

A Cross-sectional Survey of Knowledge and Practices Related to Cyromazine Usage among Layer Farmers of Haryana

Deepak Soni¹, Vijay J. Jadhav^{2*}, Pallavi Moudgil³ and Khushbu¹

Department of Veterinary Public Health and Epidemiology, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar 125 004, Haryana, India

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ABSTRACT

Pesticides are widely used to combat diseases and pests that may adversely affect the production of vegetables and animal foodstuffs. Cyromazine (CYR) is used as an insect growth regulator for fly control in cattle manure, field crops, vegetables and fruits. A cross-sectional study was carried out in 52 layer farms to assess the knowledge and practices of farmers regarding CYR usage and to identify the predisposing risk factors. The findings of the present study suggested that 57.69% farmers had knowledge of CYR and are adding it in the feed of layers as larvicidal agent. Data analysis revealed cleanliness practices at the farm (OR: 5.143, 95% CI: 1.403-18.858), number of birds kept at the farm (OR: 17.417, 95% CI: 4.307-75.146) and fly density in the farm (OR: 6.22, 95% CI: 1.836-21.090) as possible risk factors significantly associated with CYR usage in the layer farms. Keeping in view the public health concerns of CYR usage, better managerial practices and monitoring of pesticide usage in layer farms need to be strengthened.

Key words: Cyromazine, Knowledge, Layer farms, Practices, Risk factors

Introduction

Haryana is a north Indian state with 3rd highest egg production after Andhra Pradesh and Tamil Nadu with per capita availability of 250 eggs per annum (CEIC, 2022). Pesticides are widely used to combat diseases and pests that may adversely affect the production of vegetables and animal foodstuffs. Chemical methods are useful in reduction of fly density and fly-associated morbidities in various countries (Chavasse *et al.*, 1999; Emerson *et al.*, 1999). The intensive egg production system is characterized by housing of layer birds in a high-density cage system which leads to the accumulation of large quantities of wastes (manure, used litter, dead birds). This waste material is an excellent breeding place for

flies, especially house flies. These flies cause irritation to people, contaminate the food with microbes and also acts as vectors for many pathogenic microorganisms (Dogra and Aggarwal, 2010). In the rural areas, houseflies cause irritation and discomfort to livestock and indirectly lead to decreased animal productivity (Kamaraj *et al.*, 2012). Miller *et al.* (1993) reported that the high densities of the housefly leads to reduction in egg production in layer birds and also cause annoyance to the farm workers. Raipur-Rani situated in Panchkula district of Haryana is the second leading layer belt in India after Tamil Nadu. Layer farms in this area are responsible for causing a great fly problem to the locality leading to public outcry (Dogra and Aggarwal, 2010).

Layer farmers use variety of pesticides which in-

(¹M.V.Sc., ²Professor, ³Scientist)

clude dimethoate, tetrachlorvinphos, permethrin, cyfluthrin, pyrethrins, methomyl, fipronil, spinosad and cyromazine (Scott *et al.*, 2000). Out of these, only CYR is used as supplement in the feed of layer birds as it has larvicidal activity in the manure (Berry, 2003). This pesticide is an insect growth regulator with chitin synthesis inhibitor activity and widely used for fly control in cattle manure, field crops, vegetables and fruits (Roberts and Huston, 1999; EMEA, 2001; FAO, 2007). CYR undergoes metabolism by dealkylation or environmental degradation in both plant and animals to form a metabolite product melamine (MEL), which can bind with its analogues, such as cyanuric acid to form crystals which may induce significant renal toxicity and carcinogenic effects in humans and is of great public health concern (Sancho *et al.*, 2005; Baynes *et al.*, 2008). The residues of CYR and MEL can sometimes find their way into the environment and human diet (Ecobichon, 2001). CYR and MEL residues can also pass in the eggs of layer birds fed on CYR treated feed which upon consumption may lead to serious health effects in the consumers (Bao *et al.*, 2011). Keeping in view all the factors, the present study was designed to assess the knowledge and practices of farmers regarding cyromazine usage in layer birds and to identify the predisposing risk factors associated with the CYR usage in these farms.

Materials and Method

The present study was conducted between March, 2022 to September, 2022. The sampling frame for survey consisted of layer farms of five districts (Panchkula, Ambala, Panipat, Sirsa and Hisar) of Haryana, India that were in production at the time of study. A total of 52 layer farms were selected on the basis of CYR usage in the feed and capacity of birds in the farm. Out of these, 25 layer farms were from Barwala-Raipur Rani belt of Panchkula district, 5 from Ambala district adjacent to Panchkula, 4 from Hisar district, 15 from Panipat district and 3 from Sirsa district. Layer farms in Barwala-Raipur Rani belt of Panchkula district and Hisar district were visited thrice whereas layer farms of Panipat district, Sirsa district and Ambala district was visited once. A structured questionnaire was designed using EpiInfo™ software (CDC, Georgia, USA) to conduct farm-level epidemiological survey to identify the predisposing risk factors associated with fly menace in the layer farms as well as to assess the

knowledge and practices of layer regarding CYR usage in these farms. The answers to the questionnaire were recorded by personal interview with the layer farmers. Data analysis was carried out using STATA™/IC 15.1 (Stata Corp, College Station, TX). The associations between the usage of CYR in these farms and all the variables was carried out using chi-square test (χ^2). The strength of the associations was assessed by calculating odds ratio (OR) at 95% confidence interval. A p -value <0.05 was considered as significant.

Results and Discussion

In total, 52 respondents from 5 districts participated in this study. The response rate from respondents was good. The results of the socio-demographic characteristics of the respondents are presented in Table 1.

Knowledge of respondents regarding pesticides

The majority of the layer farmers (75%) used only chemical measures for fly control. The common chemicals used for fly control in these farms were organophosphate compounds, synthetic pyrethroids, neonicotinoids, insect growth regulators and Kaolin (Fig. 1). Similar patterns in the control of house flies using these insecticides were previously reported by Sathiamoorthy *et al.* (2018). Depending on the density of the fly population, these were used as single or multiple fly control agents. The fly population was at its peak in the Panchkula district's Barwala-Raipur Rani belt during the months of March-April and September-November. The favourable environmental conditions *i.e.* relative humidity $>80\%$, temperature range of $35-40^\circ\text{C}$ and rainfall shoot up the fly intensity in this poultry belt which leads to the fly menace in the nearby areas.

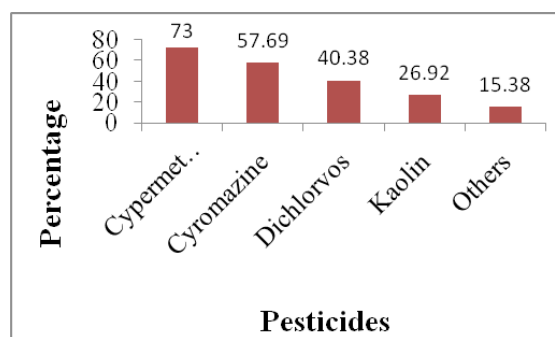


Fig. 1. Bar diagram depicting pesticide usage by layer farmers (%)

Similar patterns have been observed in previous studies (Sathiamoorthy *et al.*, 2018; Dogra and Aggarwal, 2010). Moreover, 70% of layer farmers were using CYR of the Larvadex brand followed by 26.67% of the Cyromax brand and 3.33% of the Trigard brand. About, 66.67% of layer farmers in the Panchkula-Ambala region used CYR as a fly control agent above the recommended levels (500 g/100 kg). Similar patterns were observed by Acevedo *et al.* (2009) where the poultry farmers in Argentina used the CYR for a longer period of resulting in fly control failures. The other researchers also reported the development of resistance against CYR in the house fly population (Ponnudurai *et al.*, 2009; Bloomcamp *et al.*, 1987; Sathiamoorthy *et al.*, 2018; Kristensen *et al.*, 2003). However, according to Khan and Akram (2017) if the CYR is used for the duration of 4-6 weeks at the recommended levels for fly control, resistance to this pesticide in house fly decreases. Among various pesticides, CYR offers a safe and affordable option for the control of flies (Taylor *et al.*, 2012). It is interesting to note that 100% of farmers had knowledge of pesticides and they use it in several ways like spray, sugar bait, in feed *etc.*

Management practices at layer farms

Farm management practices are critical for maximizing production and combating disease. Twenty of the 52 farms had poor cleanliness practices, and 30 of them had a high to very high fly density. More fly population annoys the nearby locality. Further, 25 farms were located less than 3 km area from the

residential locality causing more annoyance to the people residing there. According to the present survey of feeding practices, 86.54% of farmers used a twice-daily feeding schedule. Whereas, 94.23% of the farmers used self-made feed and the remaining 5.77% of the farmers used commercially available feed. Egg production is an important economic factor and the present survey found that 73% of layer farms had less than 80% of egg production per year. All farmers (100%) followed the recommended vaccination schedule. Mortality in the farms may be due to poor management practices, season, diseases/outbreak *etc.* It was observed that 59.62% of farms had a mortality of less than 25 birds/ day, whereas 40.38% of farms had a mortality of more than 25 birds/ day. Out of 52 farms, 30 farms from the Panchkula and Ambala districts collectively had a history of using CYR.

Statistical analysis

Data analysis revealed that cleanliness practices at the farm, the capacity of the birds and fly density in the farm were possible risk factors ($p < 0.05$) associated with the usage of CYR in the feed of layer birds. Table 2 shows the outcome variables with their OR, 95% C.I. and p -value. The farms with more than 75,000 birds were at a higher risk of using CYR as compared to farms with less than 75,000 birds. Similarly, farms with poor cleanliness practices were at a greater risk of using CYR as compared to the farms with fair cleanliness practices (OR: 5.143, 95% CI: 1.403-18.858). Moreover, the farms with high to very

Table 1. Knowledge of layer farmers regarding pesticide usage, management practices and socio-demographic factors

S. No.	Variable (n=52)	Results (%)	
1	Knowledge and usage of pesticides in farm	100	
2	Knowledge and usage of cyromazine in feed	57.69	
3	Knowledge about pesticide residues appear in eggs of treated birds	11.53	
4	Measures adopted to control fly problem in farm	Chemical only (75)	Chemical and Herbal (25)
5	Dose of cyromazine used in Panchkula-Ambala region (n=30)	At recommended level (33.33)	Above recommended level (66.67)
6	Feeding schedule	Twice (86.54)	More than Twice (13.46)
7	Egg production per year	Less than 80%(73)	More than 80% (27)
8	Type of feed	Self made (94.23)	Commercial (5.77)
9	Mortality (per day)	<25(59.62)	>25(40.38)
10	Vaccination	100	
11	Gender	Male (100.00)	Female (0.00)
12	Experience (in years)	<10 (55.77)	>10 (44.23)
13	Education level	Up to Secondary level (61.54)	Above secondary level (38.46)

Table 2. Risk factors depicting significant and non-significant association with usage of cyromazine in feed

S. No.	Variable	Unique value	Total (n=52)	Percent positive for pesticide (n=30)	Odds ratio	95% Cumulative interval		p value (Chi square)
						Lower value	Higher value	
1	Cleanliness practices at farm	Fair Poor	32 20	14 (43.75) 16 (80.00)	5.143	1.403	18.858	0.020*
2	Number of birds kept at farm	<75000 >75000	27 25	8 (29.6) 22 (88.00)	17.417	4.307	75.146	0.001
3	Fly density in the farm	Low to Moderate High to very high	30 22	16 (53.33) 14 (63.63)	6.22	1.836	21.090	0.004
4	Reach to Locality	<3 km >3km	25 27	09 (36.00) 21 (77.77)	1.531	0.496	4.724	0.573
5	Disposal of dead birds	Buried Open dumping/sell	43 9	25 (58.13) 5 (55.55)	0.9	0.212	3.828	1
6	Manure Management	Sold Burnt	41 11	24 (58.53) 6 (54.54)	0.850	0.223	3.245	1

* $p < 0.05$

high fly density were at a greater risk of usage of CYR as compared to the farms with low to moderate fly density (OR: 6.22, 95% CI: 1.836-21.090). Dogra and Aggarwal (2010) reported similar findings, observing that the majority of the layer farms under study were unclean, with droppings of the layer birds accumulating under the cages in the intensive egg production system, leading to more fly problems and thus more use of CYR in layer feed. Reach to the locality, dead bird disposal, and manure management were not found to be significantly associated with CYR usage but were found to be significantly associated with increased fly density in farms. The findings of the present study revealed that the residential area located >3 km from the layer farm had no significant association with the usage of CYR in the farm. Similar observations were reported by Dogra and Aggarwal (2010), where the fly problem decreased significantly in the control areas more than 5 km away from the poultry farms. In the present study, most of the farmers (82.6%) were following the practice of burying dead birds which might be the reason for less fly intensity.

Conclusion

The current study identified the potential risk factors associated with farmers' use of CYR in layer feed and suggests that better management practises

can reduce the fly menace on the farm and thus the use of CYR. Further, it was concluded that there was a huge fly problem in the Barwala Raipur Rani belt of the Panchkula district due to the presence of layer farms in this region and irregular usage of CYR and poor management practices were responsible for the fly menace in the area. Awareness campaigns should be initiated to educate the farmers about the judicious usage of pesticides. Keeping in view the public health concerns of cyromazine usage, urgent and appropriate administrative and public health actions need to be taken. Furthermore, routine surveillance and monitoring of cyromazine usage by layer farmers should be implemented to combat the fly menace in the Panchkula district's Barwala Raipur Rani belt.

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Conflict of interest

The authors declared no conflicts of interest that are directly or indirectly related to the work submitted for publication.

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