

**ECOLOGY AND CONTROL OF EYE FLIES *SIPHUNCULINA* SPP.  
( CHLOROPIDAE : DIPTERA )****\*T. V. SATHE AND DIVYA JADAV***Department of Zoology, Shivaji University, Kolhapur - 416 004, India.***ABSTRACT**

Kolhapur district of Maharashtra, India is high populated, leading in agriculture and industries and very rich in biodiversity. High rainfall (6000 mm) and decaying organic bodies of plants and animals prevail eye flies *Siphunculina* spp. (Chloropidae: Diptera) in the region from February third week to September third week every year. *Siphunculina* spp. have the forensic and medical importance. Extremely large aggregations of eye flies were common in areas of loose sandy soils and decaying organic matters in and around city Kolhapur and its tahasils. The high concentrations of flies were a great nuisance to humans and animals. Specially, agricultural, recreational, institutional and tourist areas. Eye flies were responsible for transmitting acute conjunctivitis, "pink eye" and several other diseases to humans and live stock. The flies were attracted to fluids secreted by eyes, nose, ears, wounds and excrements of humans and other animals. Four species of the genus *Siphunculina* namely *S. funicola*, *S. ulceri*, *S. faciata* and *S. striatata* were prevalent in Kolhapur region. Out of which *S. funicola* was dominant over others and *S. ulceri* was moderate. *S. funicola* and *S. ulceri* completed their life cycles within 2 weeks and 3 weeks respectively. Disposal of aggregation sources of flies and decaying organic matters and treating such breeding places with 0.03/DDVP/malathion /Azadirachtin can control the eye flies.

**KEYWORDS :** Eye flies, *Siphunculina*, Ecology, control.**T. V. SATHE**

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## INTRODUCTION

Eye flies (Chloropidae: Diptera) are nuisance to humans and domestic animals which feed on mucus membrane and various secretions from the eyes, nose, ear and wounds and other moist surfaces of their hosts. They aggregate on many hanging substrates like strings, electrical lines, electrical wires, ropes, nest trailing, decorations, cob webs, clothes hangers, etc. Eye flies (*Siphunculina*, *Liohippelates*) are noxious pests of man and domestic animals and potential vectors of pathogenic organisms (fungi, bacteria, viruses etc.) to man and domestic and wild animals (Chansang *et al.* 2010). In Kolhapur district species of the genus *Siphunculina* are responsible for transmitting active conjunctivitis (pink eye) in humans and domestic animals. From India, four species of the genus *Siphunculina* namely *S. funicola* (de Meijere), *S. striatata* (Wiedemann), *S. ulceri* Cherian and *S. faciata* Cherian has been reported (Cherian, 1977). Hence, their ecology and control strategies are given in the paper. Review of literature indicates that eye flies have been studied by Thompson (1954), Burgess (1957), Taplin *et al.* (1967), Ontrato *et al.*, (2005), Chansang (2007), Chansang *et al.*, (2010) etc

## MATERIALS AND METHODS

Ecological studies of eye flies have been carried out from Kolhapur district of Maharashtra, India from six tahasils namely Shirol, Karveer, Gargoti, Ajra, Radhanagari and Gaganbavada. The selection of tahasils was based on climatic and geographical conditions. Kolhapur is situated between 15° to 17° North latitude and 73° to 74° East latitude occurring 1,46,575 hectares land and uneven rain from 700 mm to 6000 mm. The survey of eye flies was conducted during the years 2012-2014 from above mentioned six tahasils by collecting eye flies fortnightly. Eye flies were collected aurally, without touching the human host, to prevent contamination, using sterile collecting container by one man one hr search method. Aggregating and host seeking flies were also collected by sterile container. The container was kept open in one hand, in another hand cap was taken and flies

were captured by closing suddenly the container with cap. The eye flies hovering close to humans were captured in the air using above method. The flies collected were time being kept in 70% alcohol and later, slides were prepared by adopting the standard method of dehydration. In another method, a cotton thread of 6 inch long and 2 mm in diameter was kept hanging as sitting source for eye flies. From distal 1 inch area the eye fly population on the thread was counted with the help of a large lens. Fortnightly count of flies was continued till the disappearance of the flies. Spot observations of eye flies were also made on aggregation of flies on host bodies specially eyes, nose, ears, wounds and their secretions, excrements and other secretions diurnally. Dispersal and mating and oviposition behaviours were also recorded by spot observations. For life cycle studies 15-20 eye flies were confined in glass cage, 25 x 25 x 25 cm for mating and further oviposition on loose soil layer of ½ inch of decaying organic matter, placed at bottom of the cage. Eggs were laid in loose soil. After hatching the eggs, larvae fed decaying organic matter and pupated in soil and then became adults. Within 2-3 weeks eye flies developed from egg to adult.

## RESULTS

Results are recorded in tables 1 to 4 and figs 1 to 3. The survey studies indicated that four species of the genus *Siphunculina* were prevalent in Kolhapur district. However, *S. funicola* was dominant over others. *S. ulceri* was moderate and second most prevalent species of the region. While, *S. faciata* and *S. striatata* were very low in population (Table-3) and mostly associated with wild/field animals. *S. funicola* and *S. ulceri* were associated with humans, domestic animals and wild animals in the region. The eye flies occurred from the 3<sup>rd</sup> week of February and remain present up to the September 3<sup>rd</sup> week. The incidence peak was noticed in the months April, May and June. However, after the onset of monsoon, the population of eye flies was decreased, but not a significant change in population was noticed in tahasils Radhanagari and

Gaganbawada (Table-3). The same trend in eye fly incidence was noticed with association of humans, buffalo and dogs (Table 1 & 2). The danger of cold months, October to January was passed by the flies by going into the diapause in the pupal stage. The field sex ratio (m: f) of eye flies was favouring the females (1 : 1.125). *S. funicola* and *S. ulceri* completed their life cycles from egg to adult within 2 weeks and 3 weeks respectively (Table - 4) under laboratory conditions ( $27\pm 1^{\circ}\text{C}$ , 65-70% RH,  $12 \pm 1$  hr photoperiod). Mating occurred at day time from 8.00 am to 12.00 noon. Both mates females were polygamous, mated frequently. Mating period ranged from 2 min to 6 min (average 3.5 min). Mated females oviposited in loose soil containing decaying organic matter of plants and animals. A single mated female laid about 40-50 eggs. The females were more fecund in monsoon than its over. *S. funicola* completed its life cycle from egg to adult within 2 weeks while, *S. ulceri* taken 3 weeks for completion of its life cycle from egg to adult. Biological activities of adults of *S. funicola* and *S. ulceri* were highest between the temperatures  $30^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ , 65% to 80% R.H. and  $12\pm 1$  hr photoperiod in Kolhapur region. Extremely large aggregations of eye flies were common in areas of loose soils and decaying organic

plant or animal matters. The high concentration of flies were a nuisance to humans, domestic animals and wild animals. Specially in agricultural, recreationals, zoos, and tourist areas eye flies *S. funicola* and *S. ulceri* were prevalent while, *S. faciata* and *S. triatata* were mostly associated with forest environment and wildlife. The flies were attracted to fluids secreted by their hosts from eyes, nose, ears, wounds and excrements of humans and other animals both domestic and wild. Their aggregation were noted on hanging objects like cotton threads, ropes, electric wires, decorations, twines, strings, trailings, abandoned cobwebs etc. They dispersed for at least 2 kms in search of suitable place of breeding. They were attracted to their hosts by audio visual and chemical stimuli. They immediately attracted to their hosts from the radius of 100 ft. from aggregation source. Both, males and females were attracted to humans. Eye flies fed on the secretions of eyes, nose, ears, wounds, lachrymal secretions of humans and other animals. They also fed on decaying fruits of mango, custard apple, Sapodilla and Jackfruit etc. A aggregation source of cotton thread of 6 inch long and 2 mm diameter showed about 200 to 250 eye flies and within 1 inch from distal region were 30-40 flies.

**Table - 1**  
**Incidence of eye fly *S. funicola* in Kolhapur**  
**(by 1 Inch thread counting method)**

Sr. No.	Tahasil	Rainfall (mm)	No. of flies counted									
			Jan	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
1.	Shirol	750	--	12	24	33	35	36	30	24	10	--
2.	Karveer	1050	--	14	30	36	36	32	28	20	11	--
3.	Gargoti	1375	--	11	21	32	31	32	29	18	9	--
4.	Ajra	2000	--	10	20	30	32	30	28	18	9	--
5.	Radhanagari	2500	--	11	22	32	30	30	29	15	8	--
6.	Gaganbawada	6000	--	10	20	31	30	28	24	20	7	--

**Table - 2**  
**Incidence of eye fly *S. funicola* on domestic**  
**animals from Kolhapur district (2012-2014)**

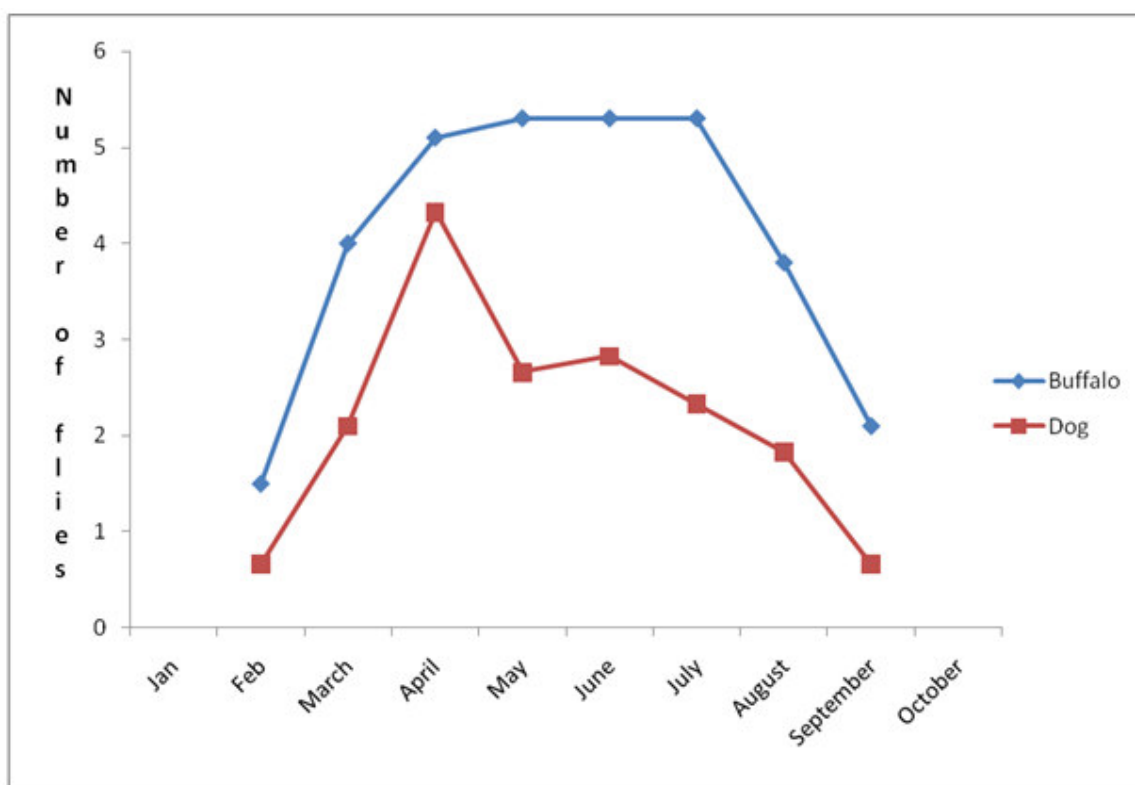
Sr. No.	Tahasil	Rainfall (mm)	No. of flies counted										Animals	
			Jan	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Buffalo	Dog
1.	Shirol	750	--	2	5	7	7	6	6	5	2	--	40	28
2.	Karveer	1050	--	2	6	7	6	6	6	4	1	--	38	22
3.	Gargoti	1375	--	1	5	6	6	5	5	3	1	--	32	18
4.	Ajra	2000	--	1	3	5	6	6	5	2	1	--	29	15
5.	Radhanagari	2500	--	2	3	3	4	5	5	5	4	--	31	14
6.	Gaganbawada	6000	--	1	2	3	4	5	4	4	7	--	25	12

**Table - 3**  
**Abundance of *Siphunculina* species in Kolhapur district**

Species	Tahasils surveyed and abundance of species					
	Shirol	Karveer	Gargoti	Ajra	Radhanagari	Gaganbawada
<i>S. funicola</i>	+++	+++	+++	+++	+++	+++
<i>S. ulceri</i>	++	++	++	++	++	++
<i>S. faciata</i>	+	+	+	+	++	++
<i>S. Striatata</i>	+	+	+	+	++	++

**Table - 4**  
**Development and life cycle duration of eye flies**

Species	Incubation (days)	Larval days	Pupal days	Adult formation (days)
<i>S. funicola</i>	2	6	6	14
<i>S. ulceri</i>	2-3	11	8	21-22



**Figure.1**  
**Incidence of *S. funicola* on Buffalo and dog in Kolhapur district**



**Figure. 2**  
***S. funicola* aggregating on hanging thread**



**Figure.3**  
***S. funicola* adult flies.**

***As a preventive control of eye flies following strategies found suitable.***

- i) Earthling of soil frequently for exposing eggs, larvae and pupae for natural mortality factors viz. biotic and abiotic.
- ii) Disposal of decaying organic matter of plant and animal origin associated with human dwelling and cattle sheds.
- iii) Periodic disposal of aggregation sites of eye flies.

***Curative control strategies of eye flies adopted were***

- i) Use of attractants and killing of flies.
- ii) Use of repellents like DEET.
- iii) Burning hanging population either at day or night.
- iv) Spraying breeding places and aggregating places with following insecticides 0.03% DDVP/ Malathion / Azadirachtin / phosphamidon.

## **DISCUSSION**

Many species of eye flies breed and feed on grass and other plant vegetable debris (Mulla and Chansang, 2007). The present form *S. funicola* breeds in loose soil containing debris of plants and animals. According to Sabrosky

(1987) both *Liohippелates* spp. and *Hippelates* spp occurred in most of the North America and about 270 species of eye flies were described from this region. Both above genera were absent in Kolhapur and only the

genus *Siphunculina* was represented from the region by only four species namely *S. funicola*, *S. ulceri*, *S. striatata* and *S. faciata*. Out of which *S. funicola* was dominant, *S. ulceri* was moderate and *S. faciata* and *S. striatata* were very low in population in Kolhapur district. According to Machtinger and Kaufman (2011) *Liohippelates pushio* was found through out the year in USA while, *L. bishoppi* was found from February to September only. In the present study *S. funicola* was also found from February to September. The abundance of males around human eyes in late summer / early autumn in *Phortica variegata* might be attributed to their need of dietary protein supplementation. In Southern Italy, the largest number *Phortica* flies have been collected during summer (July-August) in hilly to mountainous wooded areas with high relative humidity. Similarly, in the present study high number of eye flies, have been noted in hilly centers like Radhanagari and Gaganbavada which showed high rain and high % of humidity. *P. variegata* was also reported more in number on dogs, cats, foxes and humans in hilly region of France, Portugal, Spain and Switzerland where *Thelaria callipaeda* (Nematodae) infested more hosts mentioned above. In U.S.A. east significant eye fly species were *L. pusio* and *L. bishoppi*. From Central America and the Caribbean four species *L. currani*, *L. flavipes*, *L. pallipes* and *L. peruanus* have been indicated as potential significant. However, *S. funicola* the oriental eye fly, was the main species causing intolerable nuisance to humans in orient and south and south east Asian regions, including India (Russel *et al.*, 2013) while, in Sri Lanka *S. funicola* was replaced by *S. ceylonica* (Russel *et al.*, 2013). The life cycle of *P. variegata* was completed within a minimum of 9 days (in July and August) to a maximum of 18 days (in June) (Russel *et al.*, 2013). In the present study *S. funicola* and *S. ulceri* have completed their life cycles within 2 weeks and 3 weeks respectively. *Liohippelates* spp. can disperse for 7.5 km for feeding. *L. collusor* was strong flier in the genus *Liohippelates*. In the present study, *S. funicola* travelled for at least 2 km from the aggregation place for breeding, however, the flies immediately attracted to humans from the radius of 100 ft. of aggregation source. As like *Phortica* spp.

*S. funicola* was also found feeding on lachrymal secretions of animals and humans. *P. variegata* showed characteristic flight pattern around the bait before landing. Males were mostly associated with the host while females were mostly associated with baits (fermented fruits). *S. funicola* was also showed typical landing behaviour on aggregation source. A single aggregation source (cotton thread) resided 200-250 eye flies. In *P. variegata* sex ratio was variable while in *S. funicola* the sex ratio was favored the females and the males and females were polygamous. *P. variegata* acted as a vector of *T. callipaeda* when feeding on the conjunctiva of vertebrate hosts. While feeding, eye flies ingested the first stage larva from the conjunctival sac of host. The nematode larvae, second and third stage developed into the body of eye fly, reached the proboscis and finally deposited into the conjunctival sac of a new receptive host after about 4 weeks. Both males and females of *P. variegata* were carriers of the nematode larvae. In India, filaria is transmitted to humans and domestic animals by mosquitoes *Culex pipiens*, *Mansonia* group and *Anopheles* spp. (Sathe *et al.*, 2012). However, it will be very interesting to detect the role if any of *S. funicola* as vector of *Wuchereria bancrofti* in transmitting filarial from infested hosts to new healthy hosts in India and other countries. Changsang *et al.*, (2010 b) studied the role of *S. funicola* in transmitting pathogenic bacteria to hosts in Thailand. They isolated bacteria from *S. funicola* captured from wounds, host sucking flies and from their resting sites.. WHO (2004) suggested that eye flies were found to carry a large number of bacteria, gram-positive and gram-negative, most of the bacteria were in risk category-2. *L. flavipes* and *L. pallipes* transmitted Yaws in Jamaica and South America. Yaws is a skin infection that causes ulceration and affects bone and cartilage too. Yaws affected the children under the age 15 and the disease was common in poor communities and in crowded conditions (DNZ, 2010). In India, *S. ulceri* was found causing ulcers in domestic animals in Kolhapur region. Sepsis is bacterial disease transmitted by *Liohippelates* sp. which affected immune responses and other body functions. No such record is available in India. In cattle *Liohippelates*

caused acute bovine mastitis (Sanders, 1940). Vesicular Stomatitis (Viral diseases) was also known in cattle, horses, sheeps, goats and pigs. The above genus was not found in India. Since large numbers of bacteria are transmitted to humans, equines, bovines, canines and others for causing various diseases. There is a need to make the constant surveys of the eye flies and to monitor their epidemiological role in the region. Simultaneously, ecofriendly control measures are also needed. The preventive and curative control measures suggested in the text will be helpful for control of eye flies

at large extent. However, chemical control creates problems like pollutions, health hazards, killing of beneficial organisms, pest resistance, pest resurgence, secondary pest out break etc. hence more emphasis should be given on biological and ecological control for protecting environment and life of humans and other animals.

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