SOIL DISPOSAL OF RESIDUES AND THE PROLIFERATION OF FLIES IN THE STATE OF SÃO PAULO

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ABSTRACT

The paper analyses aspects of the proliferation of flies in São Paulo State as regards their sanitary importance. The most usual flies are from the Muscidae, Calliphoridae and Sarcophagidae families. The presence of these vectors is due to the disposal of vinasse on the soil, organic residues used in crop production and the lack of basic sanitary facilities. Their proliferation is intensified in the alcohol production and sugar-cane crop areas, and by poultry activities (in keeping with the country’s economic model based upon the export of poultry and manufactured goods, and urbanization). Some attempts to control the proliferation of flies are discussed. Expert staff participation for the control of vectors in organic waste disposal on the soil was found to be necessary.

KEYWORDS

Flies; vinasse; garbage; manure; control of vectors; insects; soil.

INTRODUCTION

Flies are insects belonging to the Diptera order, and are spread throughout the world. Several species, among them the Musca domestica, are synanthropic, that is, they may be related to human activities and settlements. The link between man and fly has several aspects: they breed in waste disposal areas, seek man’s food and garbage, use buildings as havens, and at times they use the skin of humans and animals (Keiding, 1979). Flies are insects with complete metamorphosis, which can be divided in 4 steps: egg, larva, pupa and adult insect. They reproduce in any kind of moist organic material and in any degree of putrefaction where suitable food for the larvae is found. The main feeding resources of adult insects are liquid substances or those that may become liquid (Pessoa, 1982), e.g., food, faeces, sputum, pus and wound exudates, putrifying animal and vegetable products, etc. Liquid substances are ingested directly, whereas solid substances are dissolved by the saliva and the fluid regurgitated from the digestive tubule. The regurgitation mechanism is a medium of parasite dissemination. Due to these habits and substrates (e.g., human and animal faeces, domestic garbage, organic waste from agricultural and pastoral activities, etc.) flies are important to public health, since they may transmit pathogenic organisms or cause myiasis (invasion of fly larvae into human or animal tissues).

There is a great number of fly families, of which three are very important with regard to sanitary aspects: Muscidae, Calliphoridae and Sarcophagidae. In
the Muscidae family the most usual species are Musca domestica and Stomoxys calcitrans. The first species is cosmopolitan and, due to the hot weather in Brazil, it completes its life cycle in 7 to 10 days. Control of this species is more effective at the larval stage. Although it is not migratory, it may travel long distances (1 to 5 km) especially in cases of breeding site over-population. Stomoxys calcitrans, known as the cow barn fly, is hematophagus. It 'bites' and attacks animals and man in large groups. Since it causes loss of cattle weight and production decreases with its attack, this species is of economic importance; in Brazil it completes its life cycle in 7 to 10 days.

Flies from the Calliphoridae family are known as blowflies, and most of them are saprophagous. The most important belong to the species or genus Chrysomia megacephala and C. chloropyga. These are African flies, brought to Brazil in 1975, which have spread throughout Brazil due to their dispersion ability (Prado, 1982; Guimarães, 1983).

Phanicia is a green or bronze-metallic coloured fly. It completes its life cycle in 4-7 days in the Brazilian summer and is usually found in slaughter-houses, meat markets, organic garbage, etc.

Cochliomyia is a myiasis-causing fly. The important species are: C. hominivorax, whose larvae are necessarily parasitic and develop in healthy, non-necrosed tissues; and C. macellaria, which lives in garbage and in putrefying organic material, and only attacks animal tissues which have already been affected by necrosis (Pessoa, 1982).

PROLIFERATION OF FLIES IN SÃO PAULO STATE

The proliferation of several species of flies in São Paulo State has concerned the authorities, disturbed the population and caused economic damage to several activities. Each county is responsible for the control of nuisance arthropods, according to the Decree No. 12342 of 27 September 1978 (São Paulo, 1978), therefore SUCEN - Superintendência de Controle de Endemias (Superintendence of Disease Control), an autonomous state institution responsible for the control of biological vectors, intermediate hosts and technical assistance to City Halls, has received an increasing number of requests for guidance regarding fly control. The most serious problems of fly proliferation have occurred in counties with sugar-cane crops and sugar-cane mills for alcohol production, in places lacking proper facilities for solid waste collection and disposal and lacking sewerage systems, and also those regions with poultry activities.

Some aspects related to fly proliferation are discussed below.

Vinassee Disposal

With the implementation of the National Alcohol Programme, which aims to encourage the production and consumption of hydrated alcohol as an alternative fuel, a substitute process for sugar-cane cultivation was started. The multiplication of mills, especially of small and medium size, has greatly aggravated the problem of final disposal of the vinasse, a residue from the alcohol production process with a high BOD and polluting potential (Gasi and Santos, 1984). Water and soil have been the vinasse receptors, usually without special care, and this has produced serious damage to both fauna and flora of the water resources and the soil.

In 1978, the Department of the Interior prohibited direct or indirect disposal of the vinasse in any water resource (Interior, 1978). Although the disposal of polluting agents on the soil had been prohibited since 1976 in São Paulo State, the legislation did not define clearly the limits and/or restrictions for such disposal (Law No. 997, 31 May 1976, has only 6 articles related to soil pollution, whereas it has 13 articles concerning water pollution). From 1978, the disposal of vinasse on the soil increased, which reduced pollution of the water resources, but caused another kind of environmental problem, namely, fly proliferation (Buralli and Guimarães, 1985).
Depending on how the vinasse is used in agriculture it may produce large areas of soil overloaded with the residue, providing an environment which encourages the proliferation of flies, especially Musca domestica (Buralli and Guimaraes, 1985). Fly problems are mainly related to blackstrap molasses (residual alcohol production), due to the increased content of organic material as compared to direct alcohol vinasse, produced by the direct fermentation of sugar-cane syrup. The organic content of residual alcohol vinasse reaches values as high as 63.4 kg/m³, whereas direct alcohol vinasse reaches values of 19.5 kg/m³ (Gloria, 1977).

The breeding sites of flies are located at the margins and surface of the vinasse and they decrease with depth. Factors influencing the choice of breeding sites are the moisture of the soil and the vinasse disposal rate. The optimal moisture is between 20 to 30% and larvae are not found in areas irrigated by sprinkling at rates between 30 and 60 m³/ha. In these areas, an average of 960 larvae per decm³ of substrate were found in the superficial layer (Buralli and Guimaraes, 1985).

Fly larvae may also be found on crusts or blocks of almost dry soil, which are formed in vinasse channels and basins. The increase of the liquid in these channels, even if by the action of rain, to over 70 mm/day, causes increased mortality of M. domestica larvae. Larvae killed due to loss of soil moisture caused by the sun begin a putrefaction process, and become targets for oviposition by Chrysomyia and M. domestica flies.

Another factor in fly control and proliferation is the pH of the soil and the vinasse. With vinasse disposal, there is initially a marked pH decrease, followed by an increase due to bacterial development, and values higher than 7.0 may be obtained (Gasì and Santos, 1984). The active fly breeding sites usually have a pH ranging from 6.5 to 8.5 (Buralli and Guimaraes, 1985).

Poultry Production

About two thirds of Brazilian exports are agricultural products, despite the large variety of exported articles (Lima, 1981; Nobrega, 1985). Moreover, fiscal and exchange incentives for exports give producers which aim at the foreign market privileges that those aiming at internal markets do not have (Lima, 1981; Nobrega, 1985). The country has thus become a great orange juice, sugar, meat and chicken exporter (Nobrega, 1985). One of the consequences in São Paulo State has been an increased number of poultry farms, and therefore an increase in the production of eggs and chickens. However, this increase was not followed by greater technical assistance to farm workers, or assistance in environmental management, since the departments in charge of these activities have given priority to urban regions.

Poultry manure is used by producers of other agricultural products (e.g., coffee, oranges) as fertilizer, and thus, the manure becomes an important factor in the budget of poultry farms in certain periods of the year. However, the manure is improperly stored as regards sanitary aspects before it is sold, and this provides favourable conditions for intense fly proliferation and dissemination to other regions. The demand for manure is also due to the interest in increased productivity which is attained by organic fertilizers.

Larvae are usually present in places where there are poultry faeces. The number of larvae varies depending on the degree of moisture of the faeces: in drier faeces which receive more ventilation and accumulate on the slats in chicken coops, larvae are found in the moist spots; on the floor, and the land surface, the number of larvae is larger than on the slats. A study carried out in a poultry farm in Assis, São Paulo, with about 2,100,000 chickens, showed that the faeces taken from permeable ground had a lower degree of moisture and, thus, fewer larvae, than faeces taken from cemented areas (SUCEN, 1984). The presence of larvae in manure stored indoors was reported although larger numbers of larvae were found in faeces heaped up outside. There is a prevalence of Musca domestica over Stomoxys calcitrans in poultry farms. However, the opposite may occur in certain places, especially those with less moisture.
Also due to the export economic model, people living in rural areas have moved into the towns in recent years, increasing the size of urban areas. Whereas 70% of the Brazilian population lived in the rural areas in 1950, thirty years later about 75% of the population lived in the urban areas of the country. Due to the cultural and economic aspects of this migrating population, there is a large number of piggeries in the urban areas of cities, mainly of small and medium size. These piggeries produce organic residues suitable for the proliferation of vectors and, furthermore, this urbanization of Brazil was not followed by a proportional increase in basic sanitary facilities for solid waste collection and disposal.

Refuse Collection and Disposal

The several steps that make up the public cleansing system (sweeping, collection, disposal, etc.) have different potentials for vector proliferation (Ramalho, 1980). There are several species that proliferate in garbage, especially *M. domestica*.

Although about 90% of the domestic garbage produced in São Paulo State is collected, in most cities the majority of it is improperly disposed of in big holes outside the town. In the last three years, about 50 sanitary landfills were introduced in the State. The disposal sites are frequently located near the urban areas, thus the flies proliferate there and then travel to residential areas. Another factor in insect dispersion is the search, by the people responsible for the piggeries, for organic residues in the garbage deposited in these landfills.

CONTROL ACTIVITIES

SUCEN suggests that the control of flies and other insects should be integrated, that is, the use, whether simultaneously or not, of several convenient and compatible measures, of which the most successful are those with permanent effects and environmental management, and those causing less negative effects in the environment. The advantages of environmental management measures are: efficacy in eliminating breeding sites; long-term effects and relatively low cost; remarkable additional benefits, besides contributing to the control of other vectors. Regarding control based upon the use of insecticides, this has the advantage of a quick reduction of the population density of flies. However, disadvantages are: temporary effect, requiring periodical use; consequently, increased long-term cost; the use of insecticides develops insect resistance, exacerbating the first two negative aspects of their use; and finally, risks of toxicity to humans and environmental damage and contamination. Besides environmental contamination risks, other problems with the use of insecticides are the high cost of both insecticides and equipment and the risk of affecting the biological control of the sugar-cane borer by flies from the Tachnidae family which is used in some areas (Buralli and Guimaraes, 1985). Moreover, low pH values may render the use of certain larvicides impossible (Buralli et al., 1980). Turning over of the soil, so that the larval foci are buried in the ground is an alternative control method.

Among the recent attempts to control larvae without using insecticides has been the use of calcium hydroxide for pH correction (which is not very successful), and the combined use of sodium tetraborate (borax) and lime (which has shown good results). The use of borax and lime is also recommended for poultry farms, in dosages of 0.3% and 3%, respectively, every fortnight underneath the cages after removing the faeces. The removal of faeces must be undertaken every week, and the manure should be stored in furrows covered with plastic canvas, preferably dark coloured. With the heat absorption there is increased mortality of fly larvae, pupas and eggs.

The implementation of SUCEN’s advice is achieved by technical assistance to City Halls, in the 'Programme of Assistance to Cities and Counties'.

Aiming at integrated control, SUCEN tries to involve other public or private departments in solving problems. Among such departments are: the Associação...
Soil disposal of residues (Neighbours Association), bodies responsible for technical assistance to rural workers, state agencies for pollution control, public health authorities, etc.

**FINAL CONSIDERATIONS**

The disposal of organic wastes, both liquid and solid, on the soil may cause serious problems of proliferation of vectors and eventually the transmission of diseases. Projects of organic waste disposal on the soil should have the participation and analysis of experts in the control of vectors.

**REFERENCES**


