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Studies on infestation of Uzi fly during silkworm rearing in different seasons in West Bengal at laboratory condition

Kunal Sarkar, Mousumi Biswas and Paramita Das

Abstract
Present paper deals with incidence of Uzi fly in different seasons of West Bengal under laboratory condition during silkworm rearing. The result clearly indicates that Uzi infestation in West Bengal is more in rainy season followed by summer. But in winter season infestation is almost negligible. Present investigation also suggests that control rearing where all precautionary measures are taken in a rearing room to prevent the entry of Uzi fly is more beneficial than experimental batch where no precautionary measures are indicated to prevent Uzi fly. Present experiment also reveals that infestation of Uzi fly varied due to different position of rearing trays and infestation of Uzi fly was more in the upper part of the rack.

Keywords: Silkworm, Uzi fly, Summer season, rainy season, winter season

Introduction
The Tachinid fly Exorista bombycis [Louis] popularly known as Uzi fly belongs to Diptera. It is an endoparasite of silkworm *Bombyx mori* L. in all the silk growing areas of South East Asian countries. Sengupta *et al.*, 1990 [11] stated that the incidence of this fly pest is very high in tropical sericultural region *viz.* Bangladesh, Southern parts of China, India, Thailand and Vietnam. According to him the pest inflicts a considerable loss in sericulture industry and estimated between 10 to 30%. Krishnaswami *et al.*, 1964 [7] stated that in West Bengal, seasonal damage of silkworm cocoon crops due to this parasitoid infestation exceeds 40%. Crop loss due to Uzi infestation was reported to be 0.008-11.6% in West Bengal by Bhattacharya *et al.*, 1993b [3] and Chakraborty *et al.*, 1996 [4]. Introduction of this parasitoid into sericultural tract of South India was reported in May, 1980 [1]. According to Jolly and Kumar (1985) [6], this fly was first noticed in Bylanarasipura village of Hoskote Taluk of Bangalore district during May, 1980. According to them outbreak of Uzi fly in West Bengal was happened due to the procurement and transportation of infested seed cocoons from West Bengal by the interested quarters from Karnataka, obviously for preparation of cross breed layings. Since then, Uzi fly menace possesses a serious threat to sericultural industry in Southern belt. Due to Uzi infestation, the yield of the cocoons per 100 DFls was reduced to as low as 5 to 10 kg in many villages in Karnataka [2]. Narayanswamy, 1991 [10] stated that temperature plays a key role on the incidence of *Exorista bombycis*. He also stated that generally, the incidence reaches the maximum during the monsoon season *i.e.*, from June to September followed by winter (October-January) and least in summer (February-May). According to him the longevity of the fly is reported to be inversely proportional to temperature *i.e*, higher the temperature lowers the adult longevity. Kumar, 1987 [9] reported that the maximum infestation takes place during rainy season followed by winter and least in summer. Dandin, 2003 [5] reported that the pest inflicts considerable loss to sericulture industry. According to him its incidence is maximum from July to November. In this context, the present investigation was carried out to evaluate the incidence of uzi fly in different seasons of West Bengal under laboratory condition.

Materials and Methods
The silkworm rearing was conducted during the Summer (April-May), Rainy (june-July) and Winter (November) crop in the Department of Sericulture, Krishnath College, Berhampore [19m MSL 24º50', 88o13'E], Murshidabad, West Bengal.

Experimental race: Nistari× (SK6×SK7)

Initiation of silkworm rearing

The hybrid layings were kept in incubation at 25°C till blue egg stage, subsequently brushed and put to rear with mulberry leaves. The silkworm larvae were reared upto 3rd moult in conventional leaf feeding method [8]. After 3rd moult the larvae were divided in two batches and each batch with three replications. Each replication was maintained with 400 larvae and in two trays taking 200 larvae each in rearing tray (starting from top to bottom). One batch was treated as control, where experiment was conducted by taking all precautionary measures in a rearing room to prevent the entry of Uzi fly. Another batch was considered as experimental batch [Test group], where rearing was conducted under uncontrolled condition in a rearing room where no precautions was taken to prevent the entry of Uzi fly, had rather allowed to oviposit the fly. Oviposition of the flies on the silkworm larvae and subsequent development of maggot have been studied elaborately. Ovipositional behaviour of the flies was also marked meticulously. Rearing data of the experiment as well as Relative humidity and Temperature were recorded during the rearing time.

Observation Uzi fly in different seasons

A. Summer Season [APRIL-MAY]

Table 1: Incidences of Uzi fly at different stages of silkworm *Bombyx mori* L. in control batch

Stages of Silkworm	Total Number of Silkworm larvae In Each Replication along with infested larva			Total	Percentage of Uzi infestation
	Replication1 [400]	Replication 2 [400]	Replication3 [400]		
3rd instar	0	0	0	0	0%
4th instar	0	0	0	0	0%
5th instar	16	7	2	25	2.08%
Cocoon Stage	8	3	1	12	1%
Total	24	10	3	37	3.08%

Table 2: Incidences of Uzi fly at different stages of silkworm *Bombyx mori* L. in experimental [Test] batch.

Stages of Silkworm	Total Number of Silkworm larvae In Each Replication Larvae in Each Replication along with infested larva			Total	Percentage of Uzi infestation
	Replication1 [400]	Replication2 [400]	Replication3 [400]		
3rd instar	0	0	0	0	0%
4th instar	44	37	15	96	8%
5th instar	58	42	20	120	10%
Cocoon Stage	50	40	1 8	108	9%
Total	152	119	53	324	27%

Table 3: Incidence of Uzi fly in different tray position in control batch*

Total Number of Replication	Tray Position	Incidence of Uzi Fly	Percentage
Replication 1	1st position [Top] 2nd position	10 6	5% 3%
Replication 2	3rd position 4th position	4 3	2% 1.5%
Replication 3	5th position 6thposition [Bottom]	2 0	1% 0%

*Total infestation occurs during larval stages (25 numbers) found in different position of trays

Table 4: Incidence of Uzi fly at different tray position in Experimental [test] batch*

Total Number of Replication	Tray Position	Incidence of Uzi Fly	Percentage
Replication 1	1st position [Top] 2nd position	54 48	27% 24%
Replication 2	3rd position 4th position	45 34	22.5% 17%
Replication 3	5th position 6th position [Bottom]	25 10	12.5% 5%

*Total infestation occurs during larval stages (216 numbers) found in different position of trays

Table 5: Record on temperature and humidity during silkworm rearing conducted in April – May

Stages of Silkworm	Temperature	Humidity
4th Instar 1st day	29^{0}c	72%
2nd day	29^{0}c	69%
3rd day	30^{0}c	70%
4th day	31^{0}c	67%
5th Instar 1st day	32^{0}c	75%
2nd day	34^{0}c	78%
3rd day	33^{0}c	81%
4th day	34^{0}c	79%
5th day	33^{0}c	80%
6th day	35^{0}c	84%

B. Rainy season [JUNE-JULY]

Table 6: Incidence of Uzi fly at different stages of silkworm Bombyx mori L. in control batch.

Stages of Silkworm	Total Number of Silkworm larvae In Each Replication along with infested larva			Total	Percentage of Uzi infestation
	Replication 1 [400]	Replication 2 [400]	Replication 3 [400]		
3rd instar	0	0	0	0	0%
4th instar	0	0	0	0	0%
5th instar	24	13	09	46	3.83%
Cocoon Stage	14	9	4	27	2.25%
Total	38	22	13	73	6.08%

Table 7: Incidences of Uzi fly at different stages of silkworm Bombyx mori L. in experimental [Test] batch.

Stages of Silkworm	Total Number of Silkworm larvae In Each Replication Larvae in Each Replication along with infested larva			Total	Percentage of Uzi infestation
	Replication 1 [400]	Replication 2 [400]	Replication 3 [400]		
3rd instar	0	0	0	0	0%
4th instar	57	41	19	117	9.75%
5th instar	81	53	35	169	14.08%
Cocoon Stage	88	60	35	173	14.41%
Total	226	154	79	459	38.25%

Table 8: Incidence of Uzi fly in different tray position in control batch*

Total Number of Replication	Tray Position	Incidence of Uzi Fly	Percentage
Replication 1	1st position [Top] 2nd position	15 09	7.5% 4.5%
Replication 2	3rd position 4th position	7 6	3.5% 3%
Replication 3	5th position 6thposition[Bottom]	6 3	3% 1.5%

*Total infestation occurs during larval stages (46 numbers) found in different position of trays

Table 9: Incidence of Uzi fly at different tray position in Experimental [test] batch*

Total Number of Replication	Tray Position	Incidence of Uzi Fly	Percentage
Replication 1	1st position [Top] 2nd position	80 58	40% 29%
Replication 2	3rd position 4th position	55 39	27.5% 19.5%
Replication 3	5th position 6th position [Bottom]	36 18	18% 9%

*Total infestation occurs during larval stages (286 numbers) found in different position of trays

Table 10: Record on temperature and humidity during silkworm rearing conducted in June – July

Stages of Silkworm	Temperature	Humidity
4th Instar 1st day	28^0c	78%
2nd day	28^0c	76%
3rd day	29^0c	77%
4th day	30^0c	75%
5th Instar 1st day	30^0c	80%
2nd day	32^0c	81%
3rd day	33^0c	84%
4th day	32^0c	84%
5th day	31^0c	85%
6th day	33^0c	87%

C. Winter season [NOV-DEC]

Table 11: Incidences of Uzi fly at different stages of silkworm Bombyx mori L. in control batch.

Stages of Silkworm	Total Number of Silkworm larvae In Each Replication along with infested larva			Total	Percentage of Uzi infestation
	Replication 1 [400]	Replication 2 [400]	Replication 3 [400]		
3rd instar	0	0	0	0	0%
4th instar	0	0	0	0	0%
5th instar	4	3	2	09	0.075%
Cocoon Stage	3	2	1	06	0.005%
Total	07	05	3	15	1.25%

Table 12: Incidence of Uzi fly at different stages of silkworm Bombyx mori L. in experimental [Test] batch.

Stages of Silkworm	Total Number of Silkworm larvae In Each Replication Larvae in Each Replication along with infested larva			Total	Percentage of Uzi infestation
	Replication 1 [400]	Replication 2 [400]	Replication 3 [400]		
3rd instar	0	0	0	0	0%
4th instar	6	4	1	11	0.091%
5th instar	9	5	3	17	1.41%
Cocoon Stage	8	6	3	17	1.41%
Total	23	15	7	45	3.75%

Table 13: Incidence of Uzi fly in different tray position in control batch*

Total Number of Replication	Tray Position	Incidence of Uzi Fly	Percentage
Replication 1	1st position [Top]	02	1%
	2nd position	02	1%
Replication 2	3rd position	02	1%
	4th position	01	0.5%
Replication 3	5th position 6thposition[Bottom]	02	1%
		00	0%

*Total infestation occurs during larval stages (09 numbers) found in different position of trays

Table 14: Incidence of Uzi fly at different tray position in Experimental [test] batch*

Total Number of Replication	Tray Position	Incidence of Uzi Fly	Percentage
Replication 1	1st position [Top]	10	5%
	2nd position	05	2.5%
Replication 2	3rd position	05	2.5%
	4th position	04	2%
Replication 3	5th position 6thposition[Bottom]	03	1.5%
		01	0.5%

*Total infestation occurs during larval stages (28 numbers) found in different position of trays

Table 15: Record on temperature and humidity during silkworm rearing conducted in June – July

Stages of Silkworm	Temperature	Humidity
4th Instar 1st day	23^0c	70%
2nd day	23^0c	71%
3rd day	24^0c	69%
4th day	24^0c	68%
5th Instar 1st day	24^0c	70%
2nd day	23^0c	69%
3rd day	23^0c	67%
4th day	242^0c	66%
5th day	22^0c	69%
6th day	23^0c	67%

Results and Discussion

It is observed that the rate of uzi infestation is significantly lower in the tune of 2.08% in 5th instar silkworm larvae and 1% manifestation in cocoon stage in control batch compared to experimental [Test] batch [Table 1 & Table 2] where as in the experimental [Test] batch the Uzi infestation started at the beginning of 4th instar effecting 8% and 10% in 5th instar plus 9% manifestation in cocoon stage [Table 2] in Summer season. In case of Rainy season uzi infestation is also significantly higher in the tune of 3.83% in 5th instar silkworm larvae and 2.25% manifestation in cocoon stage in control batch compared to experimental [Test] batch [Table 6 & Table 7] where as in the experimental [Test] batch the Uzi infestation started at the beginning of 4th instar effecting 9.75% and 14.08% in 5th instar plus 14.41% manifestation in cocoon stage [Table 7]. Uzi infestation is least in winter season where only 0.075% infestation is found in 5th instar and 0.05% more infestation is found in cocoon stage in control batch (Table-11) where as in experimental batch the Uzi infestation started at the beginning of 4th instar effecting 0.091% and 1.41% in 5th instar plus 1.41% manifestation in cocoon stage [Table 12]. This result clearly indicates that Uzi infestation in West Bengal is more in rainy season followed by summer. But in winter season infestation is almost negligible. This observation is similar in terms of Summer and Rainy Crop laid by Narayanswamy, 1991 [10], according to him incidence reaches the maximum during the monsoon season *i.e*., from June to September and least in summer (February-May). According to him the longevity of the fly is reported to be inversely proportional to temperature *i.e*, higher the temperature lower the adult longevity. But this observation is also differed from observations laid by most of the Southern researchers where they found incidence is more in winter than summer [5, 9, 10]. In West Bengal it is presumed that due to heavy infestation of white muscardine in winter crop may reduce the incidence of Uzi fly.

Present investigation also suggested that control rearing where all precautionary measures are taken in a rearing room to prevent the entry of Uzi fly is more beneficial than experimental batch where no precautionary measures are indicated to prevent Uzi fly. Since the control rearing was prevented to oviposit the fly, there should not have been infestation even though the same was recorded in lower rate that too in later stage of 5th instar as and when manage to get in touch with them, presumably due to the instinct behavior of the fly with the action of allelo chemicals for their survival strategy. However, the tendency of fly ovipositing more on the top trays (Table-3, 4, 8, 9, 13, 14) is simple as soon as it enter instantly get attracted to the top trays and then move downwards. Interesting enough that single gravid fly lays eggs not more than 2 to 3 per silkworm larvae, so that it can cover the maximum population, the another important survival strategy being parasitic in nature. Incidence and manifestation of Uzi fly in cocoon stage in the tune 1%, 2.25%, 0.005% in control batch and 9%, 14.08% and 1.41% in experimental [Test] batch in summer, rainy and winter crop

respectively clearly indicates that in these cases oviposition time during spinning stage of the larvae only. Because the fly egg after hatching enter into the spinning larvae and metamorphosised into maggot within a week, by this time the silkworm larvae managed to spin the cocoon and maggot escaped from the cocoon by damaging the larva or pupa inside, through a small puncture by the release of enzyme cocoonase and thus metamorphosed into pupa outside the cocoon.

In reality the favourable environment conditions are conducive for the exponential growth of fly population as recorded 27% and 38.25% infestation respectively in experimental [Test] batch in summer and rainy season since temperature 29-35◦C and 28-33 ^{0}C (Table 5 &10) respectively in summer and rainy and relative humidity 72-84% and 78-87% (Table 5 &10) respectively in summer and rainy were at optimum level for the growth and development in West Bengal. But in winter season temperature ranges from 22-24◦C (Table-15) and Relative Humidity 67%-71% (Table-15) do not favour the incidence of Uzi fly.

Conclusion

The West Bengal is rich in bio-diversity, the insect biocoenose in particular. More over silkworm rearing is continuous throughout the year alternated with seed crop and commercial crop. Then the availability of host is ensured for the parasitic fly to thrive well and rise and depletion of the fly community is maintained through natures balance. But it is also true that nowadays infestation of Uzi fly is gradually decreasing in West Bengal which also promotes open type of rearing in West Bengal.

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Conflict of interest

The author declares that there is no conflict of interest for this study.

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