacterial infection, the larvae may be passed alive. The presence of dead or living larvae, however, independently of a co-existing bacterial infection, causes more or less severe gastro-intestinal disturbances in most persons (vomiting, diarrhoea with abdominal cramps, nausea), as experimentally shown by Kenney.⁵

Haseman⁶ reported from the USA that a family, consisting of husband, wife, daughter aged nine, and son aged six, with the possible exception of the husband, had been subject to attacks during which large numbers of maggots were passed after taking salts, oil or other laxatives. Exhaustive enquiries into the habits and surroundings of the family led to the conclusion that live larvae had been ingested repeatedly, owing to the negligence of the mother in cooking and handling food. It had been her practice to leave cold food, such as meat, vegetables and cheese, lying uncovered on the table from one meal to the next. This view is supported by the fact that the attacks were most frequent during the heat of summer, and that they decreased when the food was heated before consumption.

Such cases cannot be regarded as a true 'intestinal myiasis'. They may be designated as a 'pseudomyiasis'.

However, reports by several authors exist, claiming that the swallowed maggots were not only able to continue their normal development in the tract, but that under the new conditions they may suddenly have adopted a paedogenetic method of reproduction. That is, the larvae may have produced other larvae without passing through the adult stage.⁷ This theory was vehemently rejected by Keilin⁸ and is more than fantastic to every trained

haemorrhagic infiltrations, owing to their secretions and the injuries inflicted by the mouthparts and body spinulation. It is therefore quite understandable that the swallowing of cheese skippers by humans may be accompanied by gastro-intestinal disturbances.

The larvae are, however, certainly not able to continue their development in the alimentary tract, or even to pupate there and give rise to adult flies (Fig. 3), as pointed out by De Stefani.⁴

biologist, but it was later again taken into consideration by Herms and Gilbert.⁹

Experimental Work

Komarek^{10,11} and Causey¹² undertook the experimental investigation of the possibility of survival of fly maggots in the alimentary tract. They tested larvae of *Lucilia*, *Calliphora*, and *Sarcophaga* a.o. *in vitro*, and also fed them to dogs and cats. They found that these larvae had a high oxygen consumption and that they soon died under the conditions prevalent in the alimentary tract. A certain percentage of the larvae reappeared in the animals' faeces, but they were dead and partly digested. Dogs which had starved for a while and to which the larvae were given in a large quantity of water, excreted them faster than usual — these larvae were still intact, but were also dead.

Riley¹³ replied to Causey's paper and pointed out that there were some reliable reports in the literature, and that he, too, had seen a few cases which spoke for a true intestinal myiasis in humans, caused by swallowed maggots. Personally I do not accept the extreme conclusion that Causey arrived at when he wrote that 'the *Calliphorinae* larvae cannot survive passage through the alimentary canal', because in some cases, as outlined above, this may be possible during certain gastro-intestinal disturbances which break up the normal functions of digestion. I support the view, however, that these larvae cannot live as facultative parasites in the gut, if the infestation took place *per os*.

Rectal Myiasis

A special kind of true intestinal myiasis is possible, and I recently proposed to define it as 'rectal myiasis'.¹⁴ Flies which are attracted to faeces may under certain circumstances, especially when humans live under filthy conditions, deposit their eggs or larvae near or into the anus, and the larvae then penetrate into the posterior part of the rectum. Their need for oxygen is met by placing the breathing organs, which always open at the posterior end of the body, outside or in the immediate vicinity of the anus. These larvae feeding on the faeces would then be able to complete their larval life in the rectum and leave it actively after having reached maturity.

The so-called rat-tailed maggots (Fig. 4) of the drone fly (*Eristalis tenax*) and of other *Eristalinae* are especially adapted for such a mode of life or 'facultative parasitism'. These larvae are frequently found in sewage, where they

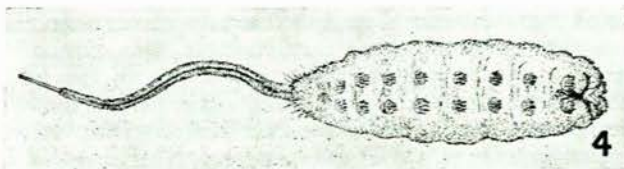


Fig. 4. A rat-tailed maggot — the larva of the drone fly, *Eristalis tenax* (after Swartzwelder and Cali).

breathe through a long tube, the terminal opening of which floats on the surface. The larvae may be situated relatively deeply in the rectum, as long as the breathing-tube reaches the anus.

Cases of myiasis caused by *Eristalis* larvae have actually been recorded several times.¹⁵⁻¹⁷ In two of these cases from England it is expressly mentioned that the patients suffered from irritation in the anus, but otherwise felt no discomfort.^{16,17} Hall¹⁵ in the USA also drew attention to the rectal irritation in two cases of infestation with *Eristalis* larvae.

There is also a possibility that the larvae of *Sarcophaga haemorrhoidalis*, mentioned above, may be 'facultative rectal parasites' at certain times. There is no free egg stage, and the larvae can penetrate into the rectum immediately after deposition.

Quite by accident, two model cases of rectal myiasis have recently been observed in this Institute in caged wild rats (*Arvicanthus niloticus* and *Saccostomus campestris*). Occasionally these rats suffer from paralysis of the hind part of the body, including the anal sphincter which remains widely open, exposing the faeces. The aetiology of this disease is not known. The larvae, which belonged to the common housefly (*Musca domestica*), were found in a compact mass within the anal opening, with their breathing-plates directed to the open air. Some of them had penetrated a little deeper into the rectum, but the anterior part and the adjoining small intestine were free of larvae. The posterior (anal) part of the rectum was inflamed and had become partly necrotic, owing to mechanical injuries inflicted by the larvae, and to their secretions.

SUMMARY

1. Human stools are frequently infested during and shortly after defaecation with larvae of various flies, and an 'intestinal myiasis' may be diagnosed.
2. Living or dead fly maggots in human faeces may be swallowed with polluted food and may cause several kinds of gastro-intestinal disturbance.
3. The theory that swallowed larvae may live as facultative parasites in the alimentary tract is rejected. This conclusion is drawn from relevant experiments by earlier authors and for biological reasons.
4. A true myiasis is possible, however, by means of an active invasion of the posterior part of the rectum by maggots *via anum*. This condition should be defined as 'rectal myiasis'.

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