(Z)-9-Tricosene based *Musca domestica* lure study on a garbage dump yard using plywood sticky trap baited with fish meal

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Abstract A study was undertaken to find out the efficacy of (Z)-9-Tricosene in attracting flies in a garbage dump yard using a plywood sticky glue trap with fish meal as a food bait. (Z)-9-Tricosene was dissolved in acetone or hexane before application on a filter paper strip fixed at the centre of the trap. The traps were left in areas of the garbage dump yard of high fly activity for 6 h and then the trapped flies were counted species wise. Significantly more number of *Musca domestica* flies were caught in (Z)-9-Tricosene treated fish meal baited traps compared to those traps without (Z)-9-Tricosene. No significant difference was noted in trap catches in (Z)-9-Tricosene treated traps between the solvents acetone and hexane. In addition *Sarcophaga* sp. and *Chrysomya* sp. flies were also caught in the traps.

Keywords Z-9-Tricosene · House fly · Sticky trap · Fish meal · Garbage dump yard

Introduction

The house fly, *Musca domestica* Linnaeus, is a well-known cosmopolitan pest of both farm and home. They accompany humans during all their daily activities everywhere, indoor, outdoor, work places, rest places causing much

disturbance and nuisance. In dairy farms, house flies cause a reduction in milk yield because cows waste lot of energy in fending off the flies and engage in avoidance behaviors that detract them from time spent on feeding and in poultry farms they cause economic losses by making specks on the eggs which reduce the egg quality. Huge fly populations also interfere with the routine farm work like feeding, milking etc. House flies are strongly suspected of transmitting at least 65 diseases to humans, including cholera, typhoid fever, dysentery, poliomyelitis, anthrax, tularemia, leprosy and tuberculosis. In addition, they also act as intermediate host for various helminth parasites affecting animals apart from acting as mechanical vectors.

Although intensive usage of insecticides is effective in immediate control of house flies, it suffers from serious drawbacks such as environmental hazard and residues in meat, milk, hide and skin. In addition, continued use of insecticides can lead to development of resistance and poses a health risk to human beings. One of the alternative environmental friendly methods of controlling house flies is by using pheromones. The best known are sex pheromones emitted usually by female flies to attract male flies. Common house fly sex pheromones have been sought by researchers but only one has been found to be effective namely (Z)-9-Tricosene. The present study was undertaken to find out the efficacy of (Z)-9-Tricosene using glue based plywood sticky trap baited with fish meal in a garbage dump yard.

Materials and methods

The field study was conducted on a garbage dump yard in the campus of Madras Veterinary College, Chennai, India. The traps were set up in the garbage dump yard where there

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was high fly activity. Experiments were replicated on six separate days. The plywood sticky trap was designed by following Hanley et al. (2004) with slight modifications. The fish meal used in the study was prepared from sardine fish (*Sardinella gibbosa*). Plywood board of 20 cm length, 10 cm width and 2 cm thickness was used to prepare traps. The board was painted with two coats of white, water soluble gloss paint. A white paper was first fixed on the surface of the board. Over the white paper, transparent polythene sheet was fixed using pins. Rat glue [Trubble Gum-Pest Control (India) Ltd.] was then smeared over the transparent polythene sheet to a thickness of 1 mm. A small pinch of finely powdered fish meal was sprinkled evenly over the glue surface without affecting the stickiness of the glue.

The synthetic female house fly sex pheromone (Z)-9-Tricosene (Sigma Aldrich) was used in the study. 50 µl of (Z)-9-Tricosene was mixed with 1,000 µl of acetone or hexane before application. A filter paper strip (2 × 2 cm) was fixed at the centre of the trap and the (Z)-9-Tricosene and solvent mixture was pipetted on to the filter paper just before keeping the traps in the garbage dump yard. Four such traps were prepared for each experiment. The trap composition is given in Table 1. The traps were prepared, labeled and kept on the floor in a longitudinal row close to each other during the study. The traps were kept in a shady area of the garbage dump yard for 6 h during day time from 10.30 a.m. to 4.30 p.m. Flies caught in each trap were counted and then a total count was made. New sheets were then fixed for the next experiment. The experiment was repeated six times. The data was subjected to statistical analysis by χ^2 test.

Results

Trap 2 (glue+powdered fish meal+(Z)-9-Tricosene dissolved in hexane) caught the maximum number of house flies followed by Trap 1 (glue+powdered fish meal+(Z)-9-Tricosene dissolved in acetone), Trap 3 (glue+powdered fish meal) and Trap 4 (glue alone) when observed 6 h after

installation of the traps (Fig. 1). The number of *M. domestica* flies caught in each trap is given in Table 2. Out of the total 968 house flies caught, 263, 288, 209 and 208 flies were caught in traps 1, 2, 3 and 4, respectively. Attracted flies got immediately stuck to the glue surface. Since the legs and wings got trapped in the glue, flies were unable to fly away and attempts made to escape made them further getting stuck to the glue surface. The flies were found dead after struggling for some time. Significant difference in the number of flies was observed in Z-9-Tricosene treated traps when compared to traps without Z-9-Tricosene. In addition, *Sarcophaga* sp. and *Chrysomya* sp. flies were also found to be attracted by the traps. Results are depicted in Tables 3 and 4.

The number of *M. domestica* flies caught in the traps with and without Z-9-Tricosene showed a high statistical significance ($\chi^2 = 26.46^{**}$, $P < 0.01$). However the trap catches of *M. domestica* in the Z-9-Tricosene treated traps using the two solvents acetone and hexane did not show any statistical significance ($\chi^2 = 1.59$). Similarly no statistical significance was observed in the control traps i.e. Fish meal and glue and glue alone traps ($\chi^2 = 0.001$). Analysis of the total catches in Traps 1 and 2 with Z-9-Tricosene and Traps 3 and 4 without Z-9-Tricosene showed a high statistical significance ($\chi^2 = 37.1^{**}$).

Discussion

One of the environmentally friendly methods is to lure and kill house flies by use of (Z)-9-Tricosene based plywood sticky traps. This study was carried out to find out the efficacy of a (Z)-9-Tricosene based plywood sticky trap baited with fish meal in attracting and killing house flies in a garbage dump yard. Statistically significant number of house flies were attracted towards traps with (Z)-9-Tricosene compared to controls irrespective of the solvents used. Out of the total 968 house flies caught, 551 flies were caught in traps with (Z)-9-Tricosene and 417 in traps without (Z)-9-Tricosene. Hanley et al. (2004) used (Z)-9-Tricosene based plywood targets for control of house flies in outdoor situations and observed that more number of flies was attracted towards Z-9-Tricosene based targets compared to controls. Similar observations were also made by Butler et al. (2007), Chapman et al. (1998) and Chapman et al. (1999) in livestock and poultry units. It was also observed that the number house flies were significantly higher in traps baited with (Z)-9-Tricosene and food bait compared with (Z)-9-Tricosene without food bait and therefore food baits were found to increase the trap catches. In the

Table 1 Traps and composition

Trap	Contents
1	Glue+powdered fish meal +(Z)-9-Tricosene dissolved in acetone
2	Glue+Powdered fish meal +(Z)-9-Tricosene dissolved in hexane
3	Glue+Powdered fish meal
4	Glue

Fig. 1 Flies attracted to (Z)-9-Tricosene based plywood sticky traps (Trap 1 and 2 are treated with (Z)-9-Tricosene) and Trap 3 and 4 are controls

Table 2 Number of *M. domestica* flies caught in each trap kept in the garbage dump yard for 6 h

Trap	Total number of flies caught	(%)
1	263	27.2
2	288	29.8
3	209	21.6
4	208	21.5
Total	968	

Table 3 Number of *Sarcophaga* sp. of flies caught in each trap kept in the garbage dump yard for 6 h

Trap	Total number of flies caught	(%)
1	5	31.3
2	7	43.8
3	3	18.8
4	1	6.3
Total	16	

present study fish meal was used as food bait and it was found to enhance the catch rates. The ammonia odour emanating from fish meal would have attracted flies towards the traps.

Table 4 Number of *Chrysomya* sp. of flies caught in each trap kept in the garbage dump yard for 6 h

Trap	Total number of flies caught	(%)
1	1	50
2	1	50
3	–	–
4	–	–
Total	2	

Glue forms an important entity in plywood sticky traps and several researchers have used many resins and glues in trapping flies. Rats glue is one among them and in the present study rats glue was used to make the sticky traps. Evaluation of rats glue to trap *M. domestica* was studied by Chin et al. (2008) and found that rat glue was effecting in trapping house flies. In the present study also rat glue proved to be an excellent trapping agent. But the disadvantage with glue is that it can get dried up and when the stickiness is lost even though flies get attracted and land on the trap it may not be efficiently restrained resulting in their easy escape from the traps. Another disadvantage of the plywood sticky traps is that these traps are saturated type of traps and after 6 h there was no place for new flies to land on since the glue surface was already saturated with flies. Therefore, (Z)-9-

Tricosene based non saturated traps can be devised for luring and killing more number of house flies and these traps can also be installed for a longer period of time.

In the present study *Sarcophaga* sp. and *Chrysomya* sp. of flies were also attracted towards the traps. Although (Z)-9-Tricosene is the specific pheromone for house flies it seemed to attract other flies also and in our observation the number of *Sarcophaga* sp. and *Chrysomya* sp. flies attracted also showed a typical pattern where in there was increased catch rate in (Z)-9-Tricosene treated traps compared to controls. Overall, the observations in the present study are in accordance with the findings of earlier researchers and results suggest that (Z)-9-Tricosene based fish meal baited glue traps can be tried to control house flies outdoor. The traps also need to be prepared in a low cost and need to be standardized for indoor situations. The use of pheromone based natural food baited traps and targets is one of the eco friendly methods in control of flies and will help tremendously in reducing environmental pollution and the

development of resistance to various insecticides routinely used in insect pest management.

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