

Breeding Ecology of the Graceful Prinia (*Prinia gracilis*) at Akiad Pond, Sharkia Governorate, Egypt.

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ABSTRACT

Characterizing the breeding ecology of birds is important for understanding their population dynamics. One of the most common small resident birds in Egypt that acts as a biocontrol agent of insects is Graceful Prinia (*Prinia gracilis*). Despite its importance, there are few studies on its breeding ecology in Egypt. Accordingly, this study is the first in investigating the population density and the breeding ecology (including the clutch size, incubation period, fledging period, hatching success, fledging success, and breeding success) of *P. gracilis* at Akiad Pond, Sharkia Governorate, Egypt during 2019. Results of the current study showed that *P. gracilis* followed the pattern spring > summer > autumn > winter in abundance during 2019. Regarding its breeding ecology, *P. gracilis* laid from 2 to 5 eggs/clutch with an average of 3.75 ± 0.25 eggs. 42 young hatched from 60 eggs recording 70% hatching success rate throughout the study period at Akiad pond. Moreover, about 37 chicks fledged and 5 died recording 88 % fledging success rate. Clutches of two and three eggs had higher fledging success than the other clutches because of the inability of parents to meet the basic feeding needs in large broods. The incubation period was 12.56 ± 0.20 days/nest to produce 2.6 hatchlings/nest, while the fledgling period was 14.62 ± 0.27 days/nest to produce 2.315 young fledged/nest. The breeding success was 61.6% in relation to the number of eggs laid. The main threats to the bird life are human activities (as burning for regrowth, cattle grazing, fishing and in some way desiccation to some patches around the pond in summer) that destroy its food and nests requirements.

INTRODUCTION

The fundamental breeding ecology of about 67% bird species is poorly understood despite being the building block in bird's life history (Xiao *et al.*, 2017). Regarding Passeriformes, less than 7% of the researches conducted on passerines include breeding information (Pienaar *et al.*, 2013).

The Graceful Prinia (*Prinia gracilis*), a small polytypic warbler species belonging to family Cisticolidae and order Passeriformes, is one of the resident passerines suffering shortage of information on its breeding ecology in Egypt. The only published article on the breeding biology of *P. gracilis* in Egypt was by **Simmons (1954)** in Fayid, lower Egypt during the breeding season 1949/1950. Since then, no studies on its breeding ecology in Egypt were conducted despite their abundance and wide distribution.

To the best of our knowledge, **Zduniak and Yosef (2004)** studied the seasonal abundance and biometric differences between sex and age groups of *P. gracilis* in Israel. **Kiat and Izhaki (2015)** analyzed the timing, sequence, extent and duration of post-juvenile moult in *P. gracilis* in Israel. **Sheta (2019)** examined the breeding habitats of *P. gracilis* in Lake Burullus, Egypt, during winter and spring 2018.

Considering the Egyptian biodiversity strategy and action plan (2015-2030) for conserving wildlife, as well as, the recommendations of **Bird Life International (2015)** and **International Union for Conservation of Nature (IUCN) (2019)**, up-to-date monitoring programs on Graceful Prinia ecology became essential to inform conservation measures. Accordingly, this paper aimed at exploring data about the population density and the breeding ecology (including the clutch size, incubation period, fledging period, hatching success, fledging success, and breeding success) of Graceful Prinia (*P. gracilis*) at Akiad Pond, Sharkia Governorate, Egypt during 2019.

MATERIALS AND METHODS

Study area:

The study area viz, Akiad Pond lies in Al-Azzazi Village, Faqous District, Sharkia Governorate, Egypt. The pond covers an area of 2000 feddan. An island covering an area of about 360 feddan divides the water in the pond into two parts. The northern part is characterized by freshwater whereas the southern is salty. The island is characterized by large reed beds which form a very good habitat for bird breeding as *Typha domingensis* (Pers.) Poir. ex Steud., *Phragmites australis* (Cav.) Trin. ex Steud., *Juncus acutus* L., *Arthrocnemum macrostachyum* (Moric.) K. Koch., *Halocneum strobilaceum* (Pall.) M. Bieb. (**Boulos, 1999; 2000; 2005 a & b, 2009**). The area is characterized by a moderate warm weather during winter.

The pond was surveyed to determine the most suitable areas for the nesting of *P. gracilis* within the area around the pond. Four points were chosen based on the plant cover and possible nesting habitats (**Figure 1**).



Figure 1. Google Earth satellite image showing the location of the four surveyed points at Akiad Pond, Sharkia Governorate, Egypt.

Field methods:

Counting:

The study was carried out from January to December 2019. Field data were obtained using the point counts method, which is suitable for studying highly visible and vocal bird species as Graceful Prinia in a wide variety of habitats (Bibby *et al.*, 2000). Bird counts were performed (from 6 to 8 am during winter and spring and from 5 to 7 am during summer and autumn) once monthly with binoculars (10 × 50) from a fixed raising position within a circle of 40 m radius (about 5024 m² at each point). The days selected for counting were clear with no winds and rain conditions. Species identity was done using Collins Bird Guide (Svensson *et al.*, 2009).

Some breeding aspects and breeding parameters associated with *P. gracilis*:

We started searching weekly for nests during February then every two to three days in March, April, May, and June 2019. Nests were numbered and checked for eggs hatching and nestlings fledging time, to determine the first egg lying date, clutch size, hatching period, number of fledging, and fledging period (Humble and Burnett, 2010).

The number of eggs laid in a nest was defined as clutch size, while the fledging period is the time between the day of the first egg hatching to the day where the bird holds true feather and leaves the nest (Jehel *et al.*, 2004).

To examine the breeding ecology of *P. gracilis*, the study estimated three reproductive rates namely; hatching success rate, fledgling success rate, and the breeding success rate. The hatching success is defined as the number of eggs hatched divided by the total number of eggs laid, whereas, the fledgling success is defined as the number of chicks fledged divided by the total number of hatched eggs (Metallaoui *et al.*, 2019). The breeding (=egg) success is the proportion of total number of chicks fledged to the total number of eggs (Awais *et al.*, 2015).

Hatching success % = (Number of hatched eggs / Total number of eggs) * 100

Fledgling success % = (Number of fledgling / Total number of hatched eggs) * 100

Breeding (or Egg) success % = (Number of fledglings / Total no. of eggs) * 100

Statistical analysis:

One-way analysis of variance (ANOVA) was used to assess the significant difference between the different points. Difference is significant when $p < 0.05$. Analysis of data was performed using SPSS software version 16 (Levesque, 2005).

RESULTS

Population density of *P. gracilis*:

In the present study, a total of 666 individual was monitored during 2019 at the four selected localities in Akiad pond, Sharkia Governorate. During 2017, Issa (2019) observed about 461 individual of *P. gracilis* in Sharkia Governorate.

Results of the population density of *P. gracilis* varied from 34 to 120 with an average (\pm SE) of 55.5 (\pm 13.46) per one hectare in Akiad pond, Sharkia Governorate during 2019 (Table 1). *P. gracilis* followed the pattern spring > summer > autumn > winter in abundance during 2019 (Figure 2). The highest densities were recorded in spring (April and May with 120 and 88 individuals, respectively). On the other hand, winter recorded the lowest density (Table 1; Figure 2). Similar results were reported in Israel by Zduniak and Yosef (2004). Issa (2019) attributed the variations in population density to the availability of the essential life requirements (as food, water, and shelter) and to the weather conditions during different months of the year. No significant difference was recorded between the four localities at Akiad pond in the current study (Table 1).

Breeding Ecology of *P. gracilis*:

In the present study, the breeding period started in March 13th, 2019. This finding is consistent with Cramp (1998) who reported that *P. gracilis* begins its breeding season in March and ends in late July, rarely in August. However, Shirihai (1996) reported that *P. gracilis* breeding season lasts from late January to September. Ryan (2006) mentioned that egg-laying differs from place to another. In Egypt, Israel, and Iraq egg-laying occurs from February to July, while in Pakistan and India from February to October (Ryan, 2006).

Table 1: Population density of the Graceful Prinia (*P. gracilis*) at Akiad Pond.

Months	Points				Total	M ± SE
	1 st	2 nd	3 rd	4 th		
Jan	10	8	9	7	34	8.5 ± 0.64
Feb	11	8	10	11	40	10 ± 0.71
Mar	9	10	7	8	34	8.5 ± 0.64
Apr	37	30	33	20	120	30 ± 3.63
May	28	24	19	17	88	22 ± 2.48
Jun	18	13	16	11	58	14.5 ± 1.55
Jul	26	20	19	15	80	20 ± 2.27
Aug	21	16	8	7	52	13 ± 3.34
Sep	14	11	9	8	42	10.5 ± 1.32
Oct	13	12	7	6	38	9.5 ± 1.75
Nov	13	10	10	9	42	10.5 ± 0.87
Dec	10	11	8	9	38	9.5 ± 0.64
Total	210	173	155	128	666	---
M±SE	17.5 ± 4.41	14.42 ± 3.44	12.92 ± 3.85	10.67 ± 2.21	55.5 ± 13.46	---
F-value		1.93344			--	--
P-value		0.138084			--	--
Significance		NS			--	--

NS: refers to no significant; M±SE: mean ± standard error.

The present study observed that *P. gracilis* built their nests in *Juncus acutus* plants around the pond. This observation was consistent with **Baha El Din (1999)** who mentioned that *P. gracilis* inhabited low vegetation. **Sheta (2019)** examined the breeding habitats of *P. gracilis* in Lake Burullus, Egypt, during winter and spring 2018. She noted the presence of *P. gracilis* in three different habitats (open water, islets, and reed beds) with significant affinities ($P < 0.01$) to islands habitat. *P. gracilis* is monogamous with the pairs defending territories throughout the year (**Kiat and Izhaki, 2015**). The male constructs the nest and the female assists by lining the cup and the incubation is carried out by males and females (**Shirihai, 1996**).

The study recorded clutch sizes with 2-5 eggs for *P. gracilis* at Akiad pond. Six of 16 clutches had four eggs (37.5%), four had three eggs (25%), four had five eggs (25%), and only two had two eggs (12.5%) (**Table 2**), resulting in an average clutch size of 3.75 ± 0.25 eggs. **Simmons (1954)** recorded (3-5 eggs) for other populations of this species in Fayid, Lower Egypt. **Paz (1987)** mentioned that *P. gracilis* can lay up to five clutches. **Lack (1947)** attributed the difference in number of clutches to the food availability and to the length of the day that can

spur the growth of the gonads. He noted that the number of eggs laid reflects the bird physical condition.

Table (2) reveals that the highest hatching success rate was recorded in the nests of two eggs (75%) while the lowest was in the nests of three eggs (66.67%). However, the clutches of two and three eggs had higher fledging success (100%) than the other clutches. The highest breeding success rate was also recorded in the two egg clutches (75%), whereas the clutch with five eggs was the lowest (55%). **Issa (2019)** attributed this finding to the inability of parents to meet the basic feeding needs in large broods; accordingly only strong individuals in large broods will survive. Indeed, the study encountered a lot of human activities (as burning for regrowth, cattle grazing, fishing, and in some way desiccation to some patches around the pond in summer) that destroy the bird's food and nests requirements.

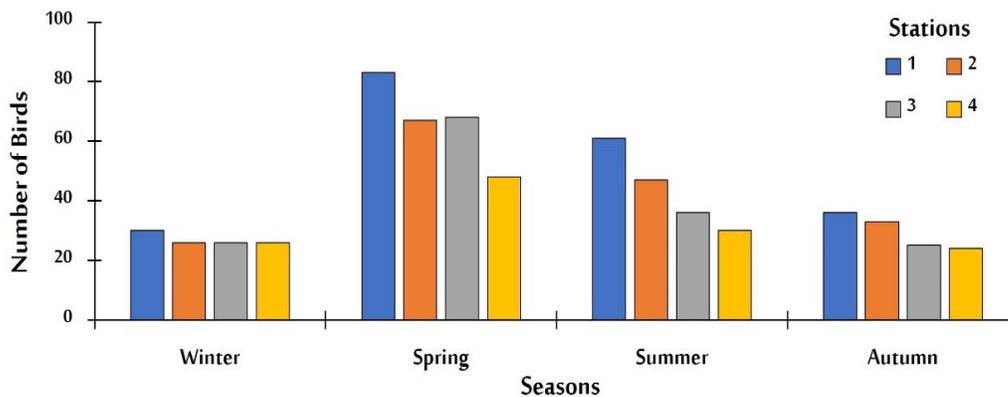


Figure 2: The seasonal number of *P. gracilis* in each station during the study period 2019 at Akiad Pond.

Overall, in the 16 observed nests, 42 young hatched from 60 eggs recording 70% hatching success rate throughout the study period at Akiad pond. Moreover, about 37 chicks fledged and 5 died recording 88 % fledging success rate. The clutch size was 3.75 ± 0.25 eggs/nest (range: 2-5, $n=16$), incubated for 12.56 ± 0.20 days to produce 2.6 hatchlings/nest. The breeding success rate was 61.6% in relation to the number of eggs laid, while the productivity was 2.315 young fledged/nest (**Table 2**).

Table (3) compares the results of the reproductive traits of *P. gracilis* in the present study with the available previous studies on the same species. It was obvious that the current results of the incubation period resembled those reported by **Simmons (1954)** and **Shirihai (1996)**. On the other hand, the fledgling period (14.62 days) recorded in our study was slightly higher than those recorded by **Simmons (1954)** and **Shirihai (1996)**. Hatching success of 70% was recorded in our study and it was lower than that was recorded by **Simmons (1954)** (78%). Breeding success depending mainly on the proportion of nests which are subjected to predation and starving (**Newton, 1964**), in our study it was higher (61.67%) than those (41%) reported **Simmons**

(1954), probably because no natural predators were observed and the surrounded areas were suitable with a good variability and availability of food supplies.

Table 2: Breeding aspects of *P. gracilis* at Akiad Pond

Parameters	Clutch size				Total
	2	3	4	5	
Number of nests	2	4	6	4	16
Total number of eggs	4	12	24	20	60
Number of hatchlings	3	8	17	14	42
Number of fledglings	3	8	15	11	37
Hatching success %	75	66.67	70.83	70	70
Hatchling/nest	1.5	2	2.83	3.5	2.625
Fledging success %	100	100	88.23	78.57	88.09
Fledglings/nest	1.5	2	2.5	2.75	2.3125
Breeding (=Egg) success %	75	66.67	62.5	55	61.67
Incubation period \pm SE (days)				12.56 \pm 0.2	
Fledging period \pm SE (days)				14.62 \pm 0.27	

SE: Standard Error; %: Percentage

Table 3. Reproductive traits of *Prinia gracilis* in the current study in comparison with other studies.

Locality	Incubation Period (days)	Fledging Period (days)	Hatching Success	Breeding Success	Reference
Akiad pond, Egypt	12.56 (\pm 0.2)	14.62 (\pm 0.27)	70%	61.67%	Present study
Fayid, Egypt	11-13 (\pm 1)	13-14 (\pm 18 hrs)	78%	41%	[1]
Israel	12-13	10-15			[2]

[1]: Simmons (1954); [2]: Shirihai (1996)

CONCLUSION

The current study examined the population density and breeding ecology of *P. gracilis* at Akiad Pond, Sharkia Governorate, Egypt. Results showed that the clutches of two and three eggs had higher fledging success than the other clutches may be because of the inability of parents to meet the basic feeding needs in large broods. Moreover, the overall breeding success rate of the bird was 61.67%. The bird can be facing a true threat that may end in its vanishing from the pond ecosystem due to human activities (as burning for regrowth, cattle grazing, fishing and in some

way desiccation to some patches around the pond in summer) that destroy its food and nests requirements.

RECOMMENDATION

There's an urgent need for more studies about *P. gracilis* especially in agricultural habitats with awareness programs for local people about its benefits and ways of protection. *P. gracilis* feeds mainly on beetles and their larvae, caterpillars and adult lepidopterans, grasshoppers, flies, and spiders (**Ryan, 2006**), so it can be used as a potential biocontrol agent of insects.

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