Original Article

Effect of Triflumuron and Pyriproxyfen on *Musca domestica* L Larval Stages in the Laboratory

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Abstract

Background: The residual effect of triflumuron and pyriproxyfen on *Musca domestica* L larval stages was studied in the laboratory.
Methods: Both IGRs at varying concentrations ranging between 0.5 to 2.5 mg/L were placed inside beakers with mice chow and vitamin B complex and water as food for the 1st, 2nd and 3rd instars *M.domestica* larvae.
Results: Both IGRs inhibit *M. domestica* adult emergence of 98-98.5% when applied at the lowest concentration of 0.5 mg/L on the 1st instar, 93-97% of adult emergence inhibition on the 2nd instar,and 91-97% of adult emergence inhibition on the 3rd instar larvae respectively. There was no significant difference between triflumuron and pyriproxyfen on housefly adult emergence inhibition when fed to the 1st, 2nd and 3rd instars *M.domestica* larvae ($P > 0.05$). However, there was a significant difference between the IGRs and the control ($P < 0.05$).
Conclusion: Both triflumuron and pyriproxyfen are effective in inhibiting adult emergence of housefly *M domestica* and therefore should be recommended for fly control particularly in chicken farms and dumping grounds in Malaysia for housefly control activities.

Keywords: Triflumuron, Pyriproxyfen, Adult emergence inhibition, *Musca domestica* L.

Introduction

In Malaysia, Sulaiman et al. (1988a, b, 1989, 2000) isolated parasites and enteropathogenic bacteria from the external body surface and gut lumen of *Musca domestica* L., *Musca sorbens* Wiedemann and *Chrysomya megacephala* (Fabricius). As they also visit clean food, they are important mechanical transmitters of pathogens causing human diseases (Reid 1953, Greenberg 1973).

In fly management programme chemicals are extensively used. Combined use of insect growth regulator (IGR) and parasitoids would yield a better reduction in fly density (Srinivasan and Amalraj 2003). Axtell and Edwards (1983) utilized cyromazine as feed additive to caged layering hens under field conditions in high rise, wide span and narrow poultry houses, the chemical effectively controlled house flies (*M domestica*) and soldier flies (*Hermatia illucens*). William and Berry (1980) evaluated the IGR cyromazine as topical spray and feed additive for controlling the housefly *M. domestica* breeding in chicken manure and provided a 70% reduction of native house flies and 100% inhibition of laboratory reared house flies.

The objective of this study was to evaluate the residual effect of IGRs triflumuron and pyriproxyfen on the larval stages of *M domestica* L.in the laboratory.

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Materials and Methods

The *M. domestica* L. used was bred in the insectarium of Department of Biomedical Science, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia. The two IGRs evaluated were triflumuron (Starycide SC480) provided by Bayer Malaysia Sdn Bhd and pyriproxyfen (Sumilarv 0.5% G) supplied by Sumitomo Chemical Company Ltd Tokyo Japan. In each of the glass beaker of 250 ml capacity was placed 5g mice chow and vitamin B complex, 5 ml distilled water and 5 ml of triflumuron or pyriproxyfen of varying concentrations viz 0.5, 1.0, 1.5, 2.0 and 2.5 mg/L. 25 1st instar *M. domestica* L. larvae were placed inside each beaker using the forceps. The beakers were then covered with nettings. For the control, only mice chow and vitamin B complex with distilled water were placed in the beaker. After pupation, the pupae were collected and transferred to a small bottle and covered with cotton wool for adult emergence. The mortality of larvae and the number of formed pupae and adults emerging were recorded. Pupae were allowed to emerge into adults for 10 d, if unemerged they were assumed as dead. The efficacy of the IGRs triflumuron and pyriproxyfen were determined by counting the numbers of dead larvae, pupae and adults daily and removing them until mortality and adult emergence were completed. There were 8 replicates per treatment. The above experiment was repeated using 2nd and 3rd instar larvae of *M. domestica*. Statistical analysis with ANOVA followed by Pos Hoc Tests using LSD Multiple Comparisons.

Results

The effect of triflumuron on 1st instar *M. domestica* larvae indicated adult emergence inhibition of 98.0-100% at concentrations of 0.5-2.5 mg/L and 23.5% adult emergence inhibition for the control, respectively (Table 1). Effect of pyriproxyfen on 1st instar *M. domestica* larvae indicated adult emergence inhibition of 98.5-100% at concentrations between 0.5 to 2.5 mg/L and 18.0% adult emergence inhibition for the control respectively (Table 2).

There was no significant difference between triflumuron and pyriproxyfen on the housefly adult emergence inhibition when fed to the 1st instar larvae. However, there was a significant difference between the IGRs and the control ($P< 0.05$). The effect of triflumuron on 2nd instar *M. domestica* larvae indicated adult emergence inhibition between 93.0 to 100% at concentrations of 0.5-2.5 mg/L and 19.0% adult emergence inhibition for the control (Table 3). Effect of pyriproxyfen on the 2nd instar *M. domestica* larvae indicated adult emergence inhibition of 97.0-100% at concentrations varying between 0.5 to 2.5 mg/L and 13.0% adult emergence inhibition for the control respectively (Table 4). There was no significant difference between triflumuron and pyriproxyfen on the housefly adult emergence inhibition when fed to the 2nd instar larvae ($P> 0.05$). However, there was a significant difference between the IGRs and the control ($P< 0.05$). The effect of triflumuron on 3rd instar *M. domestica* larvae indicated adult emergence inhibition of 91.0-99.5% at concentrations between 0.5 to 2.5 mg/L and 6.5% adult emergence inhibition for the control respectively (Table 5). Effect of pyriproxyfen on 3rd instar *M. domestica* larvae indicated adult emergence inhibition of 97.0-100% at concentrations varying between 0.5 to 2.5 mg/L and 8.5% adult emergence inhibition for the control respectively (Table 6). There was no significant difference between triflumuron and pyriproxyfen on the housefly adult emergence inhibition when fed to the 3rd instar larvae. However, there was a significant difference between the IGRs and the control ($P< 0.05$).

Table 1. Residual effect of triflumuron on 1st instar *M. domestica* L.larvae and emerging pupae and adults in the laboratory

Concentrations (mg/L)	No. of L1 larvae	Mortality of L1 larvae (% in parentheses)	No. of pupae formed (% in parentheses)	Adult emergence (% in parentheses)	Adult emergence inhibition (%)
0.5	200	98 (49.0)	102 (51.0)	4(2.0)	98.0
1.0	200	112 (56.0)	88 (44.0)	2(1.0)	99.0
1.5	200	156 (78.0)	44 (22.0)	0 (0)	100
2.0	200	140 (70.0)	60 (30.0)	1(0.5)	99.5
2.5	200	163 (81.5)	37 (18.5)	0 (0)	100
Control	200	32 (16.0)	168 (84.0)	153 (76.5)	23.5

Table 2. Residual effect of pyriproxyfen on 1st instar *M. domestica* L. larvae and emerging pupae and adults in the laboratory

Concentrations (mg/L)	No. of L1 larvae	Mortality of L1 larvae (% in parentheses)	No. of pupae formed (% in parentheses)	Adult emergence (% in parentheses)	Adult emergence inhibition (%)
0.5	200	23 (11.5)	177 (88.5)	3 (1.5)	98.5
1.0	200	26 (13.0)	174 (87.0)	1(0.5)	99.5
1.5	200	28 (14.0)	172 (86.0)	0 (0)	100
2.0	200	44 (22.0)	156 (78.0)	1 (0.5)	99.5
2.5	200	61(30.5)	139 (69.5)	0 (0)	100
Control	200	22 (11.0)	178 (89.0)	164 (82.0)	18

Table 3. Residual effect of triflumuron on 2nd instar *M. domestica* L.larvae and emerging pupae and adults in the laboratory

Concentrations (mg/L)	No. of L1 larvae	Mortality of L1 larvae (% in parentheses)	No. of pupae formed (% in parentheses)	Adult emergence (% in parentheses)	Adult emergence inhibition (%)
0.5	200	56 (28)	144 (72.0)	14 (7.0)	93.0
1.0	200	65 (32.5)	135 (67.5)	7 (3.5)	96.5
1.5	200	80 (40.0)	120 (60.0)	2 (1.0)	99
2.0	200	93 (46.5)	107 (53.5)	3 (1.5)	98.5
2.5	200	102 (51.0)	98 (49.0)	0 (0)	100
Control	200	23 (11.5)	177 (88.5)	162 (81.0)	19.0

Table 4. Residual effects of pyriproxyfen on 2nd instar *M. domestica* L. larvae and emerging pupae and adults in the laboratory

Concentrations (mg/L)	No. of L1 larvae	Mortality of L1 larvae (% in parentheses)	No. of pupae formed (% in parentheses)	Adult emergence (% in parentheses)	Adult emergence inhibition (%)
0.5	200	18 (9.0)	183 (91.5)	6 (3.0)	97.0
1.0	200	19 (9.5)	181(90.5)	5 (2.5)	97.5
1.5	200	24 (12.0)	176 (88.0)	1(0.5)	99.5
2.0	200	26 (13.0)	174 (87.0)	1(0.5)	99.5
2.5	200	26 (13.0)	174 (87.0)	0 (0)	100
Control	200	14 (7)	186 (93.0)	174 (87.0)	13.0

Table 5. Residual effect of triflumuron on 3rd instar *M. domestica* L. larvae and emerging pupae and adults in the laboratory

Concentrations (mg/L)	No. of L1 larvae	Mortality of L1 larvae (% in parentheses)	No. of pupae formed (% in parentheses)	Adult emergence (% in parentheses)	Adult emergence inhibition (%)
0.5	200	16 (8.0)	184 (92.0)	18 (9.0)	91.0
1.0	200	25 (12.5)	175 (87.5)	8 (4.0)	96.0
1.5	200	40 (20.0)	160 (80.0)	4 (2.0)	98.0
2.0	200	62 (31.0)	138 (69.0)	4 (2.0)	98.0
2.5	200	89 (44.5)	111(55.5)	1 (0.5)	99.5
Control	200	6 (3.0)	194 (97.0)	187(93.5)	6.5

Table 6. Residual effect of pyriproxyfen on 3rd instar *M. domestica* L. larvae and emerging pupae and adults in the laboratory

Concentrations (mg/L)	No. of L1 larvae	Mortality of L1 larvae (% in parentheses)	No. of pupae formed (% in parentheses)	Adult emergence (% in parentheses)	Adult emergence inhibition (%)
0.5	200	11(5.5)	189(94.5)	6(3.0)	97.0
1.0	200	11(5.5)	189(94.5)	5(2.5)	97.5
1.5	200	16(8.0)	184(92.0)	1(0.5)	99.5
2.0	200	14(7.0)	186(93.0)	2(1.0)	99.0
2.5	200	15(7.5)	185(92.5)	0(0)	100
Control	200	10(5.0)	190(95.0)	183(91.5)	8.5

Discussion

Kelly et al. (1987) evaluated cyromazine against insecticide-resistant field strains of *M. domestica*. No tolerance to cyromazine was found, neither was there a direct correlation between larval responses to cyromazine and adult responses to other insecticides. It was concluded that cyromazine has a good potential for the control of houseflies that exhibited high levels of resistance to other insecticides. Vazirianzadeh et al. (2007) studied the effects of oral application of cyromazine and triflumuron on housefly larvae. Both IGRs had sufficient effect on larval mortality compared with their controls. It was concluded that cyromazine should be used in a larvicidal programme to control housefly rather than triflumuron.

In the present study both triflumuron and pyriproxyfen had residual effects on all the larval stages of *M. domestica*. Both IGRs inhibit adult emergence of 98 to 98.5% when applied at the lowest concentration of 0.5 mg/L on the 1st instar, 93 to 97% adult emergence inhibition on the 2nd instar and 91 to 97% adult emergence inhibition on the 3rd instar larvae. According to Hatakoshi et al. (1987) S-31183 (now called pyriproxyfen) was more effective than methoprene and diflubenzuron against 4-day old larvae of *M. domestica* in artificial medium and more active than methoprene against eggs and 4-day-old larvae of *M. domestica* in the chicken manure medium. Kostina (1999) studied the influence of pyriproxyfen on preimaginal stages of *M. domestica* and *Aedes aegypti*. The presence of 10, 20, and 40 grams preparation per square meter of surface the number of fly puparia was 62.2%, 50% and 38.7% respectively. The emergence of adults was 0.5% in the case of 10 gram per square meter, and it was completely absent in the latter cases. According to Zhang and Shono (1997), the toxicity of pyriproxyfen gradually increased from the early stage of 3rd instar larva of houseflies to the white pupal stage. Further studies indicated that the white pupa was the most susceptible stage to the chemical and the mortality of pupae decreased sharply after the white pupal stage.

In conclusion, both triflumuron and pyriproxyfen are effective in inhibiting adult emergence of housefly *M. domestica* and therefore should be recommended for fly control particularly in chicken farms and dumping grounds in Malaysia for housefly control activities.

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