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Rearing of a Newly Recorded Dipterous Fly *Parasarcophaga (Liopygia) ruficornis* (Fabricius) (Diptera: Sarcophagidae) from Saudi Arabia under Laboratory Conditions

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Abstract.- Rearing of a newly recorded dipterous fly from Saudi Arabia *Parasarcophaga* (*Liopygia*) *ruficornis* (Fabricius) (Diptera: Sarcophagidae) was carried out in the laboratory to study its complete life cycle. Larvae, collected from Riyadh in November 1989 in plastic jar traps containing 500g of decaying ground beef, were reared on fish, cow liver and ground beef. The total development time was shorter on liver diet than on the other two media, while the maximum survival was recorded on ground beef diet. The mean pupal weight was higher in larvae from fish medium and lower on liver medium. The mean adult weight was higher in larvae reared on ground beef medium and lower on fish medium. The weights of larvae, pupae and adults decreased with increasing larval age.

Key words: *Parasarcophaga (Liopygia) ruficornis*, Sarcophagidae, Saudi Arabia.

INTRODUCTION

The family Sarcophagidae, broadly viewed, is of world-wide distribution and many of its species are rather easily recognised by the peculiar abdomen with a checker board pattern in which the spots change colour from black to gray and back with light incidence. The family includes a wide variety of biotic types. This fly is widespread in Oriental Region (Ceylon, India, Nepal, Pakistan, China (Kwantung), Formosa, Malay Peninsula, Somatra, Philippines, Socotra islands), but discontinuous in Afrotropical (East Africa, Zaire, Natal, Tohagos island, Madagascar), Australian (Mariana, Samoa, Hawaii islands), Neotropical (Brazil), Palaearctic (Ryukyu islands, Japan) and finally Saudi Arabia. Till now, we know only nine species of the family Sarcophagidae from Saudi Arabia including *Parasarcophaga* (*Liopygia*) *ruficornis* (Fabricius). Buttiker and Attiah (1979) reported *Sarcophaga ruficornis* (Fabricius) for the first time from this country, but no detailed study is currently available on this subject from Saudi Arabia.

New records of larvae of *P. ruficornis* were made from Riyadh in November 1989. The synanthrop of this species is recognised almost exclusively in urban habitations. However, flies frequenting human faeces have been made by several authors. Larvae develop in carrion or decaying organic matter and sometimes they may, therefore, be expected to be facultative producers of myiasis. According to Castellani and Chalmers (1919) the species occasionally causes a very severe form of dermal myiasis in India. Sinton (1921) reported a case of cutaneous myiasis in a dog, a septic wound behind the ear of a dog from which larvae of *Chrysomya bezziana* and *P. ruficornis* were removed. Patton (1922) stated that cutaneous myiasis caused presumably by this species is reported to be common in south India, especially on the east coast. Houdemer (1935) reported that larvae of *P. ruficornis* had been found in Indo-China in the hoof-wounds of horses and mules, apparently also in association with *C. bezziana*. Thus it may be possible that *P. ruficornis* is a secondary invader of wounds, after *C. bezziana*. It has also been reported in intestinal myiasis but it is useful to ascertain such case.

It is quite evident that *Parasarcophaga ruficornis* may be potential menace to human and domestic animal health and also on wild animals. Roy *et al.* (1977) reported that the parasitism is common in Indian toads (*Bufo melanosticus*) in Siliguri, West Bengal.

The present paper describes the rearing conditions and the complete life history of this newly recorded species *Parasarcophaga (Liopygia) ruficornis* from Saudi Arabia under laboratory conditions.

MATERIALS AND METHODS

Stock colony

Larvae of *Parasarcophaga ruficornis* were collected from Riyadh in November 1989 using plastic jars (8"

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deep x 6" dia) containing 500g of decaying ground beef. These traps were maintained in the laboratory at 25°C temperature, 60% relative humidity, and 15:9 (L:D) photoperiod. After the emergence of the adults, flies were maintained in wooden framed cages (25" x 15" x 25") covered with a fine screen to provide light in the cage. Two holes (dia 5") in one side of the cage were provided with a cotton-cloth sleeve through which food was passed into the cage. Flies were also handled through this hole. The diet consisted of sugar cubes in petri-dishes and water-soaked cotton wool in bottles. Sugar cubes were replaced whenever they were reduced in the Petri dishes. Fresh water-soaked cotton wool was supplied every 4th day. Forty gram of liver which formed standard protein source and larviposition medium was presented to the flies in Petri dishes and left in the cage for 24 h. Both fresh and previously frozen liver were used to feed the flies and to collect larvae. At the end of 24 h period the liver was examined for the presence of larvae. Whenever larvae were observed, the liver together with larvae were transferred to jar (3" deep x 6" dia) covered with aluminium foil. The jar was placed within an enamel large jar (15" deep x 12" dia) ¼ full of sawdust. The space between the sides of the jar and enamel jar was also filled with sawdust. Additional liver was added as the larvae grew. On the 3rd stage, fully grown larvae (the wandering phase) began to crawl out of the jar in search of pupation sites in the sawdust. When pupation was completed, pupae were sieved from the sawdust and were transferred to clean dry jars provided with a ¼ - ½ layer of dry sawdust. The jar cover was provided with a hole (2" dia) made in its center covered with cloth to permit ventilation. After the emergence of adults, the flies were lightly etherized, sexed and transferred to fresh rearing cages.

Development of immature

Ten gram of fish, cow liver and ground beef (ingredients: cow beef-soya protein produced in Saudi Arabia) larval media, with 30% water were provided to the stock colony flies in Petri dishes and left in the cage for 8 h. One hundred *Parasarcophaga ruficornis* larvae were collected from each rearing medium and transferred separately into vials (1" deep x 1.5" dia) full of the three types of media (18 g). The media vials were placed within a large vials (5" deep x 2.5" dia) 15 mm full of sawdust. The top of the vials were covered by cloths held by rubber bands. During growth, the larvae were transferred every 24 h to clean water, removed to filter paper and weighed. After complete growth, the larvae began to crawl out of the medium and wandered in the sawdust, when they were weighed daily. The cuticle began to tan and then puparia were formed. Pupae were transferred to a large vials (15 mm full of sawdust), the top of which were covered by cloths held by rubber bands. After the emergence of adults, the flies were then lightly etherized, sexed, weighed and two males and one female were placed in each cage (9" x 9" x 15"). The adults were fed as in the stock colony and examined daily for the presence of larvae.

Data analysis

Data were analysed statistically by analysis of variance (ANOVA). The significant differences of development times and weights between males and females were subjected to Student's 't' test.

RESULTS AND DISCUSSION

Immature development time

Table I shows the larval and prepupal duration periods and survival of *P. suficornis* larvae reared on three different media. The results showed that the mean larval duration period for male larvae is not significantly different in all the three media ($F=0.13$; $df=2,115$; $P>0.05$) as compared with that of female larvae ($F=4.06$; $df=2,96$; $P<0.05$). Also, the development time for both sexes were similar in all the three media. It ranged from 2.5±0.12 days to 4.7±0.09 days (Table I). It is interesting to note that the mean prepupal duration period for both males and females has the same value of significance in all three media (male: $F=34.16$; $df=2,115$; $P<0.001$; female: $F=1197$; $df=2,96$; $P<0.001$). The results indicated that the duration prolonged on fish diet (*i.e.* 5.2±0.09 days), while it was short on the liver diet (*i.e.* 4.2±0.08 days). It was also observed that the mean pupal duration period appeared to be significant in both sexes (Male: $F=5.87$; $df=2,115$; $P<0.01$, and Female: $F=3.53$; $df=2,96$; $P<0.05$), but it is little shorter in the ground beef media than in the other two media (Table II). The total duration period from larviposition to adult was only significant in the male ($F=9.50$; $df=2,115$; $P<0.001$), but the total development time for both sexes was shorter on liver diet than on the other two media (Table II).

Survival

Data on larval survival showed that the percentage was higher in the fish medium and lower in liver medium (Table I), whereas the pupal survival percentage was higher in the ground beef, but lower in

Table I.- **Larval and prepupal duration periods and larval survival of *Parasarcophaga ruficornis* larvae reared on fish, liver and ground beef larval media at 25°C, 60% RH, and 15:9 (L:D) photoperiod.**

Larval media	Sex	n	Larval duration period/day		Prepupal duration period/day		Larval survival %
			Mean±SEM	Range	Mean±SEM	Range	
Fish	M	36	4.6±0.20	4-8	5.2±0.12	3-6	
	F	32	4.4±0.13	4-7	5.2±0.14	4-7	84
	F M	68	4.5±0.12	4-8	5.2±0.09	3-7	
Liver	M	39	4.5±0.11	4-7	4.1±0.08	3-6	
	F	31	4.5±0.16	3-7	4.3±0.14	3-6	78
	F M	70	4.5±0.09	3-7	4.2±0.08	3-6	
Ground	M	43	4.5±0.11	4-7	5.3±0.13	4-7	
beef	F	36	4.9±0.13	4-7	4.9±0.10	4-6	80
	F M	79	4.7±0.09	4-7	5.1±0.09	4-7	

Mean between sexes were significantly different in ground beef larval medium for larval [$t=2.18$; $df=77$; $P<0.05$] and for prepupal stages [$t=2.88$; $df=77$; $P<0.05$]. F, female; M, male.

Table II.- **Pupal and larviposition to adult duration periods, pupal survival and emergence of adult *Parasarcophage ruficornis* larvae reared on fish (A), liver (B) and ground beef (C) larval medium at 25°C, 60% RH, and 15:9 (L:D) photoperiod.**

Larval media	Sex	No.	Pupal duration period/day		Pupal survival %	Larviposition to adult duration periods/day		Emergence %
			Mean±SEM	Range		Mean±SEM	Range	
Fish	M	36	16.7±0.14	15-18		26.5±0.14	25-28	
	F	32	16.5±0.15	15-18	80.9	26.1±0.23	24-30	68
	F M	68	16.6±0.10	15-18		26.3±0.14	24-30	
Liver	M	39	16.9±0.18	15-19		25.6±0.20	23-28	
	F	31	16.6±0.17	15-18	89.7	25.5±0.18	24-27	70
	F M	70	16.8±0.12	15-19		25.5±0.14	23-28	
Ground	M	43	16.3±0.10	15-17		26.2±0.13	25-28	
beef	F	36	16.1±0.10	15-18	98.7	25.9±0.20	23-29	79
	F M	79	16.2±0.06	15-18		26.1±0.13	23-29	

Mean between sexes were significantly different in fish larval medium [$t=1.71$; $df=66$; $P<0.05$] for larviposition to adult stage. F, female; M, male.

the fish medium (Table II). The highest survival percentage for the fly to develop from first instar larva to adult was on the ground beef diet 79% (Table II). It is interesting to note that in fish and ground beef media, females were the first ones to emerge but in liver media, males were the first to emerge (Fig. 1).

Weight

Pupal weights indicated that there was slight increase in fish medium and decrease in pupal weights fed on liver medium. The over all weights for both sexes were significant ($F=3.61$; $df=2,115$; $P<0.02$, and $F=11.70$; $df=2,96$; $P<0.001$ for males and females, respectively, Table III). Also, the mean adult weights showed significance only in the males ($F=13.73$; $df=2,115$; $P<0.001$). At the same time, the mean adult weights were higher for adults fed as larvae on ground beef medium (*i.e.* 85.39±1.49 mg) and lower in those fed on fish medium (*i.e.* 76.75±1.60 mg). During larval development, the weight increased until day 4, then it

Table III.- **Fresh pupal weight, adult weight and pre-larviposition duration period of *Parasarcophaga ruficornis* larvae reared on fish, liver and ground beef larval media at 25°C, 60% RH, and 15:9 (L:D) photoperiod.**

Larval media	Sex	No.	Fresh pupal weight (mg)		Weight per fly at emergence (mg)		No.	Prelarviposition period/day	
			Mean±SEM	Range	Mean±SEM	Range		Mean±SEM	Range
Fish	M	36	151.59±3.94	86.3-187.4	73.48±1.89	51.4-98.9			
	F	32	152.98±4.00	100.6-208.2	80.43±2.53	50.2-109.6	10	15.7±0.63	13-19
	F M	68	152.25±2.79	86.3-208.2	76.75±1.60	50.2-109.6			
Liver	M	39	138.95±2.70	85.3-161.6	83.80±1.71	57.7-1021			
	F	31	128.62±3.41	86.4-163.1	80.16±2.17	48.6-103.7	10	14.2±0.63	12-18
	F M	70	134.37±2.21	85.3-163.1	82.19±1.36	48.6-103.7			
Ground beef	M	43	145.89±3.13	95.2-173.8	87.63±2.15	55.1-112.4			
	F	36	137.26±3.20	90.2-170.8	82.72±1.97	56.3-103.2	10	13.6±0.68	11-18
	F M	79	141.96±2.28	90.2-173.8	85.39±1.49	55.1-112.4			

Mean between sexes were significantly different in fish larval medium [$t=2.20$; $df=66$; $P<0.05$] for adult weight, in liver larval medium [$t=2.37$; $df=68$; $P<0.05$] for pupal weight and in ground beef larval medium [$t=1.93$; $df=77$; $P<0.05$] for pupal weight and [$t=1.68$; $df=77$; $P<0.05$] for adult weight. F, female; M, male.

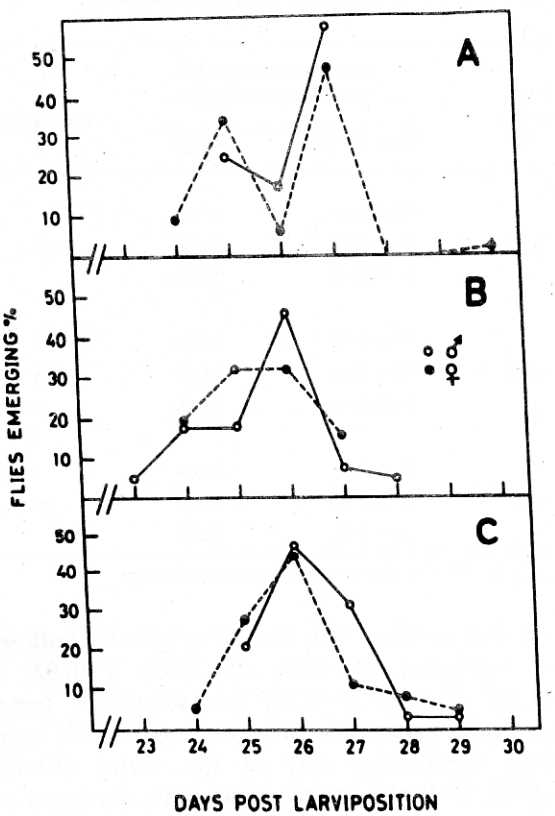

Fig. 1. Daily emergence of male and female adults of *Parasarcophaga ruficornis* from larvae reared on fish (A), liver (B) and ground beef (C) larval media.

decreased gradually afterwards (Fig. 2). It seems from Figure 2 that the increase in larval age is associated with decreased in larva weight. Similar conclusion on pupae and adults indicated that, by increasing larval age, weight for both pupa and adult decreased (Fig. 3).

Pre-larviposition period

Data on pre-larviposition period showed that flies from larvae reared on 3 media showed no significant difference in the pre-larviposition period ($F=2,77$; $df=2,27$; $P>0.05$) (Table III).

Sinton (1921) and Bohart and Gressitt (1951) have studied filth-inhabiting flies of Guam and have reported that larvae and adults of *P. ruficornis* can develop and grew on carrion, and also on human and have excreta. Adult flies can also be grown on cow excrement bait. Besides that decaying starchy vegetables and fruits and flowers can also act as baits for adults.

Shukla and Singh (1972) reported buffalo flesh and sawdust for puparium in which larvae matured after 3-5 days in hot season and after 4-7 days in cool season, pupation occurred after 5-15 days in hot season and 20-25 days in cool season. For alimentation for adults the flies survived 25-28 days in summer and 40-70 days in cool season in banana sugar water.

The studies on the population dynamics in larval blowflies have shown less cannibalism at third larval stage for *Parasarcophaga ruficornis* than for *Chrysomya rufifacies* (Macquart) (Khole, 1979).

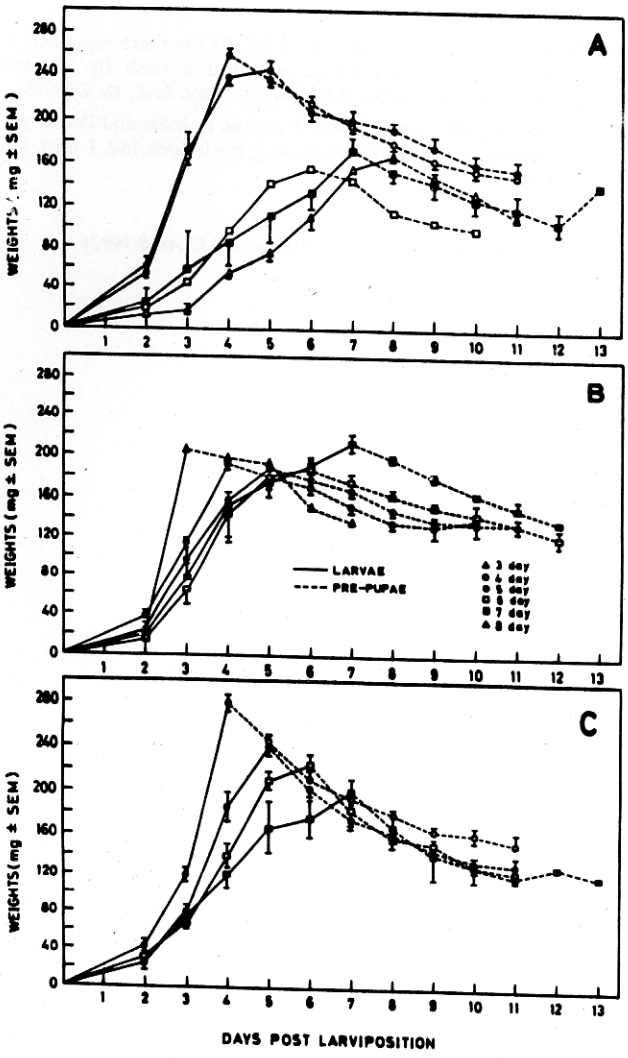

Fig. 2. The change in mean daily weight of larvae and prepupae when 3 day (n=1 on liver), 4 day (n=49 on fish, n=40 on liver and n=37 on ground beef), 5 day (n=12 on fish, n=22 on liver and n=30 on ground beef), 6 day (n=1 on fish, n=5 on liver and n=10 on ground beef), 7 day (n=4 on fish, n=2 on liver and n=2 in ground beef), and 8 day (n=2 on fish) old larvae of *Parasarcophaga ruficornis* were reared on fish (A), liver (B) and ground beef (C) larval media.

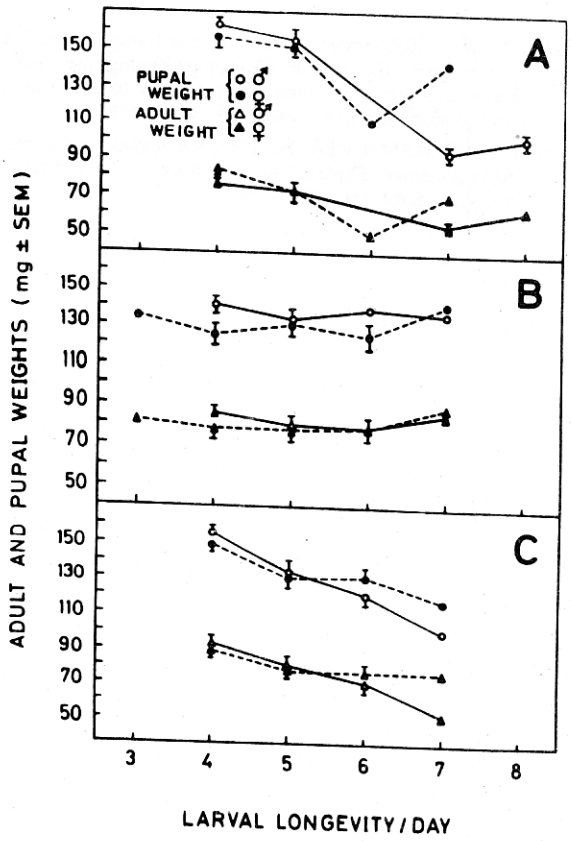

Fig. 3. Relationships between larval longevity and pupal and adult weights of males and females of *Parasarcophaga ruficornis* reared from larvae fed on fish (A), liver (B) and ground beef (C) larval media.

However, no such species has ever been reared under controlled laboratory conditions. The present report shows significant effect on the weights of adults in ground beef medium, but the other two media (*e.g.* fish and liver media) had no significant effect on the overall weight of the adults.

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