

CONTROL OF FLIES IN COMMERCIAL POULTRY FARMS

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INTRODUCTION

As the natural environment is transformed either in urban or rural area, man causes a series of radical modifications in the local flora and fauna.

On one hand, the extinction of the majority of the native species, on the other hand one can verify the adaptation of fewer species to this kind of transformations, which begin to benefit from the organic material accumulated there.

In commercial poultry farms systems, the manure of poultry hens which are constantly accumulating under the cages, constitute an excellent substrate to the development of sinantropic flies.

Sinantropic flies are the ones that take advantage of the conditions created by man for its development. These dipterous constitute a serious hazard to animal and public health, acting as vectors of pathogenic micro-organisms as virus, rickettsias, bacteria, protozoan cysts and helminth eggs .

Amongst the insects of medical interest which occur in metropolitan and rural areas, that is , in the environments modified by man , the flies, which takes on an important role not only in the ecology field, as well as in public health, for the adults are mechanical vectors to the innumerable pathogens.

In poultry farms in the state of São Paulo, Brazil, the most frequent species are: *Musca domestica*, *Stomoxys calcitrans*, *Muscina stabulans*, *Fannia spp*, *Chrysomya putoria*, *Hermetia illucens*.

Representing about 90% of the total species, *Musca domestica* is the most common species , which develop itself in such environments. however the presence of a bigger or lower number of flies from a certain species in the poultry ranches , varies directly according to the climatic conditions of the region and with the handling of the birds and the manure. In some situations an increase of *Hermetia illucens* occurs. This species is prevailing when the manure shows a high humidity (over 75%).

The importance of *Stomoxys calcitrans* in poultry farms is due to its haematophogyc behavior upon the equine and bovine, causing serious losses to the local livestock farming .

Flies scatter by olfactory stimulus and the populational pressure (high density) which triggers the mechanisms of migration. During favorable seasons (spring and summer), flies from livestock farms , like the aviaries , present a higher dispersion, due to the present overpopulation.

These flies are subsequently found in areas that exert strong attraction (factories with sweet smelling scents or substrates of fermentation or putrefraction), as well as the rural villages, villages or, even in the urban area located circa 1 to 5 km of distance.

Literature data indicate that the flies, in particular the *Musca domestica*, have quite a good range of flight (10 to 20 kms) and are able to move at 6 to 8 kms an hour.

However it's been observed that the flies fly around an extensive area to explore the place, and as soon as they find suitable and sufficient food for posture and shelter, they have a tendency to stay within a range of 100 to 500m of the developmental area.

Although the *Musca domestica* has a flight range of up to 20 kms, few adults of this species move for more than 1,6 kms from the liberation point.

Flies scatter themselves through the olfactory stimulus and populational pressure (high density) what triggers their migratory mechanisms.

In favorable seasons (spring-summer), it's been observed that some flies from extensive livestock areas, as poultry farms, due to the existing overpopulation, show a bigger dispersion. These flies are subsequently found in places that exert a strong attraction (points of attraction: factories of sweet smelling scents or substrates of fermentation or putrefaction), as well as in the rural villages, villages or even in the urban area located circa 1 to 5 kms of distance

Some experiments have shown that the flies are able to fly considerable distances particularly if the points of attraction are located in open areas with no other points of attraction nearby and which supply food and shelter. It's been experimentally shown that the *M.domestica* is able to fly against a moderate wind (2 to 12 kms /hr) towards an attractive odor, though, in general, it's been observed that the flies move towards the wind.

As for the role of the poultry farms as centers of dispersion of flies, 60% of the flies which are bred in the manure stay nearby the facilities; 13% move to other breeding facilities (swine, bovine and others) and 27% move from the farm to areas where there are no means of abundant breeding.

Dipterous cannot be totally eliminated, but one should take action to keep the entire population of these insects under acceptable levels.

Controlling the dipterous is the biggest issue for the poultry industry in the USA, being it's cost estimated at 40 million dollars per year. The dipterous cannot be totally eliminated, but one should take action to keep the entire population of these insects under acceptable levels.

The continuous use of insecticides for a prolonged period provides the appearance of populations of resistant dipterous, what's more, the bad usage of these products brings the risk of residue in the eggs and in the meat of the poultry plus environmental pollution. The indiscriminate usage of insecticides, mixed in the manure for the elimination of the dipterous, causes the destruction of other benefic arthropods which act as natural enemies of the young form of dipterous.

The consumer's market demands in relation to the quality of food free of residues and chemical substances have been growing along the years. Likewise, the big companies from the sector of food commerce require greater professionalism from the producers as for the controlling processes related to the implantation of planned specific procedures according to the target plague. Hence the implantation of the methodologies of integrated control of plagues in these zootechnical breeding is a practice required by the market with perspectives of growth in a near future. The training of the plague controller to fulfil the new demands is of crucial importance for the success to be acquired in the different commercial sectors involved in the entire process.

CONTROL

The controlling of flies in poultry farms is not an ordinary operation, being one of the most serious obstacles that the poultry industry has been having to face. Nowadays, the controlling of sinantropic flies in farms has been done based on the technique of **Integrated Pest Management (IPM)**, which gathers the methods: 1-) Cultural, 2-) Chemical, and 3-) Biological, aiming to decrease the population of dipterous. The IPM has as a philosophy the compatible and harmonic combination of controlling methods based on ecological principles and multidisciplinary methodologies in order to get better efficiency in the controlling of plagues, reducing the costs and environmental hazards.

The main goal of the integrated handling is not the extermination of the flies, but the decrease of its population to bearable levels. These levels are subjective and must be determined to each system of production, considering the reality of the integrated handling.

In order to achieve such goal it's necessary to know in details the biology and ecology of the flies and the characteristics of the handling of the operations in the breeding of domestic animals. The implementation of integrated programs keeps the levels of infestation of plagues low in aviaries, preserves the benefic biological fauna, and reduces or eliminates the need to use insecticides

1. CULTURAL METHOD

Definition: consists in the various aspects of the handling of poultry that directly or indirectly act in the process of the drying of the manure accumulated under the cages of the birds (formation of drying cones). Some of these aspects are: the system of water distribution; strain and age of the hens; details of the construction of poultry house, such as the level of the ground of the cages in relation to the ground surrounding the poultry houses, etc...

The cultural method has an important role in the formation of cones of manure. The accumulated manure under the birds cages is a strong attractive to the females of the *Musca domestica* and the *Chrysomya putoria*, among other species of flies, for oviposition during the first month of accumulation, when the humidity varies from 75% (recent manure) to 65% (older manure). After a month, the manure accumulated under the cages reaches a layer circa 10cms of high .During this period (1st month of accumulation) all the manure in the poultry house is highly favorable to the development of domestic flies.

The frequency and the way of removal the accumulated manure are fundamental in the controlling of the manure humidity and consequently, in it's bigger or smaller attractiveness to the flies for the posture of the eggs.

Some measures can be adopted to accelerate the drying of the manure accumulated under the cages facilitating the formation of cones of manure are:

- Maintenance of the roofing of the poultry houses to prevent leakage (dripping) on the manure
- Maintenance of the system of collecting, distributing and finalizing of the water in the poultry houses to avoid leakage and accumulation of water.
- Maintenance of the cleaning of the drinker, as for the accumulation of residues to avoid the leakage of water on the manure.
- Control the vegetation around the poultry houses to facilitate the circulation of air.
- Avoid tall vegetation around the poultry houses as, for example, bushes , which may prevent sun rays from getting to the poultry houses and the ventilation on the accumulated manure. In some cases the presence of trees may be favorable in the supplying of shade, what would help to lower the internal temperature of the poultry house and therefore a lower consumption of water by the birds. However one has to make sure that these trees are not going to jeopardize the ventilation and the incidence of the sun upon the manure.
- Keep the general sanitation of the farm (garbage collection and its final destination, conditioning of the food, daily removal of dead animals, building of pits.)
- Keep the cleaning of the floor of the poultry house. Prevent the fallen food in the floor from being swept and thrown on the manure, this procedure is favorable to the proliferation of flies.
- Keep the cleaning, not allowing the accumulation of the manure and vegetation, on the sides of the poultry house at a minimum of 50cms of distance.

- Keep the level difference between the ground and the cages and the soil on the sides of the poultry houses. Minimize the problems due to the inclination of the land, which can result in a bigger accumulation of rainwater on the manure.
- After changing the hens of a poultry house fix the floor under the cages, covering the holes, making the floor more even.
- Verify, daily, the occurrence of birds with diarrhea per poultry house, and get immediate treatment or isolation of the bird.

Monitoring the larvae breeding sites

Monitoring is the key to success in any kind of control; because it is easier and more economical to treat a little breeding site than to treat a whole shed or various sheds. Monitoring should be done according to the following observations:

- Have a well trained employee at disposal, which will periodically inspect the farm in search of larvae breeding sites.
- The larvae breeding sites, also characteristic for presenting humidity above 85% and greenish coloring (green spot), can be controlled in two ways: through the treatment with selective larvicides only on the focus or through the removal of the green spot.
- For the treatment with chemical products, apply the insecticide only on the green spot, to kill the larvae, arranging right after the drying of this area covering it either with sawdust or dried manure, in order to make it not attractive to the oviposition. In the case of isolated focus, determinate by leakages, egg, low residual fosforated insecticides can be used, but only on the focus.
- The removal of the green spot can be done with the help of a spade, and the material has to be placed in a wheelbarrow covered with a black plastic.
- The place of the removal has to be covered with a layer of 10cms high of sawdust or dried manure (hard consistency = 35% of humidity).
- The liquefied manure has to be immediately taken to a drying patio, where it has to be scattered in thin layers of approximately 3cms high, to be exposed to the sun in order to kill the larvae.
- The drying patio can be a cemented place or raw ground, at a site that won't let rainwater accumulates.
- In the end of the day, the plaque of dried manure has to be put in the manure bed.

Manure removal

In the months of spring and summer changes in the bioecology of the flies can be verified, due to the climatic changes with average temperatures above 30 °C and the increase of the relative humidity in the air.

The lack of removal of the manure during this period allows to naturally diminishing the critical area (manure with 65% to 75% of humidity, pasty consistency and brown color) highly attractive to the oviposition of the domestic fly and other muscides.

In observing the results all over the poultry house, we can notice:

- Great reduction on the number of flies by the simple reduction of the critical area.
- Development of the natural enemy community (predators and parasitoids) reducing part of the immature forms resulting from the posture of flies on the surface of the manure cones (critical area).
- Great economy in the usage of insecticide, during the critical period of the year.

Period of no removal: September until april

Objective: get to November with cone in formation that is, around 30 cms high and humidity below 65%.

Preparatory Measures

Objective: speed up the drying of the manure after the last removal, preparing for the coming critical period. Keep layer of 10cms high of dried manure, mainly under the entire extension on the side which gets less sunshine. Usage of growth inhibitor during the 1st month after the removal of the manure.

Complementary measures for the drying of the manure

Usage of a layer of 10 cms of sawdust, to help in the drying of the accumulated manure under the cages, mainly in the most problematic sheds. Fallen material on the sides of the sheds has to be avoided for it may facilitate the development of immature forms of flies (pupa). The sawdust should be kept dry, either in the storage sheds or in the patios, covered and protected by canvas or plastic.

2. CHEMICAL METHOD

The chemical method consists in the usage of insecticides (larvicides and adulticides) obeying the following criteria: make use of registered insecticides in the controlling of dipterous, always obeying the manufactures instructions. The larvicides used on the manure should be selective, killing just the dipterous and not interfering in the natural enemies of the fauna. The adulticides should be applied in away not to reach the manure.

Basic rules to the usage of insecticides in the controlling of flies in poultry farms.

- 1) Never mix insecticides.
- 2) Never spray directly on the manure, except for the growth inhibitors, which cause no harm to the fauna of natural enemies of the fly that lives naturally on the manure.
- 3) The adulticides should be used based on the behavior of the flies (diurnal and nocturnal rest).
- 4) The usage of adulticides and larvicides should be intensified during the period favorable to the proliferation of the flies: spring until summer.
- 5) The active principle to the larvae and adults should be alternated during the same period, in the same place.
- 6) A period of rest should be observed, without the usage of insecticides and larvicides.
- 7) Always make use of traps which, besides controlling, will serve as “.measurers” of the infestation by flies.

3. BIOLOGICAL METHOD

The natural enemies that live in the manure may contribute with more than 95% to the destruction of the population of dipterous and are divided in the following categories: predators and parasitoids. The predators are organisms that need to feed themselves of more than one individual in order to reach the adult phase. There is a development of a relationship between prey-predator. Some predators stay their whole lives at the site of the breeding of the larvae of flies, where they develop till the adult phase. Others go through the first phases in the surrounding areas nearby the poultry houses, going to the manure only when they reach the adult phase. The great majority of the predators can survive in alternative sources of food such as the fungus or decomposing organic material, keeping its population when the dipterous become scarce. The suppression of the development of the *Musca domestica* by predators was well demonstrated by some authors who verified that in a manure containing such predators, the mortality of the *Musca domestica* reached 99,5% percentage of larvae of sinantropic dipteros in the manure of hens with different levels of humidity, in farms in the state of São Paulo. According to the humidity in the manure we can find the prevailing species of fly: in a manure that's too humid (black spots) the prevailing species are the Calliforid and *Hermetia* (whose larva makes the manure liquefy); in the pasty-liquid manure the prevailing species are the *Musca domestica*, *Muscina*, and *Fannia*; in the pasty-hard manure the prevailing species is the *Stomoxys*.

Among the fly predators mentioned in the literature, some stand out like:

Coleoptera - Histeridae

Carcinops pumilio - egg and dipterous larva predator. In field tests it was estimated that this coleopteran is capable of predating 37 larvae of *Musca domestica* per day in the adult phase and 17 in the larval phase. Its predatory activity was also observed in laboratory, verifying that the adult predated 11 to 83 larvae and 13 to 24 eggs of *Musca domestica* per day. In the larval phase, *C.pumilio* consumed 13 to 26 larvae and 2 to 3 eggs of *Musca domestica* per day. This coleoptera is the most commonly found in farms in the state of São Paulo, Brasil, in abundance and great distribution. a survey in the state of São Paulo, represented 31,6% of the total of coleopterous collected from the manure of the poultry hens. In the USA, *C.pumilio* species is considered the most important species of Histerid, due to the high degree of predation, distribution in the manure and abundance. In the farms in the south of the state of California, USA, *C.pumilio* represented 54,8% of the total of coleopterous collected.

Staphylinidae

Field and lab observations show that the larval and adult phases of the Staphilinids from the genre *Creophilus* are predators of the dipterous larvae. Under lab conditions, through the usage of the eggs, larvae and pupae from the *Musca domestica*, has demonstrated that the *Philontus politus*, *P.sordidus* and *Staphylinus maxillous* are capable of predating all the phases of the dipterous. Staphilinids from the sub-family of Aleocharinae are the natural enemies of the dipterous acting as predators and parasitoids as well as. In the adult phase they predate eggs and larvae and in the larval phase they parasite pupae. In the state of São Paulo, two families of Staphilinids prevail, occurring during the entire year in the manure of poultry hens.

Acarina

The mites are also important agents in the biological controlling of the dipterous. The families Macrochelidae, Uropodidae and Parasitidae are common in the manure of domestic animals and they act as predators of eggs and larvae of dipterous in the first phase. Lab experiments have shown that each mite is capable of predating 5 to 20 eggs of *Musca domestica* per day and in the manure of bovines there are records of a reduction of 83% in the population of dipterous, due to the *Macrocheles muscadomestica* and *Glyphtholaspis confusa*.

Parasitoids

The himenopterous, mainly the ones from the Pteromalidae family, are known as the most important agents in the controlling of sinantropic dipterous that breed in the manure accumulated in domestic animals. The females of the parasitoids perforate the dipterous pupa with the ovipositor and deposit their eggs in its interior. The larvae emerge from inside the puparium and consume the pupa. Sometimes the parasitoids just perforate the puparium to feed itself from the hemolymph in order to obtain the necessary protein for the maturation of the ovaries, not necessarily depositing eggs. This shows that the number of pupas destroyed by the parasitoids is bigger than the number of parasite pupas.

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