THE HOUSE FLY*

THE house fly *Musca domestica* Linn., may be rated amongst the most common insect associates of man, but familiarity with this insect has been accompanied by a corresponding ignorance of and indifference to the dangers to health that are associated with its presence. However, there is now an awakening to this danger the reality of which is indicated by the fact that the names "disease carrier" and "typhoid fly" have been suggested as substitutes for the somewhat innocent-sounding name of "house fly". This article discusses briefly the life-history and habits of the house fly, and points out the various recognised measures which may be adopted for its control.

DISTRIBUTION

The house fly is widespread throughout the world; it is present in every continent, and has been found not only in the tropical and temperate zones, but even in subpolar regions such as Lapland and Finland. Not merely is the fly widespread, but, given suitable conditions, it is capable of breeding to enormous local populations.

LIFE-CYCLE STAGES

The eggs are tiny white objects, somewhat banana-shaped and about one-twentieth of an inch in length.

The larva or maggot is slender, white, and shining, and is about one-twelfth of an inch long when it hatches. The body thickens from a narrow-pointed head to a blunt and rounded anal segment. When full grown the length has increased to almost half-an-inch, and the colour gradually changes to a creamy shade. During the growth period the larva moults twice.

The pupal stage of the insect is passed within the final larval skin, which envelopes the insect and contracts and hardens into a cylindrical-shaped puparium with rounded ends. The colour deepens to dark-brown. The puparium is approximately one quarter of an inch in length.

A detailed description of the adult fly is rendered needless. It is necessary to refer to only a few structures. The mouth-parts are wonderfully complex, with a proboscis capable of extrusion for the purpose of sucking liquid food. It is incapable of piercing or chewing, but solid food such as sugar is first dissolved by a flow of saliva and the resultant solution is then sucked up.

The tarsal joints of the legs constituting the feet are well adapted for walking either vertically or upside down on smooth surfaces. The terminal joint has, besides two claws, two sticky pads covered with very fine hairs and furnished with glandular openings from which there exudes a sticky fluid.

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The legs and body of the fly are clothed in fine hair-like spines which make the lodgment of contaminating particles almost inevitable.

LIFE-HISTORY

The eggs are laid in batches of about 110 to 150 eggs, in fresh manure, garbage, faeces, and decaying vegetation. They hatch usually in from 8 to 24 hours, the time varying with the temperature.

The larvae or maggots may be found in squirming masses within a few inches of the surface of infested material, but if the material is soft and moist and not subject to excessive internal heating, the maggots may penetrate throughout. At the end of about five days in warm weather the maggots achieve full growth, and they move then to a suitable spot in which to pupate, the ideal site for pupation apparently being moderately damp soil giving easy penetration. Pupation may occur at depths varying from little more than 1 inch to 2 feet, the latter being recorded in sandy loam.

The pupal period lasts approximately three to five days in warm weather, but great variation in this period may occur according to the temperature conditions, development being slower with low temperatures.

This period constitutes the time during which the marked change from larve to adult is taking place, and it is terminated by the complete development and the emergence of the adult insect. The adult fly commences to feed soon after emergence, but egg-laying does not occur until after a lapse of ten days to a fortnight. It will be seen that a complete generation from egg-laying to egg-laying may occupy only a little over three weeks in warm weather.

HABITS AND MENACE OF THE ADULT FLY

In the matter of food, the house fly has most varied tastes; moist garbage and horse manure are just as attractive as man's most carefully refined food. Further, it is essential for the fly to visit putrefying material in order to lay its eggs. As has been pointed out, contaminating material will be caught in the hairs clothing the body, and on the claws and sticky pads of the feet, and on the extruded tongue. These, taken together, constitute only one section of the danger, however. It has been definitely proved that viable bacteria capable of causing human diseases, such as typhoid and tuberculosis, among many others, may be recovered from the alimentary canal of the house fly several days after infection. This means that the familiar fly specks are potentially infective material.

NATURAL CONTROL

The fluctuations in the number of flies are largely due to variations in temperature. The high summer temperatures induce rapid breeding, and if they are accompanied by high humidities, then the breeding sites are kept suitably moist. Low temperatures increase the length of the developmental period, thus slowing up the rate of breeding, and at the same time rendering sluggish the adult flies that are present.

The house fly is subject to attack by parasitic organisms, the most notable being the fungus *Empusa muscae* Cohn. The spores of this organism give rise to a growth of white fungus which ramifies and distends

the body of the insect. Swollen, sluggish, and dead house flies will probably often have been observed by householders. The effects of the fungus are most marked in the late summer and autumn months, when large numbers of the flies are killed in this manner.

Spiders, and various predatory insects such as mantids, robber flies, and wasps of various families, all take their toll of the adult house flies.

The eggs, larvae, and pupae are liable to attack from insects such as ants and ground beetles.

ARTIFICIAL CONTROL

The artificial control of the house fly and the elimination of danger from it may be take a threefold from: (*a*) Exclusion; (*b*) elimination of breeding sites; (*c*) destruction of the adults.

EXCLUSION

Infants and patients should be protected from the attentions of flies by mosquito nets or other comparable means of exclusion. Foodstuffs and cooking utensils should be adequately covered and suitable gauze-screened cupboards should be provided for fresh foods. Infants' food, feeding bottles, milk, and so on should be most carefully protected. In cases of severe and more or less permanent infestation of buildings by flies serious consideration should be given to the complete screening of all doors and windows.

ELIMINATION OF BREEDING SITES

With the growth of motor transport, the number of stables in city areas tends to decrease, and in those that remain the breeding of flies is now less possible than formerly because stable owners must take suitable precautions to prevent accumulations of manure.

There are, however, instances where manure must be stored for short periods, and it has been found that heaps of manure, if closely packed, become so heated by the processes of fermentation and permeated by the resultant gases that fly-breeding is restricted to the outermost layer of an inch or so. The heaps should be formed into a compact, almost rectilineal shape, and carefully smoothed on the sides and top by blows with the back of a shovel. The use of a borax spray composed of 1 lb. of borax in 6 gallons of water will satisfactorily deal with the insects breeding in the outer layer. As excess borax in the soil is injurious to plant growth, it has been recommended that not more than three gallons of this spray should be applied to 10 cubic feet of infected manure, and not more than 15 tons of borax-treated manure per acre be distributed in the soil.

For mounted army forces and farms, the method of drying manure may be useful. The process simply consists of spreading the manure in a thin uniform layer so that it dries quickly in the sun, thus rendering it unsuitable to the fly for oviposition. An area of flat hard ground should be selected and a rotation of freshly-placed manure, dry manure, and bare ground could be kept up in order to deal with fresh accumulations. The drying manure should be raked over. When dried the manure could be stored safely for agricultural purposes. It will be understood, however, that manure dried in this manner would have a diminished fertilising value, and it would be useful mainly because of the humus it would provide.

In city areas, the control of the house fly generally depends on the care taken in garbage disposal, and garbage should accordingly be placed in a fly-proof garbage tin. Regulations regarding the building and care of household conveniences are in force, and each householder should see that so far as he is concerned, the regulations are strictly obeyed.

DESTRUCTION OF THE ADULTS

The adult flies that gain access to a building may be dealt with in a variety of ways, as for example swatting, the use of sticky fly-papers, fly sprays, and trapping.

There are several brands of fly sprays on the market, and these generally consist of definite contact insecticides, which kill either on actually wetting the insect or as partial fumigants as a result of the fumes that are liberated when the fluid is sprayed in a fine mist.

A home-made spray may be somewhat inexpensively prepared by stable owners and farmers. The recipe is as follows: ½ lb. of pyrethrum is stirred into 1 gallon of kerosene and the mixture is agitated at intervals for two hours. Settling is then allowed to take place and the resultant clear amber-coloured fluid is later decanted or syphoned off. This spray fluid, if prepared with water-white kerosene, may be safely sprayed in furnished rooms. Householders, however, will usually find it more convenient to purchase one of the ready-prepared sprays.

It is advisable to sweep up and burn the flies that fall as a result of spraying, as a number of them may merely be stupefied and, if left, may later recover.

Traps of a multiplicity of designs have been used for house fly control, the most commonly known type being the glass bottle trap with the entrance in the bottom and with an internal trough. The trough holds a fluid which serves both to lure the flies into the trap and also to drown them. Various fluids may be used for baiting this style of trap, including milk and stale beer.

Trapping should, however, be a somewhat needless procedure, or at least it is a method to be adopted only as a last resort. If flies are sufficiently numerous in a building to warrant the use of traps, then all efforts should be directed to the elimination of the source of the flies and, if necessary, to the adequate screening of the building.