Journal of Genetic and Environmental Resources Conservation, 2015, 3(1):106-109.
www.jgerc.com

Egg morphology and components of native sandgrouse (*Pterocles alchata alchata*, Linnaeus, 1766)

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Abstract

The aim of this study was to identified the egg morphology and egg components of native sandgrous. A total of 44 freshly native sandgrous (*Pterocles alchata alchata*, Linnaeus, 1766) eggs without developed embryo were collected from three city of Al-Anbar province which were Ramadi, Hadeetha and Heet during 2014 to determined egg phenotype characteristics included egg shape, dimensions, weight, volume, specific gravity and weight and chemical composition which included protein, lipids and ash percentages of the egg components. Results revealed that native sandgrous egg breadth, length and shape index values were verified among the three city in Al-Anbar and the average values were 2.60cm, 3.23cm and 80.40 respectively. Egg weight ranged from 10.10 to 10.17gm with an average value 10.14gm, its volume ranged from 10.81 to 11.50cm^3 with an average value 11.14cm^3, whereas the egg specific gravity ranged from 0.88 to 0.93gm/cm^3 with an average value 0.91gm/cm^3. Chemical composition of native sandgrous eggs shown in Table (3), the mixture of albumen and yolk protein percentage were ranged from 12.13 to 12.15% with an average value 12.14%, lipids percentage were ranged from 13.26 to 13.33% with an average value 13.28%, ash percentage were ranged from 0.93 to 0.96% with an average value 0.95%. Statistical analysis revealed that no significant differences were appeared in egg protein and lipids percentages values.

Keywords: Sandgrous, *Pterocles alchata alchata*, Egg morphology, Egg components, Iraq.

Introduction

Sandgrouse birds belongs to the family of Pteroclididae, which is sixteen species. They are traditionally placed in two genera. The two central Asian species are classified as *Syrrhaptes* and the other fourteen species, from Africa and Asia, are placed in the genus *Pterocles*. Sandgrouse are ground dwelling birds restricted to treeless, open country, such as plains, savannahs and semi-deserts. They are distributed across northern, southern and eastern Africa, Madagascar, the Middle East and India through to central Asia (Al-Obaidi *et al.*, 2012).

In Iraq the genus *Pterocles* is common and four species are native: *Pterocles alchata alchata*, Linnaeus, 1766 (The main species); *Pterocles lichtensteinii arabicus*, Temminck, 1825; *Pterocles orientalis orientalis*, Linnaeus, 1758 and *Pterocles senegallus*, Linnaeus, 1771 (Allouse, 1962; Moudhafer *et al.*, 2006; Al-Obaidi *et al.*, 2012). The breeding season usually occur with a crop of seeds after the local rainy season and at this time, the feeding flocks tend to break up into pairs. The nesting site is a slight depression in the ground, sometimes lined with a few pieces of dry foliage. Most typically, three cryptic eggs are laid, occasionally there may be two or four. Incubation duties are shared between male and female in most species, the males incubate at night while the females sit on the eggs during the day. The incubation period is 20–25 days. Hatched chicks are covered with down and leave the nest as soon as the last hatchling has dried out. The chicks obtain their water from the soaked downy feathers on the adults breasts (Crome, 1991).

To our knowledge only very few studies about sandgrous in Iraq, to estimated large-scale geographical variation *among* populations in egg morphology and components of native sandgrous, so this results will provide a new data for Ornithologists in Iraq.

Materials and Methods

A total of 44 freshly native sandgrous (*Pterocles alchata alchata*, Linnaeus, 1766) eggs without developed embryo were collected from three city of Al-Anbar province which were Ramadi, Hadeetha and Heet during 2014 to determined egg phenotype characteristics included egg shape, dimensions,

weight, volume, specific gravity and weight and chemical composition which included protein, lipids and ash percentages of the egg components.

Egg phenotype: Egg breadth, egg length were determined by using Vernier Caliper according to the description made by Romanoff and Romanoff (1949). Egg shape index determined using the micrometer according to Stadelman and Cotterill (1995) using the equation:

$$\text{Egg shape index} = \frac{\text{short circumference (egg breadth) mm}}{\text{long circumference (egg length) mm}} \times 100$$

Egg weight determined using a sensitive digital Sartorius balance according to Stadelman and Cotterill (1995).

Egg volume determined according to Romanoff and Romanoff (1949) using the equation:

Egg volume (cm^3) = 0.51 LB^2 , L: egg length, B: egg breadth.

Egg specific gravity determined according to Stadelman and Cotterill (1995) using the equation:

$$\text{Egg specific gravity } (gm/cm^3) = \frac{\text{egg weight (gm)}}{\text{egg volume } (cm^3)}$$

Chemical analyses: The yolk and the albumen both were distributed into three replicates of glass beakers. protein, lipid a contents in albumen and yolk were carried out according to AOAC (1980), all these measurements were done in triplicates. Ash determined by ashing samples using muffle furnace oven at 600°C for 6hrs. Lipids analysis was conducted on all samples using mixture of chloroform: methanol (1:1) and stirred for 20min using magnetic stirrer for several rinsing times. Protein determined by the method of semi-microkjeldal determination of N% and the values obtained multiplied with 6.25 to calculate protein%.

Results and Discussion

Native sandgrous in Iraq (*Pterocles alchata alchata*, Linnaeus, 1766) egg breadth, length and shape index values were verified among the three city in Al-Anbar and the average values were 2.60cm, 3.23cm and 80.40 respectively (Table 1), statistical analysis revealed that no significant differences were noticed among cities. Native sandgrous egg just like most Precocial birds egg have an oval shape, with one end rounded and the other more pointed. This shape results from the egg being forced through the oviduct. Muscles contract the oviduct behind the egg, pushing it forward (Sturkie, 1986; Al-Obaidi and Al-Shadeedi, 2014).

Table (1): Egg breadth, length and shape index of native sandgrous.

City	Egg breadth (cm)	Egg length (cm)	Egg shape index
Ramadi	2.57	3.21	80.06
Hadeetha	2.63	3.26	80.67
Heet	2.60	3.23	80.49
Average	2.60	3.23	80.40
Significant	N.S.	N.S.	N.S.

N.S. : No significant differences in traits values among seasons

Native sandgrous eggs have an egg weight ranged from 10.10 to 10.17gm with an average value 10.14gm, its volume ranged from 10.81 to 11.50cm^3 with an average value 11.14cm^3, whereas the egg specific gravity ranged from 0.88 to 0.93gm/cm^3 with an average value 0.91gm/cm^3 (Table 2), statistical analysis revealed that no significant differences were noticed in egg weight, volume and specific gravity values.

Egg weight in most Precocial birds is expressed in terms of size, the size of the egg is range in size among different species and within the species between individuals. The size of the eggs laid by one individual may differ widely from those laid by another of the same species and breed, egg size influenced by climate, the amount of available food or nutrition, parents body size, evolutionary status (Stadelman and Cotterill, 1995; Krist, 2011), also wild-laid eggs were significantly bigger, heavier and denser than captive-laid eggs (Aourir *et al.*, 2013).

Table (2): Egg weight (gm), volume (cm^3) and specific gravity (gm/cm^3) native sandgrous.

City	Egg weight (gm)	Egg volume (cm^3)	Egg specific gravity (gm/cm^3)
Ramadi	10.10	10.81	0.93
Hadeetha	10.17	11.50	0.88
Heet	10.15	11.14	0.91
Average	10.14	11.14	0.91
Significant	N.S.	N.S.	N.S.

N.S. : No significant differences in traits values among seasons

Chemical composition of native sandgrous eggs shown in Table (3), the mixture of albumen and yolk protein percentage were ranged from 12.13 to 12.15% with an average value 12.14%, lipids percentage were ranged from 13.26 to 13.33% with an average value 13.28%, ash percentage were ranged from 0.93 to 0.96% with an average value 0.95%. Statistical analysis revealed that no significant differences were appeared in egg protein and lipids percentages values.

Birds are divided according to the relative amounts of the yolk into two classes, egg in which the yolk constitutes between 15 to 20 % of the total weight (lower percentage of yolk) belong to the Altricial species class, egg in which the yolk constitutes between 30 to 40 % of the total weight (high percentage of yolk) belong to the Precocial species class included sandgrous and many fowl species like chickens ducks and pheasant (Romanoff and Romanoff, 1949).

The egg yolk has the greatest food values, it contains a mixture of proteins, fats and carbohydrates in a watery medium (Marshall, 1960; Stadelman and Cotterill, 1995), the relatively large yolk assures a fairly advanced stage of development in the young at hatching for Precocial species, (Romanoff and Romanoff, 1949).

Table (3): Egg protein (%), lipids (%) and ash (%) of native sandgrous.

City	Egg protein (%)	Egg lipids (%)	Egg ash (%)
Ramadi	12.13	13.26	0.95
Hadeetha	12.15	13.33	0.93
Heet	12.13	13.28	0.96
Average	12.14	13.29	0.95
Significant	N.S.	N.S.	N.S.

N.S. : No significant differences in traits values among seasons

Yolk soluble materials can affect offspring development and phenotype in many ways, for example growth, immunity, behavior and plumage traits (Groothuis *et al.*, 2005). Carotenoids are antioxidants that reduce lipid peroxidation in the embryo, and they can also enhance immune function (Blount *et al.*, 2002). Deposition of several egg components is known to be affected by environmental or social conditions (e.g. food availability, parasite load or quality of mates) *within* populations (Groothuis *et al.*, 2005; Blount *et al.*, 2002).

To our knowledge only very few studies about sandgrous in Iraq, to estimated large-scale geographical variation *among* populations in egg morphology and components of native sandgrous, so this results will provide a new data for Ornithologists in Iraq.

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