

USE OF *Parasarcophaga* SPECIES FOR FORENSIC INVESTIGATIONS DURING RAINY SEASON IN AHMEDNAGAR M.S., INDIA

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ABSTRACT

Sarcophagid species are found in different seasons and different locations. The main objective of this research is to identify life cycle of *Parasarcophaga ruficornis* flies in rainy season for PMI estimation. Most of the work has been done in Europe, America and Australia but in India very little work is done on this aspect. In rainy season some of sarcophagid species are active. In Ahmednagar region *P. ruficornis* is commonly found in rainy season. The flies were allowed to lay the larvae and the life cycle stages were studied every day. The maximum and minimum temperature and humidity were recorded every day since the temperature and humidity plays important role in the span of the life cycle stages. Flies are larviparous and lay first instars larvae. The maggots took four days to reach the pupation stage, while pupation lasted for eleven days to emerge as the adult. The whole life cycle was completed in sixteen days.

KEYWORDS : Post mortem interval, life cycle, *Parasarcophaga ruficornis*

The main aim of forensic entomology is to establish the PMI (postmortem interval) (Rodriguez and Bass, 1983; Anderson, 1995; Benecke, 1998) i.e. the time, which has elapsed since the death or more exactly how long a dead body has been exposed to the environment. Study of cadaveric fauna is a valid method of establishing the time of death and helps the police investigations. The use of insects in death scene investigations dates back to the 13th century in China (Tzu, 1981) and came into use in Europe in the 19th century. Sarcophagid flies used as forensic indicators (Oliva, 1997; Byrd and Castner, 2001).

To date, entomology has not been used in legal investigations in India. Blowflies and flesh flies (Diptera) are the most important decomposers and the first colonizers of carrions (Tenorio et al., 2003). Therefore, they are important tools in providing an objective estimate of the minimum postmortem interval (PMI_{min}).

If we know how long *Parasarcophaga ruficornis* takes to reach the different stages of life cycle in rainy season, time can be calculated since the maggots was laid (Catts and Goff, 1992; Greenberg and Kunich, 2002; Amendt et al. 2004). This calculation of the age of the *Parasarcophaga ruficornis* can be considered as an estimate of the time of death. But even if the estimate of the insect age is correct, the death of the victim (usually) occurs before the maggots are laid. This period is quite variable and depends on temperature, time of day the death occurred, time in year the death occurred, whether the corpse is exposed or immersed in soil or water.

MATERIALS AND METHODS

The *Parasarcophaga ruficornis* (Sarcophagidae) was used as the biomaterial. Rearing necrophagous insects was problematic, due to the odour of the putrefying meat. Various diets have been described for rearing necrophagous fly maggot (Singh, 1977) which may be used for maggot therapy (Sherman and Pechter, 1988) and other investigations. Raw meat was frequently used.

Partially putrefied liver/meat was exposed in the air and within few minutes the flies were attracted. The flies were collected by the insect collecting net and were released in the insect rearing cages. In laboratory environment, rearing of some insect species can prove to be an extremely difficult task, but fortunately the needs of most insects of forensic importance easily met in captivity. Effective laboratory rearing was conducted in a room at the natural temperature and humidity in rainy season. Such environmental conditions are acceptable and will work well for a variety of rearing situations conducted outside of an environmental chamber. The stages of the same species were cultured together in rearing containers as necessary to accommodate the requirements.

RESULTS AND DISCUSSION

P. ruficornis is the most frequent species found in rainy season. On first day the flies laid first instar maggots. Length of these maggots was 0.114 cm, width 0.083 cm and weight 0.002 gm. They pass into second instars maggot. Then into third instars maggots whose length was 1.597 cm,

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Table 1: Morphometric Study of Life Cycle Stages of *Parasarcophaga ruficornis* in Rainy Season

Day	Time	Stage	Length (cm)	Width (cm)	Weight (gm)	PMI Days	Temperature °C		Humidity %	
							Max	Min	Max	Min
1 st Day	4.24pm	Maggot	0.114± 0.010	0.083± 0.007	0.002± 0.00	-	38.7	25.6	88	40
2 nd Day	9.00 am	Maggot	0.341± 0.032	0.169± 0.013	0.021± 0.001	1	38.7	25.6	88	39
3 rd Day	9.00 am	Maggot	1.589± 0.13	0.312± 0.029	0.089± 0.008	2	38.7	25.6	87	40
4 th day	9.00 am	Maggot	1.597± 0.16	0.333± 0.031	0.115± 0.010	3	38.7	25.6	88	40
5 th day	9.00 am	Pupa	1.032± 0.09	0.448± 0.042	0.097± 0.009	4	38.7	25.6	88	40
6 th Day	9.00 am	Pupa	1.031± 0.08	0.444± 0.041	0.096± 0.009	5	38.7	25.6	88	40
7 th Day	9.00 am	Pupa	1.026± 0.09	0.443± 0.041	0.096± 0.009	6	38.7	25.6	81	40
8 th Day	9.00 am	Pupa	1.125± 0.10	0.443± 0.041	0.095± 0.093	7	38.7	25.6	81	40
9 th Day	9.00 am	Pupa	1.125± 0.09	0.443± 0.040	0.094± 0.009	8	38.7	25.6	81	40
10 th Day	9.00 am	Pupa	1.123± 0.08	0.443± 0.040	0.095± 0.009	9	38.7	25.6	81	40
11 th Day	9.00 am	Pupa	1.124± 0.09	0.442± 0.039	0.095± 0.0093	10	38.7	25.6	81	40
12 th Day	9.00 am	Pupa	1.125± 0.10	0.442± 0.039	0.095± 0.009	11	38.7	25.6	81	40
13 th Day	9.00 am	Pupa	1.125± 0.09	0.440± 0.038	0.094± 0.009	12	38.7	25.6	81	40
14 th Day	9.00 am	Pupa	1.126± 0.10	0.440± 0.038	0.094± 0.009	13	38.7	25.6	81	40
15 th Day	9.00 am	Pupa	1.125± 0.09	0.439± 0.041	0.093± 0.009	14	38.7	25.6	81	40
16 th Day	9.00 am	Adult Fly	1.124± 0.10	0.121± 0.010	0.058± 0.005	15	38.7	25.6	81	40
		Empty Pupa	0.927± 0.089	0.411± 0.039	0.015± 0.003					

± indicates the standard deviation

width 0.333 cm and weight 0.115cm. Posterior spiracle of third instar maggot is the identification marks of species. Maggot stage lasts up to 4 days.

After full growth of larva it moves away from food and finds support. Maggots shrink and go in pupal stage which was light brown in colour. Its length was 1.032 cm, width 0.448 cm and weight 0.097 gm. The colour of the pupa becomes dark at both ends. Finally whole pupa became dark brown. Pupal stage lasts up to 11 days. On 16th day the adult emerged from pupa whose length

was 1.124 cm, width 0.121 cm and weight 0.058 gm. Life cycle of *P. ruficornis* was completed in 16 days.

Temperature and humidity heavily influence insect activities, such as the rate of oviposition and maturity (Smith, 1986). Temperature has a direct impact on insect metabolic and developmental rate (Andrewartha and Birch, 1954; Chapman, 1982). Development of insects is confined within a certain temperature range. Temperatures too high or too low below the threshold can prove fatal.

The dimensions of life cycle stages in relation to

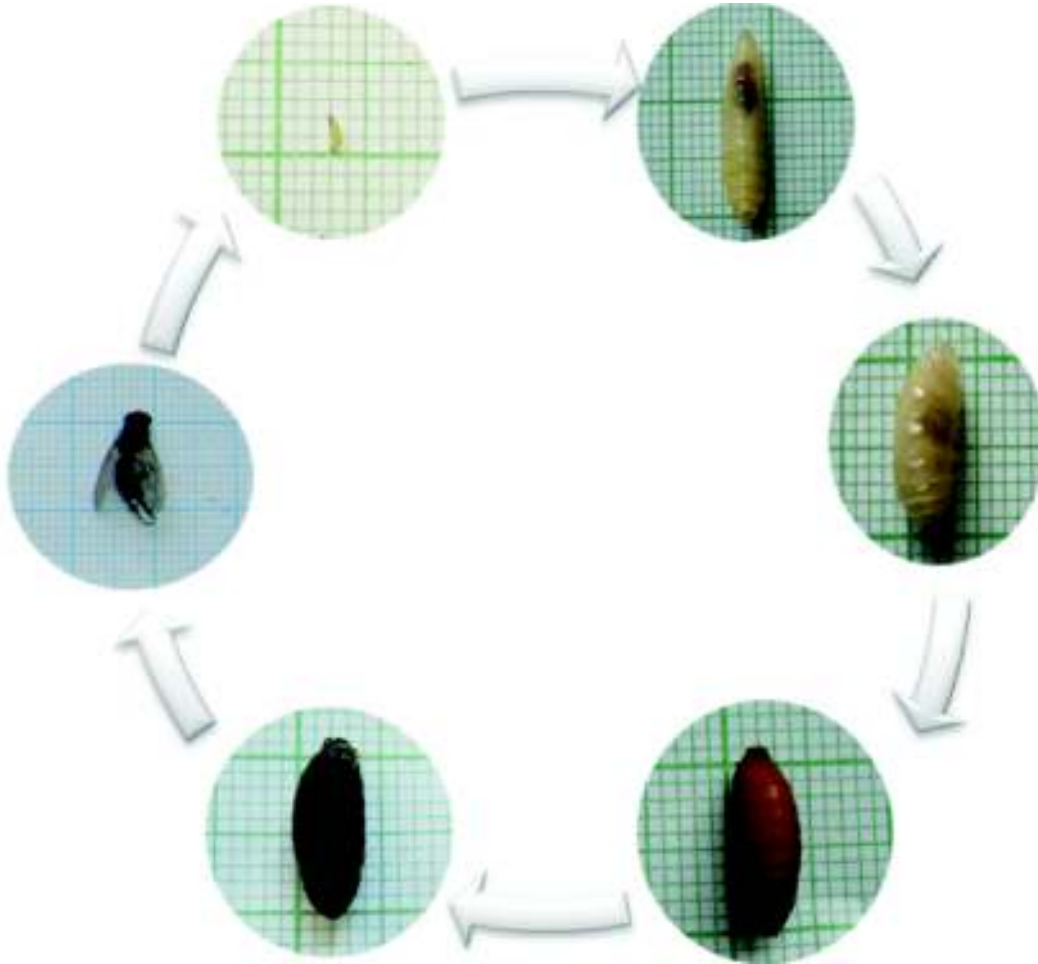


Figure 1 : Life Cycle of *Parasarcophaga ruficornis*

temperature and humidity are given in table 1. Photographs are shown in fig1. Depending on the life cycle stage on the corpse, one can determine the time since death occurred. If larva occurred at the time of scene of corpse, the larva can be reared and the time taken by the larva for pupation can be deducted from the standard time of larva to determine the exact time since death occurred. This species is useful for determining the time of death (PMI min).

CONCLUSION

The *P. ruficornis* flies are commonly found in the Ahmednagar area. These flies are most frequently found in Rainy season. These flies are used as biomarkers in forensic study. The life cycle of sarcophagid fly in rainy season was

completed in 16 days. The life cycle stages with respect to length, width and weight are presented in tables.

This data is useful for the identification of life cycle stage found on the corps and its age which can help to predict the post mortem interval. The record of temperature and humidity given in the tables helps to correctly find out the time since death.

ACKNOWLEDGEMENTS

The author is grateful to the Dr. S. P. Zambare (B.C.U.D.) Dr. B. A. M. University, Aurangabad. Author is also thankful to Principal Dr. L. A. Patil and Dr. Bhadane, V. Pratap College, Amalner for encouraging the research work.

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