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Significance of Forensic Fly and Seasonal Variation in the Temperature of Developmental Stages in Lifecycle for Family Sarcophagidae, *Sarcophaga Africa*

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Abstract: *Sarcophaga Africa, is one of the hairy maggot flesh flies which feeds on meat carrion, and dead and decaying matter of animals to the completes its life cycle which is the useful for post mortem interval (PMI). Determination in forensic investigations. The actual life cycle hours and days are calculated due to their morphological parameter of their life cycle of Sarcophaga Africa were studied in different seasons; Life cycle in rainy season was completed in 270± 1.25 hrs (11.25 ± 0.40 days), when the maximum temperature was 27.02°C and the minimum temperature was 26.4°C; in summer season when the maximum temperature was 36.6°C and the minimum temperature 33.2°C, the life cycle was completed in 220± 1.17 hrs (6.16. ± 0.10 days), while in cycle was completed in 310 ± 1.35hrs (12.91 ± 0.21 days) when the maximum and minimum winter season life cm temperatures were 27.4°C and 17.2°C respectively. The temperature is the important role to determine the developmental stages of life cycle of Sarcophaga Africa which should be considered during PMI determination. The external parameters of different stages differ from season to season. Larvae were healthy and bigger in size in rainy season but in summer were short and small sized. The size of larvae in winter season was also smaller than the size in both summer and rainy seasons.*

Keywords: Forensic Insect, PMI season , lifecycle duration; Temp change.

I. INTRODUCTION

Forensic entomology deals with entomological evidence that is relevant in legal cases, particularly those related to corpses. Proper identification of evidence is crucial as a misidentification may lead to inaccurate and erroneous conclusions of potentially dramatic consequences. Identification is usually made on the basis of morphological characters observed on adults and compiled in identification keys. However, morphological characters are sometimes difficult to be observed or do not provide a good discrimination among related taxa (Smith, 1986, Gennard, 2007, Wells & Stevens, 2010).

Flesh flies of the genera Sarcophaga (Diptera: sarcophagidae) are of considerable medical and economic importance, since they are known as myiasis producing agents in animals and humans; and they can be used to determine the post mortem interval (Gomeset. al., 2003).The development stage of insect species helps forensic specialist to determine time since death .Recovered insects from human cadavers, mostly fleshfly and flesh flies larvae, can provide information on the conditions experienced by a body following death To determine time since death, considerations of the critical factors affecting the rate of decomposition are important. These factors include location of the body, temperature, general climate, time of year, insect activity, animal activity in the area, and the amount of rainfall (Nafte, 2000). Temperature is the most important factor affecting developmental rate Temperature and access to the cadaver are two important factors affecting insect succession and temperatures generally reduce the developmental period of Diptera.(Campobasso et al., 2001).

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II. MATERIALS AND METHODS

Sarcophaga Africalarvae were collected from dead dogat cholai village of Poladpur tehsilon raigad district (M.S)-India and reared in the laboratory in the rearing box by feeding daily on fresh liver of sheep and goat and water sweetened with honey.Morphological identification was done in the laboratory using the identification keys (Sukontason et al., 2003).About 80 eggs were collected in indifferentseasons (rainy, summer and winter) with the help of fine brush and 50 eggs each were reared at the laboratory conditionand the duration of different developmental stages and their morphological parameters (length, width and weight) were determined. The temperature and the humidity were recorded by Hygro-thermometer clock OPTILAB Model THC-20.

III. OBSERVATION AND RESULTS

Sarcophaga Africa, one of the fleshflies known as hairy maggot fleshfly, adult has face and cheeks with dense silvery hairs, anterior spiracle of the adult is open and proepisternal seta (stigmatic bristle) present, The larvae have tubercles hence called hairy maggot, these tubercles along the body segment are knobs encircling mostly half of lower surface, spines are round-knob turned spirally three times around the base of each tubercle; absence of hairy like structure at the base of tubercles in the caudal region; anterior spiracles always with 09 papillae and very rear 08 papillae. Life cycle duration of Sarcophaga Africain rainy season was completed in 270 ± 1.25 hrs (11.25 ± 0.40 days),Table.1) when the maximum temperature was 27.02°C and the minimum temperature was 26.4°C, but in summer season when the maximum temperature was 36.6°C and the minimum temperature 33.02°C, the life cycle was completed in 220± 1.17 hrs (06.16.04 ± 0.10 days), (Table. 2)while in winter season cycle was completed in 310 ± 1.35hrs (12.91 ± 0.21 days)when themaximum and minimum temperatures were 27.4°C and 17.2°C respectively (Table. 3). Size of the different developmental stages varied from season to season; in summer season, the size of different stages was smaller than same stage in rainy season and bigger than the same stage in winter season.

Table 1: Duration of different life cycle stages of Sarcophaga Africain rainy season

Hours	Developed stage	Length (mm)	Width (mm)	Weight (mg)	Temperature (°C)			Humidity (%)		
					Max.	Min.	Avg	Max	Min	Avg
15	Eggs	1.2 ± 0.08	0.4 ± 0.07	0.29 ± 0.02	28.1	26.3	27.2	70	46	56.5
39	1st Instar	4.4 ± 0.11	2.1 ± 0.25	9.6 ± 0.9	28.1	26.3	27.2	70	40	55
72	2nd Instar	8.5 ± 0.15	3 ± 0.02	26.2 ± 0.05	28.2	26.2	27.2	75	41	58
104	3rd Instar	11.2 ± 0.26	3.5 ± 0.28	55.4 ± 0.32	27.6	26.4	27.00	75	41	58
150	Prepupae	10.6 ± 0.14	4.2 ± 0.9	46.4 ± 0.05	27.2	26.2	26.7	76	39.00	57.5
270	Pupae	8.2 ± 0.36	3.2 ± 0.219	39.5 ± 0.13	27.3	26.5	26.4	70	43.42	56.71
	Adult	8.3 ± 0.27	3.6 ± 0.11	32.3 ± 0.19	27.5	26.5	27.00	75	38	56.5

±) Indicate SD of five values

Table 2: Duration of different life cycle stages of Sarcophaga Africain summer season

Hours	Developed stage	Length (mm)	Width (mm)	Weight (mg	Temperature (°C)			Humidity (%)		
					Max	Min	Avg	Max	Min	Avg
11	Eggs	1.00 ± 0.05	0.2 ± 0.04	0.25 ± 0.01	35.1	33.3	34.2	71	50	60.50
30	1st Instar	4.1± 0.09	1.1 ± 0.24	8.6 ± 0.9	35.1	33.3	34.2	71	48	59.50
62	2nd Instar	7.5 ± 0.13	2± 0.02	22.2 ± 0.04	35.2	33.2	34.2	76	47	61.50
84	3rd Instar	10.2 ± 0.24	2.5 ± 0.26	49.4 ± 0.29	36.6	34.4	35.50	76	49	62.50
130	Prepupae	9.6 ± 0.12	3.2 ± 0.5	41.4 ± 0.2	36.2	34.2	35.2	77	49.00	63.00
220	Pupae	7.2 ± 0.36	2.2 ± 0.27	32.5 ± 0.09	36.3	34.5	35.4	72	53.42	62.71
	Adult	7.3 ± 0.27	2.4 ± 0.10	27.3 ± 0.13	36.5	34.5	35.00	78	58	68

±) Indicate SD of five values

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Table 3: Duration of different life cycle stages of Sarcophaga Africain winter season

Hours	Developed stage	Length (mm)	Width (mm)	Weight (mg)	Temperature (°C)			Humidity (%)		
					Max.	Min.	Avg	Max.	Min.	Avg
20	Eggs	1.43 ± 0.02	0.4 ± 0.05	0.22 ± 0.02	27.4	21.1	24.3	31	26	28.50
48	1st Instar	4.5 ± 0.12	1.4 ± 0.11	8.2 ± 0.15	23.6	20.1	22.4	31	30	30.50
80	2nd Instar	7.2 ± 0.21	2.8 ± 0.12	24.3 ± 0.27	23.2	21.2	22.8	29	27	28.00
120	3rd Instar	9.6 ± 0.07	3.5 ± 0.26	47.7 ± 0.20	21.6	19.2	21.1	26	25	25.50
170	Prepupae	8.4 ± 0.20	4.4 ± 0.21	47.2 ± 0.21	21.6	18.2	20.5	25	24	24.50
310	Pupae	8 ± 0.31	4. ± 0.14	42.4 ± 0.34	21.8	17.6	20.1	25	23	24.00
	Adult	8.1 ± 0.22	3.7 ± 0.24	45.1 ± 0.03	21.6	17.2	19.8	24	20	22.00

±) Indicate SD of five values

IV. DISCUSSION

Sarcophaga Africais a species of medical and economic importance (Sukontason et al. 2008) and playing an important role in solving the forensic cases (Smith, 1986;) This flesh fly is one of the first colonizers of the corpse. Higher temperatures generally prop up egg hatching and accelerate maturation of larvae which can double their size in few hours. If the sarcophagidae larvae have reached maximum length at the peak of feeding, they tend to decline progressively and about 75% of the sarcophagidpre-adult cycle may be spent in post feeding and pupation .The morphological parameter of different stages differs from season to season. Larvae were healthy and bigger in size in rainy season but in summer season life cycle duration was short and the size of different stages was small while in winter season the life cycle duration was longer than rainy season but the size in winter season also smaller than the size in rainy season. Study on the effect of temperature on the different developmental stage of Sarcophaga Africaand life cycle duration in rainy season and low constant temperature 10 °C reported that in rainy season life cycle duration completed in 11.04 ± 0.08 days when the maximum and minimum temperature were 29°C and 26°C respectively. But in low constant temperature 10 °C life cycle was completed in 25.38 ± 0.16 days (AbdAlgalil and Zambare, 2015), they reported impact of temperature on the morphological parameters in rainy season and low constant temperature. Effect of fluctuation of temperature on development of sarcophagidflies Protophormiaterraenovae was reported at 4-28°C and 9-23°C to their mean constant temperature, 16°C and, found that generally development at the greater fluctuation was fast and at the constant temperature was slow. The effect of summation rate is suspected to have caused this difference in development rate because fluctuations above the mean enhance the rate comparatively more than temperatures below the meancan lower the rate (Warren and Anderson, 2013).For forensic investigations, entomological evidences found in criminal scene around the corpse are collected and preserved according to medico-legal standard procedures. Alsomicroclimatic temperatures obtainable in the maggot's immediate environment at criminal site is established and linked retrospectively with the air temperature records. Assuming an average constant temperature, as is the case with corpses found indoors, maggots or pupae which recovered from the scene are stored at a constant temperature till they pupate or the first adults emerge out. Then their age can be used for PMI determination (Grassberge and Reiter, 2002).

V. CONCLUSION

In this study the effect of temperature on the life cycle of *Sarcophaga Africa*in different season indicate that life cycle duration in rainy season was completed in 11.25 ± 0.40 days, but in summer season was 6.16. ± 0.10 days, days while in winter season was completed in 12.91 ± 0.21 days. The high temperature accelerated the development in summer and delayed the development in winter season by about 3 days. Larvae were healthy and bigger in size in rainy season and small in summer season, while in winter season larvae were smaller than summer and rainy season. Temperature plays an important role in period of life cycle stages and hence correct temperature changes should be considered for PMI determination after the life cycle stages of *Sarcophaga Africa*are collected from corpse.

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