

The Occurrence of *Megaselia scalaris* (Loew) (Diptera: Phoridae) in Saudi Arabia with some Aspects on the Life History and Distribution in Riyadh Province

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(Received 9 March 1987; accepted for publication 5 March 1988)

Abstract. Surveys were conducted in four towns in Riyadh province of Saudi Arabia to collect *Megaselia scalaris*. A total of 21 males and 208 females were collected between October and December 1985. This is the first report of the occurrence of the species *M. scalaris* (Family Phoridae) in Saudi Arabia.

Studies on the biology of *M. scalaris* were conducted under laboratory conditions at 27°C and 75% RH, and under continuous light. Mean times for development and survival were: egg incubation period 14.3 h (91.1%); larval period for males, 4.6 days and for females 6.3 days, larval survival 89%, pupal period for males 9.7 days and for females 9.8 days; pupal survival 87.2%, adults longevity 12.8 days, days. Fecundity was 420.5 eggs. One generation required 18.5 days.

Introduction

Megaselia (Megaselia) scalaris (Loew) (Diptera: Phoridae) has a cosmopolitan distribution in the tropics and subtropics areas [1]. This fly infests stored vegetables, fermenting fruit and decaying organic materials such as plant and animal matter [2-4]. It has been also recorded from a range of substrates from humus to gangrenous wounds in cattle and other animals including humans [5]. *Megaselia scalaris* is known to cause cutaneous, ophthalmic, and intestinal myiasis in both humans and animals [2], and it was suspected to be a vector of *Vibrio comma* (Schroeter) in the Philippine Islands [3-4].

Numerous observations on the basic biology of *M. scalaris* have been reported [6-10]. Manix [1] has reviewed its genetics, and Miller [11] has reviewed some aspects of its behaviour.

Herein we report the distribution of the phorid fly *M. scalaris* in Riyadh province and the results of the laboratory studies on its life cycle.

Materials and Methods

Study area

Physiography, climate and vegetation

Riyadh province is 430 to 600 m above sea level with a mean precipitation of 146.3 mm, which falls in winter and spring. The mean daily air temperature ranges from 7.3 to 22.0°C in winter and 24.3 to 44.9°C in summer and the mean daily relative humidity ranges from 17% to 50%. Riyadh province is one of the richest agricultural districts of the Kingdom. The farms are irrigated by water pumped from wells and are extensively planted with wheat, vegetables, fruit, and date palms. The scarce natural vegetation consists of herbs *Citrullus colocynthis*, and *Blepharis ciliaris*, shrubs *Hammada elegans* and *Rhazya stricta*, and trees *Calotropis procera* and *Accacia* spp. A full list of the natural vegetation of the study area is given by Migahid [12].

Collecting sites

The survey was undertaken in four towns in Riyadh province (*i.e.* Riyadh, Al-Kharj, Shakra and Al-Zulfi). In these localities, *M. scalaris* was collected from fruit and vegetable markets and farms.

Specimen collection

An attraction trap was used to collect adults. The trap consisted of a plastic jar (45 × 75 mm) containing 100 g of decaying potatoes. A plastic funnel was fixed at the top of the jar. Five traps were placed for a total of 3 days during the investigation in each locality. The jars were stoppered and taken back to the laboratory, where the captures were counted. The immature stages were identified using a stereoscopic microscope.

Megaselia scalaris life cycle

Stock colony

The stock colony was maintained in the laboratory at 27°C temperature, 75% relative humidity, and under continuous light. The colony was reared in a cage (410 × 200 × 300 mm) made of wood with a fine screen and supplied with a cloth sleeve at one of its sides. Adults were fed a mixture of 70 ml distilled water, 30 ml cow milk (3% fat), 5 ml honey, and 1.5 g protein supplied on cotton wool placed at the top of the cage and covered with a petri dish [7]. Vials (30 × 45 mm) containing 100 g of the larval diet were placed in the cage for female oviposition.

Adult life span

Pupae were collected from the stock colony into vials. After the emergence of adults, two males and one female were placed in each vial. Each vial was placed into a plastic cage with a wire-screen top (90 × 60 × 160 mm). The adults were fed as in the stock colony and a vial containing 50 g of the larval diet was provided daily in each

cage for female oviposition. The eggs were counted each day and the incubation period was calculated from eggs laid within one hour.

Larval and pupal duration periods

Newly hatched larvae were collected separately into vials containing 50 g of the larval diet. The top of the vials were covered by cloths held by rubber bands.

Adult identification was carried out using the key of Hardy and Beyer [5, pp. 262-302], and was confirmed by Dr. R. H. L. Disney. Meteorological data for the area of study were obtained from Hydrology Division, Ministry of Agriculture and Water, Riyadh, Saudi Arabia.

Results and Discussion

Distribution of *M. scalaris*

The fly was collected at all four towns in Riyadh province (Riyadh, Al-Kharj, Shakra, and Al-Zulfi), (Fig. 1). This is the first record of this species reported to date from the Kingdom. A total of 21 and 208 was collected. The distribution is shown in Table 1. The flies were nowhere very common and the distribution was fairly even. The higher number of females found in the attractive traps is expected since the females are mainly attracted to the oviposition sites more than the males.

Table 1. Numbers of *M. scalaris* adults collected from four towns in Riyadh province during the period from October to December 1985.

| Locality | Male | Female |
|-----------------------------|------|--------|
| Riyadh | | |
| Fruit and vegetable markets | 2 | 20 |
| Farms | 4 | 23 |
| Al-Kharj | | |
| Fruit and vegetable markets | 1 | 15 |
| Farms | 2 | 45 |
| Shakra | | |
| Fruit and vegetable markets | 5 | 39 |
| Farms | 3 | 23 |
| Al-Zulfi | | |
| Fruit and vegetable markets | 1 | 29 |
| Farms | 3 | 14 |
| Total | 21 | 208 |

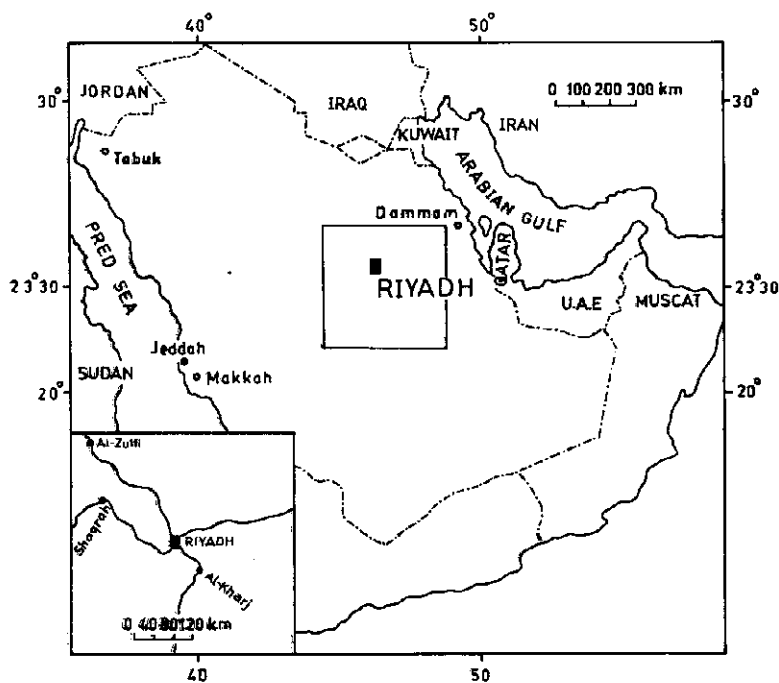


Fig. 1. Map of Saudi Arabia with inset of Riyadh Province showing the sampling localities

Ovipositional activities and egg incubation period

The mean preoviposition period was $1.8 \pm \text{SD } 0.6$ days. The oviposition period was $20.2 \pm \text{SD } 6.1$ days with egg laying on $17.5 \pm \text{SD } 5.5$ days. The postoviposition period was $1.6 \pm \text{SD } 0.7$ days (Table 2). Daily egg production of females varied throughout the ovipositional period (Fig. 2). The mean number of eggs laid per female was $420.5 \pm \text{SD } 116.4$, and varied from 179 to 588 (Table 3). The mean number of eggs laid by unfed females was $88 \pm \text{SD } 42.1$. The eggs were laid singly or in clusters, but not connected, along the periphery of the diet or in the inner side of the container near the diet. The mean egg incubation period was $14.3 \pm \text{SD } 1.3$ hr with a range of 12 to 16 hr. The percentage of eggs hatching was $91.1 \pm \text{SD } 7.9$ (Table 2).

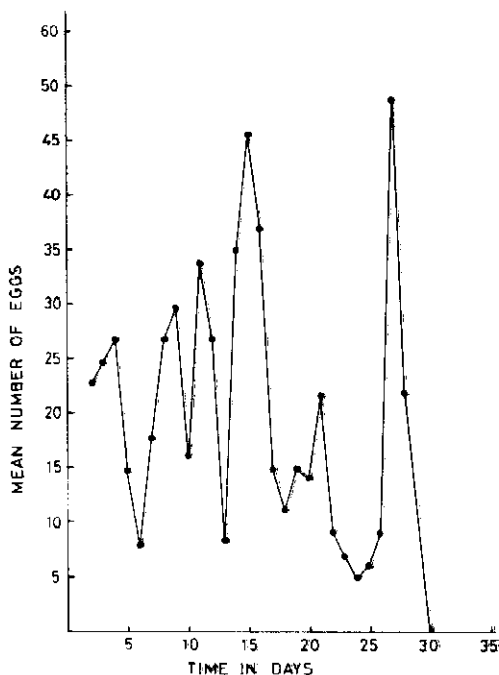


Fig. 2. The mean daily egg production of 10 female *M. scalaris* reared at 27°C temperature, 75% RH and under continuous light.

Table 2. Ovipositional activities, egg incubation periods and fertility of *M. scalaris* reared at 27°C, 75% RH, and under continuous light.*

| Observation | Min. | Max. | Mean | SD ± |
|----------------------------|------|------|------|------|
| Preoviposition period/day | 1.4 | 2.9 | 1.8 | 0.6 |
| Oviposition period/day | 8 | 27 | 20.2 | 6.1 |
| Egg laying period/day | 6 | 23 | 17.5 | 5.5 |
| Postoviposition period/day | 1 | 3 | 1.6 | 0.7 |
| Incubation period/h | 12 | 16 | 14.3 | 1.3 |
| Fertility % | 83.3 | 98.5 | 91.1 | 7.9 |

* Ovipositional activities were calculated from 10 females and incubation period from 500 eggs.

Adult life span

The mean longevity of adults was $12.8 \pm \text{SD } 5.2$ days for males and $20.5 \pm \text{SD } 5.6$ days for females. The mean longevity of unfed adults was $5.0 \pm \text{SD } 1.1$ days for males, and $10.0 \pm \text{SD } 1.9$ days for females. These results are consistent with those of Patton [6], Tumrasvin *et al.* [8] and Benner and Ostermeyer [10] in suggesting that females have greater longevity than males. The mean sex-ratio for $\delta : \text{♀}$ produced by 10 females was $43.0:57.0 \pm \text{SD } 13.1$ (Table 3). This sex-ratio of approximately 1:1.3 is considered the emergence sex-ratio of this species; similar results have been reported by El-Miniawi and Moustafa [7]. The sex-ratio observed in the attractive traps is not the true ratio and reflects the fact that the females are attracted for the purpose of oviposition. Mating occurs within 2–6 hr after the emergence of the females. This finding is in close agreement with the observation of El-Miniawi and Moustafa [7] and Prawirodisastro and Benjamin [9] who noted that the mating occurred within 2–3 hr from emergence. However, Patton [6] reported that the mating occurred on the second day after emergence. This difference could be due to the rearing conditions used. Unmated females laid sterile eggs.

Table 3. Longevity, fecundity and sex-ratio of adults *M. scalaris* reared at 27°C, 75% RH, and under continuous light.

| | Longevity/day | | Fecundity | Sex-ratio % | |
|------|---------------|--------|-----------|-------------|------|
| | n = 48 | n = 24 | n = 10 | n = 2806 | |
| Min. | 8 | 12 | 179 | 13.3 | 40.0 |
| Max. | 28 | 30 | 588 | 60.0 | 86.7 |
| Mean | 12.8 | 20.5 | 420.5 | 43.0 | 57.0 |
| SD ± | 5.2 | 5.6 | 116.4 | 13.1 | 13.1 |

The mean generation span which includes the mean egg incubation period and larval and pupal duration periods plus the mean female preoviposition period was 18.5 days.

Larval duration period

The mean duration period for larvae developing into males was $4.6 \pm \text{SD } 1.1$ days and $6.3 \pm \text{SD } 0.8$ days for larvae developing into females. The mean percentage of larvae that survived to the pupal stage was $89.0 \pm \text{SD } 5.2$ (Table 4). There was no color change during larval development.

Table 4. Larval and pupal duration periods and survival of *M. scalaris* reared at 27°C, 75% RH, and under continuous light.

| | Duration period/day | | | | Survival % | |
|------|---------------------|-----------------|------------------|-----------------|------------|------|
| | Larva n = 150 | Pupa n = 120 | Larva n = 190 | Pupa n = 180 | Larva | Pupa |
| Min. | 4 | 9 | 6 | 8 | 82 | 71 |
| Max. | 5. | 11 | 9 | 13 | 96 | 92.6 |
| Mean | 4.6 | 9.7 | 6.3 | 9.8 | 89 | 87.2 |
| SD ± | 1.1 | 0.5 | 0.8 | 1.2 | 5.2 | 3.6 |

Pupal duration period

The mean duration period for pupae developing into males was $9.7 \pm \text{SD } 0.5$ days, $9.8 \pm \text{SD } 1.2$ days for pupae developing into females. The mean percentage of pupal survival was $87.2 \pm \text{SD } 3.6$ (Table 4). Female pupae were larger than male pupae.

The present data agree, in general, with the findings reported by El-Miniawi and Moustafa [7] and Prawirodisastro and Benjamin [9]. The longevity of both males and females observed in our study was higher than that reported by El-Miniawi and Moustafa [7], but it was lower than that reported by Prawirodisastro and Benjamin [9]. These differences could be due to the rearing conditions and lighting regimes used. El-Miniawi and Moustafa [7] only reported the rearing temperature which was the same as that used in our study. Prawirodisastro and Benjamin [9] used a different lighting regime (18 hr of light per day) and a different temperature (25°C) than the lighting regime (continuous light) and temperature (27°C) used in our study. Prawirodisastro and Benjamin [9] reported a much higher fecundity for the species than that observed in our study (664.8 vs 420.5). This again could be due to the differences in the rearing and lighting conditions.

Acknowledgements: The authors are thankful to Dr. R.H.L. Disney at Cambridge University for confirming the identification of species.

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ظهور عائلة الذباب سنامي الظهر Phoridae التابع لرتبة ثنائية الجناح Diptera في المملكة العربية السعودية مع الإشارة إلى انتشار ذبابة ميغاسيليا *Megaselia scalaris* في منطقة الرياض ودورة حياتها في المختبر

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(أستلم في ٩ رجب ١٤٠٧هـ، قُبل للنشر في ١٧ رجب ١٤٠٨هـ)

ملخص البحث. أجريت هذه الدراسة في أربع مدن هي: الرياض والخرج وشقراء والزلفي التابعة لمنطقة الرياض، وقد تم جمع عينات من ذباب سنامي الظهر من أسواق الخضار والفاكهة وكذلك من المزارع المجاورة لهذه المدن، حيث جُمع ٢١ ذكراً و ٤٠٨ أنثى من هذه الذبابة في الفترة من أكتوبر حتى ديسمبر عام ١٩٨٥م.

وقد شملت الدراسة أيضاً دورة حياة هذه الذبابة في المختبر تحت درجة حرارة ٢٧°م ورطوبة نسبية ٧٥٪ وإضاءة مستمرة. وكان الذباب البالغ يغذى على مخلوط يتكون من ٧٠ ملل من الماء المقطر و ٣٠ ملل من الحليب المحتوي على ٣٪ دهن و ٥ ملل من العسل و ١٥ جم من البروتين. وقد وجد أن متوسط فترة ما قبل وضع البيض ١٨ يوم ومتوسط فترة وضع البيض ٢٠٢ يوم ومتوسط عدد الأيام التي يتم فيها وضع البيض ١٧٥ يوم ومتوسط فترة ما بعد وضع البيض ١٦ يوم وكان متوسط فترة الحضانة للبيض ١٤٣ ساعة ونسبة الفقس ٩١٪. نسبة معيشة اليرقات ٨٩٪ وفترة عمر اليرقات المتحوّلة إلى ذكور ٤٦ يوم وإلى إناث ٦٣ يوم. نسبة معيشة العذارى ٨٧٪ وفترة عمر العذارى المتحوّلة إلى ذكور ٩٧ يوم وإلى إناث ٩٨ يوم. متوسط عمر الذكور ١٢٨ يوم والإناث ٢٠٥ يوم ومتوسط الخصوبة ٤٢٠٥ بيضة ومتوسط عمر الجيل ١٨٥ يوم ونسبة الذكور إلى الإناث ١ : ١٣.

وتعتبر هذه النتائج أول تسجيل للنوع *M. scalaris* التابع لعائلة ذباب سنامي الظهر Phoridae في المملكة.